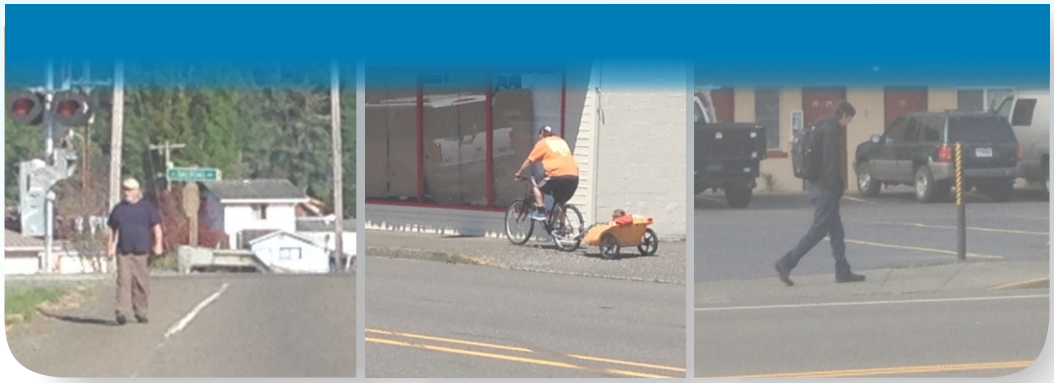
Final Report for

Reedsport Pedestrian Safety Study



Prepared for

Oregon Department of Transportation

Prepared by

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in association with

REEDSPORT

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CHAPTER 1

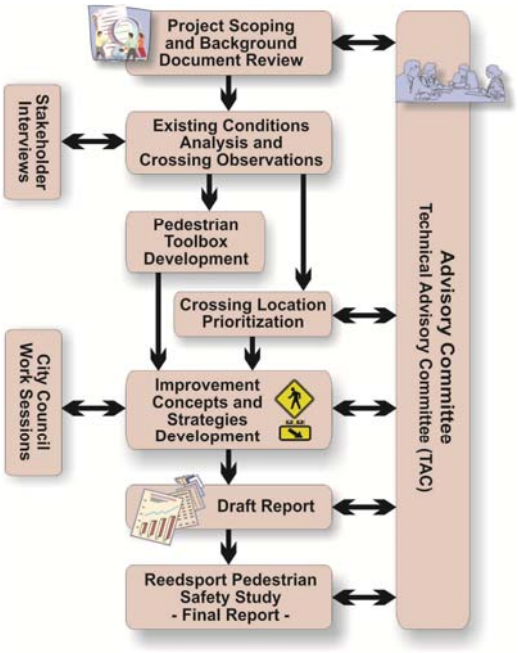
EXECUTIVE SUMMARY

INTRODUCTION

The US 101 and OR 38 corridors in Reedsport, Oregon are a safety concern for ODOT and City staff and well as residents in the area. Fatal and serious injury pedestrian crashes along the study corridors have led to ODOT and the City of Reedsport partnering to prepare a safety plan that will improve safety for all modes of travel. The primary emphasis for this study was to provide safe pedestrian and bicycle crossings on US 101 and OR 38. This study consisted of public involvement and technical analysis. The result was a compilation of recommended safety projects along the US 101 and OR 38 study corridors.

PUBLIC INVOLVEMENT

The Oregon Department of Transportation (ODOT) managed the Reedsport Pedestrian Safety Study in partnership with the City of Reedsport. Project stakeholders (including Reedsport Community Charter School, Reedsport elected officials, Reedsport Police, and two additional City of Reedsport staff members) provided feedback on all components of the study. A schematic of the study process is shown at right.



Safety Study Process

Primary direction and input were provided by the Technical Advisory Committee (TAC). This committee directed the study, reviewed methods and findings, and assisted in reaching consensus on project recommendations. Members of the TAC included agency staff from ODOT and the City of Reedsport.

Additional public involvement included one-on-one stakeholder interviews and a City Council work session. These involvement opportunities allowed citizens to comment on the plan, make

suggestions, voice concerns, and provide feedback.

TECHNICAL ANALYSIS

Technical analysis included data collection, pedestrian crossing observations, and crossing improvement location prioritization. Corridor-wide analysis was also performed. The crossing observations were made at multiple locations along US 101 and OR 38, and indicated a clear need for additional pedestrian and bicycle crossing accommodations along the corridors. Pictures of some observed crossings are shown below.

Pedestrians Crossing US 101 near 20th Street destined for 7-Eleven

OR 38 Westbound Entering Downtown Reedsport near 3rd Street

The analysis emphasized high pedestrian activity locations including businesses (primarily convenient stores), schools, and hotels. The primary factors contributing to pedestrian safety concerns include:

High vehicular speeds and volumes
Wide roadway cross section
Lack of center turn lanes for existing four-lane cross sections
Inconsistent roadway lighting (which particularly affects nighttime safety)
Absence of pedestrian crossing treatments (i.e. refuge medians, beacons and signage)

Pedestrian Toolbox

To assist in the selection of recommended conceptual crossing treatments, a toolbox of available pedestrian crossing treatments was prepared and refined to include only those treatments were considered feasible for the US 101 and OR 38 corridors. Two example strategies are shown below. See Chapter 3 (Pedestrian Crossing Treatment Toolbox) for the complete list of treatments.

Pedestrian Toolbox Example Treatments (on left: Overhead Flashing Beacon; on right: RRFB Sign Assembly)

RECOMMENDED PROJECTS

Recommended projects include conceptual unsignalized crossing and traffic signal improvements as well as corridor-wide projects. Planning level cost

estimates were also prepared for the projects.

Conceptual Crossing Improvements

Crossing improvement concepts were developed for four unsignalized locations (listed in order of priority):

Short-Term Priority

1. US 101/20th Street
2. OR 38/3rd Street

Mid-Term Priority

3. US 101/14th Street
4. US 101/21st Street

At the first priority location, recommended improvement treatments include Rectangular Rapid Flashing Beacons (RRFB) or overhead beacons (depending on the median or curb extension treatment), pedestrian refuge medians, curb extensions, and supplemental street lighting. At the second priority location, curb extensions and supplementary lighting is recommended. At the third and fourth priority locations, supplementary street lighting is the only treatment recommended at this time.

A fifth crossing location along US 101 near Juniper Avenue was also considered. However, due to current land uses, non-conforming access spacing, connectivity challenges, and inconsistent pedestrian crossing locations, pedestrian crossing improvements were not perceived to significantly facilitate safe pedestrian activity across US 101.

Chapter 4 (Pedestrian Improvement Concepts) discusses the conceptual crossing improvements in greater detail. All concepts are subject to project development and the concepts may change based on additional analysis and stakeholder feedback.

Traffic Signal Improvements

Signalized intersection safety improvements were also considered at two key intersections along the study corridors listed below in order of priority:

Short-Term Priority

1. US 101/22nd Street

Mid-Term Priority

2. US 101/OR 38 Junction

Improvements at the first traffic signal location include supplementary lighting, left turn signal head modification, signal phasing modifications, and restriping the 22nd Street approaches. An image of the current signal head as well as the desired left turn signal head is included below.

Left: Current Signal Head
Right: Desired Left-Turn Signal Head

At the second priority traffic signal location, only supplementary lighting is recommended.

Corridor-Wide Projects

Corridor-wide safety treatments were also considered along the entire length of the study area corridors and include:

- Pedestrian Countdown Timers
- Street Lighting
- Speed Feedback Signs
- Lane Conversions

No specific locations were identified for access management with the exception of the pedestrian crossing improvement locations Chapter 4 discusses the corridor-wide projects in greater detail.

US 101 Lane Conversions

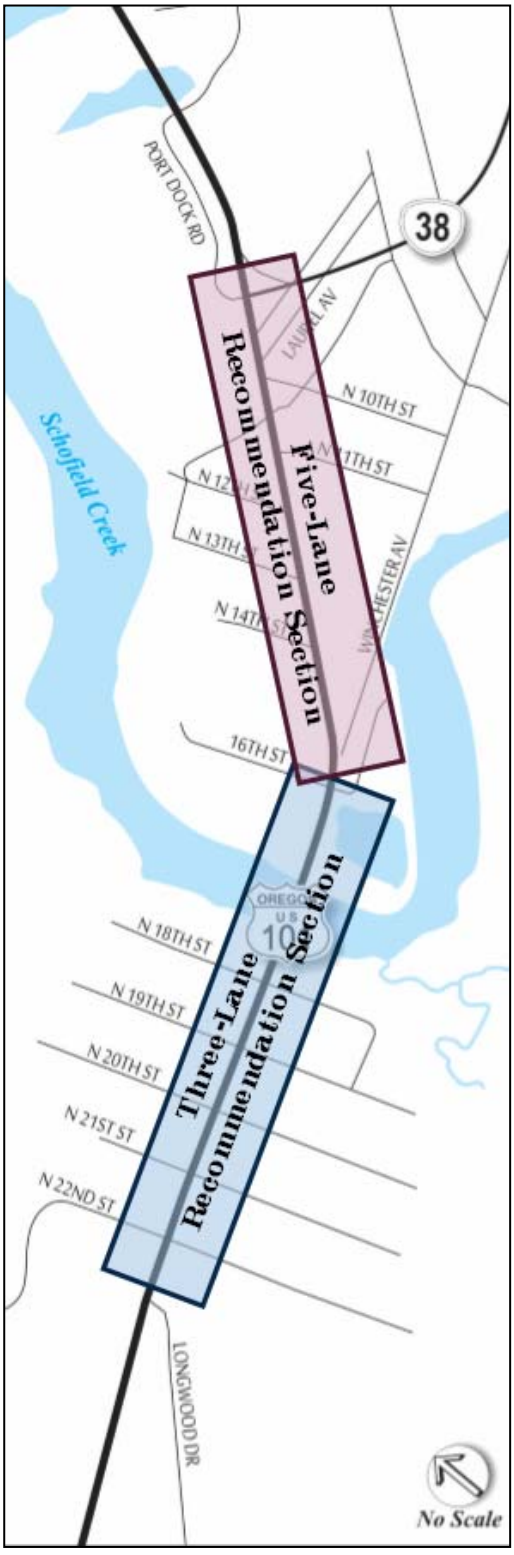
The section of US 101 south of 16th street presents an opportunity to consider a three-lane roadway conversion to increase corridor safety due to the surrounding land uses, available roadway width, collision analysis, and motor vehicle volumes.

Since the land uses along US 101 north of 16th Street may not benefit directly from a three-lane conversion and the pedestrian volumes were lower in this section, a continuous five-lane conversion in this portion of US 101 could be beneficial.

A figure displaying the regions of the proposed three-lane and five-lane cross sections along US 101 is shown to the right.

Details regarding potential US 101 lane conversions can be found in Chapter 5.

Approximate Recommend Cross-Section Segments along the US 101 Study Corridor



Cost Estimates

Cost estimates were prepared for the recommended projects and are provided in Chapter 6, which is reproduced to the right. As shown, the total estimated cost is between $217,000 and $337,000 for all crossing improvement locations, $45,000 for all signalized improvement locations, and $50,000 for corridor-wide improvements. All projects combined are estimated to cost between $312,000 and $432,000.

Cost Estimates of Recommended Safety Projects

Safety Improvement	Total Cost
Crossing Improvement Locations	
US 101/20th Street (Option A)	$110,000
US 101/20th Street (Option B)	$230,000
US 101/21st Street	$14,000
US 101/14th Street	$28,000
OR 38/3rd Street	$65,000
Total Crossing Location Improvements	**$217,000 - $337,000**
Signalized Improvement Locations	
US 101/22nd Street	$25,000
US 101/OR 38 Junction	$20,000
Total Signalized Location Improvements	**$45,000**
Corridor-Wide Treatments	
Pedestrian Countdown Timers	$10,000
Speed Feedback Signs	$40,000
Total Corridor-Wide Treatments	**$50,000**
TOTAL	**$312,000 - $432,000**

Cost estimates for the three-lane conversion option along US 101 south of 16th Street were also prepared and are show in the following table.

Under the assumption of the three-lane conversion, total costs for roadway treatments are approximately $220,000, $28,000 for crossing improvement locations, and $70,000 and the total costs for signalized and corridor-wide treatments are approximately $70,000. The estimated total cost for all combined projects is $503,000.

Cost Estimates Assuming a Three-Lane Conversion along US 101 from 16th Street to 21st Street

Safety Improvement	Total Cost
Three-Lane Roadway Conversions from 16th Street to 21st Street	
Striping and Striping	$100,000
22nd Signal Modifications	$50,000
19th Signal Modifications	$70,000
Total Roadway Treatments	**$220,000**
Crossing Improvement Locations	
US 101/20th Street (Option C)	$120,000
US 101/14th Street	$28,000
OR 38/3rd Street	$65,000
Total Crossing Improvements	**$213,000**
Signalized and Corridor-Wide Treatments	
US 101/OR 38 Junction	$20,000
Pedestrian Countdown Timers[b]	$10,000
Speed Feedback Signs	$40,000
Total Signalized and Corridor-Wide Treatments	**$70,000**
TOTAL	**$503,000**

Chapter 6 provides additional cost estimate and prioritization information for each project. These project implementation resources are intended to assist ODOT and the City of Reedsport, in using this study as a tool for acquiring the needed project funding.

CHAPTER 2 EXISTING CONDITIONS

Existing transportation conditions were evaluated for the US 101 and OR 38 study corridors in the City of Reedsport, Oregon. The US 101 study corridor spans approximately 1.3 miles from the south end of the bridge on Umpqua River to just south of 22nd Street (MP 211.5 to MP 212.8). The OR 38 study corridor ranges from the US 101/OR 38 Junction to 2nd Street and is approximately 0.65 miles in length (MP 0.0 to MP 0.65). Both corridors are shown as the project study area in Figure 2-1.

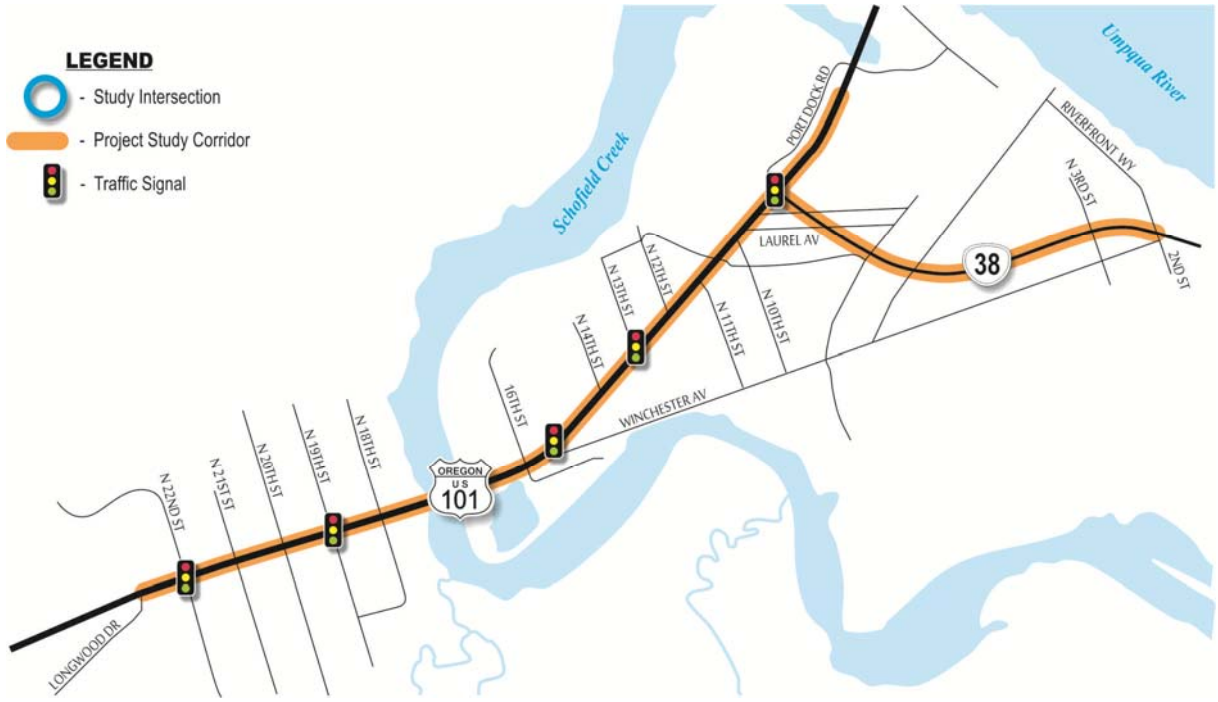


Figure 2-1: Reedsport Pedestrian Safety Study Area

The existing conditions analysis considered current pedestrian and bicycle facilities and activity, pedestrian conflict analysis, collision analysis, and motor vehicle analysis. The following sections of this chapter address each of these issues.

PEDESTRIAN AND BICYCLE FACILITIES AND ACTIVITY

Pedestrian facilities and activity were observed along the US 101 and OR 38 corridors with emphasis at select locations identified by the TAC. These locations were selected based on local knowledge,[1] pedestrian generators in the area (especially businesses such as restaurants and convenience stores) that would have higher percentages of walk-in users), and recent pedestrian collision information.

Pedestrian Facilities

A map of the pedestrian facilities is provided in Figure 2-2. Sidewalk facilities are present on the southern/eastern side of the US 101 corridor throughout the entire study area. The majority of the northern/western side of the US 101 corridor possess sidewalk facilities but there are gaps between the 10th Street and Myrtle Avenue cross streets. There are five signalized intersections that accommodate signalized pedestrian crossings (including the US 101/OR 38 intersection) and two unsignalized intersections with marked crosswalks.

Both sides of the OR 38 corridor currently have sidewalk facilities between 6th Street and 3rd Street. However, there are no sidewalks on either side of the OR 38 corridor between the US 101/OR38 intersection and 6th Street. As discussed during the project kick-off meeting, Reedsport City staff is currently working with the railroad to provide better pedestrian connectivity through the railroad crossing in this segment of OR 38. There are three unsignalized intersections with marked crosswalks and one signalized intersection (US 101/OR 38 intersection) along the OR 38 corridor within the study area boundary.

Pedestrian walking on shoulder near Railroad crossing along OR 38

Pedestrian Activity

Pedestrian crossing activity was observed for the a.m., afternoon, and p.m. peak hours along US 101 and OR 38 at four locations selected by the TAC (each location covered approximately 500 feet in each direction). These locations are shown in Figure 2-2. Pedestrian counts were taken on June 11, 2014 with the exception of US 101 between 12th Street and 10th Street where the counts were taken on June 5, 2014.

[1] *Local knowledge was provided at a project kick-off meeting with ODOT and City of Reedsport staff as well as stakeholder interviews with the Reedsport Community Charter School, Reedsport Elected Officials, a Police Officer, and two additional City of Reedsport staff members.*

Both occasions were dry days and expected to have typical pedestrian activity levels. The following locations had the highest crossing activity levels:

- US 101/20th Street: 45 total during a.m., afternoon, and p.m. peak hours
- US 101/22nd Street: 38 total during a.m., afternoon, and p.m. peak hours
- US 101/21st Street: 17 total during a.m., afternoon, and p.m. peak hours

The highest crossing volumes at these intersections occur during the afternoon peak, which is expected due to Reedsport Community Charter School's open campus lunch hour policy for high school students and the location of 7-Eleven and other lunch related uses on the opposite side of US 101. Pedestrian crossing volumes were collected from the pedestrian counts and are shown in Table 2-1 and Figure 2-2.

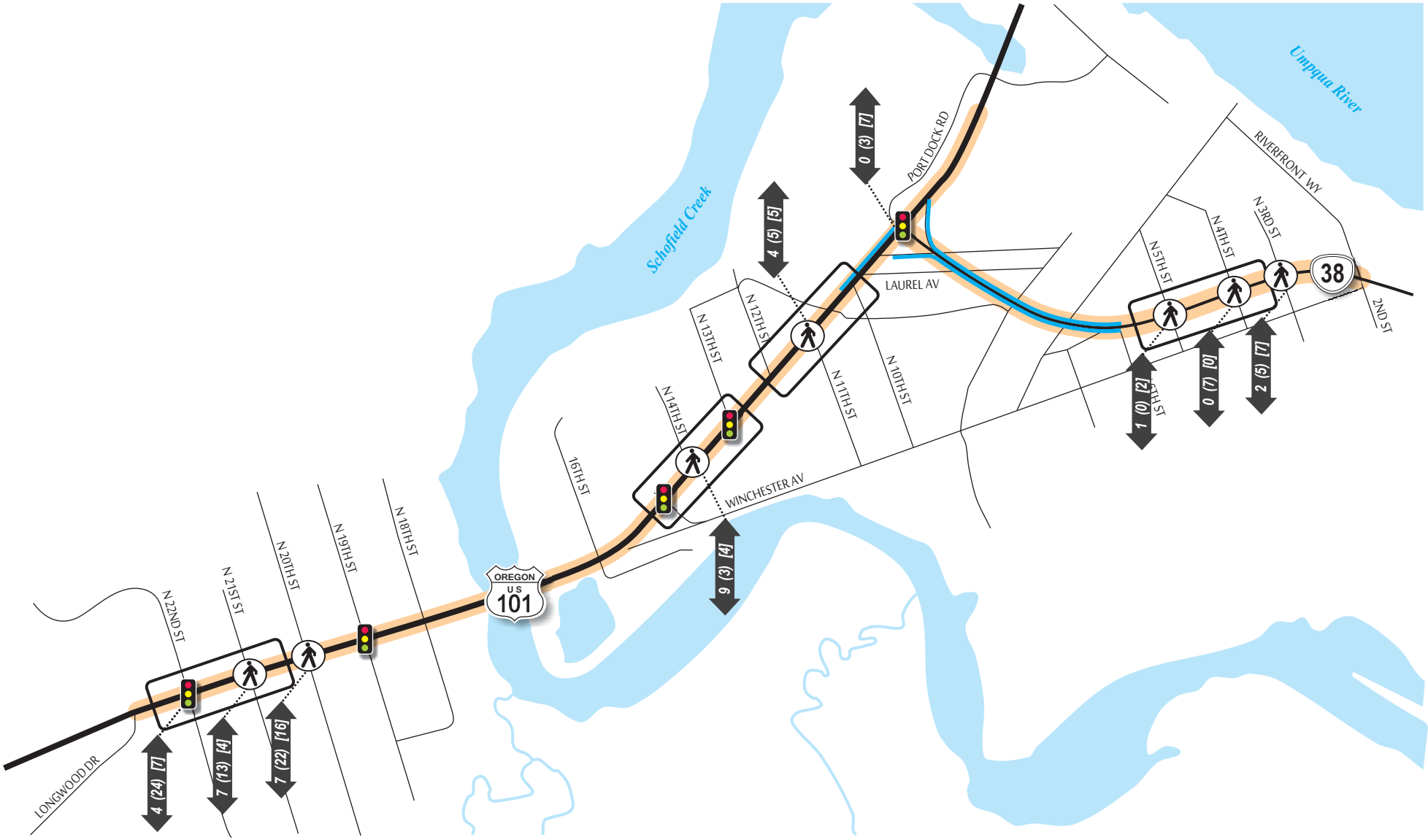
Table 2-1: US 101 and OR 38 Study Area Pedestrian Crossing Volumes

Study Intersection (Signalized Y/N)	A.M. Peak Hour Pedestrian Crossings			Afternoon Peak Hour Pedestrian Crossings			P.M. Peak Hour Pedestrian Crossings		
	Crosswalk	*Mid-Block*		*Crosswalk*	*Mid-Block*		*Crosswalk*	*Mid-Block*	
US 101/22nd Street (Y)	7			24			7		
US 101/21st Street (N)	4	3		10	3		3	1	
US 101/20th Street (N)	7			22			16		
OR 38/5th Street (N)	1			0			2		
OR 38/4th Street (N)	0	0		4	7		3	0	
OR 38/3rd Street (N)	2			5			7		
Study Location (Approx. 500 feet)	*West*	*East*	*Total*	*West*	*East*	*Total*	*West*	*East*	*Total*
US 101/Winchester Ave & 13th Street	4	5	9	3	0	3	2	2	4
US 101/12th Street & 10th Street	4	1	5	1	4	5	4	0	4

Bicycle Facilities and Activity

Bicycle facilities and activity were observed at the same locations as previously discussed in the pedestrian activity section. There are currently no bicycle lanes or facilities along either the US101 or OR 38 corridors studied, and bike volumes are low in both areas. The majority of existing bicyclists observed on US 101, an Oregon Coast Bike Route, travel on the existing sidewalks.

Student Crossing US 101 at the 22nd Street Signal toward Reedsport Community Charter School



LEGEND

- Signalized Pedestrian Crossing
- Approximate Location of 500 ft Pedestrian Count Segment
- Sidewalk Gap
- Project Study Corridor

AM (Afternoon 2-4pm) [PM]
HIGHEST HOURLY PEDESTRIAN VOLUMES DURING PEAK MOTOR VEHICLE PERIODS

DKS

No Scale

Figure **2-2**

2014 PEDESTRIAN FACILITIES AND VOLUMES

PEDESTRIAN CROSSING CONFLICT ANALYSIS

Pedestrian crossing conflict analysis was performed along the US 101 and OR 38 study corridors at four locations during the a.m., afternoon, and p.m. motor vehicle peak periods. The purpose of the conflict analysis was to observe pedestrian (and bicycle) crossing behavior in the field to better understand the safety problems identified from the collision records and to identify other safety related problems along the corridor that are not easily identified from collision records alone.

The selection of the four locations was performed by the TAC and considered various criteria, including high concentration of pedestrian collisions, high pedestrian crossing volumes, distance from nearest signalized crossing, and nearby pedestrian generators (including schools, markets, etc.). The four locations selected include the following listed from west to east:

- US 101 between 21st Street and 20th Street
- US 101 between Winchester Avenue and 13th Street
- US 101 between 11th Street and 10th Street
- OR 38 between 5th Street and 4th Street

Pedestrian crossing US 101 destined for 7-Eleven

During the observations, activity along the study corridors was also observed. A summary of the conflict analysis is provided in Table 2-2, which lists the number of crossing incidents observed during a one-hour portion of each of the motor vehicle peak periods and also identifies the key crossing location(s) in the vicinity of each area.

At the 21st Street through 20th Street segment of US 101 lunchtime observations were also performed from 11:30 a.m. to 12:30 p.m. due to the proximity of Reedsport Community Charter School and the expected crossing activity from high school students to the nearby 7-Eleven and various restaurants on the opposite side of US 101.

As shown in Table 2-2 at the top of the next page, each location had a unique trend in the variation of the number of pedestrian crossing volumes throughout the day. Most of the locations had one or two key crossing areas, which typically occurred at an intersection or near a key business.

Table 2-2: Conflict Analysis Summary for Selected Locations along US 101 and OR 38

Selected Location	Crossing Incidents by Time of Day[a]			Key Crossing Location(s)
	A.M.	*Afternoon*	*P.M.*	
US 101/21st Street	6	11	3	Majority of crossings occurred on east side of 21st Street
US 101/20th Street	5	22	2	Majority of crossings occurred on the east side of 20th Street near the 7-Eleven market
US 101/Winchester Avenue	2	2	1	Crossings were spread along the roadway section; however, key origins/destinations were hotels and the retail and supermarkets
US 101/10th Street	2	0	1	Midblock crossings between 10th Street and 11th Street occurred
OR 38/5th Street	1	0	2	Two crossings occurred on the west side of 5th street
OR 38/4th Street	1	1	3	Crossings were spread across the study location

[a]Crossing incidents were observed for one hour, which was within the two-hour motor vehicle peak hour period window. When multiple people crossed together, they were counted as one single incident.

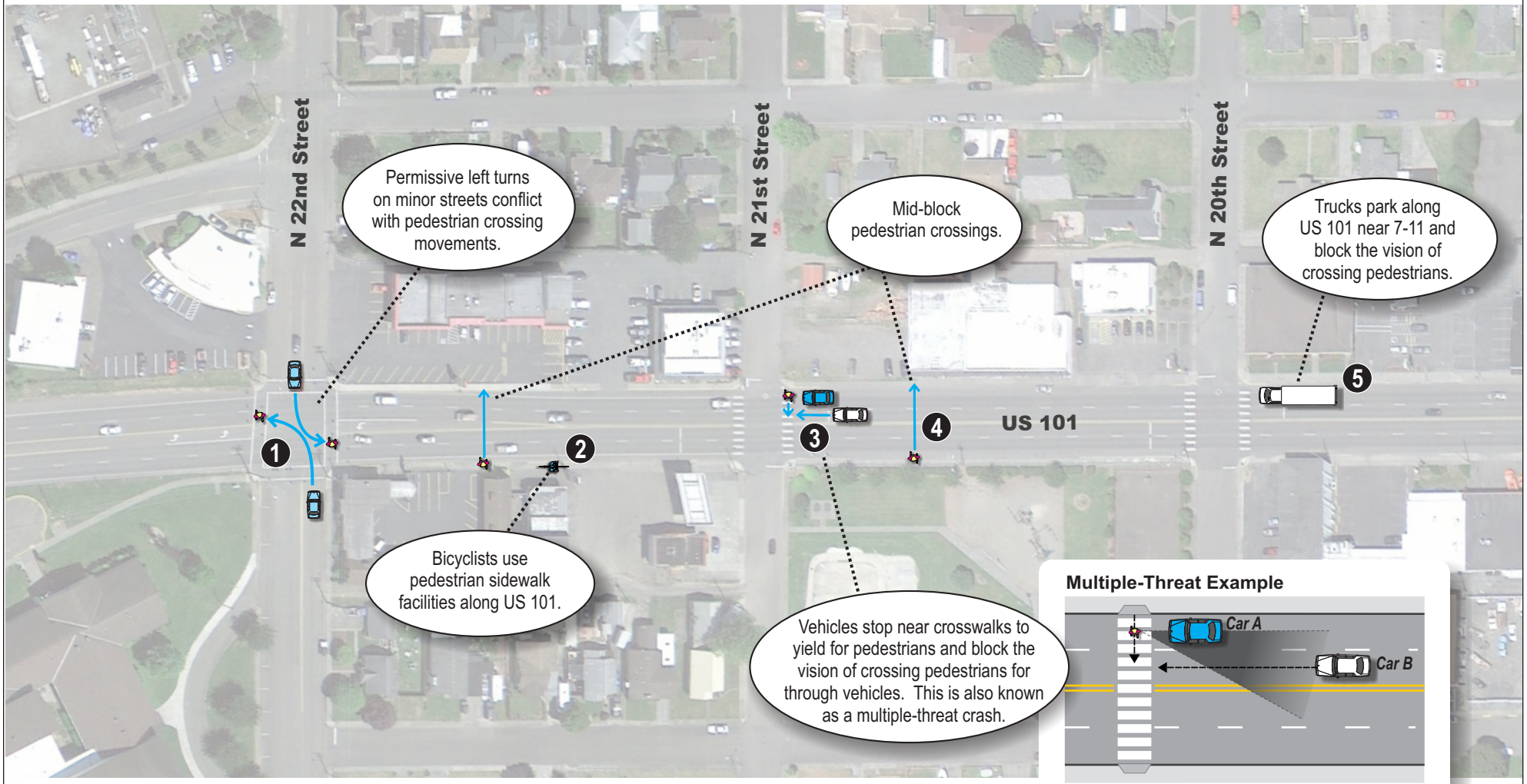
Details regarding the observed activity and patterns for each location are discussed in the following sections.

US 101 between 22nd Street and 20th Street

Most pedestrian crossings near the unsignalized 22nd and 21st Street intersections were made by children and young adults during the morning, afternoon, and end of school observation hours. It was also observed that bicycle activity was relatively low and almost all of the bicyclists traveled on the sidewalks along US 101.

Bicyclists on the sidewalk present several safety issues for pedestrians and the bicyclists themselves. Pedestrians aren't always capable of responding quickly to cyclists on sidewalks, especially elderly pedestrians or those with pets or strollers creating potential to result in minor injuries. Bicyclists traveling on the sidewalks are difficult for motor vehicles to see when they are riding behind trees, parked cars and other objects. Figure 2-3 displays further conflicts that have occurred or have the potential to occur in the future along the US 101 study corridor near the intersections of 22nd Street through 20th Street.

Bicyclist Traveling on Sidewalk



LEGEND

- Motor Vehicle or Pedestrian Movement
- Motor Vehicle
- Pedestrian
- Bicyclist

DKS

No Scale

Figure **2-3**

2014 CONFLICT ANALYSIS DIAGRAM

Pedestrian Crossing Signage along US 101 near 20th Street

Crossings in the morning were usually in the north to south direction across US 101 due to Reedsport Community Charter School's location on the south side of US 101 near the signalized intersection at 22nd Street. Singular mid-block crossings (crossings not at a striped cross walk location) were observed between 21st and 20th Street, and west of 21st street. Two groups of two pedestrians participated in mid-block crossings to the north of 20th on a path toward Reedsport Community Charter School.

Reedsport Community Charter School's open lunch period was observed to be the peak pedestrian interval. Many groups of students emerged during the start of the afternoon observation hour and crossed from the south side of US 101 toward the 7-11 and various other food options located to the north. However, north to south movements were observed toward the end of the afternoon observation period due to the children returning to Reedsport Community Charter School on the south side of US 101. The majority of unsignalized pedestrian crossings took place on the west leg of the 21st Street intersection to and from the 7-11 during the afternoon observation period.

The majority of pedestrian crossings during the PM observation hours were groups traveling south to north across US 101 as students traveled away from Reedsport Community Charter School. However, there were also small groups observed to be traveling in the opposite direction (north to south) across US 101 which is most likely due to after school activities.

Due to the lack of turn lanes present in this segment of US 101, left lane vehicles that stop for pedestrians block the vison of curb lane vehicles and has the potential to cause a pedestrian conflict. Furthermore, curb lane vehicles may be accustomed to stopped vehicles in the left lane that are waiting for a gap in the oncoming traffic to turn left. This may cause curb lane vehicles to expect the left lane vehicle is waiting to turn left when the left lane vehicle is actually

Semi-Truck Parked along US 101 near 20th Street

stopping for a pedestrian crossing the street. This confusion could result in a vehicle-pedestrian conflict with the curb lane vehicle. Although this conflict was not observed, the potential for conflict was evident and was verified in stakeholder interview discussions.

US 101 between Winchester Avenue and 13th Street

Only a few pedestrian crossings across US 101 occurred during the morning, afternoon, and evening observation times. Most of the pedestrian crossing movements were performed by adults in this area of study. The majority of pedestrian crossings occurred on the western leg of the 14th Street intersection and the eastern leg of the Winchester Avenue intersection due to the Best Western Hotel on the south side of US 101 and Safeway, coffee shops, and other food and retail sources on the north side. Bicyclists would occasionally travel along this portion of the corridor and were often observed to be riding on the sidewalks on both sides of US 101.

Cross Section of US 101 near 14th Street

US 101 between 11th Street and 10th Street

Low pedestrian crossing volumes were observed during the morning, afternoon, and evening observation periods but the highest amount of pedestrian movements in this area occurred during the morning observation. Mid-block crossings across US 101 occurred between Juniper Ave and 10th as well as Laurel Ave and OR 38. Little bicycle activity was observed along this portion of the corridor and most bicyclists were seen riding on the sidewalk.

Cross Section of US 101 near 10th Street

OR 38 between 5th Street and 4th Street

Only a few pedestrians were observed crossing this section of OR 38 during the morning, afternoon, and evening observations. Pedestrian crossings were mostly performed by adults and seen on the eastern leg of the 4th Street intersection and the western leg of the 5th Street intersection. The key pedestrian generators in this area are the Post Office and The Sugar Shack, a local bakery. No conflicts between vehicles, pedestrians and bicycles were observed.

Street Lighting Observations

Street lighting observations were conducted along the US 101 and OR 38 study area corridors on June 3rd 2014. Even though there is some existing street lighting along the majority of the US 101 and OR 38 corridors within the study area boundary, a reflection of the observed light levels indicate that additional lighting along both study corridors is recommended.[2] Table 2-3 describes in more detail the lighting observations at key locations along the US 101 and OR 38 study corridors.

Table 2-3: US 101 and OR 38 Study Area Street Lighting Observations

Location	Comments	Recommendation
US 101		
OR 38 to 22nd St (Segment)	Currently intermittent street lights (vary between 200 and 250 W) on wood poles. There are many locations with poor uniformity where additional lighting is needed.	Additional Lighting Needed
US 101/OR 38 Junction	There are two street lights currently at the intersection that offer some light but additional lighting is needed to improve light levels and uniformity.	Additional Lighting Needed
20th St	Only one 200 W street light on the southwest corner of the intersection is present and does not provide adequate lighting levels or uniformity for the intersection.	Additional Lighting Needed
21st St	Only one 200 W street light is present at the intersection and does not provide adequate lighting levels or uniformity for the intersection.	Additional Lighting Needed
22nd St	Two street lights mounted on wooden poles are present at this intersection. Additional lighting is needed to improve light levels and uniformity.	Additional Lighting Needed
OR 38		
US 101 to 6th St (Segment)	Limited lighting is currently present along this segment.	Additional Lighting Needed
6th St to 3rd St (Segment)	Ornamental street lights currently provide adequate lighting levels and uniformity.	None
3rd St	Limited lighting is currently present at this intersection. Additional lights needed to meet light levels and uniformity.	Additional Lighting Needed

COLLISION ANALYSIS

The collision analysis for the US 101 and OR 38 corridors considered ODOT's Safety Priority Index System (SPIS) findings and the past ten years of available collision data. The intent was to identify trends as well as potentially hazardous locations in need of mitigation.

Safety Priority Index System (SPIS)

The Safety Priority Index System (SPIS) is a ranking system developed by ODOT to identify potential safety problems on state highways. SPIS scores are developed based upon crash

[2] *All lighting recommendations are based on the standards located in the Traffic Lighting Design Manual, ODOT, July 2009.*

frequency, severity, and rate for a 0.10 mile or variable length segment along the state highway over a rolling three-year window (i.e., every year it is updated with the most recent three years). For the most current three years analyzed (2010-2012), there are no SPIS locations in Reedsport along either the US 101 or the OR 38 corridor that are in the top 15 percent of statewide SPIS sites.

ODOT Collision Data

This evaluation considered the most recent ten years (2003-2013) of collision data obtained from the ODOT Crash and Analysis Reporting Unit. Since latitude and longitude information wasn't available for the years 2003 through 2007, only key collisions (fatalities and severe injuries) from this time period were mapped in Figure 2-4, in addition to the collision data from 2007 to 2013.

Table 2-4 summarizes collisions along both study corridors and includes collision severity, collisions per year, and the average collision rate for the ten year period. Overall, the yearly collision rate for the US 101 corridor is 3.01 collisions per million vehicle-miles traveled and for the OR 38 corridor is 2.77 collisions per million vehicle-miles traveled. The average ODOT State Highway Crash Rate for similar function classification roadways[3] is 1.48 collisions per million vehicle-miles traveled.[4] Therefore, the study area corridor crash rate is 103 percent greater for the US 101 corridor and 87 percent greater for the OR 38 corridor than the state average for similar facilities.

Table 2-4: US 101 and OR 38 Study Area Collision Data (2003 through 2013)

Corridor (Distance)	Collisions (by Severity)				Collisions per Year	Collision Rate[b,c]
	Fatal	*Injury*	*PDO[a]*	*Total*		
US 101 (1.3 mi.)	1	58	72	130	13.0	3.01
OR 38 (0.65 mi.)	0	6	17	23	2.3	2.77

[a] PDO = Property Damage Only.
[b] Rate Calculation = Collisions per year / (Average Daily Traffic x 365 days / 1 million vehicle-miles traveled)
[c] An average ADT for each corridor was used to calculate the collision rate.

The collision data in Table 2-4 and Figure 2-4 also shows one fatal collision along the US 101 corridor between 2003 and 2013. The fatality was a pedestrian death that occurred near 16th Street along the US 101 corridor. Collision reports state that the pedestrian fatality occurred at night during conditions characterized as, "dark with street lights" also during clear and dry weather conditions. The injury A collisions at US 101/16th Street and OR 38/W Railroad Ave were reported to have occurred under dry and clear conditions during daylight hours. The injury A collision that occurred at OR 38/Myrtle Ave was reported during rainy conditions during night hours.

[3] *State Highway System – Rural Highway System, Rural Cities, Other Principal Arterials*

[4] *2012 State Highway Crash Rate Tables, ODOT Crash Analysis and Reporting Unit, July 2012; Table IV.*

Figure 2-4: Collisions by Severity (2003 through 2013)[4]

Further investigation was performed for the corridor to assess whether there are any clear trends in the collision data. First, the collision data for 2003 through 2013 was broken down by the type of collision. Table 2-5 shows the collision breakdown by type for each the study corridor segments. As shown, the most prevalent collision types were rear-end and turning movement collisions. Together they account for approximately 75 percent of the total collisions on both corridors, which is typical on urban highways. The majority of turning collisions are likely due to the lack of turn lanes along the US 101 corridor.

Table 2-5: Collision Breakdown by Collision Type (2003 through 2013)

Corridor (Distance)	Collision Breakdown by Collision Type								Total
	Rear-End	*Turn*	*Angle*	*Fixed Obj.*	*Bike/ Ped*	*Side-Swipe*	*Head On*	*Other*	
US 101 (1.3 mi.)	54	39	10	6	6	5	2	2	123
OR 38 (0.65 mi.)	9	5	5	3	0	0	1	0	23
Both Corridors	63	44	15	9	6	5	3	2	146
Percent of Collisions	*43.1%*	*30.0%*	*10.2%*	*6.1%*	*4.0%*	*3.3%*	*2.0%*	*1.3%*	*100%*

Lighting condition is an important factor in collision analysis, and is broken down in Table 2-6. As shown, the greatest number of collisions for both study corridors occurred during the daylight.

[5] *Injury A crash is a severe or debilitating injury B and injury C and injury C type crashes are lower level severity.*

This is expected due to the higher traffic volumes that occur during daylight hours. The second greatest number of collisions for the study area occurred at dusk and night time with street lighting present. All pedestrian collisions from 2003-2013 occurred during daylight hours.

Table 2-6: Collision Breakdown by Lighting Level (2003 through 2013)

Segment (Distance)	Collision Breakdown by Lighting Level				Total
	Daylight	*Dusk*	*Dark with Street Lights*	*Dark without Street Lights*	
US 101 (1.3 mi.)	99	9	8	7	123
OR 38 (0.65 mi.)	18	1	2	2	23
Entire Study Corridor	117	10	10	9	146
Percent of Collisions	*80.1%*	*6.8%*	*6.8%*	*6.2%*	*100%*

ODOT Pedestrian Collision Data

Additional collision analysis with an emphasis on pedestrians was performed for the corridor using the past ten years of available ODOT collision data (i.e., 2003 through 2013). Only pedestrian collisions were considered in the analysis. No pedestrian collisions occurred on the OR 38 study corridor during these 10 years. Of the 4 pedestrian collisions on the US 101 study corridor, 1 resulted in a fatality and the remaining 3 resulted in injuries. The pedestrian collisions are shown by severity in Table 2-7 at the top of the next page from 2003 to 2007. Figure 2-5 displays a map of the pedestrian collisions along US 101.

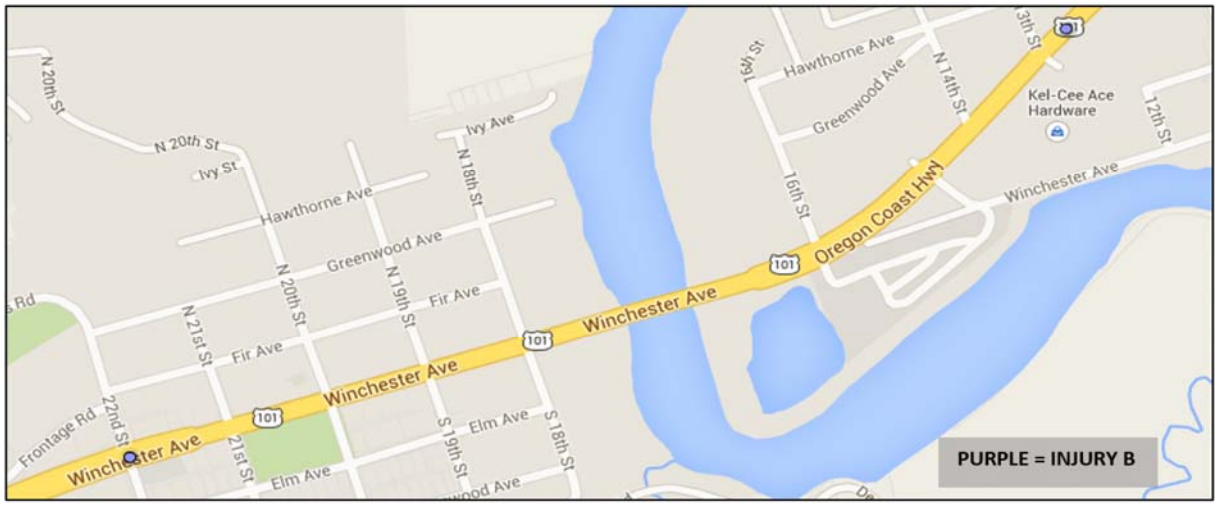


Figure 2-5: Pedestrian Collision Data (2008 - 2013)[5]

[6] *Two injury B collisions involving pedestrian transpired at the intersection of US 101/22nd Street and occurred in 2011 and 2012.*

Table 2-7: Study Area Pedestrian Collision Data (2003 through 2013)

Time Period	Pedestrian Collisions (by Severity)			Pedestrian Collisions per Year per VMT
	Fatal	*Injury*	***Total***	
2003 thru 2013	1	4	5	0.23

MOTOR VEHICLE CONDITIONS

Existing traffic conditions for the US 101 and OR 38 study corridors were evaluated and include roadway network characteristics, vehicular volume, speed, and classification analysis, intersection turn movement counts, mobility standards, existing intersection performance, collision analysis, pedestrian crossing conflict analysis, pedestrian facilities and activity, bicycle facilities and activity, and street lighting observations.

Roadway Network

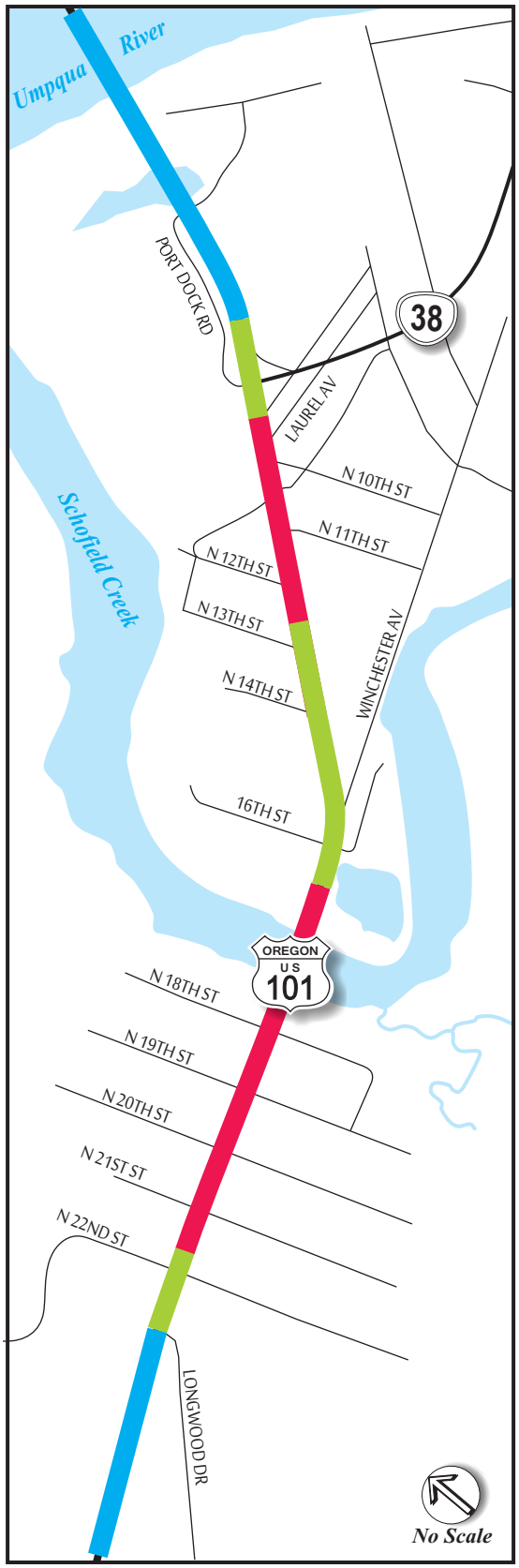
The transportation characteristics of the study area roadway and key cross streets are shown in Table 2-8 which include functional classification, number and direction of travel lanes, posted speeds, and the presence of sidewalks and/or bike lanes. The functional classification is an important roadway characteristic because it specifies the purpose of the facility[7] and is a determining factor of applicable cross-section, access spacing, and intersection performance standards. Existing cross sections along US 101 are shown in Figure 2-6.

Table 2-8: Existing Study Area Roadway Characteristics

Roadway	ODOT Functional Classification	Travel Lanes	Posted Speed	Sidewalk	Bike Lanes
US 101	Principal Arterial	4-5	30	Yes[a]	No
OR 38	Principal Arterial	2	25	Yes[b]	No
22nd Street	Minor Collector	2	25	Yes	No
21st Street	Minor Collector	2	25	Yes	No
20th Street	Minor Collector	2	25	Yes	No
Winchester Ave	Rural Major Collector	2	25	Yes[c]	No
3rd Street[d]	Local Road	2	25	Yes	No

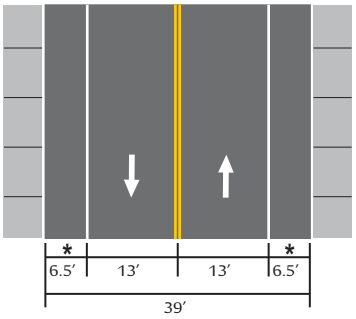
[a]US 101 has sidewalk gaps on the northern/eastern side between 10th Street and Myrtle Avenue.
[b]OR 38 has sidewalk gaps on both sides between US 101/OR 38 Junction and 6th Street.
[c]Sidewalks are present near US 101 intersection but includes significant sidewalk gaps on both sides of corridor.
[d]3rd Street is a key crossing for the OR 38 corridor.

[7] *The primary purpose of an arterial is to provide mobility, whereas at the opposite end of the spectrum, a local road is primarily concerned with site access. Collector roadways provide a transition between arterials and local roads.*



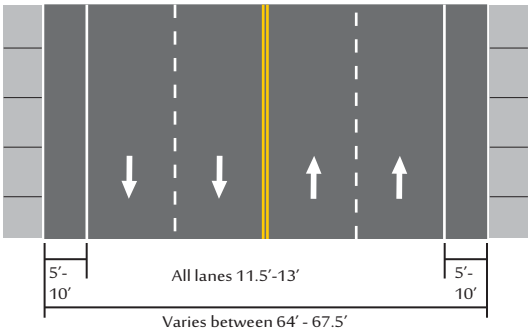
Existing Cross-Sections

2-Lane

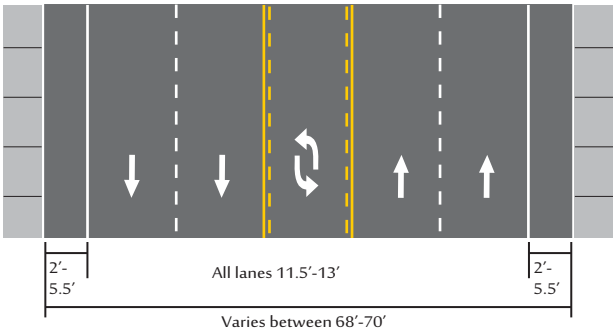


*Cross sections north of Port Dock Road do not include shoulders due to the narrowing effect of the Hwy 101 Bridge.

4-Lane



5-Lane



LEGEND

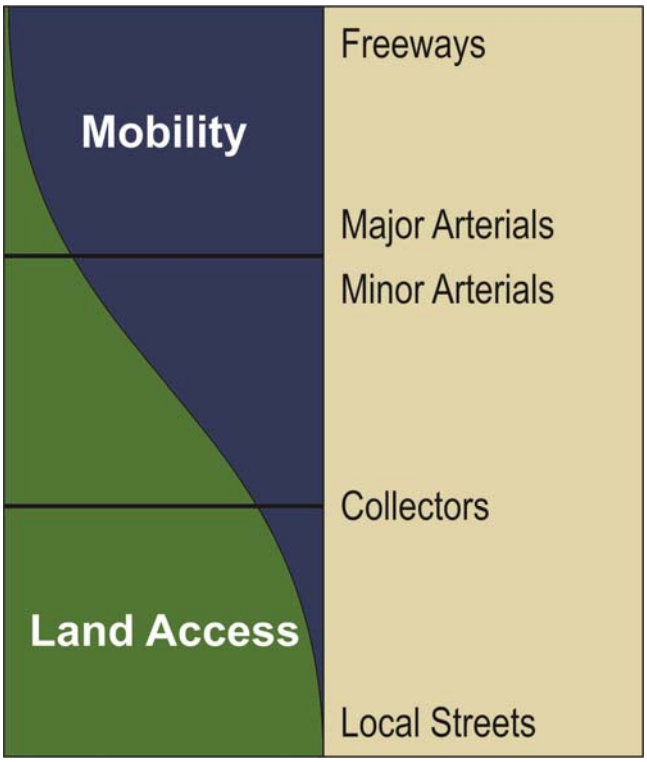
- 2-Lane Cross-Section
- 4-Lane Cross-Section
- 5-Lane Cross-Section

DKS

Figure 2-6

EXISTING CROSS SECTIONS ALONG US 101

US 101 and OR 38 are both classified in the Oregon Highway Plan (OHP)[8] as highways of National Level of importance. US 101 and OR 38 are also designated as freight routes in the OHP and routes for which "No reduction of vehicular capacity" applies (ORS 366.215). That law also says trucks must be allowed a "hole-in-the-air" which is defined by ODOT as, "the entire area (height, width and length) a truck and its load will occupy while traversing a section of roadway." Any proposed solutions that could potentially result in a Reduction of Vehicle-carrying Capacity (RVC) will have to go through further processing to receive full approval.



Functional Classification Hierarchy

The highways in the study area have two or four lane paved cross sections with curbs and sidewalks. The Average Daily Traffic (ADT) count along US 101 for this segment ranges from 9,700 to 12,900 between 22nd Street and OR 38 and 5,300 near the Umpqua River Bridge. Along OR 38 the ADT[9] is approximately 3,500.

Key north-south roadways that intersect US 101 include 22nd Street, 21st Street, 20th Street, and Winchester Avenue. 3rd Street is a key north-south crossing located on the OR 38 corridor within the study area. The functional classifications of the north-south roadways are also shown in Table 2-8 on the previous page.

Vehicular Volume, Speed, and Classification Analysis

Table 2-9 at the top of the next page presents data collected from 24-hour tube counts[10] at three select locations along the US 101 corridor and at one location along the OR 38 corridor. This data includes vehicular bi-directional volumes, 85th percentile speed,[11] and heavy vehicle traffic percentages. As shown in the table, the travel speeds range from 2 to 13 mph above the current posted speeds. This is an important finding relating higher travel speeds and impacts to pedestrians.

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[8] *1999 Oregon Highway Plan (as amended July 2006).*

[9] *All Traffic Data 24-hour classification and speed counts were taken on Thursday, June 5, 2014.*

[10] *All Traffic Data 24-hour classification and speed counts were taken on Thursday June 5, 2014.*

[11] *The 85th percentile speed is defined as the speed below which 85 percent of the vehicles are traveling.*

Table 2-9: US 101 and OR 38 Bi-Directional Volumes, Speeds, and Heavy Vehicle Usage[a]

Surveyed Data	Location along US 101				OR 38
	South of 22nd	*North of 21st Street*	*North of 11th Street*	*North of OR 38*	*East of 3rd Street*
Average Daily Traffic					
Northbound	4,900 (50%)	6,500 (51%)	4,800 (49%)	2,700 (51%)	1,700 (49%)
Southbound	4,900 (50%)	6,400 (49%)	4,900 (51%)	2,600 (49%)	1,800 (51%)
Total	9,800	12,900	9,700	5,300	3,500
85th Percentile Speed					
Northbound	34 mph	32 mph	36 mph	43 mph	38 mph
Southbound	35 mph	32 mph	34 mph	38 mph	34 mph
Posted Speed					
Both Directions	30 mph	30 mph	30 mph	30 mph	25 mph
Truck Traffic Percentage[b]					
Northbound	18%	16%	18%	20%	21%
Southbound	18%	16%	17%	17%	23%

[a] *All Traffic Data 24-hour classification and speed counts were taken on Thursday, June 5, 2014.*
[b] *Specified as vehicles with three or more axles.*

To further understand the vehicular use of US 101 and OR 38 over the course of a 24-hour period, Figure 2-7 shows the vehicle movements throughout the day at the location just north of 21st Street. This graph shows the highest traffic volume for both eastbound and westbound vehicles is during the afternoon.

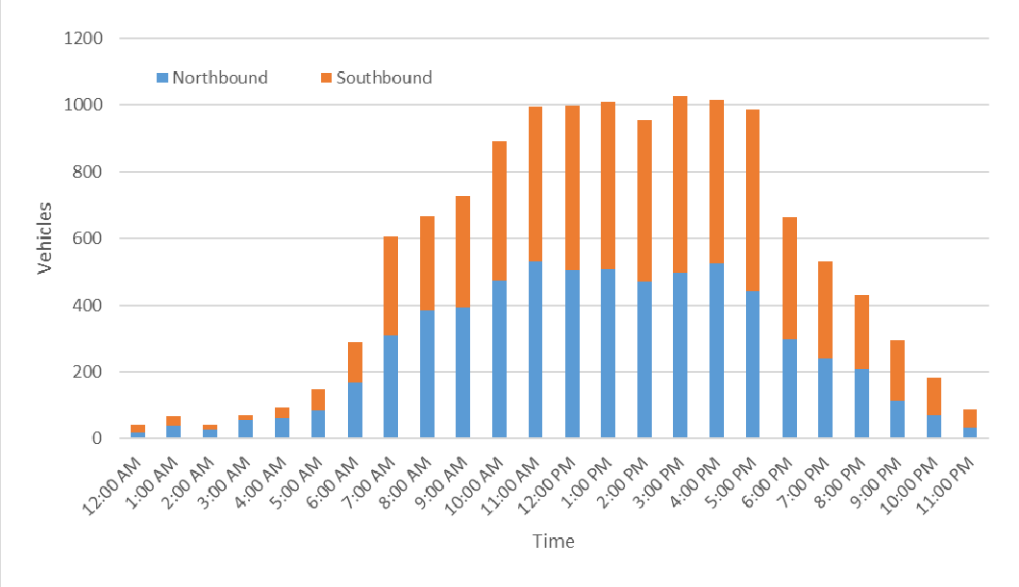


Figure 2-7: US 101 24-Hour Direction Volumes North of 21st Street

Figure 2-8 shows the 24 hour vehicular volumes as well as the highest traffic volume for both eastbound and westbound vehicles is during the afternoon just east of 3rd Street.

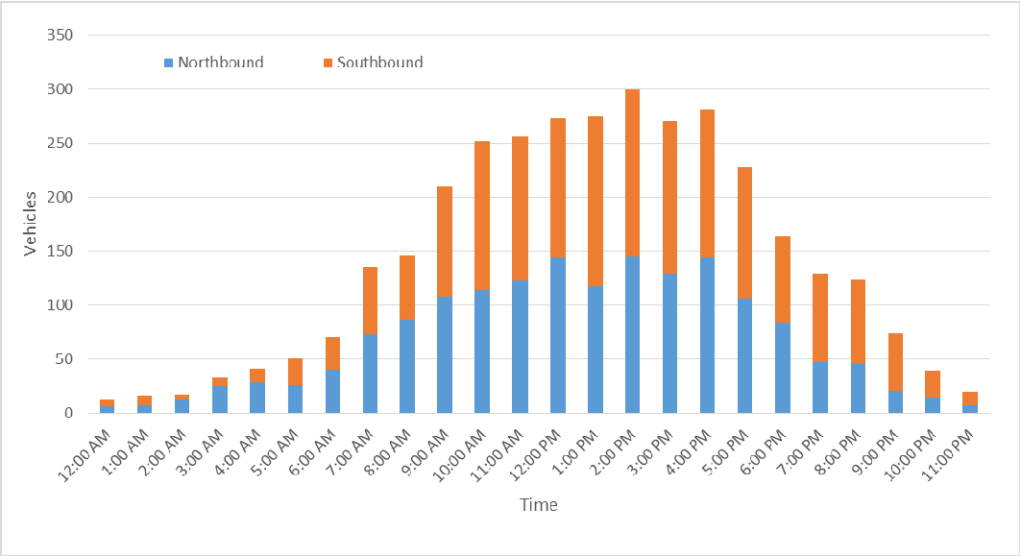


Figure 2-8: OR 38 24-Hour Direction Volumes East of 3rd Street

Intersection Turn Movement Volumes

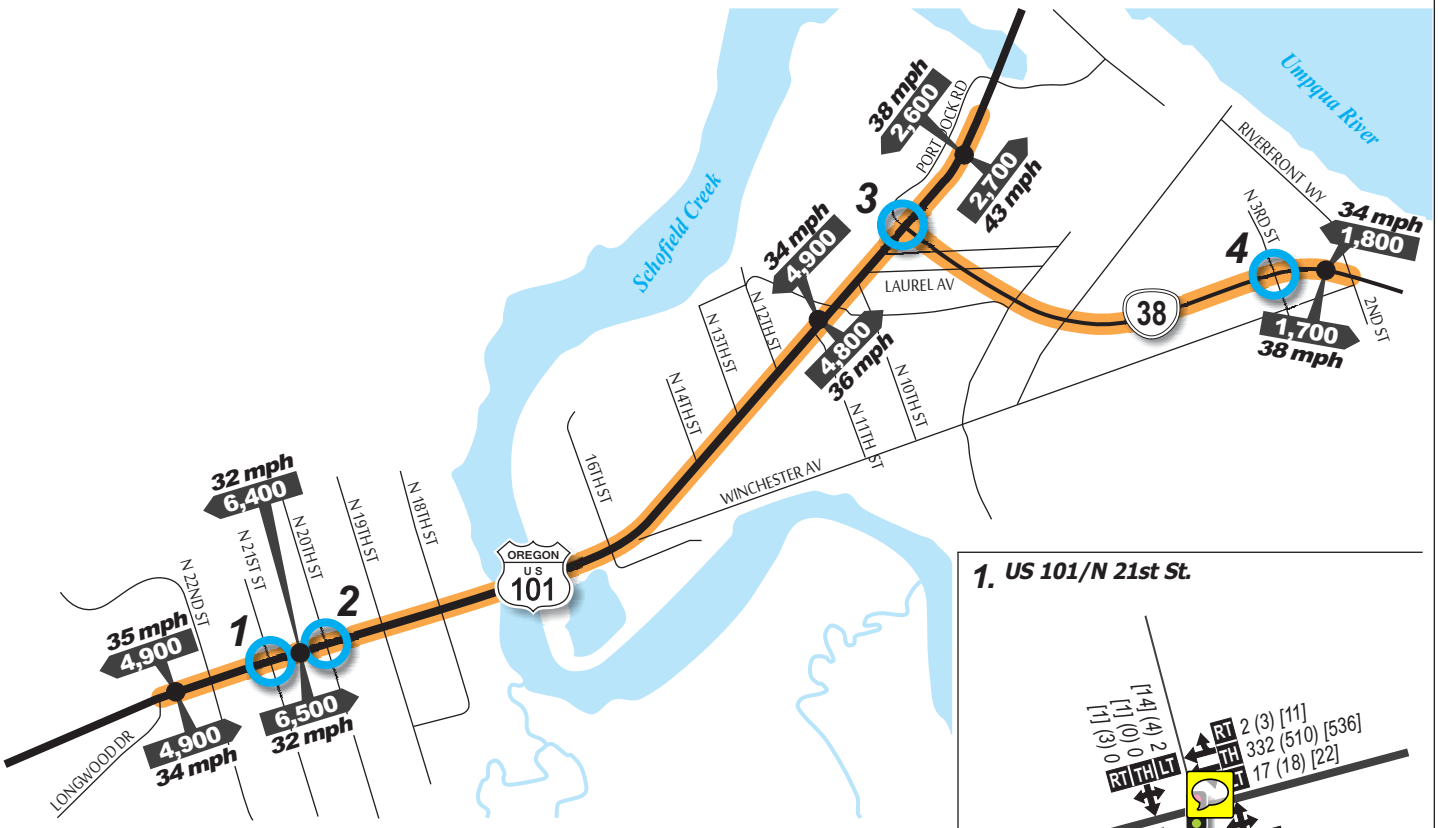
Intersection vehicle turn movement volumes were collected at four intersections along the corridors of study. The US 101/OR 38 intersection is signalized and the remaining are unsignalized. These intersections were selected based on recommendations from the TAC and are listed below from west to east:

- US 101/21st Street
- US 101/20th Street
- US 101/OR 38
- OR 38/3rd Street

The traffic volumes were counted during the a.m. (7:00 a.m. to 9:00 a.m.), afternoon (2:00 p.m. to 4:00 p.m.) and p.m. (4:00 a.m. to 6:00 p.m.) peak periods.[12] The a.m., afternoon, and p.m. peak hour traffic volumes for the four study intersections are shown in Figure 2-9. Also included in Figure 2-9 are the lane configurations and traffic control at the study intersections. The detailed two-hour traffic counts are included in the appendix. Seasonal adjustment rates were provided by ODOT[13] and were applied to the study intersections.

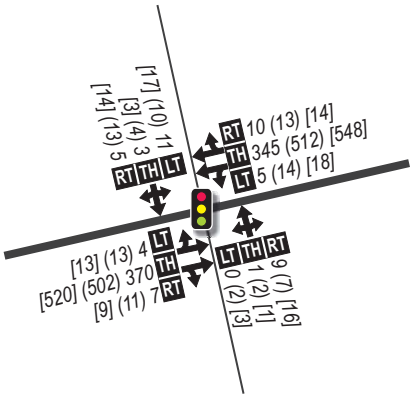
[12] *All Traffic Data turn movement counts taken on Thursday Jun 11, 2014 with the exception of AM Peak Hour for the north of 21st Street and north of OR 38 locations, Afternoon Peak Hour for the north of OR 38 location, and PM Peak Hour for the north of OR 38 and north of 21st Street locations.*

[13] *Seasonal adjustment factors provided by ODOT Traffic Operations Engineer, Ray Lapke, via email dated June 24, 2014.*

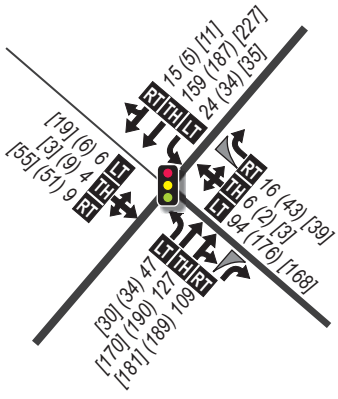


1. US 101/N 21st St.

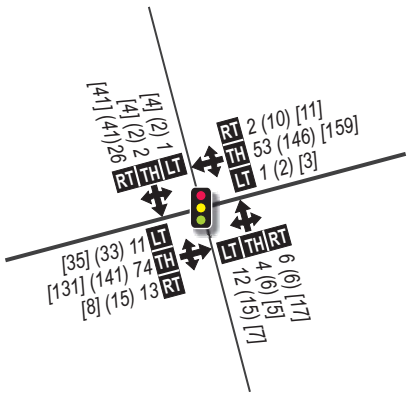
2. US 101/N 20th St.



3. US 101/OR 38/Port Dock Rd.



4. OR 38/N 3rd St.



LEGEND

- Study Intersection
- Project Study Corridor
- Traffic Signal
- Lane Configuration
- *AM (MID) [PM]* - Peak Hour Traffic Volumes
- LT TH RT (Left•Thru•Right) - Volume Turn Movement
- *00 mph* / 0,000 - 85% Speed and Average Daily Traffic (Not Adjusted)

DKS

No Scale

Figure 2-9

2014 EXISTING MOTOR VEHICLE PEAK HOUR AND DAILY TRAFFIC VOLUMES AND SPEEDS

Mobility Standards

Agency mobility standards often require intersections to meet level of service (LOS) or volume-to-capacity (V/C) intersection operation thresholds.

The **intersection LOS** is similar to a "report card" rating based upon average vehicle delay. Level of service A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. Level of service D and E are progressively worse operating conditions. Level of service F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity. This condition is typically evident in long queues and delays.

The **volume-to-capacity (V/C) ratio** represents the level of saturation of the intersection or individual movement. It is determined by dividing the peak hour traffic volume by the maximum hourly capacity of an intersection or turn movement. When the V/C ratio approaches 0.95, operations become unstable and small disruptions can cause the traffic flow to break down, as seen by the formation of excessive queues.

Both US 101 and OR 38 are Oregon Department of Transportation (ODOT) facilities classified as Statewide Highways and freight routes within the study area boundaries. According to the *1999 Oregon Highway Plan* (*OHP*), ODOT mobility standards are given as V/C ratios and are based on the highway category.[14] The applicable mobility standards and targets for US 101 and OR 38 are shown in Table 2-10 and are the same for both signalized and unsignalized intersections.

Table 2-10: Applicable Study Intersection Mobility Standards

Major Roadway	Jurisdiction (Classification and Designations)	Mobility Standard or Target
US 101	ODOT (Statewide Highway, Freight Route)	V/C ≤ 0.85
	City of Reedsport	LOS D or better
OR 38	ODOT (Statewide Highway, Freight Route)	V/C ≤ 0.85
	City of Reedsport	LOS D or better

Existing Intersection Performance

The existing performance of the study intersections was evaluated using Synchro™ software, which employs methodology from the *2010 Highway Capacity Manual*[15] for unsignalized intersections and *2000 Highway Capacity Manual*[16] for signalized intersections.

[14] 1999 Oregon Highway Plan, *Oregon Department of Transportation, 1999; Table 6 in Policy 1F displays the maximum allowable V/C ratios for areas outside of the Portland Metropolitan Area.*

[15] 2010 Highway Capacity Manual, *Transportation Research Board, Washington, D.C., 2010.*

The traffic volumes and transportation system configurations described previously were used to determine intersection levels of service (LOS) and volume-to-capacity (V/C) ratios. Intersection signal timing was obtained from ODOT and also used in the analysis. The results of the intersection operations analysis are presented in Table 2-11. As shown, all of the intersections currently meet ODOT V/C mobility targets.

Table 2-11: Study Intersection Performance

Intersection	Operating Standard	A.M. Peak Hour		Afternoon Peak Hour		P.M. Peak Hour	
	ODOT	*Delay*	*V/C*	*Delay*	*V/C*	*Delay*	*V/C*
Signalized							
US 101/OR 38	0.85 V/C	15.2	0.31	21.3	0.56	20.4	0.56
Unsignalized							
US 101/21st St	0.85 V/C	15.5	0.06	18.9	0.04	25.5	0.09
US 101/20th St	0.85 V/C	19.8	0.11	25.0	0.16	33.4	0.26
OR 38/3rd St	0.85 V/C	10.2	0.05	10.8	0.10	15.8	0.13

Signalized intersection:
Delay = Average Intersection Delay (sec.)
LOS = Level of Service
V/C = Volume-to-Capacity Ratio

Unsignalized intersection:
Delay = Critical Movement Approach Delay (sec.)
LOS = Major Street LOS/Minor Street LOS
V/C = Critical Movement Volume-to-Capacity Ratio

Future Traffic Conditions

A 20-year growth rate was applied to the US 101 and OR 38 study area corridors in order to project transportation modeling from 2014 to 2035 and analyze future estimated traffic volumes. The 20-year growth factor was obtained with direction from ODOT that utilizes ODOT Future Volumes Table.[17] The 2032 Future Highway Volume Table (FHVT) predicts a minimal amount of growth on both the US 101 or OR 38 study corridors with a 20-year factor of 1.02 for both US 101 and OR 38 (this is only a fraction of a percent per year).

Table 2-12 at the top of the next page displays the projected 2035 traffic volumes modeled from the 20-year growth rate. As shown, intersection delay, LOS, and V/C ratios hardly increase over the 20-year period.

[16] 2000 Highway Capacity Manual, *Transportation Research Board, Washington, D.C., 2000.*

[17] The 2032 Future Highway Volume Table is created using data from the Transportation Volume Tables. The future volumes are estimates only and local growth patterns and comprehensive plans may affect the actual outcome.

Table 2-12: Study Intersection Projected Performance (2035)

Intersection	Operating Standard	A.M. Peak Hour		Afternoon Peak Hour		P.M. Peak Hour	
	ODOT	*Delay*	*V/C*	*Delay*	*V/C*	*Delay*	*V/C*
Signalized							
US 101/OR 38	0.85 V/C	15.4	0.32	21.7	0.57	21.2	0.57
Unsignalized							
US 101/21st St	0.85 V/C	15.6	0.15	19.3	0.20	27.1	0.22
US 101/20th St	0.85 V/C	20.4	0.17	24.5	0.21	33.6	0.26
OR 38/3rd St	0.85 V/C	10.3	0.05	14.4	0.11	16.3	0.13

Signalized intersection:
Delay = Average Intersection Delay (sec.)
LOS = Level of Service
V/C = Volume-to-Capacity Ratio

Unsignalized intersection:
Delay = Critical Movement Approach Delay (sec.)
LOS = Major Street LOS/Minor Street LOS
V/C = Critical Movement Volume-to-Capacity Ratio

Even though the 20-year growth rate factor from the 2032 FHVT is the supported methodology, a sensitivity analysis was performed to experiment with higher growth rates and their impact to the study area. Table 2-13 displays the V/C ratios for four intersections along OR 38 and US 101 using a growth rate of 0.5% per year (10% over 20 years) which is five times higher than FHVT growth assumption. The half percent per year growth rate was selected by the PMT as appropriate for this sensitivity analysis. As shown in Table 2-13 below, all intersections still meet ODOT V/C ratio requirements.

Table 2-13: Study Intersection Sensitivity Analysis using a 0.5% Growth Rate per Year

Intersection	Operating Standard	A.M. Peak Hour		Afternoon Peak Hour		P.M. Peak Hour	
	ODOT	*Delay*	*V/C*	*Delay*	*V/C*	*Delay*	*V/C*
Signalized							
US 101/OR 38	0.85 V/C	17.0	0.34	23.6	0.61	23.7	0.62
Unsignalized							
US 101/21st St	0.85 V/C	16.8	0.07	21.1	0.05	30.5	0.11
US 101/20th St	0.85 V/C	22.2	0.13	29.3	0.18	41.3	0.31
OR 38/3rd St	0.85 V/C	10.4	0.05	14.9	0.11	17.1	0.15

Signalized intersection:
Delay = Average Intersection Delay (sec.)
LOS = Level of Service
V/C = Volume-to-Capacity Ratio

Unsignalized intersection:
Delay = Critical Movement Approach Delay (sec.)
LOS = Major Street LOS/Minor Street LOS
V/C = Critical Movement Volume-to-Capacity Ratio

Reedsport TSP Future Analysis

The City of Reedsport's Transportation System Plan (TSP) was completed in 2005 and utilized a growth rate of 2.25% per year (a total of 45% growth over 20 years). A comparison of traffic counts at the US 101/OR 38 Junction was evaluated between seasonally adjusted volumes used for the TSP that were counted on September 30th, 2004 and traffic counts used in this study counted on June 5th 2014 that are also seasonally adjusted.

As shown in the Figure 2-10 below, the traffic entering and exiting US 101 south of OR 38 has actually decreased 5% over the last ten years which does not reflect the anticipated original growth assumptions from the TSP. The declining traffic growth in Reedsport is consistent with census data that has shown a declining population in and within the vicinity of the City of Reedsport.[18]

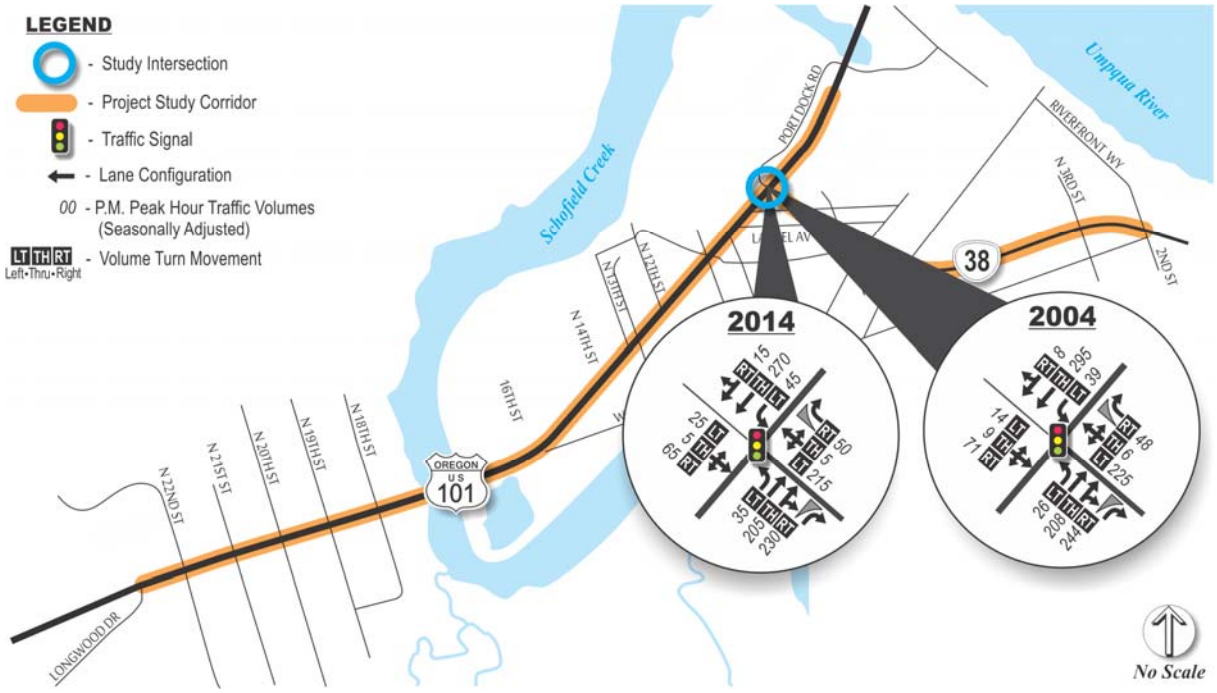


Figure 2-10: US 101 Ten-Year Volume Growth Comparison

[18] *US Census Bureau Reports the City of Reedsport's population has declined by 1,384 people over 20 years. (1990 had a population of **6,723** people, 2000 had a population of 5,755 people, and 2010 had a population of **5,339** people.)*

An analysis of the p.m. peak hour operations at study intersections under the TSP high growth assumptions was completed for consistency with the approved TSP. Table 2-14 displays p.m. peak hour intersection operations under the assumption of 45% growth over 20 years compared to 4% projected growth over 20 years which is the growth assumption used in this study. As shown, all of the study intersections meet ODOT's mobility standards.

Table 2-14: Study Intersection Sensitivity Analysis using a 2.25% Growth Rate per Year (45% growth over 20 years)

Intersection	Operating Standard	4% Growth (P.M. Peak Hour)		45% Growth (P.M. Peak Hour)	
	ODOT	Delay	*V/C*	*Delay*	*V/C*
Signalized					
US 101/OR 38	0.85 V/C	21.2	0.57	38.7	0.78
Unsignalized					
US 101/21st St	0.85 V/C	27.1	0.22	35.6	0.08
US 101/20th St	0.85 V/C	33.6	0.26	> 50s	0.41
OR 38/3rd St	0.85 V/C	16.3	0.13	18.7	0.19

Signalized intersection:
Delay = Average Intersection Delay (sec.)
V/C = Volume-to-Capacity Ratio

Unsignalized intersection:
Delay = Critical Movement Approach Delay (sec.)
V/C = Critical Movement Volume-to-Capacity Ratio

CHAPTER 3 CROSSING TREATMENT TOOLBOX

A toolbox of potential pedestrian crossing treatments at unsignalized locations along the US 101 and OR 38 study area corridors was prepared to assist in developing crossing improvement concepts for multiple priority locations. Crossing treatments are intended to improve visibility of pedestrians and reduce the potential for pedestrian crashes. This toolbox is project-specific and only includes treatment alternatives considered feasible within the scope of this safety study. These treatments are also consistent with U.S. Federal Highway Administration (FHWA) recommended guidelines.[19]

The toolbox includes the following treatment options:

- Median Refuge Islands and Curb Extensions
- Rectangular Rapid Flashing Beacon (RRFB) with Raised Median
- Pedestrian Hybrid Beacon- High intensity Activated Crosswalk (HAWK)
- Overhead Flashing Beacons (Standard and RRFB)
- Street Lighting

Not all of these treatments are being recommended for implementation on the US 101 and OR 38 corridors. Instead, these treatments served as a list of options to choose from when addressing specific locations (see further discussed in Chapter 4). Some of these treatments could be used in combination. For example, the median refuge island and street lighting could either be standalone improvements or could be combined with one of the flasher/beacon or pedestrian traffic signal improvements.

The treatment options are described next and additional information—including general costs and lists of pros and cons—is provided in the appendix. At the end of this chapter, a list of treatments considered but not included in the toolbox is provided along with supporting explanations.

[19] Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines, *US Department of Transportation, Federal Highway Administration, September 2005.*

MEDIAN REFUGE ISLAND AND CURB EXTENSIONS

Median refuge islands are raised curbs in the center of the roadway that provide a sheltered pedestrian area where pedestrians can wait for gaps in traffic. Curb extensions are protracted corner curbs that can be utilized for both signalized and unsignalized intersections.

Curb extensions provide pedestrians with shorter crosswalk travel length. They also reduce vehicle lane size, thus, vehicle speeds are often reduced as well. Median refuge islands separate opposing lanes of traffic and allow two-stage crossings where pedestrians clear one direction of travel movement at a time. This reduces the size of individual gaps in traffic needed for a pedestrian to make a safe crossing. Some disadvantages of raised center medians are the creation of added obstruction in the roadway, conflicts with left turn lane needs, and potential right of way constraints. Two example median refuge islands are shown in Figure 3-1.

Figure 3-1: Example Center Medians with Pedestrian Refuge Islands

Pedestrian refuges can have a staggered or straight pedestrian cut-through or path configuration. The example refuge island shown on the right in Figure 3-1 has a staggered pedestrian cut-through or path, which requires pedestrians to turn towards on-coming traffic before crossing. This encourages pedestrians to take a better view of the on-coming traffic. A center median with a pedestrian refuge island would be a critical component if one of the two flashing beacon systems is selected as a preferred crossing treatment. In addition, a median refuge island could also be installed as part of a pedestrian traffic signal or HAWK signal.

RECTANGULAR RAPID FLASHING BEACON (RRFB)

The Rectangular Rapid Flashing Beacon (RRFB) is a special LED flashing device installed below a crosswalk sign and placed at marked, unsignalized crosswalk locations. The RRFB increases pedestrian visibility by attracting driver attention with the flashing beacons and making them aware of the pedestrian's presence. The LED flashing devices are located below the crosswalk sign and above the arrow sign.[20] An RRFB sign assembly and a close up of the beacons are shown in Figure 3-2.

The RRFB is pedestrian actuated with either hardwired or wireless pushbuttons. It can also be solar powered, which would make for easier installation (though monetary cost would be approximately equal due to higher equipment cost). Studies to date have shown very high driver compliance rates (i.e., percents in the 80's and 90's).[21]

Figure 3-2: Example RRFB Sign Assembly and Close-Up of RRFB Flashers

[20] *Source of Figure 3-2: Manual on Uniform Traffic Control Devices (MUTCD) website, http://mutcd.fhwa.dot.gov, 6/16/2010*

[21] *MUTCD - Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11), FHWA, July 16, 2008*

PEDESTRIAN HYBRID BEACON-HIGH INTENSITY ACTIVATED CROSSWALK (HAWK)

A pedestrian hybrid beacon–high intensity activated crosswalk (commonly referred to as a HAWK) uses a yellow-red lens configuration (two red lenses on top and yellow lens on bottom) to provide a signalized, mid-block pedestrian crossing. The pedestrian hybrid beacon is used to warn and control traffic to assist pedestrians in crossing a street at a marked crosswalk. Unlike a full pedestrian traffic signal, the HAWK signal remains dark when not activated and will allow vehicles to proceed with caution during the pedestrian clearance interval. An example HAWK signal is shown in Figure 3-3.

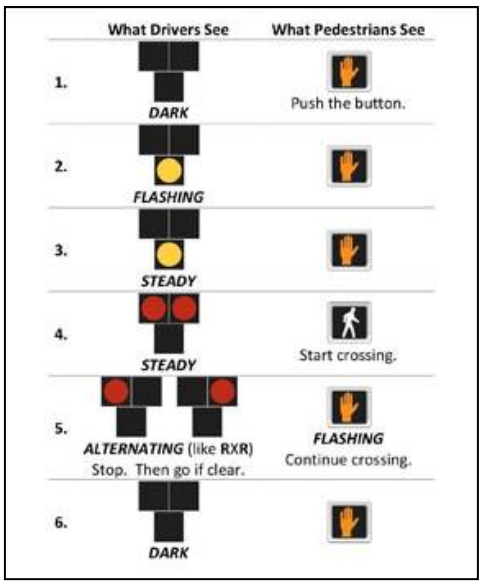


Figure 3-3: HAWK Signal and Phases

The five phases of a HAWK signal are also shown in Figure 3-3 (phase 6 is cycling back to phase 1).[22] As shown, when no pedestrians are present, the HAWK signal is dark (phase 1). Once a pedestrian pushes the crossing button, the pedestrian hybrid beacon first flashes yellow (phase 2) and then becomes solid yellow (phase 3). These two warning indications prepare traffic to stop for the upcoming 'walk' stage, which is a steady red (phase 4). The next stage is the 'don't walk' stage (phase 5), and the hybrid beacon flashes red for vehicles. Pedestrians should finish crossing the street if they have already begun, and vehicular traffic must stop but then can proceed if there are no pedestrians in the road. The beacon then goes dark again (returning to phase 1).

The MUTCD provides guidelines and volume thresholds for when pedestrian hybrid beacons should be installed.[23] For example, this beacon system should be installed at least 100 feet from side streets or driveways that are controlled by Stop or Yield signs. In addition, if it is installed within a signal system, it should be coordinated with the system. NCHRP Report 562 documented compliance for this type of beacon crosswalk at upwards of 90%.[24]

[22] *Source of Figure 3-3 image: Boise Guardian.*

[23] *Chapter 4F, Manual on Uniform Traffic Control Devices, 2009 Edition, Page 509-512.*

[24] *NCHRP 562, pg. 17.*

FLASHING BEACONS

If a pedestrian traffic signal or hybrid beacon is not warranted, another alternative is to install a flashing beacon system. Flashing beacon systems are considered by NCHRP Report 562 as active devices; meaning they warn, but do not stop traffic. Pedestrian actuation is one characteristic that should be incorporated into any flashing beacon system due to its importance for improved driver compliance.

Overhead flashing beacons are flashing amber beacons installed on traffic signal poles and mast arms along with overhead signs. Overhead flashers are used to increase driver awareness when approaching a marked crosswalk at an uncontrolled location. Warning signs are typically placed in advance of the marked crosswalk or on signs located adjacent to the crosswalk entry. The two flashing beacons can be programmed to either operate continuously or be pedestrian actuated.

Figure 3-4: Example Overhead Flashing Beacon

STREET LIGHTING

Street lighting is another important treatment that addresses night-time visibility. Street lights provide increased pedestrian and bicycle visibility during the night and the dawn/dusk periods of the day by providing contrast between the pedestrian and their surroundings. They also improve visibility of oncoming vehicles so that pedestrians and bicycles can better judge gaps in traffic.

Street lights should be included with any selected crossing treatment and should be oriented toward pedestrian activity. Lighting levels should also satisfy applicable ODOT and City of Reedsport lighting standards.

Figure 3-5: Example Street Lights

IMPROVEMENTS NOT INCLUDED

Items which were considered but left out of the Pedestrian Toolbox include:

Traffic Calming Measures: These measures (i.e. speed humps, narrow lanes) are not consistent with the 'arterial' and 'truck route' classifications of US 101 or OR 38 and the emergency services needs.

Lowering Speed Limit: The speed limit is determined by roadway characteristics and the 85th percentile speed of traffic. Studies show that 'artificially' lowering the speed of a roadway is ineffective at garnering driver compliance. However, some of the other improvements median refuge islands and curb extensions may calm traffic and result in lower travel speeds. Therefore, after other projects have been implemented, future speed investigation can be performed to see if lowering the speed is justified.

In-Roadway Lighting: These are highly susceptible to roadway damage (especially snow plows), cost intensive for both installation and maintenance, and are discouraged by ODOT.

Grade-Separated Pedestrian Crossing (i.e., Pedestrian Bridge or Tunnel): This measure would be very expensive and require significant right of way to address ADA needs. In addition, such crossings are not always used by pedestrians.

Pedestrian Traffic Signal: This measure does not meet the MUTCD minimum pedestrian volume thresholds.[25]

[25] *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). 2010 ed. Washington, D.C.: U.S. Dept. of Transportation, Federal Highway Administration, 2012.*

CHAPTER 4 PEDESTRIAN IMPROVEMENT CONCEPTS

Recommended pedestrian crossing improvement concepts were developed for the US 101 and OR 38 study corridors in the City of Reedsport, Oregon. This chapter describes how pedestrian crossing locations were prioritized and documents the recommended crossing improvement alternatives at five priority locations. The Technical Advisory Committee (TAC) directed the concept development. Stakeholder interviews and a City Council work session provided important local stakeholder feedback on the locations and their priority.

IMPROVEMENT LOCATION PRIORITIZATION

Potential crossing improvement locations along the study area corridor were prioritized based on a variety of factors. The purpose of the prioritization process was to identify where new pedestrian crossing treatments could be constructed. Therefore, the primary locations considered were those within the study area located farther than 250 feet from the nearest signalized pedestrian crossing.[26]

The prioritization of potential crossing improvement locations was performed based on preselected evaluation criteria established through coordination with the TAC. Different weighting factors were applied to provide emphasis to selected criteria, especially to pedestrian and bicycle collisions. The evaluation criteria include the following (listed in order of greatest weighting):

- **Collisions** (2003-2013)
  - Collisions in the vicinity
  - Collisions involving pedestrians and bicyclists in the vicinity
- **Pedestrian volumes** during AM, midday, and PM peak hours
- The presence of nearby pedestrian generators including:
  - Schools
  - Parks
  - Restaurants/Convenience Markets
  - Hotels
  - Post Office
  - Trail Crossings

[26] Evaluation of Alternative Pedestrian Control Devices, *SPR 721, ODOT, 2012.*

Scores for each location were calculated by summing the applicable weighted criteria scores for each potential location. The prioritized list of the top five locations resulting from the application of the evaluation criteria is provided in Table 4-1.

Table 4-1: Prioritized Crossing Improvement Locations

Potential Crossing Location	Weighted Score	Rank
US 101/20th Street	49	1
US 101/21st Street	40	2
US 101/14th Street	31	3
OR 38/3rd Street	12	4
US 101/Juniper Ave	7	5

The Levee Trail Plan is currently under development. As part of this plan, highway crossings are being examined. However, at this point, it appears that a new pedestrian crossing across 101 (between the north side of the bridge and Les Schwab) will not be possible. This crossing was not part of the detailed pedestrian crossing analysis; however, this crossing will require future study for potential crossing improvements.

CROSSING IMPROVEMENT CONCEPTS

Potential crossing improvement concepts were analyzed for each high priority unsignalized location. Figure 4-1 shows an overview map of the prioritized locations. Each location is discussed in the sections below from highest to lowest ranking, including detailed crossing improvement concept sketches and identification of potential street lighting improvements.

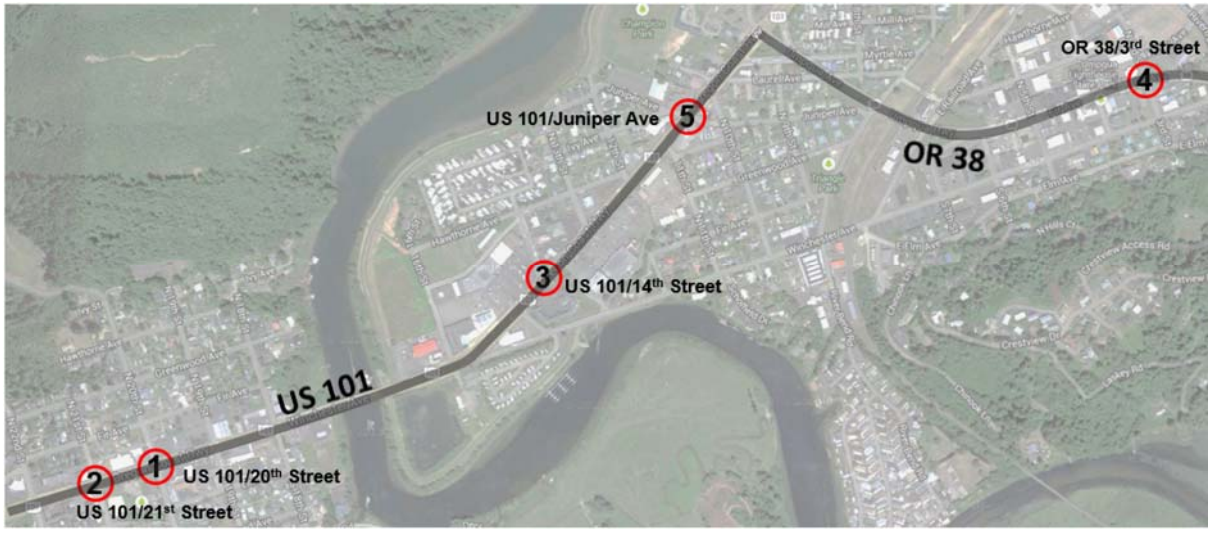


Figure 4-1: Priority Crossing Locations

US 101 and 20th Street (Priority Location #1)

Pedestrian improvements at 20th Street intersection ranked as the highest priority location due to the amount of pedestrian activity, especially during afternoon hours. The high crossing volumes are due to nearby pedestrian generators including Reedsport Community Charter School two blocks to the south on 22nd Street, Lion's Park, 7-Eleven and several other restaurants that line the north side of US 101. In addition, five collisions occurred at

this intersection from 2003 to 2013 including one pedestrian injury (DKS was also made aware of a recent pedestrian crash at this location that was not included as part of the crash analysis). This location is also noted in the City of Reedsport's TSP as a location that will need "marked crosswalk and additional enhancements."[27] Two crossing improvement concepts in coordination with the NCHRP Report 562[28] are provided for the US 101/20th Street intersection and are detailed below.

Crossing Improvement Option A

Option A (Figure 4-2 on the following page) includes a Rectangular Rapid Flashing Beacon (RRFB) or similar treatment and a raised median with pedestrian refuge.[29] The raised median allows a two-stage crossing for pedestrians so each direction of traffic can be crossed separately as gaps in traffic are available. Adding the raised median requires modifying the existing striping along US 101 to accommodate the needed width of the pedestrian refuge. The addition of the median will remove the option for on-street parking in the vicinity of the proposed improvements and will require coordination with the freight industry.

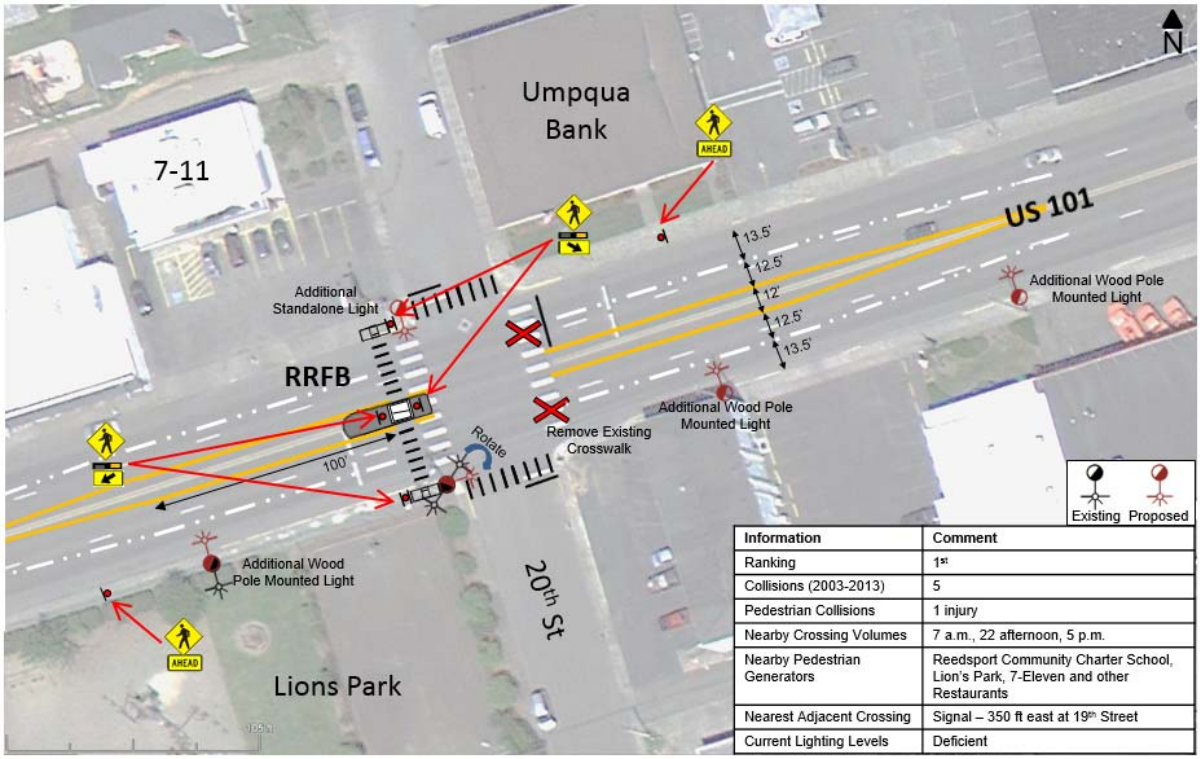
Due to the pedestrian refuge median recommended in this alternative, one of the 7-Eleven accesses along US 101 closest to 20th Street would likely be restricted to a right-in, right-out only driveway. However, 7-Eleven would still retain their existing full access driveway that is slightly further west on US 101 as well as the existing full access driveway on 20th Street. Any access modifications would require either the consent of the property owner or agency compliance with the Senate Bill 408 process.

Additionally, this concept removes the existing crosswalk striping on the east leg of the intersection and moves the southbound stop bar closer to the intersection. Removal of this crosswalk will encourage pedestrians to use the RRFB proposed on the west leg of the intersection. Striping pedestrian crossings are also recommended along the north and south stop controlled intersection legs on 20th Street to delineate pedestrian crossings across the minor street. Lighting improvement needs include three wood pole mounted lights on existing wood poles along the south side of US 101, one additional standalone on the northwest corner of the intersection, and the rotation of existing lighting on the southwest corner of the intersection to improve lighting for the proposed pedestrian facilities.

[27] Reedsport: Transportation System Plan, *Table 5-3, Reedsport (Or.); DKS Associates; Winterbook Planning, February 2006.*

[28] Improving Pedestrian Safety at Unsignalized Crossings, *Report 562, National Cooperative Highway Research Program. 2006.*

[29] *According to NCHRP Report 562, the minimum requirement for the US 101/20th Street Option A alternative is a marked crosswalk. However based on public input, discussions with the City of Reedsport, and the safety history at this location, we still recommend an RRFB under this alternative.*



Information	Comment
Ranking	1st
Collisions (2003-2013)	5
Pedestrian Collisions	1 injury
Nearby Crossing Volumes	7 a.m., 22 afternoon, 5 p.m.
Nearby Pedestrian Generators	Reedsport Community Charter School, Lion's Park, 7-Eleven and other Restaurants
Nearest Adjacent Crossing	Signal – 350 ft east at 19th Street
Current Lighting Levels	Deficient

Figure 4-2: US 101/20th Street Crossing Improvement Option A (4-Lane Option with Median)

Crossing Improvement Option B

Option B (Figure 4-3 on the following page) proposes an overhead beacon coupled with sidewalk curb extensions (bulb outs) to shorten the crossing distance across US 101 and 20th Street. This short term concept is recommended in the absence of a pedestrian refuge island due to the existing wide roadway cross section, motor vehicle volume, and 85th percentile speed.

This solution requires a mast arm and mounted beacons but less roadway and striping modification when compared to the raised median shown in Option A. Two overhead mast arm mounted beacons significantly increase the construction cost compared to the smaller pole mounted RRFB's identified in Option A.

Based on recent studies, a ground-mounted RRFB may also be appropriate when coupled with the sidewalk bulb-outs.[30] The decision between an overhead beacon or ground-mounted RRFB for this alternative should be re-evaluated as part of the design process.

[30] *Recent studies include the Evaluation of Alternative Pedestrian Traffic Control Devices, SPR 721, ODOT, March 2012 and a case study done by Portland State University in Portland, OR entitled Evaluating Driver and Pedestrian Behaviors at Enhanced and Multi-lane Midblock Pedestrian Crossings, July 2013.*

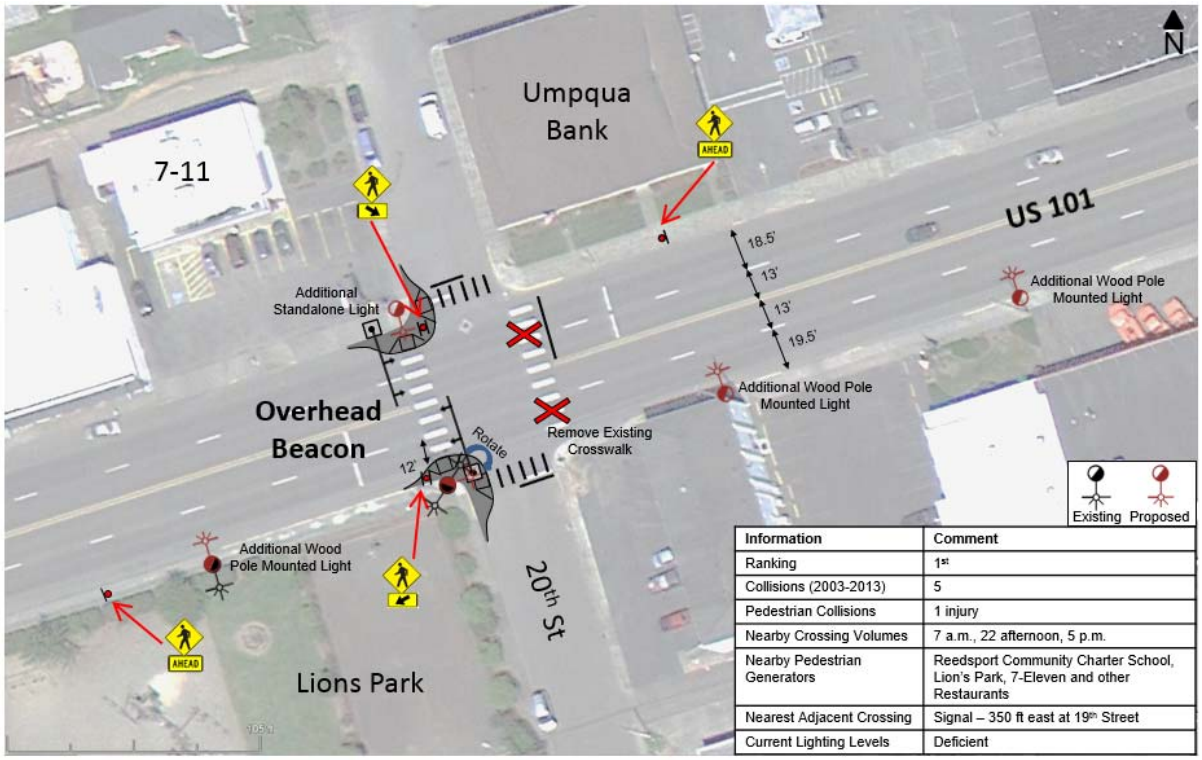


Figure 4-3: US 101/20th Street Crossing Location Improvement Option B (4-Lane Option with Curb Extensions)

US 101 and 21st Street (Priority Location #2)

Even though this location received a high prioritization ranking, it is located between an existing signalized pedestrian crossing a block to the west on 22nd street and the US 101/20th

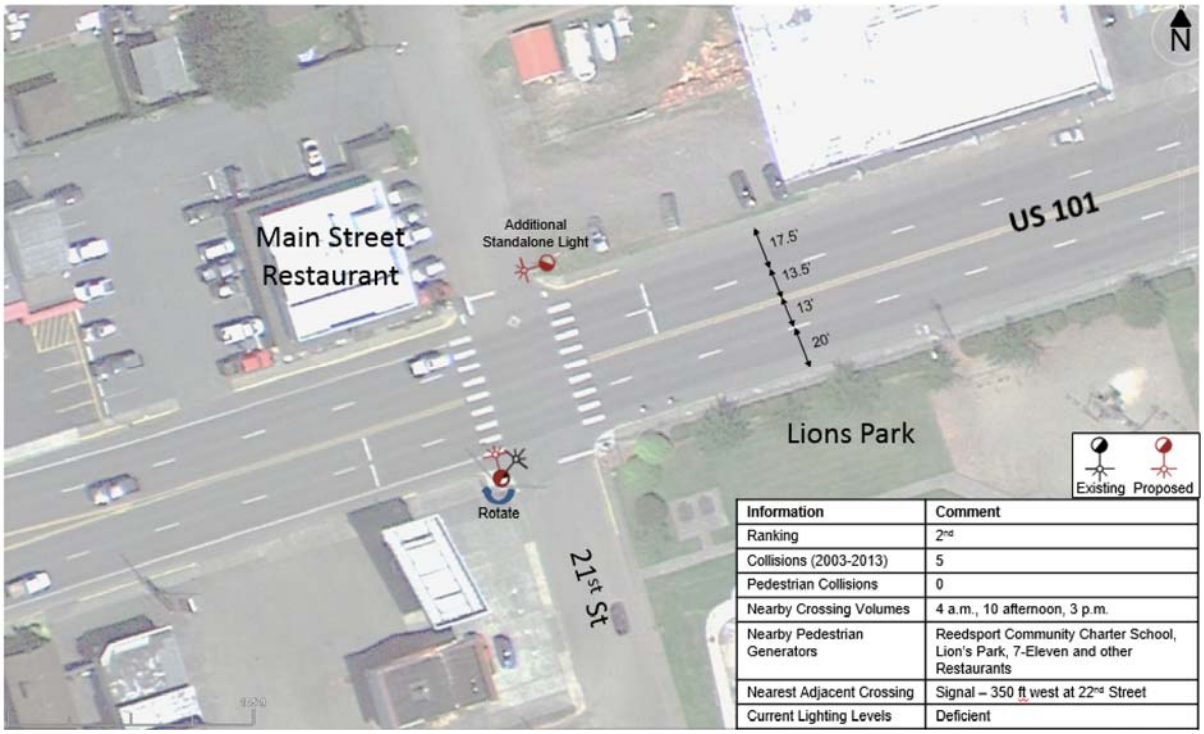


Figure 4-4: US 101/21st Street Crossing Location Improvement

Street crossing discussed earlier (Priority Location #1). For these reasons, no pedestrian crossing alternatives are recommended for this location at this time. Instead, the US 101 and 21st Street location should be further evaluated for pedestrian activity after the implementation of crossing improvements at priority location #1 (20th Street). Therefore, it is considered a mid-term priority to allow for further analysis and evaluation at a later date.

Standalone street lighting is recommended on the northeast corner of the intersection and a rotation of the existing street light on the southwest corner, as shown in Figure 4-4.

US 101 and 14th Street (Priority Location #3)

The US 101/14th Street intersection does not have a significant collision history or significant pedestrian volumes at this time. This location is only 200 feet from signalized intersections in both directions and left turn movements into the Best Western establishment or onto 14th Street would likely be prohibited if a raised median refuge was proposed. Furthermore, no crosswalk striping is recommended because existing pedestrian crossing volumes do not justify pedestrian striping as per NCHRP Report 562.[31]

As shown in Figure 4-5, additional standalone and wood pole mounted lighting is proposed at this location.

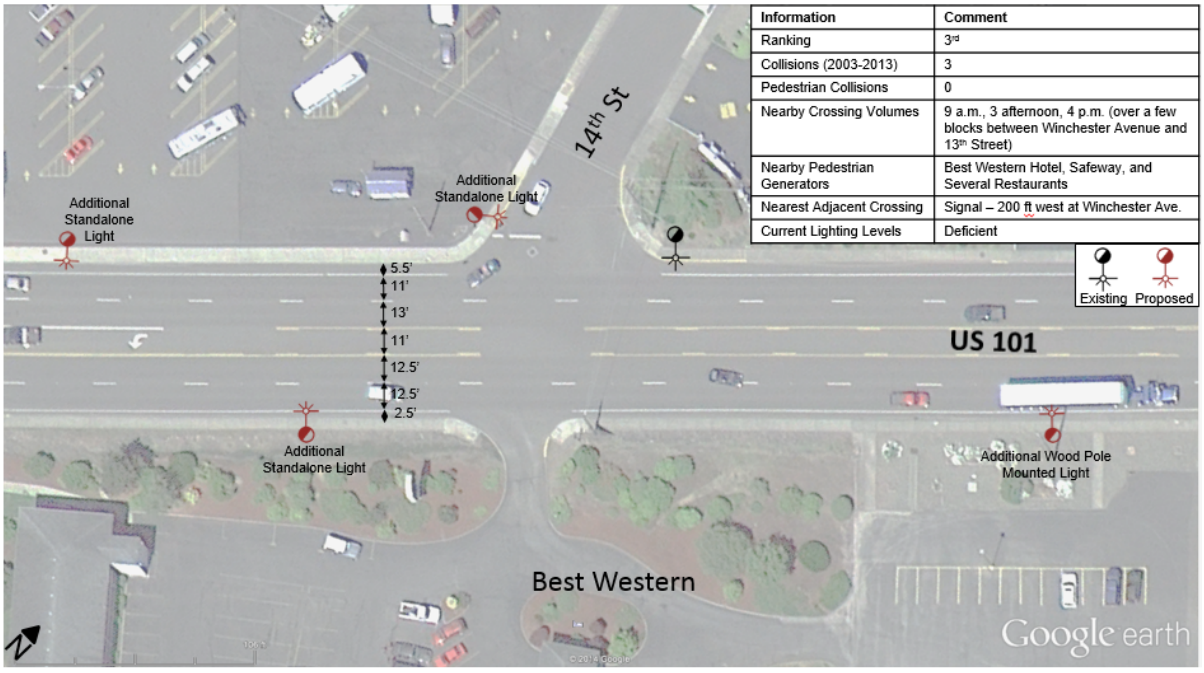


Figure 4-5: US 101/14th Street Crossing Improvement Location

[31] Improving Pedestrian Safety at Unsignalized Crossings, *Report 562, National Cooperative Highway Research Program. 2006.*

OR 38 and 3rd Street (Priority Location #4)

Downtown Reedsport consists of several shops lining both sides of OR 38 but significant pedestrian generators in the area include the City's Post Office and the Sugar Shack Bakery. Figure 4-6 on the following page depicts the curb extensions, street lighting and pedestrian signage proposed for this study area location. High travel speeds are a common complaint from Reedsport residents and 85th percentile speeds along this corridor have been observed to exceed the posted speed limits.[32] Motor vehicle speeds above the posted limit may be alleviated by narrowing OR 38 with sidewalk bulb outs which is consistent with what is proposed in this vicinity in the City of Reedsport's Waterfront and Downtown Plan but will require coordination with the freight industry due to the reduced curb to curb cross section.[33,34]

Although most street lighting in the downtown area is sufficient, three new street lights are recommended as shown in Figure 4-6. Speed feedback signs are recommended at this location in the Corridor-Wide Treatments section of this memorandum to reduce travel speeds.

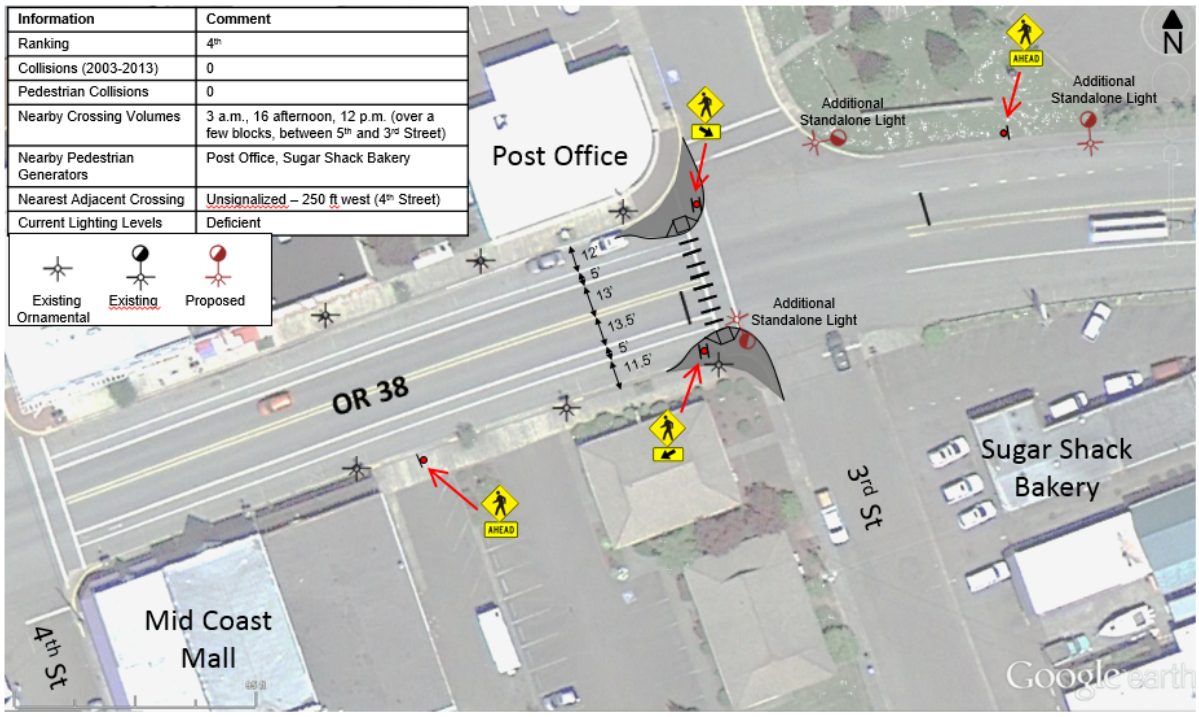


Figure 4-6: OR 38/3rd Street Crossing Improvement Concept

[32] Reedsport Pedestrian Safety Study Technical Memorandum #1: Existing Conditions Analysis, *Table 9, DKS Associates, June 30, 2014.*

[33] *Adding medians and/or curb extensions to narrow roadway width have been documented in Federal Highway Administration reports (FHWA-HRT-08-067) to reduce travel speeds.*

[34] Reedsport Waterfront and Downtown Plan, *Reedsport (Or.); ODOT, April 1, 2013.*

US 101 and Juniper Avenue (Priority Location #5)

The fifth high priority unsignalized pedestrian crossing location is the US 101/Juniper Avenue intersection, located between 11th Street and 12th Street on US 101. Due to current land uses, access spacing, connectivity challenges, and inconsistent pedestrian crossing locations[35], there are no evident locations for pedestrian crossing improvements that would significantly facilitate safe pedestrian activity across US 101.

TRAFFIC SIGNAL IMPROVEMENTS

Traffic signal improvements are another strategy that can be implemented along the study corridor to provide better pedestrian crossing accommodations. There are two signalized intersections within the study area where observed intersection safety improvements are needed; the US 101/OR 38 and US 101/22nd Street intersections. Specific needs for each location are discussed in the following sections.

US 101 and OR 38

The only observed intersection improvement need for this location is intersection lighting as shown in Figure 4-7.

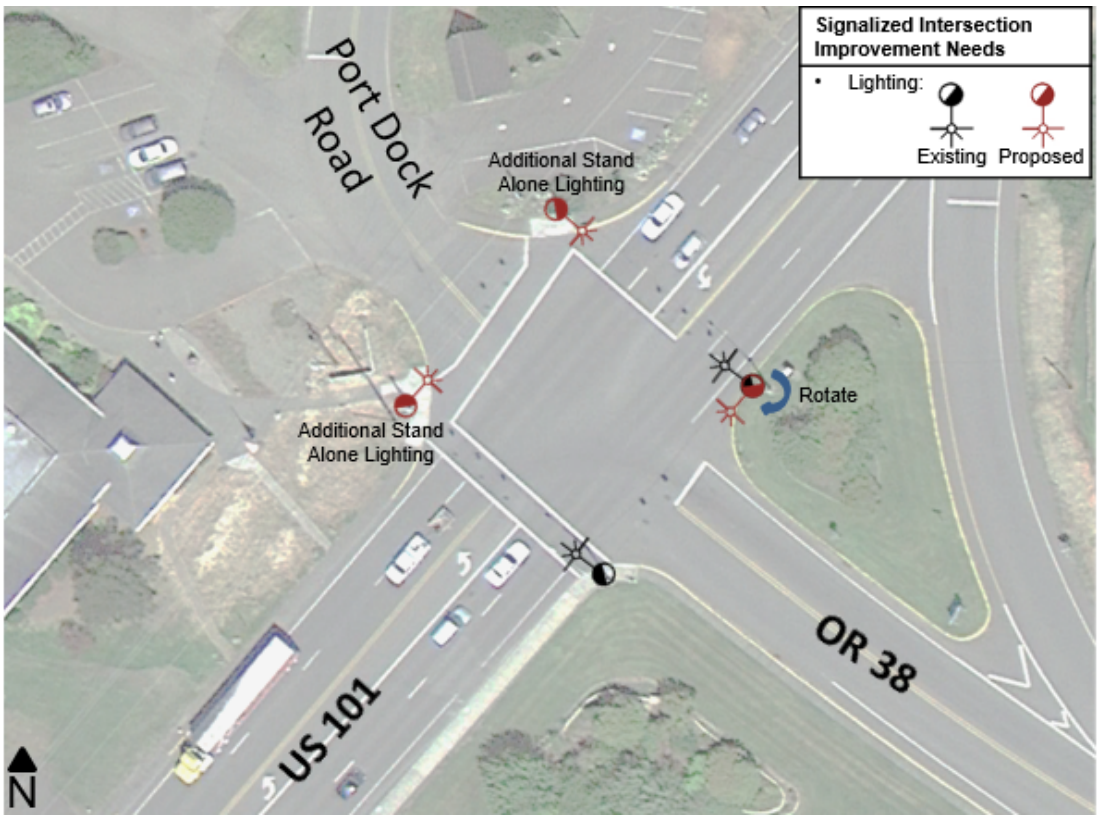


Figure 4-7: US 101 and OR 38 Junction Intersection Improvement Needs

[35] *Pedestrian crossing locations were observed on June 4th, 2014.*

Two new standalone street lights are recommended on the north and west corners of the intersection and rotation of the existing street light on the east corner of the intersection is also proposed. A development agreement exists between the City and developer for the surrounding area that includes signal modifications at this intersection as well as widening the OR 38 and Port Dock Road approaches for dedicated left turn lanes.

US 101 and 22nd Street

Safety improvements were given significant attention at the US 101/22nd Street intersection due to the nearby Reedsport Pedestrian Charter School, existing pedestrian crossing volume, and pedestrian collision history. The identified improvements for this intersection and are outlined below.

Lighting

One new wood pole mounted street light on the northeast corner and one new standalone street light on the southwest corner are recommended along with the rotation of two existing street lights on the northwest and southeast corners as shown in Figure 4-8.

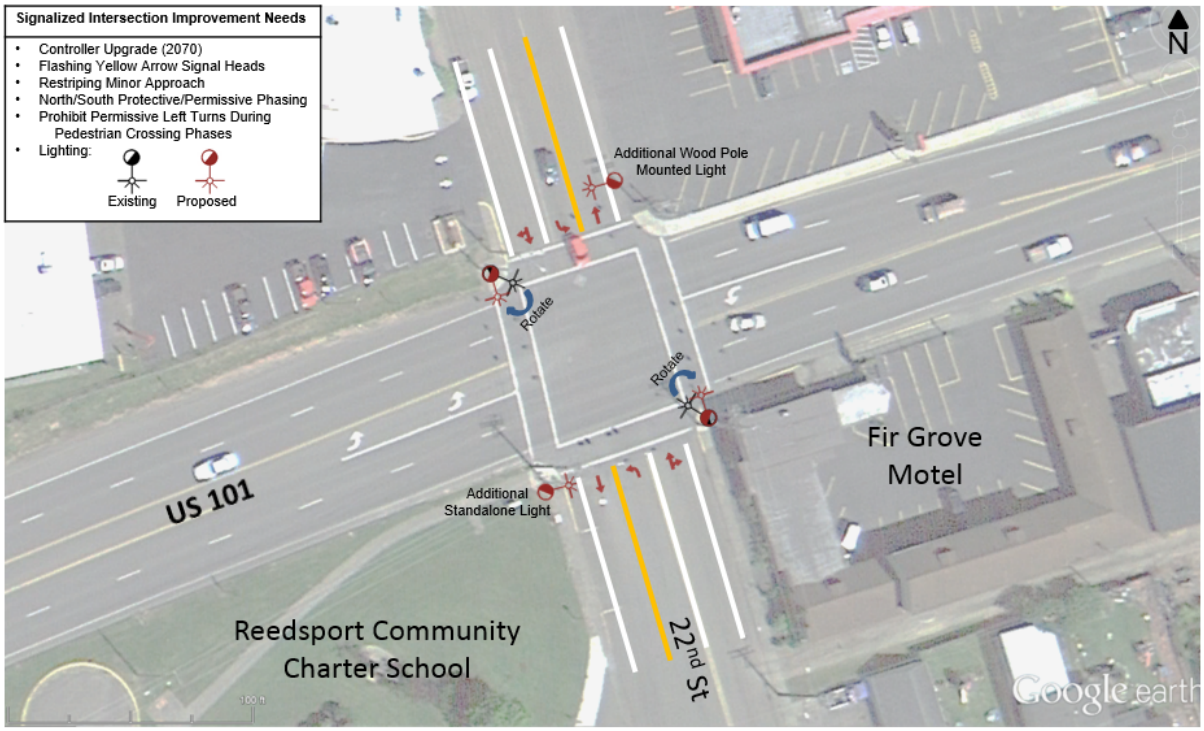


Figure 4-8: US 101/22nd Street Signalized Intersection Improvement Needs

Left Turn Signal Head Modification and Signal Phasing Modifications

Two pedestrian collisions at this intersection involved motor vehicles turning left and failing to yield to crossing pedestrians. In order to improve pedestrian safety, installation of flashing

yellow arrow left turn signal heads is recommended. A recent NCHRP report[36] concluded left-turn safety is significantly improved through the use of flashing yellow left turn heads when compared with the circular green signal that is provided on the 5-section "doghouse" signal head.

Providing flashing yellow arrow signal heads would also allow ODOT the option of prohibiting the permissive left turn phase when conflicting pedestrian phases are activated (i.e. when pedestrian pushbutton call is placed by pedestrian). This would eliminate conflicts between permissive left turning vehicles and school children crossing the street.

The existing 170 controller at this location does not allow the signal phasing flexibility necessary to operate the protected/permissive phasing required for the flashing yellow left turn arrow, or the permissive left turn prohibition during pedestrian crossings. To accommodate this functionality an upgrade to a 2070 traffic signal controller is necessary. Discussions with ODOT staff indicate the 2070 controller upgrade is already planned for this intersection.[37]

The protective/permissive phasing will also require the re-striping of 22nd Street near the intersection as shown in Figure 4-8. This will provide dedicated left turn lanes necessary to support the protective/permissive phasing and will reduce minor street delays and queuing. The striping modifications will also require modification to the existing traffic signal detection.

CORRIDOR-WIDE IMPROVEMENTS

Corridor-wide pedestrian safety treatments were also considered along the entire length of the study area corridors to improve overall pedestrian safety. Treatments include pedestrian countdown timers, speed feedback signs, street lighting, access management and a potential three-lane conversion on US 101.

Pedestrian Countdown Timers

Pedestrian countdown timers are devices used in conjunction with standard signalized intersection infrastructure that provides information to pedestrians about how much time is left to cross the street. Studies have shown pedestrian countdown timers reduce pedestrian-motor vehicle conflicts.[38]

Example of a Pedestrian Countdown Timer

[36] Flashing Yellow Arrow for Safer Left Turns, *Report 493, National Cooperative Highway Research Program*

[37] *Conversation with Aaron Brooks, ODOT Region 3 Traffic Analyst on July 9th, 2014.*

[38] *Highway Safety Manual, Edition 1, Volume 3, 14A.5.1.4. 2010.*

The installation of pedestrian countdown timers is recommended at all signalized intersections along the study corridors. All signalized intersections within the study area are displayed in Figure 4-9 and listed below:

- US 101/22nd Street
- US 101/19th Street
- US 101/Winchester Street
- US 101/13th Street
- US 101/OR 38 Junction

SPEED FEEDBACK SIGNS

Speed feedback signs are low-cost treatments that have been shown to reduce traffic speeds, particularly along roadways where travel speeds commonly exceed the posted speed limit. FHWA studies show that 85th percentile motor vehicle travel speeds could be reduced by 5 to 10% in the event of a speed feedback sign installation.[39] Since stakeholders are concerned about drivers traveling too fast and 85th percentile speeds were above the posted speed limit for both the US 101 and OR 38 study corridors[40], it is recommended that permanent speed feedback signs be placed along the corridor on both sides of the street at the following four locations shown in Figure 4-9:

- US 101 near 22nd Street for eastbound traffic
- US 101 east of the Schofield Bridge for both east and westbound traffic
- West of US 101/OR 38 Junction for westbound traffic
- OR 38 east of 3rd Street for westbound traffic

Figure 4-9: Speed Feedback Sign and Signalized Intersection Locations

[39] Engineering Countermeasures for Reducing Speeds, *Federal Highway Administration, <http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/>.*

[40] *Traffic data along US 101 and OR 38 was gathered on June 5th, 2014.*

Street Lighting

The Highway Safety Manual states that a 28% reduction in all collision types could occur when lighting is provided on roadways when there was previously no lighting present[41]. Even though there is some existing street lighting along the majority of the US 101 and OR 38 corridors, observed lighting levels indicate that supplementary lighting along both study corridors is needed in addition to the lighting proposed at the specific crossing improvement locations. Supplemental street lighting is recommended along the entire corridor with street lights provided on utility poles where available. When a utility pole is not available, stand-alone cobrahead street lights are recommended, consistent with the overall vision of future corridor lighting. This supplemental lighting is considered a mid-term priority. Coordination with the utility provider to relocate utility poles will be necessary to provide adequate light levels along the corridor.

Standalone Cobrahead Street Light (R) and Supplemental Lighting on Utility Pole (L)

Access Management

Access management refers to the use of a broad set of techniques that balance the need to provide safe, efficient, and timely travel with the ability to allow access to individual properties. Some techniques include driveway closures, consolidations with adjacent properties, and relocations. They also include roadway realignments (particularly near offset intersections), the placement of driveways onto side streets rather than onto US 101 or OR 38, and the use of medians in the roadway to limit which turn movements can be performed. Proper implementation of access management techniques along the US 101 and OR 38 study corridors is expected to reduce congestion while also increasing corridor capacity and reduce collisions approximately 25 percent[42].

Access modifications necessary to implement priority projects are recommended for the short-term. This would include the restriction of one of the 7-Eleven accesses along US 101 to a right-in, right-out only driveway under the Option A pedestrian crossing improvement at the US 101/20th Street location. Any access modifications would require either the consent of the property owner or agency compliance with the Senate Bill 408 process.No long term access management is recommended as part of this evaluation. However, the City's TSP recommends the creation of an Access Management plan along both study corridors.[43]

[41] *Highway Safety Manual, Edition 1, Volume 3, Table 13-55. 2010.*

[42] *Highway Safety Manual, Edition 1, Volume 3, Table 13-58. 2010.*

[43] Reedsport: Transportation System Plan, *Reedsport (Or.); DKS Associates; Winterbook Planning, February 2006.*

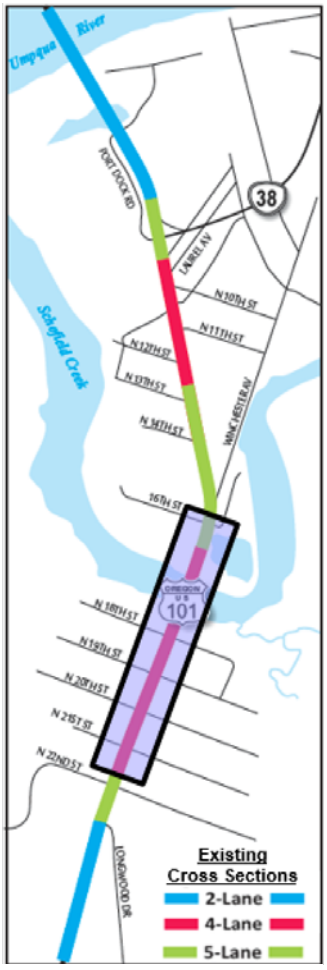
CHAPTER 5 US 101 LANE CONVERSION ALTERNATIVES

US 101 currently serves as a key connector for commercial and residential uses alike to travel across town to local schools, parks, restaurants, hotels, and other places of interest in the City of Reedsport. This presents an opportunity to consider three- and five-lane conversions to increase corridor safety and multi-modal mobility and connectivity. The sections below contain a high-level discussion regarding what a three- or five-lane conversion could do for separate portions of the US 101 corridor in Reedsport, Oregon.

THREE-LANE CONVERSION

US 101 is a two-lane facility south of 22nd Street and north of the US 101/OR 38 Junction. The roadway widens from two lanes to four lanes within the City of Reedsport which encourages through traffic to use this segment to pass slower moving vehicles. This fact has led to high travel speeds and an increase in collisions (including pedestrian collisions) along the corridor. As part of the overall transportation system, the four-lane section provides additional capacity for a 1.3 mile segment, however, through traffic is still limited by the two-lane roadway constraints north and south of the City.

Implementing a three-lane section in the southern section of US 101 between 16th Street and 22nd Street could provide a better transition to the 2-lane segments, improving safety for local and through traffic, but most importantly, for pedestrians and bicycles traveling along the corridor. The preliminary three-lane conversion was presented to the City Council at a work session on September 8, 2015 and received positive feedback. However, the City of Reedsport's Transportation System Plan[44] recommends a five-lane cross section for this section of US 101, thus, an amendment to the TSP, public involvement to receive public input, applicable policy changes, and council adoption will be needed.



Southern Section of US 101

[44] Reedsport: Transportation System Plan, *Reedsport (Or.); DKS Associates; Winterbook Planning, February 2006.*

Below is a high-level discussion on how surrounding land uses, available roadway width, collision analysis, and motor vehicle volumes relate to the US 101 corridor from 16th Street to 22nd Street and how a general four- to three-lane conversion consisting of two travel lanes and a continuous center turn lane could affect all modes of transportation within the area. Specific three-lane alternatives with corresponding considerations are presented later in this section.

Land Use

Hotels, restaurants, schools, parks and other major pedestrian, bicycle and motor vehicle attractions line the US 101 study corridor between 16th Street to 22nd Street. Even though only a few residential communities are directly adjacent to US 101, residential land use is located within a block north or south of the facility.

Thoughtful implementation of a four- to three-lane conversion in this portion of the study corridor could help create a foundation for a continuous and cohesive corridor while balancing the needs and objectives of surrounding land uses. No modification to the current pavement width would be necessary since the application of a three-lane conversion would allow 26 to 29 feet of the existing roadway width to be repurposed for travel experience enhancement for all modes of travel. This space gives way for extreme flexibility; offering adequate area for buffered bike lanes, on street parking, or a combination of other roadway elements.

Collision Analysis

As discussed in the Existing Conditions chapter, the yearly collision rate for the entire US 101 corridor is 3.01 collisions per million vehicle-miles traveled, which is almost twice the average ODOT State Highway Crash Rate for similar roadways of 1.48 collisions per million vehicle-miles traveled.[45] In order to reduce the existing crash rate to desired levels, substantial changes are necessary to US 101 in the City of Reedsport to improve safety for all modes of travel.

The Highway Safety Manual published a crash modification factor (CMF) of 0.71 when a four lane arterial inside the urban growth boundary is converted into a three-lane facility[46]. This means a three-lane conversion for the southern section of the US 101 study corridor could reduce the number and severity of collisions in the section by approximately 29%. Therefore, fatal and injury A collisions in the area could also decrease by 29%.

Key Statistic

Converting US 101 to a three-lane facility could reduce **all** collisions by **29%**.

[45] *2012 State Highway Crash Rate Tables, ODOT Crash Analysis and Reporting Unit, July 2012; Table IV.*

[46] *Highway Safety Manual, Edition 1, Volume 3, Table 13-6. 2010.*

Motor Vehicle Volume

The average daily traffic along US 101 in the project vicinity is 9,100 vehicles which is influenced by existing land use and freight routing. A 20-year growth rate that utilizes the ODOT Future Volume Tables was applied to the US 101 study area corridor in order to project transportation modeling from 2014 to 2035 and analyze future estimated traffic volumes.[47] The 20-year growth factor predicts a minimal amount of growth on the US 101 study corridor with a 20-year factor of 1.02 for US 101 (this is only a fraction of a percent per year). This small growth rate is consistent with the US Census data showing the consistently declining population of Reedsport.[48]

As shown in Table 5-1, the current four lane configuration is projected to provide adequate intersection capacity through the year 2035 along the study corridor. As shown, intersection operations at affected intersections[49] still remain adequate under the effect of a three-lane conversion.

Table 5-1: Study Intersection Performance – With Three-Lane Conversion

Intersection	Operating Standard	Existing Cross-Section (2035 P.M. Peak Hour)		With 3-Lane Conversion (2035 P.M. Peak Hour)	
	ODOT	Delay	*V/C*	*Delay*	*V/C*
US 101/21st St	0.85 V/C	23.9	0.08	33.3	0.11
US 101/20th St	0.85 V/C	29.4	0.22	41.8	0.30

Signalized intersection:
Delay = Average Intersection Delay (sec.)
V/C = Volume-to-Capacity Ratio

Unsignalized intersection:
Delay = Critical Movement Approach Delay (sec.)
V/C = Critical Movement Volume-to-Capacity Ratio

Even though the 20-year growth rate factor from the 2032 FHVT is the supported methodology, a sensitivity analysis was performed on the capacity calculations to experiment with higher growth rates and their impact to the study area. Table 5-2 at the top of the next page displays a comparison of the current four-lane configuration and the three-lane conversion V/C ratios for three intersections along US 101 using a growth rate of 0.5% per year (10% over 20 years) which is five times higher than the FHVT growth assumption. As shown in the table on the following page, all intersections still meet ODOT V/C ratio requirements under the three-lane road configuration.

[47] *The 2032 Future Highway Volume Table is created using data from the Transportation Volume Tables. The future volumes are estimates only and local growth patterns and comprehensive plans may affect the actual outcome.*

[48] *US Census Bureau Reports the City of Reedsport's population has declined by 1,384 people over 20 years. (1990 had a population of **6,723** people, 2000 had a population of 5,755 people, and 2010 had a population of **5,339** people.)*

[49] *The Highway 101/Highway 38 Junction is not included in the proposed three-lane portion of US 101 and is therefore not included in intersection analysis in this section.*

Table 5-2: Study Intersection Sensitivity Analysis – With Three-Lane Conversion

Intersection	Operating Standard	3-Lane Conversion (2035 P.M. Peak Hour)		10% Growth 3-Lane Conversion	
	ODOT	Delay	*V/C*	*Delay*	*V/C*
US 101/21st St	0.85 V/C	33.3	0.11	41.6	0.14
US 101/20th St	0.85 V/C	41.8	0.30	54.0	0.37

Signalized intersection:
Delay = Average Intersection Delay (sec.)
V/C = Volume-to-Capacity Ratio

Unsignalized intersection:
Delay = Critical Movement Approach Delay (sec.)
V/C = Critical Movement Volume-to-Capacity Ratio

Reedsport TSP Future Analysis

An analysis similar to the one discussed in the Motor Vehicle Conditions section in Chapter 2 was performed for the primary study intersections that would be affected by the three-lane conversion of the southern portion of US 101. Table 5-3 displays intersection operations under the TSP assumption of 45% growth and a three-lane conversion. As previously discussed this growth assumption does not reflect the last ten years of historical growth.

Table 5-3: Study Intersection 45% Growth – With Three-Lane Conversion

Intersection	Operating Standard	3-Lane Conversion (2035 P.M. Peak Hour)		45% Growth 3-Lane Conversion	
	ODOT	Delay	*V/C*	*Delay*	*V/C*
US 101/21st St	0.85 V/C	33.3	0.11	> 50s	0.14
US 101/20th St	0.85 V/C	41.8	0.30	> 50s	0.63

Signalized intersection:
Delay = Average Intersection Delay (sec.)
V/C = Volume-to-Capacity Ratio

Unsignalized intersection:
Delay = Critical Movement Approach Delay (sec.)
V/C = Critical Movement Volume-to-Capacity Ratio

Available Roadway Width

The US 101 study corridor's existing roadway width ranges from 67 feet near 22nd Street to 64 feet near 20th Street.[50] Despite the relatively wide width of the roadway, there are no dedicated bike lanes or left turn lanes. Both of these aspects threaten traffic for bicyclists and are the leading causes in the higher than average crash rate. Implementing the three-lane conversion along the US 101 study corridor could improve comfort and safety for all modes of travel with a relatively low cost as the modifications could be accommodated within the existing curb to curb space (only striping and traffic signal modifications would be required to implement the three-lane conversion).

[50] *Roadway width measured from face of curb to face of curb.*

Lane Conversion Alternatives

Two three-Lane conversion alternatives were evaluated to increase safety, provide left turn pockets, and compliment surrounding land uses by providing dedicated parking that encourages multimodal transportation. Details about each alternative are mentioned in the sections below as well as a concept figure displaying how the three-lane conversion could facilitate the pedestrian crossing improvements at 20th Street previously discussed in Chapter 4.

Lane Conversion Alternative 1: Maximum parking

Alternative 1 would include one northbound through lane, one southbound through lane, a two-way center left turn lane, bike lanes, and on-street parking on both sides to provide the maximum parking to adjacent land uses (see Figure 5-1).

Lane Conversion Alternative 1 Considerations	
Motor Vehicle Mobility	• Reduces number of travel lanes from four to three • Capacity reduced and travel time increased for through-traveling vehicles[51] • Maintains twelve-foot outside travel lanes • On-street parking increases motor vehicle movements in the roadway and may reduce travel speeds
Walkability	• Existing sidewalks remain • On-street parking and bike lanes provides additional separation from motor vehicle lanes
Bicycle Facilities	• Includes six-foot bike lanes
Freight Service	• Maintains twelve-foot travel lanes and a 14-foot left turn lane for freight movements • Potential conflicts with bike lanes
Business Accessibility	• Center turn lane improves access for turning vehicles • On-street parking improves ease of access to commercial facilities • Improved bicycle access
Cost	• Intersections and traffic signals would need to be reconfigured
Other	• Center left-turn lane offers opportunities for design elements including raised median treatments (e.g., landscaping, pedestrian refuge, access management)

[51] *See Synchro modeling reports in the appendix.*

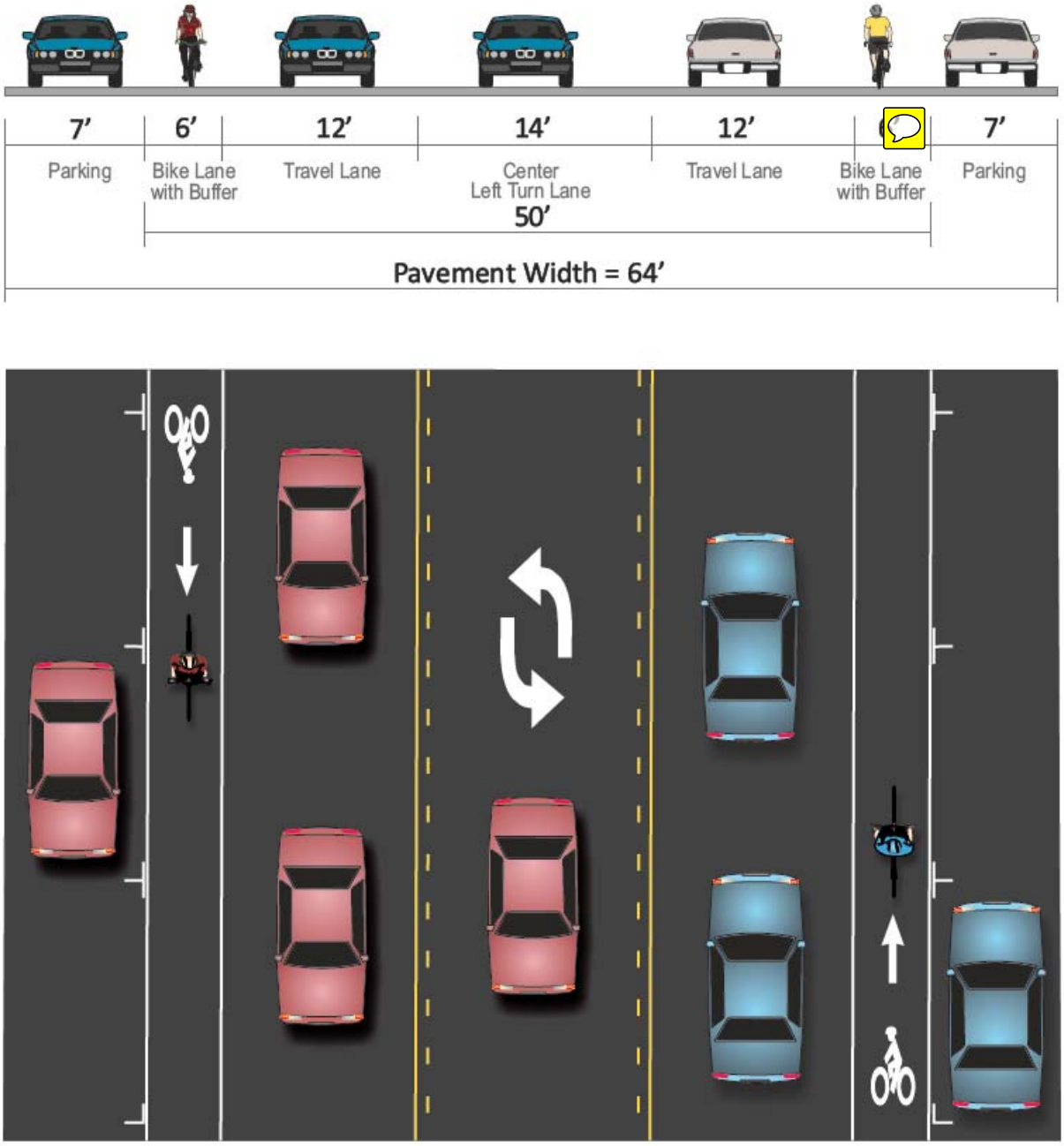


Figure 5-1: Three-Lane Conversion Alternative 1

Lane Conversion Alternative 2: Multimodal Safety

Alternative 2 would include one northbound through lane, one southbound through lane, a two-way center left turn lane, as well as buffered bike lanes on both sides with an on-street parking option for either the northbound or southbound traffic (see Figure 5-2).

	Lane Conversion Alternative 2 Considerations
Motor Vehicle Mobility	• Reduces number of travel lanes from four to three • Capacity reduced and travel time increased for through-traveling vehicles • Maintains twelve-foot outside travel lanes • On-street parking increases motor vehicle movements in the roadway and may reduce travel speeds
Walkability	• Existing sidewalks remain • Buffered bike lanes and on-street parking provide separation from motor vehicle lanes
Bicycle Facilities	• Includes five- to six-foot bike lanes with four-foot buffers
Freight Service	• Maintains twelve-foot travel lanes and a 14-foot left turn lane for freight movements • Potential conflicts with bike lanes
Business Accessibility	• Center turn lane improves access for turning vehicles • On-street parking improves ease of access to commercial facilities • Improved bicycle access
Cost	• Intersections and traffic signals would need to be reconfigured
Other	• Center left-turn lane offers opportunities for design elements including raised median treatments (e.g., landscaping, pedestrian refuge, access management)

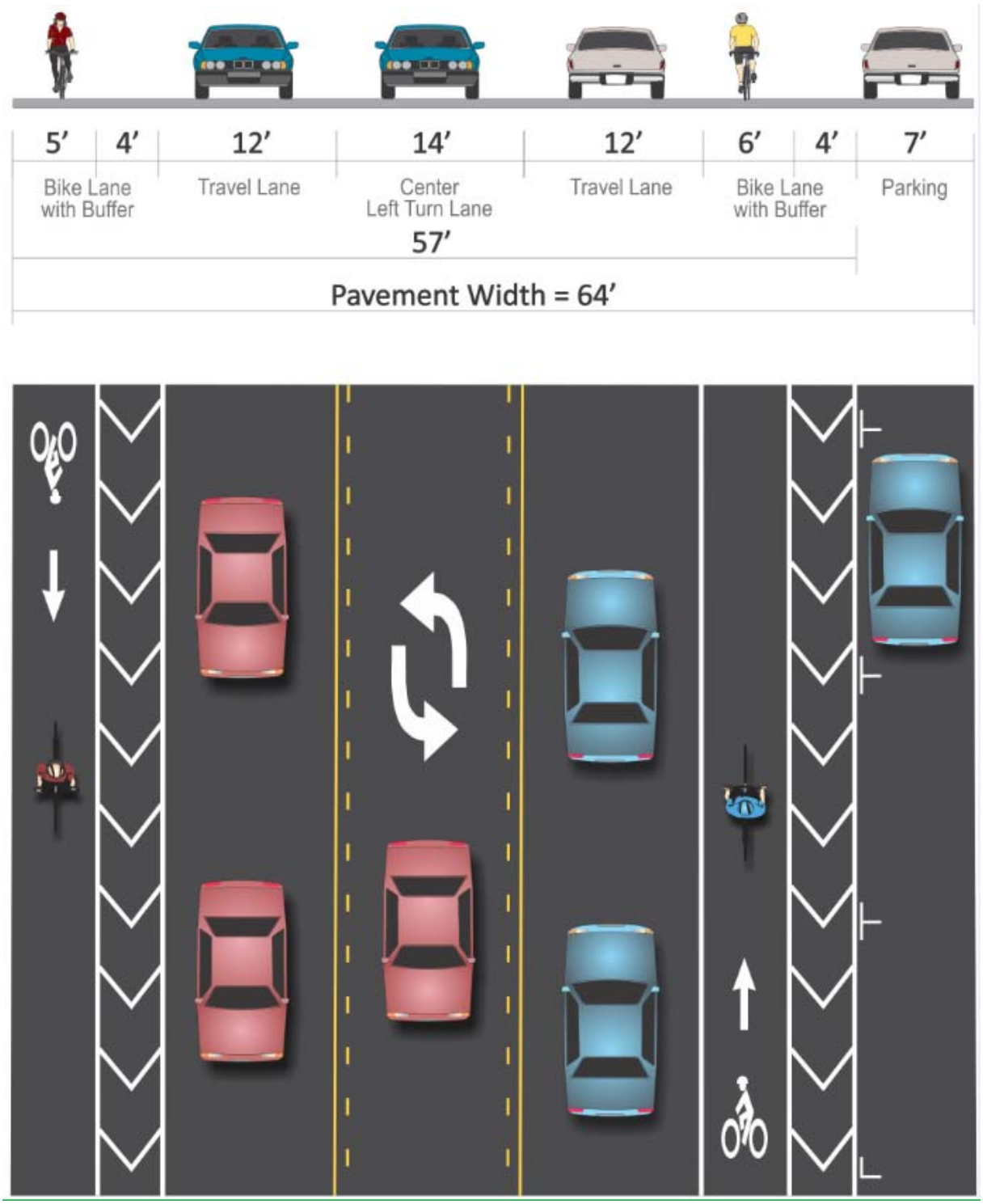


Figure 5-2: Three-Lane Conversion Alternative 2

Revised 20th Street Crossing Improvement Concept with Three-Lane Conversion

As previously discussed, several pedestrian crossing alternatives were shown. If the three-lane conversion is advanced, the following crossing improvement at 20th Street is recommended in place of those mentioned in the Crossing Improvement Concepts section. As shown in Figure 5-3, the roadway space provided from the four to three-lane conversion would allow for the combination of an RRFB or similar treatment, raised median pedestrian refuge[52] and curb extensions to provide all of the benefits mentioned in both of the short term crossing improvement concepts for the 20th Street location.[53]

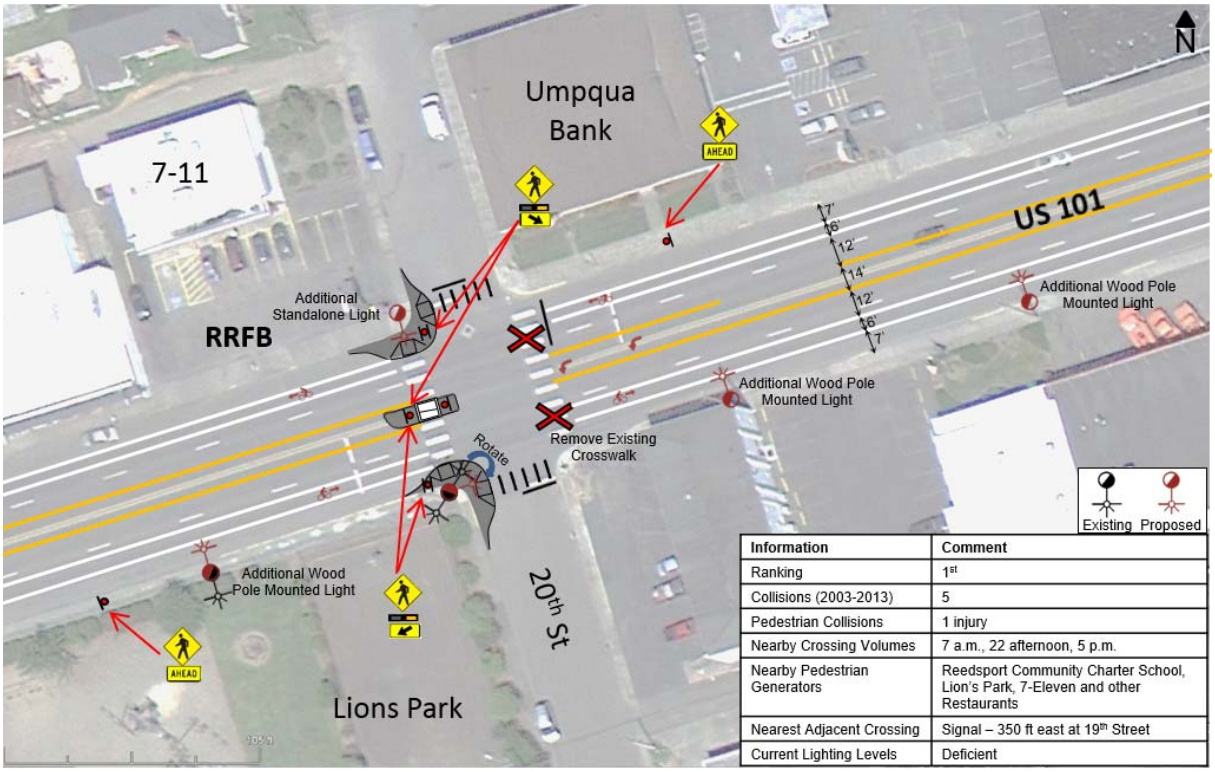


Figure 5-3: US 101 and 20th Street Three-Lane Conversion Crossing Improvement Concept (Option C)

[52] *Note: A median refuge island is a conceptual at this time and will require motor carrier coordination and approval.*

[53] *According to NCHRP Report 562, the minimum requirement for the US 101/20th Street Option A alternative is a marked crosswalk. However based on public input, discussions with the City of Reedsport, and the safety history at this location, we still recommend an RRFB under this alternative.*

FIVE-LANE CONVERSION

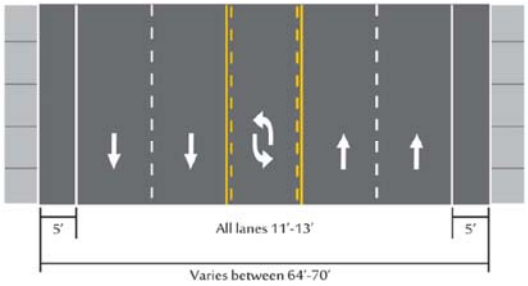


Figure 5-4: Five-Lane Cross Section Example

Since the pedestrian volumes were lower in this section and discussions with City staff indicated that land uses along US 101 north of 16th Street may not benefit directly from a three-lane conversion, converting this section to a continuous five-lane facility consisting of five foot bike lanes, eleven foot through lanes and a continuous 13 foot center turn lane as shown in Figure 5-4 to the right is recommended. Further coordination with ODOT will be necessary to gain approval for this cross-section.

The five-lane conversion along the northern portion of US 101 is considered a mid-term project and will require design exceptions to fit the proposed lane configuration within existing roadway width.

NEXT STEPS

The recommended alternative for the three-lane conversion along the southern section of US 101 and a five-lane conversion along the northern section of US 101 within the City of Reedsport will require freight mobility approval. Pedestrian crossing recommendations that include raised medians and curb extensions will also require further coordination with the freight community. The design exception process would be necessary to implement the recommended five0lane cross section along US 101 north of 16th Street.

Further coordination will be needed with property owners of the 7-Eleven to identify potential access modifications if the public decides to move forward with the Option A pedestrian crossing concept at the US 101/20th Street location. An amendment to the City of Reedsport's Transportation System Plan is necessary in order to implement the proposed three- or five-lane conversion. An amendment to the TSP will require a public involvement process that allows Reedsport residents to provide feedback on the recommended changes and would require City of Reedsport City Council adoption.

CHAPTER 6 PROJECT IMPLEMENTATION

PROJECT IMPLEMENTATION

Project implementation resources were prepared for the recommended crossing improvement concepts and overall corridor treatment options, which were discussed previously in Chapters 4 and 5. The implementation resources include prioritization of the improvement projects and associated cost estimates.

PROJECT PRIORITIZATION

The recommended safety improvement projects for the US 101 and OR 38 corridors are listed by improvement type in Table 6-1. The projects are also classified based on whether they are short-term, or mid-term priority. No long-term priorities are recommended in this study.

Table 6-1: Prioritized Safety Improvements on the US 101 and OR 38 Corridors

Improvement Type	Projects Listed by Priority	
	Short-Term	**Mid-Term**
Pedestrian Crossing Improvement	• US 101/20th Street • OR 38/3rd Street	• US 101/14th Street • US 101/21st Street
Traffic Signal Improvement	• Pedestrian Countdown Timers (All Traffic Signals) • US 101/22nd Street	• US 101/OR 38 Junction
Street Lighting	• At Crossing Improvement Locations • US 101/22nd Street	• Supplemental Lights on Utility Poles and New Stand-Alone Lights
Speed Feedback Sign	• US 101 near 22nd Street • West of US 101/OR 38 Junction • OR 38 east of 3rd Street	• US 101 east of the Schofield Bridge
Access Management	• At US 101/20th Street if Crossing Improvement Option A is Chosen	
US 101 Lane Conversion	• Continue coordination with ODOT, City, and Freight Mobility to advance conversion alternatives	

It is advised that ODOT and the City of Reedsport hold off designing and constructing the US 101 pedestrian crossing improvements until the final US 101 cross section is determined.

COST ESTIMATES

Cost estimates were prepared for each of the crossing improvement locations as well as the identified signalized improvement locations and are listed in Table 6-2. A 20% engineering and construction fee and a 20% contingency were applied individually to the cost estimate for each location. The total estimated cost is between $217,000 and $337,000 for all crossing improvement locations, $45,000 for all signalized improvement locations, and $50,000 for corridor-wide implementation of pedestrian countdown timers. All projects combined are estimated to cost between $312,000 and $432,000. Because funding sources are not currently identified for these recommended improvement projects, this study is intended to assist the Oregon Department of Transportation (ODOT) and the City of Reedsport in acquiring the needed project funding.

Table 6-2: Cost Estimates of Proposed Safety Projects

Safety Improvement	Total Estimated Cost[a]
Crossing Improvement Locations	
US 101/20th Street (Option A)	$110,000
US 101/20th Street (Option B)	$230,000
US 101/21st Street	$14,000
US 101/14th Street	$28,000
OR 38/3rd Street	$65,000
Total Cost for Crossing Improvement Locations	$217,000 - $337,000
Signalized Improvement Locations	
US 101/22nd Street[b]	$25,000
US 101/OR 38 Junction	$20,000
Total Cost for Signalized Improvement Locations	$45,000
Corridor-Wide Treatments	
Pedestrian Countdown Timers[c]	$10,000
Speed Feedback Signs	$40,000
Total Cost for Corridor-Wide Treatments	$50,000
Total Cost for All Improvement Locations	**$312,000 - $432,000**

[a] A 20% engineering and construction fee and a 20% contingency were applied to the cost estimate for each location
[b] 2070 controller upgrades at this location are assumed to be included in a separate ODOT project.
[c] The recommended pedestrian countdown timers at the signalized improvement locations are already included in the location cost estimate and are not included in the corridor-wide treatment cost estimate.

Table 6-3 shows the cost estimates that were prepared for each improvement aspect under the assumption of the implementation of a three-lane conversion along US 101 from 16th Street to 21st Street. The total estimated cost is approximately $220,000 for the three-lane conversion modifications, $213,000 for all crossing improvement locations, and $70,000 for signalized and corridor-wide improvements. All projects combined are estimated to cost approximately $503,000.

Table 6-3: Cost Estimates of Proposed Safety Projects Assuming the Implementation of a Three-Lane Conversion along US 101 from 16th Street to 21st Street

Safety Improvement	Total Estimated Cost[a]
Three-Lane Roadway Conversion from 16th Street to 21st Street	
Signing and Striping	$100,000
22nd Signal Modifications	$50,000
19th Signal Modifications	$70,000
Total Cost for Roadway Treatments	$220,000
Crossing Improvement Locations	
US 101/20th Street (Option C)	$120,000
US 101/14th Street	$28,000
OR 38/3rd Street	$65,000
Total Cost for Crossing Improvement Locations	$213,000
Signalized and Corridor-Wide Improvements	
US 101/OR 38 Junction	$20,000
Pedestrian Countdown Timers[b]	$10,000
Speed Feedback Signs	$40,000
Total Cost for Signalized and Corridor-Wide Treatments	$70,000
Total Cost for All Improvements	**$503,000**

[a] A 70% contingency and design was applied to the three-lane roadway conversion. A 20% engineering and construction fee and a 20% contingency were applied to the cost estimate for crossing improvement, signalized, and corridor-wide improvements.

[b] The recommended pedestrian countdown timers at the signalized improvement locations are already included in the location cost estimate and are not included in the corridor-wide treatment cost estimate.