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MEMORANDUM

Date: December 17, 2020

To: Project Management Team, Project Advisory Committee & Technical Advisory Committee

From: Matt Kittelson, PE, Julia Kuhn, PE, and Miranda Barrus

Project: Town of Lakeview Transportation System Plan Update

Subject: Methodology Memorandum

INTRODUCTION

This memorandum documents the methodology and key assumptions that are proposed for use as part of the analyses conducted for the Town of Lakeview Transportation System Plan Update (Lakeview TSP). The methodologies included in this memorandum are based on guidance provided in the Oregon Department of Transportation (ODOT) *Analysis Procedures Manual (APM), Version 2* (APM – Reference 1) and direction provided by the Town of Lakeview and ODOT staff. The methodology and assumptions described in this memorandum include:

- Data collection methodologies that consider the ongoing COVID-19 pandemic;
- Traffic operations at the study intersection under existing, future no-build, and future build traffic conditions;
- Traffic safety at the study intersection and along study area roadways;
- Gaps and deficiencies in the bicycle and pedestrian network;
- Gaps and deficiencies in the transit service (service frequency, hours, coverage, etc.); and
- Gaps and deficiencies in other travel modes.

This information will serve as a baseline for identifying a comprehensive list of needs to be addressed as part of the TSP update as well as to help identify and evaluate potential solutions as part of a prioritized list of improvements for the TSP update.

STUDY AREA

The Lakeview TSP update includes the multimodal transportation network within the town's urban growth boundary (UGB) and includes seven study intersections along OR 140 and US 395. Figure 1 illustrates the study area.

TSP INTERSECTIONS

The following study intersection will be evaluated to inform the identification of existing and future capacity needs: :

- Roberta Avenue/OR 140
- L Street/South 3rd Street
- US 395/South 9th Street
- US 395/J Street/Missouri Avenue
- US 395/South 7th Street
- Roberta Road/South 3rd Street
- US 395/OR 140

Figure 1 illustrates the location of the study intersections; all study intersections are unsignalized.

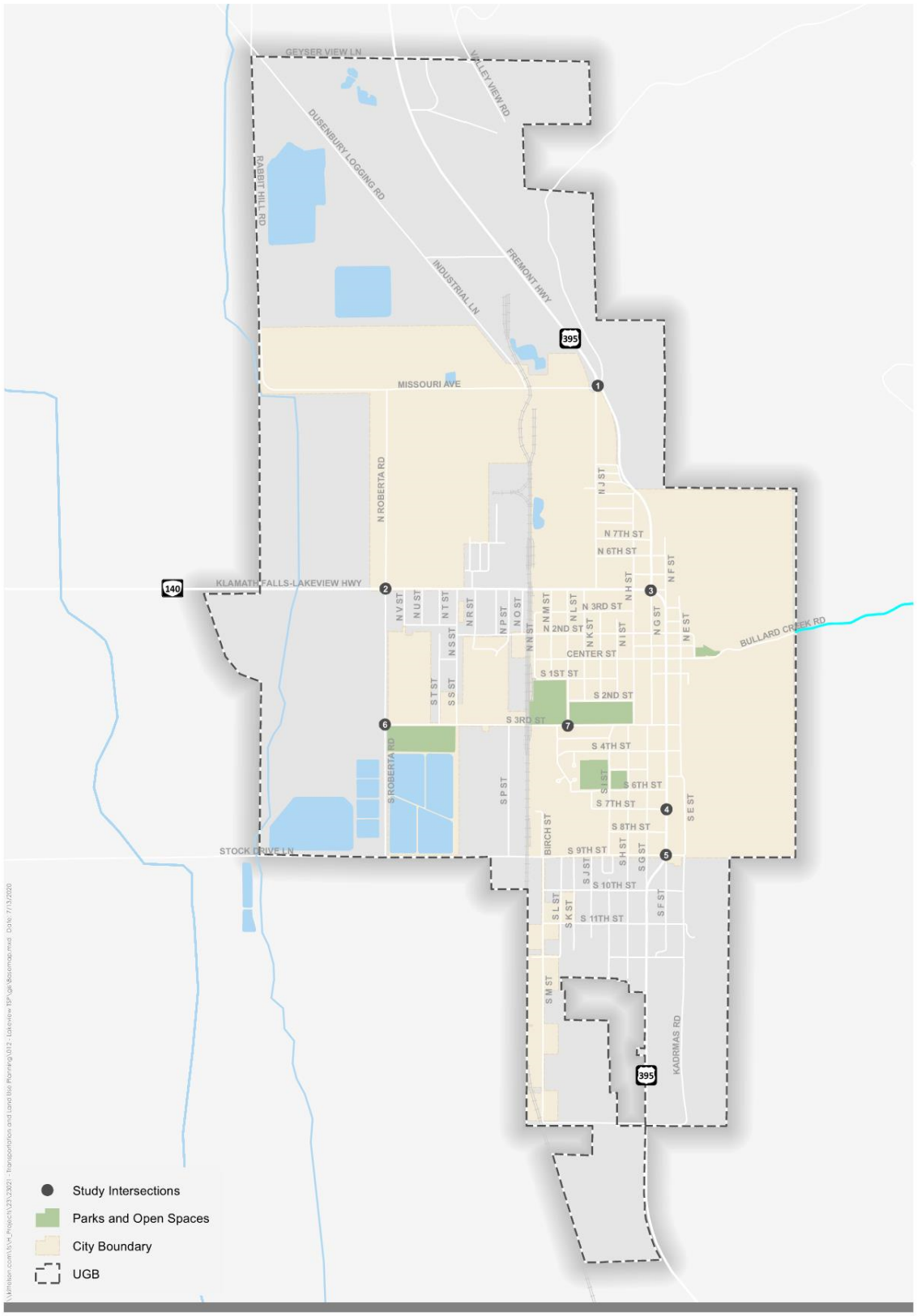

Figure 1

Study Area
Lakeview, Oregon

VOLUME DEVELOPMENT

The following sections describe how existing "proxy" volumes will be calculated at the study intersection and how they will be used to evaluate existing and future traffic intersection operations.

TRAFFIC COUNTS

Traffic patterns are not currently reflective of typical conditions due to school closures and "Stay Home, Stay Safe" orders associated with the COVID-19 pandemic. For these reasons, four-hour traffic counts will be conducted at the study intersections in Fall 2020 contingent on school being back in session. If school is not back in session in the fall, alternative methods will be pursued, including estimating current volumes based on historical counts and trends.

SEASONAL ADJUSTMENT FACTOR

30th Hour Volumes (30 HV) will be developed based on the traffic counts collected or estimated at the study intersections and the application of seasonal adjustment factors consistent with the methodology identified in the APM. The APM provides three methods for identifying seasonal adjustment factors for highway traffic volumes. All three methods utilize information provided by Automatic Traffic Recorders (ATRs) positioned in select locations throughout the State Highway System that collect traffic data 24-hours a day, 365 days a year. Each method was evaluated to determine which is most appropriate for the study intersections. Below is a description of each. Based on the evaluations, the ATR On-Site Method will be used for study intersections on State facilities.

- On-Site ATR Method: Calculates seasonal adjustment factors based on local ATR locations. This method requires that no major study intersections be located within the ATR and the project area and Average Annual Daily Traffic (AADT) be within 10 percent of the AADT within the project area.
- Characteristics Table: Calculates seasonal adjustment factors based on representative ATR locations from locations around the state based on AADT, seasonal traffic trends, area type, number of travel lanes, etc.
- Seasonal Trends Table: Calculates seasonal adjustment factors based seasonal variation trends from representative travel patterns (e.g., summer, commuter, weekend, etc.)

Lakeview is in south central Oregon at the junction of US 395 and OR 140. ATR stations are located north and south of town on US 395 (19-004 and 19-008) and west on OR-140 (18-017). As shown in Table 1, seasonal adjustment factors based on these stations range from 1.01 to 1.03 with an average of 1.02 when adjusting for data collected in September.

As regional highways connecting small communities, OR 140 and US 395 have AADT lower than that observed within the Town of Lakeview. However, these ATRs represent traffic entering or exiting Lakeview from major external destinations and, as such, reasonable fluctuation in travel demand within the town. No major cities, towns, or highway junctions exist between any of the ATR locations and Lakeview. For these reasons, we propose to utilize the On-Site ATR Method based on these stations to calculate seasonal adjustment factors for Lakeview.

Table 1 presents values that represent the percent of Average Daily Traffic (ADT) at these ATR's from the past five years during their average peak month and the month when traffic counts proposed to be collected (September 2020), which result in their respective seasonal adjustment factors.

Table 1: Seasonal Adjustment Factor Calculation

Year	2014	2015	2016	2017	2018	Average	Seasonal Adjustment
ATR 18-017 (OR 140, Beatty)							
Peak Month (July)	~~131~~	~~127~~	129	131	127	129	N/A
Count Month (September)	~~118~~	127	129	~~132~~	128	128	1.01
ATR 19-004 (US 395, Valley Falls)							
Peak Month (August)	131	~~129~~	136	~~181~~	135	134	N/A
Count Month (September)	~~121~~	131	131	130	~~136~~	130.67	1.03
ATR 19-008 (US 395, New Pine Creek)							
Peak Month (August)	125	~~120~~	126	~~163~~	121	124	N/A
Count Month (September)	~~117~~	123	129	118	~~133~~	123.33	1.01
						Average	**1.02**

Note: crossed out values are dropped from average calculations per ODOT methodology. Calculations are based on the percentage of ADT from the peak month divided by the percentage of ADT from the count month.

US 395 and OR 140 have ADT in the range of 4,000 within Lakeview. Per APM guidance, the ATRs shown in Table 1 are within 10% of that value (4,300 and 3,800)

HISTORICAL GROWTH FACTOR

If traffic counts cannot be collected in Fall 2020 and analysis requires developing "proxy volumes" to replicate current traffic volumes, available traffic counts collected in previous years will be historically adjusted per the APM utilizing data from ODOT's Future Volume Tables (FVT). Per the APM, an R-squared value (RSQ, a measure of fit) of 0.75 is preferred, however, and R-squared value of 0.5 or higher is acceptable when applying the data from the FVTs. If the R-squared value is unacceptable, then a nearby location with similar characteristics should be substituted.

Based on the data provided in ODOT's FVTs, the annual growth rate for the study intersections was calculated from the existing (2016) and future (2038) traffic volumes along OR 140 (mileposts 95.39, 95.72, 96.03, and 96.35) and US 395 (mileposts 142.88, 143.01, 143.06, 143.32, 143.65, 143.86, and 144.08) at locations within the study area with acceptable R-squared values. Based on the analyses of these locations, the applicable annual growth rate is approximately 0.2 percent and will be applied to historical traffic counts for the existing conditions analysis if traffic counts are not collection in Fall 2020.

FORECAST TRAFFIC VOLUMES

The horizon year for the Lakeview TSP will be 2040. Forecast traffic volumes for the study intersections will be developed based on the existing traffic volumes and ODOT's historical trends method, described in the previous section, by applying an annual growth rate of approximately 0.2 percent to the study intersections.

TRAFFIC ANALYSIS

This section documents the mobility standards and targets that will be used to evaluate the performance of the study intersections and to identify potential alternatives to address operational issues on ODOT and local facilities.

INTERSECTION OPERATIONAL STANDARDS

The seven identified study intersections are subject to the corresponding jurisdiction's operating standards described in the following sections.

ODOT FACILITIES

ODOT uses volume-to-capacity (v/c) ratios (mobility targets) to assess intersection operations. Table 6 of the *Oregon Highway Plan* (OHP – Reference 2) and Table 10-2 of the *Oregon Highway Design Manual* (HDM – Reference 3) provide maximum v/c ratios for all signalized and unsignalized intersection located outside the Portland metropolitan area. The OHP ratios are used to evaluate existing and future no-build conditions, while the HDM ratios are used in the creation of future alternatives for projects along state highways. The ODOT controlled intersections within the study area are located along OR 140 and US 395. The following provides a summary of the state highway classifications, freight route designations, and other roadway characteristics at each of the study intersections to help determine v/c ratios.

1. Roberta Avenue/OR 140 – The east and west legs of OR 140 are classified as Statewide Highways and designated OHP freight routes outside of an MPO with a posted speed of 40 miles per hour (mph). The north and south legs are Town facilities so ODOT's Freight Route on a Statewide Highway mobility target will be applied to the east and west approaches and ODOT's District/Local Interest Roads mobility target will be applied to the north and south approaches.
2. US 395/South 9th Street – The north and south legs of US 395 are classified as Statewide Highways and designated OHP freight routes outside of an MPO with posted speeds of 25 mph north and 35 mph south whereas the east and west legs are Town facilities. ODOT's Freight Route on a Statewide Highway mobility target will be applied to the north and south approaches and ODOT's District/Local Interest Roads mobility target will be applied to the east and west legs.
3. US 395/J Street/Missouri Avenue – The north and south legs of US 395 are classified as Statewide Highways and designated OHP freight routes outside of an MPO with a posted speed of 45 mph whereas the west leg is a Town facility. ODOT's Freight Route on a Statewide Highway mobility target will be applied to the north and south approaches and ODOT's District/Local Interest Roads mobility target will be applied to the west leg.
4. US 395/South 7th Street – The north and south legs of US 395 are classified as Statewide Highways and designated OHP freight routes outside of an MPO with a posted of 25 mph whereas the west leg is a Town facility. ODOT's Freight Route on a Statewide Highway mobility target will be applied to the north and south approaches and ODOT's District/Local Interest Roads mobility target will be applied to the west leg.
5. US 395/OR 140 – The north and south legs of US 395 and the west leg of OR 140 are classified as Statewide Highways and designated OHP freight routes outside of an MPO with posted speeds of 25 mph west and south and 35 mph north. Therefore, ODOT's Freight Route on a Statewide Highway mobility target will be applied to the north, south, and west legs.

Table 1 summarizes the v/c ratios that will be used to identify existing and potential future operational issues at the ODOT study intersections.

Table 2: ODOT Mobility Targets

Map ID	Intersection	Traffic Control	OHP Mobility Target	HDM Standard
1	US 395/J Street/Missouri Avenue	Unsignalized	US 395: 0.80 Local Streets: 0.95	US 395: 0.70 Local Streets: 0.80
2	Roberta Avenue/OR 140	Unsignalized	OR 140: 0.80 Roberta Avenue: 0.90	OR 140: 0.70 Roberta Avenue: 0.75
3	US 395/OR 140	Unsignalized	0.85	0.70
4	US 395/South 7th Street	Unsignalized	US 395: 0.85 S 7th Street: 0.95	US 395: 0.70 S 7th Street: 0.80
5	US 395/South 9th Street	Unsignalized	US 395: 0.85 S 9th Street: 0.95	US 395: 0.70 S 9th Street: 0.80

LOCAL FACILITIES

The Town of Lakeview does not have established mobility targets for local facilities. As such, we will evaluate and report operational characteristics of study intersections on the local system based on a volume-to-capacity ratio of 1.0.

Table 3: Town Mobility Targets

Map ID	Intersection	Traffic Control	Mobility Target
6	Roberta Road/South 3rd Street	Unsignalized	n/a 1.0 for planning purpose
7	L Street/South 3rd Street	Unsignalized	n/a 1.0 for planning purpose

Traffic operations at the study intersections will be evaluated as outlined above. Potential solutions will be identified and evaluated for the study intersections that are found to exceed the mobility targets and standards under existing and future traffic conditions.

ANALYSIS PARAMETERS

The bullets below identify the specific sources of data and methodologies proposed to conduct the operational analysis. Analysis of all state facilities will be conducted according to the APM, unless otherwise agreed upon by the Town and ODOT.

1. *Intersection/Roadway Geometry* (number of lanes, lane configurations, cross-section elements, etc.) will be collected through aerial photography and confirmed through a site visit. 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.
2. *Operational Data* (posted speeds, intersection control, rail crossings, etc.) will be collected through aerial photography and confirmed through Oregon digital video log, straight line charts, GIS data, and local knowledge.
3. *Peak Hour Factors* (PHF) will be calculated for each intersection, as available within traffic count data, and applied to the existing conditions analysis. Per the APM, PHF's of 0.95 will be used for the year 2040 analysis for major arterial to major arterial facilities, with 0.92 applied to major arterial to minor arterial facilities, 0.90

applied to minor arterial to minor arterial facilities, 0.88 applied to minor arterial to collector arterials, and 0.85 applied to collector to collector or lower classification roads. If the existing PHF is greater than these default future values, the existing PHF will be applied.

4. *Traffic Volume* development is described above.
5. *Traffic Operations*
    a. The methodologies identified in the *Highway Capacity Manual 6th Edition* (HCM – Reference 4) will be used to analyze traffic operations at the study intersections.
    b. Vistro 7 will be used to conduct the traffic operations analyses. Vistro 7 is a software tool designed to assist with operations analyses in accordance with HCM 6th Edition methodologies. Level-of-service (LOS), Delay (del), and Volume to Capacity (v/c) will be reported at all intersections regardless of jurisdiction. The LOS, del, and v/c will be reported for the critical movement at unsignalized intersections. Failing, unsignalized intersections will be evaluated using ODOT's ADT-based preliminary signal warrants and the Manual on Uniform Traffic Control Devices (MUTCD Warrant 1).

TRAFFIC ANALYSIS SOFTWARE & INPUT ASSUMPTIONS

Vistro software will be used for the intersection analysis. The reported results will be the level of service, intersection delay, and v/c ratios generated by the HCM reports. Analysis assumptions are listed in Table 4.

Table 4: Analysis Assumptions

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

CRASH ANALYSIS

The five most recent years of crash data will be obtained from ODOT's crash database and reviewed at the study intersections and along state and non-state roadway segments within the study area, consistent with the methodologies outlined in the APM. The crash data will be analyzed to identify potential crash patterns (such as crash types and locations). Crash rates and critical crash rates will be developed, as applicable. Intersection crash rates will be compared to the published 90th-percentile crash rates in Exhibit 4-1 of the APM. In addition, ODOT's top 10% ODOT Safety Priority System sites will be reviewed, as appropriate. Identified potential countermeasures (and resulting crash percentage reduction) will be taken from the All Roads Transportation Safety (ARTS) Crash Reduction Factors (CRF) listing or the CRF Appendix when available.

MULTIMODAL ANALYSIS

The multimodal analysis will be performed in accordance with the Level of Traffic Stress (LTS) methodologies identified in Chapter 14 of the APM for pedestrian and bicycle facilities along collector and arterial roadways within the study area. Pedestrian and Bicycle LTS have unique criteria that are used to determine a facility's LTS score (e.g.

number of lanes, bike lane widths, adjacent parking, roadway functional classification, daily volume, paved shoulder widths, posted speed limits, sidewalk conditions and widths, illumination presence, etc.). LTS scores range from little traffic stress (LTS 1) to high traffic stress (LTS 4) and are based on the perceived safety issue of being in close proximity to vehicles whether on a spacing distance or speed basis. In addition to the LTS evaluation, the multimodal analysis will assess availability of sidewalks and bicycle lanes and identify gaps in primary routes along collector and arterial roadways.

REFERENCES

1. Oregon Department of Transportation. *Analysis Procedures Manual*, 2018.
2. Oregon Department of Transportation. *Oregon Highway Plan*, 2015.
3. Oregon Department of Transportation. *Highway Design Manual*, 2012.
4. Transportation Research Board. *Highway Capacity Manual*, 6th Edition, 2016.