Oregon Department of Transportation

PEDESTRIAN AND BICYCLE SAFETY IMPLEMENTATION PLAN

February 2014

Prepared for:

Oregon Department of Transportation

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ODOT Pedestrian and Bicycle Safety Implementation Plan

State of Oregon

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Oregon Department of Transportation

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Part A

Implementation Plan Summary and Results

Implementation Plan Summary

IMPLEMENTATION PLAN SUMMARY

Pedestrian and bicycle crashes are one of the safety emphasis areas or "safety areas of interest" in Oregon's Transportation Safety Action Plan (The Plan). The Plan follows a systemic safety planning process to prioritize corridors across all public roads in Oregon. The Plan identifies corridors with the most potential for reducing frequency and severity of pedestrian and bicycle crashes. The Implementation Plan:

- Prioritizes state highway corridors with the highest risk of a pedestrian or bicycle crash;
- Identifies risk factors present on local roadways associated with pedestrian or bicycle crashes;
- Prioritizes state and non-state roadway corridors based on reported pedestrian or bicycle crash frequency and/or severity;
- Identifies a toolbox of countermeasures expected to have the greatest potential to reduce frequency and/or severity of pedestrian or bicycle crashes; and,
- Lays the framework for efficient development of corridor projects based on site-specific evaluations by ODOT Regions and local agencies.

The plan does not identify specific projects; it identifies priority locations and countermeasure options. Site-specific assessments of road user behavior and physical characteristics are necessary to identify the most appropriate treatments from the countermeasure toolbox. Such site-specific assessments were beyond the scope of this statewide plan. ODOT regional or local agency staff have the opportunity to conduct site-specific evaluations for each candidate project corridor, to identify and develop specific projects for each location using appropriate countermeasures from the toolbox.

This plan, like implementation plans developed by ODOT for roadway departure crashes (2010) and intersection crashes (2012), provides a systemic approach for reducing pedestrian and bicycle crashes. The recommendations of this plan supplement ODOT's other safety programs, such as the Safety Priority Index System (SPIS), and satisfy MAP-21 requirements.

PURPOSE

The Implementation Plan serves multiple purposes, including:

- Increasing statewide understanding of pedestrian and bicycle crash patterns;
- Promoting objective, data-driven decision making;
- Complementing behavioral safety efforts;
- Focusing limited resources at locations with the greatest potential to reduce fatal and serious injury bicycle and pedestrian crashes in the State of Oregon; and,
- Establishing a toolbox of low- to medium-cost countermeasures that are effective at reducing crashes (excluding others that may only address perceived safety or sense of comfort by the road user).

CHALLENGES

This Implementation Plan varies from previous implementation plans in terms of the methodology and outcomes. Relative to the roadway departure and intersection safety implementation plans, developing an implementation plan for bicycle and pedestrian crashes is more challenging because:

1) Fewer pedestrian and bicycle crashes have been reported, compared to motorized vehicle crashes, resulting in a smaller data set;

2) Few low-cost systemic countermeasures for reducing pedestrian and bicycle crashes are reliable and widely transferable to multiple locations; and,

3) Exposure data (i.e., pedestrian or bicycle volumes) is not widely available and travel patterns vary by user.

APPROACH

The core element of this plan is prioritizing candidate locations for countermeasure implementation through network screening. FHWA's Systemic Safety Project Selection Tool provides a framework, shown in Exhibit 1, for a systemic safety planning process. The first three of four steps in Element 1 of the process are described in this Plan. The fourth step (project development and prioritization) would be applied by ODOT region or local agency staff.

Network screening has historically been conducted based on crash frequency, severity, or other hybrid performance measures that take into account reported crash characteristics. However, to overcome the challenges identified above, the Plan is based on a combination of two network screening methods. One network screening method relies on "traditional" metrics (i.e., reported crash frequency and severity) to prioritize candidate locations for safety improvement. This method was applied to all roads across the state. The second relies on a risk-based systemic safety planning process that identifies risk

based on roadway characteristics that have contributed to pedestrian and bicycle crashes over the study period.

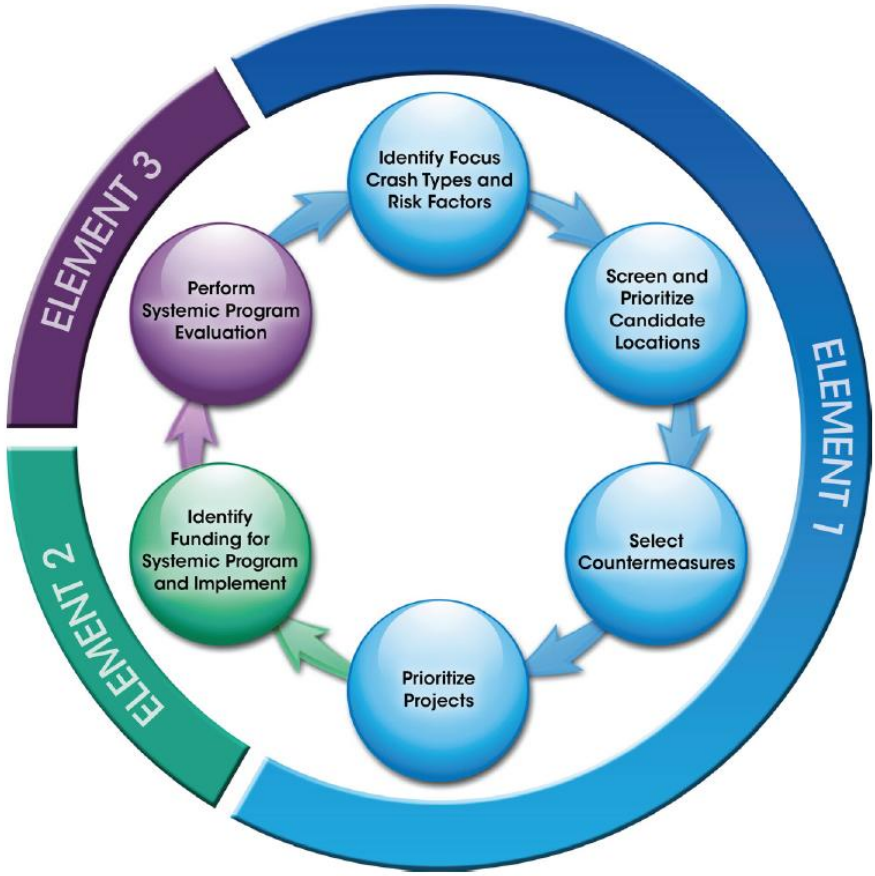


Exhibit 1. FHWA Systemic Safety Project Selection Tool Framework (Reference 1)

PLAN OUTCOMES

The systemic safety planning process outcomes include prioritized lists of candidate locations for safety improvements within each ODOT Region. Within each region, sites are prioritized in four project corridor lists based on two screening methods (risk-based or frequency-based) and crash type (pedestrian or bicycle). Candidate project corridor maps for each region and tables describing the prioritized candidate project corridors are provided in Section 2.

Risk-based and frequency-based candidate location lists are prioritized separately because frequency-based screening takes into account non-state roadways and risk-based screening does not. Due to inconsistent inventory data for non-state roadways a state-wide analysis of risk factors could not be conducted; an alternative process is necessary to incorporate non-state candidate locations into the

risk-based candidate location priorities. Candidate locations for pedestrian and bicycle crashes are prioritized separately recognizing that each requires different sets of countermeasures.

The Plan includes a list of candidate priority locations based on an objective analysis and provides a toolbox from which to choose countermeasures. The fourth and final step, prior to implementation, is project development and ranking. The Plan allows ODOT and local agencies to apply engineering judgment and contextual knowledge to develop and rank projects.

PLAN ORGANIZATION

This Plan is organized in two parts, each containing multiple sections.

Part A: Implementation Plan Summary and Results provides an overview of the core elements that will inform implementation. It includes limited explanation of "why" certain methods were selected and "how" methods were applied. Part A includes two sections: 1) Implementation Plan Summary and 2) Implementation Plan Results.

Part B: Methodology and Approach provides documentation of "how" and "why" the plan was created. Part B includes five sections: 3) Background and Goals, 4) Crash Pattern Analysis, 5) Network Screening, 6) Countermeasure Options, and 7) Improving the Plan.

Implementation Plan Results

IMPLEMENTATION PLAN RESULTS

The systemic safety planning process involved prioritizing roadway segments based on network screening and combining multiple priority segments into candidate project corridors. Combining multiple priority candidate segments into larger corridors facilitates project programming and construction efficiency. There are four candidate project corridor lists for each region, based on two screening methods (risk-based and frequency-based) and target crash types (pedestrian and bicycle). Candidate project corridor maps for each region, and tables describing the prioritized candidate project corridors are provided in the following sections.

The list of candidate priority locations may be reviewed by ODOT region and local agency staff who have more local context, know about other recently-implemented countermeasures, can identify right-of-way constraints, and can take into account other similar considerations. The rankings of each candidate project corridor and the extents of the corridor may be modified based on Regional reviews.

Candidate corridor extents are identified by milepost on state highways and nearest intersecting street on local roads and are approximated through the systemic process. Extents can be modified through project development. Candidate corridor length, as shown in the tables in the following sections, reflects the length of the corridor based on the GIS database and do not generally equal the difference in beginning and end milepost.

Candidate corridors reflect a minimum length of one-half mile, although a few exceptions were allowed for corridors located near other segments or within downtown cores. The minimum length criterion is intended to facilitate implementation by reducing project cost through design and construction efficiency. Short segments could be considered for safety improvement funding through other ODOT programs and addressed with a different method than the systemic countermeasures proposed for corridors in the methodology leading to this plans recommendations.

Regional reviews of candidate project corridors could include conducting field reviews, diagnosing contributing factors, and identifying countermeasures from the toolbox. Part B of the Highway Safety Manual provides guidance for conducting such reviews. ODOT region and local agency staff can use the countermeasure toolbox in combination with the site-specific information to develop a project that is most likely to be effective at reducing the frequency and/or severity of bicycle and pedestrian crashes.

REGION 1 PROJECT CORRIDORS

ODOT Region 1 includes the Portland Metro Area which is the most populous urban area in the state and has the highest number of pedestrians and bicyclists. Over the study period, Region 1 has the highest number of reported bicycle and pedestrian crashes of all ODOT Regions.

Table 1 Region 1 Study Statistics

Statistic	Pedestrian	Bicycle
Number of reported crashes (2007-2011)	1,893	2,161
Number of fatal or severe crashes (2007-2011)	355	180
Number of risk-based project corridors identified	10	10
Number of frequency and severity-based project corridors identified	18	26

Pedestrian Project Corridors

Region 1 Pedestrian Project Corridors, identified in Table 2, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarized in Table 1-1 of Appendix 1. Table 2 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations. Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 18 Project Corridors across Region 1, as summarized in Table 3. Individual segments are summarized in Table 2-1 of Appendix 2.

The results of both network screening methods are shown on Figure 1 to illustrate where the projects are located and where overlap from both methods occurs. Corridor #15 (Cascade Highway North) on the Frequent and Severe Crash Project Corridors is not presented on Figure 1 because it overlaps with a risk-based Project Corridor. Each Project Corridor shown in Figure 1 includes a corridor number corresponding to the corridor numbers in Table 2 and Table 3, for reference. In Region 1, Figure 1 shows the majority of the crash frequency and severity Project Corridors are downtown and east of Portland. However, many of the risk-based Project Corridors are in areas south and west of Downtown Portland.

Bicyclist Project Corridors

Region 1 Bicyclist Project Corridors, identified in Table 4, include multiple segments prioritized through risk-based network screening. The prioritized segments are summarized in Table 1-2 of Appendix 1. Table 4 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations. Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor. The Region 1 Risk-based Project Corridors reflect a mixture of facilities within the Portland City limits and some outside the City.

Priority segments selected from the crash frequency and severity network screening formed 26 Project Corridors across Region 1, as summarized in Table 5. Individual segments are summarized in Table 2-2 of Appendix 2.

Crash Frequency and Severity Project Corridors for bicycle projects were heavily concentrated in the downtown Portland area. In order to identify projects in various areas of the city, three separate scoring scenarios were developed for: downtown Portland, Southeast Portland, and Northeast Portland.

The results of both network screening methods are shown on Figure 1 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 1 includes a Corridor Number that corresponds to the Corridor Numbers in Table 4 and Table 5, for reference. In Region 1, Figure 1 shows how the Frequent and Severe Crash Project Corridors are located throughout the City as a result of the scoring thresholds for each area. The risk-based Bicyclist Project Corridors are all located in areas outside of the City.

Table 2 ODOT Region 1 Pedestrian Risk-Based Project Corridors

Corridor Rank	Corridor ID	Highway Name	Highway Number	Start ^	End^	Length (Miles)*	City	Total Number of Segments within Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that are Undivided 4-Lane	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with Pedestrian Activated Flashers or Beacons	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments with at Least 1 Signal within 100' of Segment	Average Pedestrian Score
1	R-5	NORTHEAST PORTLAND	123	3.80	6.30	2.51	Portland	25	2	2	15	0	21	4	25	1	24	0	13	13	10.52
2	R-6	OSWEGO	003	3.00	4.40	1.40	Portland	14	1	0	0	0	14	0	7	14	0	0	4	3	10.07
3	R-10	TUALATIN VALLEY	029	7.1	9.20	2.86	0	31	2	2	11	0	31	0	0	30	1	0	9	13	9.77
4	R-4	MT. HOOD	026	0.00	14.90	0.66	Gresham	7	0	3	1	0	7	0	0	7	0	0	0	1	9.43
5	R-1	CASCADE HWY NORTH	068	1.20	6.30	5.10	Portland	51	1	11	38	0	51	0	14	1	50	2	20	31	9.25
6	R-3	MT. HOOD	026	2.1	3.90	2.47	Portland	26	3	4	29	1	24	2	3	0	26	0	8	12	9.19
7	R-2	CASCADE HWY NORTH	068	6.80	9.40	2.59	0	26	0	8	14	0	25	0	3	5	21	0	11	15	9.15
8	R-8	PACIFIC HIGHWAY WEST	091	7.70	8.90	1.20	Tigard	12	0	1	4	0	12	0	3	1	11	0	4	9	8.83
9	R-9	PACIFIC HIGHWAY WEST	091	9.8	10.50	1.32	Tigard	13	0	5	6	1	13	0	0	0	12	0	4	7	8.54
10	R-7	PACIFIC HIGHWAY EAST	081	8.20	10.50	2.30	0	23	5	1	12	0	23	0	12	0	0	0	8	8	7.70

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost.

^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 3 ODOT Region 1 Pedestrian Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/ Highway Name	Start^	End^	Length (Miles)*	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Total Pedestrian Score
1	F-15	Cascade Hwy N	1.74	8.92	4.77	Portland	ODOT	1	19	41	0	142
2	F-14	W Burnside St	Maywood Dr	NE 3rd Ave	2.17	Portland	Municipal Street	2	5	38	0	97
3	F-2	122nd	SE Bush St	E Burnside St	2.16	0	County	1	3	35	3	85
4	F-16	Mt. Hood	1.27	3.38	2.41	Portland	ODOT	3	4	28	1	78
5	F-6	Broadway St	SW Jackson St	N Wheeler Ave	2.04	Portland	Municipal Street	2	3	29	0	73
6	F-7	Division St	SE 148th Ave	SE 182nd Ave	1.63	Portland	Municipal Street	2	6	17	0	58
7	F-1	SE 112th/NE 102nd	SE Market St	NE Weidler St	2.13	Portland	Municipal Street	2	2	15	0	42
8	F-5	4th	SW Grant St	Glisan St	1.46	Portland	Municipal Street	0	3	14	0	37
9	F-3	181st Ave	SE Stark St	NE Halsey St	1.21	Gresham	Municipal Street	0	2	15	0	36
9	F-4	3rd	SW Market St	Glisan St	1.06	Portland	Municipal Street	0	0	18	0	36
9	F-13	Stark	SE 117th Ave	Se 146th Ave	1.41	Portland	Municipal Street	1	1	15	0	36
9	F-18	Northeast Portland	4.39	5.94	1.54	Portland	ODOT	2	2	12	0	36
10	F-17	Mt. Hood	6.89	8.31	1.42	Portland	ODOT	1	4	10	0	35
11	F-10	Hawthorne	SE 19th Ave	SE 45th Ave	1.48	Portland	Municipal Street	0	2	12	1	31
11	F-12	Sandy Blvd.	NE Broadway	NE 59th Ave	1.09	Portland	Municipal Street	0	3	11	0	31
12	F-9	Glisan St	NW 19th Ave	Steel Bridge	0.87	Portland	Municipal Street	2	1	10	1	30
13	F-8	Foster Rd	Holgate Blvd	SE 82nd Ave	1.24	Portland	Municipal Street	2	2	7	0	26
14	F-11	Multnomah	N Interstate Ave	NE 21st Ave	1.12	Portland	Municipal Street	0	0	12	0	24

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost.

^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 4 ODOT Region 1 Bicyclist Risk-Based Project Corridors

Corridor Rank	Corridor ID	Highway Name	Highway Number	Start^	End^	Length (Miles)*	City	Total Number of Segments in Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Driveway Density (Average Number of Driveway Access Points per Segment)	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that Lack of Bicycle Facility - Right Side	Number of Segments that Lack of Bicycle Facility - Left Side	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments that are Undivided 4-Lane	Number of Segments with at Least 1 Signal within 100' of Segment	Average Bicycle Score
1	R-6	Pacific Hwy (E)	081	18.2	18.90	0.73	0	8	0	0.00	0.00	0	0.6	8	0	8	0	8	8	0	2	0	12.50
2	R-3	NE Portland	123	2.80	6.30	3.50	Portland	35	0	0	15	1	4.0	1	34	23	12	35	35	17	26	18	11.74
3	R-2	Mt. Hood	026	25.40	27.30	1.90	Sandy	19	0	0	0	0	1.4	19	0	18	0	16	16	0	5	0	11.53
4	R-4	Oswego	003	1.3	3.20	2.62	Portland	29	0	0	3	0	2.2	9	20	28	0	29	26	6	8	12	11.45
5	R-5	Oswego	003	3.00	5.50	2.50	Portland	25	0	0	0	0	2.2	25	0	25	0	21	9	7	7	9	11.44
6	R-10	Tualatin Valley	029	3.7	4.30	1.13	Beaverton	12	1	0	5	1	5.2	3	9	12	0	6	7	5	0	8	11.08
7	R-1	Beaverton-Hillsdale	040	1.00	3.40	2.44	Beaverton	26	0	2	12	0	4.8	1	22	25	0	22	20	11	5	16	11.08
8	R-7	Pacific Hwy (E)	081	19.50	21.80	2.31	Canby	23	0	1	5	0	4.2	14	9	23	0	15	16	0	3	6	10.96
9	R-9	Tualatin Valley	029	1.10	2.80	1.71	Beaverton	17	0	1	0	0	5.7	0	15	13	4	14	14	6	6	6	10.12
10	R-8	Pacific Hwy (E)	081	-4.40	-3.80	0.65	Portland	7	0	0	0	0	5.6	4	1	0	7	7	7	1	2	3	10.00

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost.

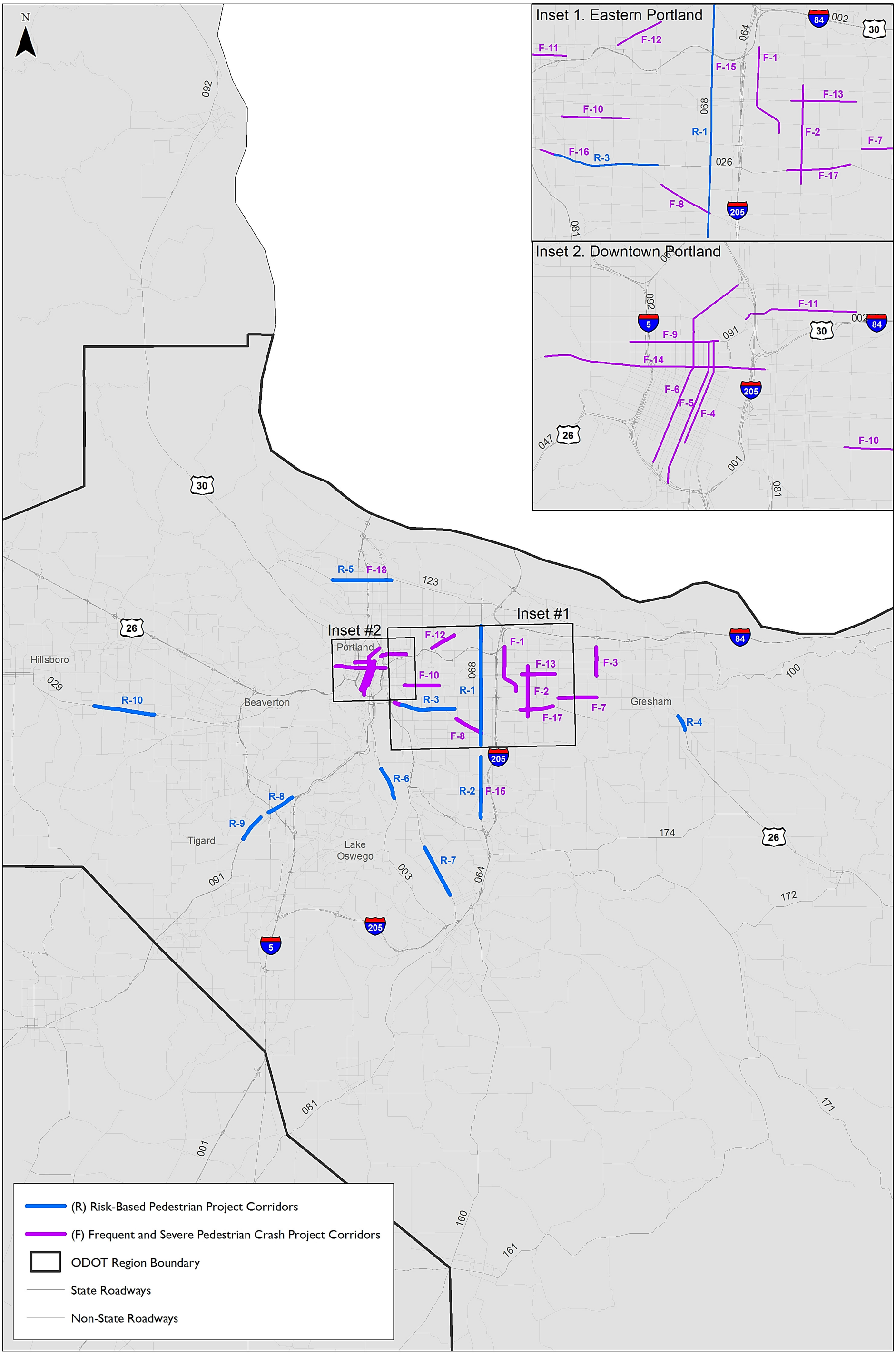
^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 5 ODOT Region 1 Bicyclist Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)*	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved, not Injured (2007-2011)	Total Bicycle Score
1	F-11	Broadway St	N Hoyt St	NE 32nd Ave	2.46	Portland	Municipal Street	0	3	63	2	137
2	F-10	Broadway St	SW Jackson St	N Wheeler Ave	2.04	Portland	Municipal Street	0	3	51	2	113
3	F-18	Hawthorne	SE Madison St	SE 30th Ave	2.00	Portland	Municipal Street	0	2	37	1	81
4	F-24	Vancouver Ave.	N Winning Way	N Roselawn St	1.96	Portland	Municipal Street	0	4	25	1	63
5	F-25	W Burnside St	NW 23rd Pl	NE Martin Luther King Jr Blvd	1.86	Portland	Municipal Street	0	2	24	1	55
6	F-26	Williams Ave	N Winning Way	NE Alberta St	1.80	Portland	Municipal Street	0	1	25	0	53
7	F-17	Grand Ave.	SE Lincoln St	NE Clackamas St	1.73	Portland	Municipal Street	0	1	20	2	45
8	F-4	20th	SE Harrison St	NE Multnomah St	1.61	Portland	Municipal Street	0	2	19	0	44
9	F-12	Cornell Rd	E Main St	NE Ray Cir	2.92	Hillsboro	County	0	2	18	1	43
10	F-1	11th	SE 12th Ave	SE Ankeny St	1.34	Portland	Municipal Street	0	1	19	1	42
10	F-14	Division St	SE 182nd Ave	NE Kane Dr	3.34	Gresham	Municipal Street	0	2	18	0	42
10	F-19	Madison	SW Park Ave	SE 9th Ave	0.94	Portland	Municipal Street	0	2	18	0	42
11	F-6	3rd	SW Market St	NW Glisan St	1.06	Portland	Municipal Street	0	2	17	0	40
11	F-7	4th	SW Hall St	NW Glisan St	1.22	Portland	Municipal Street	0	2	17	0	40
12	F-8	7th	SE Division St	SE Washington St	0.84	Portland	Municipal Street	0	2	14	1	35
13	F-16	Everett St	NW 19th Ave	NW Naito Pkwy	0.97	Portland	Municipal Street	0	1	15	1	34
13	F-20	Martin Luther King Jr. Blvd.	NE Holladay St	NE Failing St	1.43	Portland	Municipal Street	0	1	15	1	34
14	F-2	181st Ave	SE Yamhill St	NE Wilkes Rd	1.75	Gresham	Municipal Street	0	3	11	0	31
14	F-13	Division St	SE 66th Ave	SE 89th Ave	1.14	Portland	Municipal Street	1	1	12	1	31
15	F-22	Powell Blvd	NW Wallula Ave	SE Robin Way	2.20	Gresham	Municipal Street	0	2	10	0	26
16	F-3	185th Ave	SW Pheasant Ln	Hwy 26	2.70	0	County	0	1	10	1	24
17	F-23	Stark	SE 168th Ave	SE 205th Ave	1.80	Portland	Municipal Street	0	1	9	0	21
18	F-15	Eastman Parkway	SW 4th St	NW Burnside Rd	1.33	Gresham	Municipal Street	0	0	10	0	20
19	F-9	Boones Ferry Rd	SW Killarney Ln	SW Martinazzi Ave	1.64	Tualatin	Municipal Street	0	0	7	1	15
19	F-21	Murray Blvd	SW Allen Blvd	SW Millikan Way	1.21	Beaverton	County	1	0	6	0	15
20	F-5	257th Dr	SW 29th St	W Historic Columbia River Hwy	1.28	Troutdale	County	0	2	2	0	10

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost. ^Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.



Priority Sites for Implementation of Pedestrian Crash Countermeasures
ODOT Region 1

Figure **1**

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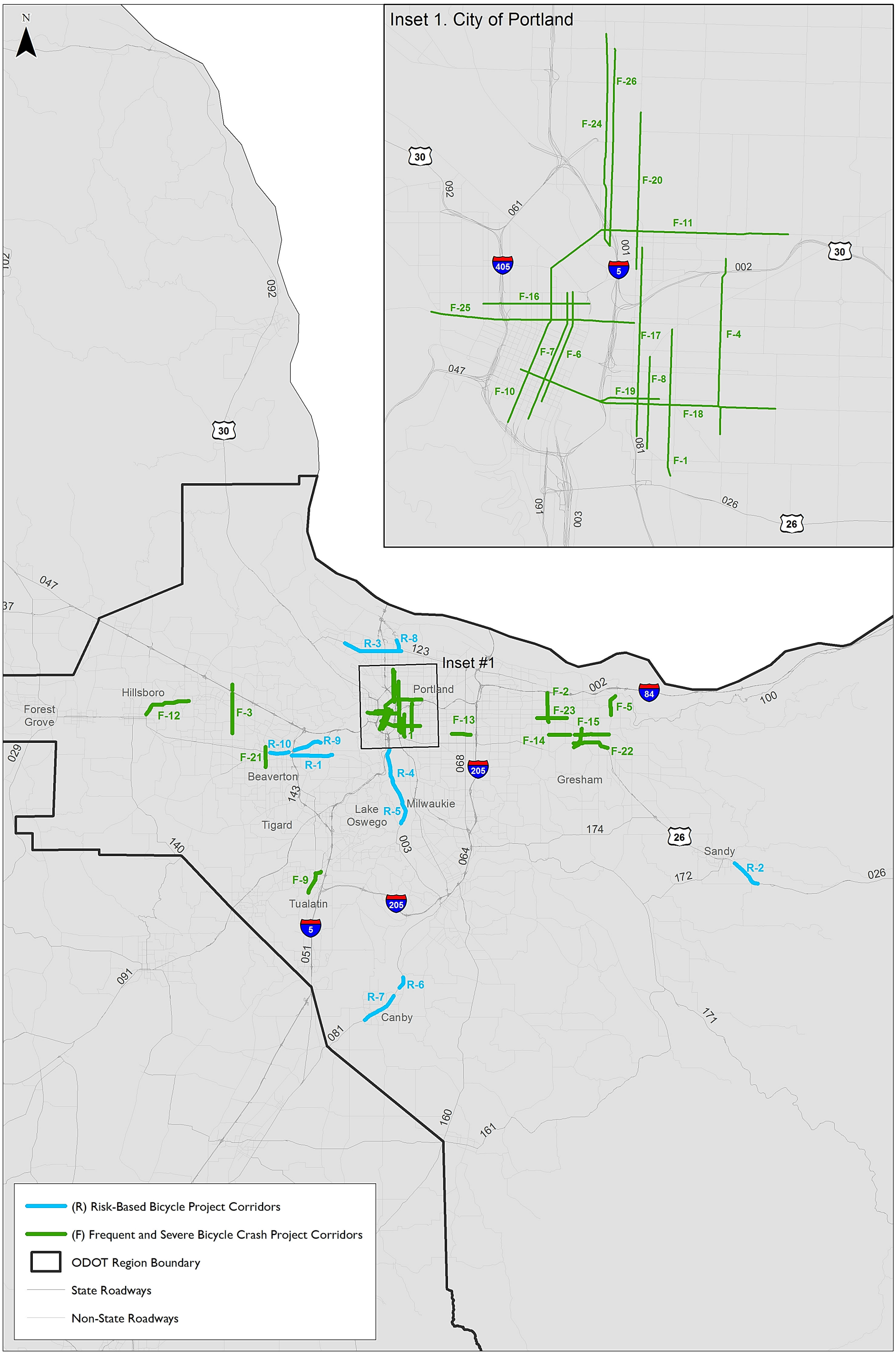

Priority Sites for Implementation of Bicycle Crash Countermeasures
ODOT Region 1

Figure **2**

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REGION 2 PROJECT CORRIDORS

ODOT Region 2 includes the Willamette Valley area and western areas of the state outside of the Portland Metro Area, including all coastal cities, Salem, Eugene, and Corvallis. Because the population is more scattered throughout the Region, the method identified results in cities throughout the Region.

Table 6 Region 2 Study Statistics

Statistic	Pedestrian	Bicycle
Number of reported crashes (2007-2011)	968	1,292
Number of fatal or severe crashes (2007-2011)	230	125
Number of risk-based project corridors identified	11	13
Number of frequency and severity-based project corridors identified	17	17

Pedestrian Project Corridors

Region 2 Pedestrian Project Corridors, identified in Table 7, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarized in Table 1-3 of Appendix 1. Table 7 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate counteremasures at different locations. Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 17 Project Corridors across Region 2, as summarized in Table 8. Individual segments are summarized in Table 2-3 of Appendix 2.

The results of both network screening methods are shown on Figure 3 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 3 includes a Corridor Number that corresponds to the Corridor Numbers in Table 7 and Table 8, for reference. In Region 2, Figure 3 shows that many of the Frequent and Severe Crash Project Corridors are located within major cities, including Eugene and Salem. However, the risk-based screening identified additional project corridors on the outer edges of these cities and in smaller cities throughout the Region and along the Oregon coast.

Bicyclist Project Corridors

Region 2 Bicyclist Project Corridors, identified in Table 9, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarized in Table 1-4 of Appendix 1. Table 9 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations. Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 17 Project Corridors across Region 2, as summarized in Table 10. Individual segments are summarized in Table 2-4 of Appendix 2.

The results of both network screening methods are shown on Figure 3 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 3 includes a Corridor Number that corresponds to the Corridor Numbers in Table 9 and Table 10, for reference. In Region 2, Figure 3 shows how the Frequent and Severe Crash Project Corridors are located in urban areas, including Eugene, Salem, and Corvallis. The risk-based Project Corridors complement the crash corridors by identifying corridors outside of the urban areas and in other cities, including Newport, Astoria, Woodburn, and Newberg.

Table 7 ODOT Region 2 Pedestrian Risk-Based Project Corridors

Corridor Rank	Corridor ID	Highway Name	Highway Number	Start ^	End^	Length (Miles)*	City	Total Number of Segments within Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that are Undivided 4-Lane	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with Pedestrian Activated Flashers or Beacons	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments with at Least 1 Signal within 100' of Segment	Average Pedestrian Score
1	R-3	CORVALLIS-LEBANON	210	0.40	1.1	0.80	0	9	1	0	0	0	8	0	4	9	0	0	0	1	9.00
2	R-11	SALEM-DAYTON	150	19.4	26.00	3.12	Salem	33	0	1	7	0	32	0	1	27	6	0	6	9	8.58
3	R-1	ALBANY-JUNCTION CITY	058	0.00	5.10	4.63	Albany	47	0	2	7	0	41	6	0	36	11	0	9	13	8.23
4	R-9	PACIFIC HIGHWAY WEST	091	20.50	22.30	1.80	Newberg	18	0	1	1	0	18	0	0	13	5	0	2	4	8.17
5	R-4	LOWER COLUMBIA RIVER	092	25.0	27.60	2.67	0	27	0	1	3	0	26	0	0	27	0	0	0	0	8.15
6	R-8	PACIFIC HIGHWAY EAST	081	45.40	46.40	1.08	0	10	1	0	6	0	5	0	1	10	0	0	1	6	8.10
7	R-7	PACIFIC HIGHWAY EAST	081	31.60	33.30	1.70	Woodburn	16	1	3	6	0	8	7	4	3	13	0	6	6	8.06
8	R-5	MCKENZIE	015	6.00	7.10	1.13	Springfield	11	2	1	2	0	7	3	0	6	0	0	4	3	7.64
9	R-6	OREGON COAST	009	138.90	140.40	1.50	Newport	15	0	2	4	0	12	3	0	4	10	0	2	8	7.53
10	R-2	BELTLINE	069	1.80	3.60	1.79	Eugene	18	0	1	0	0	9	8	0	18	0	0	1	4	7.44
11	R-10	PACIFIC HIGHWAY WEST	091	119.60	121.40	1.80	Eugene	18	1	1	7	0	17	1	2	6	0	0	4	5	7.06

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost.

^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 8 ODOT Region 2 Pedestrian Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)*	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Total Pedestrian Score
1	F-9	Lancaster Dr	Hudson Ave NE	Nester Ln NE	3.99	0	County	4	5	31	1	90
2	F-17	MCKENZIE	3.73	10.08	2.82	Springfield	ODOT	4	3	10	0	41
3	F-10	Liberty St	Miller St SE	Broadway St NE	1.48	Salem	Municipal Street	1	0	16	0	35
4	F-2	13th	Adams St	Kincaid St	1.39	Eugene	Municipal Street	1	1	11	0	28
4	F-7	Commercial St	Fairway Ave SE	Hilfiker Ln SE	2.20	Salem	Municipal Street	0	2	11	0	28
5	F-8	Hilyard	E 25th Ave	E Broadway (Hwy 99)	1.30	Eugene	Municipal Street	2	0	10	0	26
6	F-16	LOWER COLUMBIA RIVER	97.67	99.29	2.11	Astoria	ODOT	0	3	7	0	23
7	F-14	SW 14th	SW Jefferson Way	NW Harrison Blvd	0.43	Corvallis	Municipal Street	1	2	6	0	21
8	F-11	Market St	Front St NE	32nd Pl NE	2.08	Salem	Municipal Street	0	1	8	1	20
9	F-1	11th	Bailey Hill Rd	Fillmore St	1.63	Eugene	Municipal Street	2	1	5	0	19
9	F-3	18th Ave.	Monroe St	Agate St	1.71	Eugene	Municipal Street	1	0	8	0	19
10	F-5	Center St	Bieber Ave NE	45th Ave NE	1.19	Salem	Municipal Street	0	2	6	0	18
11	F-13	Queen Ave	Takena St SW	SE Clay St	1.94	Albany	Municipal Street	0	0	7	1	15
12	F-12	N River Rd	Plymouth Dr NE	Dietz Ave NE	1.10	Keizer	Municipal Street	0	0	7	0	14
13	F-15	Willamette St	W 23rd Ave	E 7th Ave (Hwy 99)	1.20	Eugene	Municipal Street	1	0	5	0	13
14	F-6	Chambers St	W 14th St	W 1st St	1.12	Eugene	Municipal Street	0	1	4	0	11
15	F-4	Capitol St	Center St NE	Myrtle Ave NE	1.15	Salem	Municipal Street	0	0	5	0	10

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost.

^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 9 ODOT Region 2 Bicyclist Risk-Based Project Corridors

Corridor Rank	Corridor ID	Highway Name	Highway Number	Start^	End^	Length (Miles)*	City	Total Number of Segments in Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Driveway Density (Average Number of Driveway Access Points per Segment)	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that Lack of Bicycle Facility - Right Side	Number of Segments that Lack of Bicycle Facility - Left Side	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments that are Undivided 4-Lane	Number of Segments with at Least 1 Signal within 100' of Segment	Average Bicycle Score
1	R-2	CORVALLIS-LEBANON	210	0.40	1.1	0.80	0	9	0	0	0	0	1.0	9	0	8	0	9	9	0	4	1	12.33
2	R-10	PACIFIC HIGHWAY WEST	091	19.80	21.30	1.50	0	15	0	0	0	0	1.1	15	0	15	0	14	14	0	0	0	11.87
3	R-13	WILLAMINA-SALEM	030	20.0	21.20	1.02	0	11	0	0	0	0	2.3	11	0	9	0	11	11	0	0	0	11.55
4	R-1	BELTLINE	069	1.50	3.10	1.59	Eugene	16	0	0	1	0	1.7	16	0	9	6	16	13	1	0	3	11.06
5	R-4	LOWER COLUMBIA RIVER	092	25.0	27.70	2.77	0	28	0	0	2	0	2.1	27	1	27	0	18	18	0	0	1	10.64
6	R-11	SALEM-DAYTON	150	19.9	20.60	2.09	Salem	23	0	2	10	1	3.7	19	4	22	0	9	8	5	0	6	10.39
7	R-12	SANTIAM	016	14.2	17.40	3.84	Lebanon	39	0	0	11	0	5.1	26	9	16	22	34	37	0	2	5	10.15
8	R-3	CORVALLIS-NEWPORT	033	52.60	54.00	1.40	Corvallis	14	0	0	3	0	6.9	14	0	0	14	10	10	3	0	3	9.93
9	R-6	OREGON COAST	009	138.60	140.90	2.30	Newport	23	0	3	4	1	6.3	7	11	15	8	13	15	2	3	9	9.35
10	R-9	PACIFIC HIGHWAY WEST	091	122.7	123.30	2.45	Eugene	25	0	0	14	0	11.8	2	0	22	3	23	22	3	0	14	9.20
11	R-8	PACIFIC HIGHWAY EAST	081	31.80	33.40	1.60	Woodburn	16	0	1	3	0	7.8	4	12	8	7	7	8	5	4	5	8.94
12	R-5	LOWER COLUMBIA RIVER	092	99.1	99.30	0.83	Astoria	9	0	1	2	0	7.7	2	0	8	0	2	5	2	8	3	8.78
13	R-7	OREGON COAST	009	113.50	115.30	1.76	Lincoln City	18	1	0	1	0	7.1	0	0	16	2	16	16	5	4	7	8.72

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost.

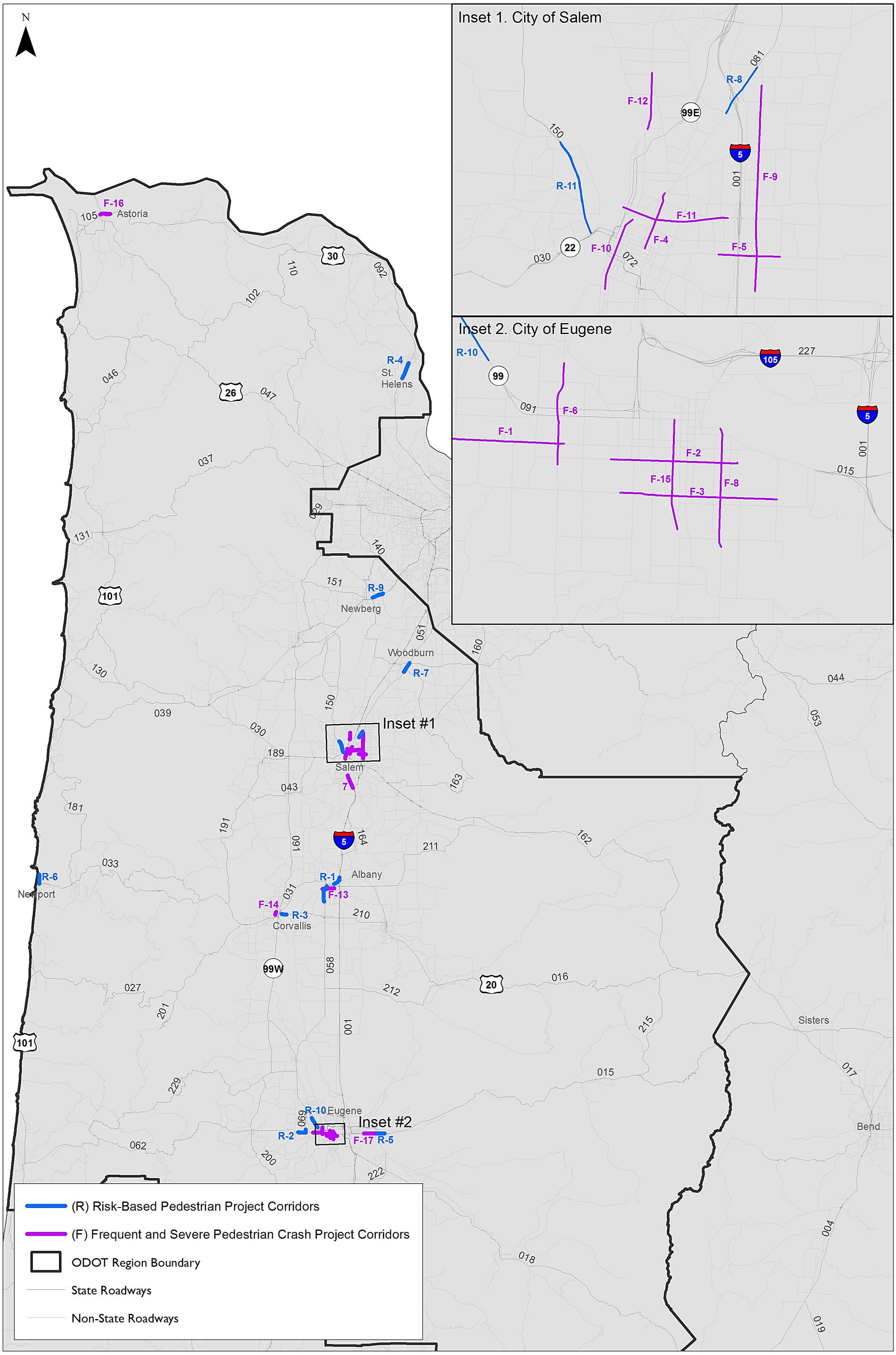
^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 10 ODOT Region 2 Bicyclist Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)*	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Total Bicycle Score
1	F-10	Lancaster Dr	State St	Cooley Dr NE	3.41	0	County	1	0	30	1	64
2	F-13	N River Rd	Delmar Dr N	Promenade Way N	2.59	Salem	Municipal Street	0	1	28	1	60
3	F-3	18th Ave.	Polk St	Agate St	2.13	Eugene	Municipal Street	0	4	22	1	57
4	F-17	Willamette St	E 30th Ave	E 7th Ave	1.97	Eugene	Municipal Street	1	3	18	0	48
5	F-12	Monroe Ave	NW 26th St	NW 3rd St	1.00	Corvallis	Municipal Street	0	2	17	0	40
6	F-11	Market St	18th St NE	Tierra Dr NE	1.75	Salem	Municipal Street	0	1	13	0	29
7	F-1	11th	Van Buren St	Franklin Blvd (Hwy 99)	1.60	Eugene	Municipal Street	1	0	12	0	27
8	F-5	Center St	23rd St NE	Sphinx Ct NE	1.80	Salem	Municipal Street	0	2	9	1	25
8	F-14	NW Highland	NW Grant Ave	NW Angelica Dr	1.08	Corvallis	Municipal Street	0	1	11	0	25
9	F-9	Hilyard	E 25th Ave	E Broadway (Hwy 99)	1.30	Eugene	Municipal Street	0	1	10	1	24
9	F-15	Pearl	E 19th Ave	E 4th St	1.14	Eugene	Municipal Street	0	0	12	0	24
10	F-2	13th	Adams St	Kincaid St	1.39	Eugene	Municipal Street	1	0	9	0	21
10	F-16	Silverton Rd	Lana Ave NE	Chiefs Ct NE	1.26	Salem	Municipal Street	0	1	9	0	21
11	F-7	Commercial St	Fabry Rd SE	Lansford Dr SE	1.57	Salem	Municipal Street	0	2	7	0	20
11	F-4	24th	Willamette St	Columbia St	1.14	Eugene	Municipal Street	0	0	9	0	18
12	F-6	Chambers St	W 10th Ave	Northwest Expy	1.08	Eugene	Municipal Street	0	1	7	0	17
12	F-8	Hawthorne Ave	Thorndale Rd NE	Freeway Ct NE	1.26	Salem	Municipal Street	0	1	7	0	17

* Length is based on GIS segment length and does not correspond directly to beginning and end milepost.

^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.



Priority Sites for Implementation of Pedestrian Crash Countermeasures
ODOT Region 2

Figure
3

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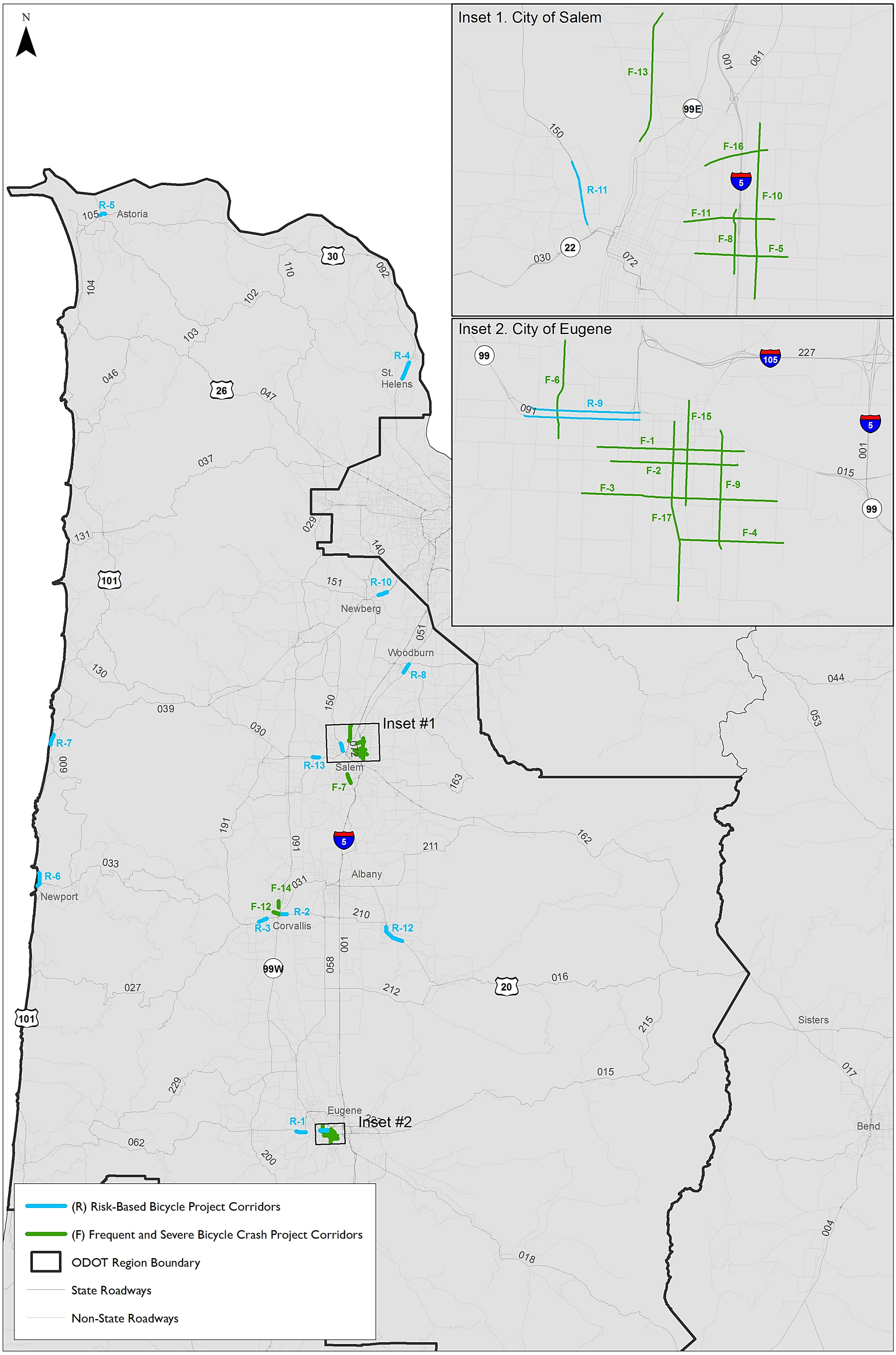

Priority Sites for Implementation of Bicycle Crash Countermeasures
ODOT Region 2

Figure **4**

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REGION 3 PROJECT CORRIDORS

ODOT Region 3 covers southwest Oregon, including the cities of Ashland, Medford, Grants Pass, and Roseburg. As shown in Table 11, a total of 17 Pedestrian Project Corridors and 33 Bicycle Project Corridors were identified for Region 3. Similar to Region 2, many of the crash frequency and severity corridors occurred within urban areas: Medford, Roseburg, Ashland, and Grants Pass. The risk-based method also identified corridors near each of these cities.

Table 11 Region 3 Study Statistics

Statistic	Pedestrian	Bicycle
Number of reported crashes (2007-2011)	380	411
Number of fatal or severe crashes (2007-2011)	98	25
Number of risk-based project corridors identified	4	8
Number of frequency and severity-based project corridors identified	13	25

Pedestrian Project Corridors

Region 3 Pedestrian Project Corridors, identified in Table 12, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarized in Table 1-5 of Appendix 1. Table 12 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations. Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 13 Project Corridors across Region 3, as summarized in Table 12. Individual segments are summarized in Table 2-5 of Appendix 2.

The results of both network screening methods are shown on Figure 5 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 5 includes a Corridor Number that corresponds to the Corridor Numbers in Table 12 and Table 12, for reference. In Region 3, Figure 5 shows that the risk-based network screening identified corridors in or near Medford, Grants Pass, and Woodburn. The crash frequency network screening identified additional Project Corridors, many on local streets, throughout the Region.

Bicyclist Project Corridors

Region 3 Bicyclist Project Corridors, identified in Table 14, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarized in Table 1-6 of Appendix 1. Table 14 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations.

Corridor crashes also include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 24 Project Corridors across Region 3, as summarized in Table 15. Individual segments are summarized in Table 2-6 of Appendix 2.

The results of both network screening methods are shown on Figure 5 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 5 includes a Corridor Number that corresponds to the Corridor Numbers in Table 14 and Table 15, for reference. As shown in Figure 5, the risk-based network screening identified Project Corridors within the major cities but also in other smaller cities including Coos Bay, Eagle Point, and Brookings.

Table 12 ODOT Region 3 Pedestrian Risk-Based Project Corridors

Corridor Rank	Corridor ID	Highway Name	Start^	End^	Length (Miles)	City	Total Number of Segments within Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that are Undivided 4-Lane	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with Pedestrian Activated Flashers or Beacons	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments with at Least 1 Signal within 100' of Segment	Average Pedestrian Score
1	R-4	REDWOOD SPUR	-0.60	1.80	3.60	Grants Pass	37	1	2	4	0	30	6	0	37	0	0	0	19	8.49
3	R-3	REDWOOD	0.00	2.60	3.31	Grants Pass	37	2	1	2	0	35	2	0	29	8	0	1	13	8.27
2	R-2	CRATER LAKE	1.0	7.10	6.71	Medford	67	4	1	2	0	56	10	7	64	3	0	4	12	8.40
4	R-1	COOS BAY-ROSEBURG	75.5	75.6	2.44	0	26	1	1	1	0	24	0	0	26	0	0	0	3	8.15

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 13 ODOT Region 3 Pedestrian Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Total Pedestrian Score
1	F-4	Central Ave	S Riverside Ave	W McAndrews Rd	3.25	Sutherlin	Municipal Street	0	0	21	0	42
2	F-11	Riverside Ave	Stewart Ave	Crater Lake Hwy	2.46	Medford	Municipal Street	1	2	15	0	39
3	F-9	Main St	N Ross Ln	Glen Oak Ct	2.69	Medford	Municipal Street	0	4	8	0	28
4	F-6	Crater Lake Ave	E Main St	Hutchins Cir	1.82	Medford	Municipal Street	0	0	10	0	20
5	F-13	NORTH UMPQUA	-1.12	124.45	2.21	Roseburg	ODOT	0	1	7	0	17
6	F-3	A St	NW Dimmick St	NE Piedmont Ave	1.46	Grants Pass	Municipal Street	0	0	8	0	16
7	F-12	Siskiyou Blvd	E Main St	Walker Ave	1.36	Ashland	Municipal Street	1	0	6	0	15
8	F-10	Old Hwy. 99	NE Prospect St	Clover Ave	1.61	Roseburg	Municipal Street	0	2	4	0	14
9	F-8	Jackson St	Summit Ave	Hillhouse Ave	1.88	Medford	Municipal Street	1	0	5	0	13
10	F-1	10th St	Lincoln St	Siskiyou Blvd	1.27	Medford	Municipal Street	0	0	5	0	10
11	F-2	8th St	Elm St	E Main St	1.22	Medford	Municipal Street	0	1	3	0	9
11	F-7	Delta Waters Rd	Lear Way	McLaughlin Dr	1.47	Medford	County	1	0	3	0	9
12	F-5	Columbus Ave	Prune St	End of Street	1.10	Medford	Municipal Street	0	0	3	1	7

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 14 ODOT Region 3 Bicyclist Risk-Based Project Corridors

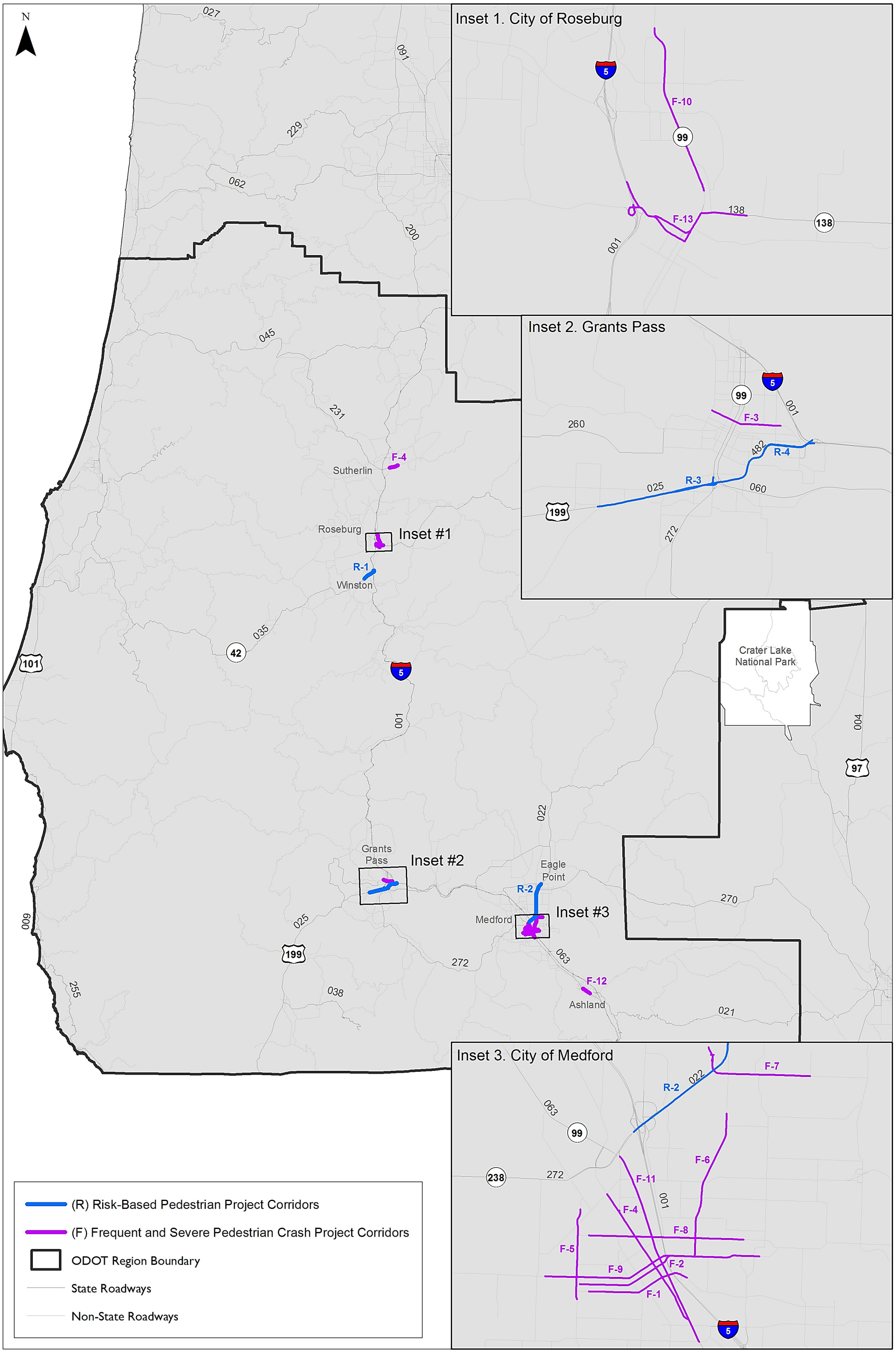
Corridor Rank	Corridor ID	Highway Name	Highway Number	Start^	End^	Length (Miles)	City	Total Number of Segments in Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Driveway Density (Average Number of Driveway Access Points per Segment)	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that Lack of Bicycle Facility - Right Side	Number of Segments that Lack of Bicycle Facility - Left Side	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments that are Undivided 4-Lane	Number of Segments with at Least 1 Signal within 100' of Segment	Average Bicycle Score
1	R-5	OREGON COAST	009	357.80	359.20	1.50	Brookings	15	0	0	0	0	2.6	15	0	1	14	13	12	0	0	2	9.80
2	R-3	CRATER LAKE	022	0.50	4.40	3.90	Medford	38	0	0	6	0	1.8	35	3	37	0	14	12	2	4	8	9.74
3	R-2	OREGON COAST	009	239.7	240.60	2.62	0	31	0	0	2	0	2.8	15	3	12	16	30	29	0	8	10	9.32
4	R-4	CRATER LAKE	022	10.90	12.20	1.32	0	14	0	0	0	0	2.9	14	0	0	13	10	10	0	0	0	8.93
5	R-7	REDWOOD	025	-1.30	0.30	2.93	Grants Pass	30	1	1	12	1	7.4	2	5	13	17	27	19	14	0	24	8.70
6	R-6	NORTH UMPQUA	138	-0.30	1.90	2.30	Roseburg	23	0	0	2	0	5.3	8	15	0	13	23	23	1	0	5	8.43
7	R-1	CAPE ARAGO	240	0.00	2.20	1.97	North Bend	22	0	1	5	0	7.8	0	17	0	14	22	21	0	2	7	7.82

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 15 ODOT Region 3 Bicyclist Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Total Bicycle Score
1	F-21	Riverside Ave	Stewart Ave	Rossanley Dr	2.51	Medford	Municipal Street	0	0	23	0	46
2	F-11	Central Ave	S Riverside Ave	Rossanley Dr	2.15	Medford	Municipal Street	0	0	16	0	32
3	F-19	McAndrews Rd	N Columbus Ave	Severson Dr	2.84	Medford	Municipal Street	0	0	15	0	30
4	F-18	Main St	Renault Ave	Highland Dr	3.13	Medford	Municipal Street	0	1	13	0	29
5	F-22	Siskiyou Blvd	E Main St	Walker Ave	1.36	Ashland	Municipal Street	0	0	12	1	25
6	F-9	Barnett Rd	Kenyon St	Kevin Way	1.35	Medford	Municipal Street	0	0	9	0	18
6	F-10	Biddle Rd	I-5	Morrow Rd	1.11	Medford	Municipal Street	0	0	9	0	18
6	F-12	Columbus Ave	Swayze Ln	End of Street	1.96	Medford	Municipal Street	0	0	9	0	18
7	F-2	JACKSONVILLE	0.01	0.86	1.09	Grants Pass	ODOT	0	1	6	2	17
7	F-13	Crater Lake Ave	E Main St	Hutchins Cir	1.82	Medford	Municipal Street	0	0	8	1	17
8	F-1	JACKSONVILLE	0.05	38.74	1.51	0	ODOT	0	0	8	0	16
9	F-8	Ashland St (Hwy 021)	Siskiyou Blvd	Faith Ave	0.74	Ashland	Municipal Street	0	0	6	1	13
9	F-14	G St	Lincoln Rd	SW 3rd St	1.09	Grants Pass	Municipal Street	1	0	5	0	13
10	F-3	NORTH UMPQUA	-1.12	124.45	2.07	Roseburg	ODOT	0	0	6	0	12
10	F-17	Jackson St	Summit Ave	Lindley St	1.53	Medford	Municipal Street	0	0	6	0	12
10	F-20	Old Hwy. 99	NE Garden Valley Blvd	NE Newton Creek Rd	1.45	Roseburg	Municipal Street	0	0	6	0	12
11	F-4	10th St	Hamilton St	Siskiyou Blvd	1.17	Medford	Municipal Street	0	0	5	0	10
11	F-5	4th St	Myers Ct	I-5	1.07	Medford	Municipal Street	0	0	5	0	10
12	F-7	Antelope Rd	7th St	24th St	1.74	0	County	0	0	4	0	8
12	F-15	Garden Valley Blvd	I-5 Ramps	NE Ross Ave	1.26	Roseburg	Municipal Street	0	0	4	0	8
12	F-24	Stewart Ave	Lozier Ln	Myers Ln	1.89	Medford	County	0	0	3	2	8
13	F-16	Hersey St	N Main St	N Mountain Ave	1.01	Ashland	Municipal Street	0	1	2	0	7
14	F-6	A St	NW 3rd St	NE Piedmont Ave	1.17	Grants Pass	Municipal Street	0	0	3	0	6
14	F-23	Stevens St	Biddle Rd	Pearl St	0.78	Medford	Municipal Street	0	0	3	0	6
14	F-25	Allen Creek Rd	W Harbeck Rd	Redwood Ave	0.71	Grants Pass	County	0	0	3	0	6

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.



Priority Sites for Implementation of Pedestrian Crash Countermeasures
ODOT Region 3

Figure **5**

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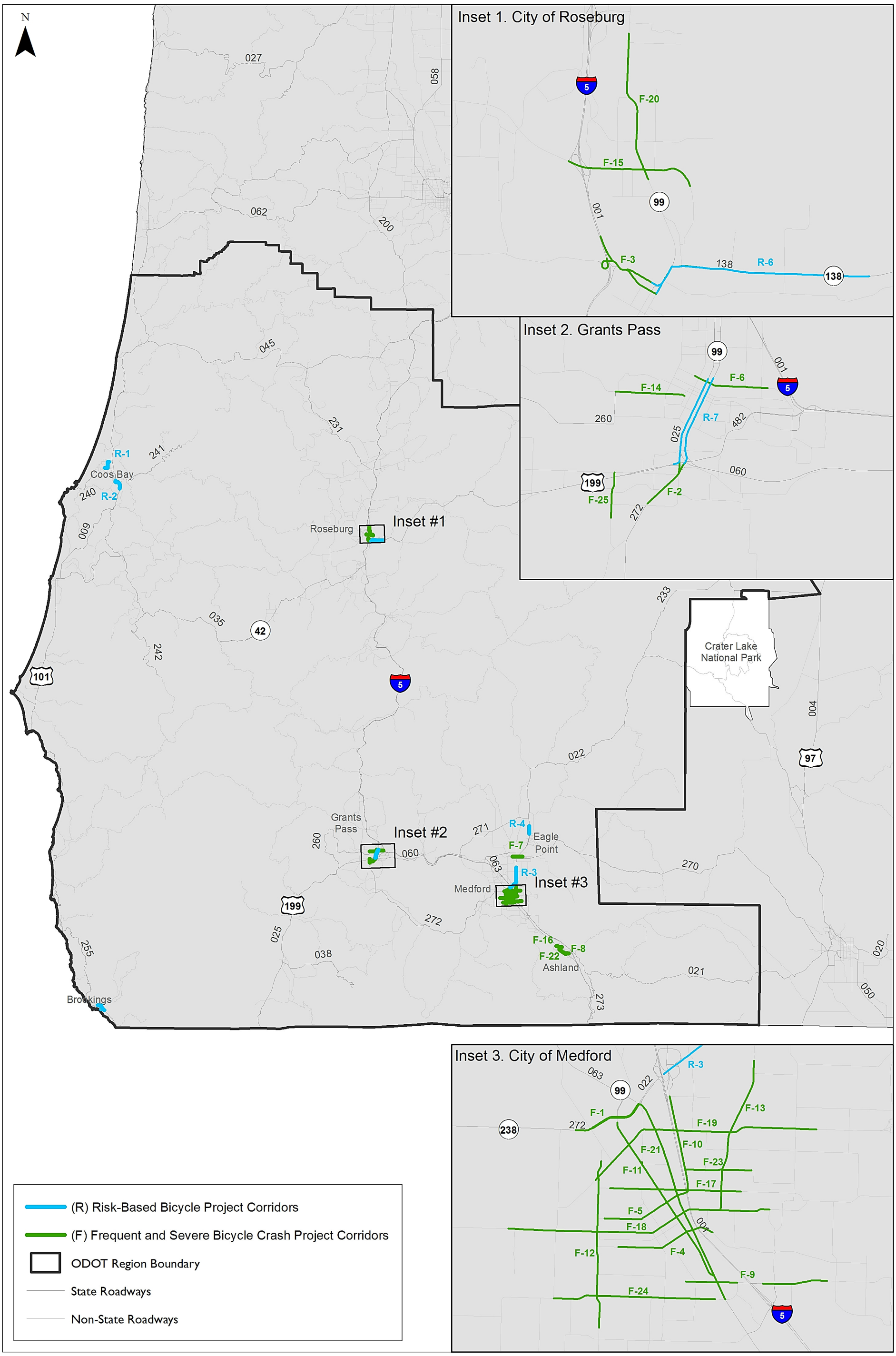

Priority Sites for Implementation of Bicycle Crash Countermeasures
ODOT Region 3

Figure **6**

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REGION 4 PROJECT CORRIDORS

ODOT Region 4 covers Central Oregon including the cities of Bend, Redmond, Klamath Falls, and Madras. Because the number of crashes in Region 4 is lower than those in Regions 1 through 3, the segments identified through the Crash Frequency and Severity Network Screening are more scattered, forming more, but shorter Project Corridors. As shown in Table 16, a total of 32 Pedestrian Project Corridors and 41 Bicycle Project Corridors were identified for Region 4.

Table 16 Region 4 Study Statistics

Statistic	Pedestrian	Bicycle
Number of reported crashes (2007-2011)	179	200
Number of fatal or severe crashes (2007-2011)	45	25
Number of risk-based project corridors identified	5	12
Number of frequency and severity-based project corridors identified	27	29

Pedestrian Project Corridors

Region 4 Pedestrian Project Corridors, identified in Table 17, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarized in Table 1-7 of Appendix 1. Table 17 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations. Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 43 Project Corridors across Region 4, as summarized in Table 18. Individual segments are summarized in Table 2-7 of Appendix 2.

The results of both network screening methods are shown on Figure 7 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 7 includes a Corridor Number that corresponds to the Corridor Numbers in Table 17 and Table 18, for reference. In Region 4, Figure 7 shows that the majority of crash frequency Project Corridors are located within cities throughout the Region while the risk-based Project Corridors are primarily located in Bend and Redmond. As shown on Figure 7, the crash frequency Project Corridor number 41 overlaps with a risk-based Project Corridor.

Bicyclist Project Corridors

Region 4 Bicyclist Project Corridors, identified in Table 19, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarizd in Table 1-8 of Appendix 1. Table 19 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations.

Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 40 Project Corridors across Region 4, as summarized in Table 20. Individual segments are summarized in Table 2-8 of Appendix 2.

The results of both network screening methods are shown on Figure 7 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 7 includes a Corridor Number that corresponds to the Corridor Numbers in Table 19 and Table 20, for reference. In Region 4, Figure 7 shows that the majority of the risk-based Project Corridors are located in Bend, Redmond, and Prineville, while the crash frequency Project Corridors are scattered in cities throughout the Region.

Table 17 ODOT Region 4 Pedestrian Risk-Based Project Corridors

Corridor Rank	Corridor ID	Highway Name	Highway Number	Start^	End^	Length (Miles)	City	Total Number of Segments within Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that are Undivided 4-Lane	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with Pedestrian Activated Flashers or Beacons	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments with at Least 1 Signal within 100' of Segment	Average Pedestrian Score
1	R-1	MCKENZIE-BEND	017	19.6	20.90	2.03	Bend	20	1	3	5	0	20	0	4	6	14	0	4	7	8.65
2	R-2	THE DALLES-CALIFORNIA	004	121.50	125.80	4.35	Redmond	44	1	1	2	0	42	2	3	44	0	0	0	2	8.34
3	R-3	THE DALLES-CALIFORNIA	004	131.2	135.20	4.01	Bend	41	0	1	0	0	40	0	0	41	0	0	0	4	8.10
4	R-4	THE DALLES-CALIFORNIA	004	135.30	138.20	2.98	Bend	29	0	0	0	0	29	0	1	29	0	0	0	0	8.07
5	R-5	THE DALLES-CALIFORNIA	004	138.30	140.00	1.66	Bend	17	0	1	0	0	16	0	0	17	0	2	0	1	7.94

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 18 ODOT Region 4 Pedestrian Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start ^	End^	Length (Miles)	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Total Pedestrian Score
1	F-2	3rd St (Old Hwy 004)	Murphy Rd	Hwy 20	2.92	Bend	Municipal Street	1	2	8	0	25
2	F-37	CENTRAL OREGON	0.52	20.99	2.25	Bend	ODOT	0	2	8	0	22
3	F-41	MCKENZIE-BEND	19.86	20.98	1.12	Bend	ODOT	1	2	5	0	19
4	F-14	Main St	Ewauna St	Henry St	1.50	Klamath Falls	Municipal Street	0	0	8	0	16
5	F-35	Washburn Way/W 10th St	Kinglsey St	Irvine St W	2.33	0	County	0	2	3	0	12
6	F-1	2nd St	I-84	Brewery Overpass Rd	1.45	The Dalles	Municipal Street	0	1	4	0	11
6	F-38	Klamath Falls-Lakeview	2.51	3.74	1.24	0	ODOT	0	3	1	0	11
7	F-18	NE 27th St	Hwy 20	NE Butler Market Rd	2.09	Bend	Municipal Street	1	0	3	0	9
8	F-13	Lynn Blvd	S Main St	SE Combs Flat Rd	0.99	Prineville	Municipal Street	0	0	4	0	8
8	F-24	NW Wall St	Cascade Lakes Scenic Byway	NW Portland Ave	1.03	Bend	Municipal Street	0	0	4	0	8
8	F-26	Pine St	N 3rd St	Esplanade Ave	0.61	Klamath Falls	Municipal Street	0	0	4	0	8
9	F-12	Klamath Ave	Hwy 97	S 12th St	0.89	Klamath Falls	Municipal Street	0	1	2	0	7
9	F-39	Klamath Falls - Malin	-5.09	-4.04	1.04	Klamath Falls	ODOT	0	1	2	0	7
9	F-43	OCHOCO	17.61	19.31	1.95	Prineville	ODOT	0	1	2	0	7
10	F-3	5th St	Hwy 97	S 6th St	0.44	Klamath Falls	Municipal Street	0	0	3	0	6
10	F-17	Masten Rd	Fawn Loop	Jackpine Loop	1.22	0	County	0	0	3	0	6
10	F-21	Newport Ave	NW 14th St	NW Wall St	0.97	Bend	Municipal Street	0	0	3	0	6
10	F-32	Union St	E 13th St	I-84	0.73	The Dalles	Municipal Street	0	0	3	0	6
10	F-42	MIDLAND	1.34	1.83	0.48	0	ODOT	0	2	0	0	6
11	F-22	NW Franklin Ave	NW Broadway St	Bend Pkwy	0.51	Bend	Municipal Street	0	1	1	0	5
12	F-7	Cherry Heights Rd	Sandstone Way	Hwy 30	1.25	0	County	0	0	2	0	4
12	F-8	Crosby Ave	Maywood Dr	Altamont Dr	0.61	0	County	0	0	2	0	4
12	F-9	E Main St	N Elm St	N Locust St	0.31	Sisters	Municipal Street	0	0	2	0	4
12	F-30	Snipes St	W 10th St	I-84	0.53	The Dalles	County	0	0	2	0	4
12	F-34	W 6th St	Webber St	Trevitt St	0.68	The Dalles	Municipal Street	0	0	2	0	4
12	F-40	MCKENZIE	SW 31st St	SW 5th St	1.93	Redmond	ODOT	0	0	2	0	4
13	F-5	Bond St	SW Powerhouse Dr	NW Wall St	0.84	Bend	Municipal Street	0	1	0	0	3

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 19 ODOT Region 4 Bicyclist Risk-Based Project Corridors

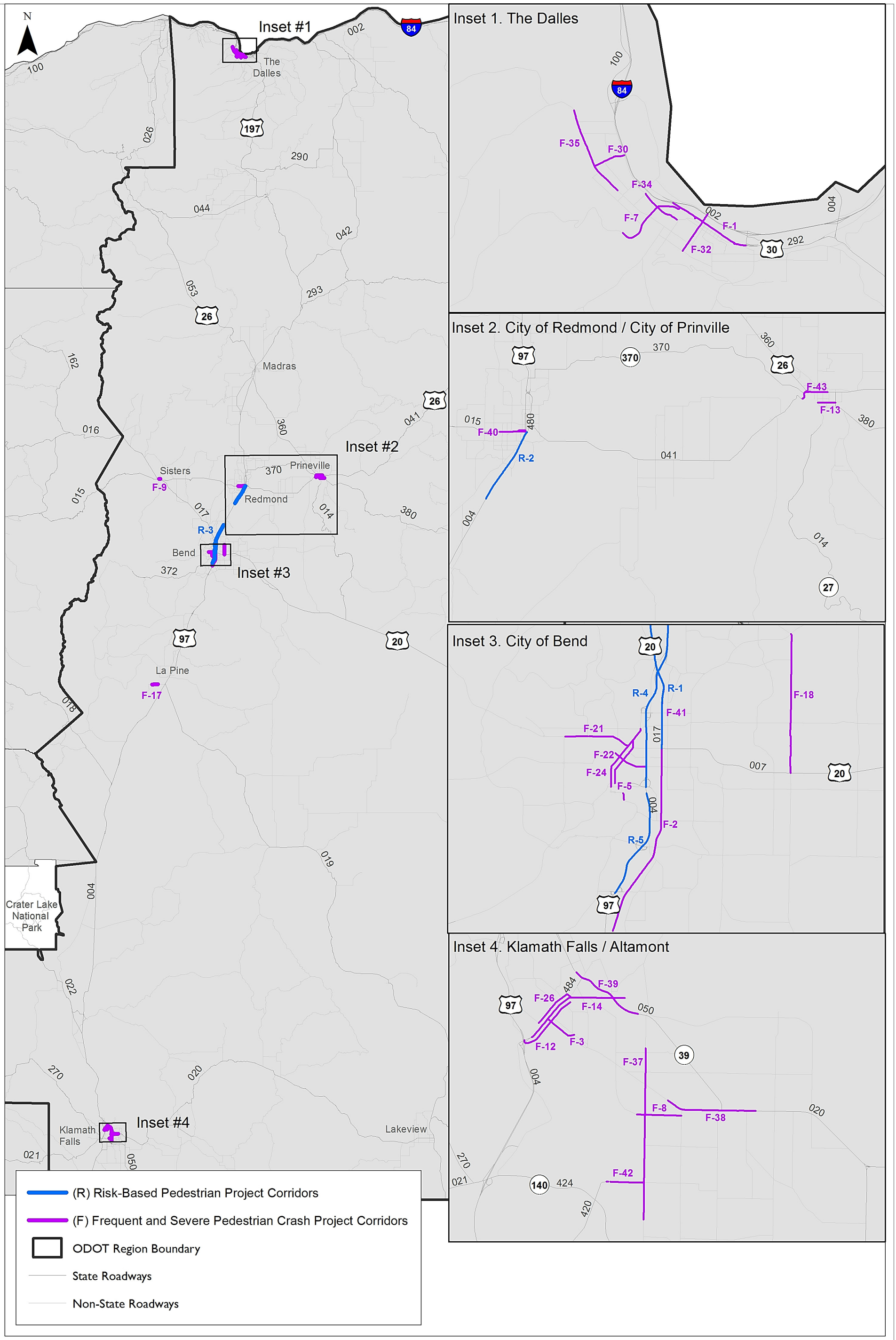
Corridor Rank	Corridor ID	Highway Name	Highway Number	Start^	End^	Length (Miles)	City	Total Number of Segments in Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Driveway Density (Average Number of Driveway Access Points per Segment)	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that Lack of Bicycle Facility - Right Side	Number of Segments that Lack of Bicycle Facility - Left Side	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments that are Undivided 4-Lane	Number of Segments with at Least 1 Signal within 100' of Segment	Average Bicycle Score
1	R-10	THE DALLES-CALIFORNIA	004	123.80	125.80	2.04	Redmond	21	0	0	0	0	0.9	21	0	21	0	14	14	0	0	0	10.76
2	R-5	THE DALLES-CALIFORNIA	004	138.70	140.20	1.50	Bend	15	1	0	3	0	0.5	15	0	13	2	1	15	0	0	1	10.67
3	R-6	THE DALLES-CALIFORNIA	004	136.90	138.20	1.34	Bend	13	0	0	0	1	0.5	13	0	13	0	2	13	0	0	0	10.54
4	R-7	THE DALLES-CALIFORNIA	004	134.50	136.50	2.02	Bend	20	0	0	0	0	0.4	20	0	18	0	6	19	0	1	2	10.35
5	R-9	THE DALLES-CALIFORNIA	004	131.2	132.90	1.73	0	18	0	0	0	0	1.2	18	0	18	0	10	10	0	0	0	10.33
6	R-12	THE DALLES-CALIFORNIA	004	118.1	119.00	0.99	0	10	0	0	0	0	1.2	10	0	0	10	10	10	0	0	0	10.20
7	R-8	THE DALLES-CALIFORNIA	004	133.50	135.00	1.50	Bend	15	0	0	0	0	0.6	15	0	15	0	0	13	0	0	4	10.13
8	R-3	MCKENZIE-BEND	017	19.7	20.90	1.93	Bend	19	0	1	3	0	4.6	6	13	19	0	6	9	4	4	7	9.68
9	R-2	MCKENZIE	015	109.1	110.50	1.41	0	15	0	0	0	0	2.0	15	0	0	14	11	11	0	0	0	9.00
10	R-1	CENTRAL OREGON	007	0.00	1.60	1.08	Bend	11	0	3	5	0	7.7	4	7	10	1	0	0	0	0	3	8.55
11	R-11	THE DALLES-CALIFORNIA	004	121.70	123.80	2.11	Redmond	21	0	0	1	0	3.5	21	0	21	0	0	0	0	3	2	8.43
12	R-4	O NEIL	370	14.9	16.80	1.99	0	20	0	0	0	0	3.0	20	0	0	0	20	20	0	0	0	8.15

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 20 ODOT Region 4 Bicyclist Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Total Bicycle Score
1	F-9	3rd St (Old Hwy 004)	Murphy Rd	Hwy 20/NE Greenwood Ave	2.92	Bend	Municipal Street	1	1	12	2	32
2	F-1	CENTRAL OREGON	0.52	20.99	3.71	Bend	ODOT	0	3	7	0	23
3	F-45	Homedale Rd	American Ave	S 6th St	1.90	0	County	0	0	10	0	20
4	F-26	Newport Ave	NW College Way	NW Drake Rd	1.25	Bend	Municipal Street	0	0	9	0	18
5	F-29	NW Wall St	Arizona Ave	NW Portland Ave	1.03	Bend	Municipal Street	0	0	8	1	17
6	F-23	NE Franklin Ave	NW Hill St	NE 10th St	0.77	Bend	Municipal Street	0	0	5	1	11
7	F-8	OCHOCO	0	20.57	3.17	Prineville	ODOT	0	0	5	0	10
7	F-41	NE 8th St	NE Emerson Ave	NE Butler Market Rd	1.53	Bend	Municipal Street	0	0	5	0	10
8	F-7	MCKENZIE-BEND	19.86	20.98	1.12	Bend	ODOT	0	1	3	0	9
8	F-40	Washburn Way	Onyx Ave	Wantland Ave	1.50	Klamath Falls	Municipal Street	0	1	3	0	9
8	F-62	Reed Market Rd	SW Division St	SE 27th St	2.16	Bend	Municipal Street	1	0	3	0	9
9	F-28	NW Greenwood Ave	NW Wall St	Bend Pkwy	0.26	Bend	Municipal Street	0	0	4	0	8
10	F-77	SW 67th St	SW Lava Ave	Fire Station Driveway	0.61	0	County	0	0	2	3	7
11	F-2	KLAMATH FALLS-LAKEVIEW	2.51	4.04	1.53	0	ODOT	0	0	3	0	6
11	F-19	Galveston Ave	NW 17th St	NW Harmon Blvd	0.68	Bend	Municipal Street	0	0	3	0	6
11	F-25	Neff Rd	NE 13th St	NE Tucson Way	1.29	Bend	Municipal Street	0	0	3	0	6
11	F-49	Bristol Ave	Summers Ln	Homedale Rd	0.77	0	County	0	0	3	0	6
11	F-59	Purcell Blvd	Bear Creek Rd	NE Francis Ct	0.60	Bend	Municipal Street	1	1	0	0	6
11	F-61	SE 27th St	Clairmont Ct	Hwy 20/ Greenwood Ave	2.03	Bend	Municipal Street	0	0	3	0	6
11	F-69	Brookswood Blvd	Lodgepole Dr	McClellan Rd	1.45	Bend	Municipal Street	0	0	3	0	6
11	F-81	E 10th St	Union St	Shearer St	1.54	The Dalles	Municipal Street	0	0	3	0	6
11	F-84	Main St	NE 3rd St	NE Mariposa Ave	0.75	Prineville	Municipal Street	0	0	3	0	6
12	F-11	6th St	S Spring St	Homedale Rd	1.28	Klamath Falls	Municipal Street	0	1	1	0	5
12	F-24	NE Greenwood Ave	Bend Pkwy	NE 3rd St	0.24	Bend	Municipal Street	0	1	1	0	5
12	F-33	Powers Rd	Brookswood Blvd	Parrell Rd	0.39	Bend	Municipal Street	1	0	1	0	5
12	F-36	Shasta Way	S 6th St	Hope St	1.58	Klamath Falls	Municipal Street	0	1	1	0	5
12	F-51	SW Reed Market Rd	Century Dr	US 97/Bend Pkwy	1.28	Bend	Municipal Street	0	0	2	1	5
12	F-60	Pettigrew Rd	SE Reed Market Rd	Bear Creek Rd	0.99	Bend	Municipal Street	0	1	1	0	5
12	F-75	American Ln	Brosterhous Rd	SE Reed Market Rd	0.59	Bend	Municipal Street	0	1	1	0	5

^Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.



Priority Sites for Implementation of Pedestrian Crash Countermeasures
ODOT Region 4

Figure **7**

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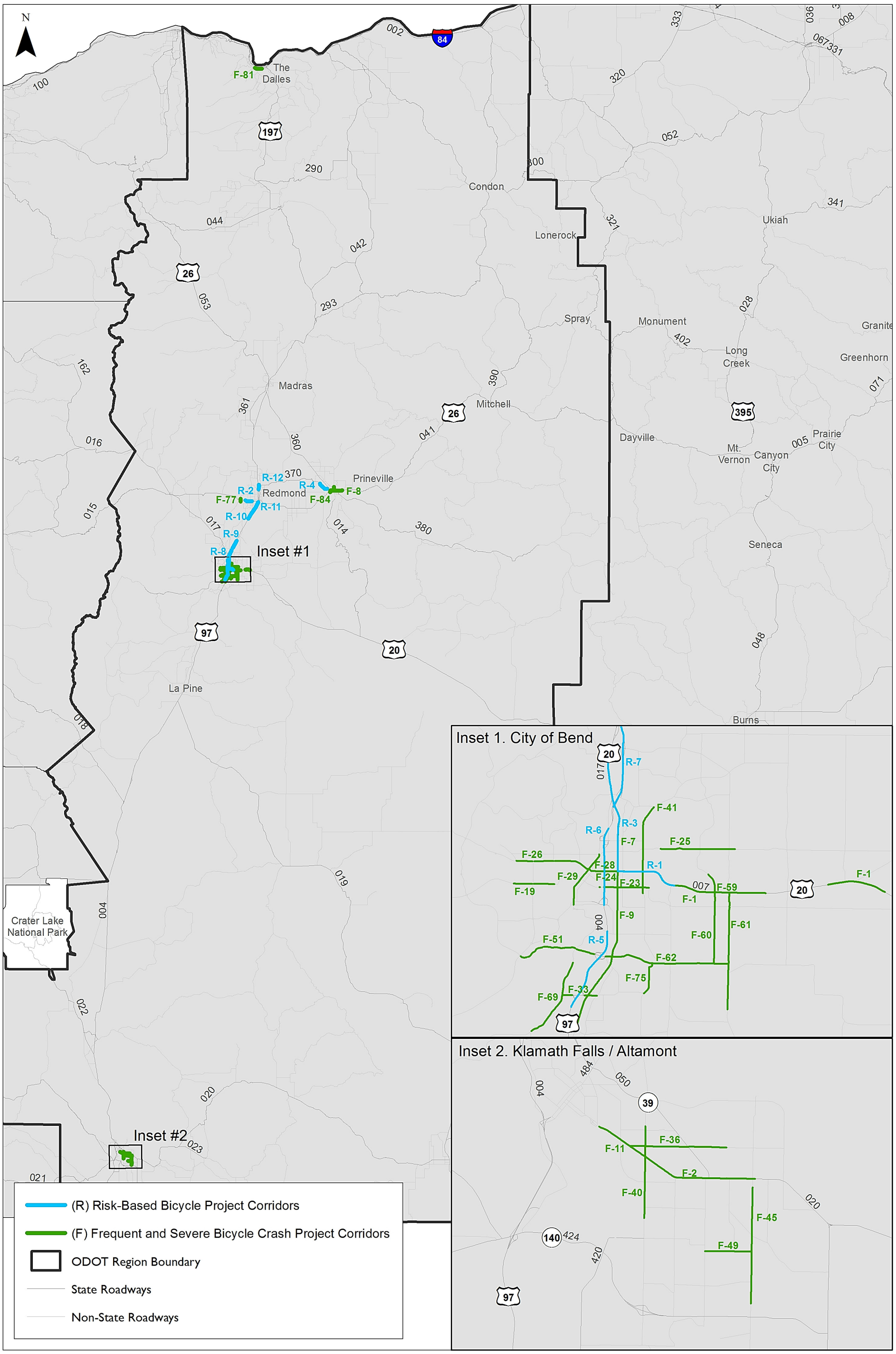


Priority Sites for Implementation of Bicycle Crash Countermeasures
ODOT Region 4

Figure **8**

REGION 5 PROJECT CORRIDORS

ODOT Region 5 covers Eastern Oregon including Pendleton, La Grande, and Baker City. As shown in Table 21, a total of 21 Pedestrian Project Corridors and 21 Bicycle Project Corridors were identified through the two methods of network screening for Region 5.

Table 21 Region 5 Study Statistics

Statistic	Pedestrian	Bicycle
Number of reported crashes (2007-2011)	80	60
Number of fatal or severe crashes (2007-2011)	22	8
Number of risk-based project corridors identified	5	11
Number of frequency and severity-based project corridors identified	16	10

Pedestrian Project Corridors

Region 5 Pedestrian Project Corridors, identified in Table 22, include multiple segments through risk-based network screening. The prioritized individual segments are summarized in Table 1-9 of Appendix 1. Table 22 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations. Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 37 Project Corridors across Region 5, as summarized in Table 23. Individual segments are summarized in Table 2-9 of Appendix 2.

The results of both network screening methods are shown on Figure 9 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 9 includes a Corridor Number that corresponds to the Corridor Numbers in Table 22 and Table 23, for reference. Figure 9 shows similar trends for Region 5 compared to those in other Regions: the crash frequency Project Corridors include projects in cities throughout the Region while the risk-based Project Corridors complement these with a few projects in Ontario, Hermiston, and Milton-Freewater. The majority of additional crash frequency Project Corridors are located on local roadways rather than state facilities.

Bicyclist Project Corridors

Region 5 Bicyclist Project Corridors, identified in Table 24, include multiple segments prioritized through risk-based network screening. The prioritized individual segments are summarized in Table 1-10 of Appendix 1. Table 24 identifies the risk factors and crash history accounted for in corridor prioritization and may be useful information when selecting appropriate countermeasures at different locations.

Corridor crashes include those that occurred on intersecting streets within 100 feet of the study corridor.

Priority segments selected from the crash frequency and severity network screening formed 14 Project Corridors across Region 5, as summarized in Table 25. Individual segments are summarized in Table 2-10 of Appendix 2.

The results of both network screening methods are shown on Figure 9 to illustrate where the projects are located and where overlap from both methods occurred. Each Project Corridor shown on Figure 9 includes a Corridor Number that corresponds to the Corridor Numbers in Table 24 and Table 25, for reference. As shown in Figure 9, the risk-based network screening identified Project Corridors throughout the Region in or near Ontario, Baker City, Pendleton, Milton-Freewater, and Hermiston. La Grande contained several crash frequency Project Corridors although no risk-based Project Corridors were selected from the City.

Table 22 ODOT Region 5 Pedestrian Risk-Based Project Corridors

Corridor Rank	Corridor ID	Highway Name	Highway Number	Start ^	End^	Length (Miles)	City	Total Number of Segments within Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that are Undivided 4-Lane	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with Pedestrian Activated Flashers or Beacons	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments with at Least 1 Signal within 100' of Segment	Average Pedestrian Score
1	R-3	ONTARIO SPUR	493	27.4	28.30	1.04	Ontario	11	0	0	1	0	11	0	1	1	8	0	0	5	6.55
2	R-4	UMATILLA-STANFIELD	054	3.2	5.40	2.63	0	27	1	0	4	0	5	21	0	17	4	0	0	7	5.70
3	R-2	OREGON-WASHINGTON	008	31.60	33.70	2.19	Milton-Freewater	22	0	0	0	0	0	16	0	22	0	0	0	0	5.45
3	R-1	OREGON-WASHINGTON	008	24.0	30.20	3.24	Milton-Freewater	33	0	0	0	0	0	27	4	30	0	2	0	0	5.45
5	R-5	UMATILLA-STANFIELD	054	5.70	7.90	2.19	Hermiston	22	0	0	2	0	0	16	0	16	4	0	0	2	4.95

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 23 ODOT Region 5 Pedestrian Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Pedestrians Involved but not Injured (2007-2011)	Total Pedestrian Score
1	F-35	LA GRANDE-BAKER	50.53	52.49	1.97	Baker City	ODOT	0	0	6	0	12
2	F-13	Main St	SW Isaac Ave	NW Despain Ave	0.62	Pendleton	Municipal Street	0	0	5	0	10
3	F-34	HERMISTON	7.7	8.93	1.63	Hermiston	ODOT	1	0	2	0	7
4	F-3	4th St	Grace St	Campbell St	0.75	Baker City	Municipal Street	0	0	3	0	6
4	F-11	Hermiston Ave	Hermiston Hwy/NW 11th St	S 1st St	0.94	Hermiston	Municipal Street	0	0	3	0	6
5	F-5	Clark St	Spring Garden Ave	Baker Copperfield Hwy	0.61	Baker City	Municipal Street	0	1	1	0	5
6	F-7	E Idaho Ave	N Oregon St	NE 4th St	0.35	Ontario	Municipal Street	0	0	2	0	4
6	F-9	Gladys Ave	S 1st St	NE 7th St	0.59	Hermiston	Municipal Street	0	0	2	0	4
6	F-17	NW 10th St	SW Emigrant Ave	NW Despain Ave	0.48	Pendleton	Municipal Street	0	0	2	0	4
6	F-26	Sunset Dr	SW 18th Ave	SW 7th Pl	0.76	0	Municipal Street	0	0	2	0	4
6	F-28	SW 7th St	W Highland Ave	W Hermiston Ave	0.37	Hermiston	Municipal Street	0	0	2	0	4
6	F-29	Tutuilla Creek Rd	Southgate	SW Nye Ave	0.96	Pendleton	Municipal Street	0	0	2	0	4
7	F-19	Orchard Ave	SW 11th St	SW 6th St	0.62	Hermiston	Municipal Street	1	0	0	0	3
7	F-23	SE 2nd St	SE Frazer Ave	SE Byers Ave	0.27	Pendleton	Municipal Street	1	0	0	0	3
7	F-32	Winesap Rd	Sunnyside Rd	Ferndale Rd	1.15	0	County	1	0	0	0	3
7	F-36	OLDS FERRY-ONTARIO	27.16	29.71	1.02	Ontario	ODOT	1	0	0	0	3

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 24 ODOT Region 5 Bicyclist Risk-Based Project Corridors

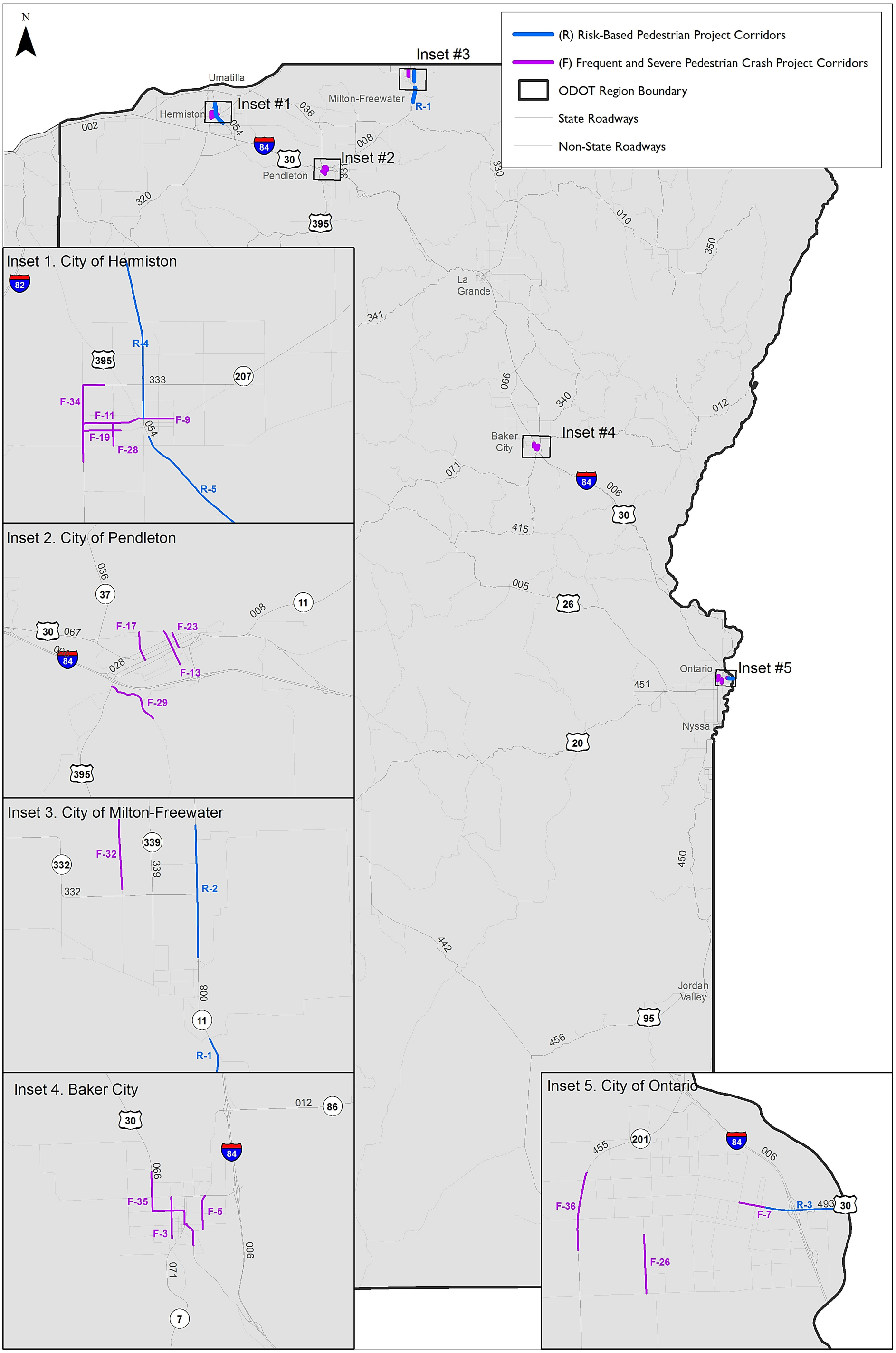
Corridor Rank	Corridor ID	Highway Name	Highway Number	Start^	End^	Length (Miles)	City	Total Number of Segments in Corridor	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Driveway Density (Average Number of Driveway Access Points per Segment)	Number of Segments that have Posted Speed Limit above 40 mph	Number of Segments with Posted Speed Limit of 35 or 40 mph	Number of Segments with ADT > 18,000	Number of Segments with ADT between 12,000 and 18,000	Number of Segments that Lack of Bicycle Facility - Right Side	Number of Segments that Lack of Bicycle Facility - Left Side	Number of Segments with at Least 1 Transit Stop within 100 feet	Number of Segments that are Undivided 4-Lane	Number of Segments with at Least 1 Signal within 100' of Segment	Average Bicycle Score
1	R-3	OREGON-WASHINGTON	008	32.80	33.70	0.99	0	10	0	0	0	0	0.0	10	0	0	10	10	10	0	0	0	10.20
2	R-2	OREGON-WASHINGTON	008	24.0	24.90	0.92	0	10	0	0	0	0	0.0	10	0	0	9	10	10	0	0	0	10.00
3	R-7	UMATILLA-STANFIELD	054	2.8	4.60	1.84	0	19	0	0	0	0	0.0	17	2	0	18	19	19	0	0	3	9.95
4	R-5	ONTARIO SPUR	493	27.4	28.10	0.74	Ontario	8	0	0	1	0	2.8	1	5	8	0	3	3	0	0	4	8.25
5	R-10	OLDS FERRY-ONTARIO	455	23.9	24.90	1.04	0	11	0	0	0	0	1.5	11	0	0	0	11	11	0	0	0	8.18
6	R-1	BAKER-COPPERFIELD	012	2.60	3.50	1.07	0	11	0	0	0	0	1.8	11	0	0	0	11	10	0	0	0	8.00
6	R-9	SUNNYSIDE-UMAPINE	332	6.5	7.90	1.47	0	16	0	0	0	0	5.3	16	0	0	0	15	15	0	0	0	8.00
8	R-6	PENDLETON-COLD SPRINGS	036	2.10	30.70	1.65	Pendleton	17	0	0	0	0	1.2	17	0	0	0	15	15	0	1	1	7.76
9	R-8	WHITNEY	071	48.2	49.70	1.62	Baker City	16	0	0	0	0	2.1	13	0	0	0	16	16	0	0	0	7.44
10	R-11	OLDS FERRY-ONTARIO	455	30.4	31.30	1.51	0	16	0	0	0	0	3.2	16	0	0	0	10	10	0	2	0	6.81
11	R-4	FREEWATER	339	1.9	3.40	1.57	0	17	0	0	0	0	6.8	1	0	0	0	17	17	0	0	0	4.47

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.

Table 25 ODOT Region 5 Bicyclist Crash Frequency and Severity Project Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start^	End^	Length (Miles)	City	Jurisdiction	Number of Fatalities (2007-2011)	Number of Severe Injuries (2007-2011)	Number of Minor or Moderate Injuries (2007-2011)	Number of Bicyclists Involved but not Injured (2007-2011)	Total Bicycle Score
1	F-3	LA GRANDE-BAKER	1.41	2.79	1.39	La Grande	ODOT	0	1	3	0	9
2	F-15	Resort St	Auburn Ave	Cambell St	0.49	Baker City	Municipal Street	0	2	0	0	6
3	F-5	4th St	Umatilla-Stanfield Hwy (395)	E Dogwood Ave	1.07	Hermiston	Municipal Street	0	0	2	0	4
3	F-7	Gladys Ave	S 1st St	NE 7th St	0.59	Hermiston	Municipal Street	0	0	2	0	4
3	F-9	Highland Ave	SW 10th St	SE 9th St	1.60	Hermiston	Municipal Street	0	0	2	0	4
3	F-14	SE 3rd St	SW Isaac Ave	SW Byers Ave	0.53	Pendleton	Municipal Street	0	0	2	0	4
3	F-18	Byers Ave	S Main St	SE 17th St	1.02	Pendleton	Municipal Street	0	0	2	0	4
3	F-20	30th St	Co 1305 Rd	Southgate	0.31	Pendleton	Municipal Street	0	0	2	0	4
3	F-25	SW 4th Ave	SW 30th St/Cairo Blvd	SW 4th St	1.57	Ontario	Municipal Street	0	0	2	0	4
4	F-16	Washington Ave	Main St	Plum St	0.68	Baker City	Municipal Street	0	1	0	0	3

^ Start and End indicate the beginning and end locations for each corridor. For state facilities, this is the nearest ODOT milepost. For non-state facilities, this is the nearest cross-street. Milepost data was obtained from the GIS network. Segments with a milepost of 0.0 were either located at the beginning of a segment or no milepost data was available in close proximity to the segment end point.



Priority Sites for Implementation of Pedestrian Crash Countermeasures
ODOT Region 5

Figure **9**

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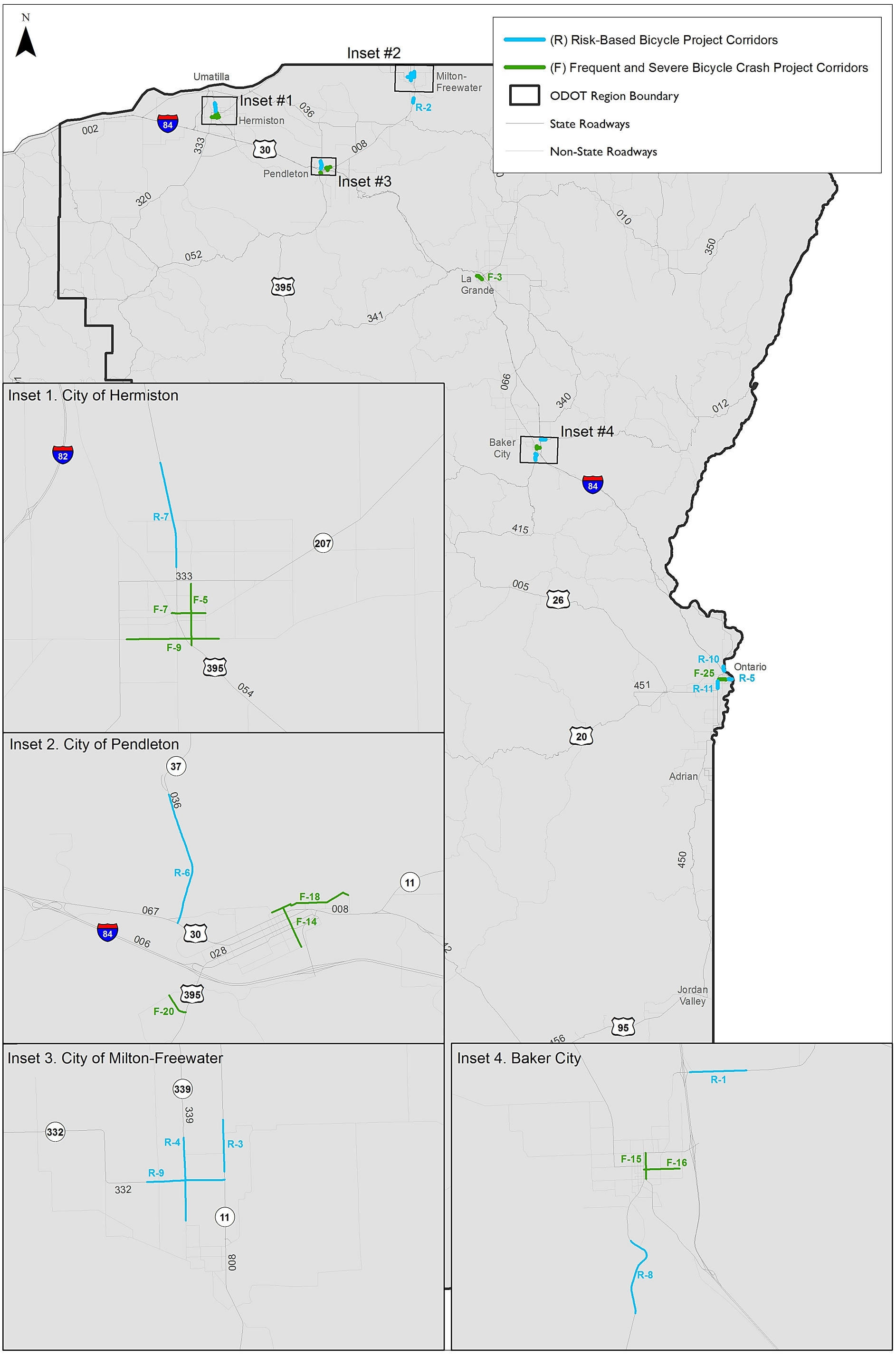

Priority Sites for Implementation of Bicycle Crash Countermeasures
ODOT Region 5

Figure **10**

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Part B
Methodology and Approach

Background and Goals

BACKGROUND AND GOALS

Pedestrian and bicyclists are the most vulnerable roadway users, more likely to be injured or killed in a crash than vehicle drivers or passengers (Reference 2). In 2011, 14 percent of all traffic fatalities in the United States were pedestrians, and 2 percent of all traffic fatalities were bicyclists. In Oregon, pedestrian fatalities accounted for 13.9 percent of all traffic fatalities in 2011 (Reference 3), and bicyclist fatalities accounted for 4.5 percent of all traffic fatalities (Reference 4).

The Oregon Department of Transportation (ODOT) recognizes the need to improve roadway safety for pedestrians and bicyclists and developed this plan to do so across the state. To be consistent with funding requirements outlined in "Moving Ahead for Progress in the 21st Century Act" (MAP-21), the plan emphasizes reducing fatal and serious injuries and is based on systematic, objective process.

PROJECT GOALS

The goal of this plan is to identify and prioritize candidate project corridors through a data-driven process to reduce fatal and severe-injury pedestrian and bicycle crashes on all public roads (regardless of jurisdiction) throughout Oregon. This plan, like implementation plans developed by ODOT for roadway departure crashes (2010) and intersection crashes (2012), provides a systemic approach for reducing pedestrian and bicycle crashes. The recommendations of this plan supplement ODOT's other safety programs, such as the Safety Priority Index System (SPIS), and satisfy MAP-21 requirements.

METHODOLOGY

The core element of this plan is prioritizing candidate locations for countermeasure implementation through network screening. FHWA's Systemic Safety Project Selection Tool provides a framework, shown in Exhibit 1, for a systemic safety planning process. The first three of four steps in Element 1 of the process are described in this Plan. Those include:

1) Identify Focus Crash Types and Risk Factors
2) Screen and Prioritize Candidate Locations
3) Select Countermeasures

The fourth step includes identifying specific projects at each of the prioritized candidate locations and requires site-specific data and analysis that is best completed by regional and local agency staff.

Network screening has historically been conducted based on crash frequency, severity, or other hybrid performance measures that take into account reported crash characteristics. However, to overcome the challenges identified above, the Plan is based on a combination of two network screening methods. One network screening method relies on "traditional" metrics (i.e., reported crash frequency and severity) to prioritize candidate locations for safety improvement. This method was applied to all roads across the state. The second relies on a risk-based systemic safety planning process that identifies risk based on roadway characteristics that have contributed to pedestrian and bicycle crashes over the study period.

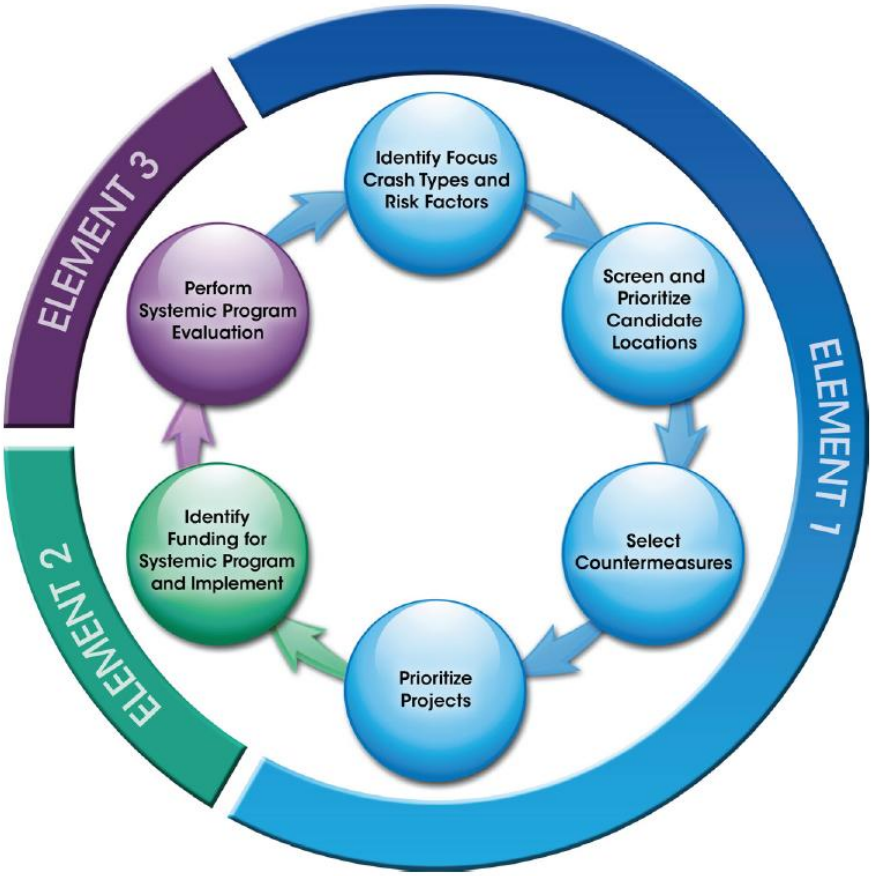


Exhibit 1. FHWA Systemic Safety Project Selection Tool Framework (Reference 1)

Network screening has historically been conducted based on crash frequency, severity, or other hybrid performance measures that take into account reported crash characteristics. However, to overcome the challenges identified above, the Plan is based on a combination of two network screening methods. One network screening method relies on "traditional" metrics (i.e., reported crash frequency and severity) to prioritize candidate locations for safety improvement. This method was applied to all roads across the state. The second relies on a risk-based systemic safety planning process that identifies risk based on roadway characteristics that have contributed to pedestrian and bicycle crashes over the study period.

The result of the two network screening approaches is a list of potential safety improvement projects for pedestrians and bicyclists within each ODOT Region. Only the highest priority sites are identified in this plan. The list of projects is intended to provide ODOT with direction for where to consider implementation of countermeasures. ODOT and local agencies should refine the project boundaries identified in this plan based on contextual and geographic factors not reflected in the objective methodology or data.

Crash Frequency and Severity Network Screening

Crash frequency and severity network screening identifies locations throughout the state that have experienced frequent or severe pedestrian and bicyclist crashes over the past five years. Traditionally, this has been a common approach for identifying safety projects. Typically, safety projects are developed by identifying individual intersections or segments that have the highest frequency and/or severity of crashes, evaluating crash history at each site, and developing custom countermeasure recommendations for each location. The crash frequency and severity network screening proposed with this methodology will follow a similar procedure and provide a toolbox of low-cost, systemic countermeasures for agencies to consider as recommendations.

Risk-Based Network Screening

FHWA released a Systemic Safety Project Selection Tool in 2013 that provides an overview of a systemic, risk-based method for developing safety projects (Reference 1). Several cities, counties, and states across the country have implemented pilot projects using this method (Reference 5). However, few have applied the method strictly to pedestrian and bicyclist crashes. This Plan applied a risk-based network screening process, consistent with guidance in the FHWA Systemic Safety Project Selection Tool, to identify candidate corridor locations.

The risk-based screening complements the crash frequency and severity screening by identifying risk factors (i.e., roadway characteristics) that are present at locations with frequent and/or severe crashes. This screening is proactive in that it may identify locations for safety improvements where multiple target crashes have not been reported. In this screening method, crash history is not excluded, but is one of many risk factors used to develop a list of prioritized locations for implementation of crash countermeasures.

Risk factors include a range of roadway or location characteristics that appear to be associated with higher frequencies of severe pedestrian or bicycle crashes. For the purposes of this project, severe crashes are defined as those resulting in one or more fatalities or category “A” Disabling Injuries (based on the K and A categories on the KABCO injury severity scale). Trends for severe crashes were considered due to the state’s goals of emphasizing reductions in fatal and severe injury crashes.

As an example, potential risk factors could include one or a combination of the following:

- Geometry – presence or absence of turn lanes, or number of intersection legs;
- Intersection traffic control – signalized, unsignalized, or all-way stop control; and
- Segment characteristics – number of access points per mile, presence of sidewalk or bike lane, and presence of illumination.

Reference Populations

Crash Analysis

Reference populations were used during crash analysis to assist in identifying trends among different types and locations of crashes. Three high-level reference populations were developed based on facility ownership: ODOT, Metro, and Non-state. Crashes reported within the METRO boundary, regardless of ownership, are categorized as METRO because METRO facility inventory data is available for use in analysis of crash patterns within the METRO boundary. Non-state jurisdiction data is inconsistent in format and therefore unable to be used at a statewide level without significant data management first.

These crash analysis reference populations were further divided based on additional characteristics. Dividing reference populations by facility type (intersection vs. segment) preceded the division by area type (rural vs. urban) in order to assist in identifying crash patterns. Reviewing trends by locations allowed us to draw better conclusions about the crash characteristics and causes, which informed risk factors.

Network Screening

Network screening is generally conducted independently for distinct facility types to avoid overrepresentation from one type of facility (e.g., signalized intersections). Network screening for this project was conducted on state and non-state roadways without dividing by intersection and segment due to lack of consistent intersection data. ODOT maintains some facility inventory data for state and non-state facilities, but ODOT has more detail on state highways. Local agencies maintain different facility inventory data than are available outside their jurisdictions.

DATA LIMITATIONS

The reliability of network screening is directly related to the quality and quantity of data available. The data available for this study is limited in completeness and consistency, as described in the following sections. The findings of this study are expected to provide reliable results and direction for implementing pedestrian and bicycle safety projects; if data is enhanced with additional roadway attributes and/or made consistent across agencies than the results of the approach described in this plan could become more reliable.

Crash Data Availability and Quality

One of the most important limitations to consider is that the crash history only includes crashes that were reported to the Oregon Department of Motor Vehicles. Of those crashes that are reported, only a small percentage involves a pedestrian or bicyclist. With fewer crashes to study, identifying crash patterns is more difficult than for other types of vehicular crashes.

The quality of crash data is limited by the amount of detail provided by the person completing the crash report form. Some form fields are left blank or the input may be based on memory rather than facts or measurements. For example, crash locations are often reported at the nearest milepost when the actual crash occurred 0.2-miles downstream. This lack of accuracy may lead to incorrectly-identifying a trend at a location where no crashes have actually occurred.

Facility Inventory Data

Network screening requires statewide roadway characteristic data in a consistent format. Facility data needs include information such as roadway functional classification, speed limit, number of travel lanes, presence of bicycle or pedestrian facilities, and presence of a median. Because roadways fall under various jurisdictions (state, county, city) and each jurisdiction has a different data collection format, developing one database for all roadways in the state requires time and resources beyond the scope of this project. Therefore, network screening was conducted for state and non-state facilities separately based on available data.

Crash frequency is often normalized by a measure of exposure to develop crash rates. However, pedestrian and bicycle count data is not available on a state-wide basis. Therefore, no pedestrian or bicycle exposure could be accounted for in developing a state-wide systemic method. Vehicle traffic volumes (AADT) are accounted for in the methodology.

STAKEHOLDER INVOLVEMENT

As an innovative application of project identification, stakeholder involvement was critical during the development of this plan. Two primary methods that were used for obtaining feedback included a workshop with stakeholders from across the state and a project website, used to provide updates and gather feedback from all interested stakeholders.

A one-day stakeholder workshop was held in July 2013 with representatives from all ODOT Regions as well as representatives from many cities and public agencies throughout the state. During the workshop, consultants presented the methodology for risk-based network screening and gathered feedback from attendees on key elements of the plan noted below.

- Risk-factors influencing pedestrian and bicyclist crashes.
    - Attendees were asked to identify any risk-factors, based on their own experience and analyses, that were not included in our initial list; and
    - Attendees discussed how to address those risk-factors through countermeasures and strategies.
- Input on the systemic methodology for identifying locations where risk factors are present and identifying applicable countermeasures.
- Input on the countermeasures that they have found effective at reducing pedestrian and bicycle crashes.

Feedback received from the website and stakeholder workshop was reviewed and incorporated into the methodology. The decision to incorporate the crash frequency and severity approach along with risk-based network screening was a result of the feedback received at the stakeholder workshop.

Crash Pattern Analysis

CRASH PATTERN ANALYSIS

Crash patterns were identified to understand where pedestrian and bicycle crashes are occurring on the state network and what factors are common in those crashes. This analysis influenced the selection of risk factors used to conduct risk-based network screening.

DATA COLLECTION

Pedestrian and bicycle crash report summaries were obtained from the ODOT Crash Analysis Reporting (CAR) unit for the most-recent five-year period available (January 1, 2007 through December 31, 2011). For the purposes of this plan, pedestrian and bicycle crashes were defined as those crashes where a pedestrian or bicyclist physically collided with one or more vehicles. The data used in the analysis includes crashes classified by ODOT as "sub-ped" (i.e., pedestrian injured subsequent to collision) and the equivalent for bicyclist. An additional dataset including "ped involved" (i.e., pedestrian involved, but not struck) or "bicycle involved" was also obtained for reference, but not used to develop study findings.

The low frequency of bicycle and pedestrian crashes relative to other vehicular crash types (i.e., rear-end, fixed object, etc.) presents challenges in developing trends with statistical significance. Therefore, additional data from Emergency Medical Services (EMS) and trauma centers was explored to determine its availability and applicability to this study. The data could not be obtained in a timeframe necessary for inclusion in the initial evaluation. A brief summary of the data and how it has been used by Clackamas County is provided in the Literature Review Memorandum provided in Appendix 3.

CRASH DATA LIMITATIONS

As described in Section 4, crash analysis is influenced by the lack of quality data in consistent formats. Specific crash data limitations that directly influence crash analysis are documented below. The findings of this study are expected to provide reliable results and direction for implementing pedestrian and bicycle safety projects; if data is enhanced with additional roadway attributes and/or made consistent across agencies than the results of the approach described in this plan could be applied more broadly.

Pedestrian Data Limitations

Roadway inventory data was not available in a consistent format for: sidewalk presence, number of lanes, posted speed limit, and presence of a median on non-state highways. These characteristics are recognized as factors in pedestrian and bicycle crashes, but the extent to which they have increased crash risk are not accounted for in the crash pattern analysis results.

Crashes reported within METRO were evaluated as a separate reference population using additional facility inventory data (including sidewalks and transit stops) from METRO's RLIS Live, Geographic Information System.

Unlike vehicular crash types that are coded as "right angle" or "rear-end," for example, crash data reports for pedestrian crashes do not indicate the type of crash that occurred. Therefore, little information is known regarding the collision except that a pedestrian was hit. Additional participant-specific fields, such as pedestrian location, vehicle movement, and participant error and cause codes were used to infer what occurred at the time of collision.

Bicycle Data Limitations

Due to data limitations, the presence of bicycle infrastructure could not be evaluated on non-state highway facilities outside the Portland METRO area boundary. Consistent roadway facility data, including: number of lanes, median presence, and posted speed limit, was only available on state highways and roadways within the METRO area boundary.

CRASH PATTERNS AND RISK FACTOR IDENTIFICATION

Before conducting analysis of reported crash characteristics, crash data were reviewed to develop an understanding of where crashes occurred among the reference populations, as illustrated by the "crash trees" in Exhibit 2 and Exhibit 3. The crash trees indicate the number of all crashes, the number of severe crashes (fatal and injury "A"), and the percentage that each group represents of the number of total and severe statewide crashes. The crash trees provide an indication of how much data was available for analysis. In many cases, the frequency of crashes was too low to observe reliable trends in the data.

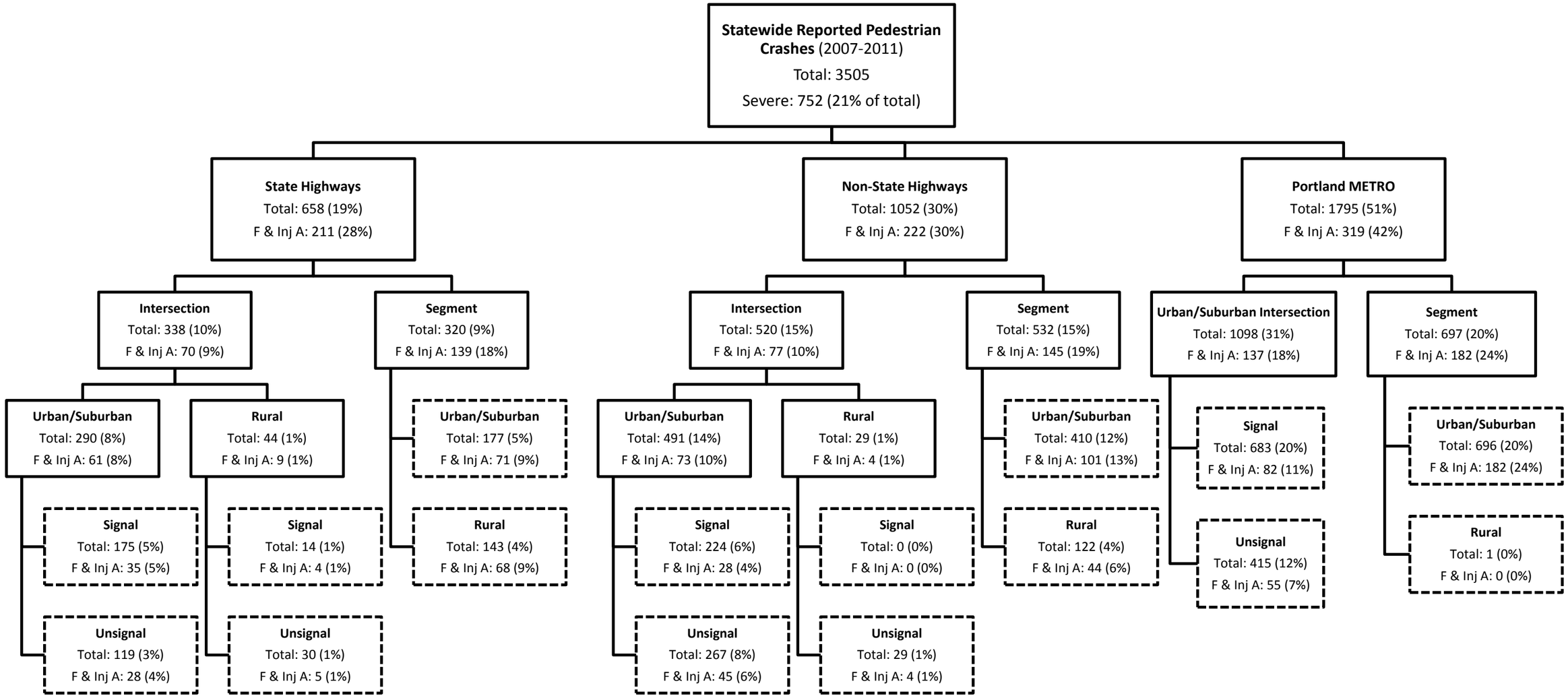


Exhibit 2. Number of Pedestrian Crashes by Reference Population (Percentage represents percentage of total crashes or percentage of fatal (F) and severe injury (Inj A) crashes)

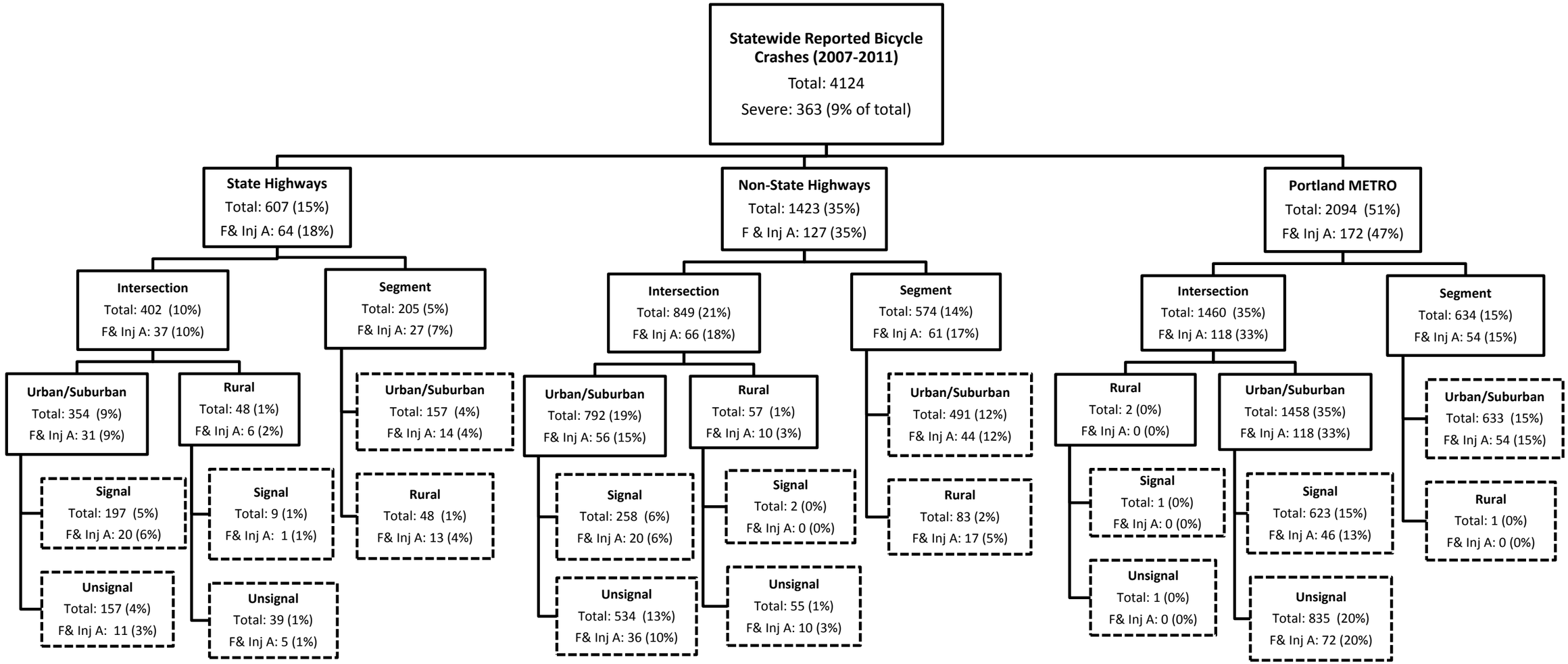


Exhibit 3. Number of Bicycle Crashes by Reference Population (Percentage represents percentage of total crashes or percentage of fatal (F) and severe injury (Inj A) crashes)

The pedestrian and bicycle crash trees in Exhibit 2 and Exhibit 3 illustrate how reported crashes have been distributed among reference populations, but do not account for exposure (e.g., number of pedestrians or bicyclists using each type of facility) or existing roadway inventory (e.g., number of miles of segments on state vs. non-state facilities).

Multiple crash data trends were evaluated for each reference population. Example characteristics evaluated include: weather, crash type, driver characteristics, roadway characteristics, traffic control, and temporal factors. When a trend was observed in the data that could be tied to a roadway characteristic or location, that characteristic was identified as a potential risk factor. Some observed crash patterns indicate risk factors that could not be applied because facility inventory data is not available to screen the statewide network to identify locations where the risk factor is present. For example, many crashes occurring at night indicate that no street lighting could be a risk factor, but no inventory of street lighting is available on all state highways.

The following sections summarize potential risk factors identified through crash pattern analysis. Risk factors that could be applied within network screening are identified in Section 5.

PEDESTRIAN CRASH ANALYSIS

Pedestrian crash patterns identified through analysis of reported pedestrian crashes from 2007 through 2011 were used to develop potential risk factors for pedestrian crashes. For example, one potential risk factor identified for pedestrian crashes on state segments in urban or suburban areas was posted speed limit of 35 miles per hour (mph) or higher. This crash trend indicated increased risk of severe crash with speeds of 35 miles per hour (mph) or higher, illustrated in Exhibit 4. All potential risk factors identified through this analysis are listed in Table 26; graphs associated with all trends observed are available in Appendix 4.

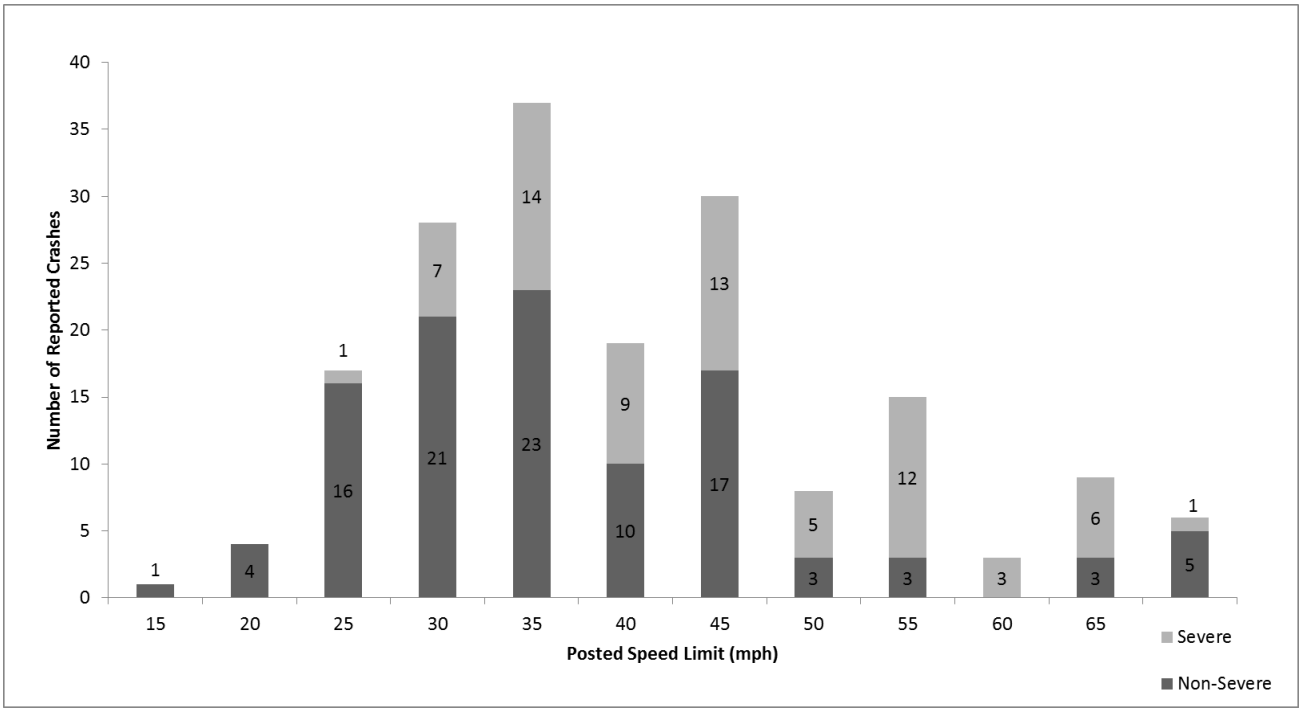


Exhibit 4. Posted Speed Limit for All Crashes on **Urban Segments** on **State** Highways

Table 26 provides a summary of risk factors identified for each reference population. Risk factors were identified based on trends observed for severe crashes, unless otherwise noted. Graphs illustrating trends that support the selection of reference populations are included in Appendix 4. As shown in Table 26, four potential risk factors were identified at intersections and nine risk factors related to segments.

Other crash patterns that influenced the selection of risk factors and countermeasures include:

- Time of year: The number of reported pedestrian crashes increases between the months of October and March, when one would expect fewer pedestrians to be on the road due to weather conditions. Data revealed that this trend is associated with an increase in crashes occurring during dark conditions (both with and without street lights) during winter months.
- Lighting: Dark lighting conditions (with and without street lights) was a factor in several reference populations. Although the association with dark lighting conditions may be confounded by exposure (more hours of the day occur during daylight in summer months), trends revealed visibility of pedestrians is a key risk factor at many locations.
- Mid-block crossings: The majority of pedestrian crashes that occurred along segments involved pedestrians attempting to cross mid-block and failing to yield to vehicles, rather than pedestrians struck while walking along the side of the road.
- Vehicle movement: At intersections, the most frequent type of severe crash involved vehicles traveling straight through an intersection and failing to yield to the pedestrian; through vehicle speeds generally exceed those of turning vehicles, causing more severe crashes. At signalized intersections, left-turn crashes were also common, although the percentage of these crashes that were severe was lower than that of vehicles traveling straight ahead. In both urban and

- rural areas, a low percentage of crashes involving vehicles turning right were severe at both signalized and unsignalized intersections.
- Alcohol or drug involvement: Impairment was a factor in a high proportion of fatal and severe pedestrian crashes. The majority of impaired cases involved an impaired pedestrian rather than an impaired driver. Emphasis should be placed at locations with proximity to liquor establishments in an effort to provide additional enforcement or designs that raise awareness of pedestrians.

BICYCLE CRASH ANALYSIS

Observed trends among reported severe bicycle crashes between 2007 and 2011 were used to develop potential risk factors for bicyclist crashes. As an example, Exhibit 5 shows the trend that informed the potential risk factor of driveway density. Many of the severe bicyclist crashes occurred at driveways or alley accesses. Due to the low numbers of crashes, this trend was also verified for crashes of all severity along state highway segments in urban areas.

Table 26 Pedestrian Crash Patterns and Potential Risk Factors for Fatal and Injury A Crashes

Roadway Type	Area	Crash Pattern	Potential Risk Factors
State, Non-State, **Intersection**	Urban/ Suburban	Vehicles turning left at signalized intersections and drivers failing to yield to pedestrian in crosswalk	• Signalized intersections with permitted or protected/permitted left-turn phases
METRO, **Intersection**	Urban/ Suburban	Over half of crashes at signalized intersections were within 100 feet of a transit stop	• Signalized intersections within 100' of transit stop
		The majority of crashes occurred on arterials or collectors; almost all severe crashes (that had number of lanes available in the data) occurred on roadways with 4 lanes	• Intersections that have collector or arterial roadways with 4-lanes on at least one approach
State, **Intersection**	Rural	80% of severe crashes at signalized intersections occurred on roadways without sidewalks and speed limits at or above 45 mph	• Intersections with approach speed limits at or above 45 mph and no sidewalks
State, **Segment**	Urban/ Suburban	80% of severe crashes occurred in dark conditions; 60% of these occurred in locations with no street lights	• Unlit streets
		High proportion of crashes involving midblock crossings and pedestrian failure to yield	• Signal spacing greater than x/mile • Roadway cross-sections without a median
		45% of crashes occurred in locations without a sidewalk and with a posted speed limit of 45 mph or higher	• No sidewalk and posted speed equal to or greater than 45 mph
State, **Segment**	Rural	Approximately 50% of crashes involved an impaired driver or pedestrian; of these, approximately 80% occurred in dark conditions with no street lights	• Number of liquor establishments within x feet
		Most crashes occurred in locations with posted speed limits above 40 mph and that lack sidewalks and street lights	• Streets that lack street lights and have speeds above 40 mph
Non-State, **Segment**	Urban, Suburban and Rural	The most common reported pedestrian action was "crossing between intersections"	• Signal spacing less than x/mile
METRO, **Segment**	Urban/ Suburban	The most common reported pedestrian error was "crossing between intersections"	• Signal spacing less than x/mile and two-lane
		Over half of crashes occurred in dark, dawn, or dusk conditions (32% of these in locations with no street lights); the majority of crashes occurred on arterials or collectors; the majority of crashes occurred on 2 or 4 lane roadways	• Collectors and arterials that have street lights and no medians
		The majority of crashes occurred in locations with sidewalks and with a posted speed limit of 35 mph or higher	• Roads with sidewalks and speed greater than 35 mph

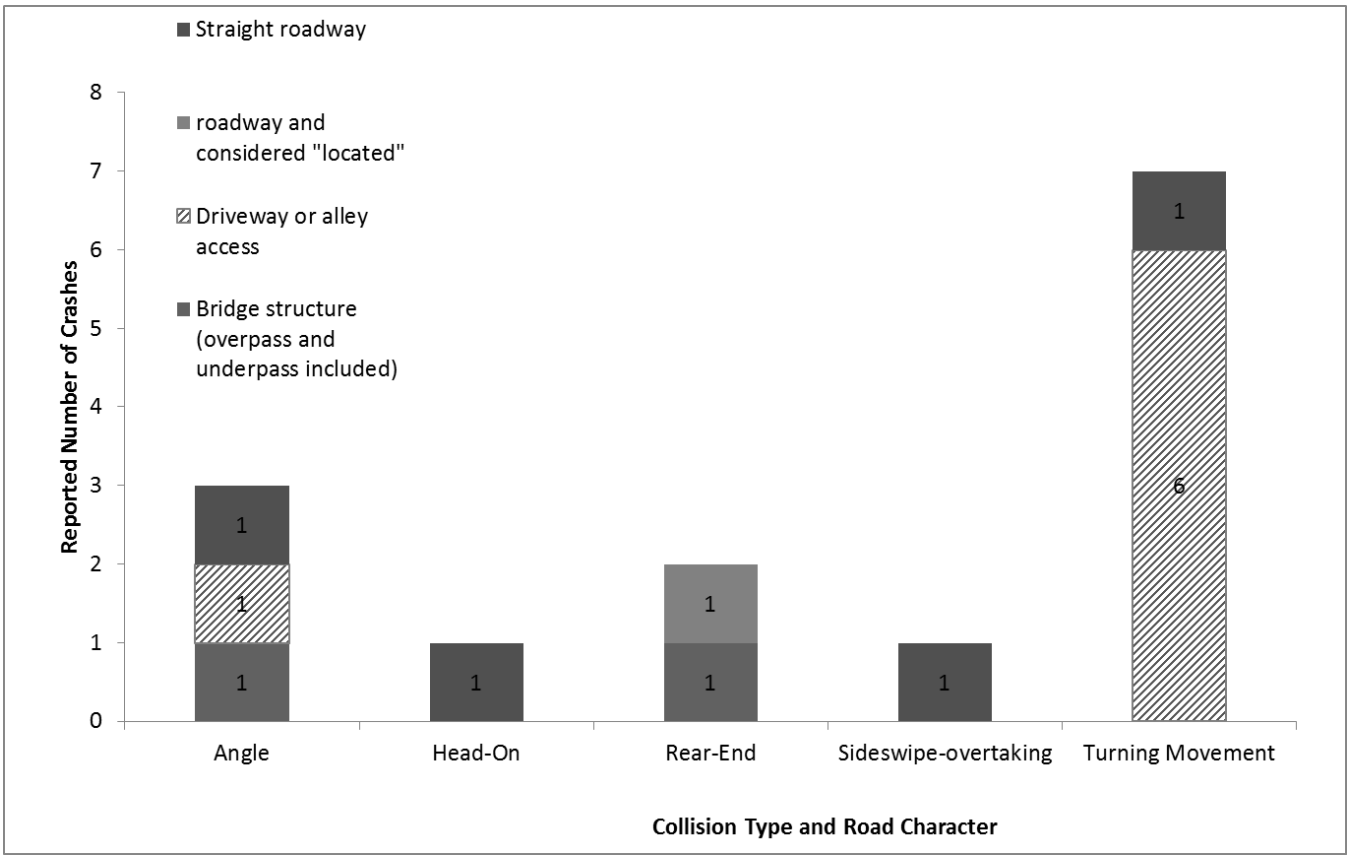


Exhibit 5. Collision Type and Road Character for **Fatal and Injury A** Crashes along **Segments** in **Urban** Areas on **State** Highways

Table 27 provides a summary of all risk factors identified for each reference population. As shown in Table 27, crash analysis led to identification of five risk factors related to intersections and one risk factor related to segments. Additional charts and graphs illustrating trends within each reference population are provided in Appendix 4. Key trends observed included the following:

- The majority of severe crashes on segments occurred at driveways, and many of those were in locations with bicycle facilities;
- Right-hook and angle crashes were the primary crash types at signalized intersections.
- At signalized intersections in the Portland Metro area there were equal numbers of severe (fatal or injury A) bicycle crashes involving vehicles going straight as there were left- or right-turning vehicles.
- At signalized intersections in urban areas on state highways there were more severe (fatal or injury A) bicycle crashes involving bicycles going straight colliding with vehicles going straight than severe crashes involving bicycles going straight colliding with left- or right-turning vehicle.

Table 27 Crash Patterns and Potential Risk Factors for Bicycle Crashes

Roadway Type	Area	Crash Pattern	Potential Risk Factors
State: **Intersection**	Urban/ Suburban	The majority of crashes at signalized intersections occurred on 4-lane roadways and were classified as either angle or turning movement crashes	• Signalized intersections with at least four lanes on major street
	Urban/ Suburban	The majority of crashes occurred on 2 or 4 lane roadways and involved vehicles turning left or right at an unsignalized intersection and colliding with a bicycle traveling straight ahead	• Unsignalized intersections with two or four lanes*
Non-State, METRO: **Intersection**	Urban/ Suburban	The majority of crashes involved a vehicle colliding with a bicycle at a right angle while executing turns to/from roadways with bicycle lanes	• Intersections with a bicycle facility on at least one approach
METRO: **Intersection**	Urban/ Suburban	Over half of severe crashes at signalized intersections occurred less than 100' from a transit stop	• Signalized intersections within 100 feet of transit stops
State and Non-state: **Intersection**	Rural	Many crashes occurred on two-lane roadways and involved a vehicle striking a bicycle while executing a right-turn while the bicyclist attempted to travel straight through the unsignalized intersection	• Unsignalized intersections with two-lane approaches*
All: **Segment**	All	The majority of crashes occurred at a driveway or alley access	• Driveway density (number of driveways/ mile)

*Note: Trend and risk factor based on all crashes rather than fatal and injury A crashes due to small population sizes of severe crashes

CRASH ANALYSIS SUMMARY

The crash data analysis identified several risk factors associated with pedestrian and bicyclist crashes. Overall, fewer crash patterns were identified for bicycle crashes than pedestrian crashes. Many of the risk factors identified in this section informed the statewide network screening, but not all risk factors could be applied to rank segments, due to limited facility inventory data.

The risk factors that were identified and applied in the network screening include:

Pedestrian Risk Factors

- Presence of transit stop
- Undivided 4-lane roadways in urban areas
- Presence of a traffic signal
- Presence of pedestrian activated flashers or beacons
- Posted speed limit
- ADT
- Reported crash frequency
- Reported crash severity

Bicycle Risk Factors

- Driveway density
- Undivided 4-lane roadways in urban areas
- Lack of bicycle facility on at least one side of the roadway
- Presence of a traffic signal
- Average daily traffic (ADT)
- Posted speed limit
- Crash frequency and severity

The following section discusses the network screening conducted to inform this implementation plan.

Network Screening

NETWORK SCREENING

The Implementation Plan is based on a combination of two network screening methods. One network screening method relies on "traditional" metrics (i.e., reported crash frequency and severity) to rank locations for safety improvement. The second process relies on crash risk, identified as roadway characteristics that have contributed to pedestrian and bicycle crashes over the study period.

This section describes the prioritization methodologies; the prioritized candidate project corridors for each ODOT Region are presented in Section 2. Both screening methods were based on review of incremental segments of the entire roadway network. Intersection crashes were incorporated into segments for the purpose of screening. Segments were defined based on ODOT's milepost reference system for state facilities and a similar milepost reference system for non-state facilities.

RISK-BASED NETWORK SCREENING

The bicycle and pedestrian crash trend analysis, summarized in Section 4, identified risk factors associated with pedestrian and bicyclist crashes. The network was screened to prioritize locations where multiple risk factors are present and pedestrian and bicycle safety countermeasures are expected to be most beneficial.

Roadway Network

The statewide network was divided into 0.10-mile segments to identify locations where risk factors are present. Segments are defined independent of intersection locations and may include one or more intersections. Due to the lack of consistent data on non-ODOT facilities throughout the state, the risk-based statewide screening was only conducted on ODOT facilities in urban areas. Risk factors for both roadway segments and intersections were included in the segment screening. Therefore, project corridors should be reviewed to identify appropriate countermeasures for each corridor, which may include intersection or segment specific countermeasures.

Segment Scoring

A segment prioritization scoring system was developed that accounts for a combination of ODOT Project Management Team (PMT) ranking of the relative importance of each risk factor and:

1. The probability that the risk factor will lead to a crash; and
2. The degree to which risk factor criteria are met or exceeded (e.g., if the risk factor is speed, more points are given for posted speed limits of 45 mph or more and fewer points are given for posted speeds between 35 and 45 mph).

For example, segments with multiple severe injury crashes two points and a segment with one severe injury crash only gets one point. Therefore, although two segments may each have one risk factor present, one segment may be prioritized higher than the other because it satisfies a risk factor that is

worth more points. As shown in Table 28 and Table 29, the scores range from one point for the lowest priority risk factors to four points for the highest priority risk factors.

Table 28 Pedestrian Risk Factor Scoring Criteria

Risk Factor	PMT Relative Weight	Risk Factor Scores
Proximity to Signal	1	• 1 point if at least 1 signal is located on the segment or within 100' of the segment
Proximity to Transit Stop	2	• 1 point for segments with 1 transit stop located on the segment or within 100' of the segment; • 2 points for 2 or more transit stops
Pedestrian Activated Beacons or Flashers	2	• 1 point subtracted (rewarded) for the presence of an enhanced midblock crossing
Posted Speed Limit	3	• 2 points for posted speed limit of 35 or 40 mph; • 4 points for posted speed limits above 40 mph
Undivided, 4-lane Segment Characteristic	3	• 2 points if segment is an undivided 4-lane segment
Number of Non-Severe Injuries and Pedestrian Involved but Not Injured in Crashes	4	• 2 points if a non-severe injury or pedestrian-involved crash was reported on the segment or within 100'; • 1 additional point for each additional injury or pedestrian involved
AADT	4	• 2 points for AADT between 12,000 and 18,000; • 4 points awarded for AADT above 18,000[1]
Number of Severe Injuries Resulting from Pedestrian-Involved Crashes	5	• 4 points awarded if a severe injurywas reported; • 2 additional points awarded for each additional severe injury
Number of Fatalities Resulting from Pedestrian-Involved Crashes	5	• 4 points awarded if a fatality was reported

[1] AADT thresholds were selected based on input from ODOT and levels that correspond to other ODOT datasets and research.

Table 29 Bicycle Risk Factor Scoring Criteria

Risk Factor	PMT Relative Weight	Risk Factor Scores
Proximity to Signal	1	• 1 point awarded if at least 1 signal is located on the segment or within 100' of the segment
Undivided, 4-lane Segment Characteristic	1	• 1 point awarded if the segment is an undivided 4-lane segment
Proximity to Transit Stop	1	• 1 point awarded for segments with 1 transit stop located on the segment or within 100' of the segment; • 2 points awarded for 2 or more transit stops
Lack of Bicycle Facility (Left side of road)	2	• 2 points awarded for the lack of a bicycle facility on the left side of the road
Lack of Bicycle Facility (Right side of road)	2	• 2 points awarded for the lack of a bicycle facility on the right side of the road
AADT	3	• 2 points awarded for AADT between 12,000 and 18,000; • 4 points awarded for AADT above 18,000
Posted Speed Limit	3	• 2 points awarded for a posted speed limit of 35 or 40 mph; • 4 points awarded for posted speed limits above 40 mph
Number of Driveways	4	• 2 points awarded for segments with 1 driveway; • 3 points for segments with 2 to 3 driveways; • 4 points for segments with 4 to 8 driveways; • 5 points for segments with more than 8 driveways
Number of Non-Severe Injuries and Bicyclists Involved but Not Injured	5	• 2 points for first occurrence • 1 additional point for each subsequent
Number of Severe Injuries Resulting from Bicyclist-Involved Crashes	6	• 4 points awarded if a severe injury was reported; • 2 additional points awarded for each additional severe injury
Number of Fatalities Resulting from Bicyclist Involved Crashes	6	• 4 points awarded if a fatality was reported

KAI applied the scores in Table 28 and Table 29 to 9,490 0.1-mile segments on the state network. Rural segments (as defined by the Census Urbanized Areas), freeways and interstates, and connectors and frontage roads (based on the highway name) were excluded because the risk factors did not apply to those facilities. A segment's score represents the sum of points awarded for all risk factors present. Table 30 and Table 31 provide a summary of point allocation among all segments. Table 30 shows there was one segment identified in the pedestrian analysis with a total score greater than twenty, 190 segments with 10 points each, and 332 with 0 points. The higher the score, the greater the risk of a pedestrian or bicycle crash.

Table 30 Results of Pedestrian Crash Risk-Based Scoring Methodology

Pedestrian Crash Risk Score	Number of Segments
0	336
1	125
2	758
3	183
4	3773
5	237
6	1740
7	305
8	1354
9	254
10	190
11	83
12	57
13	34
14	21
15	19
16	3
17	7
18	4
19	5
20	1
>20	1
Total	9490

As shown in Table 30, the scoring system allows for differentiation among segments, particularly in the top percentile. Details summarizing the characteristics of the top priority segments identified by the risk-based network screening for each ODOT Region are provided in Appendix 1.

Table 31 Results of Bicycle Risk-Based Scoring Methodology

Pedestrian Score	Number of Segments with the Score
0	32
1	16
2	121
3	38
4	603
5	170
6	956
7	358
8	2164
9	552
10	1574
11	913
12	1037
13	397
14	275
15	144
16	83
17	39
18	12
19	5
>20	1
Total	**9490**

Segment Prioritization and Candidate Project Corridor Identification

The prioritized individual segments were grouped into longer candidate project corridors where one or more pedestrian and bicycle countermeasures could be applied to reduce crash frequency and severity. Combining 0.10-mile segments into prioritized candidate project corridors is expected to increase efficiency for project development and construction. This process may also capture unranked segments with similar characteristics to ranked segments that have potential for pedestrian or bicycle crashes, introducing a proactive benefit to a project.

To establish candidate project corridor boundaries around the highest scoring individual segments, the segments were screened again to establish an additional score for each segment that accounts for the scores of upstream and downstream segments. This resulted in a unique “corridor” score for each 0.10-mile segment calculated as the average score for segments on the same roadway within one-half mile in each direction.

The analysis was conducted using a spatial analysis model developed with ArcGIS 10.1 Model Builder. The spatial analysis selects and aggregates the scores of each segment of the network. The corridor aggregate score was divided by the number of segments resulting in a score for each segment that reflects the average risk per mile long corridor.

After running the algorithm described above, the top segments were selected and used to identify the priority project corridors in each ODOT Region. Section 2 describes how segments were identified in each ODOT Region and provides tables and figures summarizing prioritized candidate project corridors for the ODOT Region.

Non-state Risk-Based Candidate Project Corridors

Non-state facilities could not be scored using a systematic process due to lack of consistent roadway inventory data. However, ODOT could consider incorporating candidate project corridors identified on non-state facilities into the ranked list. To do so, a local agency may identify priority corridors on a non-state network and score them based on the same criteria summarized in Table 28 and Table 29. An electronic Excel-based tool for calculating the score is available from ODOT for use by local agencies and region staff. The hard-copy form is available in Appendix 1.

CRASH FREQUENCY AND SEVERITY NETWORK SCREENING

The crash frequency and severity network screening complements the risk-based network screening by capturing locations with the highest frequency and most severe crash history on roadways throughout the state, including non-state facilities. These locations should be considered along with the risk-based results as candidates for countermeasure implementation.

Due to the format of the data available, this process was completed in two steps.

1. Segments were prioritized for state facilities (within ODOT's jurisdiction), including urban, rural, and suburban facilities. Interstates, freeways, connectors, and frontage roads were excluded.
2. Segments were prioritized for non-state facilities (not within ODOT's jurisdiction), including urban, rural, and suburban facilities.

Both groups were scored using a consistent methodology to provide one ranked list of both state and non-state segments.

Segment Scoring

Reported crashes on roadway segments and at intersections were scored and ranked based on number of participants involved in each pedestrian or bicycle crash.

To prioritize locations with history of severe crashes, the following point values were assigned to each segment to account for crash severity.[2]

- 1 point per number of non-injured participants involved in a crash.
- 2 points per number of participants with reported minor or moderate injuries due to a crash.
- 3 points per number of participants with reported severe-injuries due to a crash.
- 3 points per number of participants who died due to a crash.

Points were allocated for each injured or killed participant to account for the comprehensive costs to society. Non-injured participants in motor vehicles were excluded, and injured or killed participants in motor vehicles were included (if any).

Similar to risk-based network screening, GIS software summarized the pedestrian and bicycle scores of segments on the same roadway within a half mile in both directions. The total score was used to reflect the severity of crashes occurring within the corridor. Details summarizing the characteristics of the top priority segments identified by the crash frequency and severity network screening for each ODOT Region are provided in Appendix 2.

Segment Prioritization and Project Identification

The statewide and non-state roadway networks were divided into segments with a minimum of one crash and scored based on the scoring methodology identified above.[3] Segment scores reflect crashes within a half-mile upstream and downstream, resulting in an average segment score per/mile of roadway.

The results of the segment scoring for the statewide and non-state networks were combined to identify jurisdictionally blind corridor safety projects throughout the state. The segments with the highest scores among the state and non-state network were identified and grouped into project corridors with nearby or adjacent segments. This process identified project corridors throughout the state with history of frequent and severe crashes, regardless of jurisdiction. Section 2 describes how corridors were selected for each Region and presents a list of projects identified for each Region.

[2] The point values could be modified by ODOT to incorporate state-specific crash costs.

[3] The state analysis was screened using 0.01-mile segments, but the additional detail of 0.01-mile segments did not appear to provide better results than 0.10-mile segments. Therefore, non-state analysis was based on 0.10-mile segments. The use of a consistent unit score allows for direct comparison between state and non-state segments and renders the methodological difference insignificant.

Countermeasure Options

COUNTERMEASURE OPTIONS

This section identifies countermeasure options to address crashes at the candidate project corridors prioritized through network screening. The countermeasures identified in this section are expected to reduce crash frequency and/or severity; they intentionally do not include countermeasures that only improve user "comfort" or address perceived safety concerns.

A variety of countermeasures were identified to address the crash patterns and risk factors identified through crash analysis. The list of countermeasures was supplemented by stakeholders during the Stakeholder Workshop and with countermeasures identified in FHWA's *Non-Motorized User Safety: A Manual for Local Rural Road Owners (*Reference 5*).* The countermeasures were evaluated to identify documented effectiveness, ease of implementation, and relative construction costs. A list of priority countermeasures was identified and a countermeasure toolbox was developed to assist in selecting the appropriate set of countermeasures for each project corridor.

The countermeasures are organized into a Countermeasure Toolbox. The toolbox is intended to be used as a resource by ODOT and local agency staff when identifying one or more countermeasures for application within a candidate project corridor. Another resource for identifying countermeasures and countermeasure effectiveness is the Federal Highway Administration's Crash Modification Factor (CMF) Clearinghouse (www.cmfclearinghouse.org). The clearinghouse provides an online database of countermeasures with documented effectiveness that is regularly updated.

Priority Countermeasures

In January 2012, FHWA issued a "Guidance Memorandum on Promoting the Implementation of Proven Safety Countermeasures." (Reference 7) This guidance encourages use of four countermeasures that apply to pedestrian and bicycle crashes:

- Medians and pedestrian crossing islands in urban and suburban areas;
- Pedestrian hybrid beacon;
- Road diet; and,
- Corridor access management.

This guidance is based on the latest safety research. Appendix 6 includes additional information and resources from FHWA regarding each of these countermeasures.

In addition to those identified by FHWA, other preferred countermeasures are summarized below. These are expected to generally be more cost-effective and applicable to a broader range of locations than others listed in the toolbox.

Intersection

- Pedestrian countdown signals
- Signal timing modifications (e.g., leading pedestrian interval)

Segment

- Enhanced midblock crossing (could include median, hybrid beacon, and/or illumination)[4]
- Bike stencils or colored pavement to indicate conflict points between turning vehicles and bicycles

Although these countermeasures have been proven effective through empirical study, each application should take into account the location's context and road user behavior.

Countermeasure Toolbox

The countermeasure toolbox was developed as an Excel-based pivot table to assist in selecting the appropriate set of countermeasures for each project corridor. Countermeasures have been categorized by area type (i.e., rural and urban/suburban) and are further classified by facility type (intersection or segment) and traffic control (signalized and unsignalized).

The countermeasures included in the Countermeasure Toolbox are summarized in Table 32 and Table 33. The countermeasures range in terms of their construction cost, ease of implementation, and crash-reduction effectiveness.

Relative Construction Cost

Relative construction cost is categorized from low (1) to high (3) relative to other pedestrian and bicycle countermeasures within the toolbox and may vary depending on unique site conditions. Low cost projects do not require much, if any, construction and may be completed by a maintenance crew. High cost project likely require the most design and construction relative to other countermeasures within the toolbox. Moderate cost projects require some construction, but less than high-cost treatments within the toolbox.

Relative Ease of Implementation

The relative ease of implementation indicates the level of design and planning required to implement a countermeasure relative to other countermeasures within the toolbox. Ease of implementation is estimated for an "average" project to range from easy (1) to most difficult (3). Easy-to-implement projects (1) can likely be implemented by maintenance crews and require little to no planning relative to other treatments within the toolbox. Countermeasures with moderate ease of implementation (2) require limited planning and public outreach and may not require right-of-way acquisition. The most

[4] A Crosswalk Treatment Decision Matrix for selecting crossing devices is provided as Figure 7.2 in ODOT's research report titled "Evaluation of Alternative Pedestrian Control Devices" (SPR 721) available at: http://www.oregon.gov/ODOT/TD/TP_RES/pages/researchreports.aspx

difficult (3) countermeasures to implement are expected to require right-of-way and significant public involvement.

Countermeasure Effectiveness and Reliability

Countermeasure effectiveness is indicated by quantitative Crash Modification Factors developed by empirical studies. The reliability of each CMF varies from high (1) to low (3) based on the statistical rigor of the study and whether it was conducted inside or outside the US. The most reliable methods (1) were conducted in the US and were given a star rating in FHWA's CMF Clearinghouse of 4 or 5. Low reliability (3) indicates that an empirical study has documented the effectiveness, but the validity of the study is questionable. Moderate reliability (2) indicates a star rating of 3 in the CMF Clearinghouse and the study may or may not be based in the US.

No CMFs are available for several countermeasures. However, engineering judgment indicates the countermeasure will influence factors that are known to reduce crashes. In these cases, the effectiveness is described with a qualitative descriptor, rather than a quantitative estimate. The qualitative descriptors that are indicated in the toolbox are described below. Table 13-54 of the HSM provides additional documentation of trends associated with these countermeasures.

Speed

If a motor vehicle strikes a pedestrian or bicyclist the speed of the vehicle has a significant influence on the severity of the crash. Several studies have documented the linear relationship between speed and proportion of serious injuries and fatalities. Therefore, countermeasures that encourage speed reductions are expected to improve safety.

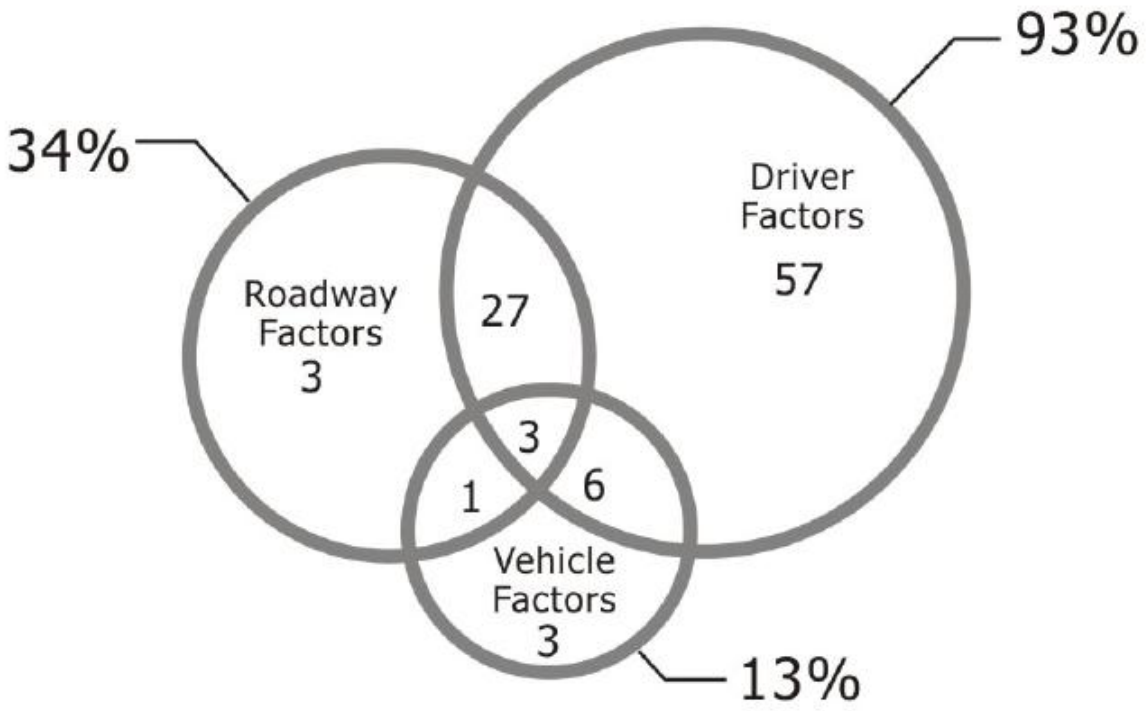
Conflict Points

Countermeasures that separate pedestrian and bicyclist movements from motorized vehicle movements may reduce the number of conflict points for pedestrians and bicyclists and reduce crash potential. At intersections, the number of conflict points is generally expected to relate directly with the number of crashes. This is one reason why roundabouts (single-lane in particular) have been shown to reduce crashes relative to two-way stop-controlled intersections.

Providing sidewalks along urban corridors reduces conflicts, particularly when the sidewalk connects pedestrians to a signalized or other enhanced crossing location.

Human Factors

As illustrated in Exhibit 6, driver factors (i.e., human factors) have been estimated to be a factor in 93 percent of all crashes. In some crashes involving pedestrians, human factors may be the primary factor contributing to the crash. For example, if a pedestrian is struck by a vehicle after the pedestrian decides to cross a high-speed roadway at a midblock location, at night, wearing dark clothes, the primary contributor in the crash is the human factor.



Source: Treat 1979

Exhibit 6. Causes of Traffic Crashes (Reference 8)

While no countermeasures can control for every human error, particularly those made by pedestrians or bicyclists, some countermeasures can help account for human factors. These countermeasures are expected to account for human factors and reduce crash potential through:

- Providing information that facilitates better decision making by roadway users (e.g., countdown pedestrian signals help pedestrians decide whether to start a crossing or wait for the next cycle)
- Managing conflicts between roadway users (e.g. pavement markings may remind a driver to check for a bicyclist before making a turn into a driveway)
- Reinforcing driver-pedestrian/bicyclist expectations, and
- Increasing pedestrian/bicyclist conspicuity on a roadway.

Table 32 Pedestrian Crash Countermeasure Toolbox

Crash Countermeasures by Area Type and Traffic Control	Relative Construction Cost	Relative Ease of Implementation	Countermeasure Effectiveness*	Relative Reliability of CMF
All Locations				
Signalized				
Lighting	2	2	0.58	1
Right-turn channelization island	2	2	Reduces conflict points	N/A
Signal Timing - Install countdown signals	1	1	0.45	2
Signal Timing - Leading pedestrian/bicyclist interval	1	1	0.63	2
Signal Timing - Modify left-turn phasing	1	1	Reduces conflict points	N/A
Vehicle turning movement restrictions	1	2	Reduces conflict points	N/A
Unsignalized				
Enhanced crossing treatment	1	2	0.58	2
Lighting	2	2	0.58	1
Reduce curb radii	2	2	Reduces speed	N/A
No Traffic Control				
Access control	3	3	0.75	1
Sidewalks	2	2	Reduces conflict points	N/A
Rural				
Unsignalized				
Stripe 4-8' Shoulder	1	1	Reduces conflict points	N/A
No Traffic Control				
Rural/suburban transition zone treatments	1	2	Reduces speed	N/A
Speed reduction treatments	2	1	Reduces speed	N/A
Construct 4-8' Paved Shoulder	3	2	Reduces conflict points	N/A
Urban/Suburban				
Unsignalized				
Pedestrian refuge island or median	2	2	0.63	2
Speed reduction treatments	2	2	0.65	3
Vehicle turning movement restrictions	1	2	Reduces conflict points	N/A
Stripe Bike Lane	2	2	0.65	3
No Traffic Control				
Enhanced midblock crossing treatment	3	3	0.58	2
Lighting	2	2	0.78	2
Road diet	1	1	0.71	1
Refuge island or median	2	2	0.63	2

* See text for descriptions of qualitative effectiveness measures

Table 33 Bicycle Crash Countermeasure Toolbox

Crash Countermeasures by Area Type and Traffic Control	Relative Construction Cost	Relative Ease of Implementation	Countermeasure Effectiveness*	Relative Reliability of CMF
All Locations				
Signalized				
Bike detection	1	1	Accounts for human factors	N/A
Lighting	2	2	0.58	1
Pavement markings	1	1	Accounts for human factors	N/A
Right-turn channelization island	2	2	Reduces conflict points	N/A
Signal Timing - Leading pedestrian interval	1	1	0.59	2
Signal Timing - Modify left-turn phasing	1	1	Reduces conflict points	N/A
Vehicle turning movement restrictions	1	2	Reduces conflict points	N/A
Unsignalized				
Enhanced crossing treatment	1	2	0.58	2
Lighting	2	2	0.58	1
Reduce curb radii	2	2	Reduces speed	N/A
Skip Striping	1	1	Accounts for human factors	N/A
Supplemental signs and markings	1	1	Accounts for human factors	N/A
No Traffic Control				
Access control	3	3	0.75	1
Bicycle route signage	1	1	Accounts for human factors	N/A
Longitudinal bike stencil	1	1	Accounts for human factors	N/A
Rural				
Unsignalized				
Parallel routes	1	1	Reduces conflict points	N/A
Stripe 4-8' Shoulder	1	1	Reduces conflict points	N/A
No Traffic Control				
Rural/suburban transition zone treatments	1	2	Reduces speed	N/A
Speed reduction treatments	2	1	Reduces speed	N/A
Construct 4-8' Paved Shoulder	3	2	Reduces conflict points	N/A
Urban/Suburban				
Signalized				
Bike signals	1	2	Reduces conflict points	N/A
Unsignalized				
Bicycle boulevards	1	1	0.37	3
Longitudinal bike stencil	1	1	Accounts for human factors	N/A
Speed reduction treatments	2	2	0.65	3
Vehicle turning movement restrictions	1	2	Reduces conflict points	N/A
Stripe Bike Lane	2	2	0.65	3
No Traffic Control				
Cycle tracks	3	3	0.84	3
Dynamic warning signs	1	2	Accounts for human factors	N/A
Enhanced midblock crossing treatment	3	3	0.58	2
Lighting	2	2	0.78	2
Restrict on-street parking	1	3	Reduces conflict points	N/A
Road diet	1	1	0.71	1
Refuge island or median	2	2	0.63	2

* See text for descriptions of qualitative effectiveness measures

Improving the Plan

IMPROVING THE PLAN

The plan described in this report identifies a method of selecting pedestrian and bicyclist safety projects throughout the state. ODOT may consider updating the plan every several years with new projects to account for updated crash history and new data available for use in network screening. There are a multiple opportunities to improve the results of this plan in the future through data collection and management, effectiveness evaluation, and incorporating education and enforcement countermeasures.

DATA COLLECTION AND MANAGEMENT

Crash pattern analysis and network screening were both limited by data availability and format. One resource for improving crash data is the Model Minimum Uniform Crash Criteria Guideline (MMUCC). MMUCC is a minimum, standardized data set for describing motor vehicle crashes and the vehicles, persons and environment involved. The Guideline is designed to generate the information necessary to improve highway safety within each state and nationally. The 4th Edition of the MMUCC Guideline is now available and is being promoted by the Governor's Highway Safety Association (GHSA) and NHTSA. A press release from GHSA describes its use and other important information,

> "MMUCC is a voluntary Guideline that helps states determine what data to collect at the scene of a motor vehicle crash. The Guideline will, among other things, help states better capture data for emerging issues such as distracted driving, secondary crashes and incidents on private property as well as determine the level of serious injury from motor vehicle crashes. States will be able to use federal funding authorized under the new surface transportation MAP-21 legislation to make improvements in their crash and other related data systems and come into compliance with the new MMUCC Guideline. (Reference 9)"

Specific to the data used to develop this Plan, the following elements were identified that could help improve future statewide bicycle and pedestrian crash analyses.

Quality of data collected for pedestrian and bicycle crashes

- Many pedestrian and bicycle crashes are unreported, reducing data available. If a higher proportion of crashes are reported, it will increase the accuracy of network screening.
- Crash reports lack critical information specific to pedestrian or bicycle crashes. One example is crash type for pedestrian crashes was often indicated as "pedestrian." Additional details related to the non-motorist involved in a crash are suggested fields in crash report forms.
- Indicating the location of the pedestrian when struck (i.e., on sidewalk, in road, etc.), the direction of pedestrian travel and vehicle travel, and the type of collision that occurred (i.e., vehicle stuck pedestrian from behind, from front, from side, etc.)
- Improving the completeness of reports that are submitted to DMV. Incomplete fields on a crash report are not assumed to be not applicable, because it could be left blank due to incriminating

evidence. For example, a self-reported crash involving a drunk driver may not have a response in the alcohol involved category. Although information such as "travel speed," "posted speed limit," and "location of pedestrian" were included in the crash data, these fields were incomplete for many of the crashes. A crash characteristic cannot be used as a risk factor if many of the crashes do not include data for that characteristic.

Facility Inventory Data Collected in Consistent Formats

- Establish a consistent format for collecting roadway facility data on all public roadways throughout the state. Although facility data such as number of lanes, sidewalks, bicycle facilities, driveway locations, transit stop locations, and pedestrian crossing locations are becoming more common across the state, they are often in varying formats across different agencies. Reliability of the data should be ensured, particularly for fields such as median type and presence, number of lanes, and midblock crossing inventory. By creating one consistent format to be used by ODOT, counties, and cities, network screening for characteristics would become possible for roadways of all jurisdictions.
- Alternatively, consider creating two consistent databases: one for state facilities, and one for City and County roads. Screening could occur on both networks, which would enable the non-state facilities to be screened for risk-based projects.

Obtain Pedestrian and Bicycle Volume Data to Indicate Exposure

- Exposure data is commonly available for vehicles, particularly on major roadways. Additional efforts to obtain consistent vehicle, pedestrian, and bicycle counts throughout the state would allow the comparison of locations using a crash rate in addition to crash frequency to identify locations with high numbers of crashes relative to the number of pedestrians or bicyclists. More complete vehicle counts would allow for better understanding of the relationship between the pedestrian or bicycle counts and vehicle traffic volumes.

EVALUATE EFFECTIVENESS OF IMPLEMENTATION

As indicated by the framework for the FHWA Systemic Safety Project Selection Tool (See Exhibit 1), program evaluation is a critical step in a systemic process and is required by MAP 21. Evaluation could include tracking project costs and crash history before and after project completion. This data can be used to determine which countermeasures are most effective in various environments.

Changes in crash history alone may not alone be enough to evaluate the effectiveness of the plan. For several reasons, an increase in pedestrian or bicycle crashes may not necessarily indicate that countermeasures were ineffective. Data have shown the numbers of pedestrians and bicyclists has been increasing and is expected to continue increasing. With more pedestrians and bicyclists on the roadway, an increase in crashes is expected. In addition, because the number of pedestrian and bicycle collisions are low overall, one or two crashes in a year may skew analysis results. Three years of crash history should be reviewed to avoid bias associated with near-term 'novelty' effects.

Because the plan focuses on methods of reducing fatal and severe injuries, evaluations should consider change in crash severity associated with project implementation. One potential performance measure to evaluate how well the projects are reducing severe crashes involves comparing the proportion of pedestrian and bicycle crashes that are severe within project corridors to the statewide average for similar facilities where countermeasures have not been implemented. For any comparison, a minimum of two years of crash data should be used, with a preferred crash history of five years.

ENFORCEMENT & EDUCATION

At the stakeholder workshop held in July 2013, many attendees suggested including an element of enforcement and education within the project, acknowledging that some crashes occur as a result of human error that is only partially preventable with physical engineering countermeasures. In order to maximize effectiveness, it is recommended that educational and enforcement-based countermeasures also be considered in locations where countermeasures are implemented.

References

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