MEMORANDUM

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Through: Derek Abe, Alta Planning + Design

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Date: March 9, 2018

Re: Mosier TSP Tech Memo #5: Future System Conditions DRAFT

This memorandum provides a summary of the future transportation conditions for Mosier as they relate to motor vehicle traffic operations. Expected peak hour driving conditions in 2037 at Transportation System Plan (TSP) study intersection are detailed. The memorandum summarizes expected growth in Mosier and methodology used to forecast 2037 design hour traffic volumes.

Expected Population Growth

Coordinated population forecasts for Mosier were used to identify the expected 2037 population, as shown in Table 1.[1] The expected population growth rate from 2016 to 2037 is 25 percent. The traffic volume forecasting approach is generally consistent with the identified population growth.

Table 1. Mosier Population Forecasts

Year	Population Estimate	Growth from 2016
2016	456	-
2035	561	23%
2037	571	25%
2040	586	29%

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[1] *Coordination Population Forecast for Wasco County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2016-2066*, Figure 23, Oregon Population Forecast Program, Population Research Center, Portland State University, June 30, 2016. http://pdxscholar.library.pdx.edu/opfp/12/

Population estimates reflect Mosier Urban Growth Boundary (UGB) Interpolated by DKS. Source: PSU Population Research Center, Portland State University

Future Driving Conditions

The following section summarizes motor vehicle demand and evaluates traffic operations performance at each TSP study intersection. Performance is evaluated for design hour demand under future conditions in 2037.

Forecasting

Future year design hour traffic volumes are based on existing (2016) volumes, additional trips from the approved Tanawashee subdivision[2], and an applied future growth rate for 2037. The growth rate is estimated to be 28 percent based on expected traffic volume growth on US 30. Growth assumptions and forecasting methodology are detailed in the Methodology Memorandum[3].

The applied growth rate of 28 percent reflects expected traffic volume growth on US 30 at Washington Street. Although this growth rate is slightly higher than the population growth rate and expected traffic volume growth on US 30 near the I-84 interchange, it was applied to all study intersections city-wide. This high-growth approach ensures motor vehicle system needs are addressed through 2037.

Traffic growth identified for the approved Tanawashee subdivision was added to existing volumes prior to applying the future growth rate, consistent with the high-growth approach identified above. The subdivision is expected to add 31 inbound trips and 18 outbound trips in the peak hour, which primarily affects the Third Avenue/Center Street study intersection.

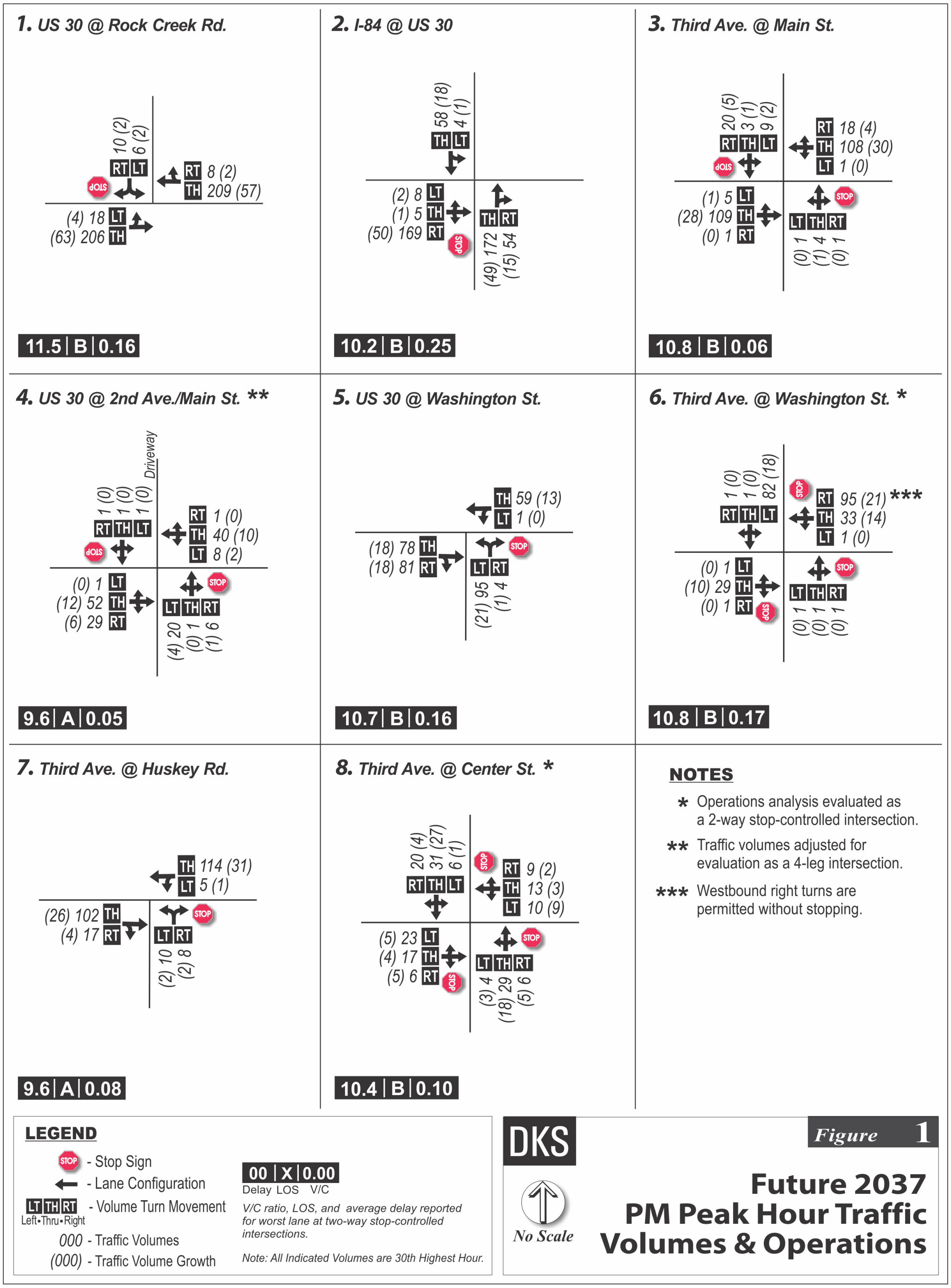
Future Traffic Volumes

The 2037 design hour traffic volume forecasts developed for the study intersections are summarized in Figure 1. Motor vehicle volumes in Mosier are expected to remain highest along US 30, Third Avenue, and Washington Street. Future volumes on these roadways are expected to generally range between 80 and 210 vehicles per direction during the afternoon peak hour. The study intersections with the largest expected peak (afternoon) traffic volumes are located on US 30, at the Rock Creek Road intersection and I-84 ramp interchange.

[2] *Tanawashee Subdivision Traffic Impact Study*. Lancaster Engineering. April 2008.

[3] *Mosier TSP Analysis Methodology Memorandum*. Alta Planning + Design. June 2017.

Figure 1: Future Motor Vehicle Volumes and Traffic Operations



Evaluating Intersection Performance

The primary method typically used to evaluate motor vehicle mobility is through intersection operations performance during peak demand periods. Two methods to gauge intersection operations include volume-to-capacity (v/c) ratios and level of service (LOS).

- Volume-to-capacity (v/c) ratio: A decimal representation (between 0.00 and 1.00) of the proportion of occupied capacity (capacity defined as the theoretical maximum vehicle throughput in a given time frame) at a turn movement, approach leg, or intersection. It is the peak hour traffic volume divided by the hourly capacity of a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. A ratio approaching 1.00 indicates increased congestion and reduced performance. ODOT mobility targets for intersections along state highways are based on v/c ratios.
- Level of service (LOS): A "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are worse operating conditions where delay may be noticeable. LOS F represents conditions where average vehicle delay has become excessive and traffic is highly congested.

All intersections under state jurisdiction in Mosier must operate within the v/c ratios identified in the Oregon Highway Plan (OHP). The ODOT v/c targets are based on highway classification and posted speeds. Study intersections that do not meet the mobility targets shown would require mitigation strategies to be identified in the TSP.

No minimum performance target is identified for intersections under Mosier jurisdiction. A Level of Service (LOS) D is commonly used in many local jurisdictions as a minimum performance target for both signalized and unsignalized intersections. This measure may serve as a guide for what levels of intersection delay on local streets may be concerning to drivers in Mosier.

Traffic Operations in 2037

Traffic operations were analyzed for all study intersections under future peak (2037 design hour) conditions based on Highway Capacity Manual (HCM) methodology. The intersection operations for each of the eight study intersections are shown in Table 2.

All the intersections are expected to continue to operate within jurisdictional mobility standards. Very little change relative to existing traffic operations[4] is identified, as average delay across all study intersections is expected to increase by less than one second. The highest calculated average delay at any study intersections was estimated to be approximately eleven seconds (LOS B) for vehicles on Rock Creek Road attempting to turn onto US 30. Detailed intersection operations worksheets are included in the Appendix.

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[4] *Mosier TSP Existing Conditions*. Alta Planning + Design. February 2018.

Table 2: Future Intersection Operations (2037 PM Peak Hour)

	Intersection	Mobility Target	Volume to Capacity Ratio*	Level of Service*	Average Delay* (sec)
1	US 30 and Rock Creek Rd.	0.95	0.16/0.04	A/B	0.8/11.5
2	I-84 and US 30	0.80	0.17/0.25	A/B	0.5/10.2
3	Third Ave. and Main St.	N/A	0.00/0.06	A/B	0.3/10.8
4	US 30 and Second Ave. / Main St.[5]	0.95	0.01/0.05	A/A	1.3/9.6
5	US 30 and Washington St.	0.95	0.12/0.16	A/B	0.1/10.7
6	Third Ave. and Washington St.[6]	N/A	0.06/0.17	A/B	7.3/10.8
7	Third Ave. and Huskey Rd.	0.95	0.16/0.04	A/B	0.8/11.5
8	Third Ave. and Center St.[7]	N/A	0.01/0.10	A/B	0.9/10.4

*V/C ratio, LOS and average delay reported for worst major/minor street movements at two-way stop-controlled intersections. All study intersections are evaluated as two-way stop-controlled intersections.

Future Deficiencies

[5] This intersection has an atypical traffic control configuration with two north legs (Second Avenue and Main Street). The intersection cannot be modeled using standard HCM (Highway Capacity Manual) intersection analysis methodology. The volumes on Second Avenue were small and combined with Main Street for traffic operations analysis.

[6] This intersection has an atypical traffic control configuration, where westbound right turns and northbound movements are permitted without stopping while all other movements are stop-controlled. The intersection cannot be modeled using standard HCM (Highway Capacity Manual) intersection analysis methodology. The reported operations are for a two-way stop-controlled intersection with stops for eastbound and westbound approaches. This representation is likely to overestimate delay on the worst minor street approach (eastbound), as eastbound right turns do not stop. To better reflect experienced delay on the stop-controlled southbound approach, the intersection was also evaluated as an all-way stop. With all movements stop-controlled, the worst approaches operate with LOS A, v/c ratio 0.11 and average delay of 8 seconds (as shown in the Appendix).

[7] This intersection has an atypical traffic control configuration, where southbound movements are permitted without stopping while all other movements are stop-controlled. The intersection cannot be modeled using standard HCM (Highway Capacity Manual) intersection analysis methodology. The reported operations are for a two-way stop-controlled intersection with stops for eastbound and westbound approaches. To better reflect experienced delay on the stop-controlled northbound approach, the intersection was also evaluated as an all-way stop. With all movements stop-controlled, the worst approaches operate with LOS A, v/c ratio 0.16 and average delay of 8 seconds (as shown in the Appendix).

No future deficiencies are identified from the analysis of future traffic operations. All study intersection movements operate with sufficient capacity (v/c ratio at or below 0.25) and low delay (LOS B or better).

As discussed in the Existing Conditions Memorandum, there are no queuing or safety needs identified within the scope of this TSP. However, it is recommended that the Huskey Street/Third Avenue intersection and study segments on I-84 within the city limits be monitored for future safety performance (based on the existing conditions safety analysis).

For project development and design on state highways, the Oregon Highway Design Manual identifies 20-year design-mobility standards. This means that any proposed improvements to change the current design on US 30 would need to meet the identified mobility target. The 20-year design-mobility standard for US 30 in Mosier is a v/c ratio of 0.80. A design exception would be required if the v/c ratio target cannot be met in the future-year horizon.

Summary of Key Findings

Below is a summary of key findings from the analysis of future transportation conditions for motor vehicle operations.

- No needs related to motor vehicle traffic operations or queuing were identified in the analysis.
- All study intersection movements operate with sufficient capacity (v/c ratio below 0.25) and low delay (LOS B or better) during peak demand conditions.

Appendix

1. HCM Worksheets
2. Tanawashee Traffic Impact Analysis

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	102	17	5	114	10	8
Future Volume (Veh/h)	102	17	5	114	10	8
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	116	19	6	130	11	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			135		268	126
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			135		268	126
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		98	99
cM capacity (veh/h)			1437		723	930

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	135	136	20
Volume Left	0	6	11
Volume Right	19	0	9
cSH	1700	1437	804
Volume to Capacity	0.08	0.00	0.02
Queue Length 95th (ft)	0	0	2
Control Delay (s)	0.0	0.4	9.6
Lane LOS		A	A
Approach Delay (s)	0.0	0.4	9.6
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	17	6	10	13	9	4	29	6	6	31	20
Future Volume (Veh/h)	23	17	6	10	13	9	4	29	6	6	31	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Hourly flow rate (vph)	37	27	10	16	21	15	6	47	10	10	50	32
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	176	155	66	174	166	52	82			57		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	176	155	66	174	166	52	82			57		
tC, single (s)	7.2	6.6	6.3	7.2	6.6	6.3	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.6	4.1	3.4	2.3			2.3		
p0 queue free %	95	96	99	98	97	98	100			99		
cM capacity (veh/h)	726	708	965	727	698	983	1443			1474		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	74	52	63	92
Volume Left	37	16	6	10
Volume Right	10	15	10	32
cSH	744	772	1443	1474
Volume to Capacity	0.10	0.07	0.00	0.01
Queue Length 95th (ft)	8	5	0	1
Control Delay (s)	10.4	10.0	0.7	0.9
Lane LOS	B	A	A	A
Approach Delay (s)	10.4	10.0	0.7	0.9
Approach LOS	B	A		

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	15.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	109	1	1	108	18	1	4	1	9	3	20
Future Volume (Veh/h)	5	109	1	1	108	18	1	4	1	9	3	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	6	140	1	1	138	23	1	5	1	12	4	26
Pedestrians		5									7	
Lane Width (ft)		12.0									12.0	
Walking Speed (ft/s)		4.0									4.0	
Percent Blockage		0									1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	168			141			337	322	140	314	312	162
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	168			141			337	322	140	314	312	162
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	99	100	98	99	97
cM capacity (veh/h)	1384			1424			592	592	913	628	600	880

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	147	162	7	42
Volume Left	6	1	1	12
Volume Right	1	23	1	26
cSH	1384	1424	623	759
Volume to Capacity	0.00	0.00	0.01	0.06
Queue Length 95th (ft)	0	0	1	4
Control Delay (s)	0.3	0.1	10.8	10.0
Lane LOS	A	A	B	B
Approach Delay (s)	0.3	0.1	10.8	10.0
Approach LOS			B	B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	20.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	52	29	8	40	1	20	1	6	1	1	1
Future Volume (Veh/h)	1	52	29	8	40	1	20	1	6	1	1	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Hourly flow rate (vph)	1	74	41	11	57	1	29	1	9	1	1	1
Pedestrians					1			1				
Lane Width (ft)					12.0			12.0				
Walking Speed (ft/s)					4.0			4.0				
Percent Blockage					0			0				
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	58			116			178	178	96	186	198	58
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	58			116			178	178	96	186	198	58
tC, single (s)	4.1			4.3			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.4			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			96	100	99	100	100	100
cM capacity (veh/h)	1546			1383			780	709	964	760	692	1009

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	116	69	39	3
Volume Left	1	11	29	1
Volume Right	41	1	9	1
cSH	1546	1383	814	799
Volume to Capacity	0.00	0.01	0.05	0.00
Queue Length 95th (ft)	0	1	4	0
Control Delay (s)	0.1	1.3	9.6	9.5
Lane LOS	A	A	A	A
Approach Delay (s)	0.1	1.3	9.6	9.5
Approach LOS			A	A

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	78	81	1	59	95	4
Future Volume (Veh/h)	78	81	1	59	95	4
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	99	103	1	75	120	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			202		228	150
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			202		228	150
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		84	99
cM capacity (veh/h)			1318		753	888

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	202	76	125
Volume Left	0	1	120
Volume Right	103	0	5
cSH	1700	1318	758
Volume to Capacity	0.12	0.00	0.16
Queue Length 95th (ft)	0	0	15
Control Delay (s)	0.0	0.1	10.7
Lane LOS		A	B
Approach Delay (s)	0.0	0.1	10.7
Approach LOS			B

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	21.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	206	209	8	6	10
Future Volume (Veh/h)	18	206	209	8	6	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	23	264	268	10	8	13
Pedestrians		10	10		10	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	288				603	293
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	288				603	293
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	98				98	98
cM capacity (veh/h)	1219				433	716

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	287	278	21
Volume Left	23	0	8
Volume Right	0	10	13
cSH	1219	1700	573
Volume to Capacity	0.02	0.16	0.04
Queue Length 95th (ft)	1	0	3
Control Delay (s)	0.8	0.0	11.5
Lane LOS	A		B
Approach Delay (s)	0.8	0.0	11.5
Approach LOS			B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	38.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	5	169	0	0	0	0	172	54	4	58	0
Future Volume (Veh/h)	8	5	169	0	0	0	0	172	54	4	58	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Hourly flow rate (vph)	10	6	217	0	0	0	0	221	69	5	74	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	340	374	74	560	340	256	74			290		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	340	374	74	560	340	256	74			290		
tC, single (s)	7.2	6.6	6.3	7.2	6.6	6.3	4.2			4.2		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.6	4.1	3.4	2.3			2.3		
p0 queue free %	98	99	78	100	100	100	100			100		
cM capacity (veh/h)	598	542	966	328	567	764	1476			1227		

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	233	290	79
Volume Left	10	0	5
Volume Right	217	69	0
cSH	923	1700	1227
Volume to Capacity	0.25	0.17	0.00
Queue Length 95th (ft)	25	0	0
Control Delay (s)	10.2	0.0	0.5
Lane LOS	B		A
Approach Delay (s)	10.2	0.0	0.5
Approach LOS	B		

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	29	1	1	33	95	1	1	1	82	1	1
Future Volume (Veh/h)	1	29	1	1	33	95	1	1	1	82	1	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	1	34	1	1	39	112	1	1	1	96	1	1
Pedestrians								3				
Lane Width (ft)								12.0				
Walking Speed (ft/s)								4.0				
Percent Blockage								0				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	328	198	4	218	198	2	2			2		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	328	198	4	218	198	2	2			2		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	95	100	100	94	90	100			94		
cM capacity (veh/h)	505	651	1067	668	651	1074	1601			1601		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	36	152	3	98
Volume Left	1	1	1	96
Volume Right	1	112	1	1
cSH	653	917	1601	1601
Volume to Capacity	0.06	0.17	0.00	0.06
Queue Length 95th (ft)	4	15	0	5
Control Delay (s)	10.8	9.7	2.4	7.3
Lane LOS	B	A	A	A
Approach Delay (s)	10.8	9.7	2.4	7.3
Approach LOS	B	A		

Intersection Summary			
Average Delay	8.9		
Intersection Capacity Utilization	26.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	23	17	6	10	13	9	4	29	6	6	31	20
Future Volume (vph)	23	17	6	10	13	9	4	29	6	6	31	20
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Hourly flow rate (vph)	37	27	10	16	21	15	6	47	10	10	50	32

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	74	52	63	92
Volume Left (vph)	37	16	6	10
Volume Right (vph)	10	15	10	32
Hadj (s)	0.26	0.13	0.16	0.05
Departure Headway (s)	4.6	4.5	4.5	4.3
Degree Utilization, x	0.09	0.06	0.08	0.11
Capacity (veh/h)	756	762	773	795
Control Delay (s)	8.1	7.8	7.8	7.9
Approach Delay (s)	8.1	7.8	7.8	7.9
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.9		
Level of Service	A		
Intersection Capacity Utilization	15.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	29	1	1	33	95	1	1	1	82	1	1
Future Volume (vph)	1	29	1	1	33	95	1	1	1	82	1	1
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	1	34	1	1	39	112	1	1	1	96	1	1

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	36	152	3	98
Volume Left (vph)	1	1	1	96
Volume Right (vph)	1	112	1	1
Hadj (s)	0.07	-0.36	-0.05	0.27
Departure Headway (s)	4.4	3.8	4.3	4.6
Degree Utilization, x	0.04	0.16	0.00	0.12
Capacity (veh/h)	796	915	778	748
Control Delay (s)	7.6	7.6	7.4	8.2
Approach Delay (s)	7.6	7.6	7.4	8.2
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.8		
Level of Service	A		
Intersection Capacity Utilization	26.0%	ICU Level of Service	A
Analysis Period (min)	15		

TANAWASHEE SUBDIVISION

Traffic Impact Study

MOSIER, OREGON

PREPARED BY
LANCASTER ENGINEERING

APRIL 2008

LANCASTER
engineering

TANAWASHEE SUBDIVISION

Traffic Impact Study

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EXECUTIVE SUMMARY

1. A residential subdivision consisting of 44 single-family homes is proposed for a site in Mosier, Oregon. The site is located south of Fourth Street and east of Center Street.

2. The trip generation calculations show that the proposed residential development will generate 37 trips during the morning peak hour, with 9 entering and 28 exiting the site. A total of 49 trips are projected during the evening peak hour with 31 entering and 18 exiting the site. A weekday total of 470 trips is expected with half entering and half exiting.

3. The intersection of Center Street at Third Avenue is currently operating acceptably and will continue to operate acceptably through 2009 either with or without the addition of site traffic from the proposed development. No operational mitigations are recommended.

4. Construction traffic is not projected to create operational problems at the study intersection provided that the southbound intersection approach remains free-flowing. No construction-related traffic mitigation is proposed.

5. Sight distance is adequate for operations and safety at the proposed driveway locations. No mitigations are recommended.

6. There were no reported crashes at the intersection of Center Street and Third Avenue during the most recent five years for which data is available. Based on a review of the intersection markings, signage and operations, however, the following improvements are recommended:

   - Replace the existing stop sign on the northbound intersection approach with a new 30” octagonal stop sign conforming to ODOT and MUTCD standards.

   - Widen the marked crosswalk on the south leg of the intersection to provide additional separation between pedestrians in the crosswalk and northbound vehicles at the stop bar. Alternatively, a northbound stop bar could be added 2 feet in advance of the existing crosswalk.

   - Re-paint the existing crosswalk markings and the stop-bar markings for the eastbound and westbound intersection approaches.

INTRODUCTION

A property located south of Fourth Avenue and east of Center Street in Mosier, Oregon has been proposed for residential development. The proposed subdivision will consist of 44 single-family homes.

The purpose of this study is to assess the potential traffic impact of development on the surrounding street system. The analysis will include trip generation calculations, level of service calculations, and a discussion of possible measures for mitigating traffic impacts associated with the proposed development.

All supporting data and calculations are included in the appendix to this report.

LOCATION DESCRIPTION

The project site is located south of Fourth Avenue and east of Center Street. It is surrounded by other residential development, both existing and planned. Mosier Community School is located near the site on the northwest corner of Center Street and Third Avenue.

The residential subdivision is proposed to take access to the existing street system primarily via Center Street. A connection to Huskey Road will also be available, however no significant traffic volumes from the proposed subdivision are expected to use this street connection since it does not provide a direct travel route to likely destinations.

As required by the City of Mosier, this study includes traffic counts and analysis at the intersection of Center Street and Third Avenue during the weekday morning and evening peak hours.

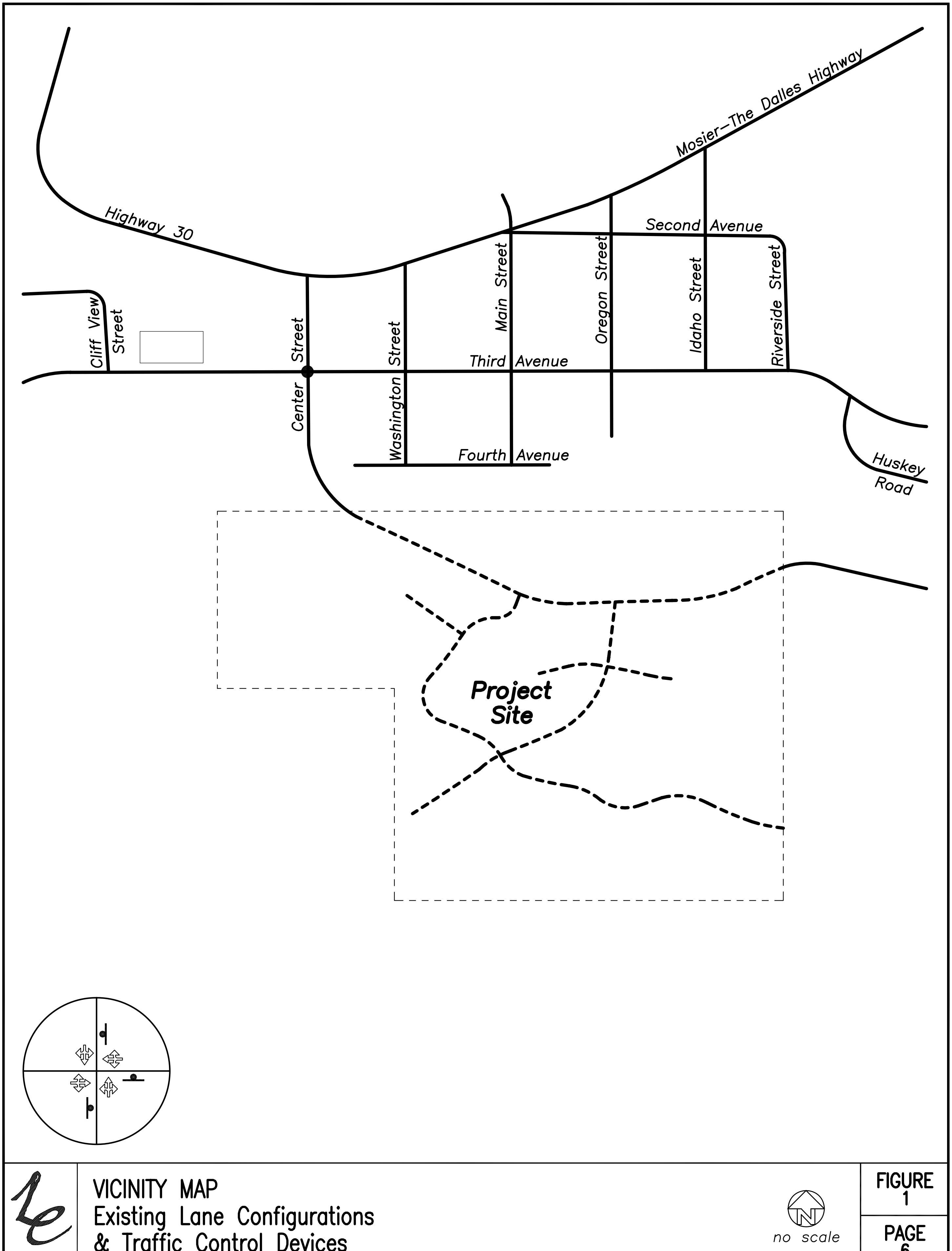
A vicinity map showing the nearby street system and the configuration of the study intersection is shown in Figure 1 on page six.

Center Street is classified as a Local street. It has a two-lane cross-section without center striping. The roadway is currently 20 feet wide north of Third Avenue and 17 feet wide south of Third Avenue. There are no curbs, sidewalks or bicycle lanes on either side of the roadway. Some on-street parking is available on grass and gravel shoulders. There is no posted speed along Center Street; however a 25 mph statutory speed limit applies based on the surrounding residential land use.

Third Street is classified as a Major Collector east of Washington Street and as a Local street west of Washington Street. It also has a two-lane cross-section approximately 23 feet wide without center striping. Curbs and sidewalks are in place on the south side of the roadway. The north side of the road has on-street parking available on gravel shoulders. There are no bicycle lanes on either side of the roadway. Third Street has a posted speed of 25 mph.

The intersection of Center Street at Third Street is controlled by stop signs on the northbound, westbound and eastbound approaches. The southbound approach is free-flowing.

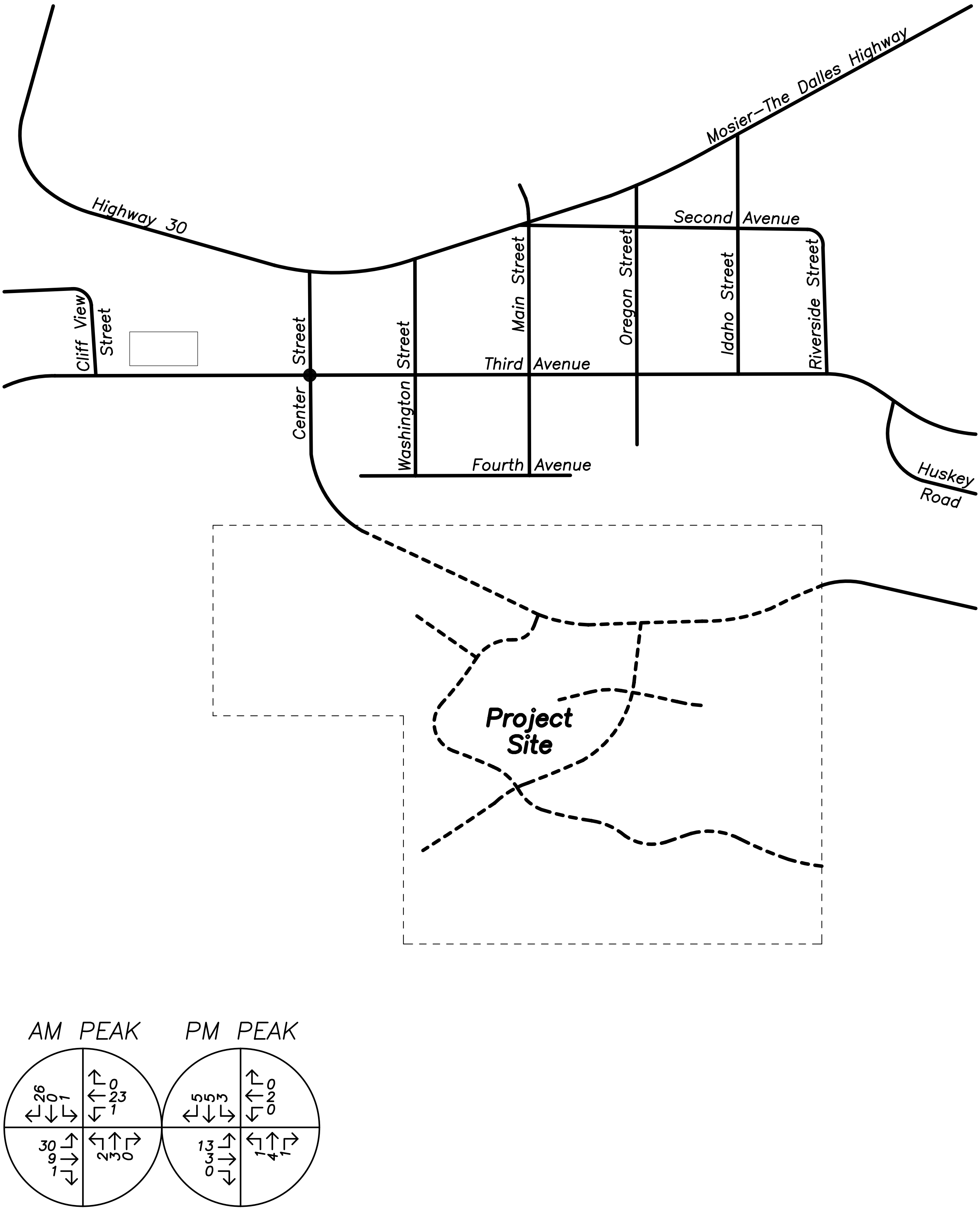
Manual turning movement counts were conducted in March of 2008 from 7:00 to 9:00 AM and from 4:00 to 6:00 PM. The peak hours were approximately 7:00 to 8:00 AM and from 4:00 to 5:00 PM. The existing traffic volumes at the study area intersections are shown in Figure 2 on page seven. Detailed traffic count data is also included in the appendix to this report.



VICINITY MAP
Existing Lane Configurations
& Traffic Control Devices

FIGURE 1

PAGE 6



TRAFFIC VOLUMES
Existing Conditions
AM & PM Peak Hours

FIGURE 2

TRIP GENERATION

To estimate the number of trips that will be generated by the proposed development, trip rates from the manual *TRIP GENERATION*, Seventh Edition, published by the Institute of Transportation Engineers (ITE), were used. The trip generation calculations show that the proposed development will generate 37 trips during the morning peak hour, with 9 entering and 28 exiting the site. A total of 49 trips will be generated during the evening peak hour with 31 entering and 18 exiting the site. A weekday total of 470 trips is expected with half entering and half exiting.

A summary of the weekday trip generation calculations is shown in the table below. Detailed calculations are included in the appendix to this report.

TRIP GENERATION SUMMARY

Tanawashee Subdivision

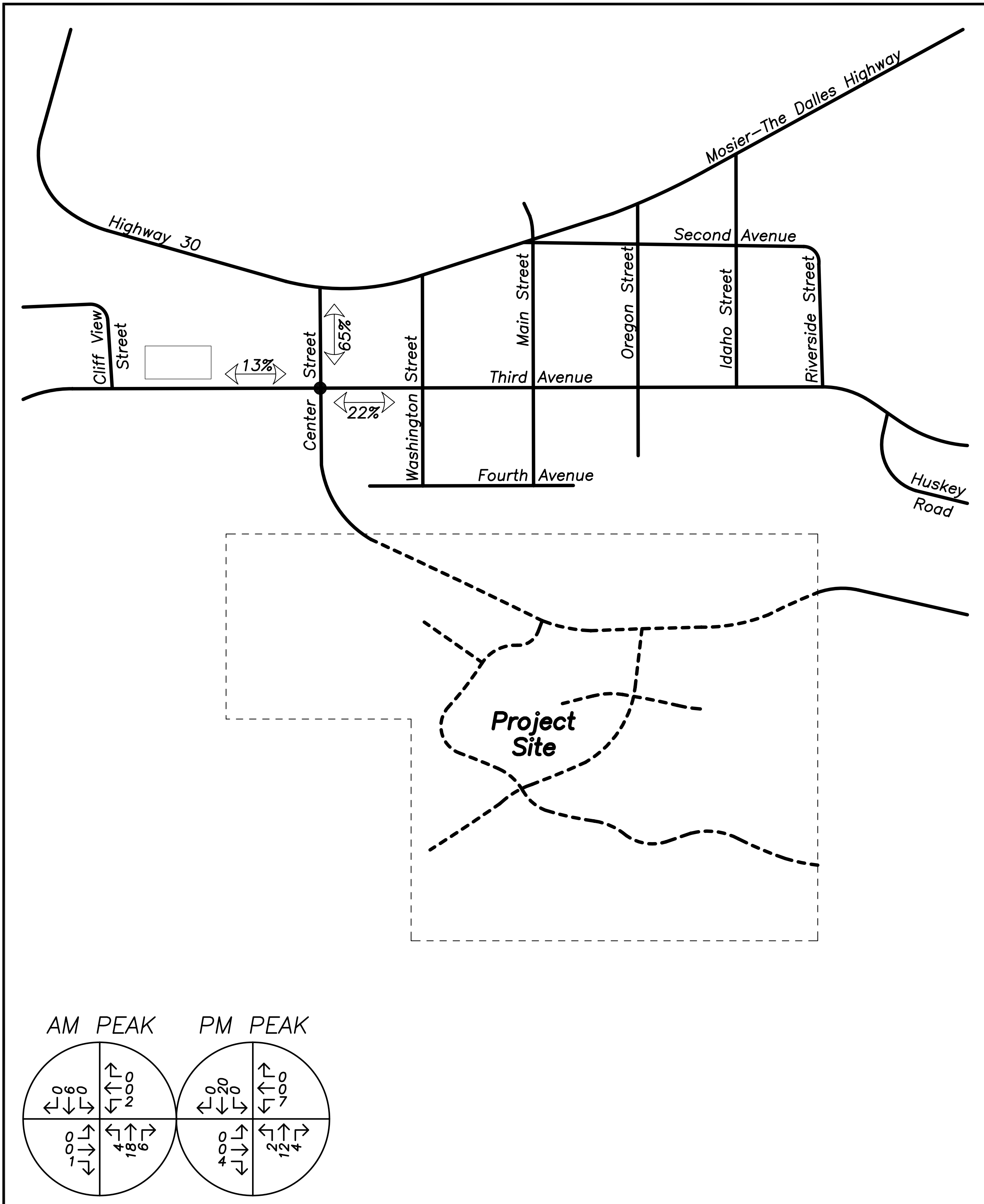
	Entering Trips	Exiting Trips	Total Trips
44 Single Family Dwellings [1]			
AM Peak Hour	9	28	37
PM Peak Hour	31	18	49
Weekday	235	235	470

[1] Land-use code 210, *Single-Family Detached Housing*

TRIP DISTRIBUTION

The south leg of the intersection of Center Street at Third Avenue currently serves residential traffic that is substantially similar to the proposed development. Therefore, the directional distribution of the site trips from the proposed development was estimated based on the existing traffic patterns at the study intersection.

The trip distribution pattern and assignment of site trips to the area intersections during the morning and evening peak hours is shown in Figure 3 on page 10.



SITE–GENERATED TRAFFIC
Proposed Development Plan
AM & PM Peak Hours

no scale

FIGURE 3

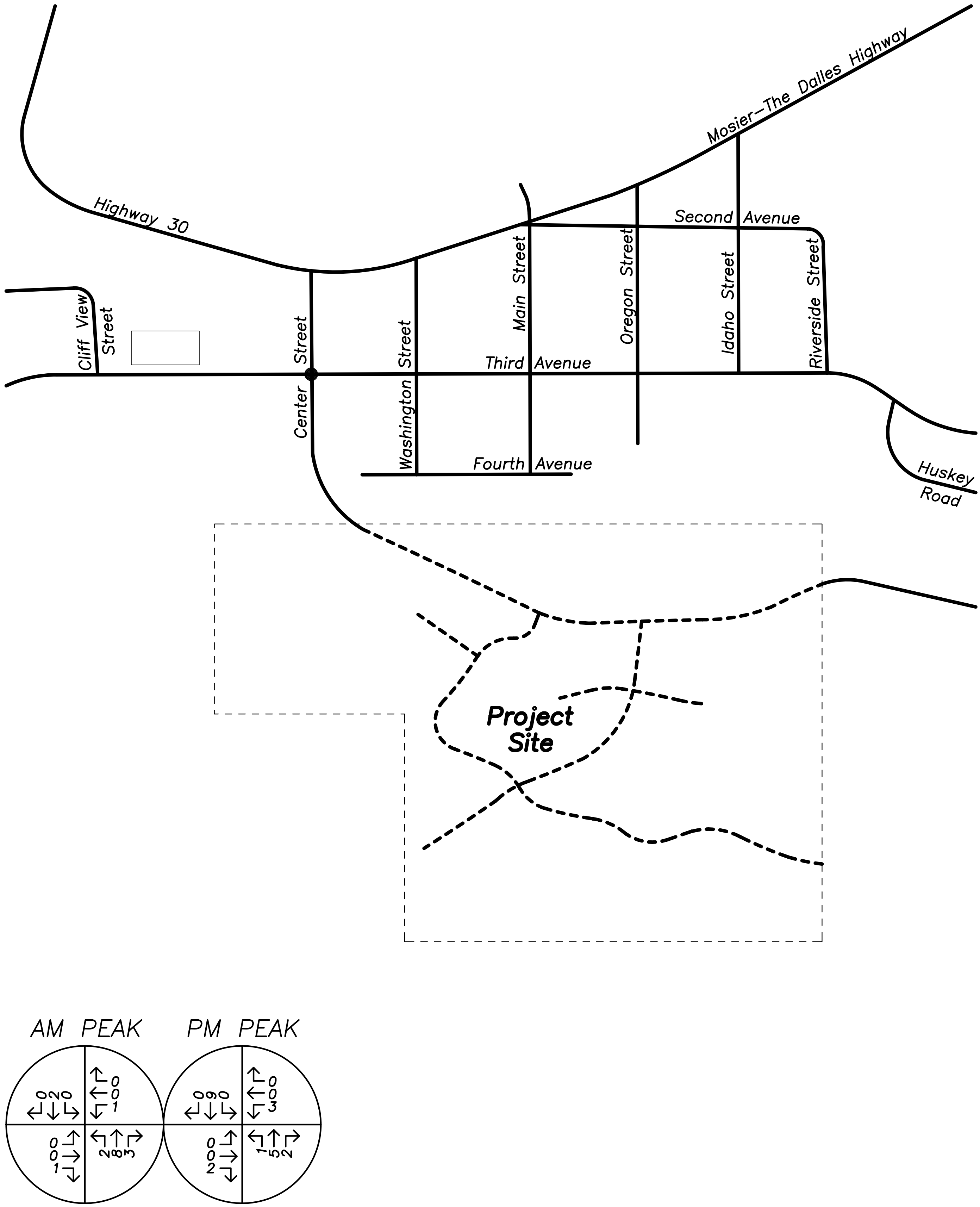
OPERATIONAL ANALYSIS

Background Traffic

Prior to assigning the site trips to the study intersection, the existing volumes were increased in order to account for anticipated growth in the study area. Based on population growth and historical traffic volumes in the site vicinity, a two percent growth rate was applied to the existing year 2008 traffic volume data. It is expected that this site could be fully developed and occupied prior to the end of 2009, so the growth rate was applied over a period of two years to generate background traffic volumes representative of end of year 2009 conditions.

In addition to the growth rate, in-process trips from other adjacent developments were added to the existing traffic volumes to represent the expected trips associate with the planned Mosier Bluffs and Able Plats developments. These in-process trips are shown in Figure 4 on page 12.

The anticipated year 2009 background traffic volumes are shown in Figure 5 on page 13. The sum of the background traffic volumes plus traffic from the proposed residential development is shown in Figure 6 on page 14.

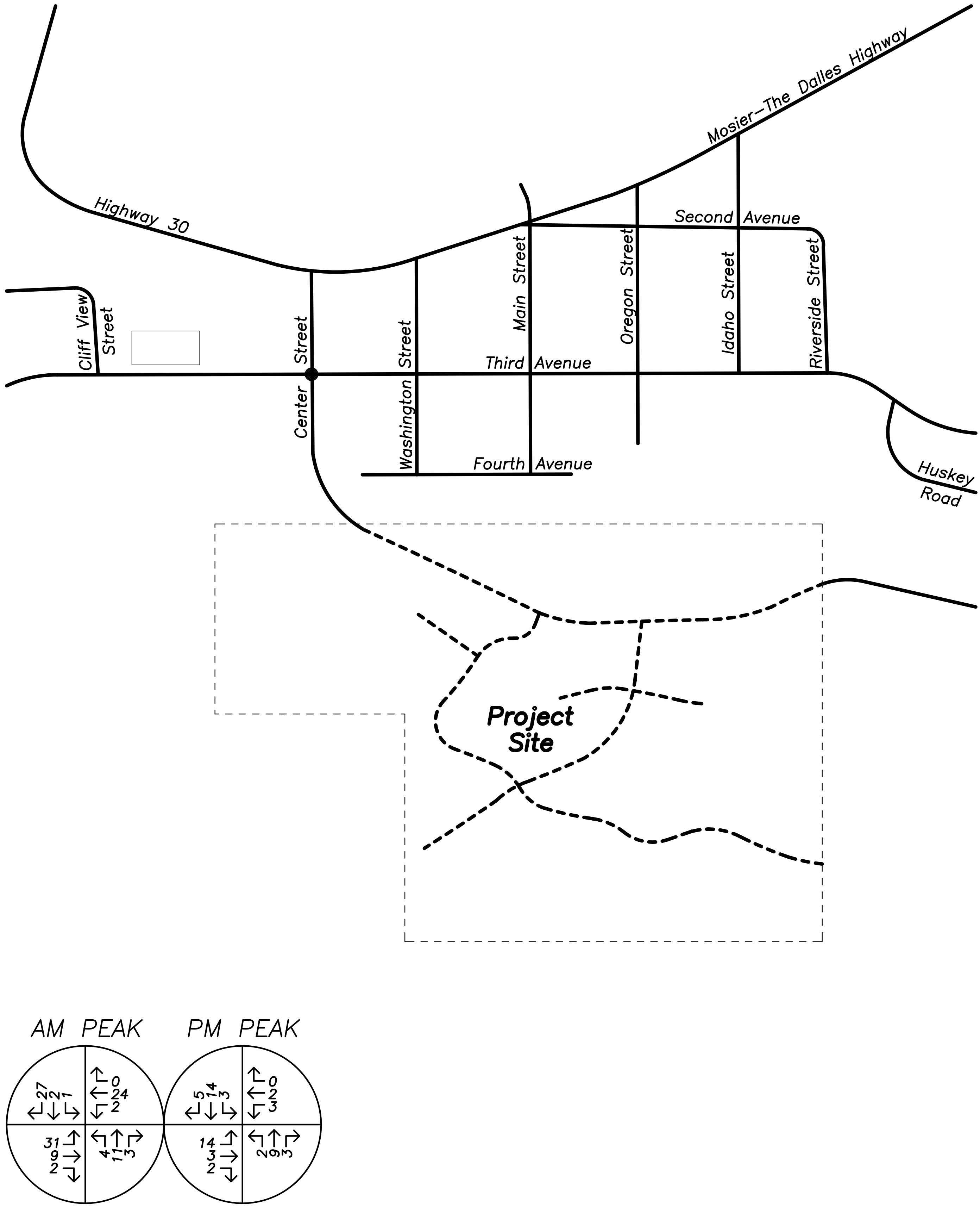


IN–PROCESS TRAFFIC VOLUMES
Site Trips from Other Developments
AM & PM Peak Hours

no scale

FIGURE 4

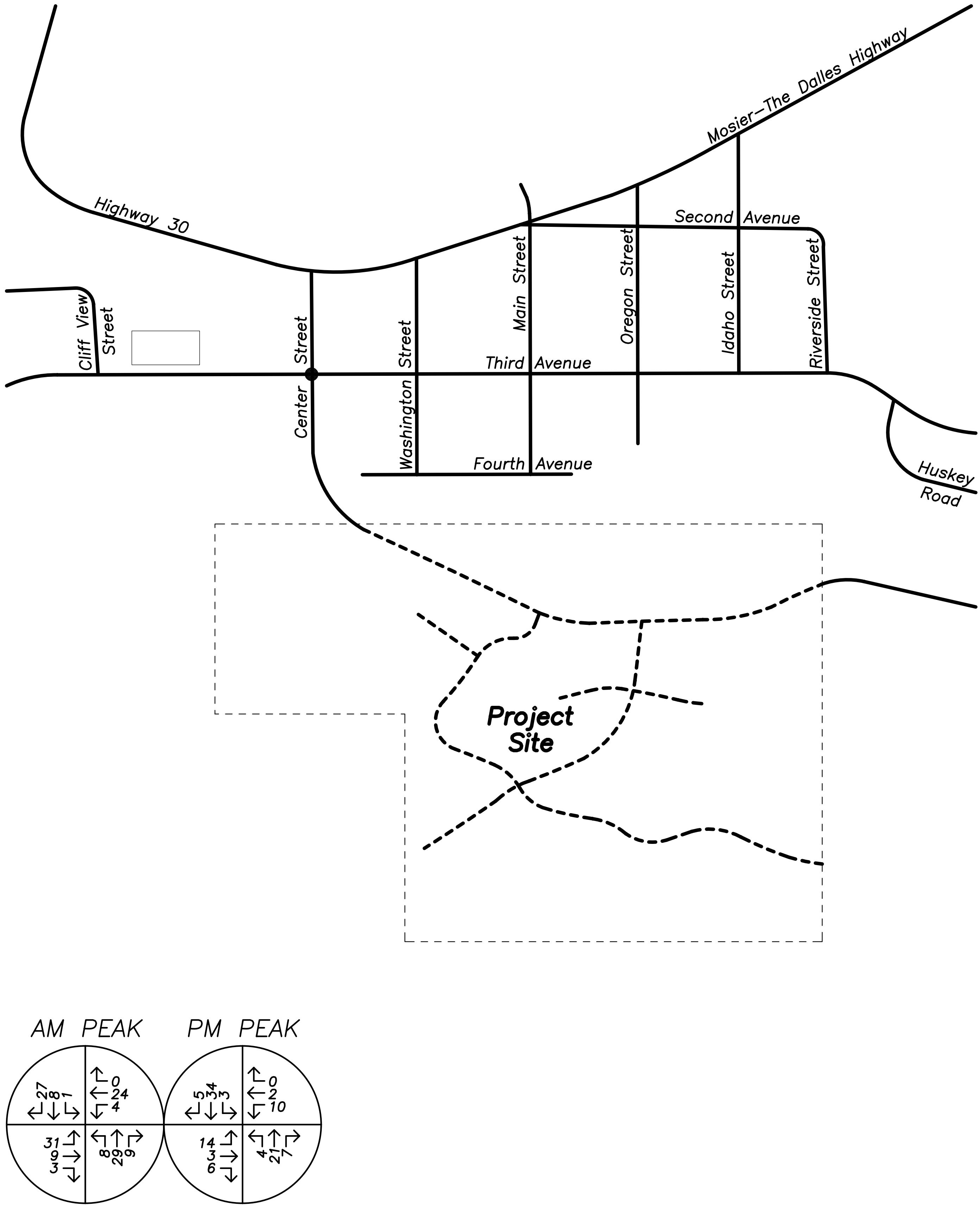
PAGE 12



TRAFFIC VOLUMES
Year 2009 Background Conditions
AM & PM Peak Hours

no scale

FIGURE 5



TRAFFIC VOLUMES
Year 2009 Background plus Site Trips
AM & PM Peak Hours

N
no scale

FIGURE 6

Capacity Analysis

To determine the level of service at the study intersection, a capacity analysis was conducted. The level of service can range from A, which indicates very little or no delay, to F, which indicates a high degree of congestion and delay. The analysis was made for the weekday evening peak hour for existing conditions, background conditions, and for the sum of background traffic plus trips generated by the proposed development.

The intersection was analyzed using the unsignalized intersection analysis methods in the 2000 *HIGHWAY CAPACITY MANUAL*, published by the Transportation Research Board. The levels of service described in this report refer only to traffic on the stop-controlled approach with the highest delay. Through traffic on that does not stop at the analyzed intersections and is not assessed a level of service.

The intersection of Center Street at Third Avenue is currently operating at level of service A during the weekday morning and evening peak hours. Under year 2009 traffic conditions, the intersection is projected to continue to operate at level of service B during the morning peak hour and level of service A during the evening peak hour either with or without the addition of site traffic from the proposed development.

The results of the capacity analysis, along with the levels of service, delay, and v/c ratios are shown in the following table. Detailed calculations, as well as tables showing the relationships between delay and level of service are included in the appendix to this report.

LEVEL OF SERVICE SUMMARY

Tanawashee Subdivision

	AM Peak Hour			PM Peak Hour		
	LOS	Delay	v/c	LOS	Delay	v/c
Center Street at Third Avenue						
Existing Conditions	A	10	0.10	A	9	0.03
Background 2009 Conditions	B	10	0.11	A	9	0.04
2009 Background + Site Trips	B	11	0.13	A	10	0.08

LOS = Level of Service
Delay = Average delay per vehicle in seconds
v/c = Volume-to-capacity ratio

Construction Traffic

During the period of construction for the Tanawashee, Mosier Bluffs and Able Plat subdivisions, it is expected that the intersection of Center Street at Third Avenue will serve construction traffic including an increased proportion of heavy vehicles. Overall traffic levels during construction normally do not exceed the traffic levels projected upon completion of a residential subdivision; however the additional heavy vehicles can affect traffic operations.

The intersection of Center Street at Third Avenue is situated on a significant slope. The northbound intersection approach has a down slope of approximately 13 percent, while the southbound approach has an up slope of approximately 15 percent grade. Heavy vehicles including those associated with construction traffic and school buses serving Mosier Community School have greater difficulty traveling up hills of significant grade than do passenger cars. This difficulty is amplified at locations where vehicles are required to stop.

Since the southbound intersection approach is free-flowing, heavy vehicles typically do not need to stop on the steep uphill grade when approaching the intersection in the southbound direction. Therefore, the affect of the steep grades is minimized at this intersection based on the traffic control that is currently in place.

No other significant traffic concerns are evident at this location that will be associated with construction traffic and no recommendations are made.

Sight Distance Investigation

Required intersection sight distance was calculated from the equations given in *A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS*, published in 2001 by the American Association of State Highway and Transportation Officials (AASHTO). For intersection sight distance, the measurements are based on a driver's eye height of 3.5 feet and an object height of 3.5 feet above the road, with the driver's eye 15 feet behind the edge of the near side travel lane.

Intersection sight distance was examined for the northbound approach to the intersection of Center Street at Third Street, since this approach will provide access to the proposed development site. The eastbound and westbound intersection approaches are stop-controlled and require only an adequate line of sight to observe vehicles stopped at the stop bars. Since these stopped vehicles are visible from the northbound intersection approach, no safety or operational problems are anticipated with traffic approaching from the east and west.

Based on the 25 mph statutory speed on Center Street, a minimum of 280 feet of intersection sight distance is required. Intersection sight distance was measured to be 286 feet to the north. Therefore, adequate sight distance is available at this intersection approach.

Crash History and Safety Analysis

A five-year crash history was obtained from the Oregon Department of Transportation's Crash Analysis and Reporting Unit. No crashes were reported at the intersection of Center Street and Third Avenue.

During a site visit, we observed existing intersection markings, signage and operation in order to determine whether any potential safety problems exist at the intersection.

It was also noted that the stop sign facing northbound traffic is only 24 inches across with colors that are severely weathered and fading. It is recommended that the existing stop sign be replaced with one that meets the size and material standards outlined in the current Manual on Uniform Traffic Control Devices, as adopted by the Oregon Department of Transportation.

The south side of the intersection has a marked crosswalk that serves moderate levels of pedestrian traffic, including school children. It was noted that the inside of the crosswalk markings align with the face of the curb and the back of the sidewalk. Although these markings provide a continuous path along the side of the roadway for pedestrians, the resulting crosswalk has a width of only six feet. If the outside crosswalk marking were shifted south by two to four feet, the crosswalk would have a more standard width and the northbound stop line would be shifted away from the path of pedestrian travel. This modification could improve pedestrian comfort and safety at the crossing. Alternatively, a northbound stop bar could be added 2 feet in advance of the existing crosswalk marking in order to provide additional separation while maintaining the crosswalk markings at the location likely to be used by pedestrians.

It is also recommended that all existing stop line markings, including both the aforementioned crosswalk markings and the eastbound and westbound stop bars be re-painted. The freshly painted markings will help to encourage compliance with the stop signs and provide a visual cue that traffic patterns are changing due to construction and development in the area.

Conclusions & Recommendations

The intersection of Center Street at Third Avenue is currently operating acceptably and will continue to operate acceptably through 2009 either with or without the addition of site traffic from the proposed development. No operational mitigations are recommended.

Construction traffic is not projected to create operational problems at the study intersection provided that the southbound intersection approach remains free-flowing. No construction-related traffic mitigation is proposed.

Sight distance is adequate for operations and safety at the proposed driveway locations. No mitigations are recommended.

There were no reported crashes at the intersection of Center Street and Third Avenue during the most recent five years for which data is available. Based on a review of the intersection markings, signage and operations, however, the following improvements are recommended:

- Replace the existing stop sign on the northbound intersection approach with a new 30" octagonal stop sign conforming to ODOT and MUTCD standards.
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- Re-paint the existing crosswalk markings and the stop-bar markings for the eastbound and westbound intersection approaches.