KITTELSON & ASSOCIATES, INC.
1001 SW EMKAY DR, STE 140
BEND, OR 97702 | P 541.312.8300

MEMORANDUM #2

Date: September 16, 2019 Project #: 23256

To: Project Management Team & Advisory Committee

From: Matt Kittelson, PE, Julia Kuhn, PE, & Steven Kochvar

Project: Wickiup Junction Refinement Plan

Subject: Technical Memorandum #2: Methodology Memorandum

INTRODUCTION

This memorandum documents the methodology and key assumptions that are proposed for use in the existing and future conditions and alternative analyses for the Wickiup Junction Refinement Plan (WJRP). The methodologies included in this memorandum are based on guidance provided in the Oregon Department of Transportation (ODOT) *Analysis Procedures Manual* (APM), Versions 1 and 2 as they relate to the WJRP.

STUDY INTERSECTIONS

To inform the identification of existing and future capacity needs, 16-hour intersection classification counts were collected in June 2019 at the following intersections:

- US 97 & Rosland Rd
- US 97 & Burgess Rd
- Burgess Rd & Huntington Rd
- US 97 & 1st St/Reed Rd
- 1st St & Huntington Rd

4-hour intersection classification counts (2:00-6:00 PM) were collected in June 2019 at the following intersections:

- US 97 & Drafter Rd
- US 97 & Frontage Rd Access
- Huntington Rd & Cagle Rd
- Burgess Rd & Skidgel Rd
- Rosland Rd & Frontage Rd
- Rosland Rd & Drafter Rd
- Pine Dr & Burgess Rd
- Rosland Rd & Darlene Wy

Figure 1 illustrates the location of the identified study intersections. Turning movement counts were collected by ODOT consistent with Task 4.2.1 of the Work Order Contract (WOC) scope of work.

16 Hour Traffic Count Locations
4 Hour Traffic Count Locations
Study Area

RIVERVIEW DR
WEST DR
COUGAR LN
DEER RUN LN
FAUN LN
PINE CREST LN
LOOP DR
PRAIRIE VIEW DR
BRIDGE DR
WALKER WAY
FOREST RD
TIMBER LANE LOOP
ALPINE DR
DYKE RD
LEONA LN
ASH DR
OAK DR
ELM DR
MURRY DR
DRAFTER RD
CAGLE RD
PINE PL
PAM LN
PAULINA VIEW RD
HOWARD LN
LOST PONDEROSA RD
RIVER PINE RD
PINE DR
ANTLER LN
SKIDGEL RD
RAILROAD ST
BURGESS RD
ROSLAND RD
GLENWOOD DR
ELENA LN
WILLOW LN
97
FS 2205
HUNTINGTON RD
FINDLEY DR
FORDHAM DR
CRESCENT CREEK DR
DARLENE WAY
MEMORIAL LN
HALE RD
COACH RD
1ST ST
1ST ST
REED RD
REED RD
ASSEMBLY WAY
2ND ST
BOX WAY
3RD ST
SLY DR
DILLON WAY
4TH ST
WILLIAM FOSS RD
WALKER ST
MORSON ST
HINKLE WAY
MITTS WAY
RUSSELL RD
0 0.25 0.5 Miles

H:\23\23256 - Wickiup Junction Refinement Plan\gis\Traffic Count Locations.mxd - mbarrus - 1:14 PM 9/16/2019

Wickiup Junction
REFINEMENT PLAN

Traffic Count Locations
La Pine, Oregon

Figure
1

Coordinate System: NAD 1983 2011 StatePlane Oregon South FIPS 3602 Ft Intl

INTERSECTION OPERATIONAL STANDARDS

Per Task 4.2.4, the following performance measures and information will be provided at each of the 11 study intersections, regardless of jurisdictional control:

- Volume-to-capacity (v/c) ratio;
- Level-of-service (LOS);
- Delay; and
- Turning movement counts.

This information will be provided in tables, figures, and/or technical appendices. Graphical summaries of the intersection operations will be provided to provide the general public a more clear and relatable understanding of the analysis results.

ODOT MOBILITY TARGETS

ODOT assesses intersection operations based on established mobility targets (as defined by the volume-to-capacity (v/c) ratio). Table 6 of the *Oregon Highway Plan* (OHP) provides the mobility targets for facilities outside the Portland Metro area (Note that Highway Design Manual standards will be used to evaluate potential solutions in TM #6, Identification of Preferred Alternatives). US 97 (The Dalles-California Highway) is designated by the OHP as a Statewide Freight Route and Expressway and five of the eleven study intersections are located on this highway. Table 6 of the OHP states that a Statewide highway designated as an Expressway within an Urban Grown Boundary should maintain a mobility target v/c ratio less than 0.80. However, the OHP states that non-state highway unsignalized intersection approaches should adhere to the volume to capacity ratio for District/Local Interest Roads. Therefore, the mobility standard for the side street approaches to US 97 intersections within the study area is a v/c ratio less than 0.90.

Table 10-2 of the ODOT 2012 Highway Design Manual (HDM) provides v/c ratios used to assist in identifying future system deficiencies and evaluating future alternatives on state highways. The ODOT HDM states that a statewide (NHS) on an expressway inside an urban growth boundary and outside an MPO should be designed for a mobility target v/c ratio less than 0.65 or 0.75 depending on the posted speed. Depending on the operational efficiencies of various identified alternative improvements, an alternative mobility standard may be presented within the refinement planning process.

The remaining six intersections are owned and maintained by Deschutes County, which has an adopted performance standard of Level of Service (LOS) D or better. Table 1 shows the intersection control and mobility targets for the study intersections. As stated in the La Pine Transportation System Plan, the City of La Pine has historically deferred to Deschutes County requirements with regards to intersection performance.

Table 1. Study Intersection Control and Mobility Target

Study Int. #	Intersection	Classification/ Jurisdiction	Intersection Control	Mobility Target	
1	US 97/Rosland Rd	ODOT	Unsignalized	Side-Street: OHP: v/c<0.90 Mainline: OHP: v/c<0.80:	HDM: v/c<0.65
2	US 97/Burgess Rd	ODOT	Unsignalized	Side-Street: OHP: v/c<0.90 Mainline: OHP: v/c<0.80:	HDM: v/c<0.65
3	US 97/1st St/Reed Rd	ODOT	Traffic Signal	Side-Street: OHP: v/c<0.95 Mainline: OHP: v/c<0.85:	HDM: v/c<0.70
4	US 97/Drafter Rd	ODOT	Unsignalized	Side-Street: OHP: v/c<0.90 Mainline: OHP: v/c<0.80:	HDM: v/c<0.65
5	US 97/Frontage Rd Access	ODOT	Unsignalized	Side-Street: OHP: v/c<0.90 Mainline: OHP: v/c<0.80:	HDM: v/c<0.65
6	1st St/Huntington Rd	County	Traffic Signal	LOS D	
7	Burgess Rd/Huntington Rd	County	Traffic Signal	LOS D	
8	Rosland Rd/Frontage Rd	County	Unsignalized	LOS D	
9	Rosland Rd/Drafter Rd	County	Unsignalized	LOS D	
10	Pine Dr/Burgess Rd	County	Unsignalized	LOS D	
11	Rosland Rd/Darlene Wy	County	Unsignalized	LOS D	
12	Huntington Rd/Cagle Rd	County	Unsignalized	LOS D	
13	Burgess Rd/Skidgel Rd	County	Unsignalized	LOS D	

SEASONAL ADJUSTMENT FACTOR

Per Task 4.2.3, all traffic counts along US 97 will be adjusted to reflect 30th highest hour conditions. Version 2 of the APM identifies three methods for identifying seasonal adjustment factors for highway traffic volumes.

As stated within Section 5.5.1 of the APM,

"The On-Site ATR Method is used when an ATR is within or near the project area. If located outside of the project area, there should be no major intersections between the ATR and the project area, and it should be within a minimal distance so that the traffic characteristics such as road class, number of lanes, rural/urban area, etc., are comparable. It is also important to check that the project area's AADT in the Transportation Volume Table is within +/- 10% of the ATRs AADT.".

There are no ATRs located at Wickiup Junction. The two closest ATRs are in Chemult and south Bend. ODOT Transportation Volume Tables include traffic AADT data and vehicle classification data throughout the state. Traffic data on US 97 is collected and reported based on milepost.

If on site ATR data is not available, the APM then suggests using the ATR Characteristic Table Method. The Characteristic Table Method averages ATR data from locations throughout the state that have general characteristics similar to the roadway in the project area. This method requires that the ATR AADT fall within 10 percent of the project area AADT. By applying the characteristics listed below from the 2018 ATR Characteristic Table and comparing the project area AADT recorded in ODOT's 2017 Transportation Volume Tables – and considering growth between 2017 and 2018 – no appropriate ATR's are available for the ATR Characteristic Table Method.

If the ATR Characteristic Table Method cannot be used, the APM recommends the Seasonal Trend Method as a final method for seasonally adjusting traffic volumes. ODOT's Seasonal Trend Table averages seasonal trend groupings from the ATR Characteristic Table and is based on ADT. Given the seasonal traffic trend in the project area is summer based, Table 2 summarizes the 2018 count date seasonal factor for the count month (May), the peak period seasonal factor, and the calculated seasonal factor to be used for analysis.

Table 2: Seasonal Trend Table Seasonal Adjustment Method

Trend	Count Date Seasonal Factor (May 1)	Peak Period Seasonal Factor	Calculated Seasonal Adjustment Factor
Summer	0.9061	0.8317	1.09

ANALYSIS MODEL PARAMETERS

The bullets below identify the proposed sources of data and methodologies to be used to analyze traffic conditions at Wickiup Junction. Analyses of all state facilities will be conducted according to the most-recent version of the APM, unless otherwise agreed upon by both ODOT's Transportation Planning and Analysis Unit (TPAU) and the consultant team.

- *Intersection/Roadway Geometry* (lane numbers and arrangements, cross-section elements, signal phasing, etc.) will be reviewed through aerial photography and confirmed through a field review. Available as-built data may also be used to verify existing roadway geometry. The analysis models will be built on scaled roadway line work from GIS or aerial photography in Synchro analysis software.
- *Operational Data* (such as posted speeds, intersection control, parking, right-turn on red, etc.) will be field verified. Data will be reviewed during a field visit and supplemented by available GIS data, aerials, photos, and the ODOT Video Log.
- *Peak Hour Factors* (PHF) will be calculated for each intersection and applied to the existing conditions analyses. Where applicable, corridor or regional PHFs may be developed. PHFs of 0.95 will be used for the future analysis for high-order facilities (arterials), with 0.90 applied to medium-order facilities (collectors) and 0.85 applied to local roads. If the existing PHF is greater than these default future values, the existing PHF will be applied.
- Traffic Operations
  - Highway Capacity Manual (HCM) 6th Edition methodology shall be used for intersection analyses of the design hour conditions; volume-to-capacity ratios for signalized intersections will be calculated manually. The existing and future no-build analysis will utilize Vistro software for all study intersections. Level-of-service, delay, and volume-to-capacity ratios will be reported at each of the study intersections regardless of roadway jurisdiction.

- Queuing analysis methodology will be based on Vistro 95th percentile queue lengths as appropriate; ODOT's two-way stop-controlled intersection calculator tool will be used to estimate queue lengths for two-way stop-controlled intersections. Microsimulation is not proposed as part of the long-range planning effort.

ANALYSIS INPUT ASSUMPTIONS

Analysis software will be used for the intersection analyses. This analysis will be consistent with the HCM procedures. Table 3 lists the proposed input parameters.

Table 3. Vistro Operations Parameters/Assumptions

Arterial Intersection Parameters	Existing Conditions
Peak Hour Factor	From traffic counts
Conflicting Bikes and Pedestrian per Hour	From traffic counts, as available
Ideal Saturation Flow Rate (for all movements)	1,750 passenger cars per hour green per lane
Lane Width	12 feet unless field observations suggest otherwise
Percent Heavy Vehicles	From traffic counts by movement, as available
95th percentile vehicle queues	HCM summary output

CRASH ANALYSES

Per Task 4.2.6, the most recent five years of crash data, as provided by ODOT, will be reviewed at the study intersections. Any intersections that are identified as a Top 5% and 10% Safety Priority Index System (SPIS) site will be included in the crash data.

Intersection crash rates at each location will be compared to the 90th percentile rates, critical crash rates and the excess proportion of specific crash types, per the APM. Crash rates will also be compared to the ODOT Crash Tables II and IV severe injury and fatal crash rates. Any locations where the rates are exceeded, we will identify potential countermeasures using the ODOT All Roads Transportation Safety (ARTS) crash reduction factors.

FORECAST YEAR VOLUME DEVELOPMENT

Per Task 4.3.1 of the scope, the baseline year 2040 will be used as the future design year. Growth factors are developed using ODOT's historical trends method, which relies on traffic volumes from previous years to develop a growth pattern for use in projected future volumes. ODOT maintains Future Volumes Tables that summarize current and future year traffic volumes for state roadways throughout the State. To calculate the growth rate for Wickiup Junction, the singular La Pine historic count location two locations north and south of La Pine were reviewed from the Future Volumes Table. The ODOT APM guidance states that data with an R-squared value (RSQ, a measure of fit) of less than 0.75 should not be used when calculating future growth. The La Pine count location exhibits an RSQ=0.85. The two adjacent count locations exhibit RSQ values above 0.75. Based on these values, we propose a growth rate of 1.6% to evaluate future condition. Table 4 shows the ODOT Future Volumes Table and the respective values.

Deschutes County typically applies a 2-3% annual growth rate to forecast future volumes on county roads. 2% annual growth rate will be applied to county roads to assume similar growth for side-street volumes as that of US 97 including the turning movements of roads intersecting with the highway.

Table 4. ODOT Future Growth Table							
HWY	MP	DIR	Location	2017	2037	RSQ1	Annual Growth Rate
004	161.84	1	0.10 mile south of Paulina Lake Road	9600	13500	0.9387	1.7%
004	167.48	1	0.02 mile north of 1st Street in La Pine	9600	13300	0.8554	1.6%
004	169.58	1	0.10 mile north of Fremont Highway (OR31)	8100	10600	0.8036	1.4%
					Average Annual Compound Growth Rate		**1.6%**

[1]RSQ=R-squared value, describing the fit of the data to the line

ACTIVE TRANSPORTATION ANALYSIS

Per Task 4.2.5, the scope of work, existing gaps in the sidewalks, bicycle network, and transit network along the primary routes will be identified. Quantitative and qualitative analysis of active transportation facilities will be performed consistent with APM, Version 2 and include:

- Qualitative (multimodal) assessment for transit modes;
- A qualitative assessment of transit service and identification of underserved areas;
- Gaps in intermodal connectivity (reference the La Pine TSP and Deschutes County TSP for existing deficiencies);
- Identification of safety concerns;
- Identification of barriers (gaps, topography);
- Level of stress analysis (already completed for US97 segments); and
- Identification of treatments to achieve Level of Traffic Stress (LTS) 1 or 2 (i.e. separation) where existing conditions currently exceed those levels.

NEXT STEPS

We look forward to your review of the assumptions and parameters documented herein and proposed to be used as part of the Wickiup Junction Refinement Plan Existing and Future conditions and alternative analyses.