US 97 BAKER ROAD INTERCHANGE AREA MANAGEMENT PLAN

MAY 5, 2025

PREPARED FOR:

Oregon Department of Transportation

PREPARED FOR THE OREGON DEPARTMENT OF TRANSPORTATION

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EXECUTIVE SUMMARY

The Oregon Department of Transportation (ODOT) prepared this Interchange Area Management Plan (IAMP) for the US 97 Baker Road interchange, located in Deschutes County approximately ½-mile south of the southern urban growth boundary (UGB) of Bend, Oregon. The purpose of IAMPs is to establish an agreement with local governments about what transportation solutions or land use/policy actions are needed in an interchange area and how to best implement those in a way that protects the intended function of the interchange and extends the life of significant investments in new transportation infrastructure.

The US 97 Baker Road interchange was constructed in the early 1990s. At that time, its intended function was to serve the sparsely developed rural lands south of Bend and accommodate truck freight traffic passing between US 97 to the south and US 20 to the east via Knott Road and SE 27th Street. The City of Bend's population is now nearly four times greater than it was when this interchange was constructed and the UGB has not only become much closer to the interchange, but is anticipated to abut it within the next 20 years.

Over time, this increasing urban growth has resulted in congestion and safety problems in the US 97 Baker Road interchange area. The unsignalized ramp terminals on Baker Road and Knott Road experience excessive delays during peak travel periods. This congestion can get much worse when the nearby railroad crossing is closed for a passing train, with queues of vehicles observed backing down the ramps and into the highway. The closely spaced intersections of the southbound ramp terminal, Baker Court, and Cinder Butte Road, which surround the railroad crossing, create confusion and conflicts that have contributed to a high number of crashes. Additional safety problems have arisen from high-speed traffic approaching the interchange from Knott Road and limited accommodations for people walking or biking through the area. These problems are only anticipated to worsen in the future as housing and employment growth in Bend approaches the interchange over the next 20 years.

In light of these problems, the purposes of the US 97 Baker Road IAMP are to:

- Ensure the safe and efficient operation of the interchange area for all modes of travel through the 20-year planning horizon.
- Identify transportation improvements, management strategies, and land use/policy actions needed to support planned development.

The US 97 Baker Road IAMP was conducted over an approximately three-year period. It began by engaging affected parties to understand interchange needs followed by the development of goals, objectives, and evaluation criteria that align with the project purpose. The goals and objectives guided the development and evaluation of interchange alternative concepts before a preferred alternative was recommended for the interchange based on the feedback received from the public and direction from the Bend MPO Policy Board.

The preferred alternative focuses on enhancing the existing ramp terminals to address the operational deficiencies along Baker Road, reducing the potential for queue spillback onto US 97,

eliminating turning conflicts between closely spaced intersections, and providing low-stress active transportation facilities to connect regional trails and support multimodal travel in an urbanizing area. The preferred alternative (described in more detail in Chapter 4 of this IAMP and shown in Figure 1 below) includes the following improvements totaling $38 million dollars[1] which are recommended to be implemented in two phases:

PHASE 1 – WEST SIDE IMPROVEMENTS - $14.8 MILLION

- US 97 southbound ramps realignment and traffic signal and railroad crossing improvements: Realign the US 97 southbound ramp with Baker Court and signalize the intersection. This includes reconstruction of the BNSF railroad crossing and coordinating the railroad crossing with the new traffic signal.
- US 97 acceleration and deceleration lanes: Lengthen the existing US 97 southbound on-ramp acceleration lane and US 97 southbound off-ramp deceleration lane.
- Cinder Butte Road realignment and turn lanes: Realign Cinder Butte Road slightly to the west, construct westbound and eastbound left turn lanes and a northbound right turn lane (side-by-side left turn lanes on Baker Road between Cinder Butte Road and Baker Court). Improvements on Baker Road west of Cinder Butte Road would be to County standards.
- Baker Road/Cinder Butte Road signalization: Construct a traffic signal and coordinate it with the railroad crossing and the new US 97 southbound ramp terminal signal.
- Confirm intersection control for US 97 northbound ramp terminal: Confirm the intersection control for the US 97 ramp terminal through the affected parties engagement process for approval outlined in ODOT Highway Directive DES 02. The intersection control at the northbound ramp terminal will influence the design of Phase 1 elements.

PHASE 2 – BRIDGE AND EAST SIDE IMPROVEMENTS - $23.2 MILLION

- Baker Road bridge widening: Widen the existing Baker Road/Knott Road bridge over US 97 to accommodate the preferred concept (and added lanes if a signal is selected as the appropriate intersection control at the northbound ramps). Consider visual or physical gateway elements as part of the bridge design.
- US 97 northbound roundabout ramp terminal: Install a roundabout at the US 97 northbound ramp terminal (assuming a roundabout is confirmed as the appropriate traffic control for this intersection) and the associated multi-use path undercrossings.
- Multi-use path connections: Complete the multi-use path network, connecting the US 97 Bend to Lava Butte and Arnold Canal facilities.
- Realign Scale House Road: Realign Scale House Road to the east.

While the preferred alternative is projected to function well through the 20-year planning horizon, it was agreed that the ability to implement a longer-term option (shown in Figure 17 on page 50) should be retained if growth exceeds expectations and sufficient funding becomes available. The longer-term option includes flyover ramps for US 97 southbound traffic so that all traffic to/from US 97 is served at a roundabout on the east side of the highway.

[1] Based on 2021 dollars reflecting a 2029 year of expenditure.

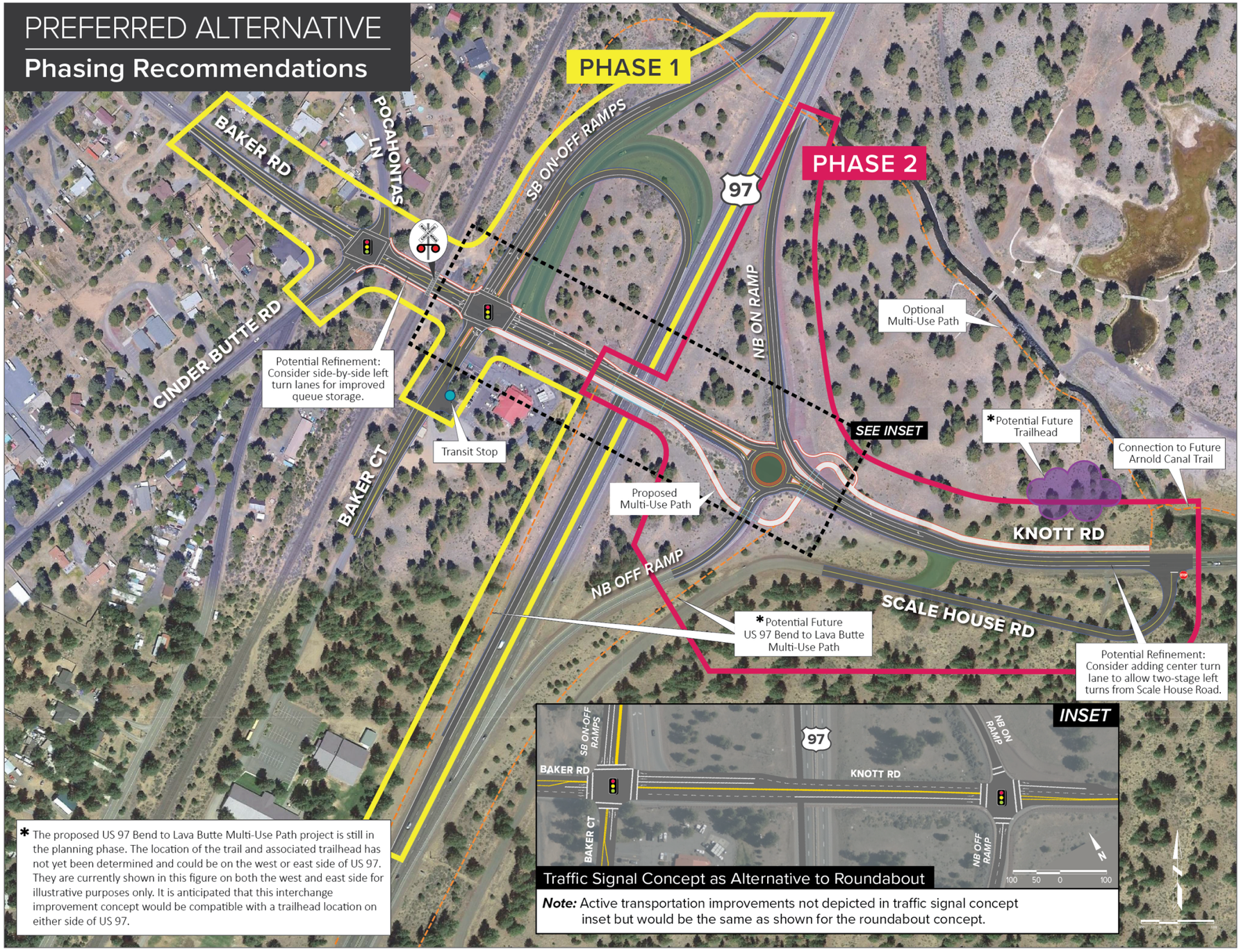

FIGURE 1: PREFERRED ALTERNATIVE FOR THE US 97 BAKER ROAD INTERCHANGE

In addition to the physical infrastructure improvements, several management actions are recommended in this IAMP to help preserve the function of the interchange and meet the goals and objectives of the IAMP. This includes transportation system management strategies (such as managing evacuation routes or reducing the posted speed limit) and an Access Management Plan, which sets a framework for managing existing private accesses and public streets and provides guidance for future development/redevelopment on area properties to ensure that the access on US 97, Baker Road, and Knott Road aligns with the access management Key Principles and Methodology (see page 52).

This IAMP is organized into six chapters:

- **Chapter 1 – Introduction:** This chapter defines the project problem and purpose, project area, interchange function and summarizes relevant background land use, demographic and environmental information within the project area. This chapter also documents the project goals, objectives, and evaluation criteria that were developed with input from key affected parties.
- **Chapter 2 – Project Process**: This chapter lists the advisory and decision-making groups for the IAMP and documents how the input from these groups were used to help evaluate and refine the alternatives before selecting the preferred alternative. The process for broader community engagement and communication with affected parties is also documented in this chapter.
- **Chapter 3 – Existing and Future Needs:** This chapter summarizes the existing and future deficiencies in the transportation system that influenced the development and evaluation of improvement concepts for the interchange.
- **Chapter 4 – Recommended Interchange Improvements:** This chapter summarizes the process for developing and evaluating alternative concepts along with the preferred alternative for the US 97 Baker Road interchange.
- **Chapter 5 – Access Management Plan and Management Strategies:** This chapter includes a collection of strategies to supplement the preferred alternative improvements that will help protect the public's investment and ensure the transportation system in the interchange area functions as intended through the planning horizon.
- **Chapter 6 – IAMP Implementation and Adoption:** This chapter documents the steps needed for IAMP implementation and adoption.

CHAPTER 1. INTRODUCTION

The Oregon Department of Transportation (ODOT) prepared this Interchange Area Management Plan (IAMP) for the US 97 Baker Road interchange, located in Deschutes County ½-mile south of the southern urban growth boundary (UGB) of Bend, Oregon. The purpose of IAMPs is to establish an agreement with local governments about what transportation solutions or land use/policy actions are needed in an interchange area and how to best implement those in a way that protects the intended function of the interchange and extends the life of significant investments in new transportation infrastructure.

This chapter in the IAMP focuses on:

- defining the project problem and purpose,
- defining the project area,
- describing the interchange function,
- summarizing relevant background land use, demographic and environmental information within the project area, and
- documenting the project goals, objectives, and evaluation criteria.

PROJECT PROBLEM AND PURPOSE

The US 97 Baker Road interchange was constructed in the early 1990s. At that time, its intended function was to serve the sparsely developed rural lands south of Bend and accommodate truck freight traffic passing between US 97 to the south and US 20 to the east via Knott Road and SE 27th Street. The City of Bend's population is now nearly four times greater than it was when this interchange was constructed and the UGB has not only become much closer to the interchange but is anticipated to abut it within the next 20 years.

Over time, this increasing urban growth has resulted in congestion and safety problems in the US 97 Baker Road interchange area. The unsignalized ramp terminals on Baker Road and Knott Road experience excessive delays during peak travel periods. This congestion can get much worse when the nearby railroad crossing is closed for a passing train, with queues of vehicles observed backing down the ramps and into the highway. The closely spaced intersections of the southbound ramp terminal, Baker Court, and Cinder Butte Road, which surround the railroad crossing, create confusion and conflicts that have contributed to a high number of crashes. Additional safety problems have arisen from high-speed traffic approaching the interchange from Knott Road and there are limited accommodations for people walking or biking through the area. These problems are only anticipated to worsen in the future as housing and employment growth in Bend approaches the interchange over the next 20 years.

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DEFINITION OF PROJECT AREA

There are three different types of "project areas" defined for the US 97 Baker IAMP, each with a different purpose.

The **Study Area** is defined as the area within which changes in land use would have measurable effects on traffic volumes at the US 97 Baker Road interchange. A map of the Study Area is provided in Figure 2. The Study Area is much larger than the other project areas described below, as the boundaries were influenced by the proximity of the interchange to areas where significant future housing and employment growth are expected, the locations of likely origins and destinations for trips associated with those areas, and the street network available to serve them. Future growth immediately to the northeast and further east out to SE 27th Street is expected to have the greatest impact.

The **Area of Potential Impact (API)**, shown in Figure 3, is defined as the area within which transportation improvements proposed through the IAMP are located. This could include a reconfigured interchange or new streets in the surrounding area to improve connectivity such that local east-west trips would not have to drive through the interchange.

The **Area of Social Impact (ASI)**, also shown in Figure 3, is defined as the area within which live the people who will be most affected by transportation improvements and management strategies proposed through the IAMP. Demographics of the people within this area are further described later in this chapter.

Twelve **Study Intersections**, also shown in Figure 3, were evaluated to help understand existing and future transportation needs within the API.

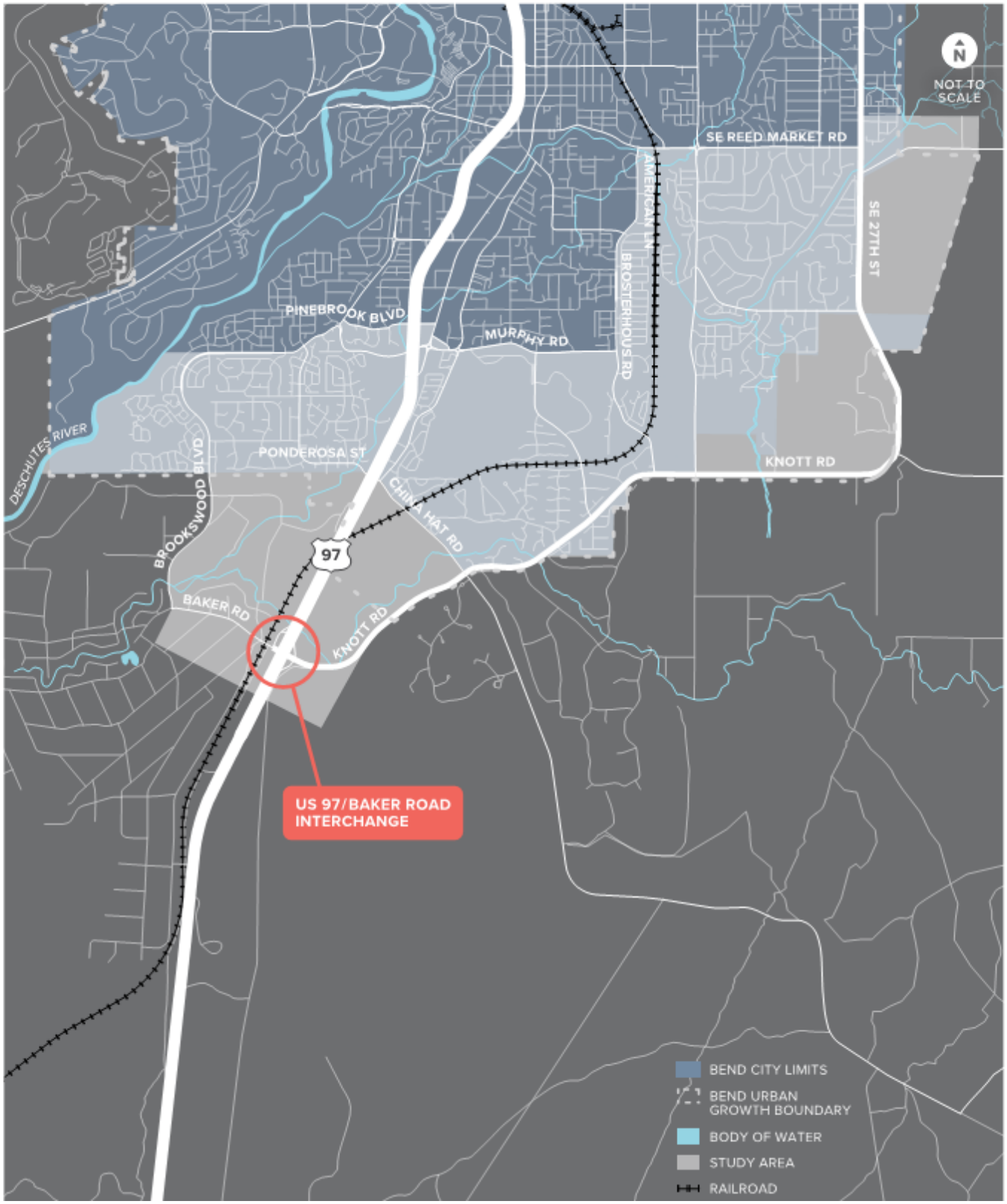

FIGURE 2: STUDY AREA

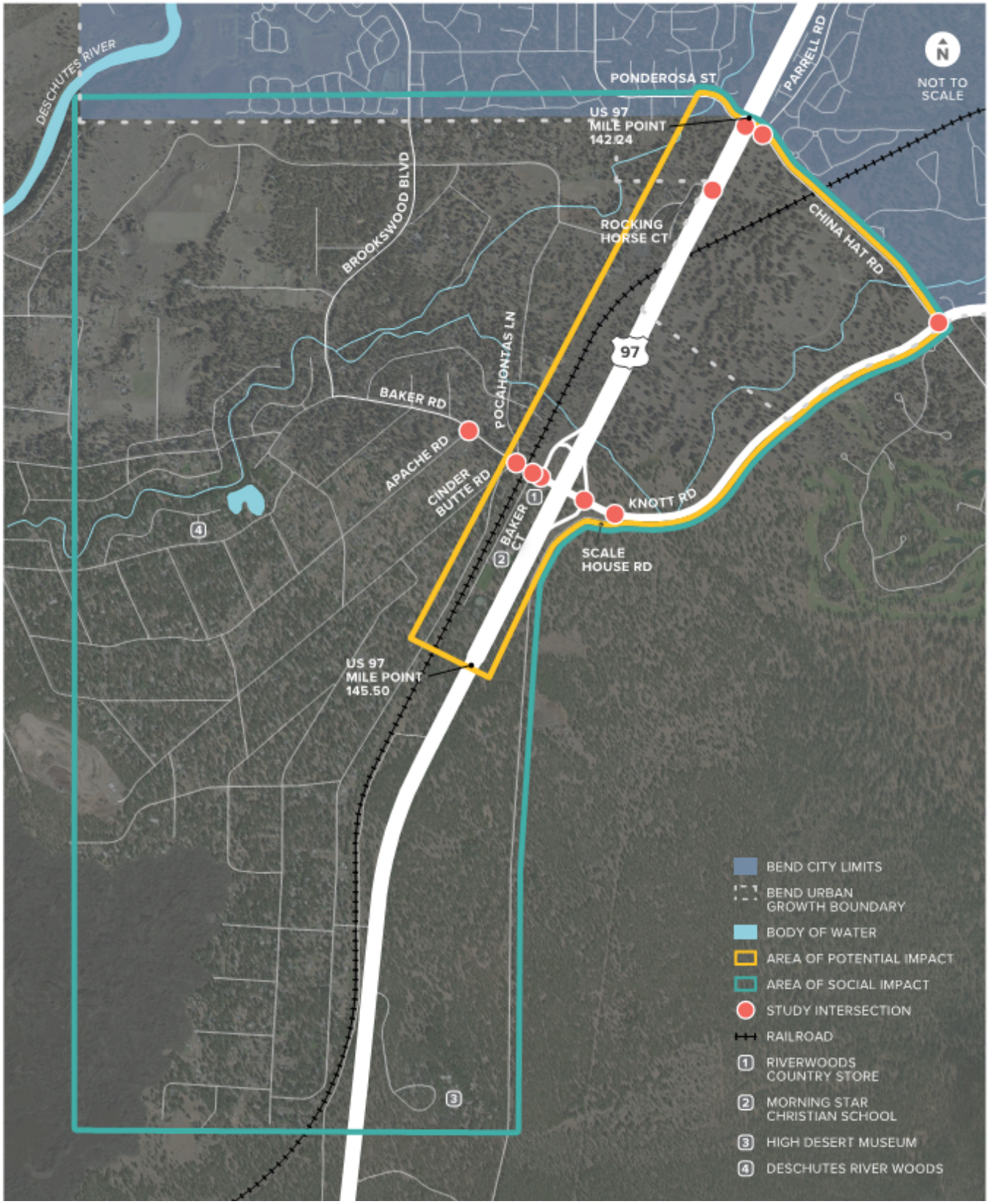

FIGURE 3: AREA OF POTENTIAL IMPACT AND AREA OF SOCIAL IMPACT

INTERCHANGE FUNCTION

Through the interchange area, US 97 is classified by ODOT as a Statewide Highway and is further designated as an expressway, state freight route, reduction review route, and high clearance route. Therefore, the primary functions of US 97 are to provide safe and efficient, high-speed and high-volume traffic movement, inter-urban and inter-regional mobility, connections to larger urban areas and major recreation areas not directly served by an Interstate Highway, facilitate efficient and reliable interstate, intrastate, and regional truck movement, and provide adequate vertical clearance for oversize loads.

FIGURE 4: EVACUATION ROUTE SIGN ON BAKER ROAD

Baker Road and Knott Road are classified as Rural Arterials by Deschutes County (Knott Road is also classified as a minor arterial by Bend within the UGB). The intended function of Rural Arterials is to provide links to cities and other major traffic generators, as well as interregional and intercounty service. Rural arterials serve the more important intra-county travel corridors and are secondary routes for the movement of goods and services. Baker Road is also identified as a Project Wildfire Evacuation Route (see Figure **4**) and serves as one of the few routes out of the Deschutes River Woods neighborhood.

The US 97 Baker Road interchange was designed to serve a rural environment but is increasingly serving urban land uses. Most of the area surrounding the interchange is zoned by Deschutes County as Rural Residential (RR10). There is a small area in the southwest quadrant of the interchange zoned Rural Commercial (RC), which is developed with the Riverwoods Country Store and includes a convenience store, gas station, espresso stand, and restaurants. Just south of this commercial development, but also accessed via Baker Court, is Morning Star Christian School. However, the Bend UGB is less than a mile north of the interchange and the City anticipates a significant amount of future residential, industrial, and commercial growth over the next 20 years.

Currently, the US 97 Baker Road interchange provides the only crossing of US 97 for about two miles (Murphy Road provides the next crossing to the north). Considering the residential development to the west and the mix of existing and future land uses to the east, another important function of this interchange is to provide east-west connectivity for the surrounding area.

PROJECT AREA BACKGROUND INFORMATION

To help identify interchange needs, adjacent land use, environmental, and demographic data was collected. The following summarizes existing data.

LAND USE

Technical Memorandum #2A: Land Use Existing Conditions in Volume 2 documents existing land use and comprehensive plan designations within the Study Area. As shown in Figure 2, the Study Area is located along the border of the City of Bend and Deschutes County and includes areas within the Bend Urban Growth Boundary (UGB), and within Bend city limits. The City manages land located outside city limits but inside the UGB pursuant to an intergovernmental agreement with Deschutes County. All land located outside the UGB is subject to Deschutes County land use and development regulations.

City of Bend Comprehensive Plan

As shown in Figure 5, the western portion of the Study Area subject to the City's land use regulations is primarily designated as Standard Density Residential (RS), which provides for housing types compatible with single-family homes, and Low-Density Residential (RL), which provides for low-density residential development with a maximum of approximately four dwellings per acre.

The area located immediately west of US 97 and north of the project interchange is designated a mix of General Commercial (CG), Mixed Employment (ME), Public Facilities (PF), Mixed Neighborhood (MN), High-Density Residential (RH), Medium Density Residential (RM), and Low-Density Residential (RL) designations. The area east of US 97 and south of China Hat Road is a mix of CG, ME, CC, Industrial Light (IL), and RS designations. The area east of US 97 and north of China Hat Road is primarily designated RS, though the large area between US 97 and Country Club Drive mostly consists of the Lost Tracks Golf Course today. Some areas to the north and south of this central portion are designated RL.

The 2016 decision to expand Bend's UGB included designating ten expansion areas, four of which are in the Study Area:

- The Southwest Expansion Area south of the city limits and west of US 97. This area is expected to provide 240 future housing units and 80 future jobs[2], largely with RS, RM, RH, and Mixed-Use Neighborhood (MN) and Commercial Limited (CL) designations.
- The "Thumb" Expansion Area south of city limits and east of US 97 (between Knott Road, China Hat Road, and US 97). This area is projected to supply 266 future housing units and 1,573 future jobs[2]. The planned designations in this area include CG, CC, IL, ME, RS, RM, and RH.

[2] Bend Urban Growth Boundary Implementation Return on Investment Analysis, Table 2 http://bend.granicus.com/MetaViewer.php?view_id=9&clip_id=424&meta_id=23134

- The Southeast Expansion Area (previously referred to as the "Elbow") in the southeast corner of the UGB south of Ferguson Road and east of SE 15th Street. This area is projected to include 1,230 new housing units and 2,800 future jobs[3] with RM, RH, CG, ME and IL designations.
- The Stevens Road Tract and Stevens Ranch Master Plan Areas south of Reed Market Road and east of SE 27th Street and south of Stevens Road. The currently vacant area is anticipated to provide for 1,001 future housing units and 880 future jobs[1]. Planned destinations here include IG, RS, RH, RM, CL, and CG.

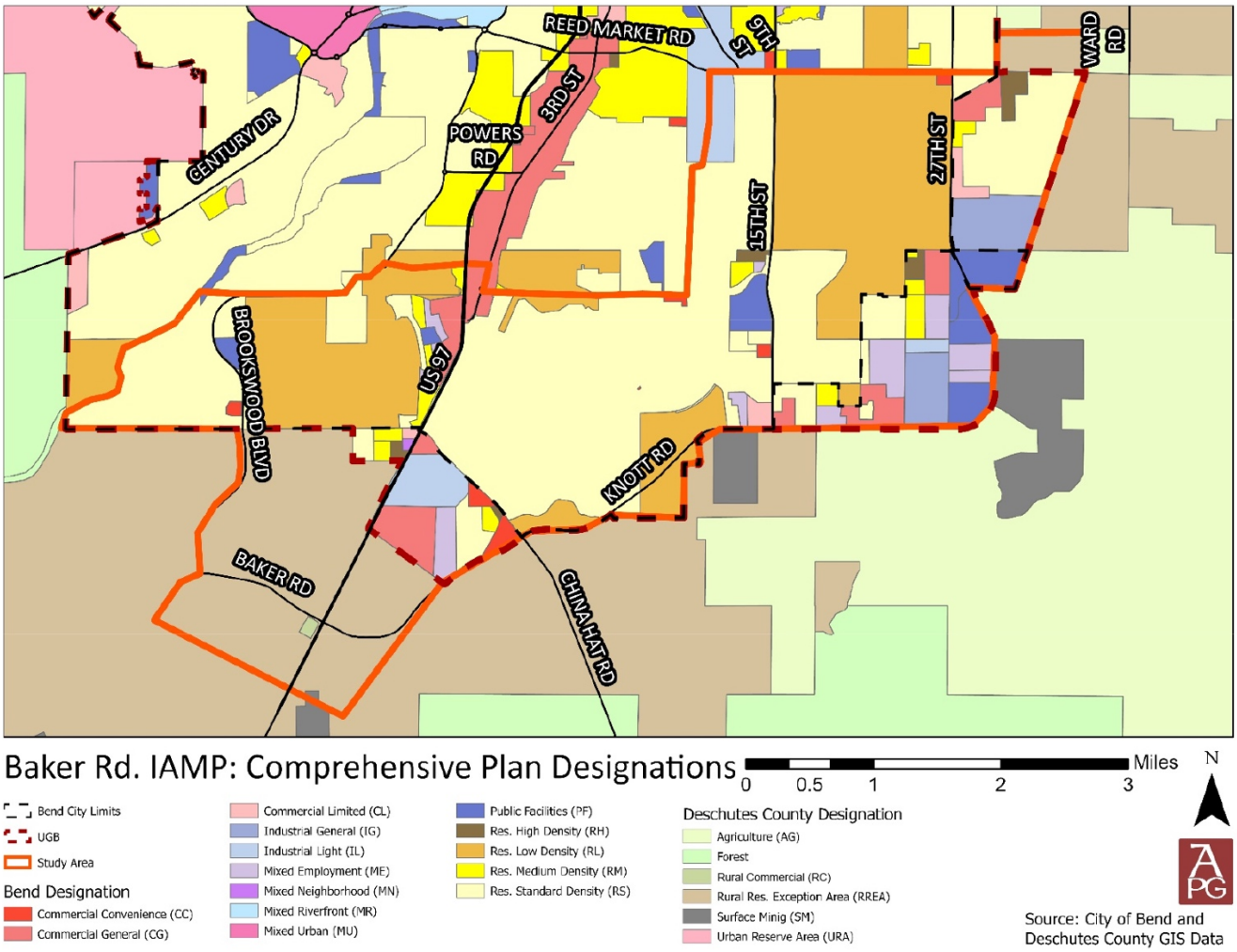

FIGURE 5: COMPREHENSIVE PLAN DESIGNATIONS IN THE STUDY AREA

[3] Bend Southeast Area Plan Summary Report, February 2021, pg. ES-2: https://www.bendoregon.gov/home/showpublisheddocument/48999/638144923125930000

DEMOGRAPHIC INFORMATION

Table 1 presents the data related to the population in the Census block groups partially included in the area of social impact (shown in Figure 6), as well as data for Deschutes County and the State of Oregon for comparison.

The Environmental Protection Agency's (EPA) *Promising Practices for EJ Methodologies in NEPA*[4] notes that when the percentage of low-income or minority populations in a selected geographic unit (i.e., Census block group) exceeds that of a reference community (e.g., state or county) by a reasonable subjective threshold, it constitutes a "meaningfully greater" low-income or minority population for purposes of environmental justice assessments. In this assessment, the county is used as the reference population and the "meaningfully greater" threshold is 150% of the reference population. As shown in Table 1, several block groups have a meaningfully greater proportion of low-income and elderly population. As some of the study area's block groups have higher proportions of low-income and elderly populations, it is important to consider the equity impacts of this project on these populations.

TABLE 1: DEMOGRAPHIC INFORMATION WITHIN THE AREA OF SOCIAL IMPACT

	BLOCK GROUP 410170004011	BLOCK GROUP 410170020001	BLOCK GROUP 410170021004	DESCHUTES COUNTY	STATE OF OREGON
	(2013-2017 ACS ESTIMATES)			(2019 ACS ESTIMATE)	
POPULATION	3,254	995	1,831	175,321	4,217,737
SIZE (SQ MILES)	41.44	1.84	1.62	3,054	98,466
MINORITY	11%	5%	3%	13%	25%
LOW-INCOME	30%	11%	31%	9%	34%
OVER 65	9%	43%	16%	21%	18%

Source: EJSCREEN online tool https://ejscreen.epa.gov/mapper/ and U.S. Census Quick Facts https://www.census.gov/quickfacts/deschutescountyoregon

Transit serves a small portion of the area of social impact. Cascades East Transit's Bend-La Pine intercity bus Route 30 has a stop at Riverwoods Country Store at the intersection of Baker Court and Baker Road[5]. This limited transit service, which only serves the study area's stop three times per day, leaves area residents with few transit options.

[4] *https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf*

[5] https://cascadeseasttransit.com/ride/la-pine-bend-route-30/

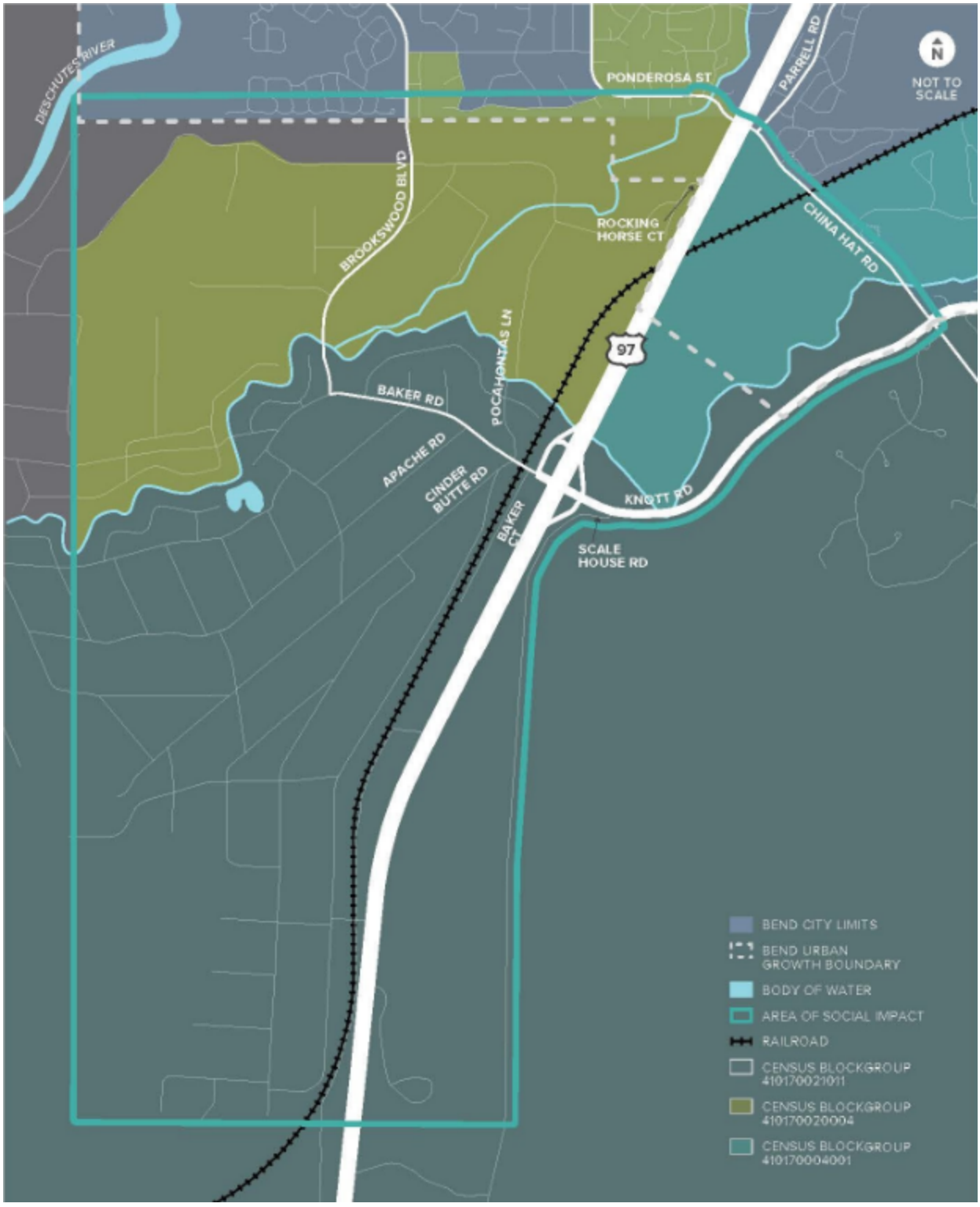

FIGURE 6: CENSUS BLOCK GROUPS IN AREA OF SOCIAL IMPACT

ENVIRONMENTAL

Oregon's Statewide Planning Goal 5 (OAR 660-015-000(5)) is intended to protect natural resources and conserve scenic and historic areas and open spaces. An inventory of environmental resources within the API was conducted based on the six resource categories identified in Goal 5. There are no landscape management rivers or streams in the API or other areas of open space and scenic views identified in the Goal 5 inventory. There are no Goal 5 inventoried wilderness areas, ecologically and scientifically significant natural areas, or recreation trails within the API. The API does not include any of the cultural and historic resources identified in the Goal 5 inventory.

The API includes several wetlands, including a National Wetland Inventory (NWI)-mapped wetland (the Arnold Canal), which derives water from the Deschutes River to support agriculture[6]. This wetland is described as an intermittent, seasonally flooded, riverine wetland. There are no mapped riparian areas adjacent to the canal. The other wetlands in the API, are mapped in the Oregon Local Wetland Inventory (LWI)[7]. They appear as open water ponds in online aerial photos and are listed as "non-significant wetlands."

Based on a review of the US Fish and Wildlife Information for Planning and Consultation database[8], no designated critical habitat of any species listed as threatened or endangered under the Endangered Species Act is present in the API. However, the southern end of the API overlaps the federally threatened Oregon Spotted Frog's range[9], so care should be taken during any construction work affecting wetlands in the area. Furthermore, US 97 through Bend is designated a hotspot for deer collisions, averaging 5 to 10 per year. US 97 within the API has had reports of 28 deer collisions between 2010 and 2020, which averages to fewer than three per year.

Topography of the API is gently sloped, rising from elevations of approximately 3,860 feet at the northern end of the API to 3,940 feet near the southern end of the API. There are no steep or unstable slopes in the API.

GOALS, OBJECTIVES, AND EVALUATION CRITERIA

The project goals, objectives, and evaluation criteria are provided in Table 2. A goal is an overarching principle or a broad statement of intent that informs the range of possible transportation solutions and guides decision-making. Objectives are more specific and relevant steps that are taken to meet the goal, while the evaluation criteria assess how well those objectives would be met by the alternatives considered.

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[6] https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/

[7] https://www.oregon.gov/dsl/ww/Pages/Inventories.aspx

[8] https://ipac.ecosphere.fws.gov/

[9] https://ecos.fws.gov/ecp/species/6633

The goals, objectives, and evaluation criteria were developed with consideration to the project problem, purpose, and interchange function previously described, as well as the goals, objectives, and evaluation criteria from other similar projects in the area such as the US 97 Parkway Plan and the US 97 Bend North Interchange Study. They were refined through discussions with the Project Advisory Committee (made up of the Technical Advisory Committee and Community Advisory Committee) and Executive Steering Committee. The resulting goals, objectives, and evaluation criteria for the US 97 Baker Road IAMP guided the development of solutions for the interchange area and were used to demonstrate how well improvement alternatives would meet the purpose of the project and the values of affected parties.

The goals and objectives have been numbered to facilitate referencing, but no weighting has been applied and the order is not an indication of relative importance.

TABLE 2: US 97 BAKER ROAD IAMP GOALS, OBJECTIVES, AND EVALUATION CRITERIA

GOALS/ OBJECTIVES	EVALUATION CRITERIA
GOAL 1. PROVIDE FOR EFFICIENT TRAVEL THROUGH THE INTERCHANGE AREA BASED ON EXISTING AND PLANNED LAND USES IN THE AREA.	
Objective A. Provide for efficient travel for regional through traffic along US 97.	Meets ODOT's adopted mobility standards for US 97 through the planning horizon.
	Meets ODOT's adopted mobility standards at the US 97 ramp terminals with Baker Road and Knott Road through the planning horizon.
Objective B. Provide for efficient travel on the local roadway system in the interchange area.	Meets Deschutes County and City of Bend mobility standards for local system study intersections through the planning horizon.
GOAL 2. IMPROVES SAFETY FOR ALL MODES OF TRAVEL.	
Objective A. Reduce the frequency and severity of crashes for all modes with an emphasis on severe and fatal injuries.	Reduces the frequency and severity of crashes, as assessed through analysis of crash data and use of Crash Modification Factors.
	Minimizes conflicts and risk factors that could lead to crashes.
	Enhances safety for vehicular and non-motorized modes of transportation at rail crossings.
Objective B. Move in the direction of meeting ODOT's adopted access spacing standards along US 97, Baker Road, and Knott Road, or meet the standards where feasible.	Meets or improves access spacing pursuant to ODOT's adopted access spacing standards.

GOALS/ OBJECTIVES	EVALUATION CRITERIA
GOAL 3. SUPPORT REGIONAL AND LOCAL ECONOMIC DEVELOPMENT.	
Objective A. Maintain access to properties along baker road and Knott Road in a manner that supports the economic development objectives of existing and future businesses consistent with the Deschutes County and Bend Comprehensive Plans.	Maintains accessibility to properties consistent with the documented needs of existing land uses and anticipated potential needs of future uses based on Comprehensive Plan designations.
Objective B. Develop an interchange design that facilitates truck freight movement along US 97 and to and from destinations to the east.	Proposed interchange geometry, such as curves, clearances, and grades, accommodates trucks and oversize vehicles.
Objective C. Allow for safe and uninterrupted service on the Burlington Northern Santa Fe railroad.	Based on qualitative criteria, reduces potential conflicts with the rail crossing on Baker Road.
GOAL 4. FACILITATE THE USE OF MULTIMODAL TRAVEL OPTIONS.	
Objective A. Provide low-stress walking and biking facilities that create east-west connectivity through the interchange area.	Based on qualitative criteria, enhances the quality of walking and biking facilities.
	Reduces the level of traffic stress for people walking and biking.
	Increases the number of grade-separated US 97 crossings provided in the Area of Potential Impact for people walking and biking.
Objective B. Identify where planned trails in the interchange area can be safely connected and accessed.	Based on qualitative criteria, enhances trail system completeness and quality of connections.
Objective C. Accommodate long-term connectivity to the south.	Incorporates the alignment of the proposed US 97: Baker/Knott Road to Lava Butte Multi-Use Path and connects it to the walking and biking network in the interchange area.
Objective D. Support future enhancements to Cascades East Transit service.	Can accommodate planned transit service improvements and expansions.
	Provides safe walking and biking access to transit.
GOAL 5. DEVELOP THE PROJECT TO SUPPORT THE COMMUNITY'S VALUE OF EQUITY.	
Objective A. Provide an equitable decision-making process that encourages participation by all.	Historically underrepresented community members within the Area of Social Impact were invited to participate in the project. (This will be used to evaluate the project process, but not individual alternatives.)

GOALS/ OBJECTIVES	EVALUATION CRITERIA
	Feedback from historically underrepresented community members indicates they were able to participate in the process. (This will be used to evaluate the project process, but not individual alternatives.)
Objective B. Achieve a just allocation of burdens and benefits among community members.	Impacts to properties owned, used by, or accessed by historically underrepresented community members are proportionate to those of other populations.
GOAL 6. PRACTICE GOOD STEWARDSHIP OF THE ENVIRONMENT.	
Objective A. Reduce vehicle emissions through reduction of vehicular delay, improved connections in the local system, and the use of alternative travel modes.	Assessment of reductions in vehicular delay and vehicle-miles traveled, as well as improvements supporting walking, biking, and use of transit.
Objective B. Minimize impacts on resource lands.	Minimizes impacts on land designated for natural resources, scenic and historic areas, and open spaces.
Objective C. Minimize adverse impacts on wildlife.	Recommendations minimize or avoid impacts to wildlife habitat and safety.
GOAL 7. DEVELOP SOLUTIONS THAT ARE CONSISTENT WITH THE ESTABLISHED SHARED CORRIDOR VISION AND ADOPTED STATE AND LOCAL PLANS.	
Objective A. Create a US 97 corridor that is compatible with the recommendations from the US 97 Parkway Plan and Bend to Lava Butte Refinement Plan.	Recommendations are compatible with those from the US 97 Parkway Plan and Bend to Lava Butte Refinement Plan.
Objective B. Ensure compatibility with future planned growth in Bend's opportunity areas and expansion areas.	Traffic forecasts and connectivity improvements in the Area of Potential Impact account for the impact of housing and employment growth in Bend's opportunity areas and expansion areas.
Objective C. Consider the visual sequence of project elements as an entry/exit node to the city of bend.	Can accommodate or does not compete with visual and physical gateway elements to south Bend.
Objective D. Support the action plan in the greater bend community wildfire protection plan to enhance community safety.	Recommendations maintain or enhance access and evacuation routes for the Southwest and Southeast Communities.
GOAL 8. DEVELOP IMPLEMENTABLE SOLUTIONS FOR THE INTERCHANGE AREA.	
Objective A. Minimize impacts on resource lands.	Minimizes impacts on land designated for natural resources, scenic and historic areas, and open spaces.

GOALS/ OBJECTIVES	EVALUATION CRITERIA
Objective B. Ensure public funds are invested efficiently and effectively, and solutions are fiscally responsible.	Based on qualitative criteria, solutions are effective at addressing goals and objectives compared to costs and would reasonably fit within funding expectations for project partners.
Objective C. Develop solutions that can be implemented in phases.	Solutions can be implemented incrementally in functional phases.
Objective D. Develop a design that is constructable and could be reasonably maintained.	Minimizes the number of potential design exceptions.
	Is easily constructable with regard to rail impacts and ability to maintain traffic.
	Does not create maintenance challenges.

CHAPTER 2. PROJECT PROCESS

The US 97 Baker Road IAMP was conducted over an approximately three-year period. It began by engaging affected parties to understand interchange needs followed by the development of goals, objectives, and evaluation criteria that align with the project purpose. The goals and objectives guided the development and evaluation of interchange alternative concepts before a preferred alternative was recommended for the interchange. The following sections describe the advisory and decision-making groups that were utilized for this project as well as the broader community engagement activities that were undertaken. Chapter 4 describes the process for developing and evaluating alternatives in more detail.

ADVISORY AND DECISION-MAKING GROUPS

The planning process for this IAMP included two advisory bodies which made up the Project Advisory Committee (PAC): the Technical Advisory Committee (TAC) and Community Advisory Committee (CAC). The PAC consisted of members that represented the following groups:

- Abilitree
- Arnold Irrigation District
- Bend-La Pine School District
- Bend Parks & Recreation District
- Bend Community Development Department
- Bend Metropolitan Planning Organization
- Bend Transportation and Mobility Department
- Bend Fire & Rescue
- Cascades East Transit
- Central Oregon Coalition for Access
- Department of Land Conservation and Development
- Deschutes County Community Development
- Deschutes River Woods
- Deschutes County Emergency Services
- Deschutes County Bike/Pedestrian Advisory Committee
- Homeless Leadership Coalition
- Morning Star Christian School
- Oregon Department of Transportation
- Riverwoods Country Store
- US Forest Service

The PAC was an advisory body that provided recommendations throughout the IAMP process. The Bend MPO Policy Board acted as the project Executive Steering Committee (ESC), which had ultimate decision-making authority and provided direction at key milestones. The Bend MPO Policy Bord is comprised of members representing Bend City Council, Deschutes County Board of Commissioners, and the Oregon Department of Transportation.

COMMUNITY ENGAGEMENT

In addition to the advisory and decision-making groups, input was sought from other community members through two online open houses and two virtual public meetings. The first round of outreach was conducted in June 2021, and focused on receiving input on the project goals and objectives, issues needing to be addressed, and preliminary interchange concepts. The second round of outreach was conducted in November 2021, and focused on receiving feedback on the top three alternatives for interchange improvements.

The project received a total of 497 unique visitors to the two online open houses and 46 survey responses. At the two virtual public meetings, a total of 42 people participated with 10 public meeting comments/questions received.

Other public engagement consisted of a regularly updated project website, interested party emails and media releases sent via GovDelivery to over 6,700 recipients, and 7,315 postcards mailed to project area neighbors announcing both the online open house and online meetings. Both online open houses were also covered by local news stations. In addition to the outreach listed above, the access management Key Principles and Methodology were shared with local property owners (in accordance with OAR 734-051-7010).

CHAPTER 3. EXISTING AND FUTURE NEEDS

Technical Memorandum #2B: Existing Transportation System Inventory and *Technical Memorandum #3: Current Transportation System Operations* in Volume 2 document the detailed analysis of existing conditions and transportation deficiencies. *Technical Memorandum #4: Future Baseline (No-Build) Conditions* in Volume 2 documents the detailed analysis of conditions expected in the year 2040 if no improvements are made in the interchange area.

This chapter summarizes the existing and future needs that influenced the development and evaluation of improvement concepts for the interchange. The main needs relate to safety, walking and biking level of traffic stress, ability to safely enter and exit the Parkway, freight operations, future land use growth, intersection operations, and vehicle queuing.

SAFETY

Safety concerns within the API were identified through an examination of risk factors and historical crash data. Risk factors include characteristics of the transportation system that may contribute to the increased likelihood of a crash occurring. Several risk factors identified include:

- **Closely spaced intersections:** intersections near the US 97/Baker Road southbound ramp terminal, including Baker Court and Cinder Butte Road, which surround the railroad crossing and create confusion and conflicts.
- **Railroad crossing:** vehicles have been observed to queue back along the US 97/Baker Road southbound ramp and onto the highway when the railroad crossing is closed.
- **Lack of dedicated left turn lanes:** when a driver stops to wait for an acceptable gap to make a left turn off Baker Road/Knott Road, all traffic following the driver must stop as well (as shown in Figure 7), increasing the likelihood of both rear-end crashes and turning/angle crashes.

FIGURE 7: VEHICLE STOPPING IN-LANE ON BAKER ROAD TO TURN LEFT ONTO US 97 NORTHBOUND

- **High speeds:** High speeds approaching the interchange from Knott Road increase the stopping sight distance required after a driver perceives a danger and may increase the degree of crash severity.
- **Lack of separation from traffic for people walking and biking:** the existing walking and biking facilities are next to high-speed traffic and, while shoulders are available in some areas, there is a lack of dedicated sidewalks and bike lanes.

Crash data from the most recent five-year period available (2014 to 2018) was obtained from ODOT's Crash Analysis and Reporting unit for the ten study intersections within the API. Over the five-year period analyzed, there were 108 crashes. Of those crashes, 75 were flagged as intersection crashes. Along the segment portion of US 97, there were 25 crashes. The remaining eight crashes were located along the segment portions of Baker Road, Knott Road, and China Hat Road. Crashes within the API are mapped in Figure 8.

Most crashes reported were rear-end crashes caused by drivers failing to avoid the driver ahead and following too closely, turning movement crashes caused by drivers failing to yield the right-of-way, and fixed object crashes caused by drivers driving too fast. It should be noted that there was one pedestrian crash located at the intersection of US 97/Ponderosa Street/China Hat Road that resulted in a minor/possible injury.

There were no crashes resulting in fatalities reported from 2014 to 2018. However, there were crashes resulting in serious injury. One was located along the segment portion of US 97 just south of the Baker Road/Knott Road interchange, one was located at the intersection of US 97/Ponderosa Street/China Hat Road, and one was located at the intersection of China Hat Road/Knott Road. Two of the serious injuries were caused by rear-end crashes and the third was caused by a driver hitting a fixed object.

Crash rate analysis was completed for study intersections and roadway segments within the API, with the results compared to rates observed for similar facilities to identify where the frequency of crashes occurring may be higher than should be expected. Intersections and segments were flagged as safety focus areas if observed crash rates surpassed the accepted rates. Six intersections were flagged as safety focus areas. These intersections include:

- **Baker Road/Apache Road –** While this intersection was flagged as a potential safety focus area based on the crash rate analysis, there were only three reported crashes between 2014 and 2018. This included two rear-end crashes and one turning crash on Baker Road with no apparent pattern.
- **Baker Road/Cinder Butte Road –** There were nine reported crashes at this intersection with the majority of the crashes involving rear-end (three) or turning (three) collisions. Most crashes occurred along Baker Road, but a few did occur on the side streets of Cinder Butte Road and Pocahontas Lane. There were no consistent trends or contributing factors for crashes at this intersection, but some turning movement and rear-end crashes may be caused by the lack of exclusive left turn lanes on Baker Road.
- **Baker Road/Baker Court –** There were 13 crashes reported at this intersection, with eight of those involving turns out of Baker Court (six with left turns from Baker Court and two with right turns from Baker Court). Four of the remaining five crashes involved rear-end collisions on Baker Road. Contributing factors for many of these crashes could be closely spaced intersections causing confusion, long delays when exiting Baker Court encouraging drivers to accept smaller gaps in traffic, and lack of an exclusive left turn lane on Baker Road.

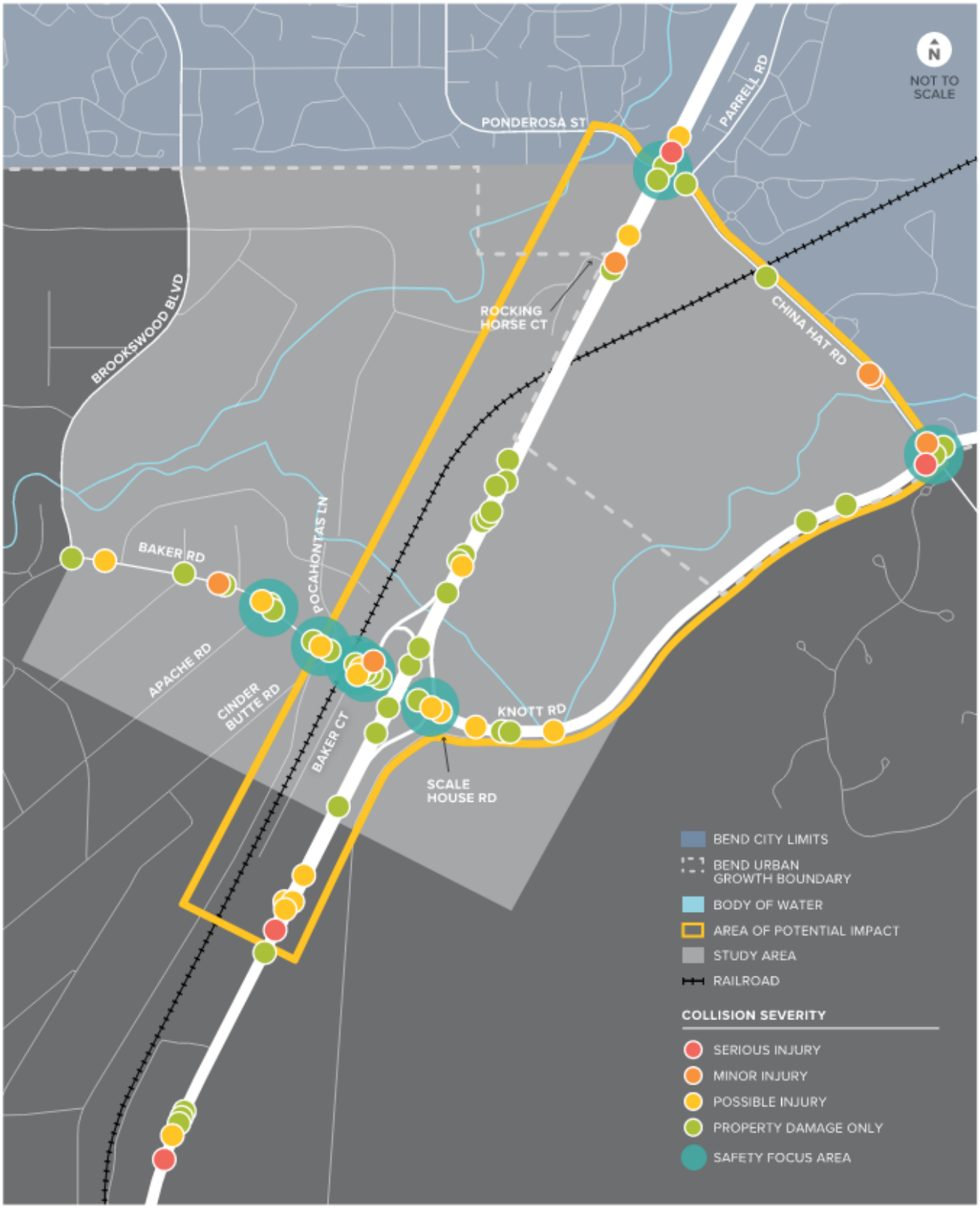


FIGURE 8: CRASHES WITHIN THE AREA OF POTENTIAL IMPACT (2014-2018)

- **Baker Road/Knott Road/US 97 Southbound Ramps –** There were 11 reported crashes at this intersection, including four eastbound rear-end crashes on Baker Road, three southbound rear-end crashes on the US 97 off-ramp, two turning crashes involving left and right turns from the off-ramp, and two other crashes of various types. Contributing factors for many of these crashes could be closely spaced intersections causing confusion, long delays when turning from the off-ramp encouraging drivers to accept smaller gaps in traffic, and lack of an exclusive left turn lane on Baker Road.
- **Knott Road/US 97 Northbound Ramps –** There were 13 reported crashes at this intersection, including six rear-end crashes (three on eastbound Knott Road, two on the northbound off-ramp, and one on westbound Knott Road), five turning crashes (all left turns coming from the off-ramp), and two crashes into the guardrail. Contributing factors for many of these crashes could be the lack of an exclusive eastbound left turn lane on Knott Road, long delays when turning from the off-ramp encouraging drivers to accept smaller gaps in traffic, and high speeds.
- **Knott Road/China Hat Road –** Most of the reported 11 crashes were classified as turning movement and angle crashes caused by drivers failing to yield the right-of-way. The long delays experienced on stop-controlled approaches may be increasing the likelihood of these types of crashes. Furthermore, there is a horizontal curve in Knott Road to the east that limits sight distance from the southern stopped approach to approximately 375-400 feet. By comparison, the desired intersection sight distance for safe operation is 500 feet (assuming a design speed of 45 mph) and the minimum distance needed for an oncoming vehicle on Knott Road to safely stop is 360 feet[10]. Therefore, this horizontal curve and limited sight distance could be another contributing factor in the crashes occurring at this location.

In addition to individual intersections, crash rates for segments of the US 97 study corridor were analyzed to identify potential problem areas. However, while crashes have occurred, the rate of crashes was well below the statewide average rate of crashes for similar facilities and there were no locations with notable Safety Priority Index System (SPIS) ratings.

WALKING AND BIKING

While common for rural areas, there are currently no sidewalks or bike lanes on any of the roads near the interchange and many of the shoulders are narrow and/or unpaved. There are no marked crosswalks or ADA accessible facilities near the interchange. Within the rest of the API, there are limited sidewalks and bike lanes along China Hat Road, but no other pedestrian or bicycle facilities. For roadways that are uncurbed with vehicle speeds greater than 25 miles per hour, Deschutes County standards[11] indicate a shoulder bikeway should be at least four feet in width. Deschutes County does not require sidewalks outside of the unincorporated communities of Terrebonne and Tumalo[12].

[10] A Policy on Geometric Design of Highway and Streets, 7th Edition, American Association of State Highway and Transportation Officials (AASHTO), 2018.

[11] Deschutes County Code 17.48.140

[12] Deschutes County Transportation System Plan

Since much of the API is sparsely developed today, trip origins and destinations are far apart, making walking and biking trips less feasible. In addition, US 97 and the railroad act as barriers to east-west travel for people walking and biking. However, the Baker Road interchange provides one of the few grade-separated crossings of US 97 for people walking and biking and is identified as a County Bikeway by the Deschutes County TSP. When development of the "thumb" area occurs, use of Baker Road as a grade-separated crossing of US 97 will continue to increase for people walking and biking.

The Level of Traffic Stress (LTS) was analyzed for pedestrian and bicycle facilities in the API using the methodology from the ODOT *Analysis and Procedures Manual*[13]. This methodology breaks road segments into four classifications to qualitatively rate the effects of traffic-based stress on people walking and biking. The measure of traffic stress quantifies the perceived safety issues stemming from physical distance to traffic and traffic speed. The four levels of stress are described below:

- **LTS 1 (lowest):** Represents little traffic stress and requires less attention, so is suitable for bicycling for all ages and abilities.
- **LTS 2 (low):** Represents little traffic stress but requires more attention than young children can handle, so is suitable for teens and adults bicycling with adequate bike handling skills. Traffic speeds are slightly higher, but speed differentials are still low, and roadways can be up to three lanes wide in total for both directions.
- **LTS 3 (medium):** Represents moderate stress and is suitable for most observant adult bicycling. Traffic speeds are moderate but can be on roadways up to five lanes wide.
- **LTS 4 (high):** Represents high stress and is suitable only for experienced and skilled people on bicycles. Traffic speeds are moderate to high and can be on roadways from two to over five lanes wide. Intersections can be complex, wide, and or high volume/speed and can be perceived as unsafe or difficult to cross by adults.

For this analysis, the mainline of the US 97 corridor, Baker Road, Knott Road, and China Hat Road within the study area were analyzed, as well as key crossing locations. The results of the LTS analysis for people walking and biking are illustrated in Figure 9 and Figure 10. The speed of the adjacent traffic is a major factor in this analysis, so corridors with lower posted speeds tend to have more favorable ratings, while corridors with higher posted speeds (over 35 mph) tend to have less favorable ratings. Along US 97 and Baker Road, the LTS is high due to the lack of sidewalks and bicycle lanes.

The LTS analyses also consider the difficulty of crossing streets (at intersections between collectors and arterials only). As shown in Figure 9 and Figure 10, all intersections have high levels of stress for people walking and biking except for the intersection of China Hat Road and Parrell Road, which exhibits medium traffic stress due to the lower motor vehicle volume entering the intersection.

[13] https://www.oregon.gov/odot/Planning/Pages/APM.aspx

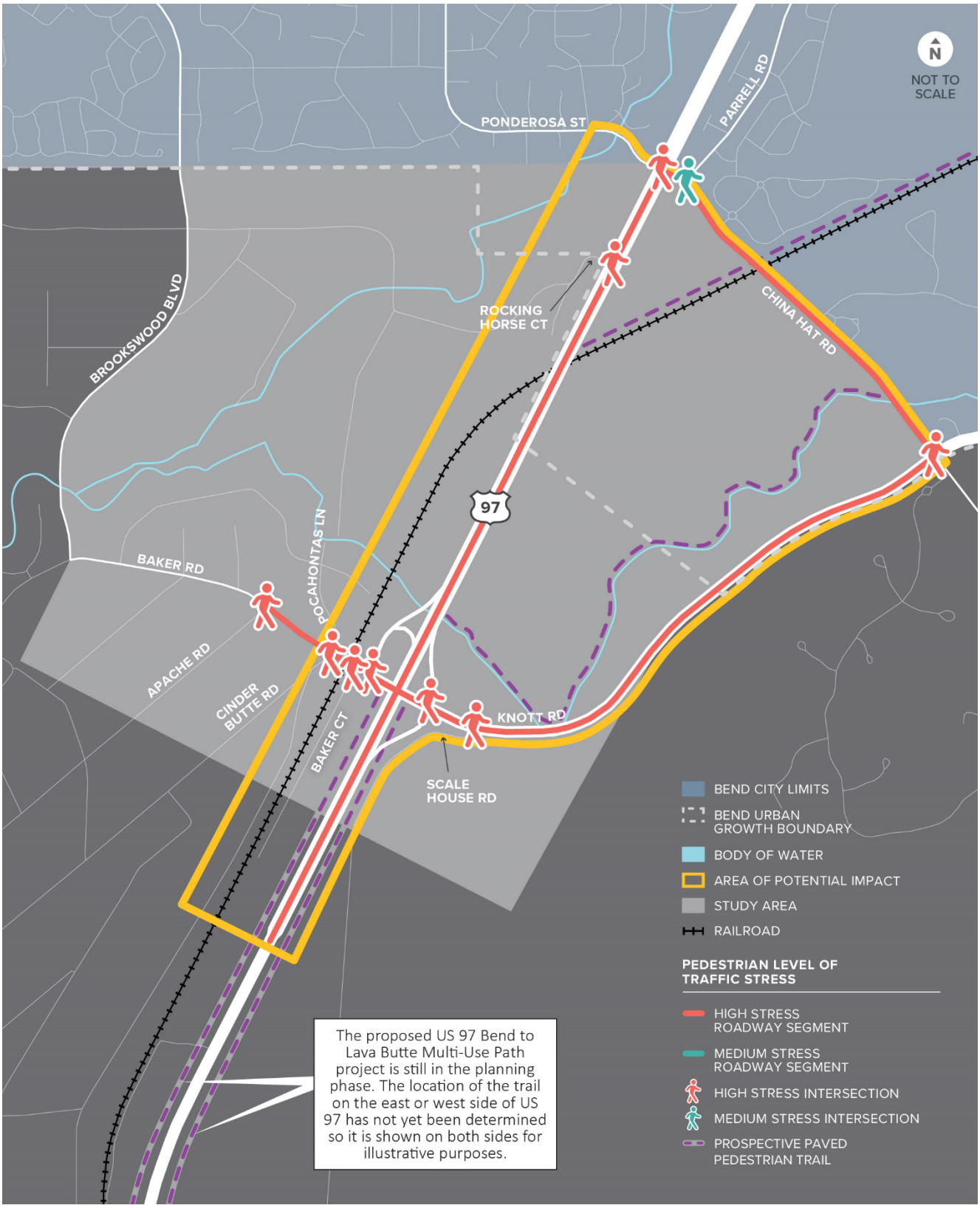


FIGURE 9. PEDESTRIAN LEVEL OF TRAFFIC STRESS

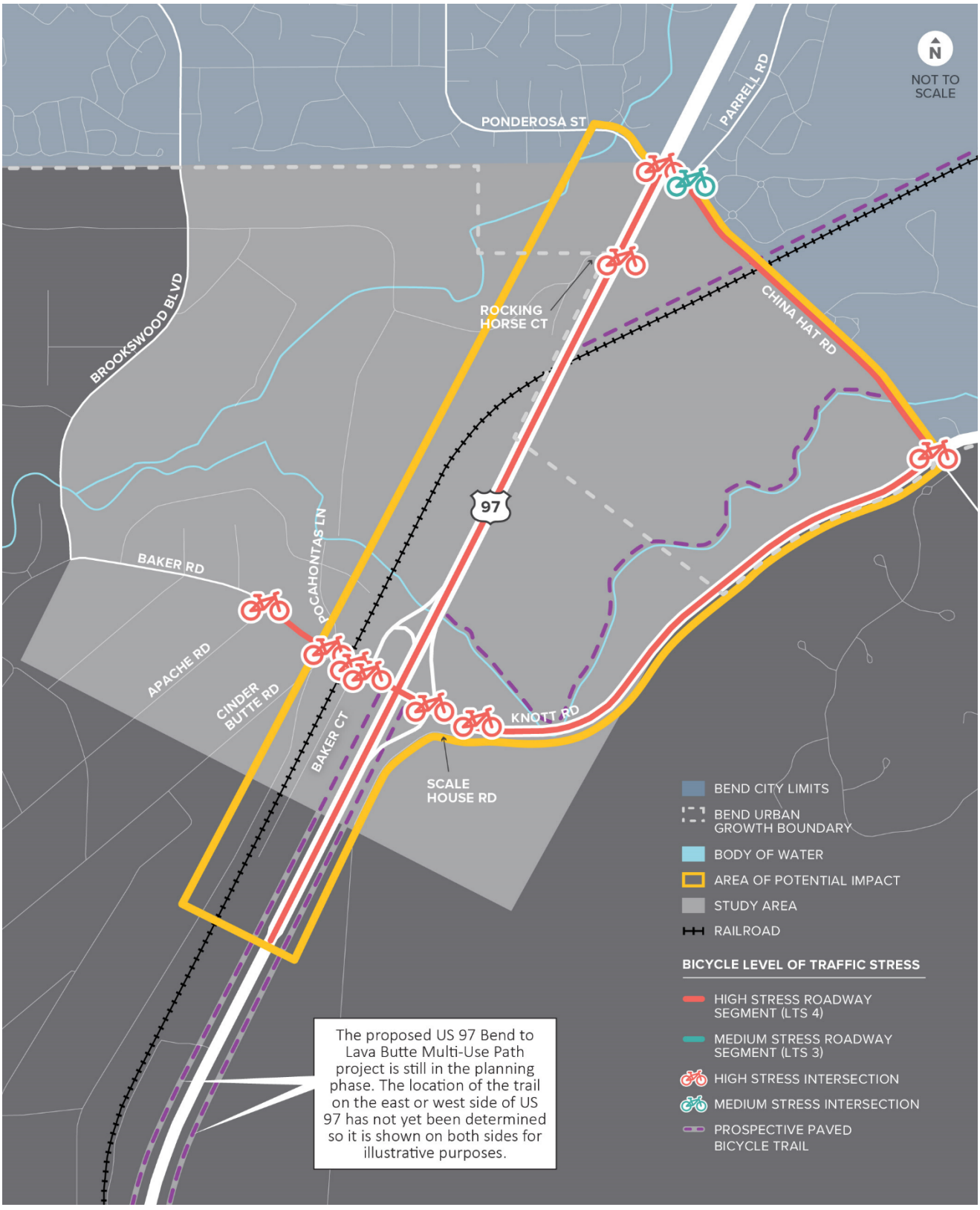


FIGURE 10. BICYCLE LEVEL OF TRAFFIC STRESS

ENTERING AND EXITING THE PARKWAY

ODOT's Highway Design Manual (HDM) provides standard lengths for acceleration and deceleration lanes at interchange ramps[14]. The southbound off-ramp and northbound on-ramp deceleration and acceleration lane lengths are longer than the minimum lengths required as shown in Table 3. However, the northbound off-ramp deceleration lane length is 30 feet shy of meeting the minimum standard length, and the southbound on-ramp, which is a loop ramp with a much lower ramp speed than the northbound on-ramp, has an acceleration lane that is 400 feet shorter than the minimum length. Ramps significantly shorter than recommended lengths, such as the southbound on-ramp, could contribute to safety concerns within the area.

TABLE 3: US 97 BAKER RD INTERCHANGE RAMP ACCELERATION AND DECELERATION LANE LENGTHS

RAMP	TYPE	POSTED MAINLINE SPEED (MPH)	POSTED RAMP SPEED (MPH)	HDM MINIMUM ACCEL./ DECEL. LANE LENGTH (FT)	EXISTING ACCEL./ DECEL. LANE LENGTH (FT)
US 97 SB TO BAKER RD	Off-Ramp	65	45	340′	420′
BAKER RD TO US 97 SB	On-Ramp	65	25	1350′	**950′**
US 97 NB TO KNOTT RD	Off-Ramp	65	45	340′	**310′**
KNOTT RD TO US 97 NB	On-Ramp	65	55	580′	735′

Bold and Red indicates existing acceleration/deceleration lengths are shorter than ODOT Highway Design Manual standards.

FREIGHT OPERATIONS

US 97 is a state freight route, reduction review route, Tier 1 lifeline route, high clearance route, and part of a Critical Route Pair with I-5 (needed as an alternative to I-5 if I-5 were to be temporarily restricted). Therefore, the ability to accommodate large and over-dimension vehicles is essential. According to data obtained from an Automatic Traffic Recorder (09-003) near Rocking Horse Court, this segment of US 97 carries approximately 2,000 to 2,800 heavy vehicles per day, which is about 11 percent of the traffic served[15].

[14] Highway Design Manual, Oregon Department of Transportation, Section 605, 2024.

[15] ODOT Transgis: https://gis.odot.state.or.us/transgis/

Furthermore, Knott Road and SE 27th Street are commonly used by truck traffic driving between US 97 to the south and US 20 to the east to bypass congestion on US 97 north of the interchange and on US 20 through Bend. The interchange also serves truck traffic making deliveries to southeast Bend. Truck traffic on the interchange ramps ranges from approximately 200 to 400 heavy vehicles per day. In addition, the "thumb" area is planned to include industrial land uses and could be developed by large distributors with heavy freight usage. Such development would further incentivize freight vehicles to exit US 97 at the Baker Road interchange to travel to the "thumb" before continuing to US 20 along Knott Road.

Approximately 1.5 miles to the southwest of the interchange on Cinder Butte Road is an area zoned as surface mining (an existing quarry and paving contractor), which is another generator of truck traffic within the API.

FUTURE LAND USE GROWTH AND BASELINE TRANSPORTATION ASSUMPTIONS

The City of Bend is expected to see substantial population and employment growth by 2040, as summarized in Table 4.

TABLE 4: CITY OF BEND POPULATION AND EMPLOYMENT FORECASTS

	YEAR 2019	YEAR 2040	GROWTH
POPULATION FORECAST	91,353	153,700	62,347 (+68%)
HOUSEHOLDS	38,064	63,444	25,230 (+67)
EMPLOYMENT	56,690	84,934	28,244 (+50%)

Source: City of Bend Transportation System Plan, https://www.bendoregon.gov/home/showpublisheddocument/47764/637381859539770000

Figure 11 and Figure 12 indicate that high levels of housing and employment growth are projected in the "thumb" area near the US 97 Baker Road interchange. This growth (listed in Table 5) will drive increased transportation demand and was incorporated into the future baseline ("No-Build") traffic analysis to help understand the impact of future growth on the interchange area.

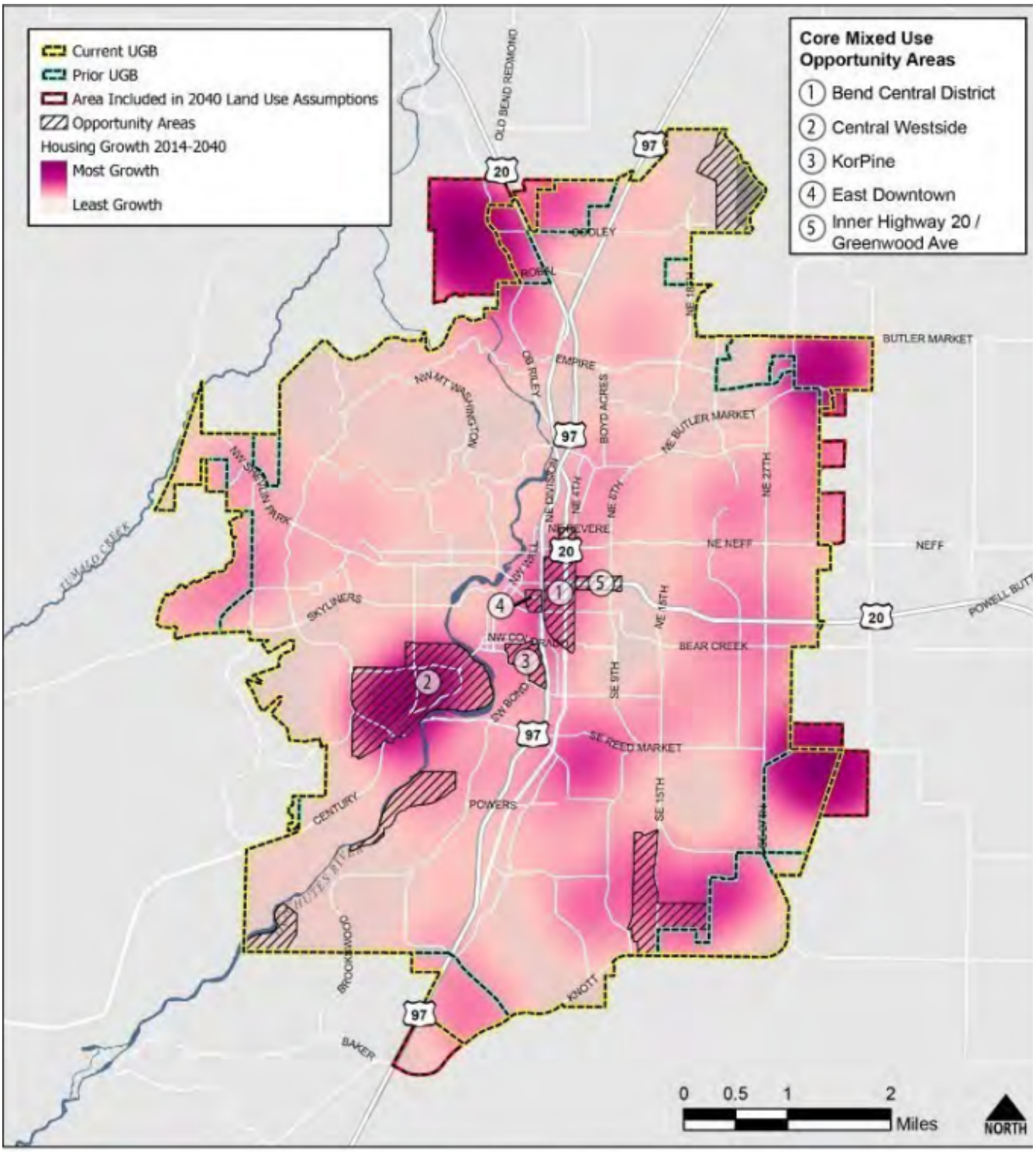


FIGURE 11: PROJECTED HOUSING GROWTH (2014-2040) IN BEND

Source: City of Bend Transportation System Plan (2020), https://www.bendoregon.gov/home/showpublisheddocument/47764/637381859539770000

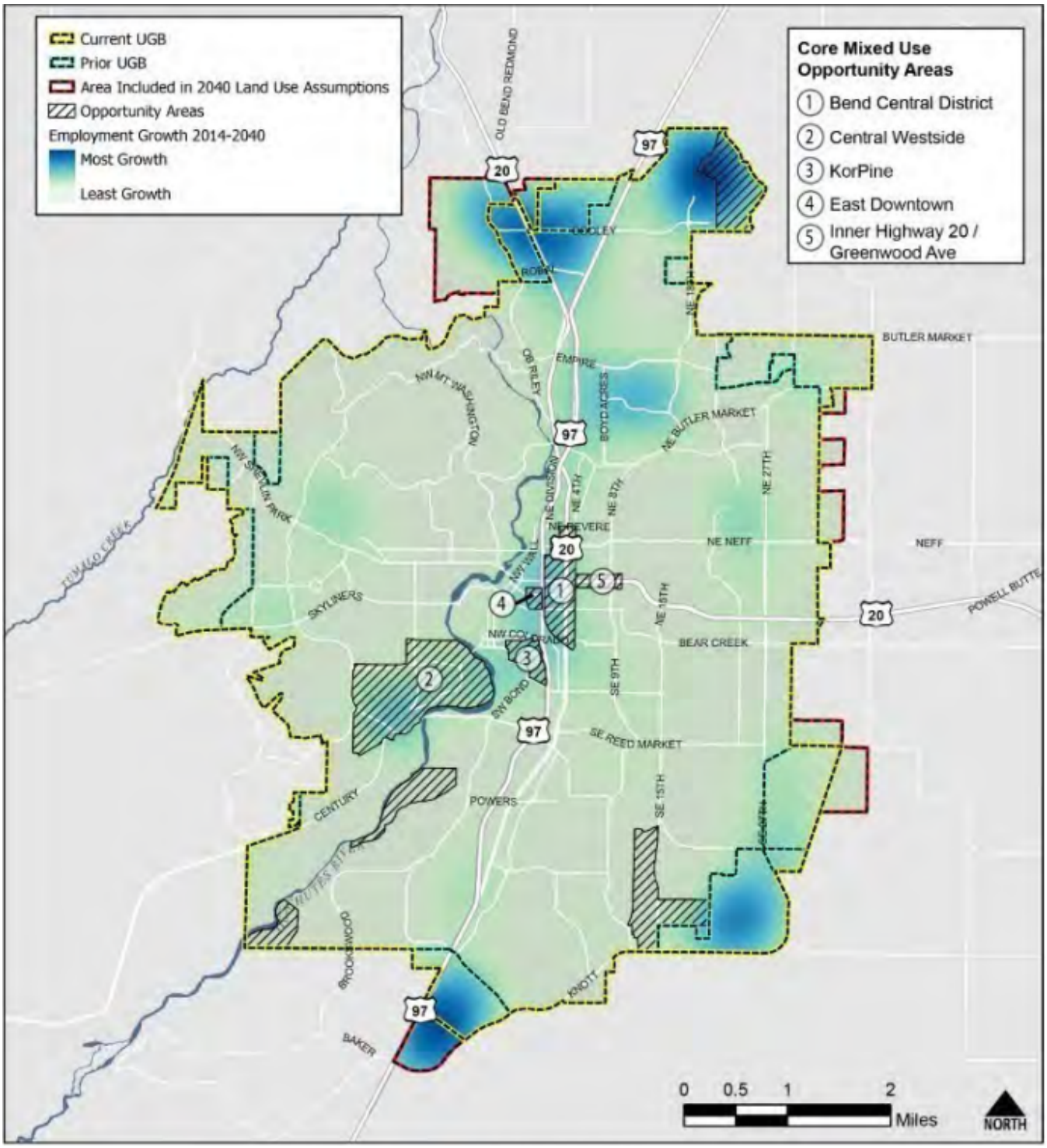


FIGURE 12: PROJECTED EMPLOYMENT GROWTH (2014-2040) IN BEND

Source: City of Bend Transportation System Plan (2020), https://www.bendoregon.gov/home/showpublisheddocument/47764/637381859539770000

TABLE 5: FUTURE LAND USE ASSUMPTIONS FROM THE BEND TSP

TRANSPORTATION ANALYSIS ZONE	GROWTH AREA	HOUSEHOLDS 2010-2040	EMPLOYEES 2010-2040
516	Thumb	+600 (100%)	+3,900 (100%)
1550, 487, 560, 1549, 486, 485, 559	SE Area	+1650 (100%)	+3,600 (100%)
556, 557, 558, 474	DSL	+2125 (100%)	+1,725 (100%)

In the "thumb" area, in particular, approximately 600 households and 3,900 jobs are assumed by 2040, leading to nearly 1,300 trips exiting and 975 trips entering the area during the 2040 weekday p.m. peak hour. The majority of the trips entering and exiting the "thumb" utilize the US 97/Baker Road interchange or China Hat Road.

To accommodate this large growth in transportation demand, the following financially constrained transportation projects were included in the future baseline (No-Build) travel demand modeling assumptions for this project:

- US 97/Murphy Road northbound on-ramp and southbound off-ramp
- Closure of at-grade US 97 right-on, right-off access at China Hat Road/Ponderosa Street and Rocking Horse Court
- China Hat Road overcrossing of US 97 (including a realignment of Parrell Road at China Hat Road to accommodate the overcrossing)
- China Hat Road/Knott Road roundabout

INTERSECTION OPERATIONS AND VEHICLE QUEUEING

Twelve study intersections and the US 97 mainline within the API were evaluated under existing and future baseline ("No-Build") conditions. As documented in *Technical Memorandum #4: Future Baseline (No-Build) Conditions*, future year 2040 design hour traffic volumes were forecast at each of the study intersections to understand how future growth in traffic would impact operations at the interchange. Performance measures used for this analysis include volume-to-capacity (V/C) ratios, seconds of control delay, levels of service (LOS), and vehicle queuing.

US 97 MAINLINE OPERATIONS

US 97 highway operations were analyzed for both northbound and southbound directions in the API. This included an evaluation of the levels of congestion occurring at the ramp connections where merging and diverging movements happen. All ramp connections currently operate well and are expected to operate well in the future, complying with adopted mobility targets.

INTERSECTION OPERATIONS

The results of the intersection analysis at the 12 study intersections are shown in Table 6 below. Key highlights of this evaluation include:

Existing (2017) Intersection Operations Analysis

- The two US 97 ramp terminals at the Baker Road interchange fail to meet the adopted mobility target under existing conditions, with stop-controlled ramp movements operating at volume-to-capacity (v/c) ratios much greater than 0.85. In fact, the southbound ramp terminal is approaching capacity and the northbound ramp terminal is operating far over capacity.
    - This suggests that as a result of long delays during peak times, drivers turning from the northbound off-ramp are likely accepting shorter gaps in traffic than would normally be expected, indicating a potential safety concern. Further discussion of crash patterns at this intersection is included in the Safety Analysis section below.
- The intersections on Baker Road with Baker Court and Cinder Butte Road are operating within County mobility standards under existing conditions, which consider the average intersection delay. However, the stop-controlled minor street approaches are operating at LOS F and are experiencing long delays.

Future (2040) Intersection Operations Analysis

- The most significant change in traffic operations seen by 2040 occurs at the US 97 Baker Road interchange ramp terminals as a result of new development to the east. Both intersections failed to meet ODOT's adopted mobility targets under existing conditions and will continue to do so in 2040, but with substantially more delay.
- Congestion will be severe at the US 97 northbound ramp terminal in the future. This is largely due to significant growth in demand to travel to and from the east and the lack of a separate eastbound left-turn lane that eventually blocks traffic on eastbound Knott Road and consequently limits the ability to make a left turn from the northbound off-ramp.
- The southbound ramp terminal also experiences a significant increase in delay (220 seconds in 2040 vs. 46 seconds under existing conditions), mostly resulting from growing demand to make the southbound left turn to reach destinations to the east.

The remaining intersections meet the adopted mobility targets in the future, although the stop-controlled approaches at Baker Court/Baker Road and Cinder Butte Road/Baker Road continue to operate at LOS F in the future and experience significant delay.

TABLE 6: EXISTING (2017) AND FUTURE (2040) DESIGN HOUR BASELINE TRAFFIC OPERATIONS AT STUDY INTERSECTIONS

STUDY INTERSECTION (MAJOR STREET/MINOR STREET)	CONTROL (EXISTING/ FUTURE)	JURISDICTION	MOBILITY TARGET	EXISTING (2017) RESULTS			FUTURE (2040) RESULTS		
				V/C [A]	LOS [A]	DELAY (SEC) [A]	V/C [A]	LOS [A]	DELAY (SEC) [A]
BAKER RD/APACHE RD	TWSC [A]	County	Average Delay ≤ 35 secs	0.36 / 0.05	A / B	1	0.42 / 0.07	A / B	1
BAKER RD/CINDER BUTTE RD	TWSC	County	Average Delay ≤ 35 secs	0.62 / 0.33	A / F	6	0.71 / 0.66	A / F	9
BAKER RD/BAKER CT	TWSC	County	Average Delay ≤ 35 secs	0.59 / 0.48	A / F	4	0.68 / 0.79	A / F	6
BAKER RD/KNOTT RD/ US 97 SB RAMPS	TWSC	ODOT	v/c ≤ 0.95 (Knott Rd) v/c ≤ 0.85 (ramp)	0.31 / **0.95**	A / E	8 / 46	0.37 / **1.32**	A / F	9 / 220
KNOTT RD/US 97 NB RAMPS	TWSC	ODOT	v/c ≤ 0.95 (Knott Rd) v/c ≤ 0.85 (ramp)	0.47 / **2.63**	A / F	11 / >300	0.92 / **>3.0**	C / F	23 / >300
KNOTT RD/SCALE HOUSE RD	TWSC	County	LOS D	NA / 0.03	NA / B	NA / 14	NA / 0.09	NA / E	NA / 36
KNOTT RD/CHINA HAT RD	TWSC / Roundabout	City	v/c ≤ 1.0	0.01 / 0.52	A / E	9 / 37	0.76	B	15
CHINA HAT RD/PARRELL RD	TWSC	City	Critical Movement Delay ≤ 50 secs	0.37 / 0.17	A / B	8 / 11	0.37 / 0.45	A / C	9 / 18
US 97/CHINA HAT RD/ PONDEROSA ST	TWSC / Closed	ODOT	v/c ≤ 0.85 (major)	NA / 0.28	NA / C	NA / 19	NA	NA	NA
US 97/ROCKING HORSE RD	TWSC / Closed	ODOT	v/c ≤ 0.85 (major)	NA / 0.02	NA / C	NA / 18	NA	NA	NA

Bold and red indicates mobility target/standard is not met.

Major streets are those not stop-controlled at intersections, while minor streets are stop-controlled.

[A] V/C ratio and LOS reported as worst major street/minor street movement at two-way stop-controlled (TWSC) intersections. Delay reported as worst major street/minor street movement for ODOT and City intersections and average for County intersections, to best match the existing mobility targets.

VEHICLE QUEUING ANALYSIS

Vehicle queue lengths on intersection approaches in the API were simulated using SimTraffic analysis software. Table 7 lists key approach queuing at the study intersections and notes where specific movement queues were either negatively impacted by downstream queuing, or positively impacted by upstream queues that limited conflicting traffic. The text below describes key findings from the queuing analysis for existing and future conditions.

TABLE 7: EXISTING (2017) AND FUTURE (2040) BASELINE INTERSECTION VEHICLE QUEUING

ID	STUDY INTERSECTION	MOVEMENT	95TH PERCENTILE QUEUE (FT)		APPROXIMATE AVAILABLE STORAGE (FT) [A]
			EXISTING (2017)	FUTURE (2040)	
2	BAKER RD/ CINDER BUTTE RD	NB	225	**>400** *	250
		WB	**175**	150 [B]	100
4	BAKER RD/ KNOTT RD/ US 97 SB RAMPS	SBL	**425** [C]	**>1,500** *	275
		SBR	**1,000**	**>1,500** *	725 [D]
		EB	75	**>1,300** *	75
5	KNOTT RD/US 97 NB RAMPS	NBL	100	**>1,200** *	150
		NBR	50	**>1,200** *	375
		EBL	175	**>775** *	700

Bold and red queue exceeds approximate available storage.

*= Queuing significantly exceeds storage due to downstream queue spillback queues

[A] Available storage reported as approximate turn bay length or approximate distance to nearest intersection/railroad crossing.

[B] Upstream congestion is metering the flow of arriving traffic, resulting in shorter queues.

[C] Turn bay frequently blocked by southbound right queue.

[D] Distance represents distance to allow vehicles leaving the highway mainline to safely come to a stop. 820 feet is needed from the gore point for safe stopping distance, assuming a 75-mph design speed, based on *AASHTO A Policy on Geometric Design of Highways and Streets*.

Existing (2017) Conditions

Under existing conditions, the greatest queueing occurs at the US 97 southbound off-ramp. Given the high volume of southbound right turns and the proximity of vehicles stopping in the westbound lane to make a left turn at Baker Court, the 95th percentile queue extends nearly 1,000 feet down the off-ramp. This length is shorter than the total 1,500-foot ramp length, but beyond the available queue storage area and extends into the segment of the off-ramp needed to allow vehicles leaving the highway mainline to safely come to a stop. Affected parties have reported that these ramp

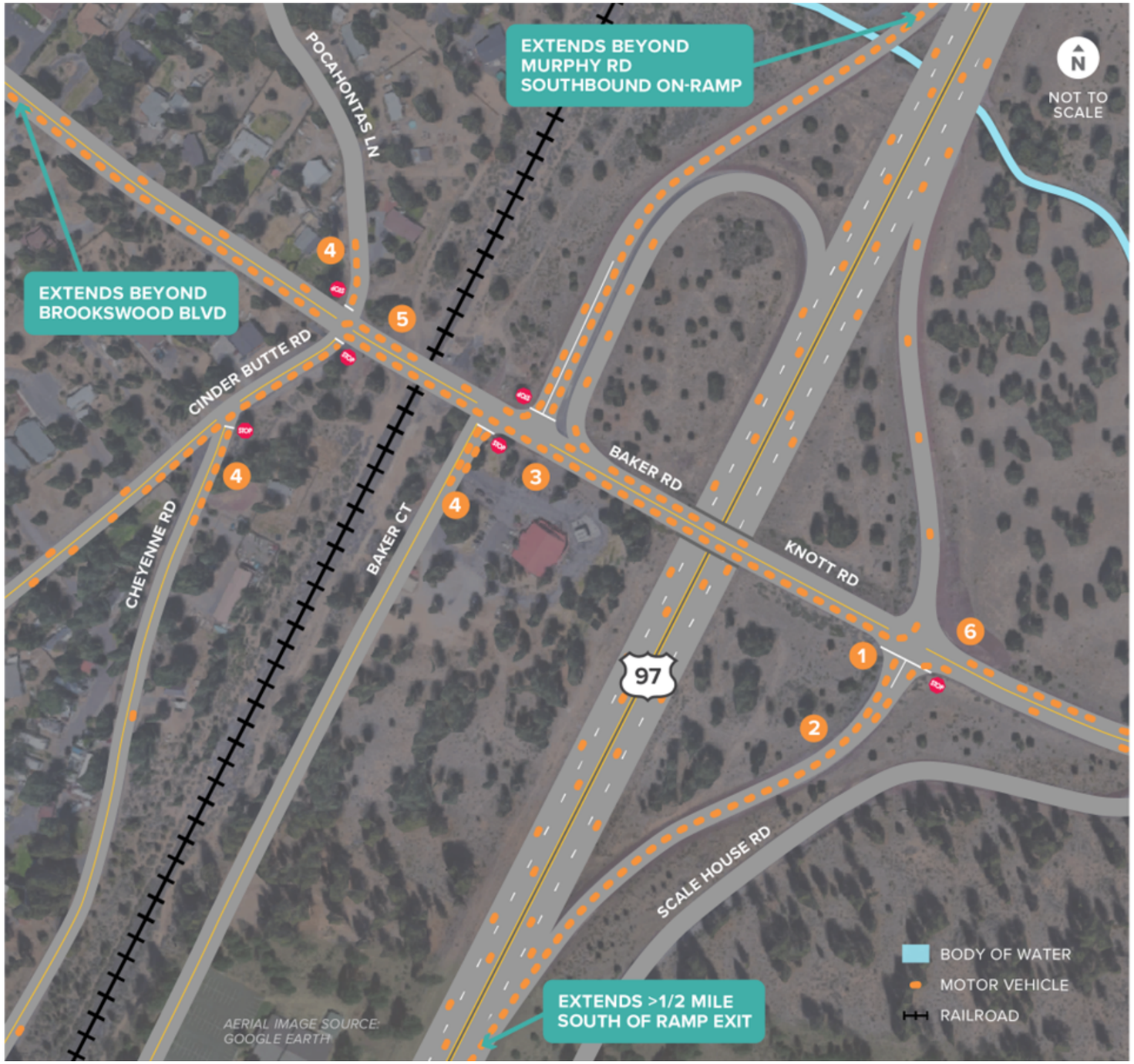
queues can extend down onto the highway mainline when the railroad crossing gates are down, which occurs about eight times per day for a duration of just under two minutes each time. Vehicles queued waiting to make an eastbound left onto the US 97 southbound on-ramp nearly block the Baker Court intersection. This situation results from the short spacing between the intersections.

At Baker Road/Cinder Butte Road, northbound vehicles queue almost to the intersection of Cinder Butte Road/Cheyenne Road. Due to stopped vehicles waiting to turn left from Baker Road, westbound 95th percentile queues at Baker Road/Cinder Butte Road extend just beyond the railroad tracks, posing a potential safety hazard. There is no separate westbound left turn lane on Baker Road but given the wide section of pavement near the intersection, it is likely that vehicles traveling westbound drive around vehicles stopped to make a left turn. At the remaining intersections, including the US 97 northbound ramps, there was limited queueing.

While queuing analysis was conducted for the weekday p.m. peak hour, affected parties have reported that during the a.m. peak hour, queues from the Morning Star Christian School at Baker Court can extend back to the interchange as well as back towards Brookswood Boulevard.

Future (2040) Conditions

Under future conditions, with traffic forecasts indicating over-capacity conditions, the two-way stop-controlled ramp terminal intersections generate queues that back up along Baker Road/Knott Road and onto the US 97 mainline. In particular, the eastbound left turn from Knott Road to US 97 northbound causes extensive eastbound queueing on Knott Road/Baker Road, causing the ramp and side street approaches to queue extensively. Figure 13 describes the key bottlenecks in the interchange area and illustrates how they impact each other, resulting in substantial congestion and unsafe conditions.



1. In the future, there is significant growth in eastbound traffic (to access new land use in the "thumb" area). Without a separate left turn lane, eastbound left turn vehicles block the through lane and cause extensive eastbound queuing on Knott Road/Baker Road (extending beyond Brookswood Blvd).

2. Because of the issue noted in (1), there are effectively no safe gaps in traffic for northbound left turning vehicles to enter Knott Road. The northbound left queue eventually blocks the northbound right turn lane and queues back to the US 97 mainline.

3. The eastbound queue at the US 97 northbound ramp extends beyond the US 97 southbound ramp. This blocks southbound left turning vehicles from entering Knott Road/Baker Road. The southbound left turn queue eventually blocks the southbound right turn lane and queues back to the US 97 mainline. Note that even if the eastbound queue at the US 97 northbound ramp did not extend to the US 97 southbound ramp, it is likely that the queue for the southbound left turn would still block access to the southbound right turn lane.

4. Since the eastbound queue at the US 97 northbound ramp extends through all of the study intersections, significant queuing develops on all of the side street approaches on Baker Road because they are unable to turn out unless another driver lets them in.

5. Even though the queuing and congestion on the US 97 ramps limits the amount of westbound traffic that can reach Cinder Butter Road/Baker Road, the lack of a westbound left turn lane causes the westbound approach to back up to the railroad tracks. Without constraints at the ramp terminals, this queue would likely extend farther.

6. Without a separate westbound right turn lane, vehicles slowing to make a westbound right turn cause westbound queues to extend nearly to Scale House Road.

FIGURE 13: FUTURE 2040 PM PEAK HOUR BASELINE (NO-BUILD) VEHICLE QUEUEING

CHAPTER 4. RECOMMENDED INTERCHANGE IMPROVEMENTS

This chapter summarizes the process for developing and evaluating alternative interchange improvement concepts and the selection of the preferred alternative for the US 97 Baker Road interchange.

PROCESS FOR DEVELOPING AND EVALUATING ALTERNATIVE CONCEPTS

Eight initial concepts were screened and discussed during a concept evaluation workshop with the Technical Advisory Committee (TAC). Based on direction received during the concept evaluation workshop, the following top three alternative concepts were selected for further refinement and evaluated against the goals and evaluation criteria from *Technical Memorandum #1*:

- Alternative 1 – Enhance Existing Ramp Terminals
- Alternative 2 – Tight Urban Diamond Interchange (with roundabouts)
- Alternative 3[16] – Southbound On- and Off-Ramp Flyovers with Roundabout Intersection

The assessment of the three refined alternative concepts (described in *Technical Memorandum #5: Concept Development and Evaluation*) helped guide the discussion of the key opportunities and tradeoffs associated with each alternative to ultimately select a preferred concept. The refined alternative concepts were discussed with the project TAC and Community Advisory Committee (CAC) and were presented at an online open house and virtual public meeting for additional public input. The following themes were seen in much of the feedback on the refined alternatives:

- Roundabouts are generally preferred over traffic signals.
- The ability to accommodate evacuation needs is essential.
- There is a desire to get improvements soon and recognition that project costs will impact this.
- There is concern about the need to serve more traffic than anticipated due to the amount of future growth expected.
- Would like more focus on improving Baker Court accessibility.
- There is interest in phasing the improvements to get construction underway sooner.

Based on the feedback received and direction from the Bend MPO Policy Board, Alternative 1 was selected as the preferred alternative concept for additional refinement and inclusion in the Interchange Area Management Plan. While Alternative 1 is projected to function well through the 20-year planning horizon, it was agreed that the ability to implement Alternative 3 should be retained if growth exceeds expectations and sufficient funding becomes available. Therefore, the design and construction of Alternative 1 should consider forward compatibility with Alternative 3.

[16] Previously referred to as Alternative 4 but was renamed after the initial screening process.

PREFERRED ALTERNATIVE CONCEPT

The preferred alternative concept focuses on enhancing the existing ramp terminals to address the operational deficiencies along Baker Road, reduce the potential for queue spillback onto US 97, and eliminate turning conflicts between closely spaced intersections. The key feature that differentiates this alternative from the others is the realignment of the southbound ramp terminal opposite Baker Court and the installation of a traffic signal, as shown in Figure 14. While ODOT access spacing standards related to the separation between ramp terminal intersections and access points on interchange crossroads are not met in this alternative, realigning the US 97 southbound ramp opposite Baker Court eliminates the existing problem with the offset intersections. In addition, the US 97 southbound off-ramp is lengthened to prevent queue spillbacks onto the US 97 mainline and the US 97 southbound on-ramp is lengthened to meet current ODOT standards and improve the ability to accelerate to merging speeds.

Table 8 summarizes the lane configurations and intersection controls shown in Figure 14 for the preferred alternative concept, which differs slightly if a roundabout or a traffic signal is implemented at the northbound ramp terminal. Note that while shown as back-to-back left turn lanes in Figure 14, it is likely that given the close intersection spacing, side-by-side left turn lanes will be needed between Cinder Butte Road and Baker Court to accommodate vehicle queue storage. In addition, it is recommended that a center turn lane on Knott Road be extended between the northbound ramp terminal and Scale House Road to allow trucks to make a two-stage left turn from Scale House Road.

TABLE 8: RECOMMENDED INTERSECTION CONTROL AND LANE CONFIGURATION

INTERSECTION	WITH ROUNDABOUT AT NB RAMPS		WITH TRAFFIC SIGNAL AT NB RAMPS	
	Intersection Control	Lane Configuration	Intersection Control	Lane Configuration
US 97 SB RAMPS/ BAKER CT/ BAKER RD	Traffic Signal	WBL, WBT, WBR NBL, NBTR EBL, EBTR SBL, SBT, SBR	Traffic Signal	WBL, WBT, WBR NBL, NBTR EBL, EBT, EBTR SBL, SBT, SBR
US 97 NB RAMPS/ KNOTT RD	Roundabout	Single-lane roundabout with a WBR turn slip lane	Traffic Signal	EBL, EBT Dual WBT, WBR NBLT, NBR
CINDER BUTTE ROAD/ BAKER RD	Traffic Signal	WBL, WBTR NBLT, NBR EBL, EBTR SBLTR	(same as shown at left)	

Note: WB = Westbound; EB = Eastbound; NB = Northbound; SB = Southbound; R = Right; T = Through; L = Left

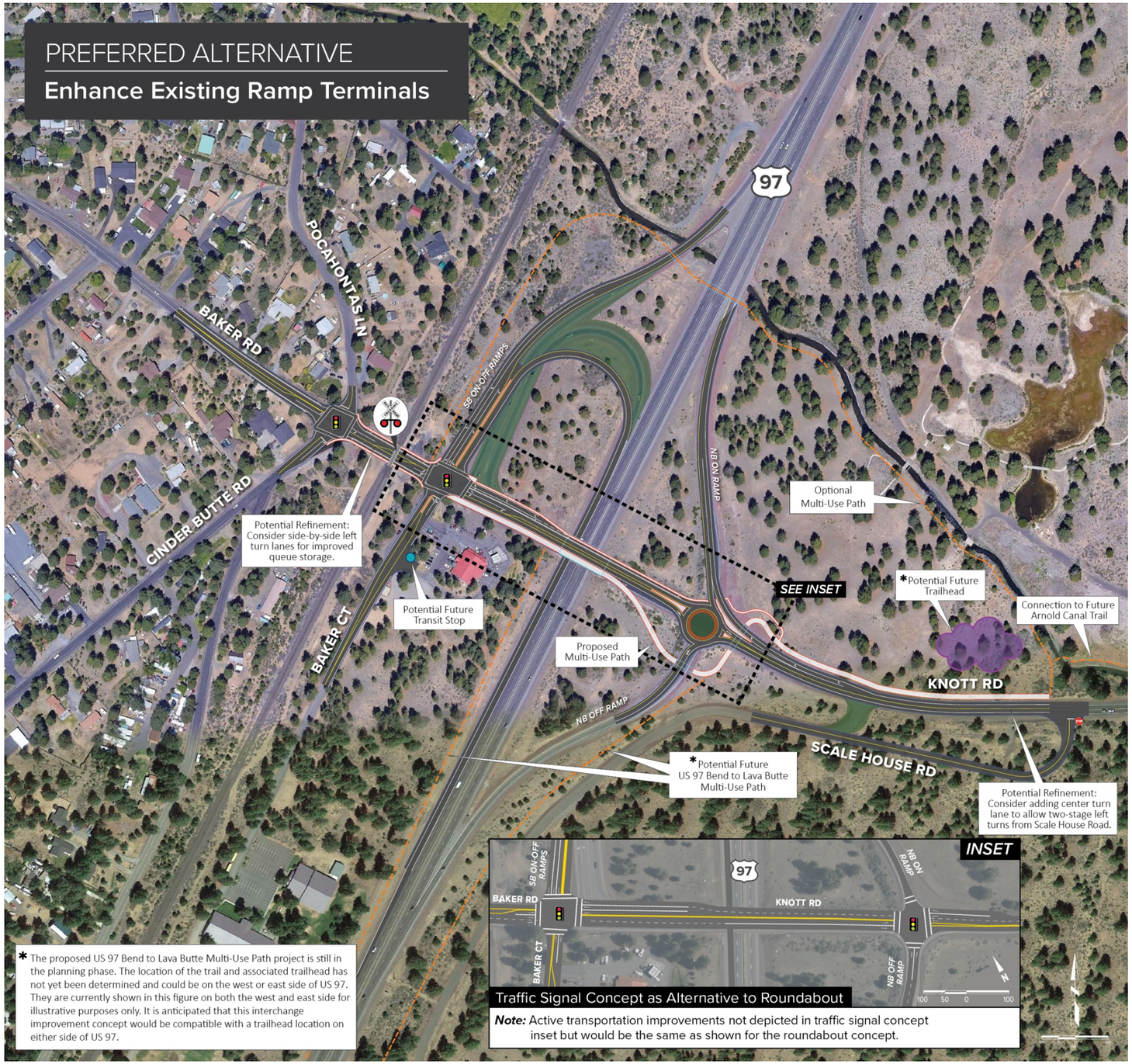


FIGURE 14: PREFERRED ALTERNATIVE CONCEPT

To increase motor vehicle capacity at the **northbound ramp terminal**, a single-lane roundabout with a westbound right turn slip lane is recommended. A roundabout at the US 97 ramp terminal would be subject to the affected parties engagement process for approval outlined in ODOT Highway Directive DES 02. If during that engagement process it is determined a roundabout would be infeasible at the US 97 ramp terminal, a traffic signal would be necessary instead. A traffic signal would require additional lanes to achieve a similar level of mobility as a roundabout, and a signal would require two additional lanes across the US 97 bridge. This change could increase the cost by an additional $3-5 million dollars.

The new signalized intersection on Baker Road at **Baker Court/US 97 southbound ramps** would be coordinated with a widened and improved railroad crossing and a new traffic signal at Cinder Butte Road. While this intersection would operate well under this configuration (volume-to-capacity ratio of 0.81 in 2040), adding a second eastbound through lane would help the intersection nearly meet ODOT's mobility standard in the Highway Design Manual (volume-to-capacity ratio of 0.76 compared to the standard of 0.75). However, since this extra eastbound lane is not needed at the northbound ramp terminal roundabout, it would likely be dropped before the overcrossing to avoid costly bridge widening. The resulting second eastbound through lane would then only extend about 300 feet past the southbound ramp terminal intersection. Since many motorists would choose not to use that lane to avoid the downstream merge, the actual capacity benefit would be diminished. Adding this lane would be more beneficial if the northbound ramp terminal were improved with a traffic signal since the signalized northbound ramp terminal intersection needs two eastbound approach lanes (a left and a through). Therefore, the second eastbound through lane from the southbound ramp terminal could be carried to the northbound ramp terminal and dropped as the left turn lane. This would significantly improve the available capacity at the ramp terminals but would add cost to the project to widen the overcrossing even more.

Signalization is recommended at the intersection on Baker Road at **Cinder Butte Road**, primarily to manage vehicle queues along Baker Road due to the proximity of the railroad and the proposed signal at the southbound ramps/Baker Court. While shown as back-to-back left turn lanes in Figure 14, it is likely that given the close intersection spacing, side-by-side left turn lanes will be needed between Cinder Butte Road and Baker Court to accommodate vehicle queue storage. The signal timing at these closely spaced signals will need to be carefully coordinated to avoid queue spillback between intersections. Furthermore, the intersection improvements at Baker Road and Cinder Butte Road must be closely coordinated with Deschutes County and their planned improvements to signalize the intersection.

Because of the proximity of the intersections and railroad crossing on Baker Road between Cinder Butte Road and the southbound ramps/Baker Court, careful consideration must be given to design and operational parameters to ensure improvements function safely and efficiently. This should involve a cooperative effort between ODOT and Deschutes County to evaluate factors such as potential access conflicts, signal phasing and timing, intersection layout, and synchronization with railroad signal operations.

To improve the spacing between intersections and busy interchange ramp terminals, **Scale House Road** will be relocated further to the east (see the access management plan). This relocation must

include an evaluation of safe intersection sight distance to ensure the horizontal and vertical curves do not obstruct needed sight lines. It is recommended that a center turn lane on Knott Road be extended between the northbound ramp terminal and Scale House Road to allow trucks to make a two-stage left turn from Scale House Road.

The anticipated operations at key intersections through the interchange area in the year 2040 with the preferred alternative in place (with a roundabout or traffic signal at the northbound ramp terminal) are shown in Table 9. As shown, in many cases ODOT's Highway Design Manual mobility standards would not be met. While this would require approval of design exceptions, the difference between the mobility standards and expected operations is relatively small. Furthermore, the mobility targets in the Oregon Highway Plan would be met. The results shown in Table 9 below are also dependent on a full buildout of the "thumb" expansion area. If that buildout were to occur on a longer time horizon, the preferred alternative would operate acceptably for a longer period of time than the results below indicate.

TABLE 9: PREFERRED ALTERNATIVE (ALTERNATIVE 1) FUTURE 2040 DESIGN HOUR TRAFFIC OPERATIONS

STUDY INTERSECTION (MAJOR STREET/ MINOR STREET)	MOBILITY STANDARD	PREFERRED ALTERNATIVE - ENHANCE EXISTING (TRAFFIC SIGNAL AND ROUNDABOUT)				PREFERRED ALTERNATIVE - ENHANCE EXISTING (TRAFFIC SIGNALS ONLY)			
		CONTROL	V/C [A]	LOS [A]	DELAY (SEC) [A]	CONTROL	V/C [A]	LOS [A]	DELAY (SEC) [A]
BAKER RD/CINDER BUTTE RD	Average Delay ≤ 55 secs	Signal w/ added turn lanes	0.59	A	6	Signal w/ added turn lanes	0.59	A	6
BAKER RD/BAKER CT	Average Delay ≤ 35 secs	Realigned (Signal)	-	-	-	Realigned (Signal)	-	-	-
BAKER RD/KNOTT RD/ US 97 SB RAMPS	v/c ≤ 0.75	Signal	**0.81**	C	32	Signal	**0.76**	C	31
KNOTT RD/US 97 NB RAMPS	v/c ≤ 0.75	RAB	**0.78**	B	13	Signal	0.65	C	23

Bold and red indicates the Highway Design Manual mobility standard would not be met, requiring approval of a design exception. However, Oregon Highway Plan mobility targets would be met.

[A] For roundabouts (RAB), v/c ratio reported for the worst approach lane and LOS/delay reported for the overall intersection. For traffic signals, v/c ratio, LOS and delay are reported for the overall intersection.

PREFERRED CONCEPT ACTIVE TRANSPORTATION IMPROVEMENTS

The active transportation improvements included as part of the preferred concept provide low-stress facilities along Baker Road for traveling through the interchange area, as well as connections to proposed regional trails.

A key element of the low-stress facilities along Baker Road is a 15-foot multi-use path for walking and biking along the south side of the road between the two ramp terminal intersections. On the north side of Baker Road, a nine-foot buffered bike lane and six-foot sidewalk would be provided. Figure 15 provides a concept drawing of the proposed bridge cross-section of Baker Road as it crosses over US 97.[17]

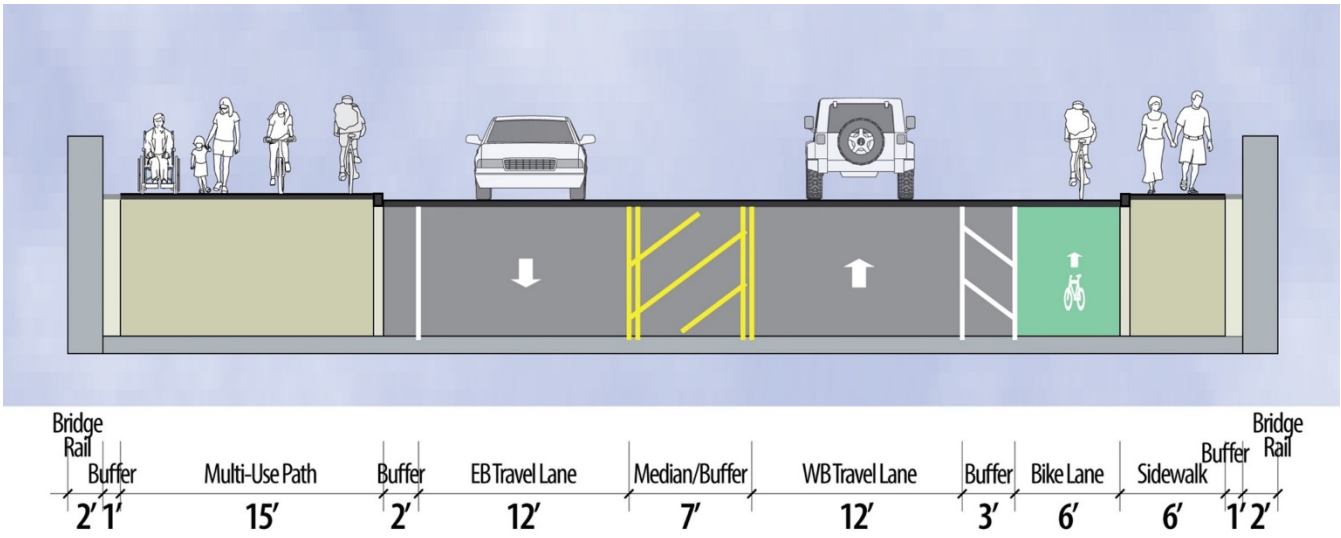


FIGURE 15: CROSS SECTION OF THE BAKER ROAD OVERCROSSING OF US 97, FACING WEST (ASSUMES A ROUNDABOUT IS CONSTRUCTED AT THE NORTHBOUND RAMPS)

Further refinements that could be considered during project design include:

- Adding a vertical barrier/rail between the multi-use path and eastbound travel lane. While this would comply with ODOT's current standards, it could be challenging for maintenance and in particular, snow storage and removal.
- Replacing the sidewalk and bike lane on the north side with another 15-foot multi-use path to match the south side.
  - Including another 15-foot multi-use path on the north side could be done by narrowing the median/buffer and shifting the westbound lane to the south by two feet.
- Delineating between people walking and biking on the multi-use path.
- Designing the widened bridge to include visual or physical gateway elements as people enter/exit Bend.

[17] Note that this cross section assumes a roundabout would be constructed at the northbound ramps. If a traffic signal is constructed instead, the median/buffer could be narrowed but as many as two additional travel lanes may be needed.

- Considering additional pavement width (curb to curb width) over the bridge to further enhance the ability to accommodate emergency evacuation needs.

On the west end of the interchange, the multi-use path would connect to Baker Court, providing access to Riverwoods Country Store and Morning Star Christian School. The local transit stop was recently relocated to be closer to the interchange, near the Riverwoods Country Store. Between Baker Court and Cinder Butte Road, sidewalks and buffered bike lanes would be provided, transitioning to only bike lanes west of Cinder Butte Road per County standards. A protected intersection design could be considered at the US 97 southbound ramp terminal to enhance safety for people biking, particularly for westbound cyclists that conflict with the westbound right turn onto US 97 southbound.

On the east end of the interchange, the multi-use path tunnels under the US 97 northbound off-ramp and Knott Road. Grade separation will improve safety for people walking and biking by eliminating conflicts with motor vehicles when crossing these roads. Crossing the multi-use path under Knott Road to the north allows the path to connect to the future Arnold Canal Trail. An optional path on the north side of the interchange is shown under US 97 along the Arnold Canal. This path could be constructed if clearance under US 97 can be obtained.

The Bend to Lava Butte Multi-Use Path project, which would construct a path from Lava Lands Visitor Center to Baker Road, is still in the planning phase. The alignment of the path and location of an associated trailhead have not yet been determined and could be on the west or east side of US 97. The path and trailhead locations shown in Figure 14 are for illustrative purposes only. It is anticipated that the improvements associated with the preferred alternative will be compatible with path, trailhead, and transit stop locations on either side of US 97.

TRANSPORTATION SYSTEM MANAGEMENT IMPROVEMENTS

In addition to the infrastructure improvements listed above, several transportation system management strategies are listed in *Chapter 5*: *Access Management Plan and Management Strategies*, including a discussion of trail wayfinding signs, evacuation routes, reducing the posted speed limit, managing traffic signal timing, transit access and property access. These strategies are an important part to ensuring the long-term function of the preferred alternative.

PHASING

Given that the preferred alternative addresses many existing needs and deficiencies in the area (rather than just future deficiencies or needs), all the improvements identified in the preferred concept should be implemented as soon as funding becomes available. However, it is possible that given the total cost of interchange improvements, available funding will only cover a portion of the identified projects. Therefore, based on the needs of the area, constructability constraints, and likely timing of additional development or projects in the area, a recommendation for phasing improvements is proposed.

Table 10 and Figure 16 summarize the recommended phasing, although the improvements could be phased in a different way based on available funding or timing of development. The

recommended costs shown in Table 10 were based on 2021 construction costs but projected out to an assumed year of expenditure of 2029. Detailed cost estimate worksheets are included in *Technical Memorandum #6: Preferred Alternative Concept* in Volume 2.

Many of the existing and future needs in the Baker Road interchange area are driven by conflicts on the west side of the interchange. The southbound ramp experiences significant delay and queueing and there are existing challenges with the close spacing of Baker Court, the railroad, and Cinder Butte Road. Therefore, it is recommended that the west side be improved first. Also, moving the southbound ramps further to the west will give the contractor more space to work when widening the overcrossing in the next phase.

Many of the identified improvements on the west side of the interchange will influence one another and could be challenging to phase separately. For example, realigning Cinder Butte Road, adding turn lanes on Baker Road, or realigning the US 97 southbound ramps would likely all trigger the requirement for a railroad crossing order. Additionally, realigning the US 97 southbound ramp terminal with Baker Court will modify the on and off-ramp alignments, which may involve reconstruction of the merging and diverging connections to the highway.

It is also important to note that while the Phase 1 improvements would address the majority of the deficiencies in this area, the lack of an eastbound left turn lane at the northbound ramp terminal could represent a downstream bottleneck until Phase 2 improvements can be constructed.

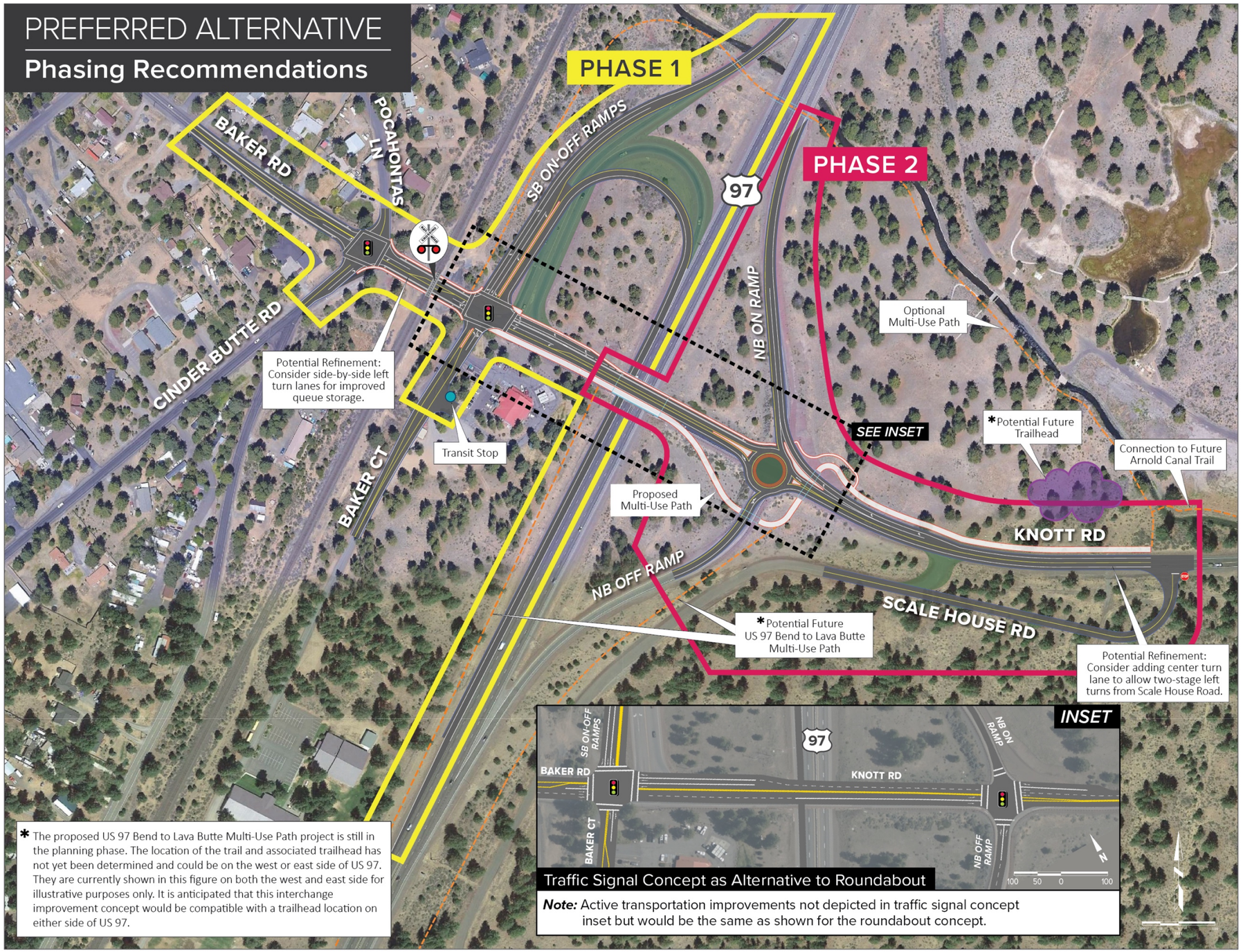


FIGURE 16: PREFERRED ALTERNATIVE RECOMMENDED PHASING

TABLE 10: US 97 BAKER IAMP PREFERRED ALTERNATIVE PHASING RECOMMENDATIONS

PHASE	ELEMENTS	DESCRIPTION	ESTIMATED COST
PHASE 1 – WEST SIDE IMPROVEMENTS	Cinder Butte Road realignment and turn lanes	Realign Cinder Butte Road slightly to the west, construct westbound and eastbound left turn lanes and a northbound right turn lane (with side-by-side left turn lanes between Cinder Butte Road and Baker Court). Improvements on Baker Road west of Cinder Butte Road would be to County standards, with six-foot bike lanes and no sidewalks.	$14.8 million
	US 97 SB ramps realignment, traffic signal, and RR crossing improvements	Realign the US 97 southbound ramp with Baker Court and signalize the intersection. This includes reconstruction of the BNSF railroad crossing and coordination with the new traffic signal.	
	US 97 acceleration and deceleration lanes	Lengthen the existing US 97 southbound on-ramp acceleration lane and US 97 southbound off-ramp deceleration lane.	
	Baker Road/ Cinder Butte Road signalization	Construct a traffic signal and coordinate it with the railroad crossing and the new US 97 southbound ramp terminal signal.	
PHASE 2 – BRIDGE AND EAST SIDE IMPROVEMENTS	Baker Road bridge widening	Widen the existing Baker Road/Knott Road bridge over US 97 to accommodate the preferred concept (and added lanes if a signal is constructed at the northbound ramps).	$23.2 million
	US 97 NB ramps roundabout	Install a roundabout at the US 97 NB ramp terminal and the associated multi-use path undercrossings.	
	Multi-use path connections	Complete the multi-use path network, connecting the US 97 Bend to Lava Butte and Arnold Canal facilities.	
	Realign Scale House Road	Realign Scale House Road to the east.	
	Total Estimated Cost (2029 year of expenditure)		**$38 million**

After addressing the safety, access, and capacity issues on the west side of the interchange, Phase 2 will complete the active transportation network and relieve congestion at the northbound ramp terminal. To provide a connected network for people walking and biking through the interchange area, the US 97 northbound ramp improvements (including tunnels) should be constructed at the same time as the bridge widening. However, that work could be deferred if needed, by using temporary at-grade path crossings.

FUTURE ALTERNATIVE 3 IMPROVEMENTS

While the preferred alternative (Alternative 1) is projected to function well though the 20-year planning horizon, it was agreed that the ability to implement the preferred alternative long-term option (Alternative 3) shown in Figure 17 should be retained if growth exceeds expectations and sufficient funding becomes available (estimated cost likely greater than $35 million). Specifically, the design and construction of any improvements in Phase 2 should consider the ability for future southbound flyover ramps to be connected to the US 97 northbound ramp terminal.

The anticipated operations at key intersections through the interchange area in the year 2040 with long-term option in place (with a roundabout or traffic signal at the northbound ramp terminal) are shown in Table 11. As shown, the combined US 97 ramp terminal intersection on Baker Road is not expected to meet ODOT's Highway Design Manual mobility standard. While this would require approval of a design exception, the difference between the mobility standard and expected operations is very small. Furthermore, the mobility targets in the Oregon Highway Plan would be met.

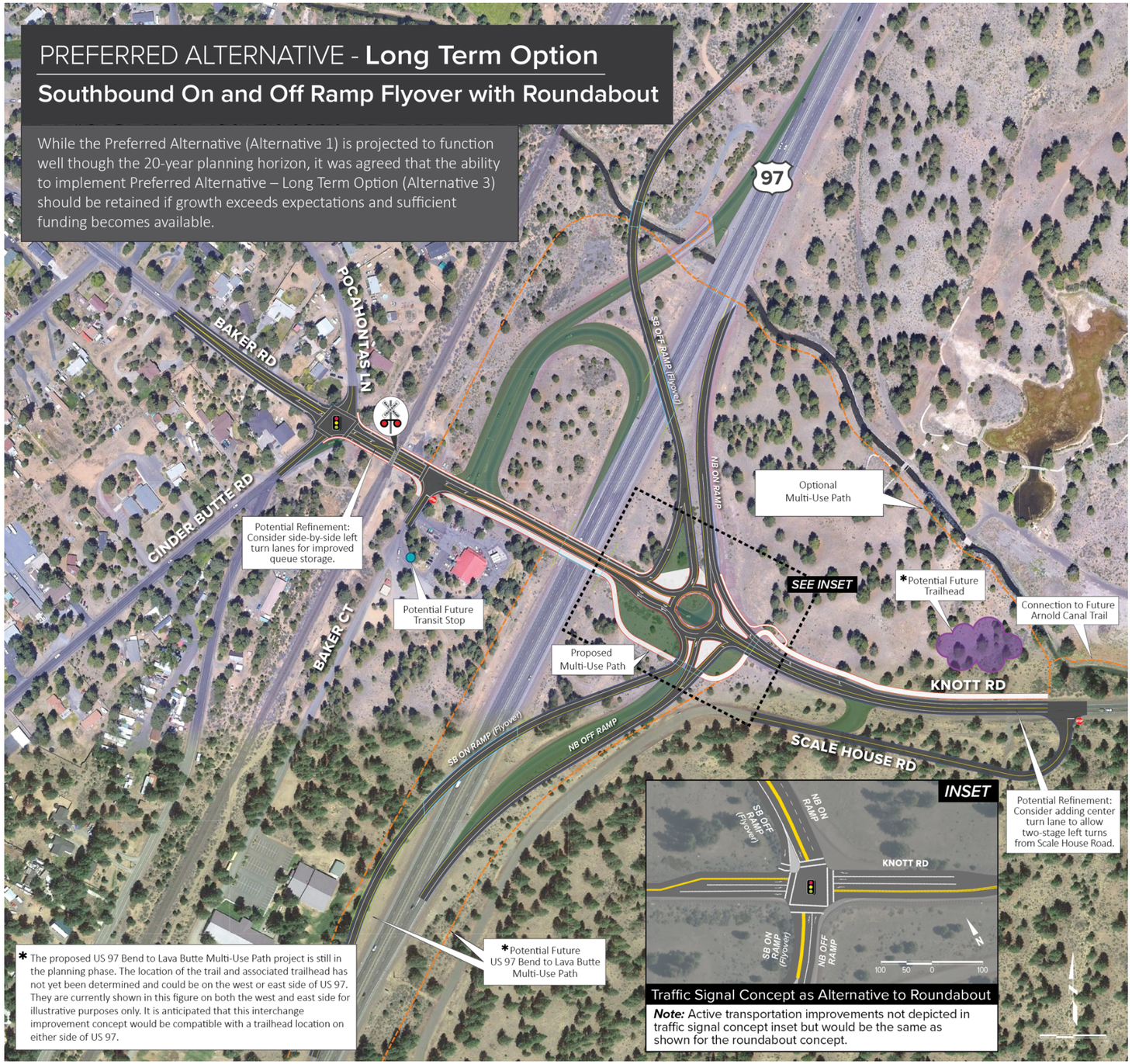


FIGURE 17: PREFERRED ALTERNATIVE LONG-TERM OPTION

TABLE 11: PREFERRED ALTERNATIVE LONG-TERM OPTION (ALTERNATIE 3) FUTURE 2040 DESIGN HOUR TRAFFIC OPERATIONS

STUDY INTERSECTION (MAJOR STREET/ MINOR STREET)	MOBILITY STANDARD	LONG-TERM OPTION - FLYOVER (ROUNDABOUT)				LONG-TERM OPTION - FLYOVER (TRAFFIC SIGNAL)			
		CONTROL	V/C [A]	LOS [A]	DELAY (SEC) [A]	CONTROL	V/C [A]	LOS [A]	DELAY (SEC) [A]
BAKER RD/CINDER BUTTE RD	Average Delay ≤ 55 secs	Signal w/ added turn lanes	0.59	A	6	Signal w/ added turn lanes	0.59	A	6
BAKER RD/BAKER CT	Average Delay ≤ 35 secs	TWSC (w/ WBL lane)	0.11 / 0.33	A / D	3	TWSC (w/ WBL lane)	0.11 / 0.33	A / D	3
BAKER RD/US 97 NB & SB RAMPS	v/c ≤ 0.75	RAB	**0.76**	B	14	Signal	**0.78**	C	32

Bold and red indicates the Highway Design Manual mobility standard would not be met, requiring approval of a design exception. However, Oregon Highway Plan mobility targets would be met.

[A] V/C ratio and LOS reported as worst major street/minor street movement at two-way stop-controlled (TWSC) intersections. Major streets are those not stop-controlled at intersections, while minor streets are stop-controlled. Delay reported as worst major street/minor street movement for ODOT and City intersections and average for County intersections, to best match the existing mobility targets. For roundabouts (RAB), v/c ratio reported for the worst approach lane and LOS/delay reported for the overall intersection.

CHAPTER 5. ACCESS MANAGEMENT PLAN AND MANAGEMENT STRATEGIES

This chapter describes a collection of strategies to supplement the preferred alternative improvements that will help protect the public's investment and ensure the transportation system in the interchange area functions as intended through the planning horizon.

ACCESS MANAGEMENT PLAN

Access management is the term used to describe a broad set of techniques that balance the need to provide safe, efficient, and timely travel with the ability to allow access to individual properties. On facilities such as expressways and arterials, there is generally an emphasis on facilitating the through movement of traffic, with direct property access being a secondary objective. However, for streets of lower functional classification, such as collectors and local streets, the emphasis shifts to prioritize direct property access. Where streets act as interchange crossroads, limited access is emphasized to protect the function of the interchanges and to minimize the need for major improvements.

Most commonly, access management involves decisions about the location and design of vehicular access points to roadways. On streets of higher functional classifications (e.g., expressways and arterials) that are serving higher volumes and speeds of traffic, closely spaced or poorly designed access points can create confusion and introduce conflicts between vehicle paths that result in congestion and crashes. The closely spaced intersections on Baker Road with the US 97 southbound ramps and Baker Court are an example of this problem and is one of the key deficiencies being addressed by the recommended interchange improvements.

The purpose of this access management plan (AMP) is to provide direction for the management of access points within the interchange area in a manner that will protect the function of the interchange and promote safety while accommodating future development or redevelopment. The AMP provides direction and decision-making criteria, referred to as the Key Principles and Methodology, but actual changes to individual property access points will occur through future land use applications and future project design phases.

ACCESS SPACING STANDARDS

This section describes the adopted access spacing requirements of each agency as they relate to roadways in the interchange area. Within the project area, US 97 and the interchange between the ramp terminals are under the jurisdiction of ODOT. US 97 is classified by ODOT as a statewide highway, and further designated as an expressway, urban/rural other principal arterial highway, state freight route, reduction review route, and high clearance route. US 97 serves approximately 19,100 to 26,700 average annual daily vehicles through the interchange area and has a posted speed of 65 miles per hour (mph).

Outside of the interchange, Baker Road and Knott Road are under the jurisdiction of Deschutes County and are classified as rural arterials. This corridor serves approximately 8,800 to 11,500 average annual daily vehicles and has a posted speed of 35 mph west of Scale House Road and 50 mph east of Scale House Road.

For further context, Deschutes County designates most of the area surrounding the interchange area as rural residential (RR10) with a small pocket of rural commercial (RC) southwest of the interchange. While this area is zoned as rural today, the City of Bend's urban growth boundary (UGB) is located less than a mile north of the interchange area, and the City expects significant commercial, residential, and industrial growth over the next 20 years that has potential to make its way to Baker Road/Knott Road within the interchange area.

State Access Spacing Standards

The Oregon Highway Plan (OHP) addresses the importance of access management and outlines access spacing standards for state highways.[18] More detailed requirements for access management are also specified in Division 51 of Chapter 734 of the Oregon Administrative Rules (OARs). The goal of an AMP is to set in place provisions by which access within the project limits can be fully compliant with OAR 734-051. However, there are often instances where requirements cannot be met due to physical, environmental, or other limitations. In these cases, the goal is to move in the direction of meeting the applicable standards as much as is feasible.

ODOT has adopted interchange and access management spacing standards that specify the minimum separation required between interchange crossroads, adjacent interchange ramp tapers, and access points along crossroads. There are different standards for urban and rural areas. While the US 97/Baker Road interchange is currently outside of the existing UGB, it is likely that in the future the UGB will be expanded to be immediately adjacent to the interchange.

Spacing between interchanges

ODOT's interchange spacing standards require a minimum of 1.9 miles between interchange crossroads in urban areas and 3 miles in rural areas.[19] For this interchange, the 1.9-mile spacing standard would be applied to the north and the 3-mile spacing standard would be applied to the south. The proposed interchange improvements will not change the location of the existing Baker Road overcrossing. The Murphy Road interchange is the nearest interchange to the north at 1.88 miles away, effectively meeting the urban spacing standard. There are no interchanges within 3 miles to the south.

Spacing between adjacent interchange ramp tapers and access points along US 97

ODOT's spacing standards for the distance between adjacent ramp tapers on a freeway (US 97 is not technically a freeway, but functions similarly to one) requires 1 mile in an urban area and 2 miles in a rural area.[20] Between the existing US 97/Baker Road and Murphy

[18] 1999 Oregon Highway Plan, as amended May 2015, Oregon Department of Transportation, Appendix C.

[19] 1999 Oregon Highway Plan, as amended May 2015, Oregon Department of Transportation, Appendix C, Table 12.

[20] 1999 Oregon Highway Plan, as amended May 2015, Oregon Department of Transportation, Appendix C, Tables 17 and 18.

Road interchanges, there is approximately 1.2 miles between tapers northbound and 1.1 miles between tapers southbound. The recommended improvements would move the southbound exit ramp taper about 400 feet further north, but the spacing between that ramp and the Murphy Road ramp would still be just over 1 mile. The location of the northbound entrance ramp is not anticipated to change significantly. Therefore, the spacing standard for interchange ramp tapers to the north would be met for urban areas but not for rural areas.

While direct access to an expressway is generally discouraged, ODOT also has access spacing standards for access points along a Statewide Highway and Expressway that require a minimum of ½-mile between at-grade intersections in urban areas and 1 mile in rural areas.[21] However, where interchanges are present, there must be at least 1 mile between the end of a ramp taper and the nearest at-grade intersection in urban areas and 2 miles in rural areas.[22] Individual existing accesses directly to US 97 are inventoried in the following section.

Spacing along interchange crossroads

OHP standards also indicate that a minimum of 1,320 feet (0.25 miles) be provided between the ramp terminals and the first intersection on the crossroad, regardless of whether all movements are provided or restricted to right-in and right-out only (note that County cooperation would be needed to apply these standards as Baker Road and Knott Road are not under state jurisdiction).[23]

This standard is not met under existing conditions. On the west side of the interchange, the Baker Court intersection which serves as access to the Riverwoods Country Store and the Morning Star Christian School is only 110 feet from the southbound ramp terminal. Further to the west, public street access is provided at Cinder Butte Road/Pocahontas Lane (425 feet away) and Apache Road (1,335 feet away). In addition, there are 14 driveways to single-family homes between Cinder Butte Road/Pocahontas Lane and Apache Road. On the east side of the interchange there are two access points within 1,320 feet of the northbound ramp terminal: one at Scale House Road (525 feet away) and a gated driveway farther to the east (970 feet away). Individual existing accesses directly to Baker Road and Knott Road are inventoried in the following section.

[21] 1999 Oregon Highway Plan, as amended May 2015, Oregon Department of Transportation, Appendix C, Table 14.

[22] 1999 Oregon Highway Plan, as amended May 2015, Oregon Department of Transportation, Appendix C, Table 19.

[23] 1999 Oregon Highway Plan, as amended May 2015, Oregon Department of Transportation, Appendix C, Table 19.

County Access Spacing Standards

Deschutes County access spacing requirements are provided in Deschutes County Code.[24] Requirements related to access spacing that are relevant to the interchange area include:

a. Intersecting streets, including driveways to commercial and industrial properties, shall be separated by at least 500 feet on arterials and 300 feet on collectors.

b. The creation of access onto arterials and collectors is prohibited unless there is no other possible means of accessing the parcel. In any event, residential access onto arterials and collectors shall not be permitted within 100 feet of an intersection or the maximum distance obtainable on the parcel, whichever is less.

EXISTING ACCESS INVENTORY

Access inventory data along US 97, Baker Road, and Knott Road within the limits of ODOT's access spacing standards for interchange areas was obtained from aerial imagery and field verified. Figure 18 through Figure 22 show all the existing accesses, divided into seven Access Management Areas used to group adjacent properties with similar access constraints and land uses. Details regarding access type, exact location, and land use being served for the accesses are included in Table 12.

Within the 1,320-foot spacing standard for interchange ramp terminals, there are four public street accesses (Baker Court, Cinder Butte Road, Pocahontas Lane, and Apache Road) and 15 private accesses west of the US 97 southbound ramp terminal (Figure 19). To the east of the US 97 northbound ramp terminal there are only two private accesses within the 1,320-foot spacing standard (Figure 20).

Additionally, there are three public accesses on US 97 within the one-mile spacing standard to the north of the interchange. These include the intersections with Rocking Horse Road, Ponderosa Street, and China Hat Road, which are all restricted to allow only right-on and right-off movements (Figure 21). However, these accesses are all planned to be closed in the future, with the Ponderosa Street and China Hat Road accesses replaced by an overcrossing.[25] To the south on US 97, there are two gated accesses (one emergency access and one forest service road) and one private access to the High Desert Museum that are within the two-mile spacing standard of the interchange (Figure 22). However, the gated accesses are anticipated to have very limited use and serve as emergency access only.

[24] Deschutes County Code 17.48.090 and 17.48.210.

[25] US 97 Parkway Plan Phase 2, Oregon Department of Transportation, February 26, 2021, Table 9, p. 44.

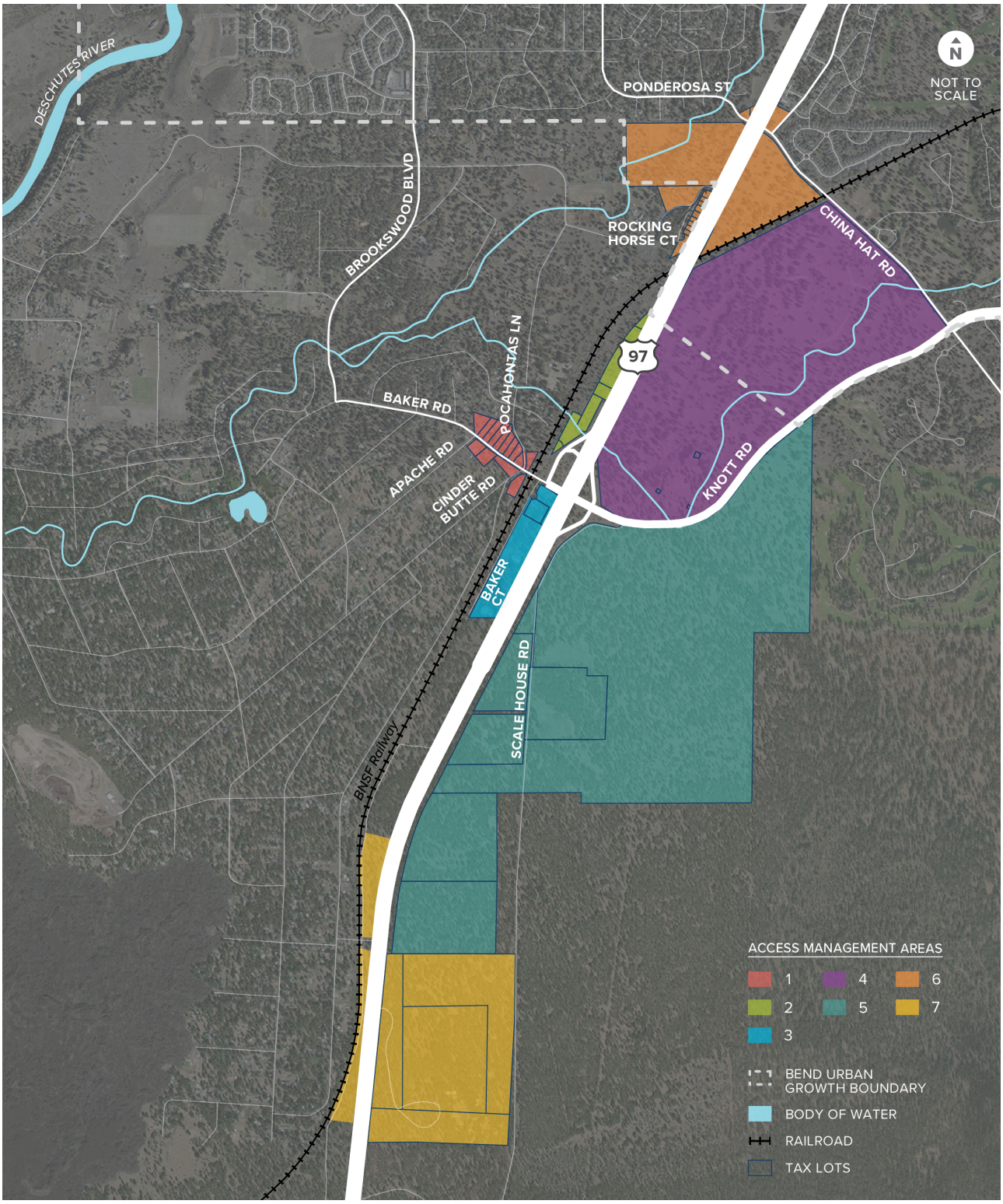


FIGURE 18: US 97 BAKER ROAD IAMP ACCESS MANAGEMENT AREAS

FIGURE 19: EXISTING ACCESSES TO BAKER ROAD WEST OF US 97

FIGURE 20: EXISTING ACCESSES TO KNOTT ROAD EAST OF US 97

FIGURE 21: EXISTING ACCESSES TO US 97 NORTH OF BAKER ROAD

FIGURE 22: EXISTING ACCESSES TO US 97 SOUTH OF BAKER ROAD

TABLE 12: INTERCHANGE AREA EXISTING ACCESS INVENTORY

ID	TAX LOT	PUBLIC OR PRIVATE/TYPE	SITE USE	SIDE OF ROADWAY (WEST TO EAST, SOUTH TO NORTH)	DISTANCE TO NEAREST ACCESS (FT)
AREA 1					
1	181219CC01800	Private/Residence	Single Family Residence	LT	60
2	181219CC01900	Private/Residence	Single Family Residence	LT	55
3	181219CC01900	Private/Residence	Single Family Residence	LT	50
4	181219CC02000	Private/Residence	Single Family Residence	LT	50
5	181219CC02000	Private/Residence	Single Family Residence	LT	50
6	181219CC02100	Private/Residence	Single Family Residence	LT	50
7	181219CC02200	Private/Residence	Single Family Residence	LT	50
8	181219CC02200	Private/Residence	Single Family Residence	LT	40
9	181219CD02300	Private/Residence	Single Family Residence	LT	105
10	181219CD02200	Private/Residence	Single Family Residence	LT	105
11	181219CD02100	Private/Residence	Single Family Residence	LT	105
12	N/A	Public/Street	Pocahontas Lane	LT	260
13	N/A	Public/Street	Apache Road	RT	155
14	181219CC02400	Private/Residence	Single Family Residence	RT	110
15	181219CC02300	Private/Residence	Single Family Residence	RT	120
16	181219CC02300	Private/Residence	Single Family Residence	RT	65
17	181230BB03000	Private/Residence	Single Family Residence	RT	65
18	N/A	Public/Street	Cinder Butte Road	RT	300
AREA 2					
No existing access points to US 97, Baker Road, or Knott Road in this Area.					

ID	TAX LOT	PUBLIC OR PRIVATE/TYPE	SITE USE	SIDE OF ROADWAY (WEST TO EAST, SOUTH TO NORTH)	DISTANCE TO NEAREST ACCESS (FT)
AREA 3					
19	N/A	Public/Street	Baker Court	RT	140
AREA 4					
No existing access points to US 97, Baker Road, or Knott Road in this Area.					
AREA 5					
20	1812300000100	Private/Street	Scale House Road	RT	450
21	1812300000100	Private/Vacant	Vacant	RT	450
AREA 6					
22	N/A	Public/Street	Rocking Horse Road	LT	1,200
23	N/A	Public/Street	Ponderosa Street	LT	1,200
24	N/A	Public/Street	China Hat Road	RT	1,200
AREA 7					
25	N/A	Public/Emergency Access	Frank Pennok Ln	LT	1,025
26	1811000001900	Private/ Institutional	High Desert Museum	RT	1,025
27	1911000000100	Private/ Government	Gated Forest Service Road	RT	3,000

Note: ID numbers correspond to the ID numbers used in Figures 19 through 22.

ACCESS MANAGEMENT KEY PRINCIPLES AND METHODOLOGY

OAR 734-051 establishes procedures, standards, and approval criteria that govern highway access management and approach permitting. Key Principles for access management address how properties abutting a state highway (and in this case, the interchange crossroad) will be evaluated to retain or obtain access to the state highway during and after plan implementation. The Methodology for access management provides the ability to assess how the Key Principles are being applied to access decisions. While the Key Principles and Methodology provide direction and decision-making criteria, actual changes to individual property access points will occur through future land use applications and future project design phases. The access management Key Principles and Methodology for the US 97 Baker Road IAMP are shown in Table 13. These Key Principles and Methodology were developed according to the process outlined in OAR 734-051-7010 and described in more detail in *Technical Memorandum #7: Access Management Plan* in Volume 2.

TABLE 13: ACCESS MANAGEMENT KEY PRINCIPLES AND METHODOLOGY

KEY PRINCIPLES	METHODOLOGY
1. Provide for efficient travel through the interchange area based on existing and planned land uses in the area	a. Meet ODOT's adopted access spacing standards along US 97 to the north and south of the US 97/Baker Road interchange or move in the direction of meeting the standards as much as feasible given physical and environmental constraints.
	b. Meet ODOT's adopted access spacing standards for interchange crossroads along Baker Road and Knott Road or move in the direction of meeting the standards as much as feasible given physical and environmental constraints.
	c. Limit access to streets with the lowest functional classification where feasible.
2. Improve safety for all modes of travel	a. Reduce the number of potential conflict points within the functional area[26] of public street intersections.
	b. Align approaches on opposite sides of the roadway, where feasible, to reduce turning conflicts.
	c. Seek opportunities to consolidate access points or establish shared access points to reduce the overall number of accesses on the interchange crossroad.
	d. Implement actions to provide minimum required safe sight distance for drivers exiting properties.
	e. Consider the ability to accommodate safe and unobstructed ingress to properties.

[26] The functional area of an intersection is the area of the physical intersection plus the area upstream and downstream of the intersection that is needed for decision and maneuvering distance, plus any required vehicle storage length needs.

KEY PRINCIPLES	METHODOLOGY
	f. Consider the relationship between accesses and historical crash records and mitigate accesses where it would resolve a recurring crash pattern.
	g. Define the width of undefined existing accesses using guidance from the Oregon Highway Design Manual or Deschutes County design standards, as applicable, to a width that will serve the existing and planned uses of the property.
3. Support regional and local economic development	a. Ensure that all properties are provided reasonable access to the public street network in accordance with existing property access rights.
	b. Consider the level of direct access to Baker Road and Knott Road that is appropriate for the type of development that exists and would be allowed according to the Comprehensive Plan.
	c. Maintain the ability for businesses to receive freight/deliveries.
	d. Ensure no access points conflict with safe and uninterrupted service on the Burlington Northern Santa Fe railroad.
	e. Locate and design accesses to adequately serve the volume and type of traffic reasonably anticipated to enter and exit the property, based on existing and planned uses.
	f. Consider the potential impacts on site circulation and parking resulting from proposed approach modifications or closures.
4. Facilitate the use of multimodal travel options	a. Modify or relocate approaches as necessary to allow for the construction of ADA-compliant pedestrian facilities.
	b. Minimize the number of vehicle crossings on regional trails.
5. Develop the project to support the community's value of equity	a. Achieve a just allocation of burdens and benefits among community members.
6. Practice good stewardship of the environment	a. Consider the impacts of access modifications and closures on resource lands and wildlife.
7. Develop solutions that are consistent with the established shared corridor vision and the adopted state and local plans	a. Provide public street connectivity consistent with Deschutes County and Bend Comprehensive Plans.
8. Develop implementable solutions for the interchange area	a. Consider the compatibility of access decisions with future phases of interchange improvements.

ACCESS MANAGEMENT ACTIONS

The AMP provides direction for the management of access points within the interchange area in a manner that will protect the function of the interchange and promote safety while accommodating future development or redevelopment. Accomplishing the desired outcomes will require cooperation from agencies and property owners to work towards the vision for safe and efficient access management in the interchange area. ODOT, Deschutes County, the City of Bend, and the MPO must cooperatively implement the access management plan recommendations, though most changes are anticipated on roadways under the jurisdiction of ODOT and the County. Access management actions for the seven Access Management Areas, corresponding to Figure 18 on page 56, are shown below in Table 14.

TABLE 14: ACCESS MANAGEMENT ACTIONS

AREA 1	
EXISTING CONDITIONS:	**ACTIONS:**
Area 1 includes properties along Baker Road between the BNSF railroad and a point that is approximately 1,320 feet west of the future intersection of the US 97 southbound ramps/Baker Court. Properties in this area are generally developed with single-family homes, consistent with Rural Residential (RR10) zoning. Many properties only have access to Baker Road and must rely on it for access, though some also abut Apache Road, Cinder Butte Road, or Pocahontas Lane.	This area is fully developed and there are no known plans to rezone the land or construct new public streets in the vicinity. Properties that are unable to access alternative public streets are anticipated to continue to have access directly to Baker Road. The public street intersection on Baker Road with Cinder Butte Road and Pocahontas Lane is proposed to be improved with turn lanes and a traffic signal. No changes are proposed to the intersection with Apache Road. As opportunities arise, such as through development and redevelopment of properties, access directly to Baker Road should be removed to properties that abut other public streets with lower functional classifications (i.e., Apache Road, Cinder Butte Road, or Pocahontas Lane) where access to those other streets is feasible and safe to construct. For properties without access to an alternative public street, no more than one direct access to Baker Road should be provided where feasible.
AREA 2	
EXISTING CONDITIONS:	**ACTIONS:**
Area 2 is located north of Baker Road between the BNSF railroad and US 97. This area is currently undeveloped.	No rights remain for properties in this Area to access the state highway and providing direct access to interchange ramps and expressways in the vicinity of interchanges would create a safety hazard. Consistent with the existing access rights of these properties, no access should be provided to US 97 or to Baker Road, as any access to Baker Road would be very close to the US 97 southbound ramps intersection and would create a safety hazard.

TABLE 14: ACCESS MANAGEMENT ACTIONS (CONTINUED)

AREA 3	
EXISTING CONDITIONS: Area 3 is located south of Baker Road between the BNSF railroad and US 97. This area includes one parcel zoned Rural Commercial (RC) that is developed with a store. Other parcels include a school and undeveloped land. All access to this area is currently taken from Baker Court.	**ACTIONS:** The public street intersection on Baker Road with Baker Court is proposed to be improved with turn lanes and a traffic signal, which will include alignment with the US 97 southbound ramp terminal. All access to Area 3 should continue to be taken from Baker Court. When designing improvements for the Baker Court approach, consideration should be given to ensuring unobstructed ingress can occur and that outbound vehicle queues and access points in the vicinity do not create unsafe backups into the Baker Road intersection. While a reservation of access to US 97 is present near the south end of Area 3, no direct access to US 97 should be provided, though consideration could be given to a gated access for emergency use only. Other than the one reservation of access noted, access control is present and should be retained along the remainder of US 97 and Baker Road.
AREA 4	
EXISTING CONDITIONS: Area 4 includes properties in the northeast quadrant of the interchange, bound by US 97, Knott Road, China Hat Road, and the BNSF railroad. All properties in this area are currently under common ownership. While the land is undeveloped today, significant urban development is anticipated in the future.	**ACTIONS:** There are no existing access points directly to US 97 or Knott Road and access control is present along US 97 and along Knott Road between US 97 and a point that is approximately opposite the existing Scale House Road intersection. No direct access to US 97 should be provided and no direct access to Knott Road should be provided within 1,320 feet of the future US 97 northbound ramp terminal. Purchase of access control along Knott Road between US 97 and a point 1,320 feet from the future US 97 northbound ramp terminal should be considered when IAMP improvements are funded for project development and delivery. Future development access should be provided along China Hat Road and the new collector roadways identified in the City of Bend's Transportation System Plan as much as feasible to reduce reliance on Knott Road for access.

TABLE 14: ACCESS MANAGEMENT ACTIONS (CONTINUED)

AREA 5	
EXISTING CONDITIONS:	**ACTIONS:**
Area 5 includes properties in the southeast quadrant of the interchange, bordered by US 97 and Knott Road. There are many tax lots under common ownership in this Area, extending to approximately 1.5 miles south of the interchange. This Area is largely undeveloped and is outside of the Bend urban growth boundary. The land abutting Knott Road is zoned Rural Residential Exception Area (RREA) with some areas zoned Surface Mining (SM). This Area primarily takes access to Knott Road via Scale House Road (private), although another gated access is present about 400 feet further east.	Scale House Road should be relocated further to the east on Knott Road to provide a minimum of 1,320 feet of separation from the US 97 northbound ramp terminal if feasible given any physical or environmental constraints. Also, the ability to achieve adequate sight distance along Knott Road from the new access location must be verified. Purchase of access control along Knott Road between US 97 and the relocated Scale House Road access should be considered when IAMP improvements are funded for project development and delivery. Additionally, the existing gated access (identified as approach number 21) should either be consolidated with the relocated Scale House Road intersection or relocated east of the relocated Scale House Road intersection, with the minimum separation to be determined by Deschutes County. While a reservation of access to US 97 is present near the south end of Area 5, no direct access to US 97 should be provided, though consideration could be given to a gated access for emergency use only. Other than the one reservation of access noted, access control is present and should be retained along the remainder of US 97.
AREA 6	
EXISTING CONDITIONS:	**ACTIONS:**
Area 6 includes properties abutting US 97 north of the BNSF railroad overcrossing to a point approximately one mile north of the interchange ramp tapers. There are three existing public accesses on US 97 (Ponderosa Street, China Hat Road, and Rocking Horse Road) and no private accesses. The Area is largely undeveloped but does include several single-family homes. The land on the east side is zoned Industrial Light (IL) and Commercial General (CG) and the land on the west side is zoned for a variety of residential uses and limited commercial.	Close all three of the public accesses as planned in both the City of Bend Transportation System Plan and the US 97 Parkway Plan, with the Ponderosa Street and China Hat Road intersections replaced by an overcrossing. Access control along US 97 is present in this Area, but three reservations of access exist on the west side and two exist on the east side. No direct access to US 97 should be provided to this Area on either side of US 97.

TABLE 14: ACCESS MANAGEMENT ACTIONS (CONTINUED)

AREA 7	
EXISTING CONDITIONS:	**ACTIONS:**
Area 7 includes properties abutting US 97 to the south of Areas 3 and 5 to a point approximately two miles from the interchange ramp tapers. There are three existing accesses, including a gated emergency access to the Deschutes River Woods neighborhood, an access to the High Desert Museum, and a gated access to a US Forest Service road.	All three accesses will remain. The gated accesses must continue to be gated when not in use. A future interchange that would replace the existing access to the High Desert Museum has been discussed in the past but is not included in an adopted plan at this time.

TRANSPORTATION SYSTEM MANAGEMENT STRATEGIES

Transportation System Management (TSM) generally includes strategies that enhance travel efficiency and safety without significant infrastructure expansion. The preferred alternative concept includes reconstruction and expansion projects that will address capacity and safety needs through 2040. However, the supporting strategies described below for managing the transportation system after the improvements are constructed may help ensure the interchange area functions as intended and that the life of the investment made is extended.

- **Consider reducing the posted speed along Baker Road and Knott Road after the improvements are constructed.** The speed limit on Baker Road is currently 35 miles per hour through the interchange area, but a lower speed limit could improve safety, create a more comfortable environment for people walking and biking, and may be appropriate as the environment becomes more urbanized.

  To initiate this process, Deschutes County must request that a speed zone investigation be performed by ODOT. Given the proximity of the future city limits, a letter of support from the City of Bend is recommended as well. The request must be submitted to the ODOT Traffic-Roadway Section and must ultimately be approved by the State Traffic-Roadway Engineer. A speed zone investigation should be conducted after installation of the interchange improvements or as the area becomes more urbanized to allow the surrounding environment to influence people to drive more slowly.

  In addition, high travel speeds on Knott Road approaching the northbound ramps have been expressed as an existing safety hazard. The interchange improvements, including the construction of a roundabout (or traffic signal) at the northbound ramps, may naturally result in lower travel speeds approaching this area. However, if the problem persists, other speed reduction measures, such as radar speed feedback signs, should be considered.

- **Maintain and enhance evacuation routes for southwest and southeast communities**. Baker Road is currently identified as a Project Wildfire Evacuation Route and serves as one of the few routes out of the Deschutes River Woods neighborhood. The function of the interchange as an evacuation route must be protected in the future, particularly during construction of the proposed improvements.
- **Add wayfinding signage when regional trails and trailheads are constructed.** A network of off-street trails are proposed in the IAMP area. These regional trails are expected to be used by visitors that may not be familiar with the area. Good wayfinding signage will help guide people walking and biking through the interchange area while taking full advantage of the low-stress features such as the separated paths, undercrossings at the northbound ramps, and signalized crossings at the southbound ramps. Wayfinding signage within the interchange area should be designed, implemented, and maintained by ODOT unless another agreement is made.
- **Manage the new interconnected traffic signals on Baker Road at the US 97 southbound ramps and Cinder Butte Road to prioritize safety.** Decisions about appropriate signal timing may involve trade-offs where some delay may be incurred in an effort to provide safe travel. This could involve issues such as safely clearing vehicle queues on the southbound exit ramp or from the railroad crossing, providing safe access for people walking and biking to the transit stop and multi-use paths, and implementing special timing to accommodate evacuation needs as they arise. When making signal timing decisions, the primary objective will be to provide for safe operation, with a secondary objective of minimizing delay. While the signalized intersections include both State and County facilities, it is anticipated that ODOT will have authority over signal operations and will have maintenance responsibilities. This strategy would also be applicable to the US 97 northbound ramp if a signal was desired at that intersection.
- **Maintain the ability to safely and conveniently accommodate transit access.** The current cul-de-sac at the end of Baker Court provides for the ability to turn buses around when arriving at the bus stop adjacent to the County Store property. Should any future development occur on the property south of the store, or should any other changes occur that would alter the use and design of the cul-de-sac, the ability of buses to safely and conveniently access the bus stop must be accommodated. As the road authority, Deschutes County will make decisions involving the design and management of Baker Court. In addition, if a future trailhead was constructed on the east side of the interchange, consideration should be given to transit access and to accommodate a transit stop and the ability for transit vehicles to turn around at the trailhead.

In addition to the management strategies described above, the potential influence of future City and County streets on traffic circulation through the interchange was considered to determine if a specific plan for phasing such improvements should be implemented. City of Bend's Transportation System Plan identifies several local street improvements near the area that could influence the US 97/Baker Road interchange. Two of the major projects include the China Hat Road Overcrossing project and the US 97/China Hat Road/Ponderosa Street right-on, right-off closure project. There are also several new roadway connections proposed in the "thumb" (area between US 97, Knott Road, and China Hat Road) and SE Area (area between 15th Street, Knott Road, 27th Street and Ferguson Road) to help accommodate planned growth in the area.

Technical Memorandum #4: Future Baseline (No-Build) Operational Conditions documents a sensitivity analysis indicating that the China Hat Road Overcrossing Project is critical to serving future demand in the "thumb" area by limiting traffic increases on Parrell Road and reducing traffic impacts to the US 97/Baker Road interchange. The sensitivity tests indicate that while keeping the right-on, right-off access at US 97/China Hat Road/Ponderosa Street open does relieve some traffic stress from the US 97/Baker Road interchange (particularly the northbound on-ramp), the minor benefits at the US 97/Baker Road interchange would not offset the negative operational impacts to China Hat Road and US 97 under full development conditions in the "thumb."

Based on the sensitivity analysis, there is no critical link between the timing of the need for interchange improvements and the need for local street network improvements at US 97/China Hat Road/Ponderosa Street. Therefore, local street improvements can occur either before or after the US 97/Baker Road interchange improvements.

CHAPTER 6. IAMP IMPLEMENTATION AND ADOPTION

To implement the IAMP, *Technical Memorandum #8: Potential Management Actions* in Volume 2 documents potential management actions/strategies and implementing agencies. The following sections summarize the key implementation steps that are needed related to zoning and land division ordinances and funding strategies.

ZONING AND LAND DIVISION ORDINANCES

- The US 97 Baker Road IAMP is considered a refinement to Deschutes County's adopted TSP. It provides background documentation and the preferred improvements within the study area to meet the identified existing and future needs for travelers going through and heading to the area. Once adopted, the IAMP will serve as a refinement to the TSP, identifying the needed local roadway enhancements in the study area that will guide future planning decisions.
  - The IAMP recommendations may be reflected in the updated TSP, but the County and ODOT will rely on the IAMP document as the policy foundation for and guidance on future actions related to funding, design, and construction of needed transportation improvements. In recognition of this role, the IAMP will be adopted by the County as a legislative amendment to the adopted Comprehensive Plan.[27]
  - Similarly, ODOT will adopt the IAMP as a refinement to the Oregon Highway Plan.
- Note that no modifications to the Deschutes County Development Procedures are necessary to implement the IAMP.
- Due to the location of the IAMP study area within the Bend Metro Planning Organization (MPO) boundaries and its proximity to Bend's Urban Growth Boundary and areas expected to urbanize in the next 20 years, the Bend Metropolitan Transportation Plan (MTP) also needs to be consistent with IAMP recommendations. Updates to the MTP were recently adopted in September 2024, which included new project descriptions for Phases 1 and 2 of the US 97 Baker Road interchange improvements consistent with those documented in this IAMP. Therefore, no further action is required.

FUNDING STRATEGIES

The US 97/Baker Road interchange area has significant safety and operational deficiencies under existing conditions that will be exacerbated as substantial future growth occurs to the east. A US 97 interchange improvement at Baker Road is included in the current Bend MTP aspirational project list but no funding has been currently identified for the improvements. Therefore, ODOT, Deschutes County, and the City of Bend should consider cooperative funding strategies that will allow for the construction of improvements in a manner that is timely for supporting future development.

[27] Note that the timing of IAMP adoption may precede, coincide with, or succeed the County's adoption of the updated TSP, also a legislative action. If IAMP adoption occurs after the County's adoption of the updated TSP, ODOT must submit a land use application for a plan amendment and carry the plan forward through public hearings before the Planning Commission and Board of County Commissioners.

While this IAMP does not include funding commitments from any party, recognizing that approximately two-thirds of the weekday p.m. peak hour trips through the interchange in the horizon year of 2040 will be from new growth, consideration should be given to implementing funding strategies that recover costs from development such as a proportionate share improvement district or a supplemental system development charge.