

PORT OF MORROW INTERCHANGE AREA MANAGEMENT PLAN

Boardman, Oregon

2022 UPDATE TO SECTION 7



BACKGROUND

In 2011, the City of Boardman, Morrow County, and Oregon Department of Transportation (ODOT) adopted the Port of Morrow Interchange Area Management Plan (IAMP). The purpose of the IAMP was to formally identify physical and access management improvements that would be needed to keep the interchange and the supporting local roadway network functioning safely and efficiently. In 2020/2021, the Port of Morrow (POM), City of Boardman, Morrow County, and ODOT jointly initiated an update to the Port of Morrow IAMP to address traffic congestion and vehicle queuing impacts being experienced at the north side of the interchange study area due to higher than anticipated growth within the POM.

This document updates (and supersedes) Section 7 of the original 2011 Port of Morrow IAMP and provides the justification for the additional improvements proposed to the interchange and connections to Columbia Boulevard. No changes are proposed to the portion of Laurel Lane south of the I-84 interchange and the connecting loop roads.

Section 7
Interchange Area Management Plan
(2022 Update)

INTERCHANGE AREA MANAGEMENT PLAN

The POM IAMP provides a transportation improvement plan and an Access Management Plan (AMP). The transportation improvement plan includes interchange and local circulation improvements, right-of-way requirements, as well as a phasing schedule. The AMP documents the justification for the necessary deviations to ODOT's access management standards.



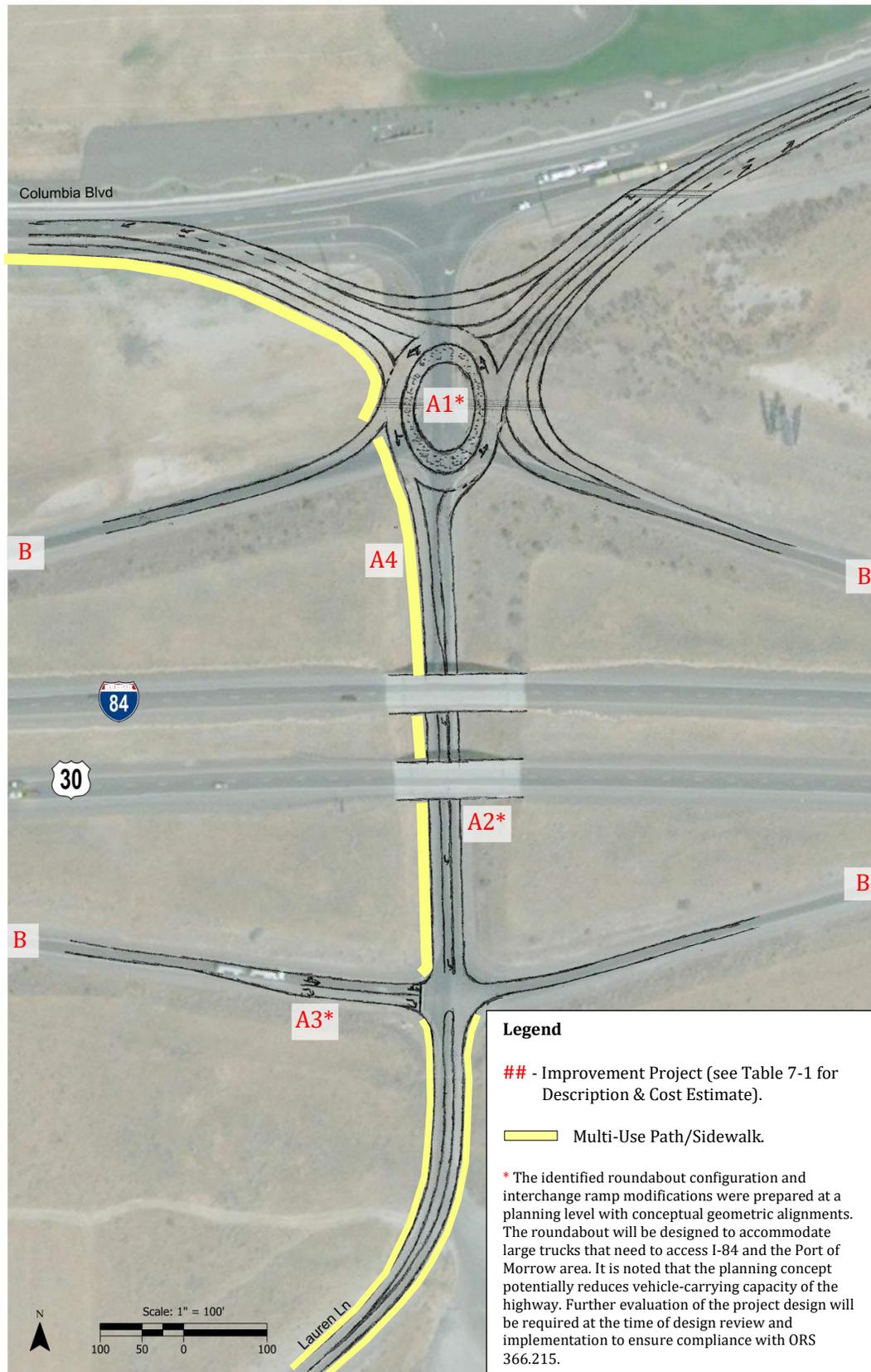
Through adoption by the City of Boardman, Morrow County, and ODOT, future development located within the Interchange Management Study Area (IMSA) will be required to make circulation and access improvements, as identified in this plan. Implementation of the IAMP is expected to preserve the functional integrity of the interchange over time and ensure viable access to existing and future land uses. Finally, the action items contained within the implementation plan (Section 8) will ensure that proper coordination between the various stakeholders occur to allow the IAMP to serve as a long-term dynamic planning tool.

Transportation Improvement Plan Overview

A comprehensive transportation improvement plan including a local circulation and access plan within the IMSA was developed based on the concept screening and evaluations outlined in the original 2011's Section 6 and this update's Technical Appendix Volume 3 (April 2021 IAMP update supporting documentation). Figure 7-1 illustrates the transportation improvement plans at the I-84/Laurel Lane interchange with a focus on Columbia Boulevard, while Figure 7-2 provides a closer look at improvements along Laurel Lane south of the interchange. This plan includes the development of new collector roadways to serve future development south of I-84, realigning and widening Laurel Lane, and modifying other existing roadways, ramps, and intersections. Each transportation improvement identified in the figures are described in Table 7-1.

The following section provides details on the major improvements identified in the Transportation Improvement Plan, including possible deviations from standards that may be required.

Figure 7-1 I-84/Lauren Lane Interchange Improvement Plan





(NO SCALE)

LEGEND

-  PROPOSED ROADWAY ALIGNMENT
-  MINIMUM SIGHT BENCH EXCAVATION LIMITS



IMPROVEMENT (SEE TABLE 7-1 FOR DESCRIPTION & COST ESTIMATE)

**Alignments for projects "D", "F", and "G" are conceptual only*

PORT OF MORROW IAMP TRANSPORTATION IMPROVEMENT PLAN
SOUTH OF POM INTERCHANGE
BOARDMAN, OREGON

7-2

Table 7-1 POM IAMP Transportation Improvement Plan

Figure 7-1 Label	Near-Term Improvement Description	Trigger for Improvement	Planning Level Cost	Potential Funding Source
A	<ol style="list-style-type: none"> Combine the Laurel Lane/Columbia Boulevard and the Laurel Lane/I-84 WB ramp terminal intersections into one single-lane roundabout intersection. Widen Laurel Lane south of the combined roundabout intersection to include a 14' wide center turn lane to accommodate southbound left-turns at the Laurel Lane/I-84 EB ramp terminal. Widen the I-84 EB off ramp to provide a separate left/through and right-turn lane. Construct a 10' wide multi-use pathway along the west side of Laurel Lane from Columbia Boulevard to the I-84 EB ramp terminal. 	When funding becomes available.	\$4.25M	PDF STIP
B	Lengthen the I-84 eastbound and westbound on- and off-ramps (to current design standards) to provide additional room for vehicles to accelerate when entering the freeway and to decelerate when exiting the freeway.	In conjunction with future I-84 mainline resurfacing projects.	\$1.5M	STIP PDF
Figure 7-2 Label	Long-Term Improvement Description	Trigger for Improvement	Planning Level Cost	Potential Funding Source
C	Acquire right-of-way and re-grade the east and west shoulders of Laurel Lane to provide intersection sight distance at Yates Lane (355 feet of intersection sight distance for southbound left-turning vehicles from Laurel Lane onto Yates Lane and 610 feet of intersection sight distance for westbound traffic on Yates Lane approaching Laurel Lane).	New development along Yates Lane that generates 25 or more daily trips.	\$0.06M ¹	PDF
D	<p>Construct a new Collector street connection to Yates Lane that would access Laurel Lane just north of the existing BPA transmission easement.</p> <p>Restrict the Laurel Lane/Yates Lane intersection to right-in/right-out access only.</p>	Peak southbound left-turn 95 th -percentile queue backs up to the I-84/Laurel Lane eastbound ramp terminal.	\$1.2M	PDF
E	Realign Laurel Lane south of the I-84/Laurel Lane eastbound ramp terminal to improve the vertical and horizontal profile. Provide a southbound left-turn lane along Laurel Lane at the new Yates Lane access described in Project "D" above.	<p>Peak southbound left-turn 95th-percentile queue backs up to the I-84/Laurel Lane eastbound ramp terminal.</p> <p>-- or --</p> <p>Eastbound approach to Laurel Lane (described in Project "F" below) operates at LOS "E" or worse.</p>	\$1.4M	PDF
F	Construct a new Collector Street connection to the parcels in the southwest quadrant of the interchange. This connection would access Laurel Lane directly across from Yates Lane.	New development requiring access east of Laurel Lane.	\$0.03M	PDF

G ²	Construct a new Collector Street connection to the remaining parcels in the southwest quadrant of the interchange. The connection would access Laurel Lane just north of the existing BPA transmission easement. Restrict the access described in Project “F” above to right-in/right-out access only.	Eastbound approach to Laurel Lane (described in Project “F” above) operates at LOS “E” or worse.	\$1.8M	
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STIP – State Transportation Improvement Project

PDF – Private Development Funds

¹ - Construction costs only, does not include right-of-way costs

² – New Collector roadway may be waived by the City if all parcels to the east or west of Laurel Lane are consolidated, developed, and owned by a single entity.

NEAR-TERM IMPROVEMENTS

The following near-term improvements are identified for Laurel Lane and the I-84 ramps.

A). I-84/Laurel Lane Interchange Improvements

The Laurel Lane/Columbia Boulevard intersection and the Laurel Lane/I-84 WB ramp terminal intersections will be combined into one single-lane roundabout intersection. The new roundabout intersection would be located at the approximate location of the existing Laurel Lane/I-84 WB ramp terminal. The east and west legs of Columbia Boulevard are realigned to connect to the new roundabout intersection. Other improvements to the interchange include:

- Widening of Laurel Lane south of the I-84 WB ramp terminal roundabout to a three-lane cross section in order to develop a southbound left-turn lane at the Laurel Lane/I-84 EB ramp terminal.
- Widening of the I-84 EB off ramp to provide a separate left/through and right-turn lane for long-term operations and queue management purposes.
- A potential bypass lane for WB movements along Columbia Boulevard.
- A potential bypass lane connecting the WB off ramp to eastbound Columbia Boulevard.
- Construction of a 10’ wide multi-use pathway along the west side of Laurel Lane from Columbia Boulevard to the I-84 EB ramp terminal.

B). I-84 Ramp Improvements

The I-84 eastbound and westbound on- and off-ramps do not meet current acceleration and deceleration design standards. These ramps will be lengthened to provide additional room for vehicles to accelerate when entering the freeway and to decelerate when exiting the freeway. The extensions will improve safety on I-84 and at the ramp terminal intersections. *The ramp improvements will be constructed in conjunction with future I-84 mainline resurfacing projects.*

C). Laurel Lane Sight Distance Improvements

To improve intersection sight distance at the Laurel Lane/Yates Lane intersection, existing embankment will be re-graded. The embankments alongside Laurel Lane will be excavated to provide approximately 355 feet of intersection sight distance for southbound left-turning vehicles from Laurel Lane onto Yates Lane and 610 feet of intersection sight distance for westbound approach vehicles on Yates Lane approaching Laurel Lane. *This improvement will be conditioned upon the approval of new development on Yates Lane that generates 25 or more daily trips.*

LONG-TERM IMPROVEMENTS

Long-term improvements to the transportation system involve developing new connections to the properties immediately south of the interchange to improve access spacing and operations along Laurel Lane.

D). Yates Lane Access Connection

A new connection to Yates Lane from Laurel Lane will be constructed (at City Collector standards) just north of the existing BPA transmission easement. The existing Yates Lane intersection will remain as a right-in/right-out access. *This improvement will be warranted when the southbound left-turn 95th-percentile queue backs up to the I-84/Laurel Lane eastbound ramp terminal.*

E). Laurel Lane Realignment

To support long-term commercial growth on the south side of the interchange, Laurel Lane will be realigned within the sight distance grading identified under Project "C" to improve the horizontal and vertical alignment. *The need for the realignment will be triggered by the need for the new Yates Lane connection described in Project "D."*

F). Near-Term SW Quadrant Access

To serve potential future development in the southwest quadrant of the interchange, a new access to Laurel Lane (constructed at City Collector standards) will be provided across from Yates Lane.

G). Long-Term SW Quadrant Access

A new Collector street connection will be constructed off of Laurel Lane just north of the BPA power transmission easement to provide access to the parcels in the southwest quadrant of the interchange. *The need for this improvement is dependent upon additional development within the southwest quadrant of the interchange and the operational threshold of Project "F". When this connection is made, the near-term access described in Project "F" will be restricted to right-in/right-out access.*

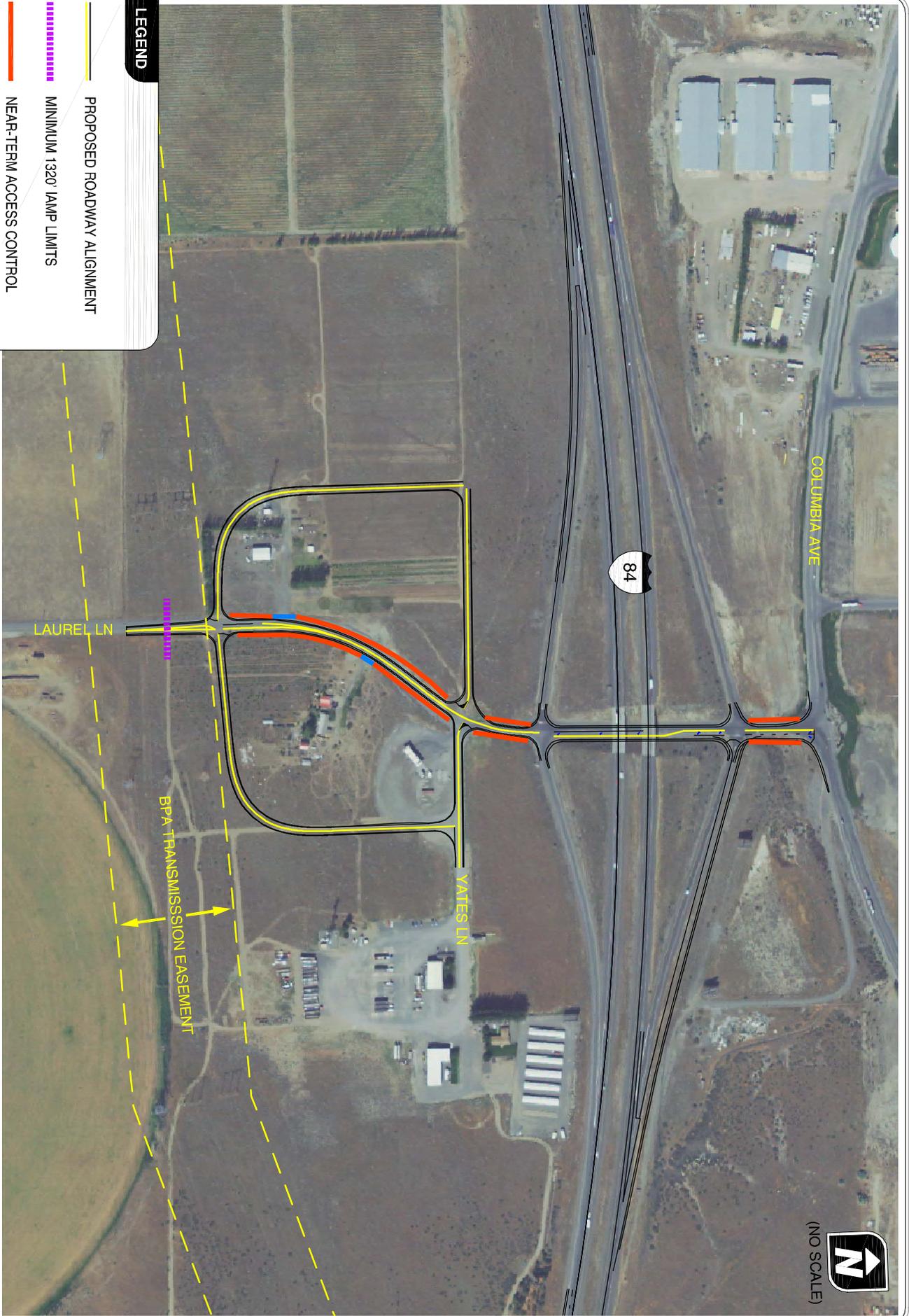
POSSIBLE EXCEPTIONS/DEVIATIONS FROM STANDARDS

The deviations that will be required for the IAMP transportation improvement plan are related to the access spacing standards outlined under Oregon Administrative Rule 734, Division 51 and the Oregon Highway Plan (OHP). These deviations are discussed in the access management subsection below.

Access Management Plan

Access locations within the IMSA were evaluated based on ODOT's Division 51 Access Management standards and an assessment of traffic operations and safety as described in Action 3C.3 of the 1999 Oregon Highway Plan. Accordingly, the Access Management Plan (AMP) will preserve the operational integrity and safety of the interchange and primary roadways (e.g. Laurel Lane) serving it, while maintaining viable access to all parcels in the IMSA. The AMP contains a plan for actions to be taken on a City of Boardman roadway (i.e., Laurel Lane) and adopted into the City's TSP.

An AMP is identified for near- and long-term timeframes. The overall AMP is illustrated in Figure 7-3. Justification is also provided for locations where deviations from ODOT's access management standards are necessary. Access management will be implemented as part of ODOT and City project development and delivery processes or as future land use actions occur.



LEGEND

-  PROPOSED ROADWAY ALIGNMENT
-  MINIMUM 1320' IAMP LIMITS
-  NEAR-TERM ACCESS CONTROL
-  LONG-TERM ACCESS CONTROL

PORT OF MORROW IAMP ACCESS MANAGEMENT PLAN
BOARDMAN, OREGON

FIGURE
7-3

GENERAL ACCESS MANAGEMENT IMPLEMENTATION

Under ODOT's current access management policy, the 1999 Oregon Highway Plan stipulates that the desired distance between an interchange ramp terminal and the first full approach (public or private) on the crossroad should be a minimum of 1,320 feet (¼-mile). The first right-in/right-out access should be a minimum of 750 feet from the ramp terminal. Currently, there are three (3) private and three (3) public approaches within 1,320 feet of the interchange ramp terminals, as was previously documented in Figure 4-6 of the original 2011 IAMP.

EXISTING PRIVATE APPROACH POLICY

ODOT guarantees Access Permit protection, as allowed within ORS 374.305 & 310, to all existing private accesses. Each will remain a valid access as long as the existing uses remain on property/site and there is no capital improvement project that would trigger review of the access (per OAR 734.051.0285). An access evaluation will be required when any of the following land use actions leads to a peak hour increase in 50 trips or more over the prior use, a daily increase of 500 trips or more over the prior use, or the increase represents a 20 percent or more increase in trips on a typical day/peak hour; if there is an identified safety or operational problem related to the approach; if the approach does not meet sight distance requirements; or if the daily traffic using the approach increases by 10 or more vehicles with a gross vehicle weight equal to or greater than 26,000 pounds:

- Modifications to existing zoning,
- Changes to plan amendment designations;
- Construction of new buildings;
- Increases in floor space of existing buildings;
- Division or consolidation of property boundaries;
- Changes in the character of traffic using the driveway/approach;
- Changes to internal site circulation design or inter-parcel circulation; or
- Reestablishment of a property's use (after discontinuance for four years or more that trigger a Traffic Impact Assessment as defined below) that occurs on the parcels served by the approaches.

In general, the types of improvements identified for accesses within the IMSA include:

- Modifying, mitigating, consolidating, or removing existing approaches pursuant to an access management plan as part of the highway project development and delivery process (OAR 734-051);
- Improving traffic safety and operations by improving the local street network to provide alternate access and reduce conflict points; and,
- Restricting highway access but improving local roadway access by introducing shared access, cross-over easements, and/or consolidated access when separate parcels are assembled for redevelopment, and access via collector or local streets.

The time period over which the following measures will be implemented will depend on the rate of redevelopment within the IMSA and when the transportation improvement plan projects identified previously are constructed. As each parcel redevelops, or upon capital improvement, accesses will be evaluated to determine how they will be modified in order to move in the direction of meeting the access spacing standards and long-term vision of driveway consolidation while still providing access as defined in OAR 734-051.

ACCESS MANAGEMENT

Figure 7-3 illustrates the AMP for the IMSA. The AMP is divided into two timeframes: near-term and long-term. The near-term plan is to not allow new access to Laurel Lane within the ¼-mile limits, except in the southwest quadrant where it may be the only feasible access point for those properties in the near-term. Long-term, the current Yates Lane access will be restricted to right-in/right-out access only, as would any access constructed opposite from it, when the new connections shown in Figure 7-3 are built. As the other properties along this section of Laurel Lane develop, their access will be provided off of either the new Yates Lane collector street or the new southwest quadrant collector street and not on Laurel Lane. The long-term plan would be implemented once the long-term improvements are constructed.

DEVIATIONS TO THE DIVISION 51 ACCESS MANAGEMENT STANDARDS

Six accesses will not meet the applicable OAR Division 51 access spacing standard, and as such, deviations are required to address them. These deviations will be reviewed by the Region Access Management Engineer. Under the provisions, the Region Access Management Engineer may approve a deviation if:

- (a) Adherence to spacing standards creates safety or traffic operation problems;*

(b) The applicant provides a joint approach that serves two or more properties and results in a net reduction of approaches to the highway;

(c) The applicant demonstrates that existing development patterns or land holdings make joint use approaches impossible;

(d) Adherence to spacing standards will cause the approach to conflict with a significant natural or historic feature including trees and unique vegetation, a bridge, waterway, park, archaeological area, or cemetery;

(e) The highway segment functions as a service road;

(f) On a couplet with directional traffic separated by a city block or more, the request is for an approach at mid-block with no other existing approaches in the block or the proposal consolidates existing approaches at mid-block; or

(g) Based on the Region Access Management Engineer's determination that:

(A) Safety factors and spacing significantly improve as a result of the approach; and

(B) Approval does not compromise the intent of these rules as set forth in OAR 734-051-0020 (Which states: The purpose of Division 51 rules is to provide a safe and efficient transportation system through the preservation of public safety, the improvement and development of transportation facilities, the protection of highway traffic from the hazards of unrestricted and unregulated entry from adjacent property, and the elimination of hazards due to highway grade intersections.)

The following is a description of the justification for deviation for each of the public accesses requiring a deviation.

Public Access to Yates Lane

A deviation to the access spacing requirements identified in OAR Division 51 is required at the Yates Lane/Laurel Lane intersection, which is located approximately 225 feet south of the I-84 Eastbound ramp terminal, as shown in Figure 7-3. The approach will be restricted to right-in/right-out access only. As was mentioned above, a deviation may be approved if:

(b) The applicant provides a joint approach that serves two or more properties and results in a net reduction of approaches to the highway

Response: Yates Lane and any future road built opposite it will serve multiple properties via the new connections described in Table 7-1. This will allow other access points to be consolidated onto the new connections and utilize this approach.

Public Access to the Yates Lane Collector and the SW Quadrant Collector

A deviation to the access spacing requirements identified in OAR Division 51 is required where the new connecting roadways identified in Table 7-1 and shown in Figure 7-3 access Laurel Lane. This new intersection will be approximately 1,200 feet south of the I-84 Eastbound ramp terminal. As was mentioned above, a deviation may be approved if:

(b) The applicant provides a joint approach that serves two or more properties and results in a net reduction of approaches to the highway

Response: The new connections will allow other access points to be consolidated onto them and utilize this approach and the Yates Lane right-in/right-out access.

(d) Adherence to spacing standards will cause the approach to conflict with a significant natural or historic feature including trees and unique vegetation, a bridge, waterway, park, archaeological area, or cemetery

Response: The new access cannot be placed further south due to the presence of transmission lines.

Appendix 1
2022 IAMP Update Supporting
Documentation

TECHNICAL MEMORANDUM

Date: April 22, 2021

Project #: 25235

To: Carla McLane
I-84/Laurel Lane Advisory Committee

From: Matt Hughart, AICP and Ali Razmpa

Project: I-84/Laurel Lane IAMP Update

Subject: Existing Conditions, Future 2040 Conditions, and Interchange Concept
Development/Evaluation

This technical memorandum documents the supporting analysis used to update the I-84/Laurel Lane Interchange Area Management Plan (IAMP). Major components include Existing Conditions, Future 2040 Conditions, and Interchange Concept Development & Evaluation.

BACKGROUND

In 2011, the City of Boardman, Morrow County, and Oregon Department of Transportation (ODOT) adopted the I-84/Laurel Lane IAMP. The purpose of the IAMP was to formally identify physical and access management improvements that would be needed to keep the interchange and the supporting local roadway network functioning safely and efficiently. In 2020, the Port of Morrow (POM), City of Boardman, Morrow County, and ODOT jointly initiated an update to the I-84/Laurel Lane IAMP to address traffic congestion and vehicle queuing impacts being experienced at the north side of the interchange study area due to higher than anticipated growth within the POM.

Consistent with the traditional planning process, this memorandum will be used to update the IAMP, documenting the current IAMP study area conditions (existing infrastructure and traffic conditions), the future no-build conditions (assuming expected local and regional growth with no infrastructure improvements), and the evaluation and selection of updated interchange improvements.

Interchange Management Study Area

The I-84/Laurel Lane interchange is located on the east side of Boardman and serves as the primary point of access to the POM and a secondary point to access to the City of Boardman. To help define the extent of the land use and traffic operations review for this update, an Interchange Management Study Area (IMSA) has been defined as depicted in Figure 1. At a minimum, the IMSA includes all properties located roughly within a ½-mile of the interchange.

Figure 1 – Interchange Management Study Area



EXISTING CONDITIONS

Existing Land Use

Pursuant to the requirements stated in the Oregon Administrative Rule 734-051-0155 for the preparation of an IAMP, the land use inventory has been updated for the IMSA. This section provides a description of the existing land-use patterns and zoning regulations that currently exist within the IMSA. Land use-related information will ultimately be combined with findings about existing transportation system conditions in an overall existing conditions section of the IAMP.

Existing Zoning and Development Standards

Any development in the IMSA will have some direct impact on the facility, so it is important to review the existing zoning for parcels surrounding the interchange and connecting roads. Permitted land uses and the applicable standards associated with the zone designations are an indicator of the potential for growth in the area. Zoning for areas within the IMSA are shown in Figure 2. This map includes both city and county zoning, as the IMSA includes unincorporated areas of Morrow County.

Morrow County

Morrow County zoning designations in the vicinity of the POM interchange include Port Industrial (PI), General Industrial (MG), Exclusive Farm Use (EFU), and Farm Residential (FR2). A portion of the PI and MG zoned land in the IMSA to the northeast of the POM interchange was previously inside the Boardman UGB but an annexation in 2018 placed much of that area inside the Boardman city limits. The few remaining parcels still within the UGB west and south of the Union Pacific mainline are managed pursuant to an intergovernmental agreement that exists between the City and County, where the City is included in the County's development review process, but development approval is subject to existing County zoning requirements, as described below. The portion that has been annexed has had applied the corresponding City zoning of General Industrial (GI), which is discussed in the next section of this memorandum.

An overview of permitted uses and development requirements of these zones, as regulated by the Morrow County Zoning Ordinance, is provided below.

- Port Industrial (PI) (Section 3.073). The PI zone was established to “provide for port-related industrial uses and aerospace-related industrial uses which are not devoted to research and development. The zone is intended to provide an industrial sanctuary, limiting commercial uses to those appropriate and necessary to serve the needs of the workers employed within the zone.” As stated in its purpose, the zone allows uses that are port-related, especially water-dependent, aerospace, manufacturing, and heavy industrial uses. Commercial and retail uses are allowed conditionally and are limited in floor area so that they are clearly secondary to the primary uses in the zone. There are no restrictions on building height or minimum requirements for lot coverage in this zone.
- General Industrial (MG) (Section 3.070). Retail and wholesale businesses, construction-related businesses, freight hubs, warehouses and distributions centers, machine shops, and

food processing are amongst the uses allowed outright in the MG zone. More intensive manufacturing and processing uses, industrial uses entailing outdoor storage, and public and semi-public uses are conditionally permitted in the MG zone. There are no specific minimum lot size or setback standards other than stream setbacks (100 feet) and building setbacks that range from 20 to 50 feet depending on whether the building fronts a local street, collector, or arterial.

- Farm Residential (FR2) (Section 3.041). This zone is a rural residential zone that acknowledges pre-existing homes on small lots outside the Urban Growth Boundary (UGB), although state policy and law discourages the expansion of such development. Single-family housing, farming (with some restriction), utilities, parks, community centers, and other public uses that serve rural residential uses are allowed outright in the FR2 zone. Duplexes, water and sewer facilities, golf courses, stables, and vet clinics are permitted conditionally. Lots in this zone must be at least two acres.
- Exclusive Farm Use (EFU) (Section 3.010). The EFU zone targets the preservation of agricultural land and uses and is designed to only allow uses that are compatible with agricultural uses. Agricultural production and harvesting, buildings associated with agricultural uses, accessory dwellings, farm worker dwellings, restoration of established dwellings and other lawful buildings, improvements to roads, schools not within three miles of the UGB, churches, wineries, and solid waste disposal facilities (with restrictions) are permitted outright in the EFU zone. Certain single-family homes, mining operations, golf courses, private recreation facilities, public- or non-profit-owned parks and community centers, utilities, road expansions, and other solid waste and composting facilities are amongst uses that are permitted conditionally. The lot standard for agricultural units in the zone is 160 acres. Income and capability tests are required for residential uses in the zone. Uses are subject to 100-foot stream setbacks, as in other zones.

City of Boardman Zoning

The POM interchange has to the south City of Boardman Service Center (SC) commercial. To the north lies City industrial land, zoned General Industrial (GI).

Chapter 2 of the City of Boardman Zoning Ordinance implements zoning “districts” that establish permitted uses and development standards for residential, commercial, and industrial zones. Below is an overview of these provisions for the zoning districts within the IMSA.

- General Industrial (GI) (Chapter 2.3). The GI district is intended for a range of light and heavy industrial uses and to provide business services close to employment centers, while limiting impacts on adjacent districts and keeping incompatible uses separate. Heavy and light industrial and manufacturing uses, warehouses and distribution centers, offices and commercial uses that serve industrial uses, limited retail uses, government facilities “where the public is not generally received,” vocational schools, open space, and Utilities are among the uses permitted outright in the GI district. Transportation facilities and improvements that are in the TSP, are part of an approved land division, or do not require land use approval are also permitted outright; transportation improvements that are not in the TSP or part of an approved land division are permitted conditionally. The maximum lot coverage in the district is 75% and building height is restricted to three stories or 35 feet. Additional standards apply to uses with significant noise, light/glare, dust, vibration, or traffic impacts, as defined in Section 2.3.160, including possible traffic impact analyses for uses that would increase average daily traffic by 20 percent or more and 100 vehicles per day.
- Service Center (SC) (Section 2.2.200). The Service Center designation is a sub-district of the City’s Commercial district. The sub-district was established to accommodate heavy commercial uses and light industrial uses along segments of the I-84 corridor. The development standards of the Commercial district apply to the sub-district, except where modifications are specified. Lot coverage is capped at 85% in the sub-district. Maximum height is four stories or 50 feet. Design and additional standards as well as pedestrian amenity requirements apply to uses in this sub-district.

Those areas of County Port Industrial (PI) and General Industrial (MG) zoning northeast of the interchange on land that is still inside the City of Boardman UGB could develop under current County zoning or could be annexed and, if so, most likely re-zoned with corresponding City General Industrial (GI) zoning. The existing County zoning and potential City zoning generally allow the same types of industrial uses. The City zoning is slightly more prescriptive when it comes to development standards, including maximum lot coverage of 75% and maximum building height of three stories or 35 feet.

Land Use Inventory

For purposes of describing existing zoning and land uses within the IMSA, as well as conducting the transportation analysis, the narrative below will consider the surroundings for each interchange.

POM Interchange

Land uses directly adjacent to the POM interchange lie entirely within Boardman’s city limits. Land in the immediate vicinity, both north and south of the highway, is zoned for highway “service” uses (SC). Industrial zoned land lies further north of this commercial land and includes land within the city zoned General Industrial and, since the annexation in 2018 fewer properties within the City’s UGB zoned Port Industrial and General Industrial. Notably, the IMSA encompasses all of the City of Boardman’s industrial land (zoned General Industrial) and all of the POM’s developable, industrial zoned land (“Port Industrial”) north of I-84. Currently, there are no developed commercial uses north of the interchange.

South of the interchange, there are only a few developed commercial properties including a Pacific Pride fueling station, storage facility, and coffee shop. The City’s SC zoned land is coterminous with the city limits and UGB in this area. Land further south is in the County, zoned for farming (EFU) and rural residential (FR2).

Existing Transportation Inventory

The second major component of the existing conditions evaluation process is to document the transportation system. The existing transportation inventory provides a detailed description of all transportation facilities and travel modes within the study area. In addition, the inventory identifies the current operational, traffic control, and geometric characteristics of roadways and other transportation facilities within the IMSA. A detailed description of these facilities is provided in the following sections.

Roadway Facilities

The roadways within the IMSAs include state, county, POM, and city roadways. A description of each of the functionally classified roadway facilities is summarized below in Table 1.

Table 1 – Existing Transportation Facilities and Roadway Designations

Roadway	Existing Roadway Ownership/ Functional Classification	Cross-section	Posted Speed (mph)	Side- walks?	Bicycle Lanes?	On-Street Parking?
Interstate-84	ODOT/ Interstate Highway	4-lane	70	No	Shoulders	No
Columbia Avenue	City-POM/Arterial	3/4-lane	35/40	Yes (north side)	Shoulders	No
Laurel Lane	City-County/Arterial	2-lane	35	No	No	No
Yates Lane	City - Local	2-lane	Not posted	No	No	No

Interstate-84

I-84 is a four-lane interstate highway that runs east-west through Morrow County. It is the main east-west travel route within the state of Oregon providing a connection between Portland, Oregon and Boise, Idaho. I-84 is part of the National Highway System and is designated in the *Oregon Highway Plan* as an Interstate Highway, Freight Route, and Truck Route.

Laurel Lane Interchange Ramps

The Laurel Lane interchange ramps are currently configured in a diamond interchange form. Both ramp terminals are stop-controlled on the off-ramp approaches. Due to the area's topography, I-84 is elevated over Laurel Lane.

Laurel Lane

Laurel Lane is a City and County roadway that provides a north-south connection across I-84 on the east side of Boardman. It is also an important roadway for providing access to the POM area. It is a two-lane roadway with narrow shoulders that are partially paved and partially gravel. Within the Boardman city limits it is classified as an arterial by the City of Boardman Transportation System Plan (TSP).

Columbia Avenue

Columbia Avenue is a three- to four-lane City arterial roadway connecting the POM area to Laurel Lane and to the commercial core area of Boardman. Many Port properties and local streets connect to Columbia Avenue making it one of the most highly traveled roadways within the POM.

Pedestrian and Bicycle Facilities

Due to the rural and industrial nature of the study area, exclusive pedestrian and bicycle facilities (e.g. sidewalks and bike lanes) are limited in the study area. The Morrow County Columbia River Heritage Trail does travel through the Port of Morrow, usually as a separate facility, north of the Interchange coming from the east along Columbia, turning north along Ullman Boulevard and finally along Marine Drive. Sidewalks are generally not present on the study roadways with the exception of the north side of Columbia Avenue. Many of the study roadways have shoulders that are at least partially paved and provide additional space for autos and bicycles to share on the roadway. Traffic volumes are also relatively low on many of the City and County roadways in the study area, making it more comfortable for non-motorized and motorized users to share the roadways.

Existing Traffic Volumes and Peak Hour Operations

Manual intersection turning movement counts were obtained from ODOT at each of the following study intersections to assess the operational performance and characteristics within the study area:

- Laurel Lane/Columbia Boulevard
- Laurel Lane/I-84 WB Ramp Terminal
- Laurel Lane/I-84 EB Ramp Terminal
- Laurel Lane/Yates Lane

These counts were conducted on mid-week days in June 2019. A description of the analysis conducted with this data is summarized in the following sections. *Appendix A contains the traffic count worksheets.*

Seasonal Adjustments

Following the methodology outlined by ODOT’s Analysis Procedures Manual (APM), a seasonal adjustment factor was applied to the traffic counts collected for the existing conditions analysis in order to estimate 30th highest hour volumes. Consistent with the previous IAMP, ATR #25-008, located on I-84 west of US 730, was determined to have the most similar traffic characteristics within the study area. The seasonal adjustment factor calculations for the intersection counts during June is 1.07 is noted in Table 2 below.

Table 2 - Seasonal Adjustment Factor Calculations

	2018	2017	2016	2015	2014	Avg
ATR 25-008						
Peak Month (August)	122	126	122	123	125	123.3
Count Month (June)	115	118	115	115	115	115

- The average peak month (August) is: $(122\% + 123\% + 125\%) / 3 = 123.3\%$
- The average count month (June) is: $(115\% + 115\% + 115\%) / 3 = 115\%$
- The seasonal adjustment factor is $123.3\%/115\% = \mathbf{1.07}$

After applying the 1.07 seasonal adjustment factor, the intersection turning movement volumes at the I-84/Laurel Lane interchange were analyzed to discern any notable traffic patterns that would help inform the IAMP update process as noted in the following sections.

Exhibits 1 through 2 illustrate the seasonally adjusted 16-hour volume profiles of the I-84 ramps at Laurel Lane, each graph illustrating the ramps have dominate traffic patterns. For example, the traffic volumes on the I-84 westbound off-ramp are significantly higher than volumes on the westbound on-ramp throughout the 16-hour period that counts were conducted. The exact reverse pattern occurs on the eastbound ramps, where the off-ramp has significantly lower volumes than the on-ramp. This indicates that much of the traffic utilizing this interchange is coming from and returning to the east on I-84.

Exhibit 1 – Year 2019 16-Hour Traffic Volume Profile for the I-84 WB Ramps at Laurel Lane

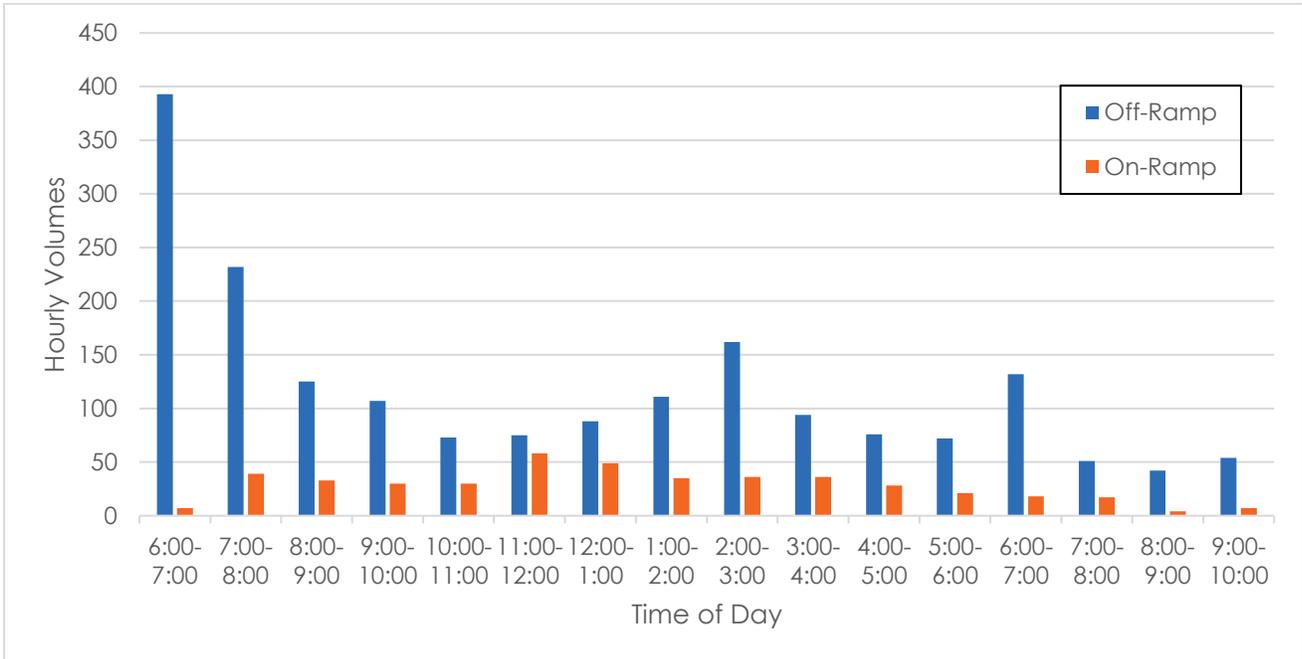


Exhibit 2 – Year 2019 16-Hour Traffic Volume Profile for the I-84 EB Ramps at Laurel Lane

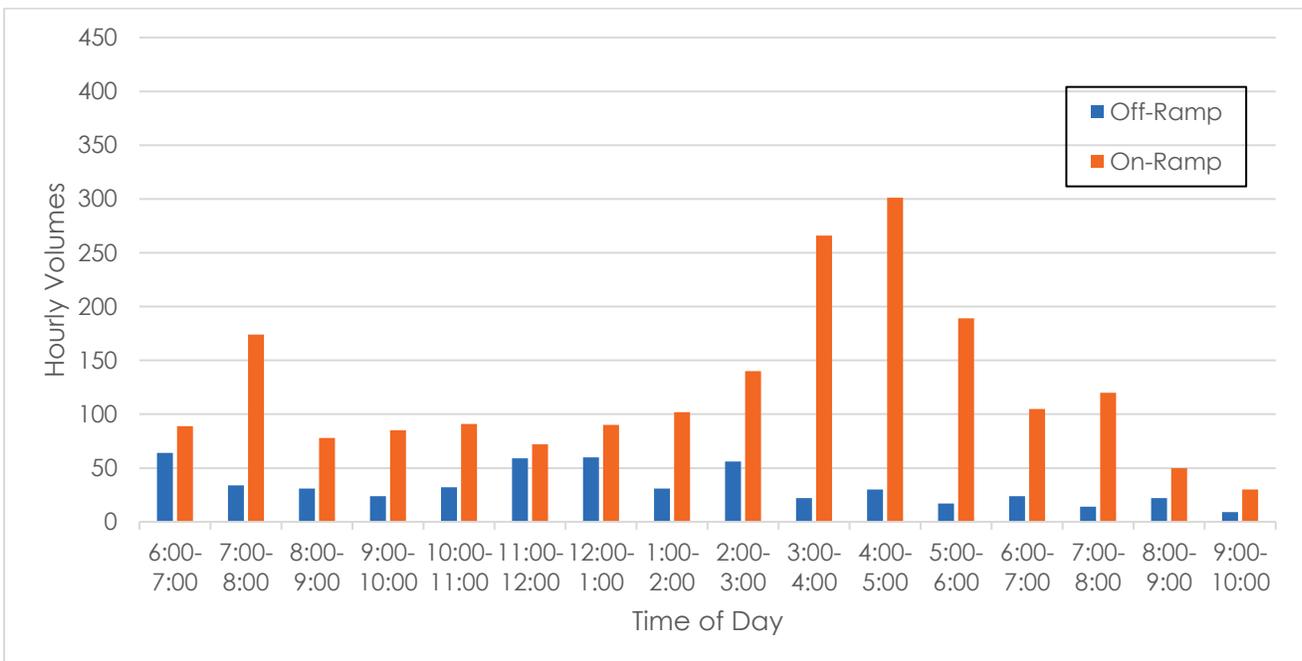
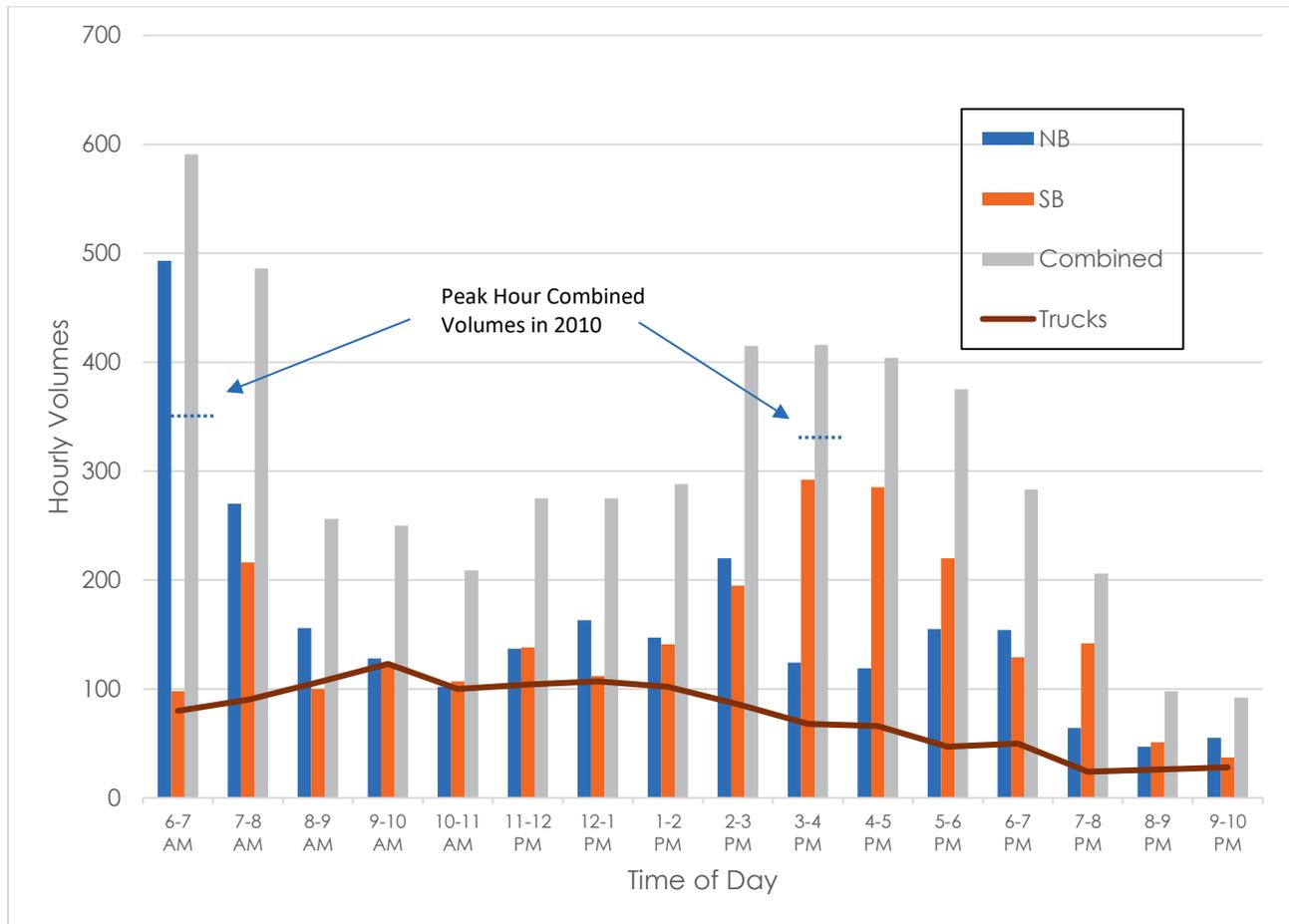


Exhibit 3 illustrates the 16-hour traffic volume profile for Laurel Lane just north of the I-84 WB ramps. As shown, the profile indicates heavy northbound demand in the 6:00-8:00 AM time period and a more evenly distributed but still significant heavy southbound demand in the 3:00-6:00 PM time period. These patterns appear to be consistent with the dominate work shift employment model used by many of the POM businesses.

Exhibit 3 – Year 2020 16-Hour Traffic Volume Profile for Laurel Lane North of the I-84 WB Ramps



Given the industrial nature of the POM area, heavy truck traffic makes up a significant proportion of the combined total traffic volumes along Laurel Lane as shown in Exhibit 3. During the non-commuting time periods, truck traffic can be anywhere from 40-50 percent of the total volume.

Existing Intersection Operations

ODOT uses volume-to-capacity (v/c) ratios to assess intersection operations. Table 6 of the *Oregon Highway Plan* (OHP) provides maximum volume-to-capacity ratio targets for all signalized/roundabout and unsignalized intersections located outside the Portland metropolitan area. Table 3 summarizes the v/c ratio that will be used to evaluate the existing and future operations at the ODOT owned/maintained I-84/Laurel Lane ramp terminals.

Table 3 – ODOT Mobility Targets

Intersection	OHP Mobility Target
Laurel Lane/I-84 WB Ramp Terminal	0.90 Laurel Lane approach / 0.85 ramp approach
Laurel Lane/I-84 EB Ramp Terminal	0.90 Laurel Lane approach / 0.85 ramp approach

The operational standard for intersections involving only City and County roadways is based on level-of-service (LOS). The City maintains a LOS standard of “C” or better for all intersections. The Morrow County standard is LOS “C” or better LOS “D” or better for areas within a City’s UGB.

Using these standards, an operations assessment was performed at the previously noted intersections. The seasonally adjusted peak hour intersection turning movement volumes at the study intersections (6:30-7:30 AM and 3:30-4:30 PM) are summarized in Figures 3 and 4 while Table 4 summarizes the corresponding traffic operations during the weekday AM and PM peak hours. As shown in Table 3, the study intersection operations satisfy applicable ODOT and Morrow County mobility targets/standards. The critical westbound left-turn movement at the Laurel Lane/Columbia Boulevard intersection is currently operating at LOS D during the weekday AM peak period which exceeds the City of Boardman’s LOS C standard. *Appendix B contains the existing traffic operations worksheets.*

Table 4 – Existing Traffic Conditions

Intersection	Critical Approach/Lane	Weekday AM Peak Hour (6:30-7:30 AM)			Weekday PM Peak Hour (3:30-4:30 PM)		
		V/C	Approach Delay (sec)	Approach LOS	V/C	Approach Delay (sec)	Approach LOS
Laurel Lane/ Columbia Boulevard	Westbound Left-Turn	0.47	28.2	D	0.38	14.6	B
Laurel Lane/ I-84 WB Ramp Terminal	Westbound Approach	0.51	13.74	B	0.13	10.0	B
Laurel Lane/ I-84 EB Ramp Terminal	Eastbound Approach	0.18	15.36	C	0.15	23.4	C
Laurel Lane/ Yates Lane	Westbound Approach	0.01	9.81	A	0.03	9.26	A

While the operations analysis indicates that the study intersections have capacity during the peak time periods, there are several traffic conditions that create operational and safety issues that are not apparent in these operational findings. These include:

- The westbound I-84/Laurel Lane off ramp is a single-lane ramp with a shared single-lane stop-controlled approach to Laurel Lane. During the weekday AM peak time period, the ramp accommodates up to 400 vehicles and trucks with the majority destined to businesses within the POM. Due to the high peaking characteristics, volumes on the westbound off ramp can back up towards the I-84 mainline at times.
- In an effort to minimize conflicts between the closely spaced Laurel Lane/Columbia Boulevard and Laurel Lane/I-84 WB Ramp Terminal intersections, all northbound movements at the Laurel Lane/Columbia Boulevard intersection are uncontrolled. Only the westbound left-turn and eastbound through movements are stop-controlled.

Figure 3 – Existing Weekday AM Peak Hour Traffic Volumes

Generated with **PTV VISTRO** Port of Morrow IAMP Update Weekday AM Peak Hour
 Version 2020 (SP 0-3) Existing Traffic Conditions HCM 6th

Traffic Volume - Future Total Volume

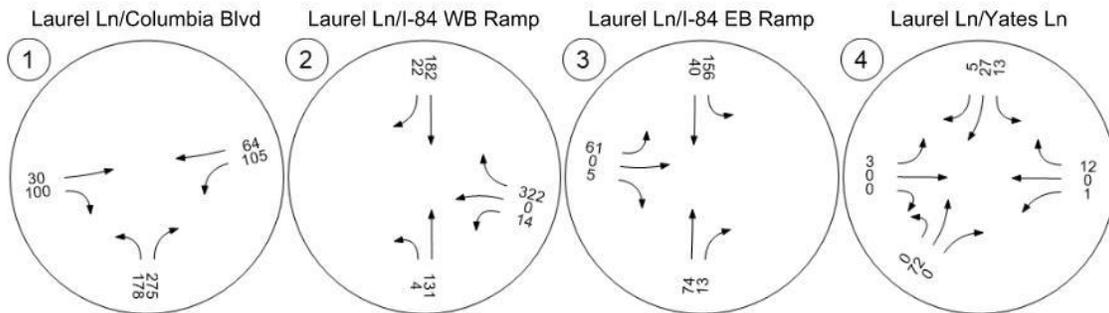
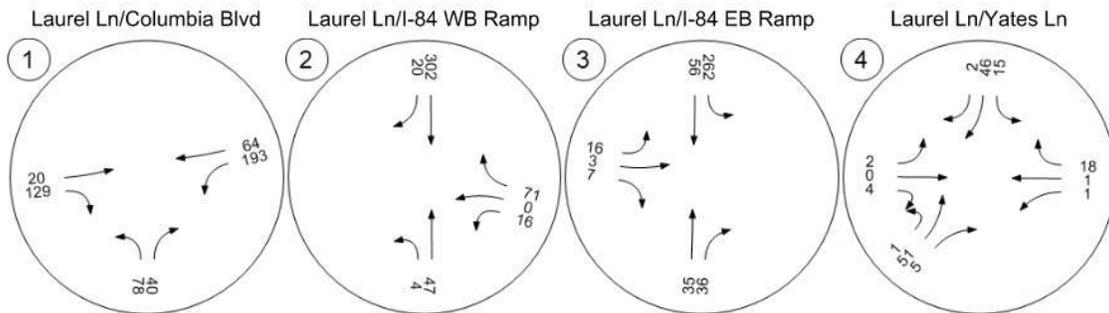


Figure 4 – Existing Weekday PM Peak Hour Traffic Volumes

Generated with **PTV VISTRO** Port of Morrow IAMP Update Weekday PM Peak Hour
 Version 2020 (SP 0-3) Existing Traffic Conditions HCM 6th

Traffic Volume - Future Total Volume



FUTURE 2040 CONDITIONS

This section documents the future land use as well as the forecast traffic operations in the vicinity of the I-84/Laurel Lane interchange through 2040. The future traffic projections are based on anticipated future land uses. Future land use information was determined through working with the City, County, and POM.

Future 2040 Land Uses/Development Projections

The analysis of future land uses in the vicinity of the I-84 / Laurel Lane interchange was focused on areas that are expected to have development or redevelopment potential that would generate traffic in the IMSA. The IMSA defined in Figure 1 includes land both inside and outside the City of Boardman and its urban growth boundary (UGB) and contains a variety of zones, including commercial, rural residential, industrial, farm use, and exclusive farm use zones. Development is anticipated to occur within the IMSA in the POM properties, south of I-84 in the City, and unincorporated Morrow County.

Unincorporated Morrow County

Through consultation with Morrow County staff, new residential development is anticipated to occur in the IMSA south of I-84. This development would occur under the FR2 zoning, which requires a minimum lot size of two acres. The specific areas identified as likely to develop in the next 20 years are along the north and south sides of Wilson Lane. Consistent with the 2011 IAMP, this is expected to equate to about 80 additional single-family homes, assuming these areas develop according to approvals or minimum lot sizes. The vehicle trip impact of these homes was cumulatively added to the existing traffic volumes at the study intersections based on an assumed distribution that is approximate to existing traffic patterns.

City of Boardman

The area immediately south of I-84 adjacent to the Laurel Lane interchange is located within Boardman City limits and is zoned as Service Center (SC), which is a sub-district of the Commercial district. This zone allows for highway-oriented commercial uses along the I-84 corridor. In order to be conservative and consistent with the original 2011 IAMP, it was assumed that the area served by Yates Lane in the southeast quadrant of the POM interchange would intensify. Specifically, it was assumed a long-term intensification of highway-oriented retail or service uses such as full truck stop could develop in this area. The vehicle trip impact of a full truck stop (serving as a conservative surrogate of future highway-oriented retail) was cumulatively added to the existing traffic volumes at the study intersections based on an assumed distribution that is primarily oriented to/from I-84.

Port of Morrow

The POM industrial area is essentially split into two areas by the Union Pacific (UP) mainline railroad. Most of the existing development in the industrial park is located south of the UP mainline and much of this area is built out with few parcels left for substantive development project. The area north of the UP mainline is known as the East Beach area has been developing rapidly over the last fifteen years with additional room for growth. POM staff anticipates that most future development in the industrial park will occur in this area over the next 20 years.

Recognizing that the Lewis and Clark Drive connection to US 730 is currently serving as a primary and secondary access for many of the East Beach properties, it is assumed that this connection will continue to accommodate future POM development, particularly in the East Beach area. As a result, long-term POM-related traffic growth is likely to equilibrate between this connection and the I-84/Laurel lane interchange to an extent. Consistent with the long-term POM traffic growth projections vetted in the 2011 IAMP and considering the Lewis and Clark connection, the more recent 2019 traffic volumes at the IAMP study intersections were proportionally grown.

Future 2040 No-Build Traffic Conditions

Future year 2040 No-Build weekday AM and PM peak hour traffic volumes were determined by applying the previously discussed growth projections and development-related trips to the existing traffic network. The resulting year 2040 No-Build weekday AM and PM peak hour traffic volumes are shown in Figures 5 and 6. Table 5 summarizes the corresponding traffic operations during the weekday AM and PM peak hours. *Appendix C contains the 2040 no-build traffic conditions worksheets.*

Table 5 –Future 2040 No-Build Traffic Conditions

Intersection	Critical Approach/Lane	Weekday AM Peak Hour (6:30-7:30 AM)			Weekday PM Peak Hour (3:30-4:30 PM)		
		V/C	Approach Delay (sec)	Approach LOS	V/C	Approach Delay (sec)	Approach LOS
Laurel Lane/ Columbia Boulevard	Westbound Left-Turn	1.67	395.2	F	0.87	48.1	E
Laurel Lane/ I-84 WB Ramp Terminal	Westbound Approach	1.06	77.2	F	0.63	27.7	D
Laurel Lane/ I-84 EB Ramp Terminal	Eastbound Approach	0.59	34.7	D	1.12	206.0	F
Laurel Lane/ Yates Lane	Westbound Approach	0.26	12.4	B	0.19	12.04	B

As shown in Table 5, the critical movements at the Laurel Lane/Columbia Boulevard, Laurel Lane/I-84 WB Ramp Terminal, and Laurel Lane/I-84 EB Ramp Terminal intersections are forecast to operate over capacity (WB left-turn at Laurel Lane/Columbia Boulevard, WB offramp approach at Laurel Lane, and EB offramp approach at Laurel lane) during one or more of the peak time periods. At the I-84 WB offramp, the forecast vehicle queues are projected to be 500 feet long. Based on the existing offramp length, this queue length will back up into the portion of the ramp needed for safe deceleration of I-84 mainline speeds.

Based on these findings, some of the long-term interchange improvements identified in the 2011 IAMP will need to be reinvestigated as well as some new alternatives investigated to address the updated forecast volumes.

Figure 5 – Future 2040 Weekday AM Peak Hour Traffic Volumes

Generated with **PTV VISTRO** Port of Morrow IAMP Update Weekday AM Peak Hour
 Version 2020 (SP 0-3) Year 2040 Traffic Volumes HCM 6th

Traffic Volume - Future Total Volume

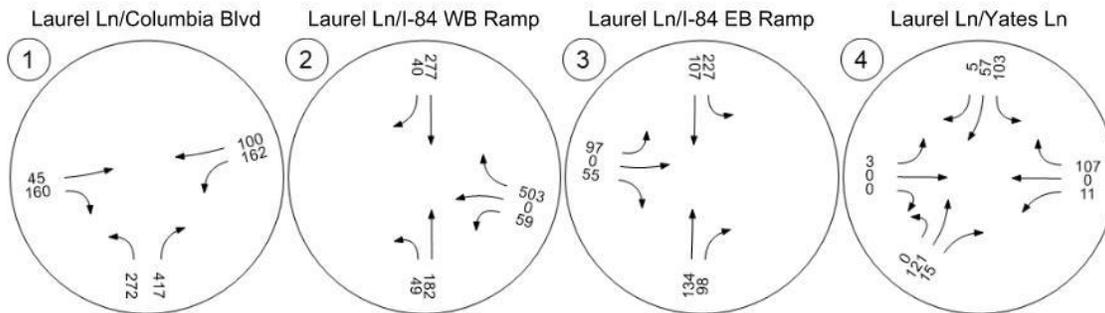
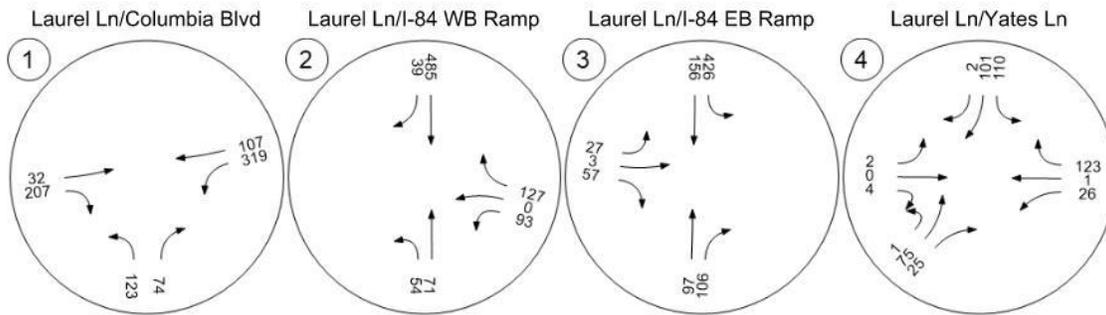


Figure 6 – Future 2040 Weekday PM Peak Hour Traffic Volumes

Generated with **PTV VISTRO** Port of Morrow IAMP Update Weekday PM Peak Hour
 Version 2020 (SP 0-3) Year 2040 Traffic Volumes HCM 6th

Traffic Volume - Future Total Volume



SUMMARY OF EXISTING and 2040 NO-BUILD CONDITIONS

2020 Existing Conditions

- No significant land use changes have occurred within the immediate vicinity of the I-84/Laurel Lane interchange since the original 2011 IAMP was developed. The City of Boardman has annexed a portion of the land within their UGB to the northeast of the Interchange retaining industrial zoning comparable to County zoning.
- The City of Boardman and POM has seen significant development on POM owned lands both north of I-84 and within the larger regional vicinity since the 2011 IAMP. At the I-84/Laurel Lane interchange, this development has generated a 60% increase in weekday AM peak hour traffic volumes and a 22% increase in weekday PM peak hour traffic volumes when compared to 2010 counts.
- While the operations analysis indicates that the study intersections have capacity during the peak time periods, the high peaking characteristics during these time periods creates queuing problems on the I-84 WB off ramp and on the stop-controlled approaches at the Laurel Lane/Columbia Boulevard intersection.

2040 No-Build Conditions

- Significant growth potential exists within the immediate vicinity of the I-84/Laurel Lane interchange and within the larger regional study area (POM and Morrow County). This growth potential could result in a significant increase in traffic volumes during both the weekday AM and PM peak hours.
- Based on the growth assumptions described in this memo:
 - The critical stop-controlled approaches (WB left-turn and EB through) at the Laurel Lane/Columbia Boulevard intersection are forecast to operate over capacity. These movements are forecast to be most significantly impacted during the weekday AM time period when inbound volumes to the POM businesses peak before shift changes.
 - The Laurel Lane/I-84 WB Off Ramp is forecast to operate over capacity during the weekday AM peak hour when inbound volumes to various POM businesses are highest.
 - The Laurel Lane/I-84 EB Off Ramp is forecast to operate over capacity during the weekday PM peak hour when outbound volumes from POM businesses are highest and returning to EB I-84 via the on-ramp.

The following section of this technical memorandum will investigate potential improvement concepts to address the forecast capacity, operations, and queuing conditions.

INTERCHANGE CONCEPT DEVELOPMENT & EVALUATION

This section of the technical memorandum documents the development and evaluation of new interchange and access configuration concepts for the I-84/Laurel Lane interchange.

Initial Interchange Concept Development

The initial interchange improvement concepts considered in this section were developed by members of the project consultant team, project committee, POM, and ODOT staff to address the existing and forecast capacity, operations, and queuing conditions within the study area¹. In particular, concepts were developed that focus on addressing the following issues:

- Mitigating the forecast over capacity constraints for the critical side-street movements at the Laurel Lane/Columbia Boulevard intersection.
- Improving the spacing between the Laurel Lane/Columbia Boulevard and Laurel Lane/I-84 WB ramp terminal intersections or modifying the geometric configuration to better accommodate the forecast operations between closely spaced intersections.
- Reducing the forecast vehicle queue length on the WB offramp.
- Improving the long-term capacity for the Laurel Lane/I-84 EB offramp.
- Improving the efficiency of traffic flow through the interchange considering the high peaking characteristics associated with the POM businesses.

Initial Interchange Concept Evaluation

In response to these issues, six distinct interchange improvement concepts were developed as documented in the following tables. Each table contains the following planning-level evaluation:

- A graphical illustration that conveys the basic components of the concept in a representative double-line sketch overlaid on an aerial photograph.
- A short narrative summarizing the main infrastructure components of the concept.
- A planning-level evaluation using the operations/land use/access spacing/cost/constructability evaluation criteria from the original IAMP.

¹ These improvements are concentrated on the Laurel Lane/ I-84 interchange ramp terminals and the Laurel Lane/Columbia Boulevard intersection. No improvements or refinements were identified for Laurel Lane south of I-84 as it was determined that the roadway improvements and local circulation enhancements identified in the original 2011 IAMP are still representative of desired long-term transportation infrastructure.

Table 6 – Concept ‘A’ Summary and Evaluation

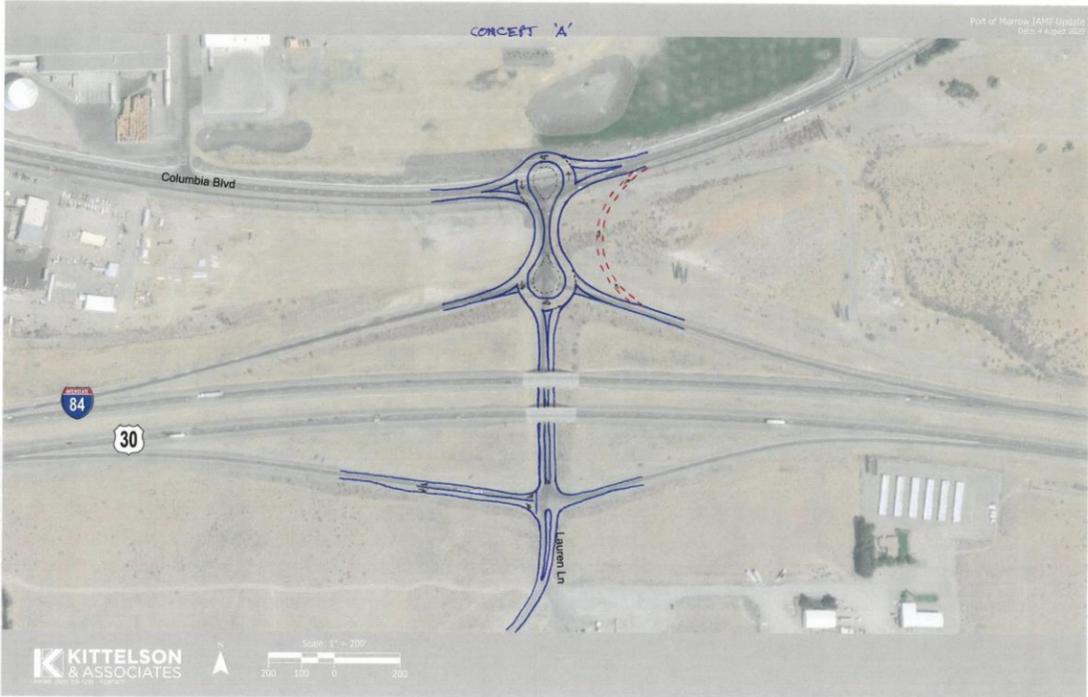
Concept ‘A’ Concept Description and Illustration	Evaluation Information			Evaluation Results		
	Category	Evaluation Criteria	Scoring Key	Score	Comments	
<p>Concept ‘A’ converts the Laurel Lane/Columbia Boulevard intersection and the Laurel Lane/I-84 WB ramp terminal intersection into a conjoined single-lane roundabout intersection (sometimes referred to as a ‘peanut’ or ‘dog bone’ roundabout for its elongated shape). The rationale for this concept is a geometric configuration that would allow two roundabouts to coexist in close proximity to one another. Other improvements to the interchange include:</p> <ul style="list-style-type: none"> • A potential bypass slip lane connecting the WB off ramp to eastbound Columbia Boulevard. • Widening of Laurel Lane south of the I-84 WB ramp terminal roundabout to a three-lane cross section in order to develop a separate southbound left-turn lane at the Laurel Lane/I-84 EB ramp terminal. • Widening of the I-84 EB off ramp to provide a separate left/through and right-turn lane for long-term operations and queue management purposes.  <p>Note: Sketch is for illustrative purposes only.</p>	Transportation	Addresses the identified operational and safety concerns at the Columbia Boulevard, WB ramp terminal, and EB ramp terminals	+1	Fully addresses the identified operation, capacity, and queuing concerns		
			-1	Partially addresses the identified operations, capacity, and queuing concerns	-1	The geometry and circulation limitations of the ‘peanut’ roundabout causes some movements (EB Columbia Boulevard and WB off-ramp to SB Laurel Lane) to circumnavigate the entire roundabout, thereby reducing its efficiency compared to other concepts (see Appendix D).
		Improves walking and biking access along Laurel Lane	+1	Improves walking and biking to existing and future destinations along Laurel Lane	+1	Assuming pedestrian improvements along the west side of Laurel Lane, the roundabout configuration and widening of Laurel Lane can be designed to accommodate pedestrian and bicycle movements.
			-1	Does not improve walking or biking to existing or future destination along Laurel Lane		
	Land Use/ Economic Development	Minimizes right-of-way impacts	+1	Alternative provides for long-term growth in the study area with minimal ROW impacts		
			-1	Alternative precludes long-term growth or has significant ROW impacts	-1	While roundabout design has private property/utility impacts north of Columbia Boulevard (including the stormwater retention pond), it is anticipated that the remaining layout could be constructed within existing right-of-way. However, the combined roundabout design has less capacity when compared to other concepts, limiting its ability to accommodate as much long-term growth.
	Access Spacing	Moves in the direction of ODOT access spacing requirements	+1	Moves in the direction of ODOT’s access spacing guidelines	+1	While the Laurel Lane/Columbia Boulevard and Laurel Lane/I-84 WB ramp terminal are still within close proximity to one another, the geometry of the ‘peanut’ roundabout minimizes the traffic flow and queuing issues associated with closely spaced intersections.
			-1	Does not move in the direction of ODOT’s access spacing guidelines		
	Cost	Cost relative to other concepts	+1	Low construction costs		
			0	Moderate construction costs		
			-1	Substantial construction costs	-1	This concept has a planning level cost estimate of approximately \$2.5M. The costs associated with a combined/elongated roundabout design are anticipated to be higher relative to other concepts.
	Implementation	Constructability	+1	Project can be constructed with relative ease and/or can maintain existing traffic during construction.		
			-1	Construction of improvements will be a physical challenge and/or will require major detours during construction.	-1	Construction is likely to require some detours and/or temporary lanes in order to maintain traffic flow.
					-2	Total Score
	Miscellaneous Evaluation Comments					
While the concept can likely be designed to accommodate large trucks, the median connecting the two roundabouts offers less flexibility for oversized loads.						
The optional slip-lane connecting the WB off-ramp to EB Columbia Boulevard would better address a major movement in the weekday AM peak hour. It may also have private property impacts.						
While not reflected in the concept sketch, the WB off-ramp may need to be lengthened to better address the high peaking characteristics of the AM time period.						
None of the identified interchange improvements would impact or require changes from the previously identified local circulation improvements to Laurel Lane south of the interchange.						
Next Steps/Justification						
Do not include for further consideration. While the ‘peanut’ roundabout design does allow for the two closely spaced intersections to be maintained, it does not have the same degree of operational and geometric design flexibility compared to other roundabout layouts.						

Table 7 – Concept ‘B’ Summary and Evaluation

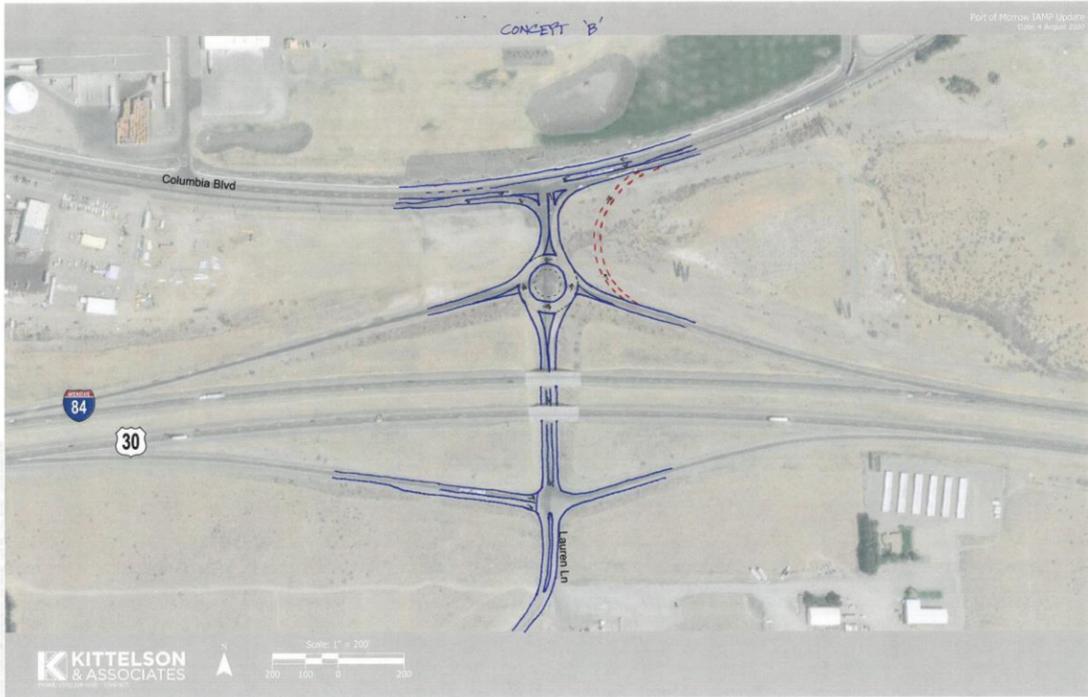
Concept ‘B’		Evaluation Information			Evaluation Results		
Concept Description and Illustration		Category	Evaluation Criteria	Scoring Key	Score	Comments	
<p>Concept ‘B’ maintains the existing Laurel Lane/Columbia Boulevard intersection geometry and traffic control and converts the Laurel Lane/I-84 WB ramp terminal intersection into a single-lane roundabout intersection. The rationale for this concept is to improve the Laurel Lane/I-84 WB ramp terminal while maintaining the recent geometric and traffic control improvements at Columbia Boulevard. Other improvements to the interchange include:</p> <ul style="list-style-type: none"> • A potential bypass slip lane connecting the WB off ramp to eastbound Columbia Boulevard. • Widening of Laurel Lane south of the I-84 WB ramp terminal roundabout to a three-lane cross section in order to develop a southbound left-turn lane at the Laurel Lane/I-84 EB ramp terminal. • Widening of the I-84 EB off ramp to provide a separate left/through and right-turn lane for long-term operations and queue management purposes.  <p>Note: Sketch is for illustrative purposes only.</p>	Transportation	Addresses the identified operational and safety concerns at the Columbia Boulevard, WB ramp terminal, and EB ramp terminals	+1 Fully addresses the identified operation, capacity, and queuing concerns				
				-1 Partially addresses the identified operations, capacity, and queuing concerns	-1	While the new Laurel Lane/I-84 WB ramp terminal roundabout would better address long-term capacity and queuing, the concept does not address the over capacity (see Appendix D) conditions associated with the WB left-turn and EB through movements at the Laurel Lane/Columbia Boulevard intersection.	
				+1 Improves walking and biking to existing and future destinations along Laurel Lane	+1	Assuming pedestrian improvements along the west side of Laurel Lane, the roundabout configuration and widening of Laurel Lane can be designed to accommodate pedestrian and bicycle movements.	
				-1 Does not improve walking or biking to existing or future destination along Laurel Lane			
	Land Use/ Economic Development	Minimizes right-of-way impacts	+1 Alternative provides for long-term growth in the study area with minimal ROW impacts				
			-1 Alternative precludes long-term growth or has significant ROW impacts	-1	All identified improvements are anticipated to fit within existing right-of-way. However, the concept does not address the existing or long-term capacity constraints of the Laurel Lane/Columbia Boulevard intersection. As such the concept does not accommodate long-term growth.		
	Access Spacing	Moves in the direction of ODOT access spacing requirements	+1 Moves in the direction of ODOT's access spacing guidelines				
			-1 Does not move in the direction of ODOT's access spacing guidelines	-1	No changes are made that separate the closely spaced Laurel Lane/Columbia Boulevard and Laurel Lane/I-84 WB ramp terminal intersections.		
	Cost	Cost relative to other concepts	+1 Low construction costs				
			0 Moderate construction costs	0	This concept has a planning level cost estimate of approximately \$1.5M. Costs are anticipated to be moderate relative to other concepts due to the lack of modifications to the Laurel Lane/Columbia Boulevard intersection.		
			-1 Substantial construction costs				
	Implementation	Constructability	+1 Project can be constructed with relative ease and/or can maintain existing traffic during construction.				
			-1 Construction of improvements will be a physical challenge and/or will require major detours during construction.	-1	Construction is likely to require some detours and/or temporary lanes in order to maintain traffic flow.		
						-3	Total Score
	Miscellaneous Evaluation Comments						
The roundabout can likely be designed to accommodate large trucks. No impacts are anticipated for oversized loads along Columbia Boulevard.							
The optional slip-lane connecting the WB off-ramp to EB Columbia Boulevard would better address a major movement in the weekday AM peak hour. It may also have private property impacts.							
While not reflected in the concept sketch, the WB off-ramp may need to be lengthened to better address the high peaking characteristics of the AM time period.							
None of the identified interchange improvements would impact or require changes from the previously identified local circulation improvements to Laurel Lane south of the interchange.							
Next Steps/Justification							
Do not include for further consideration. The forecast capacity constraints at the Laurel Lane/Columbia Boulevard intersection are not addressed under this concept, which does not allow the interchange to accommodate the anticipated near- and long-term growth within the study area. Furthermore, the concept maintains the closely spaced distance between Columbia Boulevard and the I-84 WB ramp terminal.							

Table 8 – Concept ‘C1’ Summary and Evaluation

Concept ‘C1’		Evaluation Information			Evaluation Results		
Concept Description and Illustration		Category	Evaluation Criteria	Scoring Key	Score	Comments	
<p>Concept ‘C1’ relocates the Laurel Lane/Columbia Boulevard intersection further to the north (to increase spacing from the I-84 WB ramp terminal) and converts it into a single-lane roundabout. The east and west legs of Columbia Boulevard are realigned to connect to the new roundabout intersection. The Laurel Lane/I-84 WB ramp terminal intersection is also converted to a single-lane roundabout. Unlike the peanut design under Concept ‘A’, the rationale for this concept is to allow to provide full separation between two future roundabouts. Other improvements to the interchange include:</p> <ul style="list-style-type: none"> • A potential bypass slip lane connecting the WB off ramp to eastbound Columbia Boulevard. • Widening of Laurel Lane south of the I-84 WB ramp terminal roundabout to a three-lane cross section in order to develop a southbound left-turn lane at the Laurel Lane/I-84 EB ramp terminal. • Widening of the I-84 EB off ramp to provide a separate left/through and right-turn lane for long-term operations and queue management purposes.  <p>Note: Sketch is for illustrative purposes only.</p>	Transportation	Addresses the identified operational and safety concerns at the Columbia Boulevard, WB ramp terminal, and EB ramp terminals	+1 Fully addresses the identified operation, capacity, and queuing concerns	+1	Both future roundabouts and the lane widening at the Laurel Lane/I-84 EB ramp terminal would meet the long-term capacity needs of the interchange study area (see Appendix D).		
	Transportation	Improves walking and biking access along Laurel Lane	+1 Improves walking and biking to existing and future destinations along Laurel Lane	+1	Although there is some throw-away of recently constructed sidewalks along the north side of Columbia Boulevard, the roundabouts and widening of Laurel Lane can be designed to adequately accommodate pedestrian and bicycle movements.		
	Transportation		-1 Does not improve walking or biking to existing or future destination along Laurel Lane				
	Land Use/ Economic Development	Minimizes right-of-way impacts	+1 Alternative provides for long-term growth in the study area with minimal ROW impacts				
			-1 Alternative precludes long-term growth or has significant ROW impacts	-1	The roundabout at the relocated Laurel Lane/Columbia Boulevard intersection would have significant private property and utility impacts.		
	Access Spacing	Moves in the direction of ODOT access spacing requirements	+1 Moves in the direction of ODOT's access spacing guidelines	+1	The roundabout at the relocated Laurel Lane/Columbia Boulevard intersection would increase spacing from the Laurel Lane/I-84 WB ramp terminal.		
			-1 Does not move in the direction of ODOT's access spacing guidelines				
	Cost	Cost relative to other concepts	+1 Low construction costs				
			0 Moderate construction costs				
			-1 Substantial construction costs	-1	This concept has a planning level cost estimate of approximately \$3.5M. The costs associated with two roundabouts and a relocated Laurel Lane/Columbia Boulevard intersection are anticipated to be substantially higher relative to other concepts.		
	Implementation	Constructability	+1 Project can be constructed with relative ease and/or can maintain existing traffic during construction.				
			-1 Construction of improvements will be a physical challenge and/or will require major detours during construction.	-1	Construction is likely to require some detours and/or temporary lanes in order to maintain traffic flow. However, the Laurel Lane/Columbia Boulevard intersection can remain open during most of the construction period.		
						0	Total Score
	Miscellaneous Evaluation Comments						
	The roundabouts can likely be designed to accommodate typical large trucks. Oversized truck loads would need special design consideration.						
The optional slip-lane connecting the WB off-ramp to EB Columbia Boulevard would better address a major movement in the weekday AM peak hour. It may also have private property impacts.							
While not reflected in the concept sketch, the WB off-ramp may need to be lengthened to better address the high peaking characteristics of the AM time period.							
None of the identified interchange improvements would impact or require changes from the previously identified local circulation improvements to Laurel Lane south of the interchange.							
Next Steps/Justification							
Do not include for further consideration. While this concept scores better than Concepts ‘A’ and ‘B’ from an operations and intersection spacing perspective, it is a more impactful improvement from a cost and right-of-way impact perspective.							

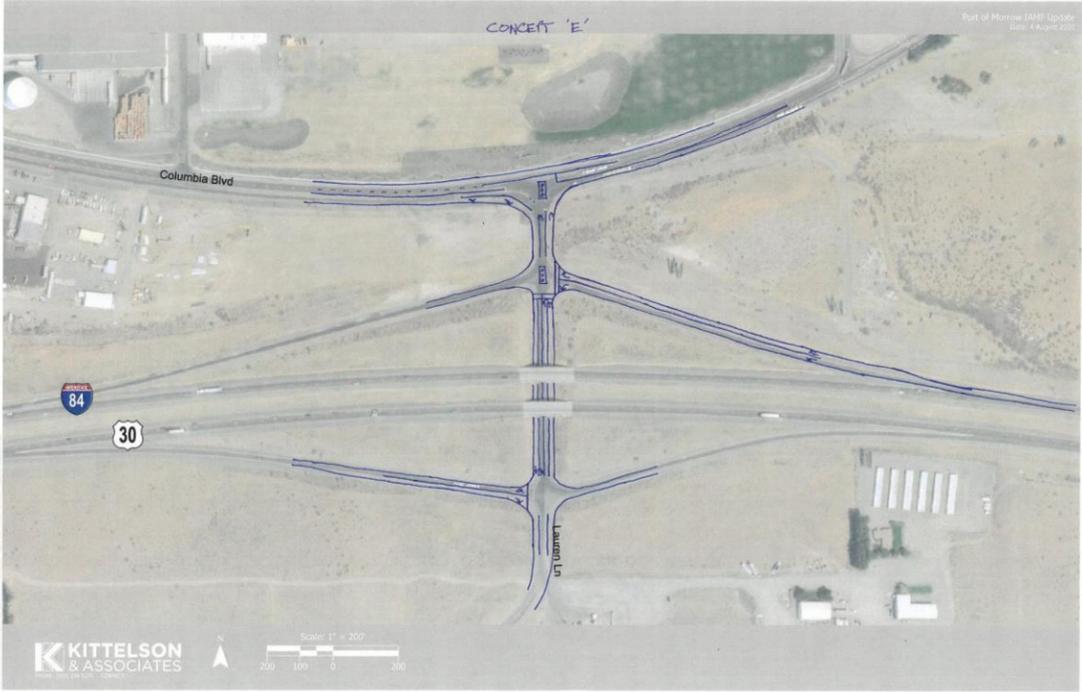
Table 9 - Concept 'C2' Summary and Evaluation

Concept 'C2'		Evaluation Information			Evaluation Results		
Concept Description and Illustration		Category	Evaluation Criteria	Scoring Key	Score	Comments	
<p>Concept 'C2' is similar to Concept 'C1', with less spacing between the two roundabouts. This is accomplished by relocated Laurel Lane/I-84 WB ramp terminal intersection slightly to the south and relocating the Laurel Lane/Columbia Boulevard intersection slightly to the north. The rationale is to minimize the amount of private property impacts north of Columbia Boulevard while providing the minimal amount of separation between the two roundabouts. Other improvements to the interchange include:</p> <ul style="list-style-type: none"> • A potential bypass slip lane connecting the WB off ramp to eastbound Columbia Boulevard. • Widening of Laurel Lane south of the I-84 WB ramp terminal roundabout to a three-lane cross section in order to develop a southbound left-turn lane at the Laurel Lane/I-84 EB ramp terminal. • Widening of the I-84 EB off ramp to provide a separate left/through and right-turn lane for long-term operations and queue management purposes.  <p>Note: Sketch is for illustrative purposes only.</p>	Transportation	Addresses the identified operational and safety concerns at the Columbia Boulevard, WB ramp terminal, and EB ramp terminals	+1	Fully addresses the identified operation, capacity, and queuing concerns	+1	Both future roundabouts and the lane widening at the Laurel Lane/I-84 EB ramp terminal would meet the long-term capacity needs of the interchange study area (see Appendix D).	
			-1	Partially addresses the identified operations, capacity, and queuing concerns			
	Improves walking and biking access along Laurel Lane	+1	Improves walking and biking to existing and future destinations along Laurel Lane	+1	Although there is some throw-away of recently constructed sidewalks along the north side of Columbia Boulevard, the roundabouts and widening of Laurel Lane can be designed to adequately accommodate pedestrian and bicycle movements (assuming all multi-modal accommodations are provided along the west side of Laurel Lane).		
		-1	Does not improve walking or biking to existing or future destination along Laurel Lane				
	Land Use/Economic Development	Minimizes right-of-way impacts	+1	Alternative provides for long-term growth in the study area with minimal ROW impacts	+1	Compared to Concept 'C1', the roundabout at the relocated Laurel Lane/Columbia Boulevard intersection would have less significant private property/utility impacts and no impacts to the stormwater retention pond.	
			-1	Alternative precludes long-term growth or has significant ROW impacts			
	Access Spacing	Moves in the direction of ODOT access spacing requirements	+1	Moves in the direction of ODOT's access spacing guidelines	+1	The roundabout at the relocated Laurel Lane/Columbia Boulevard intersection would increase spacing from the Laurel Lane/I-84 WB ramp terminal.	
			-1	Does not move in the direction of ODOT's access spacing guidelines			
	Cost	Cost relative to other concepts	+1	Low construction costs		This concept has a planning level cost estimate of approximately \$3.0M. The costs associated with two roundabouts are anticipated to be substantially higher relative to other concepts, but still less than Concept 'C1' due to only minor realignment of Columbia Avenue.	
			0	Moderate construction costs			
			-1	Substantial construction costs	-1		
	Implementation	Constructability	+1	Project can be constructed with relative ease and/or can maintain existing traffic during construction.		Construction is likely to require some detours and/or temporary lanes in order to maintain traffic flow. However, the Laurel Lane/Columbia Boulevard intersection can remain open during most of the construction period.	
			-1	Construction of improvements will be a physical challenge and/or will require major detours during construction.	-1		
						+2	Total Score
	Miscellaneous Evaluation Comments						
The roundabouts can likely be designed to accommodate typical large trucks. Oversized truck loads would need special design consideration.							
The optional slip-lane connecting the WB off-ramp to EB Columbia Boulevard would better address a major movement in the weekday AM peak hour. It may also have private property impacts.							
While not reflected in the concept sketch, the WB off-ramp may need to be lengthened to better address the high peaking characteristics of the AM time period.							
None of the identified interchange improvements would impact or require changes from the previously identified local circulation improvements to Laurel Lane south of the interchange.							
Next Steps/Justification							
Include for further consideration. Compared to other concepts, this concept scored well or better from a traffic operations and land use/right-of-way impact perspective.							

Table 10 Concept 'D' Summary and Evaluation

Concept 'D'		Evaluation Information			Evaluation Results		
Concept Description and Illustration		Category	Evaluation Criteria	Scoring Key	Score	Comments	
<p>Concept 'D' combines the Laurel Lane/Columbia Boulevard intersection and the Laurel Lane/I-84 WB ramp terminal intersections into one single-lane roundabout intersection. The new roundabout intersection would be located at the approximate location of the existing Laurel Lane/I-84 WB ramp terminal. The east and west legs of Columbia Boulevard are realigned to connect to the new roundabout intersection. Other improvements to the interchange include:</p> <ul style="list-style-type: none"> • A potential bypass lane for WB movements along Columbia Boulevard. • A potential bypass slip lane connecting the WB off ramp to eastbound Columbia Boulevard. • Widening of Laurel Lane south of the I-84 WB ramp terminal roundabout to a three-lane cross section in order to develop a southbound left-turn lane at the Laurel Lane/I-84 EB ramp terminal. • Widening of the I-84 EB off ramp to provide a separate left/through and right-turn lane for long-term operations and queue management purposes.  <p>Note: Sketch is for illustrative purposes only.</p>	Transportation	Addresses the identified operational and safety concerns at the Columbia Boulevard, WB ramp terminal, and EB ramp terminals	+1	Fully addresses the identified operation, capacity, and queuing concerns	+1	A combined single roundabout and the lane widening at the Laurel Lane/I-84 EB ramp terminal would meet the long-term capacity needs of the interchange (see Appendix D).	
				-1	Partially addresses the identified operations, capacity, and queuing concerns		
		Improves walking and biking access along Laurel Lane	+1	Improves walking and biking to existing and future destinations along Laurel Lane	+1	The combined intersection roundabout and widening of Laurel Lane can be designed to adequately accommodate pedestrian and bicycle movements. No changes would be needed to the recently constructed multi-modal infrastructure along the north side of Columbia Boulevard.	
			-1	Does not improve walking or biking to existing or future destination along Laurel Lane			
	Land Use/ Economic Development	Minimizes right-of-way impacts	+1	Alternative provides for long-term growth in the study area with minimal ROW impacts	+1	No right-of-way impacts are anticipated.	
			-1	Alternative precludes long-term growth or has significant ROW impacts			
	Access Spacing	Moves in the direction of ODOT access spacing requirements	+1	Moves in the direction of ODOT's access spacing guidelines	+1	The combination of the Laurel Lane/Columbia Boulevard intersection with the I-84 WB ramp terminal eliminates the close intersection spacing issue. However, such a design brings the functional hierarchy principal into question by aligning a local street (Columbia Boulevard) connection opposite a freeway ramp terminal. This design would likely need special consideration from ODOT and FHWA.	
			-1	Does not move in the direction of ODOT's access spacing guidelines			
	Cost	Cost relative to other concepts	+1	Low construction costs		This concept has a planning level cost estimate of approximately \$1.75M. The costs associated with a combined roundabout and realigned EB and WB Columbia Boulevard approaches are anticipated to be moderate relative to other concepts.	
			0	Moderate construction costs	0		
			-1	Substantial construction costs			
	Implementation	Constructability	+1	Project can be constructed with relative ease and/or can maintain existing traffic during construction.		Construction is likely to require some detours and/or temporary lanes in order to maintain traffic flow. However, the Laurel Lane/Columbia Boulevard intersection can remain open during most of the construction period.	
			-1	Construction of improvements will be a physical challenge and/or will require major detours during construction.	-1		
						+3	Total Score
	Miscellaneous Evaluation Comments						
The roundabouts can likely be designed to accommodate typical large trucks. Oversized truck loads would need special design consideration.							
The optional slip-lane connecting the WB off-ramp to EB Columbia Boulevard would better address a major movement in the weekday AM peak hour. It may also have private property impacts.							
While not reflected in the concept sketch, the WB off-ramp may need to be lengthened to better address the high peaking characteristics of the AM time period.							
None of the identified interchange improvements would impact or require changes from the previously identified local circulation improvements to Laurel Lane south of the interchange.							
Next Steps/Justification							
Include for further consideration. This concept scored well from a traffic operations, land use/right-of-way impact, and cost perspective.							

Table 11 – Concept ‘E’ Summary and Evaluation

Concept ‘E’		Evaluation Information			Evaluation Results	
Concept Description and Illustration		Category	Evaluation Criteria	Scoring Key	Score	Comments
<p>Concept ‘E’ would signalize the Laurel Lane/Columbia Boulevard and Laurel Lane/I-84 WB ramp terminal intersections. This concept offers a non-roundabout option in recognition that roundabouts have been interpreted as being more difficult for oversized freight to navigate. Other improvements that would be needed to support the interchange include:</p> <ul style="list-style-type: none"> Lengthening and widening of the I-84 WB off ramp to provide a separate left/through and right-turn lane. Widening of Laurel Lane between the I-84 EB and WB ramp terminals to a four-lane cross section in order to develop side-by-side left-turn lanes serving the two on ramps. The side-by-side left-turn lanes would better address the projected long-term queuing demands. Widening of the I-84 EB off ramp to provide a separate left/through and right-turn lane.  <p>Note: Sketch is for illustrative purposes only.</p>	Transportation	Addresses the identified operational and safety concerns at the Columbia Boulevard, WB ramp terminal, and EB ramp terminals	+1 Fully addresses the identified operation, capacity, and queuing concerns			
			-1 Partially addresses the identified operations, capacity, and queuing concerns	-1	While signalization would address the capacity needs, special signal timing requirements would result in long vehicle queues on the WB off ramp (see Appendix D).	
		Improves walking and biking access along Laurel Lane	+1 Improves walking and biking to existing and future destinations along Laurel Lane	+1	Signalization would accommodate bicycle and pedestrian movements better than the roundabout concepts.	
			-1 Does not improve walking or biking to existing or future destination along Laurel Lane			
	Land Use/ Economic Development	Minimizes right-of-way impacts	+1 Alternative provides for long-term growth in the study area with minimal ROW impacts	+1	All identified improvements would have little to no private property impacts.	
			-1 Alternative precludes long-term growth or has significant ROW impacts			
	Access Spacing	Moves in the direction of ODOT access spacing requirements	+1 Moves in the direction of ODOT's access spacing guidelines			
			-1 Does not move in the direction of ODOT's access spacing guidelines	-1	The Laurel Lane/Columbia Boulevard intersection does not change and would therefore result in no access spacing improvements.	
	Cost	Cost relative to other concepts	+1 Low construction costs			
			0 Moderate construction costs			
-1 Substantial construction costs			-1	This concept has a planning level cost estimate of approximately \$1.75M. Widening Laurel Lane to four travel lanes would have significant cost implications as it would require new retaining walls within the narrow I-84 underpass.		
Implementation	Constructability	+1 Project can be constructed with relative ease and/or can maintain existing traffic during construction.				
		-1 Construction of improvements will be a physical challenge and/or will require major detours during construction.	-1	It is unclear if Laurel Lane can be widened to four travel lanes without impacting the I-84 overpass structure and embankment.		
					-2	Total Score
Miscellaneous Evaluation Comments						
Oversized truck loads can be more easily accommodated with signalized intersections.						
While two separate intersections, a signalized Laurel Lane/I-84 WB ramp terminal and Laurel Lane/Columbia Boulevard would need to be timed and function as one interconnected intersection. This reduces its operation efficiency and would result in longer vehicle queues on all approaches.						
None of the identified interchange improvements would impact or require changes from the previously identified local circulation improvements to Laurel Lane south of the interchange.						
Next Steps/Justification						
Do not include for further consideration. This concept has queuing and constructability concerns.						

Preferred Interchange Concept Evaluation

As documented in the previous section, Concept 'C2' and 'D' best met the high-level evaluation criteria. In summary, these concepts outperformed the other concepts in the following areas:

- Both concepts would have the capacity to accommodate projected long-term traffic volumes.
- All of the modifications could occur within existing right-of-way or with relatively minimal private property impacts.
- A combined roundabout intersection eliminates the access spacing concerns between Laurel Lane/Columbia Boulevard and Laurel Lane/I-84 ramp terminal intersections.

Based on these findings, Concepts 'C2' and 'D' were further evaluated from a geometric and future traffic operations perspective.

Refined Geometric Layouts

Refined geometric layouts of Concepts 'C2' and 'D' were prepared taking into closer consideration the area's topography, forecast traffic demands, the vehicle/truck types associated with POM businesses, more precise geometric alignments that could be achieved under a modern roundabout layout², the potential to include several optional bypass lanes, and multi-modal accommodations. The refined Concepts 'C2' and 'D' are illustrated in Figures 7 and 8 below.

Multimodal Accommodations

Figures 7 and 8 illustrate potential multimodal accommodations with each of the refined concepts. As shown, a multi-use pathway is envisioned along the west side of Laurel Lane from Columbia Boulevard to the I-84 EB Ramp Terminal.

² The refined geometric layout is a high-level design with some additional engineering that is provided for illustrative purposes only.

Figure 7 – Refined Concept 'D' Sketch-Level Layout (with multi-modal accommodations)



Figure 8 - Refined Concept 'C2' Sketch Level Layout (with multi-modal accommodations)



Laurel Lane Widening and Multi-Modal Accommodations

As previously described and illustrated in the Concept 'C2' and 'D' refinement sketches, Laurel Lane between the I-84 WB and EB ramp terminals would require widening from its current two-lane cross section to a full three-lane cross section. This widening is primarily needed to accommodate a separate southbound left-turn lane at the Laurel Lane/I-84 EB Ramp Terminal. While this finding is consistent with the original IAMP project list, the accommodation of bicycle and pedestrian movements was not previously defined or visualized. Consistent with Concept 'C2' and 'D' and the previously described multi-modal accommodations, the following exhibit illustrates a potential implementation of the roadway widening and the development of a separated multi-use pathway along the west side of the roadway segment.



Truck Turning Evaluation

Recognizing that roundabouts have traditionally been a source of concern from truck drivers and businesses that operate large fleets of trucks (such as many of the businesses in the POM), a truck turning analysis was performed using the preliminary roundabout sketch shown in Figure 7. Based on discussions with POM officials, a WB-67 truck is the most common large vehicle that frequents POM businesses. Using this design vehicle, turning movement paths were added to the sketch layout using AutoTurn software as illustrated in Figures 9 and 10. As shown, this large design vehicle can reasonably maneuver through the roundabout. It should be noted that since this is just an illustrative sketch, some of the approaching roadway layouts would likely need to be adjusted to better meet some of the tighter turning movements. This can be accomplished in a future design phase.

Figure 9 – Concept 'D' Sketch-Level Layout with WB-67 Truck Turning Paths

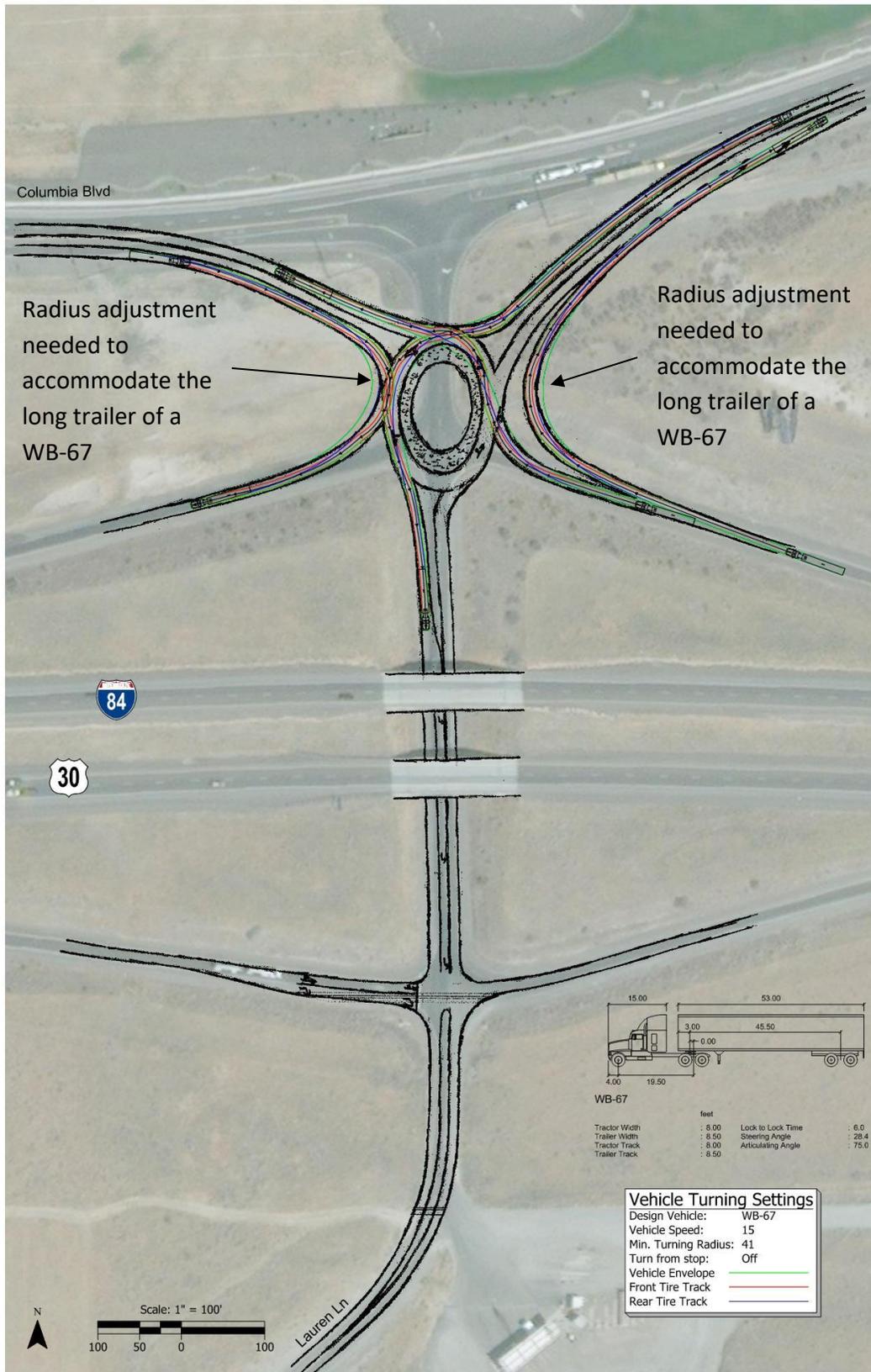


Figure 10 – Concept 'C2' Sketch Level Layout with WB-67 Design Vehicle



November 12, 2020 Mobility Advisory Committee Meeting

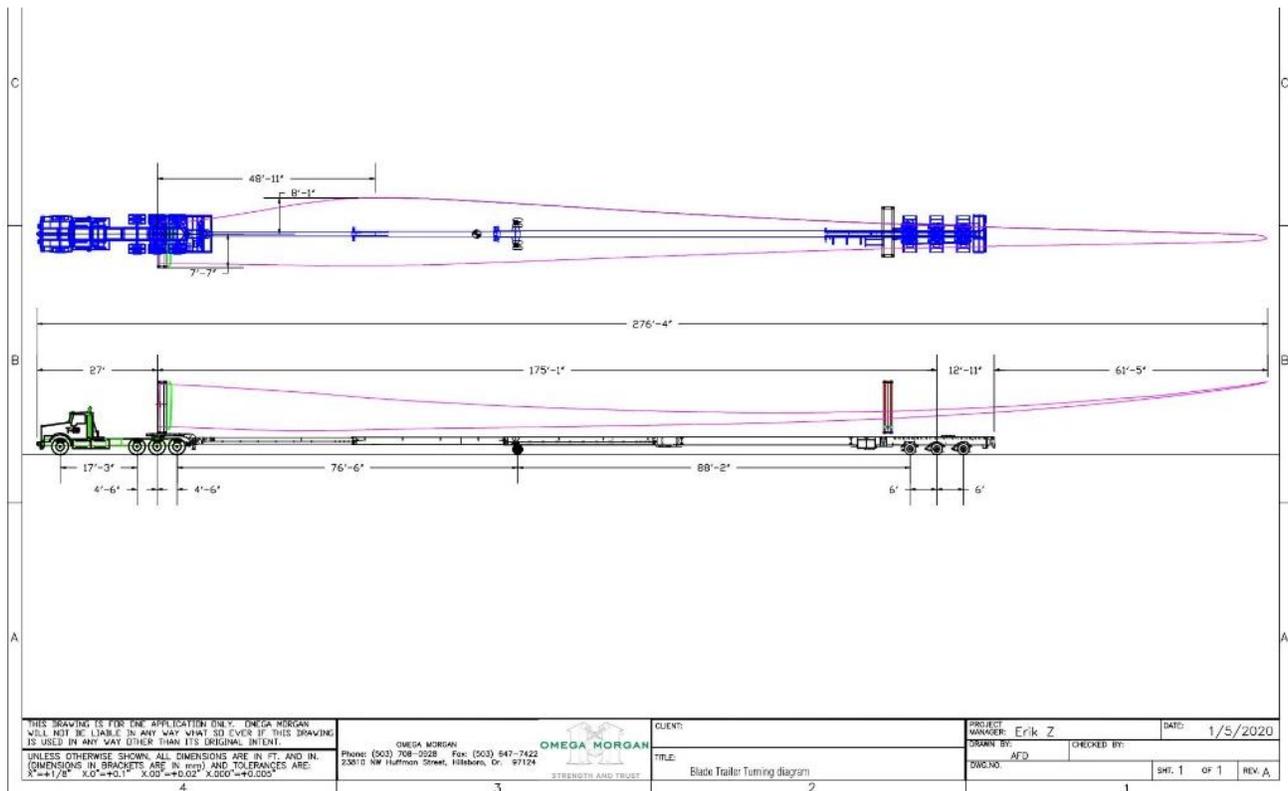
On November 12, 2020, the project team met with Oregon’s Mobility Advisory Committee (MAC) for the purposes of requesting early feedback on the planning and concept design/evaluation summarized in this technical memorandum. The meeting minutes from that meeting are included in *Appendix E*. As noted, the committee has two specific follow up requests:

- Include a truck turning diagram that shows how an anticipated trailer (for the latest generation of windmill blades) would navigate the roundabout design.
- Include a discussion/evaluation of other potential interchange design treatments used in other parts of the state with similar operating characteristics.

Additional Truck Turning Evaluation

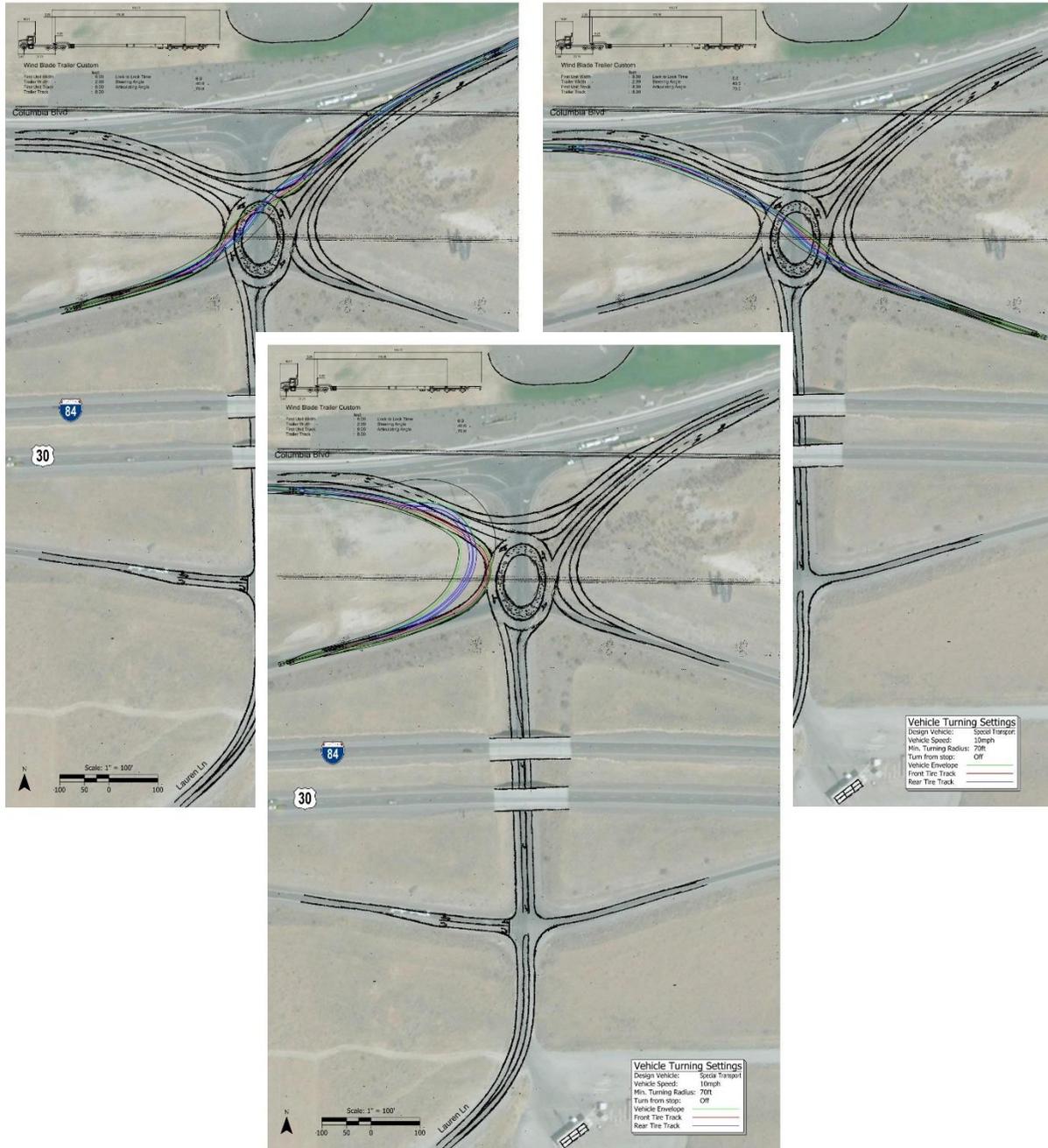
MAC members noted the POM has historically accommodated oversized loads and will likely continue to do so in the future. Representatives from Omega Morgan identified that the latest generation of windmill blades are one particular oversized load that they are concerned with. The trailer designed to accommodate this load is illustrated in Exhibit 4 below.

Exhibit 4 – Windmill Blade Trailer (provided by Omega Morgan)



To conceptually illustrate the circulation challenges associated with this design vehicle, a custom trailer was created in AutoTurn and applied to the sketch interchange layouts shown on the following exhibits. As shown, special care would need to be taken in future design stages to ensure a vehicle trailer and load of this magnitude could be accommodated³.

Exhibit 5 – Windmill Blade Turning Movements to I-84



³ This is required under ORS 366.215 which requires further evaluation of the formal project design stages when there is a likelihood that the intended design would potentially reduce the vehicle-carrying-capacity of the highway.

Although the turn exhibits illustrate special care would need to be undertaken in a future design phase, it should be noted that POM officials have established routes in place for all high, wide, and heavy loads that are generated through the port terminals. Exhibit 6 illustrates how the POM has historically and plans to continue to handle loads of this magnitude. As shown, all oversized loads would either be oriented to the existing Exit 164 interchange in Boardman or to the US 730 access via Lewis and Clark Drive depending upon the load and terminal. These routes do not rely upon the I-84/Laurel Lane interchange due to internal bridge load constraints on multiple roadway facilities within POM. Accordingly, POM staff are confident that a reasonable maximum design vehicle for the I-84/Laurel Lane interchange is a WB-67 design vehicle.

Exhibit 6 – High Wide and Heavy Travel Path Options for the Port of Morrow (source POM)



Other Potential Interchange Design Treatments

The I-84/Laurel Lane interchange serves a unique concentration of industrial land uses in a rural area. While there are other major port facilities and industrial clusters located throughout the state, they tend to be located in more urban settings where there is greater overall travel demand, geographical limitations, and a need for special high-capacity design treatments such as direct-connect freeway ramps, cut-n-cover interchange forms, and braided ramps/local street connections.

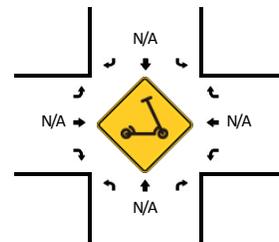
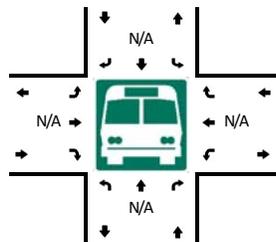
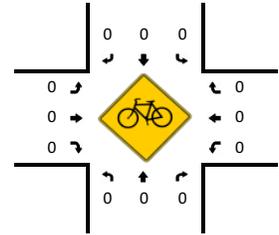
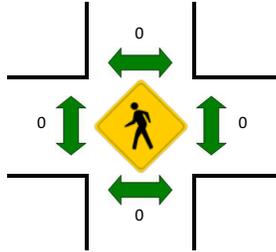
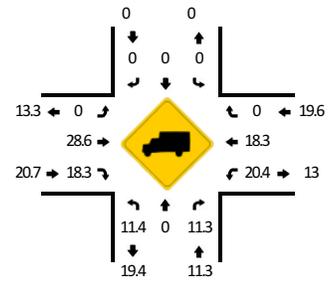
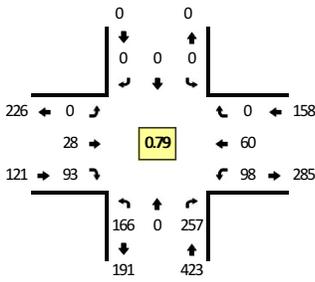
As documented in the previous sections of this technical memorandum, six different interchange design concepts were evaluated ranging from different roundabout configurations to a signalized configuration. All of these concepts represented what the project team, POM officials, and ODOT staff felt were the most reasonable and implementable improvement scenarios to address the projected travel demands and incorporate movements to/from the closely spaced Columbia Boulevard corridor. While it is understood why MAC would want to see other more elaborate design treatments that eliminate the need for roundabouts or signalized ramp terminals, the project team respectfully felt they were disproportionate to the needs of the interchange and not within the private and public funds being used to update the I-84/Laurel Lane IAMP.

Appendix A Traffic Count Worksheets

LOCATION: Laurel Ln -- Columbia Blvd
CITY/STATE: Boardman, OR

QC JOB #: 15230901
DATE: Tue, Jun 25 2019

Peak-Hour: 6:30 AM -- 7:30 AM
 Peak 15-Min: 6:45 AM -- 7:00 AM

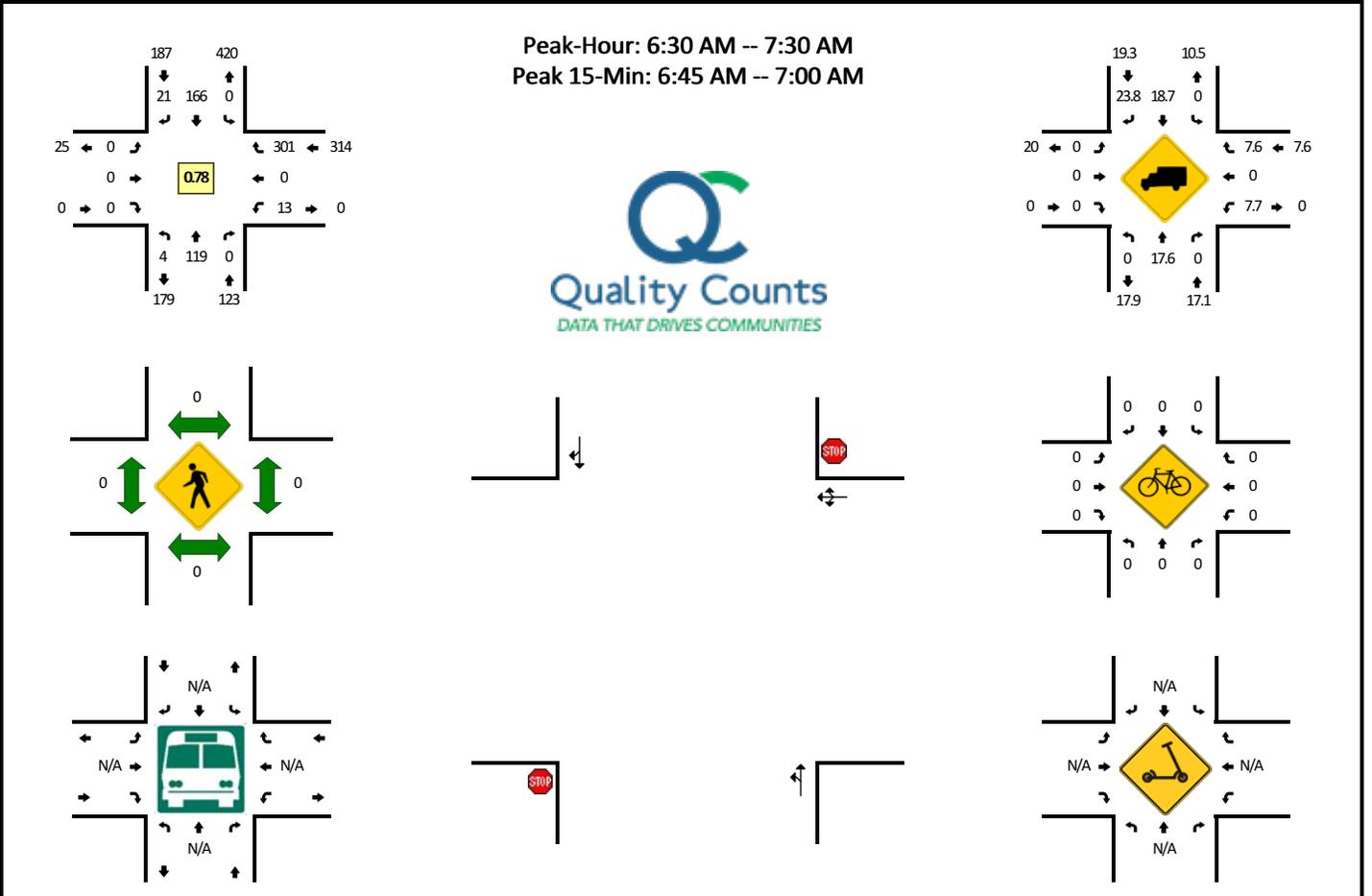


15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				Columbia Blvd (Eastbound)				Columbia Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	29	0	44	0	0	0	0	0	0	11	4	0	7	5	0	0	100	
6:15 AM	42	0	56	0	0	0	0	0	0	10	10	0	10	10	0	0	138	
6:30 AM	51	0	70	0	0	0	0	0	0	9	15	0	18	15	0	0	178	
6:45 AM	73	0	111	0	0	0	0	0	0	5	8	0	9	16	0	0	222	638
7:00 AM	20	0	38	0	0	0	0	0	0	7	22	0	38	14	0	0	139	677
7:15 AM	22	0	38	0	0	0	0	0	0	7	48	0	33	15	0	0	163	702
7:30 AM	34	0	38	0	0	0	0	0	0	7	18	0	16	6	0	0	119	643
7:45 AM	26	0	37	0	0	0	0	0	0	4	16	0	19	10	0	0	112	533
8:00 AM	16	0	31	0	0	0	0	0	0	14	12	0	7	4	0	0	84	478
8:15 AM	22	0	18	0	0	0	0	0	0	8	6	0	12	5	0	0	71	386
8:30 AM	14	0	15	0	0	0	0	0	0	2	11	0	23	6	0	0	71	338
8:45 AM	14	0	17	0	0	0	0	0	0	5	11	0	11	9	0	0	67	293
9:00 AM	53	0	71	0	0	0	0	0	0	27	43	0	70	28	0	0	292	501
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	430
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	359
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	292
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	292	0	444	0	0	0	0	0	0	20	32	0	36	64	0	0	888	
Heavy Trucks	24	0	40	0	0	0	0	0	0	8	12	0	16	24	0	0	124	
Buses																	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0			0	0		0	0	0		0	
Scoters																	0	

Comments:

LOCATION: Laurel Ln -- I-84 WB Ramps
CITY/STATE: Boardman, OR

QC JOB #: 15230903
DATE: Tue, Jun 25 2019

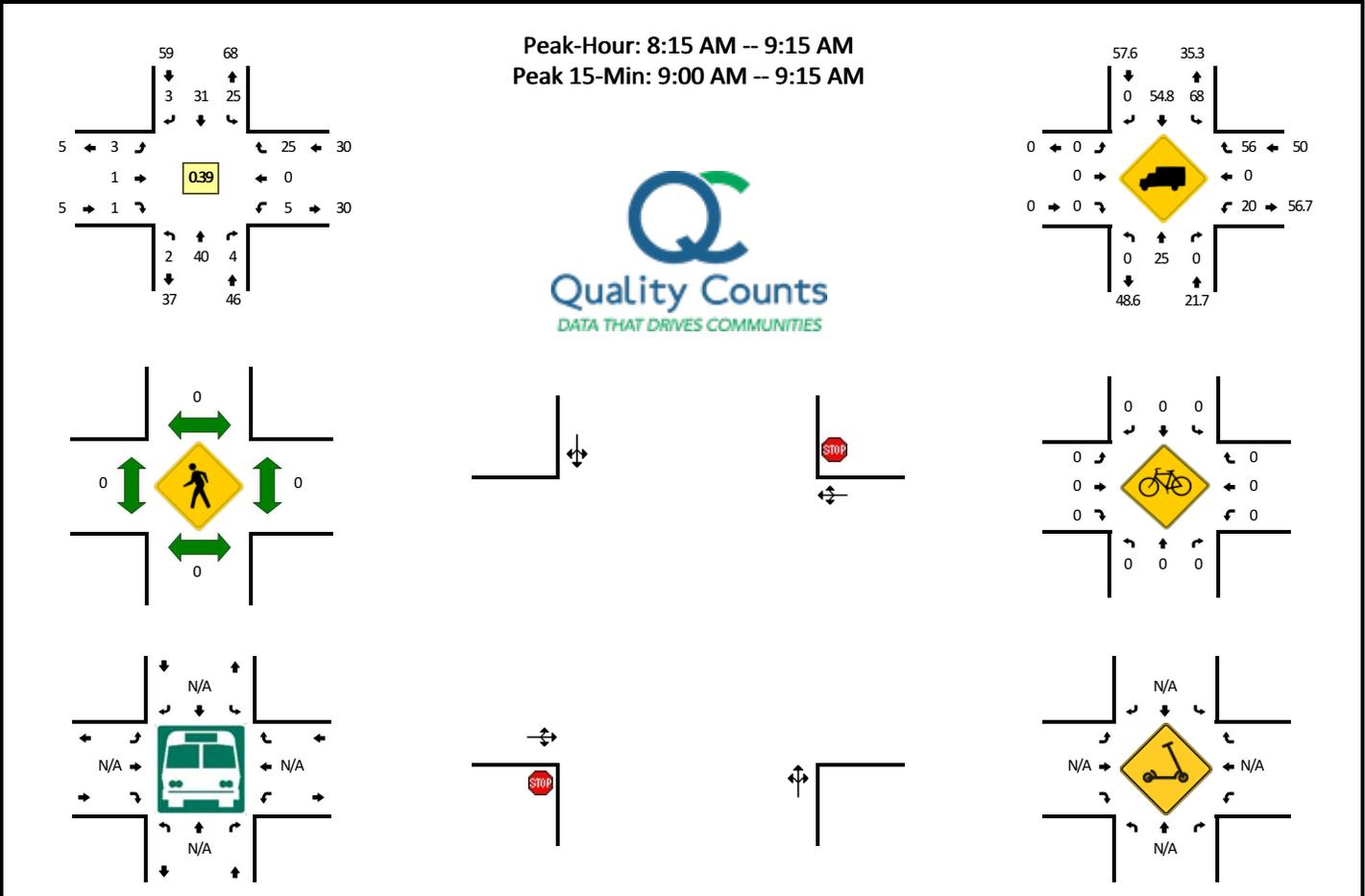


15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				I-84 WB Ramps (Eastbound)				I-84 WB Ramps (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	2	10	0	0	0	17	1	0	0	0	0	0	12	0	53	0	95	
6:15 AM	0	20	0	0	0	22	1	0	0	0	0	0	6	0	78	0	127	
6:30 AM	0	37	0	0	0	28	3	0	0	0	0	0	3	0	89	0	160	
6:45 AM	0	53	0	0	0	20	0	0	0	0	0	0	5	0	121	0	199	581
7:00 AM	2	15	0	0	0	46	10	0	0	0	0	0	1	0	43	0	117	603
7:15 AM	2	14	0	0	0	72	8	0	0	0	0	0	4	0	48	0	148	624
7:30 AM	1	11	0	0	0	28	6	0	0	0	0	0	4	0	54	0	104	568
7:45 AM	2	13	0	0	0	27	5	0	0	0	0	0	9	0	54	0	110	479
8:00 AM	1	18	0	0	0	15	4	0	0	0	0	0	7	0	28	0	73	435
8:15 AM	2	9	0	0	0	13	7	0	0	0	0	0	1	0	29	0	61	348
8:30 AM	2	7	0	0	0	23	10	0	0	0	0	0	1	0	23	0	66	310
8:45 AM	1	6	0	0	0	17	4	0	0	0	0	0	2	0	26	0	56	256
9:00 AM	5	37	0	0	0	91	23	0	0	0	0	0	17	0	83	0	256	439
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	378
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	312
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	256
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	212	0	0	0	80	0	0	0	0	0	0	20	0	484	0	796	
Heavy Trucks	0	28	0		0	32	0		0	0	0		0	0	28		88	
Buses																	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																	0	

Comments:

LOCATION: Laurel Ln -- Yates Ln
CITY/STATE: Boardman, OR

QC JOB #: 15230905
DATE: Tue, Jun 25 2019

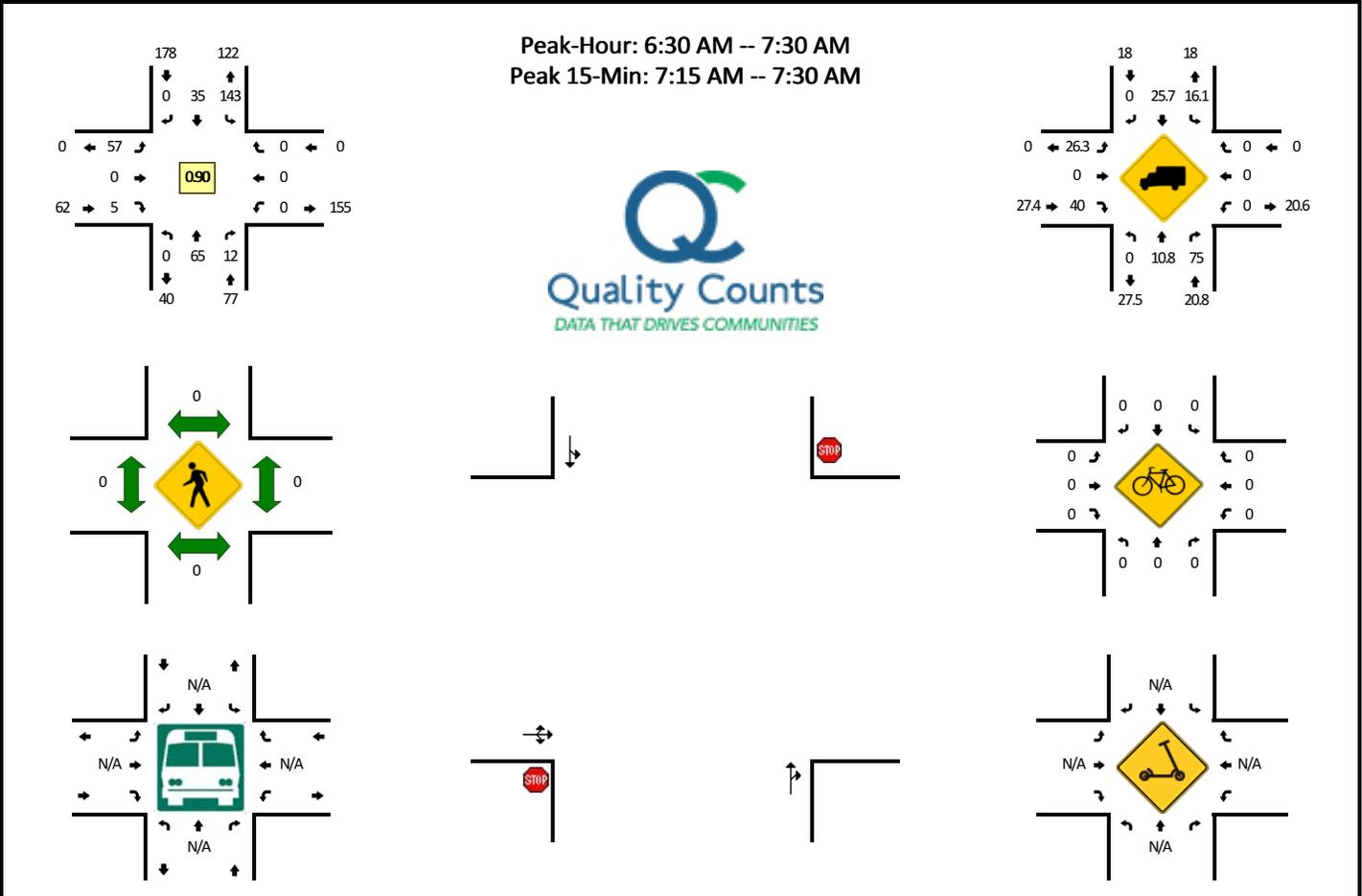


15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				Yates Ln (Eastbound)				Yates Ln (Westbound)				Total	Hourly Totals	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
6:00 AM	0	7	0	0	3	7	1	0	2	0	1	0	0	0	1	2	0	24	
6:15 AM	0	8	0	0	1	7	0	0	1	0	0	0	0	0	0	1	0	18	
6:30 AM	0	17	0	0	2	6	1	0	1	0	0	0	0	0	0	0	0	27	
6:45 AM	0	30	0	0	2	7	0	0	0	0	0	0	0	0	3	0	0	42	111
7:00 AM	0	9	0	0	5	7	2	0	1	0	0	0	0	1	0	3	0	28	115
7:15 AM	0	7	0	0	3	5	2	0	1	0	0	0	0	0	0	5	0	23	120
7:30 AM	0	10	0	0	3	7	0	0	1	1	0	0	0	1	0	2	0	25	118
7:45 AM	0	7	0	0	1	8	5	0	2	0	0	0	0	1	0	0	0	24	100
8:00 AM	1	6	1	0	5	6	1	0	0	0	0	0	0	1	0	1	0	22	94
8:15 AM	0	5	1	0	1	2	0	0	2	0	0	0	0	0	0	4	0	15	86
8:30 AM	0	4	1	0	5	2	0	0	0	0	0	0	0	1	0	6	0	19	80
8:45 AM	0	5	1	0	3	1	1	0	0	0	0	0	0	1	0	5	0	17	73
9:00 AM	2	26	1	0	16	26	2	0	1	1	1	0	0	3	0	10	0	89	140
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	106
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	89
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total		
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
All Vehicles	8	104	4	0	64	104	8	0	4	4	4	0	12	0	40	0	356		
Heavy Trucks	0	32	0	0	48	56	0	0	0	0	0	0	4	0	28	0	168		
Buses																			
Pedestrians		0				0				0				0				0	
Bicycles		0				0				0				0				0	
Scoters		0				0				0				0				0	

Comments:

LOCATION: Laurel Ln -- I-84 EB Ramps
CITY/STATE: Boardman, OR

QC JOB #: 15230907
DATE: Tue, Jun 25 2019



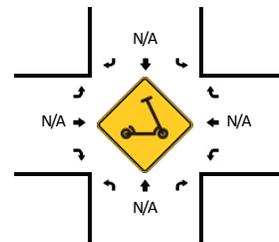
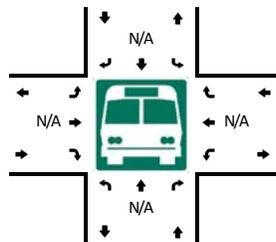
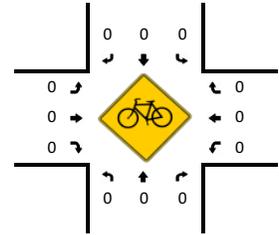
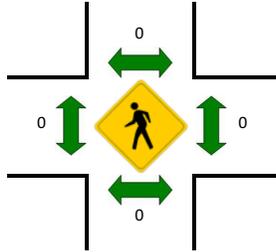
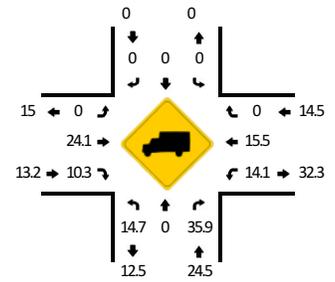
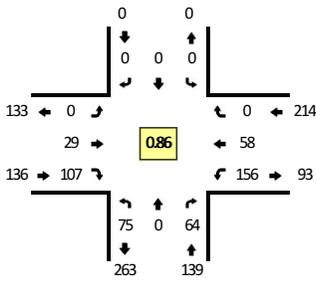
15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				I-84 EB Ramps (Eastbound)				I-84 EB Ramps (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	10	1	0	18	10	0	0	2	0	1	0	0	0	0	0	42	
6:15 AM	0	11	1	0	18	8	0	0	13	0	0	0	0	0	0	0	51	
6:30 AM	0	19	0	0	22	7	0	0	21	0	1	0	0	0	0	0	70	
6:45 AM	0	28	5	0	18	10	0	0	22	0	0	0	0	0	0	0	83	246
7:00 AM	0	13	1	0	43	10	0	0	6	0	3	0	0	0	0	0	76	280
7:15 AM	0	5	6	0	60	8	0	0	8	0	1	0	0	0	0	0	88	317
7:30 AM	0	5	8	0	24	10	0	0	7	0	0	0	0	0	0	0	54	301
7:45 AM	0	8	1	0	20	14	0	0	6	0	1	0	0	0	0	0	50	268
8:00 AM	0	5	4	0	12	10	0	0	12	0	2	0	0	0	0	0	45	237
8:15 AM	0	7	3	0	13	3	0	0	5	1	0	0	0	0	0	0	32	181
8:30 AM	0	5	3	0	18	4	0	0	4	0	3	0	0	0	0	0	37	164
8:45 AM	0	6	4	0	16	4	0	0	1	0	1	0	0	0	0	0	32	146
9:00 AM	0	27	13	0	66	44	0	0	19	1	2	0	0	0	0	0	172	273
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	241
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	204
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	172
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	20	24	0	240	32	0	0	32	0	4	0	0	0	0	0	352	
Heavy Trucks	0	0	12		4	4	0		16	0	0		0	0	0		36	
Buses																	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																	0	

Comments:

LOCATION: Laurel Ln -- Columbia Blvd
CITY/STATE: Boardman, OR

QC JOB #: 15230902
DATE: Tue, Jun 25 2019

Peak-Hour: 4:00 PM -- 5:00 PM
 Peak 15-Min: 4:00 PM -- 4:15 PM

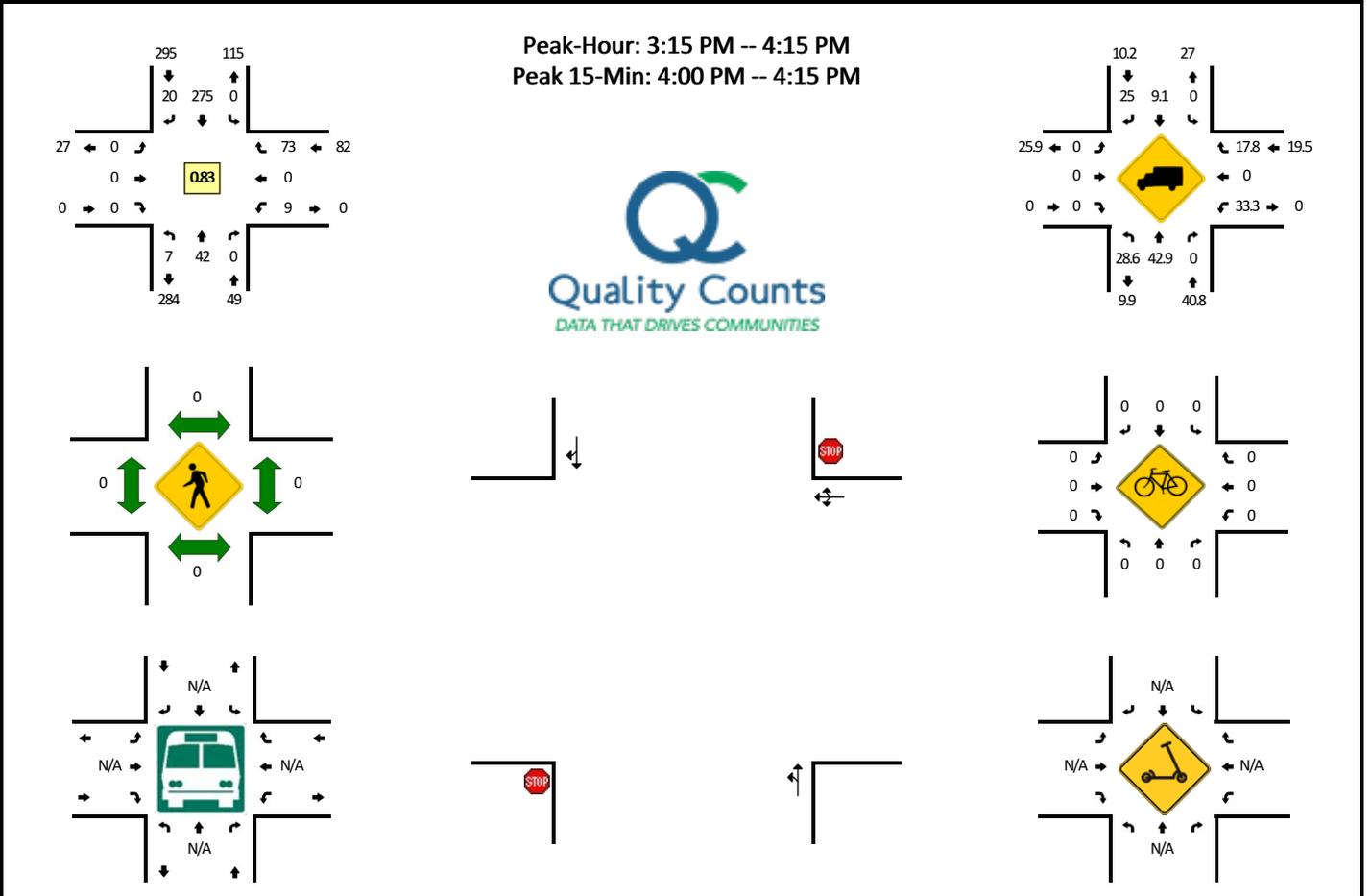


15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				Columbia Blvd (Eastbound)				Columbia Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
2:00 PM	75	0	128	0	0	0	0	0	0	41	87	0	93	49	0	0	473	
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	473
3:00 PM	12	0	10	0	0	0	0	0	0	5	22	0	57	27	0	0	133	133
3:15 PM	23	0	13	0	0	0	0	0	0	8	19	0	43	16	0	0	122	255
3:30 PM	19	0	6	0	0	0	0	0	0	3	31	0	60	21	0	0	140	395
3:45 PM	23	0	6	0	0	0	0	0	0	2	16	0	26	7	0	0	80	475
4:00 PM	10	0	13	0	0	0	0	0	0	5	47	0	51	16	0	0	142	484
4:15 PM	19	0	12	0	0	0	0	0	0	9	27	0	43	16	0	0	126	488
4:30 PM	27	0	21	0	0	0	0	0	0	8	19	0	44	16	0	0	135	483
4:45 PM	19	0	18	0	0	0	0	0	0	7	14	0	18	10	0	0	86	489
5:00 PM	12	0	3	0	0	0	0	0	0	11	42	0	33	14	0	0	115	462
5:15 PM	13	0	7	0	0	0	0	0	0	2	35	0	27	4	0	0	88	424
5:30 PM	14	0	13	0	0	0	0	0	0	8	22	0	24	9	0	0	90	379
5:45 PM	8	0	15	0	0	0	0	0	0	6	13	0	9	9	0	0	60	353
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	40	0	52	0	0	0	0	0	0	20	188	0	204	64	0	0	568	
Heavy Trucks	4	0	32	0	0	0	0	0	0	8	8	0	8	8	0	0	68	
Buses																	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0			0	0	0	0	0	0		0	
Scoters																	0	

Comments:

LOCATION: Laurel Ln -- I-84 WB Ramps
CITY/STATE: Boardman, OR

QC JOB #: 15230904
DATE: Tue, Jun 25 2019

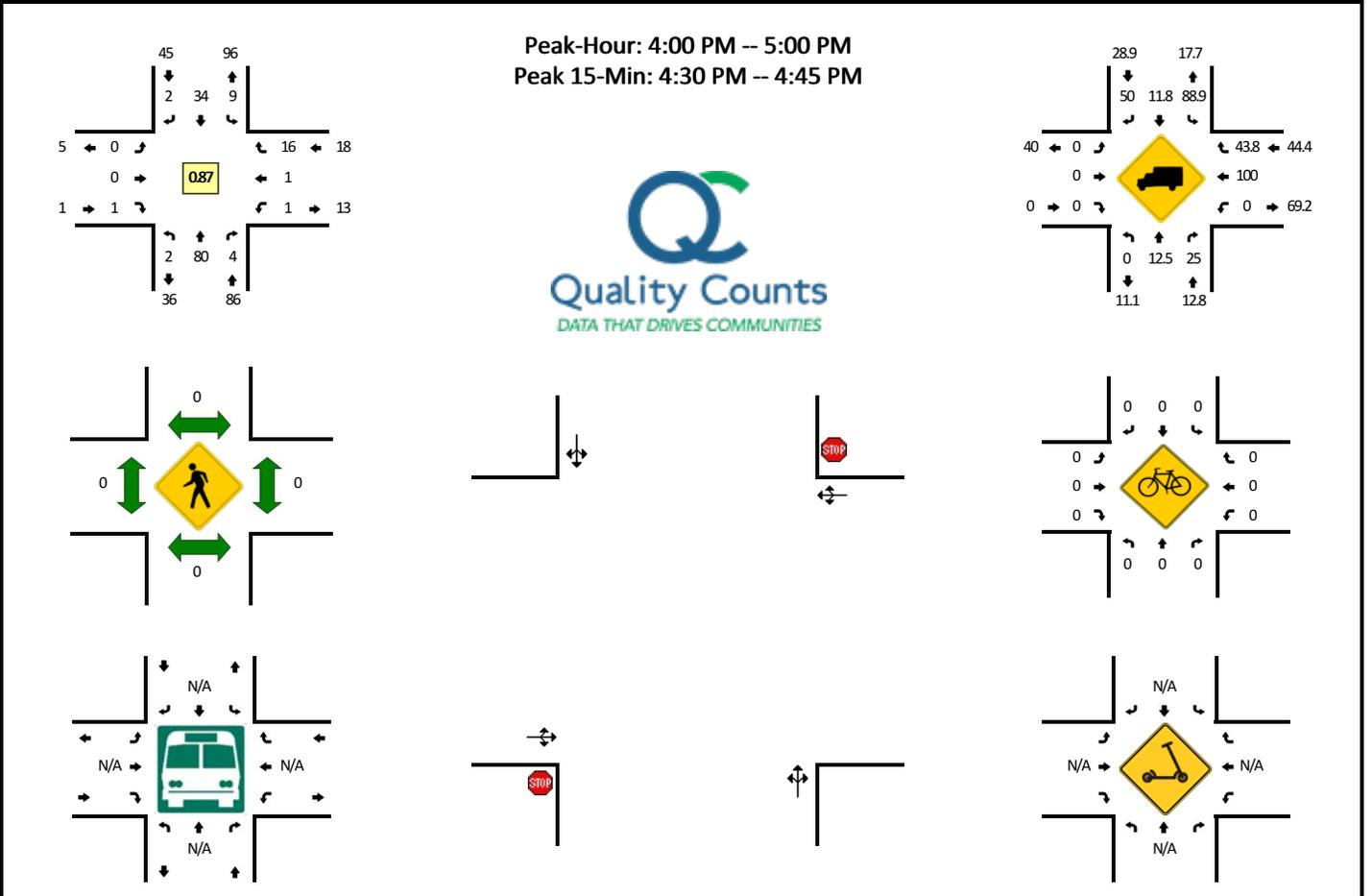


15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				I-84 WB Ramps (Eastbound)				I-84 WB Ramps (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
2:00 PM	10	72	0	0	0	158	24	0	0	0	0	0	16	1	134	0	415	
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	415
3:00 PM	4	7	0	0	0	72	8	0	0	0	0	0	5	0	15	0	111	111
3:15 PM	3	13	0	0	0	54	7	0	0	0	0	0	1	0	23	0	101	212
3:30 PM	1	12	0	0	0	80	7	0	0	0	0	0	2	0	18	0	120	332
3:45 PM	1	7	0	0	0	42	3	0	0	0	0	0	3	0	21	0	77	409
4:00 PM	2	10	0	0	0	99	3	0	0	0	0	0	3	0	11	0	128	426
4:15 PM	0	15	0	0	0	60	6	0	0	0	0	0	4	0	16	0	101	426
4:30 PM	0	8	0	0	0	59	6	0	0	0	0	0	1	0	14	0	88	394
4:45 PM	3	17	0	0	0	27	6	0	0	0	0	0	2	0	20	0	75	392
5:00 PM	2	6	0	0	0	70	6	0	0	0	0	0	1	0	9	0	94	358
5:15 PM	0	6	0	0	0	59	3	0	0	0	0	0	4	0	14	0	86	343
5:30 PM	0	8	0	0	0	41	5	0	0	0	0	0	4	0	21	0	79	334
5:45 PM	4	9	0	0	0	22	0	0	0	0	0	0	1	1	12	0	49	308
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	8	40	0	0	0	396	12	0	0	0	0	0	12	0	44	0	512	
Heavy Trucks	0	16	0	0	0	12	0	0	0	0	0	0	12	0	12	0	52	
Buses																		
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																		

Comments:

LOCATION: Laurel Ln -- Yates Ln
CITY/STATE: Boardman, OR

QC JOB #: 15230906
DATE: Tue, Jun 25 2019

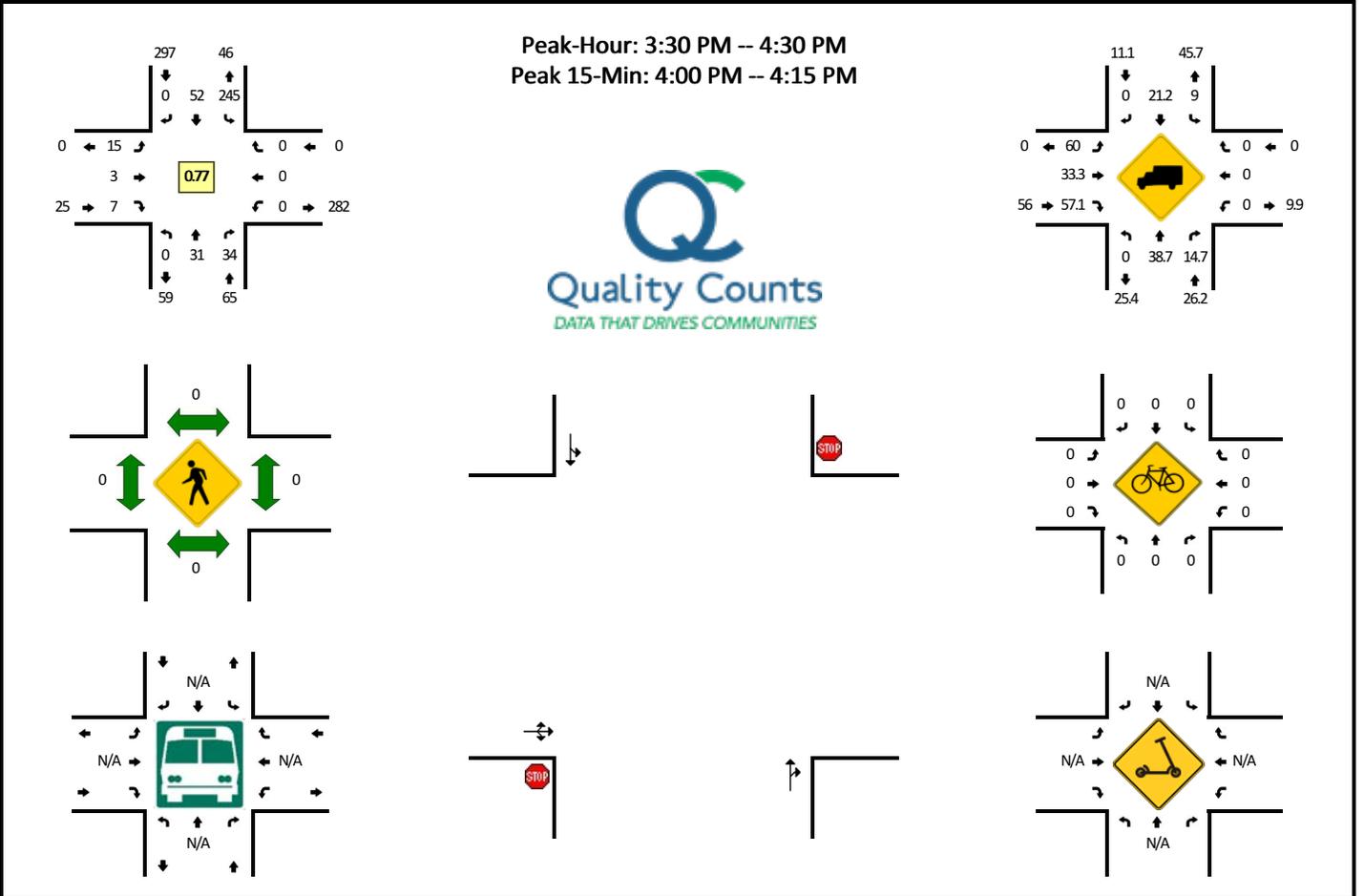


15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				Yates Ln (Eastbound)				Yates Ln (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
2:00 PM	1	39	0	0	15	37	6	0	6	0	3	0	1	0	12	0	120	
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120
3:00 PM	2	8	0	0	4	10	1	0	0	0	0	0	1	0	8	0	34	34
3:15 PM	1	11	0	0	3	6	0	0	2	0	0	0	0	0	1	0	24	58
3:30 PM	0	12	1	0	5	12	1	0	2	0	3	0	0	0	3	0	39	97
3:45 PM	0	7	0	0	3	8	1	0	0	0	0	0	0	0	7	0	26	123
4:00 PM	1	11	1	0	3	17	0	0	0	0	0	0	1	0	5	0	39	128
4:15 PM	0	13	3	0	3	6	0	0	0	0	1	0	0	1	2	0	29	133
4:30 PM	0	31	0	0	1	7	0	0	0	0	0	0	0	0	4	0	43	137
4:45 PM	1	25	0	0	2	4	2	0	0	0	0	0	0	0	5	0	39	150
5:00 PM	0	9	0	0	2	14	0	0	1	0	0	0	0	0	1	0	27	138
5:15 PM	0	6	1	0	1	10	0	0	0	0	1	0	0	0	1	0	20	129
5:30 PM	0	5	1	0	3	7	0	0	0	0	0	0	0	0	4	0	20	106
5:45 PM	0	9	0	0	1	5	0	0	0	2	0	0	0	0	2	0	19	86
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	124	0	0	4	28	0	0	0	0	0	0	0	0	16	0	172	
Heavy Trucks	0	4	0		4	4	0		0	0	0		0	0	4		16	
Buses																		
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																		

Comments:

LOCATION: Laurel Ln -- I-84 EB Ramps
CITY/STATE: Boardman, OR

QC JOB #: 15230908
DATE: Tue, Jun 25 2019



15-Min Count Period Beginning At	Laurel Ln (Northbound)				Laurel Ln (Southbound)				I-84 EB Ramps (Eastbound)				I-84 EB Ramps (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
2:00 PM	0	42	16	0	115	53	0	0	44	2	6	0	0	0	0	0	278	
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	278
3:00 PM	0	9	10	0	61	17	0	0	3	0	0	0	0	0	0	0	100	100
3:15 PM	0	10	3	0	48	8	0	0	5	0	1	0	0	0	0	0	75	175
3:30 PM	0	8	10	0	71	17	0	0	4	1	3	0	0	0	0	0	114	289
3:45 PM	0	6	9	0	37	9	0	0	2	1	1	0	0	0	0	0	65	354
4:00 PM	0	7	10	0	83	18	0	0	6	0	2	0	0	0	0	0	126	380
4:15 PM	0	10	5	0	54	8	0	0	3	1	1	0	0	0	0	0	82	387
4:30 PM	0	6	34	0	49	9	0	0	4	0	0	0	0	0	0	0	102	375
4:45 PM	0	12	18	0	28	6	0	0	7	1	3	0	0	0	0	0	75	385
5:00 PM	0	6	4	0	58	15	0	0	1	0	2	0	0	0	0	0	86	345
5:15 PM	0	4	5	0	46	10	0	0	3	0	1	0	0	0	0	0	69	332
5:30 PM	0	7	2	0	38	7	0	0	1	1	1	0	0	0	0	0	57	287
5:45 PM	0	9	3	0	21	6	0	0	4	0	2	0	0	0	0	0	45	257
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	28	40	0	332	72	0	0	24	0	8	0	0	0	0	0	504	
Heavy Trucks	0	4	4		12	12	0		16	0	8		0	0	0		56	
Buses																	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																	0	

Comments:

Appendix B Existing Traffic Conditions

**Intersection Level Of Service Report
Intersection 1: Laurel Ln/Columbia Blvd**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 28.2
 Level Of Service: D
 Volume to Capacity (v/c): 0.466

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+						┌┐			└┘		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	1	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	150.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	166	0	257	0	0	0	0	28	93	98	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	11.00	0.00	11.00	2.00	2.00	2.00	0.00	29.00	18.00	20.00	18.00	0.00
Growth Factor	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	178	0	275	0	0	0	0	30	100	105	0	0
Peak Hour Factor	0.7900	0.7900	0.7900	1.0000	1.0000	1.0000	0.7900	0.7900	0.7900	0.7900	0.7900	0.7900
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	56	0	87	0	0	0	0	9	32	33	0	0
Total Analysis Volume [veh/h]	225	0	348	0	0	0	0	38	127	133	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.12	0.47	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.33	8.94	28.16	0.00	0.00
Movement LOS	A	A	A					C	A	D		
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.42	2.33	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.19	10.40	58.31	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			0.00			11.34			28.16		
Approach LOS	A			A			B			D		
d_I, Intersection Delay [s/veh]	6.45											
Intersection LOS	D											

**Intersection Level Of Service Report
Intersection 2: Laurel Ln/I-84 WB Ramp**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 16.3
 Level Of Service: C
 Volume to Capacity (v/c): 0.034

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	←			→						↑		
Lane Configuration	←			→						↑		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	4	122	0	0	170	21	0	0	0	13	0	301
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	18.00	2.00	2.00	19.00	24.00	2.00	2.00	2.00	8.00	0.00	8.00
Growth Factor	1.0700	1.0700	1.0000	1.0000	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	131	0	0	182	22	0	0	0	14	0	322
Peak Hour Factor	0.7800	0.7800	1.0000	1.0000	0.7800	0.7800	1.0000	1.0000	1.0000	0.7800	0.7800	0.7800
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	42	0	0	58	7	0	0	0	4	0	103
Total Analysis Volume [veh/h]	5	168	0	0	233	28	0	0	0	18	0	413
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance				No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.48
d_M, Delay for Movement [s/veh]	7.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.28	16.47	13.63
Movement LOS	A	A			A	A				C	C	B
95th-Percentile Queue Length [veh/ln]	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	3.00	3.00
95th-Percentile Queue Length [ft/ln]	0.29	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.91	74.91	74.91
d_A, Approach Delay [s/veh]	0.22			0.00			0.00			13.74		
Approach LOS	A			A			A			B		
d_I, Intersection Delay [s/veh]	6.89											
Intersection LOS	C											

**Intersection Level Of Service Report
Intersection 3: Laurel Ln/I-84 EB Ramp**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 15.8
 Level Of Service: C
 Volume to Capacity (v/c): 0.169

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	T			T			+					
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	0	69	12	146	37	0	57	0	5	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	11.00	75.00	16.00	26.00	2.00	26.00	0.00	40.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0700	1.0700	1.0700	1.0700	1.0000	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	74	13	156	40	0	61	0	5	0	0	0
Peak Hour Factor	1.0000	0.9000	0.9000	0.9000	0.9000	1.0000	0.9000	0.9000	0.9000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	21	4	43	11	0	17	0	1	0	0	0
Total Analysis Volume [veh/h]	0	82	14	173	44	0	68	0	6	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.12	0.00	0.00	0.17	0.00	0.01	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	7.90	0.00	0.00	15.77	15.31	10.69	0.00	0.00	0.00
Movement LOS		A	A	A	A		C	C	B			
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.42	0.42	0.00	0.63	0.63	0.63	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	10.43	10.43	0.00	15.76	15.76	15.76	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			6.30			15.36			0.00		
Approach LOS	A			A			C			A		
d_I, Intersection Delay [s/veh]	6.47											
Intersection LOS	C											

**Intersection Level Of Service Report
Intersection 4: Laurel Ln/Yates Ln**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 9.8
 Level Of Service: A
 Volume to Capacity (v/c): 0.005

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	+			+			+			+		
Lane Configuration	+			+			+			+		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	0	67	0	12	25	5	3	0	0	1	0	11
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	10.00	0.00	42.00	28.00	0.00	0.00	0.00	0.00	0.00	0.00	82.00
Growth Factor	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	72	0	13	27	5	3	0	0	1	0	12
Peak Hour Factor	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	25	0	5	10	2	1	0	0	0	0	4
Total Analysis Volume [veh/h]	0	101	0	18	38	7	4	0	0	1	0	17
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
d_M, Delay for Movement [s/veh]	7.28	0.00	0.00	7.86	0.00	0.00	9.81	10.11	8.50	9.73	10.21	9.76
Movement LOS	A	A	A	A	A	A	A	B	A	A	B	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.04	0.04	0.04	0.02	0.02	0.02	0.07	0.07	0.07
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	1.07	1.07	1.07	0.40	0.40	0.40	1.78	1.78	1.78
d_A, Approach Delay [s/veh]	0.00			2.25			9.81			9.76		
Approach LOS	A			A			A			A		
d_I, Intersection Delay [s/veh]	1.92											
Intersection LOS	A											

**Intersection Level Of Service Report
Intersection 1: Laurel Ln/Columbia Blvd**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 14.6
 Level Of Service: B
 Volume to Capacity (v/c): 0.376

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	+						┌┐			└┘		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	1	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	150.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	73	0	37	0	0	0	0	19	121	180	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	11.00	0.00	51.00	2.00	2.00	2.00	0.00	26.00	8.00	14.00	18.00	0.00
Growth Factor	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	78	0	40	0	0	0	0	20	129	193	0	0
Peak Hour Factor	0.8600	0.8600	0.8600	1.0000	1.0000	1.0000	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	23	0	12	0	0	0	0	6	38	56	0	0
Total Analysis Volume [veh/h]	91	0	47	0	0	0	0	23	150	224	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.14	0.38	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.93	8.92	14.62	0.00	0.00
Movement LOS	A	A	A					B	A	B		
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.49	1.74	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84	12.21	43.48	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			0.00			9.19			14.62		
Approach LOS	A			A			A			B		
d_I, Intersection Delay [s/veh]	9.09											
Intersection LOS	B											

**Intersection Level Of Service Report
Intersection 2: Laurel Ln/I-84 WB Ramp**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 13.3
 Level Of Service: B
 Volume to Capacity (v/c): 0.040

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	←			→						↑		
Lane Configuration	←			→						↑		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	4	44	0	0	282	19	0	0	0	15	0	66
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	50.00	41.00	2.00	2.00	10.00	37.00	2.00	2.00	2.00	33.00	0.00	14.00
Growth Factor	1.0700	1.0700	1.0000	1.0000	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	4	47	0	0	302	20	0	0	0	16	0	71
Peak Hour Factor	0.8300	0.8300	1.0000	1.0000	0.8300	0.8300	1.0000	1.0000	1.0000	0.8300	0.8300	0.8300
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	1	14	0	0	91	6	0	0	0	5	0	21
Total Analysis Volume [veh/h]	5	57	0	0	364	24	0	0	0	19	0	86
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance				No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.09
d_M, Delay for Movement [s/veh]	8.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.26	12.82	9.33
Movement LOS	A	A			A	A				B	B	A
95th-Percentile Queue Length [veh/ln]	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.44	0.44
95th-Percentile Queue Length [ft/ln]	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.98	10.98	10.98
d_A, Approach Delay [s/veh]	0.71			0.00			0.00			10.04		
Approach LOS	A			A			A			B		
d_I, Intersection Delay [s/veh]	1.98											
Intersection LOS	B											

**Intersection Level Of Service Report
Intersection 3: Laurel Ln/I-84 EB Ramp**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 27.9
 Level Of Service: D
 Volume to Capacity (v/c): 0.118

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	←			→			↑			↓		
Lane Configuration	←			→			↑			↓		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	0	33	34	245	52	0	15	3	7	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	39.00	15.00	9.00	21.00	2.00	60.00	33.00	57.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0700	1.0700	1.0700	1.0700	1.0000	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	35	36	262	56	0	16	3	7	0	0	0
Peak Hour Factor	1.0000	0.7700	0.7700	0.7700	0.7700	1.0000	0.7700	0.7700	0.7700	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	11	12	85	18	0	5	1	2	0	0	0
Total Analysis Volume [veh/h]	0	45	47	340	73	0	21	4	9	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.23	0.00	0.00	0.12	0.02	0.01	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	8.21	0.00	0.00	27.91	25.47	11.92	0.00	0.00	0.00
Movement LOS		A	A	A	A		D	D	B			
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.91	0.91	0.00	0.51	0.51	0.51	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	22.63	22.63	0.00	12.77	12.77	12.77	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			6.76			23.39			0.00		
Approach LOS	A			A			C			A		
d_I, Intersection Delay [s/veh]	6.66											
Intersection LOS	D											

**Intersection Level Of Service Report
Intersection 4: Laurel Ln/Yates Ln**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 11.5
 Level Of Service: B
 Volume to Capacity (v/c): 0.002

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	+			+			+			+		
Lane Configuration	+			+			+			+		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	1	48	5	14	43	2	2	0	4	1	1	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	19.00	20.00	71.00	9.00	0.00	0.00	0.00	0.00	0.00	100.00	41.00
Growth Factor	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	51	5	15	46	2	2	0	4	1	1	18
Peak Hour Factor	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	17	2	5	15	1	1	0	1	0	0	6
Total Analysis Volume [veh/h]	1	66	6	19	60	3	3	0	5	1	1	23
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
d_M, Delay for Movement [s/veh]	7.32	0.00	0.00	8.09	0.00	0.00	9.82	10.10	8.60	9.74	11.48	9.14
Movement LOS	A	A	A	A	A	A	A	B	A	A	B	A
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.05	0.05	0.05	0.03	0.03	0.03	0.09	0.09	0.09
95th-Percentile Queue Length [ft/ln]	0.05	0.05	0.05	1.22	1.22	1.22	0.68	0.68	0.68	2.22	2.22	2.22
d_A, Approach Delay [s/veh]	0.10			1.87			9.06			9.26		
Approach LOS	A			A			A			A		
d_I, Intersection Delay [s/veh]	2.47											
Intersection LOS	B											

Appendix C 2040 No-Build Traffic
Conditions

Intersection Level Of Service Report
Intersection 1: Laurel Ln/Columbia Blvd

Control Type:	Two-way stop	Delay (sec / veh):	395.2
Analysis Method:	HCM 6th Edition	Level Of Service:	F
Analysis Period:	15 minutes	Volume to Capacity (v/c):	1.667

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	+						┌			└		
Lane Configuration	+						┌			└		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	1	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	150.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	166	0	257	0	0	0	0	28	93	98	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	11.00	0.00	11.00	2.00	2.00	2.00	0.00	29.00	18.00	20.00	18.00	0.00
Growth Factor	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	94	0	142	0	0	0	0	15	60	57	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	272	0	417	0	0	0	0	45	160	162	0	0
Peak Hour Factor	0.7900	0.7900	0.7900	1.0000	1.0000	1.0000	0.7900	0.7900	0.7900	0.7900	0.7900	0.7900
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	86	0	132	0	0	0	0	14	51	51	0	0
Total Analysis Volume [veh/h]	344	0	528	0	0	0	0	57	203	205	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.36	0.20	1.67	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.46	9.30	395.19	0.00	0.00
Movement LOS	A	A	A					E	A	F		
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49	0.72	15.28	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.21	18.07	382.05	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			0.00			15.91			395.19		
Approach LOS	A			A			C			F		
d_I, Intersection Delay [s/veh]	63.69											
Intersection LOS	F											

**Intersection Level Of Service Report
Intersection 2: Laurel Ln/I-84 WB Ramp**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 83.6
 Level Of Service: F
 Volume to Capacity (v/c): 0.249

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	←			→						↑		
Lane Configuration	←			→						↑		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	4	119	0	0	166	21	0	0	0	13	0	301
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	18.00	2.00	2.00	19.00	24.00	2.00	2.00	2.00	8.00	0.00	8.00
Growth Factor	1.0700	1.0700	1.0000	1.0000	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	45	55	0	0	99	18	0	0	0	45	0	181
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	49	182	0	0	277	40	0	0	0	59	0	503
Peak Hour Factor	0.7800	0.7800	1.0000	1.0000	0.7800	0.7800	1.0000	1.0000	1.0000	0.7800	0.7800	0.7800
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	16	58	0	0	89	13	0	0	0	19	0	161
Total Analysis Volume [veh/h]	63	233	0	0	355	51	0	0	0	76	0	645
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance				No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.81
d_M, Delay for Movement [s/veh]	8.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.63	83.27	76.39
Movement LOS	A	A			A	A				F	F	F
95th-Percentile Queue Length [veh/ln]	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.37	19.37	19.37
95th-Percentile Queue Length [ft/ln]	4.29	4.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	484.35	484.35	484.35
d_A, Approach Delay [s/veh]	1.76			0.00			0.00			77.15		
Approach LOS	A			A			A			F		
d_I, Intersection Delay [s/veh]	39.46											
Intersection LOS	F											

Intersection Level Of Service Report
Intersection 3: Laurel Ln/I-84 EB Ramp

Control Type: Two-way stop
Analysis Method: HCM 6th Edition
Analysis Period: 15 minutes

Delay (sec / veh): 39.4
Level Of Service: E
Volume to Capacity (v/c): 0.522

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	←			→			↑			↓		
Lane Configuration	←			→			↑			↓		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	0	65	12	143	35	0	57	0	5	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	11.00	75.00	16.00	26.00	2.00	26.00	0.00	40.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0700	1.0700	1.0700	1.0700	1.0000	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	64	85	74	70	0	36	0	50	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	134	98	227	107	0	97	0	55	0	0	0
Peak Hour Factor	1.0000	0.9000	0.9000	0.9000	0.9000	1.0000	0.9000	0.9000	0.9000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	37	27	63	30	0	27	0	15	0	0	0
Total Analysis Volume [veh/h]	0	149	109	252	119	0	108	0	61	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.20	0.00	0.00	0.52	0.00	0.07	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	8.68	0.00	0.00	39.42	38.05	26.30	0.00	0.00	0.00
Movement LOS		A	A	A	A		E	E	D			
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.77	0.77	0.00	3.54	3.54	3.54	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	19.21	19.21	0.00	88.39	88.39	88.39	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			5.90			34.69			0.00		
Approach LOS	A			A			D			A		
d_I, Intersection Delay [s/veh]	10.09											
Intersection LOS	E											

Intersection Level Of Service Report
Intersection 4: Laurel Ln/Yates Ln

Control Type: Two-way stop
Analysis Method: HCM 6th Edition
Analysis Period: 15 minutes

Delay (sec / veh): 18.1
Level Of Service: C
Volume to Capacity (v/c): 0.014

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach												
Lane Configuration	+			+			+			+		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	0	63	0	12	25	5	3	0	0	1	0	11
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	10.00	0.00	42.00	28.00	0.00	0.00	0.00	0.00	0.00	0.00	82.00
Growth Factor	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	54	15	90	30	0	0	0	0	10	0	95
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	121	15	103	57	5	3	0	0	11	0	107
Peak Hour Factor	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100	0.7100
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	43	5	36	20	2	1	0	0	4	0	38
Total Analysis Volume [veh/h]	0	170	21	145	80	7	4	0	0	15	0	151
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.12	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.22
d_M, Delay for Movement [s/veh]	7.37	0.00	0.00	8.49	0.00	0.00	18.05	14.65	8.85	15.85	16.26	12.09
Movement LOS	A	A	A	A	A	A	C	B	A	C	C	B
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.42	0.42	0.42	0.04	0.04	0.04	1.01	1.01	1.01
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	10.52	10.52	10.52	1.09	1.09	1.09	25.30	25.30	25.30
d_A, Approach Delay [s/veh]	0.00			5.31			18.05			12.43		
Approach LOS	A			A			C			B		
d_I, Intersection Delay [s/veh]	5.68											
Intersection LOS	C											

Intersection Level Of Service Report
Intersection 1: Laurel Ln/Columbia Blvd

Control Type: Two-way stop
Analysis Method: HCM 6th Edition
Analysis Period: 15 minutes

Delay (sec / veh): 48.1
Level Of Service: E
Volume to Capacity (v/c): 0.867

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	+						+R			L		
Lane Configuration	+						+R			L		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	1	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	150.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	71	0	37	0	0	0	0	19	121	180	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	11.00	0.00	51.00	2.00	2.00	2.00	0.00	26.00	8.00	14.00	18.00	0.00
Growth Factor	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	47	0	34	0	0	0	0	12	78	126	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	123	0	74	0	0	0	0	32	207	319	0	0
Peak Hour Factor	0.8600	0.8600	0.8600	1.0000	1.0000	1.0000	0.8600	0.8600	0.8600	0.8600	0.8600	0.8600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	36	0	22	0	0	0	0	9	60	93	0	0
Total Analysis Volume [veh/h]	143	0	86	0	0	0	0	37	241	371	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.23	0.87	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.43	9.35	48.14	0.00	0.00
Movement LOS	A	A	A					B	A	E		
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.87	8.76	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.71	21.68	219.12	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			0.00			9.76			48.14		
Approach LOS	A			A			A			E		
d_I, Intersection Delay [s/veh]	23.43											
Intersection LOS	E											

**Intersection Level Of Service Report
Intersection 2: Laurel Ln/I-84 WB Ramp**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 34.3
 Level Of Service: D
 Volume to Capacity (v/c): 0.475

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	←			→						↑		
Lane Configuration	←			→						↑		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	4	44	0	0	281	19	0	0	0	12	0	66
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	50.00	41.00	2.00	2.00	10.00	37.00	2.00	2.00	2.00	33.00	0.00	14.00
Growth Factor	1.0700	1.0700	1.0000	1.0000	1.0700	1.0700	1.0000	1.0000	1.0000	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	50	24	0	0	184	19	0	0	0	80	0	56
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	54	71	0	0	485	39	0	0	0	93	0	127
Peak Hour Factor	0.8300	0.8300	1.0000	1.0000	0.8300	0.8300	1.0000	1.0000	1.0000	0.8300	0.8300	0.8300
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	16	21	0	0	146	12	0	0	0	28	0	38
Total Analysis Volume [veh/h]	65	86	0	0	584	47	0	0	0	112	0	153
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance				No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.09	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.47	0.00	0.16
d_M, Delay for Movement [s/veh]	10.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.27	32.16	22.84
Movement LOS	B	A			A	A				D	D	C
95th-Percentile Queue Length [veh/ln]	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.29	4.29	4.29
95th-Percentile Queue Length [ft/ln]	7.01	7.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	107.36	107.36	107.36
d_A, Approach Delay [s/veh]	4.39			0.00			0.00			27.67		
Approach LOS	A			A			A			D		
d_I, Intersection Delay [s/veh]	7.64											
Intersection LOS	D											

**Intersection Level Of Service Report
Intersection 3: Laurel Ln/I-84 EB Ramp**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 266.5
 Level Of Service: F
 Volume to Capacity (v/c): 0.936

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration	T			T			+					
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	0	31	34	245	52	0	15	3	7	0	0	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	39.00	15.00	9.00	21.00	2.00	60.00	33.00	57.00	2.00	2.00	2.00
Growth Factor	1.0000	1.0700	1.0700	1.0700	1.0700	1.0000	1.0700	1.0700	1.0700	1.0000	1.0000	1.0000
In-Process Volume [veh/h]	0	64	70	164	100	0	11	0	50	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	97	106	426	156	0	27	3	57	0	0	0
Peak Hour Factor	1.0000	0.7700	0.7700	0.7700	0.7700	1.0000	0.7700	0.7700	0.7700	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	31	34	138	51	0	9	1	19	0	0	0
Total Analysis Volume [veh/h]	0	126	138	553	203	0	35	4	74	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.44	0.00	0.00	0.94	0.08	0.10	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	0.00	0.00	0.00	10.07	0.00	0.00	266.53	246.06	175.26	0.00	0.00	0.00
Movement LOS		A	A	B	A		F	F	F			
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	2.29	2.29	0.00	7.33	7.33	7.33	0.00	0.00	0.00
95th-Percentile Queue Length [ft/ln]	0.00	0.00	0.00	57.14	57.14	0.00	183.34	183.34	183.34	0.00	0.00	0.00
d_A, Approach Delay [s/veh]	0.00			7.37			206.04			0.00		
Approach LOS	A			A			F			A		
d_I, Intersection Delay [s/veh]	25.46											
Intersection LOS	F											

**Intersection Level Of Service Report
Intersection 4: Laurel Ln/Yates Ln**

Control Type: Two-way stop
 Analysis Method: HCM 6th Edition
 Analysis Period: 15 minutes

Delay (sec / veh): 19.2
 Level Of Service: C
 Volume to Capacity (v/c): 0.003

Intersection Setup

Name	Northbound			Southbound			Eastbound			Westbound		
Approach	+			+			+			+		
Lane Configuration	+			+			+			+		
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Entry Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Entry Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
No. of Lanes in Exit Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Exit Pocket Length [ft]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Speed [mph]	30.00			30.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Northbound			Southbound			Eastbound			Westbound		
Base Volume Input [veh/h]	1	43	5	14	43	2	2	0	4	1	1	17
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	19.00	20.00	71.00	9.00	0.00	0.00	0.00	0.00	0.00	100.00	41.00
Growth Factor	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700	1.0700
In-Process Volume [veh/h]	0	29	20	95	55	0	0	0	0	25	0	105
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	75	25	110	101	2	2	0	4	26	1	123
Peak Hour Factor	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700	0.7700
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	24	8	36	33	1	1	0	1	8	0	40
Total Analysis Volume [veh/h]	1	97	32	143	131	3	3	0	5	34	1	160
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.13	0.00	0.00	0.01	0.00	0.01	0.08	0.00	0.19
d_M, Delay for Movement [s/veh]	7.46	0.00	0.00	8.67	0.00	0.00	17.35	14.48	9.02	15.77	19.25	11.20
Movement LOS	A	A	A	A	A	A	C	B	A	C	C	B
95th-Percentile Queue Length [veh/ln]	0.00	0.00	0.00	0.44	0.44	0.44	0.05	0.05	0.05	1.13	1.13	1.13
95th-Percentile Queue Length [ft/ln]	0.05	0.05	0.05	10.91	10.91	10.91	1.19	1.19	1.19	28.15	28.15	28.15
d_A, Approach Delay [s/veh]	0.06			4.48			12.14			12.04		
Approach LOS	A			A			B			B		
d_I, Intersection Delay [s/veh]	6.05											
Intersection LOS	C											

Appendix D Concept Traffic Operations
Summary

Initial Interchange Concept Operations

The following tables summarize the forecast traffic operations for each of the initial interchange concepts.

Concept 'A' 2040 Forecast Operations

Table 12 – 2040 Concept 'A' Operations

Study Int.	Critical/ Approach Lane	Weekday AM Peak Hour				Weekday PM Peak Hour			
		V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)	V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)
Conjoined Laurel Lane/ Columbia Boulevard/ I-84 WB Ramp Terminal Roundabout	NB Laurel Lane	0.18	4.4	A	25	0.10	3.6	A	25
	WB Off Ramp	0.76	18.8	C	200	0.24	5.8	A	25
	WB Columbia Blvd	0.36	8.8	A	50	0.45	9.0	A	75
	EB Columbia Blvd	0.22	5.9	A	25	0.30	7.9	A	50
Conjoined Laurel Lane/ Columbia Boulevard/ I-84 WB Ramp Terminal Roundabout (with WB Off ramp bypass lane)	NB Laurel Lane	0.23	4.9	A	25	0.11	3.7	A	25
	WB Off Ramp	0.38	8.2	A	50	0.27	5.4	A	25
	WB Columbia Blvd	0.43	10.5	B	75	0.52	10.6	B	100
	EB Columbia Blvd	0.29	7.0	A	50	0.37	9.6	A	50
Laurel Lane/ I-84 EB Ramp Terminal (with EB ramp widening and SB Left- Turn Lane)	EB Left- Turn	0.51	39.8	E	75	0.84	241.2	F	100

WB= Westbound, SB = Southbound, EB = Eastbound, NB = Northbound, L = Left, Th = Through, Rt = Right
 V/C= Critical volume-to-capacity ratio, Delay= Intersection delay (signalized) / Critical movement delay (unsignalized)

As shown in the table, a conjoined Laurel Lane/Columbia Boulevard/I-84 WB Ramp Terminal roundabout would operate acceptably during both the weekday AM and PM peak hours. The inclusion of a bypass lane on the WB off ramp would significantly improve the vehicle queue length.

Concept 'B' 2040 Forecast Operations

Table 13 – Concept 'B' Operations

Study Int.	Critical/ Approach Lane	Weekday AM Peak Hour				Weekday PM Peak Hour			
		V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)	V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)
Laurel Lane/ Columbia Boulevard (Intersection as is)	WB Left- Turn	1.67	395.2	F	400	0.87	48.14	E	225
Laurel Lane/ I-84 WB Ramp Terminal Roundabout	NB Laurel Lane	0.24	5.1	A	25	0.16	5.3	A	25
	WB Off Ramp	0.80	21.5	C	225	0.29	7.0	A	50
	SB Laurel Lane	0.41	8.1	A	50	0.66	13.9	B	150
Laurel Lane/ I-84 WB Ramp Terminal Roundabout (with WB Off ramp bypass lane)	NB Laurel Lane	0.24	5.1	A	25	0.16	5.3	A	25
	WB Off Ramp	0.09	1.0	A	25	0.12	2.2	A	25
	SB Laurel Lane	0.41	8.1	A	50	0.66	13.9	B	125
Laurel Lane/ I-84 EB Ramp Terminal (with EB ramp widening and SB Left- Turn Lane)	Eastbound Left-Turn	0.51	39.8	E	75	0.84	241.2	F	100

WB= Westbound, SB = Southbound, EB = Eastbound, NB = Northbound, L = Left, Th = Through, Rt = Right
 V/C= Critical volume-to-capacity ratio, Delay= Intersection delay (signalized) / Critical movement delay (unsignalized)

As shown in the table, the critical side-street movements at the Laurel Lane/Columbia Boulevard intersection are forecast to continue to operate over capacity. A roundabout at the Laurel Lane/I-84 WB Ramp Terminal would operate acceptably. However, the inclusion of a bypass lane on the WB off ramp would significantly improve the operations and have a significantly lower vehicle queue length on the offramp.

Concept 'C1' 2040 Forecast Operations

Table 14 – Concept 'C1' Operations

Study Int.	Critical/ Approach Lane	Weekday AM Peak Hour				Weekday PM Peak Hour			
		V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)	V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)
Laurel Lane/ Columbia Boulevard Roundabout	NB Laurel Lane	0.34	6.5	A	50	0.17	4.7	A	25
	WB Columbia Blvd	0.42	10.0	B	75	0.48	9.2	A	75
	EB Columbia Blvd	0.29	7.1	A	50	0.34	8.4	A	50
Laurel Lane/I-84 WB Ramp Terminal Roundabout	NB Laurel Lane	0.24	5.1	A	25	0.16	5.3	A	25
	WB Off Ramp	0.80	21.5	C	225	0.29	7.0	A	50
	SB Laurel Lane	0.41	8.1	A	50	0.66	13.9	B	150
Laurel Lane/I-84 WB Ramp Terminal Roundabout (with WB Off ramp bypass lane)	NB Laurel Lane	0.24	5.1	A	25	0.16	5.3	A	25
	WB Off Ramp	0.09	1.0	A	25	0.12	2.2	A	25
	SB Laurel Lane	0.41	8.1	A	50	0.66	13.9	B	125
Laurel Lane/ I-84 EB Ramp Terminal (with EB ramp widening and SB Left- Turn Lane)	Eastbound Left-Turn	0.51	39.8	E	75	0.84	241.2	F	100

WB= Westbound, SB = Southbound, EB = Eastbound, NB = Northbound, L = Left, Th = Through, Rt = Right
 V/C= Critical volume-to-capacity ratio, Delay= Intersection delay (signalized) / Critical movement delay (unsignalized)

As shown in the table, a roundabout at the Laurel Lane/Columbia Boulevard intersection would operate acceptably during both study periods. A roundabout at the Laurel Lane/I-84 WB Ramp Terminal would also operate acceptably. However, the inclusion of a bypass lane on the WB off ramp would significantly improve the operations and have a significantly lower vehicle queue length on the offramp.

Concept 'C2' 2040 Forecast Operations

Table 15 – Concept 'C2' Operations

Study Int.	Critical/ Approach Lane	Weekday AM Peak Hour				Weekday PM Peak Hour			
		V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)	V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)
Laurel Lane/ Columbia Boulevard Roundabout	NB Laurel Lane	0.34	6.5	A	50	0.17	4.7	A	25
	WB Columbia Blvd	0.42	10.0	B	75	0.48	9.2	A	75
	EB Columbia Blvd	0.29	7.1	A	50	0.34	8.4	A	50
Laurel Lane/I-84 WB Ramp Terminal Roundabout	NB Laurel Lane	0.24	5.1	A	25	0.16	5.3	A	25
	WB Off Ramp	0.80	21.5	C	225	0.29	7.0	A	50
	SB Laurel Lane	0.41	8.1	A	50	0.66	13.9	B	150
Laurel Lane/I-84 WB Ramp Terminal Roundabout (with WB Off ramp bypass lane)	NB Laurel Lane	0.24	5.1	A	25	0.16	5.3	A	25
	WB Off Ramp	0.09	1.0	A	25	0.12	2.2	A	25
	SB Laurel Lane	0.41	8.1	A	50	0.66	13.9	B	125
Laurel Lane/ I-84 EB Ramp Terminal (with EB ramp widening and SB Left- Turn Lane)	Eastbound Left-Turn	0.51	39.8	E	75	0.84	241.2	F	100

WB= Westbound, SB = Southbound, EB = Eastbound, NB = Northbound, L = Left, Th = Through, Rt = Right
 V/C= Critical volume-to-capacity ratio, Delay= Intersection delay (signalized) / Critical movement delay (unsignalized)

As shown in the table, Concept 'C2' is forecast to have similar operations to Concept 'C1'. Despite the closer spacing, the forecast vehicle queues between the two roundabouts (in particular the SB direction in the weekday PM peak hour) can be accommodated.

Concept 'D' 2040 Forecast Operations

Table 16 – Concept 'D' Operations

Study Int.	Critical/ Approach Lane	Weekday AM Peak Hour				Weekday PM Peak Hour			
		V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)	V/C	Approach Delay (sec)	Approach LOS	95% Queue Length (ft)
Combined Laurel Lane/Columbia Boulevard/I-84 WB Ramp Terminal Roundabout	NB Laurel Lane	0.18	4.4	A	25	0.10	3.6	A	25
	WB Off Ramp	0.76	18.8	C	200	0.24	5.8	A	25
	WB Columbia Blvd	0.36	8.8	A	50	0.45	9.0	A	75
	EB Columbia Blvd	0.22	5.9	A	25	0.30	7.9	A	50
Combined Laurel Lane/Columbia Boulevard/I-84 WB Ramp Terminal Roundabout (with WB Off ramp bypass lane)	NB Laurel Lane	0.23	4.9	A	25	0.11	3.7	A	25
	WB Off Ramp	0.38	8.2	A	50	0.27	5.4	A	25
	WB Columbia Blvd	0.43	10.5	B	75	0.52	10.6	B	100
	EB Columbia Blvd	0.29	7.0	A	50	0.37	9.6	A	50
Laurel Lane/ I-84 EB Ramp Terminal (with EB ramp widening and SB Left- Turn Lane)	Eastbound Left-Turn	0.51	39.8	E	75	0.84	241.2	F	100

WB= Westbound, SB = Southbound, EB = Eastbound, NB = Northbound, L = Left, Th = Through, Rt = Right
 V/C= Critical volume-to-capacity ratio, Delay= Intersection delay (signalized) / Critical movement delay (unsignalized)

As shown in the table, a combined Laurel Lane/Columbia Boulevard/I-84 WB Ramp Terminal roundabout would operate acceptably during both the weekday AM and PM peak hours. The inclusion of a bypass lane on the WB off ramp would significantly improve the vehicle queue length.

Concept 'E' 2040 Forecast Operations

Table 17 – Concept 'E' Operations

Study Int.	Critical/ Approach Lane	Weekday AM Peak Hour				Weekday PM Peak Hour			
		V/C	Approach Delay (sec)	Approach LOS	Critical 95% Queue Length (ft)	V/C	Approach Delay (sec)	Approach LOS	Critical 95% Queue Length (ft)
Laurel Lane/ Columbia Boulevard (Signalized)	-	0.72	58.3	E	WB LT = 230	0.56	79.3	E	WB LT = 475
Laurel Lane/ I-84 WB Ramp Terminal (Signalized)	-	0.88	105.4	F	WB RT = 450	0.76	30.4	C	WB RT = 125
Laurel Lane/ I-84 EB Ramp Terminal (with EB ramp widening and SB Left- Turn Lane)	Eastbound Left-Turn	0.51	39.8	E	75	0.84	241.2	F	100

WB= Westbound, SB = Southbound, EB = Eastbound, NB = Northbound, L = Left, Th = Through, Rt = Right
 V/C= Critical volume-to-capacity ratio, Delay= Intersection delay (signalized) / Critical movement delay (unsignalized)

As shown in the table, a signalized intersection at the Laurel Lane/I-84 WB Ramp Terminal intersection is not forecast to meet the interchange design standard for a signalized intersection at a ramp terminal. Furthermore, the projected 95th percentile vehicle queue is forecast to be 450 feet. This queue length will back up into the portion of the ramp needed for safe deceleration of I-84 mainline speeds.

Appendix E Mobility Advisory Committee
Meeting Minutes

Mobility Advisory Committee Meeting Minutes

ODOT SPDB Mobility Program

Meeting Date/Time November 12, 2020; 1 PM via WebEx

Facilitator Pete Pande, Pivotal Resources

Attendees		
ODOT		
Name	Title	Representing (Division/Region)
Jennifer Bachman	Resident Engineer – Consultant Projects	Delivery & Operations/ Region 1
Nikki Bakkala	Mobility Operations Program Coordinator	Delivery & Operations/ SPDB
Manny Boswell	Mobility Program Analyst	Delivery & Operations/ SPDB
Tamira Clark	Project Development Section Manager	Delivery & Operations/ SPDB
Mike Doane	Region 2 Mobility Liaison	Delivery & Operations/ Region 2
Donnell Fowler	Programs Development Office Manager	Delivery & Operations/ SPDB
Teresa Gibson	Region 4 Mobility Liaison	Delivery & Operations/ Region 4
Bill Gross	Mobility Program Training Coordinator	Delivery & Operations/ SPDB
Jessica Horning	Pedestrian and Bicycle Program Manager	Public Transportation Division
Christy Jordan	Mobility Program Manager	Delivery & Operations/ SPDB
Mike Kimlinger	State Traffic - Roadway Engineer - Section Manager	Delivery & Operations/ SPDB
Curran Kleen-Brown	Mobility Program Analyst	Delivery & Operations/ SPDB
Jeffrey Lange	Transportation Project Manager	Delivery & Operations/ Region 2
Debbie Martisak	Region 1 Mobility Liaison	Delivery & Operations/ Region 1
Ken Patterson	Area Manager	Delivery & Operations/ Region 5
Teresa Penninger	Planning Manager	Delivery & Operations/ Region 5
Katie Scott	Mobility Operations Program Coordinator	Delivery & Operations/ SPDB
Jeff Wise	Region 5 Mobility Liaison	Delivery & Operations/ Region 5
External Stakeholders		
Name	Title	Representing (Org./Association)
Steve Bates	President	V. Van Dyke
Walt Gamble	Walt Gamble Engineering	AGC
Mavis Hartz	Committee Member	OBPAC
Jana Jarvis	President	OTA
Kristine Kennedy	President	Highway Heavy Hauling
Eric Zander	Chief Operating Officer	Omega Morgan
External Consultants		
Name	Title	Representing (Org./Association)
Matt Hughart	Principle Planner	Kittelsohn & Associates
Jared Trowbridge	Project Manager	DOWL
Nate Schroeder	Design Group Manager	DKS Associates
Local City/ County or Metropolitan Planning Organization/ Development Review Representatives		
Name	Title	Representing (City/County/Development)
Jacob Cain	Director of Engineering	Port of Morrow
Carla McLane	Consultant	Port of Morrow
Lisa Mittelsdorf	Economic Development Director	Port of Morrow
Ryan Neal	Executive Director	Port of Morrow
Mark Patton	Chief Operations Officer	Port of Morrow

Mobility Advisory Committee Meeting Minutes

ODOT SPDB Mobility Program

Agenda Topics, Highlights, Outcomes, & Action Items	
Topic	Port of Morrow Interchange Area Management Plan Update
Brief Description	<p>Presentation slides link: Port of Morrow IAMP Presentation</p> <p>This interchange area management plan (IAMP) was brought to the committee to seek early feedback on intersection design concepts for the I-84/Laurel Lane interchange area. The plan includes proposed roundabout designs for the north side of the interchange.</p>
Objective	Provide early communication and seek feedback on intersection design concepts.
Discussion Summary	<p>Carla McLane provided background on the plan. She says it was originally adopted about 10 years ago and focused mostly on the south side of the interchange.</p> <p>Matt Hughart explained the technical aspects of the plan. He said concepts 'D' and 'C2' scored the highest among the options for addressing traffic, safety, land use impacts and other criteria.</p> <p>Erik Zander commented that the proposed roundabout will make it harder to move windmill blades onto I-84, as the alternate routes are not ideal for moving them.</p> <p>Mavis Hartz commented that she would like to see a protected lane for bicycles and pedestrians, and questioned how they would move to the other side of the intersection.</p> <p>Jessica Horning commented that ODOT is required by statute to provide accommodations for bicycles and pedestrians whenever we construct or reconstruct public roadways – even if it is to accommodate a small number of people.</p> <p>Ken Patterson reiterated that this is a planning level document, and there is a lot of design detail that will need to come back to the committee until such time there is funding available to make improvements at the interchange.</p> <p>Walt Gamble commented that it is his understanding the concept for the roundabout would allow trucks to go straight over the roundabout if necessary.</p> <p>Erik commented that it is great to see the region bring the project to the committee early.</p>
Decision/Outcome	None
Follow-Up Action Items	<ul style="list-style-type: none"> • Omega Morgan would like to see the windmill blade diagrams (recently sent to the Mobility Services Team), run through the proposed roundabout(s). <i>*Katie Scott sent these diagrams to Region 5 via email.</i> • The MAC requests other design concepts be looked at (referencing similar intersection solutions in other parts of the State), and brought to the table.