Agenda

BMPO Bend Metropolitan Planning Organization

BMPO Technical Advisory Committee

January 9, 2024
Hybrid Meeting

Location
ODOT Region 4, Building M, Baney Conference Room
63055 N. Highway 97, Bend, Oregon
(From the DMV entrance on Mervin Sampels Road, Building M is straight ahead.)

Zoom webinar link: https://bendoregon-gov.zoom.us/j/89713802756?pwd=b0NiWWdHMVNaajRBQkFiL001M2QvUT09
Webinar ID: 897 1380 2756
Passcode: bendmpo
Phone: 1-888-788-0099

YouTube livestream: https://youtube.com/live/Wy8loObX_34?feature=share

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10:00 a.m. Technical Advisory Committee Meeting

Start Time	Item		Information	Presenters
10:00	**1.**	**Call to Order & Introductions**		Tyler Deke
10:05	**2.**	**Hybrid Meeting Guidelines**		Tyler Deke
10:07	**3.**	**Public Comment**		Tyler Deke
TAC Workshop on Metropolitan Transportation Plan (MTP) Update				
10:10	**4.**	**Project Status Review**	Review of work completed to date, current work items and upcoming work items	Aaron Berger, DKS

10:15	**5.**	**Outreach Update**	Brief update on recent public engagement and outreach efforts	Andrea Napoli
10:20	**6.**	**Funding Update**	Update on funding analysis	Becky Hewitt, ECO Northwest

10:35	**7.**	**Existing & Future Needs Analysis**	**Background**
			Staff will review the Draft Existing and Future Needs Memo and focus on the following:
			• Existing conditions – trend information
			• Future conditions
			  ○ Updated land use - growth maps, change compared to 2040
			  ○ "Committed" projects – maps
			  ○ Future needs
			  ▪ Key themes
			  ▪ Changes
			NOTE: the memo is lengthy. Please try to review the memo prior to meeting.
			Attachments
			Attachment A: Existing & Future Needs Memo. A link to an on-line shared version of the memo was sent to each TAC member.
			Action Requested
			Review and provide input on Draft Needs Assessment Memo
				Aaron Berger, DKS

11:15	**8.**	**Project List Evaluation**	**Background** Staff will review the draft Project List Evaluation Memo including: • High-level summary of Project List • Unaddressed, newly identified, or changing needs NOTE: the memo is lengthy. Please try to review the memo prior to meeting. **Attachments** Attachment B: Project List Evaluation Memo **Action Requested** Review and provide input on Draft Project List Evaluation Memo	Aaron Berger, DKS

11:45	**9.**	**Next Steps**		Aaron Berger, DKS
11:50	**10.**	**Public Comment**		Tyler Deke
11:55	**11.**	**Next TAC Meeting**	The next meeting of the BMPO TAC is scheduled for February 7, 2024, at 10:00 a.m.	Tyler Deke
	12.	**Adjourn**		Tyler Deke

Accommodation Information for People with Disabilities

To obtain this information in an alternate format such as Braille, large print, electronic formats, etc., please contact Kelli Kennedy at kkennedy@bendoregon.gov or 541-693-2122. Relay Users Dial 7-1-1.

EXISTING AND FUTURE NEEDS MEMORANDUM

DATE: December 27, 2023

TO: Andrea Napoli & Tyler Deke | Bend MPO

FROM: Emily D'Antonio, Eileen Chai, Kayla Fleskes-Lane, PE & Aaron Berger, PR | DKS Associates

SUBJECT: Bend 2045 MTP Update: Existing and Future Needs Project #24068-000

INTRODUCTION

The purpose of this memo is to document existing and future transportation needs within the Metropolitan Planning Area (MPA) as a part of the Bend Metropolitan Transportation Plan (MTP) update. Building off recently completed local and regional transportation planning efforts, these needs will help to complete and prioritize the MTP Project List, which is intended to address identified needs within the MPA over the next 20 years.

This memorandum contains the following sections:

- **Methodology** – This section documents the methodology for the analysis, which focuses on a review of past planning work, analysis of recent transportation trends, modeling assumptions to support the identification of needs, and changes to future needs based on updates to growth horizon and trends beyond the assumptions used for adopted local plans.
- **Summary of Needs** – This section summarizes the key themes identified throughout this memo that will help identify potential gaps or changes in needs that will then inform the initial MTP project list, which will be initially developed from local adopted plans.
- **Needs for People Walking and Biking** – This section documents existing and future needs for people walking and biking, based on a summary of past planning work and additional analysis to reflect current and future conditions.
- **Needs for People Riding Transit** – This section documents existing and future needs for people riding transit, based on a summary of past planning work and additional analysis to reflect current and future conditions.
- **Needs for People Driving and Freight** – This section documents existing and future needs for people driving and freight, based on a summary of past planning work and additional analysis to reflect current and future conditions.

METHODOLOGY

To support the identification of needs, this memorandum focuses on the breakdown of system needs by mode, separated into the following categories:

- Walking and Biking
- Transit
- Motor Vehicle

Each modal needs section is further refined into the following categories:

- Prior Plan Review
- Recent Trend Analysis
- Updated Future Needs

The following sections describe the methodology used for each of these categories to clearly identify existing and future roadway system needs for the MPA.

PRIOR PLAN REVIEW

Since the last MTP Update, several large planning efforts have been completed and adopted in and around the Bend MPA. These planning efforts provided robust existing conditions and future needs assessment within the Bend MPA. These plans are discussed in more detail below and help inform the needs analysis for each transportation mode:

- **Deschutes County Transportation System Plan (TSP) – Draft (2023)** – The most recent draft was released in August 2023 and adoption is expected before the adoption of this MTP Update. The TSP projects and implementation tasks were informed by technical analyses of existing transportation conditions and forecast year 2040 deficiencies. Existing needs, opportunities, and constraints reflect an inventory of the County transportation system conducted in 2019 and 2020.
- **Deschutes County Transportation Safety Action Plan (TSAP) (2019)** – The Deschutes County TSAP provides a comprehensive multidisciplinary approach to transportation safety in Deschutes County. This plan was adopted in 2019 and examined ODOT crash data for the years 2012-2016. The County was recently awarded funding to update the TSAP, which will include more current crash data.
- **Deschutes County Intelligent Transportation System (ITS) Plan (2020)** – The Deschutes County ITS Plan is an update to the 2011 Deschutes County ITS plan and was adopted in April 2020. The plan was a collaborative effort to implement technology solutions to improve the overall safety and management of the transportation system across the region.
- **Cascades East Transit (CET) Transit Master Plan (2020)** – The 2040 Cascades East Transit Master Plan outlines a framework for providing transit and related services to Central Oregon for the next 20 years (2040), based on 2017 ridership data and needs.
- **Bend Transportation Safety Action Plan (TSAP) (2019)** – The Bend Area TSAP focuses on the area within the Bend Urban Growth Boundary. This plan was adopted in 2019 and examined crash data from ODOT in the years 2012-2016. The City of Bend was recently awarded funding to update the TSAP, which will include more current crash data.
- **Bend Transportation System Plan/Metropolitan Transportation Plan (2020/2019)** – The most recent Bend MTP was adopted in 2019 and the City of Bend TSP was adopted in 2020. Field observations and data collection that informed both plans were conducted in the spring of 2018 and both plans utilized a future forecast year of 2040 to help establish the future needs.

Since the Bend TSP was more recently adopted than the Bend MTP, most of the discussion in this section is focused on the TSP.

- **ODOT Refinement Plans and Studies (varies)** – Since the adoption of the Bend TSP, several large refinement studies along ODOT facilities or adjacent City roadways have also been completed or are currently in progress within the MPA. The needs from the following plans were summarized: US 97/Baker Road Interchange Area Management Plan (IAMP) (on-going), Bend US 20 Facility Plan (on-going), US 97 at Reed Market Road Operations and Safety Study (2023), US 97 Bend North Interchange Study (2022) and US 97 Parkway Plan (2021).

All the aforementioned plans outline existing conditions within the study area and the region's present and future needs at the time of their completion. Since most of these planning efforts occurred over three years ago, an analysis of recent (2023) transportation trends was conducted to determine whether the existing needs from these prior planning efforts are still applicable, as discussed in the *Recent Trend Analysis* section below.

RECENT TREND ANALYSIS

As previously mentioned, the last MTP update included an existing conditions analysis based on 2018 transportation conditions. The transportation modal sections later in this memo highlight similarities and changes to the transportation system that have occurred since 2018, utilizing available data in relevance to each mode of transport analyzed. Trend data was obtained from the following sources:

- INRIX probe (speed) data accessed from Regional Integrated Transportation Information System (RITIS).
- Strava Heatmaps – A heat map showing places of high activity based on Strava user (bicyclists) data.
- Automatic Traffic Recorders (ATR) – Permanent sensors that continuously collect the number of vehicles on a roadway.
- Population estimates from American Community Survey 5-year data and Portland State University (PSU) Population Research Center Annual Oregon Population Report.

Unless otherwise noted, the data from these listed data sources compares April 2018 to April 2023, avoiding the need to adjust for the seasonal congestion patterns prevalent in Bend. In general, the transportation trends across the region were found to have remained relatively similar (with a few exceptions) and many of the existing needs from these prior planning efforts are still applicable, as documented in each of the transportation modal needs sections.

UPDATED FUTURE NEEDS

While many of the prior planning efforts included analysis of future transportation needs, future land use growth assumptions have since changed. This memorandum documents the assumptions and findings from the most current update to the Bend-Redmond Model (BRM), a regional travel demand model encompassing both the Bend MPO, the City of Redmond, and a large portion of Deschutes County. The BRM is the key tool used to evaluate future land use and transportation scenarios. The critical input assumptions used for the BRM to perform the future needs analysis are land use and roadway network. These assumptions are discussed in the subsequent sections.

PRESENT AND FUTURE LAND USE GROWTH

Population estimates and forecasts were examined for Deschutes County, unincorporated areas in the County, and the City of Bend to understand the effect of both the current and future transportation demand on the MPA's transportation system.

Current Land Use Growth

Since 2018, the population of Bend has grown by over 13,000 people (nearly 15%), as shown in Table 1.

TABLE 1: POPULATION ESTIMATES (2018-2022)

	2018[A]	2019	2020[B]	2021	2022	GROWTH 2018-2022
DESCHUTES COUNTY OVERALL	188,980	193,000	199,263	203,916	207,561	18,581 (9.8%)
CITY OF BEND	89,505	91,385	99,453	101,153	102,834	13,329 (14.8%)

A. 2018 & 2019 values were obtained from the Population Research Center at Portland State University 2020 Annual Oregon Population Report Tables published 4/15/2021.

B. 2020-2022 values were obtained from the Population Research Center at Portland State University 2022 Annual Oregon Population Report Tables 4/24/2023.

Year-over-year, PSU population estimates indicate that the City of Bend grew by approximately 2%, except for 2019 to 2020, when the population increased by almost 9%. This change was most likely due to the COVID-19 pandemic, as more jobs switched to remote work environments and Bend became an unintentional work-from-home hub due to its proximity to recreational opportunities.

Future Land Use Growth

The population of both Deschutes County as a whole and the City of Bend is projected to grow significantly by 2045, as shown in Table 2.

TABLE 2: POPULATION FORECAST

AREA	YEAR 2020	YEAR 2045	% GROWTH
DESCHUTES COUNTY OVERALL	198,253	292,443	48%
BEND UGB	99,598	155,806	56%

Source: Chen, C., Sharygin, E., Whyte, M., Loftus, D., Rynerson, C., Alkitkat, H. (2022). Coordinated Population Forecast for Deschutes County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2022-2072. Population Research Center, Portland State University

Though the population is forecast to grow substantially (nearly 50% between 2020 and 2045), it is no longer growing at a rate as great as was anticipated during the last MTP update. Estimates prepared by the Population Research Center at Portland State University predict the population in

Bend to reach 144,365[1] people by 2040 which is a decrease of about 6% compared to previous estimates (153,700) in the last MTP.

Figure 1 highlights the geographic distribution of expected growth in households within the Bend MPA. From 2019 (the BRM base year) to 2045, approximately 32,000 new households are expected to be added within the Bend MPA. Most of this household growth is expected to occur within the City of Bend in the Core Area near downtown, the Southeast Area and in the Steven's Ranch and Steven's Road Tract areas to the east. Some of the largest amounts of housing growth are near the MPO boundaries, the remaining areas of undeveloped land within the Bend UGB.

Employment is also expected to increase within the Bend MPA as more people move to the area, with approximately 34,000 new jobs expected within the City of Bend between 2019 and 2045. Figure 2 highlights the locations of expected growth in employment within the Bend MPA. The forecasted job growth is spread throughout the City of Bend central areas (along 3rd Street and US 97) and the Downtown areas, the recent UGB expansion areas in the south, southeast, and northeast, and around the colleges in the west.

[1] Coordinated Population Forecast 2022-2072: Deschutes County, Population Research Center, Portland State University June 30, 2022

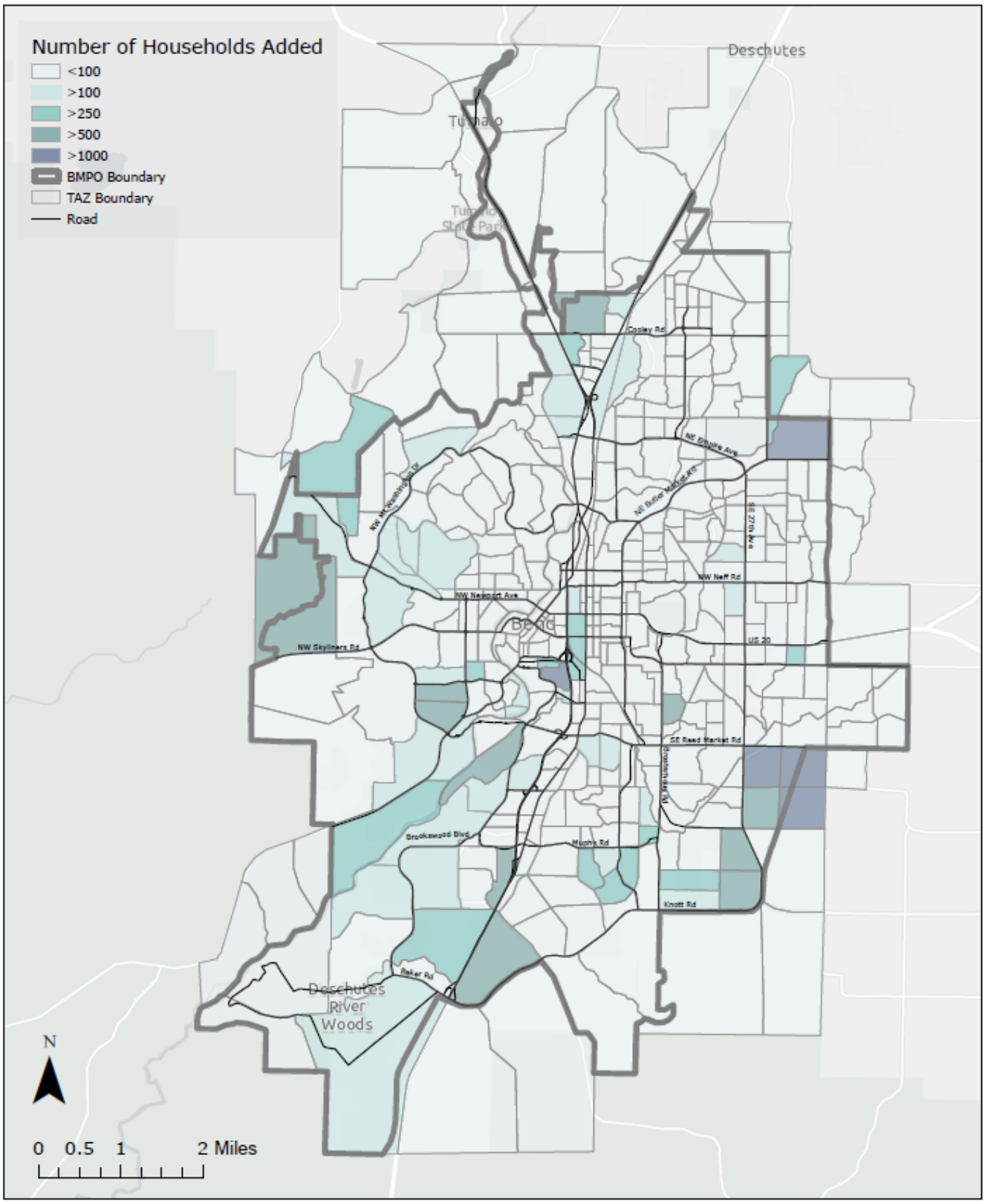

FIGURE 1. PROJECTED HOUSEHOLD GROWTH (2019-2045)

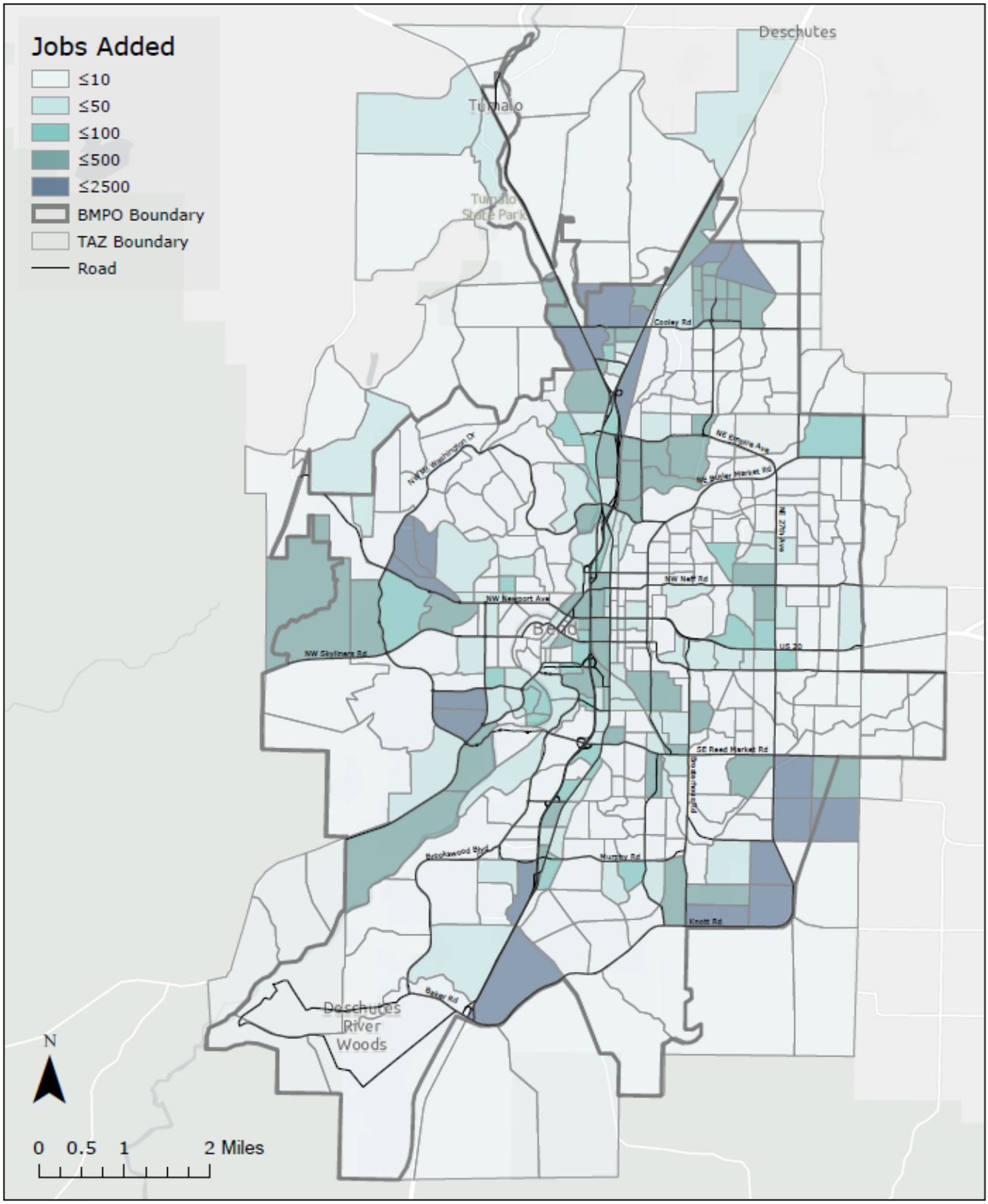

FIGURE 2. PROJECTED EMPLOYMENT GROWTH (2019-2045)

COMMITTED PROJECTS

To better understand the transportation system needs associated with the updated Bend MPA land use forecasts, a baseline 2045 "Committed" roadway network scenario was developed and modeled in the BRM. The Committed scenario assumes that the Bend MPA will experience its projected growth in population and employment and the demand for the transportation facilities will increase accordingly. The Committed roadway network includes projects that have committed/programmed funding to construct, either through the City of Bend's Capital Improvement Program (CIP), the Oregon Statewide Transportation Improvement Program (STIP), and BMPO Metropolitan Transportation Program (MTIP), or other clearly designated and committed funding sources. The transportation improvements assumed for the 2045 Committed Scenario are shown in Figure 3 and listed in Table 3.

TABLE 3: COMMITTED PROJECT LIST

FORMER PLAN PROJECT ID	PROJECT NAME	PROJECT DESCRIPTION	FUNDING SOURCE
1TNPS	Neff/ Purcell Boulevard	Intersection Capacity and Safety Improvements	Bend CIP
20378	Archie Briggs Road Bridges	Replace bridge with one that meets current standards	Federal
20714	US 97: Multi-Use Trail	Bend to Lava Butte Multi-Use Path	Federal
21756	US 20: Central Oregon Hwy Culverts Corridor	Design right-of-way and utility relocation for a future culvert replacement and repair	Federal
22739	US 97: I-84 to California Border	Install National Electric Vehicle Infrastructure	Federal
22742	US 20: From US101 to the Idaho Border	Install National Electric Vehicle Infrastructure	Federal
22767	Driver Feedback Signs	Install two speed feedback signs on each of the following roads; Alfalfa Market Rd, Burgess Rd, Cline Falls Hwy, Day Rd, Old Bend-Redmond Hwy, Powell Butte Hwy, South Canal Blvd and South Century Dr.	Federal
22774	NE Norton Ave	Installation of bike boulevard along NE Norton Avenue from 4th Street to 12th Street	Federal
22791	US 20: (3rd Street) at Empire	Replace the Traffic signals at the intersection of US 20 at Empire Avenue (planning and design only)	Federal
B-20	US 20 and Cook Avenue	Intersection safety and capacity Improvements	Federal and County

FORMER PLAN PROJECT ID	PROJECT NAME	PROJECT DESCRIPTION	FUNDING SOURCE
B-21	US 20 and Old Bend-Redmond Highway	Intersection safety and capacity improvements	Federal and County
C-2	Purcell Blvd Extension	Purcell Boulevard extension from Full Moon Drive to Jackson Avenue	City CIP
C3A	US 97 and Hawthorne Avenue	Extend southbound right-turn deceleration lane at Hawthorne Avenue	ARTS
C-5	Aune Road Extension	Aune Road extension from Bond Street to 3rd Street	GO Bond
C-18	US 97 NB On Ramp and SB Off Ramp	Northbound and southbound ramp improvements at Murphy Road	GO Bond
C-22	3rd and Wilson Avenue	Intersection improvements	GO Bond
C-26	US 20 Intersection Safety	Intersection improvements at US 20 and Robal Road and the roadways in the vicinity	Federal, State, City
C-40	US 97 North Pkwy Extension (Phase 2)	Improvements in the US 97 Bend North Corridor Project	Federal, State, City
CET 8	Bend Service Enhancement Plan	Enhancement to Route 8	Federal and state
M-4	Greenwood Avenue and 2nd Street	Intersection improvements	ARTS
23494	Hawthorne Ave Pedestrian and Bike Overcrossing	Shared Use Path between NE 1st and NE 5th Street	State and City
R7-A	Railroad and Wilson Ave	3rd Street crosswalk between railroad and Wilson Ave	GO Bond
R7-B	Railroad and Franklin Ave	3rd Street crosswalk between railroad and Franklin Ave	GO Bond
R7-C	Underpass	3rd Street underpass of railroad	GO Bond
R12-A	Wilson Ave Improvements	Pedestrian and bicycle improvements from 2nd Street to SE 9th Street	GO Bond

FORMER PLAN PROJECT ID	PROJECT NAME	PROJECT DESCRIPTION	FUNDING SOURCE
RMRP 1A	Reed Market Road and Brookswood Boulevard and Bond Street	Turn lane improvements	City CIP
RMRP 2	Reed Market Road and Chamberlain Street	Pedestrian improvements	GO Bond
RMRP 6A	3rd Street and Brosterhous Road	Striping and lighting improvements	City CIP

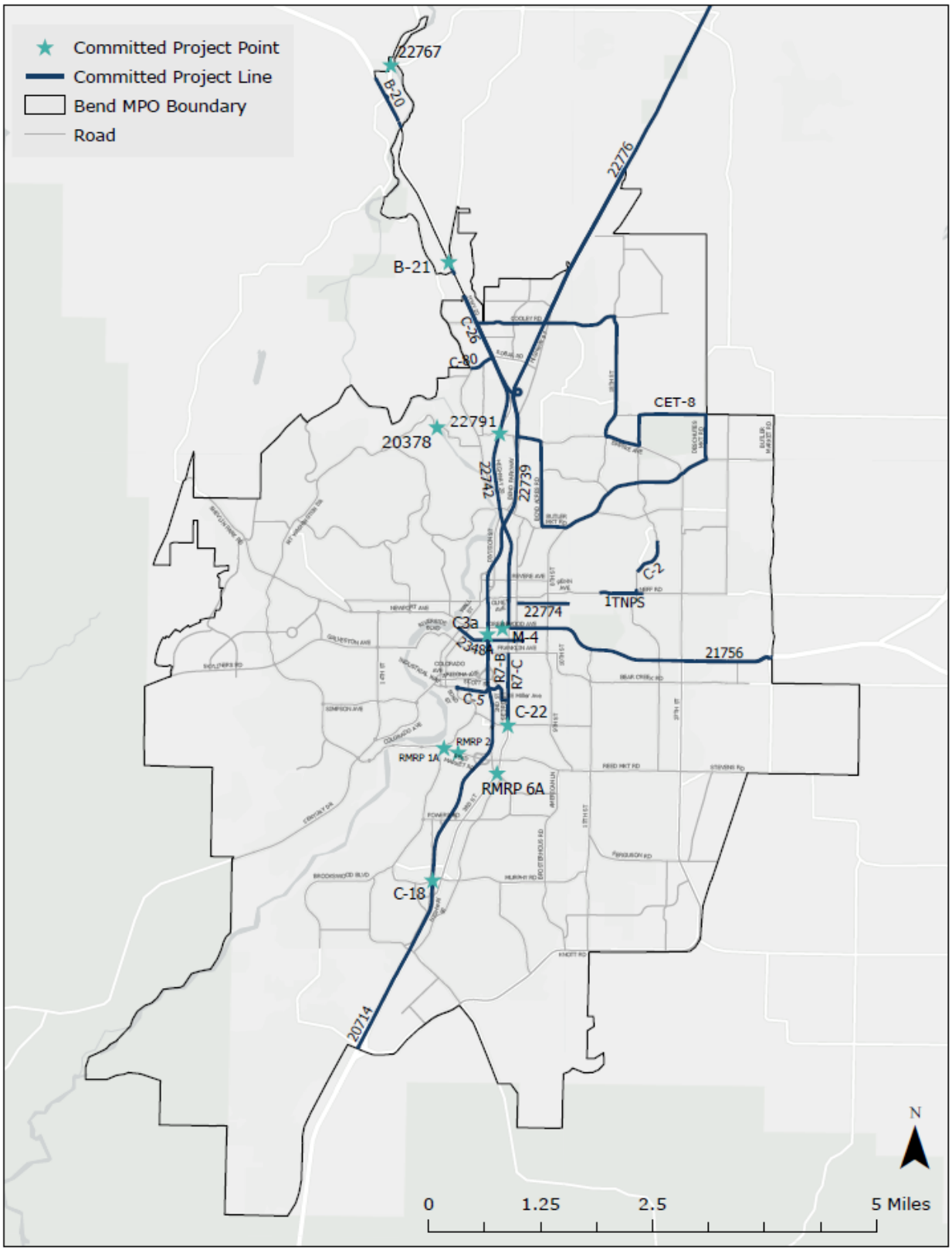

FIGURE 3. COMMITTED PROJECTS

SUMMARY OF NEEDS

Overall, the critical needs identified in the plans reviewed in this memorandum have not significantly changed since the conclusions of these prior efforts, and still include:

- Need for improved intersection safety
- Need for increased pedestrian and bicycle system quality and connections in Bend and Tumalo
- Need for congestion mitigation, particularly on US 97, major east-west corridors, north-south corridors in Bend, and at nodes where major east-west corridors cross north-south corridors.
- Need to keep up with evolving and emerging technology.
- Increased service coverage and hours for public transit
- Enhanced coordination between jurisdictions and agencies.

More specifically related to the needs of people walking and biking, the bicycle and pedestrian network continue to be improved with the Committed project list and investments in these modes have led to a decrease in single occupancy vehicle (SOV) trips in the future, as shown in Table 4.

TABLE 4: MODE SHARE

MODEL	SINGLE OCCUPANCY TRIP	NON-SINGLE OCCUPANCY TRIP
2019 BASE	68%	32%
2045 COMMITTED	66%	34%

However, most trips are still being taken by SOVs. More investments in filling sidewalk gaps, both on the outer edges of the Bend MPA, like in Tumalo and Deschutes River Woods, and throughout the City of Bend, are necessary to encourage more walking trips. An increase in protected bicycle infrastructure is also necessary to encourage the participation of those most hesitant towards bicycling. Investing in active transportation and encouraging further mode shift will help to alleviate future vehicle stress on the roadway system, as discussed in more detail in subsequent sections.

For people riding transit, issues related to adequate CET service still exist. Even with the addition of two new routes in the Committed project list, a driver shortage has led to the inability to meet the goals of improved headways as well as Sunday service.

For people driving and freight traffic, while there has been continued investment in transportation within the Bend MPA since the adoption of the last MTP, gaps and strains within the transportation network continue. The City of Bend and Deschutes County projected population growth within the MPA will continue to put more vehicles on the road and transportation users will continue to increase both in the interior and around the edges of the Bend MPA. Roadway networks in these areas will need to be built mindfully to accommodate the increase in vehicle traffic while also allowing for all transportation modes to get to where they need to be.

NEEDS FOR PEOPLE WALKING AND BIKING

A unique characteristic of the Bend MPA is the popularity of walking, running, and biking as compared to similarly sized communities. Needs for improvement of existing bicycle and pedestrian infrastructure (as well as additional infrastructure to create a more complete connected network) will always exist in the area and will continuously evolve. The following sections summarize:

- Needs for people walking and biking identified in prior planning efforts.
- Analysis of recent trends for people walking and biking and whether recent trends change the relevance of needs identified in prior planning efforts.
- Future active transportation needs based on new 2045 land use growth forecasts.

PRIOR PLAN REVIEW – BICYCLE AND PEDESTRIAN NEEDS

DESCHUTES COUNTY TRANSPORTATION SYSTEM PLAN (TSP) (DRAFT 2023)

Tumalo – a smaller, unincorporated community in the Bend MPA – was identified as the area within the county with the highest percentage of youth. Areas like Tumalo do not have dedicated bicycle facilities, and several of the roadways adjacent to schools or other pedestrian trip generators are missing sidewalks.

Providing additional connections within Tumalo for people walking was determined to be a key priority in the TSP, as well as providing regional bicycle connections that could serve broad transportation functions, such as commuting, recreation, or daily services. For example, a major designated bike route within the county is the Twin Bridges Scenic Bikeway. The bikeway exists within the Bend MPA and completely within the county boundaries. The bikeway loops 36 miles from Bend through Central Oregon.

A main issue identified along other County roadways is lack of width for comfortable and convenient connections for people walking and riding bicycles. Many of the County's bikeways and highways do not have paved shoulders that are at least six feet wide. This is standard for ODOT highways, but the County standard for paved shoulders is 3 to 5 feet. County roadways on the fringe of the Bend UGB also do not meet City of Bend standards. Providing shoulders on all County collectors and arterials in the next 20 years is currently not feasible due to constraints such as available right-of-way, environmental issues, property impacts, and the high costs to construct them. Many designated bikeways and highways do not currently have a wide enough paved shoulder to meet these requirements, including within the Bend MPA.

DESCHUTES COUNTY TRANSPORTATION SAFETY ACTION PLAN (TSAP) (2019)

Pedestrian crashes constitute a relatively low share of overall crashes in Deschutes County. However, when pedestrians are involved in crashes, the results are more likely to be severe than in crashes involving only vehicles. On the County system, four moderate-injury pedestrian crashes were reported between 2012 and 2016. Of those crashes, two occurred within the Bend MPA. One pedestrian crash occurred at the intersection of Baker Road and Riverwoods Drive in the Deschutes River Woods community. Another occurred near the intersection of US 97 and Bowery Lane.

Bicyclists also represent a vulnerable segment of the road user population. Bicyclist crashes accounted for less than 1% of total crashes in the county and approximately 3% of fatal/incapacitating crashes. Fifteen bicyclist crashes were reported on county facilities between 2012 and 2016. These fifteen crashes each resulted in some level of injury, four of which (27%) resulted in an incapacitating injury. Six of the fifteen occurred in the Bend MPA–two of which resulted in serious injury. The locations of serious injury crashes were at the intersection of NW Shelvin Park Road and the Fremont Road Trail, and the intersection of Cheyenne Road and Cherokee Road.

Of intersections that were identified as Top Sites for Safety Improvement, only US20/ Ward Road/ Hamby Road was an intersection with a pedestrian or bicyclist crash; however, since this crash data was collected a roundabout with enhanced bicycle and pedestrian infrastructure has been installed at this intersection.

BEND TRANSPORTATION SYSTEM PLAN (TSP) (2020)

An issue identified in the Bend TSP is that existing topographic constraints and the built environment limit the scope and scale of continuous, low-stress bicycle and pedestrian facilities in the city. Bend has also continued to grow over the past decades and the annexed areas generally lack complete urban streets and connected grid systems. Some neighborhoods had a relatively high proportion of arterials and collectors without sidewalks, such as southwest and southeast Bend. In addition:

- 22% of arterials and collectors were missing sidewalks completely.
- 18% of arterials and collectors had no dedicated bicycle facilities.
- Of the 82% of arterials and collectors that had dedicated bicycle facilities, more than half lacked separation/buffers for those facilities.

Some key corridors in the core of Bend lack dedicated bicycle facilities, including sections of 3rd Street, 4th Street, Greenwood Avenue, and Hawthorne Avenue. The fringes of Bend within the MPA also have gaps in the bicycle network. Injuries and fatal crashes involving pedestrians and cyclists were clustered along higher-speed, higher-volume roadways, and multi-lane roadways lacking enhanced crossings where there were no dedicated facilities.

As documented in Appendix B of the Bend TSP, several safety issues were identified. Crash data was analyzed for the years 2011-2016 and key findings from the analysis included:

- 66 crashes involved pedestrians and seven resulted in a pedestrian fatality. Three fatal crashes occurred on US 20 between Butler Market Road and Revere Avenue, and one fatal crash occurred on 4th Street between Butler Market Road and Revere Avenue. The other three fatal crashes occurred closer to the fringes of the MPO boundaries on SE 3rd, NE 27th, and US 97.
- There were 139 vehicle-bicycle crashes during the period and of those crashes, two were fatalities.

BEND TRANSPORTATION SAFETY ACTION PLAN (TSAP) (2019)

The Bend TSAP examined crash data from 2012-2016. In that period 50 crashes involved a pedestrian and 112 involved a bicyclist. Twelve pedestrian crashes and eight bicycle crashes

resulted in serious or fatal injury. Of the locations where vulnerable road user crashes occurred, the 3rd Street & Butler Market Road/ Mount Washington Drive area, and the 3rd Street near Miller Avenue were provided projects for safety improvement.

ODOT REFINEMENT PLANS AND STUDIES

One of the key needs for people walking and biking identified in the US 97 Parkway Plan, Baker Road IAMP and the US 97 Reed Market Road Operations and Safety Study was the lack of low-stress walking and biking crossings of US 97 through Bend. Grade-separated crossings are generally far apart (>1,000 feet) and typically do not include low-stress facilities. In addition, the US 97 Parkway Plan identified the need for low-stress walking and biking routes parallel to US 97. The Bend US 20 Facility Plan also identified the need to improve conditions for people walking and biking along US 20 through Bend.

RECENT ACTIVE TRANSPORTATION TREND ANALYSIS

The City of Bend has five pedestrian and bicyclist counters under its jurisdiction. These counters are on Colorado Avenue, Franklin Avenue, Galveston Avenue, Newport Avenue, and Portland Avenue. All counters are located on bridges where the roads cross the Deschutes River except for the one at Franklin Avenue, which is located on the rail undercrossing. Data was obtained for April 2018 and April 2023.

Table 5 highlights trends at counters that were not broken or unavailable. In these locations, pedestrian and bicyclist activities primarily exhibited an upward trend. Anecdotally, e-bike usage in Bend has also increased since 2018. E-bikes allow users to travel further distances at faster speeds. The increased popularity of e-bikes is something that should be considered in project and plan development.

TABLE 5: DAILY AVERAGE PEDESTRIAN AND BICYCLIST COUNTS

LOCATION	2018		2023		CHANGE	
	Pedestrian	Bicyclist	Pedestrian	Bicyclist	Pedestrian	Bicyclist
FRANKLIN AVENUE	116	74	99	86	-15%	16%
COLORADO AVENUE	45	45	63	41	40%	-9%
GALVESTON AVENUE	355	92	450	131	27%	42%

Source: Data obtained for the month of April 2018 and 2023 from the City of Bend automatic recorders.

In addition to pedestrian and bicyclist counters, Strava can be used to identify locations of higher pedestrian and bicyclist activity. Strava is a service that allows users to track their physical exercise within an app. Users must have a smartphone, tend to have higher incomes, and their

trips are generally recreational. The heat maps show areas of high activity based on a year's worth of aggregated user data, which is updated monthly.

Figure 4 and Figure 5 display this data below. Areas in white represent corridors with high activity and dark blue areas represent low activity. Looking at heat maps produced by Strava, most pedestrian and bicyclist activity today occurs near the downtown area and along the river. More activity occurs on the west side of the river than on the east.

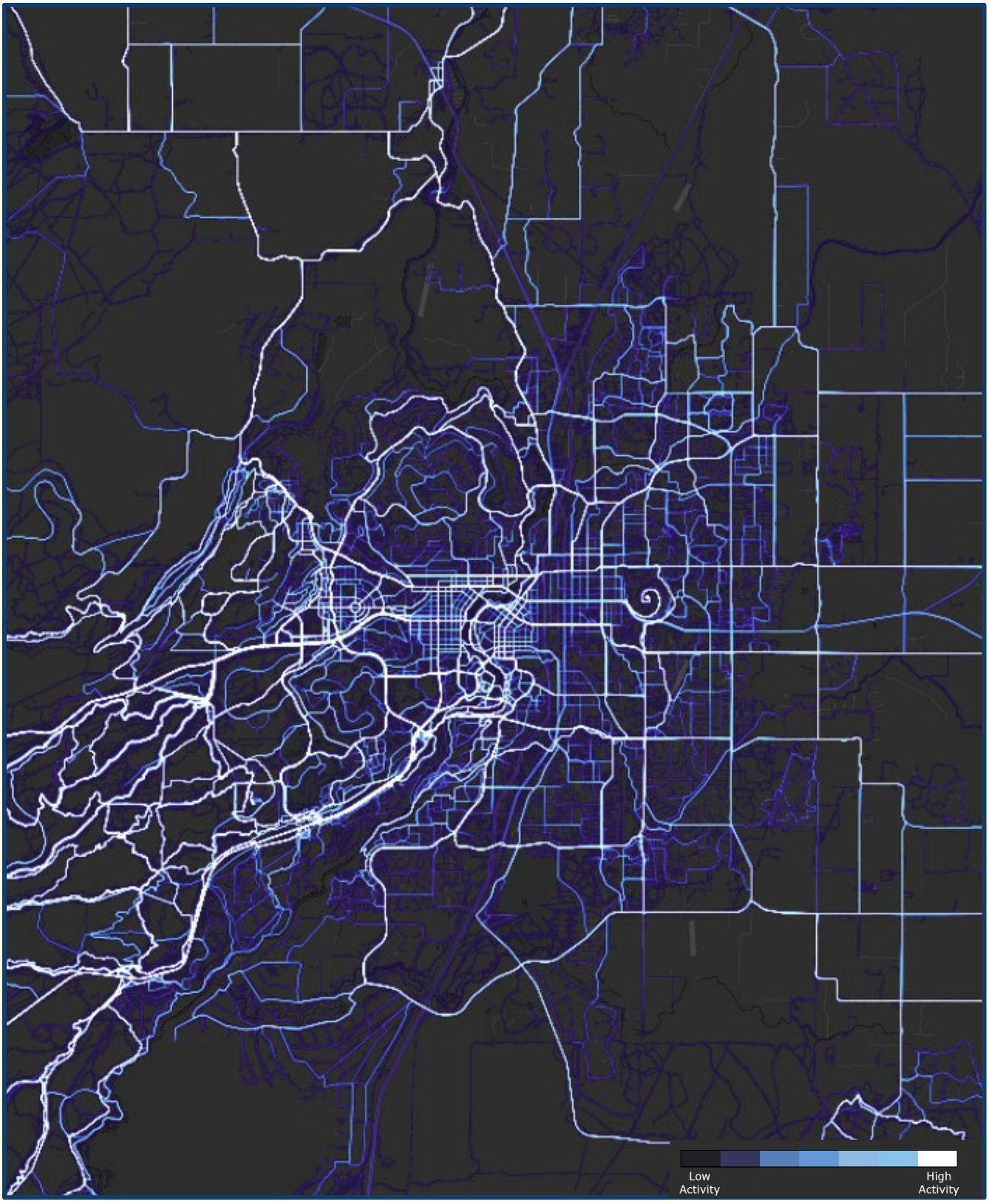

FIGURE 4: BICYCLE HEAT MAP

Source: Strava User Data 2022-2023 Retrieved November 2023

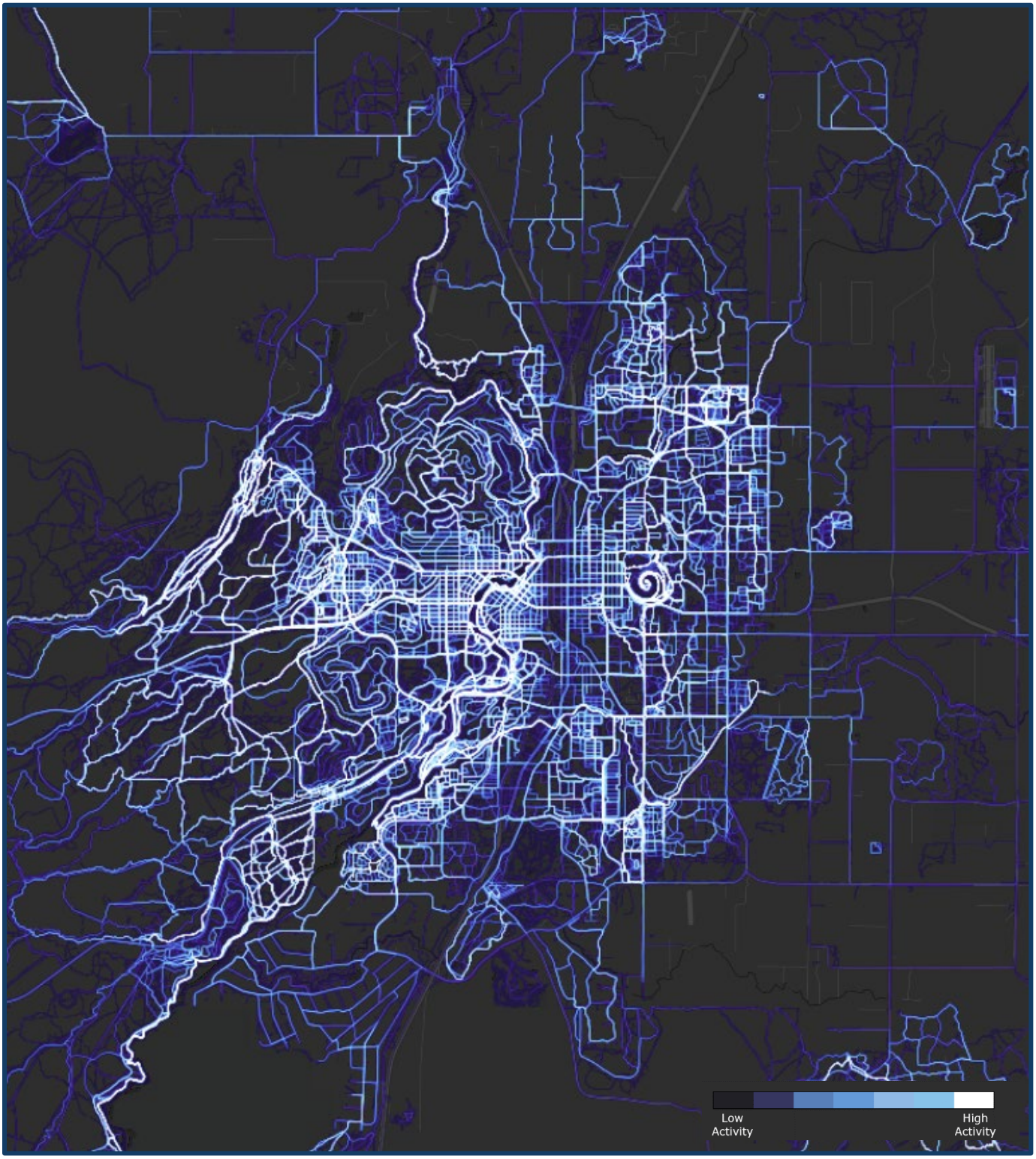

FIGURE 5: PEDESTRIAN HEAT MAP

Source: Strava User Data 2022-2023 Retrieved November 2023

Since the adoption of the TSP, the City has prioritized implementing pedestrian and bicycle facilities, including:

- Completion of the Neighborhood Greenways in 2020, which consisted of three phases and had the goal of providing safer connections, reducing traffic speeds, and helping people cross busy streets.
- In 2022, the City completed a feasibility study to identify improvement opportunities at three locations (Greenwood Avenue, Franklin Avenue, and Second Street). The construction of improvements at those three study locations is set to begin in 2024. The completion of these projects will improve both safety and east-west connectivity in the central core area of Bend.
- In 2023, the City developed a Pedestrian Network Implementation Plan to determine the areas of greatest need and prioritize sidewalk infill and improvement projects needed to create a complete pedestrian network and low stress facilities.
- The City is currently in the design process with funds allocated to construct pedestrian and bicyclist improvements along Olney Avenue, Bear Creek Road, 27th Street, and the Aune Street Extension, including key crossings along 3rd Street.
- The City is also in the process of designing two new crosstown bikeways (one east-west and one north-south route) that will provide a continuous connection for people walking and biking across Bend.

While the City is making significant investments in active transportation infrastructure, many of the needs from the TSP remain and the continued demand for active transportation over the past several years further emphasizes the need for improvements.

UPDATED FUTURE ACTIVE TRANSPORTATION NEEDS

As housing and employment growth continues (particularly dense, mixed-use developments), the demand for walking and biking trips is expected to increase if agencies within the MPA continue to invest in walking and biking infrastructure. Additionally, e-bike usage has continued to increase in Bend based on anecdotal accounts. Nationally, e-bike sales in the U.S have grown by over 300% between 2019 and 2021[2], and it is anticipated that e-bikes could be used for a continually growing number of trips in the future.

Two measures to help understand walking and biking demand were evaluated using the BRM:

- **Mode split**– Mode split provides a quantitative measure of how projects/programs shift trips between walking, biking, transit, and auto trips. A higher percentage of non-single occupancy vehicle (non-SOV) trips also has the potential to reduce congestion, improve air quality, and livability.
- **Vehicle demand on Key Routes**– The City of Bend designated Key Walking and Bicycling Routes (Key Routes) in its TSP. These routes will have dedicated investment in bicycle and pedestrian infrastructure to improve the connectedness of the network as a whole and increase the number of Low-Stress miles for bicyclists and pedestrians. Key Routes with significant

[2] Toll, Micha. Feb 2022. *US electrical bicycle sales tracking toward one million annually, global market heading to $40B with a 'B', https://electrek.co/2022/02/08/us-electric-bicycle-sales-tracking-towards-1-million-annually-global-market-heading-to-40b-with-a-b/*

increases in motor vehicle travel demand (and potentially an increase in the level of stress experienced by people walking and biking) were identified in the BRM. Note that the BRM generally only includes collector and arterial roadways, so there is no data associated with some lower-classification routes.

MODE SPLIT

To understand future active transportation demand, mode split in the 2045 Committed scenario was compared to the 2019 Base Year scenario. Table 6 shows the change in the number of active transportation trips between the two scenarios.

TABLE 6: CHANGE IN DAILY ACTIVE TRANSPORTATION TRIPS

MODE	2019 BASE	2045 COMMITTED	% CHANGE
PEDESTRIAN	10.2%	11.9%	1.6%
BICYCLE	3.4%	3.4%	0%

Even with limited investment in improved pedestrian and bicycle infrastructure through the Committed project list, a significant increase in demand for walking and biking modes still exists, indicating that many of the current active transportation needs are expected to continue into the future.

VEHICLE DEMAND ON KEY ROUTES

In 2045, the expected increase in population will yield additional vehicle trips taken. Ideally, these vehicle trips would not occur on Key Routes, helping reduce the level of stress for people walking and biking. Figure 6 shows the change in daily vehicle volumes along designated Key Routes.

The Key Route with the largest increase in daily traffic volumes is along SE 27th Street between US 20 and Ferguson Road. The on-going Bear Creek Road & 27th Street project is designing improvements along SE 27th Street, although funding has not been identified to bring the roadway up to City standards and additional walking and biking enhancements will likely be needed. SE 15th Avenue, Murphy Road, SE Wilson Avenue, and SW Century Drive are all also projected to experience increases of between 1,000 and 5,000 in daily vehicle trips.

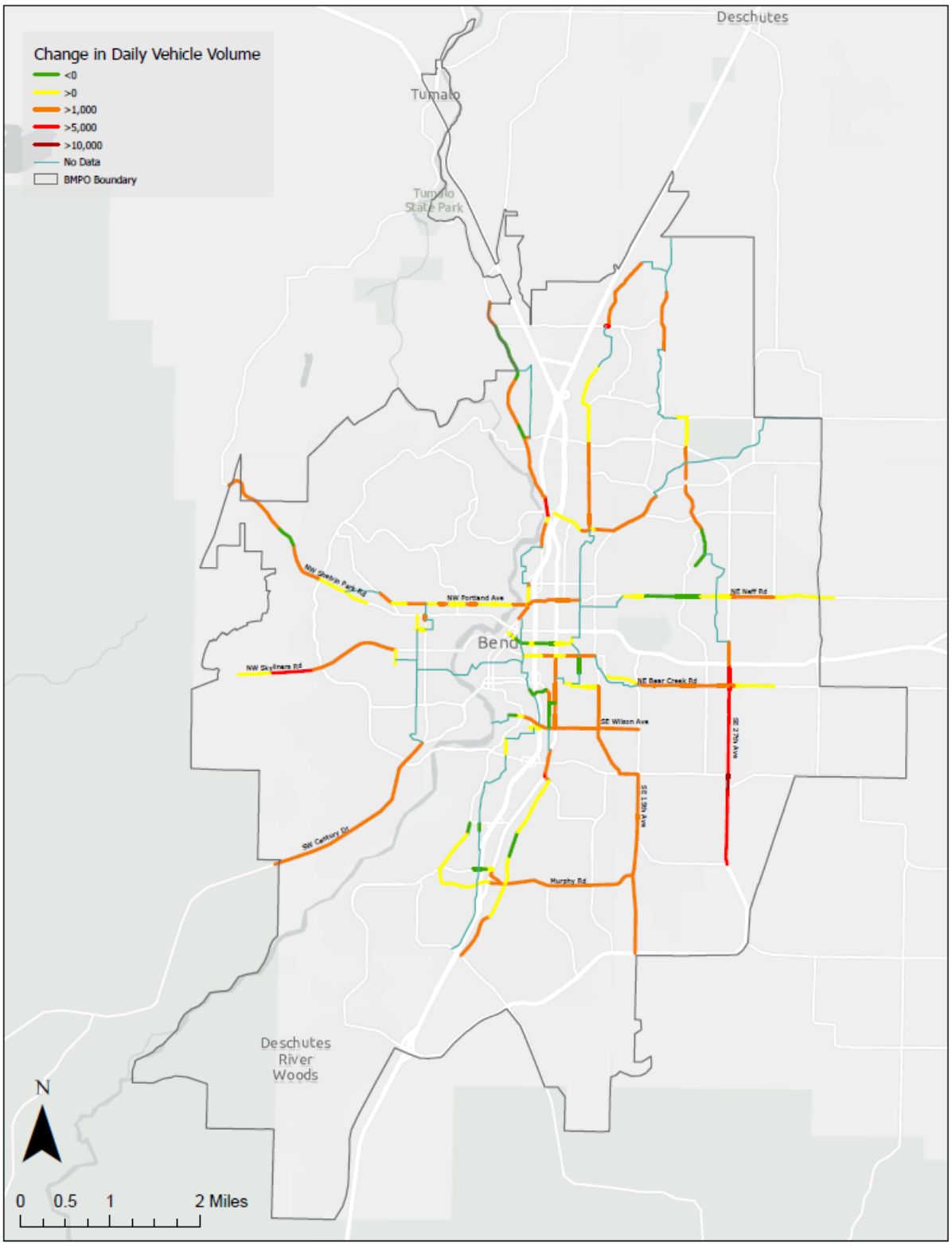

FIGURE 6: CHANGE IN DAILY VEHICLE VOLUME (2019-2045) ALONG DESIGNATED KEY WALKING AND BIKING ROUTES

NEEDS FOR PEOPLE RIDING TRANSIT

The main public transit provider within the Bend MPA is Cascades East Transit (CET), although several other providers provide service to areas outside of Central Oregon. CET is operated by the Central Oregon Intergovernmental Council (COIC) and has coverage primarily in Central Oregon with routes in Bend, La Pine, Madras, Prineville, Redmond, Sisters, and Warm Springs. The following sections summarize:

- Needs for people riding transit identified in prior planning efforts.
- Analysis of recent trends for people taking transit and whether recent trends change the relevance of needs identified in prior planning efforts.
- Future transit needs based on new 2045 land use growth forecasts.

PRIOR PLAN REVIEW – TRANSIT NEEDS

CASCADES EAST TRANSIT (CET) TRANSIT MASTER PLAN (2020)

Service Provided

There were nine fixed service routes within the City of Bend at the time of the existing conditions analysis for the CET Transit Master Plan in 2020 (Routes 1, 2, 3, 4, 5, 6, 7, 10, and 11). The existing conditions analysis was based on 2017 ridership data. Headways for these routes ranged from as short as 30 minutes to as long as 60 minutes. Routes 24, 29 and 30 provided connections to neighboring cities outside of Bend. Route 24 between Redmond and Bend had the highest ridership and the highest revenue hours of those routes at the time.

CET also offers Bend Dial-a-Ride, a complementary paratransit service for disabled individuals and low-income senior citizens who do not live near CET fixed-route bus service. Most trips for the service are between locations in downtown and east Bend.

To help reduce congestion related to recreational traffic, CET offered a variety of recreational shuttle services in 2017. These included Ride the River, the Mt. Bachelor Winter Shuttle, and the Lava Butte Shuttle. Since the adoption of the plan in 2020, a Mt. Bachelor Summer Shuttle has been added. Ride the River decreases the need for riders to park vehicles adjacent to Drake Park; the Mt. Bachelor Winter Shuttle offers a shuttle service in the winter season from Bend to Mt. Bachelor; and the Lava Butte shuttle transports riders to the top of Lava Butte. Recreational shuttle service ranges from three to nine dollars for a round-trip fare.

System Performance

Relative to the population it serves, the amount of service CET provided in 2018 is average for both rural and urban peers, according to the analysis performed in Technical Memo #1 of the CET Transit Master Plan. Routes were individually analyzed based on ridership data from October 2018. Ridership per capita and productivity were also close to the middle of the rural providers, but at the low end when compared to urban providers. Routes 1,3,4 and 7 had the highest ridership and productivity when compared to the other routes. High ridership on these routes is in line with the top five destination zones outlined in Table 7.

For routes that connect Bend with outer cities, Route 24 connecting Redmond to Bend saw the highest ridership on the first trip to Bend from Redmond (6:37 a.m.) and the 2:23 p.m. trip to Redmond. Afternoon trips, particularly to Redmond, tend to run late on the route. This could be representative of Redmond residents coming to Bend for the day for either work or leisure activities, then returning home.

Route 29, which connects Bend and Sisters, had low ridership. Service for the route started in February of 2017. Before the start of the service, there was no direct connection between Bend and Sisters. Performing outreach to determine the cause of low ridership was recommended.

Route 30, which connects La Pine and Bend also had low ridership. The potential to improve access to the route in La Pine and revaluation of the possibility of servicing Sun River was noted.

Lack of control of rail traffic from the BNSF railway tends to cause delays during the p.m. peak, which was seen throughout most routes. It was also noted that routes with 45-minute headways cause difficulty for system users to transfer and connect to other routes at Hawthorne Station, especially with the potential for delay.

Transit Master Plan Needs

The following transit service needs were highlighted in the plan.

- **Fixed Route Service Needs:**
  - More frequent routes on North and South 3rd Street and Greenwood Avenue.
  - Frequent fixed-route transit service added to north of Greenwood Road, east of Pilot Butte, along NE 27th Avenue, downtown, Old (Central) Bend, and western Bend along Newport Avenue
  - More service coverage in Bend, especially the NE and SE Bend and St. Charles area.
  - More connections to Old Mill, one of the area's major centers for employment, shopping, and recreation.
  - More direct connections to downtown from the east side.
  - Addition of limited Sunday service and early evening service.
  - 30-minute headways for Saturday service on select routes.
  - Extended Saturday service hours for fixed route service.
  - Exploring moving from a spoke-and-hub model to a multi-centric model to lessen the transit impact at Hawthorne Station and reduce dependency on transfers.
  - More frequent service between Bend and Redmond
  - Increased service on Saturdays and during the evening for regional service
  - Vanpools to dispersed employment sites
- **Recreational Service Needs (Routes where CET should expand its recreational services):**
  - Sunriver
  - Black Butte Ranch
  - High Desert Museum
  - OSU Cascades

  - Smith Rock
  - Popular Central Oregon Sno-parks
  - Mt. Bachelor and Cascades Lakes
- **Capital Needs:**
  - Additional peak buses for Routes 1, 4, and 7
  - A new short route to downtown Bend
  - Fare payment configuration to create additional fare payment options
- **Technology Needs**
  - Transit Signal Priority for all corridors on the primary transit network in Bend
  - Automated stop announcements and displays on buses
  - Upgraded communication equipment for drivers and operations staff
  - One app/platform for fare payment and trip planning
  - Upgraded and/ or replaced computer-aided dispatch/ AVL software and equipment
  - Real-time arrival information at bus stops
  - Improved Dial-A-Ride dispatch/scheduling system

DESCHUTES COUNTY TRANSPORTATION SYSTEM PLAN (TSP) (DRAFT 2023)

The Deschutes County TSP calls out the previously discussed masterplan and commits to continuing to partner on transit projects that serve the community within its boundaries.

DESCHUTES COUNTY INTELLEGENT TRANSPORTATION SYSTEMS (ITS) PLAN (2020)

The Deschutes County ITS Plan highlighted key transit ITS elements deployed by CET. These elements included:

- A Google Maps-based online trip planner
- A transit mobile app providing trip planning and real-time arrival predictions
- Automatic vehicle location installed on vehicles fleetwide and integrated with the computer-aided dispatch system
- An electronic fare collection system using TouchPass, a contactless smart card with mobile app support (CET has gone fare-free for fixed routes but still collects fares for recreational shuttle services)

At the time, OSU-Cascades operated Ride Bend, a pilot on-demand app-based transit service, available for use by everyone.

BEND TRANSPORTATION SYSTEM PLAN (TSP) (2020)

At the time of the TSP, the following transit service needs in Bend were identified:

- Lack of public transit options to the airport
- Limited transit service in the outer section of the City/MPA
- Lack of transit service on Sundays

- Limited inter-city and regional service
- No fixed transit service for close-in communities of Tumalo and Deschutes River Woods
- Fewer than half of the arterials and collectors within ¼ mile of a transit stop had sidewalks on at least one side of the roadway or dedicated bicycle facilities.

Congestion also impacted the operations of transit service in Bend. Motor vehicle congestion at key locations on US 20, US 97, 27th Street, and east-west bridge crossings impacted transit service reliability during the p.m. peak hour. Colorado Avenue/Simpson Avenue and Brookswood Boulevard/Reed Market Road were two roundabouts that also impacted transit service reliability during the p.m. peak hour.

The TSP was completed before the previously discussed CET Transit Master Plan. To ensure a coordinated set of infrastructure recommendations, the City and CET collaborated throughout the planning process to reflect the current and future vision for transit service within the community.

RECENT TRANSIT TRENDS ANALYSIS

Since the adoption of the CET Transit Master Plan, fixed route and on-demand services went fare-free during the COVID-19 pandemic in 2020 and have remained fare-free since. CET now contracts with Umo Mobility for electronic fares on recreational routes. CET also launched Passio Go, which shows all active fixed-route buses in the Cascades East Transit Network.

Route 10 was suspended in September 2021 due to driver shortages. In response, Route 11 was switched from 1 hour to 30-minute headways. Overall, fixed route service was disrupted in 2020 due to the COVID-19 pandemic and driver shortages, but as of April 30, 2023, 30-minute weekday frequencies have returned to routes 1, 3, 7, and 11. All other routes continue to have 45-minute headways. The addition of Route 9 occurred in October 2023, which serves southeast Bend along 15th Street and Murphy Road. There are also plans for the addition of Route 8 to serve the northeast area of Bend, running along 18th Street and Butler Market Road depending on bus driver recruitment. Driver shortages continue to be the largest strain on CET operations today, affecting the ability to increase headways or add Sunday service for the fixed-route system.

Routes still operate out of Hawthorne Station on a hub and spoke method. Since the adoption of the Deschutes County ITS plan, CET has created a system for users to see real-time bus positioning which was identified in the needs section of the ITS plan.

UPDATED FUTURE TRANSIT NEEDS

As housing and employment growth continues (particularly dense, mixed-use developments), the demand for transit trips is expected to increase. To help understand this future demand, the change in transit trips were evaluated using the BRM. To understand future transit needs, the 2045 Committed scenario was compared to the 2019 Base scenario. The increase in the number of transit trips is shown in Table 7. The investment in transit within the Committed Project List shows there will be an increase in transit trips. This is due, in part, to two transit lines added to the Committed scenario in comparison to the 2019 scenario, and also to expected housing and employment growth in areas with existing transit service. The addition of new lines increases the transit coverage for both northeast and southeast Bend as shown in Figure 7.

TABLE 7: CHANGE IN DAILY TRANSIT TRIPS

MODE	2019 BASE	2045 COMMITTED	% CHANGE
TRANSIT DEMAND	700	1,200	71%
PARK AND RIDE TRIPS	100	200	100%
WALK TO BUS TRIPS	700	1,100	57%

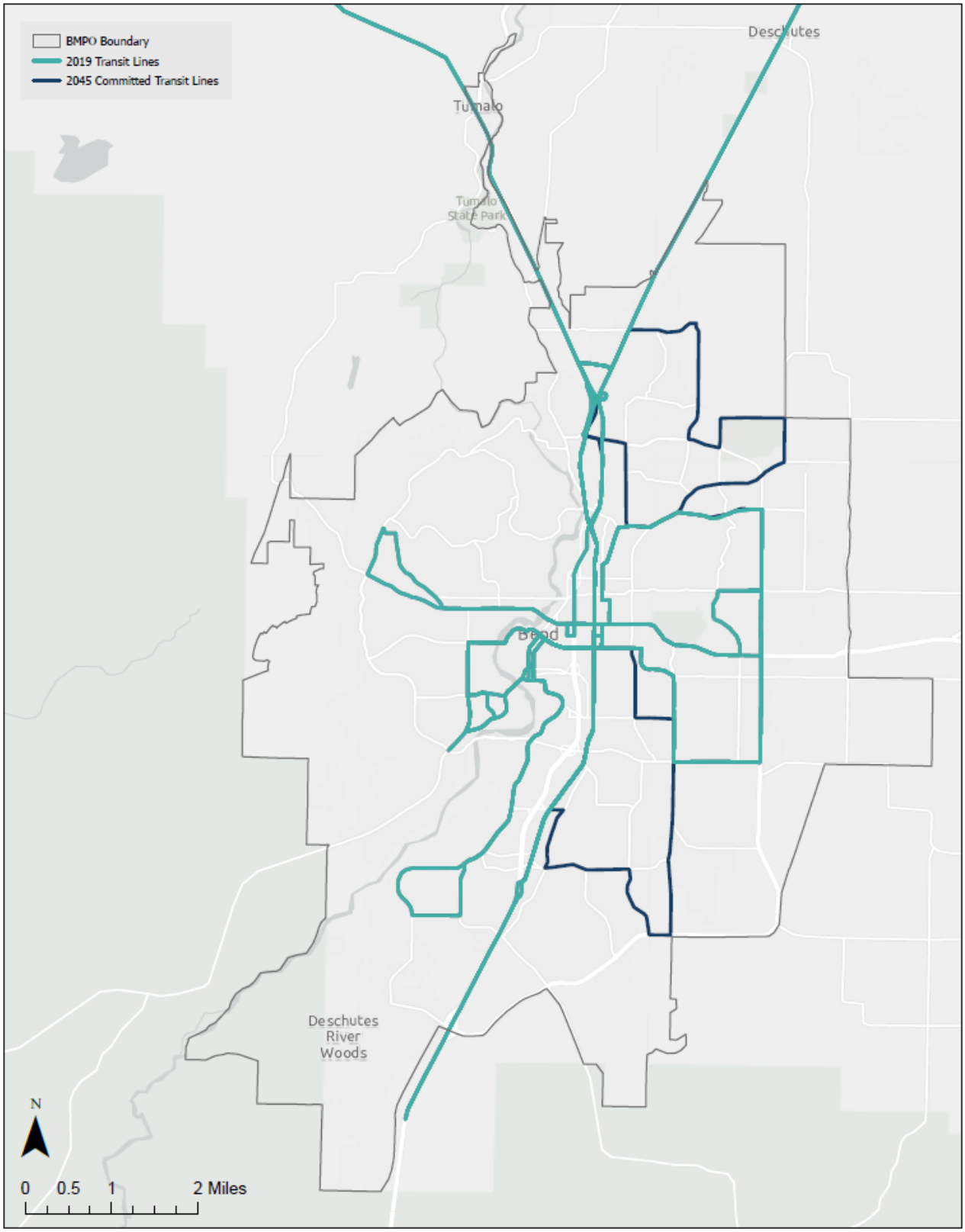

FIGURE 7: CHANGE IN BEND MPA TRANSIT NETWORK 2019-2045

NEEDS FOR PEOPLE DRIVING AND FREIGHT

One of the most common ways to get around the Bend MPA is by motor vehicle. Proximity to popular recreational opportunities, as well as constrained geography cause various stresses on the region's motor vehicle system, creating congestion and delays. This section summarizes the motor vehicle needs for the Bend MPA and is organized as follows:

- Review of motor vehicle needs identified in recently completed planning efforts within the MPA, with a focus on key themes and system and corridor level findings.
- Recent motor vehicle traffic trends since the adoption of the latest MTP update, including congestion changes, trip pattern changes, and corridor specific changes.
- Updated future motor vehicle needs based on the new 2045 Horizon year and updated land use forecasts for the MPA.

PRIOR PLAN REVIEW – MOTOR VEHICLE NEEDS

DESCHUTES COUNTY TSP (DRAFT 2023)

According to the Deschutes County TSP, roadway repairs are and will continue to be monitored and accomplished as part of the County's ongoing maintenance programs. No roadway capacity deficiencies within the Bend MPA were identified under existing conditions.

The County does not have any designated freight routes that provide connections to local industrial and employment lands with the Bend MPA. A need was identified to designate County freight routes to serve key economic priority areas to supplement the ODOT freight system.

An outcome of the TSP is to identify key intersections where the roadway geometry and/or traffic control could be changed in the future to address known safety and/or anticipated capacity needs. Another goal is to prioritize strategic roadway corridors where vehicular capacity and/or changes to the roadway characteristics may be needed to support future growth and economic development in the region, enhance the safety of all users, and strengthen connections between areas of the County and other areas in Central Oregon.

DESCHUTES COUNTY TSAP (2019)

Between 2012 and 2016, 174 reported crashes within unincorporated Deschutes County resulted in fatal or incapacitating injuries. According to the TSAP, the County experienced increasing crash frequency from 2012 to 2016. Four intersections identified as top sites for safety improvement were called out in the plan that were also within the Bend MPA. They were identified based on equivalent property damage only performance measures. These intersection locations are described as follows:

- Ward Road and Bear Creek Road
- Ward Road and US 20
- US 20 and Old Bend Redmond Highway
- US 20 and O.B. Riley Road

A concept was developed for the Ward and Bear Creek intersection in the TSAP. This concept included the installation of rural two-way stop control treatments.

DESCHUTES COUNTY ITS PLAN (2020)

The Deschutes County ITS Plan explores travel time reliability throughout the region, including the Bend MPA. Travel time reliability refers to the consistency and predictability of travel durations between two points. It ensures that individuals can confidently plan their journeys as travel times remain stable over time. Factors like traffic conditions and effective incident management influence reliability. Reliable transportation systems contribute to smoother mobility, reduced uncertainty, and increased economic efficiency for travelers.

The US 20/US 92 Business/ SE 3rd Street corridor generally experiences worse travel time reliability than the Parkway (US 97). The worse reliability is due to the frequency of driveways and intersections, as well as the number of signalized intersections along that corridor in comparison to the Parkway's controlled access.

The Bend Parkway Study analyzed travel time reliability for the US 97 corridor through the City of Bend. It found that peak period travel time (4:30 – 5:30 p.m.) was unreliable on the US 97 corridor north of Empire Boulevard due to the congested nature of the peak periods at the at-grade signalized intersections, mainly Cooley Road and Robal Road.

US 97 south of Reed Market Road was also unreliable due to the at-grade intersection at Powers Road and recent construction projects such as repaving portions of US 97 in the southern MPA in 2021.

Traffic Signals

ODOT operates and maintains all 56 traffic signals in the Bend MPA. At the time of the most recent ITS Plan Update, ODOT was transitioning its traffic signal controllers to Advanced Traffic Control Technology using MaxTime for local controller programming and MaxView for system management.

Most of the traffic signals in Deschutes County have full emergency vehicle preemption capability. The system also can provide priority for transit vehicles.

ITS Systems

ODOT currently operates a Transportation Operations Center at the Region 4 Headquarters building. The center helps with incident, emergency, and traffic management as well as traveler information, winter operations, and maintenance operations.

There are 20 closed-circuit television cameras to monitor traffic in the Bend MPA; 17 are operated by ODOT and 3 by the City of Bend. Most of the cameras are located on US 97 and US 20.

ODOT operates and maintains two fixed Variable Message Signs in the MPA. The two are located on Highway 97 at the south end of Bend. There are also Portable Variable Message Signs in operation in the region.

ODOT currently operates 10 automatic traffic recorders (ATRs) in Deschutes County. Seven are located on US 97 and two are located on US 20. Four of those ATRs are located within the City of

Bend as previously mentioned. Most of the recorders are in-pavement loops, but the Agency is planning to shift to radar camera technology.

The City of Bend operates five ATRs. Four are for the river crossings at Portland Avenue, Newport Avenue, Galveston Avenue, and Columbia Street. The fifth is at Franklin Avenue, west of the Bend Parkway and BNSF railroad undercrossing.

There is limited public agency-installed fiber optic infrastructure in Deschutes County, but there is a significant center-to-center fiber optic network due to a franchise agreement with TDS Telecom. At the time of the plan, regional agencies announced a partnership with Facebook that would construct a major fiber optic communications backbone along US 97 from La Pine to Bend to support its operations and provide access and dedicated fibers to ODOT. The project is ongoing. The conduit is currently being installed in the Bend MPA.

Overall Plan Needs

- Timely, accurate, and reliable traffic, transit, and other road conditions data collection to inform travelers of the latest conditions affecting their travel including those who are walking, biking, taking public transit, or driving.
- Need to connect and upgrade remaining older traffic signals.
- Ability to remotely manage and control traffic signals.
- A way to actively manage highway traffic on ramps, interchanges, and on the mainline, utilizing tools such as metering and variable speed limits where warranted.
- Better detection and coordination of highway and arterial operations during incidents that require response and cause travelers to divert.
- Accommodating repurposed travel lanes/roadway footprint to alternate uses.
- Need for a demand responsive system that maps and schedules pickups.
- Adoption of transit signal priority and transit corridors.
- Incorporation of arterial traffic and connected vehicle data to optimize transit service operations.
- A plan for future transit mobility hubs as well as places for EV charging infrastructure and overall grid evaluation for EV fleet operations.
- Data distribution to third-party services on street types and characteristics to provide smarter, context-sensitive routing recommendations.
- Increasing monitoring and reporting availability in parking lots, garages, and other parking areas and facilities. Curb management capabilities to balance the demand for parking, loading, and other curb uses. Sharing parking information with local drivers and regional traveler information systems for broader distribution.
- Upgrading to an automated system for towing to improve incident response time and reduce errors.
- Identification of which ITS devices are critical during major events like wildfires, and which may be susceptible to electrical outages during such events.
- Improving infrastructure monitoring to be proactive about needs for general maintenance.
- Understanding of winter maintenance, including monitoring and clearing operations for sidewalks and bicycle lanes.

- Better informing of travelers about work zones and closures due to construction. Ensuring all workers are safe in the field if travel lanes remain open during construction.
- Defining common performance measures between partner agencies, common data standards for all data types, common data formats for sharing, and long-term data storage for the maintenance of a well-working data collection system.
- A way to collect and analyze the data to understand network performance, safety analysis, and future transportation planning needs.
- A centralized location or single access point to store, access, and process multi-sourced data.

BEND TRANSPORTATION SYSTEM PLAN

During the development of the Bend TSP, several key factors were determined to be influences on the motor vehicle system including:

- Tourism – Mt. Bachelor and Sunriver are both popular tourist destinations located near the City of Bend. Tourism traffic was a major contributor to the traffic congestion on Century Drive and throughout other areas of the city.
- In addition to tourism, from 2013 to 2018 motor vehicle travel increased by almost 20%, driven by housing and employment growth within the City of Bend.
- Regional Commuters – In 2018 approximately 49% of the employees that worked in Bend lived in the surrounding communities. This regional employment-based travel significantly increased traffic volumes throughout the study area during peak commute periods, especially along the US 97 corridor, which acts as a major connector between Bend and Redmond.
- Barriers to east-west connectivity – The Deschutes River, the US 97 Parkway, and the railroad crossings on Reed Market Road all serve as barriers or constraints to east-west connectivity within the City of Bend.
- Lack of connectivity in more rural areas – Rural areas within the Bend UGB often lack a mixed land use pattern, which results in residents needing to travel to other areas of Bend for employment, shopping, and services, often by car due to incomplete street networks.
- The effect of winter snow and ice, and summer wildfires on travel patterns – Every major corridor within the study area serves as an emergency access route. In particular, the City Fire Department has identified Skyliners Road, Cascade Lakes Highway (Century Drive), Brookswood Boulevard, and OB Riley Road as key evacuation routes.

Motor vehicle issues and needs identified in the plan generally included road safety, lack of cross-town travel, and overall congestion, consolidated into the following six themes, as summarized below (and identified on page 49 of the TSP):

Bend Parkway (US 97) Congestion and Safety

As previously mentioned, there is noticeable congestion on Bend Parkway (US 97) as this facility serves as a major entrance and exit for the city. Although City roadway projects currently in design/construction will provide some relief to this corridor, additional changes are likely still needed to address future travel demand and improve safety.

East-West Corridor Congestion

The TSP identified major congestion along east-west corridors as a critical issue. Physical and topographic challenges currently constrain east-west travel in the city for those walking, biking, riding transit, and driving. Barriers such as the Deschutes River, Bend Parkway (US 97), and BNSF Railway limit the location and extent of east-west streets. This creates heavy demand for travel along a few key corridors (e.g., Greenwood Avenue, Reed Market Road, Colorado Avenue/Arizona, Wilson Avenue, Empire Avenue, and Murphy Road), which can result in breakdowns of travel time reliability for motorists. Congestion on Reed Market Road impacts congestion on north-south routes in particular, 3rd Street and Bond Street/Brookswood Boulevard.

Since the adoption of the TSP, the previously mentioned Empire Avenue Extension has helped to improve east-west connectivity and has relieved some pressure on Butler Market Road. There have also been improvements to the Murphy Corridor from Parrell Road to 15th Street. These improvements were completed in Fall 2021 and included an overcrossing of the BNSF bridge as well as an extension of Murphy Road.

North-South Corridor Congestion

North-south congestion also exists due to some geographical barriers. Pilot Butte, the extensive canal system, the BNSF Railway, and existing neighborhood development patterns limit the location and extent of north-south streets, particularly east of US 97. These constraints create heavy demand for travel along NE/SE 3rd, NE/SE 8th/9th, NE/SE 15th, and NE/SE 27th Streets and are responsible for a lack of continuous routes for those walking, biking, or taking transit. Since the adoption of the TSP, the City has designed and/or constructed several new roundabouts along 15th Street to help with congestion and improve safety, but additional improvements are likely still needed to address north-south congestion in Bend.

Century Drive/NW 14th Street is one of the longest continuous north-south routes on the west side of the river. Congestion on this corridor is influenced by recreational and school traffic.

Safety

Several safety issues were identified in Appendix B of the TSP. Crash data was analyzed for the years 2011-2016 and key findings from the analysis include:

- In that period, there were 4,953 reported vehicle crashes, equating to over 826 crashes per year.
- Compared to similar-sized cities in Oregon, Bend had one of the lowest crashes per capita.

There were 18 identified high-frequency crash locations. In addition to these locations, nine segments on state facilities and 10 sites on non-state facilities were identified as part of the top 10% ODOT Safety Priority Index System locations. The Bend Transportation Safety Action Plan was also developed around the same time and its findings were incorporated into the TSP to help address these issues.

Bend Parkway (US 97) is a key route identified by the TSP with motor vehicle safety needs. The Parkway acts as the main north-south route for the city and continues to be a primary route for those traveling within and through Bend. Since the adoption of the TSP, the North Corridor project has been underway to help fix these issues. The City also recently received funding for the Midtown

Crossings Project, which will close the at-grade right-on access to US 97, one of the key safety issues along the Parkway.

Since the adoption of the TSP, several roundabouts have been constructed to help address safety issues. This includes a roundabout constructed in 2021 at the intersection of Colorado Avenue & Columbia Street and Simpson Avenue & Columbia Street.

Technology

ODOT Region 4 in Bend at the time of the TSP housed several intelligent transportation systems (ITS), including remote weather information systems, video detection cameras, closed circuit television cameras, and an oversized vehicle closure telephone system. The TSP identified the following ITS needs:

- The ability to automate, collect, and disseminate real-time traffic conditions information as well as remote, continuous access to real-time data.
- Updating and interconnecting available conduit inventory.
- Improving the lack of access to real-time traffic conditions to improve incident response, emergency vehicle access, and travel time reliability.
- Improving the lack of real-time traveler information at key decision points including travel time, weather information, and special event information.
- Increasing traffic signal timing enhancements such as signal coordination, transit signal priority, and signal transition during a railroad priority call, which are currently limited.
- Up-to-date Intelligent Transportation System (ITS) inventory including device types and locations and available conduit inventory.

More in-depth analysis of technology in the area was previously outlined in the Deschutes County ITS plan section.

Other issues

- Of the 67 intersections studied within the TSP process, 25 did not meet the current jurisdictional mobility targets at the time of analysis. 23 of these intersections were under ODOT jurisdiction, and two intersections were under the City of Bend jurisdiction.
- There were 11 at-grade rail crossings with automatic gates and eight grade-separated rail crossings within the City. These crossings can be a major source of motor vehicle traffic delay, particularly the crossing on Reed Market Road near 9th Street.

BEND TRANSPORTATION SAFETY ACTION PLAN

Between 2012 and 2016, 92 reported crashes within the Bend UGB resulted in fatal or incapacitating injuries. The plan identified 25 sites for safety improvement with similar methodology to what was used in the Deschutes County TSAP. Of those 25 intersections, four high-level concepts were developed for four sites identified through a prioritization screening process. The four concepts were:

- 3rd Street & Butler Market Road/Mount Washington Drive Area
- Highway 97 and Powers Road Area

- 3rd Street Area
- Purcell Boulevard/Pettigrew Road and Bear Creek Road.

ODOT REFINEMENT PLANS AND STUDIES

Many of the motor vehicle needs identified in the relevant ODOT refinement plans and studies are generally consistent with the needs discussed in the above sections. Given the growth in traffic demand in Bend and regional traffic growth, significant congestion is expected on US 20 and US 97 in Bend in the future, as identified in the US 97 Parkway Plan and the US 20 Bend Facility Plan. Several safety hotspots were also identified on US 97 and US 20, including the at-grade right-on/right-off access points on US 97.

RECENT MOTOR VEHICLE TRENDS

CONGESTION TRENDS

INRIX data was used to understand current congestion trends in the Bend MPA and compare 2023 conditions against the existing conditions evaluated in prior planning efforts. This data indicates that between 2018 (existing conditions for Parkway Study and Bend TSP) and 2023, the p.m. peak hour has consistently remained the most congested period. For both years, most of the congestion within the City of Bend occurred during the 4:00 to 5:00 p.m. peak hour.

The 2018 and 2023 peak congestion comparisons are shown in Figure 8 and Figure 9. The congestion measure presented is based on the relationship between the speed experienced on the roadway at the specific point of time in relation to the free flow speed for that section of the roadway. If the current speed is the same as the free flow speed, the segment is green and no significant congestion is experienced. Note that this analysis is missing data for local roads. The 2018 data set obtained from RITIS does not have the same granularity as that for 2023. Most major roadways in Bend are included in the 2023 data set, but not in the 2018 data set. However, many of the roadways missing in the 2018 data do not exhibit significant congestion in the a.m. or p.m. peak hour in 2023, so this gap in data is inconsequential to this comparative analysis.

Some key differences between the two years include:

- **US 97 North Corridor and US 20** – There is significantly increased congestion on US 20 (and parts of US 97) between 2023 and 2018. The increased congestion along the northern portions of US 97 and US 20 is mainly due to construction occurring in the area. Construction on this segment of US 20 began in the winter of 2022 and is scheduled to be finished by the spring of 2024, and includes new roundabouts at Tumalo Road, Old Bend-Redmond Highway, Cooley Road, and Robal Road. Construction on US 97 began in the spring of 2023 and is scheduled to be finished in the winter of 2025. Both sections of construction are part of the Bend North Corridor Project which aims to realign US 97, improve intersections, create new ramp connections, and improve pedestrian and bicycle facilities along the corridor.
- **Empire Avenue/27th Street** – There is more congestion along 27th Street in 2023 when compared to 2018 in both the a.m. and p.m. peak hours. This is likely due to the completion of the Empire Avenue Extension project, which connected Empire Avenue and 27th Street at Butler Market Road. This project was completed in the fall of 2021 and provides a more direct path between northern and eastern Bend.

- **US 20/Greenwood Avenue east of 8th Street** – Between the two time periods, there was a decrease in congestion along the eastern portion of US 20. This could be in part due to the completion of the Empire Avenue Extension, which provides a more direct route between northern and eastern Bend. The City and the Oregon Department of Transportation (ODOT) are currently developing the US 20 Bend Facility Plan, which encompasses US 20 from 3rd Street to Powell Butte Highway and includes an updated existing condition needs analysis. Recommendations from this plan will be incorporated into the MTP update.

Some key similarities between the two years include:

- **US 97 North Corridor** – Major areas of congestion can be observed in both years along the northern parts of US 97 from Cooley Road to Empire Avenue.
- **Reed Market Road** – There are also similar trends in congestion along Reed Market Road throughout the study area, with congestion generally extending between Century Drive and 15th Street during the p.m. peak hour. Congestion on Reed Market Road also impacts congestion/delay on 3rd Street and Bond Street/Brookswood Boulevard.
- **US 20/Greenwood Avenue between 3rd Street and 8th Street** – There is consistent congestion around US 20/Greenwood Avenue between 3rd Street and 8th Street between 2018 and 2023.

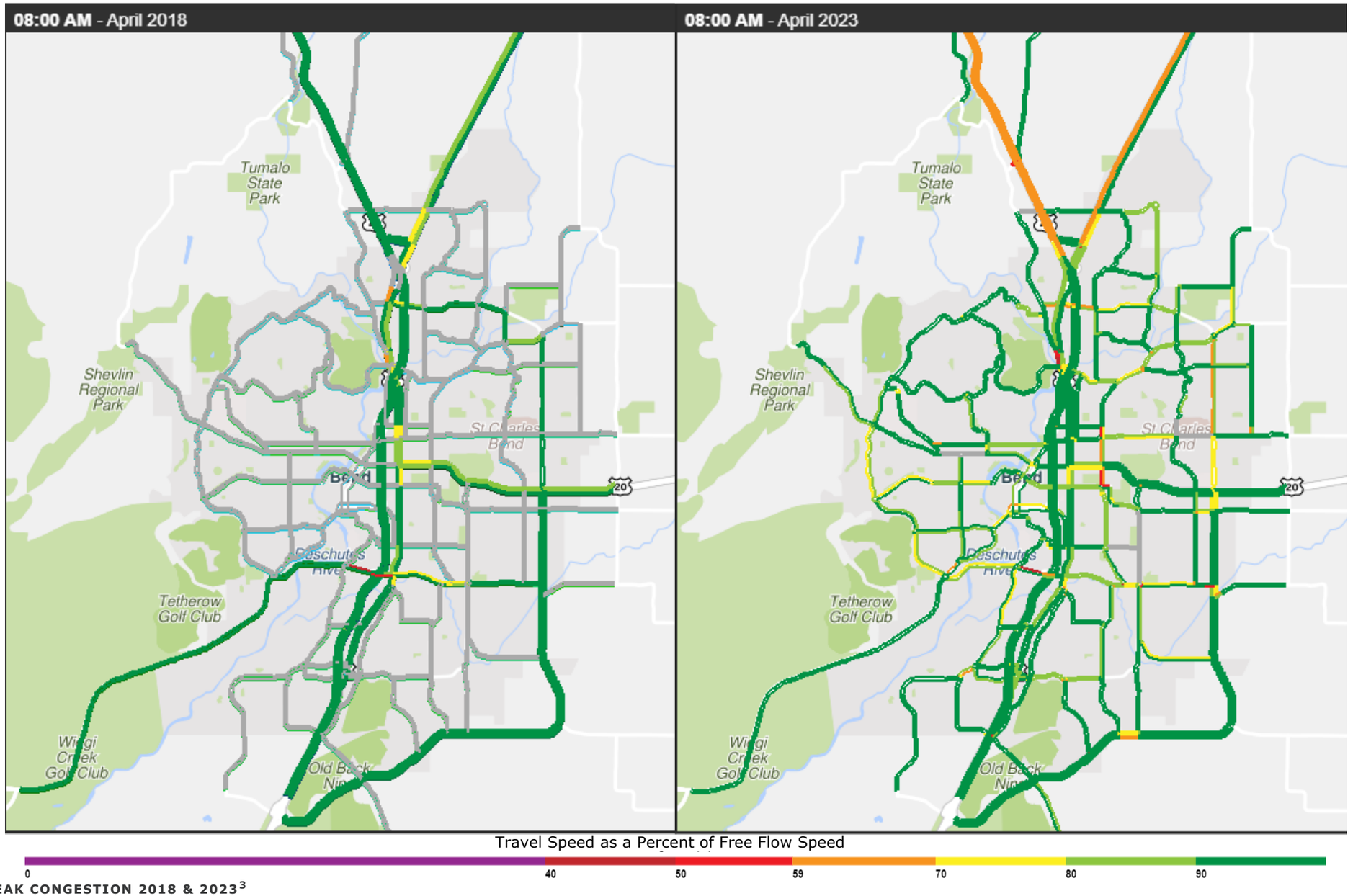

FIGURE 8: A.M. PEAK CONGESTION 2018 & 2023[3]

Source: Regional Integrated Transportation Information System Congestion Trend Map, using INRIX data

[3] Grey colored corridors represent streets with no data available.

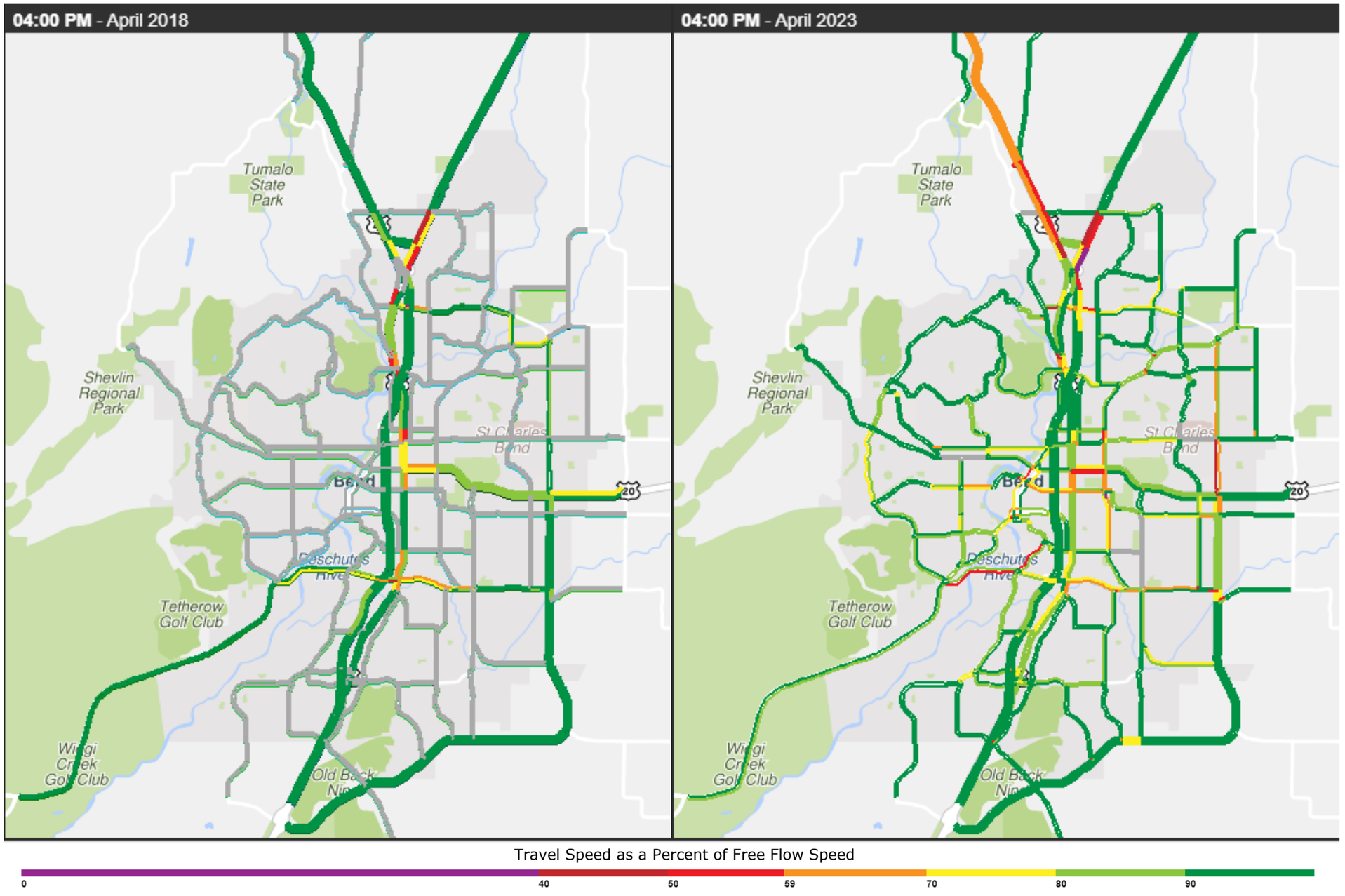

FIGURE 9: P.M. PEAK CONGESTION 2018 & 2023

Source: Regional Integrated Transportation System Congestion Trend Map

CORRIDOR-SPECIFIC TRENDS

In addition to trends in vehicle congestion, specific corridors were analyzed to understand their operation today in comparison to conditions during the last MTP adoption.

Empire Avenue

The Empire Avenue extension has had a significant impact on traffic trends in the area. This project was a 3,000-foot extension of Empire Avenue which now connects travelers directly from Purcell Boulevard to the intersection of 27th Street and Butler Market Road. In addition to the road extension, three new roundabouts were also added. Project construction was completed in October of 2021.

This project has led to a 30% increase in average traffic along the Empire Avenue Corridor between 2018 and 2022 and doubled traffic volume near the intersection with Purcell Blvd[4]. The new connection has decreased traffic on Butler Market Road.

US 97

There are four automatic traffic recorders in the City of Bend along US 97. Since 2018, there has been an increase in Annual Average Daily Traffic (AADT). 2020 saw a significant drop in AADT due to the COVID-19 pandemic, but AADT has since recovered to a little above pre-pandemic level as shown in Table 8 below.

TABLE 8: 2018 & 2022 AADT AT AUTOMATIC TRAFFIC RECORDERS ALONG US 97

LOCATION ID	NEAR	2018 AADT (VEHS)	2022 AADT (VEHS)	GROWTH
09007	South of Empire Ave	55,100	56,862	3%
09009	Revere Avenue Interchange	54,685	55,763	2%
09025	Pinebrook Boulevard	21,754	22,839	5%
09003	China Hat Road	26, 542	27,502	4%

SUMMARY OF RECENT TRANSPORTATION TRENDS COMPARISON

In general, many of the transportation trends from 2018 (the year of the last MTP update) remain the same today, with a few key exceptions. Key findings from the analysis of available data indicate:

- The population of Bend increased by nearly 15% between 2018 and 2022 (Table 1).

[4] Based on traffic counts obtained from Oregon Traffic Monitoring System for locations along the Empire corridor.

- Congestion trends along US 97, Reed Market Road, and US 20/Greenwood Avenue between 3rd Street and 8th Street have remained relatively similar between 2018 and 2023. US 97 traffic volumes have remained relatively consistent, with a slight increase in daily traffic volumes.
- Additional congestion is occurring on US 97 and US 20 on the northern end of Bend due to ongoing construction of the US 97 North Corridor project.
- Traffic volumes and congestion patterns along Empire Avenue/27th Street have changed due to the completion of the Empire Avenue extension project.

UPDATED FUTURE MOTOR VEHICLE NEEDS

To understand future system performance, the 2045 Committed scenario was compared to the 2019 Base scenario across the following motor vehicle system performance measures:

- **Demand to capacity (D/C) ratio** – The measure of peak hour congestion can be measured by the demand to capacity ratio which determines the ratio of vehicles over the capacity of a roadway. The travel demand model has the capacity of evaluating the overall flow of traffic over the length of a specified corridor. D/C ratios that are higher than 0.80 affect driving decisions due to the presence of other vehicles. A D/C ratio of 1.0 indicates significant congestion.
  - **Arterials over capacity** – Congestion on the roadway network is defined by a threshold of the D/C ratio. The number and percentage of arterial lane miles that operate with a D/C ratio greater than 1.0 are considered over capacity and congested.
- **Vehicle hours of delay** – Total hours of delay for all vehicles over the entire system within the MPA during the p.m. peak hour.
- **Vehicle miles traveled (VMT) per capita** – This measure evaluates the total daily vehicle miles traveled for household-based trips by light vehicles making a trip that starts and ends within the MPA, divided by the total population with the MPA.
  - **VMT on rural facilities** – This measure evaluates the total vehicle miles traveled by all vehicles on rural facilities (outside the UGB boundary, within one mile) during the PM peak hour and can be a measure of diversion on rural facilities due to congestion.
- **Diversion potential** -– Modeling the traffic shifts on collector roadways can serve as a proxy for diversion onto local streets. This can also serve as an indicator of increased traffic on roadways that were not designed for high volume traffic. This measure identifies the percentage of collector roads with an average daily traffic volume above 4,000 vehicles per day.
- **Corridor performance** – This measure highlights unreliable or unsafe corridors today where significantly more traffic demand is expected in the future.

DEMAND TO CAPACITY (D/C) RATIO

Figure 10 shows the forecasted demand to capacity (D/C) ratio on roadways within the MPA for the 2045 Committed scenario compared to the 2019 scenario. The D/C ratios are based on raw model outputs that serve as a general guide to identify needs and differ from the volume to capacity (v/c) ratios that are calculated using post-processed traffic volumes.

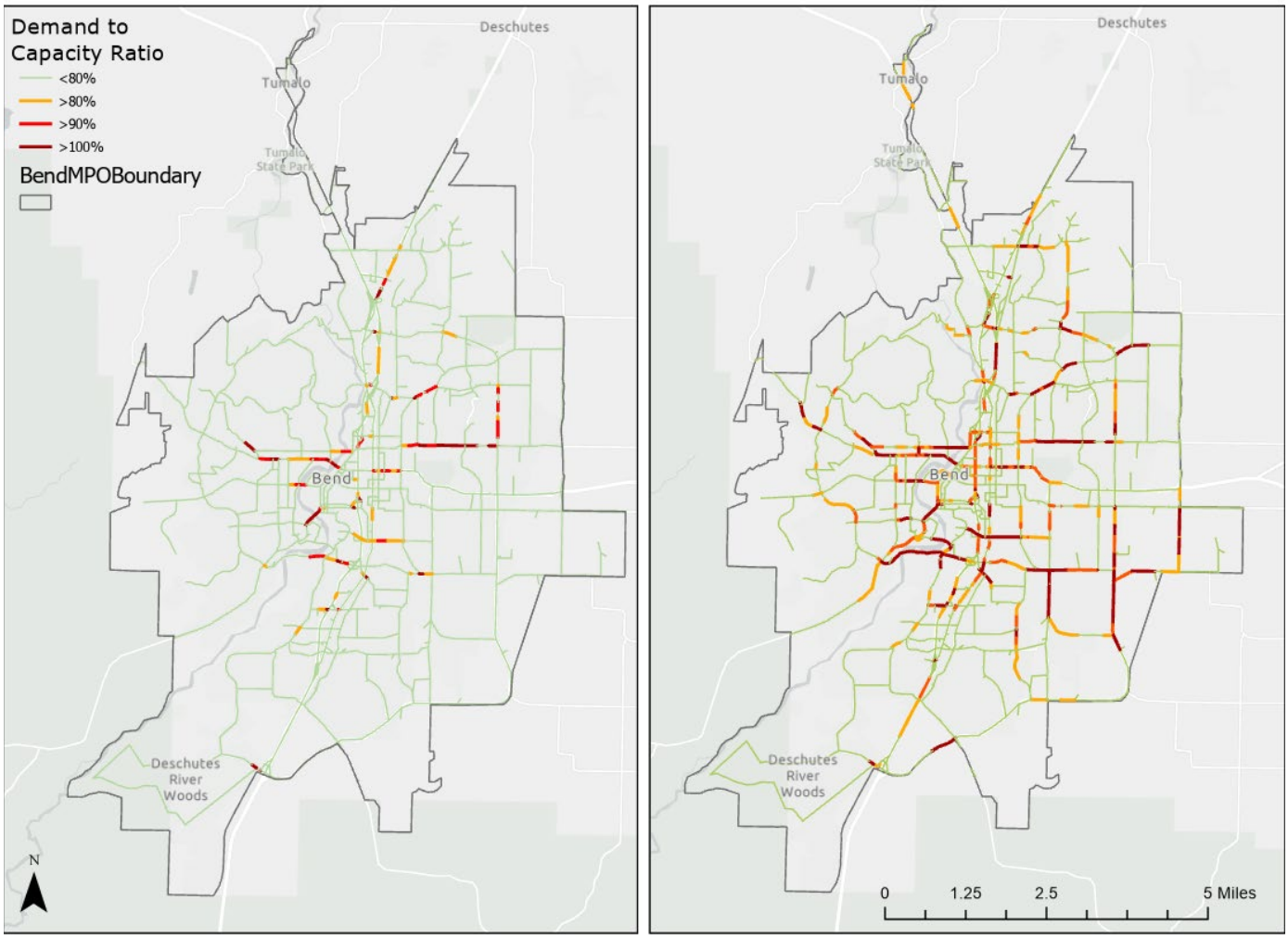

FIGURE 10. 2019 AND 2045 COMMITTED SCENARIO DEMAND TO CAPACITY RATIO

As shown, the Committed Scenario transportation system does not have adequate roadway connectivity or capacity to serve expected future travel needs. The Committed Scenario shows similar roadways at capacity compared to the 2019 scenario with additional capacity issues along other sections. The most noticeable decrease in D/C between the two scenarios is along US 97 from Cooley Road to the US 20 interchange. This is due to the construction of the bypass road from Loco Road to Empire Avenue. Additionally, there is increased demand for roadways in the southeastern portion of the Bend MPA. This is due to the previously mentioned increase in employment and housing in the area. Overall, the increased population and jobs in the area will lead to increased strain on the roadway network.

Key corridors (arterials and collectors) with demand to capacity ratios exceeding 1.0 in the study in the 2045 Committed Scenario include the following:

- NE Butler Market Road
- NW Galveston Avenue
- NE Neff Road

- NW Portland Avenue
- NE Newport Avenue
- Powers Road
- SE Reed Market Road
- SE 15th Street
- 27th Street
- Ward Road
- SE Wilson Avenue

The motor vehicle capacity needs identified in the prior MTP update were based off a 2040 horizon year and included only a subset of the current Committed Project List. In addition, the newly developed 2045 land use forecasts reallocate growth based on current City zoning decisions and development patterns, which include higher density development than was previously assumed for the 2040 forecasts. The combined impact of these changes is reflected in the following summary of changes in motor vehicle needs between the prior and current MTP updates:

- **OB Riley Road** – The corridor capacity need identified in the prior MTP is reduced to a smaller bottleneck issue at Archie Briggs, due to lower land use growth assumptions in this area
- **US 97** – North Corridor project resolves the US 97/Business 97 capacity issues between the MPA boundary and Empire Boulevard, removing these identified needs under Committed conditions
- **Shevlin Park Road** – New need identified east of Mt Washington Drive
- **Neff Road** – New need between 8th Street and 27th Street
- **Hamby Road** – New need from Stevens Road to Bear Creek Road, driven by Stevens Ranch and DSL growth
- **Stevens Road** – New need from Stevens Road to Bear Creek Road, driven by Stevens Ranch and the Stevens Road Tract
- **Powers Road** – New need between US 97 and Brookswood Boulevard

Table 9 summarizes the total arterial lane miles with a D/C ratio greater than 1.0.

TABLE 9: DEMAND TO CAPACITY RATIO

SCENARIO	2019 BASE	2045 COMMITTED	% CHANGE
TOTAL LANE MILES	2.32	12.98	459%

With only the Committed scenario improvements in place, the arterial lane miles that are congested (D/C greater than 1.0) increase by a factor of more than five.

VEHICLE HOURS OF DELAY

Vehicle hour delay was calculated by looking at the difference in travel time when links are congested and not congested. The total delay time can be seen in Table 10 below.

TABLE 10: VEHICLE HOURS OF DELAY

ROADWAY JURISDICTION	2019 BASE VEHICLE HOURS OF DELAY	2045 COMMITTED VEHICLE HOURS OF DELAY	% CHANGE
CITY OF BEND FACILITIES	144	612	325%
ODOT FACILIITES	63	226	257%
DESCHUTES COUNTY FACILIITES	2.4	24	872%
TOTAL	210	832	311%

The most delay occurs on the City of Bend facilities, followed by ODOT facilities, and then County facilities. This is due to most roadways within the Bend MPA being under City jurisdiction. Between the two time periods, total peak hour delay tripled with the largest increase being seen on County facilities. An increase in delay time on County facilities could be due to the increased development near the edges of the Bend UGB, especially in the southeast corner.

VEHICLE MILES TRAVELED

Looking at vehicle miles traveled (VMT) per capita helps to understand how traffic increases are related to the increases in population and employment. VMT per capita is also used as a surrogate for emissions impacts, indicating progression towards a more environmentally sustainable transportation system. As previously noted, the increase in jobs and population in the area has led to an increase in demand for all modes of travel on the Bend MPA roadways, including demand for motor vehicles. Not only has there been an overall increase in demand, but there has also been an increase in the total number of miles traveled per household. This could be due to more individuals taking alternate routes that may be faster but also longer. Overall, VMT per capita is estimated to increase by almost 5% over the 2019 condition under the 2045 Committed condition, as shown in Table 11.

TABLE 11: VEHICLE MILES TRAVELLED (VMT) PER CAPITA

ROADWAYS	2019 BASE	2045 COMMITTED	% CHANGE
DAILY VMT PER CAPITA	6.89	7.22	4.7%

The VMT per capita calculation methodology was shifted to a household-based measure, rather than constrained to trips internal to the MPO as prior VMT per capita measure have been. This change in methodology aligns with the new ODOT Transportation Planning Rule (TPR) definition. The VMT per capita increase shown in Table 11 includes increased commuter travel between Bend and Redmond, reflecting the inherent dependency between the two communities. Increased modal shift to transit and better system connectivity are two ways the MTP Project List can target reducing the VMT per capita measure.

Rural facilities are roadways within the Bend MPO boundary, but outside of the Bend UGB. Table 12 shows the change in vehicle volumes on rural facilities between the two models. The largest increases in VMT occurred near the eastern portion of the Bend MPO boundary along Hamby Road.

TABLE 12: VMT ON RURAL FACILITES

	2019 BASE	2045 COMMITTED	% CHANGE
PEAK HOUR VMT	34,360	54,973	60%

DIVERSION

Average daily traffic volume on collector facilities provides an indicator for risks of traffic diverting to lower classification roadways to avoid congestion. If the average daily traffic volume is greater than 4,000 vehicles on a collector roadway, individuals are more likely to divert to local roads to avoid congestion. Table 13 summarizes the collector lane miles across the MPA with modeled demand exceeding the 4,000 vehicles per day threshold.

TABLE 13: COLLECTOR ADT

SCENARIO	COLLECTOR LANE MILES	COLLECTOR LANE MILES >4,000 ADT	% LANE MILES
2019 BASE	48.9	3.3	7%
2045 COMMITTED	49.9	11.4	22%

In the 2019 base model, 7% of collectors experienced a daily volume greater than 4,000 vehicles; in the 2045 Committed scenario, this increases to 22%. Collectors that experienced these conditions include SE Wilson Avenue, NE Purcell Boulevard, Brosterhous Road, and NW Portland Avenue.

CORRIDOR PERFORMANCE

Road segments within the Bend MPA were assessed on their reliability based on the ODOT Planning Time Index[5]. A segment was *Highly* or *Extremely Unreliable* if the average travel speed is at least 50% below the posted speed limit. A segment is considered *Moderately Unreliable* if the average travel speed is between 25% to 50% below the posted speed and it is considered *Reliable* if the average travel speed is no less than 25% below the posted speed. The average travel speed during the p.m. peak, as well as the posted speed limit, was obtained from INRIX for all segments within the Bend MPA. The segments contained within Table 14 were determined to be unreliable based on the previously mentioned ODOT metric. The majority (52%) of the segments listed below are less than 1,000 feet in length due to how INRIX displays its data. Three segments are less than 500

[5] ODOT 2022 Statewide Congestion Overview, 4/12/2023

feet, indicating that in general, there are only short stretches of roadways in Bend that are unreliable, although most of the segments are expected to experience more traffic in the future.

TABLE 14: PERCENT CHANGE IN DAILY VOLUME ON UNRELIABLE SEGMENTS

ROADWAYS	SEGMENT LENGTH (FT)	CROSS ROAD 1	CROSS ROAD 2	PERCENT CHANGE
OLD BEND REDMOND HIGHWAY	1,100	O.B. Riley Road	US 20	570%
NE BRINSON BLVD	1,000	NE 18th	NE Butler Market Road	94%
SE 9TH AVE	460	SE Reed Market Road	500 Feet North SE Reed Market Road	81%
US 20	980	NE Revere Ave	NE Olney Ave	62%
NW FRANKLIN AVE	1,320	NE Louisiana Ave	NW Bond Street	62%
ROBAL ROAD	800	Nels Anderson Road	NW Hunnell Road	60%
BROSTERHOUS ROAD	700	SE Hayes Ave	SE Parrell Road	50%
NW WALL STREET	1,300	NW Franklin Ave	NW Bond St	46%
NW BOND STREET	1,170	NW Franklin Ave	NW Greenwood Ave	46%
US 97	3,000	SW Wilson Ave	SE Division Street	42%
NE 9TH STREET	2,360	US 20	SE Glenwood Drive	38%
NE DIVISION STREET	1,100	US 20	NE Tweet Place	37%
US 97	1,500	NE Greenwood Ave	NE Franklin Ave	37%
NW COLORADO AVE	300	SW Industrial Way	NW Arizona Ave	34%
POWERS ROAD	900	US 97 NB Ramp	SE Parrell Road	31%
NE BUTLER MARKET ROAD	700	NW Rippling River Court	US 97 NB	28%
SE AMERICAN LANE	400	American Loop	SE Reed Market Road	23%
NE 8TH STREET	700	NE Revere Ave	NE Penn Ave	22%
NE REVERE AVENUE	900	US 20	NE 5th Street	2%

ROADWAYS	SEGMENT LENGTH (FT)	CROSS ROAD 1	CROSS ROAD 2	PERCENT CHANGE
SE 2ND STREET	785	SE Wilson Ave	SE Vine Lane	-13%
US 97	1,800	US 20 Interchange	Robal Road	-50%

The segment with the largest increase in traffic volume between the two time periods was along the Old Bend Redmond Highway. If traffic volumes increase on already unreliable segments, the congestion along those corridors will only increase and there will be an overall increase in total delay.

CHANGES AT KEY INTERSECTIONS

As previously mentioned in the Deschutes County TSAP and the Bend TSAP, intersections for prioritization of safety investments were identified. The intersections are shown in Figure 11 below. Without additional new investment, increases in traffic volumes on these corridors may lead to increased safety issues. The intersections with the highest increase in traffic volumes are US 20 and Cooley Road, and Bear Creek Road and Ward Road; however, the safety need at the US 20 and Cooley Road intersection has recently been addressed through a new roundabout, completed in 2023.

Overall, there was an approximate 60% increase in traffic volume near high-priority intersections. The largest percentage of increase was along minor arterials at approximately 110%, and the second largest was along the state highway system at 63%.

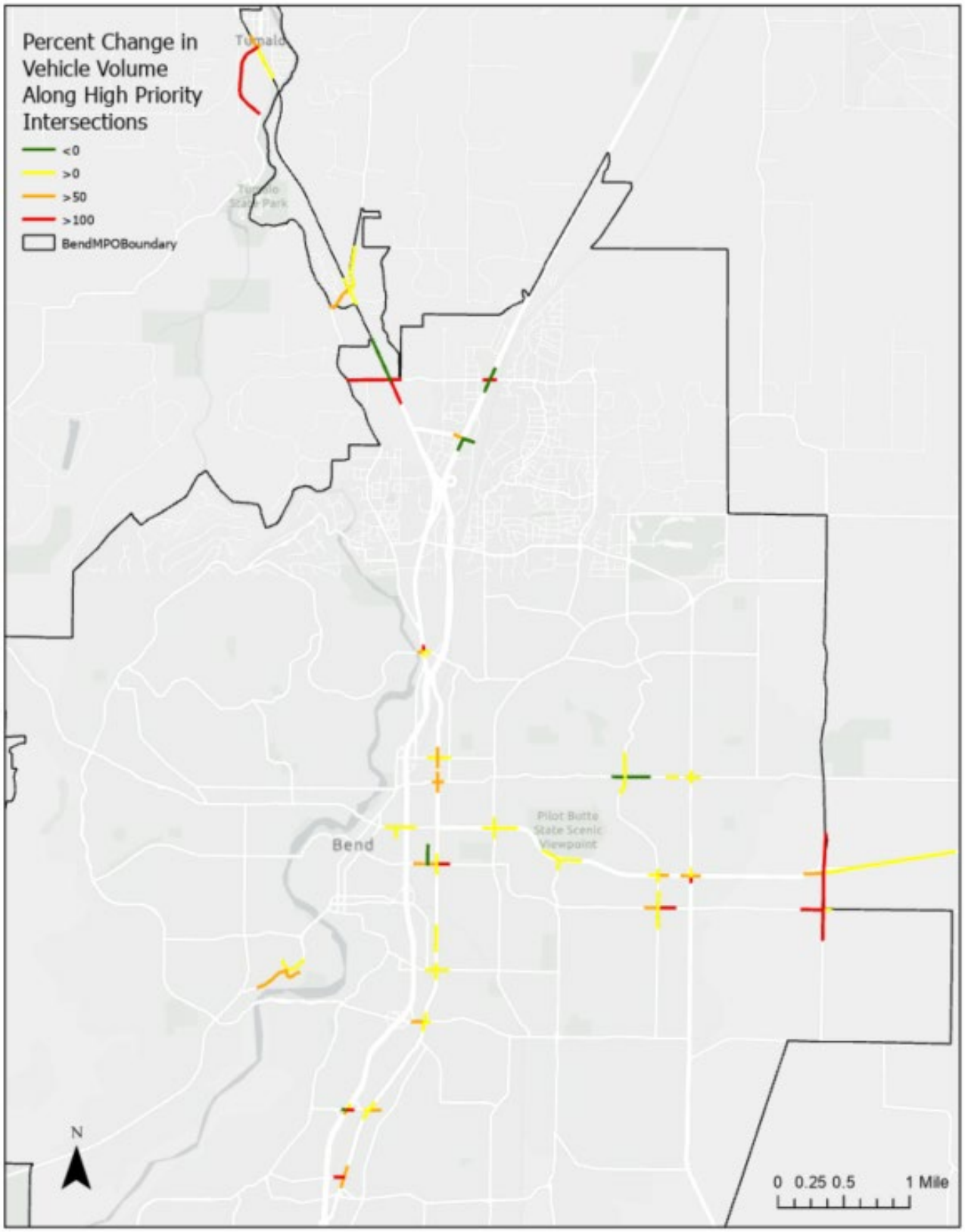

FIGURE 11: CHANGE IN VEHICLE VOLUME NEAR HIGH PRIORITY INTERSECTIONS

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DRAFT MTP PROJECT LIST EVALUATION MEMORANDUM

DATE: January 3, 2024

TO: Bend MPO Technical Advisory Committee

FROM: Emily D'Antonio, Eileen Chai, Kayla Fleskes-Lane, PE & Aaron Berger, PE | DKS Associates

SUBJECT: Bend 2045 MTP Update: Draft MTP Project List Evaluation Memorandum Project #24068-000

INTRODUCTION

This memorandum documents the 2045 Draft MTP Project List evaluation and is intended to help the Technical Advisory Committee (TAC) determine whether:

- **Any new needs have been identified** that are not addressed or targeted by the 2045 Draft MTP Project List, which was developed based on previously documented needs.
- **Any current projects on the MTP list should be re-scoped** due to the changes in future needs compared to prior local planning studies.

Based on TAC discussion, existing projects may be flagged for potential re-scoping, or additional projects may be added to the 2045 Draft MTP Project List to create a Refined MTP Project List. New projects added to the MTP list will most likely be planning/corridor studies targeting newly identified needs. Capital projects to address these new needs would be the outcomes of the planning/corridor studies and would be first adopted in local plans, then added to the MTP Project List in subsequent MTP updates.

Projects included in the Refined 2045 MTP Project List will then be analyzed using the MTP evaluation criteria to help prioritize projects into phasing buckets to outline the timeframe within which each project is recommended for implementation. This phasing will then be paired with funding availability and feasibility to separate projects into financially constrained and aspirational lists.

This memorandum is divided into the following sections:

- **Summary of Findings** - Provides an overview of outcomes of the evaluation of the 2045 Draft MTP Project List, highlighting new or changing needs caused by the new horizon year (2045) and updates from the most recent local planning efforts.

- **Evaluation Methodology** – Description of tools and methods applied to evaluate the 2045 Draft MTP Project List against both previous and newly identified multi-modal transportation system needs for the MPA.
- **Active Transportation Evaluation and Findings** – Presents findings related to active transportation focused projects from the 2045 Draft MTP Project List and discusses any new or changing needs for people walking and biking.
- **Transit Evaluation and Findings** – Presents findings related to transit projects from the 2045 Draft MTP Project List and discusses any new or changing needs for people riding transit.
- **Motor Vehicle Evaluation and Findings** - Presents projects with a significant motor vehicle system enhancement component from the 2045 Draft MTP Project List and discusses any new or changing needs for people driving.
- **Attachments Summarizing the Draft MTP Project List** – Maps and tables presenting the 2045 Draft MTP Project List, separated into Active Transportation, Transit, and Motor Vehicle categories.

SUMMARY OF FINDINGS

The following list includes newly identified or changes to already identified Bend MPA transportation system needs based on the evaluation of the 2045 Draft MTP Project List:

- Only one project from a study completed since the adoption of the Bend TSP clearly impacts a designated Key Routes for Walking and Bicycling. This project is the **proposed new interchange connecting NE 18th Street to US 97** (Project 97.A in Attachment A). This new connection would attract more motor vehicle traffic to the portion of the NE 18th Street corridor designated as a Key Walking and Bicycling Route.
- Community input on on-going projects such as the Olney Avenue Pedestrian and Bicyclist Improvements project indicates a **desire for higher levels of treatments for active transportation improvements** than was originally scoped for the Key Routes project identified in the Bend TSP. Cost estimates for the projects in this category that do not have a clearly defined scope should be re-considered during upcoming local planning efforts to better reflect community priorities.
- The 2045 Draft MTP Project List **does not provide sufficient transit coverage** to fully serve the new growth areas on the urban fringe of the Bend Metropolitan Planning Area (MPA). Many of the most critical motor vehicle needs, particularly needs related to east-west river crossings, cannot be fully resolved through new connections or corridor enhancements. Expanded transit service could provide relief to these congested corridors by shifting motor vehicle users to transit.
- **OB Riley Road** – The corridor capacity need identified in the prior local planning efforts consolidates to a smaller bottleneck issue at Archie Briggs due to lower land use growth assumptions in this area (e.g., Gopher Gulch). The multi-modal project identified for this corridor (Project C-3) should be considered for re-scoping during this MTP Update and subsequent City planning efforts.
- **Shevlin Park Road** – New traffic congestion need east of Skyline Ranch Road.
- **Neff Road** – Heightened congestion need between 8th Street and 27th Street, with potential of increasing neighborhood cut-through traffic.

- **Hamby Road** – New traffic congestion need from Stevens Road to Bear Creek Road, driven by growth in the Stevens Ranch and Department of State Lands (DSL) areas.
- **Powers Road** – New congestion need between US 97 and Brookswood Boulevard.
- **East-West River Crossings** – This congestion issue was a key need identified in the City's TSP and was flagged for monitoring. Current travel demand model forecasts indicate that these crossings will experience traffic demand well beyond existing capacity, indicating a need to move forward with a study for new/enhanced river crossings.
- **27th Street** – This corridor was flagged for monitoring in the City's TSP, with the year 2040 analysis indicating a need for a five-lane cross section from Empire Boulevard to Ferguson Road. The 2045 Draft MTP Project List evaluation indicates that by the year 2045 Horizon, a five-lane cross section is only needed between St. Charles Hospital in the north and Reed Market Road in the south.

EVALUATION METHODOLOGY

This section focuses on the following:

- **Methodology**
- **Analysis Tools and Performance Measures**
- **2045 Draft MTP Project List**

METHODOLOGY

Substantial planning efforts have already been conducted to develop the projects included in the 2045 Draft MTP Project List. However, all analysis used to develop, prioritize, and scope these projects has been based on a shorter planning horizon (2040 or earlier), including a separate set of land use assumptions. Therefore, the evaluation in this memorandum focuses primarily on the changes in future needs identified in the MTP Needs Memorandum and cross checks these changes against the 2045 Draft MTP Project List to identify any gaps or project re-scoping needs.

ANALYSIS TOOLS AND PERFORMANCE MEASURES

The primary analysis tool used to evaluate the 2045 Draft MTP Project List is the Bend-Redmond Model (BRM), a travel demand model developed and maintained by the ODOT Transportation Planning and Analysis Unit (TPAU), with support from the MPO and other local agencies. As discussed in the MTP Needs Memorandum, the BRM includes 2019 Base Year and 2045 Future Year land use scenarios. A 2045 Draft MTP Project List Scenario was developed using the same land use assumptions as the 2045 Committed Scenario. These assumptions are presented in the MTP Needs Memorandum. The 2045 Draft MTP Project List Scenario includes an updated roadway and transit network incorporating all active transportation, transit, and motor vehicle projects from the 2045 Draft MTP List that can be modeled within the structure of a trip-based travel demand model. The model results were used to provide quantitative measures throughout the MPA to determine whether projects were effectively addressing identified needs and to highlight new, increased, or decreased needs throughout the region.

The primary performance measures used to evaluate the effectiveness of the 2045 Draft MTP Project List are described by mode as follows:

- **Active Transportation**
  - ***Mode Split*** – percent change in share of all trips choosing bicycle and pedestrian modes, compared against 2019 and 2045 Committed conditions.
  - ***Change in Motor Vehicle Demand on Key Routes*** – increase/decrease in ADT on identified bicycle and pedestrian Key Routes compared against 2019 and 2045 Committed conditions.
- **Transit**
  - ***Mode Split*** – percent change in share of all trips choosing transit compared against 2019 and 2045 Committed conditions.
  - ***Transit Coverage (Households and Jobs within ¼ Mile of Transit Service)*** – Estimate of transit system coverage throughout the Bend MPA, compared against 2019 and 2045 Committed Conditions.
- **Motor Vehicles**
  - ***Demand to capacity (D/C) ratio*** – the ratio of peak hour vehicle demand over the capacity of a roadway, where a D/C >1.0 indicates severe levels of congestion. This measure is applied both at the corridor level and as a system measure summarized by roadway facility classification.
  - ***Vehicle hours of delay*** – Total hours of delay for all vehicles over the entire system within the MPA during the p.m. peak hour.
  - ***Vehicle miles traveled (VMT) per capita*** – Total daily vehicle miles traveled for household-based trips by light vehicles making a trip that starts/ends within the MPA, divided by the total population within the MPA.
  - ***Diversion potential*** – Total percentage of collector roads with an average daily traffic volume above 4,000 vehicles per day, indicating misuse of lower facility classes and risks of trip diversion onto local streets.

2045 DRAFT MTP PROJECT LIST

This memorandum breaks down the evaluation of the 2045 Draft MTP Project List into three modal focused sections: Active Transportation, Transit, and Motor Vehicle. There is significant modal overlap between many projects, particularly those that fall under the "Motor Vehicle" category as these usually include significant active transportation improvement elements. Each modal project list is further separated into "Connectivity" and "Corridor Enhancement" subcategories. Connectivity projects focus on new modal connections (e.g., new trails, new transit routes, or new roadways), while Corridor Enhancement projects focus on improvements to existing corridors (e.g., new bike lanes/sidewalks, decreased headways on existing transit lines, or added lanes). In addition, remaining projects are categorized as "Intersection" (intersection focused projects) and "Technology" (ITS projects), which do not strictly fall into any of other primary modal subcategories.

The 2045 Draft MTP Project List is mapped and summarized in attachments to this memorandum as follows:

- **Attachment A – Active Transportation**
  - ***Active Transportation Connectivity Projects***
  - ***Active Transportation Corridor Enhancement Projects***
- **Attachment B – Transit Projects**
  - ***Transit Connectivity Projects***
  - ***Transit Corridor Enhancement Projects***
- **Attachment C – Motor Vehicle Projects**
  - ***Motor Vehicle Connectivity Projects***
  - ***Motor Vehicle Enhancement Projects***
- **Attachment D – Intersection Projects**
- **Attachment E – Technology Projects**

ACTIVE TRANSPORTATION EVALUATION AND FINDINGS

This section presents the analysis and findings related to the Active Transportation needs and proposed projects within the Bend MPA, including:

- **Summary of Needs**
- **Evaluation Results**
- **New/Changing Active Transportation Needs**

SUMMARY OF NEEDS

As described in the MTP Needs Memorandum, bicycle and pedestrian system gaps and needs within the Bend MPA were identified through a series of local planning efforts. The Bend TSP identified Key Walking and Bicycling Routes throughout the City, many of which are expected to experience large increases in motor vehicle traffic by the year 2045. When enhanced, these Key Routes (shown in Figure 1) will address many of the most critical needs for people walking and biking within the City of Bend.

Beyond the Bend UGB, the on-going Deschutes County TSP Update has identified needs for dedicated bicycle facilities and complete sidewalks in Tumalo. From a more system-wide perspective, the County TSP noted that jurisdictional standards only require 3-to-5-foot shoulders, insufficient width to effectively serve bicycle travel. As the City of Bend continues to build out within the MPA, unincorporated Deschutes County roadway facilities brought into the urban area will become barriers and impedances to bicycle and pedestrian access to/from new growth areas.

ODOT planning efforts have identified critical gaps in the bicycle and pedestrian system at both the Baker/Knott and US 97 interchange and along US 97 north of the UGB at a potential future interchange connection to NE 18th Street.

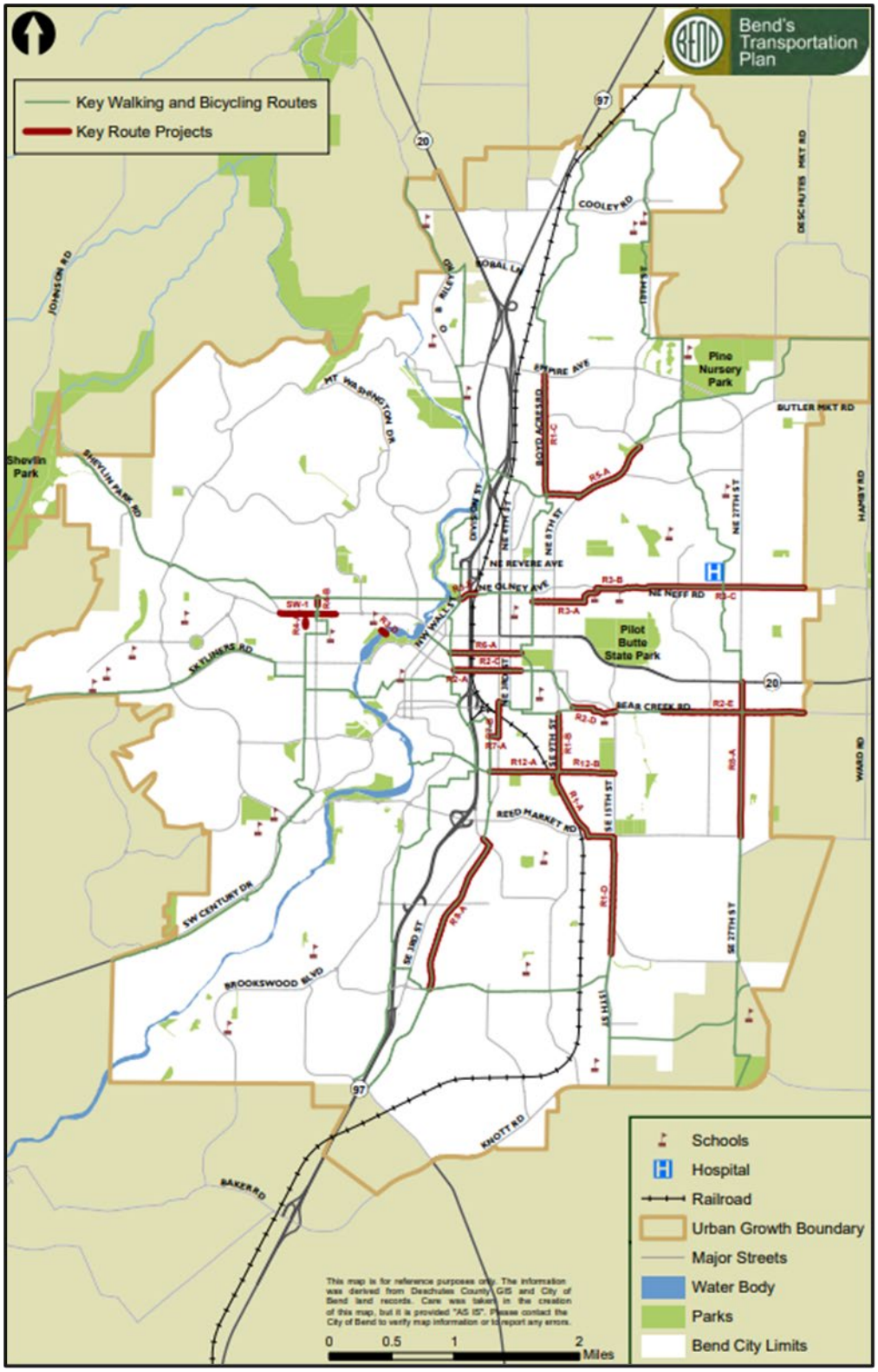

FIGURE 1: KEY ROUTES FOR WALKING AND BICYCLING

Source: Bend Transportation System Plan (2020), Figure 5-3b

EVALUATION RESULTS

The Active Transportation focused projects from the 2045 Draft MTP Project List are shown in Attachment A. These projects include the Key Routes projects from the Bend TSP. This section summarizes the key active transportation performance measures for the 2045 Draft MTP Project list, compared against the 2019 baseline and 2045 Committed conditions using the following performance measures:

- Mode Split
- Change in Motor Vehicle Demand on Key Routes

MODE SPLIT

The percentages of all person trips using walking and bicycle modes within the Bend MPA were calculated from the BRM. These percentages were based on trips that both begin and end within the Bend MPA. Table 1 documents these mode splits between the 2019 Base Year, the 2045 Committed, and the 2045 Draft MTP Project List.

TABLE 1: PERCENT WALKING AND BIKING TRIPS WITHIN THE BEND MPA

MODE	2019 BASE	2045 COMMITTED	2045 PROJECT LIST	% CHANGE BETWEEN COMMITTED AND PROJECT LIST
PEDESTRIAN	10.2%	11.9%	12.4%	4.8%
BICYCLE	3.4%	3.4%	3.5%	2.3%

Both biking and walking trips within the Bend MPA show limited changes between the 2045 Committed and 2045 Draft MTP Project List scenarios. These limited changes reflect the BRM active transportation modeling constraints, as the model has no direct sensitivity to quality of bicycle or pedestrian facilities. Projects impacting the estimated change in mode split are Active Transportation or multi-model connectivity projects and new roadways or trails/paths that create more direct routes for walking and biking between different land uses.

CHANGE IN MOTOR VEHICLE DEMAND ON KEY ROUTES

As discussed in the MTP Needs Memorandum, daily motor vehicle traffic volumes are expected to increase along most of the Key Routes for Walking and Bicycling throughout the MPA under the 2045 Committed condition. The 2045 Draft MTP Project List includes multiple projects that change the estimated 2045 daily motor vehicle traffic along these Key Routes when compared against the 2045 Committed condition. Figure 2 highlights this comparison, showing the change in daily motor vehicle traffic volume between the 2045 Committed scenario and the 2045 Draft MTP Project List scenario along the designated Key Routes.

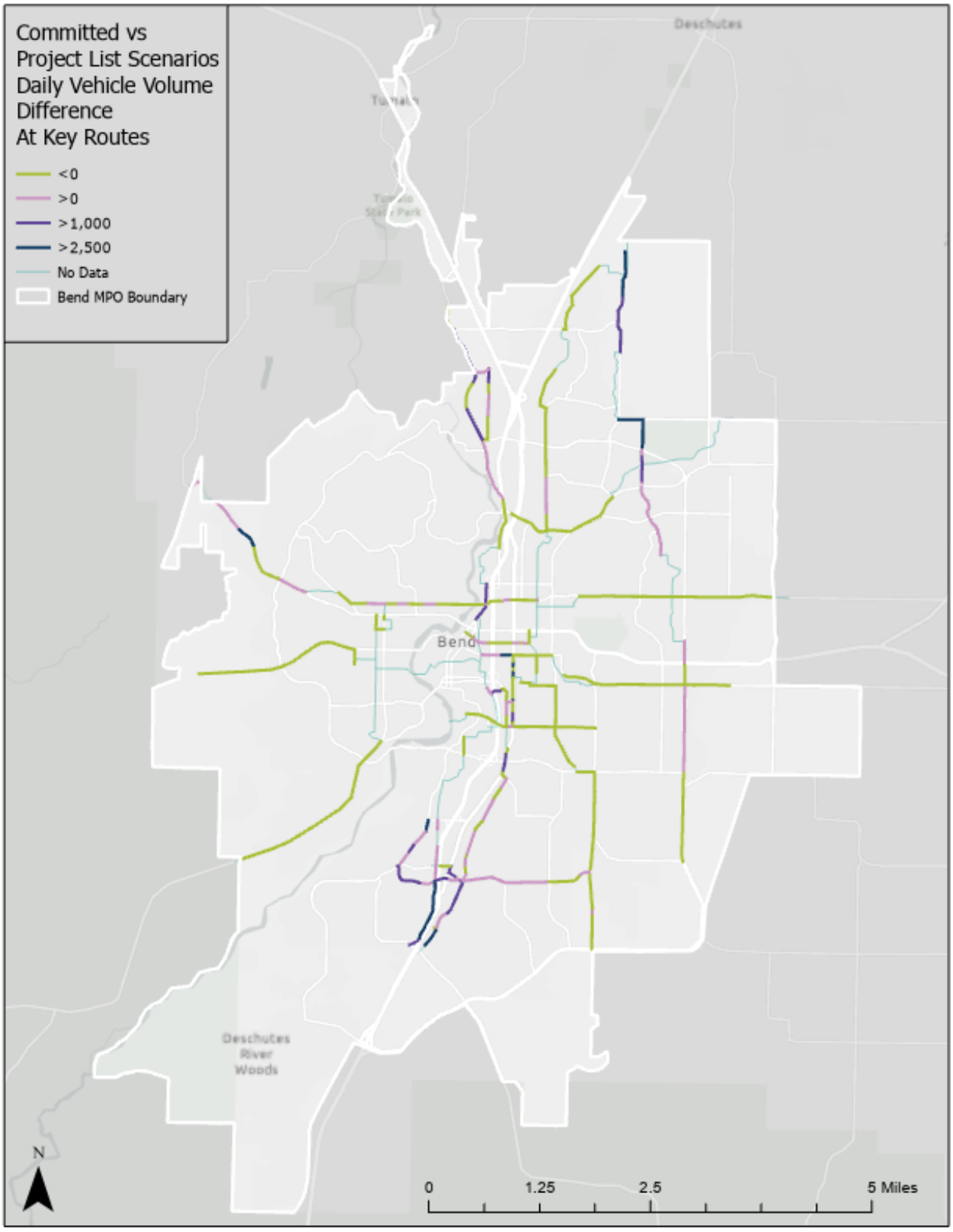

FIGURE 2: CHANGE IN DAILY VOLUME ALONG DESIGNATED KEY ROUTES BETWEEN COMMITTED AND PROJECT LIST SCENARIO

The most critical changes in daily motor vehicle traffic along Key Routes are summarized as follows:

- **Improved (Reduced Traffic)**
  - Skyliners Road (NW 17th St to NW Crossing Dr) – 19% reduction primarily due to the NW Crossing Extension (Project 202)
  - Shevlin Park Road (Mt Washington Dr to Skyline Ranch Rd) – 21% reduction due to new expansion area connections to the north (Projects 219 and 230)
  - Bear Creek Road (NE 15th St to Ward Rd) – 19% reduction due to new Steven Road Re-alignment (Project C-65) and mode shifts driven by nearby transit route enhancements (Projects CET 6 and CET 7)
  - Hawthorne Ave (NW Harriman St to US 97) - 66% decrease due to closure of eastbound right turn onto US 97 at Hawthorne Ave (Project C2B)
  - SE 9th Street (SE Glenwood Dr to Reed Market Rd) – 11% decrease due to closure of 9th Street direct vehicle access onto Reed Market Rd as part of the Rail Crossing Improvement (Project C-44)
- **Degraded (Increased Traffic)**
  - NE Franklin Ave (NW Harriman St to NE 3rd St) – 60% increase due to closure of eastbound right turn onto US 97 at Hawthorne Ave (Project C2B)
  - Parrell Rd (China Hat Rd to Murphy Rd) – 68% increase due to the closure of the China Hat Rd RI/RO access to US 97 as part of the China Hat/Ponderosa Overcrossing (Project C-58)
  - NE 18th St (NE Talus Pl to Egypt Dr) – 34% increase due to NE 18th St connection to new interchange at US 97 (Project 97.A).

NEW/CHANGING ACTIVE TRANSPORTATION NEEDS

Based on the new 2045 horizon year system analysis results, the overall active transportation needs continue to align with the needs identified in prior planning efforts. The projects identified in prior planning efforts align closely with the identified needs, and in many cases, multi-modal connectivity projects are effectively reducing vehicle travel on corridors designated as Key Routes for Walking and Bicycling. Only one project from a study completed since the completion of the Bend TSP clearly impacts a designated Key Route. This project is the proposed new interchange connecting NE 18th Street to US 97 (Project 97.A). This new connection would attract more traffic to the portion of the NE 18th Street corridor designated as a Key Walking and Bicycling Route.

Since the completion of the Bend TSP, community priorities have continued to focus on improving the active transportation system. While Key Routes address many of the most critical needs for people walking and biking within the City of Bend, recent projects have indicated that the community desires higher-quality, lower-stress facilities than what was initially assumed when scoping and budgeting the Key Route projects. For example, the on-going Olney Avenue Pedestrian and Bicyclist Improvements project conducted a detailed alternatives analysis. Through this analysis, only one of the three alternatives fit within the available project budget, while the higher cost, increased enhancement alternatives received more community support. Other Key Route project costs within the MTP should be evaluated to determine whether the proposed project budget continues to meet the intent of the Key Route.

TRANSIT EVALUATION AND FINDINGS

This section presents the following analysis and findings related to the transit needs and proposed projects within the Bend MPA:

- **Summary of Needs**
- **Evaluation Results**
- **New/Changing Transit Needs**

SUMMARY OF NEEDS

As described in the MTP Needs Memorandum, prior local plans have identified the following key needs for transit within the Bend MPA:

- Expanded fixed route service
- More service coverage and connections in Bend, especially the Old Mill and the NE and SE Bend and St. Charles area
- More direct connections to downtown from the east side.
- Expanded weekend service
- More frequent regional service, including connections to the airport
- Service to both existing and future developments in the outer growth areas of the Bend UGB
- More recreational service
- Additional buses
- Technology upgrades
- Better bicycle and pedestrian facilities near transit stops
- Improvement to PM peak hour transit travel time reliability on congested corridors, particularly the river crossings, US 20, US 97, and 27th Street

The projects in prior adopted plans are intended to address these needs, expanding transit access and reliability for all residents and employees within the Bend MPA.

EVALUATION RESULTS

The transit focused projects from the 2045 Draft MTP Project List are shown in Attachment B. This section summarizes key transit performance measures for 2045 Draft MTP Project list, compared against the 2019 baseline and 2045 Committed conditions, including:

- Mode Split
- Transit Coverage

MODE SPLIT

The percentages of all person-trips using transit within the Bend MPA were calculated from the BRM. These percentages were based off trips that both begin and end within the Bend MPA. Table 2 below documents these mode splits between the 2019 Base Year scenario, the 2045 Committed scenario, and the 2045 Draft MTP Project List scenario.

TABLE 2: PERCENT TRANSIT TRIPS WITHIN THE BEND MPA

MODE	2019 BASE	2045 COMMITTED	2045 PROJECT LIST	% CHANGE BETWEEN COMMITTED AND PROJECT LIST
TRANSIT DEMAND	0.14%	0.15%	0.59%	400%

As shown in Table 2, the CET service enhancements, travel demand management programs, and the addition of mobility hubs within the 2045 Draft MTP Project List scenario quadruple transit ridership. However, the overall percentage of transit trips compared against all person trips throughout the MPA remains extremely low, highlighting the opportunity to achieve greater benefit to the system by attracting more riders.

TRANSIT COVERAGE

The addition of new transit projects included in the 2045 Draft MTP Project List increases the coverage of transit service within the Bend MPA, allowing greater access to households and jobs, as listed in Table 3. The geographic transit coverage buffers plotted against the MPA housing and employment growth areas are shown in Figure 3 and Figure 4.

TABLE 3: PERCENT OF MPA HOUSEHOLDS AND JOBS WITHIN 0.25 MILES OF TRANSIT SERVICE

MODE	2019 BASE	2045 COMMITTED	2045 PROJECT LIST	% CHANGE BETWEEN COMMITTED AND PROJECT LIST
HOUSEHOLDS	49%	44%	50%	14%
JOBS	79%	55%	60%	9%

The number of households within a quarter mile of transit service or mobility hubs increased for the 2045 Draft MTP Project List due to a new fixed service route (Project CET-8). However, even with the new route, only 50% of households have walkable (0.25 miles or less) access to transit, similar to present day conditions. A substantial proportion of new residential growth within the Bend MPA is likely to be multi-family, high-density development, which is supportive of transit travel choices. But as shown in Figure 4, some of the largest residential growth areas, particularly in the southeast, fall outside the transit coverage area.

As shown in Figure 3, a substantial portion of the expected MPA job growth occurs outside of transit coverage, particularly the growth areas in the southeast and northeast. This results in only 60% of all MPA jobs falling within the 2045 Draft MTP Project List transit coverage area under future conditions.

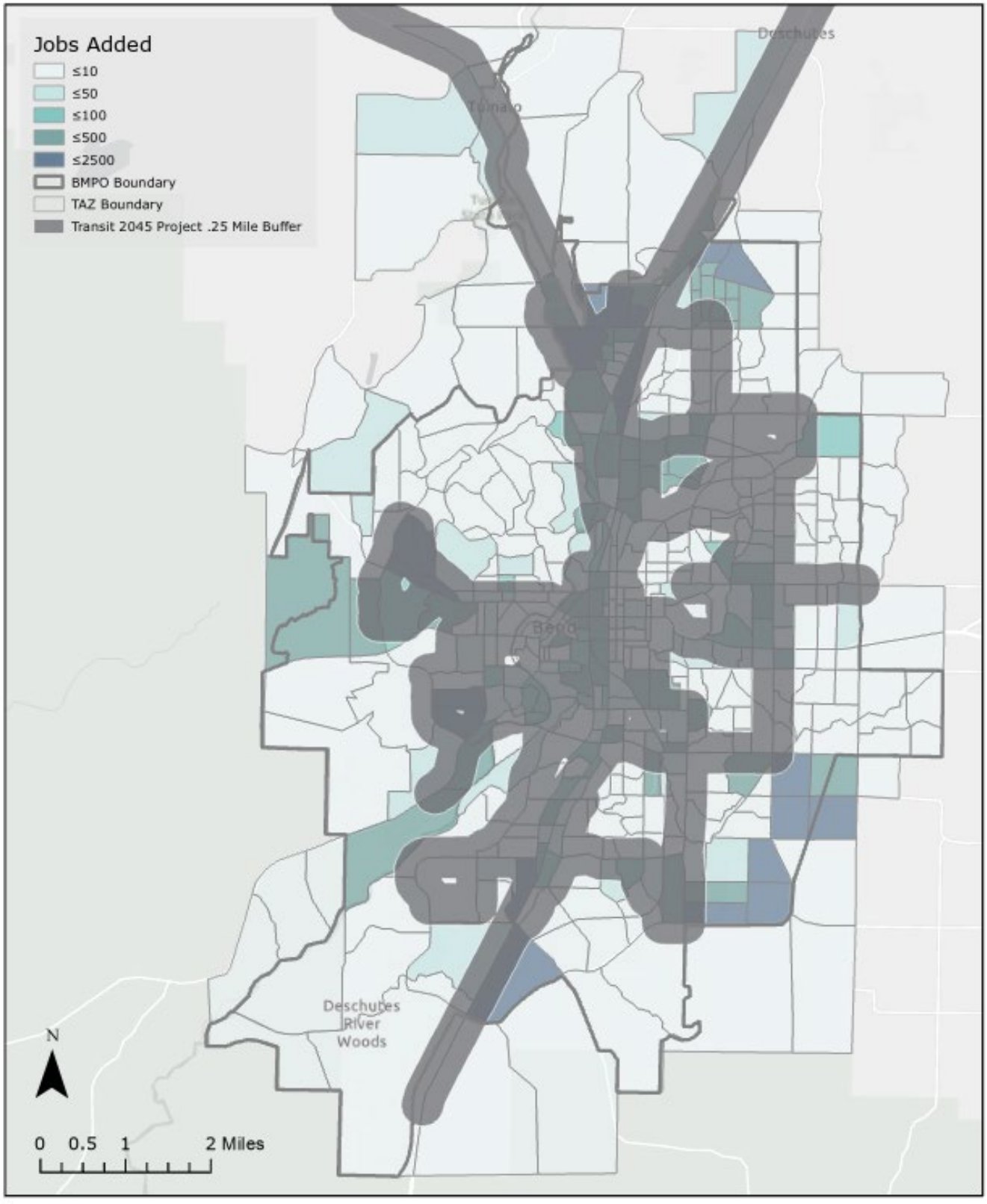

FIGURE 3. 2045 DRAFT MTP PROJECT LIST TRANSIT COVERAGE AND JOB GROWTH

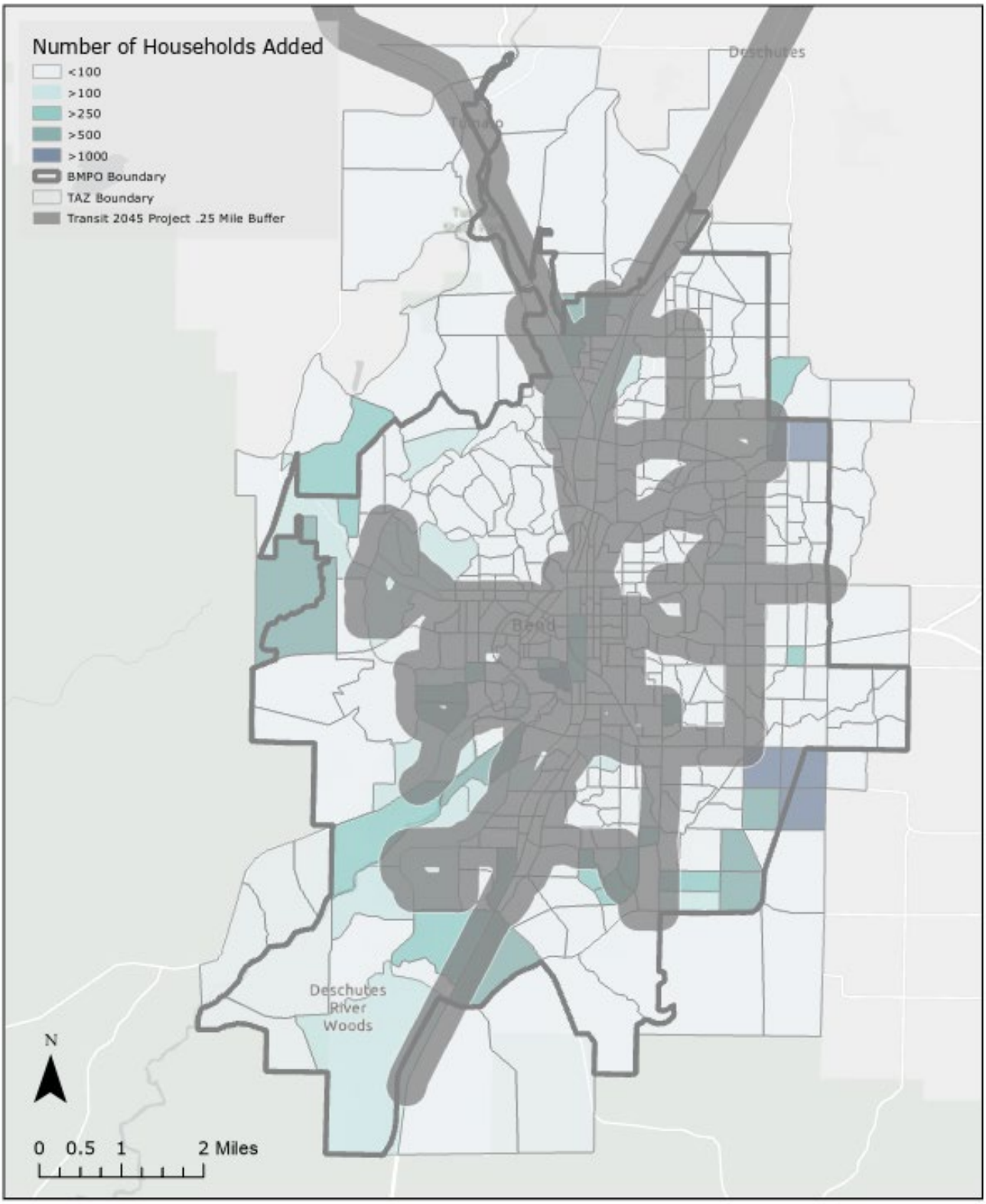

FIGURE 4. 2045 DRAFT MTP PROJECT LIST TRANSIT COVERAGE AND HOUSING GROWTH

NEW/CHANGING TRANSIT NEEDS

With the updated growth assumptions for the MPA expanding the planning horizon from 2040 to 2045, more high-density, transit-oriented growth is anticipated in the urban fringe areas of the Bend MPA. The 2045 Draft MTP Project List does not provide sufficient coverage to fully serve these new growth areas, limiting transit options for many areas across the MPA. Some of the most critical motor vehicle system needs, particularly needs related to east-west corridors, cannot be fully resolved through new connections or corridor enhancements. Expanded transit service has the potential to provide some relief to these congested corridors by shifting people from motor vehicles to transit.

MOTOR VEHICLE EVALUATION AND FINDINGS

This section presents the following analysis and findings related to the motor vehicle needs and proposed projects within the Bend MPA:

- **Summary of Needs**
- **Evaluation Results**
- **New/Changing Motor Vehicle Needs**

SUMMARY OF NEEDS

Several key needs for congestion mitigation were identified in the MTP Needs Memorandum, including the following:

- US 97
- East-west corridors
- North-south corridors
- Key intersection nodes between east-west and north-south corridors.

Under 2045 Committed conditions, the following corridors are forecasted to experience particularly elevated levels of congestion:

- NE Butler Market Road
- NW Galveston Ave
- NE Neff Road
- NW Portland Ave
- NE Newport Ave
- Powers Road
- SE Reed Market Road
- SE 15th Street
- 27th Street
- Ward Road
- SE Wilson Avenue

EVALUATION RESULTS

The motor vehicle/multi-modal focused projects from the 2045 Draft MTP Project List are shown in Attachment C (connectivity and corridor enhancement), Attachment D (intersections), and Attachment E (technology). This section summarizes the key motor vehicle performance measures for the 2045 Draft MTP Project List, compared against the 2019 baseline and 2045 Committed conditions, including:

- Corridor Congestion
- System Delay
- Vehicle Miles Traveled (VMT)
- Trip Diversion

CORRIDOR CONGESTION

The corridor levels of congestion throughout the Bend MPA were estimated using BRM model outputs, which were compiled in Demand to Capacity (D/C) ratios indicating capacity constraints throughout the system. Figure 5 compares the PM Peak Hour demand to capacity ratio results by corridor for the 2045 Draft MTP Project List and the 2045 Committed scenario.

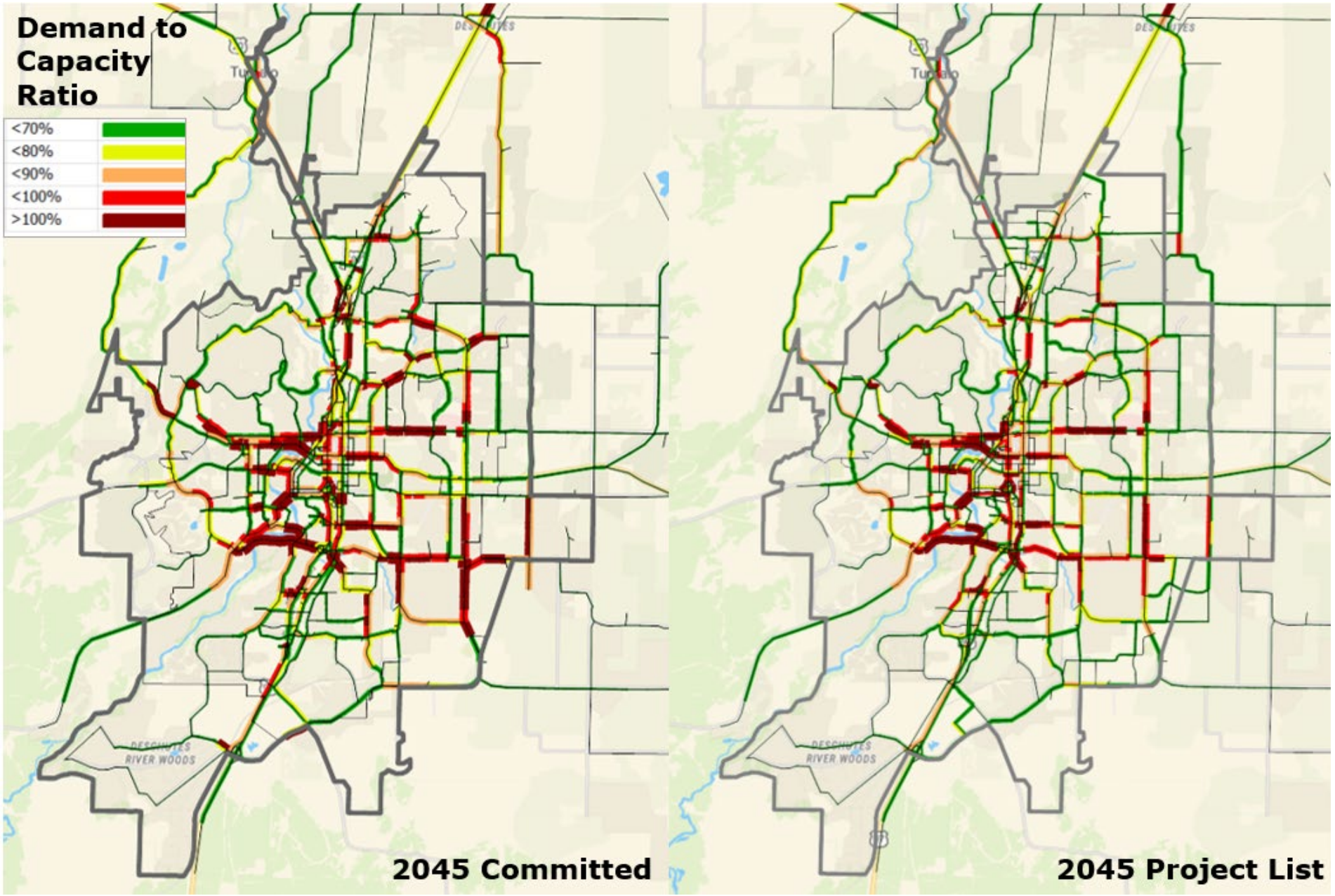

FIGURE 5: 2045 COMMITTED AND PROJECT LIST PM PEAK HOUR DEMAND/CAPACITY RATIOS

As shown in Figure 5, the 2045 Draft MTP Project List improves some of the congestion issues flagged in the MTP Needs Memorandum, including:

- US 97 Parkway - traffic operations improve, due mainly to restricted access (Projects C2A-C2H)
- North-south corridor – 27th Street improves south of Reed Market Road due to additional connectivity projects to the east
- Empire Boulevard/Butler Market Road – Improves due to Yeoman Road extension (Projects C-1 and C-76)

Congestion needs that remain include:

- All East-West river crossings
- Smaller portions of Butler Market Road
- NW Galveston Ave
- NE Neff Road
- NW Portland Ave
- NE Newport Ave
- Powers Road
- SE Reed Market Road
- SE 15th Street
- 27th Street
- Ward Road
- SE Wilson Avenue

Prior planning efforts have identified ramp metering on the Bend Parkway (US 97) as a key strategy to manage congestion on this critical statewide and regional connection through the City of Bend. To evaluate the congestion benefits/impacts of a ramp meter strategy on US 97, a separate BRM scenario was developed that included the 2045 Draft MTP Project List with ramp meters also modeled. The PM Peak Hour demand to capacity ratios for the ramp metering scenario are compared against the 2045 Draft MTP Project List results in Figure 6.

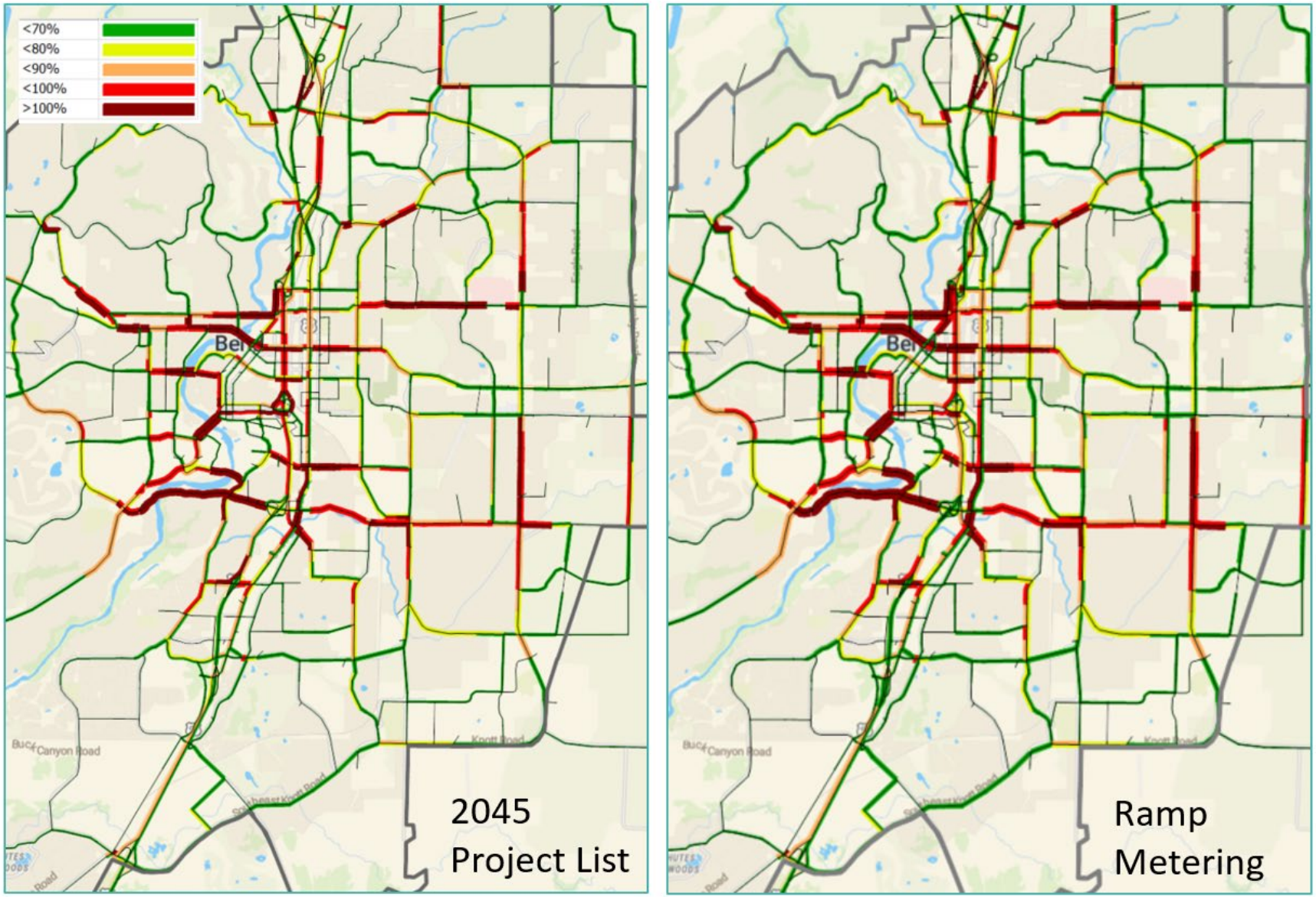

FIGURE 6: 2045 PM PEAK HOUR CONGESTION WITH/WITHOUT RAMP METERS

As shown in Figure 6, shifts in traffic from the ramp metering manage to keep the US 97 Parkway below capacity under 2045 conditions and improve traffic operations at the Colorado Interchange. Traffic congestion on 3rd Street increases as short trips are discouraged from using the Parkway due to ramp meter delay. In addition, traffic using the Colorado interchange shifts onto 3rd Street and Greenwood, increasing congestion between 3rd Street and Downtown Bend on this corridor. The remainder of the system operates very similar to conditions without ramp meters.

SYSTEM DELAY

The MPA area roadway system PM Peak Hour vehicle delay with the 2045 Draft MTP Project List is summarized in Table 4, and compared against 2019 and 2045 Committed conditions. The system delay is separated by facility jurisdiction (City of Bend, ODOT, Deschutes County).

TABLE 4: PM PEAK HOUR VEHICLE HOURS OF DELAY

ROADWAY JURISDICTION	2019 BASE	2045 COMMITTED	2045 PROJECT LIST	% CHANGE BETWEEN COMMITTED AND PROJECT LIST
CITY OF BEND FACILITIES	144	612	450	-26%
ODOT FACILITIES	63	226	180	-20%
DESCHUTES COUNTY FACILITIES	2	24	15	-38%
TOTAL	210	862	645	-25%

As listed in Table 4, the 2045 Draft MTP Project List scenario is expected to significantly decrease overall delay. The connectivity and corridor enhancement projects that add motor vehicle capacity and alternate routes to the system drive this delay reduction.

VEHICLE MILES TRAVELED (VMT)

Vehicle Miles Traveled (VMT) is a good measure of total motor vehicle travel within the system. Normalized to the population within the MPA, this measure indicates trends in both number of vehicle trips and average trip length, measures which reflect both land use planning implications on travel and approximated future year motor vehicle emissions. Table 5 summarizes the daily VMT results for trips originating from households within the Bend MPA under 2019, 2045 Committed, and 2045 Draft MTP Project List conditions. These VMT results are normalized by the Bend MPA population estimates to create VMT per capita.

TABLE 5: DAILY VMT RESULTS

MEASURE	2019 BASE	2045 COMMITTED	2045 PROJECT LIST	% CHANGE BETWEEN COMMITTED AND PROJECT LIST
DAILY VMT PER CAPITA	6.89	7.22	6.94	-4%

The VMT per capita results indicate that while the 2045 Draft MTP Project List does improve VMT over 2045 Committed conditions, compared against 2019 (approximation of present day) conditions, the future conditions show an increase of 0.7%. This increase occurs despite careful balancing of land use (housing and employment) in Bend MPA growth areas, enhancements to the transit system, and improvements to connectivity. Increased travel beyond the Bend MPA to/from Redmond is a likely factor counteracting reductions in VMT internal to Bend. The limited transit usage within the model provides an opportunity to reduce VMT per capita by targeting the vehicle trips per person portion of the measure, as increasing the transit mode share even to 3% of all trips would drop the VMT per capita well below 2019 levels. This important measure will be revisited in more detail during the Refined 2045 MTP Project List evaluation.

TRIP DIVERSION

With congestion expected to continue to grow throughout the Bend MPA in the future, traffic may divert onto local streets in attempts to bypass system or corridor bottlenecks. To estimate the system-level risk of trip diversion, the percentage of collector roadways with Average Daily Traffic (ADT) of more than 4,000 was calculated from the BRM. Table 6 summarizes this measure for 2019, 2045 Committed, and 2045 Draft MTP Project List Conditions.

TABLE 6: TRIP DIVERSION POTENTIAL

MEASURE	2019 BASE	2045 COMMITTED	2045 PROJECT LIST	% CHANGE BETWEEN COMMITTED AND PROJECT LIST
DIVERSION POTENTIAL[A]	7%	23%	19%	-4%

[A] Measured as a percent of collector roads with an average daily traffic volume above 4,000 vehicles per day.

As listed in Table 6, the 2045 Draft MTP Project List reduces the risk of trip diversion over the 2045 Committed condition, but still more than doubles the amount of high-volume collector facilities compared to present day. Corridors of particular concern for increasing local roadway trip diversion include segments along the following roadways:

- Neff Road
- Brosterhous Road

- 15th Street
- Wilson Avenue
- Portland Avenue
- Newport Avenue
- Powers Road

NEW/CHANGING MOTOR VEHICLE NEEDS

The new horizon year of 2045 and changes to land use based on recent growth trends and local planning activities have both created new needs and changed the scope of previously identified motor vehicle system needs. The combined impact of these changes is reflected in the following summary of changes in motor vehicle system needs between the prior and current MTP updates:

- **OB Riley Road** – The corridor capacity need identified in the prior MTP is reduced to a smaller bottleneck issue at Archie Briggs, due to lower land use growth assumptions near this area (e.g., Gopher Gulch). The multi-modal project identified for this corridor (Project C-3) should be considered for re-scoping during this MTP and subsequent City planning efforts.
- **Shevlin Park Road** – New traffic congestion need east of Skyline Ranch Road.
- **Neff Road** – Heightened congestion need between 8th Street and 27th Street, with potential of increasing neighborhood cut-through.
- **Hamby Road** – New traffic congestion need from Stevens Road to Bear Creek Road, driven by growth in the Stevens Ranch and DSL areas.
- **Powers Road** – New congestion need between US 97 and Brookswood Boulevard
- **East West River Crossings** – This congestion issue was a key need identified in the City's TSP and was flagged for monitoring. Current travel demand model forecasts indicate that these crossings will experience traffic demand well beyond existing capacity, indicating a need to move forward with a study for new/enhanced river crossings.
- **27th Street** – This corridor was flagged for monitoring in the City's TSP, with the year 2040 analysis indicating a need for a five-lane cross section from Empire Boulevard to Ferguson Road. The 2045 Draft MTP Project List evaluation indicates that by the year 2045 Horizon, a five-lane cross section is only needed from near St. Charles Hospital in the north to Reed Market Road in the south.

ATTACHMENTS

CONTENTS

ATTACHMENT A: ACTIVE TRANSPORTATION PROJECTS

TABLE 7: ACTIVE TRANSPORTATION CONNECTIVITY PROJECTS

MAP ID	PROJECT DESCRIPTION	DRAFT COST ESTIMATE[1]
20714	US 97: Multi-Use Trail	$5,977,172
23494	Hawthorne Ave Pedestrian Bike and Overcrossing	$24,450,000
A36	Complete Sidewalk in Unincorporated Communities	$$$
BP-1	Sidewalks on 7th Street (Tumalo)	$300,000
BP-10	Sidewalks on 8th Street (Tumalo)	$400,000
BP-2	Sidewalks on 4th Street (Tumalo)	$300,000
BP-3	Sidewalks at 2nd and Cook (Tumalo)	$1,700,000
BP-6	Sidewalks on 5th Street (Tumalo)	$500,000
M-12	Olney Avenue Bike Lanes and Undercrossing	$1,820,000
M-15A	Greenwood Undercrossing Sidewalk Widening	$7,883,975
M-15C	Franklin Avenue Underpass	$46,880,530
M-20	Knott Canal Crossing	$700,000
M-9A	Franklin Avenue Underpass Shared Use Path	$6,799,000
M-9C	Greenwood Undercrossing Sidewalk Widening and Shared Use Path	$2,978,400
P10	DRT North Trailhead	$320,000
P11	DRT Kirkaldy to Putnam	$59,713
P13	DRT Galveston to Miller's Landing	$3,000,000
P14	DRT South UGB and Bike/ Pedestrian Bridge	$1,000,000 - $5,000,000
P35	Riley Ranch Nature Reserve Bike/ Pedestrian Bridge	$1,200,000
P41	Arnold Canal Trail	$534,000
P44	Discovery West Trail	$1,600,000
P45	Hansen Park Trailhead	$250,000 - $1,000,000
P47	High Desert Park Trail	$213,600
P49	North Unit Canal Trail	$512,200
P50	Pilot Butte Canal Trail	$164,100
P55	Hansen to Big Sky Park Trail	$1,000,000 - $5,000,000
P56	Manzanita Trail	$40,000
P57	Neff and Hamby Road Crossings	$1,000,000 - $5,000,000
P6	COHCT from Blakely Road to Hansen Park	$660,900
P61	Riley Ranch Nature Reserve Neighborhood Access	<$250,000
P64	Shelving Park North to Tumalo Creek Bike/ Pedestrian Bridge	$250,000 - $1,000,000
P67	TransCanada Trail	$250,000 - $1,000,000
P69	DRT Connector to Shelvin Park	$67,900
P7	COCHT from Hansen Park to Eastgate Park	$147,700
P75	Powerline Trail	$250,000 - $1,000,000
P77	South DRT Buck Canyon Trailhead	$1,000,000 - $5,000,000
P78	Tumalo Creek Trail	$250,000 - $1,000,000
P8	COCHT from Eastgate Park to the Badlands	$250,000 - $1,000,000
P9	DRT Putnam to Riley Ranch Nature Reserve Bike/ Pedestrian Bridge	$155,000
R2-A	NW Franklin Ave: Harriman Ave to Railroad Undercrossing	$176,000
R2-B	Franklin Ave Underpass: Hill St to 1st St	See M-15C
P7	COHCT from Hansen Park to Eastgate Park	$147,700
P75	Powerline Trail	$250,000 - $1,000,000

MAP ID	PROJECT DESCRIPTION	DRAFT COST ESTIMATE[1]
P77	South Deschutes River Trail Buck Canyon Trailhead	$1,000,000 - $5,000,000
P78	Tumalo Creek Trail	$250,000 - $1,000,000
P8	COCHT from Eastgate Park to the Badlands	$250,000 - $1,000,000
P9	DRT Putnam to Riley Ranch Nature Reserve Bike/ Pedestrian Bridge	$155,000
R2-A	NW Franklin Ave: Harriman Ave to Railroad Undercrossing	$176,000

1. Costs are from prior plan years and do not reflect 2023 dollars

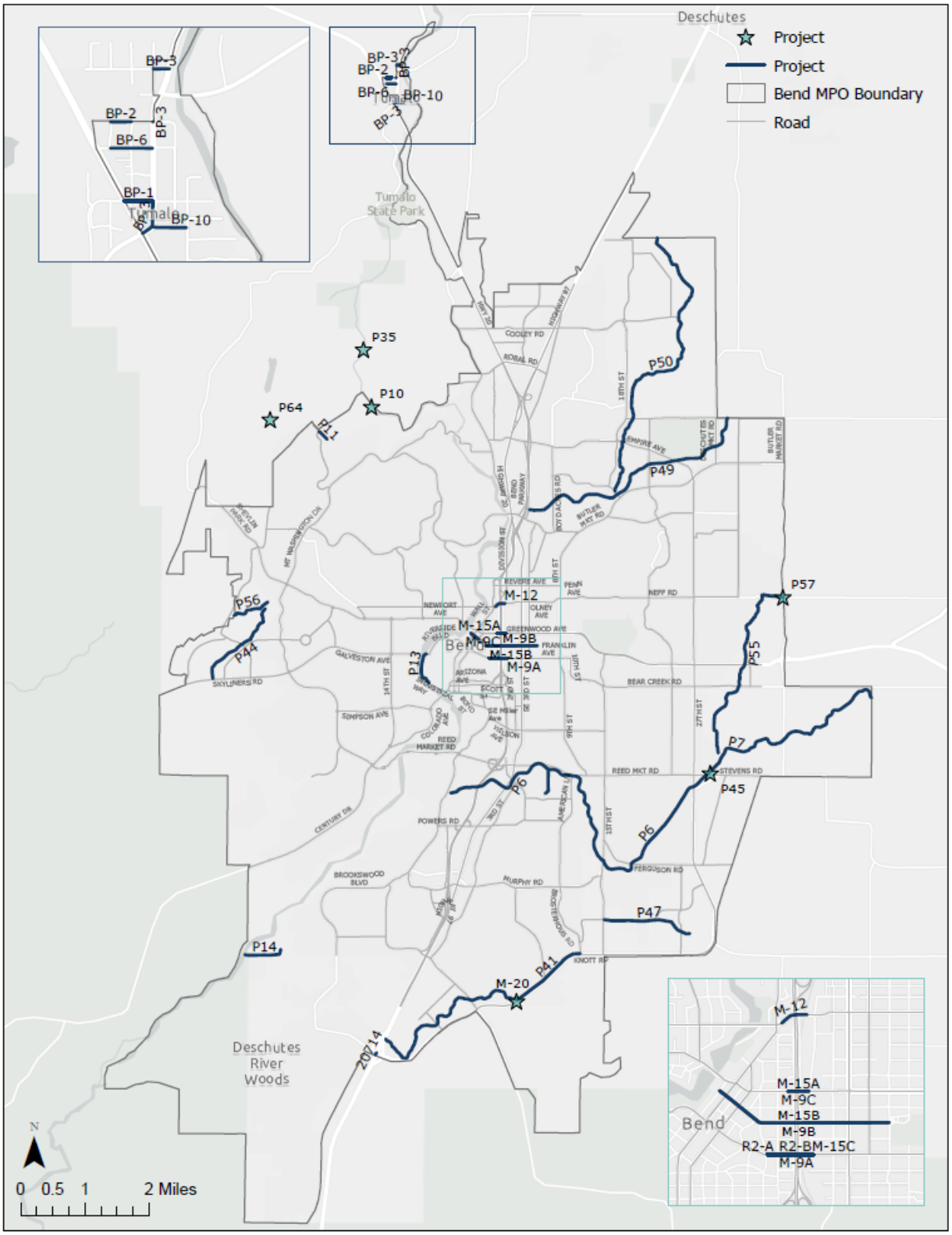

FIGURE 7. 2045 DRAFT MTP PROJECT LIST ACTIVE TRANSPORTATION CONNECTIVITY PROJECTS

TABLE 8: ACTIVE TRANSPORTATION CORRIDOR ENHANCEMENT PROJECTS

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
20391	US 20: Empire-Greenwood Improvements	$2,034,000
21489	US 20 3rd St-15th St Improvements	$6,426,900
22442	Sisters and Bend ADA Improvements	$17,633,346
C4A	Cooley Road Improvements	$3,000,000
C4B	Butler Market Road Improvements	$200,000
C4G	Canal/ Garfield Undercrossing	$1,250,000
C4H	Badger/ Pinebrook Overcrossing	$5,000,000-10,000,000
C4I	Murphy Road Improvements	$5,000,000-10,000,000
C4L	Robal Road Improvements	$1,000,000
C4P	Wilson Avenue Improvements	$860,000
M-1	Galveston Avenue Corridor Improvements	$3,900,000
M-10	Drake Park Pedestrian Bridge Improvements	$1,275,000
M-11	Archie Briggs Road Trail Improvements	$500,000
M-14	Butler Market Road Sidewalk Improvements	$3,100,000
M-16	Revere Avenue/ 2nd Street Intersection Improvement	$210,000
M-17	Olney Avenue Railroad Crossing Improvements	$500,000
M-18	Eagle Road Functional Urban Upgrade	$14,500,000
M-19	Knott Road Urban Upgrade from China Hat Road to 15th Street	$15,600,000
M-2	Parrell Road Urban Upgrade from China Hat Road to Brosterhous Road	$29,100,000
M-21	SE 27th Street rural road upgrade from Stevens Road to Ferguson Road	$1,300,000
M-22	SE 27th Street rural road upgrade from Ferguson Rd to Diamondback Ln	$600,000
M-23	SE 27th Street rural road upgrade from Diamondback Lane to access road	$100,000
M-24	SE 27th Street rural road upgrade from access road to Knott Road	$1,300,000
M-25	Knott Road rural road upgrade from 15th Street to Raintree Court	$500,000
M-26	Knott Road rural road upgrade from Raintree Court to SE 27th Street	$5,500,000
M-27	Knott Road rural road upgrade south of China Hat Road	$300,000
M-29	Cooley Road rural road upgrade from O.B. Riley Road to US 20	$1,300,000
M-3	Olney Avenue/2nd Street intersection improvement	$210,000
M-30	Cooley Road rural road upgrade from US 20 to Hunnell Road	$1,100,000
M-31	Hunnell Road rural road upgrade from Cooley Road to Loco Road	$200,000
M-32	Yeoman Rd rural road upgrade from the western terminus to Deschutes Market Rd	$2,500,000
M-33	Deschutes Market Road rural road upgrade from Yeoman Road to Canal	$500,000

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
M-34	Deschutes Market Rd rural road upgrade from Canal to Butler Market Rd	$400,000
M-36	Butler Market Road rural road upgrade from Eagle Road to Clyde Lane	$400,000
M-37	Butler Market Road rural road upgrade from Clyde Lane to Hamby Road	$1,100,000
M-38	Butler Market Rd rural road upgrade from Hamby Rd to Hamehook Rd	$1,100,000
M-39	Stevens Road rural road upgrade from Stevens realignment to Bend UGB	$1,900,000
M-4	Greenwood Avenue/2nd Street intersection improvement	$210,000
M-40	Clausen Drive rural road upgrade from Loco Road to Northern terminus	$200,000
M-41	China Hat Road rural road upgrade north of Knott Road	$200,000
M-42	China Hat Road Canal Bridge widening	$400,000
M-43	Deschutes Market Road canal bridge widening	$400,000
M-5	Franklin Avenue/2nd Street intersection improvement	$210,000
M-6	Franklin Avenue/4th Street intersection improvement	$210,000
M-7	Clay Avenue/3rd Street intersection improvement	$210,000
R10-A	O.B. Riley Road & Blakeley Road: North of Cooley Road to Knott Road	Cost captured in C-45, C-3, M-30.
R11-A	Murphy Road: Powers Road to 15th Street Shared Use Path	$2,179,000
R12-A	Wilson Ave: 2nd Street to SE 9th Street	Funded
R1-A	SE 9th St: Wilson Ave to Reed Market Rd	$1,155,000
R1-B	SE 9th St: Wilson Ave to Glenwood Ave	$3,000
R1-C	NE Boyd Acres Rd: Butler Market Rd to Empire Ave	$1,884,000
R1-D	SE 15th Street: Reed Mkt Rd to 300’ south of King Hezekiah	$1,185,000
R2-C	Franklin Ave: 1st St to 5th St	$16,000
R2-D	Bear Creek SRTS: Larkspur Trail to Coyner Trail	$385,000
R2-E	Bear Creek Rd: Cessna Ave to east UGB	$2,700,000
R3-A	Norton Ave: NE 6th St to NE 12th St	$196,000
R3-B	Hillside Trail: Connects NE 12th to Neff Rd	$241,000
R3-C	Neff Rd: NE 12th to Big Sky Park	$3,634,000
R3-E	Olney Avenue: Wall Street to railroad	$421,000
R4-A	NW 15th St: Lexington Ave to Milwaukie Ave	$110,000
R4-B	NW 14th St: Ogden Ave to Portland Ave	$110,000
R5-A	Butler Market Rd: Brinson Blvd to NE 6th St	$1,962,000
R7-A	3rd St: Crosswalk btw RR and Wilson Ave	$215,000
R7-B	3rd St: Crosswalk btw RR and Franklin Ave	$215,000
R7-C	3rd St: Underpass	$210,000
R8-A	27th St: Hwy 20 to Reed Mkt Rd - Shared use path	$4,815,000
RMRP2	Reed Market Road/ Chamberlain Street Improvements	$250,000
RMRP6A	3rd Street/ Brosterhous Road Safety Improvements	$130,000

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
US20 2	US 20/ NE 8th Street Improvements	$2,100,000

1. Costs are from prior plan years and do not reflect 2023 dollars

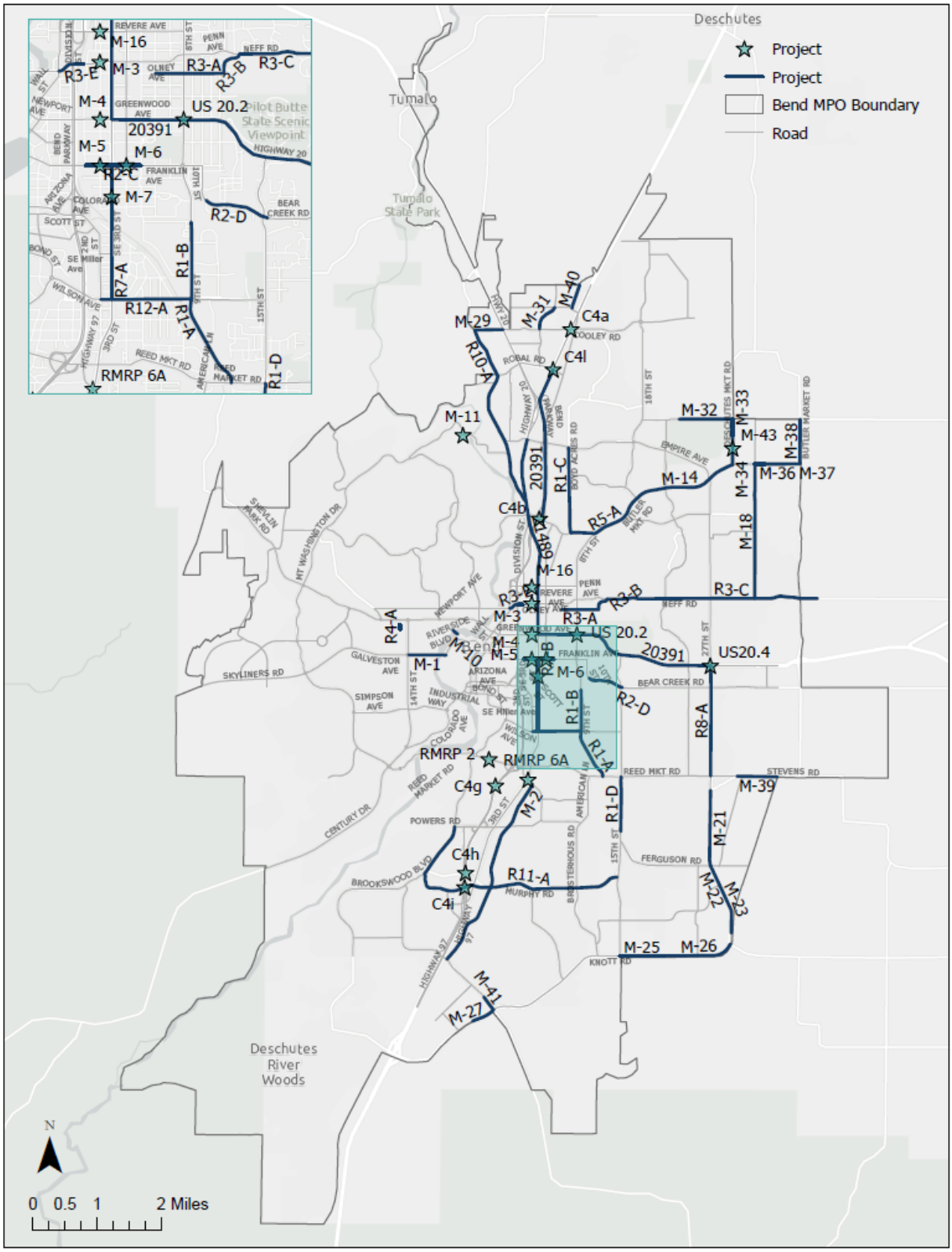

FIGURE 8. 2045 DRAFT MTP PROJECT LIST ACTIVE TRANSPORTATION CORRIDOR ENHANCEMENT PROJECTS

ATTACHMENT B: TRANSIT PROJECTS

TABLE 9. TRANSIT CONNECTIVITY PROJECTS

Cost Estimate: $7,500,000

MAP ID	PROJECT DESCRIPTION
MHND	North Downtown Mobility Hub
MHOMD	Old Mill District Mobility Hub
MHHS	Hawthorne Station Mobility Hub
MHEB	East Bend Mobility Hub
MHST	South 3rd Mobility Hub
MHNB	North Bend Mobility Hub
MHOSU	OSU Cascades Mobility Hub
MHCOC	Central Oregon Community College Mobility Hub

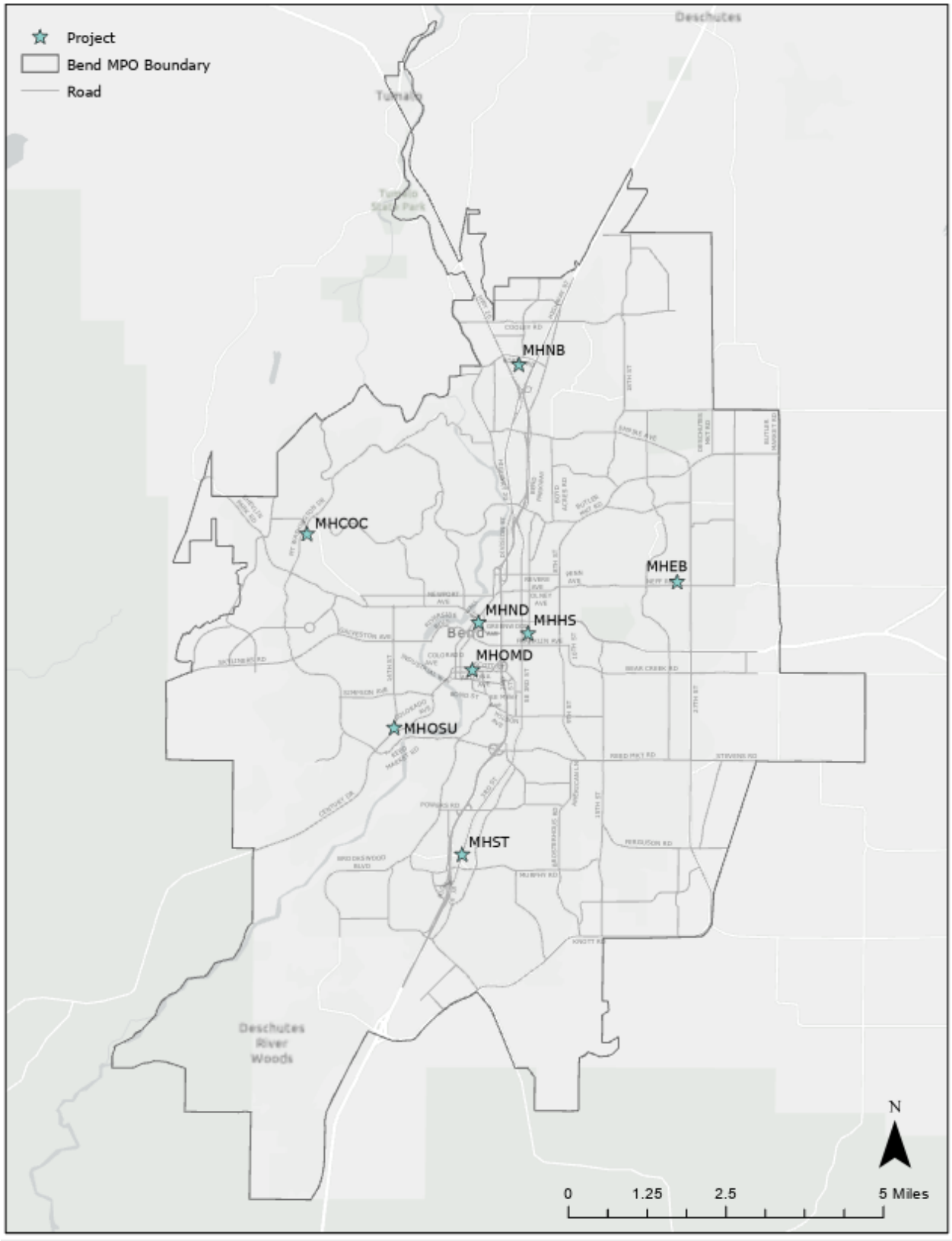

FIGURE 9. 2045 DRAFT MTP PROJECT LIST TRANSIT CONNECTIVITY PROJECTS

TABLE 10. TRANSIT SERVICE ENHANCEMENT PLAN 2045

2031-2040 Service Enhancement Cost: $24,582,000

MAP ID	PROJECT DESCRIPTION
CET 2	Bend Service Enhancement Route 2
CET 8	Bend Service Enhancement Route 8
CET 9	Bend Service Enhancement Route 9
CET 11	Bend Service Enhancement Route 11
CET 3	Bend Service Enhancement Route 3
CET 4	Bend Service Enhancement Route 4
CET 5	Bend Service Enhancement Route 5
CET 6	Bend Service Enhancement Route 6
CET 7	Bend Service Enhancement Route 7
000	Study for the Realignment of CET Routes to Service Mobility Hubs

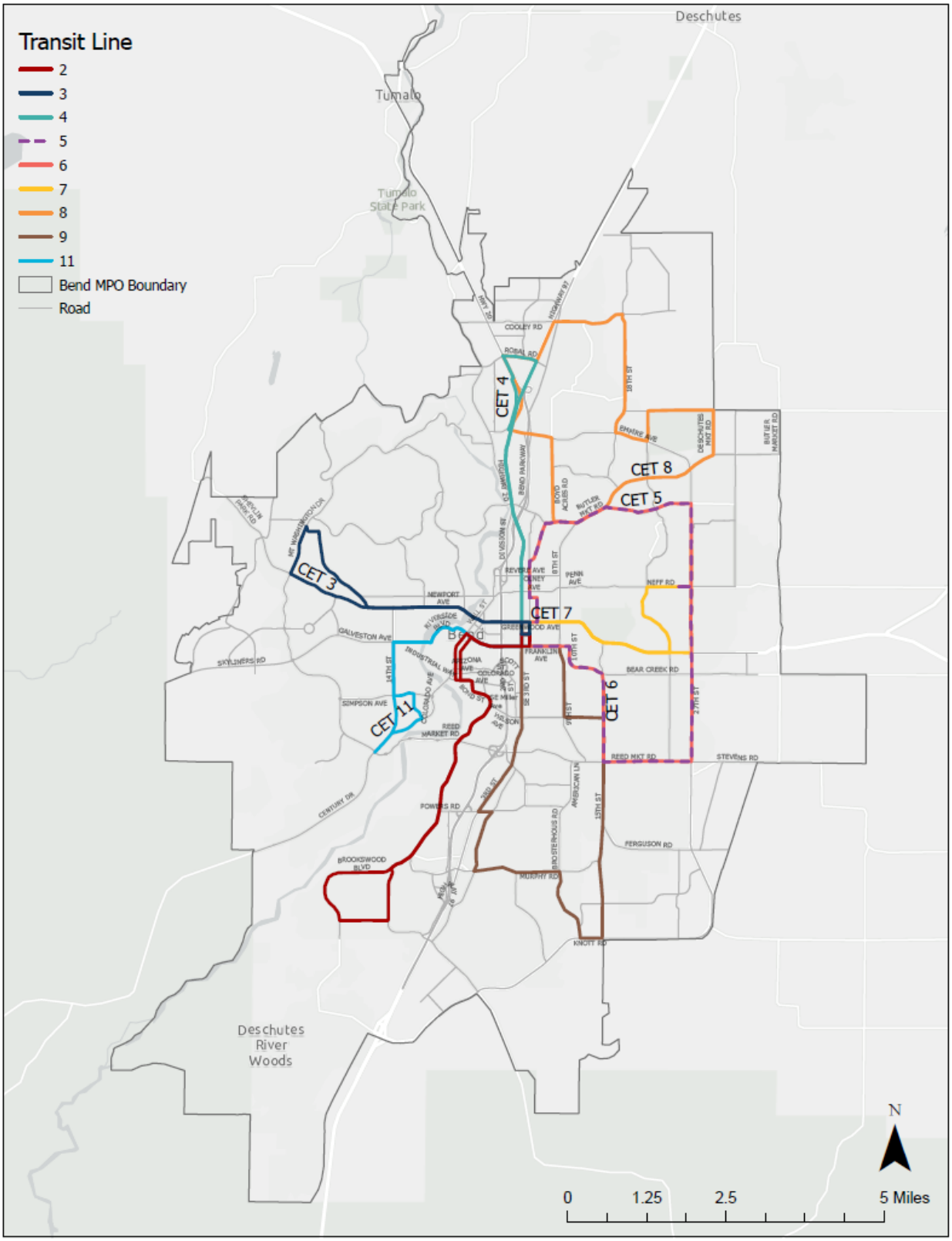

FIGURE 10. 2045 DRAFT MTP PROJECT LIST TRANSIT ROUTES

ATTACHMENT C: MOTOR VEHICLE PROJECTS

TABLE 11. MOTOR VEHICLE CONNECTIVITY PROJECTS

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
201	New collector - Skyline Ranch Rd from Shelvin Park to NW Xing	Funded
202	Crossing Drive Extension	Funded
219	Skyline Ranch Road Shevlin UGB Expansion Area	$2,700,000
230	New Road Shelvin UGB Expansion	$2,300,000
C-1	Yeoman Road Extension	$5,000,000
C-2	Purcell Boulevard Extension	Funded
C-24	Sisemore Street Extension	$2,400,000
C-25	Brentwood Ave extension from Whitetail St to American Ln	$2,300,000
C-48	New North Frontage Road near Murphy Road	$5,400,000
C-49	New South Frontage Road near Murphy Road	$13,800,000
C-5A	Aune Street extension (East)	$5,500,000
C-5B	Aune Street Extension (West)	$8,500,000
C-50	Britta Street extension (north section)	$2,700,000
C-51	Britta Street extension (south section)	$1,000,000
C-58	Ponderosa Street / China Hat Road overcrossing	$15,000,000
C-64	US 97 Frontage Road (Ponderosa to Baker Road)	$6,550,000
C-65	Stevens Road realignment	$4,700,000
C-66	Hunnell Road extension	$2,400,000
C-69	New Road in the Elbow UGB expansion area	$4,000,000
C-72	New Road in the Thumb UGB expansion area	$4,300,000
C-73	New Road in the Thumb UGB expansion area	$2,500,000
C-74	Loco Road extension	$5,300,000
C-75	New Road in Triangle UGB expansion area	$2,500,000
C-76	Yeoman Road Extension	$10,900,000
C-78	Collector between US20 and Hunnell Rd	$4,000,000
C-80	Robal Road extension from US 20 to O.B. Riley	$2,900,000
CC-18	Cooley Road Extension	$2,900,000
C-71	New Collector road between Ferguson and Knott	$9,000,000
SEAP	Local Road between SE Caldera Drive and Knott Road	$2,100,000
C-70	Extension of SE Caldera Drive between SE 15th and SE 27th	$7,400,000
SRMP	Extension of Wilderness Way	$3,900,000
SRMP	Eubanks Street collector between SE Ferguson and SE Stevens	$5,300,000
SRMP	SE Ferguson Road Extension	$2,600,000
SRT	Extension of the SE Ward Road Alignment	

1. Costs are from prior plan years and do not reflect 2023 dollars

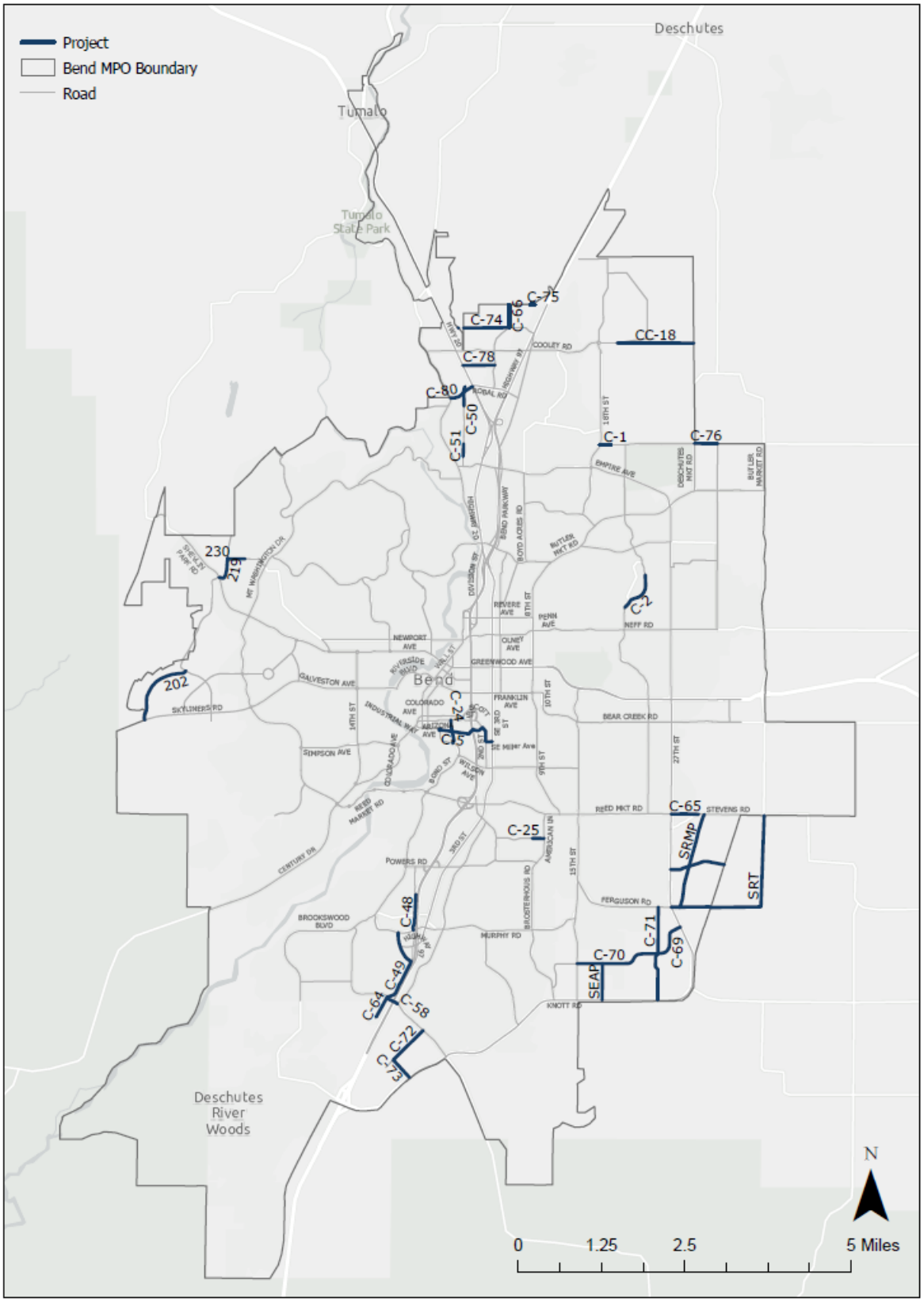

FIGURE 11. 2045 DRAFT MTP PROJECT LIST MOTOR VEHICLE CONNECTIVITY IMPROVEMENTS

TABLE 12. MOTOR VEHICLE CORRIDOR ENHANCEMENT PROJECTS

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
20378	Archie Briggs Road (Deschutes River) Bridges	$5,851,540
21756	US 20: Central Oregon Hwy Culverts Corridor	$532,916
22774	NE Norton Ave (Bend)	$579,000
22776	US 97: Redmond-Bend Phase 2	$9,310,000
97.A	Tight Urban Diamond Interchange US 97 North Interchange	TBD[2]
97.B	Realignment of 18th Street Relative to Juniper Ridge	TBD[2]
B-19	Hamby Road Corridor Safety Improvements	$51,000,000
BR-10	Old Deschutes Road Pilot Butte Canal Bridge Replacement	$400,000
C-13	Empire Avenue widening near US 97 interchange	$10,000,000
C-18	US 97 ramps at Murphy Road	$10,000,000
C-23	18th Street arterial corridor upgrade from Cooley to Butler Market	$7,800,000
C-3	O.B. Riley Road Corridor upgrade from Hardy to Archie Briggs	$6,700,000
C-31	Safety improvements to Empire Boulevard/27th Street Corridor from Boyd Acres Road to Reed Market Road	$41,800,000
C3A	Southbound Deceleration Lane Modification at Hawthorne Avenue	$1,000,000
C3C	Extend Revere Avenue northbound on-ramp acceleration lane	$1,000,000- 3,000,000
C3D	Acceleration lane modification for Colorado northbound on-ramp	$3,000,000- 5,000,000
C-40	US 97 North parkway extension (Phase 2)	$30,000,000
C-41	Powers Road interchange	$20,000,000
C-43	15th Street corridor safety and capacity improvements	$16,800,000
C-44	Reed Market rail crossing implementation	$25,000,000
C5	US 97 Shoulder-width improvements	$2,000,000-10,000,000
C-52	Mervin Samples Road / Sherman Road Collector Corridor upgrade	$6,100,000
C-53	27th Street Arterial Corridor upgrade from Bear Creek to Ferguson	$8,600,000
C-54	3rd Street railroad undercrossing widening	$13,700,000
C-55	Country Club Road Urban Upgrade from Knott to Murphy	$10,900,000
C-56	Powers Road urban upgrades from 3rd Street to Parrell Road	$1,000,000
C-57	Powers Road urban upgrades from Brookswood to 3rd	$4,200,000
C-6	Colorado Avenue corridor capacity improvements	$21,000,000
C-9	Revere Avenue interchange improvements	$8,500,000
CC-28	Bailey Road Widen and Overlay	$1,300,000
CC-29	Bear Creek Road Widen and Overlay	$3,200,000
CC-30	Cinder Butte Road Widen and Overlay	$1,300,000
CC-5	Rickard Road Widening	$2,300,000

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
F-7	China Hat Road Widen and Overlay	$900,000
I6	SE 3rd Corridor SE Cleveland Ave to SE Davis Ave Safety	
PHASE 1	US 97 Baker Interchange West Side Improvements	$14,800,000
PHASE 2	US 97 Baker Interchange Bridge and East Side Improvements	$23,200,000
RMRP1A	Reed Market Rd/ Brookswood Blvd Turn Lane Improvement Phase 1	$4,000,000
RMRP1B	Reed Market Rd/ Brookswood Blvd Turn Lane Improvement Phase 2	$700,000
RMRP3	Reed Market Road/ US 97 Southbound Ramps	$5,700,000
RMRP4A	US 97 Northbound Ramps/ Division Street: Traffic Signal	$4,000,000
RMRP4B	US 97 Northbound Ramps/ Division Street: Separate Northbound Entrance Ramp	$9,400,000
RMRP5	Reed Market Road/ 3rd Street protected intersection & turn lanes	$10,300,000
US20.3	US 20/ NE Purcell Boulevard Widening and Turn Lane Addition	
US20.4	US 20/ NE 27th Widening and Turn Lane Addition	
US20.5	US 20/ Hamby Road Right Turn Bypass lane addition	

1. Costs are from prior plan years and do not reflect 2023 dollars
2. Capital Cost Estimate not quantified in the Bend North Interchange Study Final Report

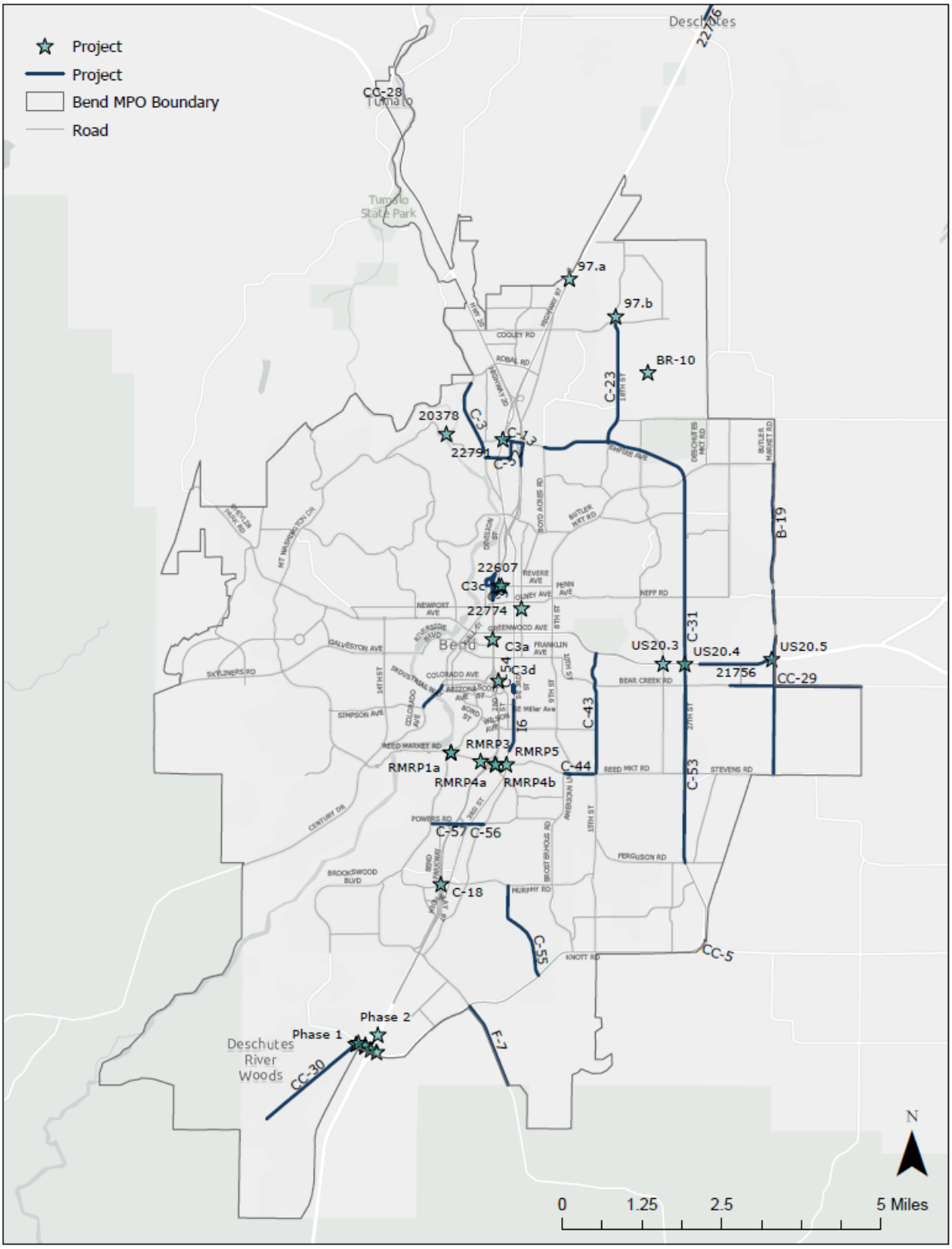

FIGURE 12. 2045 DRAFT MTP PROJECT LIST MOTOR VEHICLE CORRIDOR ENHANCEMENT PROJECTS

ATTACHMENT D: INTERSECTION PROJECTS

TABLE 13. INTERSECTION PROJECTS

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
1TNPS	Neff/ Purcell Intersection Improvements	Funded
6B	3rd Street/ Brosterhous Road Protected Intersection	$5,000,000-$10,000,000
C-14	Reed Market /15th intersection improvements	$1,100,000
C-15	Olney Avenue/8th Street intersection improvement	$3,700,000
C-16	Revere Avenue/8th Street intersection improvement	$3,700,000
C-21	Butler Market Road/US 20/US 97 Improvement.	$6,180,000
C-22	3rd Street/Wilson Avenue intersection improvement	Funded
C-26	US 20 intersection safety and capacity improvements	Funded
C-27	Butler Market intersection improvements from US 97 to 27th	$7,000,000
C-28	Revere Avenue/4th Street intersection improvement	$3,700,000
C-29	Olney Avenue/4th Street intersection improvement	$3,700,000
C2A	Lafayette Avenue/ US 97 Improvements	$2,000,000
C2B	Close Hawthorne Avenue right turn onto Parkway	$1,000,000
C2C	Close Truman Avenue RIRO intersections with Parkway	$1,000,000
C2D	Close Reed Lane RIRO intersection with Parkway	$1,000,000
C2E	Close Badger Road RIRO intersections with Parkway	$1,000,000
C2F	Close Pinebrook Blvd RIRO intersections with Parkway	$1,000,000
C2H	Close Rocking Horse RIRO intersections with Parkway	$1,000,000
C-33	Country Club /Knott intersection improvement	$3,700,000
C-34	Ferguson Road/15th Street intersection improvement	$3,700,000
C-35	NE 27th /Wells Acres intersection improvement	$3,700,000
C-39	Brosterhous /Knott intersection improvement	$3,700,000
C-45	O.B. Riley/Empire intersection improvement	$1,900,000
C-46	4th /Butler Market intersection improvement	$3,700,000
C-59	Hawthorne /3rd Intersection improvement	$3,800,000
C-60	Century Drive/Skyline Ranch Road roundabout	$3,700,000
C-61	Mt. Washington Drive/Metolius Drive roundabout	$3,700,000
C-63	China Hat Road/Knott Road Intersection Improvement	$3,700,000

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
C-7	Colorado/US 97 NB ramp intersection improvements	$4,300,000
C-79	Cooley Road/Hunnell Road Intersection Improvement	$3,700,000
C-8	Portland Avenue corridor project from College Way to Deschutes River	$17,700,000
CL-14	Cinder Butte Rd/ Cheyenne Rd intersection improvement	$200,000
CL-16	Cline Falls Hwy Cook Ave/Tumalo Rd intersection improvement	$1,800,000
CL-22	Baker Rd/ Brookswood Blvd intersection improvement	$1,400,000
S1	Butler Market & Hamby Intersection Improvement	TBD
S2	Butler Market Road & Hamehook Road	TBD
S-3	Pettigrew Road/Bear Creek Road safety improvement	$3,700,000
S-4	US 97/Powers Road interim improvements	$100,000
S-5	3rd/Miller intersection improvements and 3rd Street modifications study (Phase 1)	$100,000
S-6	3rd/Miller intersection improvements and 3rd Street modifications implementation (Phase 2)	$3,100,000
S-7	Empire Avenue/Jamison Street Turning Restrictions	$107,000

1. Costs are from prior plan years and do not reflect 2023 dollars

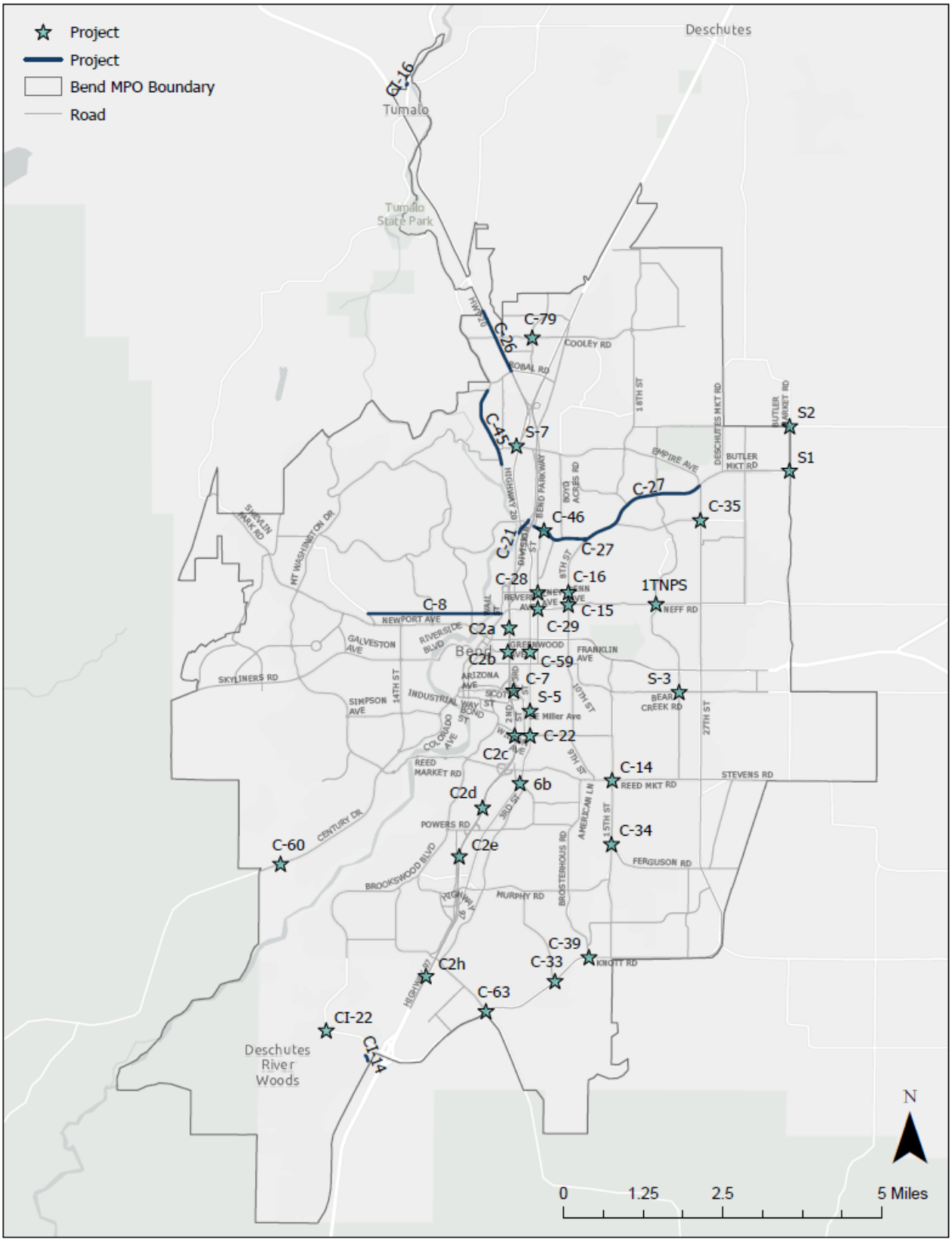

FIGURE 13. 2045 DRAFT MTP PROJECT LIST INTERSECTION PROJECTS

ATTACHMENT E: TECHNOLOGY PROJECTS

TABLE 14. TECHNOLOGY PROJECTS

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
101	3rd Street Safe and Smart Corridor	$1,390,000
102	US 97 Safe and Smart Corridor	$1,121,000
104	Hwy 20/ Greenwood Ave Smart Corridor	$2,991,000
105	27th Street Safe and Smart Corridor	$2,242,000
108	Wall Street and Bond Street Fiber Communications	$1,334,000
109	Century Drive Safety and Efficiency Improvements	$3,201,000
111	Hwy 97 Active Traffic Management (ATM) and Integrated Corridor Management	$2,867,000
112	Revere Ave Fiber Communications	
113	Neff Road Fiber Communications	$350,000
114	Empire Ave Fiber Communications	$1,276,000
115	Purcell Blvd Fiber Communications	$335,000
501	OID CAD 911 BUS Upgrade	
503	Rapid Response Situational Awareness Capabilities Responder Video System	$100,000
701	Regional Data Warehouse	$500,000-$750,000
802	Congestion Warning System	$250,000
803	In-Vehicle Communications for SPaT/MAP and ODOT CV Portal Integration	$300,000
22739	US 97: I-84 to California Border	$5,809,000
22742	US 20: from US101 to the Idaho border	$8,971,000
22767	Driver Feedback Signs (Deschutes County)	$1,032,873
C1	US 97 Install ramp meters	$15,000,000
C10	US 97 Traveler information signing	$2,000-30,000
C-36	3rd Street/Franklin Avenue signal modification	$500,000
C-37	3rd Street/Powers Road signal modification	$500,000
C-38	3rd Street/Badger Road signal modification	$500,000
C6	US 97 Weather warning system	$5,000-450,000
C7	US 97 Variable speed signs	$50,000-500,000
C9	US 97 Enhanced signal operations at ramp terminals	$50,000-500,000
DC-EM-01A	Coordinated Emergency Response - Radio System Link	TBD
DC-EM-02	Coordinated Emergency Response - Radio System Link	TBD
DC-EM-07	Responder Video System	TBD
DC-MC-06	Automated Maintenance Logging System	TBD
DC-PP-03	Intersection Collision Avoidance	TBD
DC-PP-04	Wildlife Detection	TBD
DC-PP-05	Ambulance Hospital Information System	TBD
DC-TM-02A	Region 4 TOC to 3rd St RWIS	TBD
DC-TM-06	Downtown Bend Parking Management System	TBD
DC-TM-07B	Hwy 20/Greenwood Ave from 3rd St to 8th St	TBD

MAP ID	PROJECT DESCRIPTION	DRAFT COST[1]
DC-TM-07D	Hwy 20/Greenwood/Newport - Travel Time Performance Measurements	TBD
DC-TM-11D	VMS: The Dalles-California Highway NB at Cooley	TBD
DC-TM-13A	27th/Empire/Knott Safety and Efficiency Improvements Video Monitoring	TBD
DC-TM-13B	Northeast Ring: 27th to Empire	TBD
DC-TM-14	ODOT Region 4 TOC Upgrade	TBD
DC-TM-16	Hwy 20 (Bend to Sisters) Safety and Efficiency Improvements	TBD
DC-TM-19A	Advanced Rail Warning System - Reed Market Road	TBD
DC-TM-19B	Advanced Rail Warning System - Bend and Redmond locations	TBD
DC-TM-19C	Advanced Rail Warning System - Additional Bend and Redmond locations	TBD
DC-TM-19D	Advanced Rail Warning System - Message signs and in-vehicle communications	TBD
DC-TM-30	State Highway 372/Colorado-Arizona Couplet	TBD
DC-TM-31	VMS: McKenzie-Bend Highway westbound at Cooley	TBD
DC-TM-32	Communications to Remote Traffic Signals	TBD
DC-TM-34	Franklin Avenue: 3rd Street to Bond Street Fiber Optic	TBD
DC-TM-40	Count Stations - Bridges	TBD
DC-TM-41	Count Stations - City Outskirts	TBD

1. Costs are from prior plan years and do not reflect 2023 dollars

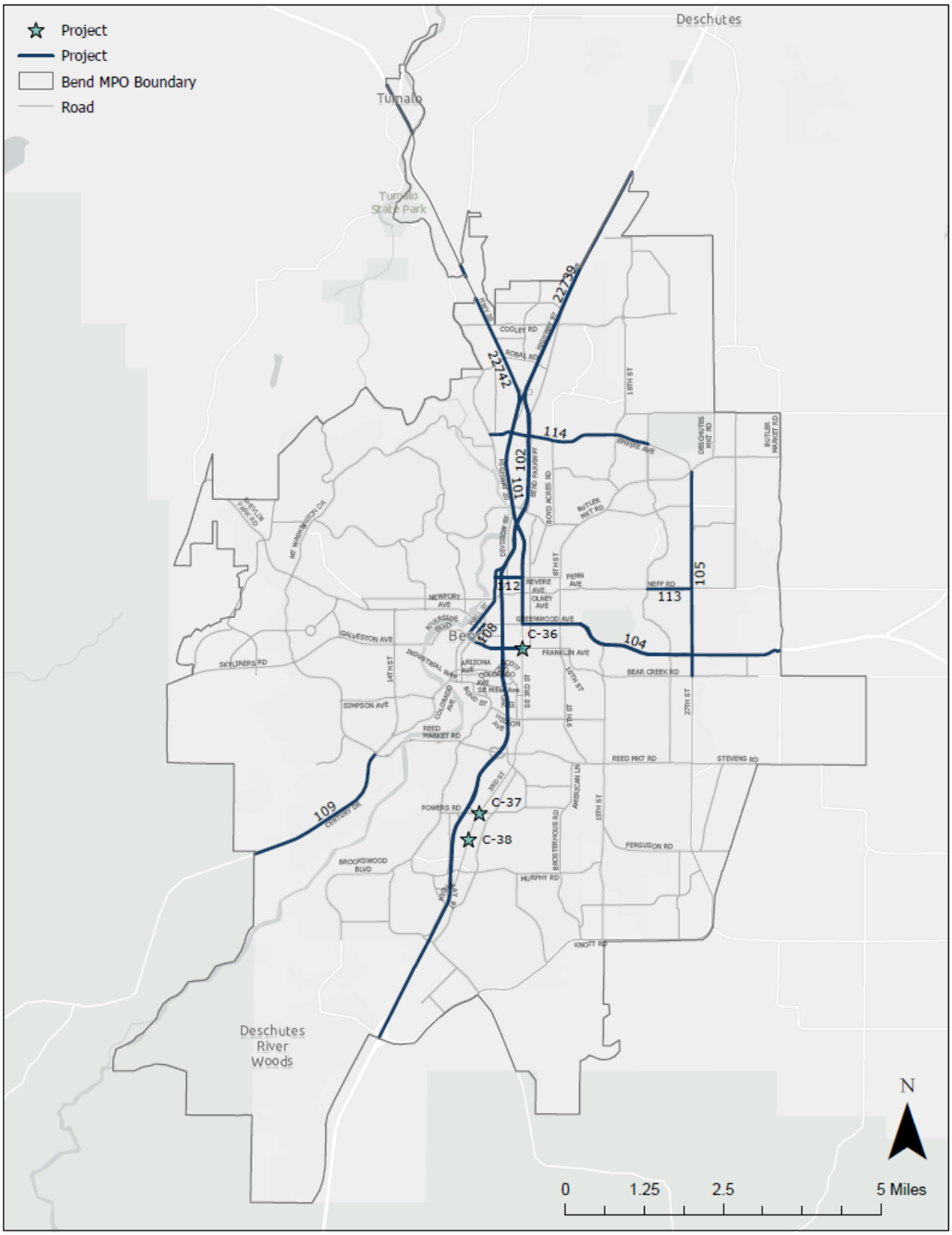

FIGURE 14. 2045 DRAFT MTP PROJECT LIST TECHNOLOGY PROJECTS