

The background of the cover is a photograph of an airport parking garage with multiple levels. In the foreground, the front of a white transit bus is visible, featuring a red stripe and the number 201. The bus has a destination sign that reads "Airport" with a red "X" icon. The title "Airport Futures Transportation Impact Analysis" is overlaid in large, bold, black text on the right side of the image.

# Airport Futures Transportation Impact Analysis

## FINAL REPORT

Submitted: March 1, 2010

Prepared for:



**PORT OF PORTLAND**

Prepared by:

**DKS Associates**  
TRANSPORTATION SOLUTIONS

# CHAPTER

# 1

## EXECUTIVE SUMMARY

The following chapter summarizes key highlights from the entire Airport Futures Transportation Impact Analysis document. Key areas of interest include existing conditions, growth expectations, future conditions, and recommended mitigation.

### Introduction

Traditionally the Port of Portland International Airport and surrounding port related land uses have submitted a Conditional Use Master Plan (CUMP) to the City of Portland for future growth in and around the airport because the land use designation (zoning) for an airport does not exist for the current terminal location. The submittal occurs every ten years and includes expected growth for the airport for the next ten years.

The Port of Portland is now seeking a permanent legislative land use designation, which will eliminate the need for submitting a CUMP application every ten years, and allow the Port of Portland to coordinate with the City of Portland for a longer time period for expected growth for the Port. In addition, this is a more efficient utilization of both Port and City resources for reviewing and approving growth and potential impacts associated with expansion of Port facilities.

A collaborative process between the City of Portland, the Oregon Department of Transportation, and the Port of Portland was established to help foster this permanent legislative land use designation. To help determine potential impacts associated with growth, a transportation impact analysis was undertaken in which the existing transportation conditions were analyzed, future growth for the Port was estimated for two planning horizons, future impacts to the transportation infrastructure was estimated base on that expected growth, and recommended mitigation for those planning horizons were developed. The following summarizes the results of this process.

### Existing Conditions

Two study areas were determined for this project: the primary and secondary areas. The secondary area was selected to gain a better understanding of transportation conditions further away from the airport area (including local neighborhoods), while the primary study area was focused in the immediate Port properties area and included intersection data to be collected as well.

Within the primary study area (bounded by the Columbia River to the north, NE 122<sup>nd</sup> Avenue to the east, NE 33<sup>rd</sup> Avenue to the west, and NE Killingsworth Street to the south) there were almost 20



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intersections where existing transportation data was collected. This data included pedestrian activity, bicycle activity, and motor vehicle turning counts. In addition, transit data for both buses and the MAX were collected at stops. Here is a key summary of each mode:

- **Pedestrian/Bicycle** – With a number of sidewalks and off-street paths in the study area, there is a minimal number of pedestrians crossing at study area intersections. All intersections had less than three pedestrians crossing either in the AM or PM peak hours, with the exception of NE Alderwood Road/NE Holman Road which had a total of eight crossings in the PM peak hour, but only two crossings in the AM peak hour. Gaps in the current pedestrian infrastructure exist along NE Cornfoot Road, NE 82<sup>nd</sup> Avenue (south of NE Alderwood Road), NE Airport Way and NE Alderwood Road.

Similar peak hour count data was collected for bicycles at study intersections. Most intersections had minimal activity with the exception of NE Columbia Boulevard/NE 47<sup>th</sup> Avenue. This intersection had 11 bicycles during the AM peak hour, and 12 bicycles during the PM peak hour. There are gaps in the designated bicycle facilities on NE 82<sup>n</sup> Avenue, NE Airport Way, NE Alderwood Road, NE Cornfoot Road, and NE Cully Boulevard.

It should be noted that either the Port of Portland or City of Portland have pedestrian and bicycle designations for facilities that have existing gaps. In addition, NE Airport Way is an area of future study for pedestrian and bicycle connectivity. There are also a number of off-street multi-use paths where data was not collected that serve pedestrians and bicycles in the area.

- **Transit** – Within the study area the MAX serves approximately 6,000 daily on/off riders, with the majority of those on/offers occurring either at the Parkrose Transit Center (1,900 daily) or the Portland International Terminal (3,250 daily). There are five bus routes that service the study area, and the bus stops have far less activity on a daily basis than the MAX line. Most individual bus stops have 50 or less on/offers during the day, with the exception of the Parkrose Transit Center which has approximately 1,560 daily bus on/offers.
- **Motor Vehicle** – Generally the PM peak had higher activity levels than the AM peak hour, although the intersection of NE 82<sup>nd</sup> Avenue/NE Airport Way has a peak of motor vehicle activity during the mid day. The following intersections do not meet jurisdictional standard for the respective time periods:

**Table 1-1**  
**Existing Intersections Not Meeting Jurisdictional Standard**

AM Peak Hour	PM Peak Hour
<ul style="list-style-type: none"> <li>• NE Alderwood Road/NE Cornfoot Road*</li> <li>• NE Killingsworth St/I-205 Southbound</li> </ul>	<ul style="list-style-type: none"> <li>• NE Airport Way/I-205 Northbound**</li> <li>• NE Airport Way/NE 122<sup>nd</sup> Avenue*</li> <li>• NE Alderwood Road/NE Cornfoot Road*</li> <li>• NE Columbia Blvd/NE Alderwood Road**</li> <li>• NE Columbia Blvd/NE 82<sup>nd</sup> Ave Southbound**</li> <li>• NE Killingsworth St/I-205 Southbound</li> </ul>

\* - Indicates an intersection with a recently constructed and/or finished improvement (after analysis).

\*\* - Indicates an intersection with a planned future improvement.



Collision data was also evaluated for all of the study intersections and it was found that all intersections had a calculated collision rate of less than 1.0 for the most recent three years of data, except the intersection of NE Killingsworth Street/I-205 Northbound, with a rate of 1.44.<sup>1</sup> Collision rates that are calculated over 1.0 represent locations where existing safety concerns are present.

### Planning Horizon/Future Growth

Two planning horizons have been selected for future forecasting and analysis. These two years are 2022 and 2035. The planning horizon of 2022 was selected to help identify potential shorter term improvements to help prioritize those improvements for funding. The interim planning horizon year also corresponds to an interim planning horizon year in the Airport Futures Master Plan (Planning Activity Level 3). The 2035 planning horizon was selected because it is the Airport Futures Master Plan horizon year (Planning Activity Level 5), as well as it coinciding with the current Metro Regional Transportation Plan for future forecasting.

**Table 1-2**  
**Existing and Future Planning Horizon Growth Assumptions**

	Existing (2008)	2022*	2035*
<b>No-Build</b>	14.3 Million Annual Passengers (MAP)	<ul style="list-style-type: none"> <li>• 18.6 MAP**</li> <li>• 53% background growth***</li> <li>• 0% proposed land uses</li> </ul>	<ul style="list-style-type: none"> <li>• 18.6 MAP**</li> <li>• 100% background growth</li> <li>• 0% proposed land uses</li> </ul>
<b>Build</b>		<ul style="list-style-type: none"> <li>• 21.0 MAP</li> <li>• 53% background growth***</li> <li>• 53% proposed land uses***</li> </ul>	<ul style="list-style-type: none"> <li>• 26.8 MAP</li> <li>• 100% background growth</li> <li>• 100% proposed land uses</li> </ul>

**SOURCE:** Port of Portland

Notes: \* Future planning horizon MAP for 2035 documented in *Airport Futures Master Plan: Technical Memorandum no. 2 – Aviation Demand Forecasts*, September 2008, Table 18, page 5-17. Planning horizon MAP for 2022 was interpolated between planning horizon MAPs for 2017 and 2027 from the same document.

\*\* Approved level of passenger activity in the 2003 Conditional Use Master Plan

\*\*\* The 53% of background growth (and proposed land uses) for the planning horizon of 2022 assumes a straight line growth between existing volumes and future 2035 volumes

Proposed growth for Port facilities by 2035 (beyond approved growth from the 2003 CUMP) includes approximately 8.2 million annual passengers at the terminal, 175,000 square feet at AirTrans Center, 15,000 square feet of commercial space in the North Frontage Road area, a compressed natural gas facility in South Airport Way area, and potentially new general aviation (similar to the existing Flightcraft area) in the Northwest Quadrant area.

### Future Conditions

Based on the projected growth for the Port facilities, the two planning horizon years were forecasted for the PM peak hours for both the No-Build and Build conditions. While the airport terminal has a peak during the midday, the PM peak hour was selected due to the fact that the existing traffic count data

<sup>1</sup> "A rule of thumb is that intersections with a crash rate of 1.0 or greater is generally considered to be an indication that further investigation is warranted." Oregon Department of Transportation (ODOT) Transportation Planning and Analysis Unit (TPAU) Analysis and Procedures Manual, April 2006 (updated July 2009), page 5-5.



indicated that the this period has the highest level of traffic activity at intersections (which would indicate the worst traffic conditions) in comparison to the midday or AM peak hour.<sup>2</sup>

### **Mitigation Criteria**

Mitigation measures or facility improvements will be identified where future conditions do not meet the identified performance measures set forth by the City of Portland and the Oregon Department of Transportation for intersection operations. In situations where the facility is not meeting the established performance standards under No Build conditions, the facility will be mitigated if it has a significant impact under Build conditions based on an additional 10 seconds of delay and/or an increase of 0.05 V/C ratio or more beyond No Build conditions. In these cases, the improvements will try to mitigate the significant impacts, at a minimum.

#### *2022 Planning Horizon*

The future year of 2022 has minor impacts under the Build condition compared to the No-Build condition primarily due to the fact that a passenger activity level of 18.6 MAP is already approved under the 2003 CUMP with the City of Portland, and the 2022 conditions only adds an additional 3.4 MAP to the roadway system, and minor additional land uses. The following list shows the potential intersections with impacts under the Build 2022 PM peak hour:

- NE Columbia Boulevard/NE Alderwood Road (+11 seconds)
- NE Columbia Boulevard/NE Cully Boulevard (greater than 100 seconds)
- NE Marine Drive/NE 33<sup>rd</sup> Avenue (+28 seconds)

All of these intersections do not meet jurisdictional standard under the No-Build and Build conditions. However all intersections under the Build condition increase delay by 10 seconds or more, or increase volume-to-capacity ratio by 0.05 or more. It is expected that all of these intersections would need mitigation based on the criteria for significant impact.

#### *2035 Planning Horizon*

The future 2035 conditions were also analyzed for potential impacts to the transportation infrastructure. Based on the growth projected by 2035 for both background and Port facilities, there are seven intersections that do not meet jurisdictional standard and have either 10 seconds or more of additional delay, and/or an increase in V/C ratio of 0.05 or more. The following list shows intersections with potential impacts under the Build 2035 PM peak hour:

- NE Airport Way/Interstate 205 northbound on-ramp (+0.11 V/C ratio)
- NE Airport Way/NE 122<sup>nd</sup> Avenue (+20 seconds)
- NE 82<sup>nd</sup> Avenue/NE Alderwood Road (+15 seconds)
- NE Columbia Boulevard/NE Cully Boulevard (greater than 100 seconds)
- NE Columbia Boulevard/NE Alderwood Road (greater than 100 seconds)
- NE Columbia Boulevard/NE 82<sup>nd</sup> Avenue Northbound (+0.19 V/C ratio)
- NE Marine Drive/NE 33<sup>rd</sup> Avenue (+11 seconds)

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<sup>2</sup> The midday does create a higher condition of traffic at NE 82<sup>nd</sup> Avenue/NE Airport Way than the PM peak, but all other intersections have higher traffic activity during the PM peak hour.



The intersections of NE Alderwood Road/NE Cornfoot Road and NE Cornfoot Road/NE Airtrans Way also had more than 10 seconds of delay associated with the Build condition, however they still met jurisdictional standard and therefore do not have a significant impact. All other intersections listed would be considered to have a significant impact and would require mitigation.

## Recommendations

The impacts at the study area intersections were evaluated for both the 2022 and 2035 PM peak hours to determine potential recommendations to mitigate those impacts. The following table summarizes the potential mitigation strategies for the intersections that have impacts identified for the shorter planning horizon of 2022 and the trigger years/development associated with those mitigations.

**Table 1-3**

**Potential Mitigation Strategies for 2022 Planning Horizon**

Intersection	Mitigation	Trigger Year/Development
<b>Alderwood Rd/Columbia Blvd</b>	Signalize intersection with center turn lane on NE Columbia Boulevard*	2010/15.0 MAP
<b>NE Columbia Blvd/NE Cully Blvd</b>	Signalize intersection with center turn lane on NE Columbia Boulevard*	2010/15.0 MAP
<b>NE Marine Dr/NE 33<sup>rd</sup> Avenue</b>	Signalize intersection	2010/15.0 MAP

Notes: \* Proximity of intersections would most likely require side-by-side left turns, rather than back-to-back left turns. This would widen NE Columbia Boulevard to a six lane section in this area.

As can be seen in the preceding table, many of these mitigation strategies are needed within the next few years. This is primarily due to the fact that all of these intersections are unsignalized and the volume on the “mainline” (free flow movement) reaches levels that have significant delay associated with side street (stop controlled) movement. Any additional traffic added to the side streets increases the delay for the side street, as well as any additional volume on the mainline can cause delay for the side streets.

The mitigation strategies outlined previously allow for adequate operations in the future planning horizon of 2035 as well. Beyond the 2022 planning horizon, potential mitigation strategies have been identified for the additional intersections beyond 2022. The 2035 planning horizon is meant to identify intersections that may need to be looked at in further detail beyond the immediate planning horizon. The following summarizes potential mitigation strategies for these locations.

- NE Airport Way/NE 122<sup>nd</sup> Avenue – Additional eastbound left turn lane, and/or separate westbound right turn pocket.
- NE Airport Way/Interstate 205 Northbound – Grade separate the intersection to allow the eastbound left turns to not conflict with the westbound through volume.
- NE 82<sup>nd</sup> Avenue/NE Alderwood Road – Additional eastbound through lane (with shared right turn movement), and overlap phases for all separate right turn pockets at the intersection.
- NE Columbia Boulevard/NE 82<sup>nd</sup> Avenue Northbound – Signalize intersection with protected eastbound phasing.



These listed mitigations would allow for adequate intersection operations by 2035, however because these potential impacts are beyond the immediate 2022 planning horizon year, these intersections represent locations to monitor based on how future growth (and the rate of growth) occurs at Port facilities. The above listed mitigation strategies is preliminary and may be subject to change upon future additional analysis.

# CHAPTER

# 2

## EXISTING CONDITIONS

The following chapter summarizes the existing transportation conditions for all study area intersections. This analysis focuses on all modes of travel (including bicycle, pedestrian, transit, and motor vehicle), and includes a review of collision data at the study intersections as well.

### Study Area

The study area has been defined by two areas for the purpose of this analysis. The “Primary” area is the area immediately surrounding the Port of Portland International Airport, and is generally bounded by NE 33<sup>rd</sup> Avenue to the west, NE Lombard Street/Killingsworth Street/Sandy Boulevard to the south, NE 122<sup>nd</sup> Avenue to the east, and the Columbia River to the north. The majority of the data collected and analyzed in this chapter of the report is within the primary study area due to the proximity to the Portland International. The following intersections have been identified as study area intersections within the primary study area and their intersection control:

- NE Airport Way/NE 82<sup>nd</sup> Avenue (signal)
- NE Airport Way eastbound on/off-ramp/NE Cascades Avenue (signal)
- NE Airport Way Frontage Road/NE Airport Way westbound off-ramp (unsignalized)
- NE Airport Way Frontage Road/NE Cascades Avenue (roundabout)
- NE Airport Way/Interstate 205 southbound ramp (signal)
- NE Airport Way/Interstate 205 northbound ramp (signal)
- NE Airport Way/NE 122<sup>nd</sup> Avenue (signal)
- NE Alderwood Road/NE 82<sup>nd</sup> Avenue (signal)
- NE Alderwood Road/NE Holman Road/NE 105<sup>th</sup> Avenue (unsignalized)
- NE Alderwood Road/NE Cornfoot Road (unsignalized)
- NE Cornfoot Road/NE Airtrans Way (unsignalized)
- NE Alderwood Road/NE Columbia Boulevard (unsignalized)
- NE Columbia Boulevard/NE Cully Boulevard (unsignalized)
- NE 47<sup>th</sup> Avenue/NE Columbia Boulevard (signal)
- NE Columbia Boulevard/NE 82<sup>nd</sup> Avenue southbound (unsignalized)
- NE Columbia Boulevard/NE 82<sup>nd</sup> Avenue northbound (unsignalized)
- NE Killingsworth Street/Interstate 205 southbound (signal)
- NE Killingsworth Street/NE Sandy Boulevard/Interstate 205 northbound (signal)
- NE Marine Drive/NE 33<sup>rd</sup> Drive (unsignalized)



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The “Secondary” study area is broader in reach and is meant to encompass more of the surrounding neighborhoods and commercial areas on the perimeter of the primary study area. Less detailed analysis will be conducted within the secondary study area, and will focus on the roadway (link) capacities in these areas.

### Roadway Functional Classification

There are a number of key roadways that service the Portland International Airport and surrounding land uses. The various roadways have different ownership as well as different functional classifications. Functional classification systems are used to assign management objectives and design standards for roadways within an agency’s jurisdiction, and can help guide the implementation of transportation policies. Figure 2.1 summarizes the ownership on key roadways where study area intersections occur, as well as the functional classification of the roadways by mode of travel.

It should be noted that ownership of key roadways in the primary study area indicates which mobility standards apply to which intersections. There are three agencies that have roadway/intersection ownership in this area: the City of Portland, the Oregon Department of Transportation, and the Port of Portland.

### Historic Volume Data

The Port of Portland has an annual traffic monitoring program in place that routinely conducts 24-hour volume counts on key roadways during the month of April. Evaluation of this data is useful to determine traffic growth along corridors over the past years. As a comparison, data collected as part of the 2002 Conditional Use Master Plan will be used as a baseline for growth. Table 2-1 summarizes the comparison in corridor (24-hour) volumes on key roadways that service the terminal within the primary study area.

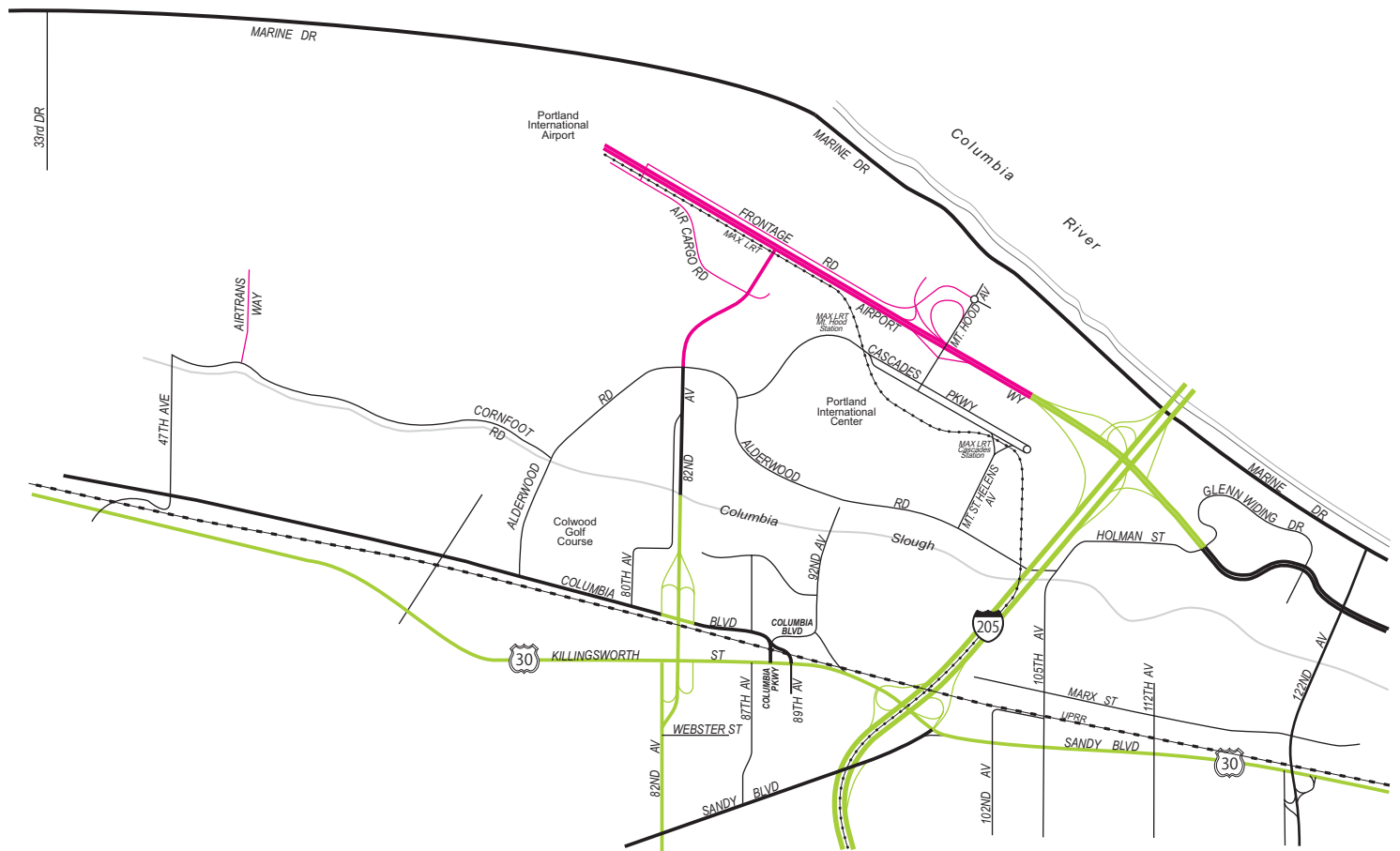
**Table 2-1**  
**Comparison of 2007 and 2002 24 Hour Traffic Volumes on Key Terminal Service Roadways**

Location	2002 Count	2007 Count	2007-2002 Change
Airport Way west of 82 <sup>nd</sup> Avenue	40,300	41,600	1,300
Airport Way east of 82 <sup>nd</sup> Avenue	45,000	46,100	1,100
82 <sup>nd</sup> Avenue south of Airport Way	22,600	18,400	(4,200)
82 <sup>nd</sup> Avenue south of Alderwood Road	14,500	12,700	(1,800)
I-205 southbound on-ramp from Airport Way	13,600	15,600	2,000
Airport Way east of I-205	45,100	46,500	1,400
I-205 northbound flyover to Airport Way	11,700	15,800	4,100

Note: Counts for both 2002 and 2007 conducted in Spring (month of April).

In recent years the historic volumes on the key roadways in Table 2-1 indicate a trend of traffic over the day shifting from using NE 82<sup>nd</sup> Avenue to Interstate 205 and NE Airport Way. It should be noted that the volumes in 2002 were still subject to the potential impact that the events of September 11, 2001 had on terminal activity and air passenger traffic.





Roadway	Bicycle	Pedestrian	Transit	Motor Vehicle	Freight
<b>ODOT</b>					
Interstate 205				Interstate Highway - NHS	Designated Freight Route
82 <sup>nd</sup> Avenue				Intermodal Connector on the NHS north of Columbia; District Highway south of Columbia	
Sandy Blvd.				District highway	
Killingsworth Street				District Collector	
Columbia Boulevard				Intermodal Connector on the NHS west of Killingsworth; Statewide Highway NHS east of Killingsworth	
Alderwood Road				Intermodal Connector on the NHS (82 <sup>nd</sup> to Cornfoot)	
Cornfoot Road				Intermodal Connector on the NHS (Alderwood to 47 <sup>th</sup> )	
Airport Way				Intermodal Connector on the NHS	
<b>PBOT</b>					
Interstate 205	Off-Street Path	Off-Street Path	Regional Transitway		Regional Truckway
82 <sup>nd</sup> Avenue	City Bikeway	City Walkway	Major Transit Priority Street	Major City Traffic Street	Priority Truck Street
Sandy Boulevard	City Bikeway	City Walkway	Major Transit Priority Street	Major City Traffic Street	Major Truck Street
Killingsworth Street	City Bikeway	City Walkway	Major Transit Priority Street		Priority Truck Street
Columbia Boulevard		City Walkway	Transit Access Street (west of 47 <sup>th</sup> ); Community Transit Street (east of 47 <sup>th</sup> )	Major City Traffic Street	Priority Truck Street
Alderwood Road	City Bikeway	City Walkway	Community Transit Street	Neighborhood Collector	Priority Truck Street
Cornfoot Road	City Bikeway	Off-Street Path	Community Transit Street	Neighborhood Collector	Priority Truck Street
Cully Boulevard	City Bikeway	City Walkway	Transit Access Street	Neighborhood Collector	Major Truck Street
Airport Way	City Bikeway	Local Service Walkway	Regional Transitway	Major City Traffic Street	Priority Truck Street
<b>METRO</b>					
Interstate 205	Regional Corridor	Multi-use facility	Existing Light Rail, Rapid Bus north of 102nd	Principal Arterial	Main Roadway Route
82nd Avenue	Community Connector			Major Arterial	Road Connector
Sandy Boulevard	Regional Corridor	Transit/mixed-use corridor	Rapid Bus	Major Arterial	
Killingsworth Street	Community Connector	Transit/mixed-use corridor	Rapid Bus	Minor Arterial	
Columbia Boulevard	Community Connector			Major Arterial	Road Connector
Alderwood Road	Community Connector			Collector of Regional Significance	Road Connector
Cornfoot Road	Community Connector			Collector of Regional Significance	Road Connector
122 <sup>nd</sup> Avenue	Community Connector			Minor Arterial	Road Connector
Cully Boulevard	Community Connector	Transit/mixed-use corridor			
Airport Way	Community Connector		Existing Light Rail	Major Arterial	Road Connector

## LEGEND

### Agency of Ownership

- Oregon Department of Transportation
- Port of Portland
- City of Portland



Information Sources: City of Portland  
Port of Portland  
ODOT

## ROADWAY OWNERSHIP AND FUNCTIONAL CLASSIFICATION

**FIGURE  
2-1**

## Pedestrian/Bicycle Operations

An inventory of existing pedestrian and bicycle facilities was done to determine where sidewalks, bicycle lanes, and off-street multiuse paths exist. For the purpose of this inventory, “bike lanes” included areas on roadways where shoulders were specifically designated for bicycle use through pavement markings, as well as other paved shoulders of at least five feet in width that could be used for bicycle travel. However, shoulders on high-speed, limited access roadways, such as I-205 and NE Airport Way west of I-205, were not assumed to be suitable for bicycle use. These facilities are generally a barrier for pedestrian and bicycle travel, and will potentially be addressed in the City of Portland Bicycle Master Plan, or future studies. Figure 2.2 shows these pedestrian and bicycle facilities.

Notable locations that do not have pedestrian facilities or bicycle lanes are:

- NE 82<sup>nd</sup> Avenue (south of NE Alderwood Road) – No sidewalks or bicycle lanes;
- NE Alderwood Road (west of NE 82<sup>nd</sup> Avenue) – Limited sidewalks available at the north end, no bicycle lanes;
- NE 105<sup>th</sup> Avenue/NE Holman Road – Limited segments of sidewalk are available and shoulder widths vary but are generally narrow;
- NE Airport Way (NE Holman Road to I-205) – No sidewalks on the north side of roadway; and
- NE Airport Way (I-205 to NE Mt. Hood Avenue) – No sidewalks or bicycle facilities.

Pedestrian and bicycle count data during the AM and PM peak hours was also collected at study area intersections. Count data indicates that on average less than ten pedestrian crossings occur per study area intersection during the AM and PM peak hours.<sup>1</sup> This low activity could be due to limited pedestrian facilities, lack of residential uses in the study area, and/or the fact that many streets within the study area have high volume motor vehicle traffic with high speeds (which make for a less appealing pedestrian environment).

Similar to pedestrian activity, bicycle activity within the study area is minimal. Bicycle count data indicates on average less than ten bicycle movements per study area intersection during the AM and PM peak hours.<sup>2</sup> Figure 2.3 identifies the pedestrian and bicycle movements for the AM and PM peak hours at study area intersections. It should be noted that there are off-street trails in the study area that serve pedestrians and bicycles that had no counts available.

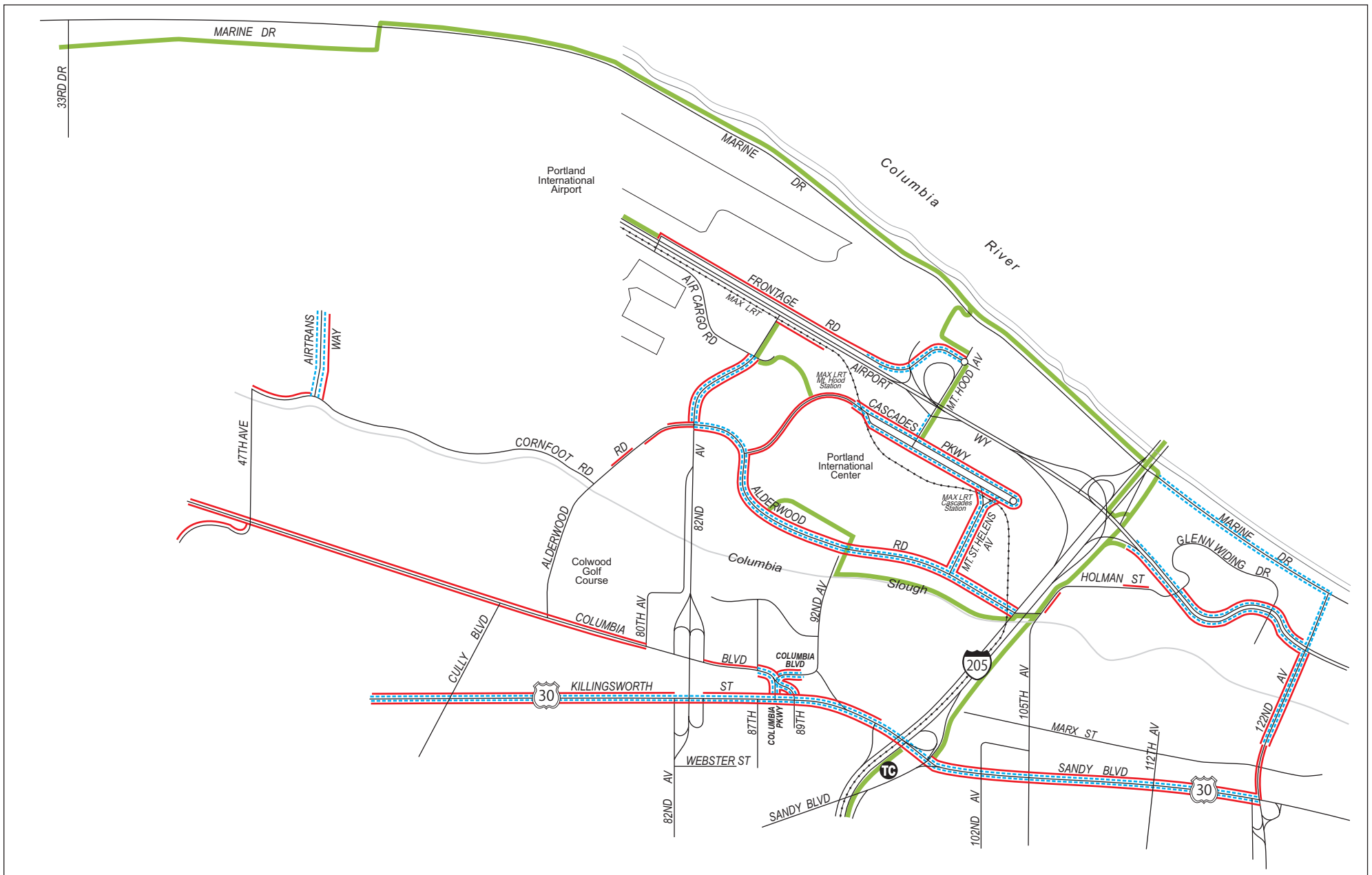
## Transit Operations

Transit service is available through the study area via five bus routes and the MAX light rail red line connecting the Portland International Airport to the city center. The designated routes for these services have been mapped in Figure 2.4, with bus stop and light rail station locations. Figures 2.5 and 2.6 show the average daily ridership for the transit stops within the immediate surrounding study area of the terminal.

<sup>1</sup> Based on counts conducted during April 2007.

<sup>2</sup> Based on counts conducted during April 2007.





#### LEGEND

- - Existing Sidewalks
- - - - Existing Bike Lane  
(Includes 5' or Wider Shoulders)
- - Multi-Use Path

N

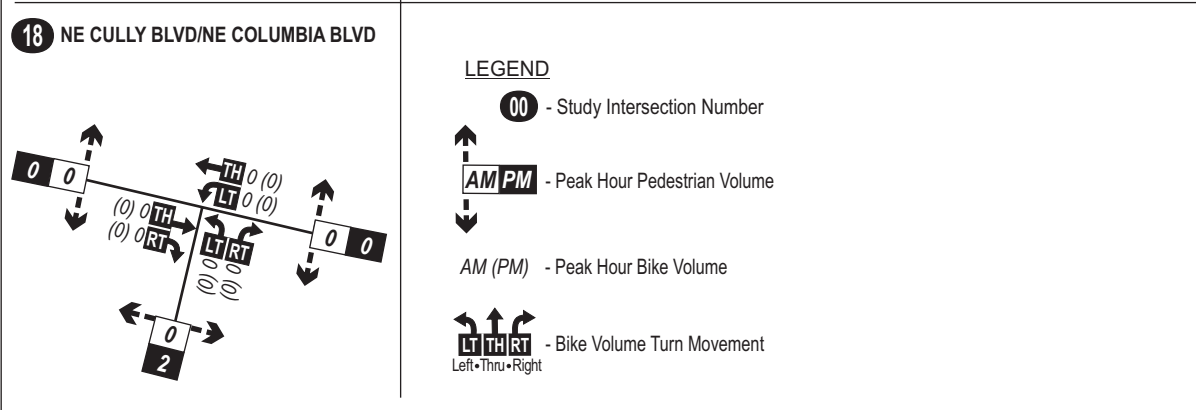
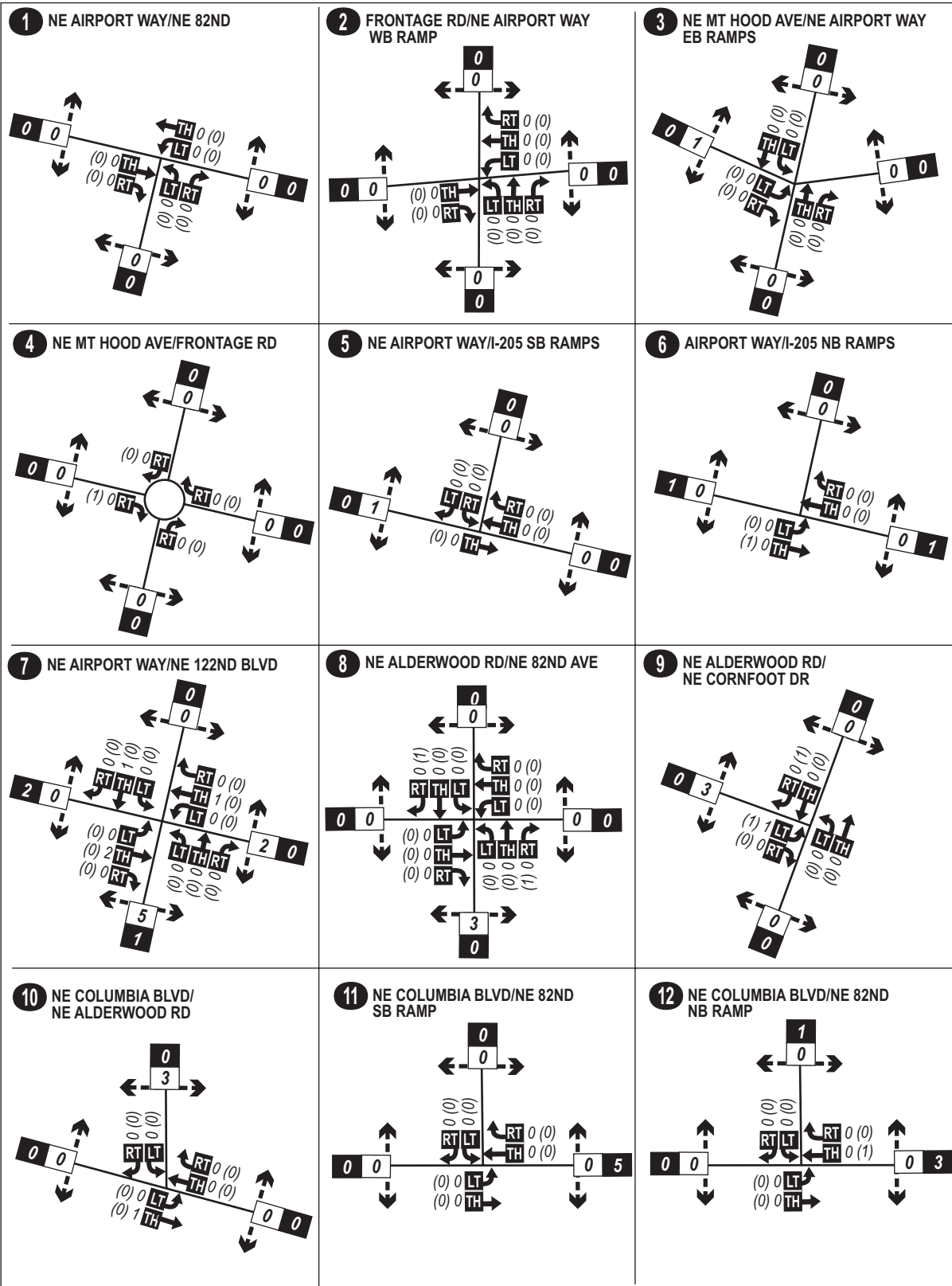


MAP NOT  
TO SCALE

Information Sources: Port of Portland

## EXISTING (2008) PEDESTRIAN & BICYCLE FACILITIES

**FIGURE  
2-2**



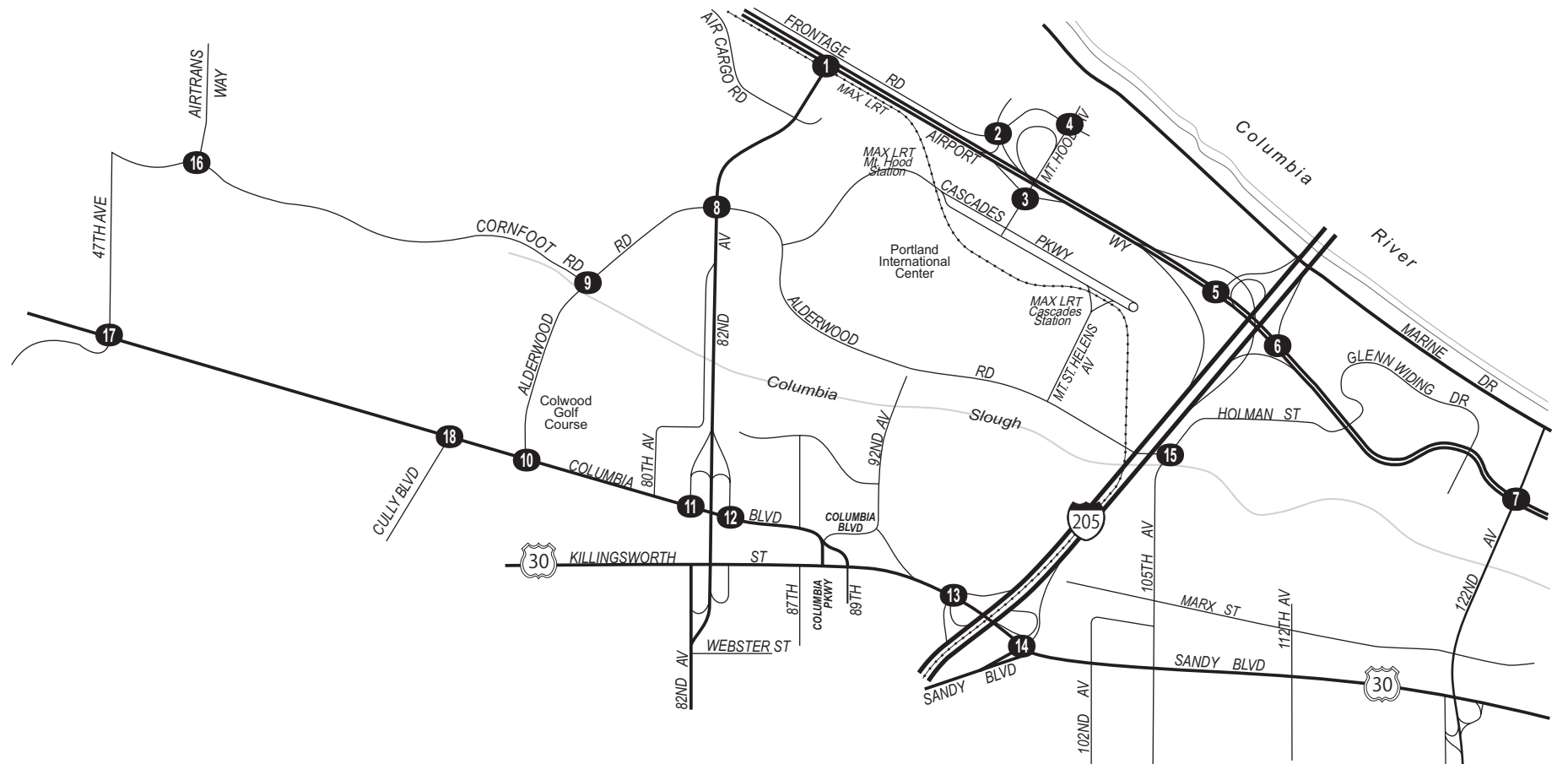
**LEGEND**

**00** - Study Intersection Number

**AM/PM** - Peak Hour Pedestrian Volume

**AM (PM)** - Peak Hour Bike Volume

**LT/TH/RT** - Bike Volume Turn Movement  
Left • Thru • Right



**EXISTING (2007) AM/PM PEAK HOUR PEDESTRIAN & BICYCLE VOLUMES**



#### LEGEND

- - Route #86
- - Route #72
- - Route #87
- - Route #12
- - Route #15
- - Light Rail Transit
- - Circle Indicates Bus Stop
  - Color Correspondes to Route # per Bus Stop
  - Black Indicates Multiple Route #s per Bus Stop
- TC - Transit Center

N



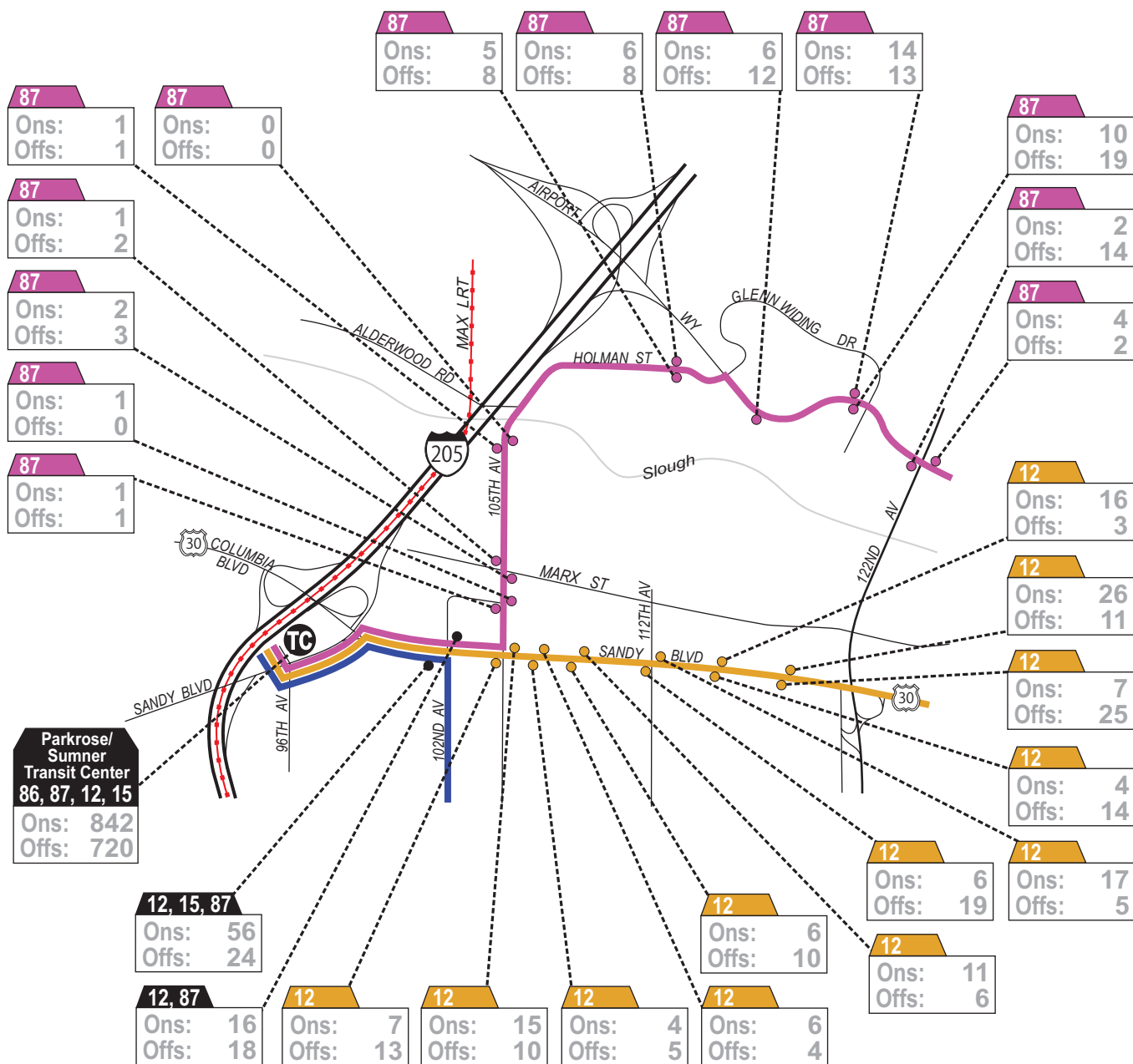
MAP NOT TO SCALE

Information Sources: Routes/Stops based on TriMet, Spring 2008 census

Some routes have been removed  
Figure dated as of 05/19/09

## TRANSIT ROUTES AND STOPS

**FIGURE 2-4**



#### LEGEND

- Route #87
- Route #12
- Route #15
- Bus Stop
- Color Indicates Rt # Per Bus Stop
- Black Indicates Multiple Rts Per Bus Stop

**00**  
Ons: 00  
Offs: 00

- Bus Routes Per Stop
- All-Day Ridership Ons
- All-Day Ridership Offs

TC - Transit Center



Information Sources: TriMet, Spring 2007 (bus) and 2008 (MAX) census

Some routes have been removed  
Figure dated as of 05/19/09

## TRANSIT RIDERSHIP

**FIGURE  
2-5**

**FIGURE 2-6**

Within this immediate area, the MAX red line maintains stops at the Parkrose/Sumner Transit Center, Cascades Station, Mt. Hood Station, and Portland International Airport and operates from approximately 5:00am to 11:30pm every day at headways ranging from 15 to 30 minutes. The Parkrose/Sumner Transit Center is slightly outside the primary study area, however it is a major transit center that connects buses to light rail for access to the terminal. All buses in the study area, with the exception of the route #72 stop at the Parkrose/Sumner Transit Center.

Based on the ridership data, the highest bus ridership occurs along Killingsworth Street on the #72 route. All other bus routes/stops have minimal activity with less than ten daily on/offers occurring. The MAX light rail has high activity at the Parkrose/Sumner station, and at the terminal itself. The stops within the Portland International Center (PIC) have less activity, which could be due to the PIC area not being fully built out yet.

In addition to these services, Ride Connection provides free shuttle service for seniors and the disabled through their RideAbout program, TriMet's Medical Transportation Program provides free rides to covered medical appointments for Oregon Health Plan Plus members, and TriMet's LIFT Program is available for people who are unable to use buses or MAX due to a disability or disabling health condition. However, none of these services operate on a fixed-route, and therefore could not be mapped.

## Motor Vehicle Operations

The following section covers the motor vehicle operations for the study area intersections as well as the roadway capacities on key roadways in both the primary and secondary study areas. Before analyzing all of the roadways and intersections it is useful to get an understanding of traffic flows over 24 hour periods on key roadways within the primary study area.

### *Volume Profiles*

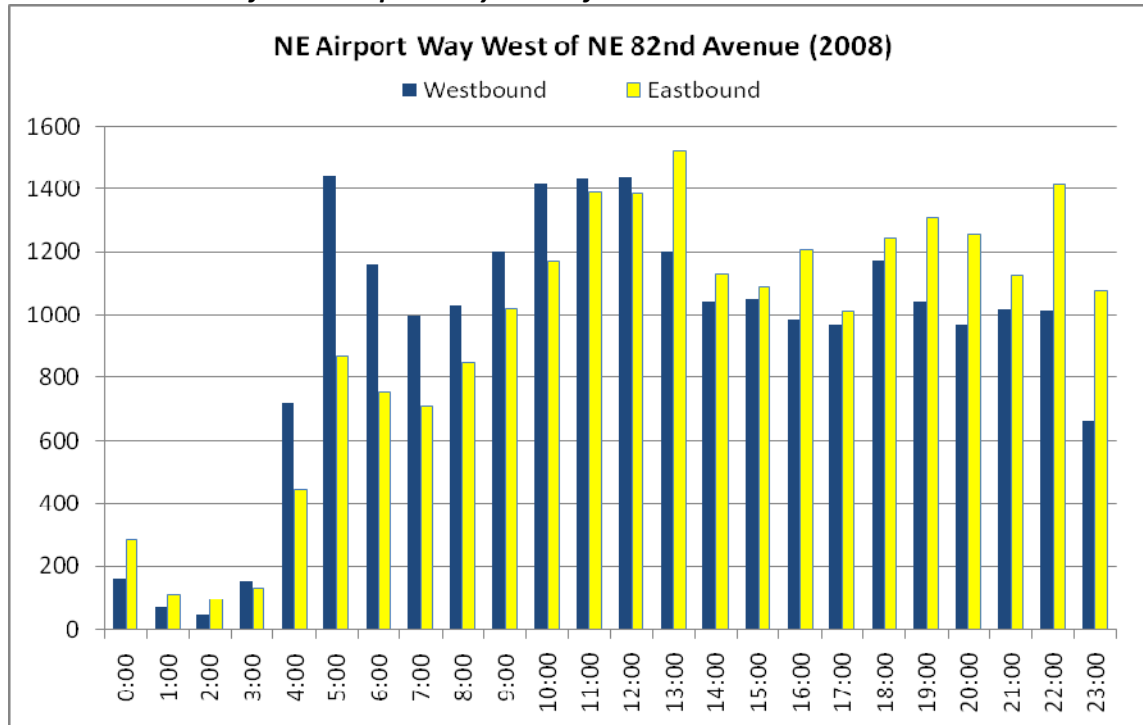
Within the primary study area 24 hour volume profile data was collected to help determine the flow of motor vehicle traffic over the course of a full day. This is helpful to understand when peak traffic conditions occur. Typically the PM peak hour is the highest traffic point on roadways and intersections during the day. Usually the AM peak hour is the second highest traffic point during the day. One reason for the PM peak being higher over the AM peak is due to retail oriented traffic during the PM peak that is typically not present during the AM peak because retail stores often open after the AM peak hour. Figure 2.7 and 2.8 summarizes traffic volume profiles at four key locations in the study area.

Based on the volume profile information, key roadways serving the airport facilities have characteristics similar to commuter traffic patterns (highest peak during the PM peak hour and the second highest peak during the AM peak hour) with the exception of NE Airport Way west of NE 82<sup>nd</sup> Avenue. At this location volumes from both NE Airport Way and NE 82<sup>nd</sup> Avenue combine during the middle of the day to create the peak volume period (at approximately 11:00am). The airport has a midday peak hour passenger activity level that creates the midday vehicle peak at this intersection, which is different than the Portland region PM Peak for motor vehicles.

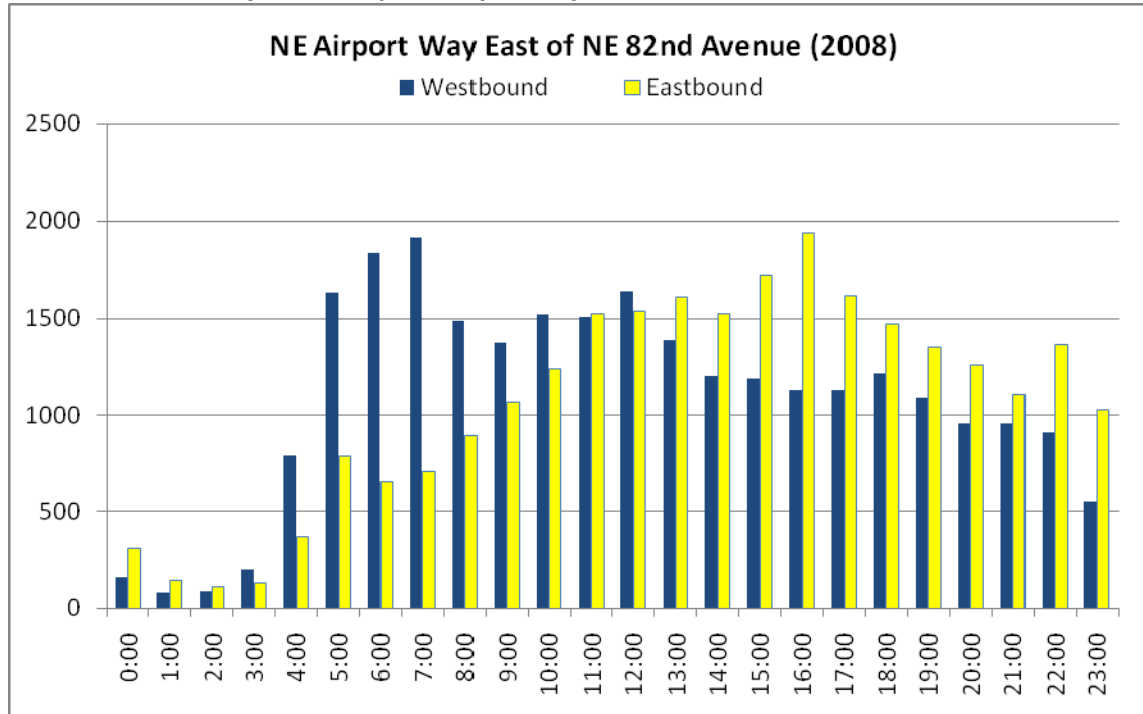


**Figure 2.7**

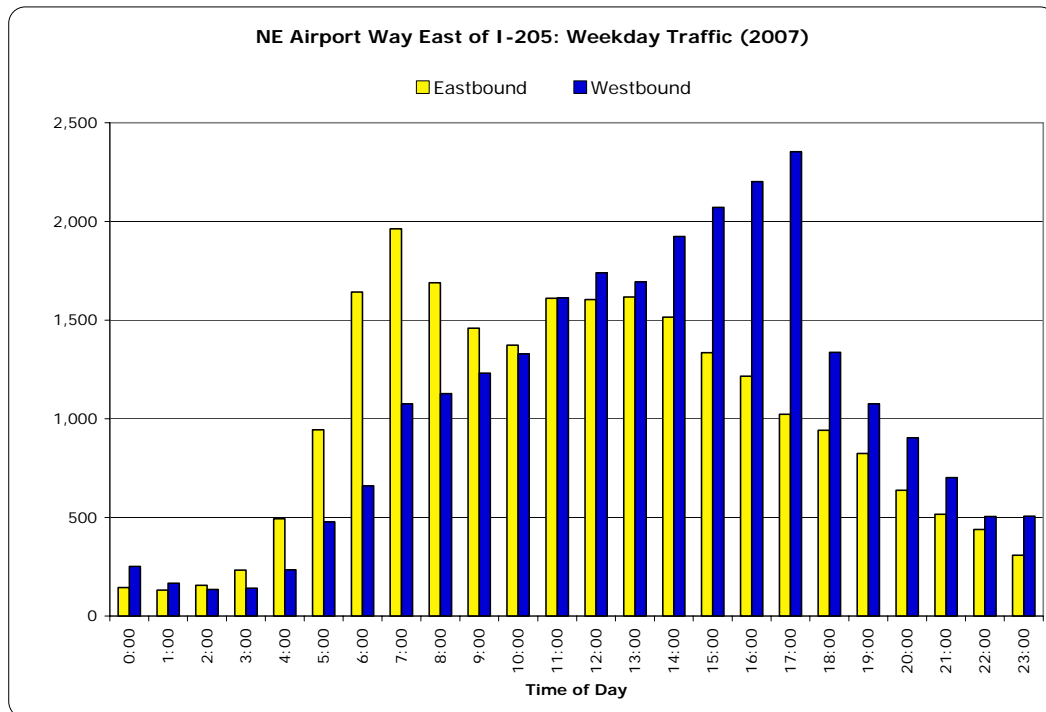
**24 Hour Volume Profiles on Airport Way West of NE 82<sup>nd</sup> Avenue**



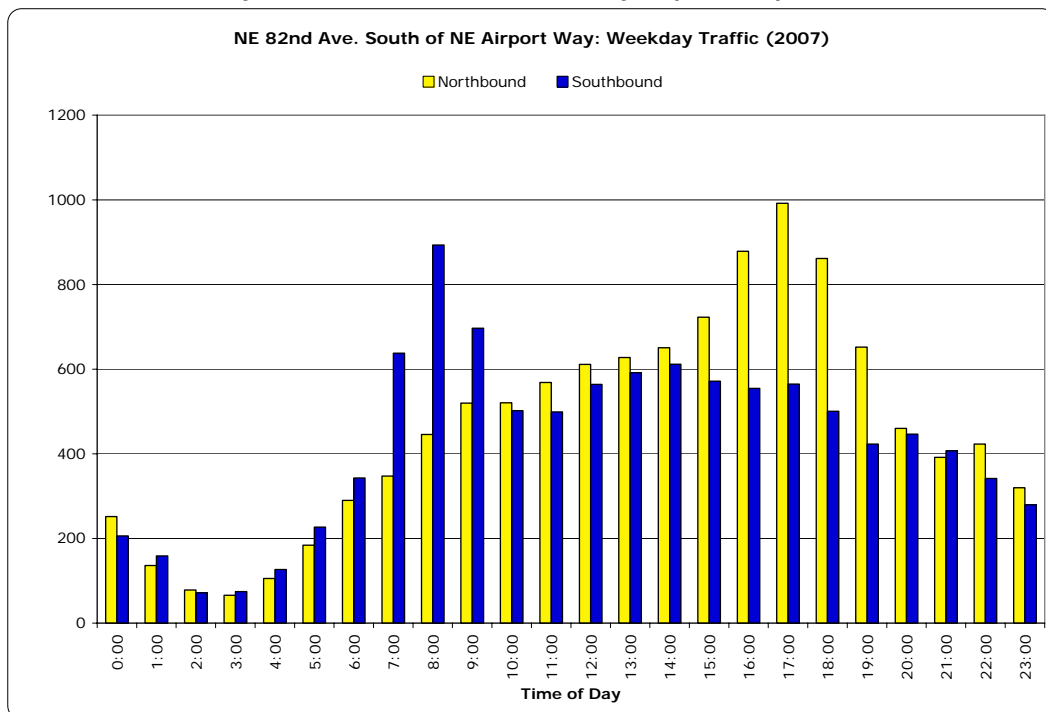
**24 Hour Volume Profiles on Airport Way East of NE 82<sup>nd</sup> Avenue**



**Figure 2.8**  
**24 Hour Volume Profiles on Airport Way east of I-205**



**24 Hour Volume Profiles on NE 82<sup>nd</sup> Avenue south of Airport Way**



### Roadway Capacity

Beyond evaluation of the roadway volume profiles to examine the nature of traffic over the day and when the peak hour of volumes occur, it is also useful to examine the volume-to-capacity (V/C) ratio of the roadways during that peak hour. This helps to measure how much capacity of a roadway is utilized during the peak hour, and how near capacity that roadway is. The regional travel demand model is utilized to help measure this value. Table 2-2 summarizes the V/C ratios at key locations on roadways within both the primary and secondary study areas.

**Table 2-2**  
**Existing PM Peak Hour Roadway Volume-to-Capacity Ratios**

Roadway/Location	Study Area	Direction	V/C Ratio
Airport Way west of 82 <sup>nd</sup> Avenue	Primary	Eastbound	0.46
		Westbound	0.44
Airport Way east of 82 <sup>nd</sup> Avenue	Primary	Eastbound	0.48
		Westbound	0.24
Airport Way east of I-205	Primary	Eastbound	0.55
		Westbound	0.89
82 <sup>nd</sup> Avenue south of Airport Way	Primary	Northbound	0.58
		Southbound	0.18
82 <sup>nd</sup> Avenue north of Columbia Boulevard	Primary	Northbound	0.27
		Southbound	0.15
Interstate 205 north of Marine Drive	Primary	Northbound	0.91
		Southbound	0.43
Interstate 205 north of Killingsworth Street	Primary	Northbound	0.98
		Southbound	0.58
Columbia Boulevard east of 82 <sup>nd</sup> Avenue	Primary	Eastbound	0.35
		Westbound	0.35
Columbia Boulevard west of 82 <sup>nd</sup> Avenue	Primary	Eastbound	1.00
		Westbound	0.75
Columbia Boulevard west of 47 <sup>th</sup> Avenue	Primary	Eastbound	0.88
		Westbound	0.49
Killingsworth Street west of 82 <sup>nd</sup> Avenue	Primary	Eastbound	0.93
		Westbound	0.71
Cornfoot Road west of Alderwood Road	Primary	Eastbound	0.91
		Westbound	0.28
47 <sup>th</sup> Avenue south of Cornfoot Road	Primary	Northbound	0.82
		Southbound	0.28
Alderwood Road west of 82 <sup>nd</sup> Avenue	Primary	Eastbound	1.00
		Westbound	0.51
122 <sup>nd</sup> Avenue south of Airport Way	Primary	Northbound	0.29
		Southbound	0.32
33 <sup>rd</sup> Avenue near Elrod Road	Primary	Northbound	0.15
		Southbound	0.19
Marine Drive east of 33 <sup>rd</sup> Avenue	Primary	Eastbound	0.74
		Westbound	0.23
Cully Boulevard south of Killingsworth Street	Secondary	Northbound	0.17
		Southbound	0.27



Roadway/Location	Study Area	Direction	V/C Ratio
82 <sup>nd</sup> Avenue south of Killingsworth Street	Secondary	Northbound	0.53
		Southbound	0.63
42 <sup>nd</sup> Avenue south of Killingsworth Street	Secondary	Northbound	0.47
		Southbound	0.62
33 <sup>rd</sup> Avenue south of Killingsworth Street	Secondary	Northbound	0.23
		Southbound	0.42
148 <sup>th</sup> Avenue south of Airport Way	Secondary	Northbound	0.15
		Southbound	0.38
Sandy Boulevard west of Interstate 205	Secondary	Eastbound	0.63
		Westbound	0.39
Prescott Street west of 82 <sup>nd</sup> Avenue	Secondary	Eastbound	0.70
		Westbound	0.49
MLK Jr. Boulevard south of Lombard Street	Secondary	Northbound	0.47
		Southbound	0.22
MLK Jr. Boulevard north of Columbia Boulevard	Secondary	Northbound	0.35
		Southbound	0.27
Lombard Street west of 33 <sup>rd</sup> Avenue	Secondary	Eastbound	0.69
		Westbound	0.71
Lombard Street east of 33 <sup>rd</sup> Avenue	Secondary	Eastbound	0.88
		Westbound	0.71

**SOURCE:** 2005 Metro Regional Travel Demand Model, PM peak hour.

As Table 2-2 shows, the more congested (higher volume-to-capacity ratios) facilities are located within the primary study area, while the secondary study area has roadway V/C values of less than 0.90 during the PM peak hour. From Table 11.1 in the City's Transportation System Plan, this V/C to a LOS D or better for roadways in the secondary study area.

### *Intersection Operations*

While it is useful to understand the flow of traffic on roadways, and the available capacity on those roadways, it is typically the intersections that are the bottlenecks to traffic operations (specifically signalized intersections). To help evaluate the study intersections, AM and PM peak hour turning movement counts were evaluated<sup>3</sup>. Similar to the traffic volume profiles, overall intersection traffic volumes during the PM peak hour were higher than volumes surveyed during the AM peak hour for the same locations.

Generally traffic flows freely within the study area for many parts of the day, however the corridors of Columbia Boulevard/Killingsworth Street and Airport Way can experience some delay during the PM peak hour, specifically near the interchange areas with Interstate 205.

The City of Portland and Oregon Department of Transportation have minimum standards set for intersection operations. The City of Portland uses level-of-service (LOS) as the intersection performance

<sup>3</sup> Field data collected for intersection turn movements during peak hours was adjusted to represent the 30<sup>th</sup> highest hour of vehicle volume during the year by following criteria to calculate the 30<sup>th</sup> highest vehicle hour outlined by the ODOT Transportation Planning Analysis Unit. The 30<sup>th</sup> highest vehicle volumes were then utilized for analysis purposes.



measure with a minimum operating standard of LOS D at signalized intersections and LOS E at unsignalized/all-way stop controlled intersections.

The Oregon Department of Transportation (ODOT) uses a volume-to-capacity ratio as the intersection performance measure. The minimum operating standard (within the study area) for intersections is 0.99, and at ramp terminals of interstate highways the standard is 0.85. Table 2-3 summarizes the existing intersection operations for study area intersections for the AM and PM peak hours by jurisdiction.

**Table 2-3**  
**Existing AM/PM Peak Hour Intersection Operations**

Intersection	Mobility Standard	AM Peak Hour			PM Peak Hour		
		Delay	LOS	V/C	Delay	LOS	V/C
82 <sup>nd</sup> Avenue/Airport Way	LOS D	23.9	C	0.75	11.9	B	0.62
Airport Way eastbound/Mt Hood Avenue	LOS D	5.8	A	0.24	5.5	A	0.45
Airport Way Frontage Rd/Airport Way westbound	LOS E	11.2	B	0.02	15.7	C	0.13
Airport Way Frontage Rd/Mt Hood Avenue	LOS E	7.0	A	0.17	6.5	A	0.23
Airport Way/I-205 southbound	0.85 V/C	59.6	E	0.72	14.3	B	0.58
Airport Way/I-205 northbound	0.85 V/C	5.6	A	0.42	28.8	C	0.96
Airport Way/122 <sup>nd</sup> Avenue	LOS D	42.9	D	0.80	58.5	E	0.94
82 <sup>nd</sup> Avenue/Alderwood Road	LOS D	25.8	C	0.66	52.9	D	0.59
Alderwood Road/Cornfoot Road	LOS E	78.3	F	1.00	>80.0	F	1.00
Cornfoot Road/Airtrans Way	LOS E	18.3	C	0.30	18.9	C	0.36
Columbia Boulevard/47 <sup>th</sup> Avenue	LOS D	20.3	C	0.60	21.9	C	0.64
Columbia Boulevard/Cully Boulevard	LOS E	10.2	C	0.94	28.5	D	0.83
Columbia Boulevard/Alderwood Road	LOS E	15.2	C	0.26	>80.0	F	1.00
Columbia Boulevard/82 <sup>nd</sup> Avenue southbound	0.99 V/C, LOS E	40.8	E	0.76	>80.0	F	0.93
Columbia Boulevard/82 <sup>nd</sup> Avenue northbound	0.99 V/C, LOS E	28.1	D	0.34	21.1	C	0.19
Killingsworth Street/I-205 southbound	0.85 V/C	39.8	D	0.88	42.2	D	1.00
Killingsworth Street/I-205 northbound	0.85 V/C	18.2	B	0.53	30.2	C	0.67
Alderwood Road/Holman Road	LOS E	14.3	B	0.19	22.2	C	0.49
Marine Drive/33 <sup>rd</sup> Drive	LOS E	>80.0	F	1.00	>80.0	F	1.00

**SOURCE:** DKS Associates, Synchro analysis based on existing count data adjusted to the 30<sup>th</sup> highest vehicle volume hour.

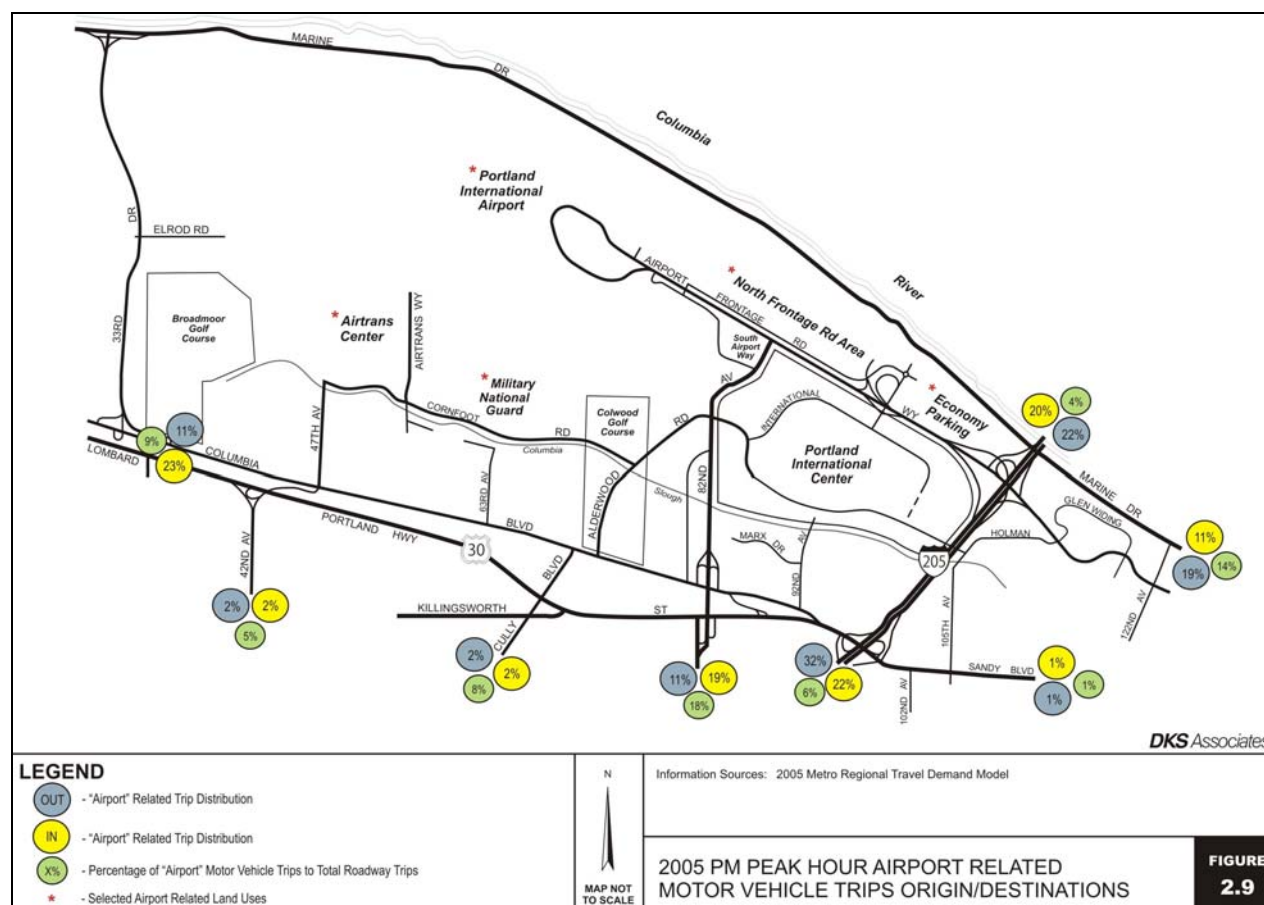
During the AM peak hour, all study area intersections operate within jurisdictional standard, with the exception of Alderwood Road/Cornfoot Road, Marine Drive/33<sup>rd</sup> Avenue and Killingsworth Street/I-205 southbound. The unsignalized Alderwood Road/Cornfoot Road, and Marine Drive/33<sup>rd</sup> Avenue intersections experience delay beyond LOS E because of heavy delay at the stop controlled movements (Cornfoot Road and 33<sup>rd</sup> Drive) due to high volumes along Alderwood Road and Marine Drive. The Killingsworth Street/I-205 southbound intersection has a V/C above 0.85 because the amount of eastbound Killingsworth Street traffic turning right to southbound I-205 is beyond available capacity.

The PM peak hour has seven intersections that do not currently meet standard. These intersections typically occur at the interchanges with I-205 and include Airport Way/I-205 northbound, Killingsworth Street/I-205 southbound. In addition to those two intersections, the intersections of Airport Way/122<sup>nd</sup> Avenue, Columbia Boulevard/Alderwood Road, Columbia Boulevard/82<sup>nd</sup> Avenue southbound and again Alderwood Road/Cornfoot Road, and Marine Drive/33<sup>rd</sup> Drive do not meet standard.



## Airport Related Trip Users

The regional travel demand model was also used to help identify the users of the airport and the surrounding airport facilities (such as AirTrans Center, National Guard Military, North Frontage Road land uses, and Economy Parking area). The motor vehicle trips within the regional travel demand model can be traced from their origin and destination based on the roadway they utilize to access these points. This is useful to examine to determine what percentage of total “airport related” trips uses the key roadways that provide access to the primary study area. In addition, those volumes within the regional travel demand model can be compared to the total model traffic volume on the roadways to evaluate the percentage of airport related motor vehicle trips compared to total roadway traffic. Figure 2.9 shows the results of this origin/destination evaluation.



Based on the travel patterns within the regional travel demand model, the majority of the airport related motor vehicle trips have their origin or destination on Interstate 205, Airport Way (east of I-205), Columbia Boulevard/Lombard Street, or 82<sup>nd</sup> Avenue. Those four facilities comprise approximately 95% of the trips to and from airport facilities, with I-205 accounting for approximately 50% of the total trips. Very little airport related traffic enters into surrounding neighborhoods, with routes such as Cully Boulevard and 42<sup>nd</sup> Avenue accounting for only about 5% of the total access.

## Safety Analysis

Three years of the most recent collision data available (2005-2007) was obtained from the ODOT Crash Analysis and Reporting Unit, covering all the study area intersections. This was done to help identify potential deficiencies, calculate crash rates at intersections for comparison to statewide crash rates for similar facilities, and identify patterns or trends of specific types of collisions. Table 2-4 summarizes the intersection crash rates.

**Table 2-4**  
**2005-2007 Study Area Intersection Collisions by Type and Rate**

Location	Collisions (by Severity)				Collisions Per Year	Collision Rate Per MEV**
	Fatal	Injury	PDO*	Total		
NE Airport Way/I-205 Northbound Ramp	0	2	7	9	3.0	0.19
NE Airport Way/I-205 Southbound Ramp	0	11	15	26	8.6	0.69
Sandy Blvd/I-205 Northbound Ramp	0	27	29	56	18.6	1.44
NE Killingsworth/I-205 Southbound Ramp	0	15	22	37	12.3	0.71
NE 122 <sup>nd</sup> Ave/NE Airport Way	0	7	10	17	5.6	0.44
NE 82 <sup>nd</sup> Ave/NE Airport Way	0	10	12	22	7.3	0.64
NE 82 <sup>nd</sup> Ave/NE Alderwood Rd	0	5	4	9	3.0	0.34
NE Alderwood Rd/NE Cornfoot Rd	0	1	5	6	2.0	0.41
NE Columbia Blvd/NE Cully Blvd	0	3	9	12	4.0	0.63
NE Columbia Blvd/NE 47 <sup>th</sup> Ave	0	4	7	11	3.6	0.43
NE Columbia Blvd/NE 82 <sup>nd</sup> Northbound	0	0	1	1	0.3	0.06
NE Columbia Blvd/NE 82 <sup>nd</sup> Southbound	0	1	1	2	0.6	0.10
NE Columbia Blvd/NE Alderwood Rd	0	1	2	3	1.0	0.13
NE Cornfoot Rd/Airtrans Way	0	0	2	2	0.6	0.41

\* Property Damage Only

\*\* Crash rate per MEV = (# of crashes)\*1 million / (# of entering vehicles)

Peak hour volume (PHV) is typically 10% of daily volume. Therefore, (# of entering vehicles) = (PHV)\*10\*365days\*3 years

Intersections where a calculated collision rate is at 1.0 or higher indicates an intersection that has an existing deficiency that should be addressed through future improvements (when future improvements are made). There is only one intersection that reaches a collision rate over 1.0, and that is the intersection of Sandy Boulevard/I-205 northbound ramp.

While the majority of intersection collisions are commonly rear-end types, there are a high number of turn collisions at signalized intersections where protected turning movements are implemented. A further examination of these turning collisions at the Sandy Boulevard/I-205 Northbound Ramp intersection indicated that many were coded as turning crashes where a vehicle was making a left turn and was hit by a vehicle traveling straight from the opposite direction. The number of turning collisions at this



intersection appears to be relatively high for signalized intersections that have protected left turn phasing, and may be an indication that high congestion and vehicle delay is encouraging drivers to run or attempt to beat red lights.

# CHAPTER

# 3

## ASSUMPTIONS & METHODOLOGY

The following chapter summarizes the assumptions for planning year horizon, future land use, future assumed roadway improvements, and methodology for analysis of future transportation operating conditions.

### Study Area and Intersections

The study area has been defined by two areas for the purpose of this analysis. The “Primary” area is the area immediately surrounding the Port of Portland International Airport and is generally bounded by NE 33<sup>rd</sup> Avenue to the west, NE Lombard Street/Killingsworth Street/Sandy Boulevard to the south, NE 122<sup>nd</sup> Avenue to the east, and the Columbia River to the north. The primary study area will contain detailed roadway and intersection analysis at study area intersections.

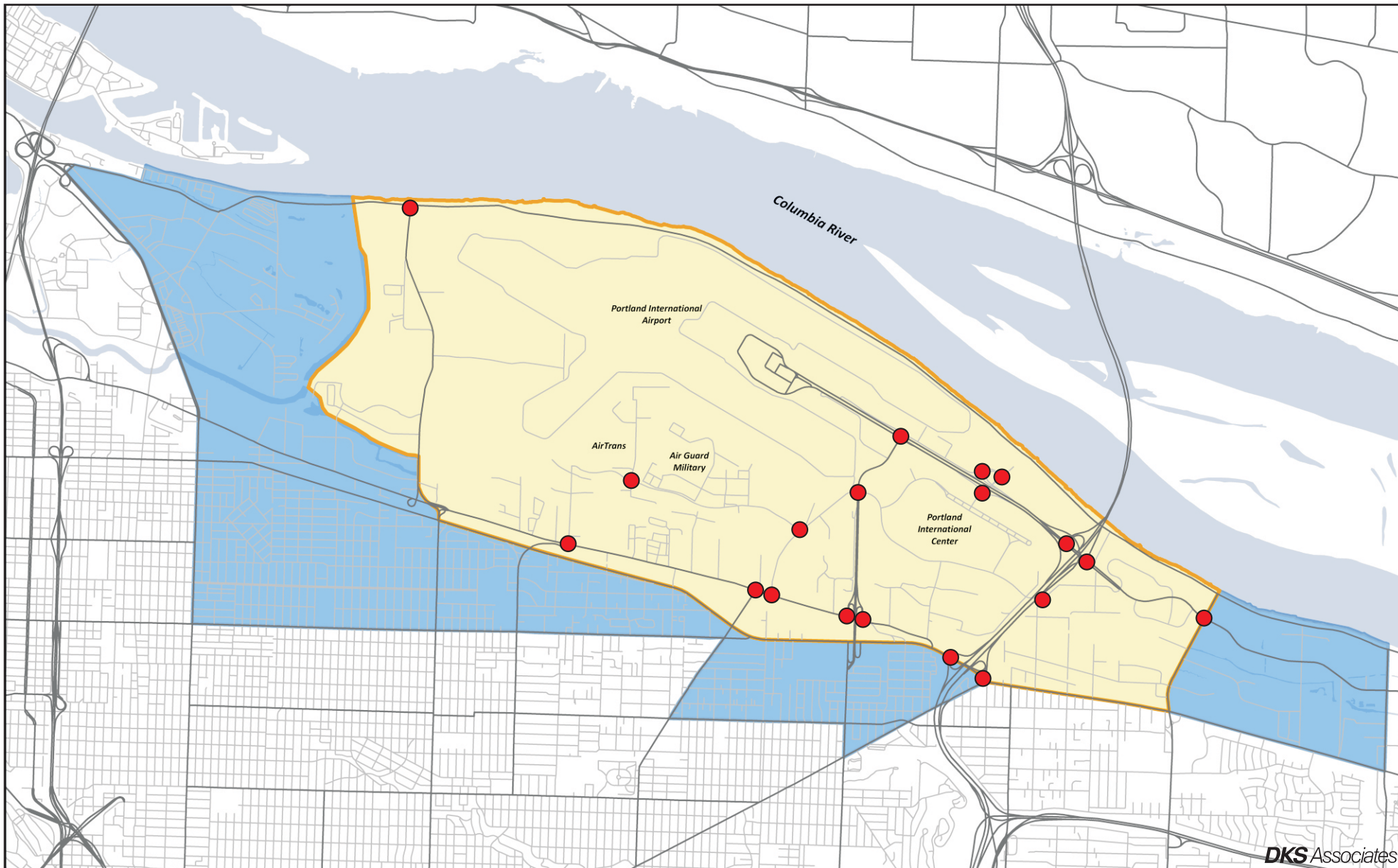
The “Secondary” area is broader in reach and is meant to encompass more of the surrounding neighborhoods and commercial areas on the perimeter of the primary study area. The general boundaries for the secondary study area are NE Martin Luther King Jr. Boulevard to the west, NE Killingsworth Street, NE Prescott Street, and NE Sandy Boulevard to the south, NE 148<sup>th</sup> Avenue to the east, and again the Columbia River to the north. Less detailed analysis will be done in the secondary study area. Analysis will focus on roadway capacities and potential influence of airport related motor vehicle trips in this area.

Within the primary study area a number of intersections have been selected for future detailed operational analysis. These intersections were selected through review of the future regional travel demand model and the potential roadway operations found in the model. The locations where the most congested roadways crossed (intersections) were selected for further detailed analysis. Figure 3.1 summarizes the primary and secondary study areas, as well as the intersection locations for further detailed analysis.

### Planning Horizon Year

As part of the permanent land use designation being sought by the Port of Portland, the future forecast year of 2035 has been selected to represent conditions that would meet the requirements for a land use action for both the Oregon Department of Transportation (ODOT), and the City of Portland.





## LEGEND

- Primary Study Area
- Secondary Study Area
- Study Area Intersection



Information Sources: Port of Portland

## STUDY AREA AND INTERSECTIONS

**FIGURE**  
**3.1**

This planning horizon also corresponds to the future planning horizon of the Airport Futures Master Plan currently being conducted. In addition to this future planning horizon, an interim analysis year of 2022 has been selected to help identify potential shorter term improvements and help prioritize the improvements. The interim planning horizon year also corresponds to an interim planning horizon year (Planning Activity Level 3) in the Airport Futures Master Plan.

### **Applicable Rules and Policies**

The Airport Futures planning process is a legislative process that will amend the City's Comprehensive Plan by establishing a Plan District. There are a number of applicable rules and policies that must be addressed in a legislative planning process. These include the Oregon Transportation Planning Rule (OAR 660-012-0060), Goal 6 Transportation and Goal 11B Public Rights of Way in the City's Transportation System Plan (TSP), and the Oregon Highway Plan. These policies are discussed here for clarification.

#### *Transportation Planning Rule*

The Oregon Transportation Planning Rule (TPR) must be addressed for amendments to acknowledged comprehensive plans that significantly affect an existing or planned transportation facility within an established planning period. If an amendment is determined to have a significant affect, then appropriate measures must be put in place to assure consistency with function and performance standards. A significant affect is determined if the amendment would:

- Change the functional classification of an existing or planned transportation facility;
- Change standards implementing a functional classification system;
- Create types or levels of travel across a facility that is inconsistent with the functional classification of that facility;
- Reduce the performance of a facility below the minimum acceptable performance standard identified in the TSP or comprehensive plan; or
- Worsen a transportation facility beyond operations in the future that would not meet the minimum acceptable performance standards.

In this case, the trip characteristics from the Airport Futures master plan will have significantly less impact than the trip characteristics of the underlying zoning (predominantly General Industrial 2 – IG2), if fully developed (see trip generation section). Therefore, the Airport Futures legislative planning effort is not expected to have a significant affect. The TPR has been adequately addressed.

#### *Goal 6 Transportation Policies (City of Portland)*

Goal 6 policies are identified to address the multiple functions of a balanced transportation system. These include addressing the multiple modes of transportation, as well as design treatments and livability. This study will address impacts to alternate modes (i.e. pedestrian, bicycle, freight, transit, etc), as well as safety of the transportation system.

#### *Goal 11B Public Rights of Way Policies (City of Portland)*

The primary policy in Goal 11B that is relevant to the Airport Futures legislative planning process is Policy 11.13 Performance Measures. The primary objective for this policy is to maintain acceptable levels of performance for legislative amendments to the City's Comprehensive Plan. Table 11.1 in the



City's TSP defines the performance measures for motor vehicle Level-of-Service (LOS) on street segments. Performance measures typically applied in intersection level analysis are further defined in the City's Portland Policy Document TRN-10.27.

Both sets of performance measures will be used in this analysis as a goal for identifying improvements to study area intersections that are under the City's and the Port's jurisdiction. This study will include both a street (link) capacity assessment as well as a detailed assessment at study area intersections to determine impacts and improvements.

The performance measures used in Table 11.1 will be applied in the link capacity analysis. These performance measures are based on volume-to-capacity ratio and are defined in the table. The intersection level analysis will follow the more traditional analysis methodology that is covered in the *2000 Highway Capacity Manual*. The City of Portland and Port of Portland use level-of-service as their performance measure at intersections.

Here is a brief description of both of these performance measures:

- **Level-of-Service** (LOS) is similar to a "report card" rating with level-of-service A, B and C the free flowing conditions where the traffic can flow smoothly without significant stops and delays. Level-of-service D and E represent stop and go traffic conditions, and there is the potential for significant queuing and delay under these conditions. A level-of-service F condition is the worst operating conditions represented by long delays (typically multiple signal cycles to get through and intersection).
- **Volume-to-capacity** (V/C) ratios are comparisons of the actual motor vehicle volume using the intersection (or a particular movement) to the maximum volume that could be served. For example, if the calculated V/C ratio is 0.85 during a peak hour at an intersection, that correlates to approximately 85% of the available capacity at that intersection is being used, and approximately 15% more motor vehicles could use the intersection before all of the available capacity is utilized. When an intersection starts to reach a 1.0 ratio, that intersection is being very heavily utilized and will typically be very congested and unstable.

On links (or street segments), the performance measures fall into three categories, including "Preferred", "Acceptable", and "Exceeds" standards. The performance measures are evaluated for both the 1<sup>st</sup> (peak) hour, and the 2<sup>nd</sup> (shoulder) hour. Depending on the facility category, the LOS standard for the first/second hours ranges from E/D to F/E.<sup>1</sup> The applicable performance threshold based on the City of Portland (or Port of Portland) facility being evaluated will be applied.

At intersections, the City of Portland and Port of Portland performance standard is LOS "D" at signalized intersections, and LOS "E" at unsignalized intersections, as found in their adopted PPD TRN-10.27.<sup>2</sup> This performance measure is generally used for development actions, however transportation projects in the City of Portland also strive to achieve these standards.

<sup>1</sup> City of Portland Transportation System Plan, Policy 11.13, Section D, Table 11.1. Adopted April 5, 2007.

<sup>2</sup> City of Portland, Transportation System Plan, section 11.13B, Adopted April 5, 2007, and further clarified in the Portland Policy Document, TRN-10.27, filed December 16, 2003.



### *Oregon Highway Plan*

The Oregon Department of Transportation applies performance measures that are defined in the Oregon Highway Plan. The performance measure is based on a V/C ratio for the facilities in the study area. Within the study area the ODOT facilities are the interchange intersections with Interstate 205, and the Columbia Boulevard/82nd Avenue north and southbound intersections. During the peak hour the standard for the interchange intersections with Interstate 205 is a 0.85 V/C ratio, and the standard for the Columbia Boulevard/82nd Avenue north and southbound intersections is a 0.99 V/C ratio.<sup>3</sup>

### **Land Uses**

A series of proposed land uses were assumed in the prior 2003 PDX CUMP for the Port of Portland. These land uses were approved by the City of Portland, mitigations have been assigned, and all of the required mitigations have been completed, or are currently in the process of being completed and are therefore assumed as part of the base planning horizon conditions. Due to the fact that the transportation analysis for the CUMP was set for a forecasted year of 2013, additional airport growth is now being proposed in Airport Futures to carry forward for future development to the planning horizon year of 2035.

Figure 3.2 shows the sub areas associated with the previous 2003 CUMP, and the following table shows the land uses assumed as part of the 2003 CUMP, and the proposed additional land use as part of this legislative land use action by sub area.

**Table 3-1**

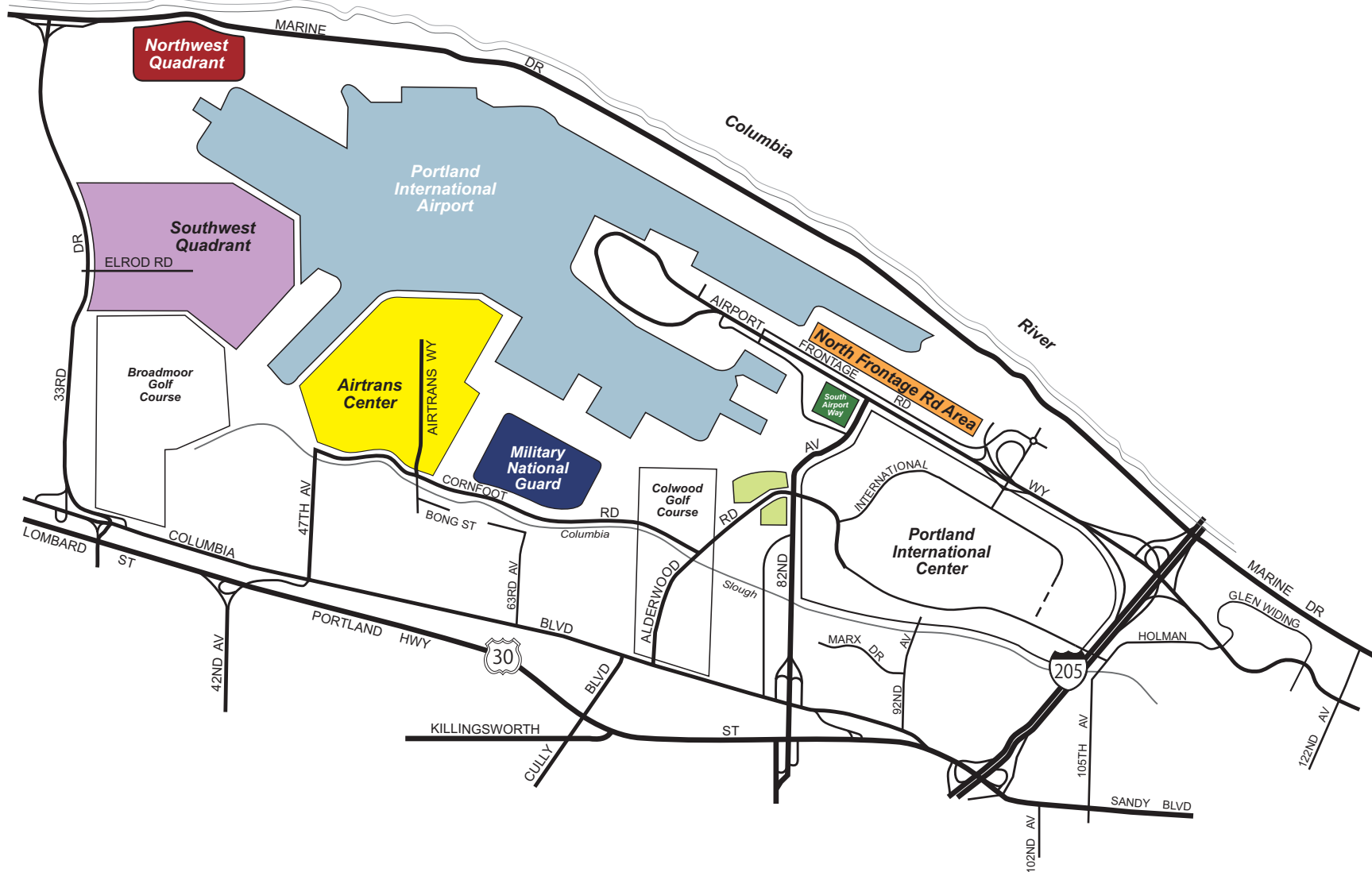
***Prior (2013) Approved and Planning Horizon (2035) Proposed Land Uses***

<b>Sub-Area</b>	<b>2003 CUMP Land Use</b>	<b>2035 Additional Land Use</b>
PDX Terminal	18.6 million annual passengers 300,000 sq. ft. office space	26.8 million annual passengers
AirTrans Center	151,500 sq. ft. air cargo	175,000 sq. ft. air cargo
Alderwood Area	26,500 sq. ft. light industrial 9,500 sq. ft. maintenance	-
North Frontage Road	103,000 sq. ft. business aviation 264,000 sq. ft. office/hotel 140,000 sq. ft. airside/air support	15,000 sq. ft. general aviation
Southwest Quadrant	103,000 sq. ft. business aviation 981,000 sq. ft. cargo facilities	-
Military/National Guard	-	-
South Airport Way	-	Compressed Natural Gas fueling facility
Northwest Quadrant	-	15,000 sq. ft. general aviation

**SOURCE:** Port of Portland

<sup>3</sup> 1999 Oregon Highway Plan, Table 7 "Maximum Volume to Capacity Ratios Inside Metro", page 84.





DKS Associates

## LEGEND

- Portland International Airport (PDX) Area
- Airtrans Center Area
- Alderwood Area
- North Frontage Road Area
- Southwest Quadrant Area
- Northwest Quadrant Area
- South Airport Way

N



MAP NOT  
TO SCALE

Information Sources: Port of Portland

## LAND USE SUB AREAS

FIGURE  
3.2

## Trip Generation

Based on the 2003 CUMP land use assumptions trip generation was conducted for each sub-area. This method of analysis conservatively treated each sub-area as if it would develop fully, rather than in balance with development in other sub-areas. For example, it has been assumed that significant business aviation development would occur in multiple sub-areas, regardless of the market demand for such development. The approach to estimating future trip generation within each sub-area was based upon a series of assumptions, specific to each land use type. Trip generation data was developed for each airport activity by using the *Institute of Transportation Engineering Trip Generation Handbook*, which incorporates nationwide research for similar land uses.<sup>4</sup> It should be noted that the land use data for the PDX terminal is in Million Annual Passengers (MAP). This information was also back verified based upon historical count data collected within the study area and local data where available. Table 3-2 summarizes this trip generation in comparison to the previous 2013 Conditional Use Master Plan.

**Table 3-2**

***PM Peak Hour Motor Vehicle Trip Forecasts for Prior (2013) and Planning Horizon (2035) Land Uses***

Sub Area	2013 Forecasted Trips	2035 Forecasted Trips
PDX Terminal	4,320	6,480
AirTrans Center	820	1,070
Alderwood Area	170	170
North Frontage Road	720	940
Southwest Quadrant	1,390	1,390
South Airport Way	-	190
Military/National Guard	360	360
Northwest Quadrant	-	220
<b>Airport Subtotal</b>	<b>7,780</b>	<b>10,820</b>

As Table 3-2 indicates, the planning horizon year has a number of additional motor vehicle trips (approximately 3,000 net new trips). This is due primarily to the increase in trips associated with passenger growth at the terminal due to the fact that the prior analysis was focused on the planning horizon of 2013 and the new planning horizon is now 2035. Growth in motor vehicle trips not associated with the terminal accounts for approximately 880 net new trips beyond levels assumed in 2013 for the PM peak hour.

As part of the TPR, one of the criteria to look at to determine if there would be a “significant affect” is to determine if the allowed land uses under the proposed amendment would increase the potential for impacts to the planned/surrounding transportation system when compared to the allowed land uses for the existing zoning. Currently the majority of the airport land uses are zoned as industrial land (with some employment, open space and residential uses) and comprises approximately 2,875 acres of land. Utilizing a trip generation rate for industrial land at that size would indicate that if the land were to be built out as industrial uses, it could generate up to 27,780 PM peak hour trips.<sup>5</sup> In comparison, the proposed legislative land use at Planning Activity Level 5 is expected to generate approximately 10,820

<sup>4</sup> *Trip Generation 8<sup>th</sup> edition*, Institute of Transportation Engineering.

<sup>5</sup> Land use and trip generation data supplied by the Port of Portland in a letter that was supplied to the Oregon Department of Transportation.

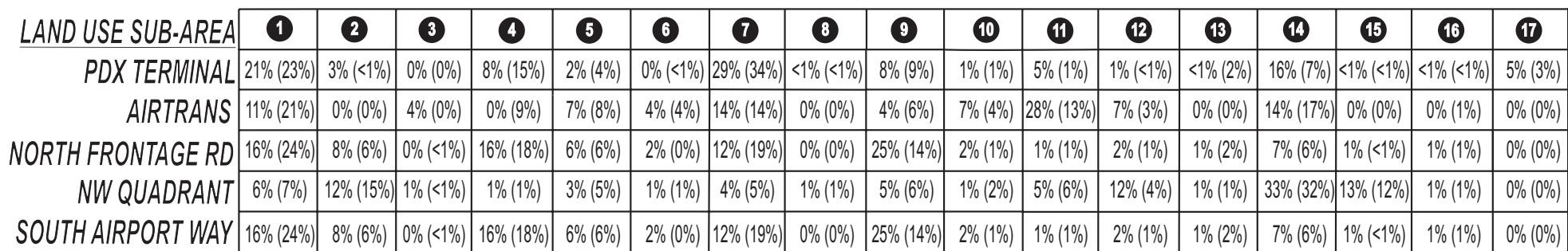


PM peak hour trips. This would indicate that the proposed zoning use would generate significantly less trips than if the land were to develop as primarily industrial use. Therefore the proposed land use would have less of an effect on the planned transportation network than the existing zoning and does not indicate a “significant affect”, as defined in the TPR.

### **Trip Distribution and Assignment**

Trip distribution represents the estimation and forecast of where trips go to and come from (their origin and destination). It is based upon predicted patterns from the Metro regional travel demand model. The base year for the Metro model is currently 2005, while the planning horizon year is 2035 (both of these models focus on the PM peak hour).

Trip distribution is represented as a percentage of the trips generated by a specific zone (or activity center) to surrounding zones, and vice versa. These zones represent the transportation activity within each activity center. Once the trip distribution is determined, trips are assigned along paths (roadways) that reflect the trip assignment on the regional network. The trip distribution assumptions can be seen in Figure 3.3.



- - Study Area Intersection
- ① - Gateway for vehicle trips to enter or exit the study area
- (X%) - Percent of vehicle trips In (Out) of Land Use sub-area to gateway



### FIGURE 3.3

## Future Traffic Forecasting

Forecasting the amount of future traffic at the intersections was done by using a methodology incorporating existing counts, base case travel demand model counts, and future travel demand model counts. This methodology minimized the effects of model error by adding the increment of growth projected between the base and future travel demand models to the base year counts. This methodology is shown in the following formula.

Figure 3.4: Future Traffic Forecasting Formula

$$\underbrace{\left( \begin{array}{cc} 2035 & 2005 \\ \text{Future Travel} & \text{Base Year} \\ \text{Model} & \text{Travel Model} \end{array} \right)}_{\text{Growth Increment in Models}} * \underbrace{\left( \frac{\left( \begin{array}{cc} \text{Planning} & \text{Existing} \\ \text{Horizon} & \text{Year} \end{array} \right)}{\left( \begin{array}{cc} \text{Future Year} & \text{Base Year} \\ \text{Model} & \text{Model} \end{array} \right)} \right)}_{\text{Factor between Existing Year and Base Model}} + \text{Existing Base Year Counts} = \text{Future Forecasted Volume}$$

Therefore, intersection approach and departure volumes used in the level-of-service and volume-to-capacity calculations have been adjusted and will not exactly match raw regional travel demand model volumes. Once the future 2035 volumes were developed, they were interpolated back to reflect 2022 conditions to forecast and analyze the interim planning horizon.

## Background and Growth Assumptions

Future traffic includes not only airport area growth, but also background regional growth. Background growth (non-airport area) was estimated using the Metro regional travel demand model for the years 2035 and 2005. The 2035 forecasted growth in traffic (subtracting out airport area uses) was compared to the existing 2005 model (subtracting out airport area uses) to determine background growth in traffic on roadways and at key intersections. The background growth included other uses that have been approved or constructed within the study area including the 2013 CUMP land uses, and the PIC which would generate approximately 2,000 net new trips for 2035 beyond levels assumed in 2013 for the PM peak hour. The future model was then adjusted to calibrate to growth levels for background traffic associated with 2013 CUMP and PIC. This growth was then reflected in the traffic analysis.

## Future Roadway Improvements

A number of improvements have been assumed to be in place by the planning horizon of 2035 to enhance the transportation network. These improvements have been identified through previous planning efforts, or through the Metro Regional Transportation Plan. The following table summarizes these improvements and what planning effort they are associated with.

**Table 3-3****Future Roadway/Intersection Planned Improvements within the Study Area**

Location	Description	Source
82nd Ave/Airport Way	Construct grade-separated overcrossing.	2035 Financially Constrained RTP
82nd Ave/Alderwood Rd	Exclusive right on southbound and westbound approaches. Extend southbound left and northbound right turn lane lengths. Construct additional westbound left.	FAA FONSI for Cascade Station/PIC, May 5, 2006 Port of Portland Airport CUMP
82nd Ave/Columbia Blvd (Southbound)	Signalize and modify southbound approach to have separate left and right turn pockets. Include two eastbound through lanes, one protected eastbound left-turn lane. Include one westbound through lane, one westbound through/right-turn lane.	2008-2011 STIP 2010-2013 Draft STIP Port Traffic Commitments Memo, Apr 26, 2006 Port of Portland Airport CUMP
Columbia Blvd from 60 <sup>th</sup> to 82 <sup>nd</sup> Ave	Widen Columbia Boulevard to five lanes.	2035 Financially Constrained RTP
Alderwood Rd/Cornfoot Rd	Signalized intersection and add southbound right-turn only lane; extend length of eastbound right turn lane.	Port Traffic Commitments Memo, Apr 26, 2006 FAA FONSI for Cascade Station/PIC, May 5, 2006
92nd Ave Improvement	Repair existing bridge and connect to Alderwood Road (includes bicycle and pedestrian improvements).	Port Traffic Commitments Memo, April 26, 2006
Alderwood Rd/92nd Avenue	All-way stop would be recommended if future analysis indicated that signal warrants are not met.	FAA FONSI for Cascade Station/PIC, May 5, 2006
Alderwood Rd/Mt. St. Helens	Signalize intersection	FAA FONSI for Cascade Station/PIC, May 5, 2006
Alderwood Rd/Holman/105th Ave	Signalize intersection	FAA FONSI for Cascade Station/PIC, May 5, 2006
105th Avenue/Sandy Boulevard	Add southbound left-turn lane	FAA FONSI for Cascade Station/PIC, May 5, 2006; Port of Portland Airport CUMP
Widen Airport Way West of 82nd	Widen Airport Way from terminal to 82nd Ave.	2035 Financially Constrained RTP
Airport Way/Frontage Road Access	Implement all way stop control or roundabout.	Port of Portland Airport CUMP
Airport Way Braided Ramps	Construct braided ramps between the I-205 interchange and Mt. Hood Interchange.	2035 Financially Constrained RTP
Airport Way/Holman Street	Add a northbound right-turn lane and extend northbound left-turn lane. Assuming split phasing is retained, modify lane configuration to provide shared left through lanes northbound and southbound in addition to the exclusive lefts.	FAA FONSI for Cascade Station/PIC, May 5, 2006 Port of Portland Airport CUMP
Airport Way/ 122nd Ave	Add second northbound left turn, second southbound through lane, minor extension of southbound left turn, adjust signal timing to be 120 second cycle length with southbound right turn overlap phase.	Port Traffic Commitments Memo, Apr 26, 2006 FAA FONSI for Cascade Station/PIC, May 5, 2006 Port of Portland Airport CUMP 2035 Financially Constrained RTP

**SOURCE:** Port of PortlandCity of Portland Bureau of  
Planning and Sustainability
PORT OF PORTLAND  
Possibility. In every direction.

## Airport Growth Alternatives

There are two different growth scenarios associated with PDX for the 2035 planning horizon year. These two growth scenarios have been developed as part of the Airport Futures Master Plan update and represent a mid-level growth (50th Percentile probabilistic forecast) and an aggressive growth (90th Percentile probabilistic forecast) scenario. The “50 Percent” scenario assumes a future passenger growth by 2035 of approximately 26.8 million annual passengers (MAP), while the “90 Percent” aggressive growth scenario assumes approximately 42.6 MAP.<sup>6</sup>

For the purposes of this transportation impact analysis the “50 Percent” growth scenario will serve as the baseline scenario in the future and will be used for detailed intersection analysis. The “90 Percent” aggressive growth scenario will be utilized as a comparative scenario to evaluate roadway capacities in comparison to the “50 Percent” growth scenario.

In addition to the growth scenarios noted above, there are two future passenger terminal growth scenarios associated with the “90 Percent” forecast. These two scenarios are known as “Centralized”, which is characterized by all future passenger processing being served by a single centralized access point via Airport Way; and “Decentralized” which is characterized by a second new terminal located on the south side of the airport with a new, separate access road to serve it. Preliminary assessment of differences between the Centralized and Decentralized terminals was conducted utilizing the Metro Regional Travel Demand Model (shown in Figures 3.4 and 3.5), and it was determined that differences in roadway capacities were only experienced primarily on airport property and by the time motor vehicle trips were outside of the immediate terminal area similar affects on the regional roadway system were experienced. For that reason, it was concluded that there is no reason to favor one of these future alternatives over the other in terms of its impacts on the regional transportation system. Based on a separate Airport Futures decision to concentrate on the Centralized Alternative the Decentralized Alternative was removed from further analysis.

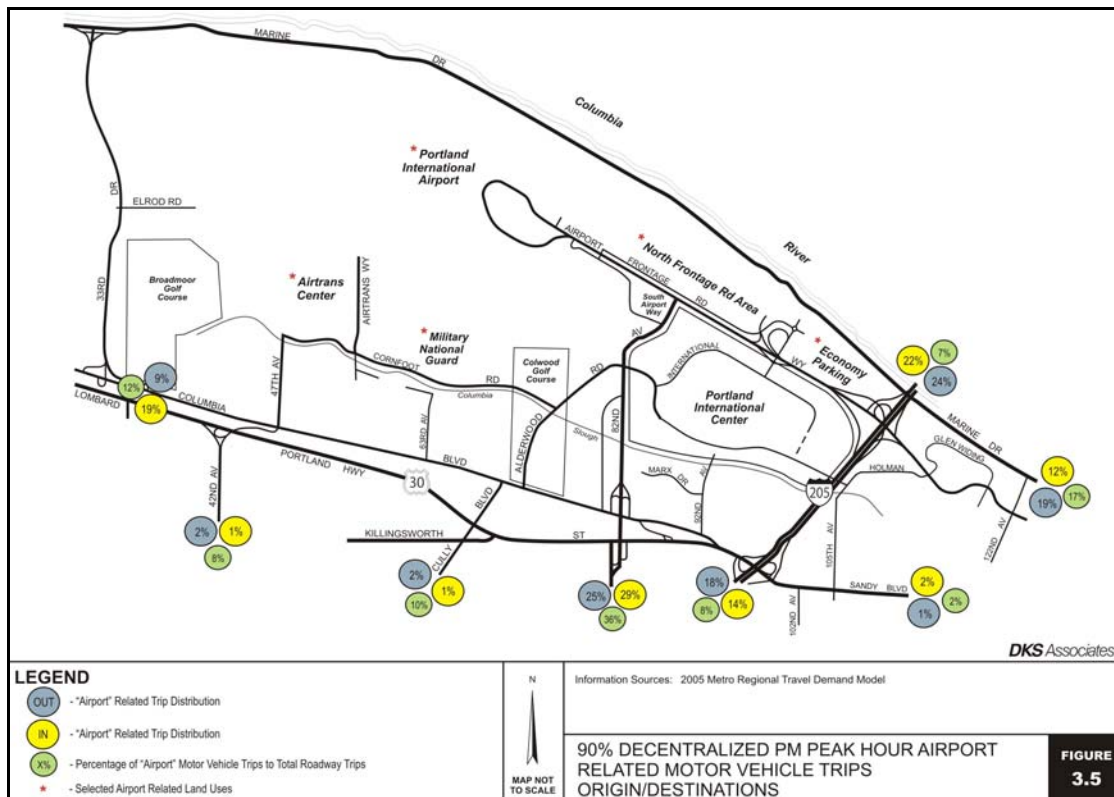
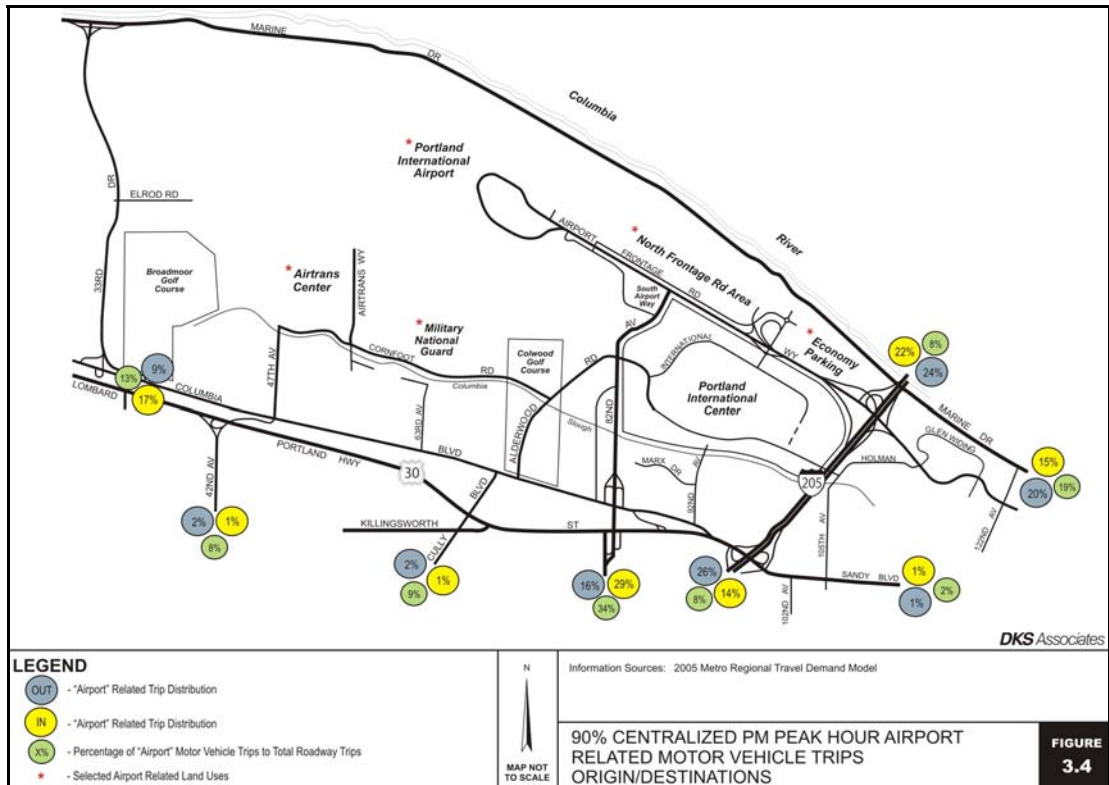
## Mitigation Criteria

Mitigation measures or facility improvements will be identified where future conditions do not meet the identified performance measures set forth by the City of Portland and the Oregon Department of Transportation for intersection operations. In situations where the facility is not meeting the established performance standards under No Build conditions, the facility will be mitigated if it has a significant impact under Build conditions based on an additional 10 seconds of delay and/or an increase of 0.05 V/C ratio or more beyond No Build conditions. In these cases, the improvements will try to mitigate the significant impacts, at a minimum.

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<sup>6</sup> Growth scenarios documented in Airport Futures Master Plan, Technical Memorandum No. 2 – Aviation Demand Forecasts, September 2008.





### Passenger Mode Choice Sensitivity Analysis

Additional analysis was done for the 2035 planning horizon to evaluate the sensitivity of the PDX terminal passenger mode choice in accessing the terminal. This assesses how certain variables such as parking pricing, travel time to and from the terminal, auto operating costs, and frequent (or free) transit service may shift users travel choices between the options of drive and park, pick-up/drop-off, taxi, rental car, shuttle or transit. In addition, this testing was used to help determine the types of conditions necessary to achieve a transit share that is slightly over double the current transit share. The following summarizes these testing/sensitivity results.

A series of initial sensitivity testing was conducted related to parking costs, roadway congestion, auto operating costs, taxi fares, and frequency of transit service. The following table summarizes the potential shift among existing passenger mode choices given different condition or policy changes.

**Table 3-4**

**Existing Passenger Mode Choice Sensitivity to Conditions and/or Policy Changes**

Passenger Choice	Existing	Condition / Policy Changes					
		Double Parking Cost	Motor Vehicle Congestion (Double Travel Time)	Double Auto Operating Costs (Fuel, etc.)	Double Taxi Fare	Frequent Service Transit (Halve Wait Time)	Free Transit
Drive and Park	34%	-19%	+3%	+1%	+1%	-1%	0%
Pick-up/Drop-off	33%	+17%	-8%	-3%	+1%	0%	0%
Taxi/Limo/Town Car	6%	+1%	0%	0%	-3%	0%	0%
Rental Car	17%	0%	0%	+1%	+1%	0%	0%
Shuttle	4%	0%	0%	0%	0%	0%	0%
Transit	6%	+2%	+5%	0%	0%	+1%	+1%

Based on the potential condition or policy changes the biggest shift in passenger mode choices comes when parking costs are doubled, however it is nearly a one for one shift from drive and park to pick-up/drop off which would still represent a motor vehicle trip to/from the airport terminal. Under this condition there was a minor shift to taxi/limo/town car and transit as well.

The other largest potential shift in passenger mode choice is increased congestion. A test on sensitivity was conducted where motor vehicle travel times were doubled in the future. This shifted 8% pick-up/drop-off trips to drive and park (approximately 3%) and transit (approximately 5%). Again, the shift from pick-up/drop-off to drive and park does not represent a reduction in potential motor vehicle trips to/from the terminal.



With such a large potential shift in from drive and park to pick-up/drop-off, additional sensitivity to parking costs was tested. The following summarizes the sensitivity for parking costs.

**Table 3-5**  
**Existing Passenger Mode Choice Sensitivity to Parking Pricing**

Passenger Choice	Existing	Parking Charge Increase				
		+10%	+25%	+50%	Double	Triple
Drive and Park	34%	-3%	-7%	-13%	-20%	-24%
Pick-up/Drop-off	33%	+3%	+6%	+11%	+17%	+21%
Taxi/Limo/Town Car	6%	0%	0%	+1%	+1%	+1%
Rental Car	17%	0%	0%	0%	0%	0%
Shuttle	4%	0%	0%	0%	0%	0%
Transit	6%	0%	+1%	+1%	+2%	+2%

Similar to previous sensitivity testing, various levels of parking charge increases has the highest effect of shifting drive and park trips to pick-up/drop-off trips, but no major change to the potential number of motor vehicles trips on the surrounding roadway occurs.

Sensitivity testing was also conducted to try and achieve a passenger mode choice for transit in the range of 12-15%. This range was selected because it would be more than double the current transit passenger choice (6%), and the upper range would be 1% higher than the current highest transit passenger mode choice for an airport in the United States. In order to accomplish this transit passenger mode choice some variables were changed.

- Motor vehicle congestion and auto operating costs were increased by 20%
- Parking costs were doubled
- Transit service was at a high frequency and free.

Many of these variables are outside the realm of control of the Port of Portland. The following summarizes the sensitivity for transit.

**Table 3-6**  
**Existing Passenger Mode Choice Sensitivity for Transit**

Passenger Choice	Existing	Mode Change	Projected Mode Share
Drive and Park	34%	-18%	16%
Pick-up/Drop-off	33%	+11%	44%
Taxi/Limo/Town Car	6%	0%	6%
Rental Car	17%	0%	17%
Shuttle	4%	0%	4%
Transit	6%	+7%	13%

# CHAPTER

# 4

## FUTURE CONDITIONS

The following chapter summarizes the future PM peak hour transportation operating conditions for the planning horizon year of 2035. In addition to the planning horizon year, an interim year of 2022 has been selected for PM peak hour operational analysis to help prioritize the level of importance of future impacts to the transportation infrastructure. The analysis in this chapter focuses on all modes of travel with quantitative evaluation for motor vehicle operation and qualitative descriptions for alternative modes of travel.

### Pedestrian and Bicycle Conditions

Based on the existing pedestrian and bicycle network within the study area there are many connectivity gaps identified (see Chapter 2 for existing pedestrian facilities figure). The Port of Portland has identified locations for pedestrian and bicycle facility improvements to help facilitate increased connectivity in the study area.<sup>1</sup> Figure 4-1 identifies the locations and types of pedestrian and bicycle improvements the Port of Portland has identified. Except for those facilities associated with the future expansion of the passenger terminal, it is assumed that the current Port pedestrian and bicycle plan will be fully implemented by 2035 (and it is likely these improvements would be in place by the interim planning horizon of 2022 as well).

Table 4-1 shows the existing (year 2005) and future (year 2035) mode share projected by Metro in the Regional Travel Demand Model for pedestrian and bicycle modes. These mode shares reflect regional model inputs and account for future improvements to the surrounding roadway network/infrastructure.

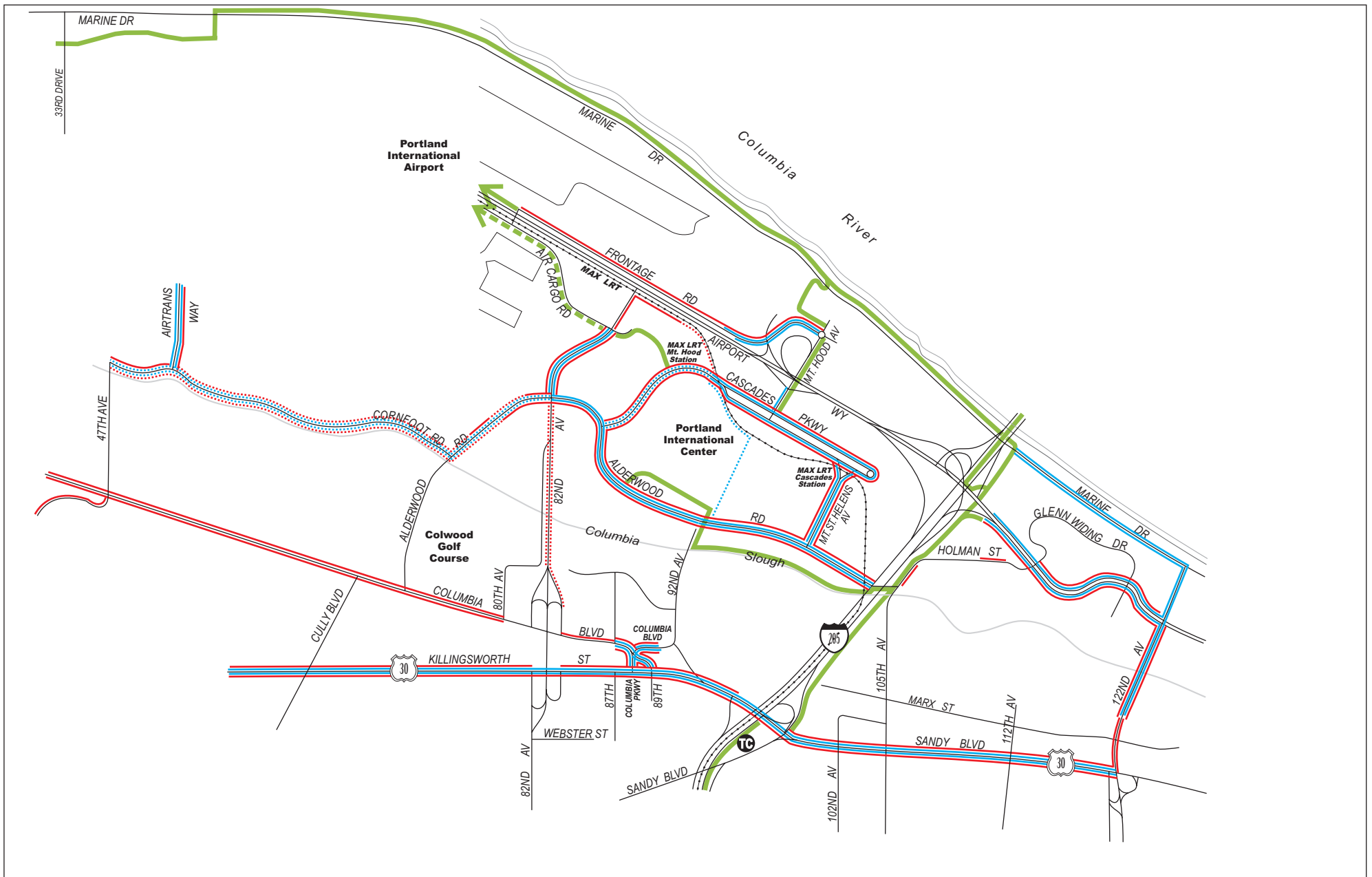
**Table 4-1 PM Peak Hour Regional Travel Demand Model Existing (2005) and Future (2035) Pedestrian/ Bicycle Mode Share**

Area	2005		2035		Delta (2035 – 2005)	
	In Trip %	Out Trip %	In Trip %	Out Trip %	In Trip %	Out Trip %
PDX Terminal	0.5%	0.5%	0.5%	0.5%	0%	0 %
Airtrans/SW Quad	1.5%	1.1%	1.7%	1.4%	+ 0.2%	+ 0.3%
NW Quad	0.7%	0.5%	0.8%	0.6%	+ 0.1%	+ 0.1%
Military National Guard	0.8%	0.6%	1.0%	0.7%	+ 0.2%	+ 0.1%
North Frontage Road	0.7%	0.4%	0.9%	0.5%	+ 0.2%	+ 0.1%
PIC	0.7%	0.4%	1.4%	0.8%	+ 0.7%	+ 0.4%

**SOURCE:** 2005/2035 Metro Regional Travel Demand Models.

<sup>1</sup> Portland International Airport Bicycle and Pedestrian Plan, Port of Portland





#### LEGEND

- - Existing Sidewalks
- - Existing Bike Lane (Includes 5' or Wider Shoulders)
- - Multi-Use Path
- ⋯ - Proposed Pedestrian Facility
- ⋯ - Proposed Bike Facility
- - Proposed Multi-Use Path

N

MAP NOT TO SCALE

Information Sources: Port of Portland

It is likely that the Port of Portland would participate in developing proposed pedestrian/bicycle facilities that abut Port properties when these properties or streets redevelop.

## FUTURE PEDESTRIAN & BICYCLE FACILITIES

**FIGURE 4-1**

In addition to the immediate airport area, a review of the primary study area was done to determine on average what the walk/bike mode share change is in the regional travel demand model from 2005 to 2035 (during the PM peak hour). The regional model indicated that the walk/bike mode share during 2005 was approximately 1.2% (combined in/out), and the 2035 mode share was approximately 1.5% making a growth of approximately 0.3% over the 30 years.

## Transit Conditions

The introduction of MAX to service the PDX terminal has had an effect on the existing and potential future transit mode share. Table 4-2 shows the existing (year 2005) and future (year 2035) transit mode share by study area sub-area.

**Table 4-2**

***Regional Travel Demand Model Existing (2005) and Future (2035) Transit Mode Share by Area***

Area	2005		2035		Delta (2035 – 2005)	
	In Trip %	Out Trip %	In Trip %	Out Trip %	In Trip %	Out Trip %
PDX Terminal	8.6%	6.4%	9.7%	8.4%	+ 1.1%	+ 2.0 %
Airtrans/SW Quad	0.0%	0.0%	0.0%	0.0%	0%	0%
NW Quad	0.8%	1.6%	1.2%	2.9%	+ 0.4%	+ 1.3%
Military National Guard	0.2%	0.9%	0.3%	1.7%	+ 0.1%	+ 0.8%
North Frontage Road	2.1%	3.7%	2.8%	5.6%	+ 0.7%	+ 1.9%
PIC	1.4%	2.8%	3.2%	7.3%	+ 1.8%	+ 4.5%

**SOURCE:** 2005/2035 Metro Regional Travel Demand Models.

The increase in transit out trips for the future 2035 mode share is related to a combination of MAX service and full build out of the PIC area. Typically higher “out trips” are experienced from “employment” or non-home related land uses, like those that exist for the terminal, north frontage road and PIC areas. Similar to the pedestrian and bicycle mode share, the transit mode share reflects regional model inputs and account for future expansion of the regional transit system.

A review of the primary study area was also done to explore the change in transit mode share from the 2005 to 2035 planning horizon year. The existing mode share was approximately 2.0%, while the future mode share was approximately 3.7% resulting in a growth in transit mode share over 35 years of approximately 1.7% during the PM peak hour.

## Motor Vehicle Conditions

Future volumes at intersections are comprised of trips generated in a variety of different land uses as well as existing and background volumes. Based on the methodology described earlier (Chapter 3), future vehicle forecasts were developed for study area intersections. These intersections were evaluated using the 2000 Highway Capacity Methodology for traffic operations. Both the interim 2022 and 2035 planning horizon years were evaluated for the PM peak hour operations. Each planning horizon was evaluated for a “No-build” and “Build” condition. The build condition assumed additional land uses associated with the airport area as proposed in Chapter 3. Comparison of these two conditions allows for an evaluation to determine where additional proposed land uses may have impacts beyond those already forecasted under the No-build conditions.



## 2022 Planning Horizon

The planning horizon of 2022 was selected to represent an interim year of analysis to help identify impacts at intersections before the 2035 planning horizon, and to help prioritize potential improvements to be made. The No-build scenario in this interim year (2022) assumes a terminal activity level of 18.6 Million Annual Passengers (MAP) and approximately 53% of the forecasted growth in background traffic. In contrast, the Build scenario assumes a 21.0 MAP for the terminal and similarly approximately 53% of the forecasted growth in background traffic and proposed land uses. The 53% level of activity correlates to when 2022 occurs between 2007 (existing) and 2035 (future). Figure 4-2 shows the future 2022 intersection operations at study area intersections for both the No-build and Build scenarios.

In addition to the results in Figure 4-2, the following Table summarizes the total change in either delay (the component that determines level-of-service) or volume-to-capacity at each intersection. This helps to portray how much impact the build scenario has at an intersection compared to the No-build scenario.

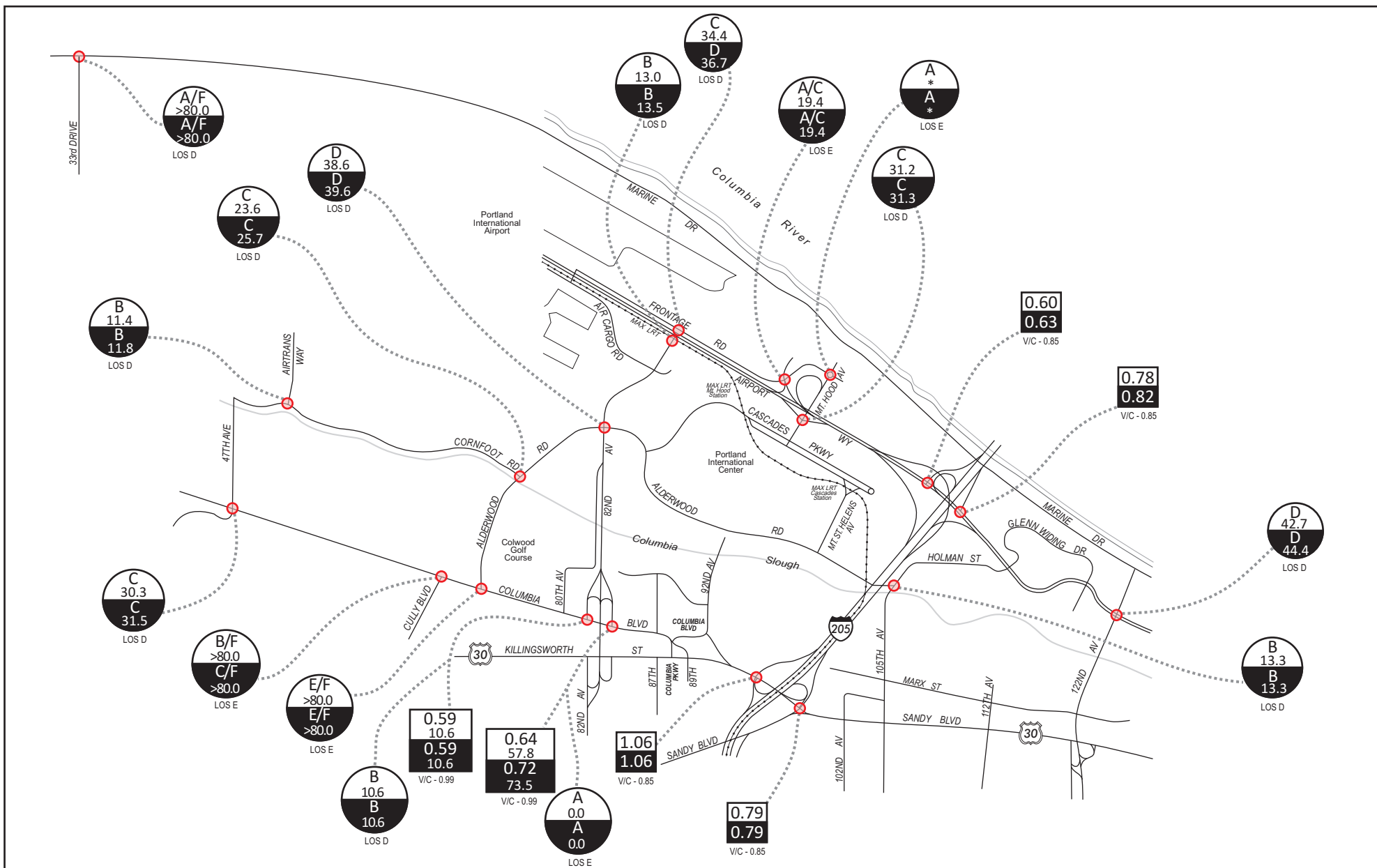
**Table 4-3**

### 2022 PM Peak Hour Change in Operations Between No-Build and Build at Study Area Intersections

Intersection	Mobility Standard	No-Build Meets Standard?	Build Meets Standard?	Change in Operations (Build – No Build)
82 <sup>nd</sup> Avenue/Airport Way westbound	LOS D	Yes	Yes	no change
82 <sup>nd</sup> Avenue/Airport Way eastbound	LOS D	Yes	Yes	+ 3 seconds
Airport Way eastbound/Mt Hood Avenue	LOS D	Yes	Yes	no change
Airport Way Frontage Rd/Airport Way westbound	LOS E	Yes	Yes	no change
Airport Way Frontage Rd/Mt Hood Avenue	LOS E	Yes	Yes	no change
Airport Way/I-205 southbound	0.85 V/C	Yes	Yes	+ 0.03 V/C ratio
Airport Way/I-205 northbound	0.85 V/C	Yes	Yes	+ 0.04 V/C ratio
Airport Way/122 <sup>nd</sup> Avenue	LOS D	Yes	Yes	+ 1 second
82 <sup>nd</sup> Avenue/Alderwood Road	LOS D	Yes	Yes	+ 1 second
Alderwood Road/Cornfoot Road	LOS D	Yes	Yes	+ 2 seconds
Cornfoot Road/Airtrans Way	LOS D	Yes	Yes	+ 1 second
Columbia Boulevard/47 <sup>th</sup> Avenue	LOS D	Yes	Yes	+ 1 second
Columbia Boulevard/Cully Boulevard	LOS E	No	No	> 80 seconds
Columbia Boulevard/Alderwood Road	LOS E	No	No	> 80 seconds
Columbia Boulevard/82 <sup>nd</sup> Avenue southbound	0.99 V/C, LOS D	Yes	Yes	no change
Columbia Boulevard/82 <sup>nd</sup> Avenue northbound	0.99 V/C, LOS E	Yes	Yes	+ 0.08 V/C ratio/ +16 seconds
Killingsworth Street/I-205 southbound	0.85 V/C	No	No	no change
Killingsworth Street/I-205 northbound	0.85 V/C	Yes	Yes	no change
Alderwood Road/Holman Road	LOS D	Yes	Yes	no change
Marine Drive/33 <sup>rd</sup> Avenue	LOS E	No	No	+ 28 seconds

Indicates an intersection under the Build condition that has an impact beyond the No Build condition based on an additional 10 seconds of delay and/or an increase of 0.05 V/C ratio or more.

**SOURCE:** DKS Associates, Synchro.



## LEGEND

Red circle - Study Area Intersection

## Unsignalized Intersection

X/X - Major Street LOS/Minor Street LOS

## Signalized Intersection

X - Major Street LOS/Minor Street LOS

X.XX - Volume-to-Capacity Ratio

## City of Portland/Port of Portland Intersection

X - No-Build Level-of-Service (LOS)

X - Build Level-of-Service (LOS)

STANDARD

## ODOT Intersection

X.XX - No-Build Volume-to-Capacity (V/C) Ratio

X.XX - Build Volume-to-Capacity (V/C) Ratio

STANDARD

N

MAP NOT TO SCALE

Information Sources: DKS Associates

\* - No delay calculated for intersection

**FUTURE 2022 NO-BUILD AND BUILD  
PM PEAK HOUR OPERATIONS**

**FIGURE  
4-2**

Based on the results in Table 4-3, there are four intersections that have an additional impact beyond those intersections that do meet standard under the No-build scenario. However, one of these intersections (NE Columbia Blvd/NE 82nd Ave) meets jurisdictional standards both under the No-build and Build conditions and therefore does not have a significant impact under the Build conditions. The following intersections fall into the category of significant impact and should be considered for mitigation in the future.

- NE Columbia Boulevard/NE Alderwood Road
- NE Columbia Boulevard/NE Cully Boulevard
- NE Marine Drive/NE 33<sup>rd</sup> Avenue

It should be noted that if the land uses in the northwest quadrant near the intersection of NE Marine Drive/NE 33<sup>rd</sup> Avenue are not included in this analysis for the planning horizon of 2022, then there is no significant impact at the NE Marine Drive/NE 33<sup>rd</sup> Avenue intersection.

## 2035 Planning Horizon

### Link Capacity Analysis

To help determine potential impacts to the regional transportation network, the 2035 regional travel demand model was used to assess the roadway (link) capacities experienced in both the primary and secondary study areas on key arterials. This review of roadway capacities is aimed at determining if the build scenario has an influence on potential roadway capacities and the ability to service vehicular access to/from the airport areas. The following table summarizes the No-build and Build roadway volume-to-capacity ratios at these key locations.

**Table 4-4**

**2035 PM Peak Hour Volume-to-Capacity Ratios on Key Roadways for No-build and Build Scenarios**

Roadway/Location	Study Area	Direction	No-Build V/C Ratio	Build V/C Ratio	Change in V/C Ratio
Airport Way west of 82 <sup>nd</sup> Ave	Primary	Eastbound	0.37	0.60	+ 0.23
		Westbound	0.35	0.58	+ 0.23
Airport Way east of 82 <sup>nd</sup> Ave	Primary	Eastbound	0.59	0.73	+ 0.14
		Westbound	0.46	0.56	+ 0.10
Airport Way east of I-205	Primary	Eastbound	0.78	0.80	+ 0.02
		Westbound	1.10	1.12	+ 0.02
82 <sup>nd</sup> Ave south of Airport Way	Primary	Northbound	0.81	0.97	+ 0.16
		Southbound	0.25	0.40	+ 0.15
82 <sup>nd</sup> Ave north of Columbia Blvd	Primary	Northbound	0.47	0.57	+ 0.10
		Southbound	0.25	0.37	+ 0.12
Interstate 205 north of Marine Drive	Primary	Northbound	1.20	1.21	+ 0.01
		Southbound	0.53	0.54	+ 0.01
I-205 north of Killingsworth St	Primary	Northbound	1.08	1.10	+ 0.02
		Southbound	0.68	0.69	+ 0.01
Columbia Blvd east of 82 <sup>nd</sup> Ave	Primary	Eastbound	0.74	0.76	+ 0.02
		Westbound	0.34	0.36	+ 0.02



Roadway/Location	Study Area	Direction	No-Build V/C Ratio	Build V/C Ratio	Change in V/C Ratio
Columbia Blvd west of 82 <sup>nd</sup> Ave	Primary	Eastbound	0.89	0.92	+ 0.03
		Westbound	0.36	0.39	+ 0.03
Columbia Blvd west of 47 <sup>th</sup> Ave	Primary	Eastbound	0.84	0.87	+ 0.03
		Westbound	0.58	0.59	+ 0.01
Killingsworth St west of 82 <sup>nd</sup> Ave	Primary	Eastbound	0.96	0.98	+ 0.02
		Westbound	0.75	0.75	+ 0.00
Cornfoot Rd west of Alderwood Rd	Primary	Eastbound	0.88	0.94	+ 0.06
		Westbound	0.33	0.34	+ 0.01
47 <sup>th</sup> Ave south of Cornfoot Rd	Primary	Northbound	0.88	0.97	+ 0.09
		Southbound	0.44	0.47	+ 0.03
Alderwood Rd west of 82 <sup>nd</sup> Ave	Primary	Eastbound	1.37	1.46	+ 0.09
		Westbound	0.80	0.83	+ 0.03
122 <sup>nd</sup> Ave south of Airport Way	Primary	Northbound	0.37	0.38	+ 0.01
		Southbound	0.48	0.50	+ 0.02
33 <sup>rd</sup> Ave near Elrod Rd	Primary	Northbound	0.31	0.33	+ 0.02
		Southbound	0.34	0.34	+ 0.00
Marine Drive east of 33 <sup>rd</sup> Ave	Primary	Eastbound	1.10	1.13	+ 0.03
		Westbound	0.45	0.45	+ 0.00
Cully Blvd south of Killingsworth St	Secondary	Northbound	0.33	0.37	+ 0.04
		Southbound	0.42	0.43	+ 0.01
82 <sup>nd</sup> Ave south of Killingsworth St	Secondary	Northbound	0.68	0.73	+ 0.05
		Southbound	0.82	0.88	+ 0.06
42 <sup>nd</sup> Ave south of Killingsworth St	Secondary	Northbound	0.58	0.58	+ 0.00
		Southbound	0.76	0.76	+ 0.00
33 <sup>rd</sup> Ave south of Killingsworth St	Secondary	Northbound	0.37	0.42	+ 0.05
		Southbound	0.47	0.47	+ 0.00
148 <sup>th</sup> Ave south of Airport Way	Secondary	Northbound	0.30	0.31	+ 0.01
		Southbound	0.57	0.58	+ 0.01
Sandy Blvd west of I-205	Secondary	Eastbound	0.71	0.73	+ 0.02
		Westbound	0.37	0.40	+ 0.03
Prescott St west of 82 <sup>nd</sup> Ave	Secondary	Eastbound	0.86	0.88	+ 0.02
		Westbound	0.46	0.54	+ 0.08
MLK Jr. Blvd south of Lombard St	Secondary	Northbound	0.56	0.56	+ 0.00
		Southbound	0.26	0.27	+ 0.01
MLK Jr. Blvd north of Columbia Blvd	Secondary	Northbound	0.67	0.69	+ 0.02
		Southbound	0.43	0.44	+ 0.01
Lombard St west of 33 <sup>rd</sup> Ave	Secondary	Eastbound	0.74	0.75	+ 0.01
		Westbound	0.64	0.66	+ 0.02
Lombard St east of 33 <sup>rd</sup> Ave	Secondary	Eastbound	0.94	0.95	+ 0.01
		Westbound	0.76	0.77	+ 0.01

**SOURCE:** 2005/2035 Metro Regional Travel Demand Model, PM peak hour.

Based on the results of the roadway (link) capacity analysis, all roadways that are over capacity (over 1.0 V/C ratio) under the No-build scenario are still over capacity under the Build scenario, and the Build scenario does not create any new additional roadways to become over capacity. The largest increase in capacity between the No-build and Build scenarios for roadways that are over 1.0 V/C ratio occurs in the



eastbound direction of NE Alderwood Road approaching NE 82<sup>nd</sup> Avenue where there is a 9% increase in vehicle capacity on NE Alderwood. This is presumably due to additional trips from both the AirTrans Center and terminal trips. All other changes to roadway capacities are minimal at 0.02 or less during the PM peak hour.

Table 4-4 summarizes only the 1st (peak) hour for all key roadways. As noted in the table, five roadway segments fall over the 1.0 V/C ratio that is noted in Table 11.1 of the City's TSP. Three of the locations that are over capacity (Airport Way east of I-205, Alderwood Road west of 82nd Avenue, and Marine Drive east of 33rd Avenue) are further analyzed in the intersection analysis to determine appropriate mitigations for demonstrated deficiencies. The remaining two roadway segments are not analyzed further, as they are on I-205 proper and there are no control points along the Interstate freeway system.

### *Intersection Analysis*

Similar to the 2022 PM peak hour analysis, the study area intersection operations were evaluated for both the No-build and Build scenarios to determine if the Build scenario caused any addition intersections to not meet jurisdictional standard beyond those that met the standards under the No-build scenario. Figure 4-3 shows the future 2035 intersection operations at study area intersections for both the No-build and Build scenarios.


In addition to the results in Figure 4-3, the following table summarizes the total change in either delay (the component that determines level-of-service) or volume-to-capacity at each intersection. This helps to portray how much impact the build scenario has at an intersection compared to the No-build scenario.

**Table 4-5**

### **2035 PM Peak Hour Change in Operations Between No-Build and Build at Study Area Intersections**

Intersection	Mobility Standard	No-Build Meets Standard?	Build Meets Standard?	Change in Operations (Build – No Build)
82 <sup>nd</sup> Avenue/Airport Way westbound	LOS D	Yes	Yes	no change
82 <sup>nd</sup> Avenue/Airport Way eastbound	LOS D	Yes	Yes	+ 9 seconds
Airport Way eastbound/Mt Hood Avenue	LOS D	Yes	Yes	+ 1 second
Airport Way Frontage Rd/Airport Way westbound	LOS E	Yes	Yes	no change
Airport Way Frontage Rd/Mt Hood Avenue	LOS E	Yes	Yes	no change
Airport Way/I-205 southbound	0.85 V/C	Yes	Yes	+ 0.11 V/C ratio
Airport Way/I-205 northbound	0.85 V/C	No	No	+ 0.11 V/C ratio
Airport Way/122 <sup>nd</sup> Avenue	LOS D	No	No	+ 20 seconds
82 <sup>nd</sup> Avenue/Alderwood Road	LOS D	No	No	+ 19 seconds
Alderwood Road/Cornfoot Road	LOS D	Yes	Yes	+ 22 seconds
Cornfoot Road/Airtrans Way	LOS D	Yes	Yes	+ 12 seconds
Columbia Boulevard/47 <sup>th</sup> Avenue	LOS D	Yes	Yes	+ 8 seconds
Columbia Boulevard/Cully Boulevard	LOS E	No	No	> 80 seconds

Intersection	Mobility Standard	No-Build Meets Standard?	Build Meets Standard?	Change in Operations (Build – No Build)
Columbia Boulevard/Alderwood Road	LOS E	No	No	> 80 seconds
Columbia Boulevard/82 <sup>nd</sup> Avenue southbound	0.99 V/C/ LOS D	Yes	Yes	+ 0.03 V/C ratio/ +2 seconds
Columbia Boulevard/82 <sup>nd</sup> Avenue northbound	0.99 V/C/ LOS E	No	No	+ 1.08 V/C ratio/ > 80 seconds
Killingsworth Street/I-205 southbound	0.85 V/C	No	No	+ 0.03 V/C ratio
Killingsworth Street/I-205 northbound	0.85 V/C	No	No	no change
Alderwood Road/Holman Road	LOS D	Yes	Yes	no change
Marine Drive/33 <sup>rd</sup> Avenue	LOS E	No	No	> 80 seconds

 - Indicates an intersection under the Build condition that has an impact beyond the No Build condition based on an additional 10 seconds of delay and/or an increase of 0.05 V/C ratio or more.

**SOURCE:** DKS Associates, Synchro.

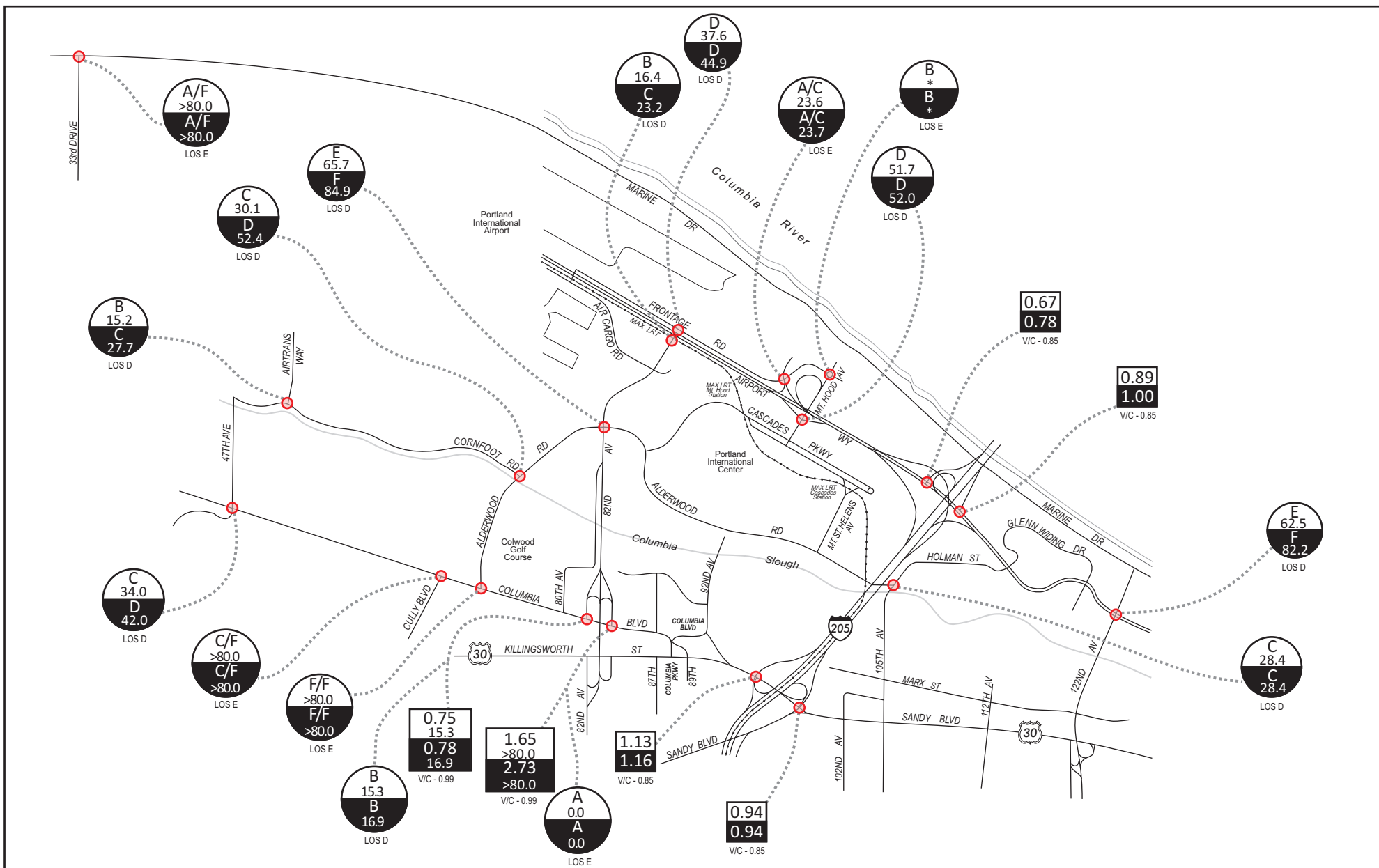
Based on the results in Table 4-5, there are ten intersections that fall into the criteria of having an increase of delay of 10 seconds or more, or an increase in V/C ratio of 0.05 or more. However, three of these intersections meet jurisdictional standards both under the No-build and Build conditions and therefore do not have a significant impact with the Build condition. The following seven intersections meet the significant impact criteria and should be considered for mitigation in the future:

- NE Airport Way/Interstate 205 northbound on-ramp
- NE Airport Way/NE 122<sup>nd</sup> Avenue
- NE 82<sup>nd</sup> Avenue/NE Alderwood Road
- NE Columbia Boulevard/NE Cully Boulevard
- NE Columbia Boulevard/NE Alderwood Road
- NE Columbia Boulevard/NE 82<sup>nd</sup> Avenue Northbound
- NE Marine Drive/NE 33<sup>rd</sup> Avenue

It should be noted that if the land uses in the northwest quadrant near the intersection of NE Marine Drive/NE 33<sup>rd</sup> Avenue are not included in this analysis for the 2022 and 2035 planning horizons, then there is no significant impact at the NE Marine Drive/NE 33<sup>rd</sup> Avenue intersection.

It is also expected that intersections that had a significant impact under the 2022 planning horizon and would require mitigation would be able to meet jurisdictional standard by 2035 and may not require additional mitigation. Of the seven intersections that show having a significant impact by 2035, three of these intersections are included in the 2022 planning horizon as having a significant impact. Therefore there would be four additional intersections by 2035 that would require additional mitigation.





Information Sources: DKS Associates

\* - No delay calculated for intersection

## FUTURE 2035 NO-BUILD AND BUILD PM PEAK HOUR OPERATIONS

**FIGURE  
4-3**

# CHAPTER

# 5

## RECOMMENDATIONS

The following chapter summarizes the potential recommendations to mitigate identified impacts associated with the proposed growth for Port facilities at intersections for both the immediate planning horizon of 2022, as well as identifying potential solutions for the longer term planning horizon of 2035.

The potential recommendations have been categorized into the two planning horizon periods because the shorter planning horizon of 2022 represents a time period where required mitigation would most likely be implemented, while the longer planning horizon helps to identify intersections that may need potential solutions further out and should be monitored and updated in the future depending on the rate at which the Port facilities may grow. For this reason, detailed mitigation has been developed for the shorter 2022 planning horizon, while potential strategies are outlined (but not detailed) for the longer 2035 planning horizon.

### **2022 Planning Horizon**

Each of the three intersections that were identified as having an impact based on projected growth from Port facilities by the planning horizon of 2022 was evaluated during the PM peak hour to determine potential mitigation strategies to achieve governing jurisdictional standards. In addition, the No-build conditions for the same planning horizon were evaluated to determine if mitigation even without the project would be necessary to meet jurisdictional standard. The two sets of mitigation were then compared to determine if the Build condition would require any additional mitigation beyond that which would be necessary under the No-build condition (if mitigation was necessary). The following outlines this analysis for each individual intersection.

#### *NE Columbia Boulevard/NE Cully Boulevard*

This intersection fails in the future under both the No-build and Build conditions due to significant delay on the side street which is stop controlled, caused from heavy volumes on the mainline (NE Columbia Boulevard). These heavy volumes make it difficult for side street traffic to turn onto NE Columbia Boulevard, especially with northbound left turns. The future configuration of this intersection has NE Columbia Boulevard as a five-lane facility (two through lanes in each direction with a center turn lane), and a shared left/right northbound approach. Due to the proximity of the NE Cully Boulevard, and Alderwood Road intersections on NE Columbia Boulevard, the intersections would most likely require side-by-side left turns, rather than back-to-back left turns, and therefore would require a six-lane cross section in this area. Additional side street geometry to allow for separate left and right turn pockets



City of Portland Bureau of  
Planning and Sustainability



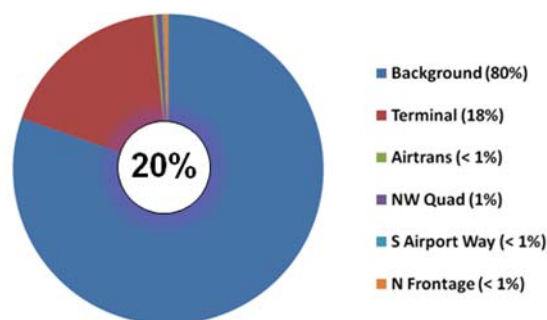
**PORT OF PORTLAND**  
Possibility. In every direction.

only reduces the delay for the right turns and allows for acceptable delay, however the northbound left turn still does not meet the jurisdictional standard of LOS E during the PM peak hour.

Signal warrant analysis was conducted for this intersection to determine if the intersection would be a likely candidate for implementation of a signal. Based on the peak hour warrant, this intersection would meet the signal warrant criteria under both the No-build and Build conditions, and therefore potential mitigation may include signalization. With a signal as potential mitigation, the intersection would meet jurisdictional standard and would operate at an LOS B or better under No-build or Build conditions.

In addition, the proportionate share of traffic related to Port facilities and background traffic was estimated for the 2022 PM peak hour at the intersection of NE Columbia Boulevard/NE Cully Boulevard. Based on future forecasting, it is estimated that 20% of the total future traffic forecasted at this intersection is related to net new traffic associated with Port facilities. Background traffic at this intersection is approximately 80% of total traffic. Existing traffic has been removed from this estimate and these percentages only represent net new traffic in the future.

**Proportionate Share of Net New Traffic at Intersection**



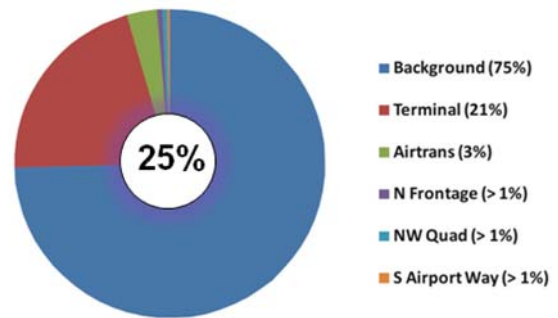
#### NE Columbia Boulevard/NE Alderwood Road

Similar to the previous intersection mentioned, the intersection of NE Columbia Boulevard/NE Alderwood Road is an unsignalized side street stop controlled intersection with NE Columbia Boulevard operating with a free flow movement. Delay to the side street (NE Alderwood Road) is heavy due to the heavy mainline volumes on NE Columbia Boulevard. NE Alderwood Road currently has separate left and right turn pockets/lanes approaching NE Columbia Boulevard, and both turn lanes experience LOS F during the PM peak hour.

Signal warrant analysis was conducted for this intersection to determine if the intersection would be a likely candidate for implementation of a signal. Based on the peak hour warrant, this intersection would meet the signal warrant criteria under both the No-build and Build conditions, and therefore potential mitigation may include signalization. With a signal as potential mitigation, the intersection would meet jurisdictional standard and would operate at an LOS C or better under No-build or Build conditions.

In addition, the proportionate share of traffic related to Port facilities and background traffic was estimated for the 2022 PM peak hour at the intersection of NE Columbia Boulevard/NE Cully Boulevard. Based on future forecasting, it is estimated that 25% of the total future traffic forecasted at this intersection is related to net new traffic associated with Port facilities. Background traffic at this intersection is approximately 80% of total traffic. This excludes existing traffic and only represents net new traffic in the future.

**Proportionate Share of Net New Traffic at Intersection**



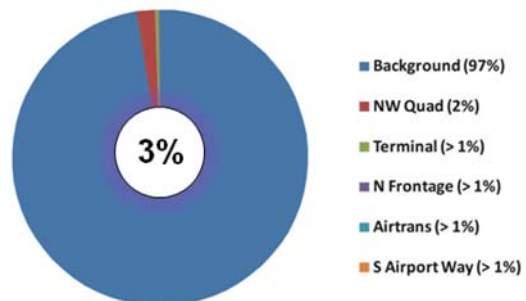
#### NE Marine Drive/NE 33<sup>rd</sup> Avenue

This intersection is similar to the previous intersections in that it is a “Tee” intersection with side street stop control on NE 33<sup>rd</sup> Avenue, and NE Marine Drive is allowed to operate in a free flow environment. Heavy volumes on NE Marine Drive create delay on NE 33<sup>rd</sup> Avenue beyond jurisdictional standards for both the No-build and Build conditions.

Signal warrant analysis was conducted for this intersection to determine if the intersection would be a likely candidate for implementation of a signal. Based on the peak hour warrant, this intersection would meet the signal warrant criteria under both the No-build and Build conditions, and therefore potential mitigation may include signalization. With a signal, and a westbound left turn lane as potential mitigation, the intersection would meet jurisdictional standard and would operate at an LOS C or better under No-build or Build conditions, however the volume-to-capacity at the intersection is getting near a 1.00 condition during the PM peak hour which would indicate constrained conditions.

In addition, the proportionate share of traffic related to Port facilities and background traffic was estimated for the 2022 PM peak hour at the intersection of NE Columbia Boulevard/NE Cully Boulevard. Based on future forecasting, it is estimated that 3% of the total future traffic forecasted at this intersection is related to net new traffic associated with Port facilities. Background traffic at this intersection is approximately 80% of total traffic. This excludes existing traffic and only represents net new traffic in the future.

**Proportionate Share of Net New Traffic at Intersection**



It should be noted that if the land use in the Northwest Quadrant is removed, or pushed out beyond the 2022 planning horizon year, the net new traffic at this intersection is estimated to be 1% or less, and would not be considered to have a significant impact.

#### Summary of 2022 Mitigation Strategies

Based on the potential impacts, the recommended mitigation strategy for each intersection has been identified in the following table. In addition, the estimated trigger year of when the proposed mitigation is needed, and the mitigated intersection operations have been identified as well. This trigger year has



been correlated to an estimated million annual passengers (MAP) at the terminal due to the terminal being the largest trip generator for potential development.

**Table 5-1**

**Summary of 2022 Potential Mitigation Strategies and PM Peak Hour Operations**

Intersection	Mitigation	Mitigated Conditions			Trigger Year/Development
		LOS	Delay (seconds)	V/C	
<b>Alderwood Rd/ Columbia Blvd</b>	Signalize intersection with center turn lane on NE Columbia Blvd*	LOS C	32.7	0.85	2010/15.0 MAP
<b>NE Columbia Blvd/ NE Cully Blvd</b>	Signalize intersection with center turn lane on NE Columbia Blvd*	LOS B	16.4	0.59	2010/15.0 MAP
<b>NE Marine Dr/ NE 33<sup>rd</sup> Ave</b>	Signalize intersection, add westbound left turn lane	LOS C	32.6	1.00	2010/15.0 MAP

Notes: \* Proximity of intersections would most likely require side-by-side left turns, rather than back-to-back left turns. This would widen NE Columbia Boulevard to a six lane section in this area.

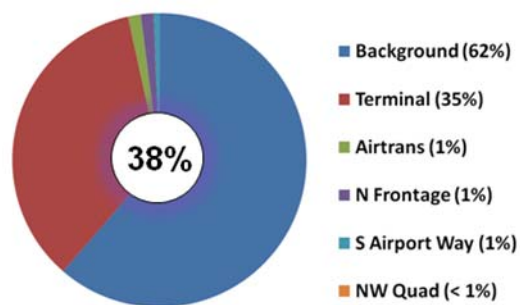
### 2035 Planning Horizon

In addition to the 2022 planning horizon, future potential impacts and mitigation strategies have been identified in the longer range 2035 planning horizon for the PM peak hour. Evaluating the 2035 impacts and potential mitigation strategies is primarily done to flag intersections that may become problematic in the future beyond the immediate planning horizon where funding would be secured for mitigation to be implemented (2022). This allows the opportunity to revisit intersections that may have potential operational constraints in the future depending on the potential rate at which the Port facilities develop. It is not expected that mitigation would be pursued at these locations at this time. The following summarizes some potential mitigation strategies that may be considered for each of the intersections identified with a significant impact during the PM peak hour by 2035.

#### NE Airport Way/Interstate 205 northbound on-ramp

This intersection is over the jurisdictional standard of 0.85 V/C ratio during the PM peak hour by 2035 under both the No-Build and Build condition. The eastbound left turn conflicts with the westbound through movement which creates a V/C ratio over the standard. The intersection reaches a 1.0 V/C ratio under the Build condition (so it is not over capacity), and the No-build condition still has some available capacity with a V/C ratio of 0.89 during the PM peak hour. Potential improvements at this intersection would grade separate the eastbound left turns with the westbound through movement. With this mitigation strategy, the intersection will no longer have signal control and all movements will be free flowing, therefore, the intersection will have no V/C ratio.

**Proportionate Share of Net New Traffic at Intersection**

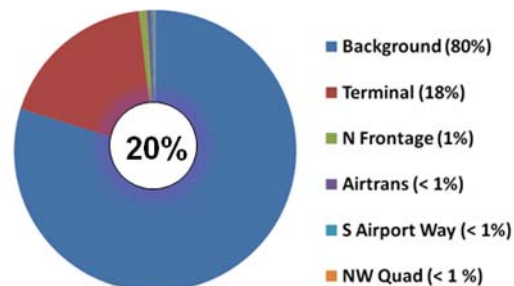


An assessment of the share of Port related traffic was evaluated at this intersection compared to background traffic. It is estimated that approximately 38% of net new traffic is related to growth with the Port land uses.

#### NE Airport Way/NE 122<sup>nd</sup> Avenue

This intersection is both over capacity and has high average delay beyond the jurisdictional standard of LOS D during the PM peak hour by 2035. The No-build condition is at LOS E, while the Build condition increases the intersection delay to LOS F. Additional capacity via separate turn lanes would allow for better operations of the intersection and reduce the potential delay allowing adequate intersection operations. Potential improvements include an additional eastbound left turn lane, and/or separate westbound right turn pocket. With these improvements, the intersection would operate at LOS E or better. The intersection will still not meet jurisdictional standards, but will no longer have a significant impact under 2035 build conditions beyond the 2035 no-build conditions, as the delay is reduced.

**Proportionate Share of Net New Traffic at Intersection**

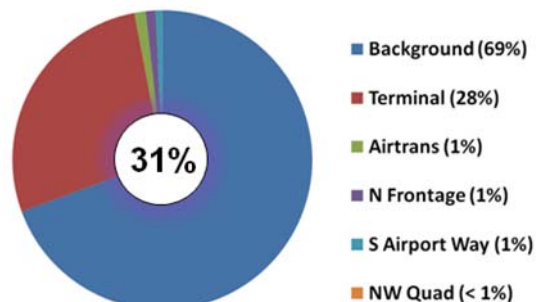


An assessment of the share of Port related traffic was evaluated at this intersection compared to background traffic. It is estimated that approximately 20% of net new traffic is related to growth with the Port land uses.

#### NE 82<sup>nd</sup> Avenue/NE Alderwood Road

This intersection is over capacity and has an LOS E under No-build and LOS F under the Build conditions during the PM peak hour by 2035. The build condition adds approximately 16 seconds of additional delay to the intersection. Additional capacity at the intersection would allow for better operations including reduced delay. Potential improvements at this intersection include an additional eastbound through lane (which could be created by converting the separate eastbound right turn pocket to a shared through/right lane). In addition to help reduce overall delay, any separate right turn pocket phasing could overlap with concurrent left turn phasing. With these improvements the intersection would operate with a LOS E. The intersection would still not meet jurisdictional standards, but will no longer have a significant impact under 2035 build conditions beyond the 2035 no-build conditions, as the delay is reduced.

**Proportionate Share of Net New Traffic at Intersection**



It should be noted that the additional westbound left turn pocket that was called out as an earlier improvement could shift the two existing eastbound through lanes on the east leg of the intersection to be in alignment with this potential improvement of an additional eastbound through lane. But

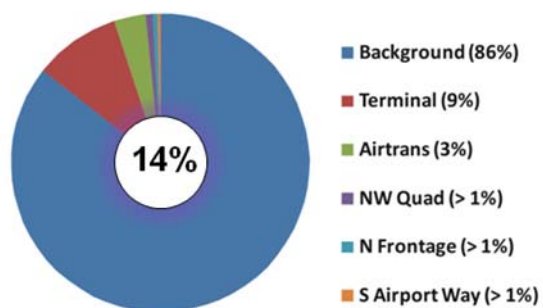
consideration should be made at this intersection to allow for lane geometries (departing and receiving lanes) to occur concurrently to line up and create a safe transition.

An assessment of the share of Port related traffic was evaluated at this intersection compared to background traffic. It is estimated that approximately 31% of net new traffic is related to growth with the Port land uses.

#### NE Columbia Boulevard/NE 82<sup>nd</sup> Avenue Northbound

This intersection has significant delay on the side street, as well as being over capacity standards of 0.99 V/C ratio, and LOS E during the PM peak hour by 2035. Additional lane geometry does little to reduce the delay or improve the capacity because the current geometry acts as a separate left and right turn lane. A potential improvement at this location would be to signalize the intersection with a protected eastbound left turn phase. A peak hour signal warrant was conducted for the PM peak hour and the intersection met signal warrant thresholds indicating the potential need for a signal. With these improvements, the intersection would meet jurisdictional standards and operate with a 0.83 V/C, and a LOS C or better.

**Proportionate Share of Net New Traffic at Intersection**



An assessment of the share of Port related traffic was evaluated at this intersection compared to background traffic. It is estimated that approximately 14% of net new traffic is related to growth with the Port land uses.

#### 2035 Planning Horizon Potential Mitigation Strategies

The 2035 planning horizon is meant to identify intersections that may need to be looked at in further detail beyond the immediate planning horizon. The following table summarizes potential mitigation strategies, and intersection operations with the mitigations for these locations.

**Table 5-2**

**2035 Potential Mitigation Strategies and PM Peak Hour Operations**

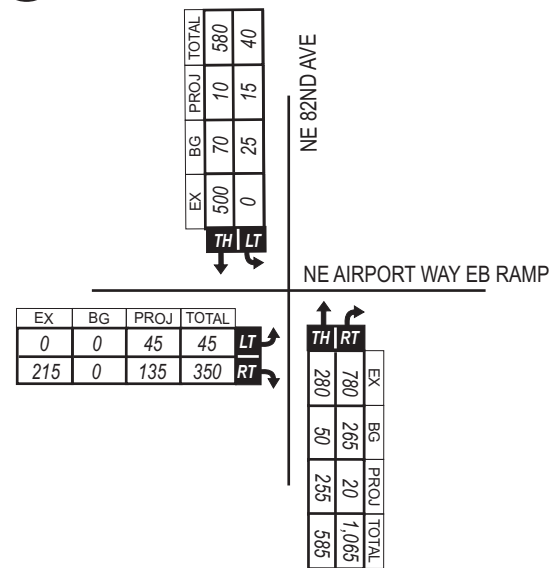
Intersection	Potential Mitigation	Mitigated Conditions		
		LOS	Delay (seconds)	V/C
<b>NE Airport Way/NE 122<sup>nd</sup> Ave</b>	Additional eastbound left turn lane, and/or separate westbound right turn pocket	LOS E	70.5	1.04
<b>NE Airport Way/ I-205 NB</b>	Grade separate the intersection to allow the eastbound left turns to not conflict with the westbound through volume	-	-	-
<b>NE 82<sup>nd</sup> Ave/NE Alderwood Rd</b>	Additional eastbound through lane (shared with right turn pocket), and overlap phases for all separate right turn pockets at the intersection	LOS E	72.5	1.05
<b>NE Columbia Blvd/NE 82<sup>nd</sup> Ave NB</b>	Signalize intersection with protected eastbound phasing	LOS C	23.9	0.83

**SOURCE:** DKS Associates

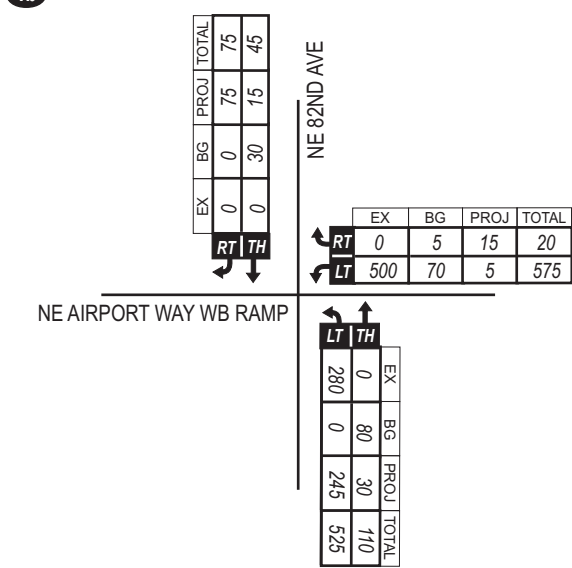
These listed mitigations would allow for adequate jurisdictional intersection operations by 2035, however some intersections listed are still over capacity. Because these potential impacts are beyond the immediate 2022 planning horizon year, these intersections represent locations to monitor based on how future growth (and the rate of growth) occurs at Port facilities. The above listed mitigation strategies is preliminary and may be subject to change upon future additional analysis.

# APPENDIX

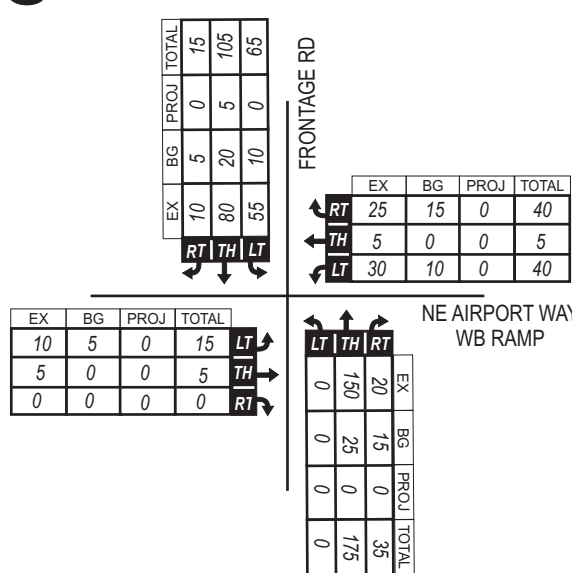
1a NE AIRPORT WAY EB/NE 82ND



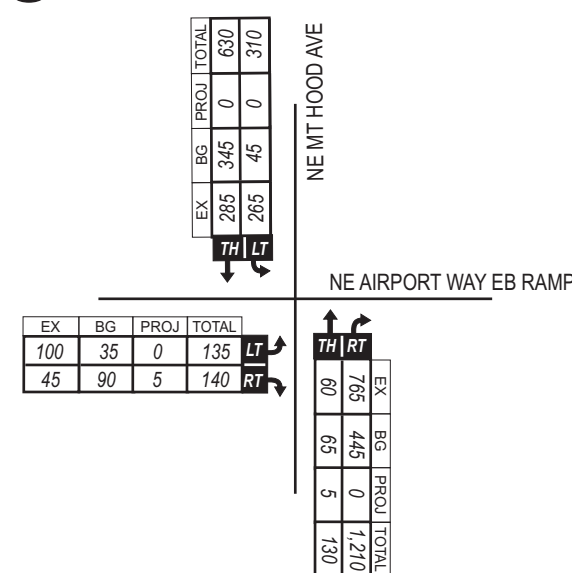
1b NE AIRPORT WAY WB/NE 82ND



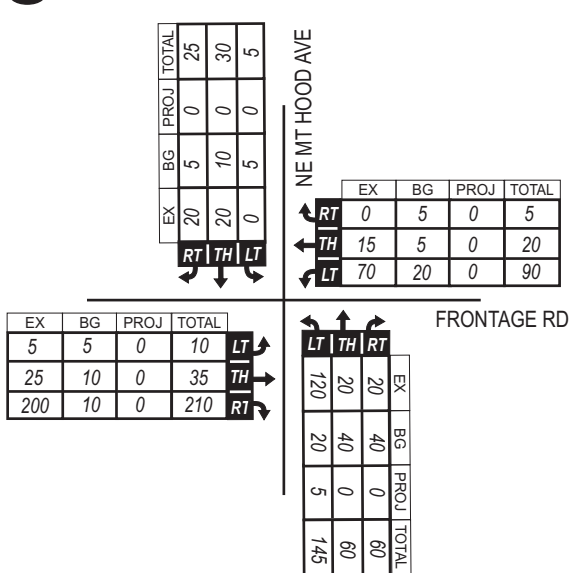
2 FRONTAGE RD/NE AIRPORT WAY WB RAMP



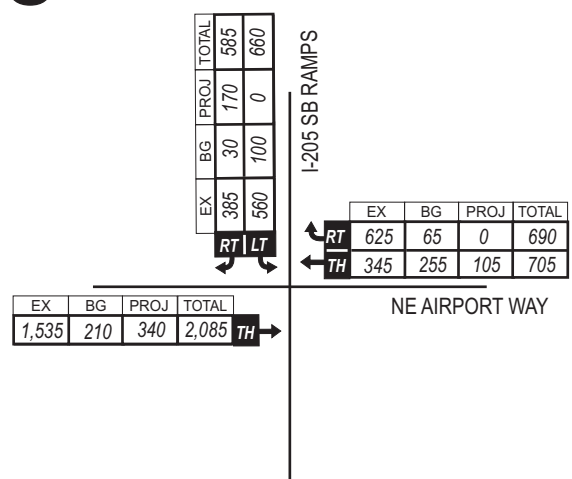
3 NE MT HOOD AVE/NE AIRPORT WAY EB RAMP



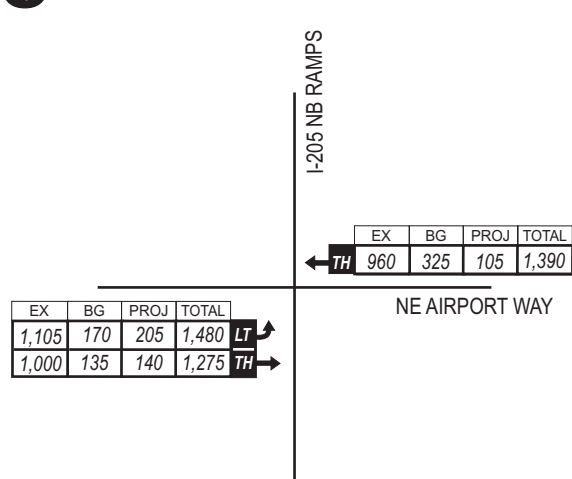
4 NE MT HOOD AVE/FRONTAGE RD



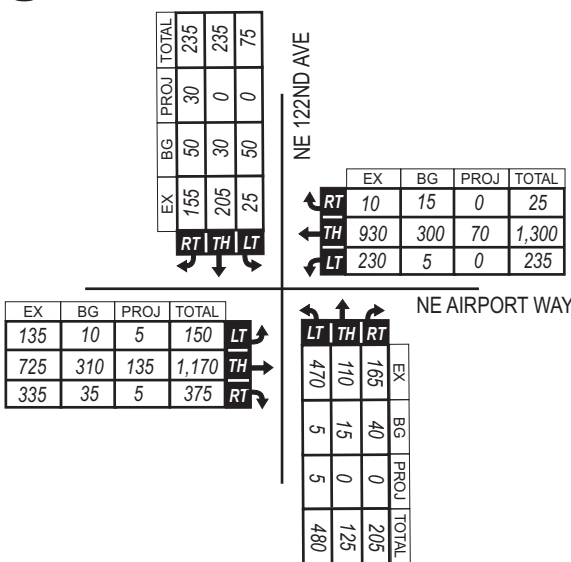
5 NE AIRPORT WAY/I-205 SB RAMP



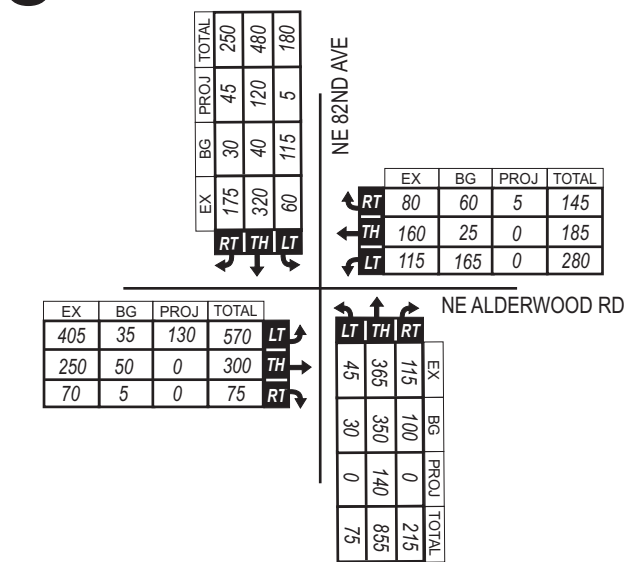
6 AIRPORT WAY/I-205 NB RAMP



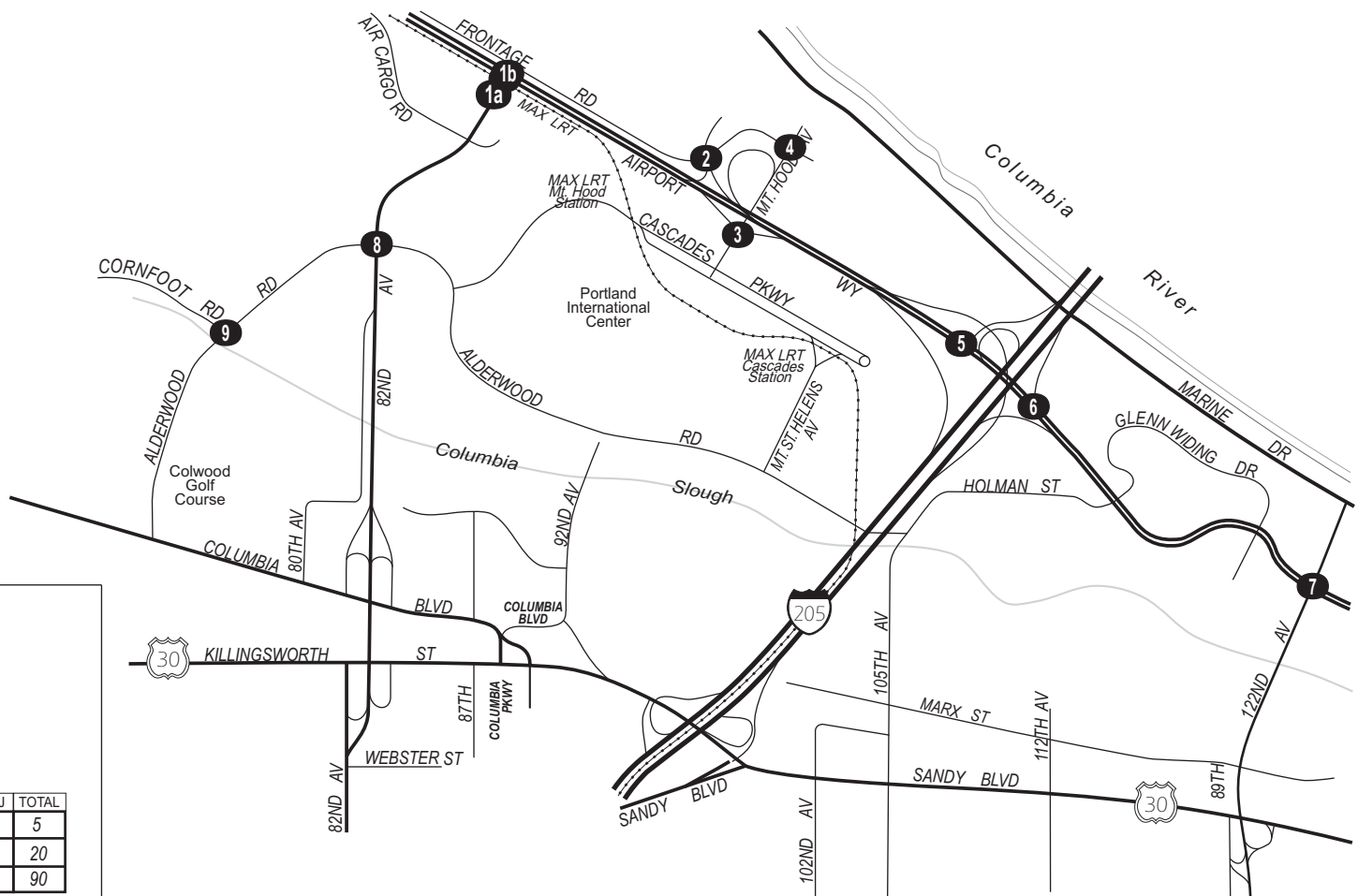
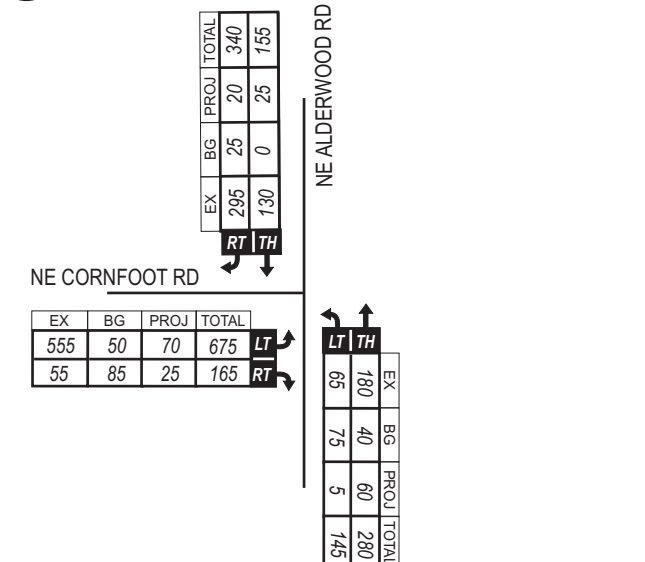
7 NE AIRPORT WAY/NE 122ND AVE



8 NE ALDERWOOD RD/NE 82ND AVE



9 NE ALDERWOOD RD/NE CORNFOT DR



Information Sources: DKS Associates

Notes: All volumes have been rounded up to the nearest increment of five.  
Existing traffic data was collected in 2007.

LEGEND

00 - Study Intersection Number

EX - Existing Traffic  
BG - Background Traffic  
PROJ - Project Traffic  
TOTAL - Total Traffic

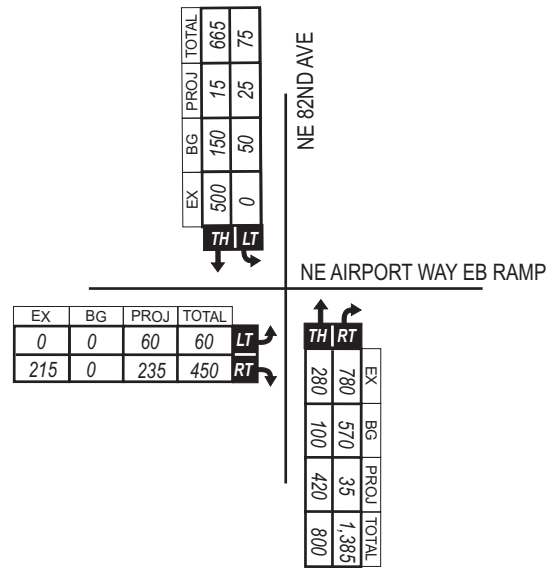
RT - Right Turn Movement  
TH - Through Movement  
LT - Left Turn Movement

2022 PM PEAK TOTAL TRAFFIC VOLUMES

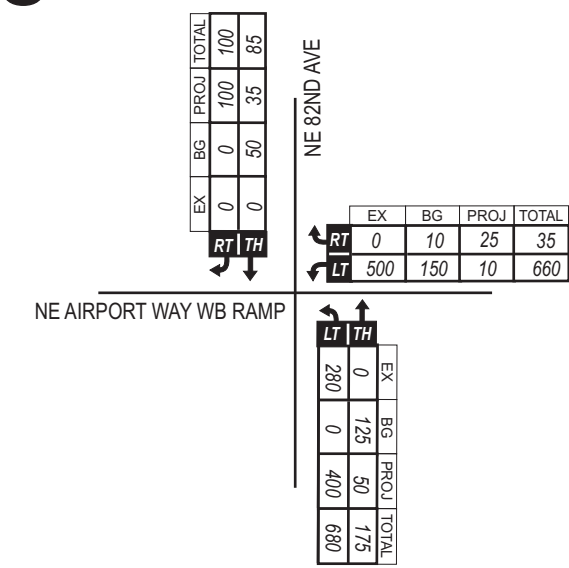
FIGURE A-1



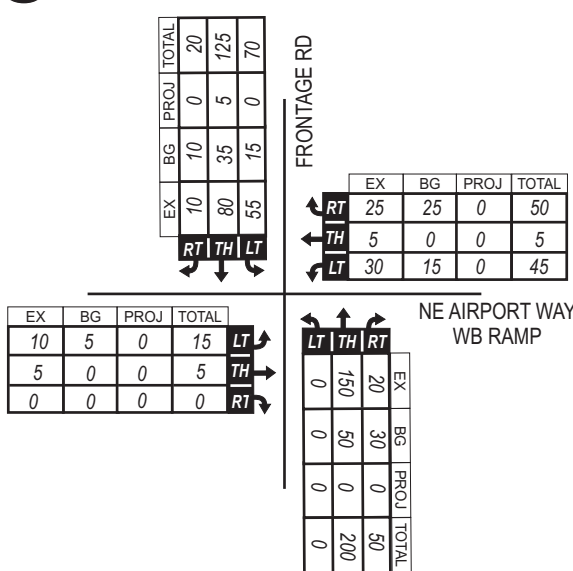
1a NE AIRPORT WAY EB/NE 82ND



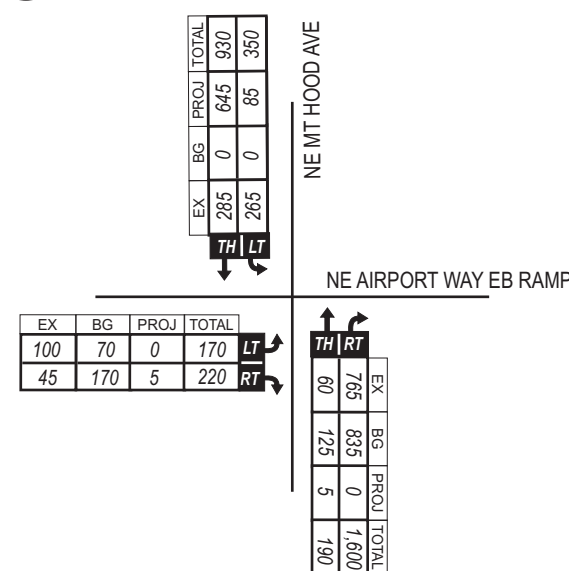
1b NE AIRPORT WAY WB/NE 82ND



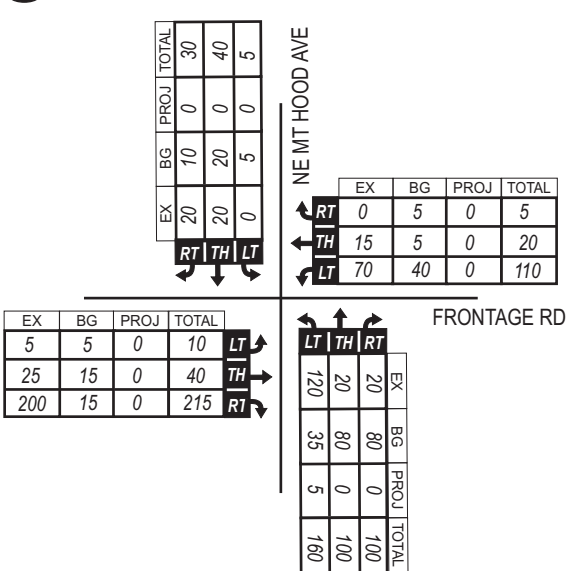
2 FRONTAGE RD/NE AIRPORT WAY WB RAMP



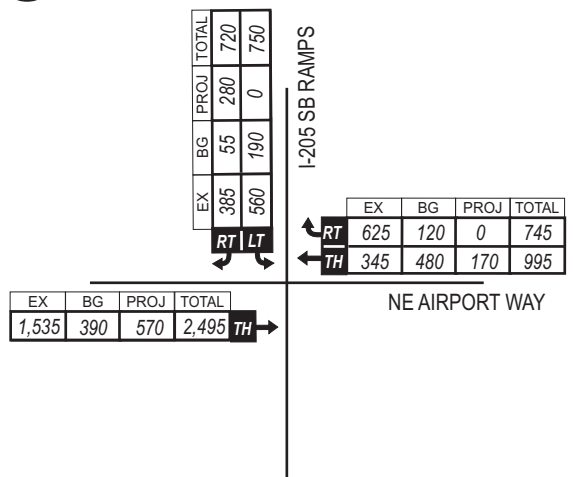
3 NE MT HOOD AVE/NE AIRPORT WAY EB RAMP



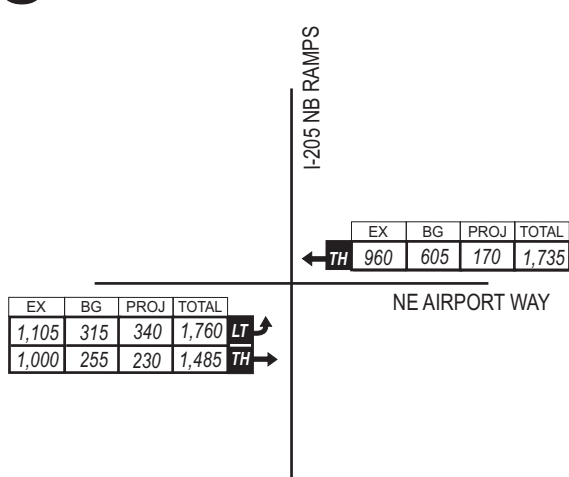
4 NE MT HOOD AVE/FRONTAGE RD



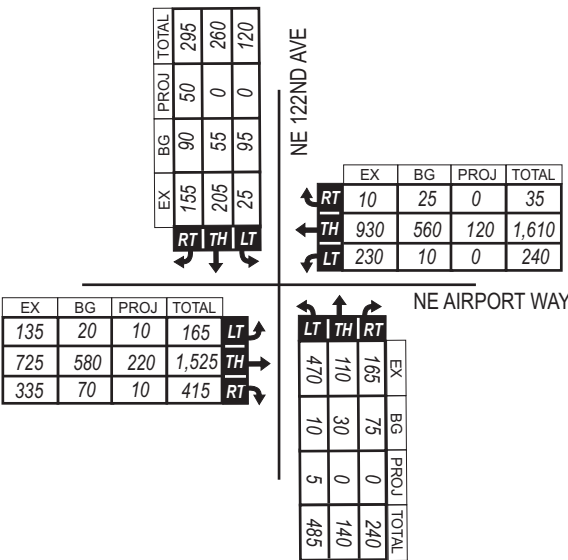
5 NE AIRPORT WAY/I-205 SB RAMP



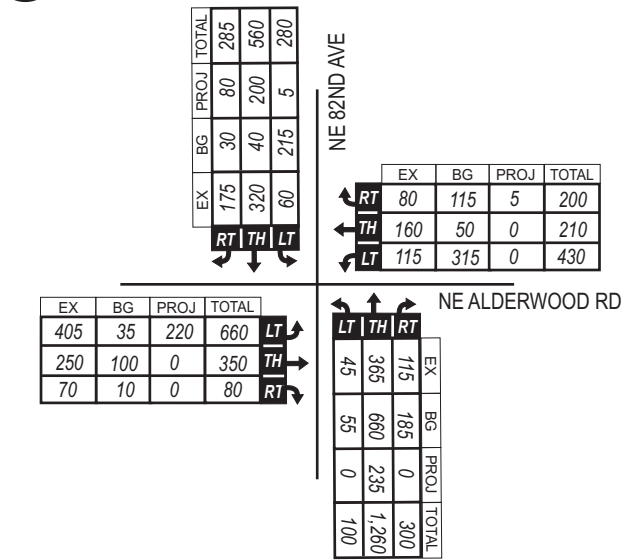
6 AIRPORT WAY/I-205 NB RAMP



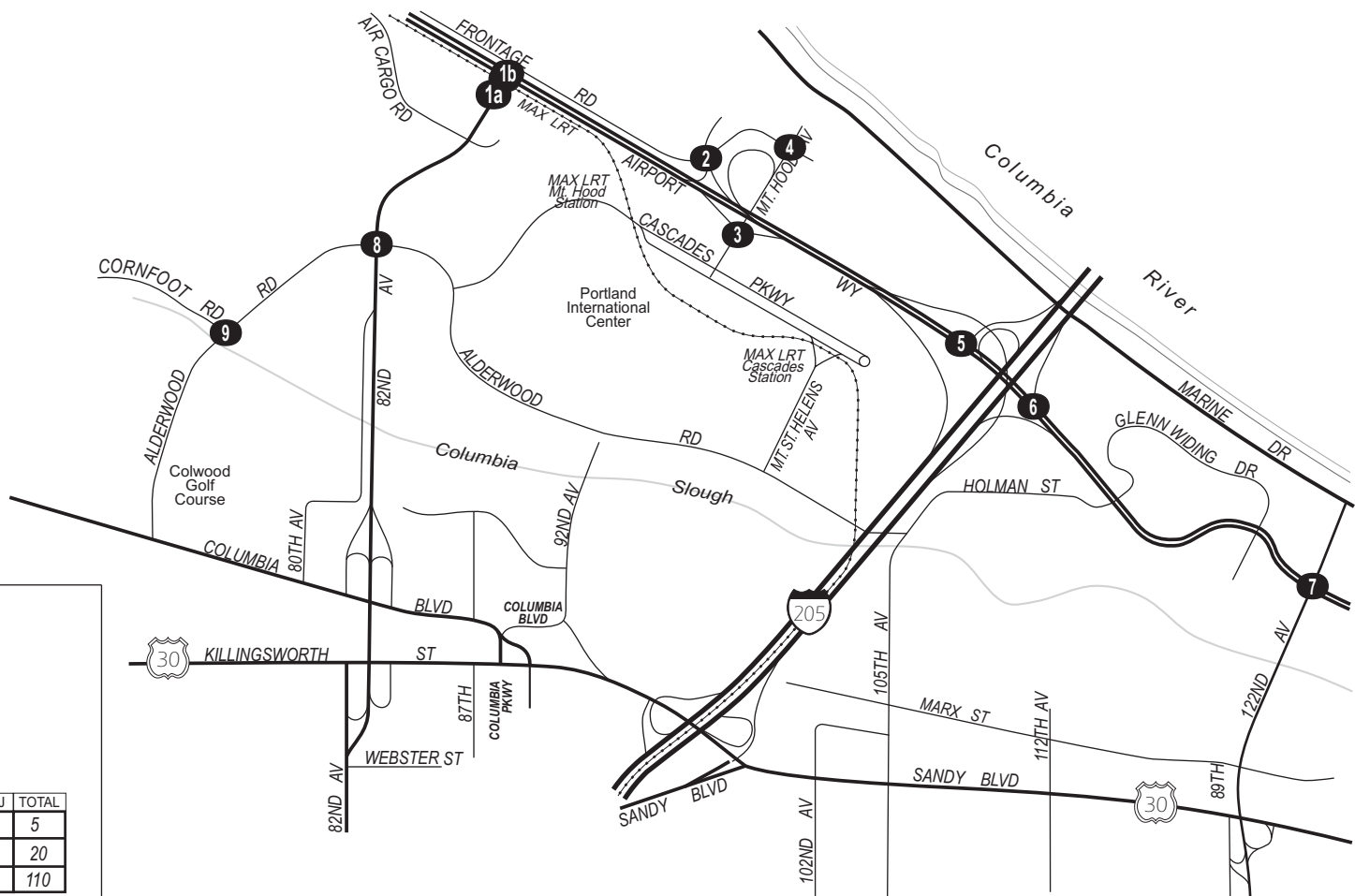
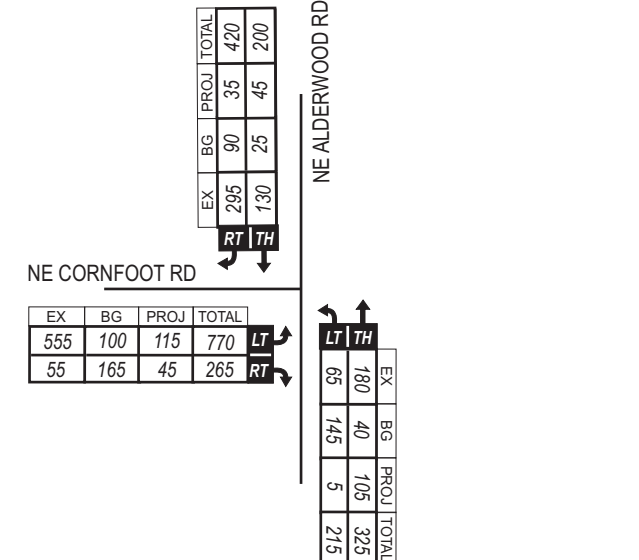
7 NE AIRPORT WAY/NE 122ND AVE



8 NE ALDERWOOD RD/NE 82ND AVE



9 NE ALDERWOOD RD/NE CORNFOT DR



Information Sources: DKS Associates

Notes: All volumes have been rounded up to the nearest increment of five.  
Existing traffic data was collected in 2007.

LEGEND

00 - Study Intersection Number

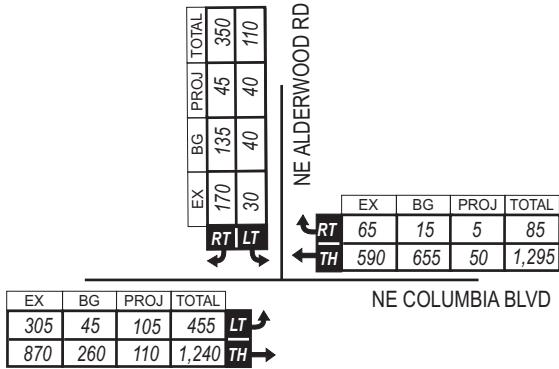
EX - Existing Traffic  
BG - Background Traffic  
PROJ - Project Traffic  
TOTAL - Total Traffic

RT - Right Turn Movement  
TH - Through Movement  
LT - Left Turn Movement

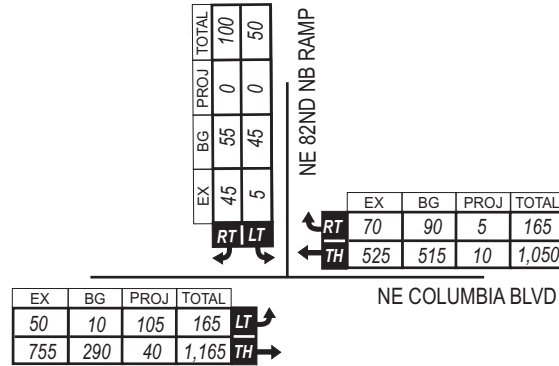
2035 PM PEAK TOTAL TRAFFIC VOLUMES

FIGURE B-1

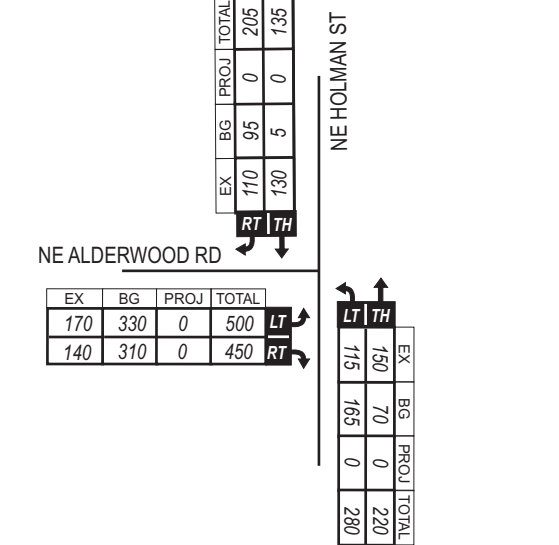
10 NE COLUMBIA BLVD/NE ALDERWOOD RD



12 NE COLUMBIA BLVD/NE 82ND NB RAMP



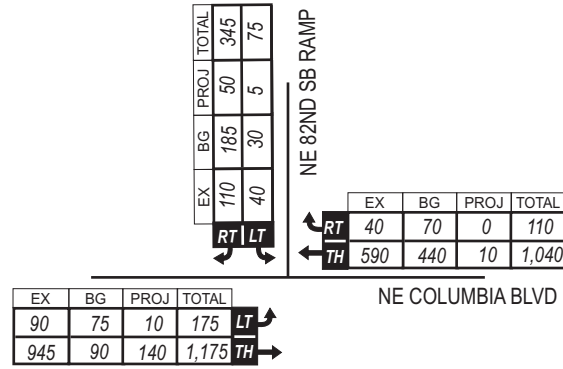
15 NE ALDERWOOD RD/NE HOLMAN ST



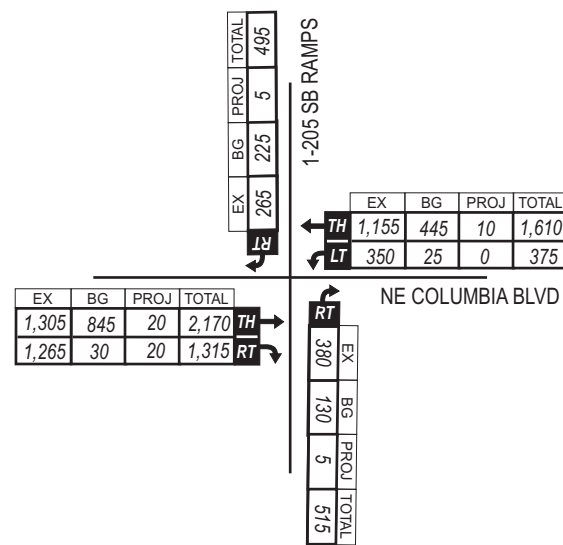
Information Sources: DKS Associates

Notes: All volumes have been rounded up to the nearest increment of five.  
Existing traffic data was collected in 2007.

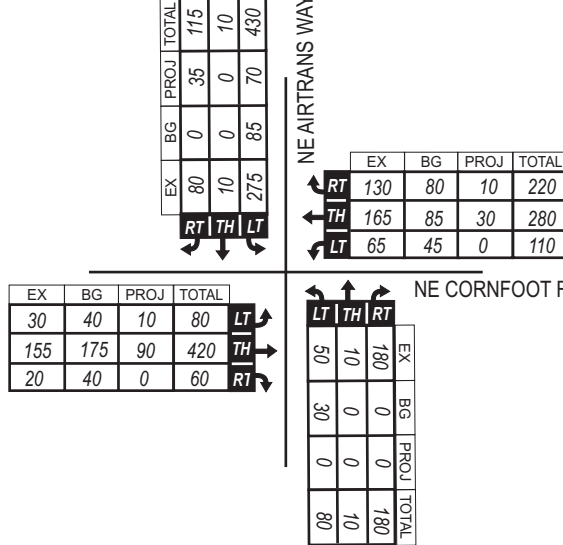
11 NE COLUMBIA BLVD/NE 82ND SB RAMP



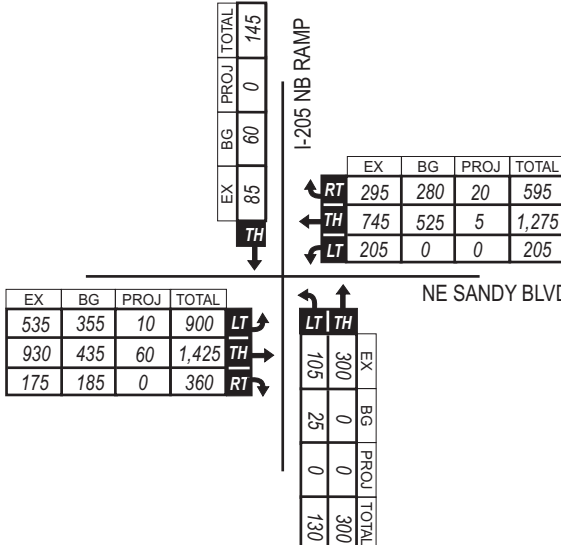
13 NE COLUMBIA BLVD/I-205 SB RAMP



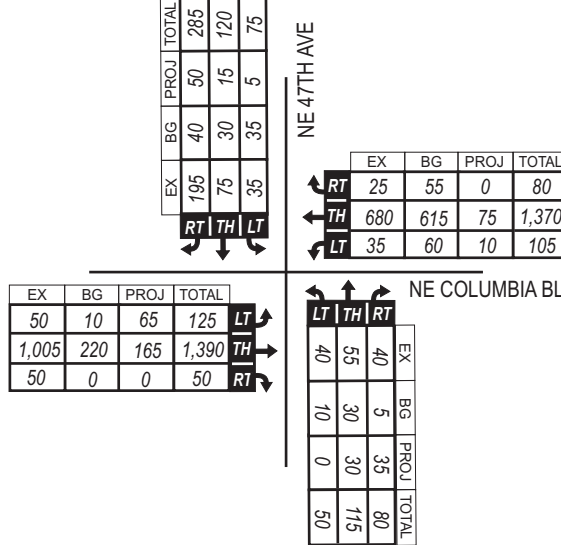
16 NE AIRTRANS WAY/NE CORNFOOT RD



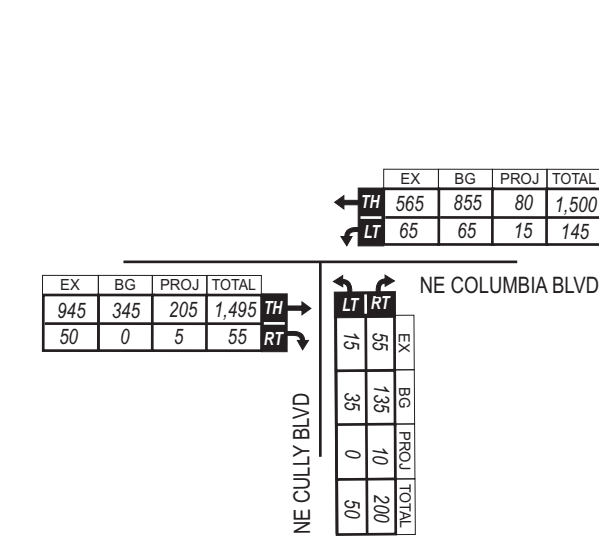
14 NE SANDY BLVD/I-205 NB RAMP



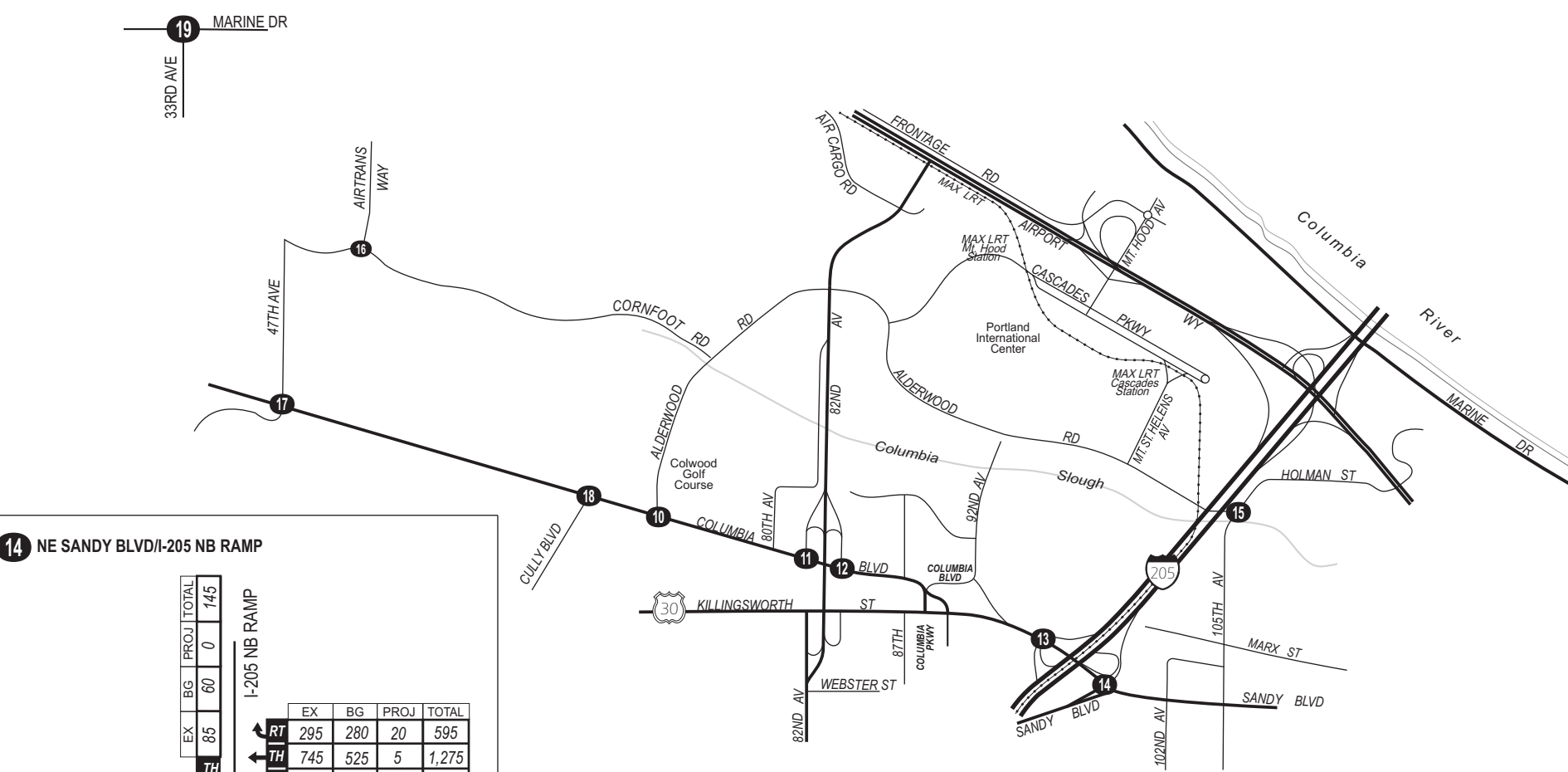
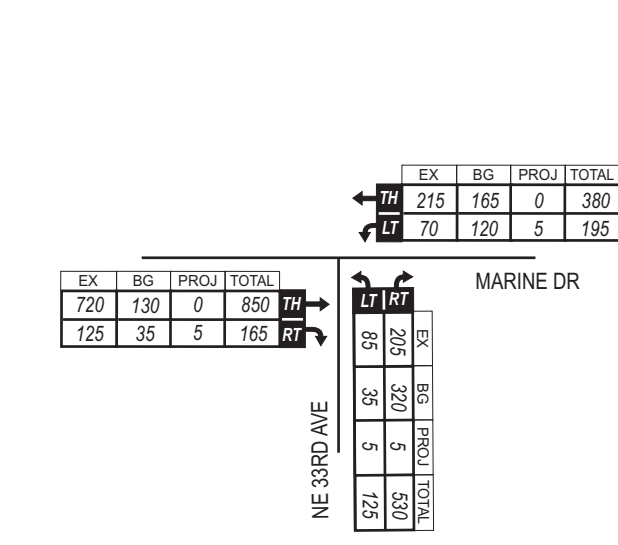
17 NE COLUMBIA BLVD/NE 47TH AVE



18 NE CULLY BLVD/NE COLUMBIA BLVD



19 NE 33RD AVE/MARINE DR



LEGEND

00 - Study Intersection Number

EX - Existing Traffic  
BG - Background Traffic  
PROJ - Projected Traffic Growth  
TOTAL - Total Traffic

RT - Right Turn Movement  
TH - Through Movement  
LT - Left Turn Movement

2035 PM PEAK TOTAL TRAFFIC VOLUMES

FIGURE B-2





## **Airport Futures Transportation Planning Rule Applicability**

(Prepared by the Port of Portland in June 2008)

The Port of Portland and City of Portland are currently undertaking the Airport Futures project which is a collaborative planning process to update the Portland International Airport Master Plan and develop a new, legislatively adopted, land use construct for PDX. The new land use construct, when adopted by the Portland City Council will become an element of the City comprehensive plan and implementing ordinances.

One of the areas where Airport Futures must show consistency with adopted state laws is with Transportation, or more specifically OAR 660-012-0060 – the Oregon Transportation Planning Rule (TPR) requirements for Plan and Land Use Regulation Amendments. This memo is intended to address the level of applicability of this rule to Airport Futures, and to reach agreement between the Port of Portland, City of Portland and Oregon Department of Transportation on that applicability.

### **OAR 660-012-0060(1) states:**

*(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. A plan or land use regulation amendment significantly affects a transportation facility if it would:*

- (a) Change the functional classification of an existing or planned transportation facility (exclusive of correction of map errors in an adopted plan);*
- (b) Change standards implementing a functional classification system; or*
- (c) As measured at the end of the planning period identified in the adopted transportation system plan:*
  - (A) Allow land uses or levels of development that would result in types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;*
  - (B) Reduce the performance of an existing or planned transportation facility below the minimum acceptable performance standard identified in the TSP or comprehensive plan; or*
  - (C) Worsen the performance of an existing or planned transportation facility that is otherwise projected to perform below the minimum acceptable performance standard identified in the TSP or comprehensive plan.*

**Step One:** The first step in reviewing applicability of this rule is determining if the proposal is “an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation”. All three agencies agree the Airport Futures land use element clearly meets this criterion.

**Step Two:** The next step in reviewing rule applicability is to determine if the allowed land uses under the proposed amendment will increase the potential for impacts to the planned transportation system when compared to the allowed land uses for the existing,

or pre-amendment condition. While this step is not explicitly called out in the rule language, it has been the standard practice in implementation of this rule since its inception in 1991. More specifically, regarding the potential for transportation system impacts, the land use authority must determine a “reasonable worst case” development scenario under both the existing and proposed land use structures. If the “reasonable worst case” transportation impact for the proposed land use is greater than the “reasonable worst case” for the existing land use, then a transportation impact analysis must be conducted to determine if the proposal has a “significant affect”. On the other hand, if the “reasonable worst case” transportation impact for the proposed land use is less than, or no worse than, the “reasonable worst case” for the existing land use, then by definition there can be no significant effect and no further analysis is required. The following analysis shows why the Airport Futures land use proposal will not increase the potential impacts on the planned transportation system over the “reasonable worst case” for the existing zoning, and therefore does not require further analysis to determine “significant affect”. For the Portland metropolitan area, Transportation System Plans adopted by Metro (RTP) and the City of Portland (PTSP) under the requirements of the TPR were based on forecasts and needs for the PM Peak Hour, hence the following analysis is based on PM peak hour impacts.

### **Reasonable Worst Case Analysis**

Using Metro's RLIS data, Portland International Airport is approximately 3300 acres in size. Of those acres, approximately 424 acres are in an area known as Portland International Center which has its own city plan district and will likely not be included in the Airport Futures land use element. This leaves about 2876 acres subject to this review. Of these 2876 acres, the vast majority, 2731 acres (95%) is zoned as IG2 (industrial) in the city code. The remainder is comprised of 30.14 acres zoned EG2 (employment) which allows more intense uses, 111.18 acres zoned OS (open space) which is mostly along PDX frontage with the Columbia River and a small parcel, 3.57 acres zoned R10 (residential) located next to the Columbia River. Even though some land uses are allowed on the OS and R10 parcels, they would be very low impact in nature and are omitted for the purpose of this analysis.

The following land use development assumptions are used for the different zoning areas:

Industrial – For the broad expanse of over 2700 acres, an averaged combination of five different industrial land uses are assumed. The land use types are taken from the ITE Trip Generation Manual, 7<sup>th</sup> Edition, and include General Light Industrial, General Heavy Industrial, Industrial Park, Manufacturing and Warehousing. The assumptions also include a single story and an average 30% lot coverage.

Employment – When compared to Industrial zoning, there are three additional allowed uses that have significant trip generation potential. These are office, retail, and a fueling station. Based on actual acreages for various fueling stations in NE Portland, we have assumed a 0.74 acres site size for a 12 fueling position site with no attached convenience store or car wash. For office and retail uses we have assumed an average 27.5% lot coverage with three stories for office and one story for retail. These trips have been averaged over the remaining 29.4 acres of the EG2 zoning.

Trips were calculated using both the published average trip rate and the fitted curve trip rate from ITE Trip Generation Manual, 7<sup>th</sup> Edition. While the fitted curve rate may be

more appropriate, we have used the more conservative average trip rate for this analysis. The table below summarizes the potential trip impact associated with the existing IG2 and EG2 acreages at PDX. The full trip impact analysis is attached as an exhibit.

Existing Zone	Acres	PM Trips
Industrial (IG2)	2731.00	26,175
Employment (EG2)	30.14	1,614
Open Space (OS)	111.18	NA
Residential (R10)	3.57	NA
<b>Total</b>	<b>2875.89</b>	<b>27,789</b>

For assumed development as a commercial airport, trip rates were taken from the traffic analysis used for the PDX Conditional Use Master Plan and rounded up to assume a worst case rate. This is contrary to the expected increase the transit modal share at the airport as the regional light rail system expands and regional congestion increases, but is nevertheless the most conservative, reasonable case for this analysis. The analysis includes a trip rate directly associated with passenger growth at the terminal and assumes all trips associated with that growth, assuming passengers, employees, concessions, rental cars, and commercial vehicles. Based on the recently completed Airport Futures aviation demand forecast for PDX, this analysis assumes a future passenger demand of 27 million annual passengers (MAP) for the year 2035. Other trips are associated with other activity areas around the airport such as air cargo, military, hotels and future expansions of the NW and SW Quadrants of the airport. The details of these assumptions are attached an exhibit.

Airport Use	Trip Rate	PM Trips
Terminal (27 MAP)	240 trips / MAP	6,480
SW Quad	Count/ITE	1,600
NW Quad (Military)	Count	350
Air Trans Center (Air Cargo)	Count/ITE	1,000
Alderwood Area	Count	250
Frontage Road	Count/ITE	1,000
<b>Total</b>		<b>10,680</b>

This analysis shows that for the 2,876 acres in review, a mix of industrial and employment development types associated with the existing zoning would generate over 2.5 times more trips on the system than the proposed zoning scheme that would limit the site to airport uses with some accessory non-airport uses. In this respect the proposed land use structure is a “down zone” of the 2,876 acres in review and clearly would not have a “significant affect” as defined in the rule.












It is possible that some could argue that assuming industrial and employment development on the 2,876 acres is not “reasonable” when one assumes the level of investment in airport infrastructure already at PDX, and therefore the “reasonable worst case” for the existing zoning is overstated. Assuming that argument, the “reasonable worst case” under the existing land use structure would by definition be an airport and associated uses which is currently allowed as a conditional use, and has been the subject of numerous land use approvals by the city over the years. Under the current city zoning there is no upper airport growth threshold; only a requirement to identify and







mitigate impacts. In addition, ORS 836.600 and OAR 660-013 both state that it is “the policy of the State of Oregon is to encourage and support the continued operation and vitality of Oregon’s airports.” With this context, there is no reason to believe that the city will not continue to allow the airport to grow as needed and operate in its current location indefinitely. As a result the existing land use and proposed land use scenarios are equivalent under this construct. Once again the Airport Futures land use proposal will not increase the potential impacts on the planned transportation system and therefore does not require further analysis to determine “significant affect”.













### **Required Airport Futures Traffic Analysis**

Even though a traffic analysis under the Transportation Planning Rule is not required, the land use element for Airport Futures still requires a land use action by the city and that action should have a traffic analysis to review impacts associated with growth. While the specific scope of such an analysis has not yet been developed, the Port of Portland, City of Portland, and ODOT all agree such an analysis should be at least be consistent with standard development review traffic analyses. Further, the three agencies agree to work cooperatively to develop a scope of work to meet the needs of all three agencies.

# **2022 No-Build Synchro Worksheets**


						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.97	1.00	1.00
Satd. Flow (prot)	1626	1455		1624	1652	1404
Flt Permitted	0.95	1.00		0.76	1.00	1.00
Satd. Flow (perm)	1626	1455		1260	1652	1404
Volume (vph)	345	304	202	187	133	160
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	401	353	235	217	155	186
RTOR Reduction (vph)	0	222	0	0	0	99
Lane Group Flow (vph)	401	131	0	452	155	87
Heavy Vehicles (%)	11%	11%	14%	14%	15%	15%
Turn Type	Perm		Perm			Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	18.5	18.5		23.2	23.2	23.2
Effective Green, g (s)	18.5	18.5		23.2	23.2	23.2
Actuated g/C Ratio	0.37	0.37		0.47	0.47	0.47
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)	605	542		588	771	655
v/s Ratio Prot	c0.25				0.09	
v/s Ratio Perm		0.09		c0.36		0.06
v/c Ratio	0.66	0.24		0.77	0.20	0.13
Uniform Delay, d1	13.0	10.8		11.0	7.8	7.5
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.7	0.2		6.0	0.1	0.1
Delay (s)	15.7	11.0		17.0	7.9	7.6
Level of Service	B	B		B	A	A
Approach Delay (s)	13.5			17.0	7.8	
Approach LOS	B			B	A	
<b>Intersection Summary</b>						
HCM Average Control Delay			13.3		HCM Level of Service	B
HCM Volume to Capacity ratio			0.72			
Actuated Cycle Length (s)			49.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			57.1%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↱	↑↑	↱	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1200	52	106	1058	34	132
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1319	57	116	1163	37	145
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1376		2162	688
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1376		2162	688
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			76		0	63
cM capacity (veh/h)			494		31	389
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	879	497	116	581	581	182
Volume Left	0	0	116	0	0	37
Volume Right	0	57	0	0	0	145
cSH	1700	1700	494	1700	1700	115
Volume to Capacity	0.52	0.29	0.24	0.34	0.34	1.58
Queue Length 95th (ft)	0	0	23	0	0	337
Control Delay (s)	0.0	0.0	14.5	0.0	0.0	365.1
Lane LOS			B			F
Approach Delay (s)	0.0		1.3			365.1
Approach LOS						F
Intersection Summary						
Average Delay			24.1			
Intersection Capacity Utilization			60.7%		ICU Level of Service	B
Analysis Period (min)			15			

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	8	33	208	91	18	3	141	62	62	3	31	25
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	9	37	234	102	20	3	158	70	70	3	35	28
Approach Volume (veh/h)	280				126				298		66	
Crossing Volume (veh/h)	140				237				49		281	
High Capacity (veh/h)	1241				1150				1332		1111	
High v/c (veh/h)	0.23				0.11				0.22		0.06	
Low Capacity (veh/h)	1030				948				1114		913	
Low v/c (veh/h)	0.27				0.13				0.27		0.07	
Intersection Summary												
Maximum v/c High			0.23									
Maximum v/c Low			0.27									
Intersection Capacity Utilization			52.7%		ICU Level of Service				A			



















2022 No Build  
1000: Airport Way EB Ramps & 82nd Avenue

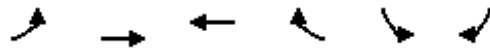
2022 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↑	↗	↘	↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00						1.00	1.00	1.00	1.00	
Frt		0.88						1.00	0.85	1.00	1.00	
Flt Protected		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1632						1863	1583	1770	1863	
Flt Permitted		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1632						1863	1583	1770	1863	
Volume (vph)	38	0	278	0	0	0	0	468	872	39	562	0
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)	42	0	305	0	0	0	0	514	958	43	618	0
RTOR Reduction (vph)	0	263	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	84	0	0	0	0	0	514	958	43	618	0
Turn Type	Perm						Free			Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4								Free			
Actuated Green, G (s)		10.3						72.2	100.0	5.5	81.7	
Effective Green, g (s)		10.3						72.2	100.0	5.5	81.7	
Actuated g/C Ratio		0.10						0.72	1.00	0.06	0.82	
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)		168						1345	1583	97	1522	
v/s Ratio Prot								0.28		0.02	0.33	
v/s Ratio Perm		0.05							c0.61			
v/c Ratio		0.50						0.38	0.61	0.44	0.41	
Uniform Delay, d1		42.4						5.3	0.0	45.8	2.5	
Progression Factor		1.00						1.00	1.00	0.78	1.44	
Incremental Delay, d2		2.3						0.8	1.7	1.5	0.4	
Delay (s)		44.8						6.2	1.7	37.0	4.0	
Level of Service		D						A	A	D	A	
Approach Delay (s)		44.8			0.0			3.3			6.1	
Approach LOS		D			A			A			A	
<b>Intersection Summary</b>												
HCM Average Control Delay		9.8										
HCM Volume to Capacity ratio		0.61										
Actuated Cycle Length (s)		100.0										
Intersection Capacity Utilization		85.6%										
Analysis Period (min)		15										
c Critical Lane Group												

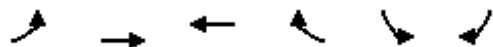
2022 No Build  
1001: Airport Way EB Ramp & Mt. Hood Ave.

2022 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0	4.0	4.0		
Lane Util. Factor	1.00		1.00					0.95	0.95	1.00	0.95		
Frt	1.00		0.85					0.88	0.85	1.00	1.00		
Flt Protected	0.95		1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)	1543		1380					1563	1504	1752	3505		
Flt Permitted	0.95		1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)	1543		1380					1563	1504	1752	3505		
Volume (vph)	137	0	137	0	0	0	0	128	1208	310	627	0	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	
Adj. Flow (vph)	154	0	154	0	0	0	0	144	1357	348	704	0	
RTOR Reduction (vph)	0	0	129	0	0	0	0	122	409	0	0	0	
Lane Group Flow (vph)	154	0	25	0	0	0	0	523	447	348	704	0	
Heavy Vehicles (%)	17%	17%	17%	2%	2%	2%	2%	2%	2%	3%	3%	3%	
Turn Type	Prot	custom						Perm		Prot			
Protected Phases	8							6		5			
Permitted Phases	8						6						
Actuated Green, G (s)	13.5	13.5						30.1		30.1		29.1	63.2
Effective Green, g (s)	13.5	13.5						30.1		30.1		29.1	63.2
Actuated g/C Ratio	0.16	0.16						0.36		0.36		0.34	0.75
Clearance Time (s)	4.0	4.0						4.0		4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0						3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	246	220						555		534		602	2615
v/s Ratio Prot	c0.10							c0.33				c0.20	0.20
v/s Ratio Perm	0.02						0.30						
v/c Ratio	0.63	0.11						0.94		0.84		0.58	0.27
Uniform Delay, d1	33.2	30.5						26.4		25.0		22.8	3.4
Progression Factor	1.00	1.00						1.00		1.00		1.00	1.00
Incremental Delay, d2	4.9	0.2						26.2		14.4		1.4	0.3
Delay (s)	38.1	30.7						52.6		39.5		24.1	3.7
Level of Service	D	C						D		D		C	A
Approach Delay (s)	34.4		0.0				45.1		10.4				
Approach LOS	C		A				D		B				
Intersection Summary													
HCM Average Control Delay			31.2		HCM Level of Service				C				
HCM Volume to Capacity ratio			0.74										
Actuated Cycle Length (s)			84.7		Sum of lost time (s)				12.0				
Intersection Capacity Utilization			73.7%		ICU Level of Service				D				
Analysis Period (min)			15										
c Critical Lane Group													


























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑	↑	↑↑	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.86	0.91	0.91	0.97	0.88
Frt		1.00	0.98	0.85	1.00	0.85
Flt Protected		1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)		6408	3183	1386	3335	2707
Flt Permitted		1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)		6408	3183	1386	3335	2707
Volume (vph)	0	1945	660	689	661	512
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	2137	725	757	726	563
RTOR Reduction (vph)	0	0	10	234	0	114
Lane Group Flow (vph)	0	2137	855	383	726	449
Heavy Vehicles (%)	2%	2%	6%	6%	5%	5%
Turn Type			Perm		Perm	
Protected Phases		2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)		53.9	53.9	53.9	26.1	26.1
Effective Green, g (s)		55.9	55.9	55.9	26.1	26.1
Actuated g/C Ratio		0.62	0.62	0.62	0.29	0.29
Clearance Time (s)		6.0	6.0	6.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		3980	1977	861	967	785
v/s Ratio Prot		c0.33	0.27		c0.22	
v/s Ratio Perm				0.28		0.17
v/c Ratio		0.54	0.43	0.45	0.75	0.57
Uniform Delay, d1		9.7	8.8	8.9	29.0	27.2
Progression Factor		1.00	0.54	9.34	1.00	1.00
Incremental Delay, d2		0.5	0.6	1.3	3.3	1.0
Delay (s)		10.2	5.4	84.7	32.3	28.2
Level of Service		B	A	F	C	C
Approach Delay (s)		10.2	38.4		30.5	
Approach LOS		B	D		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			24.1		HCM Level of Service	C
HCM Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			53.7%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←←	↑↑	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.95	0.91			
Frt	1.00	1.00	1.00			
Flt Protected	0.95	1.00	1.00			
Satd. Flow (prot)	3400	3505	5036			
Flt Permitted	0.95	1.00	1.00			
Satd. Flow (perm)	3400	3505	5036			
Volume (vph)	1394	1217	1344	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1467	1281	1415	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1467	1281	1415	0	0	0
Heavy Vehicles (%)	3%	3%	3%	3%	0%	0%
Turn Type	Prot					
Protected Phases	5	2	6			
Permitted Phases						
Actuated Green, G (s)	41.0	90.0	38.0			
Effective Green, g (s)	42.0	90.0	40.0			
Actuated g/C Ratio	0.47	1.00	0.44			
Clearance Time (s)	5.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0	3.0			
Lane Grp Cap (vph)	1587	3505	2238			
v/s Ratio Prot	c0.43	0.37	c0.28			
v/s Ratio Perm						
v/c Ratio	0.92	0.37	0.63			
Uniform Delay, d1	22.5	0.0	19.3			
Progression Factor	1.41	1.00	1.00			
Incremental Delay, d2	7.9	0.2	1.4			
Delay (s)	39.6	0.2	20.7			
Level of Service	D	A	C			
Approach Delay (s)		21.2	20.7		0.0	
Approach LOS		C	C		A	
<b>Intersection Summary</b>						
HCM Average Control Delay			21.1		HCM Level of Service	C
HCM Volume to Capacity ratio			0.78			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			72.4%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

























2022 No Build  
1006: Airport Way & NE 122nd Avenue




















2022 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	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		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1671	3343	1475	3303	3396		3242	1759	1495	1612	3223	1421
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1671	3343	1475	3303	3396		3242	1759	1495	1612	3223	1421
Volume (vph)	149	1112	374	235	1270	23	478	126	205	75	235	221
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	160	1196	402	253	1366	25	514	135	220	81	253	238
RTOR Reduction (vph)	0	0	75	0	1	0	0	0	165	0	0	146
Lane Group Flow (vph)	160	1196	327	253	1390	0	514	135	55	81	253	92
Confl. Peds. (#/hr)			1									2
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	8%	8%	8%	12%	12%	12%
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	12.0	48.2	48.2	10.7	46.9		20.0	26.2	26.2	8.0	14.2	14.2
Effective Green, g (s)	11.0	49.9	49.9	9.7	48.6		19.0	27.7	27.7	7.0	15.7	15.7
Actuated g/C Ratio	0.10	0.45	0.45	0.09	0.44		0.17	0.25	0.25	0.06	0.14	0.14
Clearance Time (s)	3.0	5.7	5.7	3.0	5.7		3.0	5.5	5.5	3.0	5.5	5.5
Vehicle Extension (s)	1.0	2.0	2.0	1.0	1.0		1.0	2.0	2.0	1.0	2.0	2.0
Lane Grp Cap (vph)	167	1512	667	290	1496		558	442	375	102	459	202
v/s Ratio Prot	c0.10	0.36		0.08	c0.41		c0.16	0.08		0.05	c0.08	
v/s Ratio Perm			0.22						0.04			0.06
v/c Ratio	0.96	0.79	0.49	0.87	0.93		0.92	0.31	0.15	0.79	0.55	0.46
Uniform Delay, d1	49.4	25.8	21.3	49.7	29.2		44.9	33.5	32.1	50.9	44.0	43.4
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	56.3	2.7	0.2	23.2	10.2		20.5	0.1	0.1	31.5	0.8	0.6
Delay (s)	105.7	28.5	21.5	72.9	39.4		65.4	33.6	32.2	82.4	44.8	44.0
Level of Service	F	C	C	E	D		E	C	C	F	D	D
Approach Delay (s)		33.9			44.6			52.0			49.8	
Approach LOS		C			D			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			42.7			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			110.3			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			78.4%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

2022 No Build  
1008: Alderwood & 82nd Avenue

2022 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.97	1.00	1.00	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	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Volume (vph)	520	303	75	282	187	143	74	801	213	176	430	228
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)	542	316	78	294	195	149	77	834	222	183	448	238
RTOR Reduction (vph)	0	0	55	0	0	125	0	0	114	0	0	136
Lane Group Flow (vph)	542	316	23	294	195	24	77	834	108	183	448	102
Heavy Vehicles (%)	4%	4%	4%	16%	16%	16%	7%	7%	7%	10%	10%	10%
Turn Type	Prot		Perm	Prot		Perm	Prot	pm+ov		Prot		Perm
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	21.0	23.9	23.9	14.4	17.3	17.3	8.3	37.4	51.8	15.7	44.8	44.8
Effective Green, g (s)	20.0	23.9	23.9	13.4	17.3	17.3	7.3	38.4	51.8	14.7	45.8	45.8
Actuated g/C Ratio	0.19	0.22	0.22	0.13	0.16	0.16	0.07	0.36	0.49	0.14	0.43	0.43
Clearance Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	5.0	3.0	3.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	633	410	349	380	266	226	116	1218	791	227	1413	632
v/s Ratio Prot	c0.16	c0.17		0.10	0.12		0.05	c0.25	0.02	c0.11	0.14	
v/s Ratio Perm			0.01			0.02			0.05			0.07
v/c Ratio	0.86	0.77	0.07	0.77	0.73	0.11	0.66	0.68	0.14	0.81	0.32	0.16
Uniform Delay, d1	41.8	38.7	32.5	45.0	42.4	38.0	48.4	28.9	15.0	44.5	20.0	18.6
Progression Factor	1.00	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	11.0	8.7	0.1	9.5	10.0	0.2	13.4	3.1	0.1	18.5	0.6	0.6
Delay (s)	52.8	47.4	32.5	54.5	52.3	38.2	61.7	32.0	15.1	63.0	20.6	19.1
Level of Service	D	D	C	D	D	D	E	C	B	E	C	B
Approach Delay (s)		49.3			50.0			30.7			29.1	
Approach LOS		D			D			C			C	
Intersection Summary												
HCM Average Control Delay			38.6				HCM Level of Service			D		
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			106.4				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			69.9%				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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99			0.96		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1770	3517		1770	3513			1765		1770	1669	
Flt Permitted	0.95	1.00		0.95	1.00			0.78		0.58	1.00	
Satd. Flow (perm)	1770	3517		1770	3513			1386		1083	1669	
Volume (vph)	80	1181	51	69	1056	55	46	82	55	55	99	224
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)	88	1298	56	76	1160	60	51	90	60	60	109	246
RTOR Reduction (vph)	0	3	0	0	3	0	0	11	0	0	62	0
Lane Group Flow (vph)	88	1351	0	76	1217	0	0	190	0	60	293	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	8.0	46.2		7.4	45.6			38.2		38.2	38.2	
Effective Green, g (s)	8.0	46.2		7.4	45.6			38.2		38.2	38.2	
Actuated g/C Ratio	0.08	0.45		0.07	0.44			0.37		0.37	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	136	1565		126	1543			510		399	614	
v/s Ratio Prot	c0.05	c0.38		0.04	0.35						c0.18	
v/s Ratio Perm								0.14		0.06		
v/c Ratio	0.65	0.86		0.60	0.79			0.37		0.15	0.48	
Uniform Delay, d1	46.5	26.0		46.8	25.0			24.0		21.9	25.1	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	10.1	5.2		7.9	2.8			2.1		0.8	2.6	
Delay (s)	56.7	31.2		54.7	27.7			26.1		22.7	27.8	
Level of Service	E	C		D	C			C		C	C	
Approach Delay (s)		32.7			29.3			26.1			27.1	
Approach LOS		C			C			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			30.3			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			103.8			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			80.6%			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		↑↑	↑	↑	↑↑↑				↑↑			↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0				4.0			4.0
Lane Util. Factor		0.95	1.00	1.00	0.91				0.88			1.00
Frt		1.00	0.85	1.00	1.00				0.85			0.86
Flt Protected		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (prot)		3438	1538	1641	4715				2760			1536
Flt Permitted		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (perm)		3438	1538	1641	4715				2760			1536
Volume (vph)	0	1763	1275	363	1396	0	0	0	450	0	0	385
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1818	1314	374	1439	0	0	0	464	0	0	397
RTOR Reduction (vph)	0	0	196	0	0	0	0	0	119	0	0	86
Lane Group Flow (vph)	0	1818	1118	374	1439	0	0	0	345	0	0	311
Heavy Vehicles (%)	5%	5%	5%	10%	10%	10%	3%	3%	3%	7%	7%	7%
Turn Type		Perm custom							custom			custom
Protected Phases		2		1	8	6			1	8		8
Permitted Phases			2	1					1	8		8
Actuated Green, G (s)		51.1	51.1	38.9	60.8				38.9			29.2
Effective Green, g (s)		53.1	53.1	38.9	62.8				38.9			29.2
Actuated g/C Ratio		0.53	0.53	0.39	0.63				0.39			0.29
Clearance Time (s)		6.0	6.0		6.0							4.0
Vehicle Extension (s)		3.0	3.0		3.0							3.0
Lane Grp Cap (vph)		1826	817	638	2961				1074			449
v/s Ratio Prot		0.53		c0.23	0.31				0.12			c0.20
v/s Ratio Perm			c0.73									
v/c Ratio		1.00	1.37	0.59	0.49				0.32			0.69
Uniform Delay, d1		23.3	23.4	24.2	10.0				21.3			31.4
Progression Factor		0.65	1.05	1.49	0.46				1.00			1.00
Incremental Delay, d2		14.5	170.3	1.2	0.5				0.2			4.6
Delay (s)		29.6	195.1	37.1	5.1				21.5			36.0
Level of Service		C	F	D	A				C			D
Approach Delay (s)		99.0			11.7			21.5			36.0	
Approach LOS		F			B			C			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			61.2			HCM Level of Service				E		
HCM Volume to Capacity ratio			1.06									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			105.7%			ICU Level of Service				G		
Analysis Period (min)			15									
c Critical Lane Group												

2022 No Build  
1014: Killingsworth St. & I-205 NB Ramp


















2022 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis






















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		0.95			0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			1.00	
Satd. Flow (prot)	3335	3438	1505	3335	3438	1538		3358			3534	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.82			1.00	
Satd. Flow (perm)	3335	3438	1505	3335	3438	1538		2793			3534	
Volume (vph)	727	1185	273	205	1025	450	118	300	0	0	117	10
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)	757	1234	284	214	1068	469	123	312	0	0	122	10
RTOR Reduction (vph)	0	0	68	0	0	76	0	0	0	0	6	0
Lane Group Flow (vph)	757	1234	216	214	1068	393	0	435	0	0	126	0
Confl. Peds. (#/hr)			7									
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	6%	6%	6%	1%	1%	1%
Turn Type	Prot		Perm	Prot		Perm	Perm					
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2		6	6	8					
Actuated Green, G (s)	26.6	54.6	54.6	11.3	39.3	39.3		20.1			20.1	
Effective Green, g (s)	27.1	55.6	55.6	11.8	40.3	40.3		20.6			20.6	
Actuated g/C Ratio	0.27	0.56	0.56	0.12	0.40	0.40		0.21			0.21	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0		4.5			4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	904	1912	837	394	1386	620		575			728	
v/s Ratio Prot	c0.23	0.36		0.06	c0.31						0.04	
v/s Ratio Perm			0.14			0.26		c0.16				
v/c Ratio	0.84	0.65	0.26	0.54	0.77	0.63		0.76			0.17	
Uniform Delay, d1	34.4	15.4	11.5	41.6	25.8	23.9		37.3			32.7	
Progression Factor	0.65	1.65	2.15	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	3.3	0.8	0.3	1.5	4.2	4.9		5.6			0.1	
Delay (s)	25.5	26.1	25.1	43.1	30.0	28.8		43.0			32.8	
Level of Service	C	C	C	D	C	C		D			C	
Approach Delay (s)		25.8			31.3			43.0			32.8	
Approach LOS		C			C			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			29.7				HCM Level of Service				C	
HCM Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			80.8%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

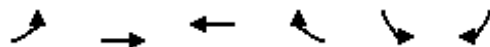
	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	788	143	128	302	103	374
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	866	157	141	332	113	411
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1023		1558	945
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1023		1558	945
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			79		0	0
cM capacity (veh/h)			679		98	318
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1023	473	524			
Volume Left	0	141	113			
Volume Right	157	0	411			
cSH	1700	679	214			
Volume to Capacity	0.60	0.21	2.45			
Queue Length 95th (ft)	0	19	1082			
Control Delay (s)	0.0	5.6	699.8			
Lane LOS		A	F			
Approach Delay (s)	0.0	5.6	699.8			
Approach LOS			F			
Intersection Summary						
Average Delay		182.9				
Intersection Capacity Utilization		111.9%		ICU Level of Service		H
Analysis Period (min)		15				

2022 No Build  
2002: NE Airport Way & Parking Lot

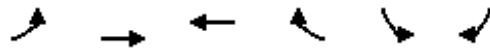
2022 PM Peak Hour - No Build  
HCM Unsignalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	177	36	63	101	15	38	5	38	13	5	0
Peak Hour Factor	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Hourly flow rate (vph)	0	277	56	98	158	23	59	8	59	20	8	0
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1						
Volume Total (vph)	333	98	181	67	59	28						
Volume Left (vph)	0	98	0	59	0	20						
Volume Right (vph)	56	0	23	0	59	0						
Hadj (s)	0.12	0.89	0.30	0.54	-0.60	0.60						
Departure Headway (s)	5.5	6.3	5.7	6.7	5.6	7.0						
Degree Utilization, x	0.51	0.17	0.29	0.13	0.09	0.05						
Capacity (veh/h)	635	555	615	495	588	463						
Control Delay (s)	14.0	9.3	9.7	9.5	8.0	10.4						
Approach Delay (s)	14.0	9.6		8.8		10.4						
Approach LOS	B	A		A		B						
Intersection Summary												
Delay			11.4									
HCM Level of Service			B									
Intersection Capacity Utilization			35.4%		ICU Level of Service		A					
Analysis Period (min)			15									

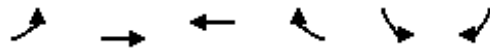
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85		0.91		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1770	1827		1770	1863	1583		1665		1770	1609	
Flt Permitted	0.59	1.00		0.41	1.00	1.00		0.91		0.62	1.00	
Satd. Flow (perm)	1094	1827		762	1863	1583		1529		1150	1609	
Volume (vph)	56	279	41	89	208	177	66	10	180	357	10	99
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)	62	307	45	98	229	195	73	11	198	392	11	109
RTOR Reduction (vph)	0	5	0	0	0	133	0	79	0	0	53	0
Lane Group Flow (vph)	62	347	0	98	229	62	0	203	0	392	67	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases	4			8		8	2			6		
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	14.8	14.8		14.8	14.8	14.8		24.1		24.1	24.1	
Effective Green, g (s)	14.8	14.8		14.8	14.8	14.8		24.1		24.1	24.1	
Actuated g/C Ratio	0.32	0.32		0.32	0.32	0.32		0.51		0.51	0.51	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	345	577		240	588	500		786		591	827	
v/s Ratio Prot	c0.19			0.12						0.04		
v/s Ratio Perm	0.06			0.13		0.04		0.13		c0.34		
v/c Ratio	0.18	0.60		0.41	0.39	0.12		0.26		0.66	0.08	
Uniform Delay, d1	11.6	13.6		12.6	12.5	11.4		6.4		8.4	5.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.3	1.8		1.1	0.4	0.1		0.2		2.8	0.0	
Delay (s)	11.9	15.3		13.7	13.0	11.5		6.6		11.2	5.8	
Level of Service	B	B		B	B	B		A		B	A	
Approach Delay (s)	14.8			12.6				6.6		9.9		
Approach LOS	B			B				A		A		
Intersection Summary												
HCM Average Control Delay			11.4		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			46.9		Sum of lost time (s)				8.0			
Intersection Capacity Utilization			70.5%		ICU Level of Service				C			
Analysis Period (min)			15									
c Critical Lane Group												














Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑	↑↑		↰	↑
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	366	1047	979	76	72	245
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	436	1246	1165	90	86	292
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1256				2705	628
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1256				2705	628
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	18				0	30
cM capacity (veh/h)	528				3	418
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	436	623	623	777	479	377
Volume Left	436	0	0	0	0	86
Volume Right	0	0	0	0	90	292
cSH	528	1700	1700	1700	1700	12
Volume to Capacity	0.82	0.37	0.37	0.46	0.28	30.76
Queue Length 95th (ft)	206	0	0	0	0	Err
Control Delay (s)	36.3	0.0	0.0	0.0	0.0	Err
Lane LOS	E					F
Approach Delay (s)	9.4			0.0		Err
Approach LOS						F
<b>Intersection Summary</b>						
Average Delay		1142.9				
Intersection Capacity Utilization		63.7%		ICU Level of Service		B
Analysis Period (min)		15				



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1687	3374	2970		1626	1455
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1687	3374	2970		1626	1455
Volume (vph)	134	1048	828	77	58	248
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	146	1139	900	84	63	270
RTOR Reduction (vph)	0	0	8	0	0	225
Lane Group Flow (vph)	146	1139	976	0	63	45
Heavy Vehicles (%)	7%	7%	20%	20%	11%	11%
Turn Type	Prot			Perm		
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	7.0	34.5	23.5		8.6	8.6
Effective Green, g (s)	7.0	34.5	23.5		8.6	8.6
Actuated g/C Ratio	0.14	0.68	0.46		0.17	0.17
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)	231	2278	1366		274	245
v/s Ratio Prot	c0.09	0.34	c0.33		c0.04	
v/s Ratio Perm						0.03
v/c Ratio	0.63	0.50	0.71		0.23	0.19
Uniform Delay, d1	20.8	4.1	11.1		18.4	18.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.5	0.2	1.8		0.4	0.4
Delay (s)	26.4	4.2	12.9		18.8	18.6
Level of Service	C	A	B		B	B
Approach Delay (s)		6.8	12.9		18.6	
Approach LOS		A	B		B	
<b>Intersection Summary</b>						
HCM Average Control Delay			10.6		HCM Level of Service	B
HCM Volume to Capacity ratio			0.59			
Actuated Cycle Length (s)			51.1		Sum of lost time (s)	12.0
Intersection Capacity Utilization			47.4%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						





















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔↔	↔↔		↔↔	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	96	930	803	119	29	75
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	100	969	836	124	30	78
Pedestrians		1	1		1	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		590	881			
pX, platoon unblocked					0.90	
vC, conflicting volume	961				1585	482
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	961				1541	482
tC, single (s)	4.3				7.3	7.4
tC, 2 stage (s)						
tF (s)	2.3				3.8	3.6
p0 queue free %	85				53	83
cM capacity (veh/h)	675				64	468
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	423	646	558	403	108	
Volume Left	100	0	0	0	30	
Volume Right	0	0	0	124	78	
cSH	675	1700	1700	1700	169	
Volume to Capacity	0.15	0.38	0.33	0.24	0.64	
Queue Length 95th (ft)	13	0	0	0	90	
Control Delay (s)	4.2	0.0	0.0	0.0	57.8	
Lane LOS	A				F	
Approach Delay (s)	1.7		0.0		57.8	
Approach LOS					F	
Intersection Summary						
Average Delay			3.8			
Intersection Capacity Utilization			71.0%		ICU Level of Service	C
Analysis Period (min)			15			












						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.98	1.00	1.00
Satd. Flow (prot)	1736	1553		1744	1667	1417
Flt Permitted	0.95	1.00		0.78	1.00	1.00
Satd. Flow (perm)	1736	1553		1393	1667	1417
Volume (vph)	651	165	145	256	146	329
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	715	181	159	281	160	362
RTOR Reduction (vph)	0	72	0	0	0	234
Lane Group Flow (vph)	715	109	0	440	160	128
Heavy Vehicles (%)	4%	4%	7%	7%	14%	14%
Turn Type	Perm		Perm		Perm	
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	46.6	46.6		29.9	29.9	29.9
Effective Green, g (s)	46.6	46.6		29.9	29.9	29.9
Actuated g/C Ratio	0.55	0.55		0.35	0.35	0.35
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)	957	856		493	590	501
v/s Ratio Prot	c0.41				0.10	
v/s Ratio Perm		0.07		c0.32		0.09
v/c Ratio	0.75	0.13		0.89	0.27	0.26
Uniform Delay, d1	14.5	9.1		25.8	19.5	19.4
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.2	0.1		18.2	0.2	0.3
Delay (s)	17.7	9.2		43.9	19.8	19.7
Level of Service	B	A		D	B	B
Approach Delay (s)	16.0			43.9	19.7	
Approach LOS	B			D	B	
<b>Intersection Summary</b>						
HCM Average Control Delay			23.6		HCM Level of Service	C
HCM Volume to Capacity ratio			0.80			
Actuated Cycle Length (s)			84.5		Sum of lost time (s)	8.0
Intersection Capacity Utilization			75.2%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

2022 No Build  
3010: Airport Way WB Ramps & 82nd Avenue













2022 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		0.95	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	0.97			1.00	1.00
Satd. Flow (prot)				1770	1583		1681	1714			1863	1583
Flt Permitted				0.95	1.00		0.95	0.72			1.00	1.00
Satd. Flow (perm)				1770	1583		1681	1268			1863	1583
Volume (vph)	0	0	0	570	0	17	416	90	0	0	27	61
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	626	0	19	457	99	0	0	30	67
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	0	47
Lane Group Flow (vph)	0	0	0	626	7	0	271	285	0	0	30	20
Turn Type				Perm			Prot					Perm
Protected Phases				8			5		2		6	
Permitted Phases				8							6	
Actuated Green, G (s)				38.2	38.2		19.7	53.8			30.1	30.1
Effective Green, g (s)				38.2	38.2		19.7	53.8			30.1	30.1
Actuated g/C Ratio				0.38	0.38		0.20	0.54			0.30	0.30
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				676	605		331	770			561	476
v/s Ratio Prot					0.00		c0.16	0.07			0.02	
v/s Ratio Perm				c0.35				c0.13				0.01
v/c Ratio				0.93	0.01		0.82	0.37			0.05	0.04
Uniform Delay, d1				29.5	19.2		38.4	13.3			24.8	24.7
Progression Factor				1.00	1.00		1.42	1.42			1.00	1.00
Incremental Delay, d2				18.6	0.0		13.6	0.3			0.2	0.2
Delay (s)				48.2	19.2		68.4	19.2			25.0	24.9
Level of Service				D	B		E	B			C	C
Approach Delay (s)		0.0			47.3			43.2			24.9	
Approach LOS		A			D			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			43.9			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			85.6%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

# **2022 Build Synchro Worksheets**


						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.97	1.00	1.00
Satd. Flow (prot)	1626	1455		1624	1652	1404
Flt Permitted	0.95	1.00		0.76	1.00	1.00
Satd. Flow (perm)	1626	1455		1260	1652	1404
Volume (vph)	345	304	202	187	133	160
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	401	353	235	217	155	186
RTOR Reduction (vph)	0	222	0	0	0	99
Lane Group Flow (vph)	401	131	0	452	155	87
Heavy Vehicles (%)	11%	11%	14%	14%	15%	15%
Turn Type	Perm		Perm			Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	18.5	18.5		23.2	23.2	23.2
Effective Green, g (s)	18.5	18.5		23.2	23.2	23.2
Actuated g/C Ratio	0.37	0.37		0.47	0.47	0.47
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)	605	542		588	771	655
v/s Ratio Prot	c0.25				0.09	
v/s Ratio Perm		0.09		c0.36		0.06
v/c Ratio	0.66	0.24		0.77	0.20	0.13
Uniform Delay, d1	13.0	10.8		11.0	7.8	7.5
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.7	0.2		6.0	0.1	0.1
Delay (s)	15.7	11.0		17.0	7.9	7.6
Level of Service	B	B		B	A	A
Approach Delay (s)	13.5			17.0	7.8	
Approach LOS	B			B	A	
<b>Intersection Summary</b>						
HCM Average Control Delay			13.3		HCM Level of Service	B
HCM Volume to Capacity ratio			0.72			
Actuated Cycle Length (s)			49.7		Sum of lost time (s)	8.0
Intersection Capacity Utilization			57.1%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1251	52	110	1077	34	134
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1375	57	121	1184	37	147
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1432		2237	716
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1432		2237	716
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			74		0	60
cM capacity (veh/h)			470		27	373
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	916	515	121	592	592	185
Volume Left	0	0	121	0	0	37
Volume Right	0	57	0	0	0	147
cSH	1700	1700	470	1700	1700	103
Volume to Capacity	0.54	0.30	0.26	0.35	0.35	1.79
Queue Length 95th (ft)	0	0	25	0	0	372
Control Delay (s)	0.0	0.0	15.3	0.0	0.0	464.0
Lane LOS			C			F
Approach Delay (s)	0.0		1.4			464.0
Approach LOS						F
Intersection Summary						
Average Delay			30.0			
Intersection Capacity Utilization			62.5%		ICU Level of Service	B
Analysis Period (min)			15			

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	8	33	208	91	18	3	142	62	62	3	31	25
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	9	37	234	102	20	3	160	70	70	3	35	28
Approach Volume (veh/h)	280				126				299		66	
Crossing Volume (veh/h)	140				238				49		282	
High Capacity (veh/h)	1241				1149				1332		1110	
High v/c (veh/h)	0.23				0.11				0.22		0.06	
Low Capacity (veh/h)	1030				947				1114		912	
Low v/c (veh/h)	0.27				0.13				0.27		0.07	
Intersection Summary												
Maximum v/c High			0.23									
Maximum v/c Low			0.27									
Intersection Capacity Utilization			Err%		ICU Level of Service				H			




















2022 Build  
1000: Airport Way EB Ramps & 82nd Avenue

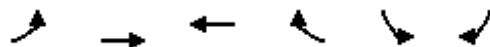
2022 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↑	↗	↘	↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00						1.00	1.00	1.00	1.00	
Frt		0.88						1.00	0.85	1.00	1.00	
Flt Protected		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1632						1863	1583	1770	1863	
Flt Permitted		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1632						1863	1583	1770	1863	
Volume (vph)	47	0	349	0	0	0	0	584	1064	39	579	0
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)	52	0	384	0	0	0	0	642	1169	43	636	0
RTOR Reduction (vph)	0	236	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	200	0	0	0	0	0	642	1169	43	636	0
Turn Type	Perm						Free			Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4								Free			
Actuated Green, G (s)		16.1						66.4	100.0	5.5	75.9	
Effective Green, g (s)		16.1						66.4	100.0	5.5	75.9	
Actuated g/C Ratio		0.16						0.66	1.00	0.06	0.76	
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)		263						1237	1583	97	1414	
v/s Ratio Prot								0.34		0.02	0.34	
v/s Ratio Perm		0.12							c0.74			
v/c Ratio		0.76						0.52	0.74	0.44	0.45	
Uniform Delay, d1		40.1						8.6	0.0	45.8	4.4	
Progression Factor		1.00						1.00	1.00	1.09	0.66	
Incremental Delay, d2		12.2						1.6	3.1	1.5	0.5	
Delay (s)		52.3						10.2	3.1	51.4	3.4	
Level of Service		D						B	A	D	A	
Approach Delay (s)		52.3			0.0			5.6			6.4	
Approach LOS		D			A			A			A	
<b>Intersection Summary</b>												
HCM Average Control Delay		12.8						HCM Level of Service		B		
HCM Volume to Capacity ratio		0.74										
Actuated Cycle Length (s)		100.0						Sum of lost time (s)		0.0		
Intersection Capacity Utilization		97.8%						ICU Level of Service		F		
Analysis Period (min)		15										
c Critical Lane Group												

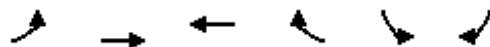
2022 Build  
1001: Airport Way EB Ramp & Mt. Hood Ave.

2022 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00					0.95	0.95	1.00	0.95	
Frt	1.00		0.85					0.88	0.85	1.00	1.00	
Flt Protected	0.95		1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1543		1380					1564	1504	1752	3505	
Flt Permitted	0.95		1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1543		1380					1564	1504	1752	3505	
Volume (vph)	137	0	138	0	0	0	0	129	1208	310	627	0
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	154	0	155	0	0	0	0	145	1357	348	704	0
RTOR Reduction (vph)	0	0	130	0	0	0	0	121	409	0	0	0
Lane Group Flow (vph)	154	0	25	0	0	0	0	524	448	348	704	0
Heavy Vehicles (%)	17%	17%	17%	2%	2%	2%	2%	2%	2%	3%	3%	3%
Turn Type	Prot	custom							Perm	Prot		
Protected Phases	8							6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)	13.5		13.5					30.1	30.1	29.1	63.2	
Effective Green, g (s)	13.5		13.5					30.1	30.1	29.1	63.2	
Actuated g/C Ratio	0.16		0.16					0.36	0.36	0.34	0.75	
Clearance Time (s)	4.0		4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	246		220					556	534	602	2615	
v/s Ratio Prot	c0.10							c0.33		c0.20	0.20	
v/s Ratio Perm			0.02						0.30			
v/c Ratio	0.63		0.11					0.94	0.84	0.58	0.27	
Uniform Delay, d1	33.2		30.5					26.5	25.1	22.8	3.4	
Progression Factor	1.00		1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.9		0.2					26.2	14.6	1.4	0.3	
Delay (s)	38.1		30.7					52.7	39.6	24.1	3.7	
Level of Service	D		C					D	D	C	A	
Approach Delay (s)		34.4			0.0			45.2			10.4	
Approach LOS		C			A			D			B	
Intersection Summary												
HCM Average Control Delay			31.3									
HCM Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			84.7							12.0		
Intersection Capacity Utilization			73.7%									
Analysis Period (min)			15									
c Critical Lane Group												



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑	↑	↑↑	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.86	0.91	0.91	0.97	0.88
Frt		1.00	0.98	0.85	1.00	0.85
Flt Protected		1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)		6408	3200	1386	3335	2707
Flt Permitted		1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)		6408	3200	1386	3335	2707
Volume (vph)	0	2085	702	689	661	584
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	2291	771	757	726	642
RTOR Reduction (vph)	0	0	8	248	0	97
Lane Group Flow (vph)	0	2291	876	396	726	545
Heavy Vehicles (%)	2%	2%	6%	6%	5%	5%
Turn Type			Perm		Perm	
Protected Phases		2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)		53.4	53.4	53.4	26.6	26.6
Effective Green, g (s)		55.4	55.4	55.4	26.6	26.6
Actuated g/C Ratio		0.62	0.62	0.62	0.30	0.30
Clearance Time (s)		6.0	6.0	6.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		3944	1970	853	986	800
v/s Ratio Prot		c0.36	0.27		c0.22	
v/s Ratio Perm				0.29		0.20
v/c Ratio		0.58	0.44	0.46	0.74	0.68
Uniform Delay, d1		10.4	9.2	9.3	28.5	28.0
Progression Factor		1.00	0.57	10.08	1.00	1.00
Incremental Delay, d2		0.6	0.5	1.4	2.9	2.4
Delay (s)		11.0	5.8	95.2	31.4	30.4
Level of Service		B	A	F	C	C
Approach Delay (s)		11.0	43.5		30.9	
Approach LOS		B	D		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			25.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.63			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			55.7%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						














































Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←←	↑↑	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.95	0.91			
Frt	1.00	1.00	1.00			
Flt Protected	0.95	1.00	1.00			
Satd. Flow (prot)	3400	3505	5036			
Flt Permitted	0.95	1.00	1.00			
Satd. Flow (perm)	3400	3505	5036			
Volume (vph)	1476	1275	1386	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1554	1342	1459	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1554	1342	1459	0	0	0
Heavy Vehicles (%)	3%	3%	3%	3%	0%	0%
Turn Type	Prot					
Protected Phases	5	2	6			
Permitted Phases						
Actuated Green, G (s)	43.1	90.0	35.9			
Effective Green, g (s)	44.1	90.0	37.9			
Actuated g/C Ratio	0.49	1.00	0.42			
Clearance Time (s)	5.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0	3.0			
Lane Grp Cap (vph)	1666	3505	2121			
v/s Ratio Prot	c0.46	0.38	c0.29			
v/s Ratio Perm						
v/c Ratio	0.93	0.38	0.69			
Uniform Delay, d1	21.6	0.0	21.2			
Progression Factor	1.38	1.00	1.00			
Incremental Delay, d2	8.2	0.3	1.8			
Delay (s)	37.9	0.3	23.1			
Level of Service	D	A	C			
Approach Delay (s)		20.5	23.1		0.0	
Approach LOS		C	C		A	
<b>Intersection Summary</b>						
HCM Average Control Delay			21.3		HCM Level of Service	C
HCM Volume to Capacity ratio			0.82			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			75.6%		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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	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		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1671	3343	1475	3303	3397		3242	1759	1495	1612	3223	1421
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1671	3343	1475	3303	3397		3242	1759	1495	1612	3223	1421
Volume (vph)	150	1167	376	235	1299	23	479	126	205	75	235	233
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	161	1255	404	253	1397	25	515	135	220	81	253	251
RTOR Reduction (vph)	0	0	72	0	1	0	0	0	166	0	0	144
Lane Group Flow (vph)	161	1255	332	253	1421	0	515	135	54	81	253	107
Confl. Peds. (#/hr)			1									2
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	8%	8%	8%	12%	12%	12%
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	12.0	49.2	49.2	10.7	47.9		19.0	25.7	25.7	8.0	14.7	14.7
Effective Green, g (s)	11.0	50.9	50.9	9.7	49.6		18.0	27.2	27.2	7.0	16.2	16.2
Actuated g/C Ratio	0.10	0.46	0.46	0.09	0.45		0.16	0.25	0.25	0.06	0.15	0.15
Clearance Time (s)	3.0	5.7	5.7	3.0	5.7		3.0	5.5	5.5	3.0	5.5	5.5
Vehicle Extension (s)	1.0	2.0	2.0	1.0	1.0		1.0	2.0	2.0	1.0	2.0	2.0
Lane Grp Cap (vph)	166	1536	678	289	1521		527	432	367	102	471	208
v/s Ratio Prot	c0.10	0.38		0.08	c0.42		c0.16	0.08		0.05	c0.08	
v/s Ratio Perm			0.23						0.04			0.08
v/c Ratio	0.97	0.82	0.49	0.88	0.93		0.98	0.31	0.15	0.79	0.54	0.51
Uniform Delay, d1	49.7	25.9	20.9	50.0	29.1		46.2	34.2	32.7	51.2	43.8	43.7
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	59.8	3.3	0.2	23.6	10.8		32.9	0.2	0.1	31.5	0.6	0.9
Delay (s)	109.6	29.2	21.1	73.5	39.8		79.1	34.3	32.8	82.7	44.4	44.5
Level of Service	F	C	C	E	D		E	C	C	F	D	D
Approach Delay (s)		34.5			44.9			60.4			49.8	
Approach LOS		C			D			E			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			44.4			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			110.8			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			79.3%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

2022 Build  
1008: Alderwood & 82nd Avenue

2022 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.97	1.00	1.00	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	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Volume (vph)	570	303	75	282	187	144	74	858	213	177	479	248
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)	594	316	78	294	195	150	77	894	222	184	499	258
RTOR Reduction (vph)	0	0	55	0	0	126	0	0	114	0	0	149
Lane Group Flow (vph)	594	316	23	294	195	24	77	894	108	184	499	109
Heavy Vehicles (%)	4%	4%	4%	16%	16%	16%	7%	7%	7%	10%	10%	10%
Turn Type	Prot		Perm	Prot		Perm	Prot	pm+ov		Prot		Perm
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	22.7	25.0	25.0	15.2	17.5	17.5	8.4	37.3	52.5	15.6	44.5	44.5
Effective Green, g (s)	21.7	25.0	25.0	14.2	17.5	17.5	7.4	38.3	52.5	14.6	45.5	45.5
Actuated g/C Ratio	0.20	0.23	0.23	0.13	0.16	0.16	0.07	0.35	0.49	0.14	0.42	0.42
Clearance Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	5.0	3.0	3.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	676	423	359	397	265	225	115	1195	789	222	1381	618
v/s Ratio Prot	c0.18	c0.17		0.10	0.12		0.05	c0.26	0.02	c0.11	0.15	
v/s Ratio Perm			0.02			0.02			0.05			0.07
v/c Ratio	0.88	0.75	0.07	0.74	0.74	0.11	0.67	0.75	0.14	0.83	0.36	0.18
Uniform Delay, d1	41.9	38.6	32.4	45.2	43.1	38.6	49.2	30.7	15.3	45.5	21.4	19.6
Progression Factor	1.00	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	12.4	7.1	0.1	7.3	10.1	0.2	13.8	4.3	0.1	21.8	0.7	0.6
Delay (s)	54.4	45.7	32.5	52.4	53.2	38.9	63.0	35.0	15.4	67.3	22.1	20.2
Level of Service	D	D	C	D	D	D	E	C	B	E	C	C
Approach Delay (s)		49.9			49.5			33.1			30.4	
Approach LOS		D			D			C			C	
Intersection Summary												
HCM Average Control Delay			39.6				HCM Level of Service			D		
HCM Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			108.1				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			73.0%				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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99			0.96		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1770	3518		1770	3514			1761		1770	1668	
Flt Permitted	0.95	1.00		0.95	1.00			0.76		0.56	1.00	
Satd. Flow (perm)	1770	3518		1770	3514			1354		1038	1668	
Volume (vph)	97	1222	51	71	1074	55	46	89	65	55	100	231
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)	107	1343	56	78	1180	60	51	98	71	60	110	254
RTOR Reduction (vph)	0	3	0	0	3	0	0	13	0	0	64	0
Lane Group Flow (vph)	107	1396	0	78	1237	0	0	207	0	60	300	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	8.5	47.7		7.5	46.7			38.2		38.2	38.2	
Effective Green, g (s)	8.5	47.7		7.5	46.7			38.2		38.2	38.2	
Actuated g/C Ratio	0.08	0.45		0.07	0.44			0.36		0.36	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	143	1592		126	1557			491		376	605	
v/s Ratio Prot	c0.06	c0.40		0.04	0.35						c0.18	
v/s Ratio Perm								0.15		0.06		
v/c Ratio	0.75	0.88		0.62	0.79			0.42		0.16	0.50	
Uniform Delay, d1	47.4	26.2		47.6	25.2			25.3		22.7	26.1	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	19.1	5.8		8.7	2.9			2.6		0.9	2.9	
Delay (s)	66.5	32.0		56.3	28.1			27.9		23.6	29.0	
Level of Service	E	C		E	C			C		C	C	
Approach Delay (s)		34.4			29.8			27.9			28.3	
Approach LOS		C			C			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			31.5			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			105.4			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			83.3%			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		↑↑	↑	↑	↑↑↑				↑↑			↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0				4.0			4.0
Lane Util. Factor		0.95	1.00	1.00	0.91				0.88			1.00
Frt		1.00	0.85	1.00	1.00				0.85			0.86
Flt Protected		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (prot)		3438	1538	1641	4715				2760			1536
Flt Permitted		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (perm)		3438	1538	1641	4715				2760			1536
Volume (vph)	0	1763	1275	363	1396	0	0	0	450	0	0	385
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	1818	1314	374	1439	0	0	0	464	0	0	397
RTOR Reduction (vph)	0	0	196	0	0	0	0	0	119	0	0	86
Lane Group Flow (vph)	0	1818	1118	374	1439	0	0	0	345	0	0	311
Heavy Vehicles (%)	5%	5%	5%	10%	10%	10%	3%	3%	3%	7%	7%	7%
Turn Type		Perm custom							custom			custom
Protected Phases		2		1	8	6			1	8		8
Permitted Phases			2	1					1	8		8
Actuated Green, G (s)		51.1	51.1	38.9	60.8				38.9			29.2
Effective Green, g (s)		53.1	53.1	38.9	62.8				38.9			29.2
Actuated g/C Ratio		0.53	0.53	0.39	0.63				0.39			0.29
Clearance Time (s)		6.0	6.0		6.0							4.0
Vehicle Extension (s)		3.0	3.0		3.0							3.0
Lane Grp Cap (vph)		1826	817	638	2961				1074			449
v/s Ratio Prot		0.53		c0.23	0.31				0.12			c0.20
v/s Ratio Perm			c0.73									
v/c Ratio		1.00	1.37	0.59	0.49				0.32			0.69
Uniform Delay, d1		23.3	23.4	24.2	10.0				21.3			31.4
Progression Factor		0.65	1.05	1.49	0.46				1.00			1.00
Incremental Delay, d2		14.5	170.3	1.2	0.5				0.2			4.6
Delay (s)		29.6	195.1	37.1	5.1				21.5			36.0
Level of Service		C	F	D	A				C			D
Approach Delay (s)		99.0			11.7			21.5			36.0	
Approach LOS		F			B			C			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			61.2			HCM Level of Service			E			
HCM Volume to Capacity ratio			1.06									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			105.7%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

2022 Build  
1014: Killingsworth St. & I-205 NB Ramp



















2022 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		0.95			0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			1.00	
Satd. Flow (prot)	3335	3438	1505	3335	3438	1538		3358			3534	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.82			1.00	
Satd. Flow (perm)	3335	3438	1505	3335	3438	1538		2793			3534	
Volume (vph)	727	1197	273	205	1025	455	118	300	0	0	117	10
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)	757	1247	284	214	1068	474	123	312	0	0	122	10
RTOR Reduction (vph)	0	0	67	0	0	76	0	0	0	0	6	0
Lane Group Flow (vph)	757	1247	217	214	1068	398	0	435	0	0	126	0
Confl. Peds. (#/hr)			7									
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	6%	6%	6%	1%	1%	1%
Turn Type	Prot		Perm	Prot		Perm	Perm					
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2		6	6	8					
Actuated Green, G (s)	26.6	54.6	54.6	11.3	39.3	39.3		20.1			20.1	
Effective Green, g (s)	27.1	55.6	55.6	11.8	40.3	40.3		20.6			20.6	
Actuated g/C Ratio	0.27	0.56	0.56	0.12	0.40	0.40		0.21			0.21	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0		4.5			4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	904	1912	837	394	1386	620		575			728	
v/s Ratio Prot	c0.23	0.36		0.06	c0.31						0.04	
v/s Ratio Perm			0.14			0.26		c0.16				
v/c Ratio	0.84	0.65	0.26	0.54	0.77	0.64		0.76			0.17	
Uniform Delay, d1	34.4	15.5	11.5	41.6	25.8	24.0		37.3			32.7	
Progression Factor	0.65	1.64	2.14	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	3.3	0.8	0.3	1.5	4.2	5.0		5.6			0.1	
Delay (s)	25.6	26.3	24.9	43.1	30.0	29.1		43.0			32.8	
Level of Service	C	C	C	D	C	C		D			C	
Approach Delay (s)		25.9			31.4			43.0			32.8	
Approach LOS		C			C			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			29.8				HCM Level of Service				C	
HCM Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			80.8%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

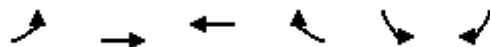
						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	789	146	131	302	105	377
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	867	160	144	332	115	414
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1027		1567	947
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1027		1567	947
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			79		0	0
cM capacity (veh/h)			676		96	317
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1027	476	530			
Volume Left	0	144	115			
Volume Right	160	0	414			
cSH	1700	676	211			
Volume to Capacity	0.60	0.21	2.51			
Queue Length 95th (ft)	0	20	1107			
Control Delay (s)	0.0	5.7	727.8			
Lane LOS		A	F			
Approach Delay (s)	0.0	5.7	727.8			
Approach LOS			F			
Intersection Summary						
Average Delay		191.0				
Intersection Capacity Utilization		112.6%		ICU Level of Service		H
Analysis Period (min)		15				

2022 Build  
2002: NE Airport Way & Parking Lot

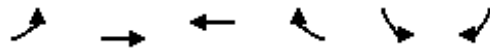
2022 PM Peak Hour - Build  
HCM Unsignalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	177	36	63	101	15	38	5	38	13	6	0
Peak Hour Factor	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Hourly flow rate (vph)	0	277	56	98	158	23	59	8	59	20	9	0
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1						
Volume Total (vph)	333	98	181	67	59	30						
Volume Left (vph)	0	98	0	59	0	20						
Volume Right (vph)	56	0	23	0	59	0						
Hadj (s)	0.12	0.89	0.30	0.54	-0.60	0.60						
Departure Headway (s)	5.5	6.3	5.7	6.7	5.6	7.0						
Degree Utilization, x	0.51	0.17	0.29	0.13	0.09	0.06						
Capacity (veh/h)	634	555	614	494	587	464						
Control Delay (s)	14.0	9.4	9.7	9.5	8.0	10.4						
Approach Delay (s)	14.0	9.6		8.8		10.4						
Approach LOS	B	A		A		B						
Intersection Summary												
Delay			11.4									
HCM Level of Service			B									
Intersection Capacity Utilization			35.4%	ICU Level of Service				A				
Analysis Period (min)			15									

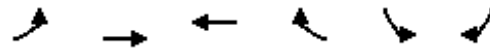
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85		0.91		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1770	1829		1770	1863	1583		1665		1770	1609	
Flt Permitted	0.58	1.00		0.38	1.00	1.00		0.91		0.61	1.00	
Satd. Flow (perm)	1072	1829		714	1863	1583		1528		1140	1609	
Volume (vph)	56	303	41	89	217	177	66	10	180	357	10	99
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)	62	333	45	98	238	195	73	11	198	392	11	109
RTOR Reduction (vph)	0	4	0	0	0	130	0	81	0	0	54	0
Lane Group Flow (vph)	62	374	0	98	238	65	0	201	0	392	66	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases	4			8		8	2			6		
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	16.0	16.0		16.0	16.0	16.0		24.3		24.3	24.3	
Effective Green, g (s)	16.0	16.0		16.0	16.0	16.0		24.3		24.3	24.3	
Actuated g/C Ratio	0.33	0.33		0.33	0.33	0.33		0.50		0.50	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	355	606		237	617	524		769		574	809	
v/s Ratio Prot	c0.20			0.13						0.04		
v/s Ratio Perm	0.06			0.14		0.04		0.13		c0.34		
v/c Ratio	0.17	0.62		0.41	0.39	0.12		0.26		0.68	0.08	
Uniform Delay, d1	11.5	13.6		12.5	12.4	11.3		6.9		9.1	6.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.2	1.9		1.2	0.4	0.1		0.2		3.4	0.0	
Delay (s)	11.7	15.5		13.7	12.8	11.4		7.0		12.4	6.3	
Level of Service	B	B		B	B	B		A		B	A	
Approach Delay (s)	14.9			12.4				7.0		11.0		
Approach LOS	B			B				A		B		
Intersection Summary												
HCM Average Control Delay			11.8		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			48.3		Sum of lost time (s)				8.0			
Intersection Capacity Utilization			71.7%		ICU Level of Service				C			
Analysis Period (min)			15									
c Critical Lane Group												














Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑	↑↑		↰	↰
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	392	1073	991	76	72	256
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	467	1277	1180	90	86	305
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type					None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1270				2797	635
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1270				2797	635
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	11				0	26
cM capacity (veh/h)	521				1	414
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	467	639	639	787	484	390
Volume Left	467	0	0	0	0	86
Volume Right	0	0	0	0	90	305
cSH	521	1700	1700	1700	1700	7
Volume to Capacity	0.89	0.38	0.38	0.46	0.28	58.87
Queue Length 95th (ft)	256	0	0	0	0	Err
Control Delay (s)	46.0	0.0	0.0	0.0	0.0	Err
Lane LOS	E					F
Approach Delay (s)	12.3			0.0		Err
Approach LOS						F
<b>Intersection Summary</b>						
Average Delay		1153.0				
Intersection Capacity Utilization		65.5%		ICU Level of Service		C
Analysis Period (min)		15				



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1687	3374	2970		1626	1455
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1687	3374	2970		1626	1455
Volume (vph)	134	1074	828	77	58	260
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	146	1167	900	84	63	283
RTOR Reduction (vph)	0	0	8	0	0	231
Lane Group Flow (vph)	146	1167	976	0	63	52
Heavy Vehicles (%)	7%	7%	20%	20%	11%	11%
Turn Type	Prot			Perm		
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	7.0	34.6	23.6		8.7	8.7
Effective Green, g (s)	7.0	34.6	23.6		8.7	8.7
Actuated g/C Ratio	0.14	0.67	0.46		0.17	0.17
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)	230	2276	1366		276	247
v/s Ratio Prot	c0.09	0.35	c0.33		c0.04	
v/s Ratio Perm						0.04
v/c Ratio	0.63	0.51	0.71		0.23	0.21
Uniform Delay, d1	20.9	4.2	11.1		18.4	18.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.6	0.2	1.8		0.4	0.4
Delay (s)	26.6	4.4	12.9		18.8	18.8
Level of Service	C	A	B		B	B
Approach Delay (s)		6.8	12.9		18.8	
Approach LOS		A	B		B	
<b>Intersection Summary</b>						
HCM Average Control Delay			10.7		HCM Level of Service	B
HCM Volume to Capacity ratio			0.59			
Actuated Cycle Length (s)			51.3		Sum of lost time (s)	12.0
Intersection Capacity Utilization			48.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						





















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	122	930	803	119	29	75
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	127	969	836	124	30	78
Pedestrians		1	1		1	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		590	881			
pX, platoon unblocked					0.89	
vC, conflicting volume	961				1639	482
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	961				1596	482
tC, single (s)	4.3				7.3	7.4
tC, 2 stage (s)						
tF (s)	2.3				3.8	3.6
p0 queue free %	81				45	83
cM capacity (veh/h)	675				55	468
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	450	646	558	403	108	
Volume Left	127	0	0	0	30	
Volume Right	0	0	0	124	78	
cSH	675	1700	1700	1700	151	
Volume to Capacity	0.19	0.38	0.33	0.24	0.72	
Queue Length 95th (ft)	17	0	0	0	106	
Control Delay (s)	5.2	0.0	0.0	0.0	73.5	
Lane LOS	A				F	
Approach Delay (s)	2.1		0.0		73.5	
Approach LOS					F	
Intersection Summary						
Average Delay			4.8			
Intersection Capacity Utilization			71.8%		ICU Level of Service	C
Analysis Period (min)			15			












						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.98	1.00	1.00
Satd. Flow (prot)	1736	1553		1746	1667	1417
Flt Permitted	0.95	1.00		0.78	1.00	1.00
Satd. Flow (perm)	1736	1553		1391	1667	1417
Volume (vph)	675	165	145	282	157	338
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	742	181	159	310	173	371
RTOR Reduction (vph)	0	71	0	0	0	234
Lane Group Flow (vph)	742	110	0	469	173	137
Heavy Vehicles (%)	4%	4%	7%	7%	14%	14%
Turn Type	Perm		Perm			Perm
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	46.7	46.7		32.1	32.1	32.1
Effective Green, g (s)	46.7	46.7		32.1	32.1	32.1
Actuated g/C Ratio	0.54	0.54		0.37	0.37	0.37
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)	934	836		514	616	524
v/s Ratio Prot	c0.43				0.10	
v/s Ratio Perm		0.07		c0.34		0.10
v/c Ratio	0.79	0.13		0.91	0.28	0.26
Uniform Delay, d1	16.2	10.0		26.0	19.2	19.1
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.7	0.1		20.5	0.3	0.3
Delay (s)	20.9	10.0		46.6	19.5	19.4
Level of Service	C	B		D	B	B
Approach Delay (s)	18.8			46.6	19.4	
Approach LOS	B			D	B	
<b>Intersection Summary</b>						
HCM Average Control Delay			25.7		HCM Level of Service	C
HCM Volume to Capacity ratio			0.84			
Actuated Cycle Length (s)			86.8		Sum of lost time (s)	8.0
Intersection Capacity Utilization			78.5%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						







2022 Build  
3010: Airport Way WB Ramps & 82nd Avenue













2022 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		0.95	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	0.97			1.00	1.00
Satd. Flow (prot)				1770	1583		1681	1713			1863	1583
Flt Permitted				0.95	1.00		0.95	0.67			1.00	1.00
Satd. Flow (perm)				1770	1583		1681	1178			1863	1583
Volume (vph)	0	0	0	574	0	19	523	108	0	0	44	77
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	631	0	21	575	119	0	0	48	85
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	0	0	0	63
Lane Group Flow (vph)	0	0	0	631	8	0	338	356	0	0	48	22
Turn Type				Perm			Prot					Perm
Protected Phases					8		5	2			6	
Permitted Phases				8								6
Actuated Green, G (s)				38.5	38.5		24.0	53.5			25.5	25.5
Effective Green, g (s)				38.5	38.5		24.0	53.5			25.5	25.5
Actuated g/C Ratio				0.38	0.38		0.24	0.54			0.26	0.26
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				681	609		403	759			475	404
v/s Ratio Prot					0.01		c0.20	0.11			0.03	
v/s Ratio Perm				c0.36				c0.14				0.01
v/c Ratio				0.93	0.01		0.84	0.47			0.10	0.05
Uniform Delay, d1				29.4	19.0		36.2	14.4			28.5	28.1
Progression Factor				1.00	1.00		1.36	1.36			1.00	1.00
Incremental Delay, d2				18.6	0.0		12.4	0.4			0.4	0.3
Delay (s)				48.0	19.0		61.6	20.1			28.9	28.4
Level of Service				D	B		E	C			C	C
Approach Delay (s)		0.0			47.1			40.3			28.6	
Approach LOS		A			D			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			42.2				HCM Level of Service			D		
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			8.0		
Intersection Capacity Utilization			97.8%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

# **2035 No-Build Synchro Worksheets**


						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.97	1.00	1.00
Satd. Flow (prot)	1626	1455		1621	1652	1404
Flt Permitted	0.95	1.00		0.74	1.00	1.00
Satd. Flow (perm)	1626	1455		1235	1652	1404
Volume (vph)	500	450	280	220	135	205
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	581	523	326	256	157	238
RTOR Reduction (vph)	0	317	0	0	0	118
Lane Group Flow (vph)	581	206	0	582	157	120
Heavy Vehicles (%)	11%	11%	14%	14%	15%	15%
Turn Type	Perm		Perm		Perm	
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	31.3	31.3		40.3	40.3	40.3
Effective Green, g (s)	31.3	31.3		40.3	40.3	40.3
Actuated g/C Ratio	0.39	0.39		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)	639	572		625	836	711
v/s Ratio Prot	c0.36				0.10	
v/s Ratio Perm		0.14		c0.47		0.09
v/c Ratio	0.91	0.36		0.93	0.19	0.17
Uniform Delay, d1	22.8	17.1		18.4	10.7	10.6
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.8	0.4		20.7	0.1	0.1
Delay (s)	39.6	17.5		39.1	10.8	10.7
Level of Service	D	B		D	B	B
Approach Delay (s)	29.1			39.1	10.8	
Approach LOS	C			D	B	
Intersection Summary						
HCM Average Control Delay	28.4		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.92					
Actuated Cycle Length (s)	79.6		Sum of lost time (s)		8.0	
Intersection Capacity Utilization	71.9%		ICU Level of Service		C	
Analysis Period (min)	15					
c Critical Lane Group						

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↱	↑↑	↲	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1355	50	136	1442	50	195
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1489	55	149	1585	55	214
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1544		2608	772
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1544		2608	772
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			65		0	37
cM capacity (veh/h)			426		13	342
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	993	551	149	792	792	269
Volume Left	0	0	149	0	0	55
Volume Right	0	55	0	0	0	214
cSH	1700	1700	426	1700	1700	55
Volume to Capacity	0.58	0.32	0.35	0.47	0.47	4.87
Queue Length 95th (ft)	0	0	39	0	0	Err
Control Delay (s)	0.0	0.0	18.0	0.0	0.0	Err
Lane LOS			C			F
Approach Delay (s)	0.0		1.5			Err
Approach LOS						F
Intersection Summary						
Average Delay			759.7			
Intersection Capacity Utilization			71.4%		ICU Level of Service	C
Analysis Period (min)			15			

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	10	40	215	110	20	5	158	100	100	5	40	30
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	11	45	242	124	22	6	178	112	112	6	45	34
Approach Volume (veh/h)	298				152				402		84	
Crossing Volume (veh/h)	174				301				62		324	
High Capacity (veh/h)	1208				1093				1320		1074	
High v/c (veh/h)	0.25				0.14				0.30		0.08	
Low Capacity (veh/h)	1001				897				1102		880	
Low v/c (veh/h)	0.30				0.17				0.37		0.10	
Intersection Summary												
Maximum v/c High			0.30									
Maximum v/c Low			0.37									
Intersection Capacity Utilization			60.1%		ICU Level of Service				B			




















2035 No Build  
1000: Airport Way EB Ramps & 82nd Avenue

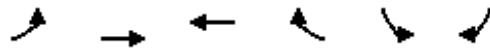
2035 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↑	↗	↘	↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00						1.00	1.00	1.00	1.00	
Frt		0.88						1.00	0.85	1.00	1.00	
Flt Protected		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1631						1863	1583	1770	1863	
Flt Permitted		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1631						1863	1583	1770	1863	
Volume (vph)	37	0	278	0	0	0	0	515	1350	50	650	0
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)	41	0	305	0	0	0	0	566	1484	55	714	0
RTOR Reduction (vph)	0	218	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	128	0	0	0	0	0	566	1484	55	714	0
Turn Type	Perm						Free			Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4								Free			
Actuated Green, G (s)		12.5						68.0	100.0	7.5	79.5	
Effective Green, g (s)		12.5						68.0	100.0	7.5	79.5	
Actuated g/C Ratio		0.12						0.68	1.00	0.08	0.80	
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)		204						1267	1583	133	1481	
v/s Ratio Prot								0.30		0.03	0.38	
v/s Ratio Perm		0.08							c0.94			
v/c Ratio		0.63						0.45	0.94	0.41	0.48	
Uniform Delay, d1		41.5						7.4	0.0	44.2	3.4	
Progression Factor		1.00						1.00	1.00	0.88	1.24	
Incremental Delay, d2		5.9						1.1	12.0	0.9	0.5	
Delay (s)		47.5						8.5	12.0	39.9	4.7	
Level of Service		D						A	B	D	A	
Approach Delay (s)		47.5			0.0			11.0			7.2	
Approach LOS		D			A			B			A	
<b>Intersection Summary</b>												
HCM Average Control Delay		14.1						HCM Level of Service		B		
HCM Volume to Capacity ratio		0.94										
Actuated Cycle Length (s)		100.0						Sum of lost time (s)		0.0		
Intersection Capacity Utilization		92.4%						ICU Level of Service		F		
Analysis Period (min)		15										
c Critical Lane Group												

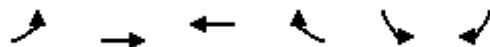
2035 No Build  
1001: Airport Way EB Ramp & Mt. Hood Ave.

2035 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0	4.0	4.0		
Lane Util. Factor	1.00		1.00					0.95	0.95	1.00	0.95		
Frt	1.00		0.85					0.89	0.85	1.00	1.00		
Flt Protected	0.95		1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)	1543		1380					1569	1504	1752	3505		
Flt Permitted	0.95		1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)	1543		1380					1569	1504	1752	3505		
Volume (vph)	170	0	218	0	0	0	0	188	1600	350	930	0	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	
Adj. Flow (vph)	191	0	245	0	0	0	0	211	1798	393	1045	0	
RTOR Reduction (vph)	0	0	110	0	0	0	0	110	401	0	0	0	
Lane Group Flow (vph)	191	0	135	0	0	0	0	752	746	393	1045	0	
Heavy Vehicles (%)	17%	17%	17%	2%	2%	2%	2%	2%	2%	3%	3%	3%	
Turn Type	Prot	custom						Perm		Prot			
Protected Phases	8							6		5			
Permitted Phases	8						6						
Actuated Green, G (s)	15.9	15.9						30.1	30.1	29.1	63.2		
Effective Green, g (s)	15.9	15.9						30.1	30.1	29.1	63.2		
Actuated g/C Ratio	0.18	0.18						0.35	0.35	0.33	0.73		
Clearance Time (s)	4.0	4.0						4.0	4.0	4.0	4.0		
Vehicle Extension (s)	3.0	3.0						3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	282	252						542	520	585	2543		
v/s Ratio Prot	c0.12							0.48		c0.22	0.30		
v/s Ratio Perm	0.10						c0.50						
v/c Ratio	0.68	0.54						1.39	1.44	0.67	0.41		
Uniform Delay, d1	33.2	32.3						28.5	28.5	24.9	4.7		
Progression Factor	1.00	1.00						1.00	1.00	1.00	1.00		
Incremental Delay, d2	6.3	2.2						185.6	206.8	3.0	0.5		
Delay (s)	39.5	34.5						214.1	235.3	27.9	5.2		
Level of Service	D	C						F	F	C	A		
Approach Delay (s)	36.7				0.0			226.2				11.4	
Approach LOS	D				A			F				B	
Intersection Summary													
HCM Average Control Delay	125.4			HCM Level of Service				F					
HCM Volume to Capacity ratio	0.98												
Actuated Cycle Length (s)	87.1			Sum of lost time (s)				12.0					
Intersection Capacity Utilization	92.1%			ICU Level of Service				F					
Analysis Period (min)	15												
c Critical Lane Group													


























Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑	↑	↑↑	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.86	0.91	0.91	0.97	0.88
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)		6408	3251	1386	3335	2707
Flt Permitted		1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)		6408	3251	1386	3335	2707
Volume (vph)	0	2102	877	745	750	532
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	2310	964	819	824	585
RTOR Reduction (vph)	0	0	1	331	0	46
Lane Group Flow (vph)	0	2310	985	466	824	539
Heavy Vehicles (%)	2%	2%	6%	6%	5%	5%
Turn Type			Perm		Perm	
Protected Phases		2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)		50.6	50.6	50.6	29.4	29.4
Effective Green, g (s)		52.6	52.6	52.6	29.4	29.4
Actuated g/C Ratio		0.58	0.58	0.58	0.33	0.33
Clearance Time (s)		6.0	6.0	6.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		3745	1900	810	1089	884
v/s Ratio Prot		c0.36	0.30		c0.25	
v/s Ratio Perm				0.34		0.20
v/c Ratio		0.62	0.52	0.58	0.76	0.61
Uniform Delay, d1		12.2	11.1	11.7	27.1	25.5
Progression Factor		1.00	0.74	10.71	1.00	1.00
Incremental Delay, d2		0.8	0.6	1.9	3.1	1.2
Delay (s)		12.9	8.9	127.2	30.2	26.7
Level of Service		B	A	F	C	C
Approach Delay (s)		12.9	61.8		28.7	
Approach LOS		B	E		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			32.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.67			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			60.2%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←←	↑↑	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.95	0.91			
Frt	1.00	1.00	1.00			
Flt Protected	0.95	1.00	1.00			
Satd. Flow (prot)	3400	3505	5036			
Flt Permitted	0.95	1.00	1.00			
Satd. Flow (perm)	3400	3505	5036			
Volume (vph)	1524	1328	1622	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1604	1398	1707	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1604	1398	1707	0	0	0
Heavy Vehicles (%)	3%	3%	3%	3%	0%	0%
Turn Type	Prot					
Protected Phases	5	2	6			
Permitted Phases						
Actuated Green, G (s)	42.8	90.0	36.2			
Effective Green, g (s)	43.8	90.0	38.2			
Actuated g/C Ratio	0.49	1.00	0.42			
Clearance Time (s)	5.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0	3.0			
Lane Grp Cap (vph)	1655	3505	2138			
v/s Ratio Prot	c0.47	0.40	c0.34			
v/s Ratio Perm						
v/c Ratio	0.97	0.40	0.80			
Uniform Delay, d1	22.4	0.0	22.5			
Progression Factor	1.37	1.00	1.00			
Incremental Delay, d2	12.6	0.3	3.2			
Delay (s)	43.3	0.3	25.8			
Level of Service	D	A	C			
Approach Delay (s)		23.3	25.8		0.0	
Approach LOS		C	C		A	
<b>Intersection Summary</b>						
HCM Average Control Delay			24.2		HCM Level of Service	C
HCM Volume to Capacity ratio			0.89			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			81.5%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						





























2035 No Build  
1006: Airport Way & NE 122nd Avenue




















2035 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	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		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1671	3343	1475	3303	3394		3242	1759	1495	1612	3223	1421
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1671	3343	1475	3303	3394		3242	1759	1495	1612	3223	1421
Volume (vph)	157	1376	405	240	1528	35	483	140	240	120	260	261
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	169	1480	435	258	1643	38	519	151	258	129	280	281
RTOR Reduction (vph)	0	0	66	0	1	0	0	0	156	0	0	127
Lane Group Flow (vph)	169	1480	369	258	1680	0	519	151	102	129	280	154
Confl. Peds. (#/hr)			1									2
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	8%	8%	8%	12%	12%	12%
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	11.0	51.9	51.9	10.0	50.9		17.0	21.6	21.6	11.5	16.1	16.1
Effective Green, g (s)	10.0	53.6	53.6	9.0	52.6		16.0	23.1	23.1	10.5	17.6	17.6
Actuated g/C Ratio	0.09	0.48	0.48	0.08	0.47		0.14	0.21	0.21	0.09	0.16	0.16
Clearance Time (s)	3.0	5.7	5.7	3.0	5.7		3.0	5.5	5.5	3.0	5.5	5.5
Vehicle Extension (s)	1.0	2.0	2.0	1.0	1.0		1.0	2.0	2.0	1.0	2.0	2.0
Lane Grp Cap (vph)	149	1597	705	265	1591		462	362	308	151	506	223
v/s Ratio Prot	c0.10	0.44		0.08	c0.49		c0.16	0.09		0.08	0.09	
v/s Ratio Perm			0.25						0.07			c0.11
v/c Ratio	1.13	0.93	0.52	0.97	1.06		1.12	0.42	0.33	0.85	0.55	0.69
Uniform Delay, d1	51.1	27.5	20.4	51.5	29.8		48.1	38.7	38.0	50.1	43.7	44.7
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	114.3	9.5	0.3	47.4	39.0		80.1	0.3	0.2	33.7	0.7	6.9
Delay (s)	165.4	36.9	20.7	98.9	68.8		128.2	39.0	38.2	83.8	44.4	51.6
Level of Service	F	D	C	F	E		F	D	D	F	D	D
Approach Delay (s)		44.0			72.8			88.7			54.7	
Approach LOS		D			E			F			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			62.5			HCM Level of Service			E			
HCM Volume to Capacity ratio			1.01									
Actuated Cycle Length (s)			112.2			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			87.2%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2035 No Build  
1008: Alderwood & 82nd Avenue

2035 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis






















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 			 				 			 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.97	1.00	1.00	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	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Volume (vph)	507	350	80	430	210	198	100	1100	300	278	424	226
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)	528	365	83	448	219	206	104	1146	312	290	442	235
RTOR Reduction (vph)	0	0	48	0	0	163	0	0	59	0	0	137
Lane Group Flow (vph)	528	365	36	448	219	43	104	1146	253	290	442	98
Heavy Vehicles (%)	4%	4%	4%	16%	16%	16%	7%	7%	7%	10%	10%	10%
Turn Type	Prot		Perm	Prot		Perm	Prot	pm+ov		Prot		Perm
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	19.0	25.0	25.0	19.0	25.0	25.0	12.0	39.0	58.0	22.0	49.0	49.0
Effective Green, g (s)	18.0	25.0	25.0	18.0	25.0	25.0	11.0	40.0	58.0	21.0	50.0	50.0
Actuated g/C Ratio	0.15	0.21	0.21	0.15	0.21	0.21	0.09	0.33	0.48	0.18	0.42	0.42
Clearance Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	5.0	3.0	3.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	505	381	324	453	341	290	155	1125	780	287	1368	612
v/s Ratio Prot	c0.16	c0.20		0.15	0.13		0.06	c0.34	0.05	c0.18	0.13	
v/s Ratio Perm			0.02			0.03			0.12			0.07
v/c Ratio	1.05	0.96	0.11	0.99	0.64	0.15	0.67	1.02	0.32	1.01	0.32	0.16
Uniform Delay, d1	51.0	47.0	38.5	50.9	43.4	38.8	52.7	40.0	19.0	49.5	23.6	21.9
Progression Factor	1.00	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	52.5	34.9	0.2	39.0	4.1	0.2	10.9	31.6	0.2	55.8	0.6	0.6
Delay (s)	103.5	81.8	38.6	89.9	47.5	39.0	63.6	71.6	19.2	105.3	24.2	22.4
Level of Service	F	F	D	F	D	D	E	E	B	F	C	C
Approach Delay (s)		89.9			67.2			60.6			48.1	
Approach LOS		F			E			E			D	
Intersection Summary												
HCM Average Control Delay			65.7				HCM Level of Service			E		
HCM Volume to Capacity ratio			1.01									
Actuated Cycle Length (s)			120.0				Sum of lost time (s)			16.0		
Intersection Capacity Utilization			89.8%				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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99			0.96		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1770	3519		1770	3509			1770		1770	1669	
Flt Permitted	0.95	1.00		0.95	1.00			0.63		0.54	1.00	
Satd. Flow (perm)	1770	3519		1770	3509			1129		1008	1669	
Volume (vph)	78	1279	50	96	1316	80	50	94	56	70	107	242
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)	86	1405	55	105	1446	88	55	103	62	77	118	266
RTOR Reduction (vph)	0	3	0	0	4	0	0	11	0	0	66	0
Lane Group Flow (vph)	86	1457	0	105	1530	0	0	209	0	77	318	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	8.4	54.0		10.0	55.6			37.4		37.4	37.4	
Effective Green, g (s)	8.4	54.0		10.0	55.6			37.4		37.4	37.4	
Actuated g/C Ratio	0.07	0.48		0.09	0.49			0.33		0.33	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	131	1676		156	1720			372		332	550	
v/s Ratio Prot	0.05	0.41		c0.06	c0.44						c0.19	
v/s Ratio Perm								0.18		0.08		
v/c Ratio	0.66	0.87		0.67	0.89			0.56		0.23	0.58	
Uniform Delay, d1	51.1	26.6		50.1	26.1			31.2		27.6	31.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	11.3	5.1		10.9	6.1			6.0		1.6	4.4	
Delay (s)	62.4	31.7		61.0	32.2			37.2		29.2	35.9	
Level of Service	E	C		E	C			D		C	D	
Approach Delay (s)		33.4			34.1			37.2			34.8	
Approach LOS		C			C			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			34.0			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			113.4			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			88.2%			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		↑↑	↑	↑	↑↑↑				↑↑			↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0				4.0			4.0
Lane Util. Factor		0.95	1.00	1.00	0.91				0.88			1.00
Frt		1.00	0.85	1.00	1.00				0.85			0.86
Flt Protected		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (prot)		3438	1538	1641	4715				2760			1536
Flt Permitted		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (perm)		3438	1538	1641	4715				2760			1536
Volume (vph)	0	2150	1265	375	1600	0	0	0	510	0	0	490
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	2216	1304	387	1649	0	0	0	526	0	0	505
RTOR Reduction (vph)	0	0	209	0	0	0	0	0	107	0	0	73
Lane Group Flow (vph)	0	2216	1095	387	1649	0	0	0	419	0	0	432
Heavy Vehicles (%)	5%	5%	5%	10%	10%	10%	3%	3%	3%	7%	7%	7%
Turn Type		Perm custom							custom			custom
Protected Phases		2		1	8	6			1	8		8
Permitted Phases			2	1					1	8		8
Actuated Green, G (s)		46.2	46.2	43.8	55.5				43.8			34.5
Effective Green, g (s)		48.2	48.2	43.8	57.5				43.8			34.5
Actuated g/C Ratio		0.48	0.48	0.44	0.58				0.44			0.34
Clearance Time (s)		6.0	6.0		6.0							4.0
Vehicle Extension (s)		3.0	3.0		3.0							3.0
Lane Grp Cap (vph)		1657	741	719	2711				1209			530
v/s Ratio Prot		0.64		c0.24	0.35				0.15			c0.28
v/s Ratio Perm			c0.71									
v/c Ratio		1.34	1.48	0.54	0.61				0.35			0.82
Uniform Delay, d1		25.9	25.9	20.7	13.9				18.6			29.9
Progression Factor		0.73	1.01	1.62	0.37				1.00			1.00
Incremental Delay, d2		154.4	219.3	0.5	0.6				0.2			9.4
Delay (s)		173.3	245.5	33.9	5.7				18.8			39.2
Level of Service		F	F	C	A				B			D
Approach Delay (s)		200.1			11.1			18.8			39.2	
Approach LOS		F			B			B			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			114.8			HCM Level of Service			F			
HCM Volume to Capacity ratio			1.13									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			105.8%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

2035 No Build  
1014: Killingsworth St. & I-205 NB Ramp


















2035 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		0.95			0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			1.00	
Satd. Flow (prot)	3335	3438	1505	3335	3438	1538		3355			3541	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.80			1.00	
Satd. Flow (perm)	3335	3438	1505	3335	3438	1538		2735			3541	
Volume (vph)	890	1381	360	205	1270	579	130	300	0	0	145	10
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)	927	1439	375	214	1323	603	135	312	0	0	151	10
RTOR Reduction (vph)	0	0	78	0	0	78	0	0	0	0	5	0
Lane Group Flow (vph)	927	1439	297	214	1323	525	0	447	0	0	156	0
Confl. Peds. (#/hr)			7									
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	6%	6%	6%	1%	1%	1%
Turn Type	Prot		Perm	Prot		Perm	Perm					
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2		6	6	8					
Actuated Green, G (s)	31.2	54.1	54.1	11.3	34.2	34.2		20.6			20.6	
Effective Green, g (s)	31.7	55.1	55.1	11.8	35.2	35.2		21.1			21.1	
Actuated g/C Ratio	0.32	0.55	0.55	0.12	0.35	0.35		0.21			0.21	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0		4.5			4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	1057	1894	829	394	1210	541		577			747	
v/s Ratio Prot	c0.28	0.42		0.06	c0.38						0.04	
v/s Ratio Perm			0.20			0.34		c0.16				
v/c Ratio	0.88	0.76	0.36	0.54	1.09	0.97		0.77			0.21	
Uniform Delay, d1	32.3	17.3	12.6	41.6	32.4	31.9		37.2			32.6	
Progression Factor	0.58	1.54	1.94	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.9	0.3	0.1	1.5	55.3	31.9		6.4			0.1	
Delay (s)	19.6	26.9	24.5	43.1	87.7	63.8		43.6			32.7	
Level of Service	B	C	C	D	F	E		D			C	
Approach Delay (s)		24.1			76.5			43.6			32.7	
Approach LOS		C			E			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			46.4				HCM Level of Service				D	
HCM Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			92.6%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	850	159	180	380	119	525
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	934	175	198	418	131	577
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1109		1835	1021
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1109		1835	1021
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			69		0	0
cM capacity (veh/h)			630		57	287
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1109	615	708			
Volume Left	0	198	131			
Volume Right	175	0	577			
cSH	1700	630	165			
Volume to Capacity	0.65	0.31	4.29			
Queue Length 95th (ft)	0	34	Err			
Control Delay (s)	0.0	8.0	Err			
Lane LOS		A	F			
Approach Delay (s)	0.0	8.0	Err			
Approach LOS			F			
Intersection Summary						
Average Delay		2911.8				
Intersection Capacity Utilization		133.3%		ICU Level of Service		H
Analysis Period (min)		15				






















2035 No Build  
2002: NE Airport Way & Parking Lot

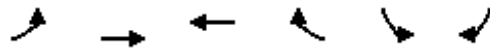
2035 PM Peak Hour - No Build  
HCM Unsignalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	200	50	70	118	20	45	5	50	15	5	0
Peak Hour Factor	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Hourly flow rate (vph)	0	312	78	109	184	31	70	8	78	23	8	0
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1						
Volume Total (vph)	391	109	216	78	78	31						
Volume Left (vph)	0	109	0	70	0	23						
Volume Right (vph)	78	0	31	0	78	0						
Hadj (s)	0.10	0.89	0.29	0.55	-0.60	0.61						
Departure Headway (s)	5.7	6.5	5.9	7.1	5.9	7.4						
Degree Utilization, x	0.61	0.20	0.35	0.15	0.13	0.06						
Capacity (veh/h)	617	535	592	471	556	430						
Control Delay (s)	17.3	9.9	10.8	10.1	8.6	10.9						
Approach Delay (s)	17.3	10.5		9.3		10.9						
Approach LOS	C	B		A		B						
Intersection Summary												
Delay			13.2									
HCM Level of Service			B									
Intersection Capacity Utilization			38.7%	ICU Level of Service				A				
Analysis Period (min)			15									

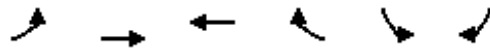
2035 No Build  
2005: Cornfoot & Airtrans

2035 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

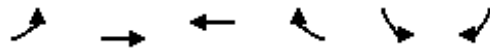
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85		0.91		1.00	0.87	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1770	1823		1770	1863	1583		1670		1770	1614	
Flt Permitted	0.51	1.00		0.31	1.00	1.00		0.89		0.57	1.00	
Satd. Flow (perm)	951	1823		581	1863	1583		1510		1065	1614	
Volume (vph)	70	361	60	110	259	210	80	10	180	360	10	80
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)	77	397	66	121	285	231	88	11	198	396	11	88
RTOR Reduction (vph)	0	5	0	0	0	140	0	72	0	0	46	0
Lane Group Flow (vph)	77	458	0	121	285	91	0	225	0	396	53	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases	4			8		8	2			6		
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	24.4	24.4		24.4	24.4	24.4		29.8		29.8	29.8	
Effective Green, g (s)	24.4	24.4		24.4	24.4	24.4		29.8		29.8	29.8	
Actuated g/C Ratio	0.39	0.39		0.39	0.39	0.39		0.48		0.48	0.48	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	373	715		228	731	621		723		510	773	
v/s Ratio Prot	c0.25			0.15						0.03		
v/s Ratio Perm	0.08			0.21		0.06		0.15		c0.37		
v/c Ratio	0.21	0.64		0.53	0.39	0.15		0.31		0.78	0.07	
Uniform Delay, d1	12.5	15.3		14.5	13.6	12.2		9.9		13.4	8.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.3	2.0		2.4	0.3	0.1		0.2		7.3	0.0	
Delay (s)	12.8	17.3		16.9	13.9	12.3		10.2		20.7	8.8	
Level of Service	B	B		B	B	B		B		C	A	
Approach Delay (s)	16.7			13.9				10.2		18.3		
Approach LOS	B			B				B		B		
Intersection Summary												
HCM Average Control Delay			15.2		HCM Level of Service				B			
HCM Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			62.2		Sum of lost time (s)				8.0			
Intersection Capacity Utilization			78.0%		ICU Level of Service				D			
Analysis Period (min)			15									
c Critical Lane Group												














Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↱↱	↰↱		↰	↱
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	385	1165	1260	80	70	317
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	458	1387	1500	95	83	377
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type					None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1595				3158	798
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1595				3158	798
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	0				0	0
cM capacity (veh/h)	389				0	323
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	458	693	693	1000	595	461
Volume Left	458	0	0	0	0	83
Volume Right	0	0	0	0	95	377
cSH	389	1700	1700	1700	1700	0
Volume to Capacity	1.18	0.41	0.41	0.59	0.35	Err
Queue Length 95th (ft)	454	0	0	0	0	Err
Control Delay (s)	135.5	0.0	0.0	0.0	0.0	Err
Lane LOS	F					F
Approach Delay (s)	33.7			0.0		Err
Approach LOS						F
Intersection Summary						
Average Delay			Err			
Intersection Capacity Utilization		72.6%		ICU Level of Service		C
Analysis Period (min)		15				



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1687	3374	2965		1626	1455
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1687	3374	2965		1626	1455
Volume (vph)	165	1070	1030	110	69	310
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	179	1163	1120	120	75	337
RTOR Reduction (vph)	0	0	9	0	0	203
Lane Group Flow (vph)	179	1163	1231	0	75	134
Heavy Vehicles (%)	7%	7%	20%	20%	11%	11%
Turn Type	Prot			Perm		
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	10.5	48.3	33.8		11.5	11.5
Effective Green, g (s)	10.5	48.3	33.8		11.5	11.5
Actuated g/C Ratio	0.15	0.71	0.50		0.17	0.17
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)	261	2404	1478		276	247
v/s Ratio Prot	c0.11	0.34	c0.42		0.05	
v/s Ratio Perm						c0.09
v/c Ratio	0.69	0.48	0.83		0.27	0.54
Uniform Delay, d1	27.1	4.3	14.6		24.5	25.7
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	7.3	0.2	4.2		0.5	2.4
Delay (s)	34.4	4.4	18.8		25.0	28.1
Level of Service	C	A	B		C	C
Approach Delay (s)		8.4	18.8		27.6	
Approach LOS		A	B		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			15.3		HCM Level of Service	B
HCM Volume to Capacity ratio			0.75			
Actuated Cycle Length (s)			67.8		Sum of lost time (s)	12.0
Intersection Capacity Utilization			57.8%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						





















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔↔	↔↔		↔↔	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	95	1044	1040	160	50	100
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	99	1088	1083	167	52	104
Pedestrians		1	1		1	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		590	881			
pX, platoon unblocked	0.97				0.88	0.97
vC, conflicting volume	1251				1910	627
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1231				1812	591
tC, single (s)	4.3				7.3	7.4
tC, 2 stage (s)						
tF (s)	2.3				3.8	3.6
p0 queue free %	81				0	73
cM capacity (veh/h)	516				38	382
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	461	725	722	528	156	
Volume Left	99	0	0	0	52	
Volume Right	0	0	0	167	104	
cSH	516	1700	1700	1700	95	
Volume to Capacity	0.19	0.43	0.42	0.31	1.65	
Queue Length 95th (ft)	18	0	0	0	311	
Control Delay (s)	5.5	0.0	0.0	0.0	412.6	
Lane LOS	A				F	
Approach Delay (s)	2.2		0.0		412.6	
Approach LOS					F	
Intersection Summary						
Average Delay			25.8			
Intersection Capacity Utilization			84.6%		ICU Level of Service	E
Analysis Period (min)			15			












						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.98	1.00	1.00
Satd. Flow (prot)	1736	1553		1736	1667	1417
Flt Permitted	0.95	1.00		0.73	1.00	1.00
Satd. Flow (perm)	1736	1553		1288	1667	1417
Volume (vph)	681	220	210	255	167	369
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	748	242	231	280	184	405
RTOR Reduction (vph)	0	105	0	0	0	231
Lane Group Flow (vph)	748	137	0	511	184	174
Heavy Vehicles (%)	4%	4%	7%	7%	14%	14%
Turn Type	Perm		Perm		Perm	
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	47.0	47.0		41.3	41.3	41.3
Effective Green, g (s)	47.0	47.0		41.3	41.3	41.3
Actuated g/C Ratio	0.49	0.49		0.43	0.43	0.43
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)	847	758		552	715	608
v/s Ratio Prot	c0.43				0.11	
v/s Ratio Perm		0.09		c0.40		0.12
v/c Ratio	0.88	0.18		0.93	0.26	0.29
Uniform Delay, d1	22.2	13.8		26.0	17.7	17.9
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.8	0.1		21.5	0.2	0.3
Delay (s)	32.9	14.0		47.6	17.8	18.2
Level of Service	C	B		D	B	B
Approach Delay (s)	28.3			47.6	18.1	
Approach LOS	C			D	B	
<b>Intersection Summary</b>						
HCM Average Control Delay			30.1		HCM Level of Service	C
HCM Volume to Capacity ratio			0.90			
Actuated Cycle Length (s)			96.3		Sum of lost time (s)	8.0
Intersection Capacity Utilization			81.6%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

2035 No Build  
3010: Airport Way WB Ramps & 82nd Avenue













2035 PM Peak Hour - No Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		0.95	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	0.97			1.00	1.00
Satd. Flow (prot)				1770	1583		1681	1725			1863	1583
Flt Permitted				0.95	1.00		0.95	0.75			1.00	1.00
Satd. Flow (perm)				1770	1583		1681	1320			1863	1583
Volume (vph)	0	0	0	650	0	10	415	137	0	0	50	61
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	714	0	11	456	151	0	0	55	67
RTOR Reduction (vph)	0	0	0	0	6	0	0	0	0	0	0	51
Lane Group Flow (vph)	0	0	0	714	5	0	296	311	0	0	55	16
Turn Type				Perm			Prot					Perm
Protected Phases				8			5		2		6	
Permitted Phases				8							6	
Actuated Green, G (s)				42.9	42.9		20.8	49.1			24.3	24.3
Effective Green, g (s)				42.9	42.9		20.8	49.1			24.3	24.3
Actuated g/C Ratio				0.43	0.43		0.21	0.49			0.24	0.24
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				759	679		350	732			453	385
v/s Ratio Prot					0.00		c0.18	0.09			0.03	
v/s Ratio Perm				c0.40				c0.12				0.01
v/c Ratio				0.94	0.01		0.85	0.42			0.12	0.04
Uniform Delay, d1				27.3	16.4		38.1	16.4			29.5	28.9
Progression Factor				1.00	1.00		1.50	1.49			1.00	1.00
Incremental Delay, d2				19.6	0.0		15.4	0.4			0.5	0.2
Delay (s)				46.9	16.4		72.4	24.8			30.1	29.2
Level of Service				D	B		E	C			C	C
Approach Delay (s)		0.0			46.5			48.0			29.6	
Approach LOS		A			D			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			45.7			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			92.4%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

# **2035 Build Synchro Worksheets**


						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.97	1.00	1.00
Satd. Flow (prot)	1626	1455		1621	1652	1404
Flt Permitted	0.95	1.00		0.74	1.00	1.00
Satd. Flow (perm)	1626	1455		1235	1652	1404
Volume (vph)	500	450	280	220	135	205
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	581	523	326	256	157	238
RTOR Reduction (vph)	0	317	0	0	0	118
Lane Group Flow (vph)	581	206	0	582	157	120
Heavy Vehicles (%)	11%	11%	14%	14%	15%	15%
Turn Type	Perm		Perm			Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6
Actuated Green, G (s)	31.3	31.3		40.3	40.3	40.3
Effective Green, g (s)	31.3	31.3		40.3	40.3	40.3
Actuated g/C Ratio	0.39	0.39		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)	639	572		625	836	711
v/s Ratio Prot	c0.36				0.10	
v/s Ratio Perm		0.14		c0.47		0.09
v/c Ratio	0.91	0.36		0.93	0.19	0.17
Uniform Delay, d1	22.8	17.1		18.4	10.7	10.6
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.8	0.4		20.7	0.1	0.1
Delay (s)	39.6	17.5		39.1	10.8	10.7
Level of Service	D	B		D	B	B
Approach Delay (s)	29.1			39.1	10.8	
Approach LOS	C			D	B	
<b>Intersection Summary</b>						
HCM Average Control Delay			28.4		HCM Level of Service	C
HCM Volume to Capacity ratio			0.92			
Actuated Cycle Length (s)			79.6		Sum of lost time (s)	8.0
Intersection Capacity Utilization			71.9%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↱	↑↑	↱	
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1492	53	147	1500	51	202
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1640	58	162	1648	56	222
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1698		2816	849
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1698		2816	849
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			56		0	27
cM capacity (veh/h)			371		8	304
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1093	605	162	824	824	278
Volume Left	0	0	162	0	0	56
Volume Right	0	58	0	0	0	222
cSH	1700	1700	371	1700	1700	36
Volume to Capacity	0.64	0.36	0.44	0.48	0.48	7.68
Queue Length 95th (ft)	0	0	53	0	0	Err
Control Delay (s)	0.0	0.0	22.0	0.0	0.0	Err
Lane LOS			C			F
Approach Delay (s)	0.0		2.0			Err
Approach LOS						F
<b>Intersection Summary</b>						
Average Delay			735.3			
Intersection Capacity Utilization			76.4%		ICU Level of Service	D
Analysis Period (min)			15			

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Right Turn Channelized												
Volume (veh/h)	10	40	215	110	20	5	160	100	100	5	40	30
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	11	45	242	124	22	6	180	112	112	6	45	34
Approach Volume (veh/h)	298				152				404		84	
Crossing Volume (veh/h)	174				303				62		326	
High Capacity (veh/h)	1208				1091				1320		1072	
High v/c (veh/h)	0.25				0.14				0.31		0.08	
Low Capacity (veh/h)	1001				896				1102		878	
Low v/c (veh/h)	0.30				0.17				0.37		0.10	
Intersection Summary												
Maximum v/c High			0.31									
Maximum v/c Low			0.37									
Intersection Capacity Utilization			60.2%		ICU Level of Service				B			




















2035 Build  
1000: Airport Way EB Ramps & 82nd Avenue

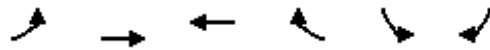
2035 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕						↑	↗	↘	↑	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00						1.00	1.00	1.00	1.00	
Frt		0.88						1.00	0.85	1.00	1.00	
Flt Protected		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1631						1863	1583	1770	1863	
Flt Permitted		0.99						1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1631						1863	1583	1770	1863	
Volume (vph)	60	0	451	0	0	0	0	797	1385	74	667	0
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)	66	0	496	0	0	0	0	876	1522	81	733	0
RTOR Reduction (vph)	0	178	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	384	0	0	0	0	0	876	1522	81	733	0
Turn Type	Perm						Free			Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4								Free			
Actuated Green, G (s)		25.7						55.4	100.0	6.9	66.3	
Effective Green, g (s)		25.7						55.4	100.0	6.9	66.3	
Actuated g/C Ratio		0.26						0.55	1.00	0.07	0.66	
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)		419						1032	1583	122	1235	
v/s Ratio Prot								0.47		0.05	0.39	
v/s Ratio Perm		0.24							c0.96			
v/c Ratio		0.92						0.85	0.96	0.66	0.59	
Uniform Delay, d1		36.1						18.8	0.0	45.4	9.4	
Progression Factor		1.00						1.00	1.00	1.23	0.25	
Incremental Delay, d2		24.6						8.7	15.1	5.5	0.9	
Delay (s)		60.7						27.5	15.1	61.3	3.2	
Level of Service		E						C	B	E	A	
Approach Delay (s)		60.7			0.0			19.6			9.0	
Approach LOS		E			A			B			A	
<b>Intersection Summary</b>												
HCM Average Control Delay		23.5										
HCM Volume to Capacity ratio		0.96										
Actuated Cycle Length (s)		100.0										
Intersection Capacity Utilization		122.1%										
Analysis Period (min)		15										
c Critical Lane Group												

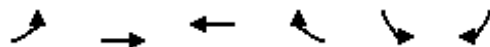
2035 Build  
1001: Airport Way EB Ramp & Mt. Hood Ave.

2035 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis
























													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)	4.0		4.0					4.0	4.0	4.0	4.0		
Lane Util. Factor	1.00		1.00					0.95	0.95	1.00	0.95		
Frt	1.00		0.85					0.89	0.85	1.00	1.00		
Flt Protected	0.95		1.00					1.00	1.00	0.95	1.00		
Satd. Flow (prot)	1543		1380					1570	1504	1752	3505		
Flt Permitted	0.95		1.00					1.00	1.00	0.95	1.00		
Satd. Flow (perm)	1543		1380					1570	1504	1752	3505		
Volume (vph)	170	0	220	0	0	0	0	190	1600	350	925	0	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	
Adj. Flow (vph)	191	0	247	0	0	0	0	213	1798	393	1039	0	
RTOR Reduction (vph)	0	0	110	0	0	0	0	109	401	0	0	0	
Lane Group Flow (vph)	191	0	137	0	0	0	0	752	749	393	1039	0	
Heavy Vehicles (%)	17%	17%	17%	2%	2%	2%	2%	2%	2%	3%	3%	3%	
Turn Type	Prot	custom						Perm		Prot			
Protected Phases	8							6		5			
Permitted Phases	8						6						
Actuated Green, G (s)	15.9	15.9						30.1		30.1		29.1	
Effective Green, g (s)	15.9	15.9						30.1		30.1		29.1	
Actuated g/C Ratio	0.18	0.18						0.35		0.35		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)	282	252						543		520		585	
v/s Ratio Prot	c0.12							0.48		c0.22		0.30	
v/s Ratio Perm	0.10						c0.50						
v/c Ratio	0.68	0.54						1.39		1.44		0.67	
Uniform Delay, d1	33.2	32.3						28.5		28.5		24.9	
Progression Factor	1.00	1.00						1.00		1.00		1.00	
Incremental Delay, d2	6.3	2.4						184.7		209.3		3.0	
Delay (s)	39.5	34.7						213.2		237.8		27.9	
Level of Service	D	C						F		F		C	
Approach Delay (s)	36.8		0.0				227.3		11.4				
Approach LOS	D		A				F		B				
Intersection Summary													
HCM Average Control Delay	126.1		HCM Level of Service				F						
HCM Volume to Capacity ratio	0.98												
Actuated Cycle Length (s)	87.1		Sum of lost time (s)				12.0						
Intersection Capacity Utilization	92.1%		ICU Level of Service				F						
Analysis Period (min)	15												
c Critical Lane Group													



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑	↑	↑↑	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		0.86	0.91	0.91	0.97	0.88
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)		6408	3262	1386	3335	2707
Flt Permitted		1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)		6408	3262	1386	3335	2707
Volume (vph)	0	2495	994	745	750	721
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	0	2742	1092	819	824	792
RTOR Reduction (vph)	0	0	0	381	0	27
Lane Group Flow (vph)	0	2742	1092	438	824	765
Heavy Vehicles (%)	2%	2%	6%	6%	5%	5%
Turn Type			Perm		Perm	
Protected Phases		2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)		46.1	46.1	46.1	33.9	33.9
Effective Green, g (s)		48.1	48.1	48.1	33.9	33.9
Actuated g/C Ratio		0.53	0.53	0.53	0.38	0.38
Clearance Time (s)		6.0	6.0	6.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		3425	1743	741	1256	1020
v/s Ratio Prot		c0.43	0.33		0.25	
v/s Ratio Perm				0.32		c0.28
v/c Ratio		0.80	0.63	0.59	0.66	0.75
Uniform Delay, d1		17.0	14.7	14.3	23.2	24.4
Progression Factor		1.00	0.74	8.59	1.00	1.00
Incremental Delay, d2		2.1	0.9	1.7	1.2	3.1
Delay (s)		19.1	11.7	124.2	24.5	27.5
Level of Service		B	B	F	C	C
Approach Delay (s)		19.1	59.9		26.0	
Approach LOS		B	E		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			33.3		HCM Level of Service	C
HCM Volume to Capacity ratio			0.78			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			67.3%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						














































Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←←	↑↑	↑↑↑			
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0			
Lane Util. Factor	0.97	0.95	0.91			
Frt	1.00	1.00	1.00			
Flt Protected	0.95	1.00	1.00			
Satd. Flow (prot)	3400	3505	5036			
Flt Permitted	0.95	1.00	1.00			
Satd. Flow (perm)	3400	3505	5036			
Volume (vph)	1759	1487	1739	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1852	1565	1831	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	1852	1565	1831	0	0	0
Heavy Vehicles (%)	3%	3%	3%	3%	0%	0%
Turn Type	Prot					
Protected Phases	5	2	6			
Permitted Phases						
Actuated Green, G (s)	44.0	90.0	35.0			
Effective Green, g (s)	45.0	90.0	37.0			
Actuated g/C Ratio	0.50	1.00	0.41			
Clearance Time (s)	5.0	6.0	6.0			
Vehicle Extension (s)	3.0	3.0	3.0			
Lane Grp Cap (vph)	1700	3505	2070			
v/s Ratio Prot	c0.54	0.45	c0.36			
v/s Ratio Perm						
v/c Ratio	1.09	0.45	0.88			
Uniform Delay, d1	22.5	0.0	24.5			
Progression Factor	1.34	1.00	1.00			
Incremental Delay, d2	47.1	0.3	6.0			
Delay (s)	77.1	0.3	30.5			
Level of Service	E	A	C			
Approach Delay (s)		41.9	30.5		0.0	
Approach LOS		D	C		A	
<b>Intersection Summary</b>						
HCM Average Control Delay			37.9		HCM Level of Service	D
HCM Volume to Capacity ratio			1.00			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			90.4%		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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	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		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1671	3343	1475	3303	3395		3242	1759	1495	1612	3223	1421
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1671	3343	1475	3303	3395		3242	1759	1495	1612	3223	1421
Volume (vph)	163	1528	411	240	1609	35	486	141	240	120	261	295
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	175	1643	442	258	1730	38	523	152	258	129	281	317
RTOR Reduction (vph)	0	0	62	0	1	0	0	0	141	0	0	111
Lane Group Flow (vph)	175	1643	380	258	1767	0	523	152	117	129	281	206
Confl. Peds. (#/hr)			1									2
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	8%	8%	8%	12%	12%	12%
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2						8			4
Actuated Green, G (s)	11.0	53.9	53.9	9.0	51.9		16.0	23.2	23.2	11.7	18.9	18.9
Effective Green, g (s)	10.0	55.6	55.6	8.0	53.6		15.0	24.7	24.7	10.7	20.4	20.4
Actuated g/C Ratio	0.09	0.48	0.48	0.07	0.47		0.13	0.21	0.21	0.09	0.18	0.18
Clearance Time (s)	3.0	5.7	5.7	3.0	5.7		3.0	5.5	5.5	3.0	5.5	5.5
Vehicle Extension (s)	1.0	2.0	2.0	1.0	1.0		1.0	2.0	2.0	1.0	2.0	2.0
Lane Grp Cap (vph)	145	1616	713	230	1582		423	378	321	150	572	252
v/s Ratio Prot	c0.10	0.49		0.08	c0.52		c0.16	0.09		0.08	0.09	
v/s Ratio Perm			0.26						0.08			c0.14
v/c Ratio	1.21	1.02	0.53	1.12	1.12		1.24	0.40	0.36	0.86	0.49	0.82
Uniform Delay, d1	52.5	29.7	20.7	53.5	30.7		50.0	38.8	38.5	51.4	42.6	45.5
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	140.9	26.6	0.4	96.0	61.8		125.3	0.3	0.3	34.7	0.2	17.4
Delay (s)	193.4	56.3	21.1	149.5	92.5		175.3	39.1	38.7	86.1	42.9	62.9
Level of Service	F	E	C	F	F		F	D	D	F	D	E
Approach Delay (s)		60.1			99.8			115.3			59.3	
Approach LOS		E			F			F			E	
<b>Intersection Summary</b>												
HCM Average Control Delay			82.2			HCM Level of Service			F			
HCM Volume to Capacity ratio			1.08									
Actuated Cycle Length (s)			115.0			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			89.9%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

2035 Build  
1008: Alderwood & 82nd Avenue

2035 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	0.97	1.00	1.00	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	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	1827	1553	3019	1638	1392	1687	3374	1509	1641	3282	1468
Volume (vph)	660	350	80	430	210	200	100	1262	300	280	559	279
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)	688	365	83	448	219	208	104	1315	312	292	582	291
RTOR Reduction (vph)	0	0	48	0	0	166	0	0	53	0	0	174
Lane Group Flow (vph)	688	365	35	448	219	42	104	1315	259	292	582	117
Heavy Vehicles (%)	4%	4%	4%	16%	16%	16%	7%	7%	7%	10%	10%	10%
Turn Type	Prot		Perm	Prot		Perm	Prot	pm+ov		Prot		Perm
Protected Phases	7	4		3	8		5	2	3	1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	21.0	25.9	25.9	19.0	23.9	23.9	12.0	41.0	60.0	18.0	47.0	47.0
Effective Green, g (s)	20.0	25.9	25.9	18.0	23.9	23.9	11.0	42.0	60.0	17.0	48.0	48.0
Actuated g/C Ratio	0.17	0.22	0.22	0.15	0.20	0.20	0.09	0.35	0.50	0.14	0.40	0.40
Clearance Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	5.0	3.0	3.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	566	398	338	457	329	280	156	1192	812	235	1325	593
v/s Ratio Prot	c0.20	c0.20		0.15	0.13		0.06	c0.39	0.05	c0.18	0.18	
v/s Ratio Perm			0.02			0.03			0.12			0.08
v/c Ratio	1.22	0.92	0.10	0.98	0.67	0.15	0.67	1.10	0.32	1.24	0.44	0.20
Uniform Delay, d1	49.5	45.5	37.2	50.3	43.8	39.1	52.2	38.5	17.4	51.0	25.7	23.0
Progression Factor	1.00	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	112.5	25.5	0.1	36.8	5.0	0.2	10.3	59.1	0.2	139.8	1.1	0.7
Delay (s)	161.9	70.9	37.3	87.1	48.8	39.4	62.5	97.6	17.6	190.7	26.8	23.7
Level of Service	F	E	D	F	D	D	E	F	B	F	C	C
Approach Delay (s)		123.6			66.2			81.0			67.1	
Approach LOS		F			E			F			E	
Intersection Summary												
HCM Average Control Delay			84.9				HCM Level of Service		F			
HCM Volume to Capacity ratio			1.08									
Actuated Cycle Length (s)			118.9				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			94.4%				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												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99			0.96		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	1.00	
Satd. Flow (prot)	1770	3520		1770	3510			1762		1770	1668	
Flt Permitted	0.95	1.00		0.95	1.00			0.50		0.48	1.00	
Satd. Flow (perm)	1770	3520		1770	3510			887		885	1668	
Volume (vph)	124	1392	51	102	1370	81	52	114	81	72	122	281
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)	136	1530	56	112	1505	89	57	125	89	79	134	309
RTOR Reduction (vph)	0	2	0	0	4	0	0	14	0	0	68	0
Lane Group Flow (vph)	136	1584	0	112	1590	0	0	257	0	79	375	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	11.4	57.6		10.3	56.5			37.1		37.1	37.1	
Effective Green, g (s)	11.4	57.6		10.3	56.5			37.1		37.1	37.1	
Actuated g/C Ratio	0.10	0.49		0.09	0.48			0.32		0.32	0.32	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	172	1733		156	1695			281		281	529	
v/s Ratio Prot	c0.08	0.45		0.06	c0.45						0.22	
v/s Ratio Perm								c0.29		0.09		
v/c Ratio	0.79	0.91		0.72	0.94			0.91		0.28	0.71	
Uniform Delay, d1	51.6	27.4		51.9	28.6			38.4		30.0	35.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	
Incremental Delay, d2	21.4	7.9		14.6	10.4			35.4		2.5	7.8	
Delay (s)	73.1	35.3		66.5	39.0			73.8		32.4	43.0	
Level of Service	E	D		E	D			E		C	D	
Approach Delay (s)		38.3			40.8			73.8			41.4	
Approach LOS		D			D			E			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			42.0			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.91									
Actuated Cycle Length (s)			117.0			Sum of lost time (s)			12.0			
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		↑↑	↑	↑	↑↑↑				↑↑			↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0				4.0			4.0
Lane Util. Factor		0.95	1.00	1.00	0.91				0.88			1.00
Frt		1.00	0.85	1.00	1.00				0.85			0.86
Flt Protected		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (prot)		3438	1538	1641	4715				2760			1536
Flt Permitted		1.00	1.00	0.95	1.00				1.00			1.00
Satd. Flow (perm)		3438	1538	1641	4715				2760			1536
Volume (vph)	0	2170	1314	375	1609	0	0	0	512	0	0	492
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	2237	1355	387	1659	0	0	0	528	0	0	507
RTOR Reduction (vph)	0	0	210	0	0	0	0	0	107	0	0	73
Lane Group Flow (vph)	0	2237	1145	387	1659	0	0	0	421	0	0	434
Heavy Vehicles (%)	5%	5%	5%	10%	10%	10%	3%	3%	3%	7%	7%	7%
Turn Type		Perm custom							custom			custom
Protected Phases		2		1	8	6			1	8		8
Permitted Phases			2	1					1	8		8
Actuated Green, G (s)		46.1	46.1	43.9	55.4				43.9			34.6
Effective Green, g (s)		48.1	48.1	43.9	57.4				43.9			34.6
Actuated g/C Ratio		0.48	0.48	0.44	0.57				0.44			0.35
Clearance Time (s)		6.0	6.0		6.0							4.0
Vehicle Extension (s)		3.0	3.0		3.0							3.0
Lane Grp Cap (vph)		1654	740	720	2706				1212			531
v/s Ratio Prot		0.65		c0.24	0.35				0.15			c0.28
v/s Ratio Perm			c0.74									
v/c Ratio		1.35	1.55	0.54	0.61				0.35			0.82
Uniform Delay, d1		25.9	25.9	20.6	14.0				18.6			29.8
Progression Factor		0.74	1.00	1.62	0.36				1.00			1.00
Incremental Delay, d2		161.2	250.7	0.5	0.6				0.2			9.5
Delay (s)		180.4	276.6	33.8	5.7				18.7			39.3
Level of Service		F	F	C	A				B			D
Approach Delay (s)		216.7			11.0			18.7			39.3	
Approach LOS		F			B			B			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			124.5			HCM Level of Service			F			
HCM Volume to Capacity ratio			1.16									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			108.8%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

2035 Build  
1014: Killingsworth St. & I-205 NB Ramp



















2035 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00		0.95			0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			1.00	
Satd. Flow (prot)	3335	3438	1505	3335	3438	1538		3355			3541	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.80			1.00	
Satd. Flow (perm)	3335	3438	1505	3335	3438	1538		2735			3541	
Volume (vph)	897	1426	360	205	1274	593	130	300	0	0	145	10
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)	934	1485	375	214	1327	618	135	312	0	0	151	10
RTOR Reduction (vph)	0	0	75	0	0	78	0	0	0	0	5	0
Lane Group Flow (vph)	934	1485	300	214	1327	540	0	447	0	0	156	0
Confl. Peds. (#/hr)			7									
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	6%	6%	6%	1%	1%	1%
Turn Type	Prot		Perm	Prot		Perm	Perm					
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2		6	6	8					
Actuated Green, G (s)	31.4	54.1	54.1	11.3	34.0	34.0		20.6			20.6	
Effective Green, g (s)	31.9	55.1	55.1	11.8	35.0	35.0		21.1			21.1	
Actuated g/C Ratio	0.32	0.55	0.55	0.12	0.35	0.35		0.21			0.21	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0		4.5			4.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	1064	1894	829	394	1203	538		577			747	
v/s Ratio Prot	c0.28	0.43		0.06	c0.39						0.04	
v/s Ratio Perm			0.20			0.35		c0.16				
v/c Ratio	0.88	0.78	0.36	0.54	1.10	1.00		0.77			0.21	
Uniform Delay, d1	32.2	17.7	12.6	41.6	32.5	32.5		37.2			32.6	
Progression Factor	0.58	1.53	1.89	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.9	0.3	0.1	1.5	59.0	39.7		6.4			0.1	
Delay (s)	19.7	27.5	23.9	43.1	91.5	72.2		43.6			32.7	
Level of Service	B	C	C	D	F	E		D			C	
Approach Delay (s)		24.4			81.2			43.6			32.7	
Approach LOS		C			F			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			48.2				HCM Level of Service				D	
HCM Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			92.9%				ICU Level of Service			F		
Analysis Period (min)			15									
c Critical Lane Group												

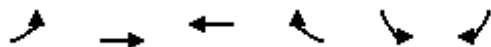
						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	851	164	185	380	122	530
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	935	180	203	418	134	582
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			1115		1849	1025
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1115		1849	1025
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			68		0	0
cM capacity (veh/h)			626		55	285
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	1115	621	716			
Volume Left	0	203	134			
Volume Right	180	0	582			
cSH	1700	626	160			
Volume to Capacity	0.66	0.32	4.47			
Queue Length 95th (ft)	0	35	Err			
Control Delay (s)	0.0	8.3	Err			
Lane LOS		A	F			
Approach Delay (s)	0.0	8.3	Err			
Approach LOS			F			
Intersection Summary						
Average Delay		2923.0				
Intersection Capacity Utilization		134.4%		ICU Level of Service		H
Analysis Period (min)		15				

2035 Build  
2002: NE Airport Way & Parking Lot

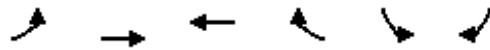
2035 PM Peak Hour - Build  
HCM Unsignalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	0	200	50	70	120	10	45	5	50	15	5	0
Peak Hour Factor	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64
Hourly flow rate (vph)	0	312	78	109	188	16	70	8	78	23	8	0
Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1						
Volume Total (vph)	391	109	203	78	78	31						
Volume Left (vph)	0	109	0	70	0	23						
Volume Right (vph)	78	0	16	0	78	0						
Hadj (s)	0.10	0.89	0.34	0.55	-0.60	0.61						
Departure Headway (s)	5.6	6.5	5.9	7.0	5.9	7.4						
Degree Utilization, x	0.61	0.20	0.33	0.15	0.13	0.06						
Capacity (veh/h)	619	535	587	473	559	432						
Control Delay (s)	17.2	9.9	10.7	10.1	8.5	10.9						
Approach Delay (s)	17.2	10.4		9.3		10.9						
Approach LOS	C	B		A		B						
Intersection Summary												
Delay			13.2									
HCM Level of Service			B									
Intersection Capacity Utilization			38.2%		ICU Level of Service		A					
Analysis Period (min)			15									

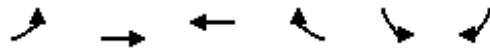
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85		0.91		1.00	0.86	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	
Satd. Flow (prot)	1770	1828		1770	1863	1583		1670		1770	1606	
Flt Permitted	0.47	1.00		0.26	1.00	1.00		0.87		0.55	1.00	
Satd. Flow (perm)	876	1828		479	1863	1583		1477		1017	1606	
Volume (vph)	79	420	60	110	280	218	80	10	180	430	10	116
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)	87	462	66	121	308	240	88	11	198	473	11	127
RTOR Reduction (vph)	0	4	0	0	0	129	0	71	0	0	65	0
Lane Group Flow (vph)	87	524	0	121	308	111	0	226	0	473	73	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases	4			8		8	2			6		
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)	44.5	44.5		44.5	44.5	44.5		49.9		49.9	49.9	
Effective Green, g (s)	44.5	44.5		44.5	44.5	44.5		49.9		49.9	49.9	
Actuated g/C Ratio	0.43	0.43		0.43	0.43	0.43		0.49		0.49	0.49	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	381	794		208	810	688		720		496	783	
v/s Ratio Prot	c0.29			0.17						0.05		
v/s Ratio Perm	0.10			0.25		0.07		0.15		c0.46		
v/c Ratio	0.23	0.66		0.58	0.38	0.16		0.31		0.95	0.09	
Uniform Delay, d1	18.2	23.0		21.9	19.6	17.6		15.9		25.1	14.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.3	2.1		4.1	0.3	0.1		0.3		28.8	0.1	
Delay (s)	18.5	25.0		26.0	19.9	17.7		16.1		54.0	14.1	
Level of Service	B	C		C	B	B		B		D	B	
Approach Delay (s)	24.1			20.2				16.1		45.0		
Approach LOS	C			C				B		D		
Intersection Summary												
HCM Average Control Delay	27.7			HCM Level of Service			C					
HCM Volume to Capacity ratio	0.82											
Actuated Cycle Length (s)	102.4			Sum of lost time (s)			8.0					
Intersection Capacity Utilization	85.0%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												














Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑↑	↑↑		↰	↰
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	454	1238	1297	85	110	350
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	540	1474	1544	101	131	417
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type					None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1645				3412	823
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1645				3412	823
tC, single (s)	4.2				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	0				0	0
cM capacity (veh/h)	371				0	311
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	540	737	737	1029	616	548
Volume Left	540	0	0	0	0	131
Volume Right	0	0	0	0	101	417
cSH	371	1700	1700	1700	1700	0
Volume to Capacity	1.46	0.43	0.43	0.61	0.36	Err
Queue Length 95th (ft)	708	0	0	0	0	Err
Control Delay (s)	247.0	0.0	0.0	0.0	0.0	Err
Lane LOS	F					F
Approach Delay (s)	66.3			0.0		Err
Approach LOS						F
Intersection Summary						
Average Delay			Err			
Intersection Capacity Utilization		79.8%		ICU Level of Service		D
Analysis Period (min)		15				



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1687	3374	2965		1626	1455
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1687	3374	2965		1626	1455
Volume (vph)	173	1175	1039	110	74	343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	188	1277	1129	120	80	373
RTOR Reduction (vph)	0	0	9	0	0	198
Lane Group Flow (vph)	188	1277	1240	0	80	175
Heavy Vehicles (%)	7%	7%	20%	20%	11%	11%
Turn Type	Prot			Perm		
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	10.5	49.2	34.7		13.2	13.2
Effective Green, g (s)	10.5	49.2	34.7		13.2	13.2
Actuated g/C Ratio	0.15	0.70	0.49		0.19	0.19
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)	252	2358	1461		305	273
v/s Ratio Prot	c0.11	0.38	c0.42		0.05	
v/s Ratio Perm						c0.12
v/c Ratio	0.75	0.54	0.85		0.26	0.64
Uniform Delay, d1	28.7	5.1	15.6		24.4	26.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	11.4	0.3	4.8		0.5	5.0
Delay (s)	40.0	5.4	20.4		24.9	31.5
Level of Service	D	A	C		C	C
Approach Delay (s)		9.8	20.4		30.3	
Approach LOS		A	C		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			16.9		HCM Level of Service	B
HCM Volume to Capacity ratio			0.78			
Actuated Cycle Length (s)			70.4		Sum of lost time (s)	12.0
Intersection Capacity Utilization			60.1%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						










Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕↕	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	163	1086	1049	163	50	101
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	170	1131	1093	170	52	105
Pedestrians		1	1		1	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		590	881			
pX, platoon unblocked	0.97				0.84	0.97
vC, conflicting volume	1264				2085	633
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1244				2010	598
tC, single (s)	4.3				7.3	7.4
tC, 2 stage (s)						
tF (s)	2.3				3.8	3.6
p0 queue free %	67				0	72
cM capacity (veh/h)	510				21	378
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	547	754	728	534	157	
Volume Left	170	0	0	0	52	
Volume Right	0	0	0	170	105	
cSH	510	1700	1700	1700	58	
Volume to Capacity	0.33	0.44	0.43	0.31	2.73	
Queue Length 95th (ft)	36	0	0	0	403	
Control Delay (s)	9.4	0.0	0.0	0.0	935.5	
Lane LOS	A				F	
Approach Delay (s)	4.0		0.0		935.5	
Approach LOS					F	
Intersection Summary						
Average Delay			56.0			
Intersection Capacity Utilization			88.2%		ICU Level of Service	E
Analysis Period (min)			15			

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.98	1.00	1.00
Satd. Flow (prot)	1736	1553		1741	1667	1417
Flt Permitted	0.95	1.00		0.72	1.00	1.00
Satd. Flow (perm)	1736	1553		1282	1667	1417
Volume (vph)	767	263	216	323	197	422
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	843	289	237	355	216	464
RTOR Reduction (vph)	0	121	0	0	0	240
Lane Group Flow (vph)	843	168	0	592	216	224
Heavy Vehicles (%)	4%	4%	7%	7%	14%	14%
Turn Type	Perm		Perm			Perm
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	46.8	46.8		51.3	51.3	51.3
Effective Green, g (s)	46.8	46.8		51.3	51.3	51.3
Actuated g/C Ratio	0.44	0.44		0.48	0.48	0.48
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)	766	685		620	806	685
v/s Ratio Prot	c0.49				0.13	
v/s Ratio Perm		0.11		c0.46		0.16
v/c Ratio	1.10	0.24		0.95	0.27	0.33
Uniform Delay, d1	29.6	18.6		26.3	16.3	16.8
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	63.5	0.2		25.2	0.2	0.3
Delay (s)	93.2	18.8		51.5	16.4	17.1
Level of Service	F	B		D	B	B
Approach Delay (s)	74.2			51.5	16.9	
Approach LOS	E			D	B	
<b>Intersection Summary</b>						
HCM Average Control Delay		52.4		HCM Level of Service		D
HCM Volume to Capacity ratio		1.02				
Actuated Cycle Length (s)		106.1		Sum of lost time (s)		8.0
Intersection Capacity Utilization		91.8%		ICU Level of Service		F
Analysis Period (min)		15				
c Critical Lane Group						

2035 Build  
3010: Airport Way WB Ramps & 82nd Avenue

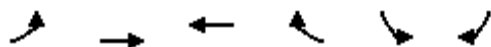
2035 PM Peak Hour - Build  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		0.95	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	0.97			1.00	1.00
Satd. Flow (prot)				1770	1583		1681	1718			1863	1583
Flt Permitted				0.95	1.00		0.95	0.61			1.00	1.00
Satd. Flow (perm)				1770	1583		1681	1079			1863	1583
Volume (vph)	0	0	0	658	0	35	680	177	0	0	83	100
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	723	0	38	747	195	0	0	91	110
RTOR Reduction (vph)	0	0	0	0	22	0	0	0	0	0	0	91
Lane Group Flow (vph)	0	0	0	723	16	0	459	483	0	0	91	19
Turn Type				Perm			Prot					Perm
Protected Phases				8			5		2		6	
Permitted Phases				8							6	
Actuated Green, G (s)				41.7	41.7		28.7	50.3			17.6	17.6
Effective Green, g (s)				41.7	41.7		28.7	50.3			17.6	17.6
Actuated g/C Ratio				0.42	0.42		0.29	0.50			0.18	0.18
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				738	660		482	726			328	279
v/s Ratio Prot					0.01		c0.27	0.19			0.05	
v/s Ratio Perm				c0.41				c0.14				0.01
v/c Ratio				0.98	0.02		0.95	0.67			0.28	0.07
Uniform Delay, d1				28.7	17.2		35.0	18.6			35.7	34.4
Progression Factor				1.00	1.00		1.16	1.17			1.00	1.00
Incremental Delay, d2				27.7	0.0		18.2	1.1			2.1	0.5
Delay (s)				56.5	17.2		58.9	22.8			37.8	34.8
Level of Service				E	B		E	C			D	C
Approach Delay (s)		0.0			54.5			40.4			36.2	
Approach LOS		A			D			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			45.6			HCM Level of Service				D		
HCM Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			122.1%			ICU Level of Service				H		
Analysis Period (min)			15									
c Critical Lane Group												

# **2022 Mitigated Build Synchro Worksheets**

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↘	↑↑	↘	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	0.95	1.00	
Frt	0.99		1.00	1.00	0.89	
Flt Protected	1.00		0.95	1.00	0.99	
Satd. Flow (prot)	3518		1770	3539	1645	
Flt Permitted	1.00		0.95	1.00	0.99	
Satd. Flow (perm)	3518		1770	3539	1645	
Volume (vph)	1251	52	110	1077	34	134
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	1375	57	121	1184	37	147
RTOR Reduction (vph)	4	0	0	0	111	0
Lane Group Flow (vph)	1428	0	121	1184	73	0
Turn Type			Prot			
Protected Phases	4		3	8	2	
Permitted Phases						
Actuated Green, G (s)	42.4		13.4	59.8	22.2	
Effective Green, g (s)	42.4		13.4	59.8	22.2	
Actuated g/C Ratio	0.47		0.15	0.66	0.25	
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)	1657		264	2351	406	
v/s Ratio Prot	c0.41		0.07	c0.33	c0.04	
v/s Ratio Perm						
v/c Ratio	0.86		0.46	0.50	0.18	
Uniform Delay, d1	21.2		35.0	7.6	26.7	
Progression Factor	1.00		0.89	0.18	1.00	
Incremental Delay, d2	4.9		0.5	0.1	1.0	
Delay (s)	26.1		31.6	1.5	27.7	
Level of Service	C		C	A	C	
Approach Delay (s)	26.1			4.3	27.7	
Approach LOS	C			A	C	
<b>Intersection Summary</b>						
HCM Average Control Delay			16.4		HCM Level of Service	B
HCM Volume to Capacity ratio			0.59			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			62.5%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗		↘	↗	↘	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.89	
Flt Protected	1.00		0.95	1.00	0.99	
Satd. Flow (prot)	1824		1770	1863	1648	
Flt Permitted	1.00		0.11	1.00	0.99	
Satd. Flow (perm)	1824		213	1863	1648	
Volume (vph)	789	146	131	302	105	377
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	867	160	144	332	115	414
RTOR Reduction (vph)	7	0	0	0	145	0
Lane Group Flow (vph)	1020	0	144	332	384	0
Turn Type			Perm			
Protected Phases	4			8	2	
Permitted Phases			8			
Actuated Green, G (s)	59.0		59.0	59.0	22.1	
Effective Green, g (s)	59.0		59.0	59.0	22.1	
Actuated g/C Ratio	0.66		0.66	0.66	0.25	
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)	1208		141	1234	409	
v/s Ratio Prot	0.56			0.18	0.23	
v/s Ratio Perm			0.68			
v/c Ratio	0.84		1.02	0.27	0.94	
Uniform Delay, d1	11.5		15.0	6.2	32.8	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	5.6		81.5	0.1	29.1	
Delay (s)	17.1		96.6	6.3	61.9	
Level of Service	B		F	A	E	
Approach Delay (s)	17.1			33.6	61.9	
Approach LOS	B			C	E	
<b>Intersection Summary</b>						
HCM Average Control Delay			32.6		HCM Level of Service	C
HCM Volume to Capacity ratio			1.00			
Actuated Cycle Length (s)			89.1		Sum of lost time (s)	8.0
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						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1703	3406	3053		1719	1538
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1703	3406	3053		1719	1538
Volume (vph)	392	1073	991	76	72	256
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	467	1277	1180	90	86	305
RTOR Reduction (vph)	0	0	6	0	0	247
Lane Group Flow (vph)	467	1277	1264	0	86	58
Heavy Vehicles (%)	6%	6%	17%	17%	5%	5%
Turn Type	Prot			Perm		
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	24.0	65.0	37.0		17.0	17.0
Effective Green, g (s)	24.0	65.0	37.0		17.0	17.0
Actuated g/C Ratio	0.27	0.72	0.41		0.19	0.19
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)	454	2460	1255		325	291
v/s Ratio Prot	c0.27	0.37	c0.41		c0.05	
v/s Ratio Perm						0.04
v/c Ratio	1.03	0.52	1.01		0.26	0.20
Uniform Delay, d1	33.0	5.6	26.5		31.2	30.8
Progression Factor	0.61	0.15	1.00		1.00	1.00
Incremental Delay, d2	42.6	0.1	27.1		2.0	1.5
Delay (s)	62.8	0.9	53.6		33.1	32.3
Level of Service	E	A	D		C	C
Approach Delay (s)		17.5	53.6		32.5	
Approach LOS		B	D		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			32.7		HCM Level of Service	C
HCM Volume to Capacity ratio			0.85			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			65.5%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

# **2035 Mitigated Build Synchro Worksheets**





























2035 Build (Mitigated)  
1006: Airport Way & NE 122nd Avenue

2035 PM Peak Hour - Build (Mitigated)  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	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	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1671	3343	1480	3303	3406	1524	3242	1759	1495	1612	3223	1429
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1671	3343	1480	3303	3406	1524	3242	1759	1495	1612	3223	1429
Volume (vph)	163	1528	411	240	1609	35	486	141	240	120	261	295
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	175	1643	442	258	1730	38	523	152	258	129	281	317
RTOR Reduction (vph)	0	0	33	0	0	13	0	0	96	0	0	6
Lane Group Flow (vph)	175	1643	409	258	1730	25	523	152	162	129	281	311
Confl. Peds. (#/hr)			1									2
Heavy Vehicles (%)	8%	8%	8%	6%	6%	6%	8%	8%	8%	12%	12%	12%
Turn Type	Prot	pm+ov		Prot	Perm		Prot	pm+ov		Prot	pm+ov	
Protected Phases	5	2	3	1	6		3	8	1	7	4	5
Permitted Phases			2			6			8			4
Actuated Green, G (s)	11.0	51.9	72.4	9.0	49.9	49.9	20.5	22.3	31.3	12.3	14.1	25.1
Effective Green, g (s)	10.0	53.6	73.1	8.0	51.6	51.6	19.5	23.8	31.8	11.3	15.6	25.6
Actuated g/C Ratio	0.09	0.48	0.65	0.07	0.46	0.46	0.17	0.21	0.28	0.10	0.14	0.23
Clearance Time (s)	3.0	5.7	3.0	3.0	5.7	5.7	3.0	5.5	3.0	3.0	5.5	3.0
Vehicle Extension (s)	1.0	2.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	2.0	1.0
Lane Grp Cap (vph)	148	1590	1012	234	1559	698	561	371	475	162	446	375
v/s Ratio Prot	c0.10	0.49	0.07	0.08	c0.51		c0.16	0.09	0.02	0.08	0.09	c0.07
v/s Ratio Perm			0.21			0.02			0.08			0.14
v/c Ratio	1.18	1.03	0.40	1.10	1.11	0.04	0.93	0.41	0.34	0.80	0.63	0.83
Uniform Delay, d1	51.4	29.6	9.4	52.4	30.6	16.8	45.9	38.4	32.1	49.6	45.8	41.5
Progression Factor	1.00	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	131.4	31.6	0.1	89.0	59.1	0.0	22.3	0.3	0.2	21.8	2.1	13.4
Delay (s)	182.7	61.2	9.5	141.4	89.7	16.8	68.2	38.7	32.3	71.3	48.0	54.9
Level of Service	F	E	A	F	F	B	E	D	C	E	D	D
Approach Delay (s)		60.5			94.9			53.5			55.1	
Approach LOS		E			F			D			E	
<b>Intersection Summary</b>												
HCM Average Control Delay			70.5			HCM Level of Service			E			
HCM Volume to Capacity ratio			1.04									
Actuated Cycle Length (s)			112.7			Sum of lost time (s)			16.0			
Intersection Capacity Utilization			88.7%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

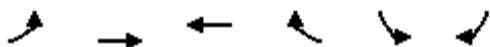
2035 Build (Mitigated)  
1008: Alderwood & 82nd Avenue

2035 PM Peak Hour - Build (Mitigated)  
HCM Signalized Intersection Capacity Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 				 			 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3367	3375		3019	1638	1392	1687	3374	1509	1641	3282	1468
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3367	3375		3019	1638	1392	1687	3374	1509	1641	3282	1468
Volume (vph)	660	350	80	430	210	200	100	1262	300	280	559	279
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)	688	365	83	448	219	208	104	1315	312	292	582	291
RTOR Reduction (vph)	0	17	0	0	0	3	0	0	50	0	0	118
Lane Group Flow (vph)	688	431	0	448	219	205	104	1315	262	292	582	173
Heavy Vehicles (%)	4%	4%	4%	16%	16%	16%	7%	7%	7%	10%	10%	10%
Turn Type	Prot			Prot	pm+ov		Prot	pm+ov		Prot	pm+ov	
Protected Phases	7	4		3	8	1	5	2	3	1	6	7
Permitted Phases					8				2			6
Actuated Green, G (s)	21.0	21.6		19.0	19.6	37.6	11.8	41.1	60.1	18.0	47.3	68.3
Effective Green, g (s)	20.0	21.6		18.0	19.6	36.6	10.8	42.1	60.1	17.0	48.3	68.3
Actuated g/C Ratio	0.17	0.19		0.16	0.17	0.32	0.09	0.37	0.52	0.15	0.42	0.60
Clearance Time (s)	3.0	4.0		3.0	4.0	3.0	3.0	5.0	3.0	3.0	5.0	3.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	587	636		474	280	493	159	1238	843	243	1382	925
v/s Ratio Prot	c0.20	0.13		0.15	c0.13	0.06	0.06	c0.39	0.05	c0.18	0.18	0.03
v/s Ratio Perm						0.09			0.12			0.09
v/c Ratio	1.17	0.68		0.95	0.78	0.42	0.65	1.06	0.31	1.20	0.42	0.19
Uniform Delay, d1	47.4	43.3		47.9	45.5	30.6	50.1	36.3	15.5	48.9	23.4	10.6
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	94.5	2.9		27.8	13.3	0.6	9.3	43.8	0.2	123.2	0.9	0.1
Delay (s)	141.9	46.2		75.7	58.8	31.2	59.4	80.1	15.7	172.1	24.3	10.7
Level of Service	F	D		E	E	C	E	F	B	F	C	B
Approach Delay (s)		104.1			60.9			67.3			57.9	
Approach LOS		F			E			E			E	
Intersection Summary												
HCM Average Control Delay			72.5			HCM Level of Service				E		
HCM Volume to Capacity ratio			1.05									
Actuated Cycle Length (s)			114.7			Sum of lost time (s)				16.0		
Intersection Capacity Utilization			93.6%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

2035 Build (Mitigated)  
2012: Columbia & 82nd Avenue NB Ramps

2035 PM Peak Hour - Build (Mitigated)  
HCM Signalized Intersection Capacity Analysis

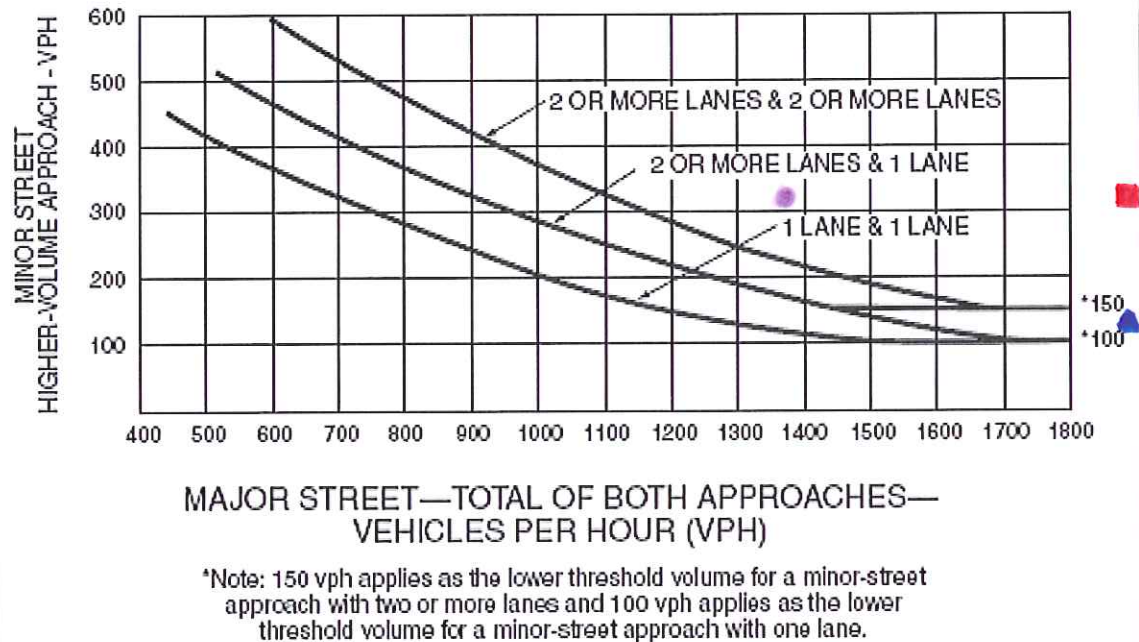


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	0.95		1.00	
Frpb, ped/bikes	1.00	1.00	1.00		0.99	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.98		0.91	
Flt Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1671	3343	2988		1327	
Flt Permitted	0.95	1.00	1.00		0.98	
Satd. Flow (perm)	1671	3343	2988		1327	
Volume (vph)	363	1086	1049	163	50	101
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	378	1131	1093	170	52	105
RTOR Reduction (vph)	0	0	14	0	87	0
Lane Group Flow (vph)	378	1131	1249	0	70	0
Confl. Peds. (#/hr)	1			1	1	1
Confl. Bikes (#/hr)				1		
Heavy Vehicles (%)	8%	8%	18%	18%	27%	27%
Turn Type	Prot					
Protected Phases	7	4	8		6	
Permitted Phases						
Actuated Green, G (s)	15.5	55.2	35.7		9.4	
Effective Green, g (s)	15.5	55.2	35.7		9.4	
Actuated g/C Ratio	0.21	0.76	0.49		0.13	
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)	357	2542	1469		172	
v/s Ratio Prot	c0.23	0.34	c0.42		c0.05	
v/s Ratio Perm						
v/c Ratio	1.06	0.44	0.85		0.41	
Uniform Delay, d1	28.5	3.2	16.1		29.0	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	64.0	0.1	4.9		1.6	
Delay (s)	92.6	3.3	21.0		30.6	
Level of Service	F	A	C		C	
Approach Delay (s)		25.6	21.0		30.6	
Approach LOS		C	C		C	
<b>Intersection Summary</b>						
HCM Average Control Delay			23.9		HCM Level of Service	C
HCM Volume to Capacity ratio			0.83			
Actuated Cycle Length (s)			72.6		Sum of lost time (s)	12.0
Intersection Capacity Utilization			73.5%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						




# Signal Warrant Analysis

## Signal Warrant Analysis

*Figure 4C-3. Warrant 3, Peak Hour*

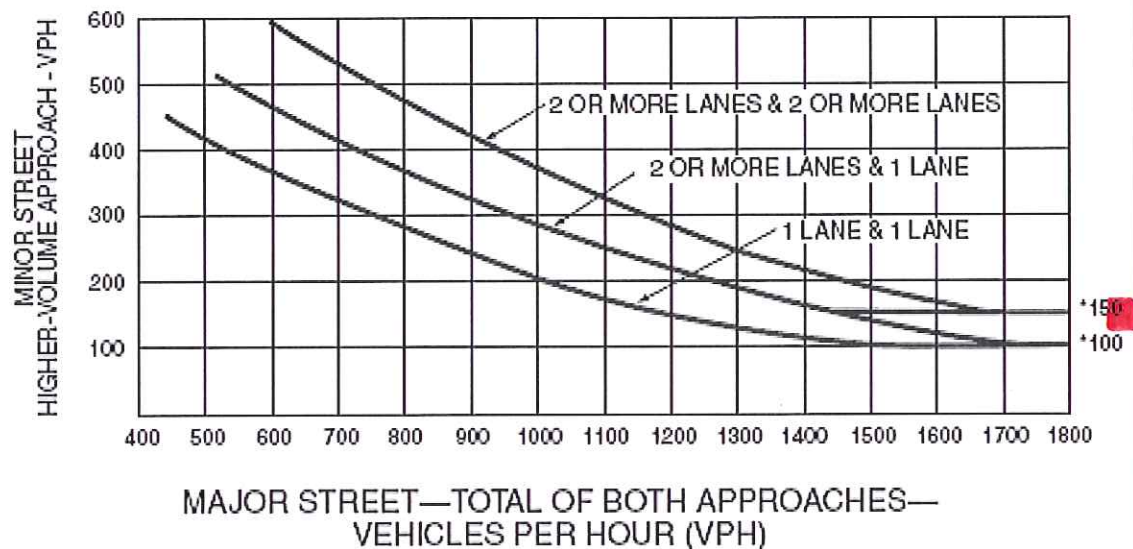


Scenario: 2022 PM Peak Hour

Intersection	Symbol	Major Volume	Minor Volume	Major Geometry/ Minor Geometry	Warrant Met
Alderwood Rd/NE Columbia Blvd		2,530	320	2 / 1	Yes
NE Columbia Blvd/NE Cully Blvd		2,490	115	2 / 1	Yes
NE Marine Dr/NE 33 <sup>rd</sup> Dr		1,370	305	1 / 1	Yes

## Signal Warrant Analysis

**Figure 4C-3. Warrant 3, Peak Hour**



\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

**Scenario: 2035 PM Peak Hour**

[illegible]