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& ASSOCIATES
NCHRP 20-44(13) – ODOT Pedestrian and Bicycle Safety Implementation Plan
Results Meeting
10/29/20

Agenda

- Welcome/Introductions
- Project Background/Purpose
- Review and Application of Systemic Safety Process
- Discussion/Feedback on Process
- Closeout

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2

Project Team

- ODOT
- NCHRP Staff and Panel
- Consultant Team
  - Kittelson & Associates, Inc.
  - DKS
  - Chris Monsere, PhD, PE

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3

Project Background and Purpose

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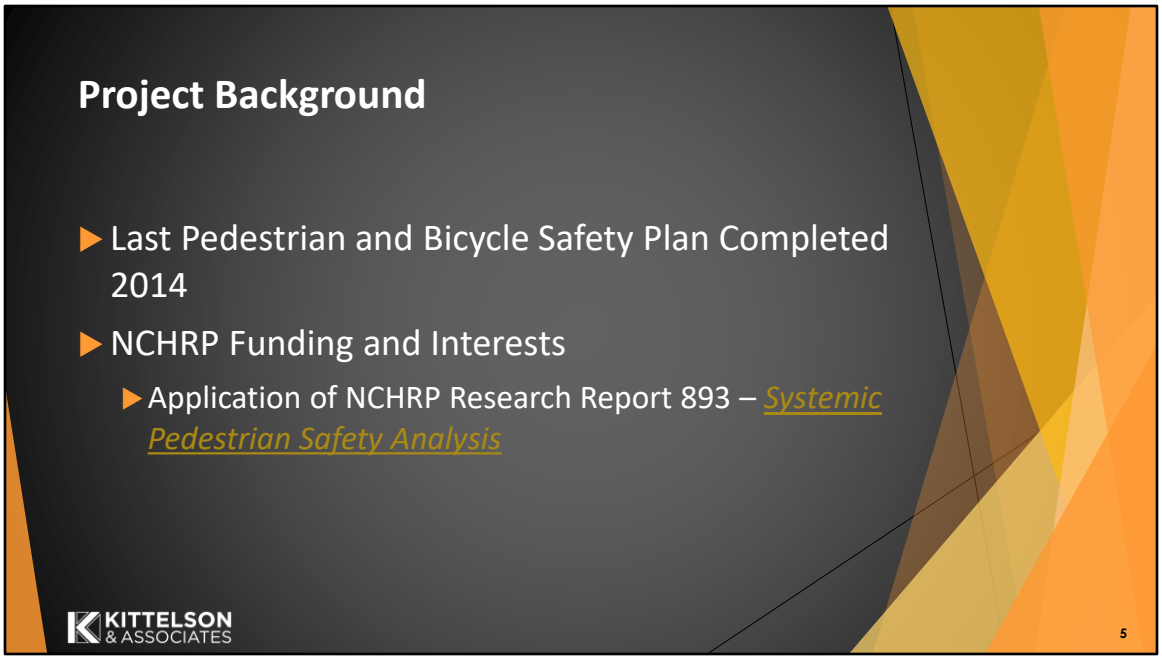
4



- ODOT's current plan was completed in 2014
- Since then:
  - ODOT's data has improved
  - Recommended systemic analysis methods have been published in NCHRP Research Report 893
- ODOT applied for and was awarded NCHRP implementation funds to apply the results of NCHRP Research Report 893 to update the 2014 plan.

- This slide shows the project objectives
- The emphasis is that this project is not a typical plan with resulting in projects, but rather it provides a framework for how to conduct analyses, what risk factors ODOT Regions and local agencies can use to identify locations for treatments, and provides example applications

Pedestrian and Bicycle Systemic Safety Process

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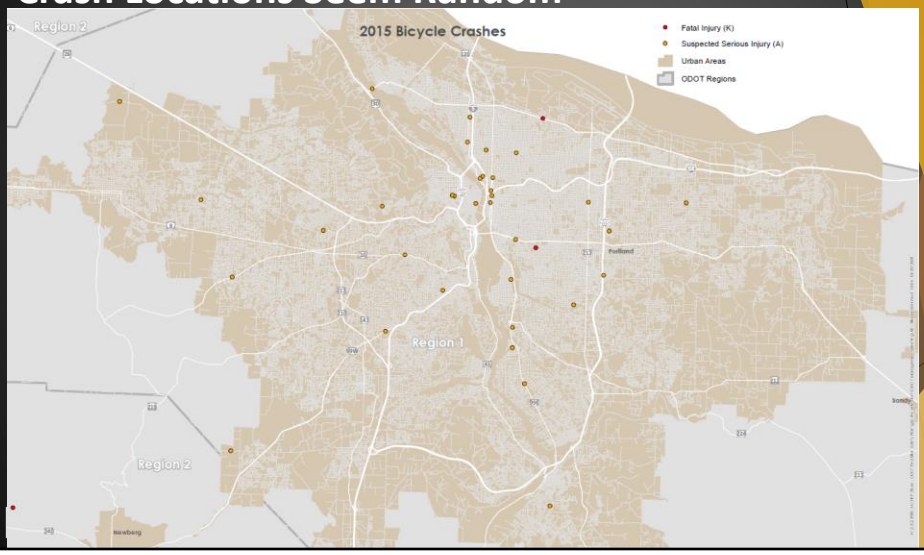
7

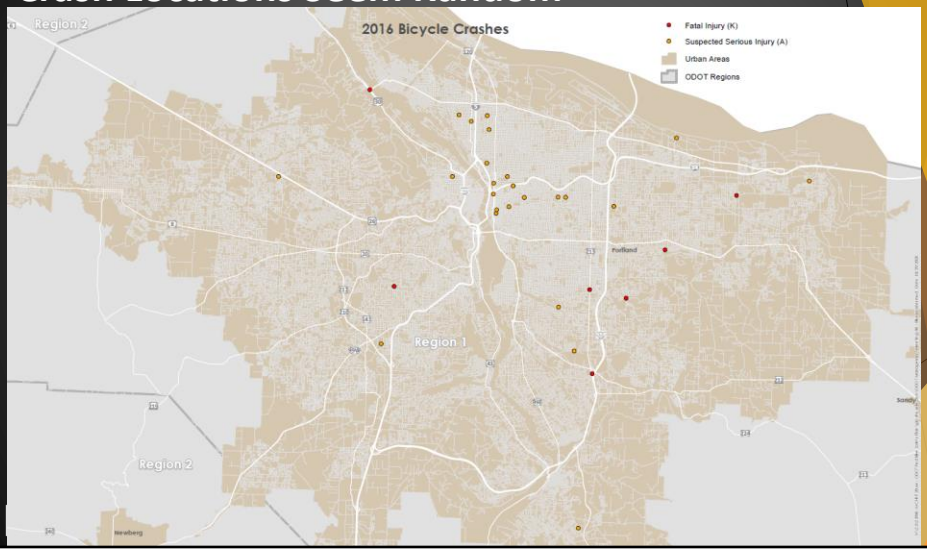
Crash Locations Seem Random



8

- This slide shows Fatal and Injury A bike crashes in the Portland Metro area from 2015

Crash Locations Seem Random



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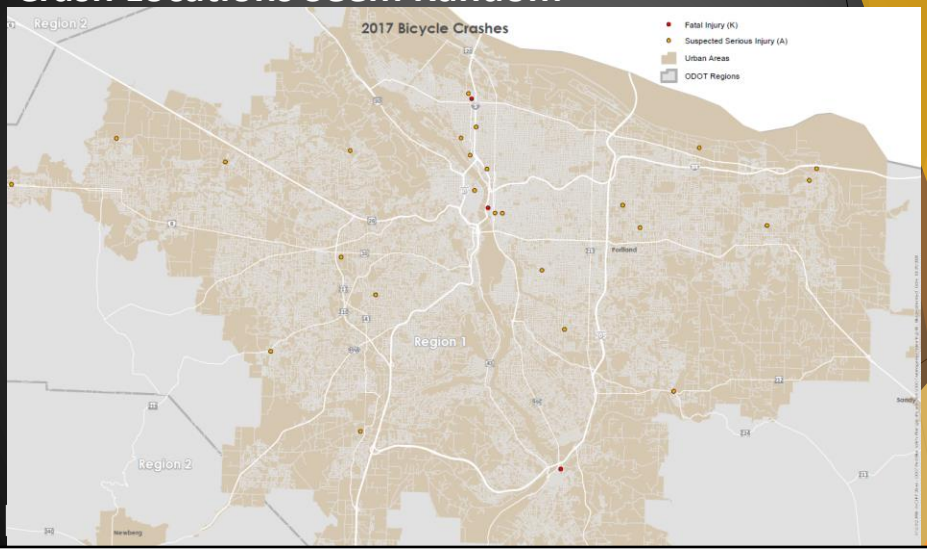
- This slide shows Fatal and Injury A bike crashes in the Portland Metro area from 2016
- Note how the locations have shifted since 2015

Crash Locations Seem Random



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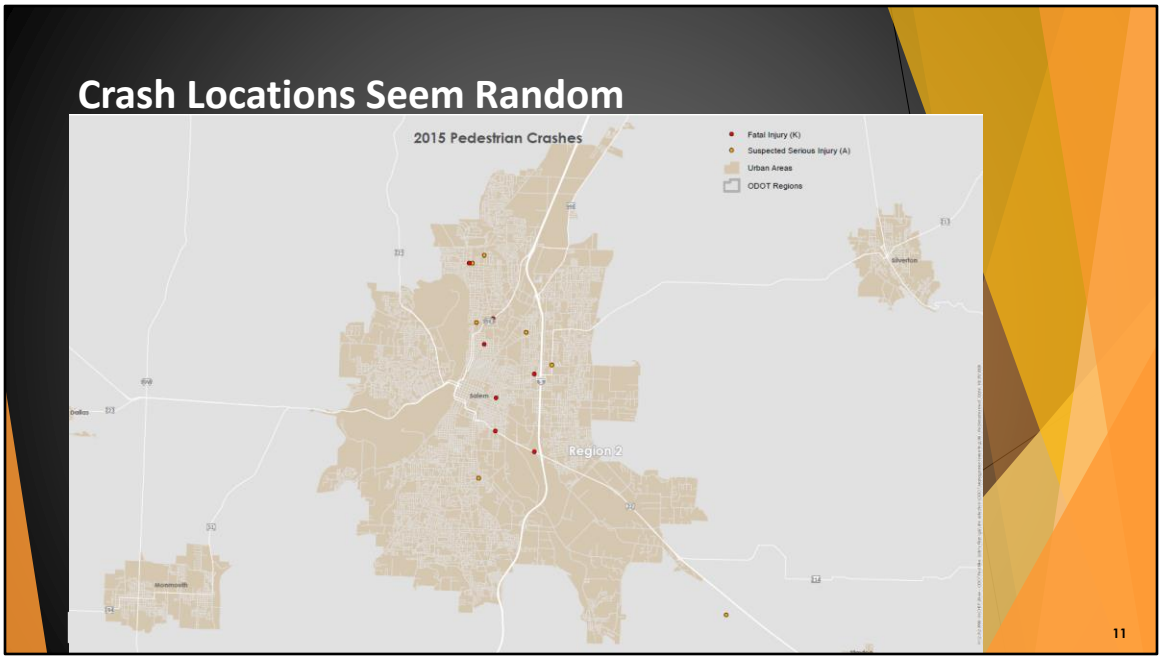
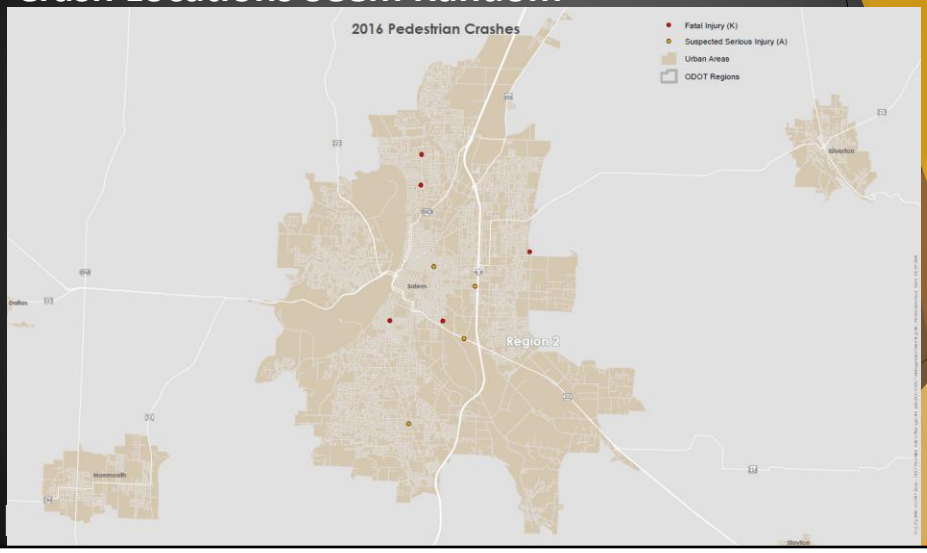
- This slide shows Fatal and Injury A bike crashes in the Portland Metro area from 2017
- Note how the locations have shifted since 2015 and 2016



- This slide shows Fatal and Injury A pedestrian crashes in the Salem area from 2015

Crash Locations Seem Random



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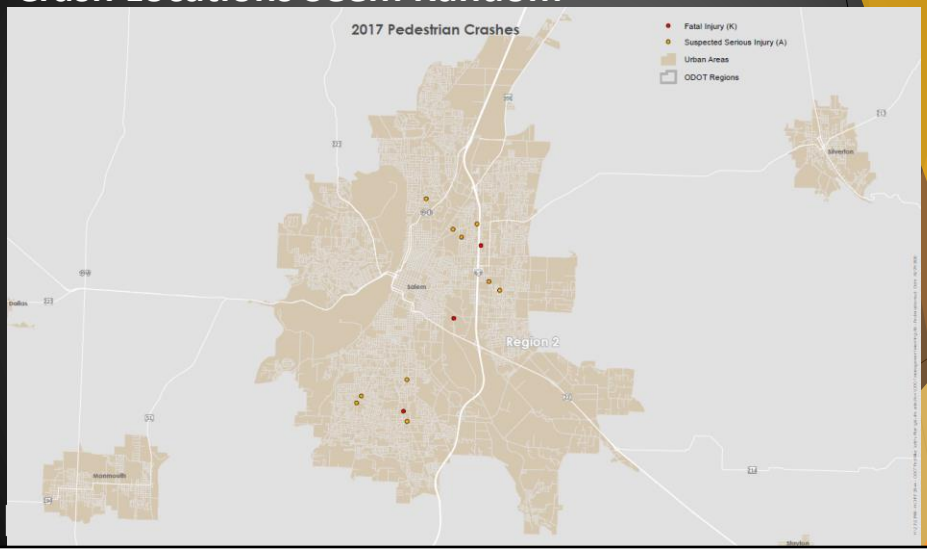
- This slide shows Fatal and Injury A pedestrian crashes in the Salem area from 2016
- Note how the locations have shifted since 2015

Crash Locations Seem Random



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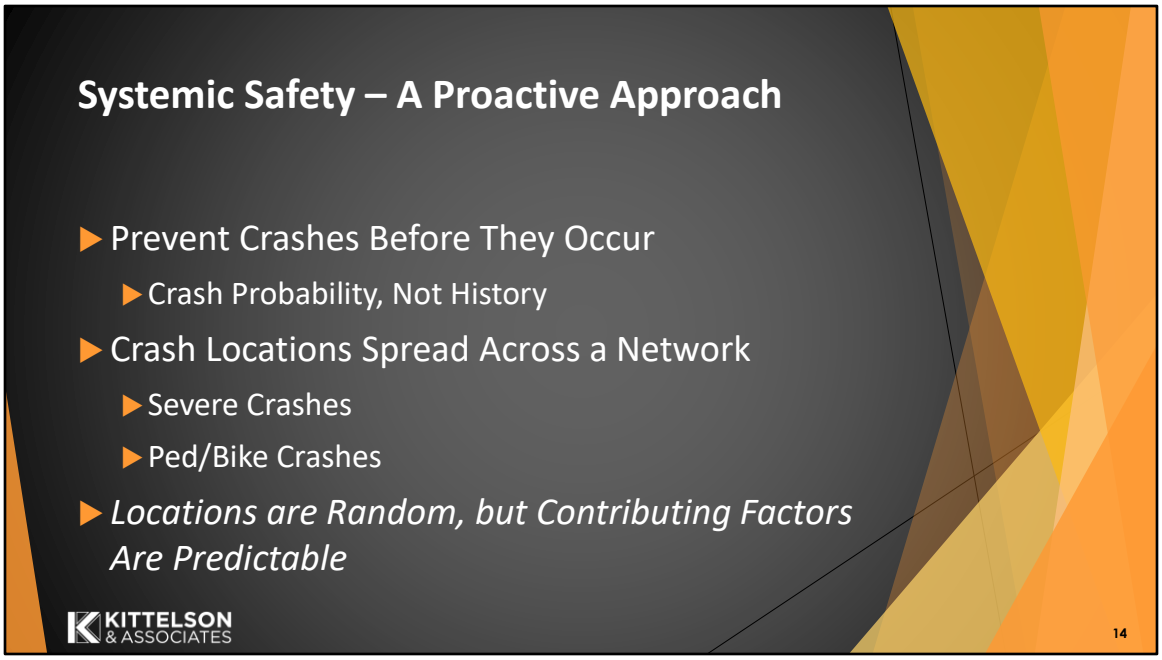
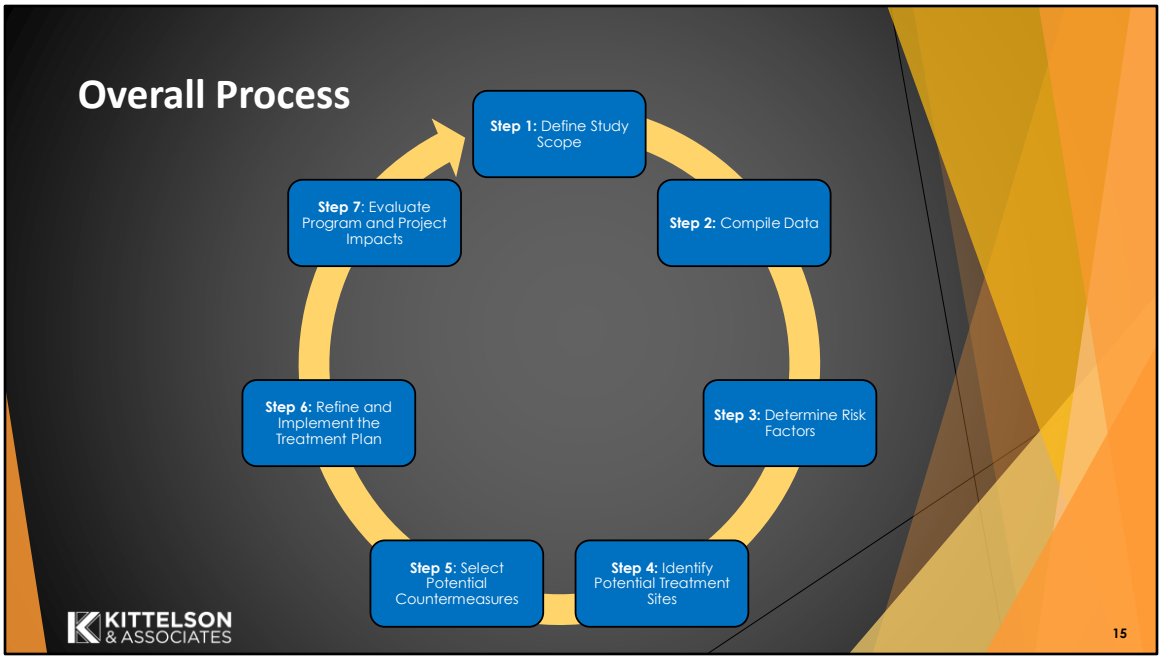
- This slide shows Fatal and Injury A pedestrian crashes in the Salem area from 2017
- Note how the locations have shifted since 2015 and 2016



- This slide describes what the systemic safety approach is
- The key takeaway is emphasized in italicized text. These crash types are spread around the network, so it appears that the locations are random but the factors that contribute to these factors are predictable so these crashes can be effectively prevented



- This slide presents the 7-step process from NCHRP Research Report 893.
- It is an iterative process
- We will discuss each of the seven steps in more detail in the coming slides
- This project focused on steps 1-5

Systemic Safety Benefits

- Comprehensive Decision-making Basis
- Cost-effective
  - Typically Low-cost Treatments at Similar Sites
- Data-driven
- Proactive
- Consistency

Graphic source: NCHRP Research Report 893

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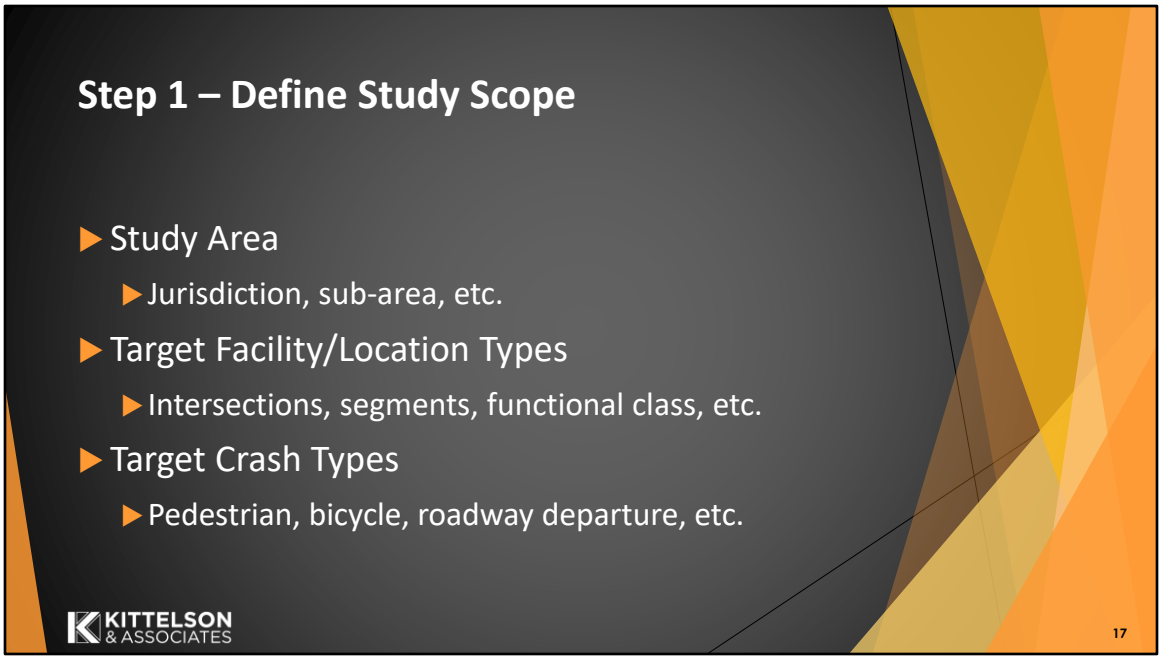
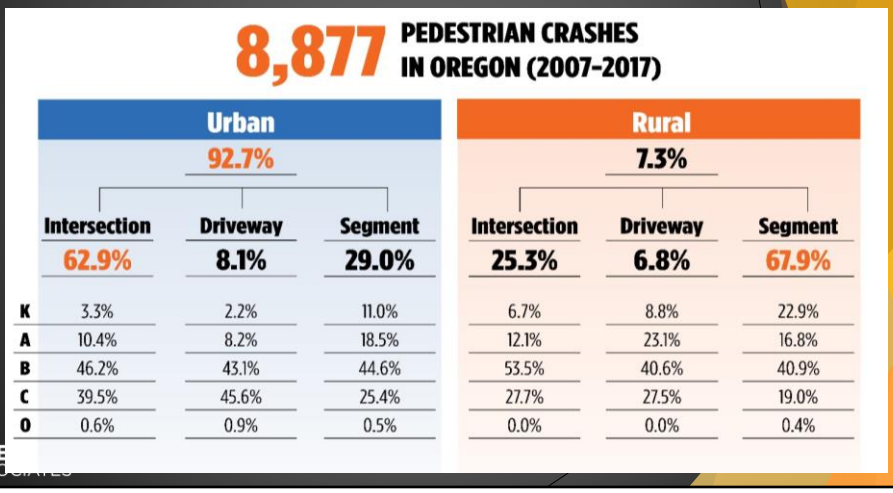
16

-This slide presents the benefits of a systemic approach
-Comprehensive decision making – accounts for factors that a hot-spot type of approach does not, including randomness
-It's important to note that since it's a data-driven process, it is approved for use in the HSIP project selection process



- This slide presents the elements that go into Step 1 in the NCHRP Research Report 893 process
- A crash tree or other analysis can help determine how the study scope should be focused

Step 1 – Define Study Scope – Oregon Pedestrian Crash Tree



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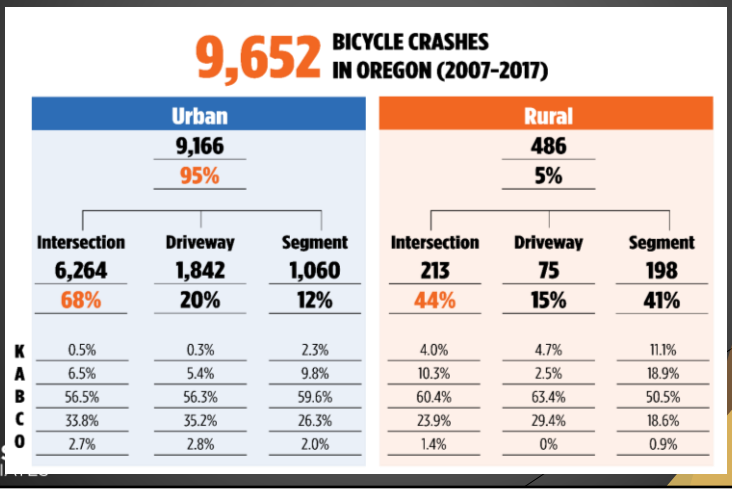
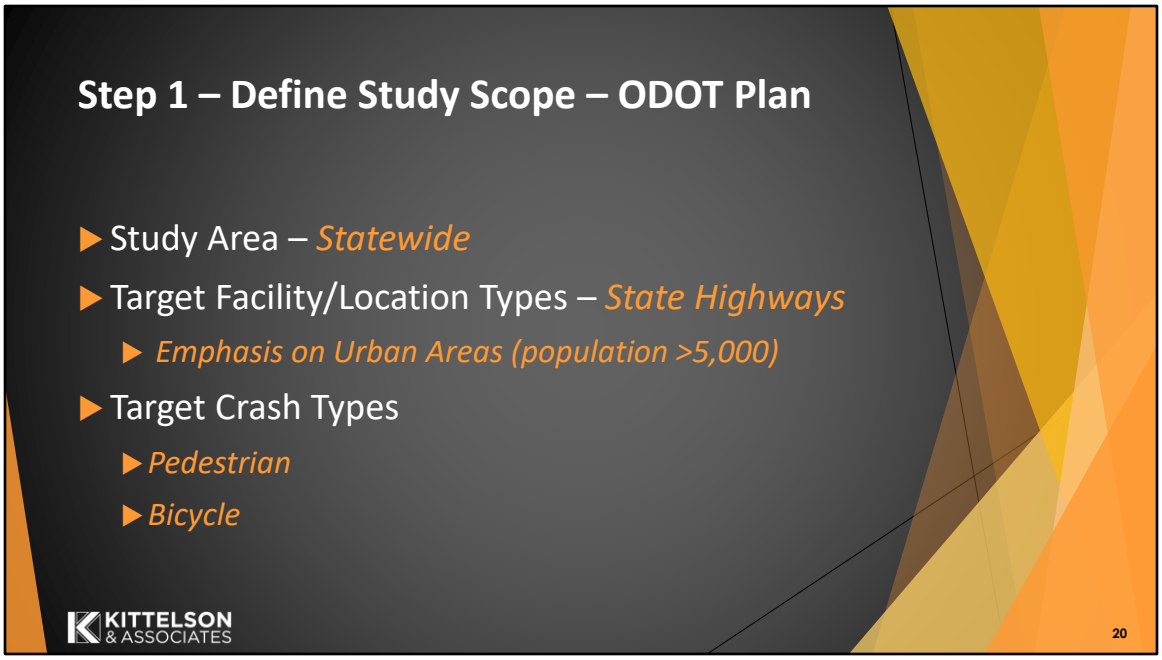
18

- This slide presents the crash tree completed for pedestrian crashes
- Most pedestrian crashes occur in urban areas
    - And within urban areas, at intersections
- Crashes are more prevalent in-between intersections in rural areas
- Crashes in rural areas and along segments tend to be more severe than at intersections or driveways
- Many of the segment crashes are mid-block crossing crashes

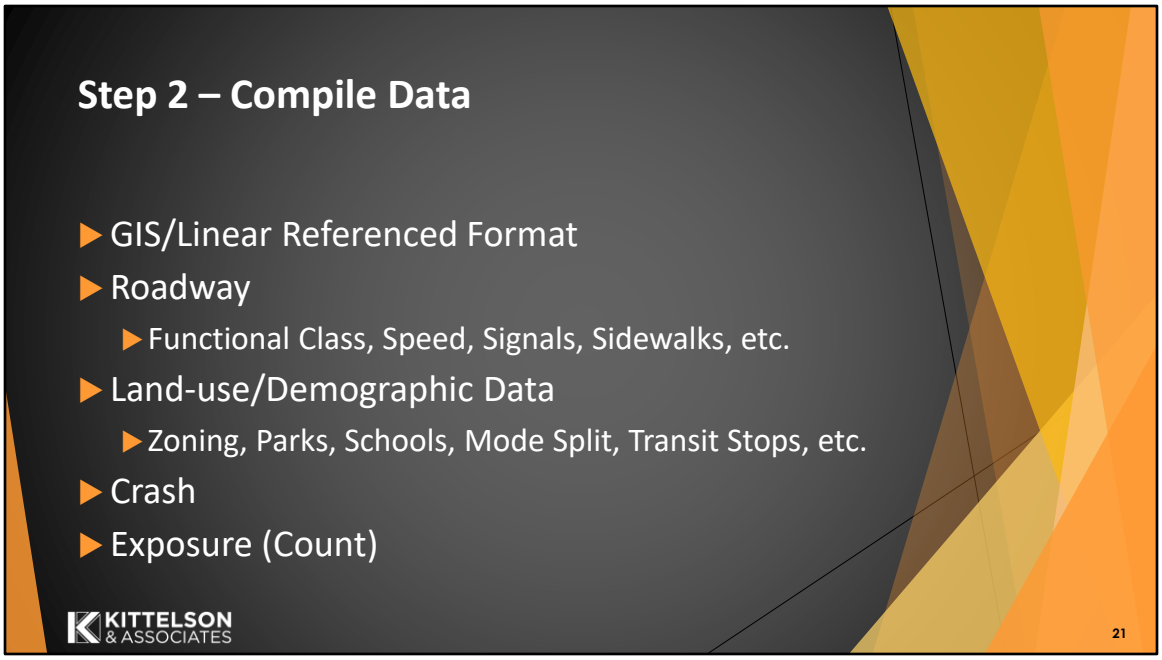
Step 1 – Define Study Scope – Oregon Bicycle Crash Tree



- This slide presents the crash tree completed for bicycle crashes
- Most bicycle crashes occur in urban areas
    - And within urban areas, at intersections
- Crashes are more evenly split between segments and intersections in rural areas
- Crashes in rural areas and along segments tend to be more severe than at intersections or driveways
- Difference from peds – more crashes at driveways and fewer at segments – generally, fewer midblock crossing crashes.



- This slide presents how the study scope was defined for the ODOT plan
- Urban areas are emphasized, but rural areas are still considered so as to show a variety of applications
- Bicycle and pedestrian crashes are analyzed separately



- This slide presents the elements that go into Step 2 in the NCHRP Research Report 893 process
- Ideally, all data is available in GIS or other linear referenced format
- There are four categories of data
    - Roadway
    - Land-use/demographic
    - Crash
    - Exposure/Count

Step 2 – Compile Data – ODOT Plan

Data Type	Eugene	Portland	Bend	ODOT
Ped Counts				X
Vehicle Counts		X		X
Zoning	X	X	X	X
Parks	X	X	X	X
Schools	X	X	X	X
Transit Stops				X
Functional Class	X	X	X	X
Ped Facility	X	X	X	X
Bike Facility	X	X		X
Trails/Shared-use Paths	X	X		X
Road Centerlines	X	X	X	X
Road Lanes			X	X
Road Shoulders				X
Road Speed	X	X		X
Traffic Signals	X	X	X	X
Enhanced Crossings	X			X
Crashes 2007 - 2017				X
SPIS Data 2009 – 2015				X

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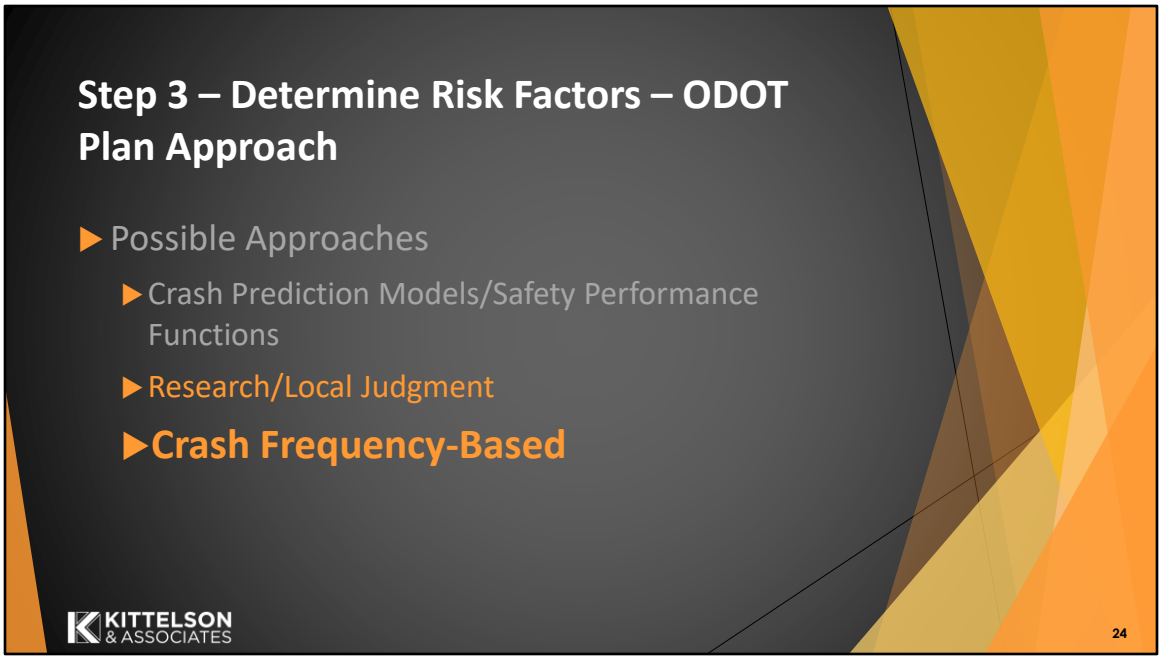
22

- This slide presents the data compiled for the ODOT plan
- ODOT's dataset was the most complete
- The datasets from the larger three metro areas were used to augment the analysis for some factors
    - These three metro areas were selected since they had count programs and relatively complete infrastructure datasets

- This slide presents three possible approaches to Step 3 in the NCHRP Research Report 893 process
- Crash prediction models/safety performance functions are ideal, but they are data intensive and many jurisdictions may not have the necessary data to develop them
- Research/Local Judgment is simple and could be particularly good for smaller jurisdictions
- Crash Frequency is intuitive and can provide some local data backing for choosing risk factors, but it has its holes, too, especially if working with a smaller dataset.



- This slide presents the chosen approach for the ODOT plan
- It is primarily crash frequency-based, but it's also augmented with research on factors for which the data was not available or the analysis was inconclusive

Step 3 – Determine Risk Factors – Analysis Example – Functional Classification

Functional Classification	Percent of Oregon Roadways by Mileage	Percent of Total Bicycle Crashes	Percent of Fatal/Severe Bicycle Crashes
Urban Principal Arterial	***3.4%***	***31.3%***	***28.8%***
Urban Minor Arterial	***4.7%***	***31.1%***	***30.7%***
Urban Collector	9.4%	19.6%	19.0%
Urban Local	0.2%	12.5%	8.5%
Rural Major Collector	29.1%	1.7%	4.5%
Rural Principal Arterial	9.6%	1.3%	2.8%
Rural Minor Arterial	7.9%	0.9%	2.5%
Rural Local	0.4%	0.8%	1.6%
Freeways	6.6%	0.6%	0.7%
Rural Minor Collector	28.7%	0.3%	0.9%

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25

- This slide presents an example of how functional classification was analyzed with respect to bicycle crashes
- Notably, about 62% of all bicycle crashes occur on Urban Principal and Minor Arterials, which collectively make up about 8% of Oregon roadways based on mileage

Step 3 – Determine Risk Factors – ODOT Plan Results - Pedestrian

Risk Factor	Facility Type	Urban	Rural
Roadway Characteristics			
Principal Arterial	General	X	X
Number of Lanes (>= 4 Lanes)	Segment	X	X
High-Access Density	Segment	X	
No Sidewalks (or Only One Side)	Segment	X	
Posted Speed (>=35 mph)	Segment	X	X
Context			
Mixed Use Zoning	General	X	
Other Zoning	General		X
Proximity to Schools (1 Mile)	General	X	X
Proximity to Transit Stops (1/4 Mile)	General	X	X
Demographics			
High Population over the Age of 64	General	X	X
Other Risk Factors (Not Used in Screening Due to Data Availability)			
High-turning Volumes at Intersections	Intersection	X	X
Left-turn Signal Phasing (Permissive)	Intersection	X	X
Lighting	Intersection	X	X
Propensity for Mid-block Crossings	Intersection/Mid-block	X	X
Exposure	Intersection	X	X

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26

- This slide presents the identified risk factors for pedestrian crashes
- Data and research backs these up – used a combination to determine which to select.
- There are different urban and rural factors
- These can be used for screening or site analysis
- There is overlap across certain variables

Step 3 – Determine Risk Factors – ODOT Plan Results - Bicycle

Risk Factor	Facility Type	Urban	Rural
Roadway Characteristics			
Principal Arterial	General	X	X
Minor Arterial	General	X	
Number of Lanes (>= 4 Lanes)	Segment	X	X
High-Access Density	Segment	X	
No Bike Lanes	Segment	X	
Posted Speed (>=35 mph)	Segment	X	X
Context			
Mixed Use Zoning	General	X	
Proximity to Schools (1 Mile)	General	X	X
Proximity to Transit Stops (1/4 Mile)	General	X	X
Demographics			
High Population over the Age of 64	General	X	X
Other Risk Factors (Not Used in Screening Due to Data Availability)			
High-turning Volumes at Intersections	Intersection	X	X
Left-turn Signal Phasing (Permissive)	Intersection	X	X
Time of Day/Lighting	Intersection	X	X
Scenic Bikeways	General	X	X
Exposure	General	X	X

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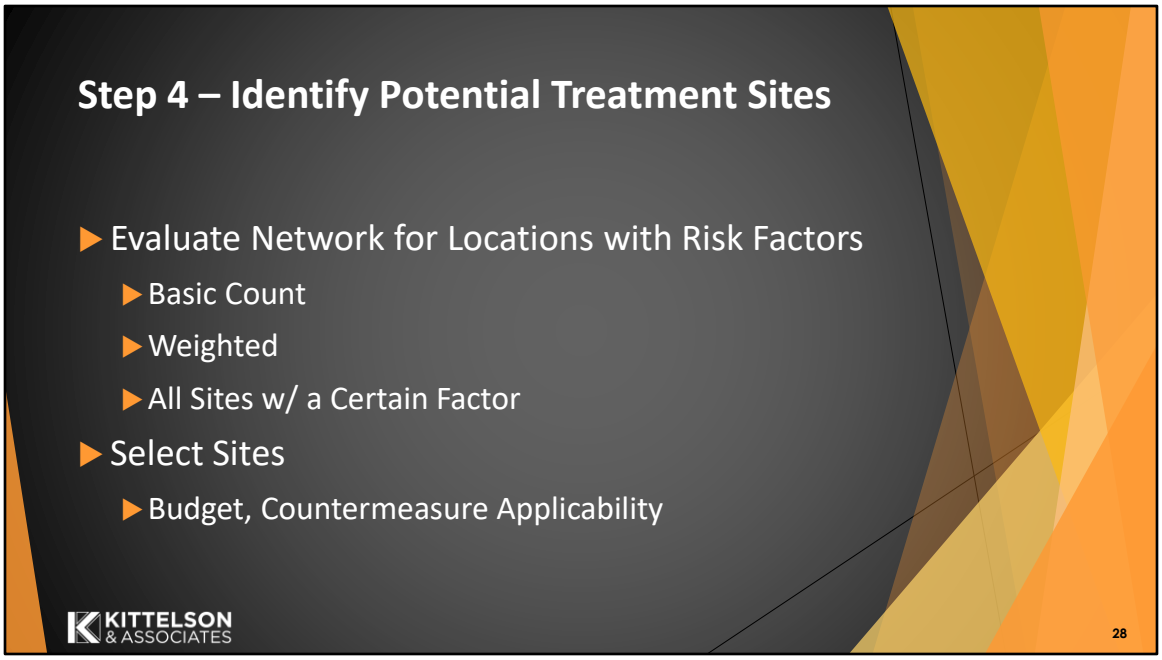
27

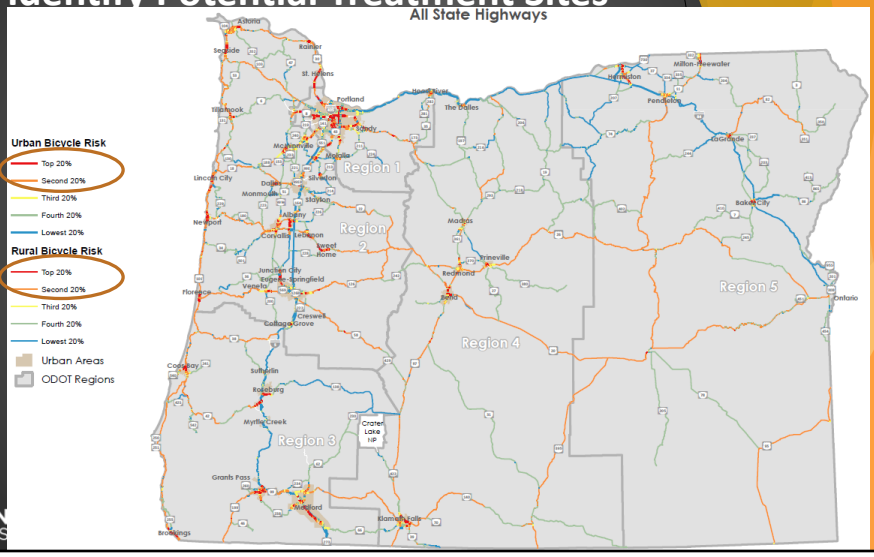
- This slide presents the identified risk factors for bicycle crashes
- Data and research backs these up – used a combination to determine which to select.
- There are different urban and rural factors
- These can be used for screening or site analysis
- There is overlap across certain variables



- This slide presents what goes into Step 4 of the NCHRP Research Report 893 process
- There are three ways to evaluate the network according to the risk factors
    - Basic count = 1 point per risk factor
    - Weighted = Different points are assigned for the presence of different risk factors based on some type of weighting
    - All sites with a certain factor = This is typically chosen if there is a countermeasure an agency wants to deploy that is valid for a certain type of factor (e.g., installing pedestrian logic at flashing yellow arrow installation sites)
- There are a number of factors that can go into selecting white sites to move forward with, including an agency's budget and whether there are pre-selected countermeasures and if they apply to a site

- This slide presents ODOT's approach to Step 4
- Risk factors were weighted based on their correlation with crash severity
- After the initial analysis was completed, the project team manually reviewed the segments to create corridors with logical start/end points

Step 4 – Identify Potential Treatment Sites – Bicycle Results



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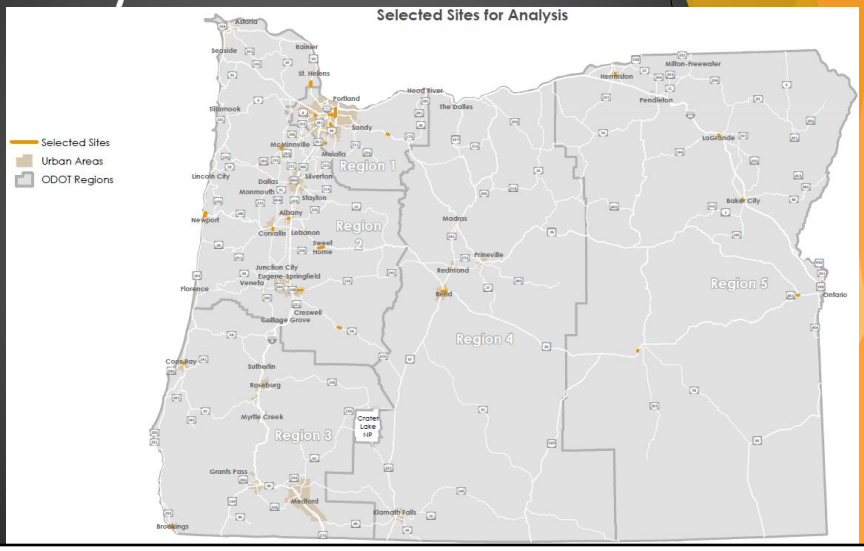
30

- This slide presents the results of the bicycle screening.
- Sites were generally selected from the two highest scoring quintiles
- The same process was completed for pedestrian sites

Step 4 – Identify Potential Treatment Sites – Example Bicycle Sites



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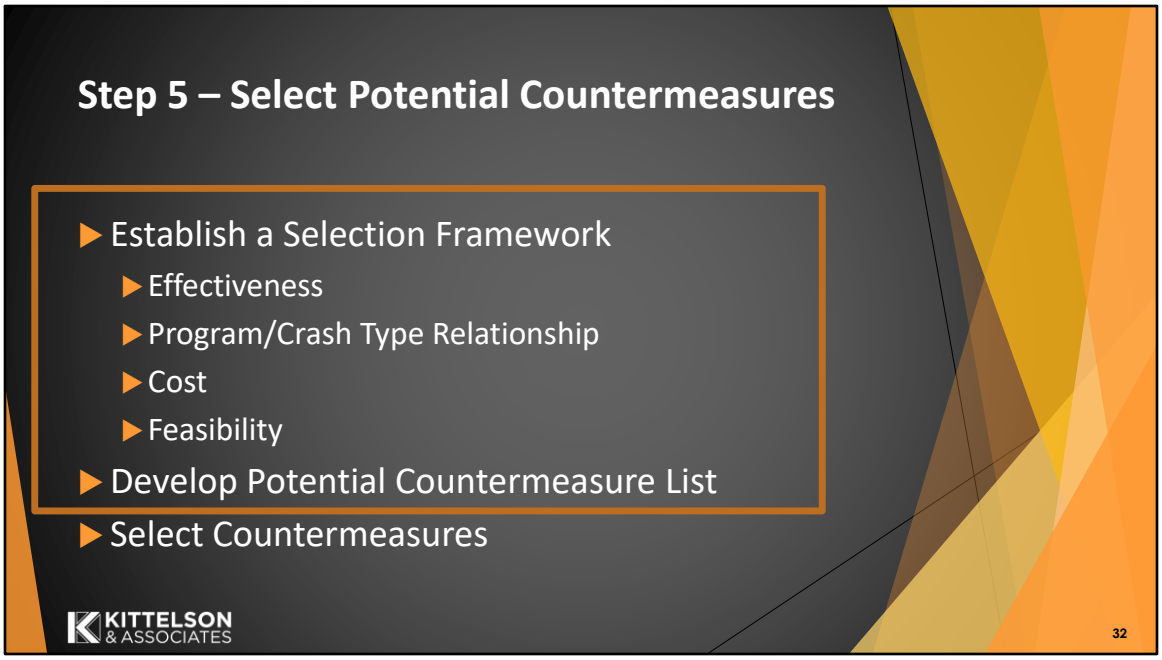
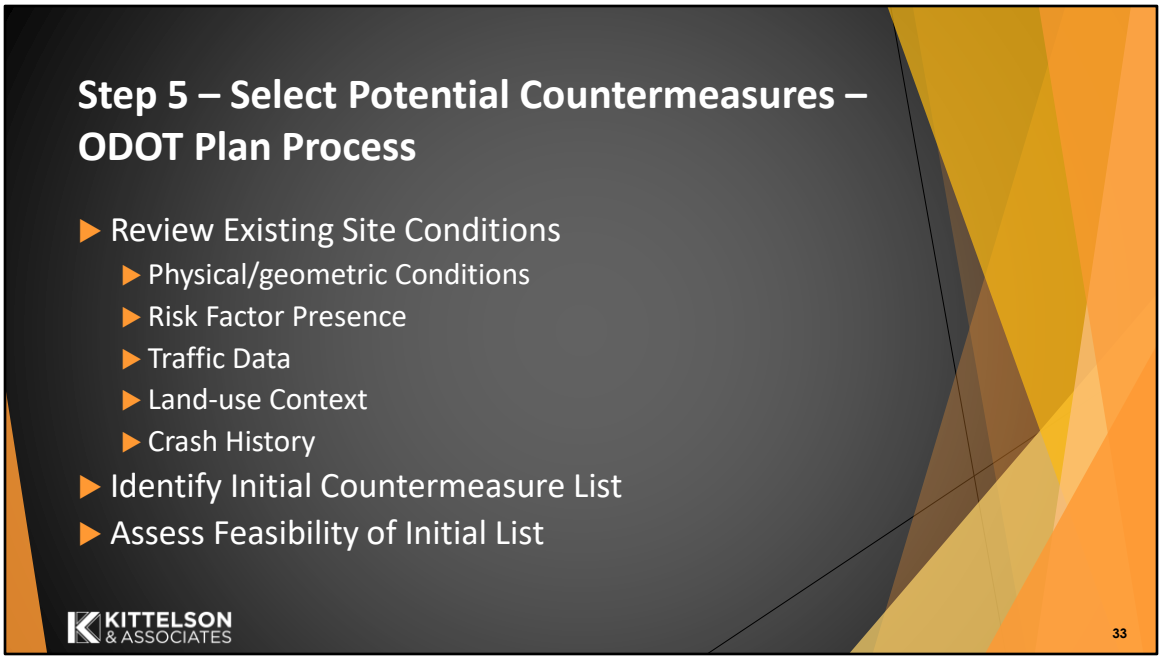
31

- This slide presents the 25 sites selected for example applications for bicycles
- These are sites for examples and they were picked to be representative of a range of conditions. They are not selected for projects, necessarily.
- The same process was completed for pedestrian sites

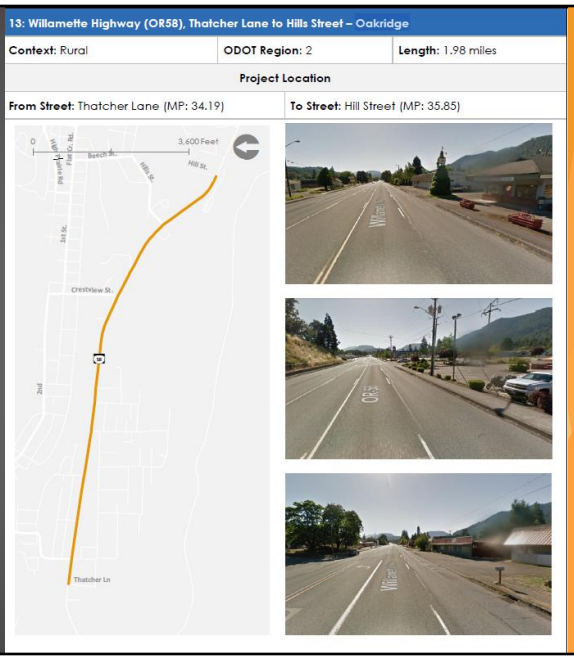


- This slide presents what goes into Step 5 of the NCHRP Research Report 893 process
- This project focuses on the first two steps



- This slide presents the process followed for Step 5 for the ODOT plan
- The resulting countermeasures list for each site is wide ranging. Each site would need to be investigated further to determine which countermeasures are the most cost effective and feasible

Step 5 – Select Potential Countermeasures – Example Sites – OR 58 (Oakridge)



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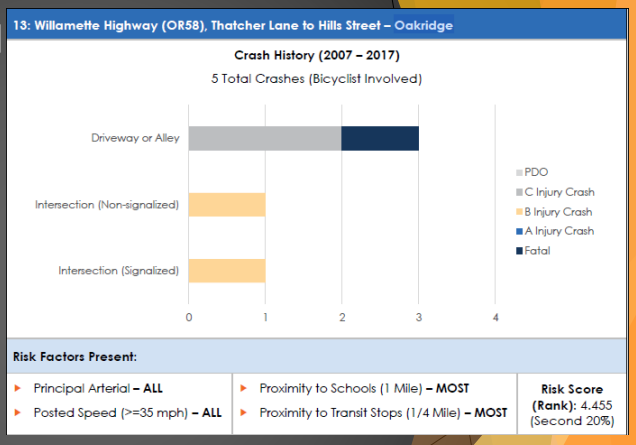
34

- This slide presents the first page of each site. It shows:
  - Context
  - Location

Step 5 – Select Potential Countermeasures – Example Sites – OR 58 (Oakridge)



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35

- This slide shows how crash data is shown for each site, including:
  - Crash history, if there is any
  - The risk factors that are present

Step 5 – Select Potential Countermeasures – Example Sites – OR 58 (Oakridge)

Countermeasure: Install Buffered Bike Lane	**ARTS #:** BP20	**CRF:** 36
Potential Segment Locations:		
▸ Segments of OR58 lacking bicycle facilities (all))		
*Note: Only **one** of BP18 or BP20 are recommended to be installed at a given location* *Note: A roadway reorganization would be required to fit on-street bicycle facilities*		
Potential Affected Risk Factor and/or Conflict: Cycling in road or on shoulder crashes		
Planning Level Countermeasure Cost: $247,000 per 1,000 feet (one side)		
Countermeasure: Install Urban Green Bike Lanes at Conflict Points	**ARTS #:** BP5	**CRF:** 39
Potential Segment Locations:		
▸ Driveway access points along OR58 with high-volume driveways		
Note: Countermeasure to be completed in conjunction with BP18 or BP20		
Potential Affected Risk Factor and/or Conflict: Cycling in road or on shoulder crashes		
Planning Level Countermeasure Cost: $10,000 per 100 feet (one side)		
Countermeasure: Access Management (>48 per Mile to 26-48 per Mile)	**ARTS #:** H30	**CRF:** 29
Potential Segment Locations:		
▸ Segments of OR58 with high levels of commercial access (majority of corridor)		
Potential Affected Risk Factor and/or Conflict: Vehicle vs. bicycle crashes at driveways		
Planning Level Countermeasure Cost: Case by case basis[1]		
Countermeasure: Convert 4-Lane Roadway to 3-Lane Roadway with Center Turn Lane (Road Diet)	**ARTS #:** BP16	**CRF:** 29
Potential Segment Locations:		
▸ Segments of OR58 with 4-lanes (consider reducing 5-lane sections to 3-lane as well)		
Note: Countermeasure to would allow for installation of on-street bicycle facilities: BP18 or BP20		
Potential Affected Risk Factor and/or Conflict: Cycling in road or on shoulder crashes		
Planning Level Countermeasure Cost: $193,000 per 1,000 feet		

1. Cost specific to context and number of access points.

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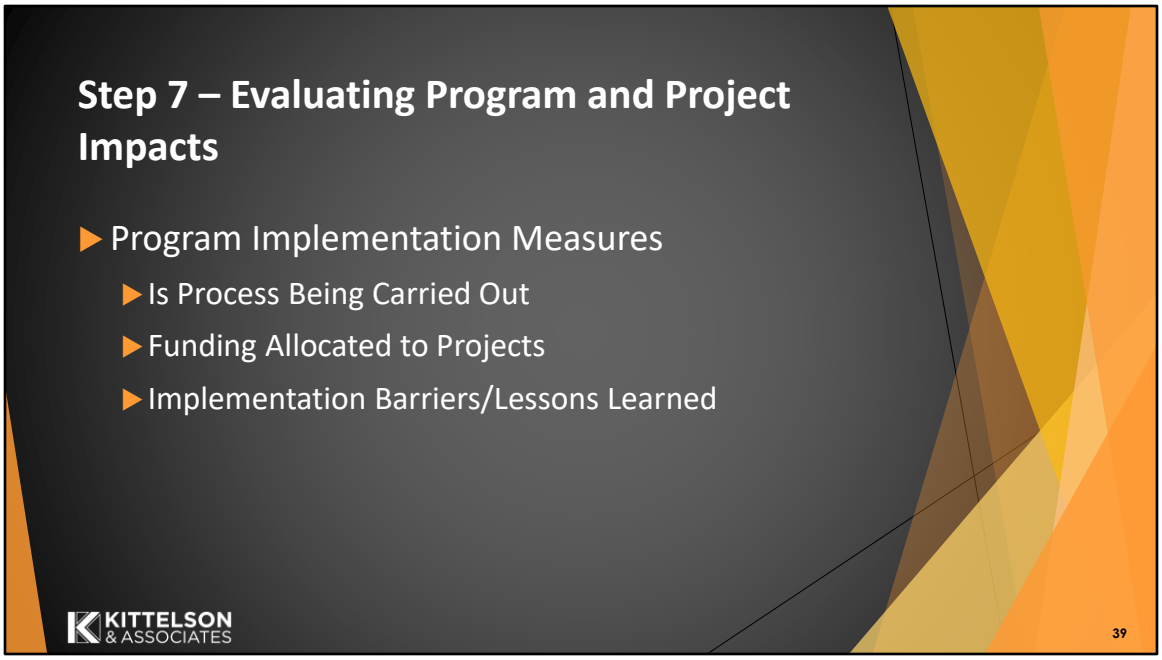
36

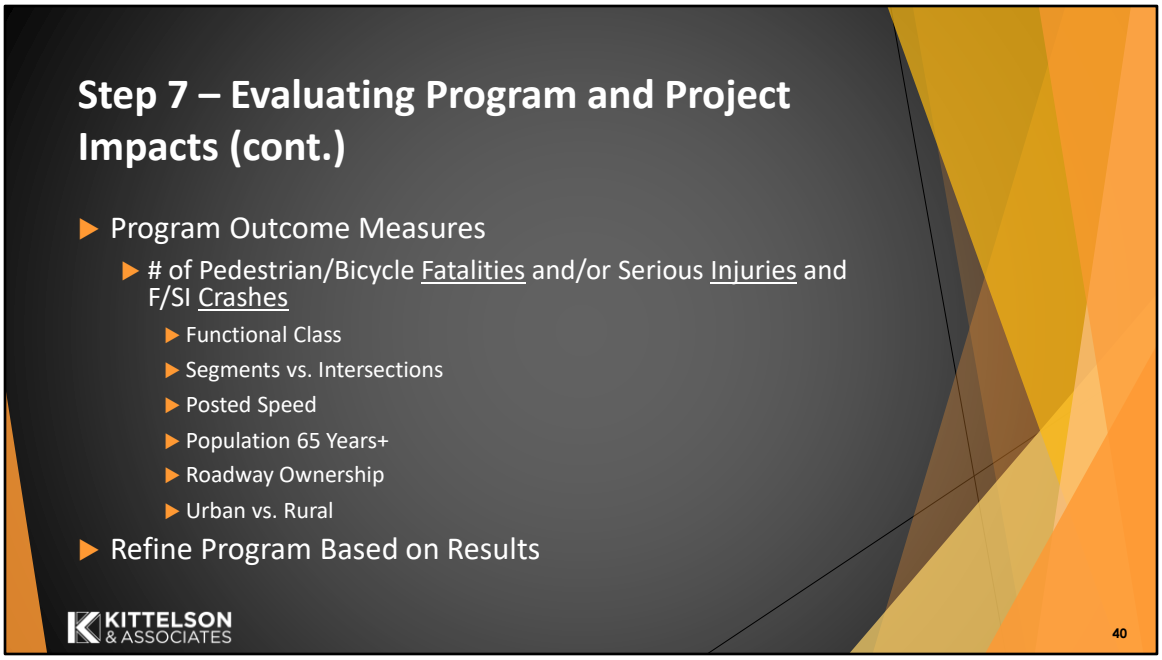
- This slide shows an example of how countermeasures are presented.
- For each countermeasure, the following information is presented:
  - Its crash reduction factor (CRF)
  - Its ARTS #
  - Where it might be applicable
  - What crash types/risk factors it addresses
  - Implementation considerations
  - Planning-level cost estimates

- This slide presents what goes into Step 6 of the NCHRP Research Report 893 process
- This step was not completed for this project

- This slide presents how ODOT plans to implement the plan
- Note that two webinars have already been conducted with ODOT and local agency staff



- This slide presents what goes into Step 7 of the NCHRP Research Report 893 process
- This step was not completed for this project
- The first set of measures evaluate whether/how the program is being implemented



- This slide presents what goes into Step 7 of the NCHRP Research Report 893 process
- This step was not completed for this project
- The second set of measures evaluate the program's outcome
- The performance measures shown here are those selected by ODOT
    - They will be evaluated separately for pedestrian and bicycle crashes

Discussion

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41