Oregon Pedestrian and Bicycle Safety Implementation Plan

Pedestrian and Bicycle Safety

- Three primary focus areas for Infrastructure Safety in the Oregon Transportation Safety Action Plan
  - Roadway Departure
  - Intersections
  - Pedestrian and Bicycles
- ODOT has completed systemic plans identifying potential “sites with promise” for improving Roadway Departure and Intersections
- Kittelson and Associates was hired to develop a Ped/Bike plan

Project Goals

- Provide a data informed approach
- Targeted towards reducing fatal and serious injuries
- Increase understanding of pedestrian and bicycle crashes
- Provide tool box of effective low to medium cost countermeasures to improve ped/bike safety

Traditional Road Safety

- The Traditional Approach is to identify hot spots based on severity or frequency of crashes
- Once a location is identified the location is analyzed to diagnose the problems
- Effective countermeasures are selected
- Generally the most cost effective treatments are selected to get the biggest bang for the buck.

Systemic Road Safety

- Systemic is a different approach
- Systemic looks for target crash types to identify potential sites
- Uses cost effective proven measures to address target crash types
- Can be used over multiple locations with similar characteristics or crash trends (i.e., risk)
- May identify different locations than traditional “hot spot” approach
- Complements the traditional approach

Challenges with Systemic for Ped/Bike

- Relatively small sample of crashes
  - Ped/bike crashes are rare and sporadic
  - Harder to identify trends of crashes
- Fewer reliable and/or proven low cost countermeasures
- Volumes of peds and bikes not widely available
- Inconsistent roadway data available across jurisdictions
- Systemic looks a little different for Ped/Bike

Approach for Project

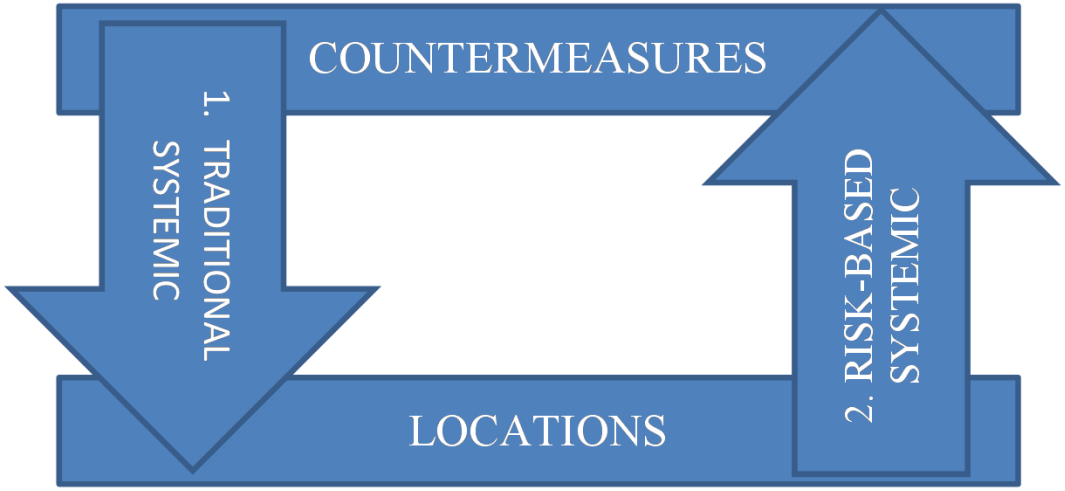
- Set a framework for future that is repeatable
- A framework that can be built upon as more data becomes available
- Develop an approach that can be used when jurisdictions have little or no roadway data
- Search for common risk factors like high speeds, multilane roadways, transit stops, multiple accesses
- Select countermeasures that might address common risks

Approach for Project

- Expert Task Group led the effort with the consultant
- Mid-way through the project Stakeholders were consulted to get feedback and further guidance

Two systemic methods

- More Traditional Systemic
  - Identify high crash corridors
- Risk-based systemic
  - Identify corridors with factors that increase the risk of pedestrian or bike crashes



Identify Risk Factors

Review crash data for patterns

- Look for traffic and geometric characteristics present at fatal and severe-injury crash sites

Select factors that represent crash trends and have data to support

- For instance near transit stops or posted speeds or number of lanes

Develop matrix with score for each risk factor

- Use data and engineering judgment to score, but keep it simple

Additional steps for Project

- Assign scores and weighting for screening
- Evaluate risk factors and crash frequencies to identify priority corridors
- Combine segments where they are close to one another
- Search for common overlapping corridors and different corridors

Prioritized lists for each Region

- Screening methods
  - Risk based
  - Crash Frequency based
- For each crash type
  - Pedestrian
  - Bicycle
- Different thresholds in each region to get adequate list of candidate locations

Risk Factors Considered

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

Risk Factors Considered

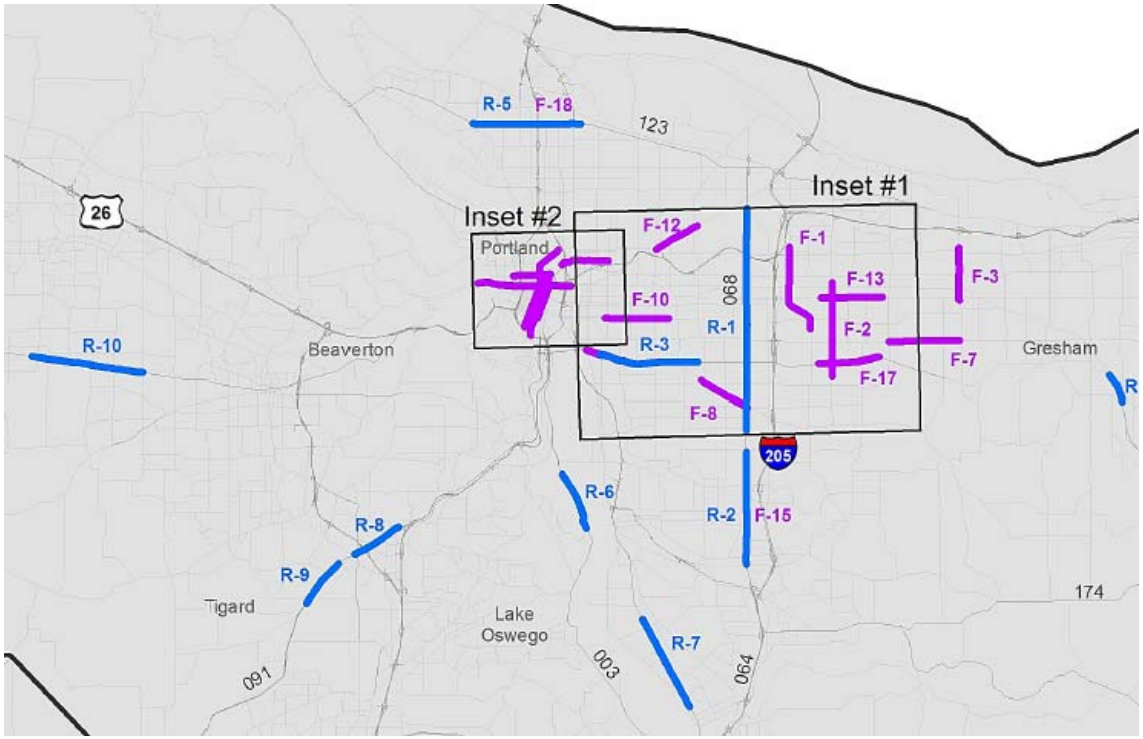
Table 28 Pedestrian Risk Factor Scoring Criteria

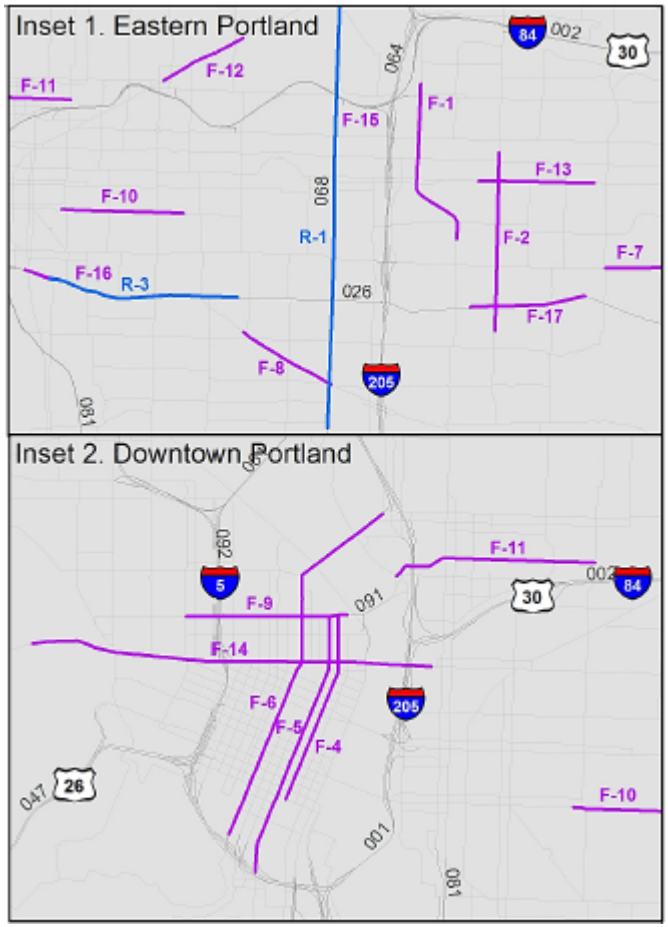
Risk Factor	PMT Relative Weight	Risk Factor Scores
Proximity to Signal	1	• 1 point if at least 1 signal is located on the segment or within 100' of the segment
Proximity to Transit Stop	2	• 1 point for segments with 1 transit stop located on the segment or within 100' of the segment; • 2 points for 2 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

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

Example Map of Priority Sites for Pedestrians





(R) Risk-Based Pedestrian Project Corridors

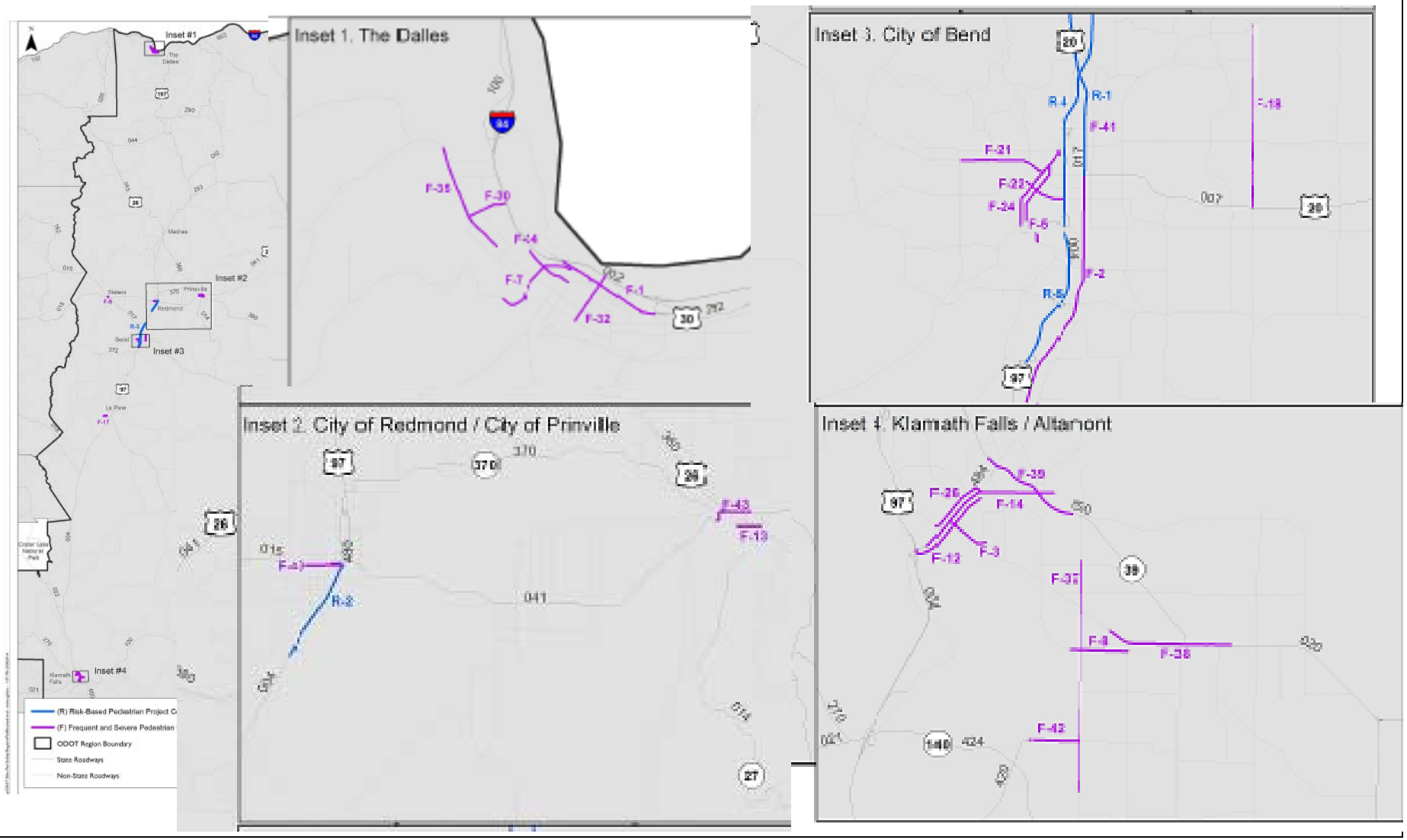
(F) Frequent and Severe Pedestrian Crash Project Corridors

ODOT Region Boundary

State Roadways

Non-State Roadways

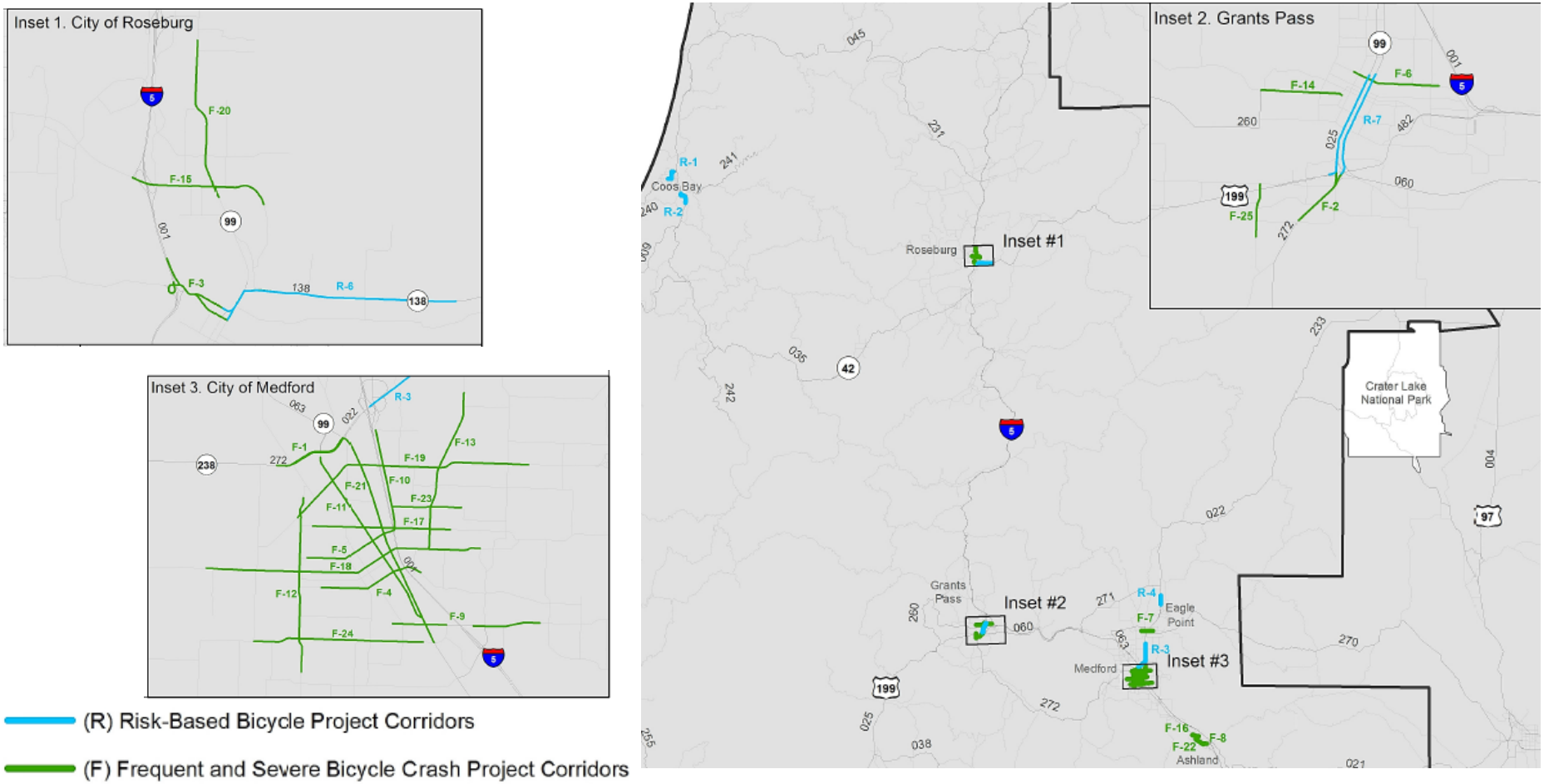
Priority Sites for Implementation of Pedestrian Crash Countermeasures

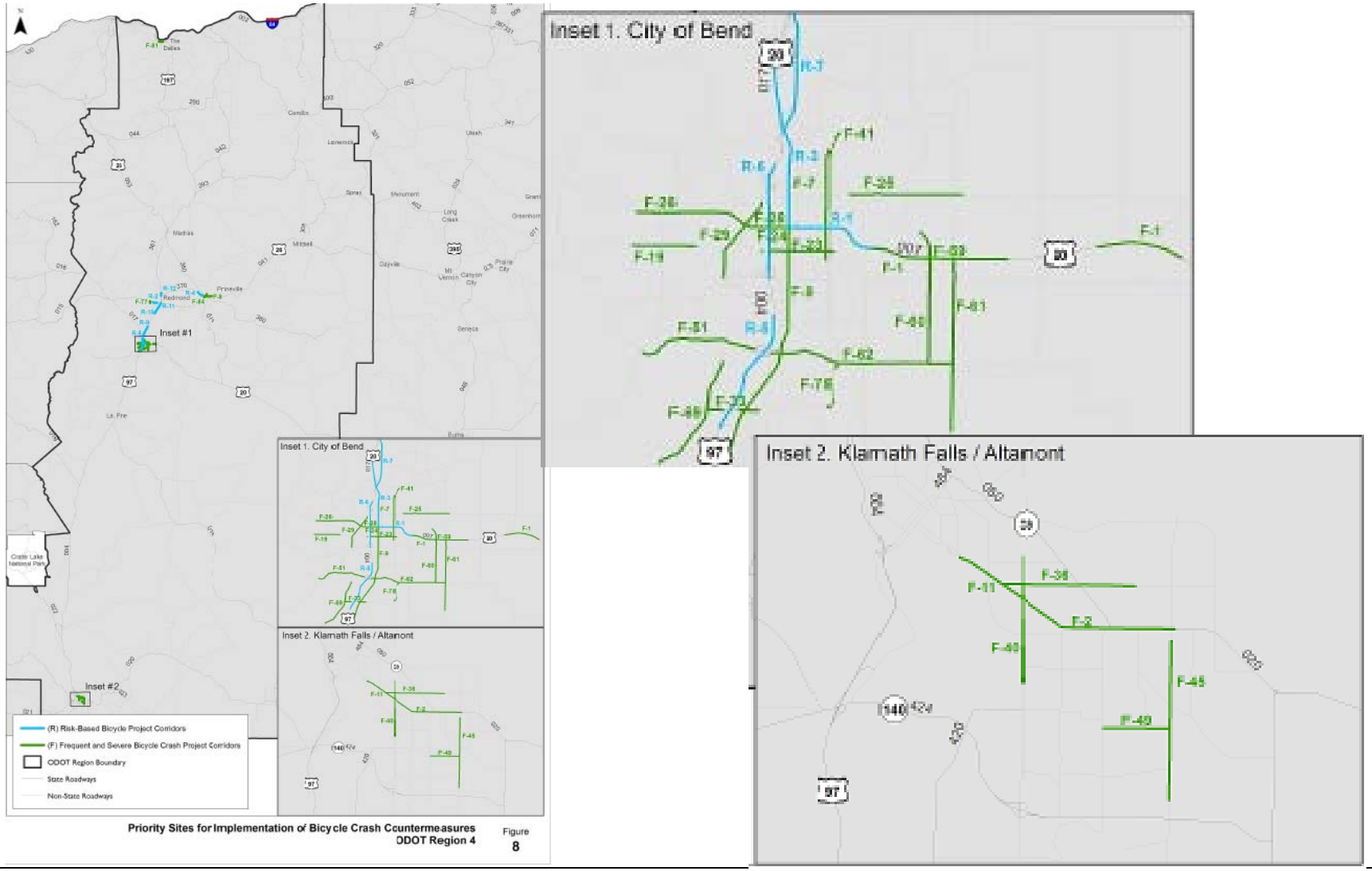


Example Corridors

Corridor Rank	Corridor ID	Roadway/Highway Name	Start A	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 Both 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	Kingsley 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

Example Map of Priority Sites for Bicyclists





Priority Sites for Implementation of Bicycle Crash Countermeasures
ODOT Region 4

Figure 8

Example List of Priority Sites for Bicyclists

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

Example Sites for Bicycle Corridors

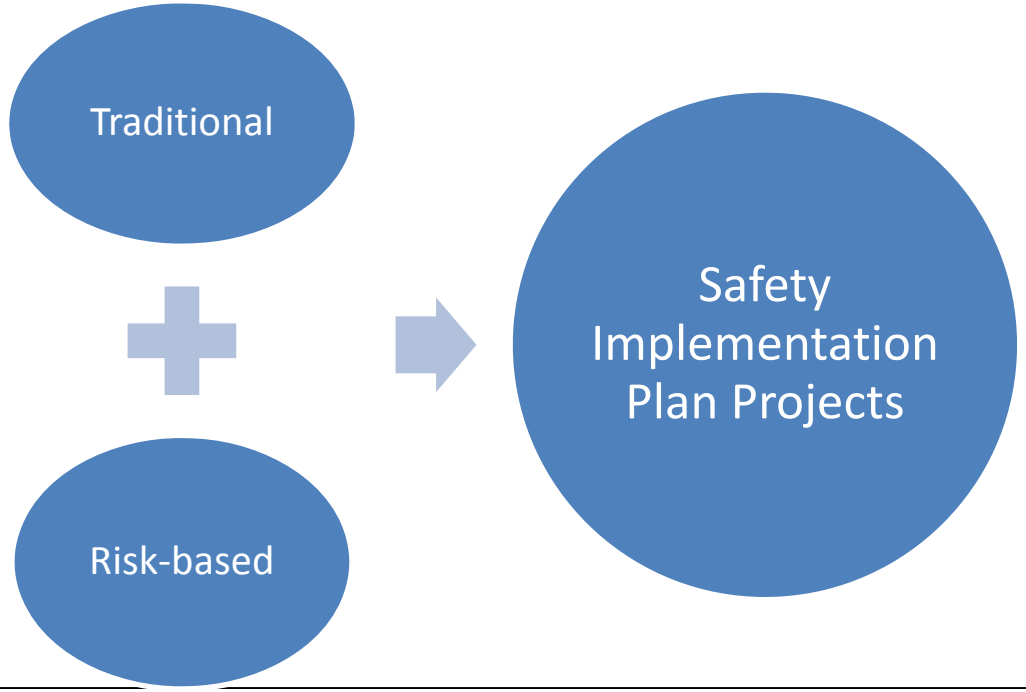
Table 19 **ODOT Region 4 Bicyclist Risk-Based Project Corridors**

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.

Two methods compliment each other

- Implementation
  - Implement agency reviews of corridors
  - Selects proven low/med cost countermeasures
  - Broadly implements countermeasures on corridors



Countermeasures

- A variety of countermeasures were evaluated
- Several of the FHWA proven countermeasures included
- Other countermeasures suggested by stakeholders and experts were included
- Suggested that there also be information on the relative cost and ease of implementation
- Developed a countermeasure toolbox

Typical Pedestrian Countermeasures

Unsignalized Intersections

(Medians, Enhanced Marking and Signing, and Illumination)

- Application: a history of pedestrian crossing crashes
- Cost: $2,000 for enhanced marking and signing, $5,000 - $30,000 for medians, and $25,000 for illumination
- Expected Improvement for Pedestrian Crashes: 15% for enhanced marking and signing, 46% for medians, 50% for dark crashes
- Delivery Timeline may be affected by stakeholder outreach
- Follow Bike and Pedestrian Design Guidelines

Typical Pedestrian Countermeasures

Signalized Intersections

(Pedestrian Countdown Timers)

- Application: signalized intersections with a history of pedestrian crossing crashes
- Crash Types: pedestrian-related crashes (includes crossings)
- Cost: $1,200 - $4,600 per intersection
- Expected Improvement: 25% for pedestrian-related crashes

Typical Pedestrian Countermeasures

Mid-Block Locations

(Lighting, Medians, Enhanced Marking and Signing)

- Application: mid-block locations with a history of pedestrian crossing crashes
- Cost: $50,000 - $100,000 per location
- Expected Improvement:
  - Lighting: 20% for all nighttime crashes
  - Medians: 25% for pedestrian crashes
  - Enhanced Marking and Signing: 15% for pedestrian Crashes
- Delivery timeline may be affected by stakeholder outreach

Typical Bicycle Countermeasures

Between Intersections

traffic calming

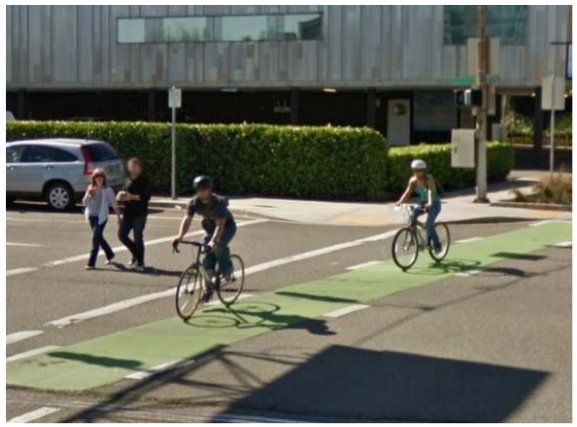
bicycle warning signage

sharrows

reconfigured lanes

- Application: high risk or high crash corridors
- Crash Types: bicycle-related crashes
- Cost: varies by treatment
- Expected Improvement of Bicycle Crashes:
  - Traffic calming: 35%
  - Bicycle Warning Signage: 15%
  - Sharrows: TBD
  - Road diet or other means of providing bike lane: 41%

Typical Bicycle Countermeasures



Intersections

painted conflict areas

crossing islands

- Application: locations with a history of bicycle incidents or high crash risk
- Crash Types: bicycle-related crashes
- Cost: varies by treatment
- Expected Improvement of Bicycle Crashes:
  - Colored Bike Lanes at Conflict Points: 39%
  - Crossing island: 37%

Crash Countermeasures

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	3
Right-turn channelization island	2	2	Reduces conflict points	N/A
Signal Timing - Install countdown signals	1	1	0.45	3
Signal Timing - Leading pedestrian/bicyclist 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	1
Lighting	2	2	0.58	3
Reduce curb radii	2	2	Reduces speed	N/A
No Traffic Control				
Access control	3	3	Reduces conflict points	N/A
Sidewalks	2	2	0.23	1
Rural				
Unsignalized				
Stripe 4-8' Shoulder	1	1	0.29	1
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	0.29	1
Urban/Suburban				
Unsignalized				
Pedestrian refuge island or median	2	2	0.63	1
Speed reduction treatments	2	2	0.65	1
Vehicle turning movement restrictions	1	2	Reduces conflict points	N/A
Stripe Bike Lane	2	2	0.65	1
No Traffic Control				
Enhanced midblock crossing treatment	3	3	0.51	1
Lighting	2	2	0.54	1
Road diet	1	1	0.59	2
Refuge island or median	2	2	0.63	1

* See text for descriptions of qualitative effectiveness measures

HSIP Funds for Pedestrian and Bicycle

- Starting in 2017
  - ODOT begins the All Roads Transportation Safety
  - Pedestrian and Bicycle funding at $4 Million per year
  - Each ODOT region will receive funds based on number of Ped/Bike F&A in the region
  - ODOT and local agencies will compete for the funds on an application basis
  - Applications with the highest score will receive funding
  - Scoring will be based on the risk based approach, i.e., those with highest risk based score

Any Questions?

Photo: Jonathan Maus