ROAD SAFETY AUDIT REPORT

June 2020

OREGON DEPARTMENT OF TRANSPORTATION

OR 8: SW 17th Avenue to S 26th Avenue

Cornelius
Oregon's Family Town

Hillsboro OREGON

KITTELSON & ASSOCIATES

ROAD SAFETY AUDIT (RSA) REPORT

OR 8: SW 17th Avenue to S 26th Avenue

Washington County, Oregon

Prepared for:
OREGON DEPARTMENT
OF TRANSPORTATION
REGION 1

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ODOT Project Key No. 20479
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June 2020

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Attachment A: Pre-Audit/Kick-off Meeting Presentation
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PURPOSE

A road safety audit (RSA) is a formal safety performance examination of an existing road or intersection by an independent audit team. It also considers the safety of all road users, examines the interaction of project elements, considers interactions at the limits of the project, and proactively considers mitigation measures to address safety issues. An RSA is not a "standards" check for examining adherence to design guidelines. It seeks to identify opportunities to improve safety. This RSA report summarizes key safety related issues, and the independent RSA team developed a series of suggestions to address these safety issues. The suggestions may not be within ODOT's (Oregon Department of Transportation) current design guidelines and criteria, but the RSA team wanted to highlight various options including safety countermeasures that have been used by other agencies. ODOT will consider the RSA suggestions in their formal response to the RSA report, refer to Step #7 of the Federal Highway Administration (FHWA) RSA process.

RSA TEAM SUMMARY

Project Title: OR 8: SW 17th Avenue to S 26th Avenue – Road Safety Audit (RSA)

Date: May 11th – 15th, 2020

RSA Team:

- Terry Keyes, City of Cornelius, Engineer
- Rich Crossler-Laird, ODOT, Roadway
- Mariana Montes, ODOT, Traffic Investigator
- Matt Dorado, Washington County, Engineer
- Hermanus Steyn, Kittelson & Associates, Inc., Senior Principal Engineer
- Eric Germundson, Kittelson & Associates, Inc., Engineer

RSA Support Resources:

- Robert DeVassie, ODOT, Project Manager
- Martin Jensvold, ODOT, Traffic Investigations Engineer
- Jonathan Burnitt, ODOT, Traffic Investigator
- Lili Boicourt, ODOT, Community Affairs
- Ashleigh Ludwig, Kittelson & Associates, Inc., Senior Engineer/Planner
- Molly McCormick, Kittelson & Associates, Inc., Engineering Associate

RSA Stakeholders:

- Joseph Auth, Community Participation Organizations (CPO) District 12C (Chair), City of Hillsboro
- John Bennett, Cornelius Police (Chief)
- Ben Baldwin, TriMet

- Scott Pears, ODOT Maintenance
- Jeff Lee, ODOT Maintenance
- Rob Drake, City of Cornelius (City Manager)
- Carol Hatfield, Hillsboro School District
- Crystal Araujo, Youth Advisory Council (YAC)

PROJECT CHARACTERISTICS

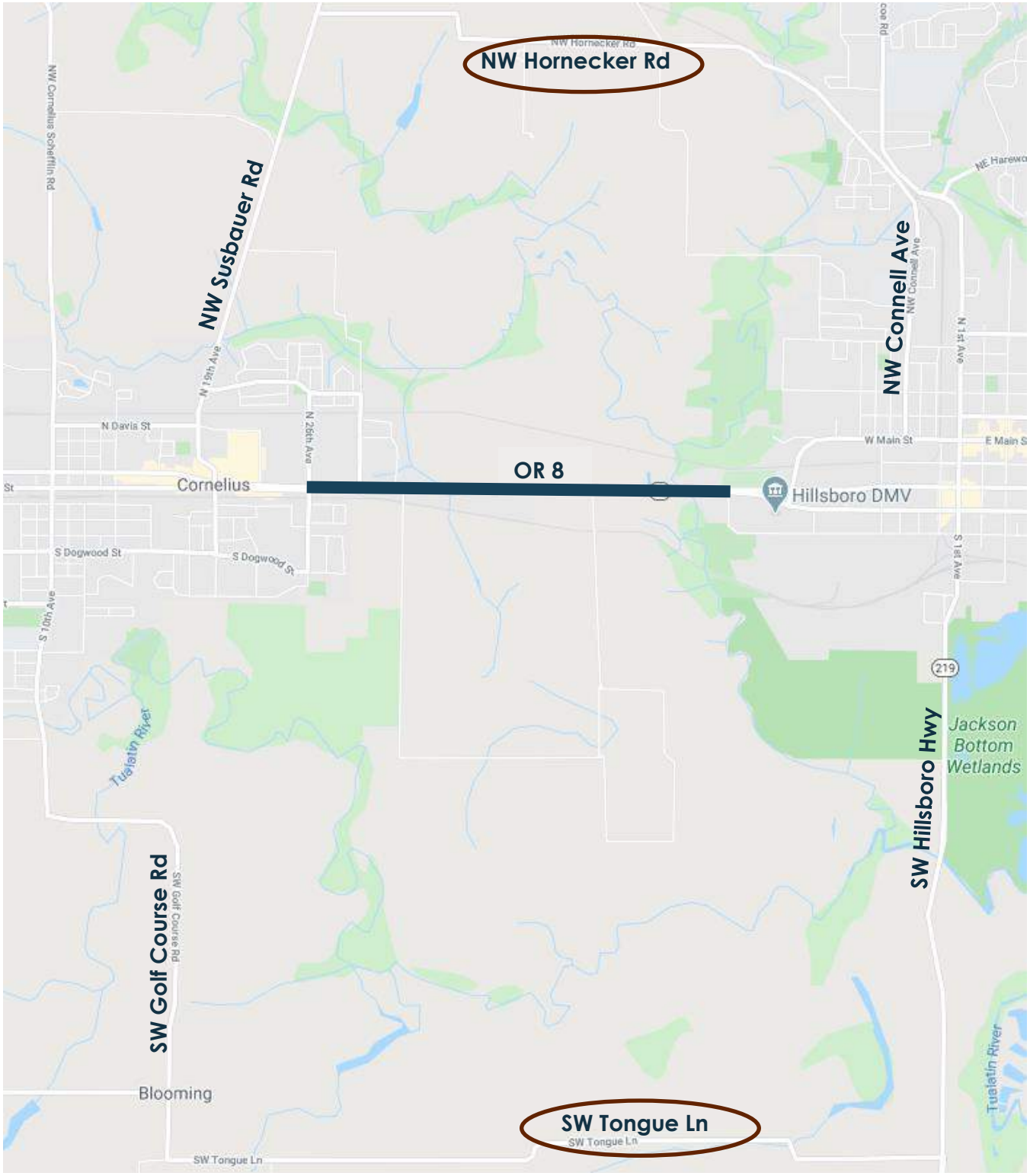
The Road Safety Audit (RSA) Team studied a segment of OR 8 from SW 17th Avenue in Hillsboro, Oregon to S 26th Avenue in Cornelius, Oregon. Exhibit 1 illustrates the extents of the 1.6-mile study corridor, which included portions within the Cornelius and Hillsboro city limits and unincorporated Washington County.

Exhibit 1: RSA Study Corridor Extents

Source: Base Image from Google Earth

As shown in Exhibit 2, OR 8 is one of the few east-west routes connecting Hillsboro and Cornelius. The nearest parallel connecting route to the north is NW Hornecker Road, approximately 1.7 miles north of OR 8. The nearest parallel connecting route to the south is SW Tongue Lane, approximately 2.4 miles south of OR 8.

Exhibit 2: Roadway Network Near OR 8 Study Corridor



Source: Base Image from Google Maps

Existing Roadway and Land Use Characteristics

This section highlights existing roadway and traffic characteristics of the study corridor based on data that was either provided by ODOT and stakeholders or was easily accessible through online databases. Table 1 summarizes project characteristics. All references to OR 8 focus on the previously defined study corridor unless otherwise noted.

Table 1: Project Characteristics

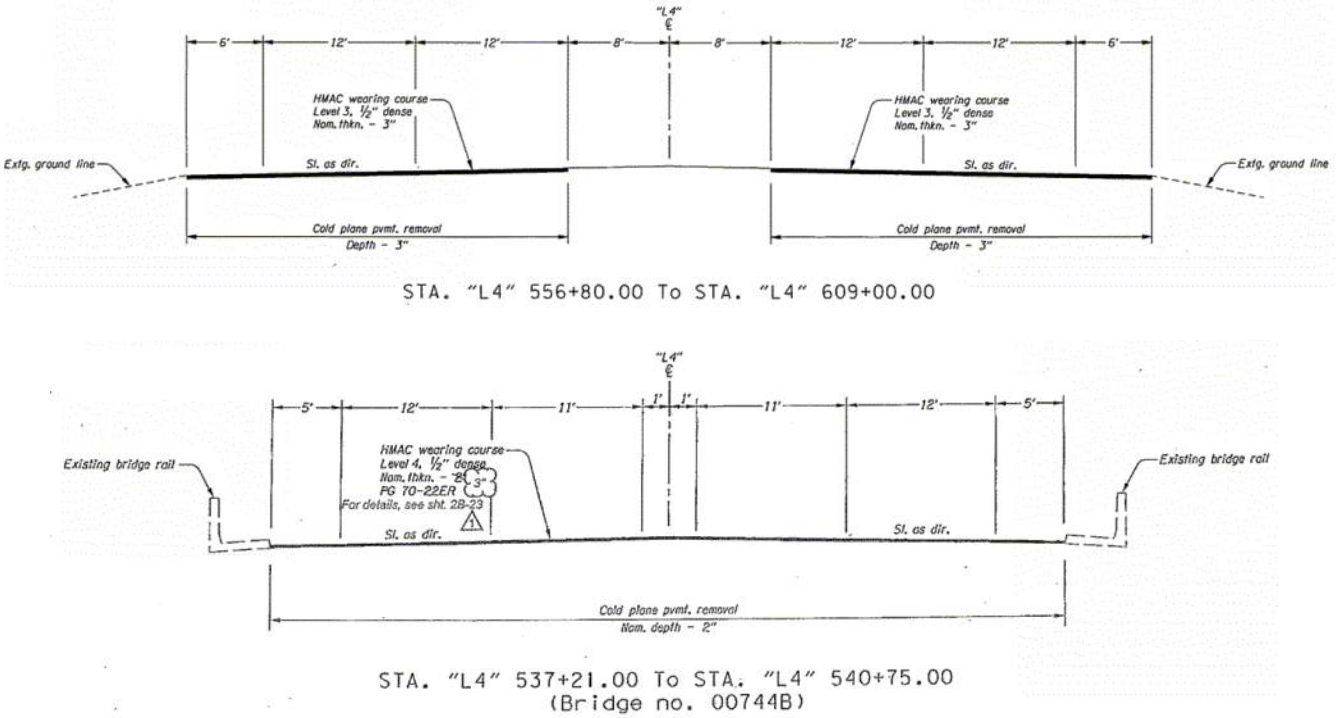
Description	Project Characteristic
Audit Type:	Planning stage
Land Use Development Proposal:	No
Units of Measure:	US
Adjacent Land Use:	Rural and suburban (transition zone from suburban to rural to suburban) including farm use, heavy industrial, residential, and commercial
Posted Speed—US in miles per hour (mph)	40-45 mph, including a temporary speed zone reduction from 50 mph to 45 mph
Median Type:	Two-way left-turn (TWLT) lane striping for majority of corridor and two sections of raised medians between 26th Avenue and N 29th Avenue and between SW 345th Avenue and East Lane
Service Function:	
Highway Number:	• ODOT Highway 29 (Tualatin Valley Highway)
Functional Classification:	• Arterial (Cornelius), arterial (Hillsboro), arterial (Washington County), principal arterial (Federal) • Special designation as part of Regional Arterial and Throughway Network
Oregon Highway Plan (OHP) Designation:	• Statewide highway • National Highway System (NHS) • National Network • Reduction Review Route
Freight Routes:	• Designated as a County Over-Dimensional Truck Route and a Metro Regional Freight Road Connecter

Description	Project Characteristic
Terrain:	Rolling terrain
Climatic Conditions–Temperature:	Mild winter (rain with some freezing, icing possible), warm summer (sporadic hot days)
Climatic Conditions–Precipitation:	Rain during fall, winter, and spring with some snow possible during winter months. Foggy conditions at dawn possible

Roadway Facilities

OR 8 has four to five lanes with varying cross-section widths. The narrowest cross-section is located on the bridge crossing Dairy Creek west of SW 17th Avenue. The existing pavement width of OR 8 ranges from 58 feet to 76 feet. The available right-of-way is 110 feet for the majority of the corridor. Striped bike lanes are provided westbound. Eastbound striped bike lanes are provided except at the segment between the Dairy Creek bridge and 17th Avenue. Curbs are provided within the city of Cornelius, otherwise there are gravel shoulders beyond the bike lanes. On-street parking is prohibited on OR 8. Exhibit 3 presents example cross-sections along OR 8.

Exhibit 3: Roadway Cross-Section



Source: ODOT

There are 10 stop-controlled intersections, two signalized intersections, and a number of private and commercial access points in this segment. For the majority of its length there is a continuous TWLT lane. Major street directional left-turn lanes are provided at five intersections.

Temporary Speed Zone Investigation

At the beginning of 2020, ODOT conducted a temporary speed zone investigation on OR 8, from 150 feet west of Sunset Highway (mile point 0.20) to Poplar Street (mile point 18.26). A speed study was conducted in February 2020 as part of the investigation for the section of OR 8 from Dairy Creek Bridge (mile point 14.31) to SW 345th Avenue (mile point 15.36), which is within the RSA study corridor. The speed study evaluated the posted and measured speeds of vehicles at two locations on the study corridor. At the time of the speed study, the posted speeds on the east and west ends of the study corridor were 40 mph and the central section was posted at 50 mph. Speed measurements were taken at two locations within the posted 50 mph section and exceeded posted speeds. The 85th percentile speeds at the two locations are shown in Table 2.

Table 2: ODOT 2020 Speed Study 85th Percentile Speeds

85th Percentile Speeds	
Measured at SW 331st Avenue	
Westbound	55 mph
Eastbound	54 mph
Measured at NW 338th Avenue	
Westbound	55 mph
Eastbound	54 mph

Based on the speed study, ODOT implemented a temporary speed zone reduction from 50 mph to 45 mph for the section the section of OR 8 from Dairy Creek Bridge to SW 345th Avenue, as shown in Exhibit 4. This reduction, implemented in early 2020, was in place during the RSA efforts and will continue to be in place until the end of 2020.

Exhibit 4: Study Corridor Posted Speed

***Temporary Speed Zone reduction from 50 mph until December 31, 2020**

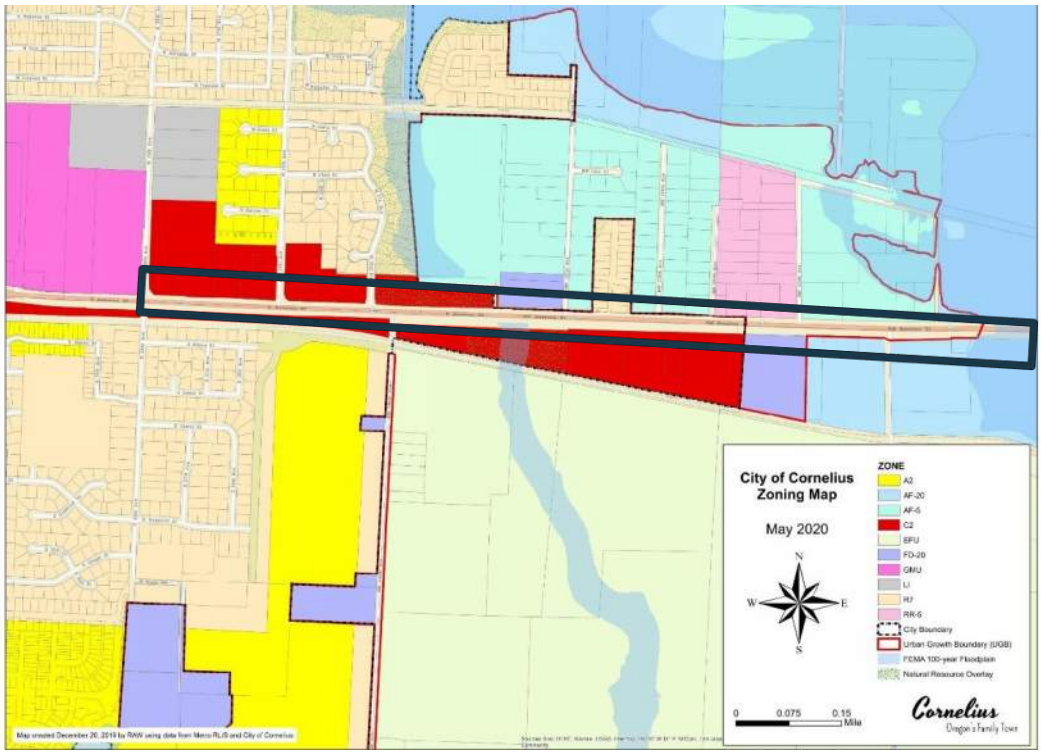
Source: Base Image from Google Earth

Land Use

As Cornelius and Hillsboro grow, the land use context along OR 8 evolves, becoming more urbanized. Exhibits 5, 6, and 7 illustrate land use zoning by jurisdiction: City of Cornelius, City of Hillsboro, and Washington County. The Cornelius city boundary ends east of NW 336th Avenue. The Cornelius urban growth boundary (UGB) encompasses a majority of the study corridor, extending past SW 331st Avenue.

Land use zoning immediately adjacent to the study corridor includes residential (R-7, A-2, RR-5), commercial, (C-2), agricultural (AF5, AF20, EFU), and industrial. Areas adjacent to OR 8 are zoned as FD-20, which applies to "*unincorporated urban lands added to the UGB by Metro through a Major or Legislative Amendment process after 1998. The FD-20 District recognizes the desirability of encouraging and retaining limited interim uses until the urban comprehensive planning for future urban development of these areas is complete. The provisions of this District are also intended to implement the requirements of Metro's Urban Growth Management Functional Plan*" (Washington County Community Development Code, Section 308).

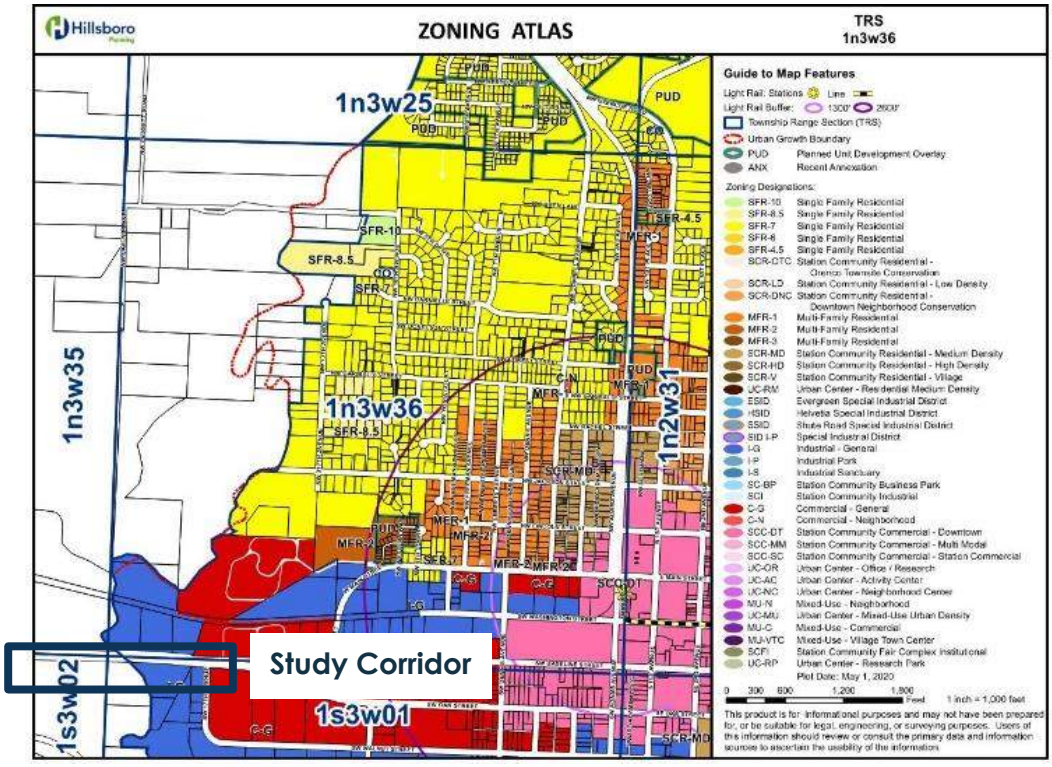
Exhibit 5: Zoning Map for East Cornelius



Study Corridor

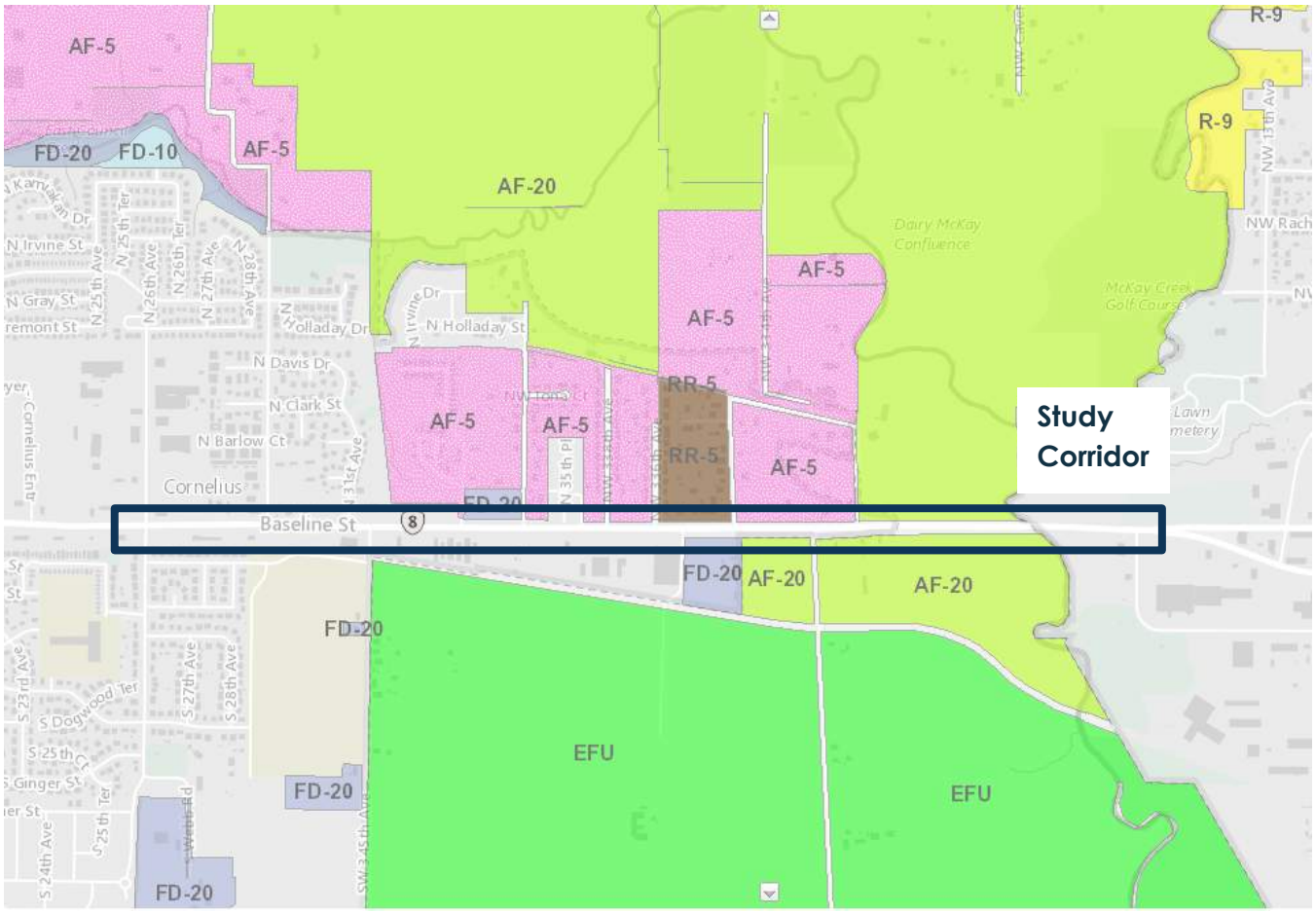
Source: City of Cornelius

Exhibit 6: Zoning Map for West Hillsboro



Source: City of Hillsboro Zoning Atlas - https://www.hillsboro-oregon.gov/services/maps/zoning-atlas

Exhibit 7: Washington County Zoning Map for Study Corridor



Source: Washington County Online Intermap - http://gisims.co.washington.or.us/InterMap/theDetails.cfm?GoNav=1

Bus Services

OR 8 is used for public transit and school bus routes as represented schematically in Exhibit 8. The exhibit shows the approximate location of TriMet and school bus stops on OR 8, as of May 2020.

Exhibit 8: TriMet and School Bus Stops Located on OR 8

Source: Base Image from Google Earth

PUBLIC TRANSIT

TriMet Line 57 – TV Highway/Forest Grove runs bidirectionally on OR 8. All bus stops are delineated by a pole and signage. The majority of the bus stops require the transit vehicle to stop in-lane to pick up and drop off passengers. Four stops along the western portion of the study corridor include paved bus pull-outs, where the bus pulls out of the travel lane for passenger pickup and drop-off and then pulls back into traffic.

Bus Stop on OR 8

Ridership data was provided by TriMet for the stops and are summarized in Table 3. The data included daily weekday values for the Fall 2019 Passenger Census.

Table 3: TriMet Line 57 2019 Fall Ridership

Westbound to Forest Grove			Eastbound to Beaverton Transit Center		
Stop Location	Daily Weekday Ons	Daily Weekday Offs	Stop Location	Daily Weekday Ons	Daily Weekday Offs
SW Baseline St & SW 331st Ave	1	2	E Baseline St & S 26th Ave	43	14
SW Baseline St & NW 334th	2	9	E Baseline St & N 29th Ave/NW Hobbs Rd	10	5
SW Baseline St & NW 338th Ave	1	5	E Baseline St & SW 345th Ave	10	6
E Baseline St & Valley View (East Lane)	2	14	E Baseline St & Valley View (East Lane)	9	1
E Baseline St & N 31st Ave	5	6	SW Baseline St & NW 338th Ave	4	3
E Baseline St & N 29th Ave/NW Hobbs Rd	7	14	SW Baseline St & NW 334th Ave	7	2
E Baseline St & N 26th Ave	9	35	SW Baseline St & SW 331st Ave	3	1

SCHOOL BUS SERVICE

There are three schools within Hillsboro School District that bus students along or to/from OR 8 in the study corridor:

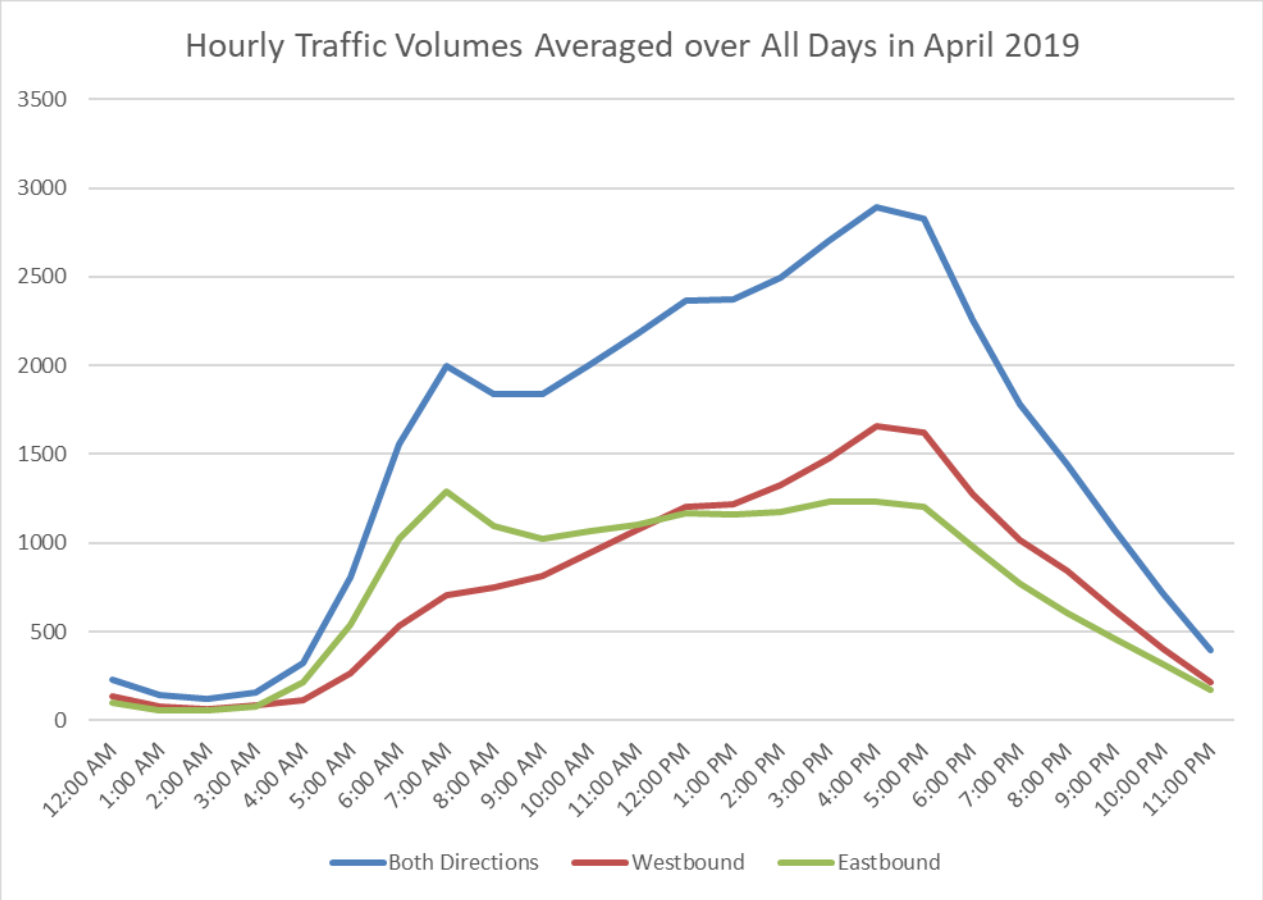
- Free Orchards Elementary, located in Cornelius
- Evergreen Middle School, located in Hillsboro
- Glencoe High School, located in Hillsboro

The school bus routes located within the project corridor are routes 744, 747, 754, and 760. The stop locations for these routes are highlighted in Exhibit 8 above.

Existing Traffic Characterisitcs

ODOT provided April 2019 hourly Automatic Traffic Recorder (ATR) counts for one location on OR 8. The ATR is located west of NW 334th Avenue. Exhibit 9 shows the average daily hourly traffic profile, averaged over all days in April 2019.

Exhibit 9: April 2019 Average Hourly Traffic Volume Profile for ODOT ATR 34-009



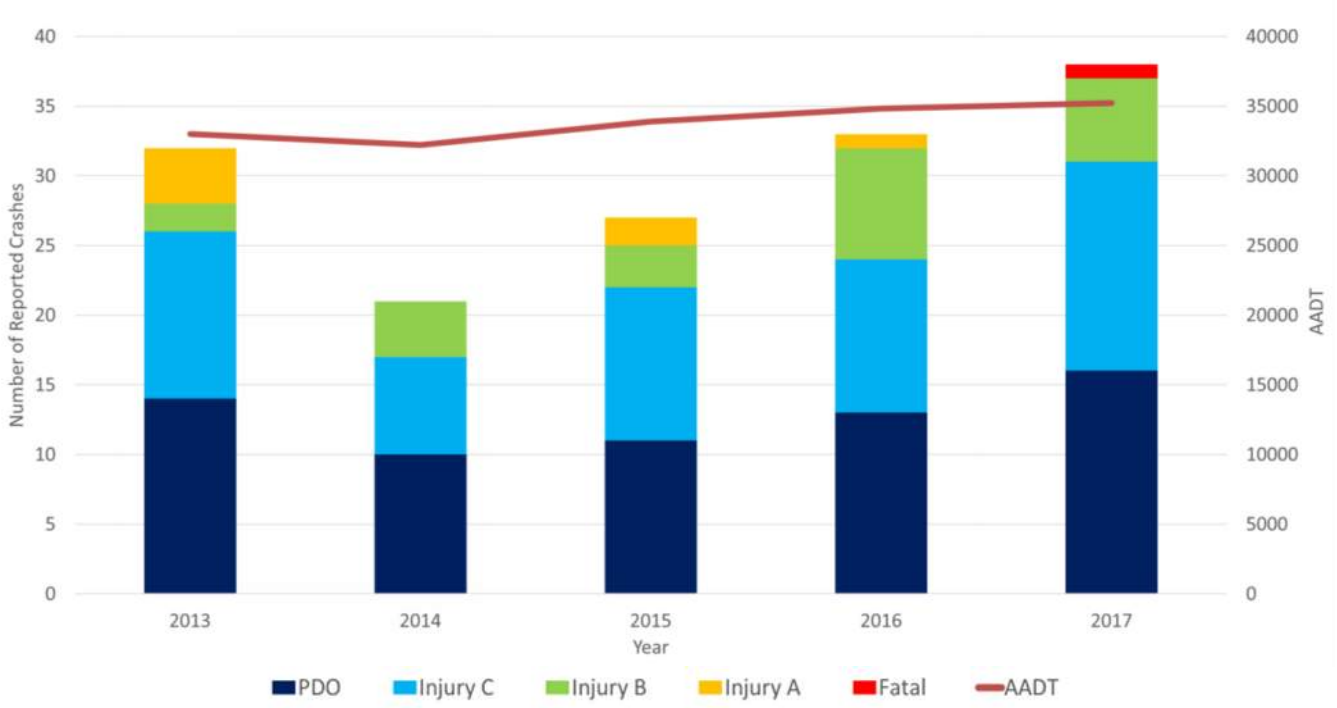
Overview of Crash History

Two types of information were provided by ODOT regarding the crash history. The first information source is the reported ODOT crash data for the five-year period between January 1, 2013 and December 31, 2017. ODOT's crash reports include crashes for which a crash report was completed. According to Oregon law, crash reports are required when damages associated with the crash exceed $1,500.[1]

Exhibit 10 presents the reported 2013-2017 crash numbers. Injury A crashes involve participant(s) that have a suspected serious, but non-fatal injury. Injury B crashes involve participant(s) that have a suspected minor injury. Injury C crashes involve participant(s) that have a suspected injury that is not minor or serious. "PDO" crashes refer to crashes that involve "property damage only". As shown, the number of crashes per year has increased since 2014 with a similar profile to the annual average daily traffic (AADT) profile. The one fatal crash that occurred in the reported 2013-2017 timeframe was a pedestrian crash.

Exhibit 11 presents crashes by severity and collision type. The majority of 2013-2017 reported crashes were classified as rear-end or turning movement collision types.

Exhibit 10: 2013-2017 Reported Crash Severity and Average Annual Daily Traffic by Year



[1] The reporting threshold increased from $1,500 to $2,500 on January 1, 2018. The crash data used in this report is based on the $1,500 threshold. Source: https://www.oregon.gov/ODOT/Data/documents/Crash_Data_Disclaimers.pdf

Exhibit 11: 2013-2017 Reported Crash Severity by Collision Type

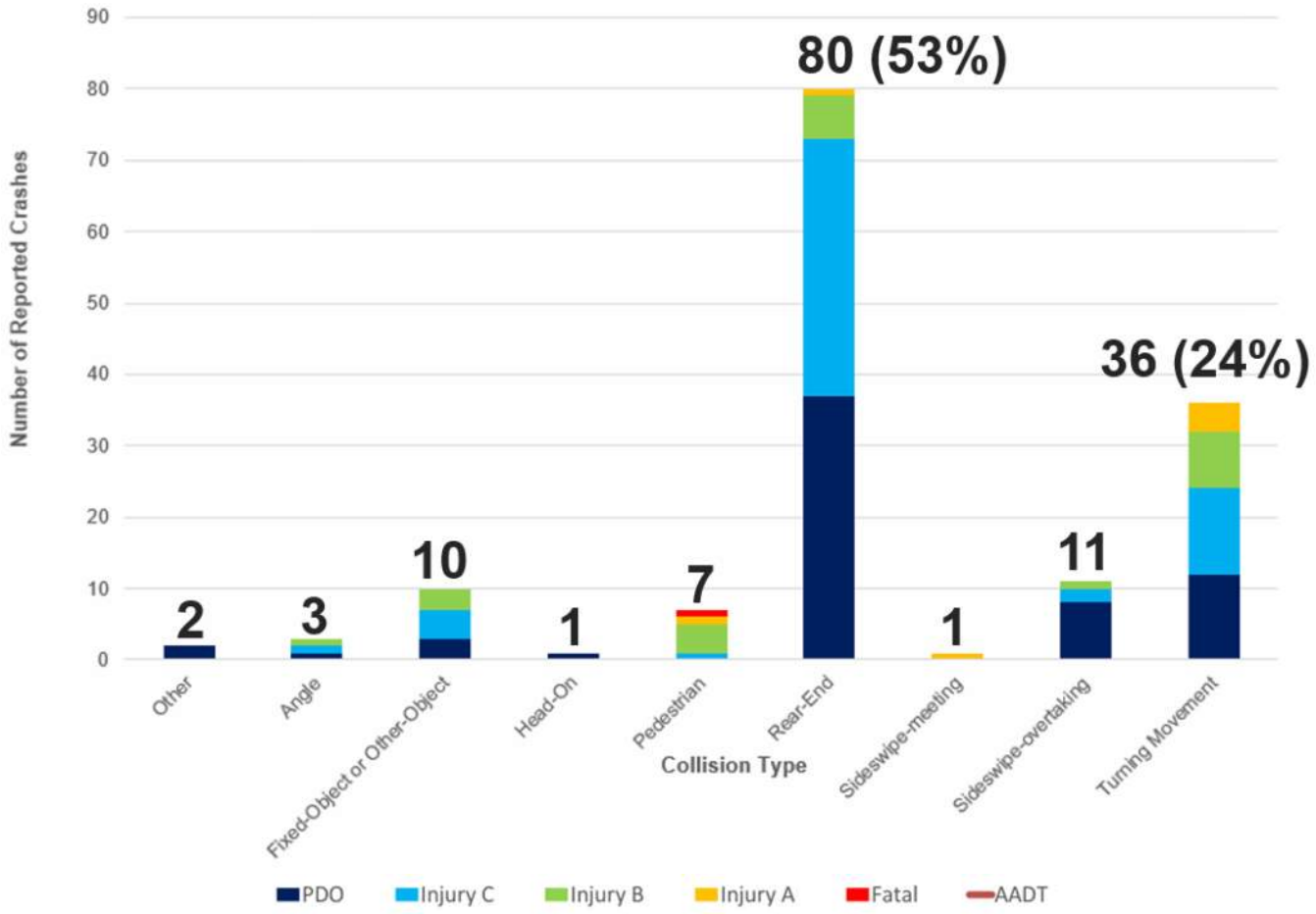


Table 4 summarizes the crash rate for the study corridor and compares it to the statewide average crash rates for state highways classified as "other principal arterials" in suburban and rural locations. The comparison to suburban and rural locations is provided due to the unique context of this location. Although the corridor has historically included rural characteristics, it continues to evolve to a more urban/suburban context. When looking at the reported five-year crash history, the average crash rate exceeds the statewide average crash rate for suburban and rural other principal arterial facilities.

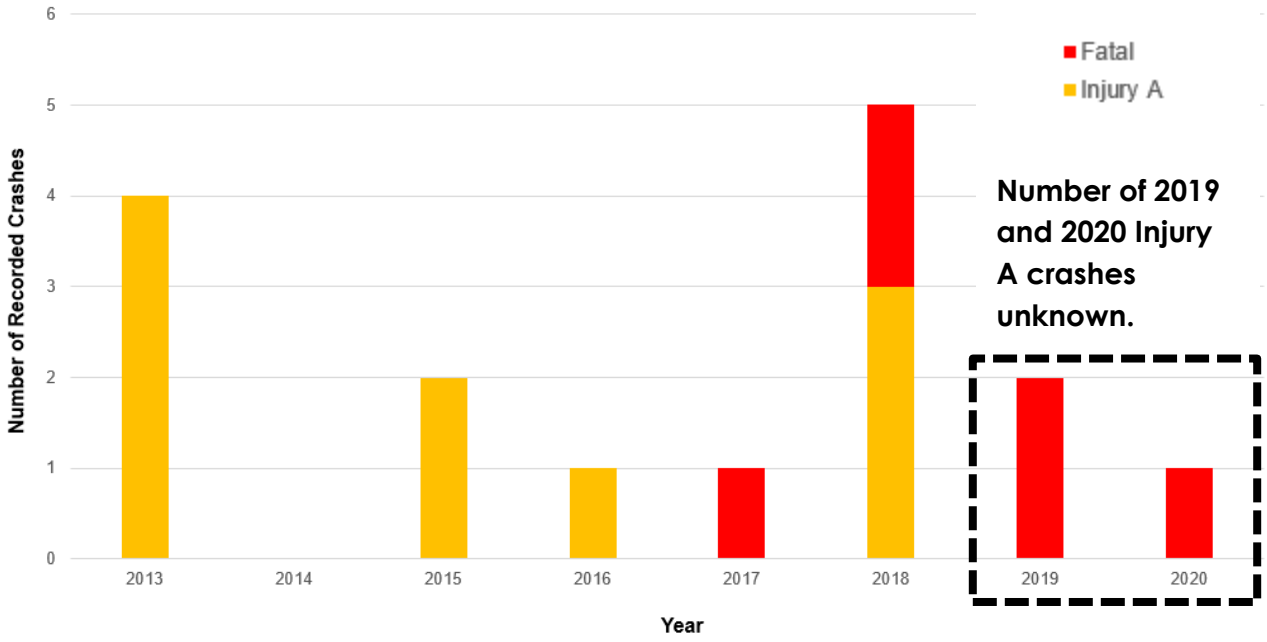
Table 4: Crash Rate Comparison (Based on Reported 2013-2017 Crash Data)

	Average Crash Rate (Crashes per Million Entering Vehicles)
OR 8 Study Corridor	**1.88**
Statewide Crash Rate (Suburban)*	1.39
Statewide Crash Rate (Rural Cities)*	1.47

*Source: ODOT Analysis and Procedures Manual (APM)

The second type of crash information provided for the study corridor includes preliminary and anecdotal data for crashes that occurred between 2018 and 2020. ODOT provided preliminary 2018 crash data that includes fatal and injury A crashes. This data is supplemented with fatal crash information for 2019 and 2020 that could be found through newspaper and online searches. Exhibit 12 summarizes the known fatal and injury A crashes for 2013-2020 on the study corridor.

Exhibit 12: 2013-2020 Fatal Crashes and 2013-2018 Injury A Crashes



As shown, one fatal crash occurred within the five-year reported crash data time period, but at least one fatal crash has occurred every year since 2017. Known fatal crash history for 2013-2020 is summarized below.

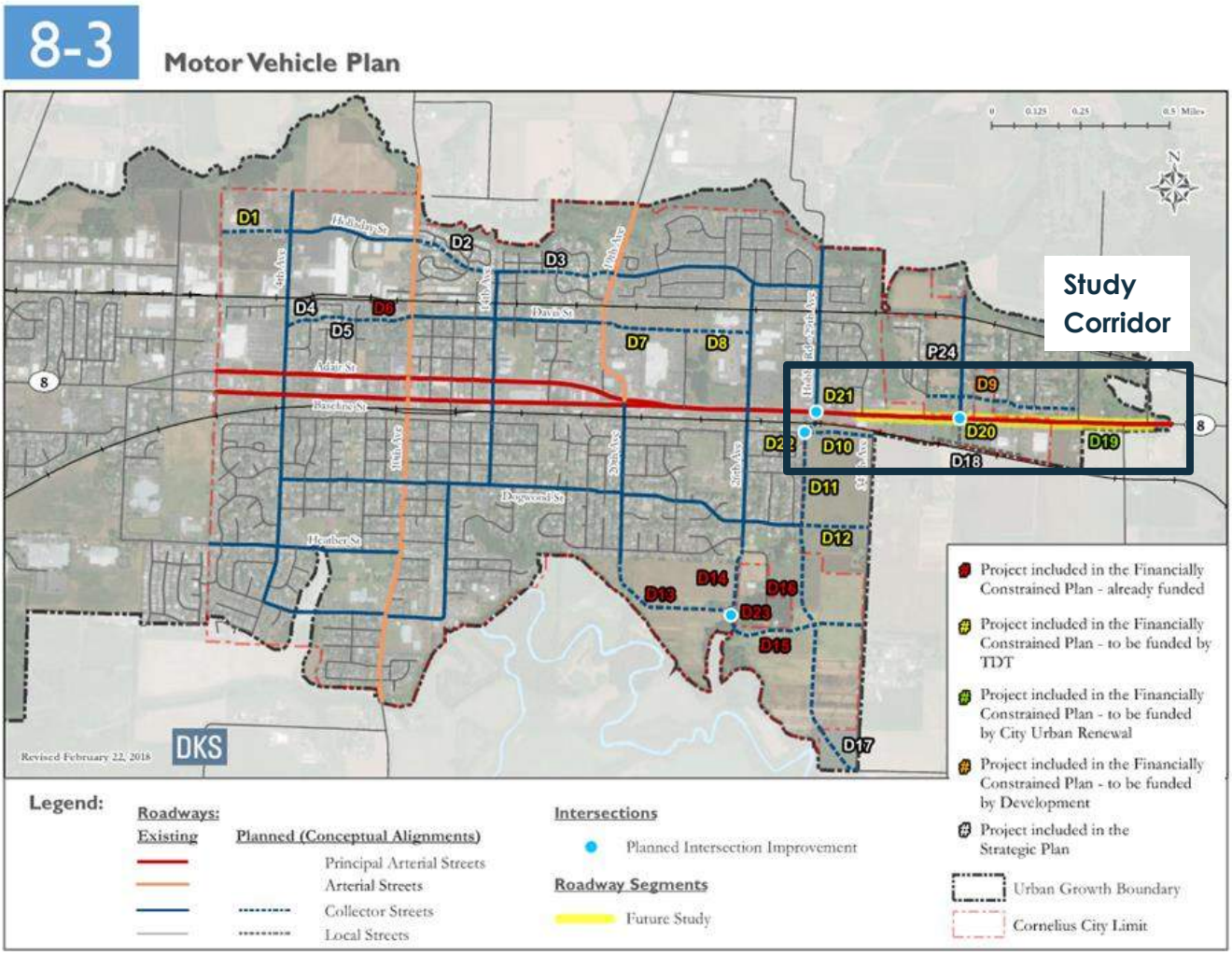
1. Friday, September 22, 2017 at 9:00 pm
    a. Location: East of NW 334th Avenue (MP 14.77)
    b. Collision Type: Pedestrian
2. Monday, October 1, 2018 at 9:15 pm
    a. Location: East of SW 331st Avenue (MP 14.38)
    b. Collision Type: Bicycle
3. Saturday, November 17, 2018 at 7:00 pm
    a. Location: West of NW 341st (MP 15.14)
    b. Collision Type: Head-on
4. Saturday, March 9, 2019 at 7:00 pm
    a. Location: NW 334th Avenue (MP 14.79)

    Collision Type: Pedestrian
5. Thursday, November 7, 2019 at 2:10 pm
    a. Location: NW 334th (MP 14.79)
    b. Collision Type: Turning Movement
6. Tuesday, January 18, 2020 at 7:00 am
    a. Location: NW 341st Avenue (M.P. 15.12)
    b. Collision Type: Pedestrian

Recent and Future Planned Projects

The 2018 Cornelius Transportation System Plan (TSP) provides guidance on future planned projects on OR 8. As shown in Exhibit 13, the proposed projects include a frontage road on the north and south sides of OR 8 (D9 and D18), consolidated access to OR 8, and future traffic signals once warrants are met (D20 and D21).

Exhibit 13: Planned Motor Vehicle Projects for the City of Cornelius



Source: 2018 Cornelius Transportation System Plan Update - https://www.ci.cornelius.or.us/cdp/page/cornelius-transportation-system-plan

Aside from the completed Cornelius TSP, two planning efforts were discussed during the RSA:

- Requested Metro funding as part of the 2020 Transportation Regional Investment Measure to install sidewalks and street lighting
- The City of Hillsboro is currently updating its TSP

RSA PROCESS

The purpose of the RSA is to independently examine the study corridor's safety performance. The RSA helps identify potential issues contributing to crashes and suggests treatments for addressing those issues.

The purpose of the RSA is to complete an independent examination of safety performance.

The RSA team initiated work on Monday May 11, 2020 with a virtual kickoff meeting. The presentation from the pre-audit/kickoff meeting is provided as Attachment A. The meeting was attended by the RSA team, RSA support resources from ODOT, and stakeholders.

The following main topics were discussed at the kickoff meeting:

- The RSA team was challenged to objectively observe the study corridor and consider a range of potential solutions in concert with reported crash data.
- The RSA team provided updated information regarding city limits, UGBs, and adjacent land uses along the study corridor.
- Community concerns collected through CPO12C were presented.

The RSA Team held work sessions virtually on the following Tuesday, Wednesday, and Thursday. The preliminary findings meeting was held virtually on Friday, May 15, 2020. The presentation from the preliminary findings meeting is provided as Attachment B. The complete RSA team schedule is summarized in Table 5:

Table 5: RSA Team Schedule

OR8 Road Safety Audit: RSA Week Schedule						
Timeframe		Monday May 11th	Tuesday May 12th	Wednesday May 13th	Thursday May 14th	Friday May 15th
6:00 AM	7:00 AM		Morning Peak Period			
7:00 AM	8:00 AM					
8:00 AM	9:00 AM			Brainstorming	Document issues, suggestions and initial priority	Presentation refinement
9:00 AM	10:00 AM	Kick-off Meeting	Work Session			
10:00 AM	11:00 AM					Presentation Review with ODOT PM
11:00 AM	12:00 PM			Stakeholder Meeting		
12:00 PM	1:00 PM	Lunch	Lunch	Lunch	Lunch	Lunch
1:00 PM	2:00 PM	Project Start-up / Virtual Site Visit	Brainstorming	Document issues, suggestions and initial priority	Preparation of presentation	Preliminary Findings Meeting
2:00 PM	3:00 PM					
3:00 PM	4:00 PM					
4:00 PM	5:00 PM	Evening Peak Period				
5:00 PM	6:00 PM					
6:00 PM	7:00 PM					
7:00 PM	8:00 PM					
8:00 PM	9:00 PM					
9:00 PM	10:00 PM	Nighttime Site Visit				

RSA Team and Stakeholders	RSA Team - Work Session	RSA Team - Field Visit	Stakeholder Meeting	Consultant Team	Consultant Team and ODOT PM

SUMMARY OF SAFETY ISSUES

The RSA team identified and categorized safety issues based on a qualitative risk scale. For the purposes of the RSA, risk is defined as a function of exposure, probability, and consequence of a safety issue. Table 6 describes the three elements.

Table 6: Description of Qualitative Risk Rating Elements

Element	Description
Exposure	Reflects the number of vehicles/bikes/pedestrians/road users that could be influenced by the design feature
Probability	Reflects the likelihood of a crash influenced by the identified design feature
Consequence	Reflects the severity of a crash if one occurs

The qualitative risk rating of safety issues identified at the OR 8 corridor are assigned relative to other issues observed. Issues are assigned categories, described in Table 7, based on their relative risk.

Table 7: Description of Risk Rating Categories

Category	Description
Category I – Low Risk	Category I issues indicate the least risk compared to the other observed issues; they are associated with lower exposure, probability, and/or consequence.
Category II – Medium Risk	Category II issues indicate higher risk than some issues and lower risk relative to other observed safety issues.
Category III – High Risk	Category III issues have the greatest potential risk compared to the other observed issues; they are associated with higher exposure, probability, and/or consequence than other issues. Crash data typically reflects injury A and/or fatal crashes.

Table 8 summarizes identified issues and the overall qualitative risk rating assigned to each issue. The qualitative rating of risk given to each observed safety issue is further described and documented in follow-up sections. Six corridor-wide issues, shown in grey, were identified within the study corridor. Each issue was assigned an icon. When these icons appear in the report, it indicates that one of the specific issues is being discussed.

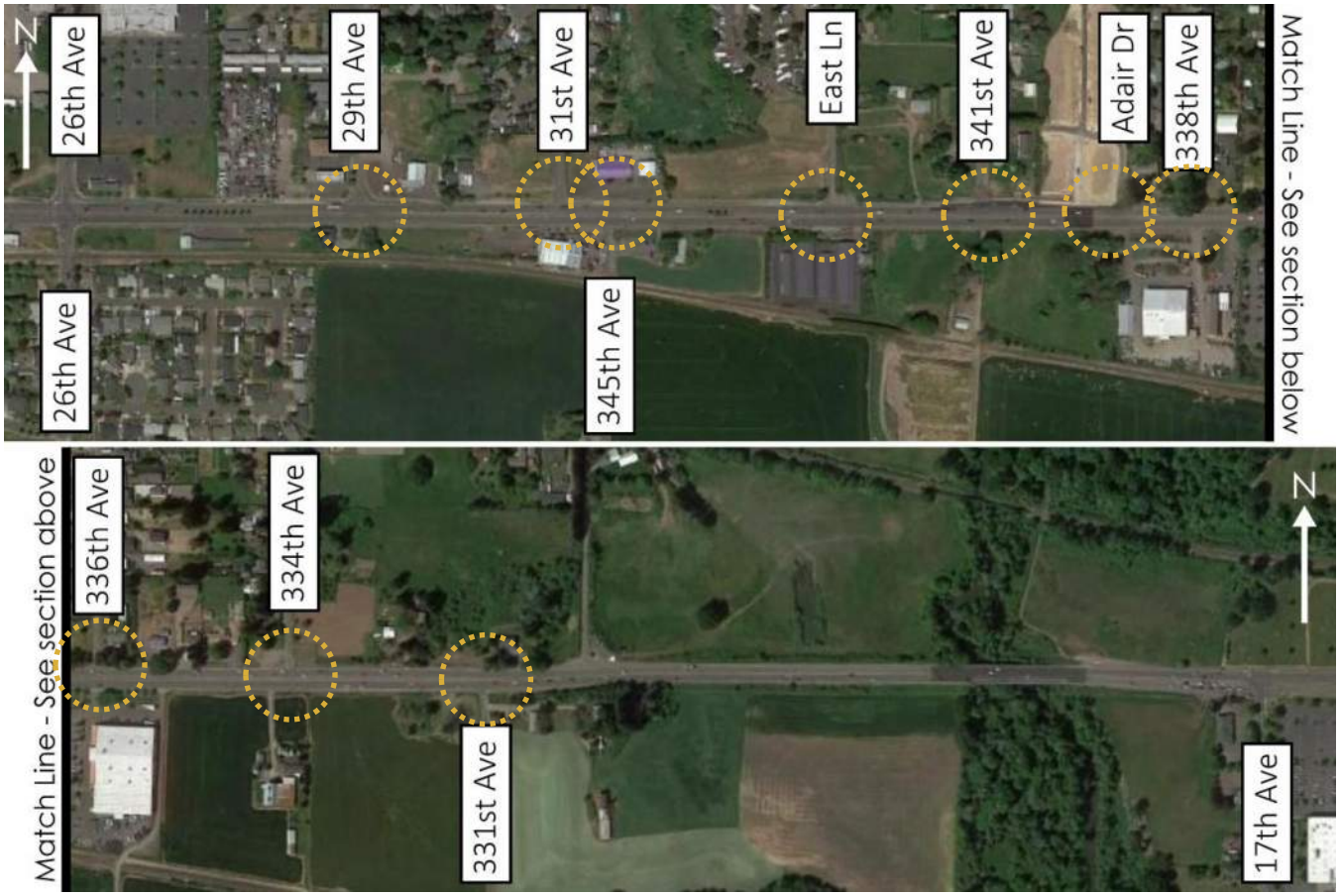
Table 8: RSA Findings – Issues Summary

Issues Summary	
	■ Category III – High Risk Inconsistent Pedestrian Facilities
	■ Category III – High Risk High Speed Corridor
	■ Category II – Medium Risk High Density of Minor Streets/Accesses
	■ Category II – Medium Risk Limited Illumination
	■ Category I – Low Risk Limited Intersection Visibility
	■ Category I – Low Risk Limited Sight Distance
	■ Category III – High Risk Intersection - OR 8/26th Avenue
	■ Category III – High Risk Intersection - OR 8/17th Avenue

The corridor-wide issues are prevalent at many of the minor street intersections along the study corridor, shown in Exhibit 14. Because of this, a summary of the minor intersections where the various issues were noted as existing is provided in Table 9.

Issues related to the signalized intersections at 17th Avenue and 26th Avenue are included in the Location-Specific Issues section below.

Exhibit 14: Location of Minor Street Intersections on the OR 8 Study Corridor



Source: Base Image from Google Earth

Table 9: Summary of Minor Street Observations

Summary of Minor Street Observations

Intersection	Corridor Issue Observed					
	Inconsistent Pedestrian Facilities	High Speed Corridor	High Density of Minor Streets/ Accesses	Limited Intersection Visibility	Limited Sight Distance	Limited Illumination
29th Avenue	X	X	X		X	X
31st Avenue / 345th Avenue	X	X	X		X	X
East Lane	X	X				X
341st Avenue	X	X		X	X	X
Adair Drive	X	X	X	X	X	X
338th Avenue	X	X	X	X	X	X
336th Avenue	X	X	X	X	X	X
334th Avenue	X	X		X	X	X
331st Avenue/ North Side Access	X	X		X	X	X

In addition to the corridor-wide issues observed at the minor intersections, the following observations were also made. Attachment A provides available traffic volume and crash data for the intersections. See Attachment B for the full list of observations and accompanying images.

- Minor Intersection: 29th Avenue
  - Key north-south route within Cornelius
  - Land use transitions in eastbound direction from suburban to rural
  - Westbound right-turn lane may be unnecessary
  - Large turning radii, impacting location of pedestrian ramp
- Minor Intersection: 31st Avenue / 345th Avenue
  - There is approximately 160 feet of offset between offset T intersections
  - The rail crossing to the south is yield-controlled
  - Inconsistent bus stop configuration (e.g., in-lane and pullout configurations)
  - Future project to align 31st Avenue with 345th Avenue
- Minor Intersection: East Lane (Valley View)
  - Bus pullouts in both directions
  - Some street frontage improvements
- Minor Intersection: 341st Avenue
  - Stop sign visibility
  - One light oriented to side-street on utility pole in northwest corner
  - Cornelius TSP notes this location as a potential future signal with frontage roads
- Minor Intersection: Adair Drive
  - Adair Drive is a temporary connection
  - Current condition to OR 8 to provide access for Cascadia Gardens subdivision
  - The road will be closed when future development builds a street to connect to either 341st Avenue or 338th Avenue (i.e., part of future frontage road)
  - Luminaire of street light pole hidden in large tree
  - Short existing sidewalk in front of development with no connections to other intersections
- Minor Intersection: 338th Avenue
  - All observations related to corridor-wide issues discussed below

- Minor Intersection: 336th Avenue
    - Multiple driveways across the street providing access to Coastal Farm & Ranch

Minor Intersection: 334th Avenue

- Three pedestrian fatalities near this intersection
- In-lane bus stops in both directions
- One of the highest TriMet ridership stops for study corridor
- Higher turning movement volumes compared to other stop-controlled side streets on the study corridor
- Tall grass in the northeast corner of the intersection causes difficulty seeing westbound vehicles from the side street

- Minor Intersection: 331st Avenue / North Side Access
    - No westbound left-turn pocket to 331st Avenue
    - Left turns onto 331st Avenue from a westbound leftmost travel lane
    - Overhanging branches encroaching into westbound bike lane
    - Right-of-way (ROW) in the vicinity of the future trail exists for the North Side Access to connect to 334th Ave

RSA FINDINGS: CORRIDOR-WIDE ISSUES

The RSA findings presented in this section summarize the key issues identified by the RSA Team

Issue: Inconsistent Pedestrian Facilities

■ Category III – High Risk

The study corridor has limited sidewalks and no enhanced pedestrian crossings. Reported crash data include pedestrian and bicycle crashes. Exhibit 15 shows crash locations. For the five years of reported crash data from 2013 to 2017, nine pedestrian and/or bicycles crashes were reported. All nine of these crashes resulted in injuries. Between 2013 and 2020, six fatal crashes occurred; four were pedestrian and/or bicycle crashes. The exhibit below shows the location of the 2013-2020 fatal crashes and depicts the four with participants that included pedestrians and/or bicyclists with icons. These fatal crashes were located at NW 341st Avenue, NW 334th Avenue, and east of SW 331st Avenue and appear to be crossing related.

Exhibit 15: Location of Fatal Crashes 2013-2020

Source: Base Image from Google Earth

In addition to the crash data, several pedestrian-facility related issues were observed on site. It is difficult to cross OR 8. The following observations were made:

- OR 8 creates a long pedestrian crossing distance
- A lack of vehicle gaps on OR 8 makes it difficult for pedestrians to cross at an uncontrolled crossing location
- Many pedestrians make their crossing in two stages (see photo to the right):
  - One stage to the median
  - One stage to complete the crossing
- Visually impaired users or those who walk more slowly are currently unable to cross the street

Pedestrian facilities are not consistent throughout the corridor. However, most of the corridor does not have sidewalk or other pedestrian facilities.

- Pedestrians use the bicycle lane, which has no buffer from the high-speed traffic (see third photo down to the right).
- Access to TriMet and Hillsboro School District bus stops are unsafe
  - OR 8 has been designated a hazard area by the Hillsboro School District for Free Orchards Elementary School. Based on this designation, it is not considered safe for students to use it to walk to school

Pedestrian crossing midblock

Bicyclist crossing in two stages

Pedestrian walking in bike lane

Pedestrian couldn't clear the intersection within the allowed time

Taking into consideration the observations described on the previous page, a risk rating was completed for pedestrian and bicycle users. The risk rating is summarized in Table 10.

Table 10: Qualitative Risk Rating of Inconsistent Pedestrian Facilities

Function	Classification	Reasoning
Exposure		The lack of pedestrian facilities separated from higher speed vehicles forces pedestrians onto shoulders. The cross-section is too wide for a single-stage pedestrian crossing. Finding gaps in the high-speed environment is difficult. There is no refuge for crossing pedestrians.
Probability		The existing number of pedestrians present is low, in part due to lack of facilities and risk exposure, but there are pedestrian generators along the corridor (bus stops, commercial uses, etc.)
Consequence		There were nine pedestrian crashes between 2013 and 2017. All resulted in fatalities or severe injuries. From 2017 to 2020 there were three pedestrian and one bicycle crashes in the corridor that resulted in fatalities.
Overall		-

Category I – Low Risk Category II – Medium Risk Category III – High Risk

Issue: High Speed Corridor

■ Category III – High Risk

A recent ODOT speed study indicated the 85th percentile speed on the study corridor is 55 mph. ODOT temporarily reduced the speed limit earlier in 2020 (see photo at right).

Portable speed feedback sign

Source: Washington County Sheriff's Office

The speed is too high for the current corridor context and will continue to be too high for the context in the future for the following reasons:

- The City of Cornelius recently expanded their UGB to include an additional length of OR 8, which is expected to lead to development in the area
- The properties within Cornelius city limits are zoned residential to the north and commercial to the south
- There is a school district property near 345th Avenue which may be used to construct a new school
- There are three residential developments along the corridor (two constructed and one proposed) that are initializing the transition into a suburban context

It is difficult for drivers turning left onto the roadway to find gaps to make turning movements. This results in drivers making left turns in two stages. The first stage is to turn into the center median. The second is to merge into the travel lane (as shown in the photos below).

Waiting for gap

Turn into TWLT lane

Accelerate in TWLT lane

Additionally, the following observations were made related to the issue of high speed within the corridor:

- No separation for vulnerable users, resulting in undesirable speed differential (upper left and right images below)
- Makes school bus and TriMet bus pick-up/drop-off more difficult (lower left image)
- Two-way transit users must cross the street at least once (lower right image)

Bicyclist positioning towards travel lane

Bicyclist crossing in two stages

Near-side bus stop at 17th Avenue in Hillsboro

Bus approaching 331st Avenue

A risk assessment was completed for the high speed issue. Results are summarized in Table 11.

Table 11: Qualitative Risk Rating of High-Speed Corridor

Function	Classification	Reasoning
Exposure		The majority of the vehicles are traveling faster than the posted speed.
Probability		Speed differentials exacerbate conflicts at side streets, accesses, bus stops, and TWLTL.
Consequence		Crashes at higher speeds increase the risk of injury and fatal crashes. Non-motorized users are especially vulnerable. There have been 3 fatal pedestrian crashes and 1 fatal bicyclist crash from 2017 – 2020.
Overall		-

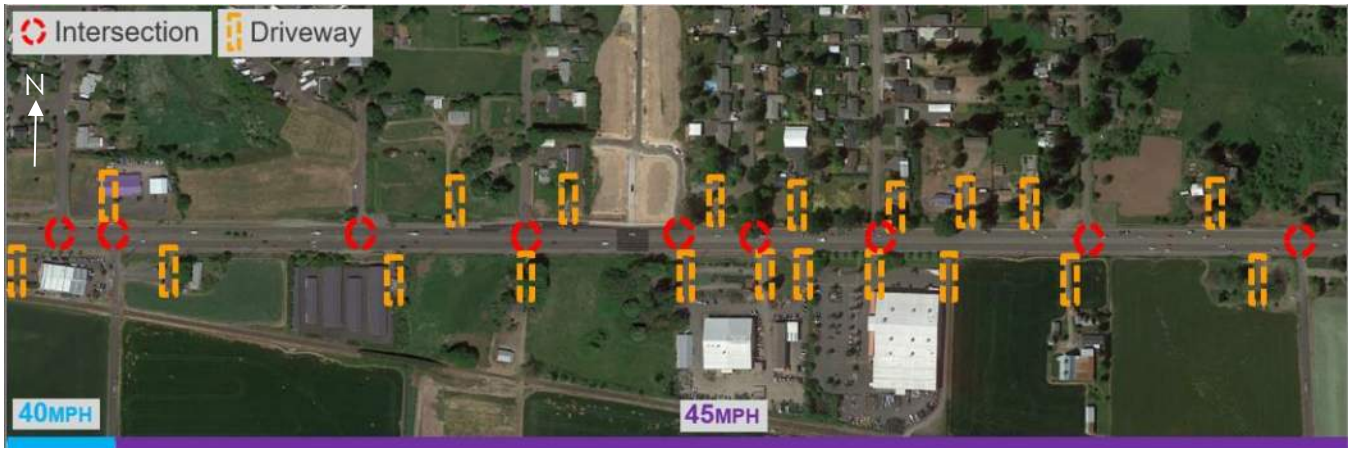
Category I – Low Risk Category II – Medium Risk Category III – High Risk

Issue: High Density of Minor Streets/Accesses

■ Category II – Medium Risk

The RSA team determined the density of combined minor streets and accesses was also an issue. From N 31st Avenue to SW 331st Avenue, there are numerous intersections and driveways (see Exhibit 16).

Exhibit 16: Location of Minor Streets and Accesses

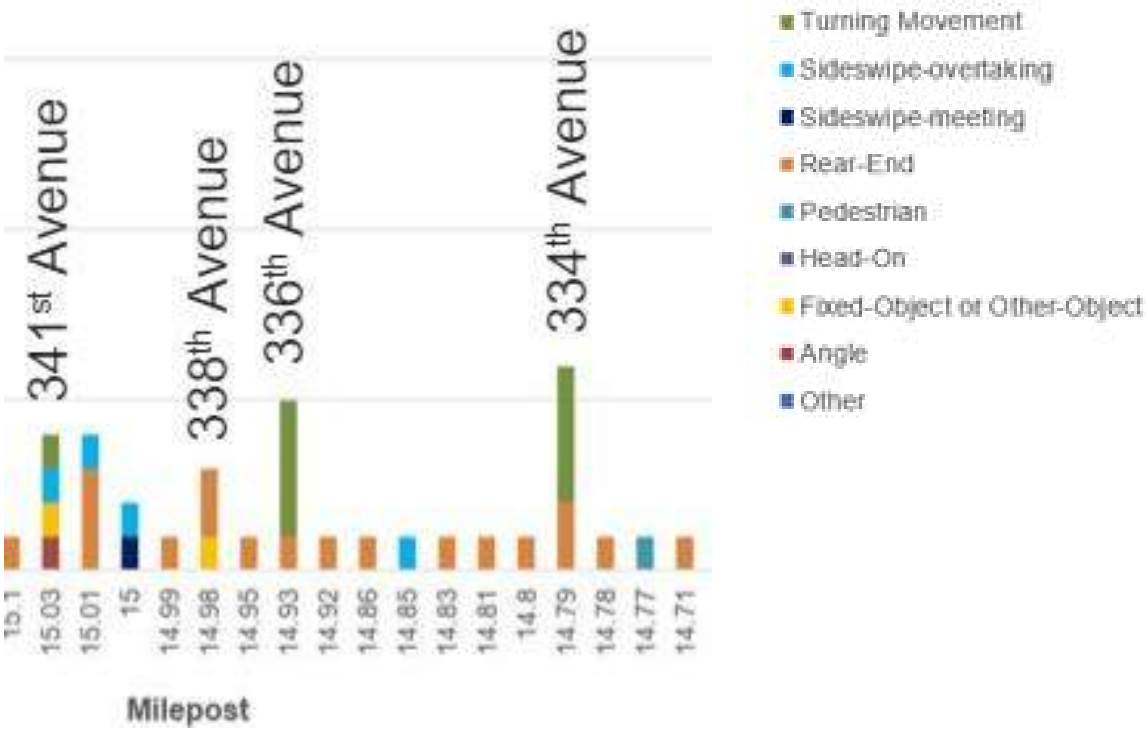


Source: Base Image from Google Earth

Although a direct correlation between access density and the crashes on the corridor cannot be made, there is potential for the crashes to be associated with vehicle movements near minor intersections and/or driveways. The following observations can be made regarding the reported crash data.

- Crashes are located throughout areas with high access density
- Rear-end crashes are the most common collision type and are distributed throughout the study corridor (see Exhibit 17)

Exhibit 17: 2013-2017 Crash Data Excerpts



There are many examples of intersections and accesses which are spaced close to each other. One is shown in the photos below:

Driveway near 336th Avenue

Driveway near 336th Avenue

The high-density accesses and unsignalized intersections are an issue because they can create conflicts in the TWLT lane when vehicles are making two-stage left turning movements, as also discussed in the high speed corridor issue section. Examples of vehicles completing a two-stage left turn are shown in the following photos:

Black pickup waiting in TWLT to merge right

White pickup waiting in TWLT to merge right

A related observation from the RSA team including vehicles turning left from OR 8 into the vacant lot on the northwest corner of the OR 8/334th Avenue intersection and then making a right turn onto OR 8.

A risk assessment was completed for the issue of high density of minor streets and accesses. The results are summarized in Table 12.

Table 12: Qualitative Risk Rating of High Density Minor Streets/Accesses

Function	Classification	Reasoning
Exposure		Minor street and driveway density is high and left-turn movements are made more difficult due to OR 8 speed and volume.
Probability		There are low turning movement volumes for the minor streets and accesses.
Consequence		Turning movement crashes occur along the study corridor, often resulting in lower severity crashes based on the reported data.
Overall		-

Category I – Low Risk Category II – Medium Risk Category III – High Risk

Issue: Limited Illumination

■ Category II – Medium Risk

The crash data show that from 2013 to 2017, 26% of the 151 reported crashes occurred in dark conditions. Dark conditions included darkness (without streetlights), darkness (with streetlights), dawn, and dusk. Of the 151 crashes, 14% occurred during dark conditions without streetlights.

The recent fatalities were also concentrated during dark conditions. Of the six fatalities from 2017 to 2020, five of them occurred during dark conditions (before sunrise or after sunset). The crash times are listed below:

- Friday, September 22, 2017 at 9:00 pm (pedestrian crash)
- Monday, October 1, 2018 at 9:15 pm (bicycle-related)
- Saturday, November 17, 2018 at 7:00 pm
- Saturday, March 9, 2019 at 7:00 pm (pedestrian-related)
- Tuesday, January 14, 2020 at 7:00 am (pedestrian-related)

Luminaire oriented towards side street

The RSA team completed a site visit during dark conditions. The team observed the following issues related to illumination during this time:

- Limited lighting created dark conditions
- Business signage created bright spots in the study corridor
- Linear lighting only exists in a few locations and was installed as part of street frontage improvements (see yellow areas in Exhibit 18)

Exhibit 18: Location of Existing Illumination

Source: Base Image from Google Earth

A risk assessment was completed for the issue of limited illumination. Results are summarized in Table 13.

Table 13: Qualitative Risk Rating of Limited Illumination

Function	Classification	Reasoning
Exposure		There is little linear illumination along the corridor. There are a few individual luminaires on side streets. All users traveling the study corridor experience the unlit environment.
Probability		Approximately 26% of the 151 reported crashes from 2013 to 2017 occurred in dark conditions. Approximately 14% of the reported crashes from 2013 to 2017 occurred in dark conditions without street lighting. For reported 2013-2017 crashes during dark conditions, approximately 50% occurred at locations without street lighting.
Consequence		Of the crashes occurring during dark lighting conditions, about half resulted in injuries. From 2013 to 2020, six of the seven fatalities occurred during dark conditions (before sunrise or after sunset).
Overall		-

Category I – Low Risk Category II – Medium Risk Category III – High Risk

Issue: Limited Intersection Visibility

- Category I – Low Risk

An additional issue identified by the RSA team is limited intersection visibility along the corridor. This means that it is difficult for drivers to identify intersections while they are driving along the corridor. Two examples of intersections that are difficult to see are shown in the photos below:

Traveling westbound—336th Avenue not identified

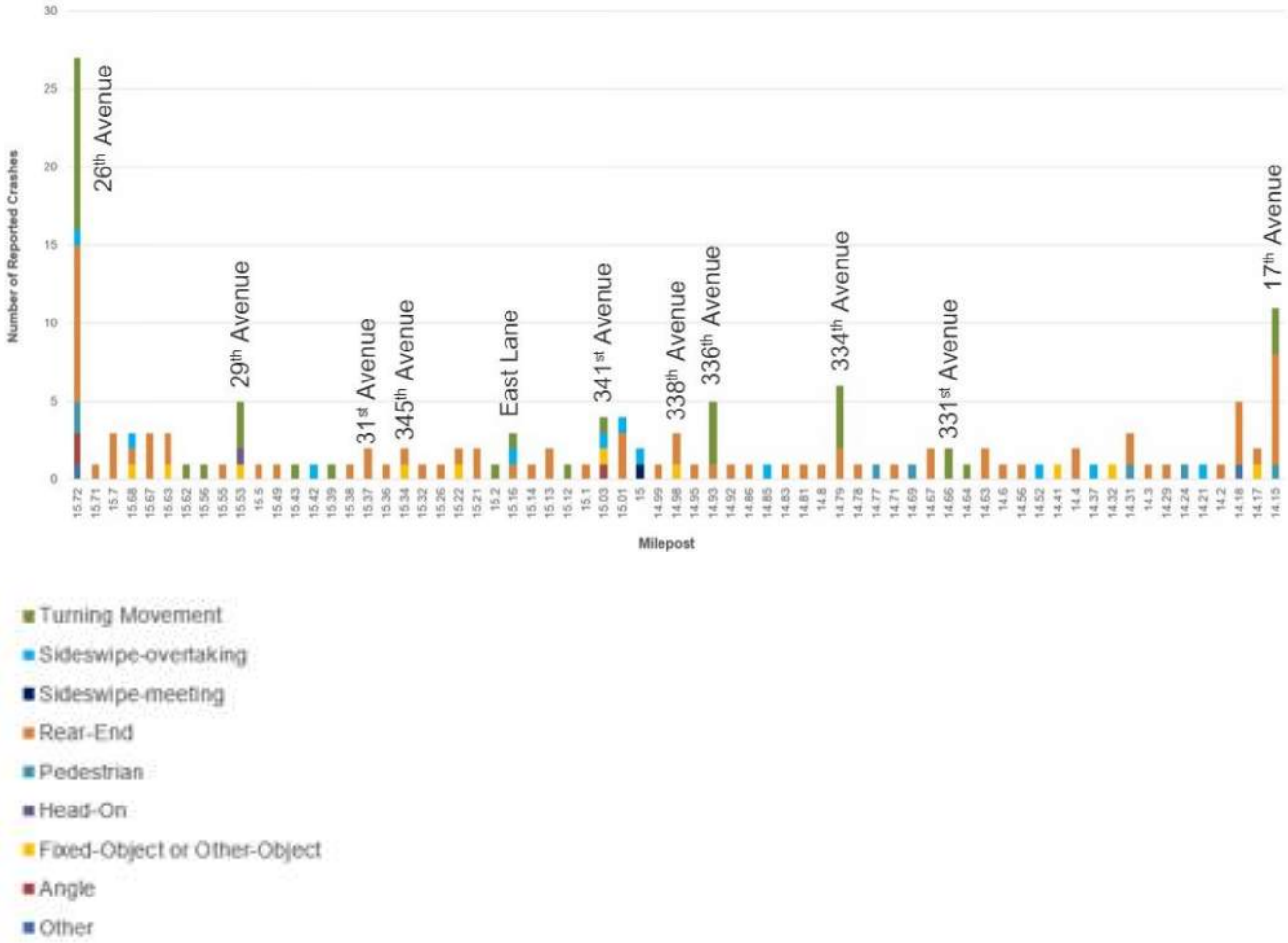
Traveling westbound—334th Avenue not identified

The RSA team identified factors that made intersections less visible:

- Limited reflectivity of signs and pavement markings creates issues (especially at night)
- The street signs are mounted on the stop signs
- There are no signs on the opposite side of tee intersections
- Some intersections are hidden by trees or other roadside items

The crash data show that there were a high number of rear-end crashes which could be exacerbated by late and assertive deceleration at intersections due to limited intersection visibility. The data also show that the crashes are spread throughout the study corridor (as shown in orange in Exhibit 19).

Exhibit 19: Reported 2013-2017 Collision Types by Milepost



The RSA team also determined that intersection visibility issue is worse at night due to lighting conditions. Intersection visibility is also worse during wet weather and makes it if more difficult for pedestrians to cross. An example of lighting conditions is shown in the photo to the left.

- Luminaires on side streets are located far from the main line
- Dark spots along the corridor
- Bright spots at new development

Nighttime: Lighting near new development only

Limited visibility during rain

A risk assessment was completed for the issue of limited intersection visibility. The results are summarized in Table 14.

Table 14: Qualitative Risk Rating of Limited Intersection Visibility

Function	Classification	Reasoning
Exposure		Vehicles on the main line that are planning to turn onto a side street have difficulty locating the intersection. Under night conditions, the intersections are even less visible. The total number of intersections is high.
Probability		The number of trips to destinations along the corridor is low.
Consequence		Crashes related to access to corridor destinations are often low severity and property-damage-only.
Overall		-

Category I – Low Risk Category II – Medium Risk Category III – High Risk

Issue: Limited Sight Distance

■ Category I – Low Risk

The RSA team observed two types of limited sight distance issues from side streets for drivers attempting to turn onto OR 8. First, there are instances of limited sight distance for side street vehicles due to vertical curves and grade changes on OR 8. Second, there are locations where sight distance is limited by objects within the intersection corners at side streets. No sight distance measurements were taken as part of the RSA and would need to be completed in future work along the study corridor.

There are two locations where vertical curves of the street limit sight distance and others where intersection sight distance is limited. Photos of these sightlines are shown below. The first photo shows a driver's view to their left (east) at NW 31st Avenue. The second photo shows a driver's view to their right (east) at SW 331st Avenue.

At NW 31st Avenue looking east

At SW 331st Avenue looking east

The intersection sight distance (ISD) is also an issue at some of the intersections along the corridor. Vehicles were observed pulling forward past stop bar and/or stop signs to see oncoming traffic. Examples of limited ISD are shown in the photos below:

At 336th Avenue looking east

At 336th Avenue looking west

At 338th Avenue looking east

At 29th Avenue looking west

A risk assessment was completed for the issue of limited sight distance. The results are summarized in Table 15.

Table 15: Qualitative Risk Rating of Limited Sight Distance

Function	Classification	Reasoning
Exposure		Based on observations, side street vision triangle is impacted at 338th Avenue, 336th Avenue, and 29th Avenue. Based on observations, there are two intersections with vertical limit sight distance: 31st Avenue and 331st Avenue.
Probability		The side street turning movement volumes at these intersections are low.
Consequence		There are a limited number of turning movement crashes documented at these intersections.
Overall		-

Category I – Low Risk Category II – Medium Risk Category III – High Risk

RSA FINDINGS: LOCATION-SPECIFIC ISSUES

In addition to the minor intersections discussed in the previous section, two signalized intersections were observed as part of the RSA. The intersections of OR 8/26th Avenue (Cornelius) and OR 8/17th Avenue (Hillsboro) were identified as key issue locations in the field and through crash data review. The RSA findings presented in this section summarize the key issues identified at each intersection.

Issue: Intersection - OR 8/26th Avenue

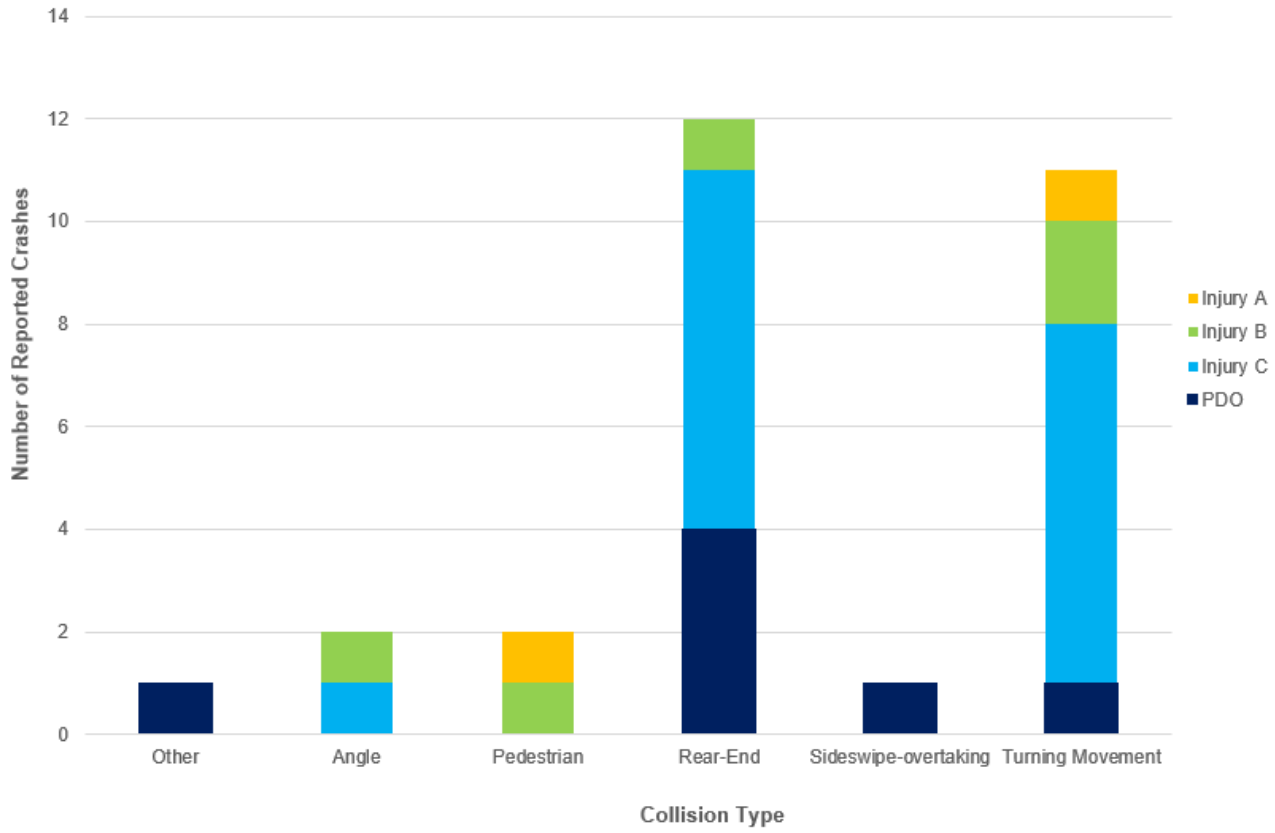
+

■ Category III – High Risk

26th Avenue is a primary north-south route in Cornelius. This intersection had the highest total entering volume (TEV) of vehicles in the study corridor. Additionally, it had the most crashes of the study intersections. Most of the crashes at this intersection were either rear-end or turning movement (See Exhibit 20). In addition, OR 8/26th Avenue is identified on the 5% Safety Priority Index System (SPIS) list for 2017. Some key observations at the 26th Avenue intersection are summarized below:

- Highest transit ridership within the study corridor
- Curb ramps and crosswalk are not well aligned, especially due to the large curb radii in the northern intersection corners.
- East-west permitted-protected left turns
- Side streets have shared left/through and right lane configurations operating as permissive phasing that results in undesirable north-south left-turn driver confusion
- Medians with tubular markers are not visible
- Drivers of left-turning vehicles from OR 8 have trouble seeing opposing through traffic

Exhibit 20: Reported 2013-2017 Crash Severity by Collision Type at OR 8/26th Avenue



Intersection configuration At OR 8/26th Avenue

Source: Google Earth Aerial

Eastbound permitted/protected left-turn display and low visibility of tubular markers

Potential red-light running

Northbound approach: Shared left/through and right

Southbound approach: Shared left/through and right

Risk assessment results are summarized in Table 16:

Table 16: 26th Avenue – Top 5% SPIS

Function	Classification	Reasoning
Exposure		This intersection has the highest volumes.
Probability		This intersection has the highest number of reported crashes.
Consequence		Of the reported crashes from 2013-2017, 21 of the 27 involved injuries. Reported crashes that involved eastbound left-turn movement and westbound through movement resulted in injuries. Turning movement and rear-end crashes are the most commonly reported crash types.
Overall		-

Category I – Low Risk Category II – Medium Risk Category III – High Risk

Issue: Intersection - OR 8/17th Avenue

■ Category III – High Risk

Some key observations at 17th Avenue are summarized below:

- Observed high TriMet use
- Westbound left-turn Injury A crashes
- Eastbound bike lane dropped prior to intersection
- Northbound left turn:
  - Queues unable to clear in one cycle
  - Failure to yield right-of-way to pedestrians
- Short pedestrian walk times
- Permitted-protected westbound left-turn

Lack of eastbound bike lane at 17th Avenue

Intersection configuration At OR 8/17th Avenue

Source: Google Earth Aerial

Pedestrian unable to cross within phase at 17th Avenue

A risk assessment was completed for issues associated with the intersection of OR8 and 17th Avenue. The results are summarized in Table 17.

Table 17: 17th Avenue – Recent Injury A Crashes

Function	Classification	Reasoning
Exposure		This is a high-volume intersection. The westbound left-turn is the highest corridor left-turn volume. The northbound left-turn volume is also high.
Probability		This intersection has the second highest number of reported crashes.
Consequence		Six crashes were reported between 2013 and 2017 involving westbound left-turning movements and eastbound through movements. Three of those crashes involved injuries. Two injury A crashes occurred in 2018 involving westbound left-turn movements.
Overall		-

Category I – Low Risk Category II – Medium Risk Category III – High Risk

RSA FINDINGS: SUGGESTIONS

This section describes the suggestions identified by the RSA team to address corridor-wide issues as well as location-specific intersection issues. The suggestions are meant to include a comprehensive set of options to give the agencies flexibility in determining the most appropriate treatments; some of the treatments will not be appropriate if other treatments are pursued. For example, the long-term suggestions include options for traffic signals or roundabouts; only one of these options would be pursued.

Many of the suggestions identified address multiple issues on the corridor. Because of this, the suggestions are not grouped based on the issue they address. The summary matrix at the end of the section indicates which issues are addressed by each suggestion.

When possible, the effectiveness of a suggestion is also documented by identifying the crash reduction factor (CRF) associated with the treatment. CRFs provide a quantitative estimate for the percentage of crashes (or specific crash types) likely to be reduced by the treatment. These factors are based on national research. The CRFs are obtained from ODOT's approved CRF list unless otherwise noted. The ODOT Countermeasure Number, corresponding to the list of approved CRFs, is also provided.

The suggestions are grouped into immediate, near-term, mid-term, and long-term categories to assist the agencies with planning. The four categories are relative to each other and not based on any specific timeframe thresholds. The RSA team decided to provide these initial categories for suggestions within the study corridor to outline a potential phased approach.

Immediate suggestions are typically low-cost "quick fixes" that may be achieved through maintenance. Near-term suggestions are high priority, limited-scope suggestions. Mid-term suggestions reflect additional priorities for the corridor that may require additional project development. Long-term suggestions provide options for an ultimate vision for the corridor; significant project development would be needed prior to these projects moving forward. No cost estimates were prepared during the RSA process; these groupings are based on engineering judgment and experiences with typical costs.

The following page provides a summary of the immediate, near-term, mid-term, and long-term suggestions. Following are more detailed summaries for each topic. The RSA team established this potential phased approach working towards a potential long-term vision for the corridor. The suggestions in this phased implementation strategy build on each other with limited overlapping implementations that would result in rebuilding a previous investment.

A Phased Approach that Leads to a Long-Term Vision for the Corridor

Immediate	Near-Term	Mid-Term	Long-Term
☑ Improve intersection sight distance	☑ Install priority enhanced crossings at 334th Avenue and East Lane	☑ Provide pedestrian facilities	☑ Install corridor illumination
☑ Improve reflectivity	☑ Install sidewalk infill to serve near-term enhanced crossings	☑ Install additional enhanced crossings	☑ Complete the pedestrian sidewalk network
☑ Improve intersection visibility	☑ Install ADA-compliant pedestrian ramps in coordination with upcoming projects	☑ Install large-scale signalized intersection upgrades	☑ Pursue access management and network connectivity
☑ Complete systemic signal enhancements	☑ Evaluate lighting		**Option 1**: Signalized corridor with U-turns and/or frontage roads
☑ Install advance signage	☑ Review and upgrade bus stop amenities		**Option 2**: Series of roundabouts
☑ Restripe roadway to install buffered bike lanes	☑ Upgrade signalized intersections		
☑ Install striping for speed management			
☑ Install permanent speed feedback signs			
☑ Engage the community through education and outreach			
☑ Advocate for additional local connectivity and establish future corridor plan			

Immediate Suggestions

The RSA Team identified the following immediate suggestions and the corridor-wide issues they aim to address:

Summary of Immediate Suggestions

Suggestion	Issues Addressed							
	Inconsistent Pedestrian Facilities	High Speed Corridor	High Density of Minor Streets/ Accesses	Limited Intersection Visibility	Limited Sight Distance	Limited Illumination	26th Avenue	17th Avenue
Immediate								
Improve intersection sight distance		X			X			
Improve reflectivity		X	X	X				
Improve intersection visibility		X	X	X			X	
Complete systemic signal enhance-ments	X	X					X	X
Install advance signage	X	X		X			X	X
Restripe roadway to install buffered bike lanes		X						

Summary of Immediate Suggestions

Suggestion	Issues Addressed							
	Inconsistent Pedestrian Facilities	High Speed Corridor	High Density of Minor Streets/ Accesses	Limited Intersection Visibility	Limited Sight Distance	Limited Illumination	26th Avenue	17th Avenue
Install striping for speed manage-ment	X	X		X				
Install permanent speed feedback signs		X						
Engage the community through education and outreach	X	X		X				
Advocate for local connectivity and establish future corridor plan	X	X	X					

The following provides additional information about the strategies summarized in the previous pages.

Improve Intersection Sight Distance

Increasing intersection sight distance at unsignalized locations throughout the corridor will allow drivers to see oncoming traffic with enough advance warning to make turning movement decisions with adequate gaps. Substantial improvements may be completed by working with maintenance staff from agencies to maintain vegetation in the clear zones and remove trees, grass, and other vegetation that is encroaching on intersection sight distance triangles. Completing the bike skip striping along OR 8 through the intersection will help inform side-street drivers how far they may pull forward to achieve better sight distance without entering the travel lanes on OR 8.

Clearing vegetation will improve sight distance, but additional earthwork is likely to be necessary to achieve the minimum intersection sight distance for a roadway with vehicles traveling at 45 mph.

Increase Triangle Sight Distance
CRF: Up to 48% reduction in all injury crashes
ODOT Countermeasure Number: I10

Example of sight distance constraint on the corridor (left photo – 338th Avenue) and one without constraint (right photo -331st Avenue)

Improve Reflectivity

Improving reflectivity of signs, posts, and pavement markings provides better delineation of the roadway and key intersections for drivers, particularly when traveling at night and in low-light conditions, such as rain. ODOT has a qualified product list (QPL) of reflective sheeting and reflective posts that are approved for use. In addition to reflective treatments, increasing the

text size on signs improves visibility for drivers. Raised or recessed pavement markers can be installed along the roadway centerline and edge-line to increase visibility of the lane.

Install recessed or raised pavement markers
CRF: Up to 15% reduction in night-time crashes
ODOT Countermeasure Number: RD12

Diamond grade reflective sheeting

Source: https://www.3m.com/3M/en_US/road-safety-us/resources/upgrade-to-diamond-grade-reflective-sign-sheeting/

Reflective Posts

Source: http://www.barcoproducts.com/reflective-sign-post-panel

Improve Intersection Visibility

Improving intersection visibility raises awareness of the potential conflicts for drivers approaching intersections along OR 8. When drivers see an intersection ahead, they are better prepared for potential vehicles slowing, accelerating, or turning. In addition, adequate intersection visibility allows drivers time to decelerate when approaching a turn. Intersection visibility can be improved through several measures, such as:

Example of MUTCD sign indicating multiple intersections/ driveways ahead

Source: MUTCD

- Increasing reflectivity, as discussed in the previous section, with reflective flexible delineators along intersection corners
- Installing street name signage on both sides of the street
- Installing advance warning signs for stretches of the corridor with a high density of access points

Example of delineators and additional street name signs to increase intersection visibility on Highway 30

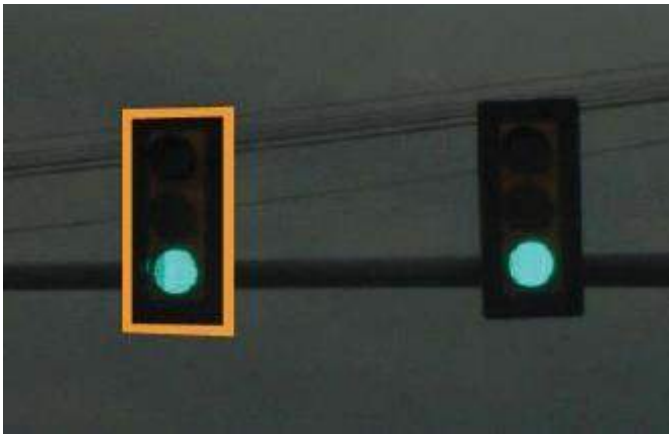
Source: Google Streetview

Complete Systemic Signal Enhancements

Systemic signal enhancements are relatively low-cost treatments that may be completed at existing traffic signals to reduce crash risk by increasing intersection visibility to drivers and improving operations. These systemic signal enhancements may be easily coordinated and implemented at multiple signals on the study corridor. The signal modifications that may be relevant on OR 8 at 26th Avenue and 17th Avenue intersections include:

- Installing retro-reflective strips on all existing traffic signal back-plates
- Installing pedestrian countdown displays
- Installing gap detection associated with permissive lefts
- Upgrading signal controllers to advanced models
- For this immediate suggestion, the intent is not to rebuild the pedestrian ramps, but to include ramps as part of intersection rebuild (mid-term suggestion).

CRF: Varies based on the number of treatments installed:
20% for up to 2 treatments
25% for 3 to 4 treatments
30% for 5 to 6 treatments
ODOT Countermeasure Number: I2



Example of retro reflective signal back plates

Source: FHWA
https://safety.fhwa.dot.gov/intersection/conventional/signalized/case_studies/fhwasa09011/

Example of countdown pedestrian signals

Source: ODOT CRF Appendix
https://www.oregon.gov/odot/Engineering/Docs_TrafficEng/CRF-Appendix.pdf

Install Advance Signage

Advance signage alerts drivers to potential conflicts ahead and provides additional warning to allow them to decelerate prior to an intersection or bus stop. On OR 8, these signs may be used to warn drivers of school bus stops or upcoming intersections. Based on feedback from the Hillsboro School District, motorists do not obey the school buses' red flashing lights. The RSA team researched custom signs, as shown in the examples below, to emphasize the law to stop for school buses. These custom signs can be placed on both sides of the road for westbound prior to 331st Avenue and eastbound prior 341st Avenue to provide a regulatory message for the road segment with six school bus stops. According to the MUTCD, if a bus can be seen from 500 feet away, the stop does not warrant a sign (S3-1). MUTCD advance signal ahead warning signs may be helpful in the westbound direction as drivers approach 26th Avenue and in the eastbound direction as they approach 17th Avenue, since these are the first signals entering the two study corridor cities.

Source: https://www.seton.com/stop-for-school-bus-school-parking-signs-l9055.html

Source: https://www.codot.gov/library/traffic/signing-and-pavement-markings/sign-library-files/regulatory

Source: https://store.hallsigns.com/HR5-12-All-Lanes-Stop-When-School-Bus-Stops_p_2520.html

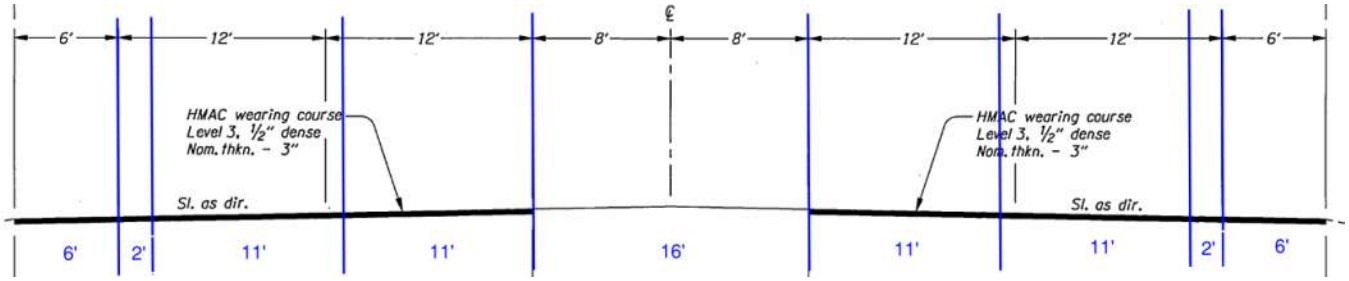
Bus Stop Ahead and Signal Ahead Warning Signs

Source: MUTCD

Restripe Roadway to Install Buffered Bike Lanes

The existing cross-section of OR 8 includes bike lanes approximately six feet wide. However, there is currently no buffer separating bicyclists from vehicles. Due to the relatively high speeds and volume on OR 8, the cross-section may be reallocated to provide a buffer for further separation between vehicles and bicyclists. This may be achieved by reducing one or two lanes per direction to 11 feet in width and is consistent with ODOT's *Blueprint for Urban Design* principles. As shown in Exhibit 21, the lane skip stripe is the only stripe that would need to move (e.g., one foot) to accommodate the reallocation of space.

Exhibit 21: Illustration of reallocation of cross-section width to accommodate buffered bicycle lane



Install Striping for Speed Management

Installing in-lane lateral striping in conjunction with speed feedback signs has been shown to be effective at reducing speeds along corridors. The striping creates the illusion of a narrower lane and encourages slower travel speeds. *NCHRP Report 613: Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections* provides additional information about this treatment. Photos below illustrate example installations along Barbur Boulevard and OR 211 south of Sandy.

Example installation of in-lane lateral striping on Barbur Boulevard south of Sandy

Source: Google Earth

Example in-lane lateral striping installation, OR 211 south of Sandy
Source: Google Earth

Optical Speed Bars
Source: FHWA

Install Permanent Speed Feedback Signs

Speed feedback signs have been shown to be effective at reducing vehicle speeds when placed in conjunction with a posted speed limit sign. Studies have shown speed feedback signs start to lose effectiveness beyond 300 feet of the sign.[2] Therefore, placement of the sign is important. Temporary speed feedback signs have been installed along the corridor, and observations indicate that motorists respond to them.

Install Individual Changeable Speed Warning Signs
CRF: 41% reduction in all crashes
ODOT Countermeasure Number: H47

Speed feedback sign example

Source: County of San Luis Obispo Public Works
https://www.slocounty.ca.gov/Departments/Public-Works/Department-News/2018/Installation-of-Dynamic-Feedback-Signs-to-Begin-on.aspx

Speed feedback sign example

Source:
https://www.oksolar.com/lion/Item/160749/radar-speed-your-speed-signs

[2] Source: https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa1304/2_6.htm

Engage the Community through Education and Outreach

Community education and outreach are an important part of comprehensively addressing the safety issues on the study corridor. Engineering treatments may help reduce crash risk, but driver behavior is also associated with many crash patterns, such as excessive speeds and distracted driving. Outreach may be accomplished through a variety of means, including:

- Increased enforcement
- School education (targeting both students and parents)
- Temporary message board to communicate key issues
    - Speed
    - Stop for school buses in both directions when a median is not present

Messages may be targeted to certain times of the year, such as the start of the school year.

Example of using a message board to educate drivers

Source: https://encrypted-tbn0.gstatic.com/images?q=tbn%3AANd9GcRc5ujclykf OzeHpZR7QcrXL4RYNVoRZGX_fe-TUoNaXpzAO-pi&usqp=CAU

Advocate for Local Connectivity and Establish Future Corridor Plan

The Cornelius Transportation System Plan (TSP) identifies a vision of frontage roads to provide additional local connectivity, moving traffic to key intersections along the corridor where improvements may be made to accommodate higher traffic volumes. In the immediate future, agencies should review new developments to ensure consistency with the TSP and the future vision. In addition, Cornelius, Hillsboro, and ODOT should work together to create a corridor refinement plan or ODOT facility plan for the corridor that outlines a clear path for improvements along this corridor.

Near-Term Suggestions

The RSA Team identified the following near-term suggestions and the corridor-wide issues they aim to address:

Summary of Near-Term Suggestions

Suggestion	Issues Addressed							
	Inconsistent Pedestrian Facilities	High Speed Corridor	High Density of Minor Streets/ Accesses	Limited Intersection Visibility	Limited Sight Distance	Limited Illumination	26th Avenue	17th Avenue
Near-Term								
Install priority enhanced crossings at 334th Avenue and East Lane	X	X		X		X		
Install sidewalk infill to serve near-term enhanced crossings	X	X						
Install ADA-compliant pedestrian ramps in coordi-nation with upcoming projects	X	X	X		X			

Summary of Near-Term Suggestions

Suggestion	Issues Addressed							
	Inconsistent Pedestrian Facilities	High Speed Corridor	High Density of Minor Streets/ Accesses	Limited Intersection Visibility	Limited Sight Distance	Limited Illumination	26th Avenue	17th Avenue
Evaluate lighting	X			X		X		
Review and upgrade bus stop amenities	X							
Upgrade signalized intersections							X	X

The following provides additional information about the strategies summarized above.

Install Priority Enhanced Crossings at 334th Avenue and East Lane

The RSA team suggests enhanced crossing treatments be investigated in the vicinity of 334th Avenue and of East Lane. Both locations have a relatively high number of riders accessing nearby TriMet stops and fatal crash history within the last five years.

Enhanced crossings may include active features that alert drivers when a pedestrian is present, increasing their awareness of the crossing and the likelihood they will need to yield to pedestrians. Many enhanced crossings also include a pedestrian refuge island, allowing the pedestrian to cross in two stages, rather than having to find a gap in both directions of traffic to cross all at once. There are several different options for enhanced crossing treatments, including a rectangular rapid flashing beacon (RRFB) (a yellow device) and a pedestrian hybrid beacon (PHB) (a red device). An engineering study is needed to determine the appropriate treatment for this corridor. Due to the traffic volumes and speeds, an overhead installation is likely to be most effective for RRFBs and PHBs.

Regardless of the type of device selected, the following treatments should be considered in the enhanced crossings:

- Pedestrian ramps and potential refuge islands. Location-specific studies to review impacts of refuge islands, such as limiting ability to make a two-stage left-turn, needed.
- Typical striping and signage
- Illumination immediately in advance of the pedestrian crossing (see Exhibit 22)

Rectangular Rapid Flashing Beacon (RRFB)
CRF: 10 - 65% reduction in pedestrian crashes
ODOT Countermeasure Number: BP9

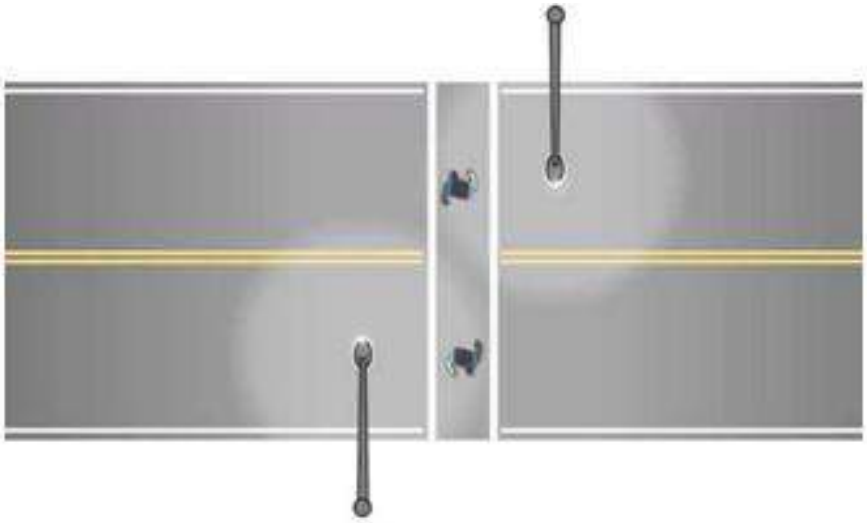
Pedestrian Hybrid Beacon (PHB)
CRF: 55% reduction in pedestrian and bicycle crashes
ODOT Countermeasure Number: BP15

Pedestrian Refuge Island
CRF: 31% reduction in pedestrian crashes
ODOT Countermeasure Number: BP7

Provide Intersection Lighting (Bike & Pedestrian)CRF: 42% reduction in pedestrian and bicycle nighttime injury crashes
ODOT Countermeasure Number: BP2

Continental Crosswalks with Advanced Warning Signs
CRF: 15% reduction in pedestrian crashes
ODOT Countermeasure Number: BP11

Exhibit 22: Illustration of illumination located in advance of pedestrian crossing to highlight pedestrians and the crosswalk for approaching drivers



Source: FHWA - https://www.fhwa.dot.gov/publications/research/safety/08053/

Example of Overhead RRFB Installation

Source: Google Earth

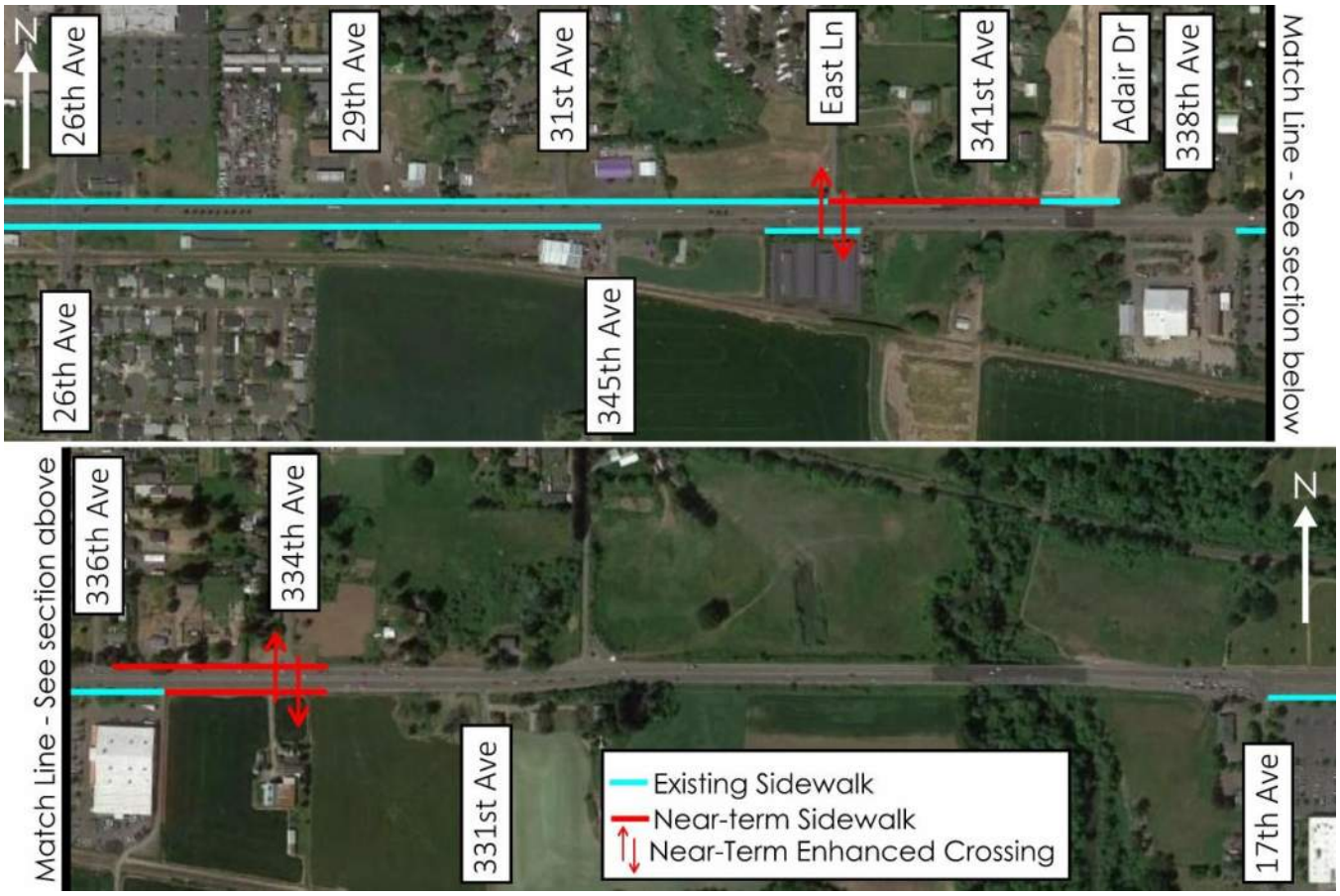
The RSA Team suggests that enhanced crossings be located at the following locations, as shown in Exhibit 23:

- **334th Avenue**: This location experienced three fatal crashes between 2017 and 2020. In addition, this bus stop experiences the highest ridership of the minor intersections along the study corridor. If the crossing is located on the east leg of the intersection, a pedestrian refuge island may be feasible and should be considered in a future engineering study.

- **East Lane:** This location has bus pull-outs. It also experiences relatively high transit ridership compared to other stops along the corridor. In addition, this location is approximately 0.1 miles west of the pedestrian crash at NW 341st Avenue. If the crossing is located on the east leg of the intersection, a pedestrian refuge island may be feasible and should be considered in a future engineering study. .

The two crossings should be connected by sidewalk infill, as shown in red in Exhibit 23. Existing sidewalk is shown in blue in the exhibit. The sidewalk infill and enhanced crossings may provide an opportunity to consolidate bus stops within this section of the corridor.

Exhibit 23: Illustration of potential near-term enhanced pedestrian crossing locations



Source: Base Image from Google Earth

Install Sidewalk Infill to Serve Enhanced Crossings

Completing sidewalk infill provides dedicated space for pedestrians to travel along the corridor without encroaching on the roadway. Sidewalk infill should be coordinated with enhanced crossings and bus stop locations, as illustrated in the previous section, between East Lane and 334th Avenue. Sidewalk should connect to crossings to create a connected system for pedestrians. A temporary asphalt path may be constructed in the near-term for connectivity; concrete sidewalks with full right-of-way (ROW) and stormwater considerations may follow later as a mid-term project or street frontage improvements.

Examples of locations on OR 8 where sidewalk ends abruptly under current conditions

Install ADA-Compliant Pedestrian Ramps in Coordination with Upcoming Projects

ODOT is following a systematic approach to update pedestrian ramps. There is a STIP project to upgrade pedestrian ramps along the OR 8 corridor. However, the study corridor is not included in the funded project and currently lacks consistent, ADA-compliant ramps. The RSA Team suggests that ODOT coordinate appropriate staff to identify potential project overlaps and needs along the study corridor.

Illustration of ADA-Compliant Pedestrian Ramps

Source: Google Earth Street View

Evaluate Lighting

Illumination can help raise visibility at key locations and potential conflict points, such as intersections, crossings, and bus stops. However, it may not be appropriate to install segment lighting along OR 8, given the rural nature of the study corridor between Hillsboro and Cornelius. Illumination may be appropriate at the transition segments into each city. Further evaluation is needed to review each intersection and bus stop to determine if lighting is needed. In addition, lighting should be implemented as part of the enhanced pedestrian crossings and sidewalk suggestions from the RSA (refer to near-term Suggestions). There may be opportunities to coordinate with new developments and incorporate lighting improvements in conjunction with their frontage improvements.

Example of Short Segment of Existing Lighting on the Corridor

Intersection Lighting
CRF: 38% reduction in night-time injury crashes
ODOT Countermeasure Number: H25

Segment Lighting
CRF: 28% reduction in night-time injury crashes
ODOT Countermeasure Number: H26

Review and Upgrade Bus Stop Amenities

Providing bus stop amenities such as covered seating in a pull-out location provides dedicated space for transit users to wait for the bus rather than waiting on the side of the road where they are more vulnerable to traffic. The RSA team suggests local agencies coordinate with TriMet to provide bus stop upgrades in tandem with the enhanced pedestrian crossings. A review of each specific site should be conducted to determine appropriate amenities, which may include benches and a shelter. The determination of level of bus stop amenities will be completed by TriMet. The review should also consider whether modifications to bus operations and bus stop consolidation is desired and feasible to provide bus pull-outs rather than in-lane stops.


Types of TriMet stop amenities

Source: Google Earth Street View

Upgrade Signalized Intersections

In addition to the low-cost systemic immediate suggestions, additional operations and geometric modifications at the two signalized intersections (OR 8/26th Avenue and OR 8/17th Avenue) may help reduce crash risk, particularly for turning movement crashes and pedestrian crashes. The following potential signal phasing/timing updates may be considered:

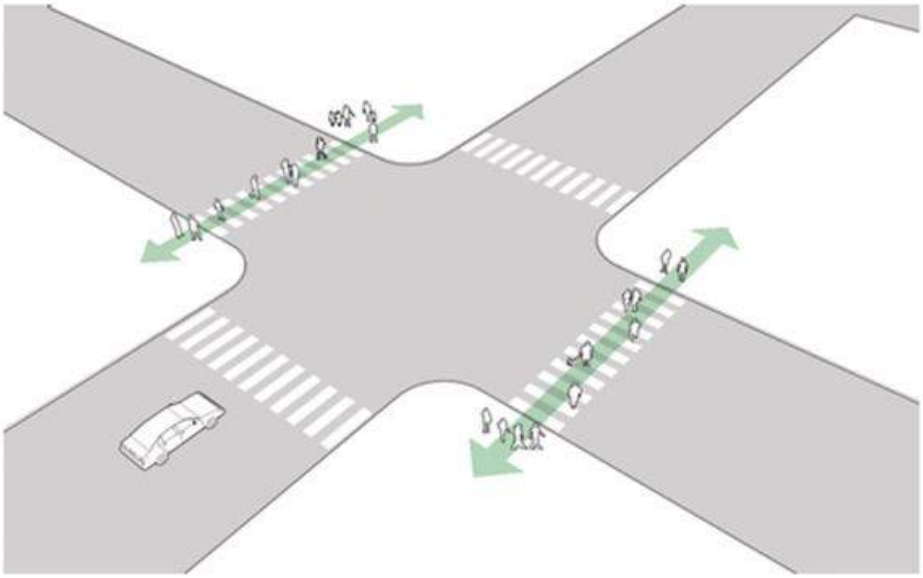
- **Gap detection for left turns:** Re-evaluate the need to allow left-turn phasing to change during the day based on gap detection. Operating the left-turn movement as a protected or protected-permitted turn will decrease the risk of turning movement crashes.
- **Leading pedestrian intervals (LPIs):** Providing leading pedestrian intervals allows pedestrians to start crossing before vehicles receive a green signal. This allows pedestrians to enter the crosswalk and be visible prior to vehicles approaching. See Exhibit 24 for an illustration.

In addition to the signal timing suggestions, the RSA team identified several specific suggestions at each intersection:

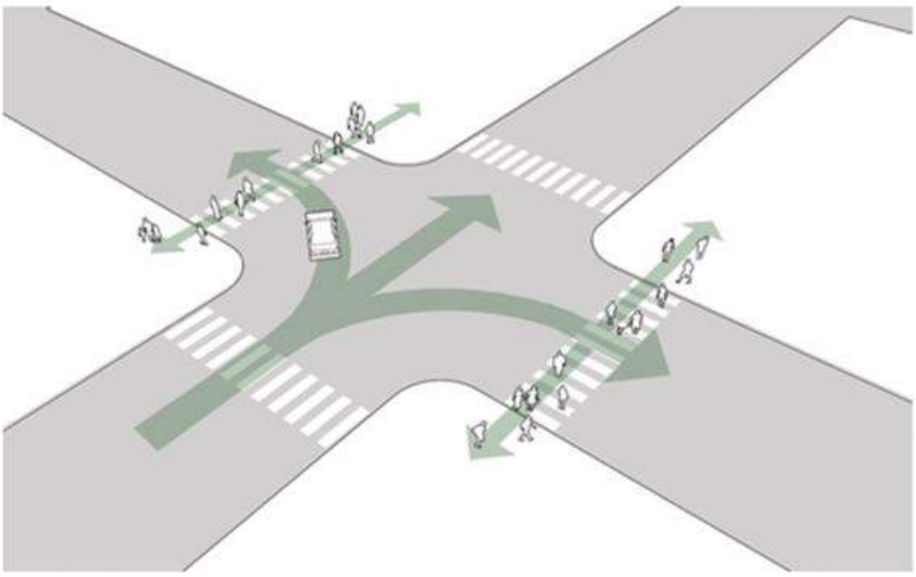
- **26th Avenue Signal**
  - Evaluate the lane configuration of the north and south legs. The existing lane configuration on these approaches includes a shared through-left lane and a dedicated right-turn lane. This differs from more typical situations in which a dedicated left-turn lane is provided and the through and right-turn movements share a lane. Drivers may not expect to encounter through-movements from the left lane.

- **17th Avenue Signal**
  - The northbound left-turn operations may be evaluated to determine if they can be modified without upgrading or replacing the signal equipment to address northbound queuing associated with left-turn movement. This evaluation should consider whether there is a potential for dual left-turn lanes by providing a dedicated left-turn lane and a shared left-turn/right-turn lane, which should address impacts on the west leg crosswalk.

Exhibit 24: Illustration of the benefits associated with a leading pedestrian interval at a signalized intersection



Phase 1: Pedestrians only



Phase 2: Pedestrians and cars

Source: NACTO

Mid-Term Suggestions

The RSA Team identified the following mid-term suggestions and the corridor-wide issues they aim to address:

Summary of Mid-Term Suggestions

Suggestion	Issues Addressed							
	Inconsistent Pedestrian Facilities	High Speed Corridor	High Density of Minor Streets/ Accesses	Limited Intersection Visibility	Limited Sight Distance	Limited Illumination	26th Avenue	17th Avenue
Mid-term								
Provide pedestrian facilities	X	X			X			
Install additional enhanced pedestrian crossings	X	X		X		X		
Install large-scale signalized intersection upgrades	X					X	X	X

The following provides additional information about the strategies summarized above.

Provide Pedestrian Facilities

Building upon the near-term suggestions, this mid-term suggestion provides additional connected pedestrian facilities to further connect to additional enhanced crossing locations proposed as mid-term suggestions. These facilities extend beyond the infill opportunities identified in the near-term suggestions and involve additional project development to complete. These facilities may be sidewalks or shared-use paths but should include a small buffer between the edge of pavement and the sidewalk/path to create additional separation between vehicles and pedestrians. The sidewalks/paths will also enable pedestrians to travel along the corridor until they reach an enhanced pedestrian crossing. This will encourage appropriate use of the crossings and discourage unexpected pedestrian crossings in the corridor. The design of the pedestrian facilities (sidewalks) should consider illumination. If illumination is not installed immediately, the design may incorporate conduits and junction boxes to allow for streamlined future retrofits.

Example of separated pedestrian facilities on Brookwood Parkway in Washington County, OR

Source: Google Earth Street View

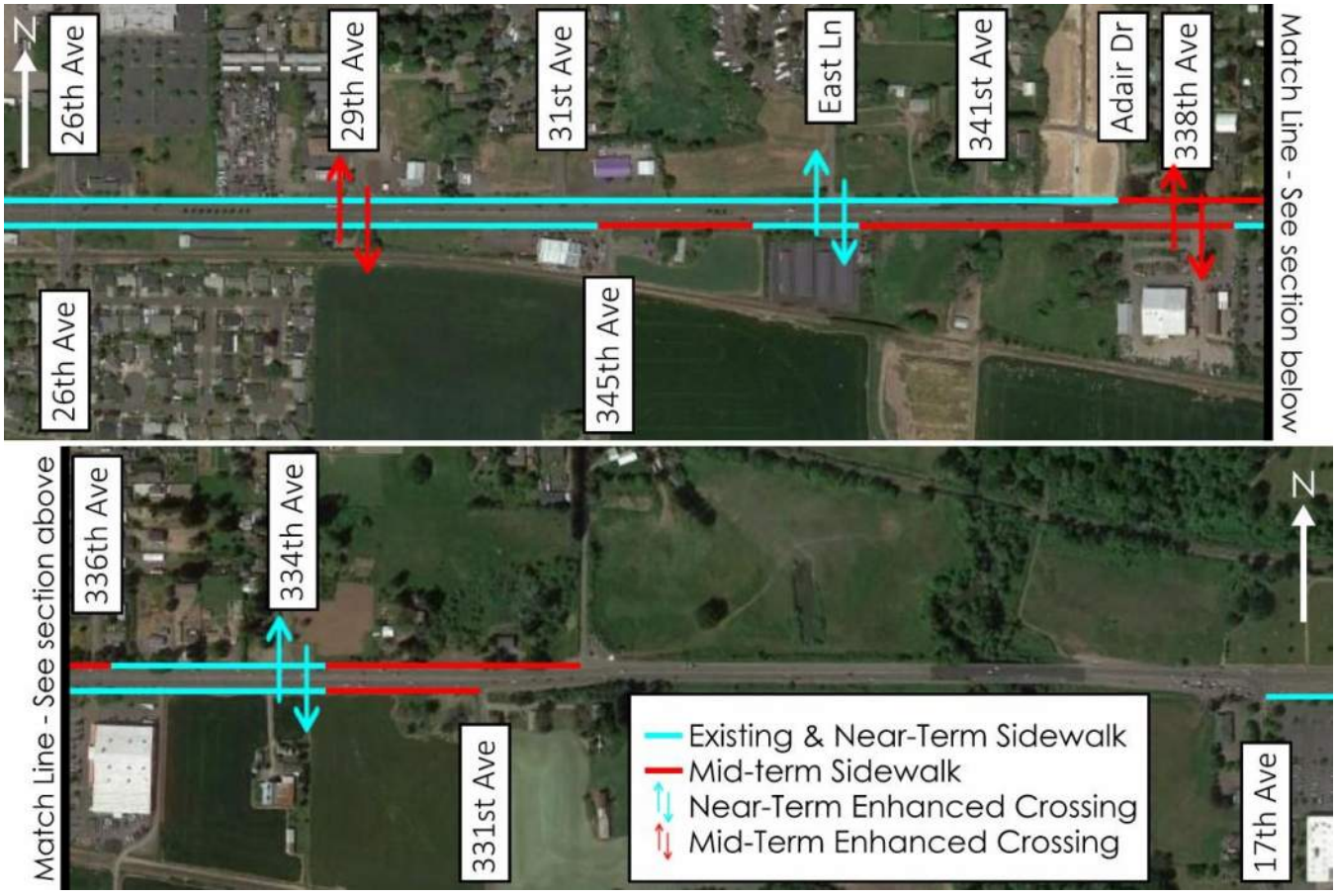
Completing the connected pedestrian facilities may be done in phases. Phase 1 may include separated sidewalks from 26th Avenue to 331st Avenue, at the transition into Cornelius. This would connect with the sidewalk infill completed as a near-term suggestion.

Install Additional Enhanced Crossings

After the near-term suggested enhanced crossings are completed at East Lane and 334th Avenue, additional crossing locations should be identified and evaluated. These locations should be coordinated with bus stops and sidewalk connections to provide a complete, connected pedestrian system for the study corridor. OR 8 should be evaluated using guidance from ODOT's *Blueprint for Urban Design* to determine appropriate target spacing between crossings, identify potential locations, and identify appropriate treatments.

As shown in Exhibit 25, potential additional mid-term crossings (shown in red) could be located at 29th Avenue and 338th Avenue, with connecting sidewalk (also shown in red). The near-term suggested crossings and sidewalk infill are shown in blue in the exhibit. Bus stops adjacent to these crossing locations should be evaluated and upgraded. Consolidating bus stops to these crossing locations may also be considered.

Exhibit 25: Illustration of Mid-Term Vision for Connected Sidewalks and Enhanced Pedestrian Crossings



Source: Base Image from Google Earth

Install Large-Scale Signalized Intersection Upgrades

More substantial intersection improvements, which would cost more and involve additional project development compared to the near-term suggestions, may be considered at the two signalized intersections (26th Avenue and 17th Avenue). These improvements may include treatments that help improve operations, provide appropriate turning radii, and provide enhanced facilities for pedestrians and bicyclists. These suggestions may require partial or complete rebuilding of the intersection, which may trigger a railroad crossing order. Potential projects by location are as follows:

- **26th Avenue**
  - Upgrade signal equipment
  - Reconstruct curbs to provide appropriate turning radii
  - Review traffic operations as part of study before large-scale upgrades to verify signal timing, phasing, and configurations for all users
  - Evaluate the left-turn lanes, as discussed in the near-term suggestions, considering the driver's expectation of conflicting left-turn movements
  - Evaluate the lane alignment of north and south approaches
  - Relocate pedestrian pushbutton locations to meet ADA guidance, as needed
- **17th Avenue**
  - Upgrade/replace signal equipment
  - Review the design for the eastbound approach (determine if separation can be provided between the bike lane and the right-turn lane)
  - Revisit traffic operations, particularly for the westbound left turn and northbound approach
  - Relocate pedestrian pushbutton locations to meet ADA guidance, as needed

Long-Term Suggestions

The RSA Team identified the following long-term suggestions and the corridor-wide issues they aim to address:

Summary of Long-Term Suggestions

Suggestion	Issues Addressed							
	Inconsistent Pedestrian Facilities	High Speed Corridor	High Density of Minor Streets/ Accesses	Limited Intersection Visibility	Limited Sight Distance	Limited Illumination	26th Avenue	17th Avenue
Long-term								
Install corridor illumination	X	X		X		X		
Complete the pedestrian sidewalk network	X	X			X			
Pursue access manage-ment and network connectivity	X	X	X	X		X		
Option 1: *Signalized corridor with U-turns and/or frontage roads*	X		X	X		X		
Option 2: *Series of roundabouts*	X	X	X	X		X		

The following provides additional information about the strategies summarized above.

Install Corridor Illumination

As the OR 8 becomes more developed, it will take on more of a suburban/urban context and it may be appropriate to consider lighting throughout the study corridor, in addition to the key locations identified in the near- and mid-term suggestions. The RSA team suggests a corridor-wide evaluation to identify segments, key intersections, and crossings for illumination. ODOT and local agencies will work together to evaluate and consider corridor illumination. Local agencies will need to coordinate on maintenance and ongoing operating responsibilities. In addition, the evaluation should consider potential options to mitigate light pollution and conduct community outreach.

Typical roadway lighting along a multilane facility

Source: Google Earth

Intersection Lighting
CRF: 38% reduction in nighttime injury crashes
ODOT Countermeasure Number: H25

Segment Lighting
CRF: 28% reduction in night-time injury crashes
ODOT Countermeasure Number: H26

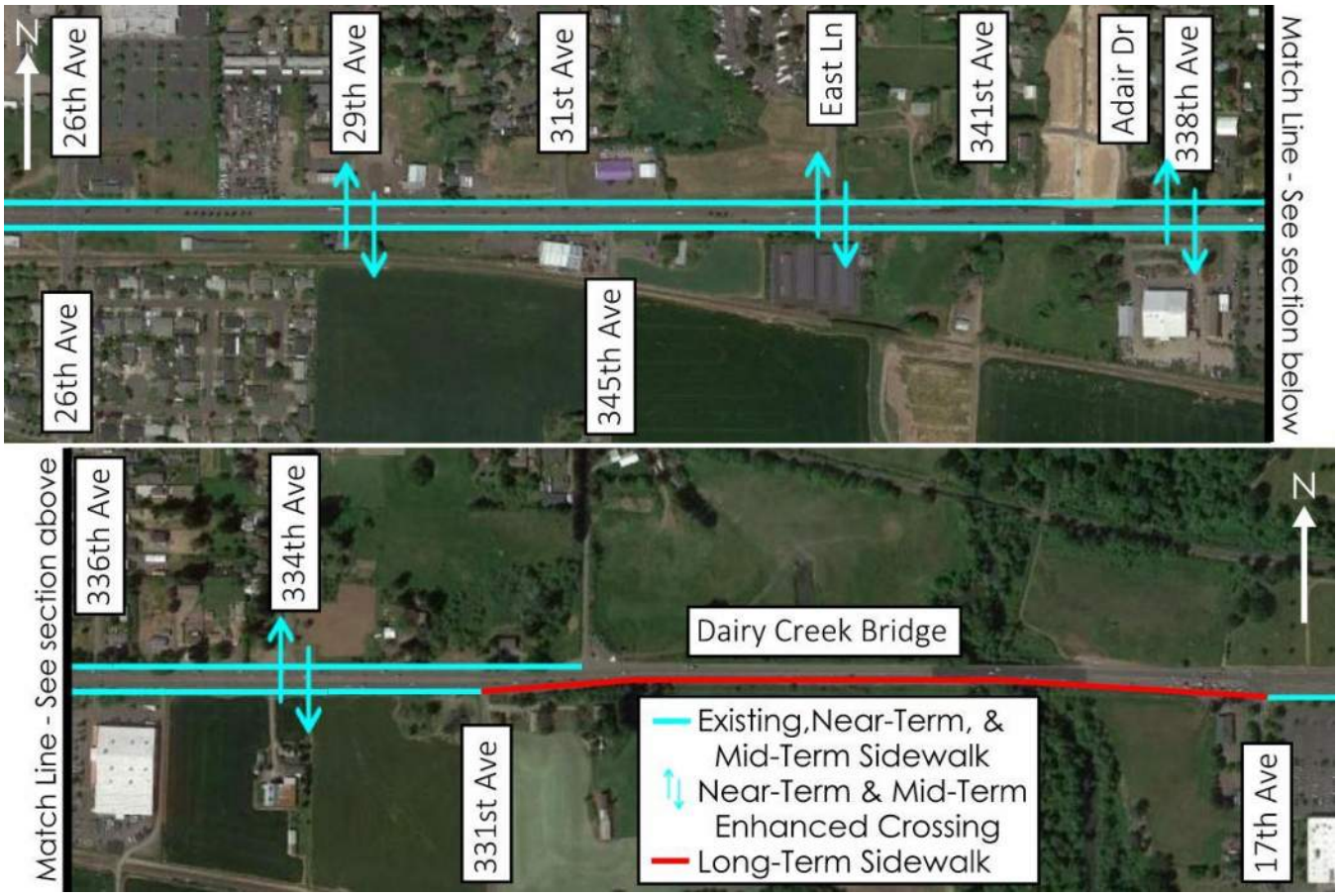
Complete the Pedestrian Sidewalk Network

This option builds on the sidewalk infill and pedestrian network near- and mid-term suggestions. The long-term vision is to have complete pedestrian facilities between Cornelius and Hillsboro. This final phase would likely involve a shared-use path between 331st Avenue (Cornelius) and 17th Avenue (Hillsboro) on the south side of OR 8. The shared-use path would accommodate pedestrian and bicycle travel in both directions and need to be connected to enhanced pedestrian crossings at both ends. The path, as shown in Exhibit 26, would require bridge widening or a new bridge over Dairy Creek, at higher cost than the previous infill.

It should be noted that Cornelius, Hillsboro, Forest Grove, and other agencies are continually reviewing the pedestrian and bicycle needs of this area. One potential project is the Council Creek trail along the ODOT rail tracks that run parallel of OR 8 to the north. Additionally,

Hillsboro is currently updating their TSP and expect to identify projects for the pedestrian and bicycle networks on the study corridor.

Exhibit 26: Potential Long-term Pedestrian Connection: Shared-use Path from 331st Avenue to 17th Avenue



Source: Base Image from Google Earth

Examples of Shared-Use Paths

Source: Google Earth StreetView

Pursue Access Management and Network Connectivity

The higher the number of access points along a corridor, the more potential conflict points. By minimizing the number of access points, or the movements permitted into and out of access points, conflict points can be reduced, lowering crash risk. In some situations, closing an access point maybe preferred, but in other situations, restricting left turns may be adequate. Restricting left turns in and out of properties/intersections reduces the potential for turning movement crashes. A median may be used to restrict left turns, encouraging stronger compliance. Minimizing the number of access points necessitates strategies to provide access to each property along the corridor. This may take several forms:

- **Consolidating access points into fewer locations:** In situations where properties connect or can be joined by driveways or frontage roads, consolidating access points into one (or few) key locations may be an option.
- **Local street connectivity:** In situations where many local streets have intersections with OR 8, several of these may be closed or restricted to right-in/right-out only if the local streets have connectivity to another key road with an intersection on OR 8. This would allow improvements at a key intersection, such as a signalized one, and minimize conflicts at smaller intersections along the corridor. This is consistent with City of Cornelius' TSP.
- **Provide U-turn options:** If connectivity to an alternate access location cannot be achieved, providing a U-turn option will allow drivers to access the property with right turns only. U-turns would need to be consolidated at key, improved locations that are appropriately designed to facilitate U-turn movement.

A combination of these strategies may be appropriate on the study corridor. The RSA team identified potential suggestions, summarized below, but additional engineering study and outreach is needed to determine the preferred solution for access management. The significant project development, coordination, and outreach needed to develop this strategy makes this suggestion a long-term option. The communities should work together to identify the long-term vision for the study corridor.

Potential access management strategies to reduce the number of driveways/intersections on OR 8 include:

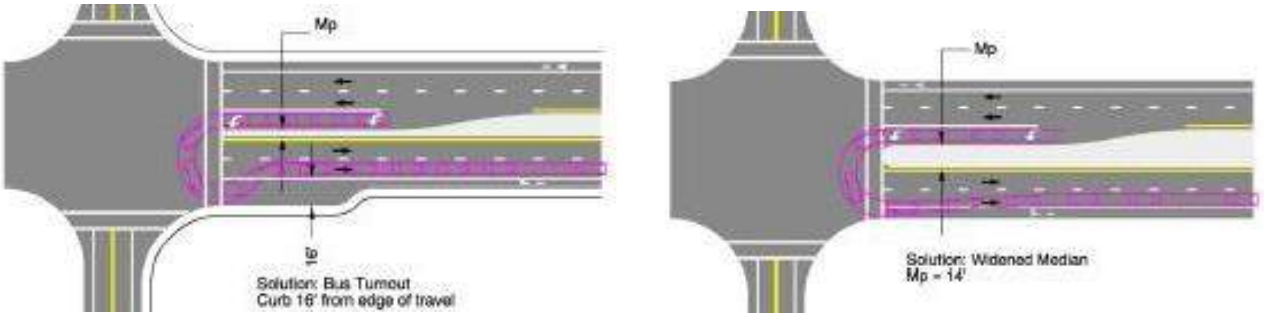
- **Consolidate access points:** This may be appropriate on OR 8 across from 338th Avenue between Coastal Farm and John Deere. Property owners would need to coordinate to provide one enhanced access location.
- **Relocate access points from OR 8 to side streets:** One example of a potential location for this option is the northeast corner of 336th Avenue.

- **Provide a continuous raised median along the entire corridor:** Providing a landscaped median along the corridor would restrict left-turn movements in and out of the minor intersections and driveways along the corridor, minimizing potential turning movement conflicts. In order for this to work, access must be provided through either frontage roads, local street connectivity, or U-turn opportunities. Options for potential U-turn treatments include:
    - Widen intersections to accommodate U-turns (widening the intersection may require additional right-of-way, see Exhibit 27)
    - Construct J-hook to allow U-turns at key locations throughout the corridor (may require additional right-of-way, see Exhibit 28)
    - Construct frontage roads to provide connections to key intersections where full turning movements are permitted (may require additional right-of-way)
    - Modify intersection control at key locations to facilitate turning movements. This may be done through signalized intersections or roundabouts, which are further discussed in the following section. These intersection control changes would also reduce crash risk at the intersections where they are located.
    - Reduce or consolidate the number of driveway accesses to OR 8

CRF Varies for reducing the number of driveways, based on number of driveways
ODOT Countermeasure Number: H30, H31, H32

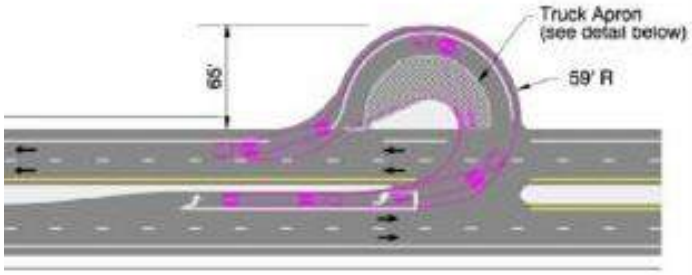
CRF: 12 – 22% for installing a raised median on multi-lane roads
ODOT Countermeasure Number: H34, H35

Exhibit 27: Example of Potential Opportunities to Facilitate U-turns by Widening Intersections



Source: ODOT HDM

Exhibit 28: Example of J-Turn Concept



Source: ODOT HDM

SIGNALIZED INTERSECTIONS OPTION

The signalized intersection option would involve introducing additional traffic control devices between 26th Avenue and 17th Avenue, the two existing signals on the corridor, and consolidating access points to use these signalized intersections. If local intersection connectivity is consolidated to these locations, the higher traffic volumes may meet signal warrants; this would need to be analyzed during project development. Right-of-way would need to be obtained to complete the frontage roads, and a center median along OR 8 would be needed to limit accesses to right-in, right-out only.

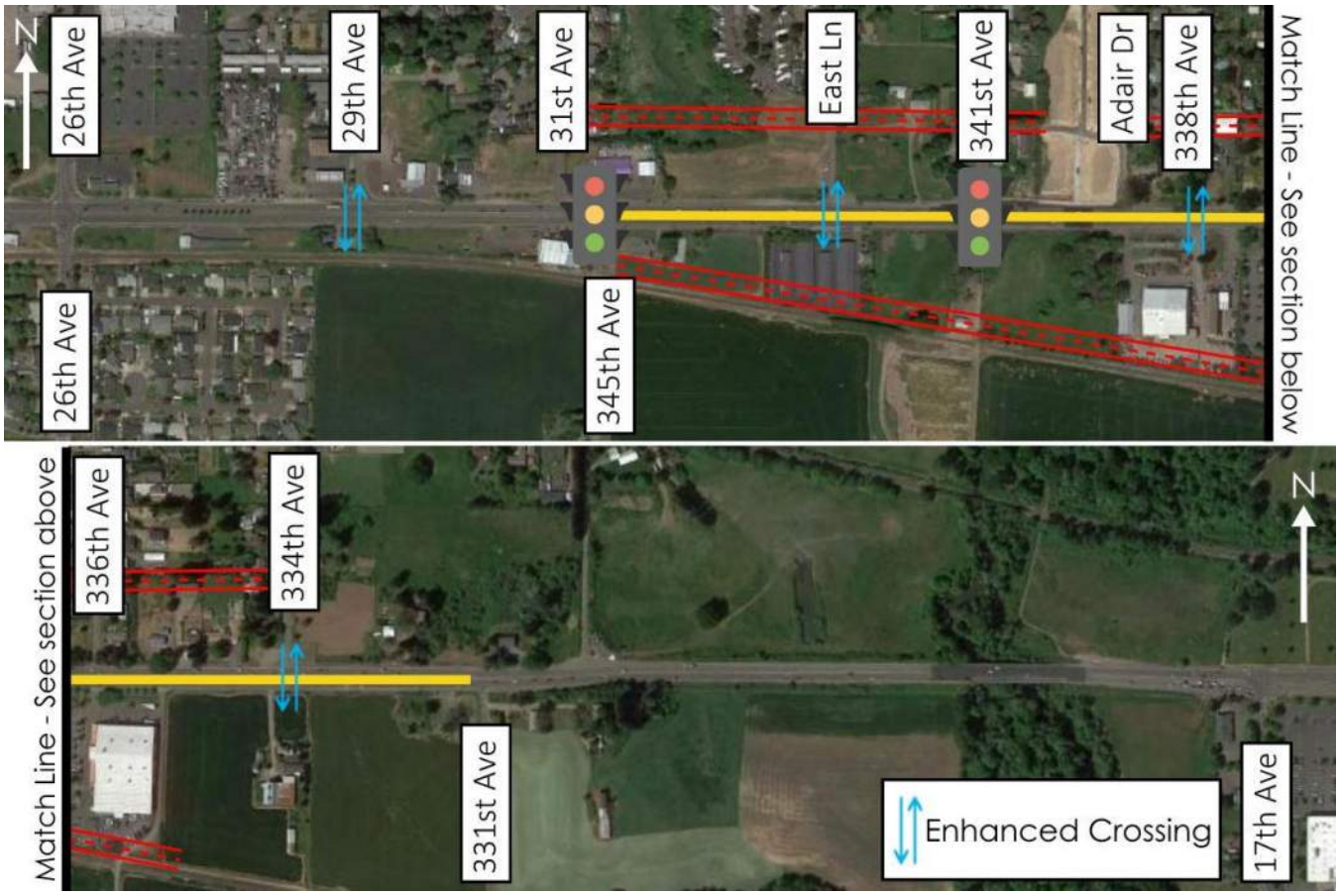
Signals may be considered at 345th Avenue and 341st Avenue, as shown in Exhibit 29. As part of improvements at 345th Avenue (south leg), 31st Avenue (north leg) may be realigned with 345th Avenue. With this realignment and a nearby planned school, the intersection may meet signal warrants. The City of Cornelius' TSP identifies the 341st Avenue intersection for a potential signal, but only if the frontage roads are implemented and the intersection meets signal warrants.

Install Traffic Signal

CRF: In urban areas, traffic signals are associated with a 67% reduction in angle crashes but also a 143% increase in rear-end crashes. (ODOT Countermeasure Number: H20).

In rural areas, traffic signals are associated with a 77% reduction in angle crashes but also a 58% increase in rear-end crashes. (ODOT Countermeasure Number: H20 and H21)

Exhibit 29: Illustration of Signalized Option



Source: Base Image from Google Earth

ROUNDABOUT OPTION

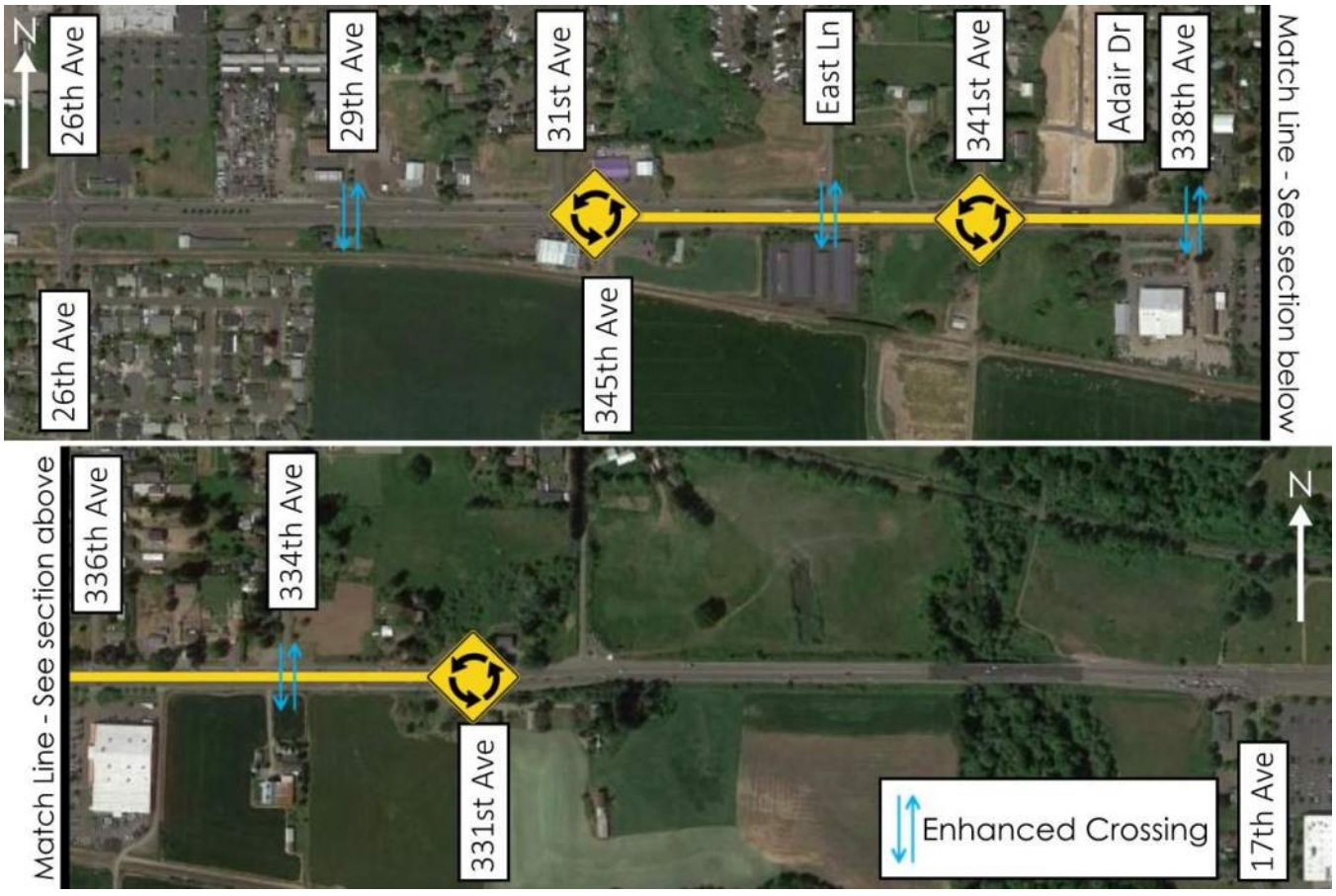
This option would involve installing roundabouts at key locations to provide access and facilitate U-turns, as shown in Exhibit 30. Unlike the signalized intersection option, frontage roads would not be needed because roundabouts accommodate U-turn movements. However, the roundabouts may require additional right-of-way at the locations where they are constructed. Similar to the signalized option, a raised median would be constructed along OR 8 to limit access points to right-in, right-out only. Roundabouts provide an additional speed management benefit to all users requiring all vehicles to slow when approaching and navigating the roundabout. A series of multiple roundabouts on the study corridor would encourage slower speeds along OR 8 rather than simply in one location.

Similar to the signalized option, roundabouts would need to be considered at key locations between 26th Avenue and 17th Avenue, including:

- 345th Avenue (including realignment of 31st Avenue as the north leg of the intersection)
- 341st Avenue
- 331st Avenue

Install Roundabout from Minor Road Stop Control
CRF: 82% reduction in all injury crashes
ODOT Countermeasure Number: H16

Exhibit 30: Illustration of Roundabout Option



Source: Base Image from Google Earth

AGENCY RESPONSE TO SUGGESTIONS

Agency Response to Suggestions				
Immediate Suggestions				
SUGGESTION	**AGENCY RESPONSE / COMMENT**	**CONSIDER**	**REJECT**	**FURTHER DISCUSSION**
Improve intersection sight distance				
Improve reflectivity				
Improve intersection visibility				
Complete systemic signal enhancements				

Agency Response to Suggestions

SUGGESTION	AGENCY RESPONSE / COMMENT	CONSIDER	REJECT	FURTHER DISCUSSION
Install advance signage				
Restripe roadway to install buffered bike lanes				
Install striping for speed management				
Install permanent speed feedback signs				

Agency Response to Suggestions				
SUGGESTION	**AGENCY RESPONSE / COMMENT**	**CONSIDER**	**REJECT**	**FURTHER DISCUSSION**
Engage the community through education and outreach				
Advocate for local connectivity and establish future corridor plan				
Near-Term Suggestions				
SUGGESTION	**AGENCY RESPONSE / COMMENT**	**CONSIDER**	**REJECT**	**FURTHER DISCUSSION**
Install priority enhanced crossings at 334th Avenue and East Lane				

Agency Response to Suggestions

SUGGESTION	AGENCY RESPONSE / COMMENT	CONSIDER	REJECT	FURTHER DISCUSSION
Install sidewalk infill to serve near-term enhanced crossings				
Install ADA-compliant pedestrian ramps in coordination with upcoming projects				
Evaluate lighting				
Review and upgrade bus stop amenities				

Agency Response to Suggestions				
SUGGESTION	**AGENCY RESPONSE / COMMENT**	**CONSIDER**	**REJECT**	**FURTHER DISCUSSION**
Upgrade signalized intersections				
Mid-Term Suggestions				
SUGGESTION	**AGENCY RESPONSE / COMMENT**	**CONSIDER**	**REJECT**	**FURTHER DISCUSSION**
Provide pedestrian facilities				
Install additional enhanced pedestrian crossings				

Agency Response to Suggestions				
SUGGESTION	**AGENCY RESPONSE / COMMENT**	**CONSIDER**	**REJECT**	**FURTHER DISCUSSION**
Install large-scale signalized intersection upgrades				
Long-Term Suggestions				
SUGGESTION	**AGENCY RESPONSE / COMMENT**	**CONSIDER**	**REJECT**	**FURTHER DISCUSSION**
Install corridor illumination				
Complete the pedestrian sidewalk network				

Agency Response to Suggestions

SUGGESTION	AGENCY RESPONSE / COMMENT	CONSIDER	REJECT	FURTHER DISCUSSION
Pursue access management and network connectivity				
Option 1: *Signalized corridor with U-turns and/or frontage roads*				
Option 2: *Series of roundabouts*				