Appendix

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Technical Memorandum #9
Appendix A

Recommended Traffic Impact Analysis Guidelines

The following guidelines are intended to provide assistance to transportation planners/traffic engineers who will prepare transportation impact analysis (TIA) for developments located within the City of Philomath's planning jurisdiction. Transportation impact assessments will be required for any of the following land use actions:

- All proposed subdivisions of greater than four units;
- All Comprehensive Plan Map Amendments/Zone Changes, Master Plans, and Planned Unit Developments (PUD's); and,
- Applicable Design Review and Conditional Use Permit (CUP) applications.

The preparation of the transportation impact report is the responsibility of the land owner or applicant. The applicant can choose any qualified traffic engineer. All transportation impact reports shall be reviewed by the City Public Works Director or designated responsible party (referred to as "City" in this document). Chapter 18.105 of the Philomath Municipal Code establishes the procedures for development applications and reviews; this document provides guidance to help prepare a successful Traffic Impact Study.

The transportation impact report shall be prepared under the supervision of a Registered Traffic Engineer in Oregon or a Registered Civil Engineer in Oregon with a traffic engineering background. Studies that do not address the requirements set by the City Public Works Director shall be returned to the engineer for modification.

Study Scope

The firm preparing the transportation impact report should contact the City at the project's outset. The City will then establish the project study area, intersections for analysis, scenarios to be evaluated and any other pertinent information concerning the study. In general, studies will fall into one of two categories based on their estimated trip generation:

- Projects that generate fewer than 100 daily trips (total, in and out)
- Projects that generate 100 or more daily trips (total, in and out)

If a phased buildout is proposed, the ultimate full buildout will be used to determine the trip generation. If three years have passed since a TIA was completed, the City may evaluate if the TIA must be updated and may require an update with new scope. Report content for each category are described below:

Report Outline (Fewer than 100 daily trips)

Trip generation should be estimated for the proposed project using the latest version of the ITE Trip Generation Manual and/or trip generation surveys conducted at similar facilities[1]. If the estimated trip generation for the proposed project is less than 100 daily trips, a 2-3 page letter report would be required, including a discussion of the following items:

- Weekday AM/PM peak hour and daily trip generation estimate
- Sight distance at project access point(s) (verified by a registered Traffic or Civil Engineer in Oregon)
- On site circulation and street connectivity to adjacent parcels discussion/evaluation

It is at the City's discretion whether additional analysis would be required once this initial information is collected. In general, addressing the items listed above would be sufficient analysis.

Report Outline (100 or more daily trips)

If the estimated trip generation for the proposed project is 100 or more daily trips, a full transportation impact report will be required. The report shall include the following components:

Introduction and Summary

Brief description of the project and summary of project impacts. Any recommended mitigation measures and/or operational issues shall be discussed.

Existing Conditions

This section shall include the following elements:

- description of roadways in the study area, including roadway classification, number of lanes, average daily traffic volume, roadway width, presence or absence of sidewalks and/or bicycle facilities, nearest transit route, posted speed, presence or absence of on-street parking, etc.
- existing geometric deficiencies at study intersections
- existing traffic volumes at the study intersections measured within the previous twelve months
- crash data at study intersections for the most recent three-year period available
- other pertinent features

Study area intersections shall be determined by the City, generally based on the following criteria:

- all intersections of regional significance (arterials, collectors and local streets) where the traffic generated by the proposed project exceeds ten percent of existing AM or PM peak hour total intersection traffic volumes within the Philomath City limits
- all project access points onto the public roadway system

Intersection analysis shall be determined for study area intersections for the weekday AM and PM peak periods using the most recent version of the Highway Capacity Manual. The analysis shall include level of service, average delay, and volume to capacity ratio.

Figures showing the study area roadway network and AM and PM peak hour intersection turn movement volumes shall be provided.

[1] Use of trip generation surveys collected independently from ITE should be verified with the City prior to use.

Impacts

A detailed description of the proposed project shall be provided including the intended land use and intensity of use. Trip generation shall be estimated using the most recent version of the *ITE Trip Generation Manual* (as discussed previously), or other sources previously agreed upon with the City and shown in a table.

The following figures shall be provided (combining them is allowable as long as data is clearly shown):

- Existing peak hour traffic volumes (AM and PM—listed previously)
- Project trip distribution (percentages)
- Added project peak hour traffic volumes (AM and PM)
- Existing plus project peak hour traffic volumes (AM and PM)
- Existing plus approved project (trips from projects that have been approved but not yet constructed/occupied) peak hour traffic volumes (PM)
- Total peak hour traffic volumes (existing plus project plus approved—PM)
- If applicable, planning horizon future peak hour traffic volumes (PM)

Intersection analysis shall be conducted for the following scenarios:

- Existing plus project (AM and PM)
- Existing plus approved (PM)
- Existing plus project plus approved (PM)
- In the case of Comprehensive Plan Map Amendments/Zone Changes, the applicant must demonstrate conformance with the Transportation Planning Rule, including PM peak period analysis to the applicable Planning Horizon Year of the most recent Transportation System Plan.

Information regarding approved project traffic will be provided by the City. Information to be provided in the appendix includes the following:

- Map showing location of approved projects in the City
- Trips associated with each approved project (i.e. remaining trips associated with unoccupied portion of project)
- Figures from individual projects' transportation impact reports showing trip generation, distribution and assignment, if available.

The intersection analysis for each scenario shall be summarized in a table with the calculation sheets provided in an appendix to the report.

A list of planned improvements (Philomath CIP, Benton County CIP, and ODOT STIP) assumed in the intersection analysis shall be provided.

Signal warrant analysis based on the *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)* shall be conducted at unsignalized study area intersections that are at or below minimum level of service thresholds. The peak hour warrant (Warrant 3) should be checked and, if met, Warrants 1 and 2 (8-hour and 4-hour warrants) should be checked.

Left-turn and right-turn lane needs shall be evaluated using the current ODOT left turn and right turn siting criteria of the *Highway Design Manual (Appendix F)*.

Sight distance at project access points shall be evaluated using *American Association of State Highway and Transportation Officials,* AASHTO methodology.

A brief review of the site plan, including a site plan layout shall be provided. On-site circulation/connectivity issues shall be discussed.

Bicycle and pedestrian issues shall be discussed and planned facilities shall be compared with the *Philomath Transportation System Plan* (TSP) to make sure any facilities proposed in the TSP on the proposed project site are included as part of the proposed project. For residential projects within ½ mile of a school, a safe (walking) route to school shall be described. Potential path connections to adjacent parcels shall be determined and discussed.

Mitigation

Project specific and area-wide specific mitigation measures shall be recommended where study intersections don't meet minimum level of service standards (provided in Philomath Transportation System Plan). At a minimum, the study shall consider improvements identified in the Philomath CIP, Benton County CIP, and ODOT STIP. The study shall clearly state the mitigation measures recommended by the analysis to mitigate project impacts.

Appendix

The following items shall be in the appendix:

- Existing traffic counts
- Approved project information
- Level of service calculations
- Current site plan

B – Synchro Report

US20/OR34 and Clemens Mill Road

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	725	905	15	110	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.979	
Flt Protected	0.950				0.959	
Satd. Flow (prot)	1554	1683	1679	0	1536	0
Flt Permitted	0.198				0.959	
Satd. Flow (perm)	324	1683	1679	0	1536	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			3		15	
Link Speed (mph)		40	40		25	
Link Distance (ft)		1565	1125		394	
Travel Time (s)		26.7	19.2		10.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	7%	4%	4%	7%	7%	7%
Adj. Flow (vph)	5	763	953	16	116	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	5	763	969	0	137	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (mph)	15			9	15	9
Number of Detectors	2	2	2		2	
Detector Template	Side St	Det35	Det35		Side St	
Leading Detector (ft)	78	223	223		78	
Trailing Detector (ft)	2	107	107		2	
Detector 1 Position(ft)	2	107	107		2	
Detector 1 Size(ft)	16	16	16		16	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	
Detector 2 Position(ft)	72	217	217		72	
Detector 2 Size(ft)	6	6	6		6	
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)	0.0	0.0	0.0		0.0	
Turn Type	Perm	NA	NA		Perm	
Protected Phases		4	8			
Permitted Phases	4				6	
Detector Phase	4	4	8		6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0		4.0	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Minimum Split (s)	20.8	20.8	20.8		20.0	
Total Split (s)	40.0	40.0	40.0		20.0	
Total Split (%)	66.7%	66.7%	66.7%		33.3%	
Maximum Green (s)	35.2	35.2	35.2		16.0	
Yellow Time (s)	4.3	4.3	4.3		3.5	
All-Red Time (s)	0.5	0.5	0.5		0.5	
Lost Time Adjust (s)	-0.8	-0.8	-0.8		0.0	
Total Lost Time (s)	4.0	4.0	4.0		4.0	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Recall Mode	Min	Min	Min		None	
Walk Time (s)	5.0	5.0	5.0		5.0	
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	
Pedestrian Calls (#/hr)	0	0	0		0	
Act Effct Green (s)	42.9	42.9	42.9		10.0	
Actuated g/C Ratio	0.75	0.75	0.75		0.17	
v/c Ratio	0.02	0.61	0.77		0.49	
Control Delay	4.2	8.4	14.2		25.9	
Queue Delay	0.0	0.0	0.0		0.0	
Total Delay	4.2	8.4	14.2		25.9	
LOS	A	A	B		C	
Approach Delay		8.3	14.2		25.9	
Approach LOS		A	B		C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 57.2			
Natural Cycle: 70			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.77			
Intersection Signal Delay: 12.6		Intersection LOS: B	
Intersection Capacity Utilization 67.3%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 99: US 20/OR 34 & Clemens Mill

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	725	905	15	110	20
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	1.00		0.98	
Flt Protected	0.95	1.00	1.00		0.96	
Satd. Flow (prot)	1554	1683	1678		1537	
Flt Permitted	0.20	1.00	1.00		0.96	
Satd. Flow (perm)	323	1683	1678		1537	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	763	953	16	116	21
RTOR Reduction (vph)	0	0	1	0	13	0
Lane Group Flow (vph)	5	763	968	0	124	0
Heavy Vehicles (%)	7%	4%	4%	7%	7%	7%
Turn Type	Perm	NA	NA		Perm	
Protected Phases		4	8			
Permitted Phases	4				6	
Actuated Green, G (s)	40.9	40.9	40.9		8.4	
Effective Green, g (s)	41.7	41.7	41.7		8.4	
Actuated g/C Ratio	0.72	0.72	0.72		0.14	
Clearance Time (s)	4.8	4.8	4.8		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	231	1207	1204		222	
v/s Ratio Prot		0.45	c0.58			
v/s Ratio Perm	0.02				c0.08	
v/c Ratio	0.02	0.63	0.80		0.56	
Uniform Delay, d1	2.4	4.2	5.5		23.1	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.0	1.1	4.0		3.0	
Delay (s)	2.4	5.3	9.5		26.2	
Level of Service	A	A	A		C	
Approach Delay (s)		5.3	9.5		26.2	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	58.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

C – Preliminary Signal Warrant Worksheet

US20/OR34 and Clemens Mill Road

Oregon Department of Transportation
Transportation Development Branch
Transportation Planning Analysis Unit

Preliminary Traffic Signal Warrant Analysis[1]

Major Street:	US 20 / OR 34	**Minor Street:**	Clemens Mill Rd.
Project:	Philomath TSP	**City/County:**	Philomath
Year:	2040	**Alternative:**	2040 No-Build

Preliminary Signal Warrant Volumes

Number of Approach lanes		ADT on major street approaching from both directions		ADT on minor street, highest approaching volume	
Major Street	Minor Street	Percent of standard warrants 100	70	Percent of standard warrants 100	70
Case A: Minimum Vehicular Traffic					
1	1	8850	6200	2650	1850
2 or more	1	10600	7400	2650	1850
2 or more	2 or more	10600	7400	3550	2500
1	2 or more	8850	6200	3550	2500
Case B: Interruption of Continuous Traffic					
1	1	13300	9300	1350	950
2 or more	1	15900	11100	1350	950
2 or more	2 or more	15900	11100	1750	1250
1	2 or more	13300	9300	1750	1250

X	100 percent of standard warrants
	70 percent of standard warrants[2]

Preliminary Signal Warrant Calculation

	Street	Number of Lanes	Warrant Volumes	Approach Volumes	Warrant Met
Case A	Major	2	10600	16500	N
	Minor	1	2650	1375	
Case B	Major	2	15900	16500	Y
	Minor	1	1350	1375	

Analyst and Date: BLC 9/18/2017	Reviewer and Date:

[1] Meeting preliminary signal warrants does **not** guarantee that a signal will be installed. When preliminary signal warrants are met, project analysts need to coordinate with Region Traffic to initiate the traffic signal engineering investigation as outlined in the Traffic Manual. Before a signal can be installed, the engineering investigation must be conducted or reviewed by the Region Traffic Manager who will forward signal recommendations to headquarters. Traffic signal warrants must be met and the State Traffic Engineer's approval obtained before a traffic signal can be installed on a state highway.

[2] Used due to 85th percentile speed in excess of 40 mph or isolated community with population of less than 10,000.