



PUBLIC TRANSPORTATION NEEDS MEMORANDUM

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 To: Cascades East Transit Master Plan, Project Management Team
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 Subject: Needs Analysis

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INTRODUCTION

This memorandum describes transit needs with respect to the local and regional plans review, existing conditions analysis, and short-term implementation strategies from Memorandums #1, 2, and 3, as well as from information gathered during the first two rounds of public outreach, an operator and on-board survey, and information from the regional travel demand model.

The vision, goals, and objectives established early in the project are provided first to provide context to the identified needs. The transit needs are then summarized for Central Oregon cities within the Qualified Entities served by CET as follows:

- ▶ Transit riders and operator survey results analysis
- ▶ Existing system operations and needs
- ▶ Travel demand and land use analysis
- ▶ Future needs and constraints
- ▶ Technological opportunities analysis

VISION, GOALS, AND OBJECTIVES

This section describes the vision, goals, and objectives developed through the first round of outreach of this project, which are used to guide the process in identifying needs.

Goal 1 Develop and maintain a public transportation system that is well integrated with local communities, planning documents, and partner agencies

Objectives:

- ▶ Coordinate with partner agencies to establish transit supportive corridors and a higher density and level of pedestrian-oriented development standards within generally ¼ mile of existing and planned transit stops.
- ▶ Encourage and facilitate community plan policies, model codes, and design incentives that promote transit supportive development patterns.
- ▶ Partner with communities and private developers to develop model projects on primary corridors and at community transit hubs.
- ▶ Strengthen coordination with other agencies and community partners to continually improve the safety, accessibility, and efficiency of transit service.
- ▶ Ensure regional transit services are coordinated with local and other inter-city transit service providers, including measures such as regular meetings, collaborating with Commute Options (regarding ridesharing for major employers), Transportation Management Associations, and other employer transportation programs, co-submitting grant applications, and consideration of joint operations/funding of cross-jurisdictional services.
- ▶ Establish a structure for ongoing coordination between public transportation providers and health and human service providers.
- ▶ Develop a balanced regional system structure that supports and integrates various transit services, such as primary urban corridors, urban feeder buses, shuttles, interurban corridors and connectors, bus rapid transit, micro-transit, park-and-ride facilities, and community transit hubs.

Goal 2 Provide convenient and attractive public transportation choices for users throughout Central Oregon both within and between communities

Objectives:

- ▶ Based on analysis and community input, expand or provide fixed route and flex route services in larger urban communities such as Redmond and Bend as needed. Define urban transit levels of service (frequency, times, and stops) and service areas. Continue and potentially expand demand-response services, such as providing vouchers for Transportation Networking Companies (TNCs) and establishing more park-and-ride facilities as needed.
- ▶ Based on analysis and community input, improve services in smaller communities and rural areas with measures such as expanding CET Community Connector services (frequency, times, and stops), increasing service areas, continuing and potentially expanding demand-response services, providing vouchers for Transportation Networking Companies (TNCs), and establishing more park-and-ride facilities as needed.
- ▶ Based on analysis and community input, maintain and/or expand Community Connector services that connect the communities of Central Oregon.

Goal 3 Make riding easy and comfortable with improved stop amenities and information about how to ride readily available to residents, employees, and visitors

Objectives:

- ▶ Implement transit stop design guidelines to provide functional and appealing amenities at transit stops appropriate to the amount the stop is used.
- ▶ Support Transportation Demand Management (TDM) efforts that address ridesharing programs, park-and-ride facility development, and more effective (e.g., personalized) outreach regarding existing transportation options.
- ▶ Address cultural and language barriers to using transit including consulting with Limited English Proficiency (LEP) populations to improve CET outreach and materials.
- ▶ Continue to improve ease of access/use of CET services for all customers, including centralized and accessible service information.
- ▶ Continue to improve marketing and access for visitors/tourists.

Goal 4 Enhance transit options to provide a time and cost competitive alternative to traveling by automobile and increase transit ridership while reducing automobile dependency

Objectives:

- ▶ Support, market, and track a regional transportation pass program that enlists employers, schools, institutions, and communities in a regional effort to increase transit travel and reduce auto dependency.
- ▶ Coordinate with partner agencies and organizations to assess and improve pedestrian and bicycle connections and access to transit corridors and stops, including encouraging the completion of pedestrian and bicycle system gaps, implementing protected road crossings, and providing bicycle parking.
- ▶ Support initiatives that promote under-utilized transit/non-SOV services such as vanpooling (ridesharing) that require limited operation and capital resources.
- ▶ In partnership with other transit planning in the region, explore expansion of services, including additional routes, frequency, and days of service, as needed and resources allow.
- ▶ Coordinate with human services providers to understand and meet the needs of transportation disadvantaged populations, including subsidized fare pricing.

Goal 5 Evaluate emerging technologies and transit service models and how they might be used to support transportation options in Central Oregon

Objectives:

- ▶ Monitor emerging technologies and transit service models and how relevant advancements might support the vision and goals of CET.
- ▶ Work with partner agencies to evaluate micro-transit services.
- ▶ Explore the viability of transit/mobility hubs (access to transit, bike share, car share, etc.) at key gateways and activity centers. Assist development of regional and local transit/mobilities hubs with guidelines and conceptual locations in each community.
- ▶ Develop one user-friendly platform to access all CET services and information such as fare purchase and storage, route maps and stop locations, schedules, and real-time arrival information.

SURVEY RESULTS ANALYSIS

This section summarizes the results of the on-board surveys and operator interviews conducted in May and June, 2019; copies of the surveys are attached to this memo. These surveys provide CET with real-time assessment of existing services meeting rider needs, gaps or limiting factors in the existing service, and the infrastructure or service needs from the rider and driver perspective.

ON-BOARD SURVEY RESULTS

For the on-board surveys conducted on the CET Fixed-Route System in Bend and the regional Community Connector system between May 8 and June 3, 2019, 413 riders participated with 277 using the fixed-route system and 136 riding the Community Connector. Key findings from the surveys follow. For more details in the full summary, see Appendix A.

Trip Purpose

- ▶ Bend Fixed Route
 - ▶ Work is the most common primary trip purpose (34%)
 - ▶ School is the second most common trip purpose (16%)
- ▶ Community Connector Routes
 - ▶ School/college is the most common primary trip purpose (42%)
 - ▶ Work is the second most common trip purpose (23%)

Frequency of Use

- ▶ 55% ride the bus 5 or more days per week
- ▶ 27% ride the bus 2 to 4 days per week (indicating 82% of CET riders use the system for routine transportation needs)
- ▶ 18% of riders use CET for occasional trips 1 to 4 days per month or less

Number of Years Riding CET

- ▶ 37% surveyed on Bend fixed-routes have been riding for 4 years or more
- ▶ 11% surveyed on Community Connector have been riding CET 4 years or more
- ▶ 52% of Community Connector riders surveyed have been riding the bus between 1 and 4 years
- ▶ 29% of Bend fixed-route riders surveyed have been riding the bus between 1 and 4 years.
- ▶ Roughly a third of riders system-wide started using CET within the last year.

Transfers Between Routes

- ▶ 65% of riders reported needing to transfer onto another route.
- ▶ Over 70% surveyed on Bend fixed-route services and half on Community Connector service indicated they needing to transfer onto another route.
 - ▶ The Bend routes with the highest percentages of riders making transfers were routes 10 (93%), 1 (82%), and 6 (81%)
 - ▶ The Community Connector routes with the highest percentages of riders making transfers were routes 22 (86%) and 30 (71%).
- ▶ The highest number of reported transfers occurred between:
 - ▶ Bend fixed-routes routes
 - 1 and 4 (riders connecting between north and south 3rd street)

- 4 and 7 (riders connecting between N 3rd Street and the 27th/St. Charles area) and
- 5 and 6 (which are interlined connecting areas north and south of Greenwood east of 3rd Street)
- ▶ Community Connector route 24 and Bend fixed-routes 2 and 5, e.g., riders connecting to downtown and the St. Charles area.

Transit Access

- ▶ 76% of riders walked to/from his/her bus stop.
- ▶ Riders on Community Connector routes walked longer to access transit than riders on Bend fixed-routes, 12 minutes versus 9 minutes
- ▶ The average bicycle trip to/from transit was approximately two miles.
- ▶ A relatively small share of riders drove to access the bus – traveling an average of 8.5 miles.

Fare Type and Discounts

- ▶ 33% of riders paid fares in cash.
- ▶ 3% use of TouchPass mobile app system-wide.
- ▶ 37% of Bend fixed-route riders used a senior (age 60 or older) or disabled discount fare.
- ▶ 38% of riders on Community Connector routes participate in a Group Pass Program.

Alternatives to CET Service

- ▶ 39% of Community Connector riders and 32% of Bend fixed-route riders said they would not have made their trip if bus service was not available.

Customer Perceptions of Current CET Service

- ▶ 80% of CET's riders are satisfied with the overall service and rated it as either Excellent or Good.
 - ▶ Bend fixed-route riders were least satisfied with on-time performance and timing/reliability of transfers (45% fair or poor).
 - ▶ Community Connector riders were most concerned with seat availability (20% poor and 15% fair) and condition of bus stops (38% fair or poor).

Improvement Priorities

- ▶ Longer Saturday service hours (earlier and/or later) and later weekday evening hours on Bend fixed-routes.
- ▶ Community Connector service on Saturdays.
- ▶ More frequent weekday service in Bend.
- ▶ Ensuring buses run on time.
- ▶ Increasing frequency in the morning/afternoon and running later in the evening on the Community Connector system.

Rider Feedback

- ▶ Needing weekend bus service
- ▶ Buses running later on weekdays
- ▶ Increasing service frequency on Community Connector routes
- ▶ Providing mid-day Community Connector service
- ▶ Frustration about late or early buses, leading to missed transfers, e.g.,
- ▶ Route 4 consistently late
- ▶ Mistimed transfers independent of buses running on-schedule
- ▶ Modifying route coverage or adding stops
- ▶ Buses being overcrowded, dirty, or bypassing passengers

- ▶ Improving transit app accuracy and accessibility on phones
- ▶ Improving bus stop amenities (e.g., trash cans, out-of-date schedules, seating/shelters, crosswalks, accessibility during snow events)
- ▶ Appreciating most CET drivers, but equally needing more time from CET drivers for safe seating

Demographics of CET Riders

- ▶ 79% of Bend fixed-route riders and 70% of Community Connector riders reported themselves as Caucasian.
 - ▶ 10% of Bend fixed-route and 7% of Community Connector riders reported themselves as Hispanic or Latino.
 - ▶ 1% of Bend fixed-route and 12% of Community Connector riders reported themselves as American Indian or Alaska Native.
- ▶ The largest cohort of Bend fixed-route riders are aged 25 to 34
- ▶ 42% of Community Connector riders are 18 and younger (83% of these riders are students)
- ▶ 10% of riders are 65 or older.
- ▶ A majority of Bend fixed-route riders are employed
- ▶ 37% of Community Connector riders are students
- ▶ approximately 45% of riders on both Bend fixed-routes and Community Connector routes report household earnings of under \$12,000 per year
- ▶ The majority of riders on Bend fixed-routes (53%), and 22% of those on Community Connector routes come from households that do not own a vehicle.

OPERATOR SURVEY RESULTS

For the operator surveys conducted on the CET Fixed-Route System in Bend and the regional Community Connector system between May 8 and June 3, 2019, 26 operators participated with four (4) operating dial-a-ride, nine (9) operating fixed-route, four (4) operating Community Connectors, six (6) operating all services, and the remaining not specifying. Key findings from the surveys follow. For more details in the full summary, see Appendix B.

General Information

- ▶ More than half (54%) of participating operators have worked at CET for one to five years
- ▶ CET has slightly more part time operators (42%) than full time operators (38%)
- ▶ Thirty-one percent of drivers operate the Bend fixed-routes

Planning Considerations

- ▶ The top locations identified by operators as difficult to navigate are Courtney Drive (Route 7 and dial-a-ride), left turns at Wells Acres/Butler Market and Jamison Rd/Highway 20
- ▶ Bend fixed-route 4 was identified as the most difficult route to keep on schedule (39% of answers)
- ▶ A majority of passengers' suggestions to drivers (45%) included adding or modifying routes and providing on-time service
- ▶ The top destinations that operators suggest CET should serve are Empire Ave (13%), Deschutes River Woods (15%), and Redmond with fixed-route service (8%)
- ▶ The top capital, infrastructure, and technology needs identified by operators were stop amenities (11%), trash and shelter maintenance at stops (9%), and new/improved radios (9%)

Operations

- ▶ Approximately 42% of operators feel securing passenger wheelchairs is somewhat difficult to difficult
- ▶ Approximately 46% of operators feel handling difficult rider behavior is somewhat difficult to difficult
- ▶ Approximately 58% of operators feel taking scheduled breaks is somewhat difficult to difficult
- ▶ Approximately 62% of operators feel maintaining on-time performance is somewhat difficult to difficult
- ▶ Approximately 38% of operators feel coordinating with dispatch and CET staff is somewhat difficult to difficult
- ▶ Half of operators indicate that scheduling and breaks are fair to poor for them
- ▶ Approximately 65% of operators indicate that dispatch works fair to poor for them

Future Funding Opportunities

- ▶ 33% of operators indicate that the priority for funding for the CET service area should be providing additional routes

Overall Recommendations

- ▶ The number one recommendation made by participating operators is that all Bend fixed-routes have 35 to 45-minute runs (Routes 1, 3, 4, and 7 on 30-minute runs for weekday schedule)

EXISTING SYSTEM OPERATIONS AND NEEDS

This section determines deficiencies and needs of the existing system, including rider satisfaction and the degree to which current routes meet stakeholder expectations. This is based on the existing conditions memorandum, public outreach, on-board and operator surveys, planning precedent memorandum, and short-term implementation strategy memorandum.

BEND AREA

General Needs

The list below describes the general transit service and capital needs within Bend considered "High Priority" by the public.

Transit Service

- ▶ More frequent routes, North and South 3rd Street and Greenwood Avenue
- ▶ More service coverage in Bend including NE and SE Bend and St. Charles area
- ▶ More direct connections to downtown from the eastside
- ▶ Reduce dependence on transfers

Transit Capital

- ▶ Real-time arrival displays on shelters
- ▶ Fare payment configuration to allow credit cards on buses
- ▶ Better maps

Specific Needs

Table 1 describes the specific transit service and capital needs within Bend, considered "near-term" (i.e. FY2019-2021), identified through previous planning documents, public outreach

efforts throughout this current planning effort, and Tech Memo 3 – Short-Term Implementation Strategy.

Table 1: Specific Transit Service and Capital Needs in Bend

Transit Service	
New Services	<ul style="list-style-type: none"> ▶ New local route serving northeast Bend (e.g. Route 8) ▶ New local route or route extension serving southeast Bend (e.g. Route 9) ▶ Limited Sunday service ▶ Early evening service hours (fixed-route and Dial-A-Ride (DAR) until 8 p.m.)
Enhanced Services	<ul style="list-style-type: none"> ▶ 30-minute headway Saturday service on select routes ▶ Extended Saturday service hours (fixed-route and DAR, 7 a.m. to 7 p.m.)
Other Services	<ul style="list-style-type: none"> ▶ Low-income fare subsidy and/or student fare pass programs ▶ Pilot program to subsidize evening TNC trips (could be limited, e.g., transit riders with passes) ▶ Vanpools to dispersed employment sites ▶ Travel training and promotion
Transit Capital	
<ul style="list-style-type: none"> ▶ Low-floor vehicles prioritized for routes with high levels of wheelchair boardings ▶ Procure Dial-A-Ride dispatch system that supports on-demand scheduling and mobile applications ▶ Real-time signage at secondary hubs (Northern Bend) ▶ Hawthorne Station access, safety, and operational improvements ▶ Additional peak buses for Routes 1, 4, 7, and short route to downtown Bend (possibly Route 3) ▶ On-going transit-supportive capital improvements program (e.g. bus stop amenities, accessibility, bicycle/pedestrian access/crossings, etc.) ▶ 3rd Street speed and reliability and access improvements 	

AREAS OUTSIDE OF BEND

General Needs

The list below describes the general transit service and capital needs for CET service areas outside of Bend identified through previous planning documents, public outreach efforts throughout this current planning effort, and Tech Memo 3 – Short-Term Implementation Strategy.

Transit Service

- ▶ More frequent routes for Community Connectors, Bend-Redmond especially
- ▶ Community Connector Saturday service between Redmond and Bend
- ▶ Fixed-route/deviated route service in Prineville and Redmond
- ▶ Expanded DAR coverage area in La Pine, Prineville, Redmond, and Sisters
- ▶ Travel training and promotion

Transit Capital

- ▶ Real-time arrival displays on shelters
- ▶ Fare payment configuration to allow credit cards on buses
- ▶ Better signage and maps

Specific Needs

This section describes the specific transit service and capital needs for Warm Springs, Deschutes County, Crook County, and Jefferson County identified through previous planning documents, public outreach efforts throughout this current planning effort, and Tech Memo 3 – Short-Term Implementation Strategy.

Warm Springs Needs

Table 2 describes the specific transit service and capital needs within and to/from Warm Springs.

Table 2: Specific Transit Service and Capital Needs in Warm Springs

Transit Service	
Government Camp	<ul style="list-style-type: none"> ▶ Intercity service (weekday to/from Warm Springs) ▶ Saturday service
Route 20 (Warm Springs-Madras)	<ul style="list-style-type: none"> ▶ Three Saturday round trips
Other Services	<ul style="list-style-type: none"> ▶ Formal scheduled stop for Central Oregon Breeze
Transit Capital	
	<ul style="list-style-type: none"> ▶ Warm Springs transit center

Deschutes County Needs

Table 3 describes the specific transit service and capital needs within and to/from Deschutes County.

Table 3: Specific Transit Service and Capital Needs in Deschutes County

Transit Service	
Route 24 (Redmond-Bend)	<ul style="list-style-type: none"> ▶ Three additional midday trips ▶ One additional later evening weekend trip ▶ Five Saturday round trips
Route 26 (Prineville-Redmond)	<ul style="list-style-type: none"> ▶ One additional morning, midday, or afternoon trip ▶ One additional later evening weekday trip ▶ Through-route to Bend during peak periods and interline with Route 24; includes service to Redmond COCC and Airport (additional bus required) ▶ Three Saturday round trips
Route 22 (Madras-Redmond)	<ul style="list-style-type: none"> ▶ One additional morning and two additional midday or other trips ▶ One additional later evening weekday trip ▶ Three Saturday round trips
Route 29 (Sisters-Bend)	<ul style="list-style-type: none"> ▶ One additional morning, midday, or afternoon trip ▶ Three Saturday round trips
Route 30 (La Pine-Bend)	<ul style="list-style-type: none"> ▶ One additional morning, midday, or afternoon trip ▶ Three Saturday round trips
New Service	<ul style="list-style-type: none"> ▶ Redmond fixed-route service – weekday & Saturday – four routes w/ADA Paratransit, redirecting Redmond DAR service hours ▶ Local circulating service in Sisters (utilizing Community Connector vehicle) ▶ Local circulating service in La Pine (utilizing Community Connector or DAR service)

Jefferson County Needs

Table 4 describes the specific transit service and capital needs within and to/from Jefferson County.

Table 4: Specific Transit Service and Capital Needs in Jefferson County

Transit Service
Route 22 (Madras-Redmond) <ul style="list-style-type: none"> ▶ One additional morning and two additional midday or other trips ▶ One additional later evening weekday trip ▶ Three Saturday round trips
Route 20 (Warm Springs-Madras) <ul style="list-style-type: none"> ▶ Three Saturday round trips
New Service <ul style="list-style-type: none"> ▶ Local circulating service in Madras (utilizing Community Connector or DAR vehicle)

Crook County Needs

Table 5 describes the specific transit service and capital needs within and to/from Jefferson County.

Table 5: Specific Transit Service and Capital Needs in Crook County

Transit Service
More service for Route 26 (Prineville-Redmond) <ul style="list-style-type: none"> ▶ One additional morning, midday (before 11 a.m.), or afternoon trip (4:45-5:15 p.m.) ▶ One additional later evening weekday trip ▶ Through-route to Bend during peak periods and interline with Route 24; includes service to Redmond COCC and Airport (additional bus required)
Route 26 (Prineville-Redmond) <ul style="list-style-type: none"> ▶ Three Saturday round trips
New Service <ul style="list-style-type: none"> ▶ Local circulating service in Prineville (utilizing Community Connector vehicle) – could include connection to Juniper Canyon

DIAL-A-RIDE NEEDS

Dial-A-Ride trips are more expensive to operate per ride (\$26.90 per trip¹) than traditional fixed-route transit (\$7.17²); therefore most transit agencies seek to reduce the demand on their complementary paratransit Dial-A-Ride services by trying to shift people to fixed-route transit as feasible through travel training and route adjustments. Bend’s Dial-A-Ride has seen declining ridership as alternative options such as Uber and Lyft have become more available resulting in a decline in ridership and productivity (although three passengers per service hour is a typical productivity for most paratransit services).

To increase productivity (Rides per Hour), CET needs to increase the efficiency of Dial-A-Ride service (allowing more rides per hour) with improved scheduling technology. Upgrading scheduling and dispatch software will improve the route scheduling and capacity to handle more rides as well as the customer experience through more flexible scheduling (online and mobile device, same day requests, etc.). This will help CET’s Dial-A-Ride services evolve into

¹ Specific to Bend Dial-A-Ride for 2017.

² Specific to Bend Fixed Routes for 2017.

microtransit service which is likely to result in an increase in demand over time as CET's services are more economical for the customer (\$2.50 per ride currently) than commercial alternatives.

To increase demand and therefore productivity on the Bend Dial-A-Ride, CET should work with various human services agencies to understand unmet needs and gaps in service.

For Rural Dial-A-Ride, as the technology increases and the service operates more like microtransit, demand will increase. As demand increases, the more productive areas can be converted into flex-routes.

TRAVEL DEMAND ANALYSIS

This memorandum provides insight into potential transit needs within the Bend MPO area by evaluating the following:

- ▶ Bend's local and intercity vehicle trip origins and destinations using trip tables from the travel demand model including
 - ▶ Bend local trips (start and end in Bend)
 - ▶ Trips between Bend and Redmond
 - ▶ Trips between Bend and the other cities served by CET
- ▶ Trip purpose data from the 2017 American Household Survey
- ▶ Airport travel information including
 - ▶ Flight schedules for arrivals and departures to identify travel patterns to/from the airport
 - ▶ Air traveler origin-destinations in Central Oregon
 - ▶ Opportunities and costs to provide service to the airport via new or modified routes

ORIGIN – DESTINATION STUDY

Bend's current and future travel patterns were examined using vehicle trip information from the Bend MPO region travel demand model. The analysis considered vehicle trips that started and ended in Bend, trips between Bend and Redmond, and trips between Bend and the other cities served by CET. Vehicle trip data was used to form a comprehensive understanding of travel patterns. Projected transit trips reflect existing routes only and do not identify unserved trip patterns.

TRAVEL DEMAND WITHIN BEND

Bend Local trips (start and end in Bend)

For the analysis of trips with origins and destinations in Bend, the Bend area Transportation Analysis Zones (TAZs) from the travel demand model were grouped into 32 larger geographic areas to help visualize the data. The groups were formed by combining similar land uses, areas that comprised the same general location, and natural and built environmental factors such as rivers, highways, and railroads. The groups and their identification number are presented in Figure 1; the identification numbers reflect each group's ranking based on the total number of daily trips starts and ends, with group with 1 having the largest number of daily trips and group 32 having the least.

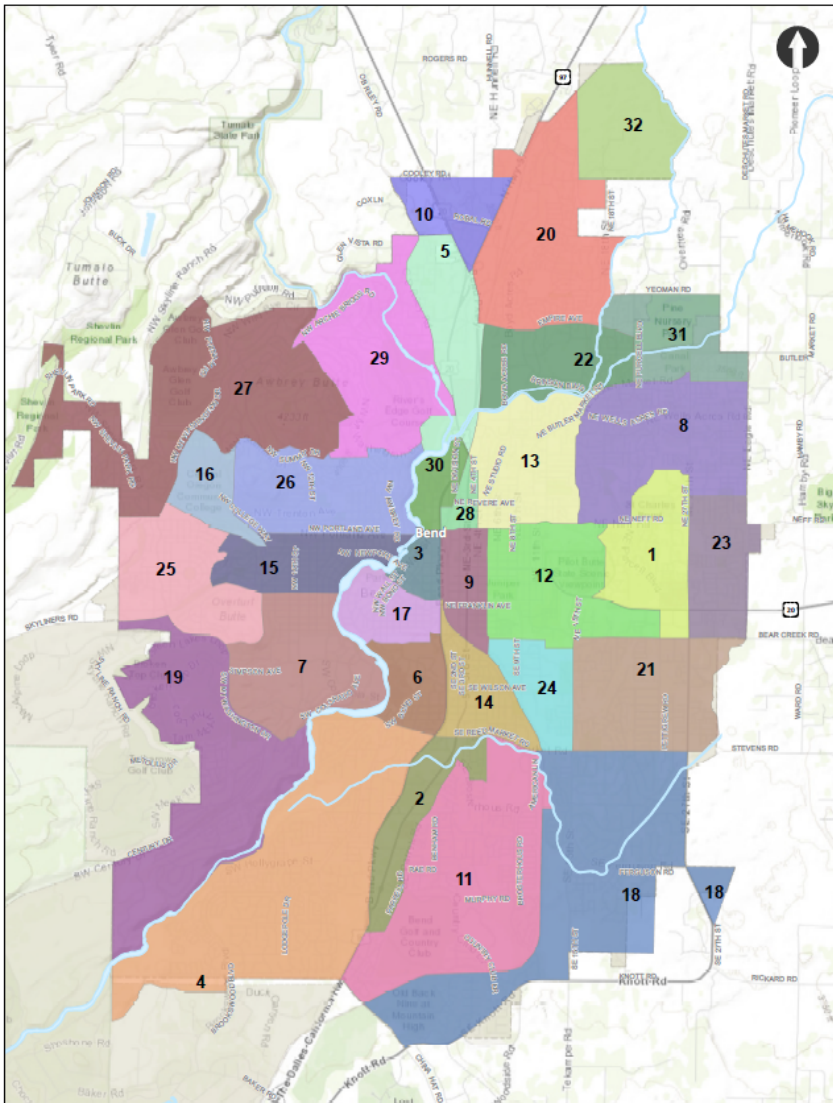


Figure 1: Bend TAZ Groups used in Origin-Destination Analysis

The analysis produced a set of figures that summarize the trip patterns for each TAZ group. Figure 2 provides the 2010 trip origins and destinations for trips with one end in the medical center (TAZ group 1, outlined in yellow). The base year in the Bend-Redmond Model is 2010, which is consistent with the base year model being used in other local planning efforts including the ongoing Bend Transportation System Plan Update. The map on the left shows the total daily trips to/from each group while the map on the right shows the total daily trips normalized by trips per acre. The full set of figures includes year 2010 and 2040 information for each TAZ group and is included in Appendix C.

Tables summarizing the data are also included in Appendix C. They are organized with the TAZ groups that generated the greatest number of trips in 2010 located at the top (origins) and left (destinations) of the table. There are three tables: (1) vehicle Trips in the 2010 model, (2) vehicle Trips in the 2040 model, and (3) Change in trips between 2010 and 2040.

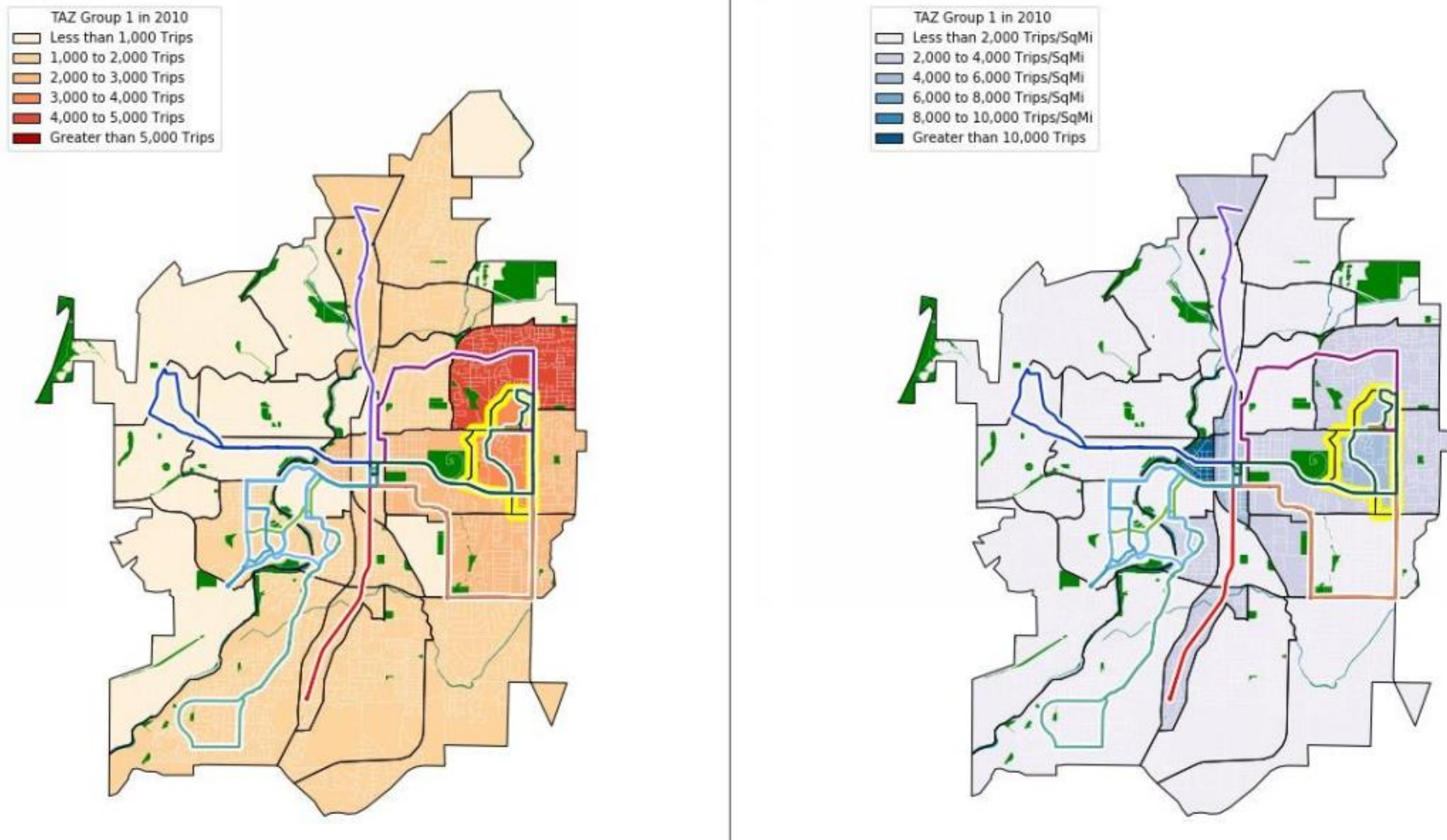


Figure 2: Trip Distribution to/from Group 1: Medical Center (2010)

Findings

- ▶ **Medical Center (Group 1)** – The medical center generated the most total trips and is well connected by transit to the immediate areas around the hospital. It is less well connected to the area west of Highway 97, including Downtown Bend. In 2010, the model showed that 11 percent of trips to/from the medical center are from downtown. These trips require a transit rider to transfer at Hawthorne Station.
- ▶ **Downtown Bend (Group 3)** – In the 2010 model, Downtown Bend generated the third most trips of all the TAZ groups. Due to the smaller size of the TAZ group, trip starts and ends are among the most concentrated (most trips per acre) compared to other TAZ groups. Compared to other TAZ groups, trips to and from Downtown Bend are more evenly distributed throughout the city. The area is served by four bus routes that connect it to the west and southwest parts of the city. There is no direct transit access for people traveling from east of Highway 97; they must transfer at Hawthorne Station.
- ▶ **Retail/Commercial Corridors along Highway 20-3rd Street (Groups 2 and 9)** – Retail and commercial areas on the north and south side of the city generate a large number of trips. The model shows that travel to the corridor is largely east/west (there are few trips that cross from between the north and southside of the city to access the corridor). Trips from adjacent residential areas east and west of the corridor are not well served by transit (or don't have direct transit access such as between Brookwood Boulevard and South 3rd Street which is one of the highest trip origin-destination pairs in the Bend model).
- ▶ **Oregon State University-Cascades (Group 7)** – Between 2010 and 2040, the TAZ group that includes OSU-Cascades is projected to generate more than 50 percent more trips. The growth is projected to largely occur in the area immediately around the campus (daily trips within the TAZ group are projected to increase from 1,690 to 7,464). Transit currently serves this area. Still, the large increase in trips may justify increased bus frequency as well as other improvements to facilitate non-motorized trips.
- ▶ **Oregon State University-Cascades (Group 7)** – The model also projects a significant increase in trips from the OSU-Cascades area (Group 7) to the Brookwood Boulevard area (most likely as a significant location of off-campus student and employee housing) with the highest concentration of trips to downtown and the Old Mill District (potentially as housing location and destinations for those living on campus).
- ▶ **Juniper Ridge (Group 32)** – Trips to and from the northeast corner of Bend are projected to grow by the largest percent of any of TAZ groups between 2010 and 2040. Depending on the scale of development at the site, the growth could justify extending transit service from the North 3rd Street route to connect it to Cascade Village Shopping Center.

Considerations

- ▶ The model indicates that there is demand for improved east/west connections between Downtown and areas east of Highway 97. Some of this demand could be served by extending the Greenwood or other routes from Hawthorne Station to terminate in Downtown Bend. This would provide a one-seat ride between the Hospital and Downtown, for example, and would provide additional service between Hawthorne Station and Downtown.
- ▶ The trips density maps indicate that the current "hub and spoke" transit network is effective for providing a transit option for the major origin-destination trip pairs. Looking forward, the growth of the OSU-Cascades campus and the Brookwood Boulevard and South 3rd Street corridors may generate demand for a new service that connects the southwest and southeast sides of the city without going through the center of the city.

- ▶ The alternatives analysis phase of the project should consider if locating the center of the current “hub and spoke” system from Hawthorne Station to an area west of Highway 97 near Downtown and the Old Mill District would increase the number of single-seat rides and/or reduce the amount of out-of-direction travel for transfers.

TRAVEL DEMAND BETWEEN BEND AND REDMOND

In the 2010 Bend-Redmond model, there are approximately 13,600 total weekday trips between Bend and Redmond. The model projects that the number of trips between the cities will grow by approximately 65 percent by 2040 to 22,500. As a result, vehicle travel patterns in 2010 and 2040 were evaluated to understand travel between the two cities and identify if intercity service can be improved with additional stops on the Connector Routes in Bend or Redmond or if they would be best served by a local fixed route service in Redmond.

The analysis in this section identifies all trips that start in either Bend or Redmond and end in the other city. The trips were analyzed separately for Bend and Redmond. One analysis looked at all trips to identify what TAZ they connect to in Redmond (e.g. where people traveling from Bend go to in Redmond). The other analysis identified where the trips are associated with in Bend (e.g. where people traveling from Redmond go to in Bend). By aggregating trips at the city level we can identify specific locations with higher demand that could benefit from improved regional or local transit service.

For each city in 2010 and 2040, large numbers of trips travel to TAZs located at the edge of each city. However, trips are most densely concentrated along the major corridors and downtowns for each city. This may indicate a pattern of people traveling from residential locations on the edges of each city to large trip generators in the other city, such as job centers, the medical center, airport, etc.

Bend

Figure 3 and Figure 4 below show the number and density of trips to each TAZ in Bend from Redmond. The maps demonstrate:

- ▶ In 2010, intercity trips with Redmond are most concentrated in the Cascade Village area, various places along 3rd Street north of Downtown, Downtown Bend, Old Mill, Central Oregon Community College (COCC), and the medical center.
- ▶ Existing bus service in Bend provides a connection from Hawthorne Station to Downtown Bend, Old Mill, COCC, OSU-Cascades, and to the medical center. To ride transit to these destinations requires a rider to transfer at Hawthorne Station. Trips to Downtown Bend and Old Mill could be potentially be served directly by extending Route 24 from Hawthorne Station to a stop west of Highway 97.
- ▶ Between 2010 and 2040, the locations in Bend that generate more intercity trips with Redmond remain relatively unchanged, with one exception. In 2040, trips increase to the TAZ that includes the OSU-Cascades campus.

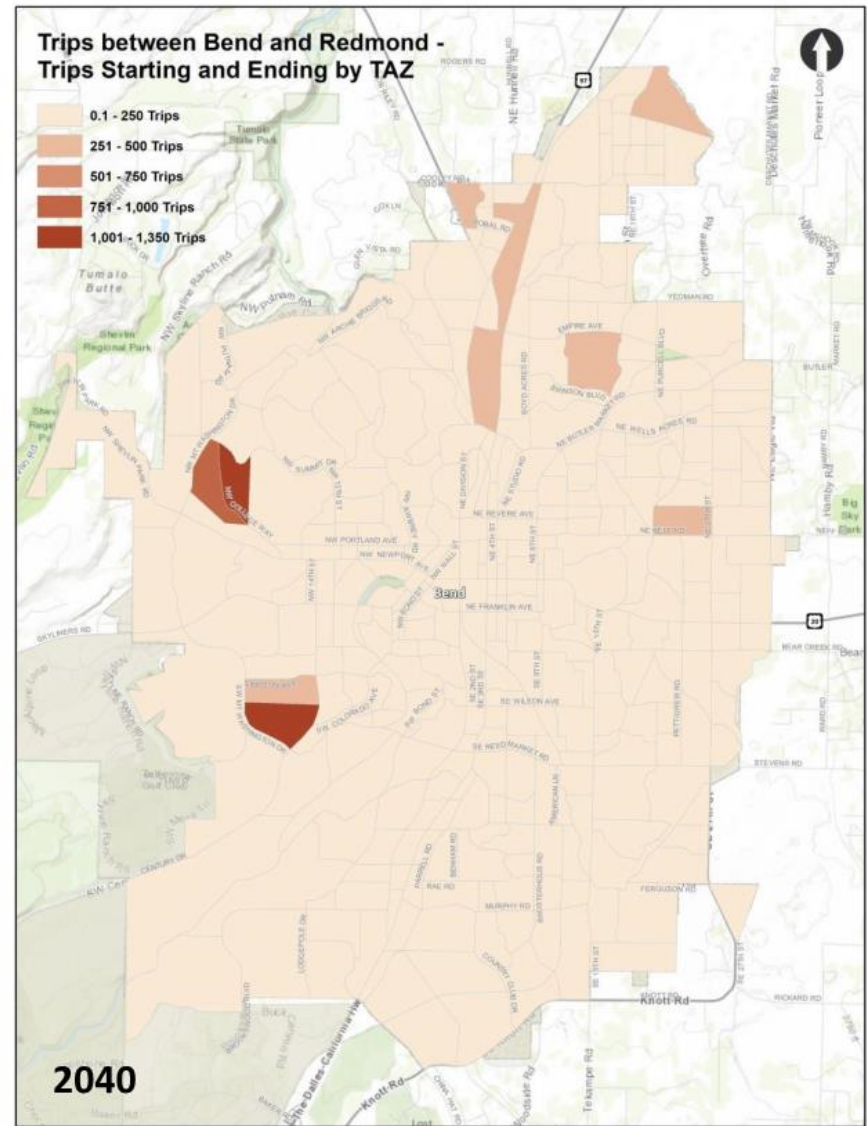
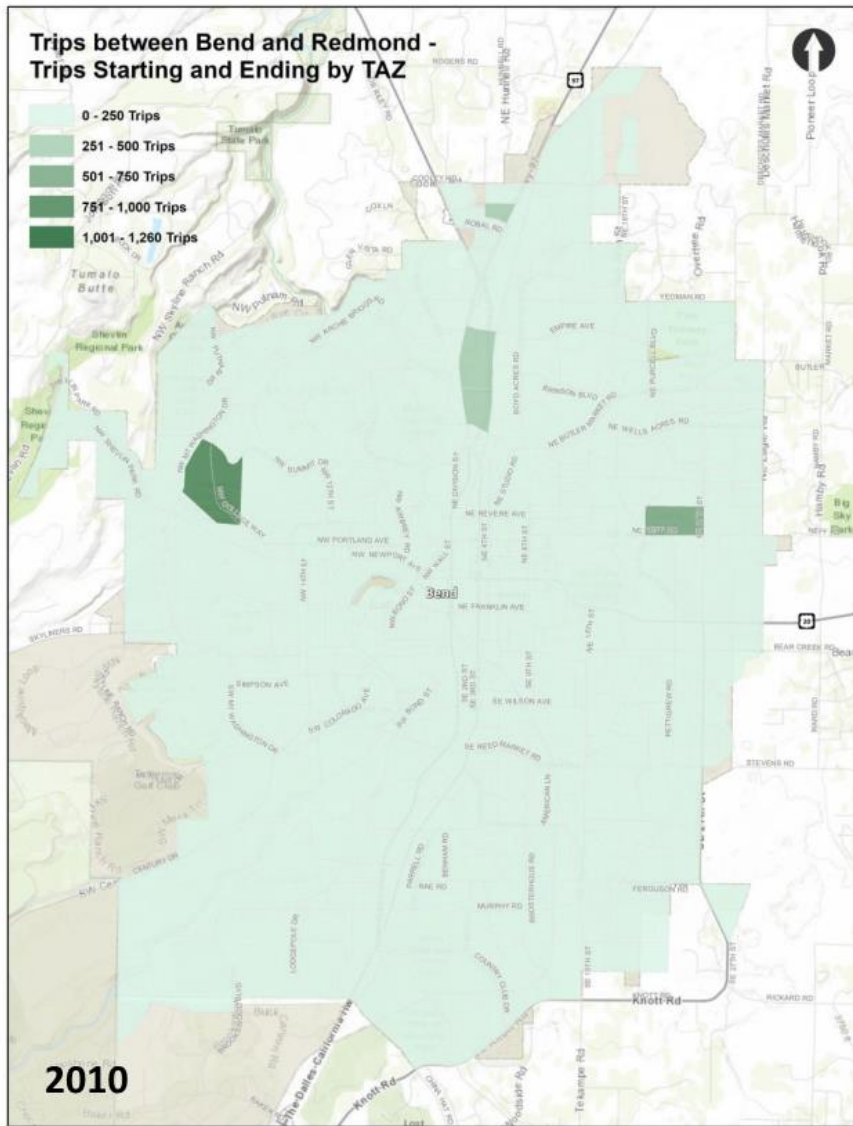


Figure 3: Bend Trips that connect to Redmond (Total Trips per TAZ)

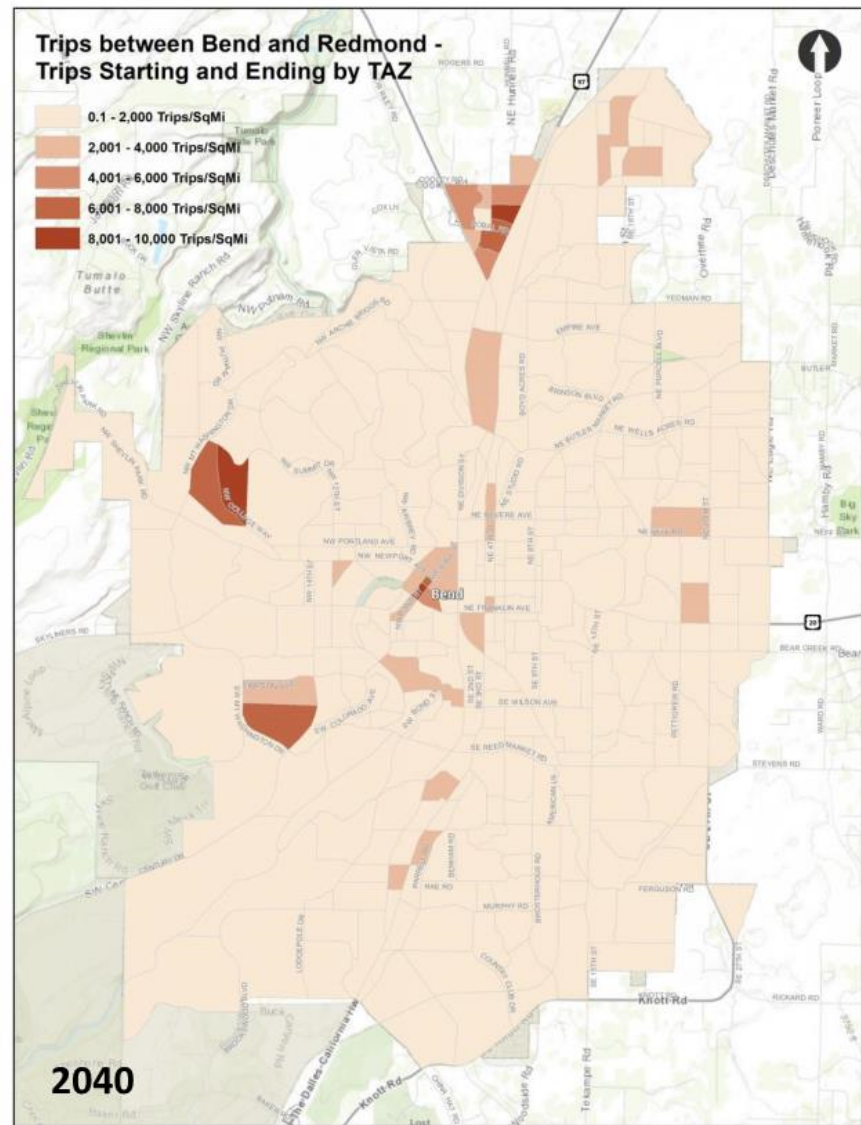
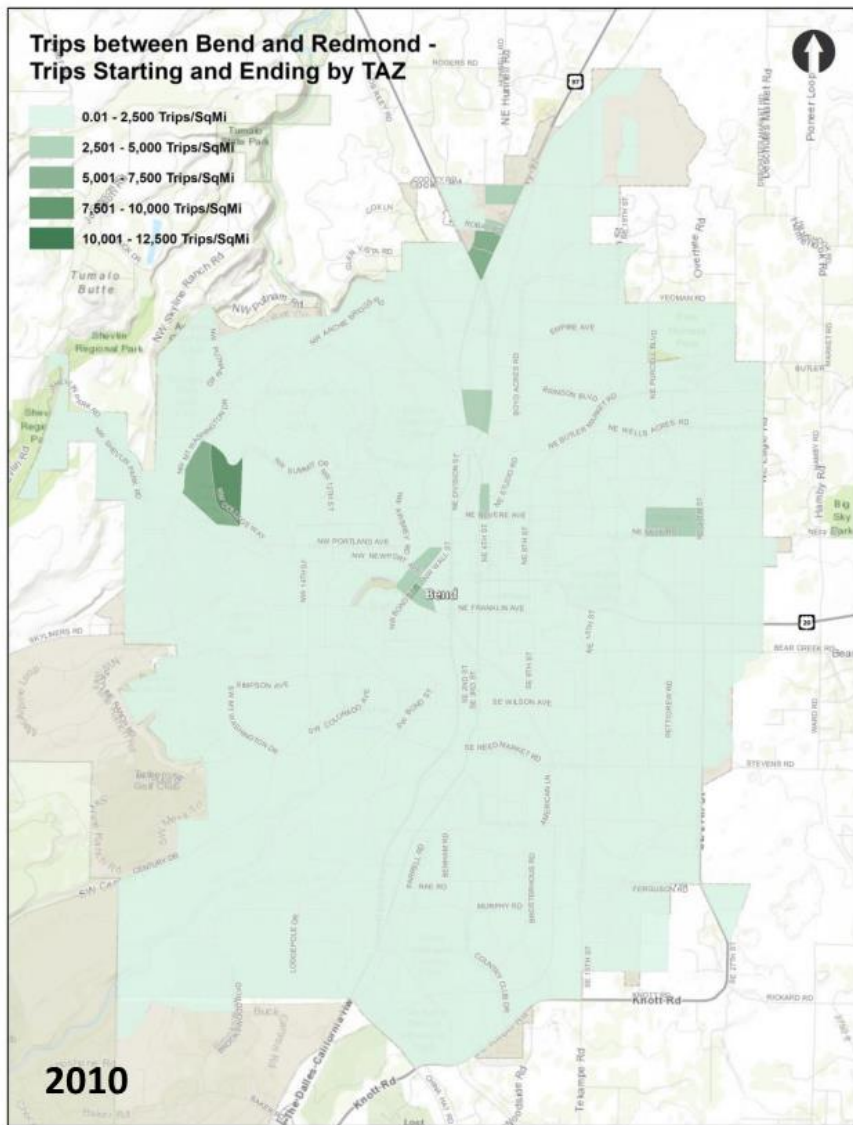


Figure 4: Bend Trips that connect to Redmond (Trips per SqMi)

Redmond

Figure 5 and Figure 6 show the number and density of trips to each TAZ in Redmond from Bend. The maps demonstrate:

- ▶ Intercity trips with Bend are concentrated in Redmond along Highway 97 and near the airport (most likely representing destinations for trips from Bend such as work trips) but are also widely distributed throughout Redmond (indicating residential trips from Redmond headed to Bend for work, shopping, medical trips, etc.).
- ▶ Trips to the airport from Bend are currently served by private shuttle providers; however, there may be potential to serve the airport with Route 24 or provide a transit connection from downtown Redmond to the Airport.

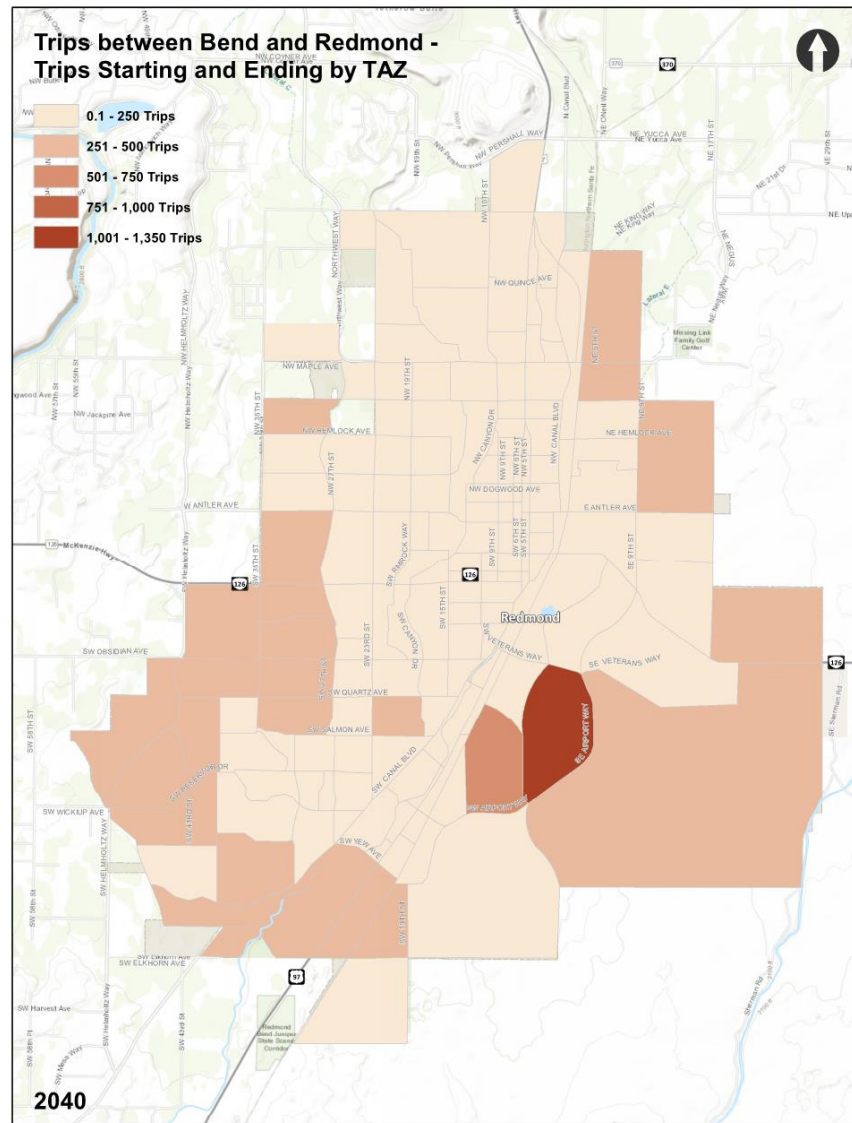
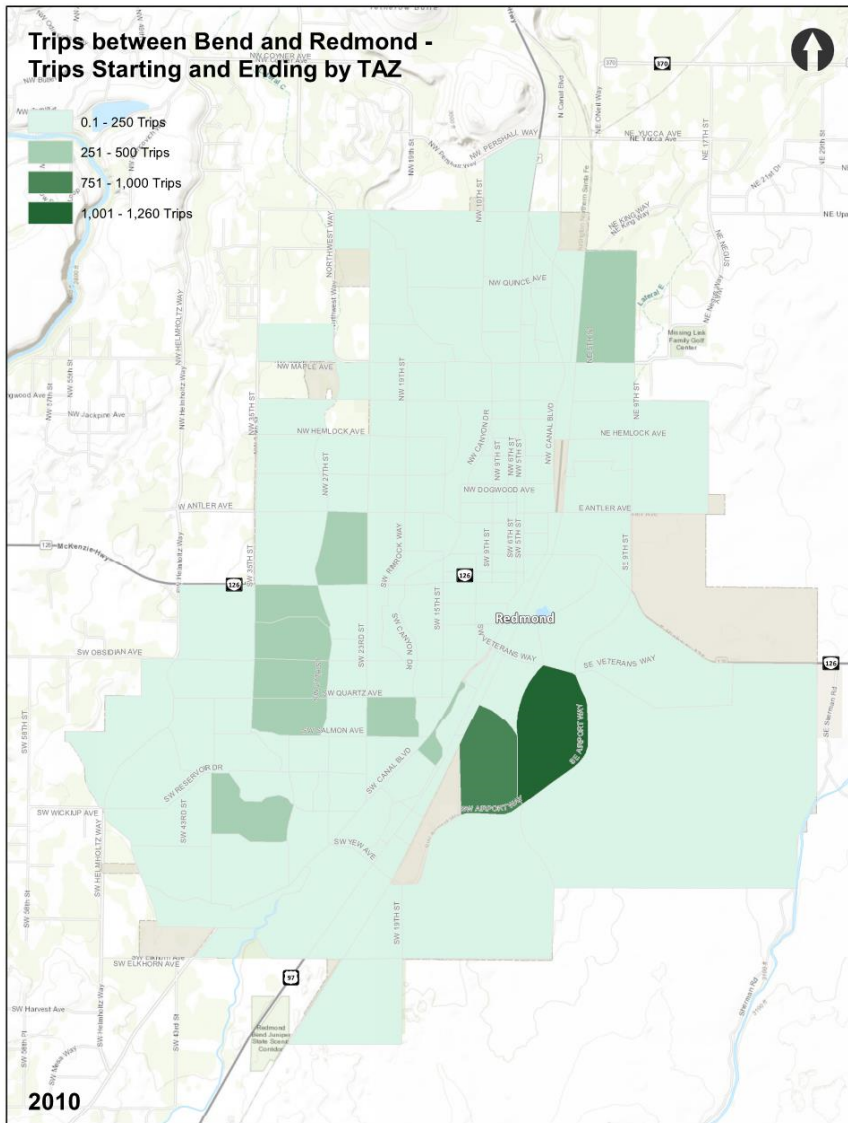


Figure 5: Redmond Trips that connect to Bend (Total Trips per TAZ)

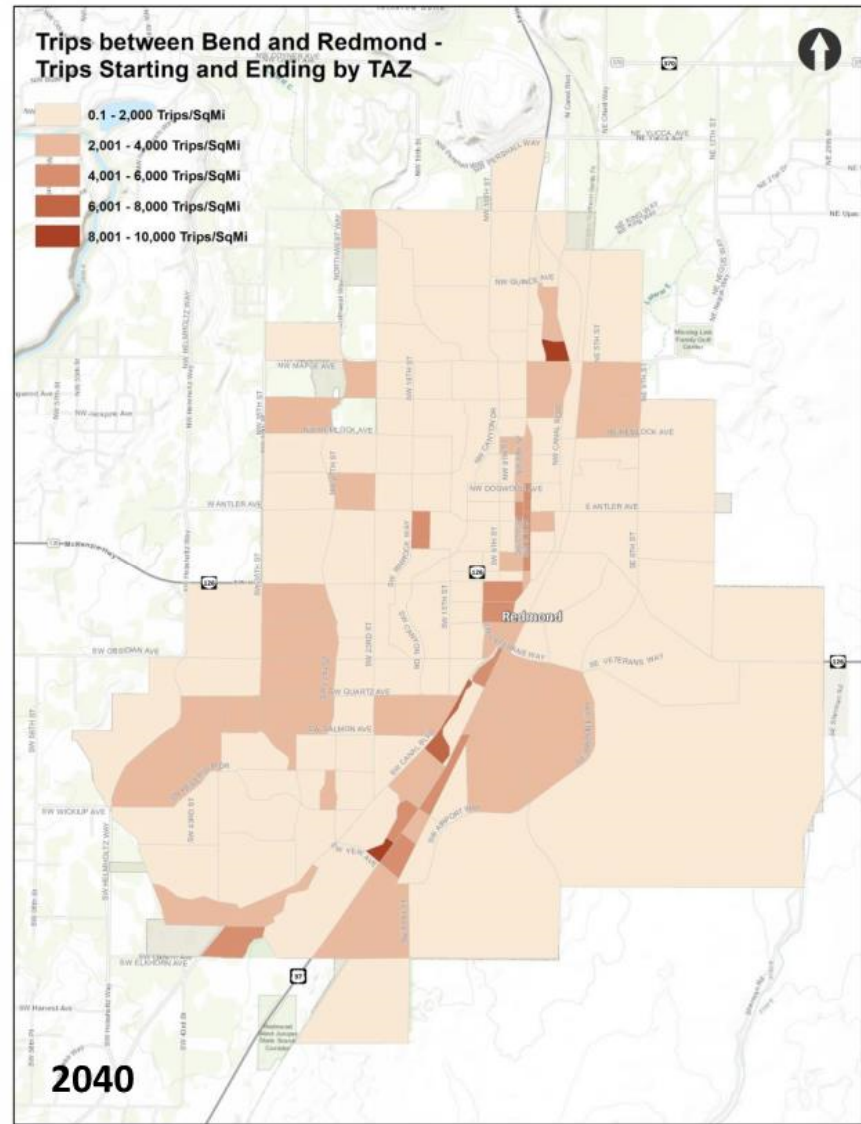
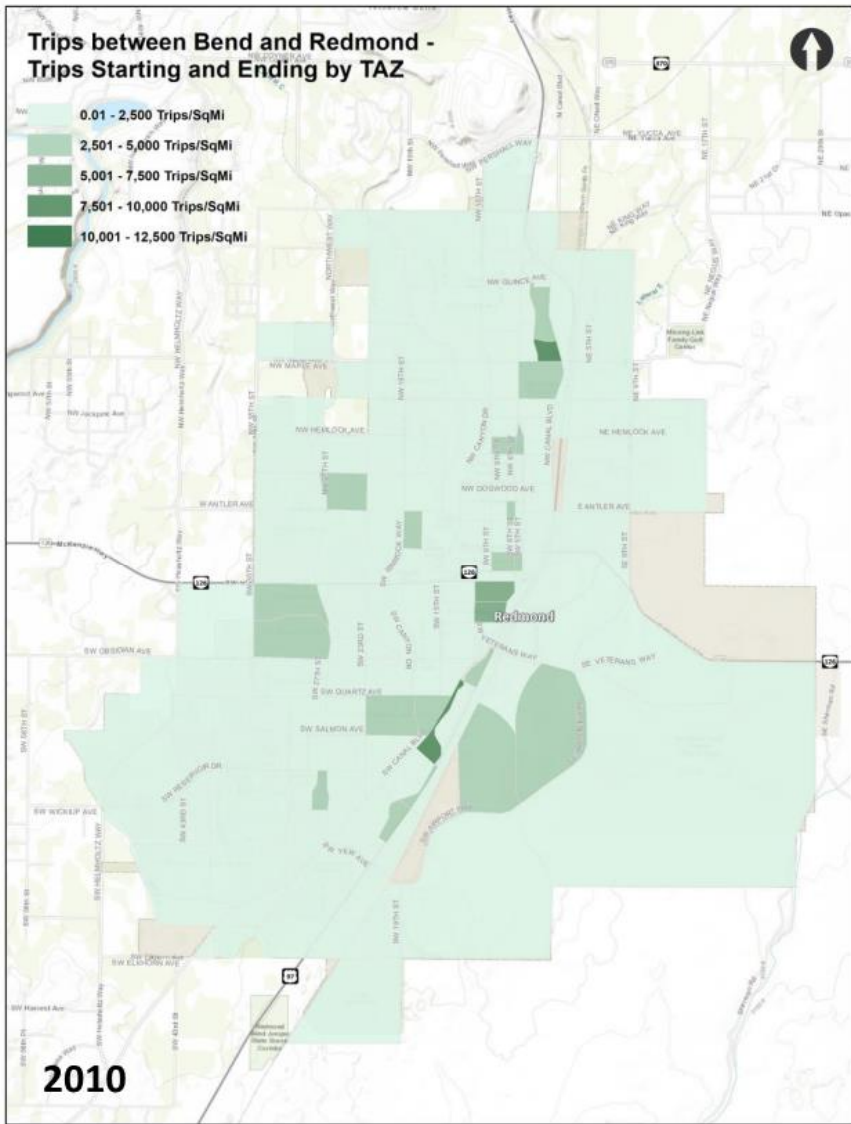


Figure 6: Redmond that connect to Bend (Trips per SqMi)

TRAVEL DEMAND BETWEEN CENTRAL OREGON CITIES AND BEND

Origins and destinations for intercity trips to or from locations within the Bend-Redmond model to or from locations outside of the model area were evaluated for model years 2010 and 2040. Between 2010 and 2040, the Bend-Redmond model predicts that intercity trips to the Bend-Redmond model area will grow from 45,310 to 65,991 trips per day (a 45 percent increase).

In the Bend-Redmond model, trips are assigned to gates on major roadways entering the model area. These external gates are shown in Figure 7 as blue dots. The origin or destination outside of the Bend-Redmond model area for trips with an origin or destination within the model area may be the immediate cities outside of the model area, such as Madras, Sisters, and La Pine; however, they can also be from greater distances away such as Salem and Portland. As a result, these external trips to/from the model area are referred to as “trips to and from the direction” of the nearest city. The full set of figures showing the Bend-Redmond origin or destination of the external trips to/from the area in the year 2010 and 2040 for each of the external areas is included in Appendix D. Example figures for trips to/from the direction of Madras/Warm Springs and Prineville are shown in Figure 8 and 9, respectively.

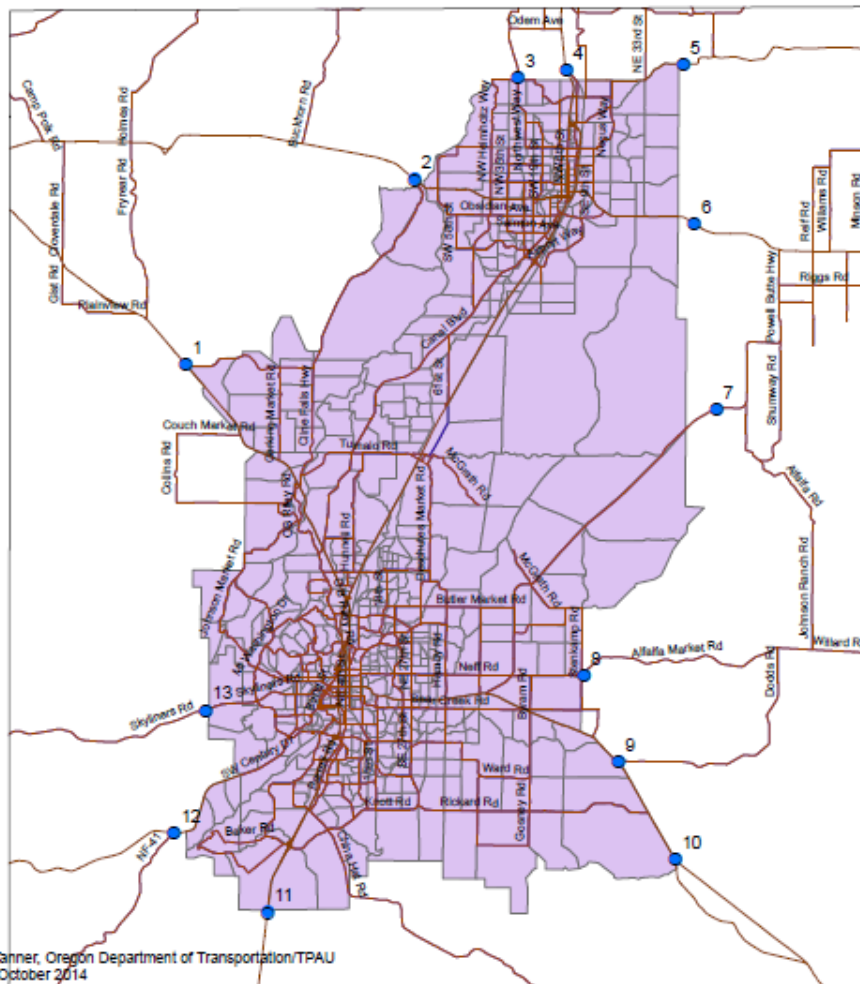


Figure 7: Bend-Redmond Model External Areas

The four directions that generate the most intercity trips to the Bend-Redmond model area are La Pine/Sunriver, Warm Springs/Madras, Prineville, and Sisters. Data for these locations are summarized in Table 6.

Table 6: Total Daily Regional Trips to and from Bend and Redmond

Direction of Travel	2010		2040	
	Bend	Redmond	Bend	Redmond
La Pine / Sunriver	9,009	353	11,567	653
Warm Springs / Madras	4,806	7,051	7,326	8,195
Prineville	3,591	4,734	5,147	6,124
Sisters	5,029	2,700	7,424	3,870

The following summarizes the travel patterns for trips to/from outside of the model area with an origin or destination in the Bend-Redmond model area based on the maps in Figure 8 and 9 and in Appendix D.

- ▶ Intercity trips are not clearly concentrated in a specific pattern in Bend and Redmond. Generally, the TAZs that receive the most intercity trips are either along the primary highway corridors in Bend and Redmond or larger residential areas.
- ▶ In 2010, each location generates over 3,500 daily trips to Bend. In 2040, the number increases to 5,100. Of note, Warm Springs / Madras direction generates a comparable number of trips to Bend as to Redmond in 2040 (as shown in Figure 8).
- ▶ Prineville generates a comparable number of trips to Bend as to Redmond in 2010 and 2040.
- ▶ The model estimates very few trips from the La Pine/Sunriver direction to Redmond in 2010 and 2040.

★ Star indicates where model assigned external trips

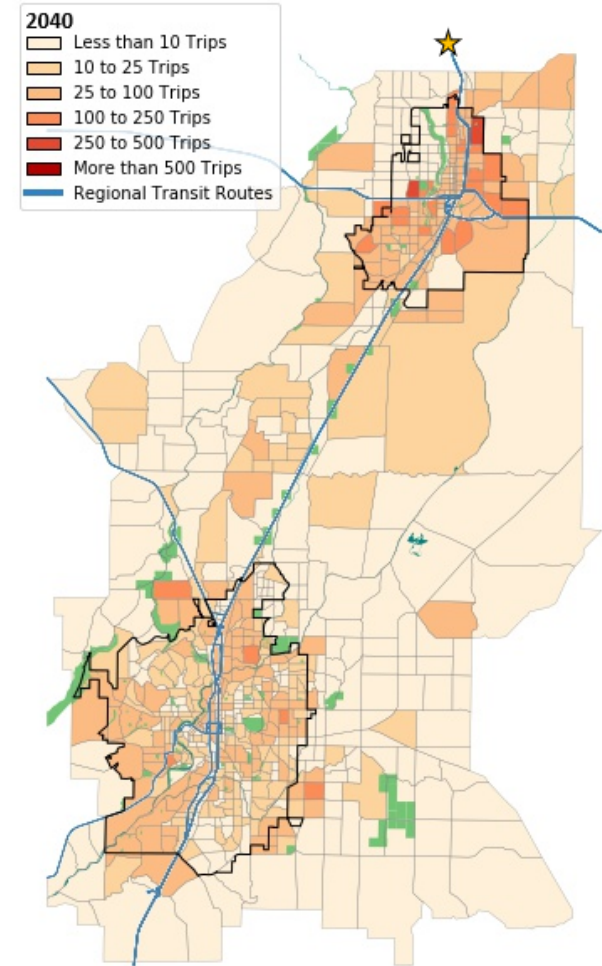
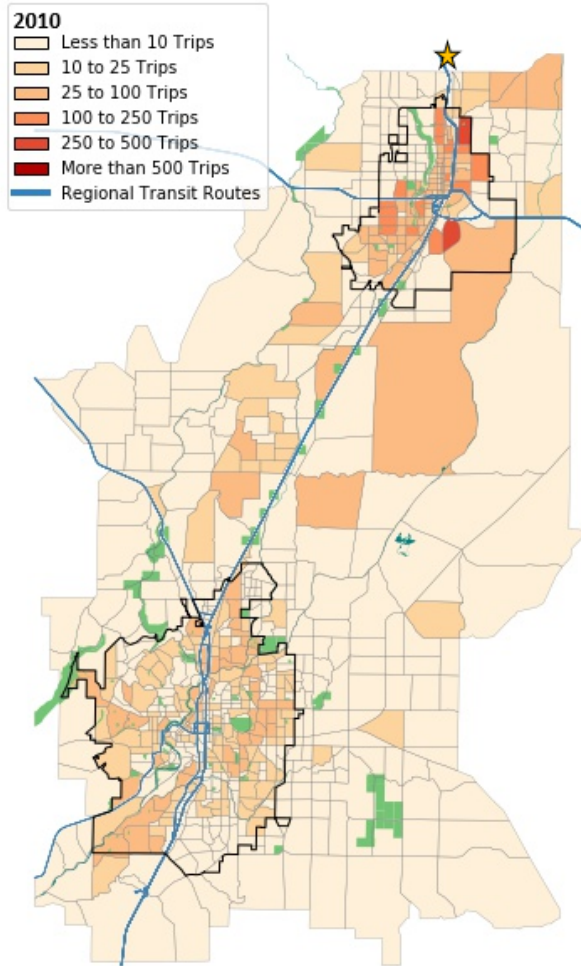


Figure 8: Trips to and from Warm Springs/Madras Direction

★ Star indicates where model assigned external trips

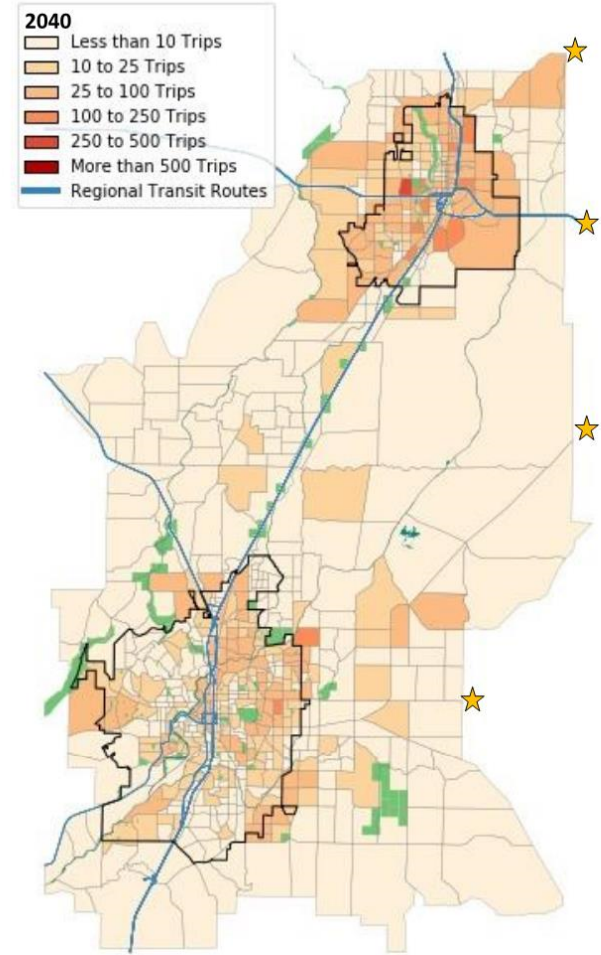
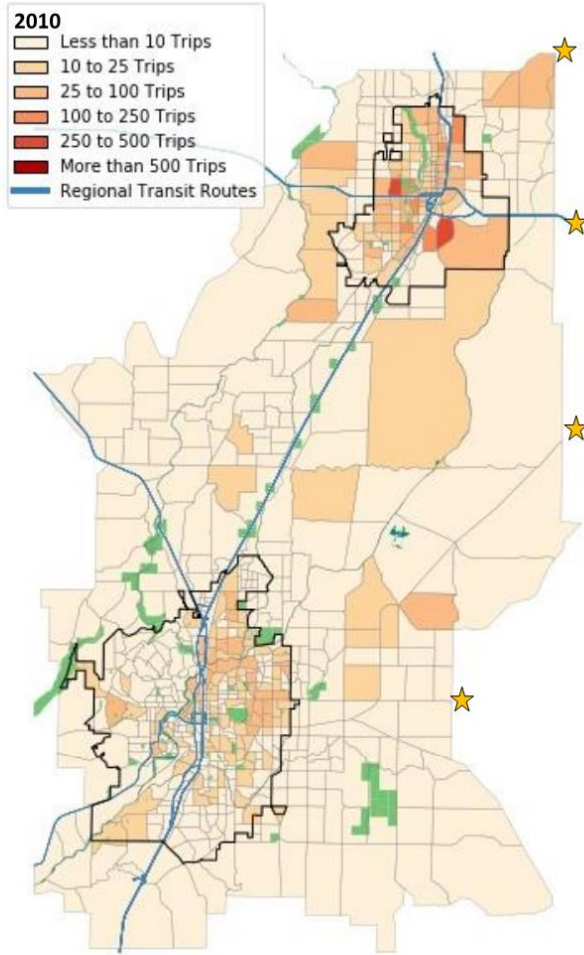


Figure 9: Trips to and from Prineville Direction

TRAVEL DEMAND FOR THE REDMOND MUNICIPAL AIRPORT

This section evaluates the feasibility of adding a transit route or stop to existing routes that serve the Redmond Municipal Airport (RDM) based on airport arrival and departure statistics as well as airport employee information.

ARRIVALS AND DEPARTURES

The flight data aggregator website, flightradar24.com, provides flight arrival and departure data in 15-minute intervals along with aircraft type. Table 7 lists the arriving and departing aircraft at RDM between Sunday, June 23 and Saturday, June 29, 2019 –capturing flight patterns for each day of the week – and the estimated number of passengers onboard each. Overall traffic did not vary noticeably between days of the week.

Table 7: Maximum Passengers by Aircraft Type Serving RDM

Aircraft Type	Number of Passengers Assumed Onboard
E75L/E75S	75
CRJ7	70
CRJ2	50
DH8D	80
A319	160

The number of passengers entering and exiting the airport were analyzed by hour blocks using the Monday travel data to represent typical weekday travel patterns (e.g. all passengers entering RDM between 6:00 and 6:59 a.m. were categorized as the 6:00 a.m. group). It was assumed that passengers arrive at the airport one hour prior to flight departure and leave the airport 30 minutes following flight arrival. It was also assumed that each plane arriving at and departing RDM were at capacity.

According to RDM, 38,528 passengers departed the airport in May 2019, compared to an estimated full-capacity volume of 40,830. The full-capacity estimate is based on day-of-the-week data from June 2019 and was seasonally adjusted by 0.89. Given the ratio between actual departing passengers and estimated departing passengers is over 0.94, the analysis relied on the estimated passenger volume.

Based on the analysis, the number of passengers entering RDM peak (greater than 200 per hour) during the 6:00 a.m. and 11:00 a.m. blocks, with steady entries throughout other times of the day. The number of passengers exiting RDM peak (greater than 200 per hour) during the 11:00 a.m., 3:00 p.m., 9:00 p.m., and 10:00 p.m. blocks, with fewer passengers exiting throughout the late morning and all afternoon. Combined passengers' entries and exits peak (greater than 300 per hour) during the 6:00 a.m., 11:00 a.m., and 3:00 p.m. These patterns are shown in Figure 10. CET Redmond service hours as of July 2019 are Monday-Friday, 6:30am-6:00pm.

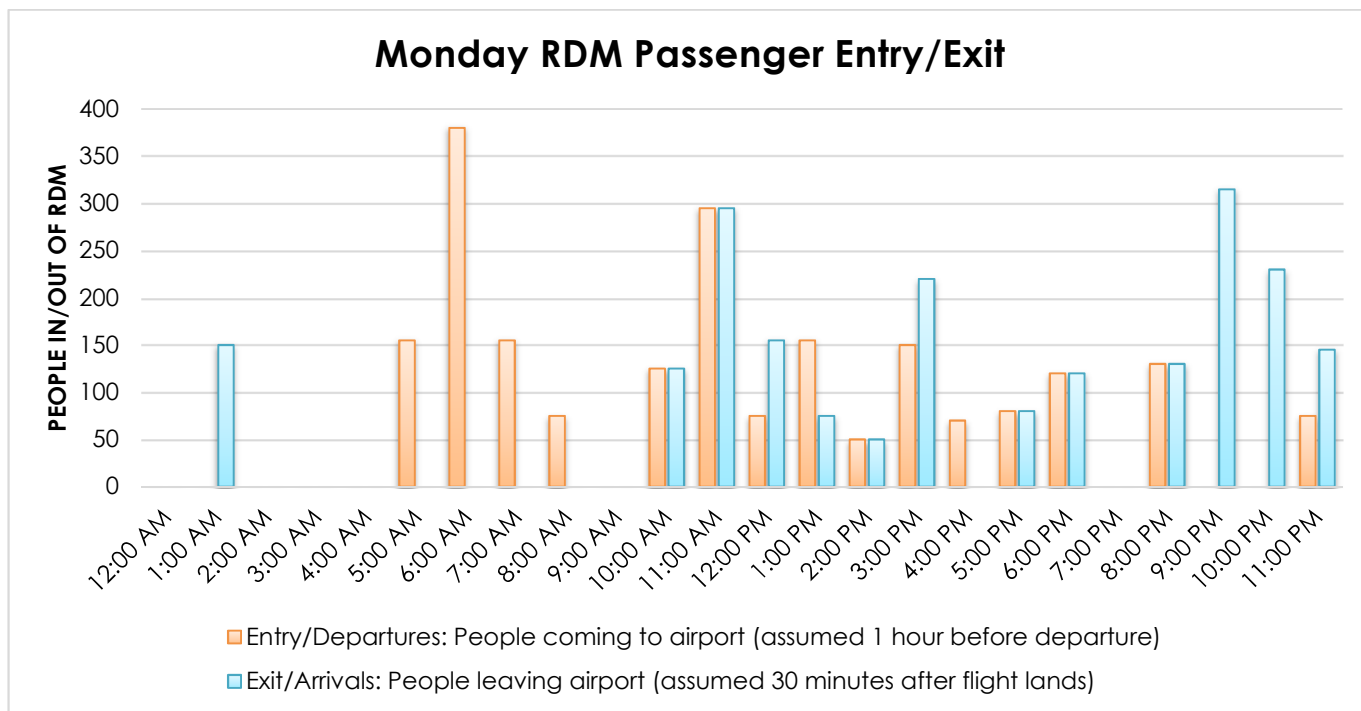


Figure 10: Monday RDM Passenger Entry/Exit

While this data was recorded the week of June 23rd, 2019, flight patterns vary at RDM by season. Utilizing 2018 Enplanement/Deplanement statistics from RDM, seasonal adjustment factors were calculated by month to adjust the above data; see Table 8. Because the data were collected in June, the seasonal adjustment factor for June is 1.00. Arrivals and departures both peak in July and August and reach their lowest count in January and February.

Table 8: RDM Seasonal Passenger Data

Month	Departures Seasonal Adjustment Factor	Arrivals Seasonal Adjustment Factor
January	0.79	0.71
February	0.75	0.72
March	0.84	0.82
April	0.84	0.82
May	0.89	0.89
June	1.00	1.00
July	1.16	1.13
August	1.14	1.10
September	0.96	0.92
October	0.98	0.92
November	0.92	0.90

Additionally, traffic in and out of RDM increases annually, and in recent years, has grown at approximately 12.1% per year, based on 2018 and 2019 enplanement data for March (10.2%), May (7.6%), and June (18.5%). This annual growth may complicate long-term use of the above seasonal adjustment factors when comparing RDM entry/exit traffic between different years.

The Redmond Airport provided data on passengers utilizing RDM and from where they travel. Figure 11 shows a general breakdown by percentage of passengers being served from the

Bend/Sunriver area, Redmond, "other" Central Oregon cities and towns, and those not traveling within Central Oregon. As shown, a majority of passengers served at RDM travel between the airport and the Bend/Sunriver area.

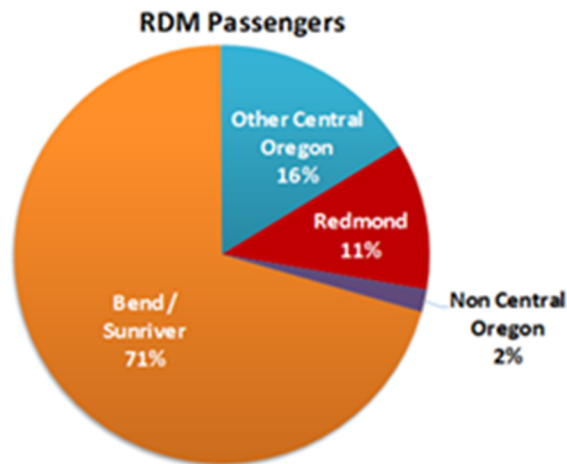


Figure 11: RDM Passenger Origins and Destinations

In contrast, the Bend MPO travel demand model, which includes vehicle trips between Bend and RDM and Redmond and RDM, shows that the majority of vehicle trips move between Redmond and RDM. The trips disperse throughout the City limits, but are densest along US 97, Canal Boulevard, and the Downtown core. This origin-destination data likely illustrates the employees that work at RDM who reside in Redmond; it may speak to the needs of RDM employees traveling to and from work that might benefit from routine transit service to the airport.

AIRPORT EMPLOYEES

Redmond Municipal Airport provided the following shift information of employees working at the airport, with 16 employers at RDM; shift information of the following groups is listed below:

- ▶ SP Plus three shifts: 12 a.m. to 8 a.m., 8 a.m. to 4 p.m., 4pm-12am
- ▶ TSA: 3am - last departure flight (typically 11:15pm)
- ▶ Ground crews: 3am - 1 hour after last flight arrival (typically 1:30am)
- ▶ Air mechanics: 7pm-7am
- ▶ Pub employees: 4:30am-8:30pm
- ▶ Retail employees: 3:30am-8:30pm
- ▶ Five rental car companies: Begins 7:30am, leaves 1:00am
- ▶ Security five shifts: 5am-1pm, 10am-5pm, 2pm-10pm, 5pm-12am, 10pm-6am
- ▶ Airport administration: 7am-4:30pm
- ▶ Airport custodial staff: 4am-2am
- ▶ Airport operations: 4am-11pm (summer), 4am-1am (winter)
- ▶ Others: 5am-7pm

According to RDM, the 16 employers listed above employ approximately 370 staff. This does not include airfield staff, such as FBO, flight school staff, etc. Therefore, the number of employees is greater than the 370 staff working for the above employers.

AIRPORT TRANSIT NEEDS

Based on the passenger entry and exit analysis and the existing and future travel demand within CET's service area, the following preliminary service additions will be considered during the next phase of the project to better serve those flying into and out of Central Oregon as well as those who work at RDM:

- ▶ New fixed route connection between Hawthorne Station in Bend, the Redmond Transit Hub in Redmond, and RDM.
 - ▶ Hours of operation could serve 6:00 a.m. and 11:00 a.m. flight departures as well as 11:00 a.m. and 3:00 p.m. arrivals (all other peak times served by dial-a-ride transit).
 - ▶ Circulate Community Connector throughout Redmond between flight departures and arrivals.
 - ▶ Annual service cost is approximately \$460k at \$106/hour for 12 hours a day 365 days a year
- ▶ New stop added to the Community Connector Route 24 (Redmond-Bend)
 - ▶ Leave Redmond Transit Hub at 5:00 a.m. and final arrival to Redmond Transit Hub at 9:02 p.m.
 - ▶ Additional annual service cost is approximately \$58k for operating an extra 90 minutes a day 365 days a year

FUTURE POPULATION AND EMPLOYMENT DENSITIES FOR BEND & REDMOND

TRANSIT MARKET LAND USE GUIDELINES

Public transportation service is generally designed to be compatible with the surrounding land use context and intensity of development, which is often measured using population and employment densities. These densities reflect the presence of residential locations and activity centers where people need to get to and from on a regular basis. Setting development density guidelines provides transit agencies with quantifiable benchmarks that they can use to most efficiently target public transportation resources where there is the greatest likelihood people will choose to use transit.

Transit service can be categorized into the following types:

- ▶ **Local service** provides connections within communities, generally with relatively closely spaced stops. Local services can be designed to achieve productivity or coverage, although in practice most transit systems have a mix of these services and strike a balance between these goals:
 - ▶ **Productivity-oriented services** are relatively high frequency routes designed to operate to maximize ridership per hour of service. These routes aim to provide quick, convenient trips that provide high convenience and mobility to the busiest activity centers and highest concentrations of residences and jobs.
 - ▶ **Coverage-oriented services** are lower frequency services typically designed to serve fewer riders over a relatively large area. Service types in this category may provide transit-dependent customers not living near bus routes with reliable mobility options that may require reservations and less direct travel.

- ▶ **Regional or intercity services**, such as the CET Community Connector routes, typically connect cities, serving relatively few major stops at key activity or employment centers and connecting to local service with each city. Intercity frequency is based on market size and can be scaled to meet demand.

Figure 12 summarizes the local transit route types, with a description, typical transit service type and vehicle used to serve the routes, and population and employment density threshold guidelines for both route and activity center scales.


















LAND USE			TRANSIT	
Land Use Type	Residents per Acre	Jobs per Acre	Appropriate Types of Transit	Frequency of Service
 Urban Mixed-Use	20+	15+	 BRT  Rapid Bus  Local Bus	 10-15 minutes
 Neighborhood & Suburban Mixed-Use	10-20	10-15	 Local Bus	 15-30 minutes
 Mixed Neighborhoods	10-15	5-10	 Local Bus  On-Demand	 30-60 minutes or on-demand
 Low Density	2-10	2-5	 On-Demand  Rideshare  Volunteer Driver Pgm	 60 mins or less or on-demand

Figure 12: Local Transit Service Design Policy Guidelines Summary

Source: Nelson\Nygaard

The following sections assess population and employment densities in Bend and Redmond compared to the above guidelines for local transit service types and frequency. It then analyzes the distribution of population and jobs in Bend and Redmond (using information within the Bend-Redmond Travel Demand Model) along with the presence of existing transit service and identifies existing and potential future underserved areas in Bend and transit supportive areas in Redmond. The model data supporting this analysis is not currently available for all of the cities outside of Bend and Redmond; however, the information about Bend workers and Bend jobs is relevant to all of Central Oregon given the regional commute patterns and percentage of Community Connector trips for work purposes.

BEND POPULATION AND EMPLOYMENT DENSITIES

POPULATION DENSITY

An important factor for transportation planning is how densely developed residential areas are as it helps match bus service to the expected number of riders.

The Bend Metropolitan Planning Organization (BMPO) maintains a travel demand model used to forecast transportation needs throughout the region. The model includes forecasted population and employment based on county- and city-level forecasts prepared by the State of Oregon and Portland State University's (PSU) Population Research Center. The forecasts are based on historical data from the State and the U.S. Census Bureau and are updated annually. The current model years are 2010 (base year) and 2040 (horizon year).

Figure 13 shows the population density throughout Bend in the years 2010 and 2040 relative to a quarter-mile walkshed from existing transit service. The City of Bend's population is forecast to reach 125,000 people by the year 2040 – a 65% increase – within current city limits.³ Population within the Bend Urban Growth Boundary (UGB) – including outside current city limits – is projected to increase to nearly 145,000 people – by 87%.⁴

Moderate or higher residential density is an indicator of an adequate concentration of population to support reasonably frequent fixed-route transit service. Some areas of moderate residential density in Bend include north of Greenwood Road east of Pilot Butte, along NE 27th Avenue, Downtown and Old (Central) Bend, and in western Bend along Newport Avenue. The population forecasts suggest increased densities in these areas plus eastern Bend (Mountain View neighborhood), near NE Butler Market Road (Orchard District), southwest Bend, and the Old Farm / southeast Bend districts.

³ Bend MPO (Population data by TAZ)

⁴ Portland State University Population Research Center, Deschutes County Coordinated Population Forecast, 2015-2065

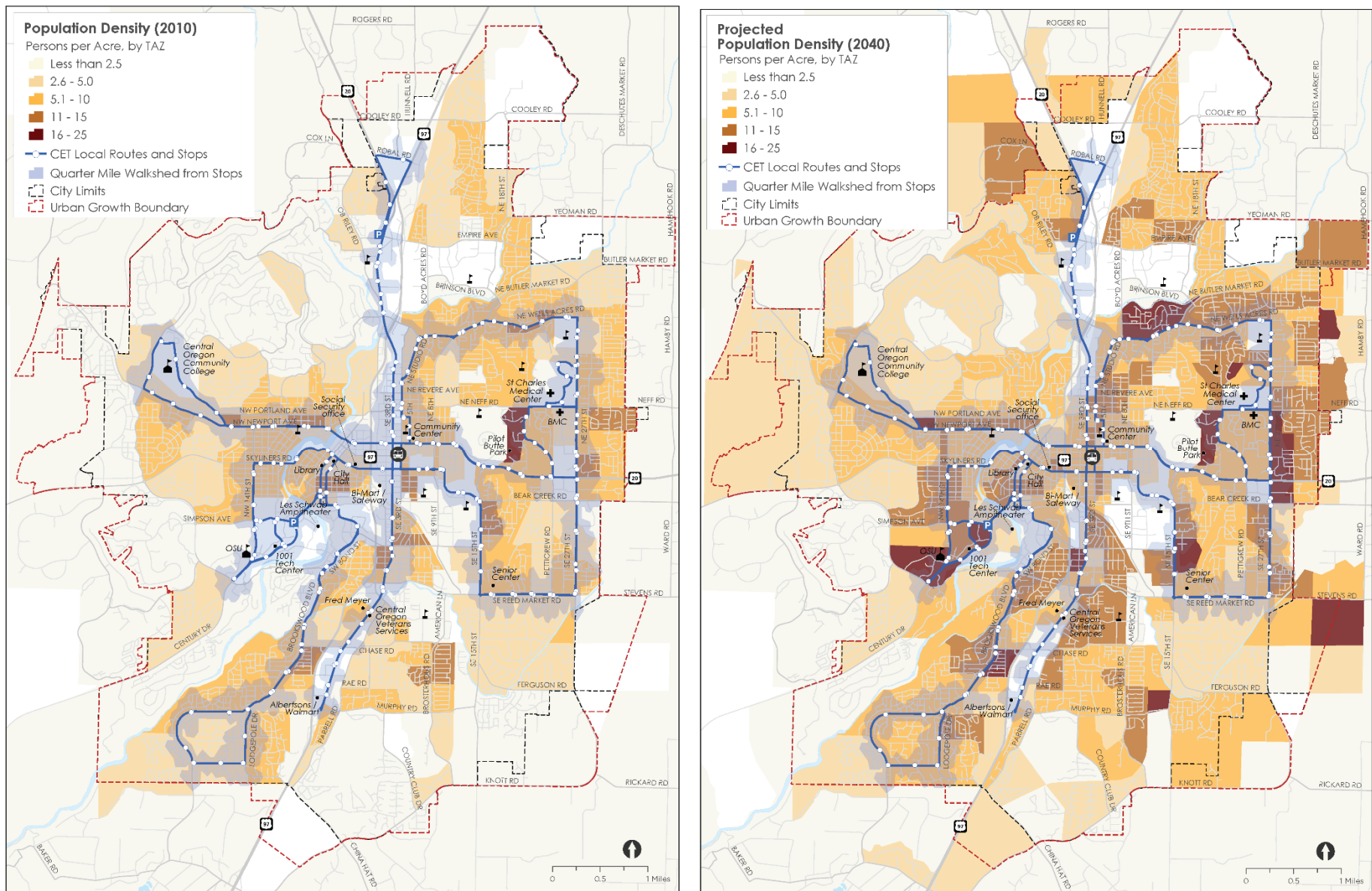


Figure 13: Population Density, 2010 and 2040

Where Bend Workers Live

The U.S. Census Bureau compiles Longitudinal Employer-Household Dynamics (LEHD) data that provides an understanding of work commute patterns. Analyzing where people live and work helps point to where different route types may be most needed to connect people to their jobs. For the purpose of this analysis of local transit service in Bend, where workers live in Bend is most relevant and is considered for both people who live and work in Bend and people who live in Bend but commute outside Bend for work. The regional Transit Master Plan will look in more detail at local service in other cities in the region (including home locations of people who live outside of Bend and commute to Bend for work). Figure 14 shows home locations for people working in Bend (left panel) and outside Bend (right panel).

In general, the geographic distribution of worker home locations is consistent with the distribution of the population as a whole, with greater concentrations of workers living in eastern, northeastern, and southern Bend, and in the Downtown area. People who live and work in Bend have relatively short-distance commutes and providing well-timed transfers or single-seat transit rides and improving walking access to transit are likely important to increasing the appeal of local transit service. There are fewer Bend residents working outside the city, and their density is in the same corridors and neighborhoods as those working in Bend, in particular in eastern Bend on Highway 20, in northeastern Bend on NE Butler market Road, and near Downtown. Efficiently connecting Bend residents who work outside of Bend to Hawthorne Station (or another Community Connector stop) at convenient times could help increase the appeal of CET's longer-distance intercity connections.

Most home locations are within a quarter mile of existing transit service. Several exceptions with moderate or higher concentrations of workers include portions of the Summit West (northwest), Old Farm District (southeast), and Boyd Acres (northeast) neighborhoods. Transit service gaps are discussed in more detail below. Table 9 summarizes the cities where Bend residents work. Most workers both live and work in Bend (67%). Over 5% of Bend residents work in Redmond with approximately 1% each working Sunriver, Prineville, and Sisters. The data also indicates commuting to cities in the Willamette Valley, which may be a limitation of the data, e.g., people who work for an employer based in another city, although they may work at an office or home office location in or near Bend.

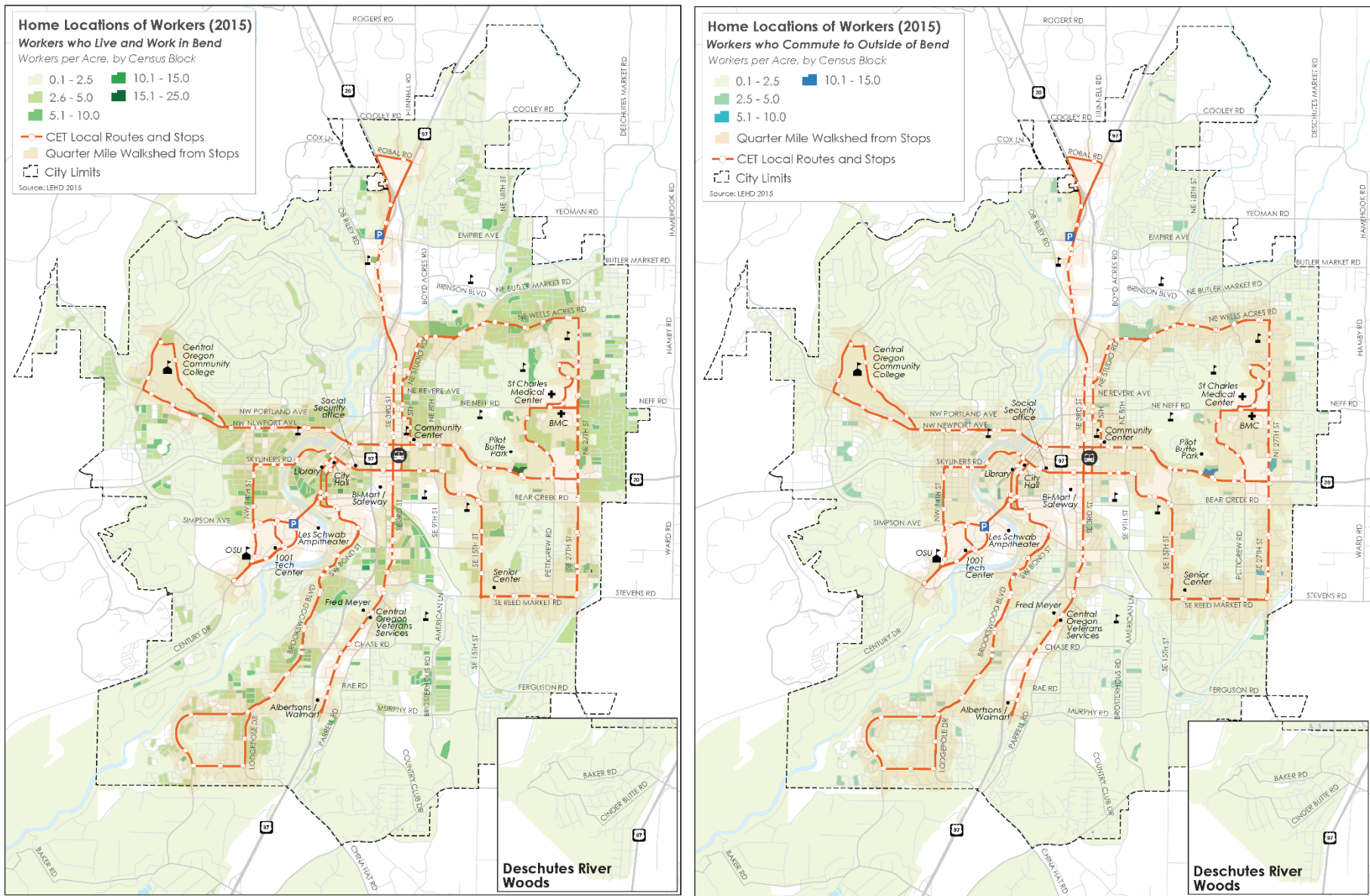


Figure 14: Worker Home Locations: Work and Live in Bend (left) and Work Outside Bend (right)

Table 9: Where Bend Residents Work (Top 10)

Work Location	Persons	Share of total workers
Bend	24,974	67.0%
Redmond	1,890	5.1%
Portland	1,195	3.2%
Salem	497	1.3%
Eugene	448	1.2%
Sunriver CDP	376	1.0%
Prineville	305	0.8%
Sisters	238	0.6%
Medford	236	0.6%
Tigard	219	0.6%
All Other Places	6,870	18.4%

Source: U.S. Census Bureau, 2015

BEND EMPLOYMENT DENSITY

Understanding job locations and densities is equally important to informing transit service priorities in Bend. Figure 15 below illustrates employment densities in Bend from the BMPO travel demand model. The year 2010 and 2040 maps show the distribution of employment in the City relative to a quarter-mile walkshed from existing transit service. Overall the employment in the region is forecasted to increase 115% between the years 2010 and 2040. In the City of Bend, employment is forecasted to increase about 80% in that period, from nearly 40,000 jobs to over 70,000. Bend's share of regional employment is forecasted to decrease 10 percentage points to about 65%.

In 2010 the moderate (or higher) density employment areas include:

- ▶ Downtown Bend and the Central District along 3rd Street east of downtown
- ▶ St. Charles Medical Center area and health services office locations in the near vicinity
- ▶ Oregon State University Campus
- ▶ Central Oregon Community College Campus (northwest)
- ▶ The Old Mill District in southwestern Bend

The employment forecasts to the year 2040 indicate each of the areas listed above growing/intensifying with medium- to high-density of employment. Other emerging employment areas include:

- ▶ Southern Bend, in the Highway 97 Corridor
- ▶ North-central Bend between NE Butler Market Road and Empire Avenue (Orchard / Boyd Acres Districts)
- ▶ Northern Bend in the Highway 97 / Highway 20 triangle (central Boyd Acres District)
- ▶ Juniper Ridge area in northeastern Bend, north of Cooley Road (north Boyd Acres District)

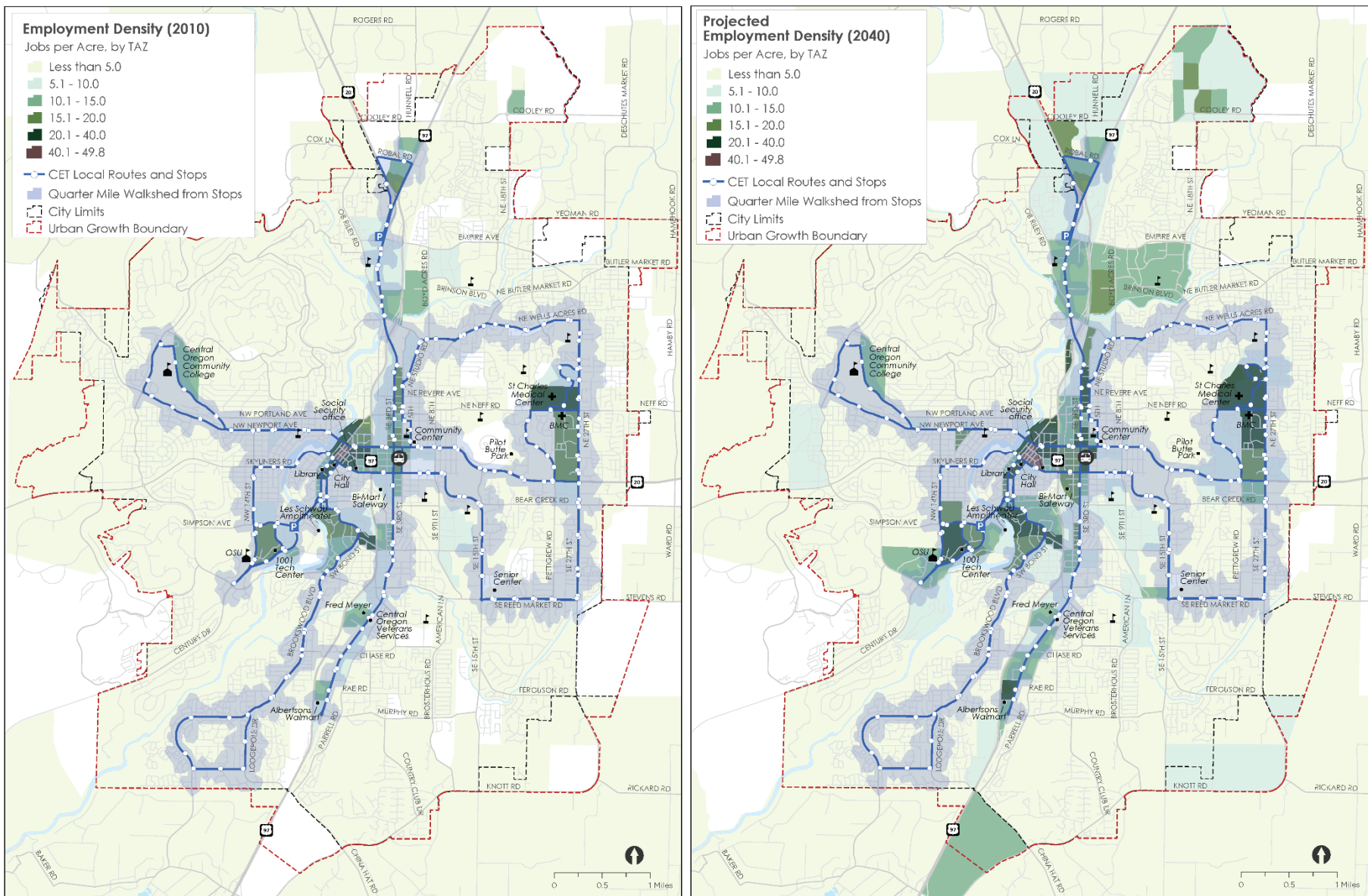


Figure 15: Employment Density, 2010 and 2040

Bend Work Commute Patterns

As noted above, LEHD data helps understand work commute patterns and informs how transit service may be designed to support those travel patterns. Figure 16 shows the work locations for people who commute into Bend from outside the city (by any mode). The densest employment areas are at Central Oregon Community College, in Downtown and the Old Mill, near St. Charles Medical Center, at OSU and adjacent employment areas, and along 3rd Street (e.g., Bend River Promenade). The transit market potential for in-commuters can be maximized by providing interlined (single-seat) or well-timed local connections from Community Connector routes at times that are convenient for workers.

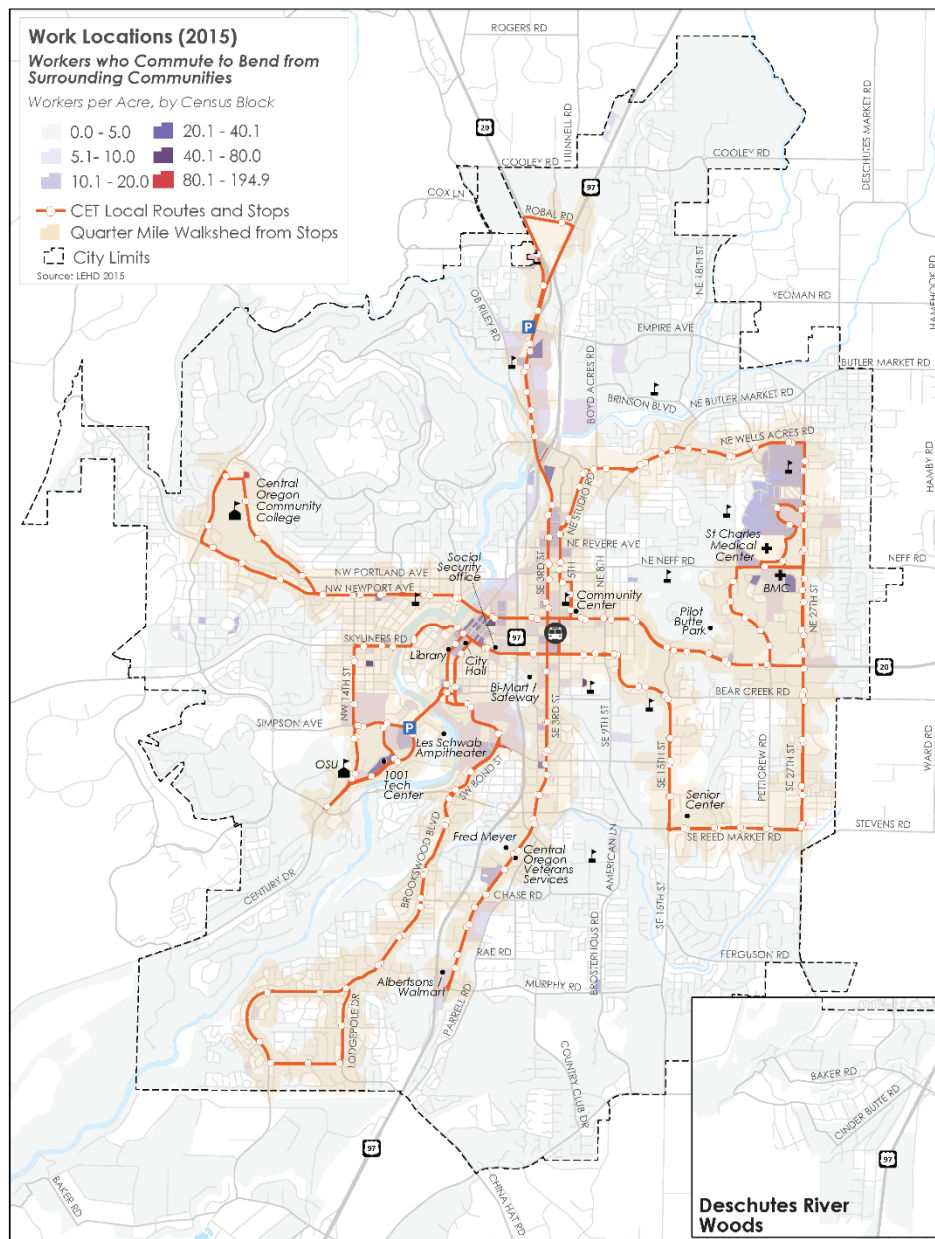


Figure 16: Work Locations for People Living Outside Bend

Table 10 summarizes where people who work in Bend live. Over half of workers live in Bend. Other concentrations of workers are in Redmond (7.2%), Deschutes River Woods (3.3%, located

just outside Bend city limits), and Prineville (1.2%). A relatively small share number of works commute from Madras (less than 1%). Taken together with work commute patterns from Bend to the region (see Table 10), the data show that about twice as many people commute from Redmond to Bend for work, as from Bend to Redmond, and the combined data suggests that Redmond is a relatively large potential transit commute market for CET, while other markets (such as Prineville-Bend) have only a moderate market size. See the *Needs Memo Supplement* for additional information on origins and destinations for trips between Redmond and Bend.

Table 10: Where People Working in Bend Live, 2015

Home Location	Persons	Share of total workers
Bend	24,974	53.1%
Redmond	3,392	7.2%
Deschutes River Woods	1,561	3.3%
Portland	692	1.5%
Prineville	556	1.2%
Eugene	418	0.9%
Three Rivers	285	0.6%
Madras	242	0.5%
Salem	232	0.5%
Eagle Crest	222	0.5%
All Other Places	14,476	30.8%

Commute Start Times

This section describes commute start times based on 2017 American Community Survey (ACS) data for those leaving for work from individual origins throughout the day. Table 11 summarizes the share of regional, Bend, and Redmond commuters leaving for work during specific time blocks. The list below provides key observations of commute start times. Most routes in Bend currently operate from approximately 6 a.m. to 7:00-7:30 p.m.

- ▶ The largest share of early commuters leaves between 6 a.m. and 7 a.m.
- ▶ The highest share of commuters leaves for work between 7 a.m. and 9 a.m.
- ▶ There doesn't appear to be a consistent regional pattern in this data for commuters who leave for work very early. Although a larger share of La Pine and Metolius residents reported leaving for work prior to 6 a.m., the sample size for these communities is relatively low.
- ▶ The ACS does not provide data for when people get off work but has broad categories that likely include people who leave work in the later evening. Similar to early commuters, there doesn't appear to be a consistent regional pattern.

Table 11: Share of Commuters Leaving for Work at Certain Times by Region, Bend, and Redmond (All Modes)

Geography/Category	# of People	% of Geography
REGIONAL (All Cities)		
Share of Regional Commuters Leaving for work between 5 and 6 am.	4,473	7%
Share of Regional Commuters Leaving for work between 6 and 7 am.	10,440	16%
Share of Regional Commuters Leaving for work between 7 and 9 am.	30,524	47%
Share of Regional Commuters Leaving for work between 4 pm and 12 am.	3,380	5%
Share of Regional Commuters Leaving for work between 12 and 5 am.	3,163	5%
BEND		
Share of Bend Commuters Leaving for work between 5 and 6 am.	2,157	6%
Share of Bend Commuters Leaving for work between 6 and 7 am.	6,356	16%
Share of Bend Commuters Leaving for work between 7 and 9 am.	19,054	49%
Share of Bend Commuters Leaving for work between 4 pm and 12 am.	1,823	5%
Share of Bend Commuters Leaving for work between 12 and 5 am.	966	2%
REDMOND		
Share of Redmond Commuters Leaving for work between 5 and 6 am.	1,057	9%
Share of Redmond Commuters Leaving for work between 6 and 7 am.	2,056	17%
Share of Redmond Commuters Leaving for work between 7 and 9 am.	5,251	43%
Share of Redmond Commuters Leaving for work between 4 pm and 12 am.	870	7%
Share of Redmond Commuters Leaving for work between 12 and 5 am.	1,024	8%

Source: American Community Survey, 2013-2017, Table B08302

The following list summarizes origins having the top number of commuters leaving during early and late hours of the day.

- ▶ Top places with commuters leaving between 5 and 6 a.m.
 - ▶ Bend (2,157), Redmond (1,057), Deschutes River Woods (374), and Prineville (318)
- ▶ Top places with commuters leaving between 4 p.m. and 12 a.m.
 - ▶ Bend (1,823), Redmond (870), Deschutes River Woods (162), and Prineville (156)
- ▶ Top shares of commuters leaving between 5 and 6 a.m.
 - ▶ Deschutes River Woods (14%), Culver (13%), Metolius (11%), and Warm Springs (11%)
- ▶ Top shares of commuters leaving between 4 p.m. and 12 a.m.
 - ▶ Terrebonne (13%), Sunriver (10%), Culver (8%), and Redmond (7%)

Table 12 summarizes the estimate of the time residents leave home to commute to work, by city or town.

Table 12: Number of Residents Leaving Home to Commute to Work by Time of Day (All Modes)

Place	Total	12 a.m.	5 a.m.	6 a.m.	7 a.m.	9 a.m.	12 p.m.	4 p.m.
		to 5 a.m.	to 6 a.m.	to 7 a.m.	to 9 a.m.	to 12 p.m.	to 4 p.m.	to 12 a.m.
Bend city	38,706	966	2,157	6,356	19,054	6,001	2,349	1,823
Culver city	661	73	88	95	231	81	43	50
Deschutes River Woods CDP	2,700	137	374	321	1,199	347	160	162
La Pine city	693	55	70	161	226	95	57	29
Madras city	2,343	272	84	374	1,044	158	321	90
Metolius city	413	55	44	93	119	21	59	22
Prineville city	3,437	292	318	480	1,365	528	298	156
Redmond city	12,205	1,024	1,057	2,056	5,251	1,287	660	870
Sisters city	1,058	22	83	120	542	165	114	12
Sunriver CDP	258	-	-	-	222	-	9	27
Terrebonne CDP	476	25	36	17	197	-	140	61
Three Rivers CDP	1,536	173	62	275	596	236	167	27
Warm Springs CDP	880	69	100	92	478	40	50	51

Note: Top 20 Time Blocks with the highest estimated commute starts, across all 13 places, are shaded grey.
 Source: American Community Survey, 2013-2017, Table B08302

Based on the estimates in Table 12 above, Table 13 summarizes the percentages of the time residents leave home to commute to work, by city or town.

Table 13: Percentage of Residents Leaving Home to Commute to Work by Time of Day (All Modes)

Place	Total	12 a.m.	5 a.m.	6 a.m.	7 a.m.	9 a.m.	12 p.m.	4 p.m.
		to 5 a.m.	to 6 a.m.	to 7 a.m.	to 9 a.m.	to 12 p.m.	to 4 p.m.	to 12 a.m.
Bend city	38,706	2%	6%	16%	49%	16%	6%	5%
Culver city	661	11%	13%	14%	35%	12%	7%	8%
Deschutes River Woods CDP	2,700	5%	14%	12%	44%	13%	6%	6%
La Pine city	693	8%	10%	23%	33%	14%	8%	4%
Madras city	2,343	12%	4%	16%	45%	7%	14%	4%
Metolius city	413	13%	11%	23%	29%	5%	14%	5%
Prineville city	3,437	8%	9%	14%	40%	15%	9%	5%
Redmond city	12,205	8%	9%	17%	43%	11%	5%	7%
Sisters city	1,058	2%	8%	11%	51%	16%	11%	1%
Sunriver CDP	258	0%	0%	0%	86%	0%	3%	10%
Terrebonne CDP	476	5%	8%	4%	41%	0%	29%	13%
Three Rivers CDP	1,536	11%	4%	18%	39%	15%	11%	2%
Warm Springs CDP	880	8%	11%	10%	54%	5%	6%	6%

American Community Survey, 2013-2017, Table B08302

Bend Employment Centers

The concentration of jobs at existing and future employment centers in Bend is important to understanding where public transportation can provide the most effective mobility services, and which types of services and strategies should be considered. Table 14 presents guidelines for employment center types based on density and employment characteristics that are analyzed in this section for different employment centers in Bend. These are intended to help understand what type or level of transit service is (or will be) needed.

Employment density provides a quantitative measure that directly relates to the ability to support transit service. Other factors that could be considered include job type or industry sector (e.g. retail, manufacturing, office), major academic institutions, typical shift hours, and parking availability. For some types of employment uses, the number of jobs can also act as a proxy for the number of customers, another potential public transportation market.

Table 14: Employment Center Guidelines

Route Type	Description	Density Guideline at Activity Centers (jobs per acre)
Tier 1 – Anchor	Highest daytime work population and consistent customer volumes	20+ jobs
Tier 2 – Major	High work population, and/or significant customer volumes	10 – 20 jobs
Tier 3 - Local	Moderate trip generator; fewer jobs (senior center, event venue)	5-10 jobs

Figure 17 identifies areas in the city of Bend that could be considered employment centers based on job density thresholds. These areas include employment and opportunity areas identified by the City of Bend's Comprehensive Plan and Core Area Project. Table 15 provides the number of jobs and job density in the zones based on current and forecasted conditions. Current conditions were based on LEHD data for 2015, which is the most recent available, while forecasted conditions were from Bend MPO projections.

Downtown Bend and St. Charles Medical Center stand out as employment anchors, both today and in the future. Several other major employment centers today include the Old Mill, Central Westside, and Central Eastside. These areas along with the Forum Shopping Center are forecasted to grow through 2040, although the most significant growth areas are forecasted to be Cascade Village, Juniper Ridge, along Empire Avenue, and far south US 97. Other local employment areas include the COCC and OSU campuses, where the student population (commuter or residential) would be an additional indicator of transit demand.

These current and emerging employment centers indicate where expanded and improved public transportation service is likely to see the strongest demand in the future. This is evident in the employment density analysis, analysis of local travel patterns, and City plans to continue encouraging development in these areas.

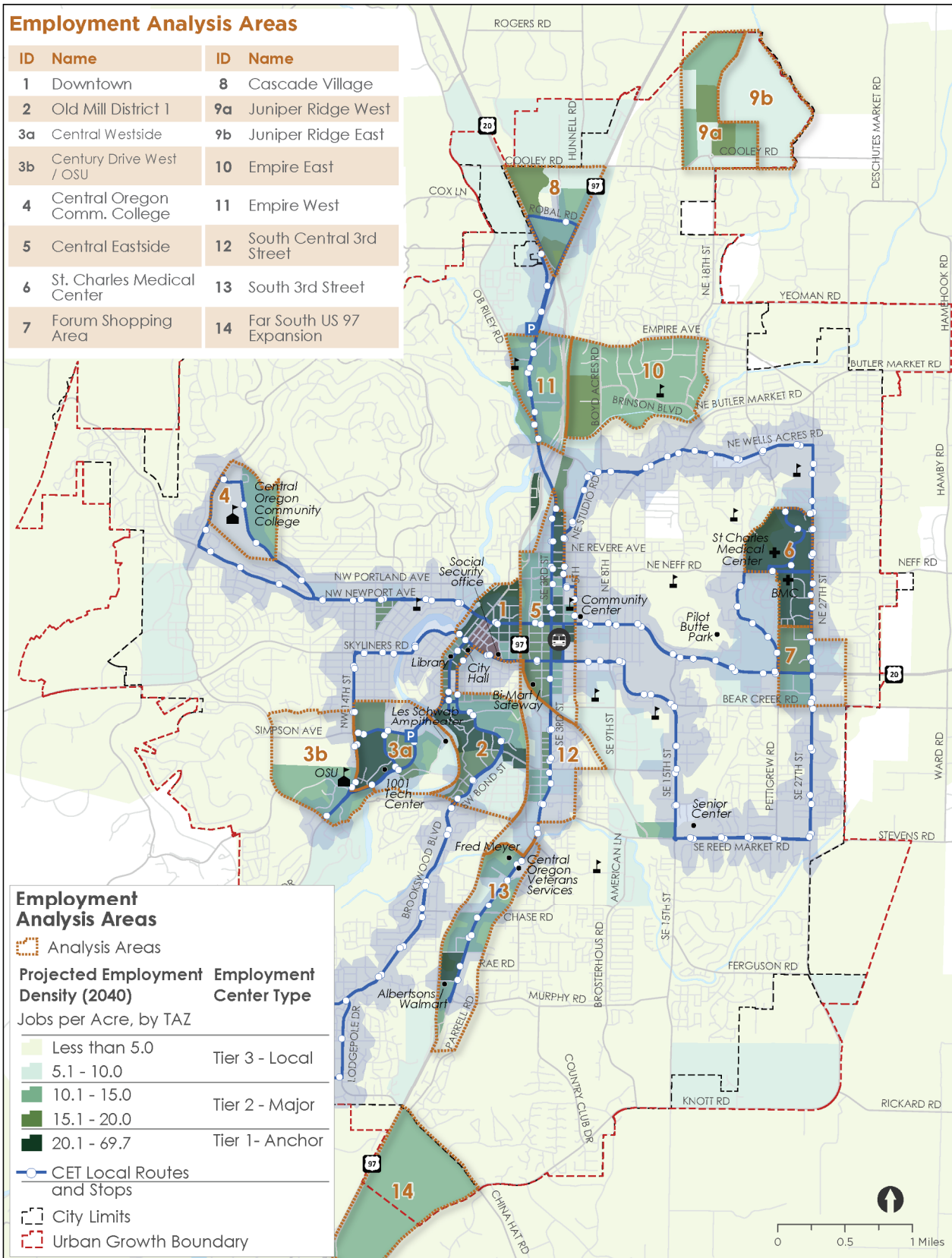


Figure 17: Bend Employment Analysis Areas Map

Notes: [1] Includes KorPine site

Source: Analysis of U.S. Census Bureau LEHD Data and Bend MPO Projections

Table 15: Bend Employment Analysis Areas Jobs and Jobs Density, 2015 and 2040

#	Employment Center	Number of Jobs [b]		Density of Jobs		Area Type in 2015
		2015	2040	2015	2040	
1	Downtown	4,300	4,900	25	30	Tier 1 - Anchor
2	Old Mill District [a]	3,700	4,900	12	15	Tier 2 - Major
3a	Central Westside	2,800	3,700	10	13	Tier 2 - Major
3b	Century Drive West (OSU)	1,200	2,000	4	7	Tier 1 - Local
4	Central Oregon Community College	1,000	1,100	6	6	Tier 3 - Local
5	Central Eastside	3,900	4,300	12	13	Tier 2 - Major
6	St. Charles Medical Center	6,400	5,800 [2]	33	33	Tier 1 - Anchor
7	Forum Shopping Area	1,600	1,900	9	11	Tier 3 - Local
8	Cascade Village	1,200	2,400	6	12	Tier 3 - Local
9a	Juniper Ridge West	100	3,000	0.3	12	--
9b	Juniper Ridge East	-	1,900	-	7	--
10	Empire East	2,800	5,400	7	14	Tier 3 - Local
11	Empire West	1,300	2,100	7	11	Tier 3 - Local
12	South Central 3rd Street	1,300	1,800	5	7	Tier 3 - Local
13	South 3rd Street	3,300	2,600 [b]	11	11	Tier 2 - Major
14	Far South US 97 Expansion	-	3,900	-	10	--

Notes: [a] Includes KorPine site [b] The total employment appears to be less in 2040 in two of the areas analyzed, St. Charles Medical Center and South 3rd Street. This is likely due to different data sources that were used for current and forecasted conditions; since the base year of the Bend MPO model is 2010 (nine years old), more recent LEHD data for 2015 was used to analyze current conditions. The data are also aggregated using different underlying zones, which may have contributed to the discrepancy. Future densities were manually adjusted based on an expectation that density is not expected to decrease in the future.

Source: Analysis of [2] U.S. Census Bureau LEHD Data (2015) and [3] Bend MPO Projections (2040)

BEND TRANSIT-UNDERSERVED AREAS

CET provides good transit coverage in many parts of the City of Bend, offering important mobility to major population and employment centers. There are several different types of areas the City and CET may consider for short- and long-term service coverage expansion.

- ▶ *Areas just beyond existing bus stop access.* Research has shown that most people consider walking about ¼-mile to a bus stop is a reasonable access distance, although they will often walk longer distances, e.g., ½ mile (as seen in on-board survey data). This is particularly true where frequency is higher and the stops are developed with quality amenities (e.g., shelters). However, there are employment and population areas beyond this distance yet still within a mile of the route. While changing routes or stops may improve access, other solutions include improving the active transportation network, which may reduce walking distance or provide a safer and more comfortable walk to transit or providing micromobility solutions such as electric scooter- and bike-share. These areas may have near-term mobility needs.
- ▶ *Low density development areas.* Some areas have low density development both today and in the future that may not support fixed route transit services. Emerging transportation service and technology models can provide potential future mobility options for people in these

areas, such as micromobility and accessible demand response services. These areas may have near-term mobility needs.

- ▶ *Future development areas.* There are several areas that are expected to see significant development over the next 20 years that are beyond the existing transit services. These developments can be planned in ways that more easily facilitate future transit service expansion. The City and CET can monitor development to ensure the transportation system keeps pace with growth.

Table 16 and Figure 19 summarize areas of Bend that are underserved by existing transit services, e.g., are beyond an approximately ¼ to ½ mile walk of a transit stop, showing population and employment density by TAZ⁵ for 2010 and 2040. Research generally shows that people are willing to walk at least ¼ mile (approximately 10 minutes) to access a bus, although some people are willing to walk ½ mile or more, particularly for higher quality service (in terms of frequency, amenities, etc.); based on the on-board survey conducted for this plan, this is consistent with CET riders.

Depending on the potential mobility needs, different transportation services may provide relevant solutions, as suggested in the table. (These are preliminary assessments and will be refined further in the next phase of the project.)

- ▶ **Local fixed route transit service** is relevant for areas meeting the population or employment density guidelines presented in Figure 12, with average population density above 10 people per acre or average employment density above five jobs per acre (combined population and employment densities can also be considered).
- ▶ **Deviated fixed-route (or flex-route) service** is relevant for lower-density areas that do not meet fixed route service guidelines, or that may be just beyond existing fixed routes, such that occasional route deviations may provide sufficient mobility to certain areas. (Although not the focus of this analysis, deviated services can be used to provide local access as part of an intercity, i.e., Community Connector, route.) This service type can also include **shared-ride shuttles**, such as regularly scheduled trips between transit stops/stations and significant employment areas at key times of the day or trips with a demand-responsive element to major shopping and medical centers to help people meet non-work transportation needs on selected days/times. (CET currently provides demand-responsive service within Bend city limits to people with disabilities and low-income seniors. Demand-response service costs more to provide per trip, which limits the amount of service that can be provided.) New technology and service models may make it possible to expand the availability of services in this category.
- ▶ **Micromobility** includes shared active transportation vehicles such as scooters and bicycles, possibly with electric assist motors; this service type may be considered for low density areas within 1 mile of a fixed route stop or development centers to increase the access area.
- ▶ **Mobility hubs** are places that provide connections between different types of transportation options, often including transit, micromobility, and on-demand services. Mobility hubs may be co-located with transit centers, secondary transit hubs, or places where routes intersect to facilitate easy transfers. Additional mobility options present at these hubs expand access to

⁵ A TAZ refers to a Transportation Analysis Zone. Transportation planning models typically divide regions or cities into these zones for the purpose of forecasting population and job growth in these zones, and demand for travel within and between the zones.

transit, and hubs typically include physical and digital information that makes access to these services seamless and easy-to-navigate.

- ▶ Low stress active transportation networks are critical to providing access to public transportation services. In some areas that are served by existing routes, there are areas beyond a typical $\frac{1}{4}$ to $\frac{1}{2}$ mile walking distance of a transit stop where improved pedestrian and bicycle connections can expand access to existing transit stops. Improving walking and biking routes along and across roadways around bus stops makes it safer and more comfortable to access transit.

Table 16: Bend Transit Underserved Areas

#	Potential Service Area	Description	Population Density		Employment Density		Potential Services (Preliminary Assessment of Feasibility)					
			2010	2040	2010	2040	Fixed route		Deviated fixed-route (flex-route) or Shuttle		Micro-mobility	Low stress active transport
							Assessment	Time Frame	Assessment	Time Frame		
1	North Triangle	Low density future growth	0.4	5.6	0.1	4.7	✓	Future	✓	Future	✓	-
2	Juniper Ridge	Emerging employment	0.0	0.1	0.8	9.8	✓	Future	✓	Current	✓ with fixed-route ext.	-
3	North of Empire (Boyd Acres)	Moderate density residential	4.7	7.6	0.2	0.4	✓	Future	✓	Current	✓	✓
4	Northwest	Low density population	2.5	3.8	0.2	0.3		N/A	✓	Current	✓	-
5	South of Empire	Emerging employment area	1.4	1.4	4.6	11.1	✓	Future	✓	Current	✓	✓
6	Northeast Butler Market Rd	Moderate residential beyond existing fixed route	8.0	10.6	0.2	1.1	-	N/A	-	N/A	✓	✓
7	Northwest Crossing	Moderate residential	5.7	8.1	0.3	1.2	✓	Current	✓	Current	✓	-
8	Neff Road, north of Pilot Butte	Moderate residential beyond existing fixed route	5.7	8.0	0.4	0.7	✓	Current	✓	Current	✓	✓
9	East of 27th	Future residential	3.6	6.6	0.2	0.4	-	N/A	✓	Future	✓	-
10	West of Bond / Brookwood	Moderate residential beyond existing fixed route	6.8	9.9	1.6	3.1	-	N/A	-	N/A	✓	✓
11	Kiwanis Park	Moderate residential beyond existing fixed route	6.2	7.8	1.4	2.0	-	N/A	✓	Current	✓	✓
12	Larkspur	Moderate residential beyond fixed route	5.8	9.3	0.0	0.4	-	N/A	✓	Current	✓	✓
13	Old Farm (Murphy / Brosterhous)	Moderate residential	4.0	8.0	0.6	1.0	✓	Current	✓	Current	✓ with fixed-route ext.	-
14	South of Reed Market	Low residential beyond fixed route	4.1	5.0	0.1	0.3	-	N/A	✓	Current	✓	✓

#	Potential Service Area	Description	Population Density		Employment Density		Potential Services (Preliminary Assessment of Feasibility)					
			2010	2040	2010	2040	Fixed route		Deviated fixed-route (flex-route) or Shuttle		Micro-mobility	Low stress active transport
							Assessment	Time Frame	Assessment	Time Frame		
15	Stevens Road	Future residential area	0.2	9.6	0.0	1.3	✓	Future	✓	Future	✓	-
16a	South 15th Street – North zones	Future residential or mixed-use area	1.4	6.4	0.1	1.0	✓	Future	✓	Future	✓	✓
16b	South 15th Street – South zones	Future employment area	0.3	4.5	0.0	7.3	✓	Future	✓	Future	✓	✓
17	South US 97	Future employment area	0.0	3.5	0.0	10.2	✓	Future	✓	Future	✓	✓
18	Deschutes River Woods	Low density residential area	1.3	1.7	0.1	0.1	-	N/A	✓	Current	✓	-

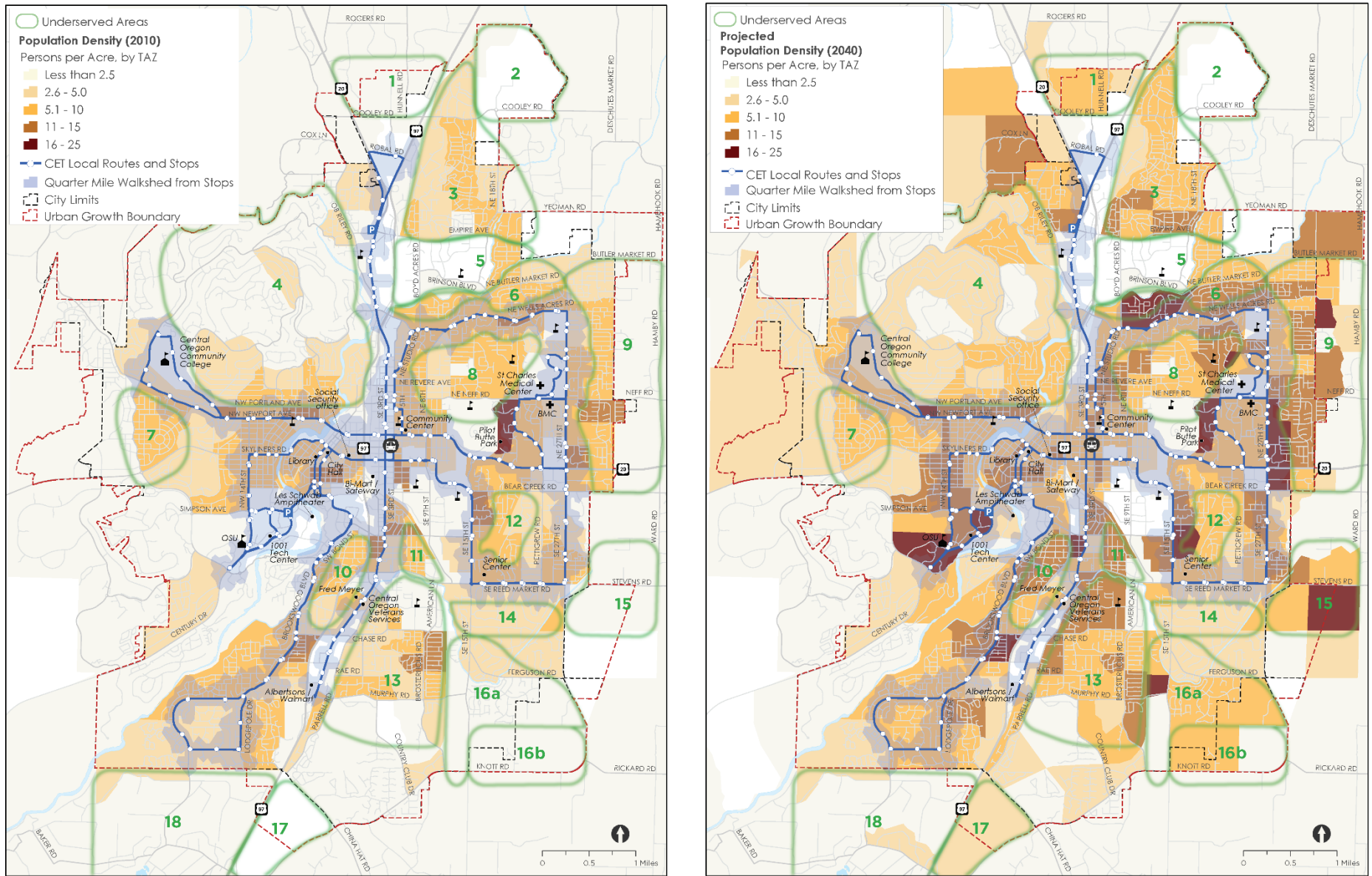


Figure 18: Bend Underserved Transit Areas, 2010 and 2040 Population Density

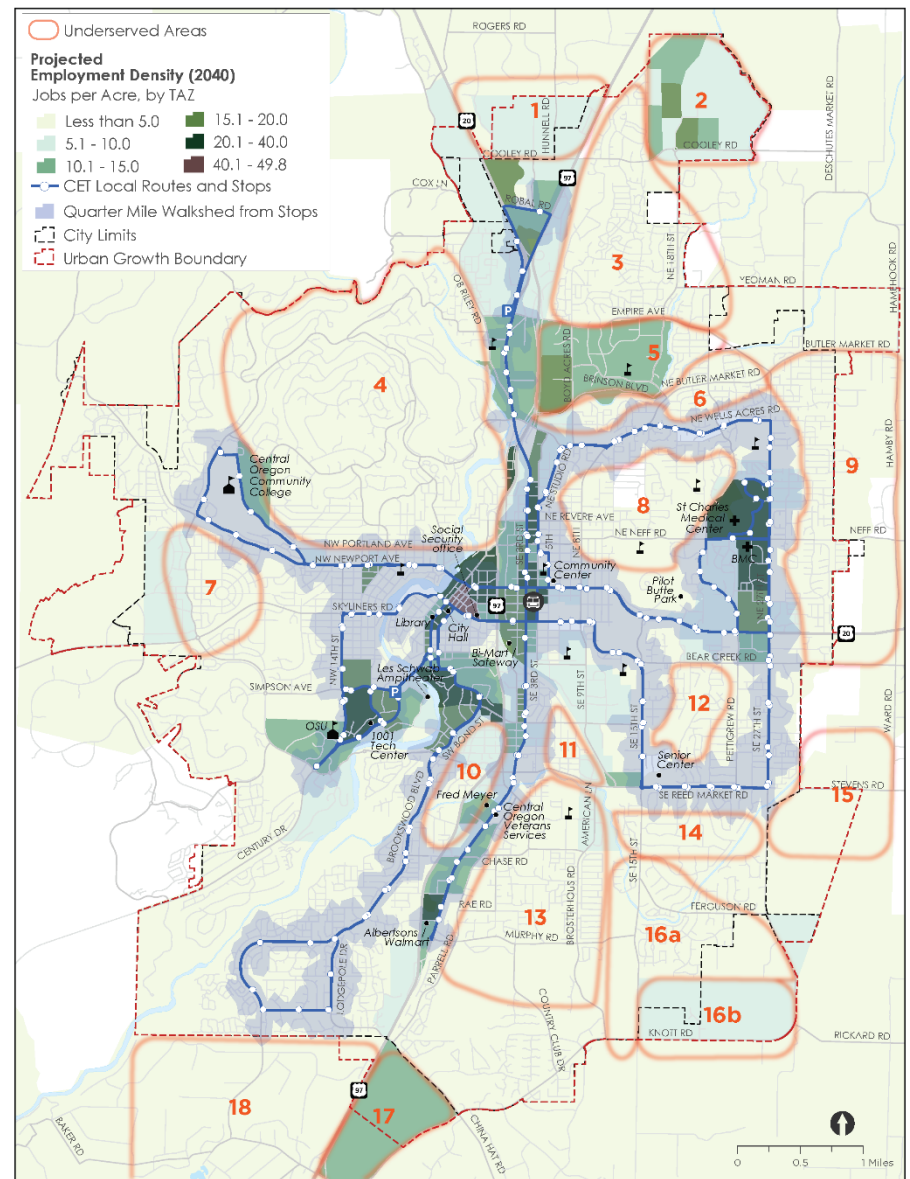
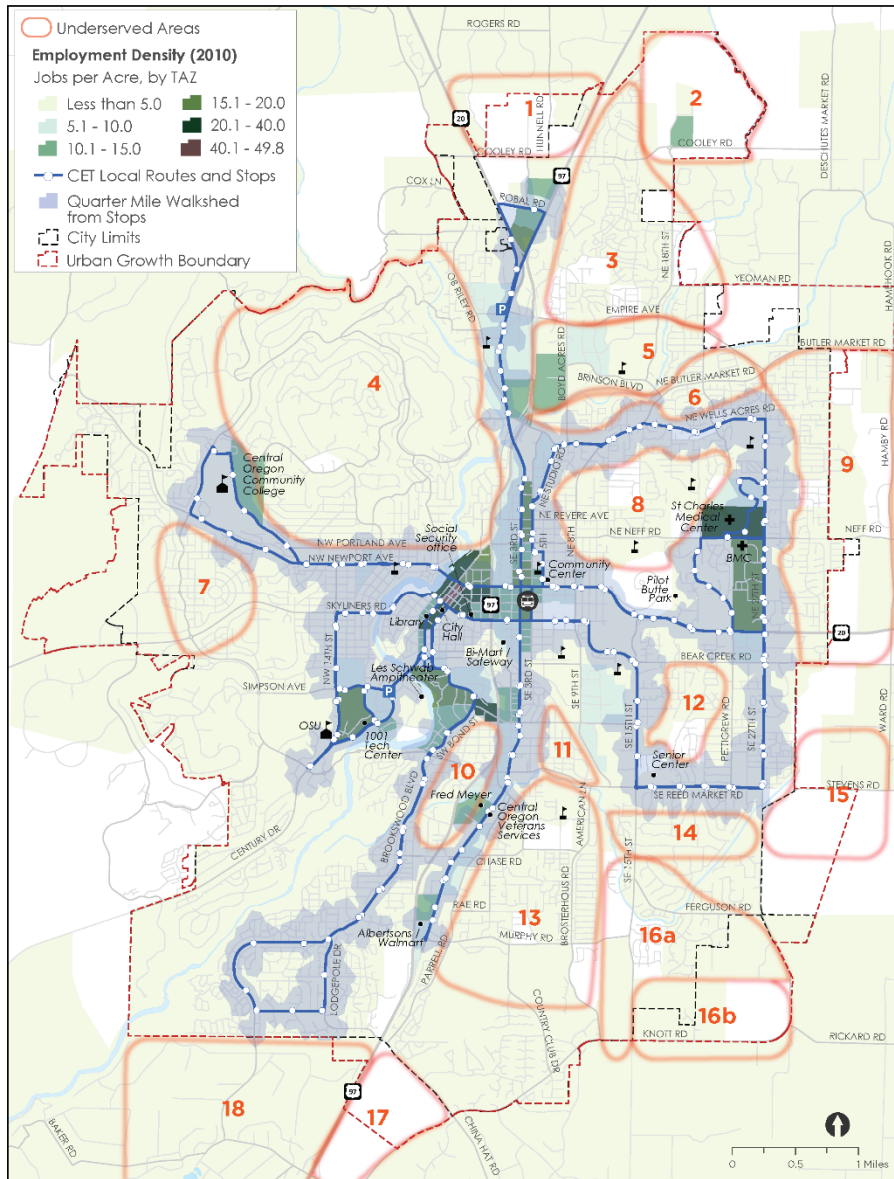


Figure 19: Bend Underserved Transit Areas, 2010 and 2040 Employment Density

REDMOND POPULATION AND EMPLOYMENT DENSITIES

REDMOND POPULATION DENSITY

The Bend Metropolitan Planning Organization (BMPO) maintains a travel demand model used to forecast transportation needs throughout the region. The model includes forecasted population and employment based on county- and city-level forecasts prepared by the State of Oregon and Portland State University's (PSU) Population Research Center. The forecasts are based on historical data from the State and the U.S. Census Bureau and are updated annually. The current model years are 2010 (base year) and 2040 (horizon year).

Figure 20 shows the population density for Redmond in 2010 and projected in 2040. Moderate or higher residential density is an indicator of an adequate concentration of population to support reasonably frequent fixed-route transit service. According to Figure 12, such population densities range from 10 to 15 residents per acre for mixed neighborhoods and 10 to 20 residents per acre for neighborhoods and suburban mixed-use. Some areas reflecting this residential density in Redmond in 2040 include the following:

- ▶ The area east of Ridgeview High School, north of SW Elkhorn Ave and east of SW Canal Blvd
- ▶ The area bound by OR 126, SW Salmon Ave, SW 35th St, and SW 27th St
- ▶ The area bound by SW Quartz Ave, SW Salmon Ave, SW 23rd St, and SW Canal Blvd
- ▶ The area south of W Antler Ave and east of NW 23rd St
- ▶ The area bound by NW Elm Ave, W Antler Ave, NW 27th St, and NW 23rd St
- ▶ The area bound by NW Hemlock Ave, NW Elm Ave, NW 19th St, and the canal
- ▶ The area bound by NW Maple Ave, NW Hemlock Ave, NW 27th St, and NW 19th St/NW Rimrock Dr
- ▶ The area bound by NE Negus Way, NE Kingwood Ave, US 97, and NE 9th St
- ▶ The area bound by the northern city limits, NW Maple Ave, NW 35th St/Northwest Way, and NW 22nd St

REDMOND EMPLOYMENT DENSITY

Understanding job locations and densities is equally important to informing transit service priorities in Bend. Figure 21 illustrates projected 2040 employment densities in Redmond from the BMPO travel demand model. Moderate or higher population density is an indicator of an adequate concentration of jobs to support reasonably frequent fixed-route transit service. According to Figure 12, such employment densities range from 5 to 10 jobs per acre for mixed neighborhoods and 10 to 15 jobs per acre for neighborhoods and suburban mixed-use. Some areas reflecting this employment density in Redmond in 2040 include the following:

- ▶ The area surrounding US 97, north of SW Yew Ave to just north of SW Odem Medo Way
- ▶ The area adjacent to the east side of US 97 from SW Odem Medo Way to just north of SW Veterans Way
- ▶ The area bound by SE Airport Way, US 97, SW 13th St, and SW 6th St
- ▶ The area adjacent to the west side of US 97 from SE Pumice Ave to SW Veterans Way
- ▶ The area bound by SW Veterans Way, SW Evergreen Ave, SW 9th St, and US 97
- ▶ The southern half of downtown Redmond

- ▶ The area bound by NW Dogwood Ave, NW Jackpine Ave, NW Canyon Dr, and NW 5th St
- ▶ The area bound by NW Jackpine Ave, NE King Way, NW 6th St, and US 97
- ▶ The area bound by NE Hemlock Ave, NE Kilnwood Pl, US 97, and SE 9th St

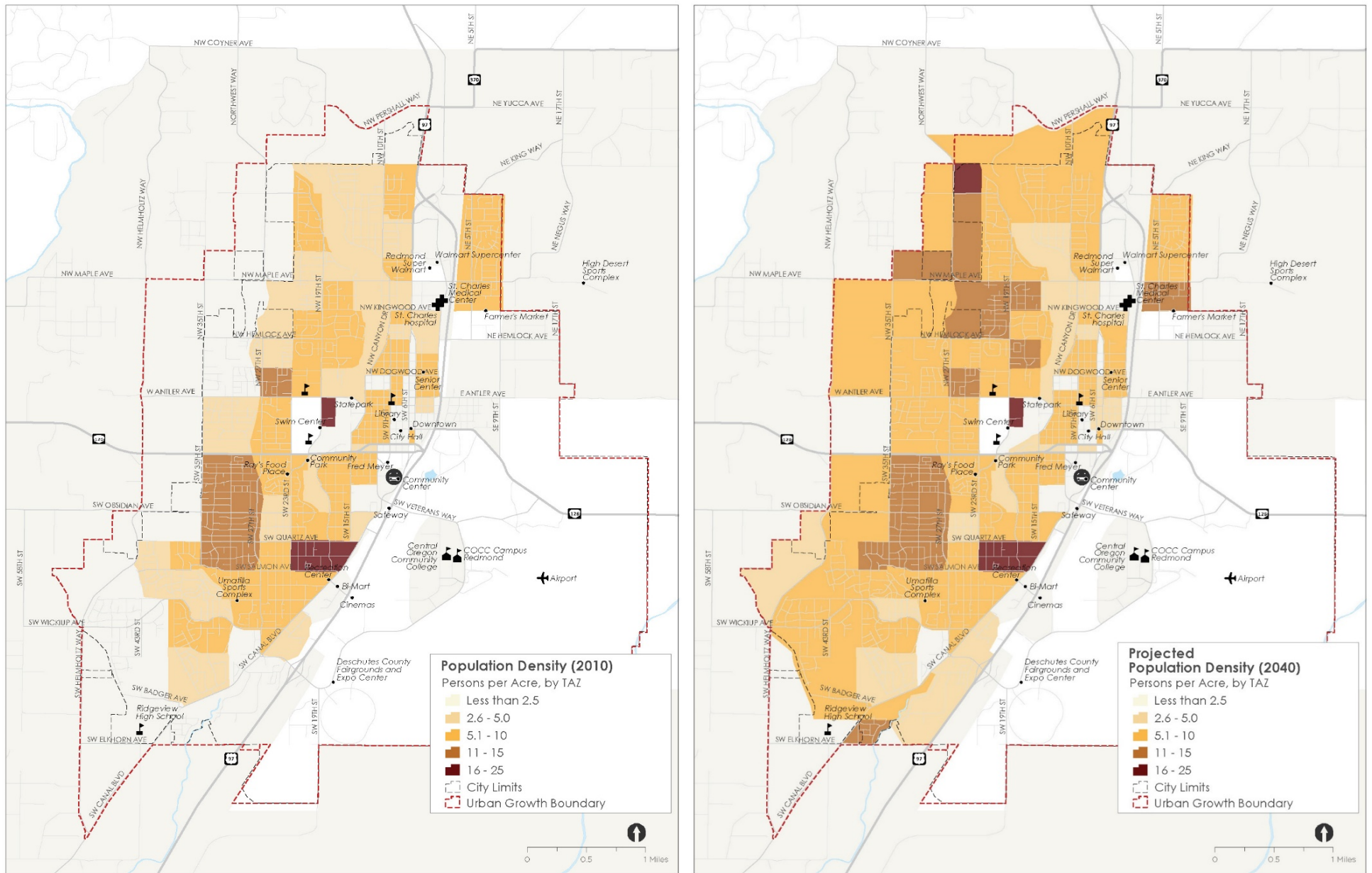


Figure 20: Redmond Projected Population Density (2010 and 2040)

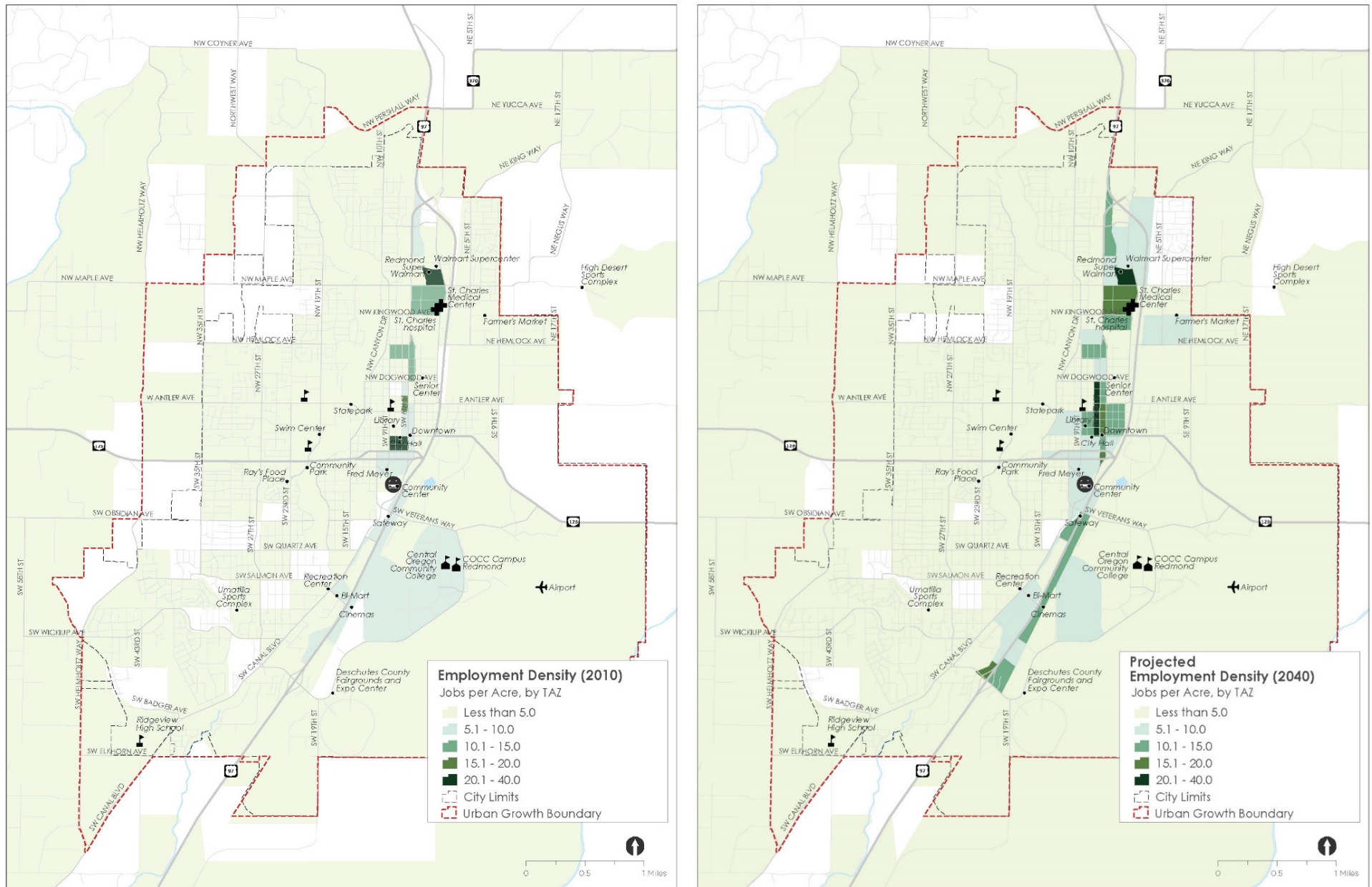


Figure 21: Redmond Projected Employment Density (2010 and 2040)

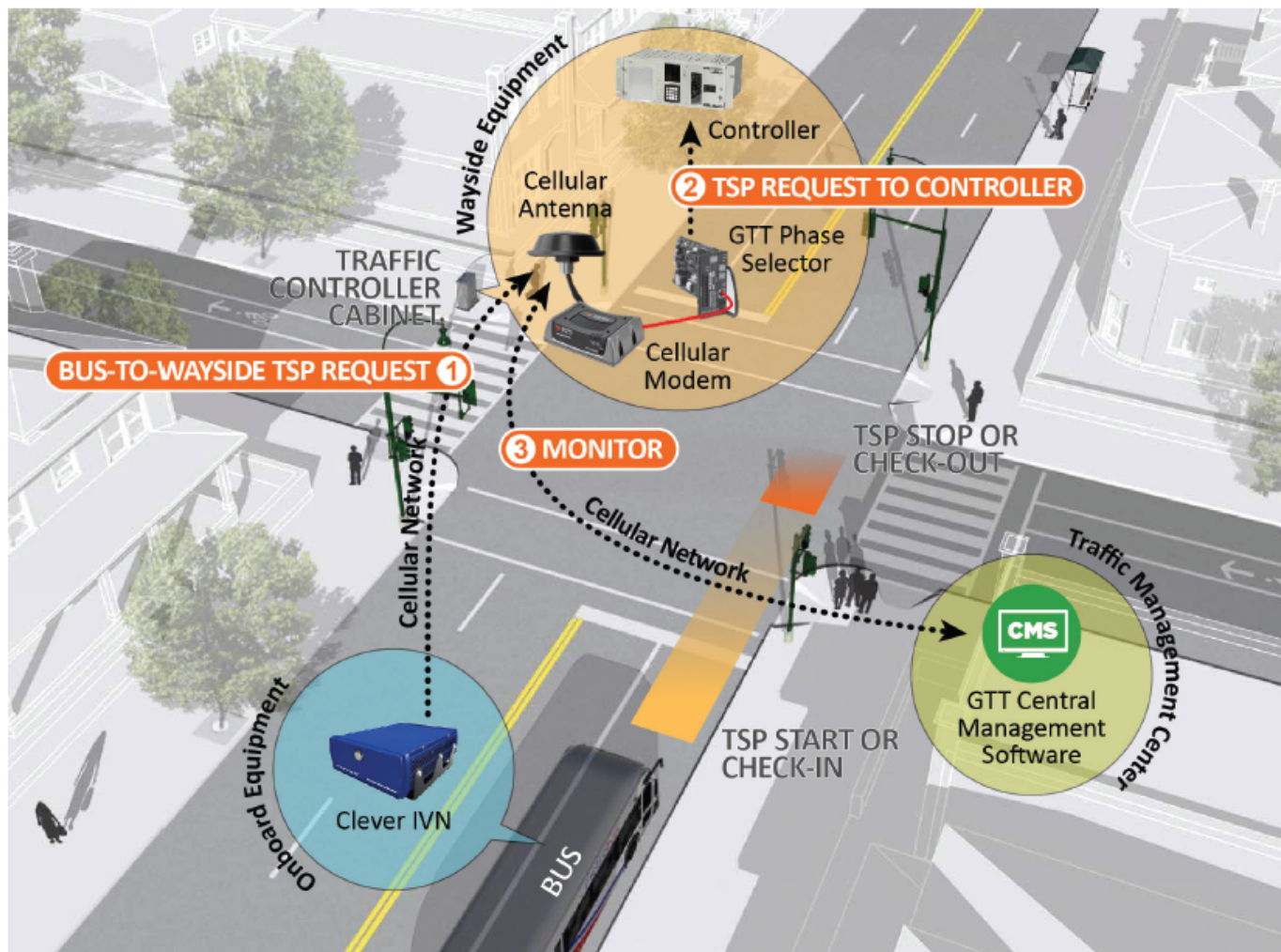
TECHNOLOGY NEEDS

The following describes technology needs on transit routes as well as on buses, at stops and transit centers, and online.

PRIMARY TRANSIT NETWORK TECHNOLOGY OPTIONS

Transit Signal Priority (TSP) should be considered for all corridors on the primary transit network in Bend as well as routes traveled by the Community Connector routes. Transit Signal Priority is a general term for a set of operational improvements that use signal controller technology to reduce the wait time for buses at traffic signals by holding the green time and reducing the red time when a bus is detected. This can be done at all times or just when the bus is running late and may be implemented at individual intersections or across corridors or entire street systems. This is particularly valuable on routes with schedule adherence issues (such as Route 4: North 3rd Street) and can help reduce the travel time variability. Reduction in travel time variability allows agencies to tighten schedules and reduce travel time.

Individual locations considered for TSP will need to also consider items such as roadway geometry, transit stop locations, nearby driveway interaction, or other features that may impact how TSP could be implemented.



Clever Devices/GTT TSP System in Washington Metro Area (Source: Kittelson & Associates, Inc.)

Figure 22: Example Distributed TSP System

Transit Signal Priority can be planned for the entire primary transit network; however, there are different system architectures and technologies which must be identified in advance in order for each agency to implement their piece of the system. For example, the architecture could be centralized or distributed. A central system organizes and manages requests for priority from many vehicles across the entire system whereas in a distributed system priority decisions are made at the intersection level. Identifying viable technology to implement transit signal priority requires engagement with the traffic signal owners and operators (e.g., ODOT, City of Bend) and the transit agency staff responsible for the vehicle fleet's communication, automatic vehicle location, and other technological systems to select an architecture and technology. Both existing infrastructure and future technology needs should be considered for both the vehicle and traffic system technologies.

The Deschutes County Intelligent Transportation System (ITS) Plan defines the Regional Federal Architecture. CET should work with ODOT and the City of Bend to conduct a Transit Signal Priority Evaluation of System Function and Needs This would allow implementation of a

demonstration corridor (such as Route 4) that could be expanded to the rest of the primary transit network or entire transit network as needed.

OTHER TECHNOLOGY NEEDS

Separate from Transit Signal Priority, the following additional technology needs have been identified for potential inclusion in the Transit Master Plan:

- ▶ Automated stop announcements and displays on buses (eliminating the need for the driver to make stop announcements)
 - ▶ Funding sources have been awarded through the Statewide Transportation Improvement Fund (STIF) to implement these improvements for fiscal year 2021.
- ▶ Upgraded communication equipment for drivers and operations staff
- ▶ Online app maintenance
- ▶ Computers and tablets
- ▶ Real-time arrival information at bus stops (see transit hubs)
 - ▶ Funding sources have been awarded through STIF to implement these improvements for fiscal year 2021.
- ▶ Improved Dial-A-Ride dispatch/scheduling system (see Bend Dial-A-Ride section)
 - ▶ Funding sources have been awarded through STIF to implement these improvements for fiscal year 2021.

FUTURE PUBLIC TRANSPORTATION NEEDS

This section summarizes future needs for public transportation connections, transit stops, transit centers, park-and-rides, and other infrastructure within the CET service area based on previous analyses (local and regional plans review, existing conditions, and short-term implementation strategies), information gathered during the first two rounds of public outreach, and the future travel demand and growth. Needs are summarized for each County and Warm Springs as well as countywide and include timeframes.

- ▶ Short: 1 to 5 years
- ▶ Mid: 6 to 10 years
- ▶ Long: 11 to 20 years

DESCHUTES COUNTY

The future public transportation needs for Deschutes County including Bend, Redmond, Sisters, La Pine, and other communities specifically identified through public outreach are summarized in Table 17.

Table 17: Future Public Transportation Needs – Deschutes County

Future Need	Service City	Notes	Timeframe
Transit Service			
<i>Local Fixed-Routes</i>			
More frequency for Route 1 (South 3 rd Street)	Bend	▶ Also identified as need by stakeholders in the other counties	Short
More frequency for Route 4 (North 3 rd Street)	Bend	▶ Also identified as need by stakeholders in the other counties	Short
More frequency for Route 7 (Greenwood)	Bend	▶ Also identified as need by stakeholders in the other counties	Short
More service coverage for Northeast: new local route (e.g. Route 8) including Empire Blvd, Boyd Acres, Butler Market Rd, and Juniper Ridge	Bend	▶ Also identified as need by stakeholders in the other counties	Short
More service coverage for Southeast Bend: new local route or route extension (e.g. Route 9), including Old Farm district and UGB expansion	Bend	▶ Also identified as need by stakeholders in the other counties	Short
More service coverage for St. Charles area	Bend	▶ Also identified as need by stakeholders in the other counties	Short
More direct connections to downtown and Old Mill especially from the eastside	Bend	-	Short
Less dependence on transfers for major travel patterns	Bend	-	Short
Early evening weekday service hours (until 8 p.m.)	Bend	-	Short
30-minute headways Saturday service on select routes	Bend	-	Short
Extended Saturday service hours (7 a.m. to 7 p.m.)	Bend	-	Short
Limited Sunday service	Bend	-	Short
Redmond fixed-route service (weekday/Saturday; four routes w/ADA paratransit, redirecting Redmond DAR service hours) including increased service south of Evergreen (identified as area of need by Federal government)	Redmond	▶ Also identified as need by Crook County stakeholders	Short
Local circulating service in Sisters (utilizing Community Connector vehicle) ▶ Shopper shuttle service that loops/makes select stops within Sisters	Sisters	-	Short
Local circulating service in La Pine (utilizing Community Connector or DAR service) – use one of two CET buses stored at Sheriff's office for local circulator; consider flex-route service as an alternative ▶ Add routes to proposed four routes that serve Ridgeview High School, new growth in the south and west, Canal/Odem Medo to the south (high percentage of low-income populations), and Walmart/other retail services (realigning proposed SE route) ▶ Service needs to southern industrial land ▶ Service needs to NE with UGB expansions	La Pine	-	Short
Improve bus on-time arrival/reliability	Bend	-	Evaluate
Provide new/enhanced services to Bend transit-underserved areas	Bend	-	Evaluate
More frequency for Route 2 (Brookwood)	Bend	▶ Also identified as need by stakeholders in the other counties	Mid
More frequency for Route 5 (Wells Acres)	Bend	▶ Also identified as need by stakeholders in the other counties	Mid
More frequency for Route 6 (Reed Market)	Bend	▶ Also identified as need by stakeholders in the other counties	Mid
More service coverage for Southwest Bend	Bend	▶ Also identified as need by stakeholders in the other counties	Mid
More service coverage for Downtown	Bend	▶ Also identified as need by stakeholders in the other counties	Mid
More service coverage for 3 rd Street corridor	Bend	▶ Also identified as need by stakeholders in the other counties	Mid
More service coverage for OSU-Cascades area	Bend	▶ Also identified as need by stakeholders in the other counties	Mid
More frequency for Route 3 (Newport Ave)	Bend	▶ Also identified as need by stakeholders in the other counties	Long
More frequency for Route 10 (Colorado)	Bend	▶ Also identified as need by stakeholders in the other counties	Long
More frequency for Route 11 (Galveston/14 th)	Bend	▶ Also identified as need by stakeholders in the other counties	Long
More service coverage for Northwest Bend including Summit West	Bend	▶ Also identified as need by stakeholders in the other counties	Long
More service coverage for Century/14 th Street corridor	Bend	▶ Also identified as need by stakeholders in the other counties	Long
Reroute fixed-routes that utilize Courtney Drive, Wells Acres/Butler Market, and Jamison Rd/Highway 20 (difficult to navigate)	Bend	-	Evaluate
<i>Community Connector</i>			
More frequency for Route 24 (Redmond-Bend) ▶ Three additional midday trips ▶ One additional later evening weekday trip ▶ One additional early morning weekday trip ▶ Five Saturday round trips	Bend Redmond	▶ Also identified as need by stakeholders in the other counties	Short
Saturday service for Route 24 (Bend-Redmond)	Bend Redmond	▶ Also identified as need by stakeholders in the other counties	Short
More frequency for Route 30 (La Pine-Bend) ▶ One additional morning, midday, or afternoon trip ▶ One additional later evening weekday trip ▶ Three Saturday round trips	Bend La Pine	▶ Also identified as need by stakeholders in the other counties	Short
Saturday service for Route 30 (La Pine-Bend)	Bend La Pine	▶ Also identified as need by stakeholders in the other counties	Short

More frequency for Route 26 (Prineville-Redmond) <ul style="list-style-type: none"> ▶ One additional morning, midday, or afternoon trip ▶ One additional later evening weekday trip ▶ Through-route to Bend during peak periods and interline with Route 24; includes service to Redmond COCC and Airport (additional bus required) ▶ Three Saturday round trips 	Redmond Prineville	▶ Also identified as need by stakeholders in the other counties	Short
More frequency for Route 22 (Madras-Redmond) <ul style="list-style-type: none"> ▶ One additional morning and two additional midday or other trips ▶ One additional later evening weekday trip ▶ Three Saturday round trips 	Redmond Madras	▶ Also identified as need by stakeholders in the other counties	Short
More frequency for Route 29 (Sisters-Bend) <ul style="list-style-type: none"> ▶ One additional morning, midday, or afternoon trip ▶ One additional later evening weekday trip ▶ Three Saturday round trips 	Bend Sisters	▶ Also identified as need by stakeholders in the other counties	Short
Service to airport for early morning flight departures and afternoon flight arrivals	Bend	-	Evaluate
Route 28 (Sisters-Redmond) Airport stop (mid-afternoon)	Sisters Redmond	-	Evaluate
Built in time for Routes 28 (Sisters-Redmond) and 29 (Sisters-Bend) to do pick-ups and drop-offs within Sisters to minimize barriers to accessing Community Connector	Sisters Redmond Bend	-	Evaluate
Service to Sunriver (via Huntington) – possibly include Mount Bachelor <ul style="list-style-type: none"> ▶ 8 a.m. to 5 p.m. (work hours) ▶ Give priority to students (4-hour shifts) – possibly free fare; partner with the high school ▶ In need of regular runs ▶ Include early morning/late evening weekday trips and weekend trips ▶ Create loop with US 97, Day Road, Corner Store, Wickiup Junction, Sunriver, and Bend 	La Pine	-	Evaluate
More frequency for Route 22 (Redmond-Madras)	Redmond Madras	▶ Also identified as need by stakeholders in the other counties	Mid
Saturday service for Route 22 (Redmond-Madras)	Redmond Madras	▶ Also identified as need by stakeholders in the other counties	Mid
More frequency for Route 26 (Redmond-Prineville)	Redmond Prineville	▶ Also identified as need by stakeholders in the other counties	Mid
Saturday service for Route 26 (Redmond-Prineville)	Redmond Prineville	▶ Also identified as need by stakeholders in the other counties	Mid
Saturday service for Route 29 (Sisters-Bend)	Bend Sisters	▶ Also identified as need by stakeholders in the other counties	Mid
Service to Deschutes River Woods	Deschutes River Woods	-	Evaluate
More frequency for Route 28 (Sisters-Redmond)	Redmond Sisters	▶ Also identified as need by stakeholders in the other counties	Long
Saturday service for Route 28 (Sisters-Redmond)	Redmond Sisters	▶ Also identified as need by stakeholders in the other counties	Long
More frequency for Route 29 (Sisters-Bend)	Bend Sisters	▶ Also identified as need by stakeholders in the other counties	Long
New Prineville-Redmond-Bend route (increases frequency on Route 24 and connects to the airport)	Bend Redmond Prineville	-	Evaluate
Dial-A-Ride			
Expand dial-a-ride coverage area	Bend Redmond La Pine Sisters	-	Short
Early evening service hours (until 8 p.m.)	Bend	-	Short
Extended Saturday service hours (7 a.m. to 7 p.m.)	Bend	-	Short
Expand service to areas outside of Sisters (population outside of Sisters city limits)	Sisters	-	Evaluate
Service needs outside of City limits (within Deschutes County)	La Pine	-	Evaluate
Pilot Programs			
Pilot program to subsidize evening TNC trips (could be limited, e.g., transit riders with passes)	Bend	-	Short
Vanpools to dispersed employment sites	Bend	-	Short
Route 28 (Sisters-Redmond) midday run pilot (1 year)	Sisters Redmond	-	Evaluate
Route 29 (Sisters-Bend) midday run pilot (arriving in Bend midmorning: 9-10 a.m.)	Sisters Bend	-	Evaluate
Additional dial-a-ride service day pilot	Sisters	-	Evaluate
Utilize Uber/Lyft through CERC (Oregon Health Plan applicants can reserve rides through non-CET services)	La Pine	-	Evaluate
Transit Capital			
Bus Stops			
Real-time signage at secondary hubs (northern Bend)	Bend	-	Short
Hawthorne Station access, Safety, and operational improvements	Bend	-	Short
New Route 24 (Bend-Redmond) stop at airport for trips beyond Redmond Transit Hub	Bend Redmond	-	
New Route 24 (Bend-Redmond) stop west of US 97 for trips beyond Hawthorne Station to downtown and Old Mill	Bend Redmond	-	
New stops <ul style="list-style-type: none"> ▶ Sisters foodbank and Forest Service parking lot ▶ Route 29 (Sisters-Bend) stop in the Robal Road/Cascade Village area (bus pullout on US 97) 	Sisters Bend	-	Evaluate
New stop at the Corner Store (Day Road/Burgess)	La Pine	-	Evaluate

Service to Sunriver (via Huntington) – possibly include Mount Bachelor <ul style="list-style-type: none"> ▶ Community Connector stop ▶ Chamber office is an ideal stop (avoid driving throughout Sunriver – Sunriver has shuttles that can distribute riders) 	La Pine	-	Evaluate
Transit hubs (transit/museum/visitor center hub) – mid-term	Sisters	-	Evaluate
New stops for Route 22 (Madras-Redmond) <ul style="list-style-type: none"> ▶ Hospital ▶ Walmart area ▶ Downtown Redmond ▶ Senior Center ▶ Swim Center (common stop for dial-a-ride) 	Redmond Madras	-	Evaluate
Vehicles			
Additional peak buses for Routes 1, 4, 7, and short route to downtown Bend (possibly Route 3)	Bend	-	Short
Technology			
Transit signal priority	Bend	-	Evaluate
Streets			
3 rd Street speed and reliability and access improvements	Bend	-	Short
Enhanced pedestrian and bicycle connections to transit stops (City ownership and planning)	All Qualified Entities	-	Evaluate

JEFFERSON COUNTY

The future public transportation needs for Jefferson County including Madras, Culver, Metolius, and other communities specifically identified through public outreach are summarized in Table 18.

Table 18: Future Public Transportation Needs – Jefferson County

Future Need	Service City	Notes	Timeframe
Transit Service			
<i>Local Fixed-Routes</i>			
New fixed-route/deviated route service	Madras	-	Short
▶ Local circulating service in Madras (utilizing Community Connector or DAR vehicle)			
Expanded flex-route service based on dial-a-ride ridership patterns	Madras	-	Evaluate
<i>Community Connector</i>			
More service for Route 20 (Warm Springs-Madras)	Madras Warm Springs	▶ Also identified as need by stakeholders in the other counties	Short
▶ Three Saturday round trips			
▶ Loop between casino and neighborhoods			
Saturday service for Route 20 (Warm Springs-Madras)	Madras Warm Springs	▶ Also identified as need by stakeholders in the other counties	Short
More service for Route 22 (Madras-Redmond)	Madras Redmond	▶ Also identified as need by stakeholders in the other counties	Short
▶ One additional morning and two additional midday or other trips			
▶ One additional later evening weekday trip			
▶ Three Saturday round trips			
More service for Route 22 (Madras-Redmond)	Madras Redmond	-	Evaluate
▶ Need for on-demand shopper/medical shuttle (specific days and time periods)			
Saturday service for Route 22 (Madras-Redmond)	Madras Redmond	▶ Also identified as need by stakeholders in the other counties	Short
Community Connector service to Government Camp	Madras Warm Springs	-	Evaluate
<i>Dial-A-Ride</i>			
Expand dial-a-ride coverage area	Crooked River Ranch Culver Metolius	▶ Also identified as need by stakeholders in the other counties	Mid
▶ Crooked River Ranch (new service)			
▶ Metolius (new service)			
▶ Culver (new service)			
Transit Capital			
New stops for Route 22 (Madras-Redmond) and Future Redmond Fixed Routes	Redmond Madras	▶ Also identified as need by Deschutes County stakeholders	Evaluate
▶ Crooked River Ranch			
▶ Future Health and Wellness Campus in Madras			
▶ Hospital in Redmond			
▶ Smith Rock State Park			
▶ Walmart area in Redmond			
▶ Downtown Redmond			
▶ Downtown Madras (between A & B and 4 th and 5 th , near the north "Y" intersections – US 97/OR 26 or Saley Park)			
▶ Senior Center in Redmond			
▶ Swim Center (common stop for dial-a-ride) in Redmond			
New stops for Route 20 (Madras-Warm Springs)	Madras Warm Springs	-	Evaluate
▶ Between G and H and C and D streets			
Transit hubs	Madras Metolius Culver Warm Springs	-	Evaluate

CROOK COUNTY

The future public transportation needs for Crook County including Prineville and other communities specifically identified through public outreach are summarized in Table 19.

Table 19: Future Public Transportation Needs – Crook County

Future Need	Service City	Notes	Timeframe
Transit Service			
<i>Local Fixed-Routes</i>			
New fixed-route/deviated route service <ul style="list-style-type: none"> ▶ Local circulating service in Prineville (utilizing Community Connector vehicle) – could include connection to Juniper Canyon 	Prineville Juniper Canyon	-	Short
<i>Community Connector</i>			
More service for Route 26 (Prineville-Redmond) <ul style="list-style-type: none"> ▶ One additional morning, midday (before 11 a.m.), or afternoon trip (4:45-5:15 p.m.) ▶ One additional later evening weekday trip ▶ Through-route to Bend during peak periods and interline with Route 24; includes service to Redmond COCC and Airport (additional bus required) ▶ Three Saturday round trips 	Prineville Redmond	▶ Also identified as need by stakeholders in the other counties	Short
Saturday service for Routes 26 (Redmond-Prineville)	Prineville	▶ Also identified as need by stakeholders in the other counties	Short
New Community Connector route between Prineville and Bend	Prineville Bend	-	Evaluate
New Community Connector route between Prineville and Madras	Prineville Madras	-	Evaluate
<i>Dial-A-Ride</i>			
Expand dial-a-ride coverage area <ul style="list-style-type: none"> ▶ Juniper Canyon area ▶ 20-mile loop with 3-5 stops (Remington, Kayu, Granny's Café, Fire Hall) 	Prineville	-	Short
Transit Capital			
Common deviated fixed-route stop within walking distance for all riders/requests	Prineville	-	Evaluate
New stops for Route 26 (Prineville-Redmond) or Future Prineville Flex-Route <ul style="list-style-type: none"> ▶ Juniper Canyon area ▶ Hospital ▶ Bi-Mart/Rays (possible park-n-ride area) ▶ Airport ▶ COCC ▶ Stryker Park (high dial-a-ride ridership) 	Prineville Redmond	▶ Also identified as need by Deschutes County stakeholders	Evaluate
Transit hubs <ul style="list-style-type: none"> ▶ Lot behind Thriftway or Rays 	Prineville	-	Evaluate

WARM SPRINGS

This section summarizes the future public transportation needs for Warm Springs and other communities specifically identified through public outreach as detailed in Table 20.

SYSTEMWIDE

This section summarizes the future public transportation capital needs for all of CET's service area specifically identified through public outreach as detailed in Table 21.

Table 20: Future Public Transportation Needs – Warm Springs

Future Need	Service City	Notes	Timeframe
Transit Service			
<i>Community Connector</i>			
More service for Route 20 (Warm Springs-Madras) <ul style="list-style-type: none"> ▶ Three Saturday round trips ▶ Loop between casino and neighborhoods 	Madras Warm Springs	▶ Also identified as need by stakeholders in the other counties	Short
Saturday service for Route 20 (Warm Springs-Madras)	Madras Warm Springs	▶ Also identified as need by stakeholders in the other counties	Short
Service to Government Camp <ul style="list-style-type: none"> ▶ Intercity service (weekday to/from Warm Springs) ▶ Saturday service 	Warm Springs	-	Evaluate
Formal scheduled stop for Central Oregon Breeze	Warm Springs	-	Evaluate
<i>Dial-A-Ride</i>			
Expand dial-a-ride coverage area	Crooked River Ranch Culver Metolius	▶ Also identified as need by stakeholders in the other counties	Mid
Transit Capital			
New stops for Route 20 (Madras-Warm Springs) <ul style="list-style-type: none"> ▶ Between G and H and C and D streets 	Madras Warm Springs	-	Evaluate
Transit hubs <ul style="list-style-type: none"> ▶ Warm Springs transit center 	Warm Springs	-	Evaluate

Table 21: Future Public Transportation Needs – Systemwide Transit Capital

Future Need	Service City	Notes	Timeframe
Bus Stops			
Real-time arrival displays on shelters	All	▶ Identified as need by stakeholders in all counties	Evaluate
Better maps	All	▶ Identified as need by stakeholders in all counties	Evaluate
Better signage	All	▶ Identified as need by stakeholders in all counties	Evaluate
Visitor kiosks	All	▶ Identified as need by stakeholders in all counties	Evaluate
Bus stop amenities, crossings, and safety improvements (improve bus stop conditions)	All	▶ Identified as need by stakeholders in all counties	Evaluate
Bus Fare			
Low-income fare subsidy and/or study fare pass programs	All	▶ Identified as need by Deschutes County stakeholders	Evaluate
Vehicles			
Low-floor vehicles prioritized for routes with high levels of wheelchair boardings	All	▶ Identified as need by stakeholders in all counties	Evaluate
Energy efficient buses	All	▶ Identified as need by stakeholders in all counties	Evaluate
Enhanced bus radios	All	▶ Identified as need by stakeholders in all counties	Evaluate
Increase capacity/availability of seats on Community Connector buses	All	▶ Identified as need by stakeholders in all counties	Evaluate
Improve wheelchair equipment on buses	All	▶ Identified as need by stakeholders in all counties	Evaluate
Wifi on buses	All	▶ Identified as need by stakeholders in all counties	Evaluate
Real-time arrival displays on buses	All	▶ Identified as need by stakeholders in all counties	Evaluate
Additional buses to support long-term service increases	All	▶ Identified as need by stakeholders in all counties	Evaluate
Technology			
One app for fare payment and trip planning that provides real-time arrival information	All	▶ Identified as need by stakeholders in all counties	Evaluate
Fare payment configuration to allow credit cards on buses	All	▶ Identified as need by stakeholders in all counties	Evaluate
Computers and tables	All	-	Evaluate
Programs			
On-going transit-supportive capital improvements program (e.g. bus stop amenities, accessibility, bicycle/pedestrian access/crossings, etc.)	All	▶ Identified as need by stakeholders in all counties	Evaluate
Travel Training	All	▶ Identified as need by stakeholders in all counties	Evaluate
Transit marketing funding for CET services	All	▶ Identified as need by stakeholders in all counties	Evaluate
Driver/dispatch training for handling difficult riders	All	▶ Identified as need by stakeholders in all counties	Evaluate
Improve dispatch system for coordination between drivers and dispatchers	All	▶ Identified as need by stakeholders in all counties	Evaluate
Coordination with existing services leaving/driving through Central Oregon	All	▶ Identified as need by stakeholders in all counties	Evaluate
Streets			
Enhanced pedestrian and bicycle connections to transit stops (City ownership and planning)	All	▶ Identified as need by stakeholders in all counties	Evaluate