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TECHNICAL MEMORANDUM #6 (Exit 207)

Pendleton IAMPs: Exit 207

Preferred Concept

Date:	August 25, 2020	Project #: 24043
To:	Technical Advisory Committee, Citizen Advisory Committee	
From:	Amy Griffiths; Nick Foster, AICP, RSP; and Matt Hughart, AICP	

This memorandum describes and evaluates the preferred interchange and local circulation improvement concept developed for the Exit 207 Interchange Area Management Plan (IAMP). The preferred concept was developed through an evaluation process that included a high-level screening of initial interchange alternatives, a detailed evaluation of two selected alternatives, and feedback from the project's advisory committees.

SUMMARY OF CONCEPT EVALUATION

The Exit 207 interchange and local circulation improvement ideas were initially developed by members of the project team, the Technical Advisory Committee (TAC), and the Citizen Advisory Committee (CAC) to address known, and anticipated future, geometric and traffic operations and safety conditions. The project team distilled these ideas into unique concepts, which were evaluated in a tiered evaluation process against an established set of criteria. This evaluation was described in *Technical Memorandum #5* (Reference 1).

TAC/CAC Meeting #3 Results

The findings of *Technical Memorandum #5* (Reference 1) were discussed at TAC/CAC Meeting #3, which was held on June 10, 2020. It was determined at the meeting that the preferred concept would be Concept #1B with Accessory #2 (assuming a detailed engineering evaluation finds a roundabout at Airport Road physically possible). If it was determined that the Accessory #2 roundabout at Airport Road would not be possible, then the preferred concept would be Concept #1B paired with the signalization of Airport Road from Concept #3.

PREFERRED CONCEPT

This section describes and evaluates the preferred concept for the Exit 207 interchange. Figure 1 shows a concept drawing of the preferred concept.

The fundamental components of the preferred concept are listed below and shown in Figure 1.

A. **I-84 Westbound Ramp Reconfiguration:** Convert the westbound interchange ramps to a diamond form with a roundabout at the ramp terminal intersection. This includes:
    - Realigning the existing westbound off-ramp away from its current intersection across from Airport Road
    - Removing the I-84 westbound looping on-ramp
    - Realigning the I-84 westbound on-ramp on the north side of US 30 to align with the roundabout ramp terminal.

B. **Airport Road/US 30 Intersection Reconfiguration:** Convert the existing intersection to a roundabout with four legs: Airport Road, US 30 (Westgate), and a new access road behind the businesses on the north side of US 30.
    - The roundabout could be constructed with minimal impacts to private right-of-way.
    - Based on initial consideration of elevation profiles in Google Earth and an overlay of the newly-constructed crime lab, this roundabout appears feasible to construct, though it will likely require significant cut and fill.
    - The roundabout will require either relocating or eliminating the new public street that connects Airport Road and provides access to the Oregon State Police (OSP) crime lab. Access to the OSP lab may be relocated to the new access road described below or cross-access could potentially be provided through the property to the north.

C. **New Access Road:** Construct a new access road for businesses on the north side of US 30 (Westgate). Access to US 30 is relocated to this road as properties redevelop to improve access spacing along US 30.

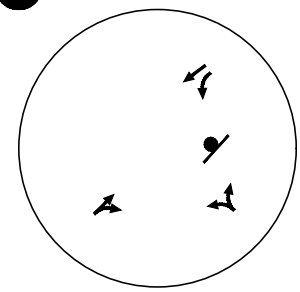
Operations Evaluations Results

The assumed lane configurations for the preferred concept are shown in Figure 2. The year 2040 AM and PM motor vehicle traffic volumes and operations are shown in Figure 3 and Figure 4 respectively. All intersections are projected to operate under-capacity and meet ODOT mobility targets with the lane configurations shown in Figure 2. *Traffic operations worksheets are shown in Attachment "A."*

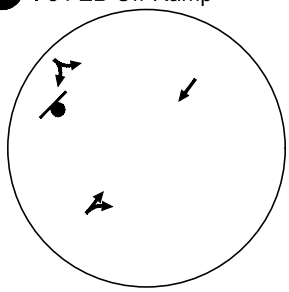
Exit 207 Preferred Concept
Pendleton, OR

Figure 1

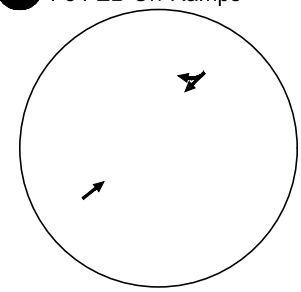
1 Rieth Rd / NW Pioneer Pl



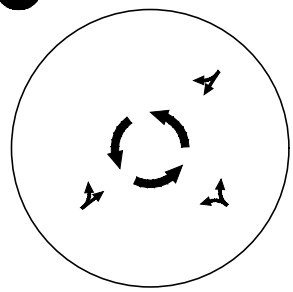
2 US 30 / I-84 EB Off-Ramp



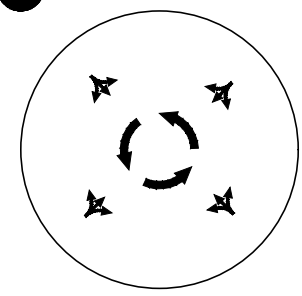
3 US 30 / I-84 EB On-Ramps



4 US 30 / I-84 WB On-Ramps



5 US 30 / Airport Road



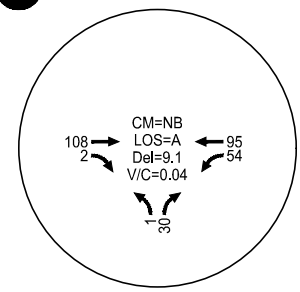
LEGEND

- Lane Movement
- # - Study Intersections
- Stop Sign

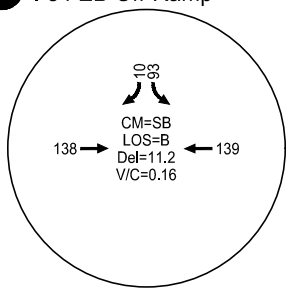
Lane Configurations
Exit 207 Preferred Concept
Pendleton, OR

Figure 2

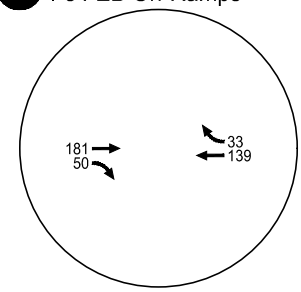
1 Rieth Rd / NW Pioneer Pl



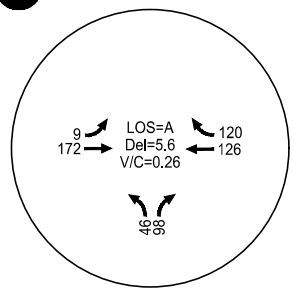
2 US 30 / I-84 EB Off-Ramp



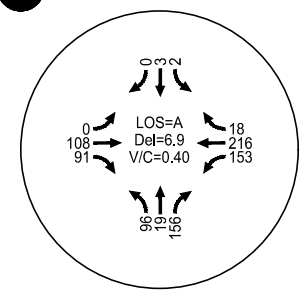
3 US 30 / I-84 EB On-Ramps



4 US 30 / I-84 WB On-Ramps



5 US 30 / Airport Road

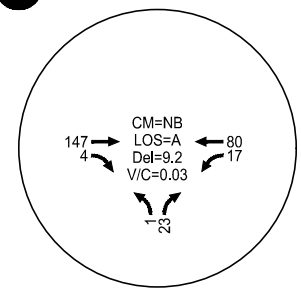


- Study Intersections
CM - Critical Movement
LOS - Level of Service
Del - Vehicle Delay (s)
V/C - Volume-To-Capacity Ratio

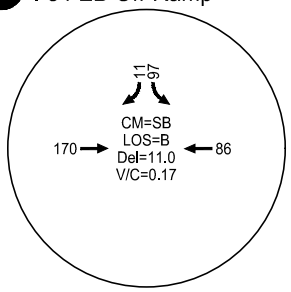
Future AM Peak Hour Traffic Operations
Exit 207 Preferred Concept
Pendleton, OR

Figure
3

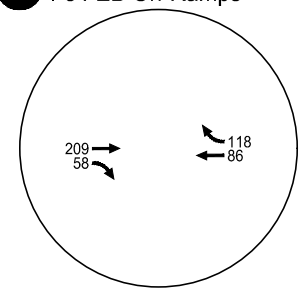
1 Rieth Rd / NW Pioneer Pl



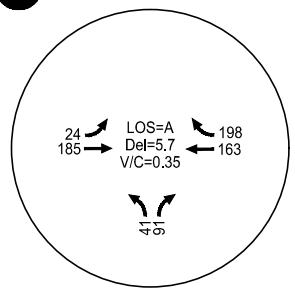
2 US 30 / I-84 EB Off-Ramp



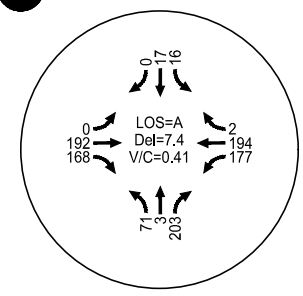
3 US 30 / I-84 EB On-Ramps



4 US 30 / I-84 WB On-Ramps



5 US 30 / Airport Road



(#) - 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
Exit 207 Preferred Concept
Pendleton, OR

Figure
4

Future Safety Effects

The crash histories at the study intersections and along the study area roadways were reviewed in the *Existing Conditions: Transportation System Operations* memorandum (Reference 2). Crash reduction factors (CRFs) for the roadway and intersection treatments were identified for Concept #1B with Accessory #2 in *Technical Memorandum #5* (Reference 1). The CRFs are used to estimate the potential reduction in crashes that could occur with the implementation of the preferred concept.

Table 1 shows the countermeasures considered in developing the CRF.

Table 1 Crash Reduction Factors

Countermeasures Considered	Crash Reduction Factor (CRF)	Appropriate Intersections/Segments
Convert interchange ramp terminal to roundabout[1]	24% (All Crashes)	US 30 / I-84 WB On-Ramp
Convert intersection with minor-road stop control to modern roundabout[2]	82% (Injury/Fatal Crashes)	US 30 / I-84 WB Off-Ramp / Airport Road
Change in driveway density[3]	16% (All Crashes)	US 30

[1] http://www.cmfclearinghouse.org/detail.cfm?facid=9445
[2] ODOT Crash Reduction Factor List H16
[3] Change in driveway density from 8 to 3 driveways in ¼ mile; http://www.cmfclearinghouse.org/detail.cfm?facid=2507

Table 2 shows the adjusted crash rates at the study intersections and roadway segments, based on the application of the CRFs presented in Table 1. The preferred concept is expected to reduce the study intersection and roadway segment crash frequencies in the study area.

Table 2: Crash Rate[1] Assessment

Study Intersection or Segment	Observed Crashes/Year[1]	Preferred Concept Adjusted Crashes/Year
Reith Road / NW Pioneer Place	0.00	0.00[2]
Rieth Road / I-84 EB Off-Ramp	0.20	0.20
US 30 / I-84 EB On-Ramp	0.00	0.00[2]
US 30 / I-84 WB On-Ramp	0.00	0.00[2]
US 30 / I-84 WB Off-Ramp / Airport Road	0.60	0.27
Airport Road / US 30	0.00	0.00[2]
Rieth Road (within Operation and Access Study Area)	0.40	0.40
US 30 (within Operation and Access Study Area)	0.40	0.33
Total	**1.60**	**1.20**

[1] Observed crashes per year from 2013 to 2017.
[2] The number of crashes per year in the long-term is likely more than 0; however, no crashes were reported at this intersection from 2013 to 2017.

Slide-offs on the I-84 Westbound Off-Ramp

Comments from several agency staff at ODOT, the City of Pendleton, and Oregon State Police, indicate that multiple slide-offs occur each year on the I-84 westbound off-ramp during icy conditions. This information does not show up in crash reports, because no damage typically occurs. To try to quantify these occurrences, ODOT provided dispatch logs for the Exit 207 area. From June 2015 through May 2020, there were 30 incidences (i.e., closures, disabled vehicles, crashes) that occurred on or near the I-84 westbound Exit 207 interchange that may be winter weather related. It is not clear from the records what number of these incidences occurred on the off-ramp. It is also not clear if these incidences capture each event that City or State police have responded to.

This history of slide-offs influenced the advisory committees' preferred concept recommendation. Concept #1B includes a full realignment of the westbound off-ramp into a diamond form that is straighter than the current loop ramp. This should reduce the likelihood of future slide-offs on this off-ramp.

Bicycle and Pedestrian Elements

The City of Pendleton's Transportation System Plan includes a project to either build a multi-use path along the north side of US 30 or to build sidewalk and bike lanes along both sides of US 30 through the project area. The realigned portions of US 30 would build out this project along those sections. Further, it is expected that sidewalks would be built along all other new roads and intersections (i.e., both roundabouts and along both sides of the proposed backage road).

Cost Estimates

Table 3 shows the cost estimate for the I-84 westbound ramp reconfiguration, the Airport Road/US 30 intersection reconfiguration, and the and new access road. The cost estimates assume a construction contingency cost of 20 percent, a construction engineering cost of 15 percent, and a preliminary engineering costs of 15 percent. The total cost of the preferred concept is estimated to be $8.8 million.

Table 3: Preferred Concept Cost Estimate

Component	Estimated Cost
I-84 Westbound Ramp Reconfiguration	$5,400,000
Airport Road/US 30 Intersection Reconfiguration and New Access Road	$3,400,000
Total	**$8,800,000**

This cost estimate is greater than the estimate presented in *Technical Memorandum #5* (Reference 1). This is the result of the more detailed assessment of the feasibility of the roundabout at the Airport Road/US 30 intersection, which revealed more information about the level of fill that would be required, as well as the inclusion of the sidewalk and bike lanes described in the preceding section. *Detailed cost estimate sheets are shown in Attachment "B*."

Access Plan

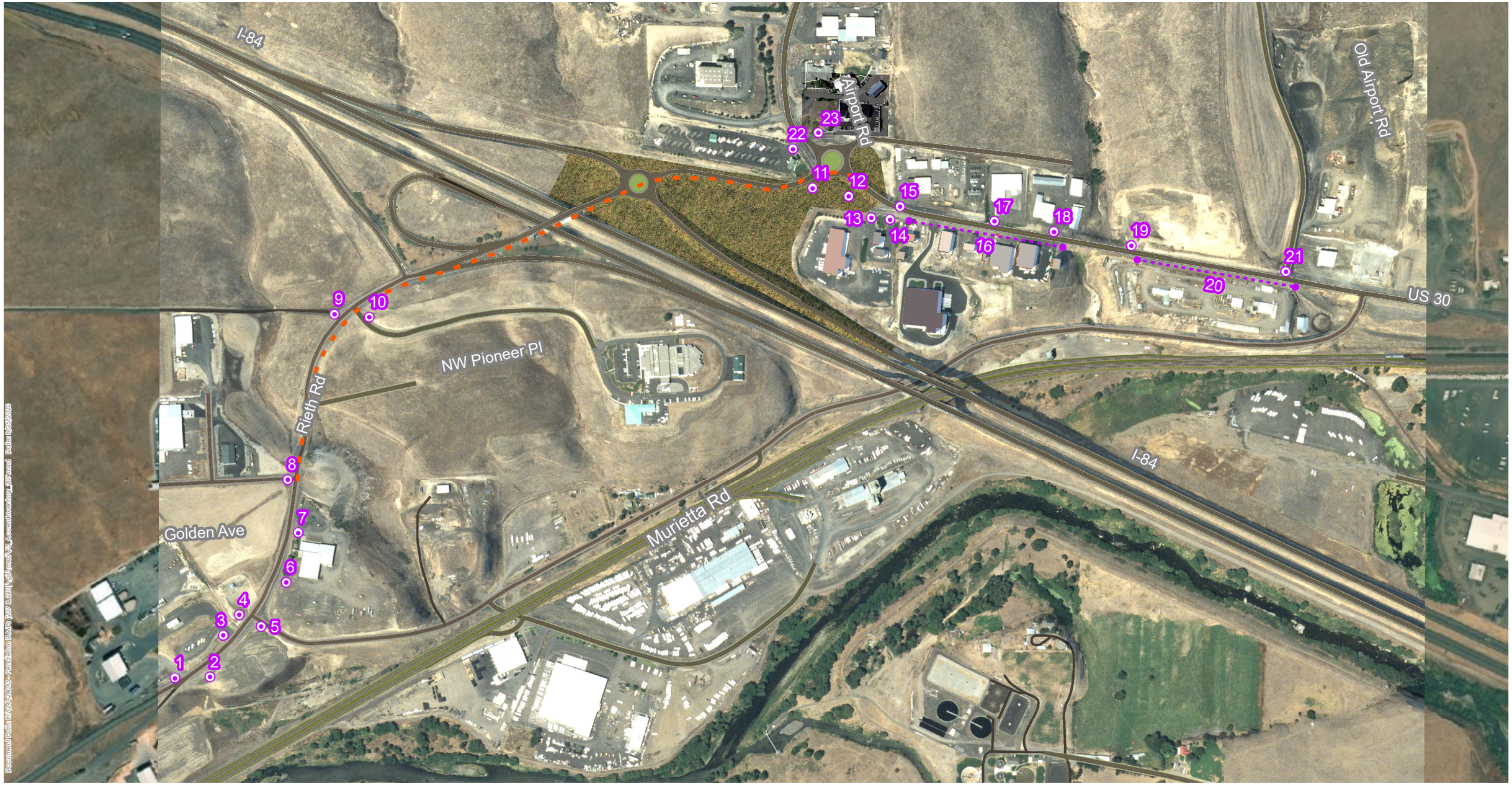
The project team has developed a preliminary access management plan for the Operations and Access Study Area (OASA) that reflects the preferred interchange concept. The plan aims to move access locations in the OASA towards ODOT's access spacing standards through consolidation of driveways and relocation of public streets. Some of these access changes would need to be implemented with the interchange reconfiguration and others are anticipated to occur over time as properties develop or redevelop.

As Figure 5 shows, there are 23 accesses within the OASA. Table 4 summarizes the proposed access management plan for the Exit 207 OASA for accesses located within ODOT's ¼-mile spacing standard. Accesses shaded grey are located within ¼ mile of the interchange ramp terminals.

Accesses 13, 14, 22, and 23 may be in the intersection influence area and may need to be modified to meet operational and safety performance standards. Details to be addressed in future design efforts.

Table 4 Access Management Plan for Exit 207 Interchange

Access Number	Roadway	Approach Type	Side of Roadway	Access Width (ft)[1]	Proposed Access Management Plan Action Under the Preferred Concept
1	Rieth Rd	Private	West	52	No changes are proposed to the accesses located outside of ODOT's ¼-mile spacing standard.
2	Rieth Rd	Private	East	400	
3	Rieth Rd	Private	West	72	
4	Rieth Rd	Private	West	20	
5	Rieth Rd	Public	East	90	
6	Rieth Rd	Private	East	45	
7	Rieth Rd	Private	East	45	
8	Rieth Rd	Public	West	47	Revisit access location and configuration when property redevelops.
9	Rieth Rd	Private	West	43	Revisit access location and configuration when property redevelops.
10	Rieth Rd	Public	East	35	Revisit access location and configuration when property redevelops.
11	US 30	Public	North	60	These accesses between Airport Road to US 30 are consolidated into one leg of the US 30/Airport Road roundabout.
12	US 30	Public	North	240	
13	US 30	Private	South	55	Future design of US 30/Airport Road Roundabout will need to include consultation with the property owners to consider how these accesses function. Access may be able to remain where they are currently located or they may need to be relocated or otherwise modified to function with the realigned roadway and the needs of the adjacent properties.
14	US 30	Private	South	35	
15	US 30	Private	North	94	Access would be relocated to a backage road when property redevelops.
16	US 30	Private	South	900	Reduce access width to standards as part of property redevelopment or through negotiation with the property owner
17	US 30	Private	North	66	Access would be relocated to a backage road when property redevelops.
18	US 30	Private	North	37	Access would be relocated to a backage road when property redevelops.
19	US 30	Private	North	65	No changes are proposed to accesses located outside of ODOT's ¼-mile spacing standard.
20	US 30	Private	South	900	
21	US 30	Public	North	54	
22	Airport Rd	Private	West	50	Future design of US 30/Airport Road Roundabout will need to include consultation with the property owners to consider how these accesses function. Access may be able to remain where they are currently located or they may need to be relocated or otherwise modified to function with the realigned roadway and the needs of the adjacent properties.
23	Airport Rd	Public	East	60	



Access Location - Driveway or Public Street

Access Location - Open Frontage

Minimum 1320' IAMP Limits

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Figure 5

OASA Access Inventory
Exit 207
Pendleton, OR

NEXT STEPS

The preferred concept will be presented to the general public for feedback. That feedback will be used to refine the preferred concept for the Exit 207 interchange, which will be incorporated into the draft IAMP. Recommended code changes and supporting ordinances for implementation of the IAMP will be developed and presented in after the preferred concept is refined.

REFERENCES

1. Kittelson and Associates, Inc. *Pendleton IAMPs: Detailed Evaluation of Select Concepts.* 2020.
2. Kittelson and Associates, Inc. *Pendleton IAMPs: Exit 207 – Existing Conditions: Transportation System Operations.* 2019.

Attachment A
Traffic Operations Worksheets

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	108	2	54	95	1	30
Future Vol, veh/h	108	2	54	95	1	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	5	-	-	-5	-3	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	42	0	0	35	0	0
Mvmt Flow	126	2	63	110	1	35

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	128	0	363	127
Stage 1	-	-	-	-	127	-
Stage 2	-	-	-	-	236	-
Critical Hdwy	-	-	4.1	-	5.8	5.9
Critical Hdwy Stg 1	-	-	-	-	4.8	-
Critical Hdwy Stg 2	-	-	-	-	4.8	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1470	-	680	938
Stage 1	-	-	-	-	923	-
Stage 2	-	-	-	-	840	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1470	-	651	938
Mov Cap-2 Maneuver	-	-	-	-	651	-
Stage 1	-	-	-	-	923	-
Stage 2	-	-	-	-	804	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.7	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	925	-	-	1470	-
HCM Lane V/C Ratio	0.039	-	-	0.043	-
HCM Control Delay (s)	9.1	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↱	
Traffic Vol, veh/h	0	138	139	0	93	10
Future Vol, veh/h	0	138	139	0	93	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-3	-	-2	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	31	19	2	24	8
Mvmt Flow	0	147	148	0	99	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	295	148
Stage 1	-	-	-	-	148	-
Stage 2	-	-	-	-	147	-
Critical Hdwy	-	-	-	-	6.24	6.08
Critical Hdwy Stg 1	-	-	-	-	5.24	-
Critical Hdwy Stg 2	-	-	-	-	5.24	-
Follow-up Hdwy	-	-	-	-	3.716	3.372
Pot Cap-1 Maneuver	0	-	-	0	674	890
Stage 1	0	-	-	0	842	-
Stage 2	0	-	-	0	843	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	674	890
Mov Cap-2 Maneuver	-	-	-	-	674	-
Stage 1	-	-	-	-	842	-
Stage 2	-	-	-	-	843	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	11.2
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	690
HCM Lane V/C Ratio	-	-	0.159
HCM Control Delay (s)	-	-	11.2
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.6

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	147	4	17	80	1	23
Future Vol, veh/h	147	4	17	80	1	23
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	5	-	-	-5	-3	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	7	0	0	17	0	0
Mvmt Flow	162	4	19	88	1	25

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	166	0	290	164
Stage 1	-	-	-	-	164	-
Stage 2	-	-	-	-	126	-
Critical Hdwy	-	-	4.1	-	5.8	5.9
Critical Hdwy Stg 1	-	-	-	-	4.8	-
Critical Hdwy Stg 2	-	-	-	-	4.8	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1424	-	740	898
Stage 1	-	-	-	-	894	-
Stage 2	-	-	-	-	924	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1424	-	730	898
Mov Cap-2 Maneuver	-	-	-	-	730	-
Stage 1	-	-	-	-	894	-
Stage 2	-	-	-	-	912	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	889	-	-	1424	-
HCM Lane V/C Ratio	0.03	-	-	0.013	-
HCM Control Delay (s)	9.2	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↱	
Traffic Vol, veh/h	0	170	86	0	97	11
Future Vol, veh/h	0	170	86	0	97	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-3	-	-2	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	11	13	0	13	25
Mvmt Flow	0	189	96	0	108	12

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	285	96
Stage 1	-	-	-	-	96	-
Stage 2	-	-	-	-	189	-
Critical Hdwy	-	-	-	-	6.13	6.25
Critical Hdwy Stg 1	-	-	-	-	5.13	-
Critical Hdwy Stg 2	-	-	-	-	5.13	-
Follow-up Hdwy	-	-	-	-	3.617	3.525
Pot Cap-1 Maneuver	0	-	-	0	705	906
Stage 1	0	-	-	0	911	-
Stage 2	0	-	-	0	835	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	-	705	906
Mov Cap-2 Maneuver	-	-	-	-	705	-
Stage 1	-	-	-	-	911	-
Stage 2	-	-	-	-	835	-

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

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	721
HCM Lane V/C Ratio	-	-	0.166
HCM Control Delay (s)	-	-	11
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.6

MOVEMENT SUMMARY

Site: 102 [US-30/I-84 Roundabout]

207 Concept 1B Accesssory 2 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: I-84												
3	L2	49	17.0	0.162	5.5	LOS A	0.7	18.0	0.40	0.28	0.40	33.7
8	T1	1	0.0	0.162	4.9	LOS A	0.7	18.0	0.40	0.28	0.40	34.1
18	R2	104	11.0	0.162	5.3	LOS A	0.7	18.0	0.40	0.28	0.40	32.9
Approach		154	12.8	0.162	5.3	LOS A	0.7	18.0	0.40	0.28	0.40	33.2
East: US-30												
6	T1	134	24.0	0.262	6.1	LOS A	1.0	32.1	0.22	0.10	0.22	34.2
16	R2	128	33.0	0.262	6.3	LOS A	1.0	32.1	0.22	0.10	0.22	32.9
Approach		262	28.4	0.262	6.2	LOS A	1.0	32.1	0.22	0.10	0.22	33.5
West: US-30												
5	L2	10	43.0	0.178	5.3	LOS A	0.0	0.0	0.00	0.00	0.00	36.5
2	T1	183	27.0	0.178	4.9	LOS A	0.0	0.0	0.00	0.00	0.00	37.6
Approach		193	27.8	0.178	4.9	LOS A	0.0	0.0	0.00	0.00	0.00	37.5
All Vehicles		609	24.3	0.262	5.6	LOS A	1.0	32.1	0.20	0.11	0.20	34.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 102 [US-30/I-84 Roundabout]

207 Concept 1B Accesssory 2 PM
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: I-84												
3	L2	46	3.0	0.158	5.0	LOS A	0.6	17.4	0.41	0.29	0.41	34.0
8	T1	1	0.0	0.158	4.9	LOS A	0.6	17.4	0.41	0.29	0.41	34.0
18	R2	101	18.0	0.158	5.5	LOS A	0.6	17.4	0.41	0.29	0.41	32.6
Approach		148	13.2	0.158	5.4	LOS A	0.6	17.4	0.41	0.29	0.41	33.1
East: US-30												
6	T1	181	9.0	0.345	6.4	LOS A	1.8	49.6	0.27	0.13	0.27	34.3
16	R2	220	10.0	0.345	6.5	LOS A	1.8	49.6	0.27	0.13	0.27	33.2
Approach		401	9.5	0.345	6.5	LOS A	1.8	49.6	0.27	0.13	0.27	33.7
West: US-30												
5	L2	27	20.0	0.189	4.8	LOS A	0.0	0.0	0.00	0.00	0.00	37.2
2	T1	206	11.0	0.189	4.5	LOS A	0.0	0.0	0.00	0.00	0.00	37.7
Approach		232	12.0	0.189	4.5	LOS A	0.0	0.0	0.00	0.00	0.00	37.6
All Vehicles		781	11.0	0.345	5.7	LOS A	1.8	49.6	0.22	0.12	0.22	34.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [US-30/Airport Road Roundabout]

207 Concept 1B Accessory 2 AM
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: US 30												
3	L2	104	13.0	0.280	6.1	LOS A	1.3	35.6	0.33	0.19	0.33	33.3
8	T1	21	12.0	0.280	6.1	LOS A	1.3	35.6	0.33	0.19	0.33	33.4
18	R2	170	15.0	0.280	6.2	LOS A	1.3	35.6	0.33	0.19	0.33	32.3
Approach		295	14.1	0.280	6.1	LOS A	1.3	35.6	0.33	0.19	0.33	32.7
East: US 30												
1	L2	166	20.0	0.404	8.0	LOS A	2.1	58.1	0.38	0.24	0.38	32.3
6	T1	235	11.0	0.404	7.7	LOS A	2.1	58.1	0.38	0.24	0.38	32.7
16	R2	20	11.0	0.404	7.7	LOS A	2.1	58.1	0.38	0.24	0.38	31.7
Approach		421	14.6	0.404	7.8	LOS A	2.1	58.1	0.38	0.24	0.38	32.5
North: Backage Road (New)												
7	L2	2	11.0	0.010	5.3	LOS A	0.0	0.9	0.53	0.38	0.53	33.7
4	T1	3	12.0	0.010	5.4	LOS A	0.0	0.9	0.53	0.38	0.53	33.8
14	R2	1	32.0	0.010	6.3	LOS A	0.0	0.9	0.53	0.38	0.53	32.3
Approach		7	15.0	0.010	5.5	LOS A	0.0	0.9	0.53	0.38	0.53	33.5
West: Airport Road												
5	L2	1	23.0	0.235	6.3	LOS A	0.9	27.3	0.39	0.26	0.39	33.9
2	T1	117	12.0	0.235	6.0	LOS A	0.9	27.3	0.39	0.26	0.39	34.4
12	R2	99	31.0	0.235	6.6	LOS A	0.9	27.3	0.39	0.26	0.39	32.9
Approach		217	20.7	0.235	6.2	LOS A	0.9	27.3	0.39	0.26	0.39	33.7
All Vehicles		939	15.8	0.404	6.9	LOS A	2.1	58.1	0.37	0.23	0.37	32.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [US-30/Airport Road Roundabout]

207 Concept 1B Accessory 2 PM
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: US 30												
3	L2	79	28.0	0.328	7.8	LOS A	1.5	41.6	0.46	0.35	0.46	32.6
8	T1	3	8.0	0.328	7.1	LOS A	1.5	41.6	0.46	0.35	0.46	33.2
18	R2	226	9.0	0.328	7.2	LOS A	1.5	41.6	0.46	0.35	0.46	32.2
Approach		308	13.9	0.328	7.3	LOS A	1.5	41.6	0.46	0.35	0.46	32.3
East: US 30												
1	L2	197	10.0	0.365	6.8	LOS A	2.0	52.9	0.32	0.18	0.32	32.8
6	T1	216	8.0	0.365	6.8	LOS A	2.0	52.9	0.32	0.18	0.32	32.9
16	R2	2	10.0	0.365	6.8	LOS A	2.0	52.9	0.32	0.18	0.32	31.9
Approach		414	9.0	0.365	6.8	LOS A	2.0	52.9	0.32	0.18	0.32	32.9
North: Backage Road (New)												
7	L2	18	10.0	0.052	5.6	LOS A	0.2	5.1	0.54	0.44	0.54	33.4
4	T1	19	8.0	0.052	5.5	LOS A	0.2	5.1	0.54	0.44	0.54	33.5
14	R2	1	9.0	0.052	5.5	LOS A	0.2	5.1	0.54	0.44	0.54	32.5
Approach		38	9.0	0.052	5.5	LOS A	0.2	5.1	0.54	0.44	0.54	33.5
West: Airport Road												
5	L2	1	40.0	0.410	9.3	LOS A	2.1	57.4	0.51	0.40	0.51	32.4
2	T1	213	8.0	0.410	8.2	LOS A	2.1	57.4	0.51	0.40	0.51	33.4
12	R2	187	9.0	0.410	8.3	LOS A	2.1	57.4	0.51	0.40	0.51	32.4
Approach		401	8.6	0.410	8.3	LOS A	2.1	57.4	0.51	0.40	0.51	32.9
All Vehicles		1161	10.1	0.410	7.4	LOS A	2.1	57.4	0.43	0.31	0.43	32.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

HCS7 Freeway Diverge Report

Project Information			
Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future AM
Project Description	Exit 207 IAMP - Segment 1 (EB Off-Ramp) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	200
Terrain Type	Specific Grade	Rolling
Percent Grade, %	-3.10	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (V_i)	1089	103
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	22.00
Single-Unit Trucks (SUT), %	30	-
Tractor-Trailers (TT), %	70	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.775	0.694
Flow Rate (v_i),pc/h	1597	158
Capacity (c), pc/h	4646	1995
Volume-to-Capacity Ratio (v/c)	0.34	0.08

Speed and Density			
Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O)	0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.312
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	61.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	76.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1597	Ramp Junction Speed (S), mi/h	61.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	13.0
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	16.2

HCS7 Freeway Diverge Report

Project Information

Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future PM
Project Description	Exit 207 IAMP - Segment 1 (EB Off-Ramp) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	200
Terrain Type	Specific Grade	Rolling
Percent Grade, %	-3.10	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Demand Volume (V_i)	1006	108
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	14.00
Single-Unit Trucks (SUT), %	30	-
Tractor-Trailers (TT), %	70	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.775	0.781
Flow Rate (v_i),pc/h	1475	147
Capacity (c), pc/h	4646	1995
Volume-to-Capacity Ratio (v/c)	0.32	0.07

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O)	0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.311
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	61.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	76.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1475	Ramp Junction Speed (S), mi/h	61.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	12.0
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	15.1

HCS7 Basic Freeway Report

Project Information

Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future AM
Project Description	Exit 207 IAMP - Segment 2 (Between EB On and Off Ramps) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data

Number of Lanes, ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.83
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	67.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	986	Heavy Vehicle Adjustment Factor (f_{HV})	0.625
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	896
Total Trucks, %	30.00	Capacity (c), pc/h/ln	2372
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2296
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.39
Passenger Car Equivalent (E_T)	3.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	67.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	13.3
Total Ramp Density Adjustment	2.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.2		

HCS7 Basic Freeway Report

Project Information

Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future PM
Project Description	Exit 207 IAMP - Segment 2 (Between EB On and Off Ramps) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data

Number of Lanes, ln	2	Terrain Type	Rolling
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.83
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	67.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	898	Heavy Vehicle Adjustment Factor (f_{HV})	0.625
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	816
Total Trucks, %	30.00	Capacity (c), pc/h/ln	2372
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2296
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.36
Passenger Car Equivalent (E_T)	3.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	67.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	12.1
Total Ramp Density Adjustment	2.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.2		

HCS7 Freeway Merge Report

Project Information			
Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future AM
Project Description	Exit 207 IAMP - Segment 3 (EB ON-Ramp #1) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	700
Terrain Type	Rolling	Specific Grade
Percent Grade, %	-	-2.00
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	986	33
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	41.00
Single-Unit Trucks (SUT), %	-	30
Tractor-Trailers (TT), %	-	70
Heavy Vehicle Adjustment Factor (fHV)	0.625	0.715
Flow Rate (vi),pc/h	1793	49
Capacity (c), pc/h	4646	1805
Volume-to-Capacity Ratio (v/c)	0.40	0.03

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.311
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	1793	Ramp Junction Speed (S), mi/h	61.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	1842	Average Density (D), pc/mi/ln	15.0
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	15.5

HCS7 Freeway Merge Report

Project Information			
Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future PM
Project Description	Exit 207 IAMP - Segment 3 (EB On-Ramp #1) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	700
Terrain Type	Rolling	Specific Grade
Percent Grade, %	-	-2.00
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	898	118
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	21.00
Single-Unit Trucks (SUT), %	-	30
Tractor-Trailers (TT), %	-	70
Heavy Vehicle Adjustment Factor (fHV)	0.625	0.828
Flow Rate (vi),pc/h	1633	152
Capacity (c), pc/h	4646	1805
Volume-to-Capacity Ratio (v/c)	0.38	0.08

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.309
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	1633	Ramp Junction Speed (S), mi/h	61.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	1785	Average Density (D), pc/mi/ln	14.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	15.0

HCS7 Freeway Merge Report

Project Information			
Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future AM
Project Description	Exit 207 IAMP - Segment 4 (EB On-Ramp #2) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	600
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-4.40	-2.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1019	50
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	33.00
Single-Unit Trucks (SUT), %	30	30
Tractor-Trailers (TT), %	70	70
Heavy Vehicle Adjustment Factor (fHV)	0.775	0.758
Flow Rate (vi),pc/h	1494	70
Capacity (c), pc/h	4646	1900
Volume-to-Capacity Ratio (v/c)	0.34	0.04

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.298
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	1494	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	1564	Average Density (D), pc/mi/ln	12.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	14.0

HCS7 Freeway Merge Report

Project Information			
Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future PM
Project Description	Exit 207 IAMP - Segment 4 (EB On-Ramp #2) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	35.0
Segment Length (L) / Acceleration Length (LA),ft	1500	600
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	-4.40	-2.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1016	58
Peak Hour Factor (PHF)	0.88	0.92
Total Trucks, %	30.00	9.00
Single-Unit Trucks (SUT), %	30	30
Tractor-Trailers (TT), %	70	70
Heavy Vehicle Adjustment Factor (fHV)	0.775	0.907
Flow Rate (vi),pc/h	1490	70
Capacity (c), pc/h	4646	1900
Volume-to-Capacity Ratio (v/c)	0.34	0.04

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.298
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	1490	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	1560	Average Density (D), pc/mi/ln	12.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.9

HCS7 Freeway Diverge Report

Project Information

Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future AM
Project Description	Exit 207 IAMP - Segment 5 (WB Off-Ramp) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Deceleration Length (LA),ft	1500	300
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	2.70	5.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity

Demand Volume (v_i)	971	144
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	12.00
Single-Unit Trucks (SUT), %	30	30
Tractor-Trailers (TT), %	70	70
Heavy Vehicle Adjustment Factor (f_{HV})	0.759	0.859
Flow Rate (v_i),pc/h	1454	178
Capacity (c), pc/h	4646	1805
Volume-to-Capacity Ratio (v/c)	0.31	0.10

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O)	0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.574
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	53.9
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	76.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	1454	Ramp Junction Speed (S), mi/h	53.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	13.5
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	14.1

HCS7 Freeway Diverge Report

Project Information			
Analyst	KAI	Date	1/20/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future PM
Project Description	Exit 207 IAMP - Segment 5 (WB Off-Ramp) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Deceleration Length (LA),ft	1500	300
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	2.70	5.80
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	1004	132
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	13.00
Single-Unit Trucks (SUT), %	30	30
Tractor-Trailers (TT), %	70	70
Heavy Vehicle Adjustment Factor (fHV)	0.759	0.852
Flow Rate (vi),pc/h	1503	165
Capacity (c), pc/h	4646	1805
Volume-to-Capacity Ratio (v/c)	0.32	0.09

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.573
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	54.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	76.8
Flow in Lanes 1 and 2 (v12), pc/h	1503	Ramp Junction Speed (S), mi/h	54.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	13.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	14.5

HCS7 Basic Freeway Report

Project Information

Analyst	KAI	Date	1/21/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future AM
Project Description	Exit 207 IAMP - Segment 6 (Between WB Off and On Ramps) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data

Number of Lanes, ln	2	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.80
Measured or Base Free-Flow Speed	Base	Grade Length, mi	0.20
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.83
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	67.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	827	Heavy Vehicle Adjustment Factor (f_{HV})	0.765
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	614
Total Trucks, %	30.00	Capacity (c), pc/h/ln	2372
Single-Unit Trucks (SUT), %	30	Adjusted Capacity (c_{adj}), pc/h/ln	2296
Tractor-Trailers (TT), %	70	Volume-to-Capacity Ratio (v/c)	0.27
Passenger Car Equivalent (E_T)	2.026		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	67.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	9.1
Total Ramp Density Adjustment	2.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.2		

HCS7 Basic Freeway Report

Project Information

Analyst	KAI	Date	1/21/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future PM
Project Description	Exit 207 IAMP - Segment 6 (Between WB Off and On Ramps) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data

Number of Lanes, ln	2	Terrain Type	Specific Grade
Segment Length (L), ft	-	Percent Grade, %	2.80
Measured or Base Free-Flow Speed	Base	Grade Length, mi	0.20
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.83
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	67.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.968
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

Demand and Capacity

Demand Volume veh/h	872	Heavy Vehicle Adjustment Factor (f_{HV})	0.765
Peak Hour Factor	0.88	Flow Rate (V_p), pc/h/ln	648
Total Trucks, %	30.00	Capacity (c), pc/h/ln	2372
Single-Unit Trucks (SUT), %	30	Adjusted Capacity (c_{adj}), pc/h/ln	2296
Tractor-Trailers (TT), %	70	Volume-to-Capacity Ratio (v/c)	0.28
Passenger Car Equivalent (E_T)	2.026		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	67.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	9.6
Total Ramp Density Adjustment	2.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	67.2		

HCS7 Freeway Merge Report

Project Information			
Analyst	KAI	Date	1/21/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future AM
Project Description	Exit 207 IAMP - Segment 7 (WB On-Ramp) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	2.80	-3.40
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	827	129
Peak Hour Factor (PHF)	0.88	0.94
Total Trucks, %	30.00	43.00
Single-Unit Trucks (SUT), %	30	30
Tractor-Trailers (TT), %	70	70
Heavy Vehicle Adjustment Factor (fHV)	0.765	0.706
Flow Rate (vi),pc/h	1228	194
Capacity (c), pc/h	4646	1805
Volume-to-Capacity Ratio (v/c)	0.31	0.11

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.292
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	1228	Ramp Junction Speed (S), mi/h	61.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	1422	Average Density (D), pc/mi/ln	11.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	10.9

HCS7 Freeway Merge Report

Project Information			
Analyst	KAI	Date	1/21/2020
Agency		Analysis Year	2040
Jurisdiction	City of Pendleton	Time Period Analyzed	Future PM
Project Description	Exit 207 IAMP - Segment 7 (WB On-Ramp #1) - Alternative 1B with Accessory 2	Unit	United States Customary

Geometric Data		
	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	70.0	25.0
Segment Length (L) / Acceleration Length (LA),ft	1500	900
Terrain Type	Specific Grade	Specific Grade
Percent Grade, %	2.80	-3.40
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors		
Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Final Capacity Adjustment Factor (CAF)	0.968	0.950
Demand Adjustment Factor (DAF)	1.000	1.000

Demand and Capacity		
Demand Volume (Vi)	872	222
Peak Hour Factor (PHF)	0.88	0.88
Total Trucks, %	30.00	20.00
Single-Unit Trucks (SUT), %	30	30
Tractor-Trailers (TT), %	70	70
Heavy Vehicle Adjustment Factor (fHV)	0.765	0.835
Flow Rate (vi),pc/h	1295	302
Capacity (c), pc/h	4646	1805
Volume-to-Capacity Ratio (v/c)	0.34	0.17

Speed and Density			
Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.295
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	1295	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	1597	Average Density (D), pc/mi/ln	12.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	12.2

Attachment B
Cost Estimate Worksheets

ODOT- Exit 210 IAMP
PLANNING LEVEL COST ESTIMATE
IAMP
(YEAR 2020 COSTS)
8/19/2020

Prepared By: DR
Reviewed By: ASL
Anderson Perry and Associates, Inc

Exit 207 - Alternate 1B Accessory #2: Full Section w/Bike Path and Sidewalk
I-84 Ramps Demo/Construction and Ramp Terminal Roundabout

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization (10%)	LS	$ 328,000	All Req'd	$ 328,000
2	Temporary Protection and Direction of Traffic	LS	$ 49,000	All Req'd	49,000
3	Asphalt Concrete Pavement	TON	100	12,100	1,210,000
4	Aggregate Base	TON	28	30,300	848,400
5	Geotextile Fabric	SQYD	2	29,300	44,000
6	Concrete Apron/Sidewalk	SQYD	50	1,500	75,000
7	Concrete Curb	LF	30	2,300	69,000
8	Extra for Curb Ramps	EA	1,500	32	48,000
9	Earthwork/Excavation	CY	20	45,000	900,000
10	Permanent Signing and Striping	LS	10,000	All Req'd	10,000
11	Erosion Control	LS	$ 17,000	All Req'd	17,000

Total Estimated Construction Cost	**$ 3,598,400**
Construction Condingency (20%)	$ 720,000
Construction Engineering (15%)	$ 540,000
Preliminary Engineering (15%)	$ 540,000
TOTAL ESTIMATED PROJECT COST (2020)	**$ 5,398,400**

Exit 207 - Alternate 1B Accessory #2: Full Section w/Bike Path and Sidewalk
Airport/US30 Roundabout/ Additional Backage Road

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization (10%)	LS	$ 205,000	All Req'd	$ 205,000
2	Temporary Protection and Direction of Traffic	LS	$ 31,000	All Req'd	31,000
3	Asphalt Concrete Pavement	TON	100	4,900	490,000
4	Aggregate Base	TON	28	15,400	431,200
5	Geotextile Fabric	SQYD	2	16,600	24,900
6	Concrete Apron/Sidewalk	SQYD	50	1,700	85,000
7	Concrete Curb	SQYD	30	3,900	117,000
8	Extra for Curb Ramps	EA	1,500	32	48,000
9	Earthwork/Excavation	CY	20	40,000	800,000
10	Permanent Signing and Striping	LS	10,000	All Req'd	10,000
11	Erosion Control	LS	$ 11,000	All Req'd	11,000

Total Estimated Construction Cost	**$ 2,253,100**
Construction Condingency (20%)	$ 451,000
Construction Engineering (15%)	$ 338,000
Preliminary Engineering (15%)	$ 338,000
TOTAL ESTIMATED PROJECT COST (2020)	**$ 3,380,100**