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Technical Memorandum

June 27, 2022 Project# 23021.046

To: Cheryl-Jarvis Smith, ODOT Region 5

From: Molly McCormick and Nick Foster AICP, RSP_1

CC: Dani Schulte, CTUIR

RE: Confederated Tribes of Umatilla Indian Reservation Transportation System Plan Update

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This memorandum documents the methodologies and assumptions to be used in preparation of analyses for the Confederated Tribes of Umatilla Indian Reservation (CTUIR) Transportation System Plan (TSP) update. The methodologies and assumptions included in this memorandum are based on guidance provided in the Oregon Department of Transportation (ODOT) Transportation System Plan Guidelines (Reference 1), the ODOT Analysis Procedures Manual (APM – Reference 2), and direction provided by CTUIR and ODOT staff. The methodologies and assumptions described in this memorandum will help identify potential deficiencies in the transportation system, including:

- Traffic operations at the study intersections under existing and future traffic conditions,
- Traffic safety at the study intersections and along study area roadways,
- Gaps and deficiencies in bicycle and pedestrian facilities,
- Gaps and deficiencies in transit facilities and services, and
- Gaps and deficiencies in other travel modes.

This information will serve as a baseline for identifying a comprehensive list of multi-modal transportation system needs to be addressed as part of the TSP update. It will also serve as a baseline for identifying and evaluating potential solutions and developing a prioritized list of improvements for the TSP update.

STUDY AREA

The study area for the CTUIR TSP update encompasses all lands within the boundaries of the Umatilla Indian Reservation (UIR), including several roads on off-reservation Trust lands. The primary focus of the project will be on areas within the UIR. The project will describe the location and access management conditions for off-reservation Trust lands. Figure 1 illustrates the primary study area.

FREIGHT MOBILITY ROUTES AND LOCAL TRUCK ROUTES

A summary map and description will be provided for the freight mobility routes, local truck routes, and snowplow routes in the study area. This information will be obtained from CTUIR documents and GIS files and ODOT's TransGIS database.

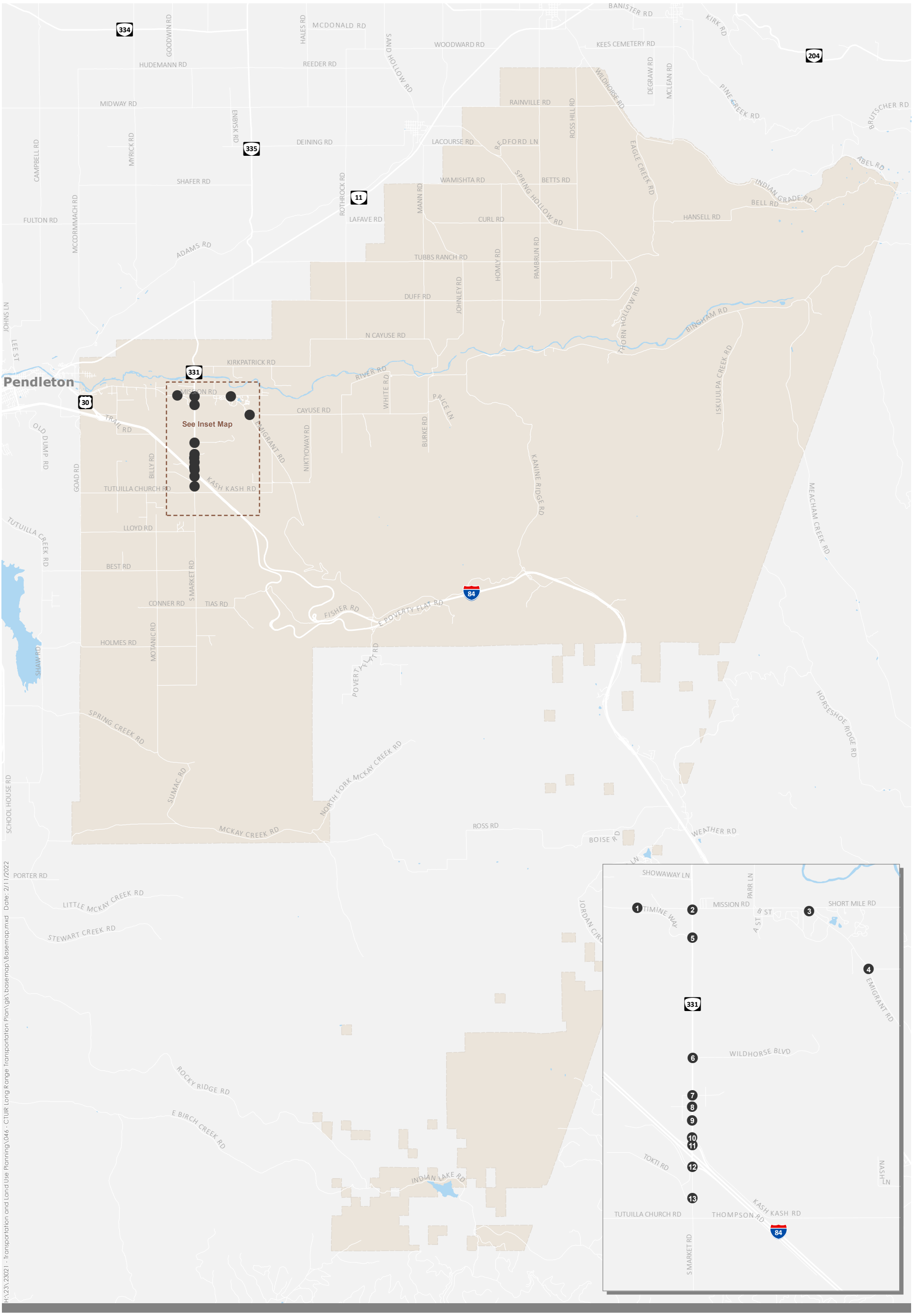

Figure 1

Study Area and Study Intersections
Confederated Tribes of the Umatilla Indian Reservation

STUDY INTERSECTIONS

The study intersections for the TSP update were determined by CTUIR in coordination with ODOT. There is a total of 13 study intersections located along tribal, County, and ODOT facilities, all of which are unsignalized. Figure 1 illustrates the location of the study intersections, which include:

1. Mission Road/Timíne Way
2. Mission Road/OR 331
3. Mission Road/Short Mile Road
4. Mission Road/Emigrant Road-Cayuse Road
5. OR 331/Timíne Way
6. OR 331/Wildhorse Boulevard
7. OR 331/Kusi Road
8. OR 331/Spilya Road
9. OR 331/Arrowhead Travel Plaza Access
10. OR 331/Kash Kash Road
11. I-84/OR 331 Interchange Westbound Ramps
12. I-84/OR 331 Interchange Eastbound Ramps
13. S Market Road/Tokti Road

VOLUME DEVELOPMENT

Traffic Counts

Turning movement counts were conducted by ODOT at the study intersections on March 24th, March 31st, April 1st, and April 13th, 2021. The counts were conducted on mid-weekdays. All counts were conducted over a 16-hour period (6:00 AM to 10:00 PM) and include the total number of pedestrians, bicyclists, and motor vehicles that entered the study intersections in 15-minute intervals.

Peak Hour Development

The counts will be post-processed to determine system-wide PM peak hour. A system-wide peak hour will be utilized since the study intersections are generally closely spaced with limited access in between. The PM peak hour counts will be adjusted to develop analysis volumes as discussed below.

SEASONAL ADJUSTMENT FACTORS

30th Hour Volumes (30 HV) for the project will be developed based on the traffic counts collected 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 the most appropriate method for the study intersections. As discussed below, the seasonal adjustment factor shown in Table 1 will be used to

derive 30 HV volumes at the I-84 Ramp Terminals, while the average seasonal adjustment factors for Commuter and Summer facilities from Table 2 will be used to derive 30 HV at all other ODOT study intersections.

I-84

For I-84, ATR #30-026 was reviewed to see if it was able to be applied for this project. The project team does not recommend moving forward with using this ATR because it has had equipment failures and incomplete data for several of the most recent count years and would suggest a seasonal factor greater than 30% if the estimated data is utilized. There is another ATR available west of the study area that was reviewed for determining a seasonal adjustment factor for I-84 ramps in the study area. ATR 30-004 is an interstate non-urbanized ATR location on I-84 approximately 12.7 miles northwest of the OR 311 interchange. Because this ATR is west of the Pendleton interchange but is within the ten percent volume limitation, ODOT suggested its use for the west leg of the interchange only. The ODOT ATR Characteristic Table indicates this location has a weekend traffic trend, therefore the average daily traffic based on days of the week was used. Table 1 shows the calculated seasonal factor.

Table 1: Seasonal Adjustment Factor for ATR #30-004 (Pendleton)

	2016	2017	2018	2019	2020	Average
Peak Month (July)	119*	123*	119	121	123	121
Count Month (March)	97*	96	96	96	88*	96
Seasonal Adjustment Factor = 121 (Peak)/96 (Count) = 1.26						

*Indicates values that were discarded from the average as indicated in the APM.

For the east leg of the interchange, the Seasonal Trend Table Method was used to calculate the seasonal adjustment factor. The Seasonal Trend Table Method is used when there is not an ATR nearby or nearby ATRs do not meet the requirements outlined in the APM, and when there are no ATRs with similar characteristics to the study road segment. The corresponding factors were calculated using the 2019 Seasonal Trend Table[1] for the late March and early April 2021 counts. Table 2 shows the values for the count month, peak period seasonal factor, and the calculated seasonal factors that will be used for I-84 based on the interstate non-urbanized trend.

Table 2: Seasonal Adjustment Factors for I-84 Counts East of OR 331

Trend	Late March/Early April 2021 Count Date Season Factor	Peak Period Seasonal Factor	Seasonal Adjustment
Interstate Non-urbanized	1.0382	0.8139	1.0382/0.8139= 1.28

[1] The Seasonal Trend Table accessed in February 2022 is based off the 2019 values due to the irregularity caused by the Covid-19 pandemic.

OR 331

The Seasonal Trend Table Method was used to calculate the seasonal adjustment factor along OR 331. The Seasonal Trend Table Method is used when there is not an ATR nearby or nearby ATRs do not meet the requirements outlined in the APM, and when there are no ATRs with similar characteristics to the study road segment. The recently completed CTUIR Mission Community Master Plan was conducted in coordination with ODOT and reviewed some of this project's study intersections. The Mission Community Master Plan used an average of the Commuter and Summer seasonal trends for this segment of OR 331.

This project proposes to use a similar method. The corresponding factors were calculated using the 2019 Seasonal Trend Table[2] for the late March and early April 2021 counts. Table 3 shows the values for the count month, peak period seasonal factor, and the calculated seasonal factors that will be used for OR 331.

Table 3: Seasonal Adjustment Factors for OR 331 Counts

OR 331 Counts Conducted in Late March/Early April 2021				
Trend	March 2021 Count Date Season Factor	Peak Period Seasonal Factor	Seasonal Adjustment	Average of Commuter and Summer Seasonal Factors
Commuter	1.0014	0.9355	1.0014/0.9355= 1.07	1.17
Summer	1.0620	0.8299	1.0620/0.8299= 1.28	
OR 331 Counts Conducted in Mid April 2021				
Trend	April 2021 Count Date Season Factor	Peak Period Seasonal Factor	Seasonal Adjustment	Average of Commuter and Summer Seasonal Factors
Commuter	0.9759	0.9355	0.9759/0.9355= 1.04	1.13
Summer	1.0100	0.8299	1.0100/0.8299= 1.22	

FORECAST TRAFFIC VOLUMES

Forecast traffic volumes for the study intersections will be developed based on the methodology identified in the National Cooperative Highway Research Program (NCHRP) Report 255 Highway Traffic Data for Urbanized Area Project Planning and Design. The methodology combines the year 2021 30 HV developed at the study intersections with the base year and future year traffic volume forecasts from the current Pendleton travel demand model, which covers the study area.

TRAFFIC ANALYSIS

Per the project scope, volume-to-capacity (V/C) ratio will be used to review performance thresholds/targets for the study intersections. This information will be provided in tables, figures, and/or technical appendices,

[2] The Seasonal Trend Table accessed in February 2022 is based off the 2019 values due to the irregularity caused by the Covid-19 pandemic.

but where possible will be provided in figures to give the general public a more clear and relatable understanding of the analysis results.

Table 6 of the Oregon Highway Plan (OHP) provides volume-to-capacity targets for facilities outside the Metro area. The OHP ratios are used to evaluate existing and future no-build conditions, while Table 10-2 of the ODOT 2012 Highway Design Manual (HDM) provides V/C ratios used to assist in evaluating future alternatives on State highways. Table 4 summarizes the classifications and applicable performance thresholds for study intersection roadways.

Table 4: Roadway Classification and Mobility Targets

Roadway	Existing Roadway Ownership	Functional Classification	Mobility Target/ Standard	HDM 20-year Design Mobility Target
I-84	ODOT	Interstate	0.70	0.60
OR 331	ODOT	District Highway	0.75[1]	0.70
Mission Road east of OR 331	Umatilla County	Major Collector	LOS E	N/A
Cayuse Road	Umatilla County	Major Collector	LOS E	N/A
Short Mile Road	Umatilla County	Minor Collector	LOS E	N/A
Emigrant Road	Umatilla County	Minor Collector	LOS E	N/A
Market Road	Umatilla County	Minor Collector	LOS E	N/A
Mission Road west of OR 331	CTUIR	-	-[2]	N/A
Timíne Way	CTUIR	-	-[2]	N/A
Wildhorse Boulevard	CTUIR	-	-[2]	N/A
Kusi Road	CTUIR	-	-[2]	N/A
Spilya Road	CTUIR	-	-[2]	N/A
Arrowhead Travel Plaza Access	Private Driveway	-	-[2]	N/A
Kash Kash Road	Public Use Road	-	-[2]	N/A
Tokti Road	CTUIR	-	-[2]	N/A

[1] ODOT assesses intersection operations based on volume-to-capacity ratios. Table 6 of the Oregon Highway Plan identifies maximum volume-to-capacity targets for all intersections outside the Portland Metro area. Based on the OHP, OR 331 is classified as a District Highway and designated Freight Route. The resulting volume-to-capacity target for all intersections along OR 331 is a maximum volume-to-capacity ratio of 0.75.

[2] For intersection operations, the major road standard will apply.

TRAFFIC ANALYSIS PARAMETERS

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

1. Intersection/Roadway Geometry (lane numbers and arrangements, cross-section elements, signal phasing, 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 (such as posted speeds, intersection control, parking, transit stops, rail crossings, right-turn on red, etc.) will be collected through a site visit.

3. Peak Hour Factors (PHF) will be calculated for each intersection and applied to the existing conditions analyses. Per the APM, PHFs of 0.95 will be used for the year 2040 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.
4. 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. Synchro 11 will be used to conduct the traffic operations analyses. Synchro 11 is a software tool designed to assist with operations analyses in accordance with HCM 6th methodologies. The analysis results will be reported for the overall intersection at signalized intersections and the critical movement at unsignalized intersections – overall intersection v/c ratios will be developed for the signalized intersections in accordance with the methodologies identified in the APM.

Traffic Analysis Software and Input Assumptions

Synchro 11 software will be used for the intersection analysis. The reported results will be the level of service and intersection delay generated by the HCM report. Analysis assumptions are listed in Table 5.

Table 5: Synchro 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
Area Type	Other
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
Percent Grade	Estimated based on field observations
Parking Maneuvers per Hour	Estimated based on field observations
Bus Blockages	Estimated based on frequency of service
95th percentile vehicle queues	Synchro 11 summary output

SAFETY ANALYSIS

Safety analyses will include reviewing historical crash data and examining roadway crossings, as described in the following sections.

Crash Analyses

The five most recent years of crash data will be obtained from ODOT's crash database and reviewed at the study intersections and along the study roadway segments, consistent with the methodologies outlined in the APM. In addition, the five most recent years of bicyclist and pedestrian-related crash data will be obtained from ODOT's crash database and reviewed.

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 at study intersections. Intersection crash rates will be compared to the published 90th percentile crash rates in Exhibit 4.1 of the APM, and segment crash rates will be compared to Table II in the current ODOT Crash Rate Tables. In addition, ODOT's Safety Priority Index System (SPIS) sites will be reviewed, as appropriate. At intersections or segments where the critical threshold is exceeded, a crash diagram will be prepared, and crash trends will be reviewed to identify contributing factors and potential countermeasures. Particular attention will be paid to the details of crashes involving pedestrians and bicyclists.

The risk factor screening methodology from ODOT's Pedestrian and Bicycle Safety Implementation Plan (2020) will be applied to the Project Area roadway network (to the extent sufficient data is available to apply the risk factors). This analysis will be used to identify areas with the greatest potential for bicycle and pedestrian crashes.

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. If no CRF is available from the ARTS database, then the FHWA CMF Clearinghouse may be reviewed to identify a suitable CRF. Only CMFs with a quality rating of three stars or greater and within 10% of the study roadway's/intersection's volume will be used.

Pedestrian Crossing Review

Key pedestrian crossings identified through the public involvement process, past work in the area, or the project team's review of the system will be evaluated to determine whether the type of crossing currently presented may warrant an enhancement. This review will include assessing the crossing using National Cooperative Highway Research Board (NCHRP) Report 562 procedures. If the crossing is not currently marked and is located on an ODOT Highway, it will be reviewed against ODOT's Criteria for Establishing Marked Crosswalks on State Highways (Section 6.6.2 of the ODOT Traffic Manual).

LEVEL OF TRAFFIC STRESS

The existing pedestrian, bicycle, and trail network will be reviewed to identify gaps and deficiencies. A gap is defined as a missing link in the network, such as a missing sidewalk on a collector or arterial roadway. A deficiency, or obstacle, is defined as a bicycle or pedestrian facility that is not up to standards or sufficient to meet users' needs. Examples of deficiencies include:

- On-street connection on a collector or arterial roadway that has a Bicycle Level of Traffic Stress rating greater than 2 (to support the Interested but Concerned bicyclists)
- Arterial or collector roadway crossing where enhancement may be warranted according to the Pedestrian Crossing Review analysis described previously
- Sidewalks that are too narrow to meet ADA standards or crossings without a curb ramp

Pedestrian Level of Traffic Stress (PLTS) and Bicycle Level of Traffic Stress (BLTS) analyses will be performed on significant roadways within the CTUIR water/sewer service area. Roadways to be studied include

Mission/Cayuse Road, Cedar Street, Confederated Way, Short Mile Road, Ti'mine Way, Wildhorse Blvd, A Street, B Street, Whirlwind Drive, Kusi Road, Spilya Road, Coyote Road, Kirkpatrick Road, and OR 331 between Showaway Lane and the I-84 Interchange. The analyses will be conducted in accordance with the procedures outlined in Chapter 14 of the ODOT APM.

The target level of traffic stress for the bicycle system will be LTS 2, as this target most closely appeals to most of the potential bicycle riding population and maximizes the available bicycle mode share. The target level of traffic stress for the pedestrian system will also be LTS 2, as this target will generally be acceptable to the majority of users; however, the project team may also review areas within a quarter mile of schools, and other routes heavily used by children, to determine what improvements may be necessary to achieve LTS 1 on these routes.

QUALITATIVE MULTIMODAL ASSESSMENT

A Qualitative Multimodal Assessment (QMA) will be used to evaluate the transit facilities and services within the study area to identify potential issues in transit connectivity that can be addressed as part of the Active Transportation Update. The QMA uses context-based subjective ratings of Excellent, Good, Fair, and Poor.

As outlined in the ODOT APM, the following factors are considered within the QMA:

- Frequency and on-time reliability
- Schedule speed/travel times
- Transit stop amenities
- Connecting pedestrian/bike network

Table 6 outlines the methodology that will be used for determining transit QMA within the study area.

Table 6: QMA Methodology

Category	Excellent	Good	Fair	Poor
Frequency and on-time reliability	<15-minute headways	15 to 30-minute headways	30 to 60-minute headways	60+ minute headways
Schedule speed/travel times	<20% slower than driving	20% to 40% slower than driving	40% to 60% slower than driving	>60% slower than driving
Transit stop amenities	Shelter	Bench	Sign with waiting area	No waiting area and/or no sign
Connecting pedestrian/bike network	BLTS and PLTS 2 or better and crossing	BLTS and PLTS 2 or better with no crossing	BLTS or PLTS >2 and no crossing	BLTS and PLTS >2 and no crossing

REFERENCES

1. Oregon Department of Transportation. Analysis Procedures Manual, 2020.
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.