

TECHNICAL MEMORANDUM #4

Pendleton IAMPs: Exit 210

Future Baseline Conditions: Transportation System Operations

Date: January 28, 2020

Project #: 24043

To: Technical Advisory Committee, Citizen Advisory Committee

From: Amy Griffiths, Mark Heisinger, Nick Foster, AICP, and Matt Hughart, AICP; Kittelson & Associates, Inc.

This memorandum describes future land-use and traffic growth projections and future traffic operations within the vicinity of the I-84 Exit 210 interchange. The information in this memorandum provides a basis for the development and analysis of potential project alternatives. It will inform the identification of various opportunities and constraints for meeting the goals and objectives of the interchange area management plan (IAMP).

FUTURE LAND USE ANALYSIS

The analysis of potential future land use in the Interchange Management Study Area (IMSA) builds off the analysis of vacant and re-developable land presented in the *Existing Conditions: System Inventory* memorandum (Reference 1). Most vacant and re-developable land within the IMSA is located northeast and south of the Exit 210 interchange. Vacant and re-developable land northeast land is primarily zoned for residential uses (i.e., R-1 – Low Density Residential, R-2 – Medium Density Residential, or R-3 – High Density Residential), commercial uses (i.e., C-3 – Service Commercial), or farm use (i.e., EFU-CO – Farm Use). Vacant and re-developable land south of the interchange is zoned for commercial uses (i.e., C-3 – Service Commercial and C-2 – Tourist Commercial).

The project team evaluated the development potential of the vacant and re-developable lands under their current zoning designations. Table 1 summarizes the results of this analysis by zone. Note that this analysis assumes full build-out of the vacant and re-developable properties and does not necessarily reflect 20-year development projections.

Table 1 – Estimated Development Potential

Zoning Designation	Development Potential
Residential (R-1, 2, & 3 & EFU)	250 - 2,100 ¹
Tourist Commercial (C-2)	11,000 ²
Service Commercial (C-3)	378,000 ²

¹ number of units

²sq. ft of gross leasable area

The land-use analysis is further described in Attachment "A."

FUTURE GROWTH PROJECTIONS

The project team obtained the Pendleton Travel Demand Model for year 2015 and year 2040 from the Oregon Department of Transportation (ODOT) and used it to develop future traffic volumes within the Exit 210 Operations and Access Study Area (OASA). This process included manually redistributing some volumes and then post-processing the volumes using National Cooperative Highway Research Program (NCHRP) Report 765 methodology to develop intersection turning movement and link volumes for the AM and PM peak hours.

In addition to analyzing the processed volumes from the ODOT travel demand model, the project team also conducted a sensitivity analysis assuming additional growth in the vacant properties northeast and south of the interchange.

Modifications to Travel Demand Model Projections

An initial review of the future travel demand model revealed several roadway links within the Exit 210 OASA that experienced a decline in traffic volumes between year 2015 and year 2040. These declines were inconsistent with the projected growth in employment in the area. Further inspection revealed that the model was routing large amounts of traffic along US 30 to the Barnhart Road interchange with I-84 via a new connection along Old Airport Road (i.e., shifting demand from I-84 to this northerly route). To address this unrealistic shift in volumes, the project team redistributed some traffic volume from the US 30-Old Airport Road-Barnhart Road route to I-84 through the Exit 207 and Exit 210 interchanges. The project team also redistributed some local road traffic volumes to achieve growth commensurate with the expected increase in development in the area.

Developing Final Projected Volumes from the Travel Demand Model

The project team post-processed the redistributed model volumes using the NCHRP Report 765 methodology, as recommended by the ODOT *Analysis Procedures Manual* (Reference 1). This analysis produced year 2040 intersection turning movements and I-84 link volumes for the AM and PM peak hours. These volumes were then balanced between study intersections. The resulting year 2040 traffic volumes are shown in Figures 1 and 2 for the AM and PM peak hour, respectively.

FUTURE BASELINE TRANSPORTATION SYSTEM OPERATIONS

The project team analyzed year 2040 AM and PM peak hour transportation operations for all study intersections within the Exit 210 OASA and for all I-84 merge, diverge, and mainline segments within the vicinity of the Exit 210 interchange. The traffic operations analysis was performed in accordance with the same methodologies used for the existing conditions operations analysis, presented in the *Existing Conditions: Transportation System Operations* memorandum (Reference 2).

ODOT uses volume-to-capacity (V/C) ratios to assess highway segment and intersection operations. The applicable mobility targets at each of the Exit 210 OASA study intersections, I-84 interchange terminals, and highway segments are summarized in Table 2.

Table 2 – Study Intersection Performance Targets

Intersection	OHP Mobility Target
OR 11/SE Isaac Avenue	0.80 OR 11 approach / 0.90 Isaac Avenue approach
OR 11/SE Kirk Avenue	0.80 OR 11 approach / 0.90 Kirk Avenue approach
I-84 Westbound Ramp Terminal/OR 11	0.85 ¹
I-84 Eastbound Ramp Terminal/OR 11	0.85 ¹
SE 3 rd Avenue/SE Nye Avenue ²	0.90 ²

¹ The I-84 westbound and eastbound ramp terminals were evaluated with a more conservative v/c of 0.85 per Action 1F.1 of the Oregon Highway Plan.

² The City of Pendleton does not have intersection or roadway performance targets – target v/c of 0.90 assumed.

³ The highway segment mobility target for I-84 is 0.80.

Study Intersections

The results of the year 2040 traffic operations analysis for the study intersections are shown in Figures 1 and 2 for the AM and PM peak hours, respectively. The critical movements at each intersection are forecast to operate under the applicable mobility targets outlined in Table 2. *Intersection operations worksheets are shown in Attachment “B.”*

I-84 Merge, Diverge, and Mainline Segments

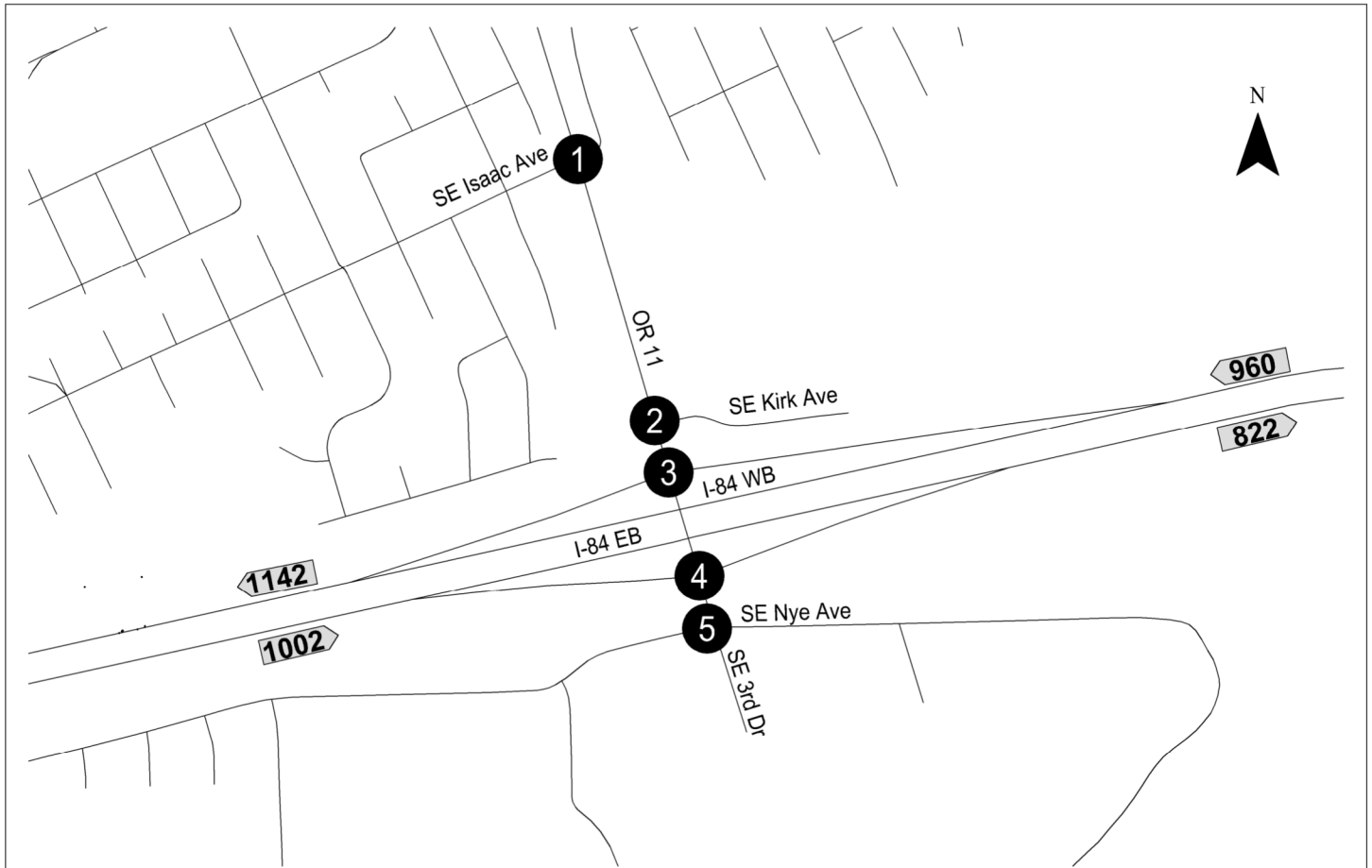
The results of the year 2040 traffic operations analysis for I-84 merge, diverge, and mainline segments are shown in Table 3. As shown in Table 3, all segment v/c ratios are forecast to operate below the target v/c ratio of 0.80 during the AM and PM peak hours. *Freeway operations worksheets are shown in Attachment “C.”*

Table 3 I-84 AM and PM Peak Hour Operations

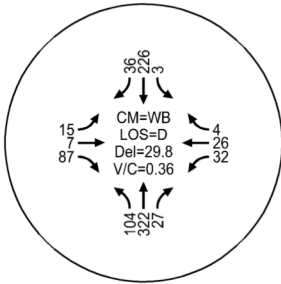
Segment #	Direction	Type	Location	LOS ¹		V/C ²	
				AM	PM	AM	PM
1	EB	Diverge	W of EB Off-Ramp	B	B	0.32	0.36
2	EB	Main	EB Off-Ramp to EB On-Ramp	A	B	0.30	0.34
3	EB	Merge	EB On-Ramp	B	B	0.36	0.40
4	WB	Diverge	EB of WB Off-Ramp	B	B	0.38	0.39
5	WB	Main	WB Off-Ramp to WB On-Ramp	B	B	0.36	0.35
6	WB	Merge	WB On-Ramp	C	B	0.55	0.40

¹Level-of-service – defined in terms of vehicle density (passenger car/mile/lane).

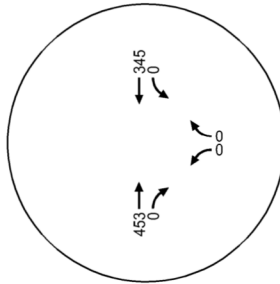
² Volume-to-capacity ratio. For merge/diverge segments – the reported v/c indicates worst-case for either the ramp or mainline facilities.



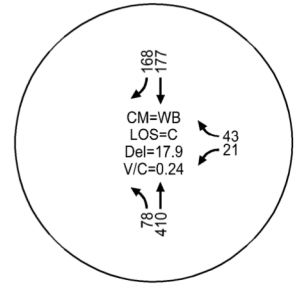
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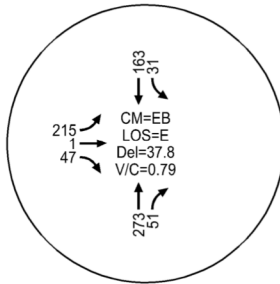
2 SE Kirk Ave / OR 11



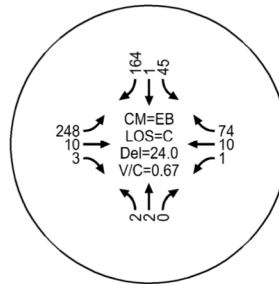
3 I-84 WB Ramp Terminal / OR 11



4 I-84 EB Ramp Terminal / OR 11



5 SE Nye Ave / SE 3rd Dr

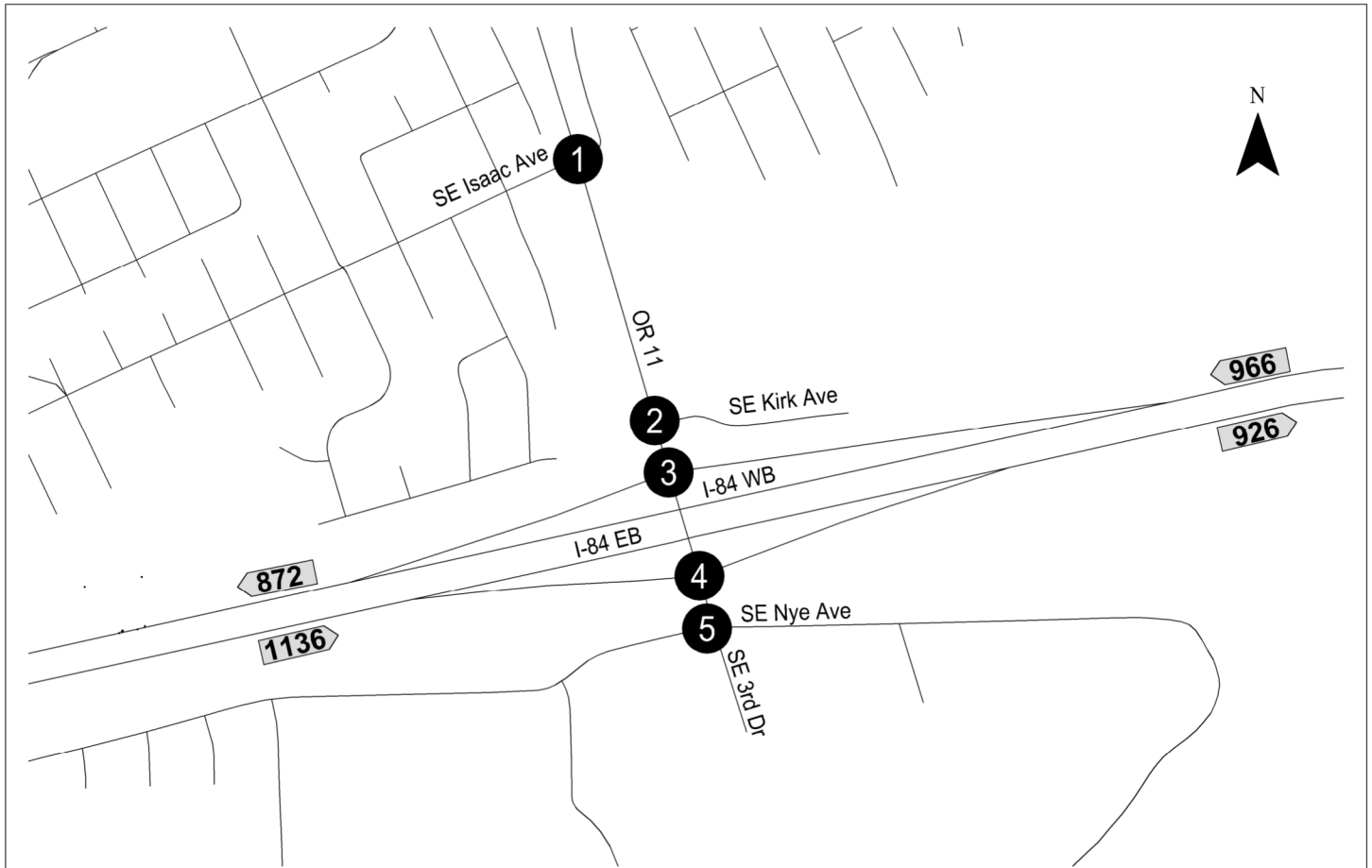


- # - Study Intersections
- CM - Critical Movement
- LOS - Level of Service
- Del - Vehicle Delay (s)
- V/C - Volume-To-Capacity Ratio
- ### - I-84 Peak Hour Volume

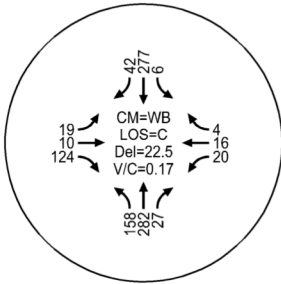
**Future AM Peak Hour Traffic Operations
Exit 210
Pendleton, OR**

**Figure
1**

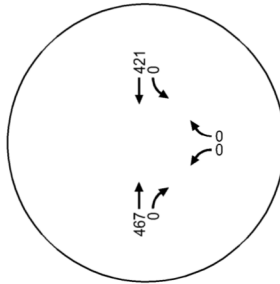
H:\2A\24043 - Pendleton IAMPs (20' & 210)\dwgs\Lane Configurations Exit 210_AEG.dwg Jan 22, 2020 - 10:39am - agriffiths Layout Tab: Futur e AM



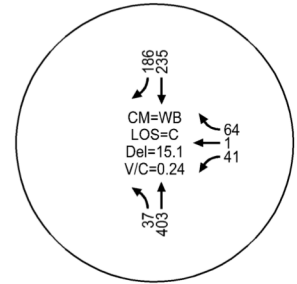
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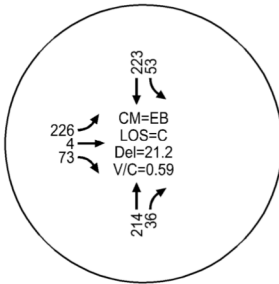
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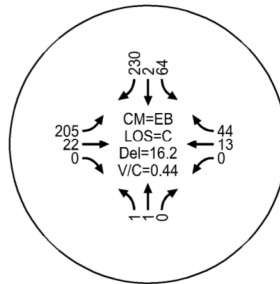
3 I-84 WB Ramp Terminal / OR 11



4 I-84 EB Ramp Terminal / OR 11



5 SE Nye Ave / SE 3rd Dr



- # - Study Intersections
- CM - Critical Movement
- LOS - Level of Service
- Del - Vehicle Delay (s)
- V/C - Volume-To-Capacity Ratio
- ### - I-84 Peak Hour Volume

Future PM Peak Hour Traffic Operations
Exit 210
Pendleton, OR

Figure
2

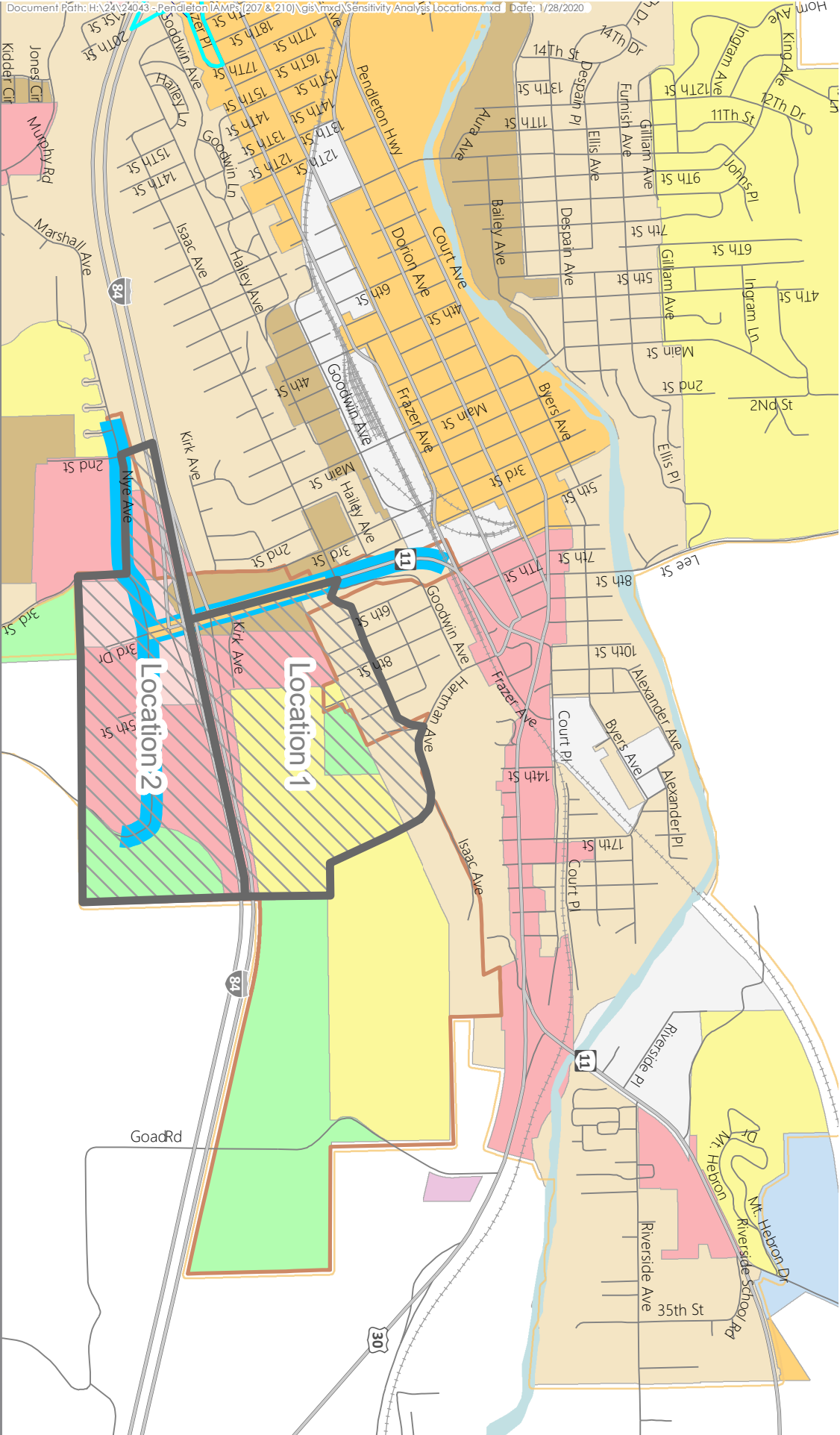
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Sensitivity Analysis

As noted previously, the travel demand model assumed modest growth in the study area, below the development potential of the area. Therefore, the project team conducted a sensitivity analysis to evaluate the effect that additional development might have on the Exit 210 OASA. This analysis focuses on growth that could occur in two general areas that will have a direct effect on the function of the Exit 210 interchange:

- **Location 1:** Vacant properties northeast of the Exit 210 interchange. They are accessed by Kirk Avenue, Isaac Avenue, and Goad Road. These properties are currently zoned for Service Commercial, Low-Density Residential, Medium-Density Residential, High-Density Residential and Farm uses.
- **Location 2:** Infill development south of the Exit 210 interchange. These properties access Nye Avenue on either side of SE 3rd Drive. These properties include the former Bi-Mart site, the vacant property east of the Super 8 Hotel, and the vacant property east of the Hampton Inn. These properties are zoned for Service Commercial

Locations 1 and 2 and their underlying zoning designations are shown in Figure 3.



Sensitivity Analysis Locations

- Minimum 1320' IAMP Limits
- Operations/Access Study Area
- Interchange Management Study Area
- Pendleton City UGB

Zoning Classification

- CMU - Central Mixed Use
- C-2 - Tourist Commercial
- C-3 - Service Commercial
- M-1 - Light Industrial
- M-2 - Heavy Industrial
- AA - Airport Activities
- R-1 - Low Density Residential
- R-2 - Medium Density Residential
- R-3 - High Density Residential
- EFU-CO - Farm Use
- IRA - Industrial Reserve Area Overlay
- UC - Uncorporated Community
- RR-2 - Rural Residential 2 Ac
- RR-4 - Rural Residential 4 Ac
- RHI - Rural Heavy Industrial
- RLI - Rural Light Industrial



Sensitivity Analysis Locations and Zoning
Exit 210

Figure 3

Sensitivity Analysis - Trip Generation and Trip Distribution

The additional development assumed in the sensitivity analysis was based on the build-out of Location 1 and 2 in accordance with the current City of Pendleton zoning designations¹. Tables 3 and 4 show the assumed level of development and their trip generation potential in Locations 1 and 2, respectively.

Table 4 Trip Generation Northeast of Exit 210 Interchange (Location 1)

Land Use (unit type)	ITE Code ¹	Units	Daily	Weekday AM Peak Hour			Weekday PM Peak Hour		
				Total	In	Out	Total	In	Out
Multi-family Housing (Low-Rise)	220	94	670	45	10	35	56	35	21
Single-family Housing	210	508	4638	365	91	274	484	305	179
Total Residential:			5308	410	102	309	540	340	200
Gas Station (1000 sf)	944	1	1203	85	42	43	109	55	54
Shopping Center (1000 sf)	820	116	6650	210	130	80	606	291	315
Hotel (rooms)	310	100	702	45	26	18	49	25	24
Fast Food (1000 sf)	934	3	1413	121	61	59	98	51	47
Total Commercial:			9968	460	260	200	863	422	441
Internal Capture (Commercial):			-1196	-60	-34	-26	-95	-46	-48
Total Commercial (Adjusted for Internal Capture):			8772	400	226	174	768	376	392
Total:			14,080	810	328	482	1307	716	592

¹In accordance with ITE Trip Generation Manual 10th Edition (Reference 3)

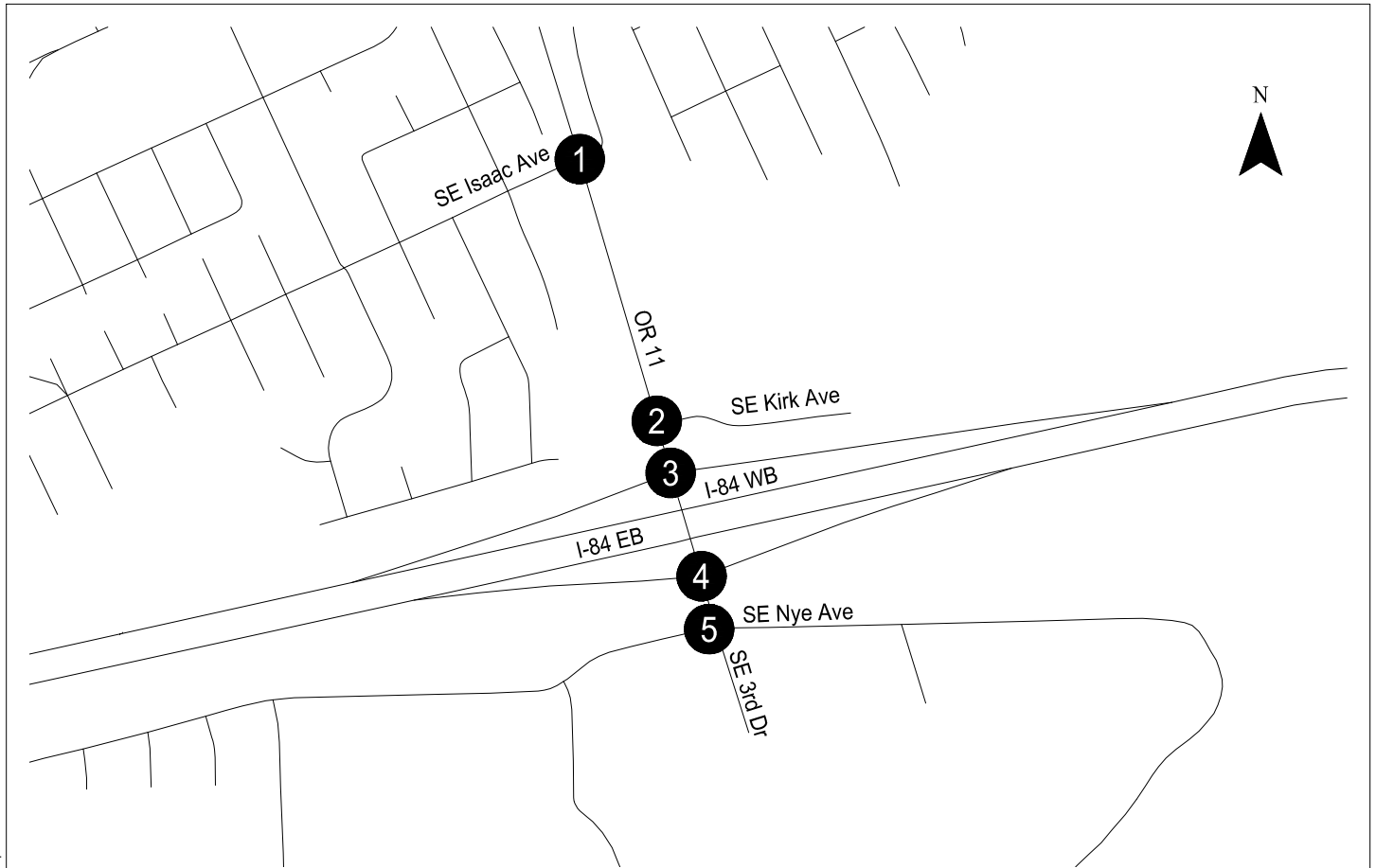
Table 5 Trip Generation South of Exit 210 Interchange (Location 2)

Land Use (unit type)	ITE Code ¹	Units	Daily	Weekday AM Peak Hour			Weekday PM Peak Hour		
				Total	In	Out	Total	In	Out
Hotel - West of 3rd Dr (rooms)	310	100	702	45	26	18	49	25	24
Hotel - East of 3rd Dr (rooms)	310	100	702	45	26	18	49	25	24
Gas Station (1000 sf)	944	1.8	2165	152	76	76	197	98	99
Fast Food (1000 sf)	934	3	1413	121	61	59	98	51	47
Total:			4982	362	190	172	393	199	194

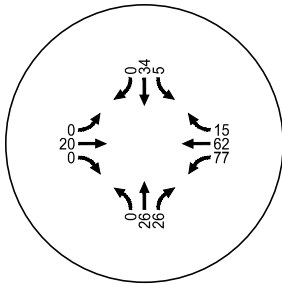
¹In accordance with ITE Trip Generation Manual 10th Edition (Reference 3)

As shown in Tables 3 and 4, there are approximately 1,200 trips generated in the AM peak hour and 1,700 trips generated in the PM peak hour by the additional development. The project team assigned the trips onto the surrounding roadway network, assuming that most of the trips are I-84-oriented, as shown in Figures 4 and 5 for the AM and PM peak hours, respectively.

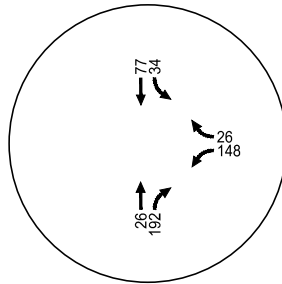
¹ The area in Location 1, northeast of the Exit 210 interchange, is designated as a Mixed-use Opportunity Area in the City's Comprehensive Plan. This designation allows the underlying zoning of this area to change with a master plan development application.



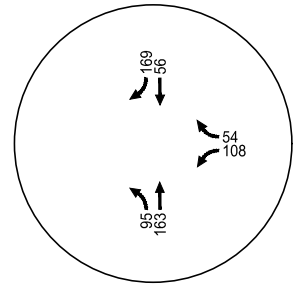
1 SE Isaac Ave / OR 11



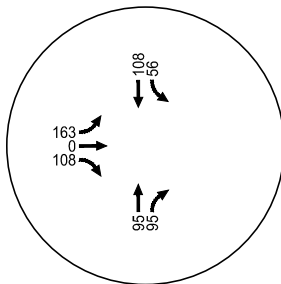
2 SE Kirk Ave / OR 11



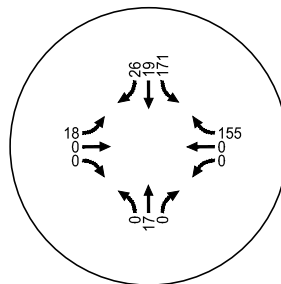
3 I-84 WB Ramp Terminal / OR 11



4 I-84 EB Ramp Terminal / OR 11



5 SE Nye Ave / SE 3rd Dr

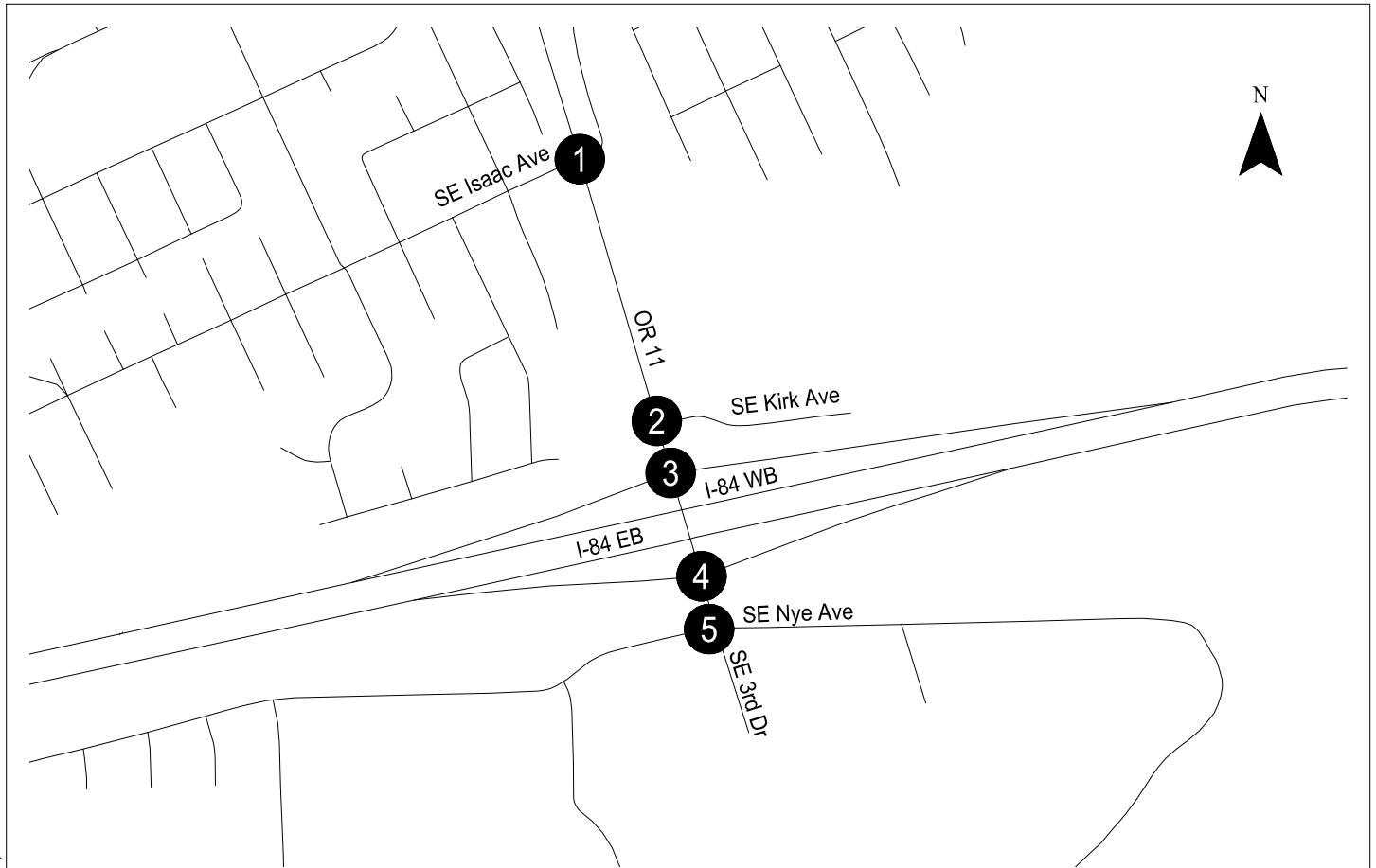


- Study Intersections

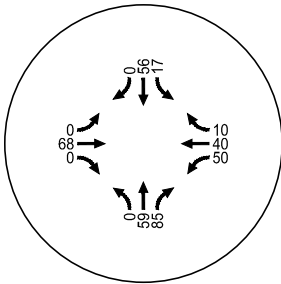
Future AM Peak Hour Trip Assignment
Sensitivity Analysis - Exit 210
Pendleton, OR

Figure
4

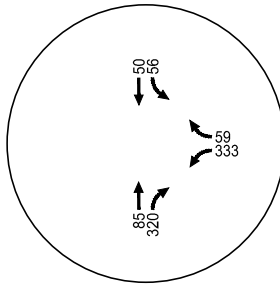
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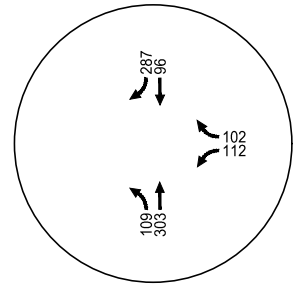
1 SE Isaac Ave / OR 11



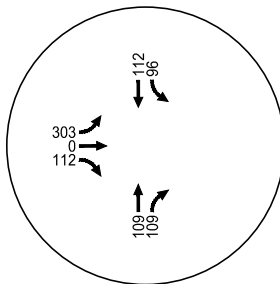
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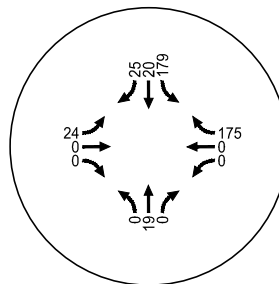
3 I-84 WB Ramp Terminal / OR 11



4 I-84 EB Ramp Terminal / OR 11



5 SE Nye Ave / SE 3rd Dr



- Study Intersections

Future PM Peak Hour Trip Assignment Sensitivity Analysis - Exit 210 Pendleton, OR

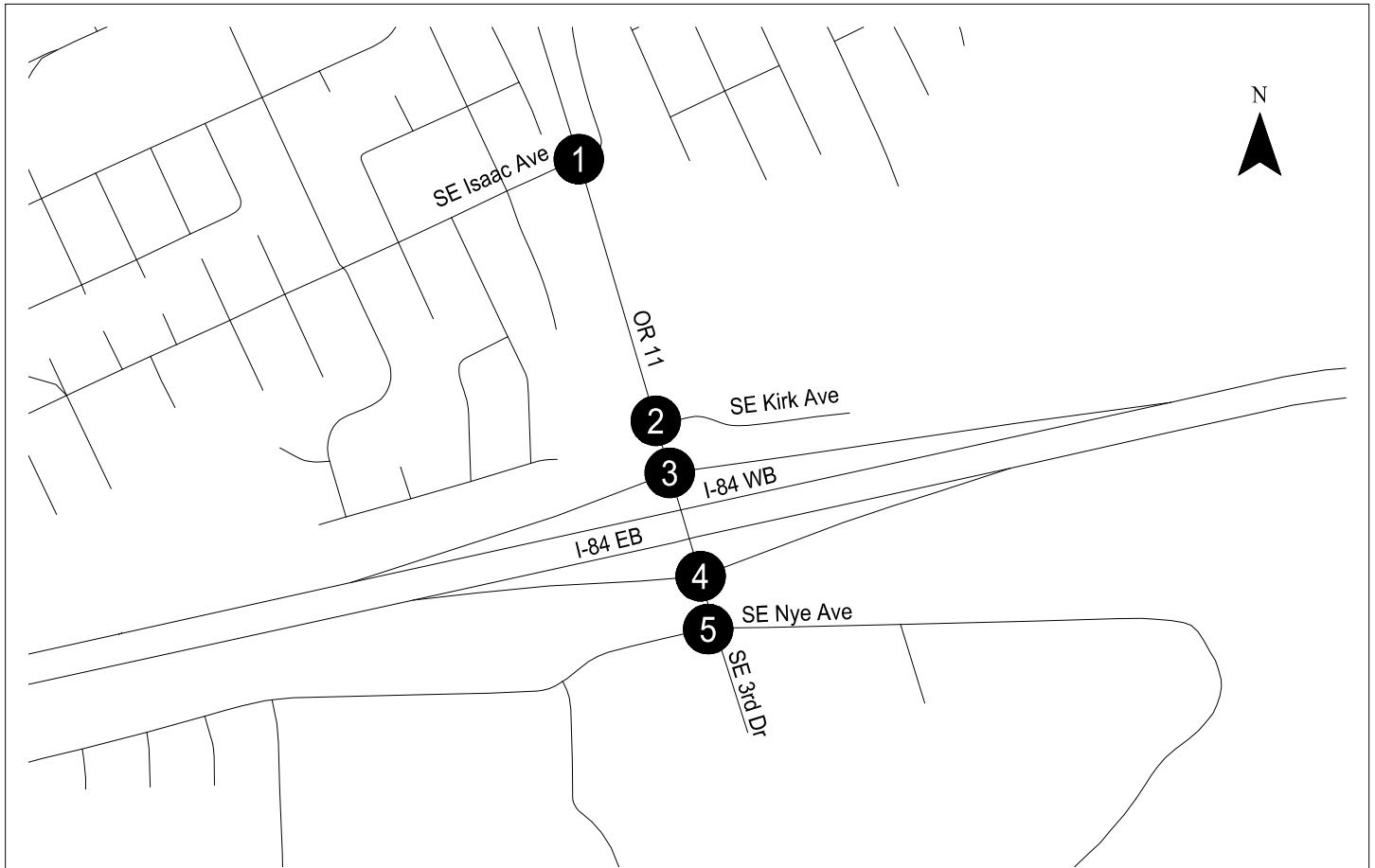
Figure 5

Sensitivity Analysis – Study Intersection Traffic Operations

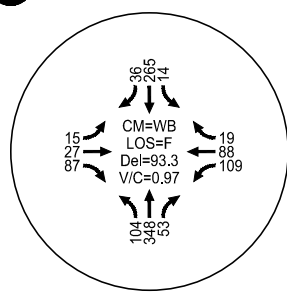
The results of the year 2040 traffic operations analysis for the study intersections are shown in Figures 6 and 7 for the AM and PM peak hours, respectively. The critical movements at each intersection operate above the applicable mobility targets outlined in Table 1, except for the SE Kirk Ave/OR 11 intersection in the AM peak hour. The critical movements of all intersections operate at level of service (LOS) F during the AM and PM peak hour, except for the SE Kirk Ave/OR 11 intersection in the AM peak hour which operates at LOS D. *Intersection operations worksheets are included in Attachment “D.”*

NEXT STEPS

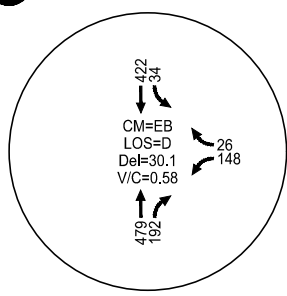
The project team will review the findings of these analyses with the project Technical and Citizen Advisory Committees (TAC/CAC). The results of these findings will be used to create project alternatives for the Exit 210 interchange area. These alternatives may include modifications related to the Exit 210 interchange, local circulation and/or access, and/or land development requirements/guidelines.



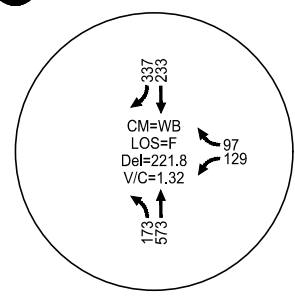
1 SE Isaac Ave / OR 11



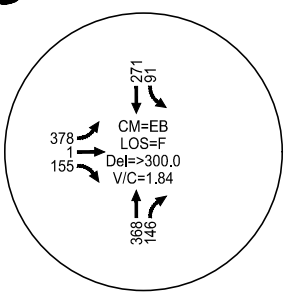
2 SE Kirk Ave / OR 11



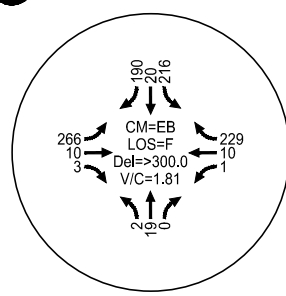
3 I-84 WB Ramp Terminal / OR 11



4 I-84 EB Ramp Terminal / OR 11



5 SE Nye Ave / SE 3rd Dr



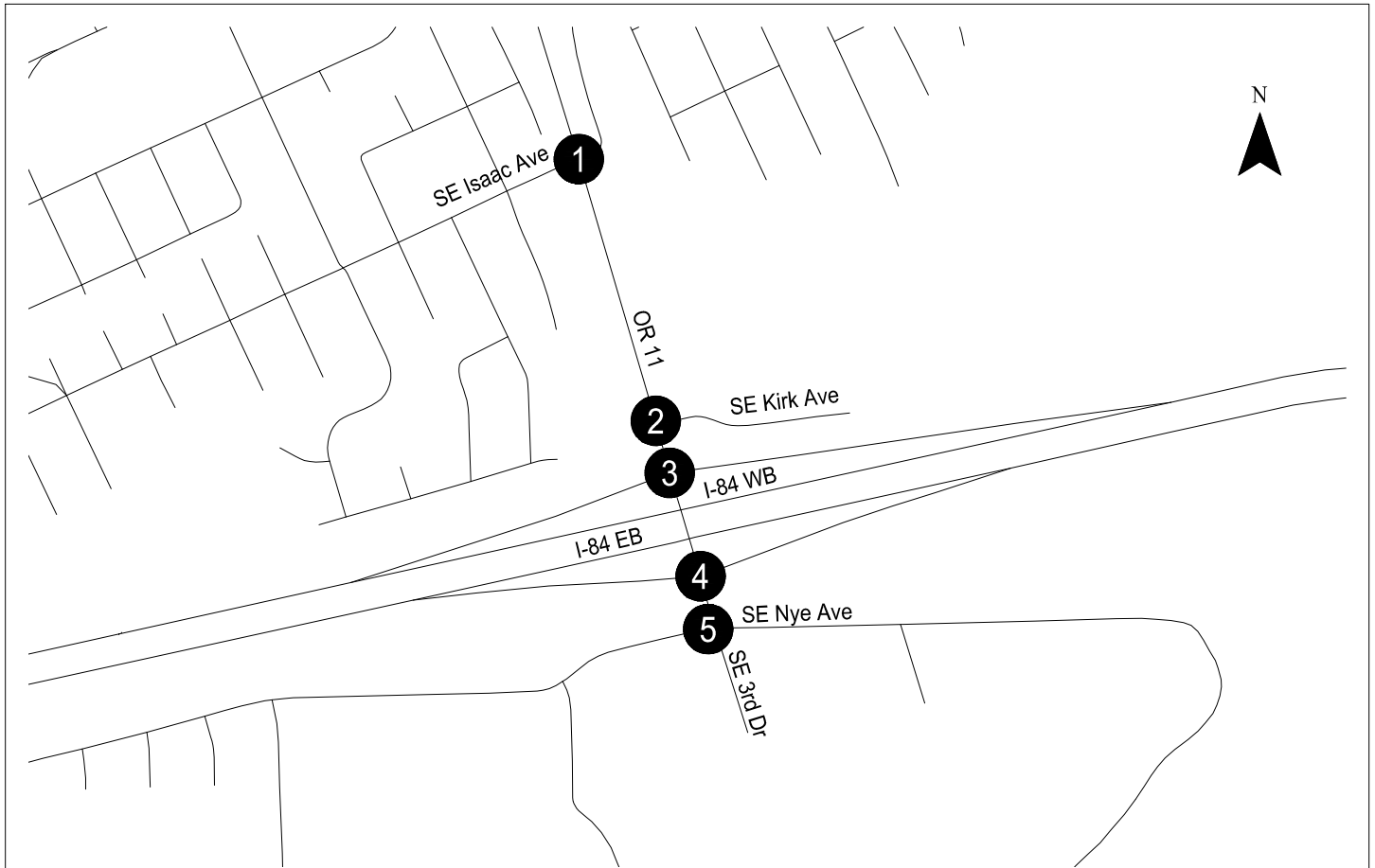
- Study Intersections
 CM - Critical Movement
 LOS - Level of Service
 Del - Vehicle Delay (s)
 V/C - Volume-To-Capacity Ratio

Future AM Peak Hour Traffic Operations
 Sensitivity Analysis - Exit 210
 Pendleton, OR

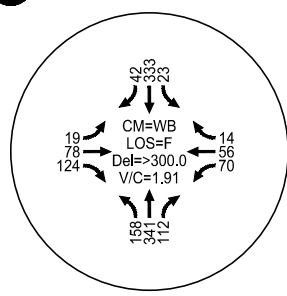
Figure
 6

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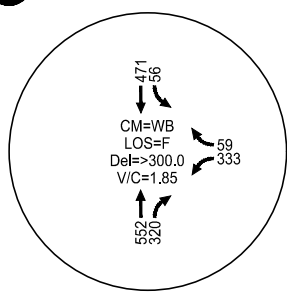




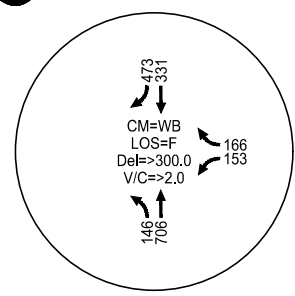
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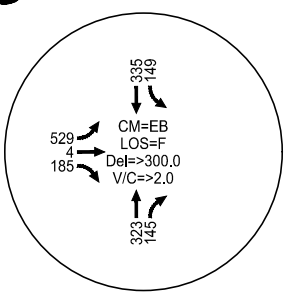
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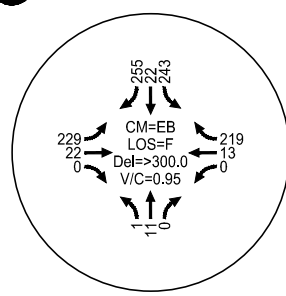
3 I-84 WB Ramp Terminal / OR 11



4 I-84 EB Ramp Terminal / OR 11



5 SE Nye Ave / SE 3rd Dr



- Study Intersections
 CM - Critical Movement
 LOS - Level of Service
 Del - Vehicle Delay (s)
 V/C - Volume-To-Capacity Ratio

Future PM Peak Hour Traffic Operations
 Sensitivity Analysis - Exit 210
 Pendleton, OR

Figure
 7

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REFERENCES

1. Oregon Department of Transportation. *Analysis Procedures Manual – Version 2*. 2019.
2. Kittelson and Associates, Inc. *Pendleton IAMPs: Exit 210 – Existing Conditions: Transportation System Operations*. 2019.
3. Institute of Transportation Engineers. *Trip Generation Manual – 10th Edition*. 2017.