

US 97 BAKER RD INTERCHANGE AREA MANAGEMENT PLAN (IAMP)

TECHNICAL ADVISORY COMMITTEE MEETING #2
MAY 6, 2021

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- Please mute your microphone when not speaking.
- Please try not to speak over others.
- During the presentation, committee members can use the chat function to raise questions.
- Following the presentation of each section, staff will answer questions that have been listed in chat and committee members can use the chat function to raise new questions or let staff know if you have a comment or question.
- If you think of a question after the meeting or would like more information about anything, contact Don Morehouse Donald.MOREHOUSE@odot.state.or.us

AGENDA

- 1 / INTRODUCTIONS, AGENDA OVERVIEW, PROJECT STATUS
(*THIS MEETING IS BEING RECORDED)**
- 2 / EXISTING CONDITIONS (LAND USE, TRANSPORTATION,
ENVIRONMENTAL)**
- 3 / FUTURE NO-BUILD CONDITIONS**
- 4 / DISCUSS SOLUTION SUGGESTIONS**
- 5 / PUBLIC COMMENT**
- 6 / NEXT STEPS**

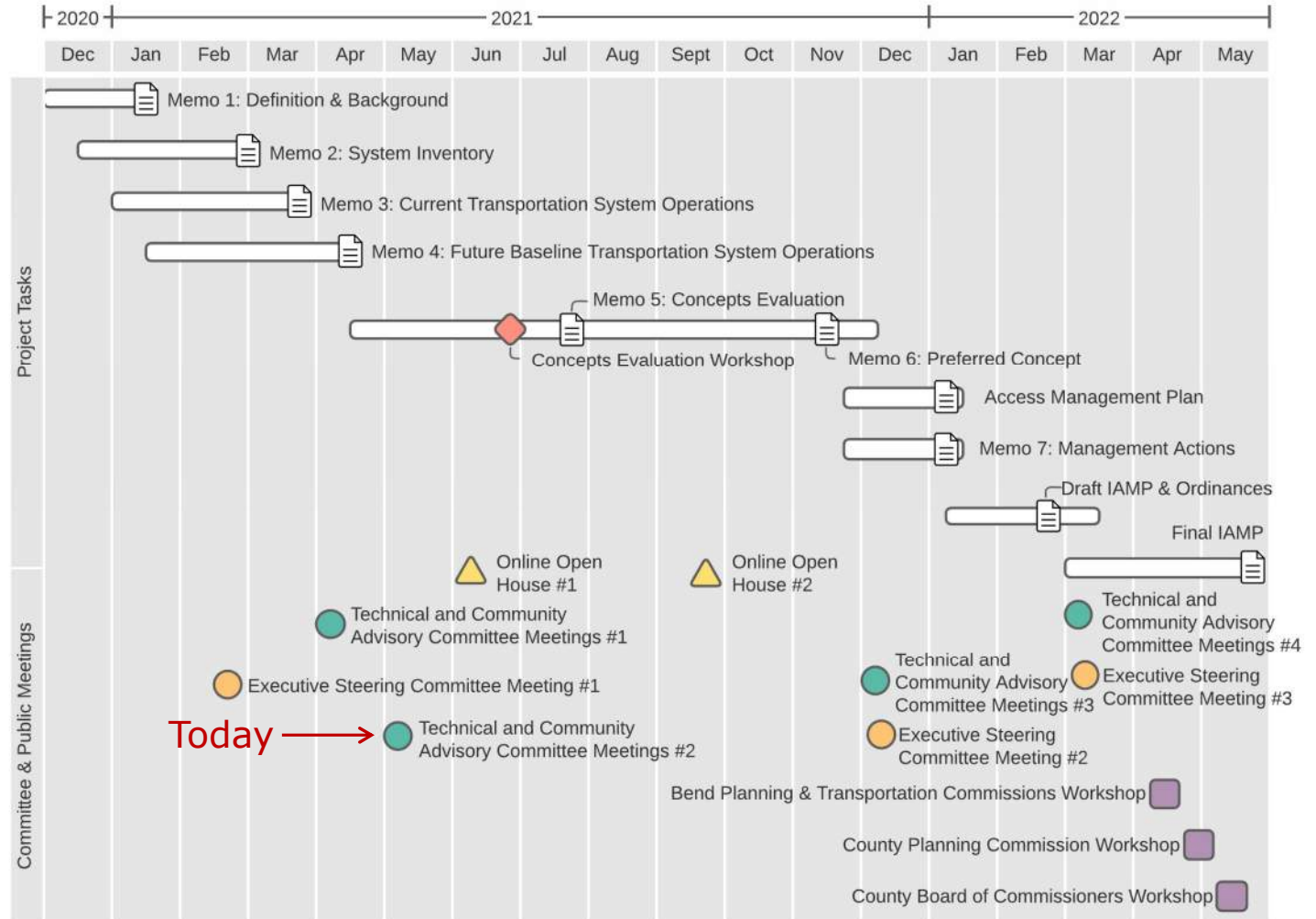
INTRODUCTIONS



PROJECT STATUS

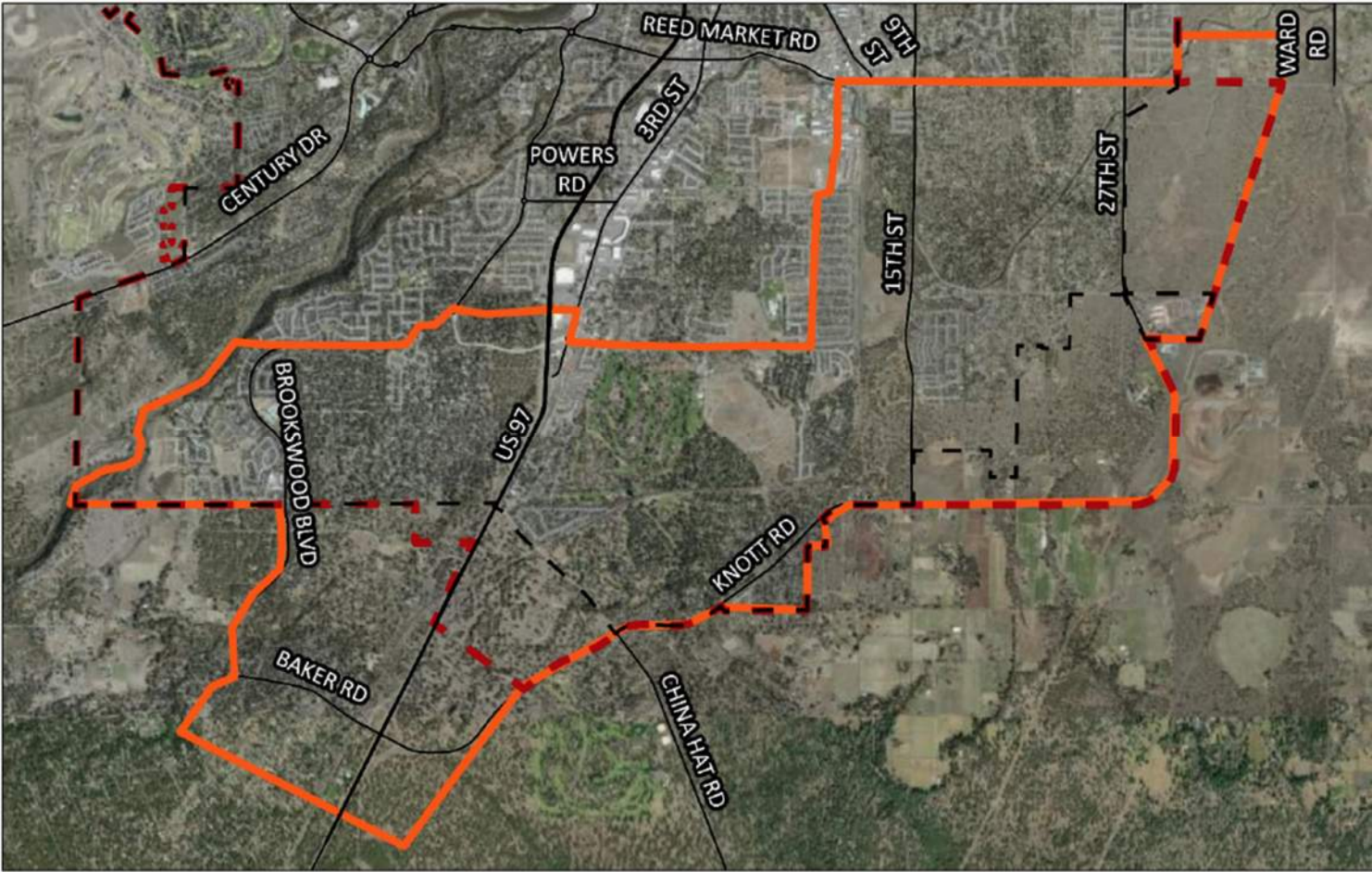
US 97 / Baker Road Interchange Area Management Plan (IAMP)

Project Schedule



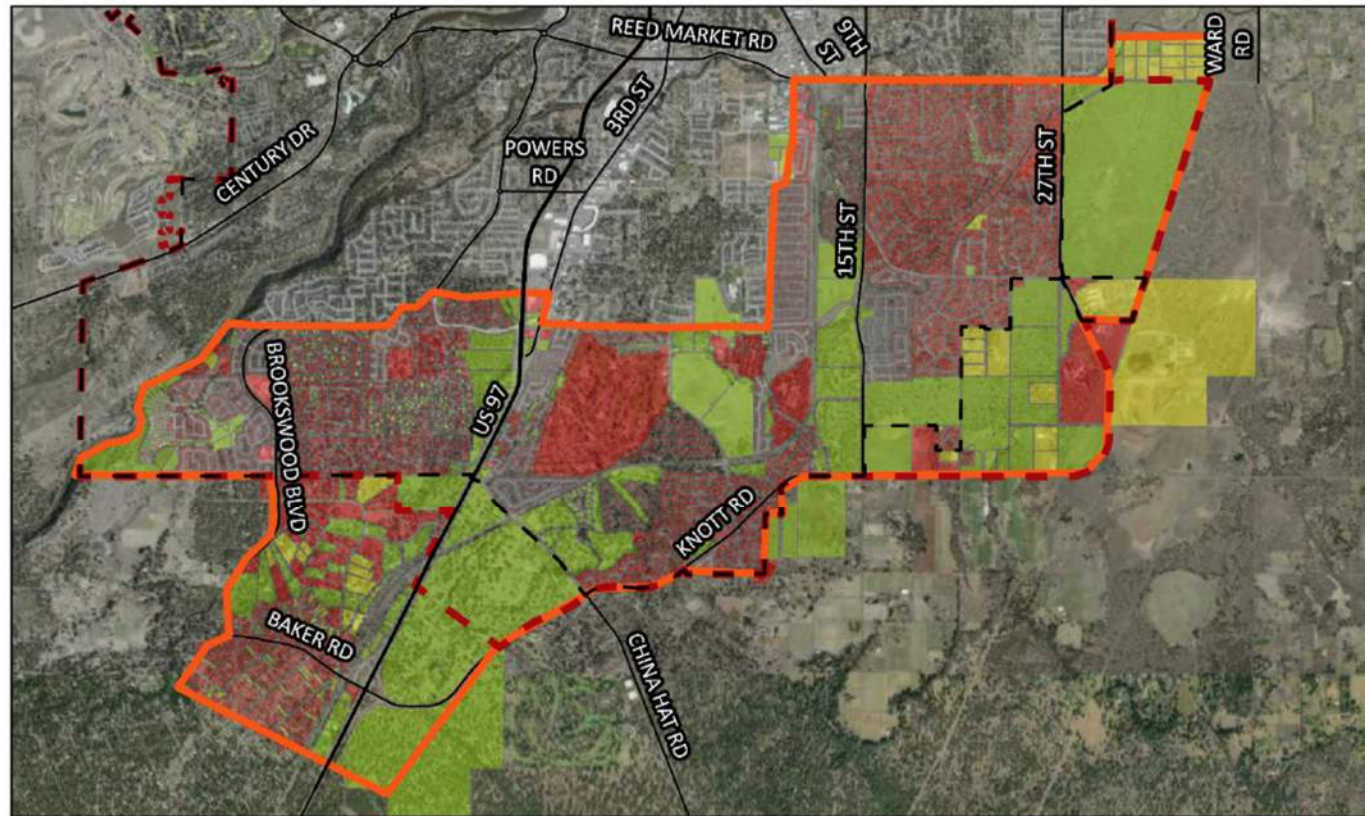
LAND USE INVENTORY

Study Area Boundary



LAND USE INVENTORY

Developed vs.
Redevelopable and
Vacant Land



Baker Rd. IAMP: Buildable Lands Inventory

- Bend City Limits
- UGB
- Study Area

Development Status

- Developed
- Redevelopable
- Vacant

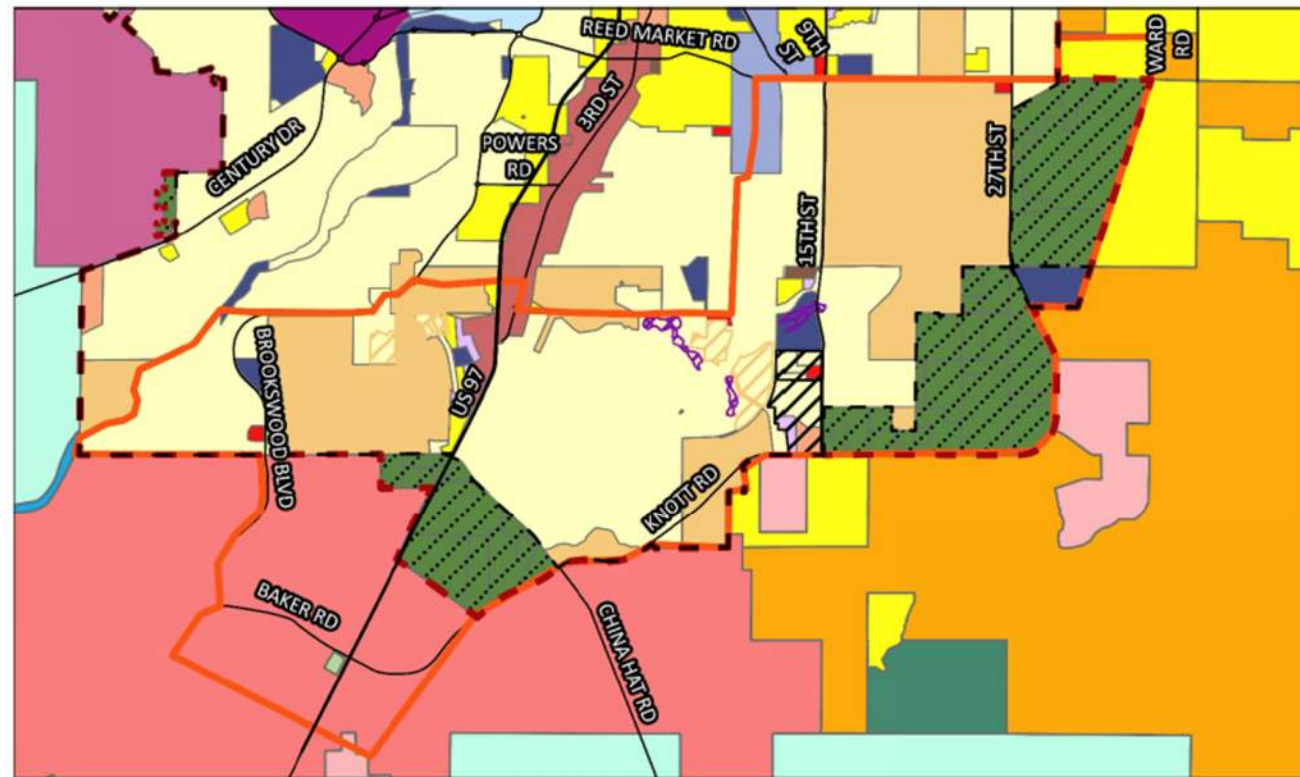


LAND USE INVENTORY

Zoning and Expansion/ Opportunity Areas

- SW Expansion Area – 240 homes, 80 jobs
- Thumb Expansion Area – 266 homes, 1,573 jobs
- SE Expansion Area – 819 homes, 2,274 jobs
- DSL Expansion Area/ Stevens Rd Tract – 1,001 homes, 880 jobs

(estimates through 2028)

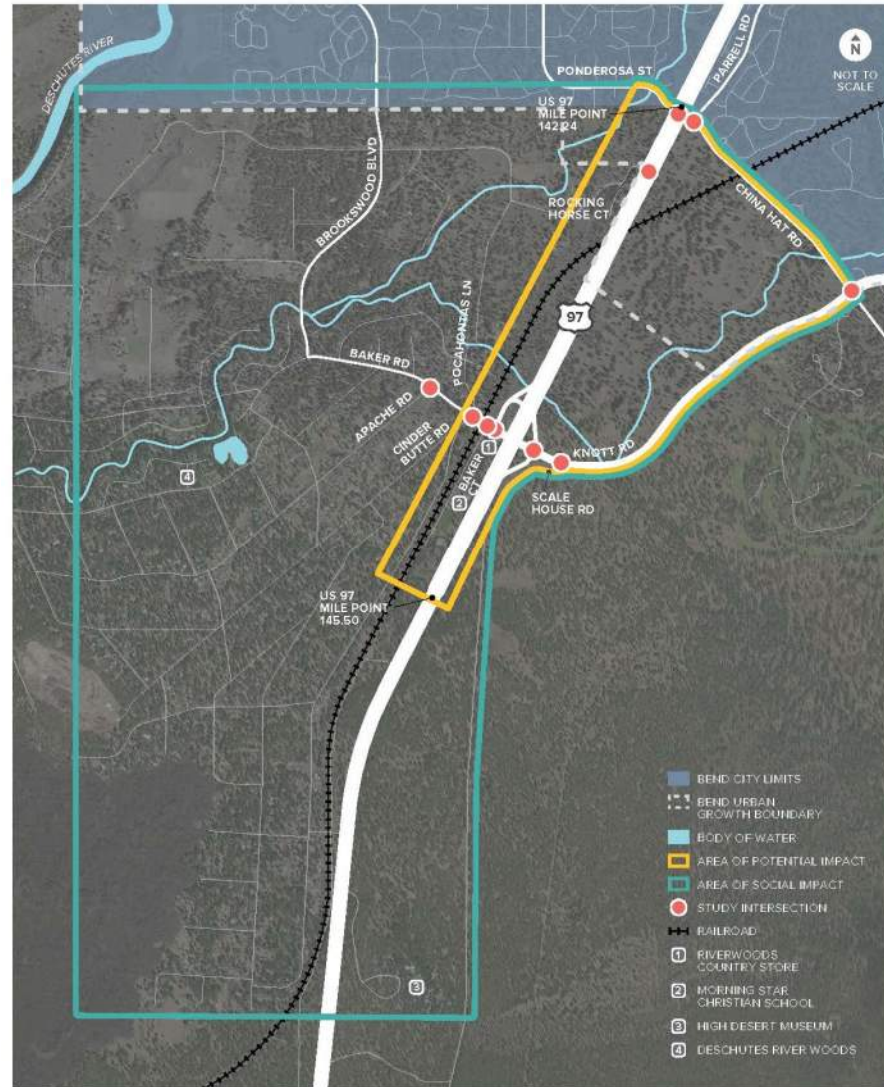


Baker Rd. IAMP: Zoning Designations

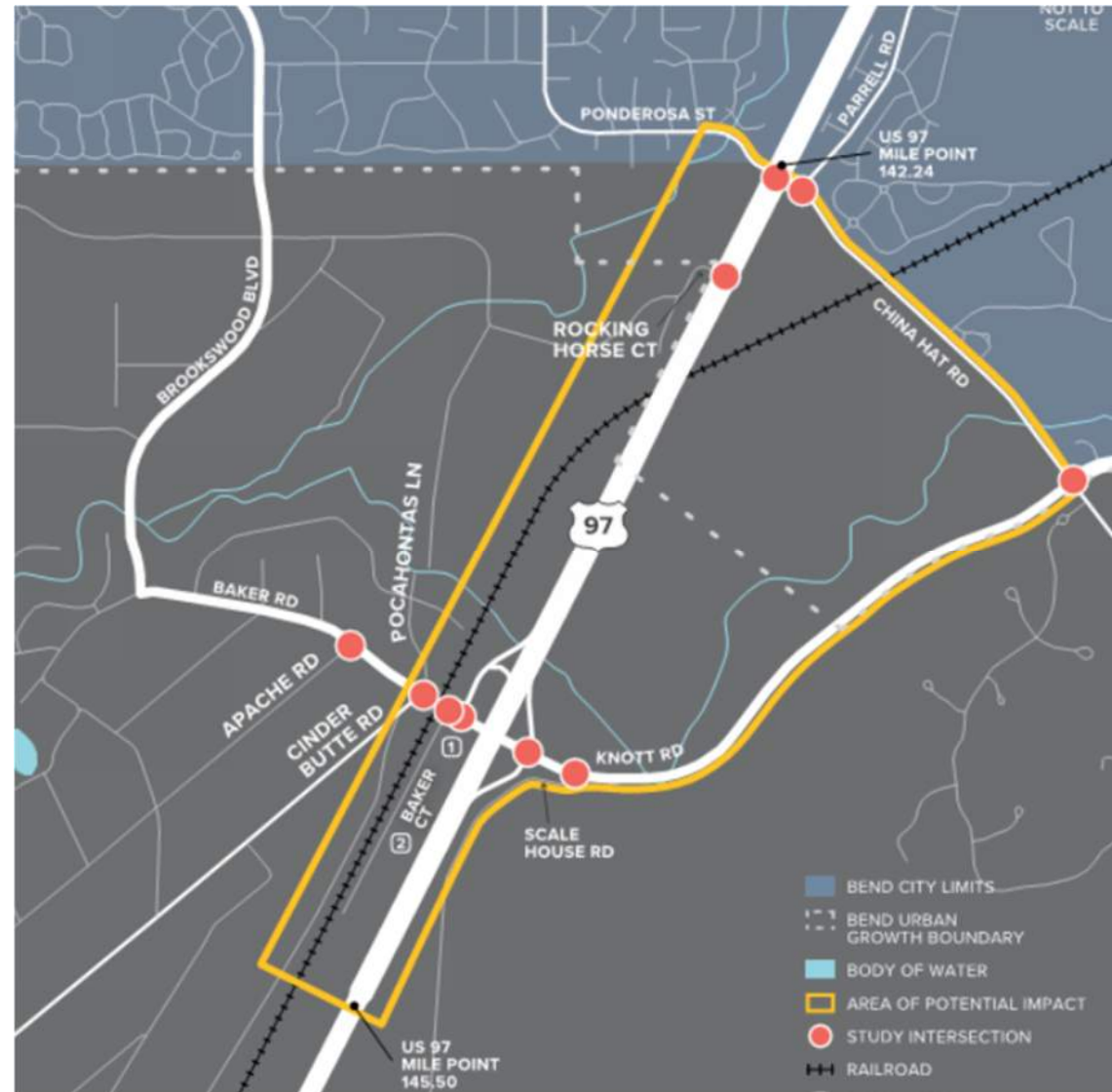


Source: City of Bend and Deschutes County GIS Data

ENVIRONMENT STUDY AREA



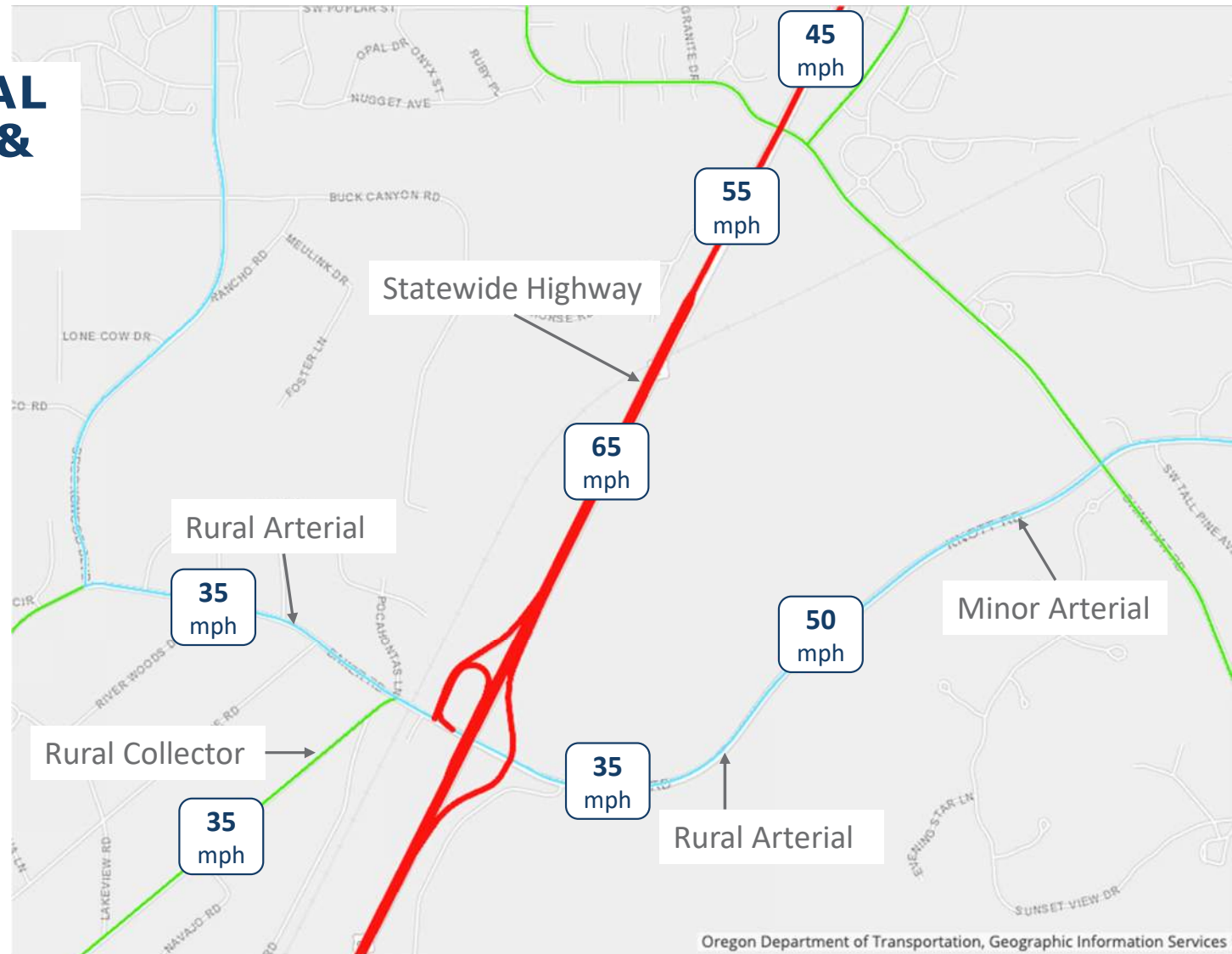
AREA OF POTENTIAL IMPACT



STREET FUNCTIONAL CLASSIFICATIONS & POSTED SPEEDS

US 97 is also:

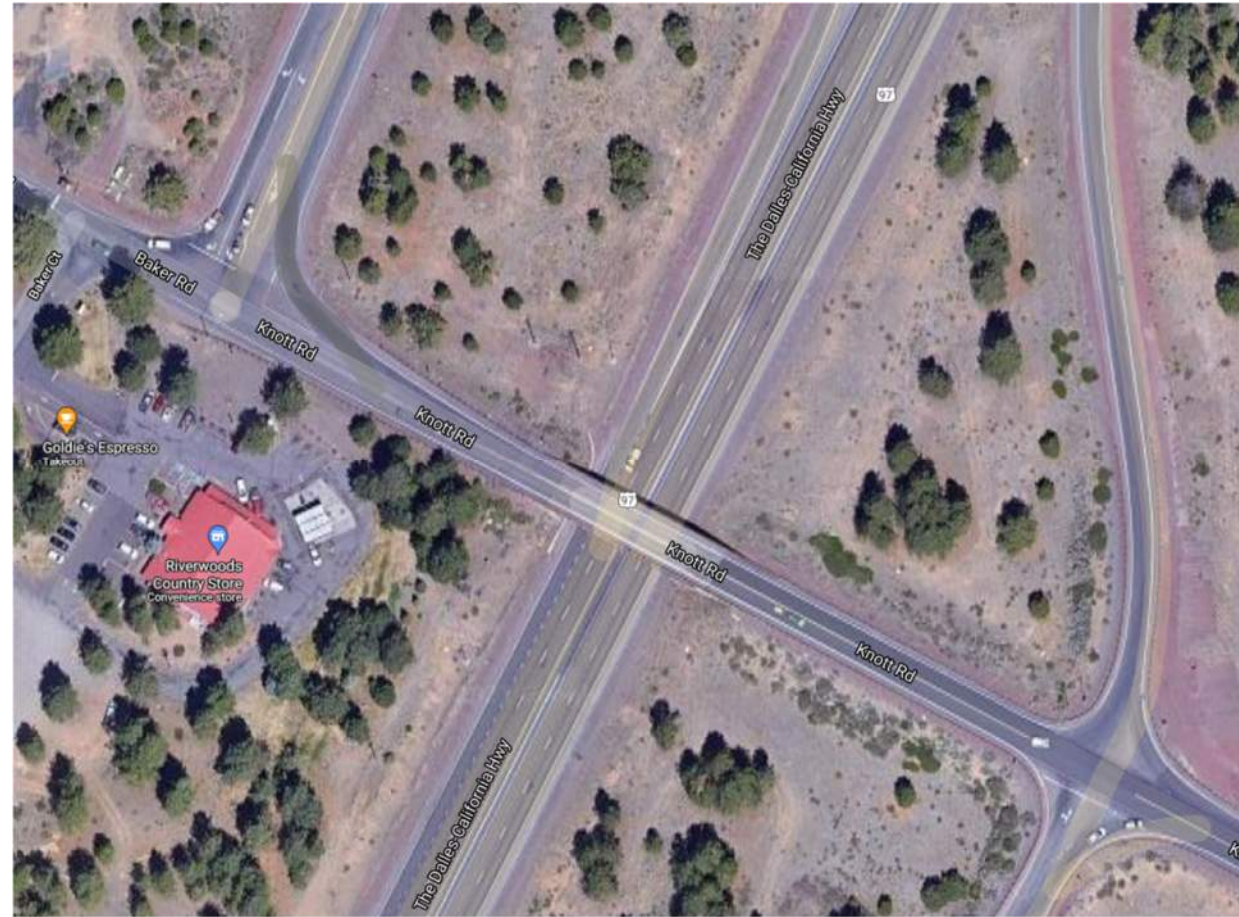
- National Highway System
- Expressway
- State Freight Route
- Reduction Review Route
- High Clearance Route
- Seismic Tier 1 Route



Oregon Department of Transportation, Geographic Information Services

TRAFFIC CONTROLS AND TRAVEL LANES

- No traffic signals
- Few separate turning lanes – no left turn lanes on Baker/ Knott Roads



INTERCHANGE RAMP LENGTHS

TABLE 4: US 97/BAKER RD INTERCHANGE RAMP ACCELERATION AND DECELERATION 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 ROAD	Off-Ramp	65	45	340'	420'
BAKER ROAD TO US 97 SB	On-Ramp	65	25	1350'	950'
US 97 NB TO KNOTT ROAD	Off-Ramp	65	45	340'	310'
KNOTT ROAD TO US 97 NB	On-Ramp	65	55	580'	735'

- The southbound loop on-ramp needs more acceleration distance
- The northbound off-ramp is just shy of meeting the standard length



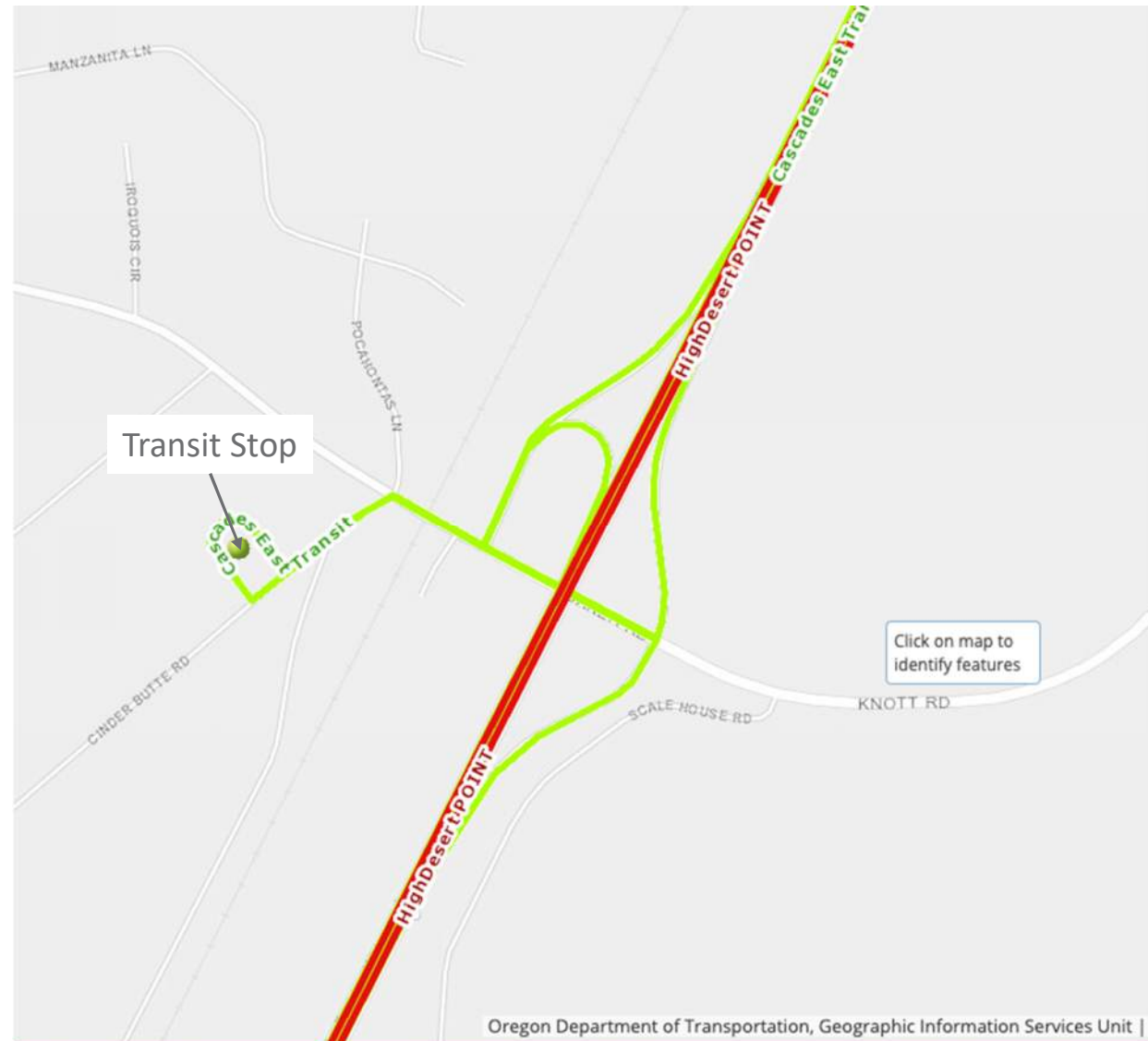
ACCESS SPACING

- Spacing between interchanges
 - > meets urban standard
- Spacing between ramp tapers
 - > meets urban standard
- Spacing of access along US 97
 - > will meet urban standard to north when China Hat/Ponderosa and Rocking Horse intersections are closed
 - > To the south, access to High Desert Museum is 1.35 mi. compared to 2 mi. standard for rural areas
- Spacing of access along Baker/Knott Rd.
 - > ODOT standards require 1/4-mile between ramp terminals and adjacent driveways/ street intersections
 - > To the west, there are 14 driveways and 2 streets within 1/4-mile. To the east, only Scale House Road and a gated driveway are within 1/4-mile



TRANSIT

- Cascades East Transit provides fixed route service between Bend and LaPine (Route 30) – serving more than 7,300 rides per year
- Also Dial-a-Ride service
- Transit stop at Riverwoods Baptist Church – 3 stops per weekday
- Potential future improvements
 - > Reduce delay by moving the stop closer to the interchange
 - > Increase frequency and add weekend service



RAILROAD



- At-grade railroad crossing on Baker Rd. 225 feet west of the southbound ramps.
- Up to 8 train crossings/day (no passenger service).
- Average train crossing closes the road for about 1 minute and 50 seconds.

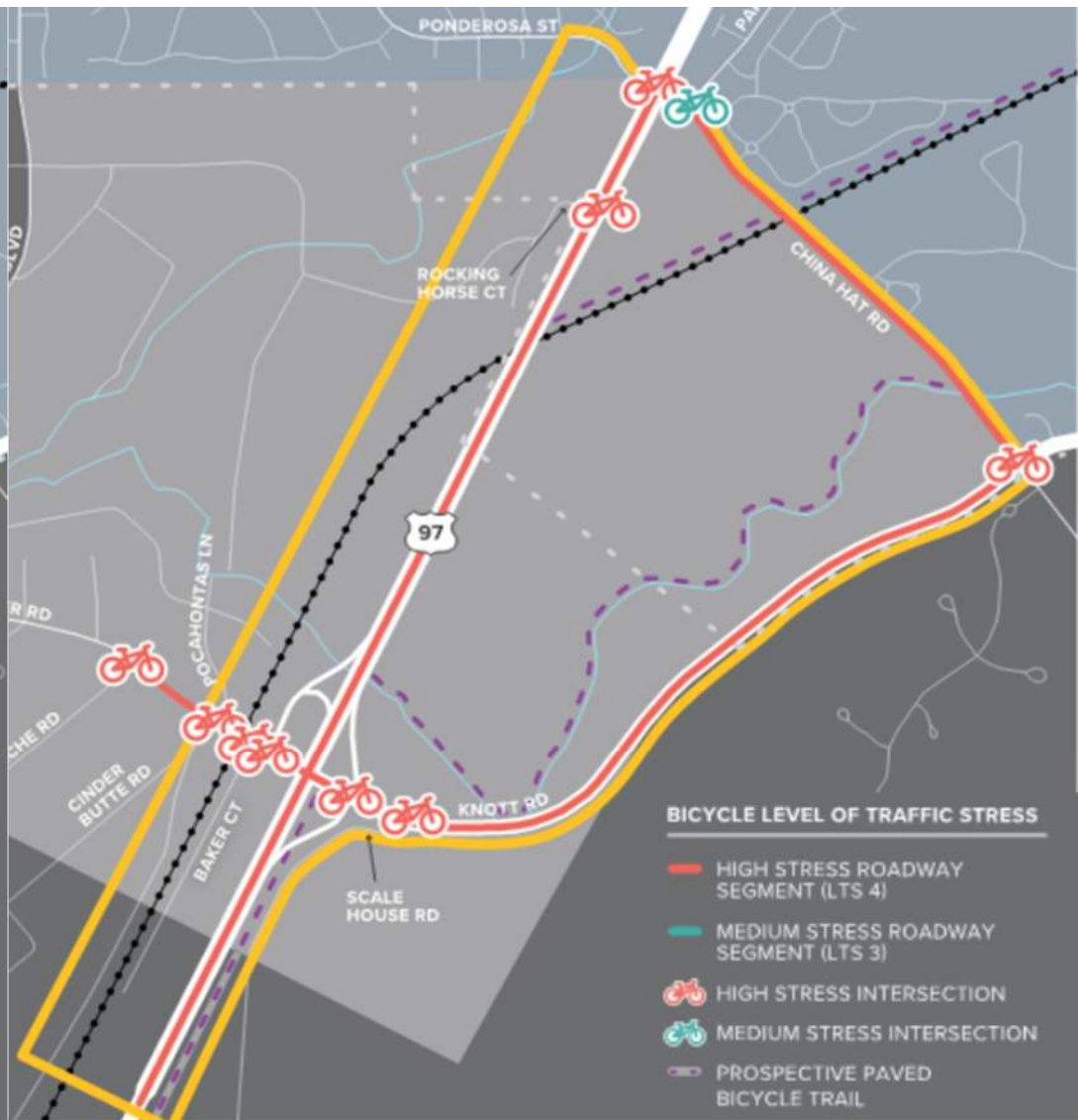
WALKING AND BIKING

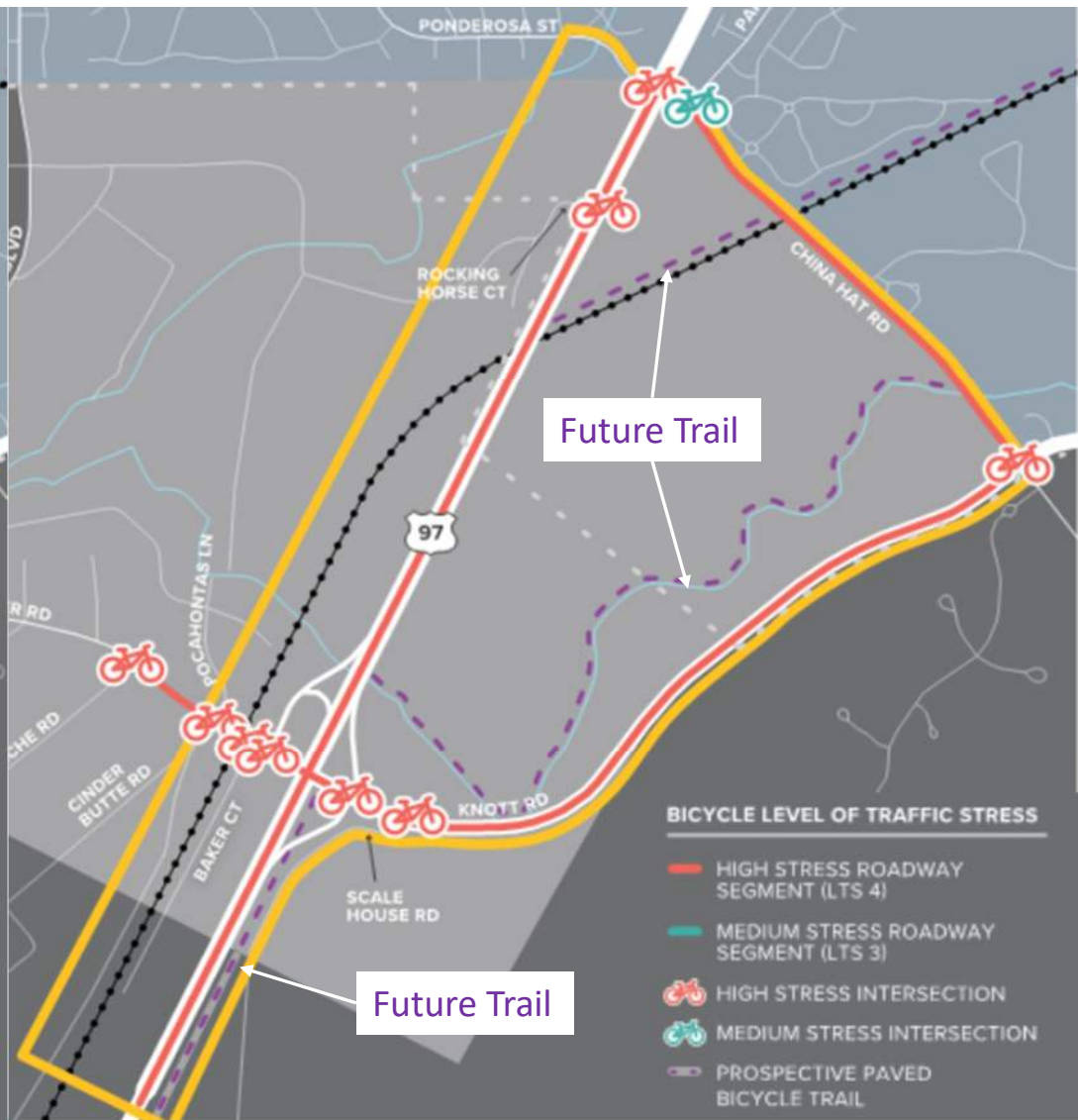
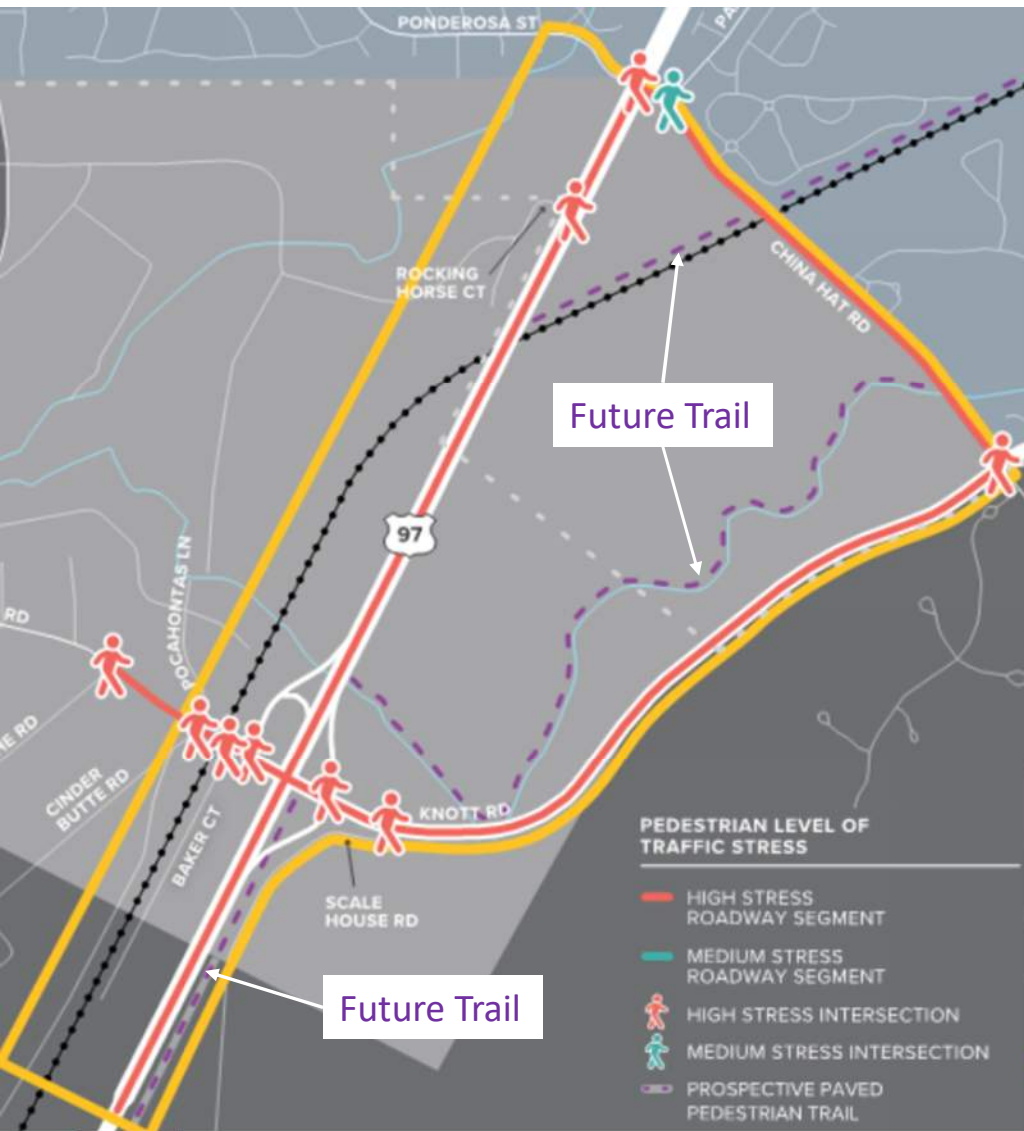
- No sidewalks or bike lanes near the interchange
- Limited sidewalks and bike lanes along China Hat Rd.
- Baker Rd. interchange is the only way to safely cross US 97 for people walking or biking in the area (Murphy Rd. is 2 mi. north)
- Baker/Knott Road is a County Bikeway
- Future growth to the east, as well as planned trails, will drive more walking and biking demand



WALKING AND BIKING

- Evaluated the “Level of Traffic Stress” (LTS) for people walking and biking
 - > Quantifies the perceived safety risk of being in close proximity to vehicles (speed and separation are major factors)
 - > LTS 1 (very little stress) to LTS 4 (maximum stress)





TRAFFIC VOLUMES

- For this project, “existing conditions” is 2017 (avoids recent COVID-19 impacts on traffic patterns).
- Time period used for analysis is the “30th highest annual hour”, which is similar to a weekday p.m. peak hour in the summer.
 - > No pre-COVID traffic data is available for the a.m. peak period.

Figure 15: US 97 ATR Average Weekday Traffic Seasonal Trends through Bend

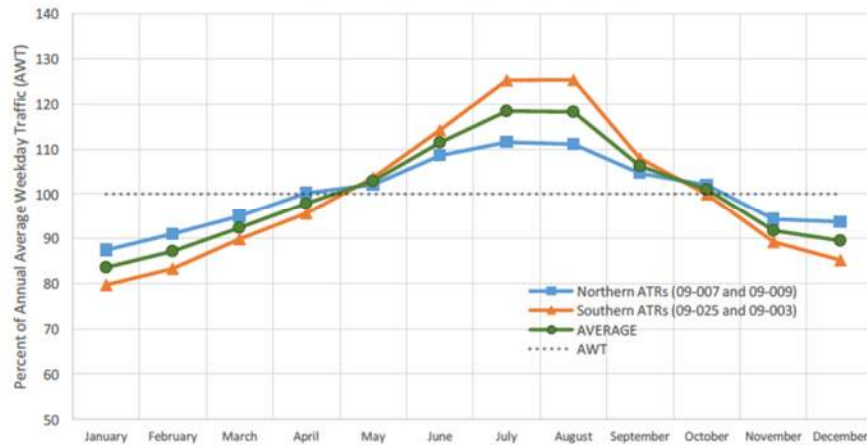
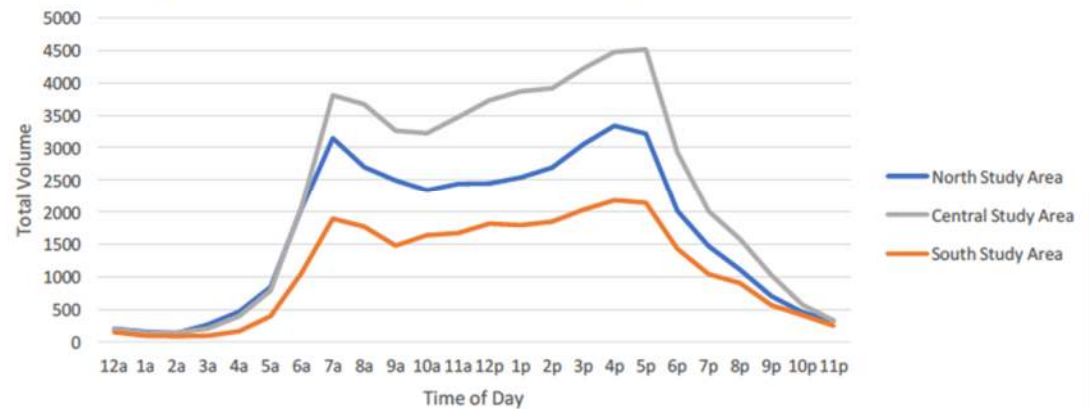


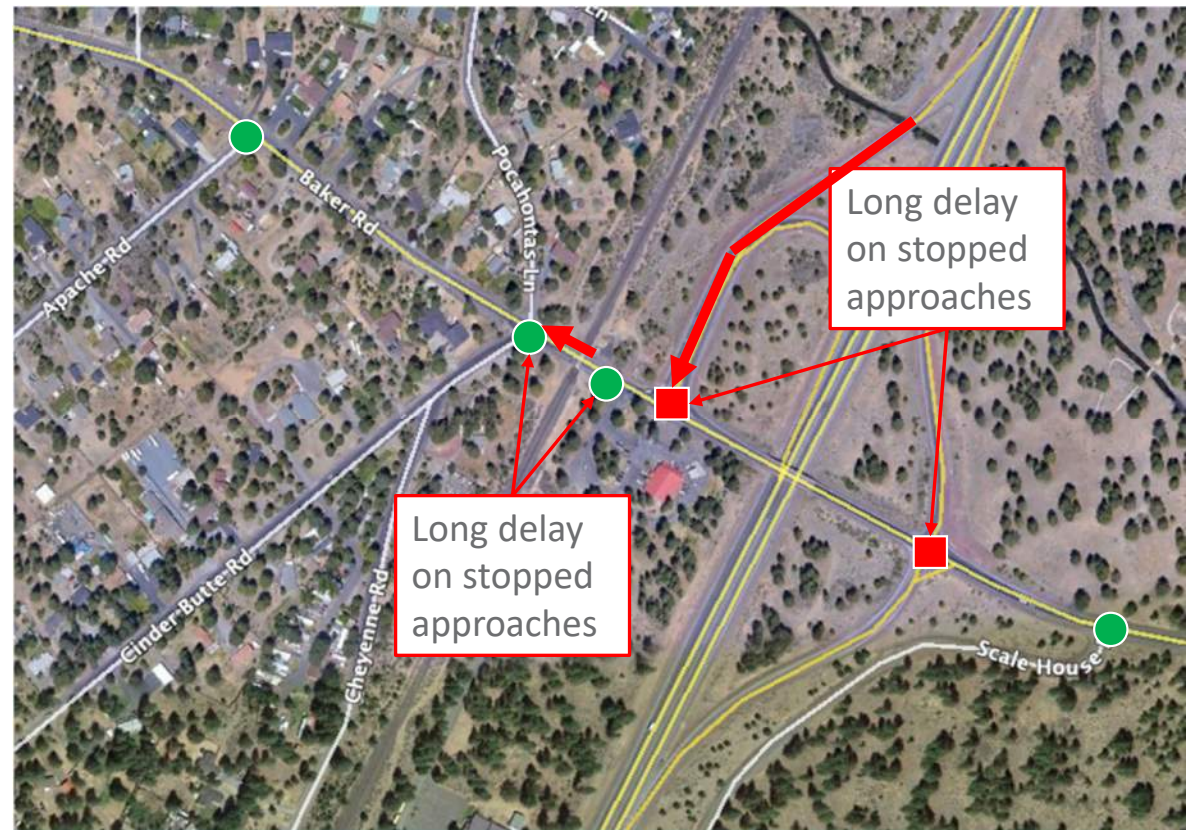
Figure 16: Average Weekday Traffic Volume Profile by Study Area



TRAFFIC OPERATIONS (CONGESTION)

- Both ramp terminals are experiencing significant congestion with long delays on the stopped approaches.
- Cinder Butte Rd. and Baker Ct. meet adopted mobility standards, but stopped approaches still experience long delays.
- Queues on the southbound off-ramp back up near or to the highway.
- The westbound left queue to Cinder Butte Rd. backs across the railroad.
- Queues can block closely spaced intersections

- meets mobility targets
- does not meet mobility targets
- ← unsafe vehicle queues

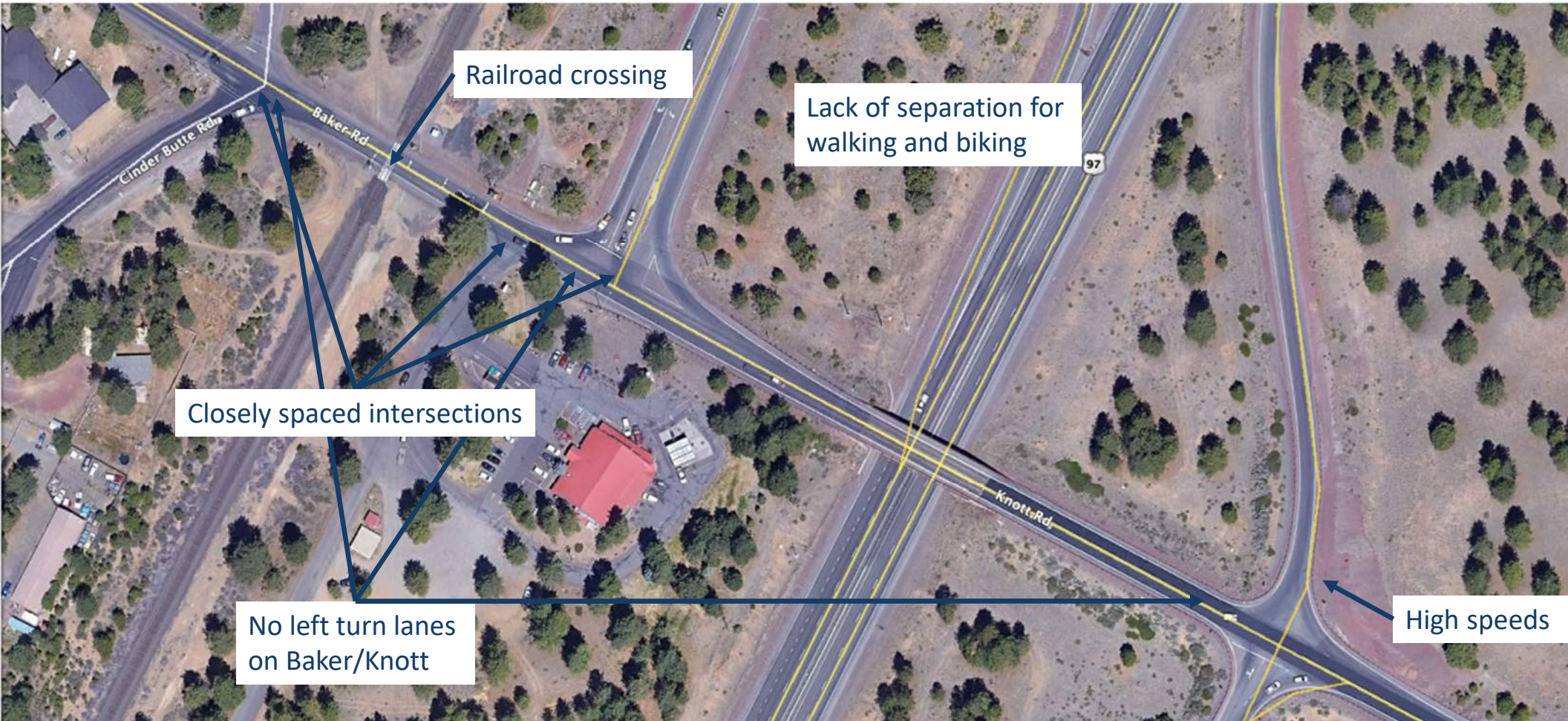


TRAFFIC OPERATIONS (CONGESTION)

- Ramp merge and diverge areas on US 97 operate well.
- Not much congestion in the API away from the interchange.



SAFETY – RISK FACTORS



SAFETY – ANALYSIS OF REPORTED CRASHES (2014-2018)

- No fatalities
- One crash involving a pedestrian (US97/Ponderosa)

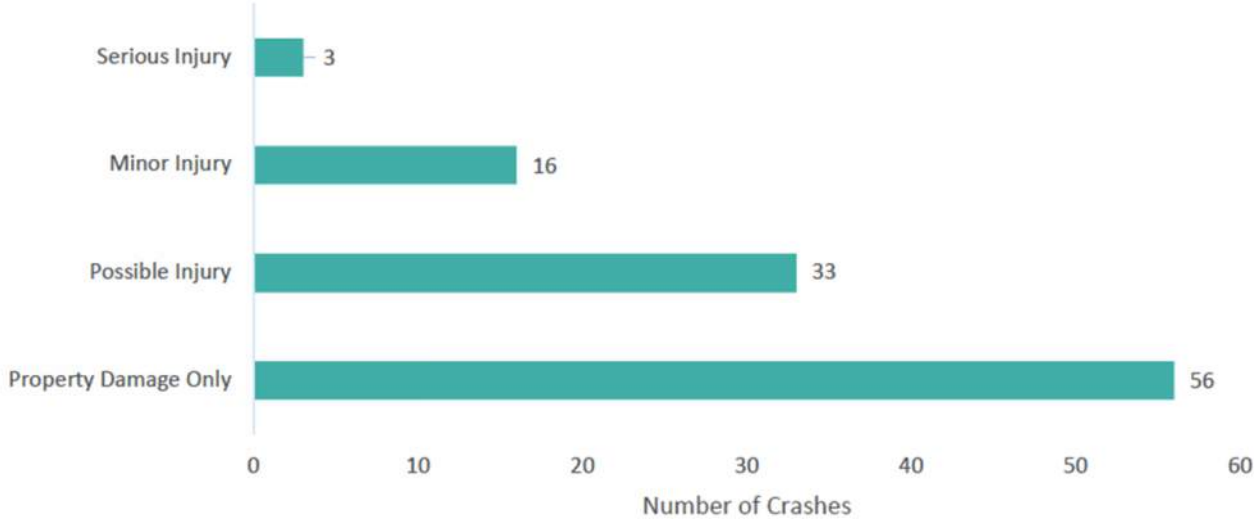


FIGURE 4: CRASH SEVERITIES WITHIN THE API (2014-2018)

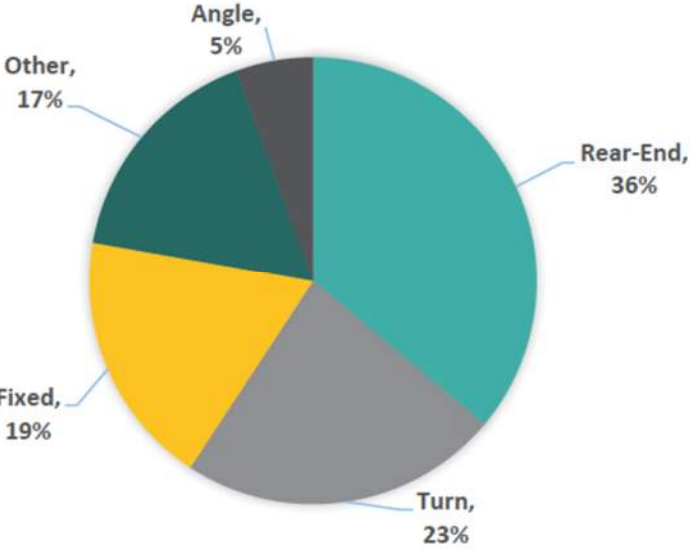


FIGURE 3: CRASH TYPES WITHIN API (2014-2018)

SAFETY – ANALYSIS OF REPORTED CRASHES (2014-2018)

Intersections noted as having higher than expected rates of crashes

- 1. Baker Road/ Cinder Butte Road (9 crashes)** – No clear trend but some turning and rear-end crashes could be mitigated with a left turn lane on Baker Road.
- 2. Baker Road/ Baker Court (13 crashes)** – Included 8 crashes involved turns out of Baker Court (6 left turns, 2 right turns). Closely spaced intersections, long delays getting out of Baker Court, and no left turn lane on Baker Road could be contributing factors.
- 3. Baker Road/ SB US 97 Ramps (11 crashes)** – Included 4 eastbound rear-end crashes on Baker Road. Closely spaced intersections, long delays for stopped movements, and no left turn lane on Baker Road could be contributing factors.

SAFETY – ANALYSIS OF REPORTED CRASHES (2014-2018)

Intersections noted as having higher than expected rates of crashes

- 4. Knott Road/ NB US 97 Ramps (13 crashes)** – Included 5 crashes involving left turns from the ramp and 3 rear-ends on Knott Road. Closely spaced intersections, long delays for stopped movements, and no left turn lane on Knott Road could be contributing factors.
- 5. Knott Road/ China Hat Road (11 crashes)** – Most were angle and turning crashes. Long delays for stopped movements and the curve to the east that limits sight distance could be contributing factors. (There is a planned roundabout for this intersection.)

FUTURE NO-BUILD CONDITIONS (2040)

- Key transportation system improvements assumed to be in place by 2040:
 - > US 97/Murphy Road northbound on-ramp and southbound off-ramp
 - > Closure of right-on/right-off direct connections to US 97 (China Hat Rd., Ponderosa St., and Rocking Horse Ct.)
 - > China Hat Rd. overcrossing of US 97 (and realignment of Parrell Rd./China Hat Rd. intersection)
 - > China Hat Rd./Knott Rd. roundabout

FUTURE NO-BUILD CONDITIONS (2040)

- Significant growth in housing and employment are planned to the east by 2040.
- This includes the “thumb” expansion area adjacent to the interchange that includes 600 homes and 3,900 jobs by 2040 (assumes another UGB expansion).



FUTURE NO-BUILD CONDITIONS (2040)

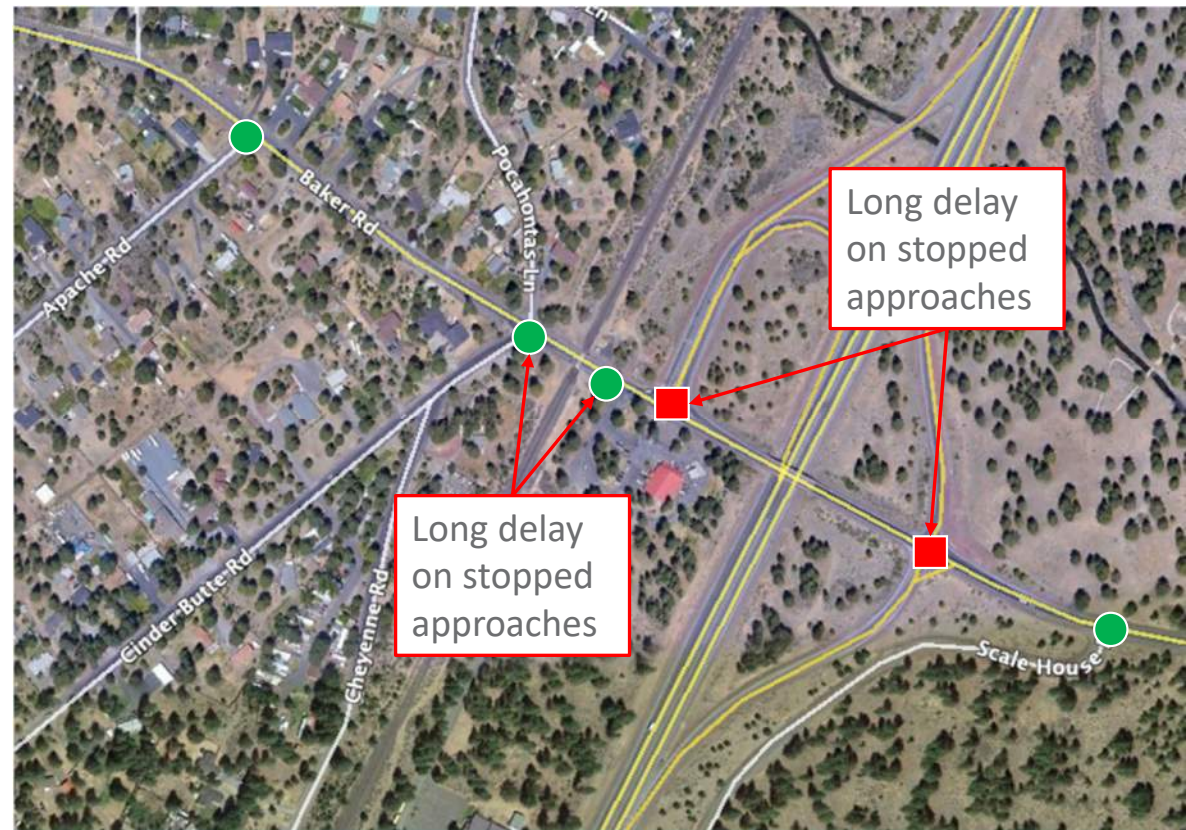
TABLE 1: FUTURE TRAFFIC GROWTH ON MAJOR ROADWAYS IN THE API

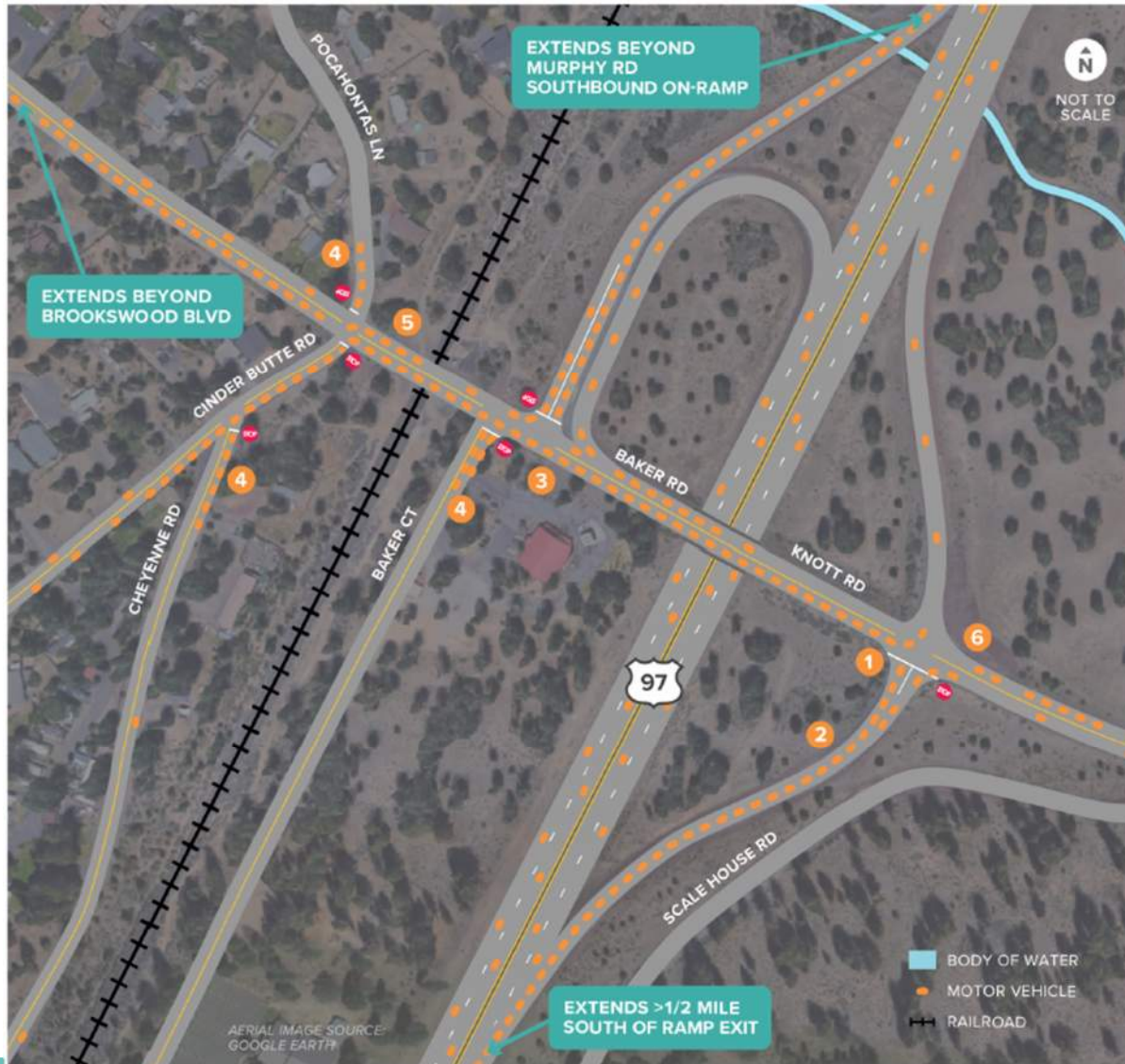
ROADWAY	LOCATION	2040 DESIGN HOUR TRAFFIC VOLUME	TRAFFIC GROWTH (2017 TO 2040)
US 97 SOUTHBOUND	Between Baker Rd and China Hat Rd	2,525	47%
US 97 NORTHBOUND	Between Baker Rd and China Hat Rd	1,870	87%
BAKER RD	West of the US 97/Baker Rd interchange	1,660	15%
KNOTT RD	East of the US 97/Baker Rd interchange	1,775	114%
CHINA HAT RD	East of Parrell Rd	1,115	337%

FUTURE NO-BUILD CONDITIONS (2040)

- Both ramps terminals on Baker/Knott will experience extreme congestion.
- Cinder Butte Rd. and Baker Ct. still meet adopted mobility standards, but stopped approaches still experience long delays (really long).
- Merging and Diverging movements on US 97 still operate well (other than the queued vehicles down the shoulder).

- meets mobility targets
- does not meet mobility targets





- 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 Brookwood 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 Butte 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 2. FUTURE 2040 PM PEAK HOUR BASELINE (NO-BUILD) QUEUEING

SENSITIVITY TESTING FUTURE STREET NETWORK CHANGES (2040)

- What impact do the planned improvements to close the US 97/China Hat/Ponderosa right-on/right-off intersections and build the China Hat overcrossing have on the US 97/Baker Road interchange?
 - > The China Hat Rd. overcrossing is critical for serving future traffic from the “thumb” area by limiting increased traffic on Parrell Rd. and reducing impacts on the interchange.
 - > Leaving the China Hat Rd./Ponderosa St. right-on/right-off intersections open does relieve some congestion at the US 97/Baker Rd. interchange, but not enough to avoid significant interchange improvements and probably not enough to offset problems at US 97/China Hat.

GOALS AND OBJECTIVES

- The project goals and objectives will guide the development of solutions and evaluate how well each solution meets the purpose of the project and stakeholder values.
- The initial draft goals and objectives considered the project problem and purpose, as well as the goals and objectives used for similar local projects (US 97 Parkway Plan & US 97 Bend North Interchange Study).
- No weighting applied, order is not significant.

example

Goals and Example Evaluation Criteria	Constrained Width	Balanced Street Width	Active Transportation Enhanced
Safety Potential to reduce crashes and vehicle speeds.	⬇️	⬆️	⬆️
Business Community Change in travel time to access businesses, availability of truck routes, and potential impacts on business signing.	⬇️	⬇️	⬇️
Mobility Delay at intersections, travel time through Main Street, and potential impacts to freight Reduction Review Route.	⬇️	⬇️	⬇️
Transportation Choices Frequency of crossings for people walking and biking, and the comfort of the walking and biking infrastructure.	⬇️	⬆️	⬆️
Vital Community Potential for streetscape improvements, such as landscaping, and the directness of routes between neighborhoods and Main Street destinations and services.	⬆️	⬆️	⬆️
Feasibility Degree to which recommendations can be implemented due to cost and right-of-way impacts, and the benefit of safety-focused improvements.	⬆️	⬆️	⬇️

Note: The safety elements above have been scored using the criteria described in Technical Memorandum #11: Solutions Evaluation Criteria. Scores are not intended to determine a single option, but rather help inform the conversation about which safety solutions work best for Main Street. Options might score differently if used together with other elements but are shown here without consideration for how they may be combined.

⬆️ Strongly supports, ⬇️ Moderately supports, ⬇️ No significant changes, ⬆️ Moderately conflicts, ⬇️ Strongly conflicts

GOALS AND OBJECTIVES

- Currently 8 goals focused on:
 1. Efficient (motor vehicle) travel
 2. Improving safety for all modes of travel
 3. Supporting regional and local economic development
 4. Creating opportunity for more multimodal travel
 5. Providing for equitable participation in the process and evaluating just allocation of burdens and benefits among community members
 6. Environmental stewardship
 7. Consistency with the shared state and local vision for the corridor/area
 8. Developing implementable solutions

CONCEPT EVALUATION – 3 STEPS

- 1) Develop Options - Based on Goals and Objectives the team will develop 5 options
- 2) Workshop - 4 hour virtual workshop in June to compare and refine options, reduce the number of alternatives to 3
- 3) Evaluation and Refinement - Refine 3 concepts, develop descriptions and estimated costs, review potential environmental impacts

EXAMPLE EVALUATION – NORTH INTERCHANGE

Draft Objectives	Draft Preliminary Evaluation Criteria	Tight Diamond (TUDI)	DDI	Dual Round-about	Comments and Notes
<ul style="list-style-type: none"> Consider long term growth needs of Juniper Ridge to the east of US 97 north of Cooley and the area west of US 97 north of Cooley Road. Preserve and provide adequate business access and vitality by improving conditions for existing businesses or by maximizing values for properties. Improve livability for adjacent neighborhoods. Avoid and minimize impacts to resources in the project study area to streamline environmental process. Develop a prioritized implementation strategy/action plan. Ensure public funds are invested efficiently and effectively. 	Future transportation system performance	2	2	2	Each option serves future growth through 20 years. Some added benefit beyond 20 years for DDI and DRAB. DDI likely can facilitate the best auto traffic operations at the interchange.
	Modifications to access	0	0	0	Impacts nearly identical across options to driveways.
<ul style="list-style-type: none"> Improve safety for drivers, bicyclists and pedestrians. 	Potential for diversion on Boyd Acres and Hunnell	0	0	0	None of the options are likely to result in added diversion from the future condition.
	Potential impacted resources	2	-0.5	1	DDI has the greatest amount of impact, DRAB 2nd and TUDI the least. Scores updated since workshop based on recent design work.
<ul style="list-style-type: none"> Create a US 97 corridor that aligns with the extension of the parkway vision. Statewide goal exception 	Ability to phase project, forward compatibility	0	0	0	Each project can be phased with some limited throwaway.
	Effectiveness of project concept to address goals and objectives per \$	2	1	1	TUDI is approximately \$75M, DRAB and DDI approximately \$85M, in 2027 dollars
<ul style="list-style-type: none"> Improve safety for drivers, bicyclists and pedestrians. 	Previous planning statement of alternative vision	2	2	2	All options are consistent with Parkway Vision
		-1	-1.5	-1.5	All options are likely to require a goal exception.
<ul style="list-style-type: none"> Maintain or enhance efficient travel for regional traffic along US 97. 	Safety for all modes	1	1.5	1.5	DDIs and DRABs tend to have better safety than TUDIs depending on the many design variables for each. Serving access on frontage or backage roads will improve safety on US 97.
	Operations and delay at key intersections	2	2	2	Intersection operations are anticipated to meet all applicable standards upon opening and through the planning horizon.
<ul style="list-style-type: none"> Maintain or enhance efficient travel for local trips. 	Serve local trips, enhance ability for local trips to avoid US 97	1	1	1	No differences among alternatives for local trips. Access road configurations allow for additional multi-modal circulation off US 97 for shorter trips.
	Comparison of future no-build and project for relative comfort of facilities and connections. Ability to attract "interested-but-concerned" riders.	2	0.5	2	Some differences among alternatives, pending decisions on specific elements such as turn lane locations, transitions across ramps and grades. Scoring was from workshop and has not been updated.
<ul style="list-style-type: none"> Improve the comfort and connectivity of or add facilities for people walking or bicycling along the corridor and crossing the corridor, including the multi-use path along US 97. 	Provide locations consistent with transit plans to accommodate transit connections	0	0	0	No discernable differences across alternatives.
	Business access opportunities that accommodate freight turning movements	0	0	0	No discernable differences across alternatives.
<ul style="list-style-type: none"> Accommodate transit operations in facility designs. Provide adequate access to businesses along the US 97 corridor for both customers and freight/delivery 	Serve local trips, enhance ability for local trips to avoid US 97	0	0	0	No discernable differences across alternatives.
	Business access opportunities that accommodate freight turning movements	1	1	-0.5	Anticipated that DRAB is less desirable to freight stakeholders. Each option will be built to accommodate freight design vehicles.
<ul style="list-style-type: none"> Reduce the number of local trips on US 97 	Out-of-direction travel	1	1	1	No discernable differences across alternatives.
	Impacts to properties owned, used by or accessed by EJ populations	1	1	1	Impacts nearly identical across options.
<ul style="list-style-type: none"> Design to accommodate freight movement Minimize out-of-direction travel 	# of potential design exceptions	1	1	1	Applicable standards achieved with each option.
	Constructability and ability to maintain traffic	1	0.5	1	No change to scores since workshop
<ul style="list-style-type: none"> Avoid disproportionate impacts to EJ populations 	Consideration of maintenance	1	1	1.5	No change to scores since workshop
	Challenges/opportunities (e.g. plowing)	1	1	1.5	No change to scores since workshop
		19	13.5	16	

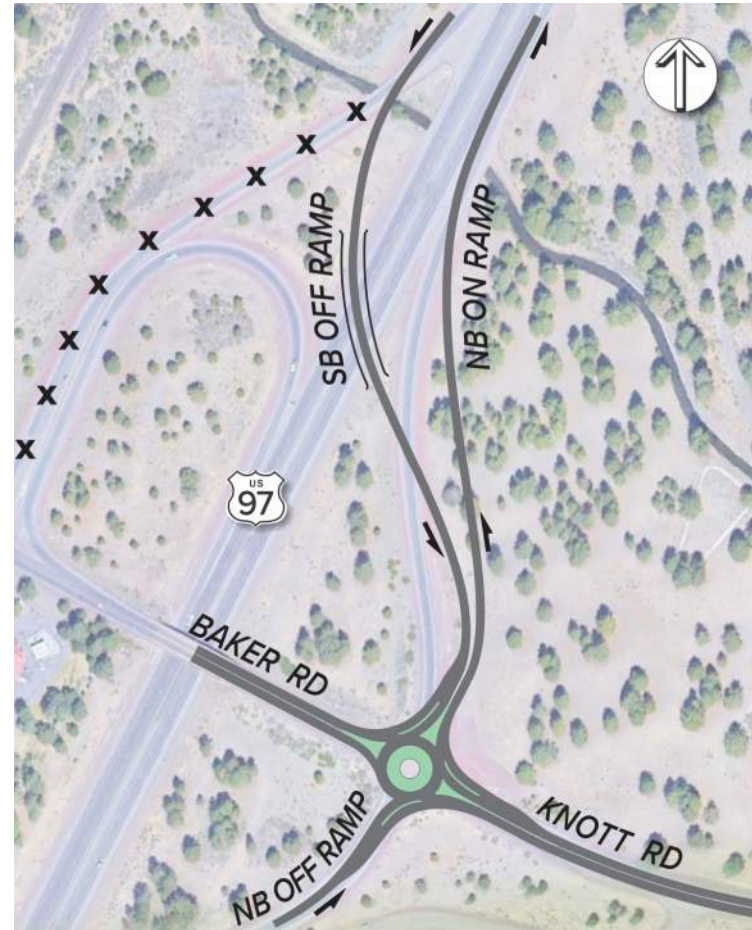
EXAMPLE OF OPTION – RAISE RR



EXAMPLE OF OPTION – RAISE BAKER ROAD

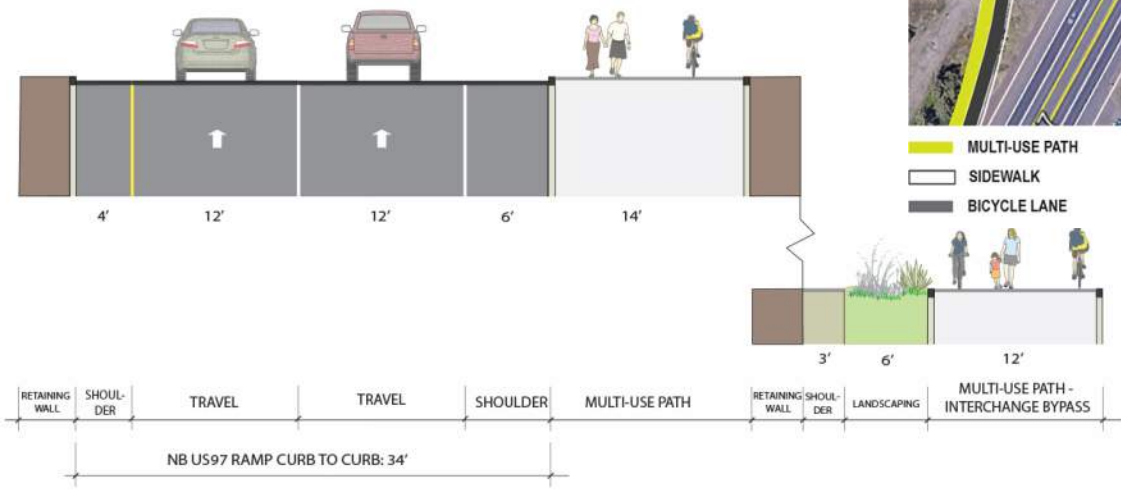


EXAMPLE OF OPTION – RAB FLYOVER



EXAMPLE OF BIKE AND PEDESTRIAN CONSIDERATIONS

B Northbound US97 Ramp



- MULTI-USE PATH
- SIDEWALK
- BICYCLE LANE
- POSSIBLE MULTI-USE PATH INTERCHANGE BYPASS
- UNDER CROSSING

WHAT OPTIONS SHOULD WE CONSIDER?

PUBLIC COMMENT

CONCLUSIONS AND NEXT STEPS

- Develop Preliminary Solution Concepts
- Online Open House 1
- Concept Evaluation Workshop
- Memo 5: Concepts Evaluation
- Online Open House 2

