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TRANSPORTATION RESEARCH BOARD

Systemic Pedestrian Safety Analysis and Risk-Based Prioritization

Monday, February 4, 2019
1:00-2:30 PM ET

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RCEP

REGISTERED CONTINUING EDUCATION PROGRAM

Purpose

Discuss NCHRP Research Report 893.

Learning Objectives

At the end of this webinar, you will be able to:

- Describe how a data-driven systemic approach to pedestrian safety may help spot safety and planning approaches
- Describe the steps of the systemic safety process
- Describe attributes of systemic countermeasures and explain how to apply them to treat systemic risks
- Discuss how agencies have developed systemic pedestrian processes, addressed challenges, and how they are improving their programs

Systemic Pedestrian Safety Analysis

TRB Webinar
February 4, 2019
UNC Highway Safety Research Center
Seattle, WA DOT
Kimley-Horn and Associates, Inc.

From NCHRP Report 893, developed in NCHRP Project 17-73

Presentation Overview

- Background
- Project Description
  - Objectives
  - Key Tasks and Findings
- Guidebook Overview
  - Systemic Analysis Process
  - Highlights of Guidebook Steps
- Conclusions
  - Project Limitations and Considerations
  - Future Research Needs

Background

Tenets of a Systemic Approach*

- Identifies a safety concern based on an evaluation of data at the system (or network) level
- Establishes common characteristics (risk factors) of locations where severe crashes frequently occur
- Emphasizes low-cost safety countermeasures to address the risk factors identified
- Prioritizes locations across the entire roadway network where risk factors are present, with or without a prior crash history

*From FHWA's Systemic Safety Project Selection Tool (Preston et al. 2013)

Benefits of a Systemic Approach

- Improved safety with more proactive approach
  - Don't simply "chase the hot spots"
- Informed decision-making utilizes data on key risk factors
- Optimized investment
  - Cost-effective use of resources
  - Consistency in application

Spot Safety Approach

Makes improvements at individual sites or road segments with relatively high numbers of crashes, without regard to other sites with similar risk factors.

Corridor Retrofit Approach

Makes improvements at several adjacent locations (with possibly similar risk factors), not all of which may have experienced a high number of crashes.

Systemic Approach

Makes improvements at locations with a high predicted crash risk or presence of key risk factors, regardless of actual crash history.

Systematic Approach

Makes improvements at all sites in an area, regardless of predicted crash risk or crash history.

Key Takeaway: Systemic Approach Definition

"A systemic approach is a data-driven, network-wide (or system-level) approach to identifying and treating high-risk roadway features correlated with specific or severe crash types. Systemic approaches seek not only to address locations with prior crash occurrence, but also those locations with similar roadway or environmental crash risk characteristics."

FHWA's Systemic Approach to Safety

- Identifies focus crash types and risk factors
- Screens the network to identify locations with relevant risks for treatment
- Identifies candidate countermeasures to address risks
- Prioritizes projects
- Identifies / allocates funding
- Evaluates safety and other impacts of systemic projects

*From FHWA's Systemic Safety Project Selection Tool (Preston et al. 2013)

Why Do We Need a Systemic Safety Process Specific to Pedestrians?

- Pedestrian crashes may be rare or widely dispersed across a network, making a hot spot approach unreliable and cost-ineffective in identifying and addressing pedestrian safety.
- Crash risk factors for pedestrians are different than for motor vehicles, and there is a need for specific guidance and research to augment existing tools and guides.
- The process needs to be tailored to data related to pedestrians, and to provide guidance on how to gather needed data.

Project Description

Project Objectives

Develop a process (and Guidebook) that includes:

1) Analytical methods to identify roadway features, behaviors, and other contextual risk factors associated with pedestrian crashes
2) Methods to identify appropriate and cost-effective systemic pedestrian safety improvements to address the associated risk factors
3) Information to enable transportation agencies to prioritize candidate locations for selected safety improvements

Key Project Tasks

- **Phase 1:** Review State of the Practice
  - Conduct a literature review and interviews with practitioners
  - Focus on differences and challenges for implementing an analytic systemic process for pedestrian safety
  - Identify data needs and sources for a robust systemic pedestrian process
- **Phase II**: Conduct Additional Research
  - Compile risk factors (associated with pedestrian crash frequency and/or severity) from published analyses
  - Conduct original analysis to identify additional risk factors associated with two types of pedestrian midblock collisions
  - Review and identify a select set of candidate pedestrian crash countermeasures compatible with systemic processes
- **Phase III:** Develop Guidance
  - Develop Guidebook on a systemic pedestrian safety process
  - Develop and incorporate case studies describing real or hypothetical applications

Key Findings

- Systemic Processes – not well developed or understood
- Analysis of two types of segment-related (midblock) pedestrian collisions using network-wide data was performed to:
  - Test an application of a systemic analysis
  - Identify additional risk factors associated with segments
  - Risks identified were incorporated into the Guidebook
  - Applied results to illustrate identification and prioritization of sites

- Identified more than a dozen effective countermeasures feasible for systemic application

Guidebook Overview

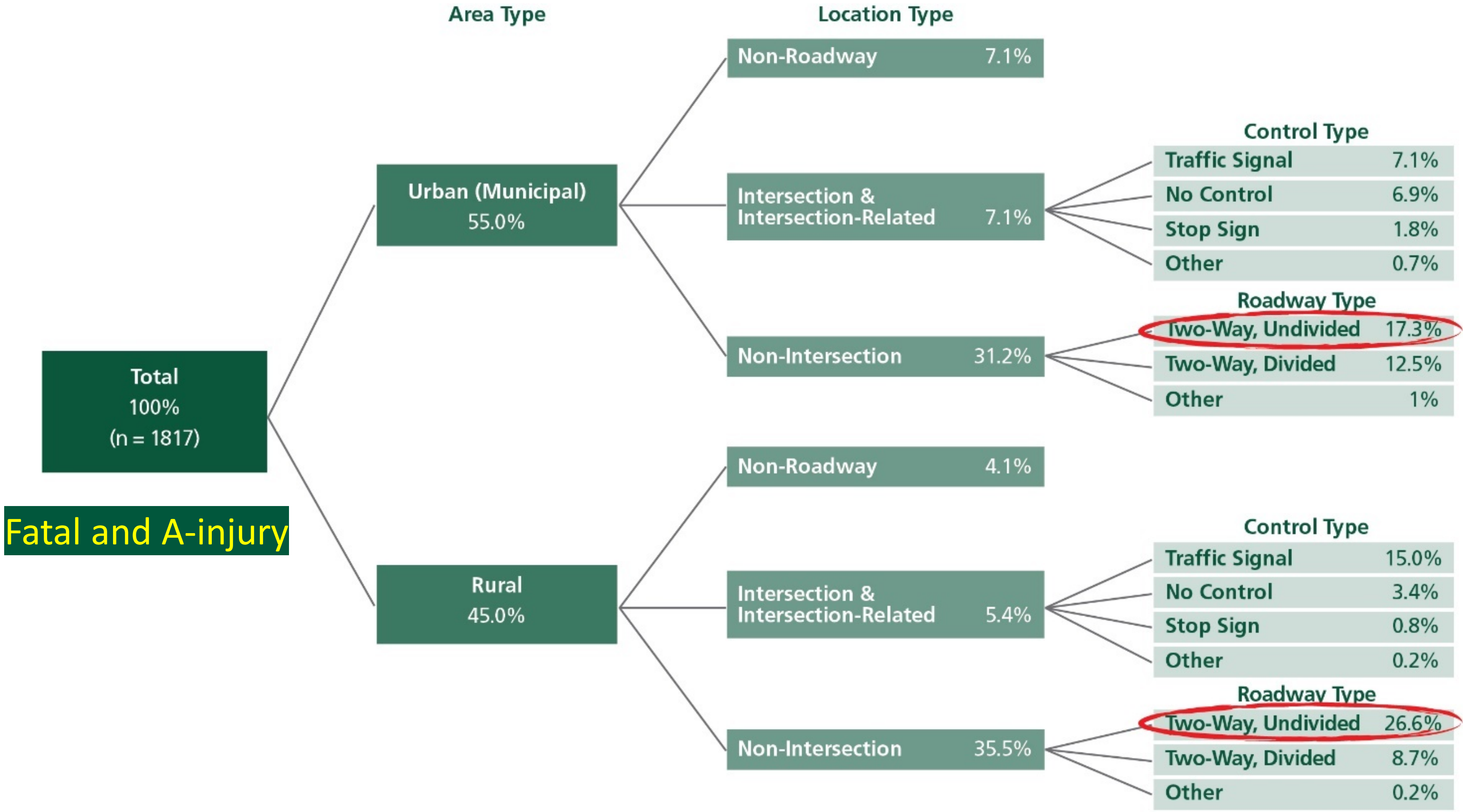
Guidebook Elements

- Overview
  - Background on a Systemic Process and key features
  - How to use the Guidebook and intended audience
  - Relation to other agency processes
- Process steps
- Examples
- Glossary of key terms
- Appendices
- Companion: Final Report, details of analysis, research process

Steps in the Guidebook

Step 1: Define Study Scope

- Purpose is to identify a 'problem' type that accounts for a large % of the problem
- Typically, only crash data is used
- Uses descriptive means such as crash tree diagrams (see NC example at right)



Step 2: Compile Data

- Guidebook provides information and examples on how and why to make data: current and complete, easily accessible, centralized, digitized, linkable across databases, and spatially-referenced

Step 2: Compile Data

- Recommended data for systemic analysis include:
  - Pedestrian crashes: location, type, severity
  - Roadway data with key characteristics such as # of lanes, facility types
  - Vehicle traffic and pedestrian volumes and/or secondary data to estimate volumes (e.g., transit ridership, population/employment density, etc.)
  - Other measures of the built and social environment (census, land use)

Table 2. Example database compiling key volume, land use, and roadway features for target sites.

Site ID	# of ped crashes	MV AADT	Hourly ped count	% seniors in tract	Distance to university	Median presence	Crosswalk presence	...
1	0	604	6	47	2.4	0	0	
2	0	810	6	06	3.3	0	0	
3	0	1109	7	04	1.2	0	0	
4	1	1897	8	11	0.0	0	0	
5	0	1897	8	11	0.0	0	0	
...								

Step 3: Identify Risk Factors

- Recommended approach:
  - Identify risk factors from regression modeling of jurisdiction-wide data (i.e., develop Safety Performance Functions or SPFs)
- Alternative approaches:
  - Identify risk factors from prior research plus local judgment
  - Infer risk factors from roadway and crash data frequency analyses

Advantages of a Modeling/SPF Approach

- More reliable than other methods:
  - Accounts for crash randomness to identify sites with more than average risk
  - Simultaneously accounts for multiple risk factors, including activity/ exposure of people to vehicles
  - Accounts for local context, which may differ from where other risk factor studies were developed
- Expedites subsequent steps in the process since data are already available for screening and prioritization
- Builds on the current best practice (from the traffic engineering field) for estimating risk of crashes at particular locations

Step 3: Recommended Method: Identify Risk Factors by Developing Safety Performance Functions (SPFs)

- Identify *treatable risk factors* from the model
- Characteristics of risk factors for systemic approach
  - Factors supported by other research and safety / exposure principles
  - Relate to readily available, *effective* countermeasures

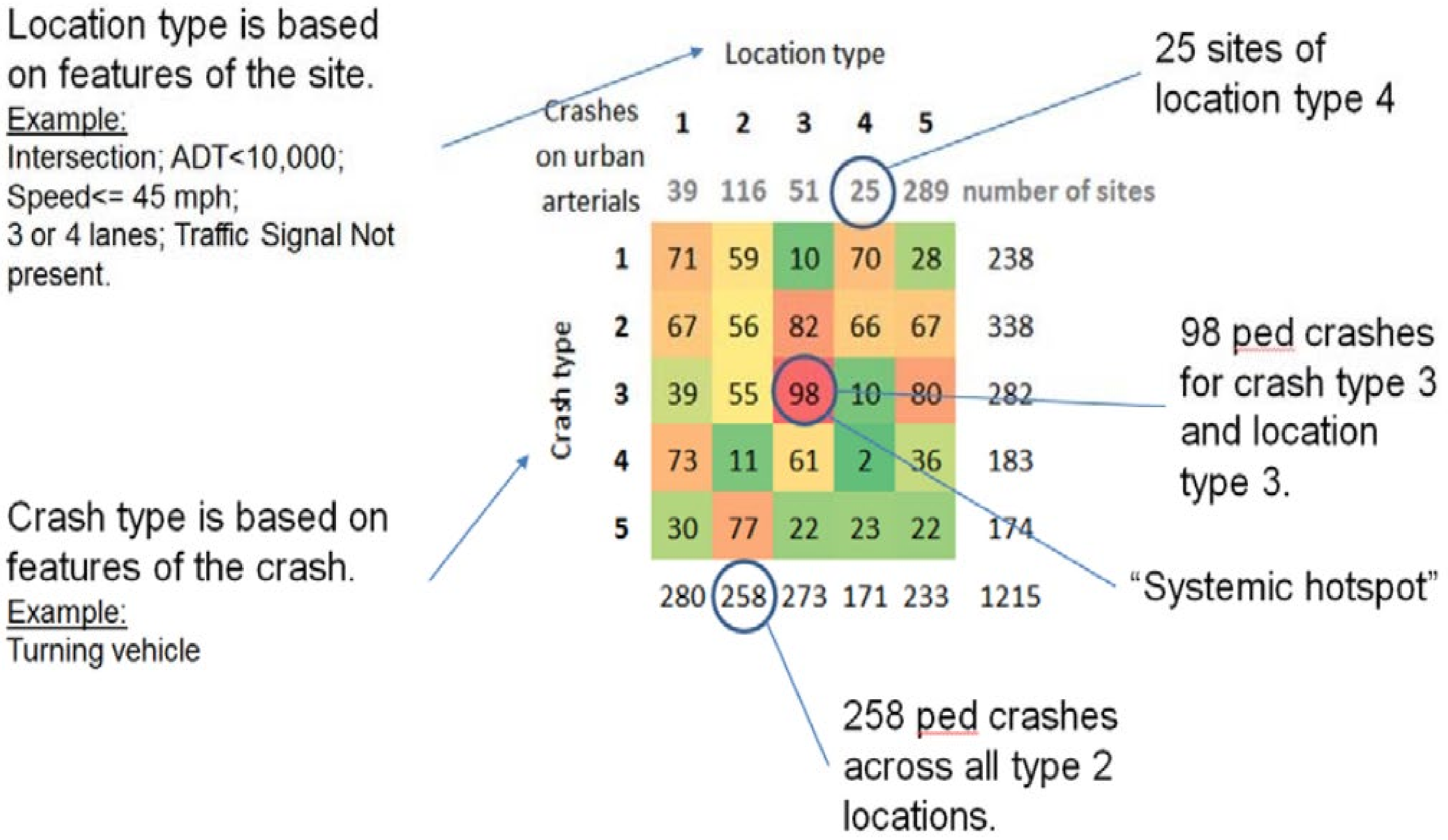
- Example treatable risk factors identified from models (SPFs) of segment-related pedestrian crash types:
  - Presence of one or more midblock crosswalks
  - Number of through lanes = 4, or 5+
  - Presence of a two-way left turn lane (TWLTL)
  - Presence of striped on-street parking
  - Presence of a right turn lane at an adjacent intersection
  - Speed limits >/ = 30 mph

Step 3: Alternate Method - Identify Risk Factors from Prior Research

- The Systemic Pedestrian Safety Analysis report identifies many prior risk factors associated with crash frequency and increasing severity of injury
  - Intersection risk factors
  - Segment risk factors
  - Note that these may not be independent

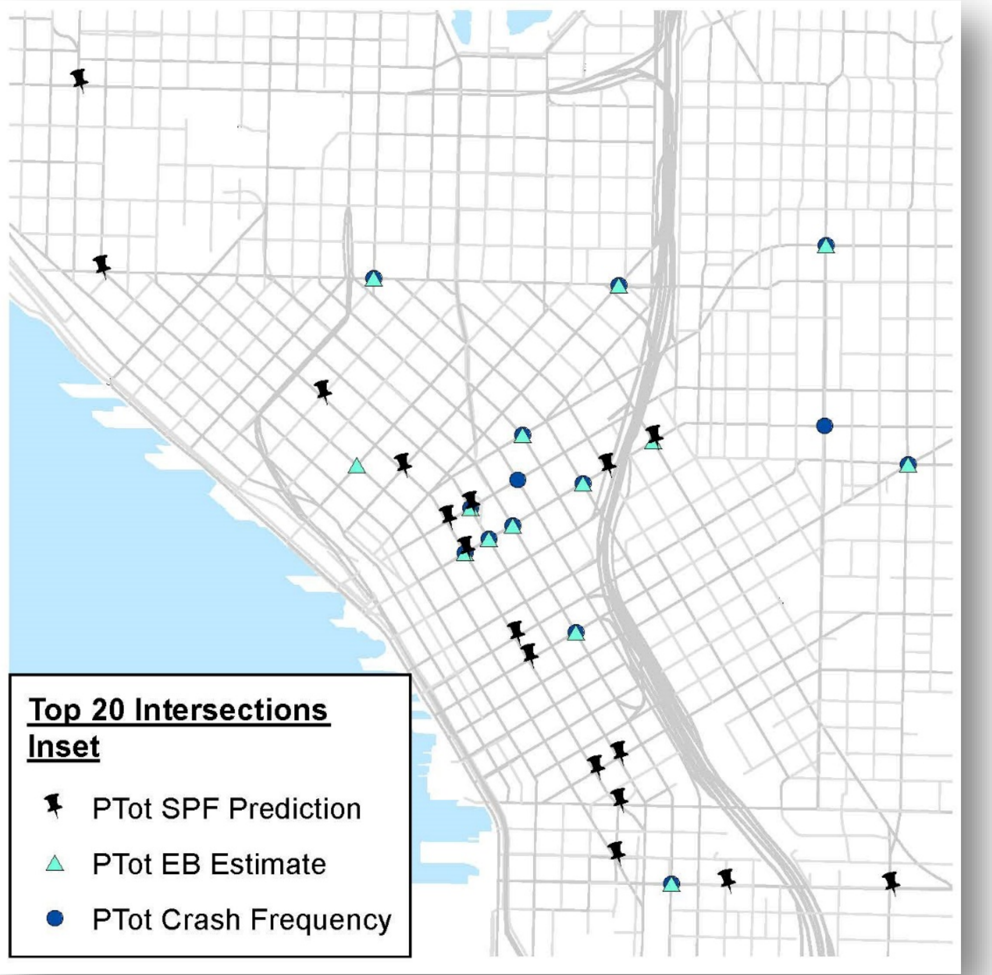
Step 3: Alternate Method - Infer Risk Factors from Roadway and Crash Data

- Use prevalent crash type and location characteristics



Step 4: Identify Potential Treatment Sites

- Options for Performing Network Screening
  - Iterative screening and ranking methods possible / desirable
  - Combinations of identified risk factors can be used to identify potential sites
  - SPF-derived ranking metrics (if available) are useful for prioritization



Step 4: Example

- Combinations of identified risk factors can be used to identify/prioritize sites

Pedestrian Crossing at Non-Intersection Location, Struck by Through Motor Vehicle – from 23,651 Original Segments

Combination of Roadway Factors	Number of Relevant Sites	Traffic Volume Range (AADT)	Pedestrian Volume Range (AADP)	SPF-Predicted Rank
Presence of 4, 5+ thru lanes (and non-zero AADP or ped. volume)	1,425	1,060 - 93,600	300 - 7,040	1 - 6,585
Presence of 4 or more thru lanes and < 25,000 ADT	946	1,060 – 25,000	300 - 7,040	1 - 6,585
4, 5+ Lanes and Presence of two-way, left-turn lane (TWLTL)	279	5,170 - 71,900	300 - 4,440	7 - 4,145
4, 5+ Lanes, TWLTL, and Parking	44	8,950 - 40,100	420 - 1,860	15 - 2,090

Step 5: Select Countermeasures

- Criteria for selecting countermeasures:
  - Relation to systemic program focus or target crash types or locations
  - Safety effectiveness
  - Cost (initial + maintenance)
  - Feasibility of systemic implementation
- Countermeasure selection process:
  - Iterative process to match treatment sites (i.e., exhibiting risk factors or focus crash types) with potential countermeasures – (Crash Modification Factors / CMFs)
  - Perform diagnosis at proposed treatment sites to confirm

Step 5: Select Countermeasures

- 12 recommended countermeasures described in Report 893, detail in Appendix:

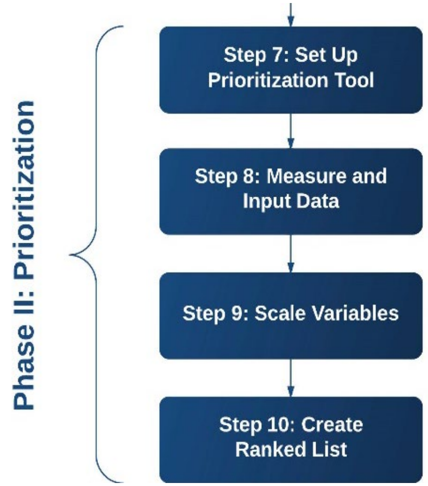
Signalized or Unsignalized crossing locations (including midblock)	Unsignalized locations only (midblock or intersection)	Signalized Intersections only (or signal is added)
High visibility crosswalks	In-Roadway Yield-to-Pedestrian (R1-6) sign	Leading pedestrian interval
Traffic calming (raised devices)	Advance Stop/Yield Bars and R1-5/5a Sign	Longer pedestrian phase
Median crossing island	Pedestrian Hybrid Beacon	Restricted left turn
Reduce number of lanes / road diet		
Curb extension and parking restriction		
Location-specific lighting improvement		

Step 5: Example

Risk Factors	Number of Sites	Potential Countermeasures
1) Presence of Midblock Crosswalk (1 or more)	196	High visibility crosswalk and potentially many others
2) AND 4 or 5+ Thru Lanes	26	Advance Stop/Yield Bars & Signs, Median Islands with refuge; and a treatment to increase yielding - potentially PHBs OR In-Roadway Yield signs; and potentially others
3) AND On-Street Parking	12	Above list, as well as curb extension/parking restrictions

Step 6: Refine and Implement Treatment Plan

- Provides guidance and supplemental resources for:
  - Considering additional community priorities;
  - Performing additional diagnostics;
  - Performing economic assessments; and
  - Allocating funding.



Example Prioritization Tool: ActiveTrans Priority Tool Guidebook (Lagerwey et al. 2015)

$$CEI = \frac{Project\ cost}{Expected\ reduction\ in\ pedestrian\ or\ bicycle\ crashes}$$

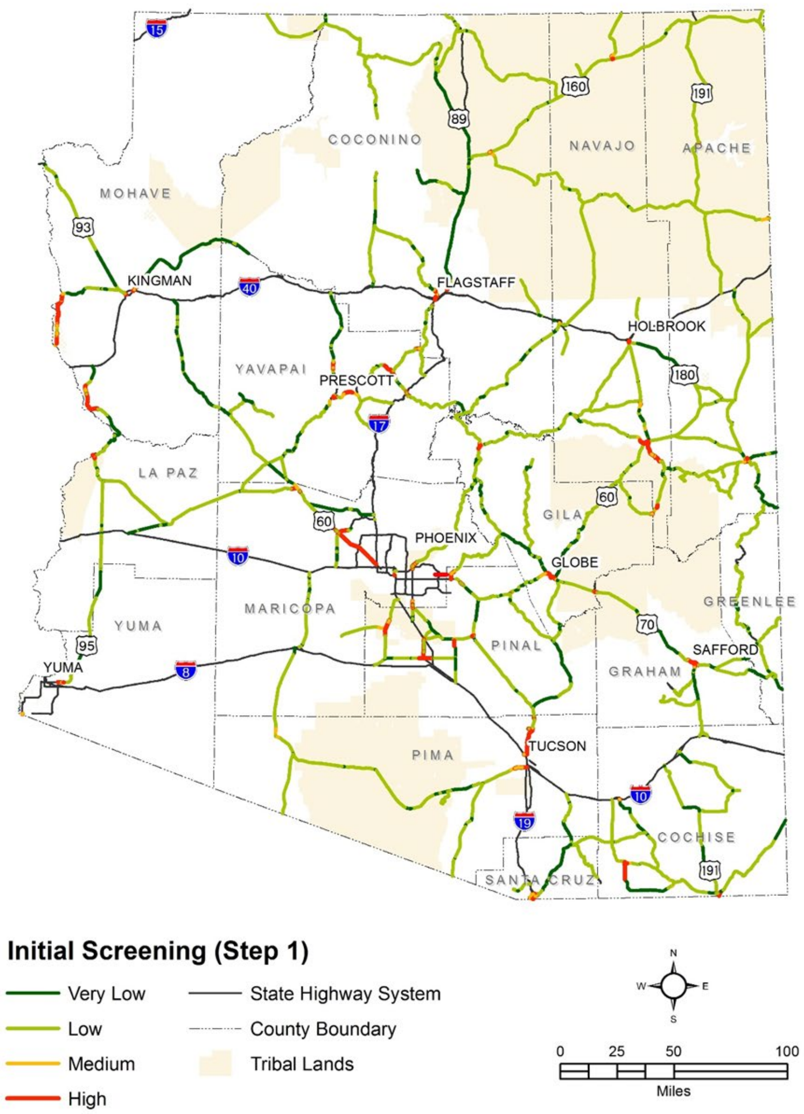
Example economic analysis tool from ODOT (Siddique et al. 2017)

Step 7: Evaluate Projects and Process

- Evaluate the program - Process evaluation
  - Implementation
  - Barriers/data needs
- Evaluate projects – Safety evaluation
  - Across all sites
  - Crashes (preferred) or surrogate measures (e.g., speed, yielding, conflicts)
- Renew the process
  - Improve data
  - Update analyses
  - New screening/ranking

Examples with Key Takeaways

1. Seattle DOT – TODAY webinar
2. Oregon DOT
3. Arizona DOT – TODAY webinar
4. California DOT (Caltrans)



Preliminary Identification of High-Risk Segments (ADOT 2017).

Conclusions

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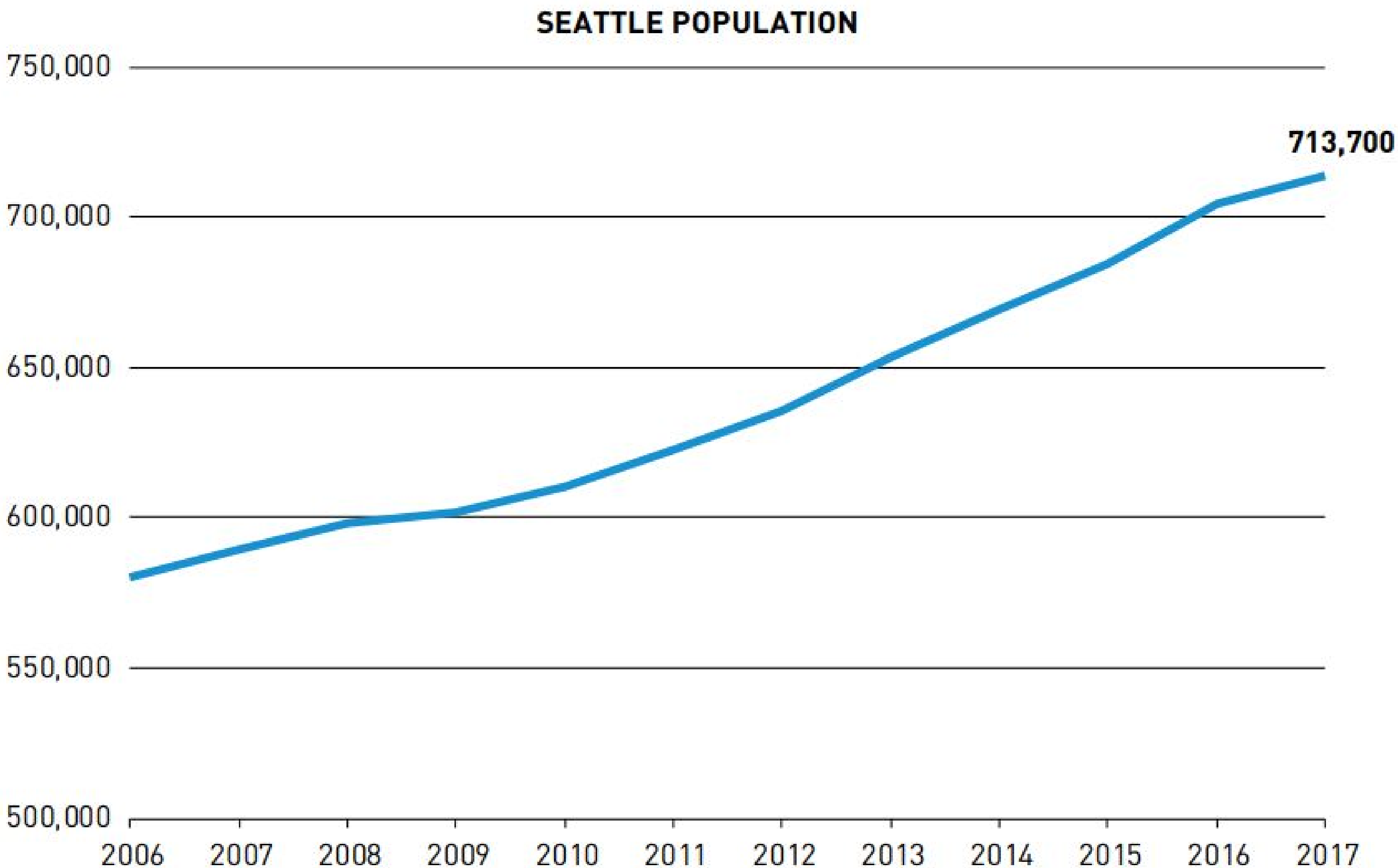
NCHRP 17-73 Project Information

- NCHRP Research Report number 893, *Systemic Pedestrian Safety Analysis*
- Link to report page: http://www.trb.org/NCHRP/Blurbs/178087.aspx

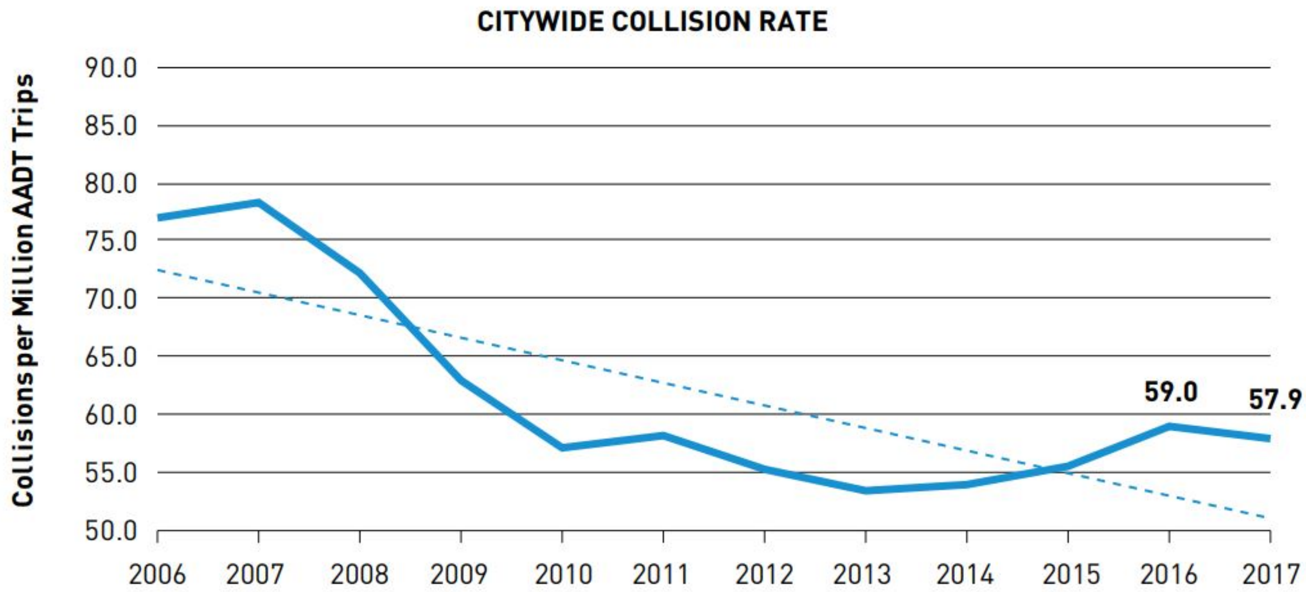
Bicycle and Pedestrian Safety Analysis

Seattle and Vision Zero

- Targeting zero severe/fatal collisions by 2035



Data



Fatal Collisions
2013-2015

23

Pedestrian and bicycle collisions make up 6% of total crashes but 40% of fatalities*

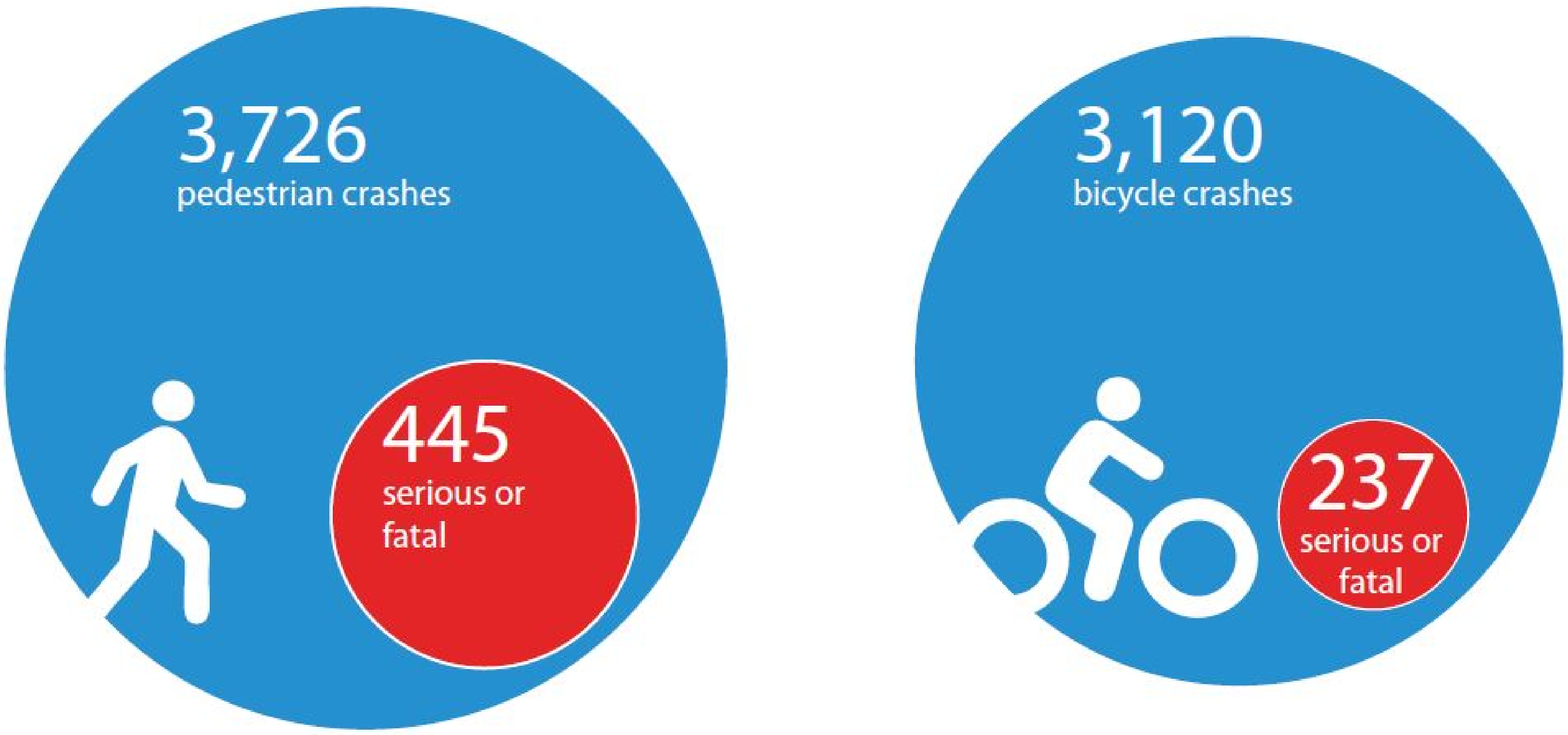
4

9 out of 10 reported bicycle/pedestrian collisions result in injury

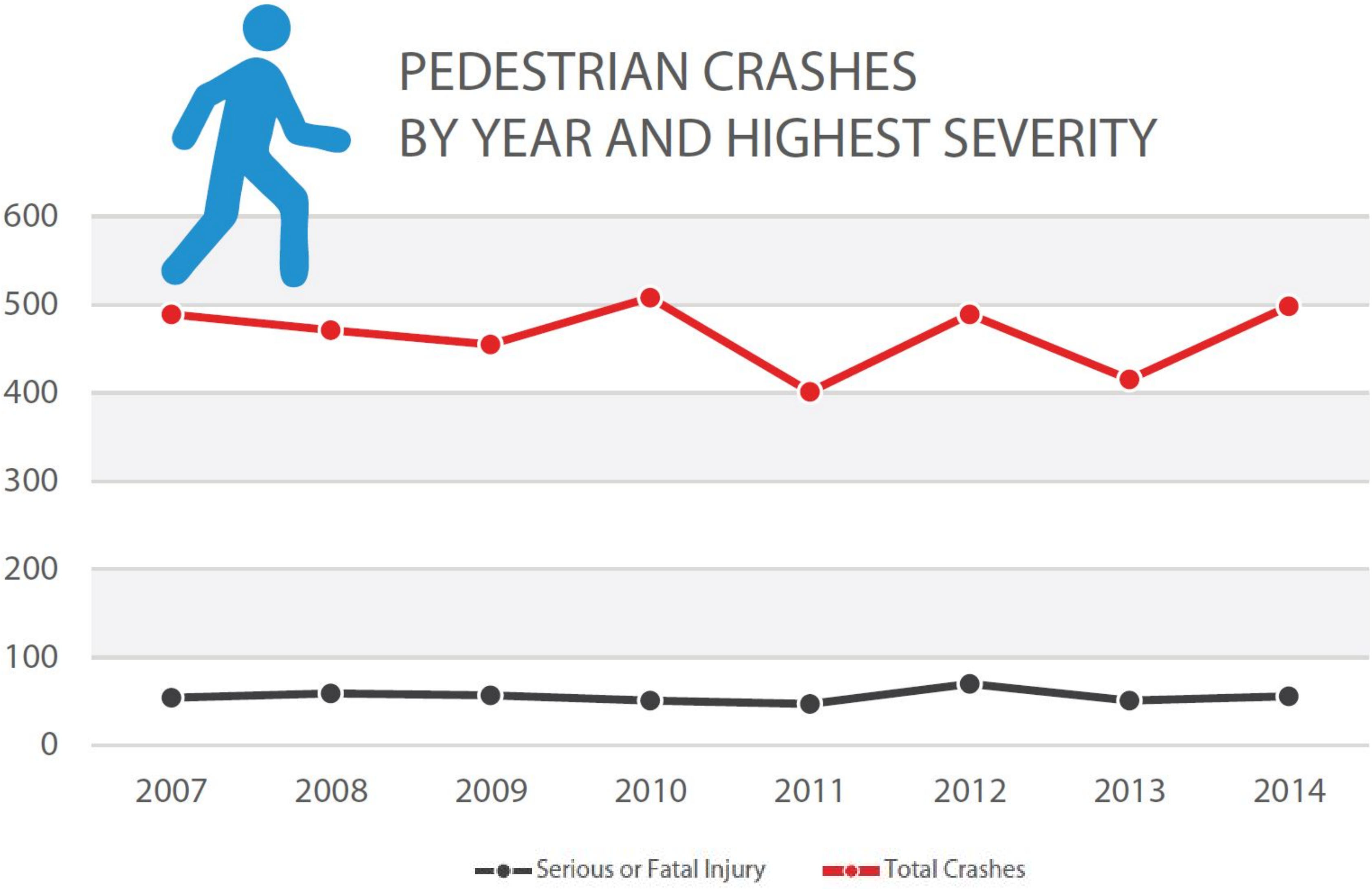
Purpose of Bicycle and Pedestrian Safety Analysis

- Better understand risk factors contributing to pedestrian and bicyclist crashes
- Proactively and systemically address risk factors to mitigate potential crashes
- Advance Seattle's Vision Zero Goals

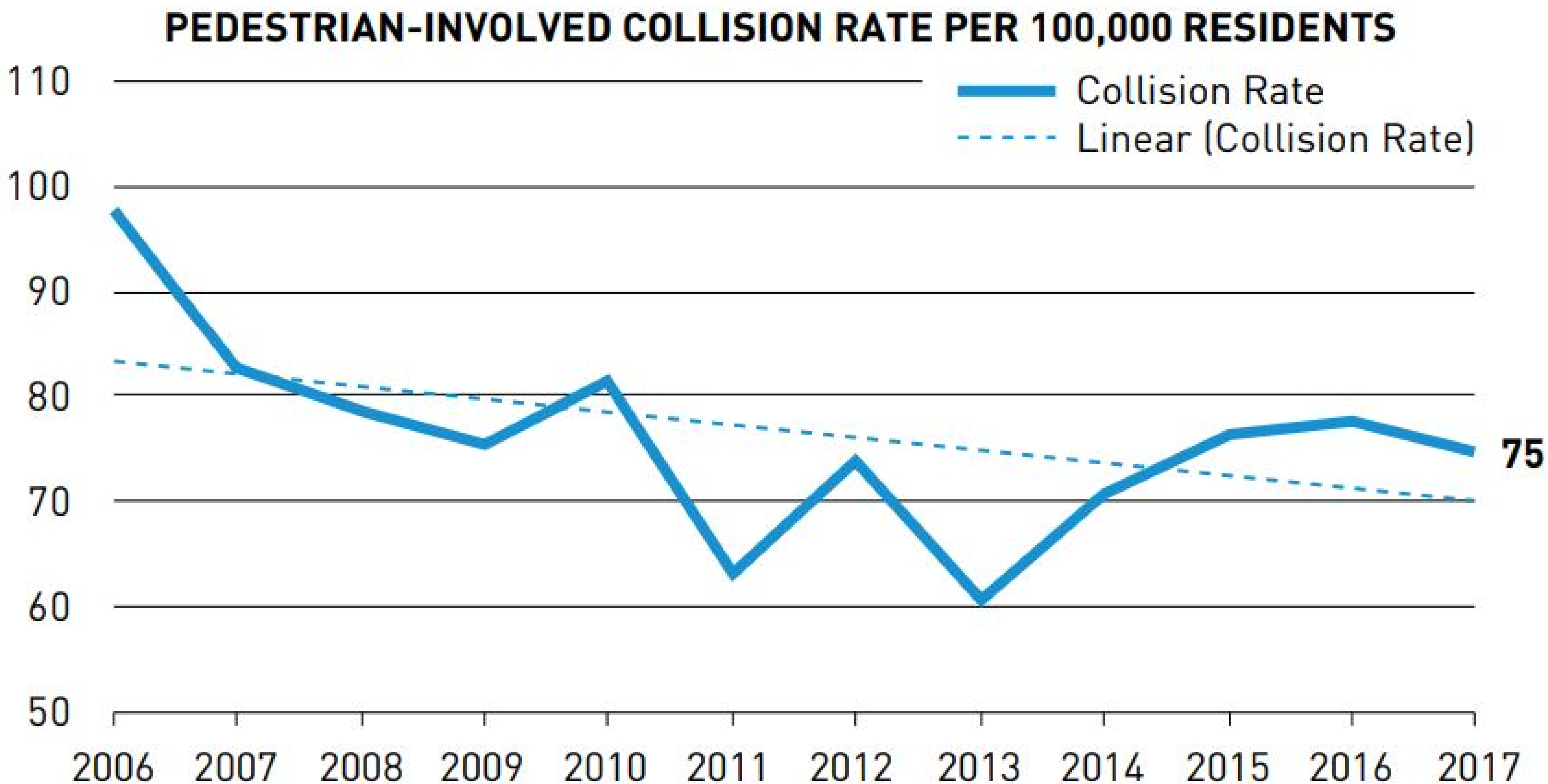
Data At a Glance – Crash Data



Pedestrian Collision Trends

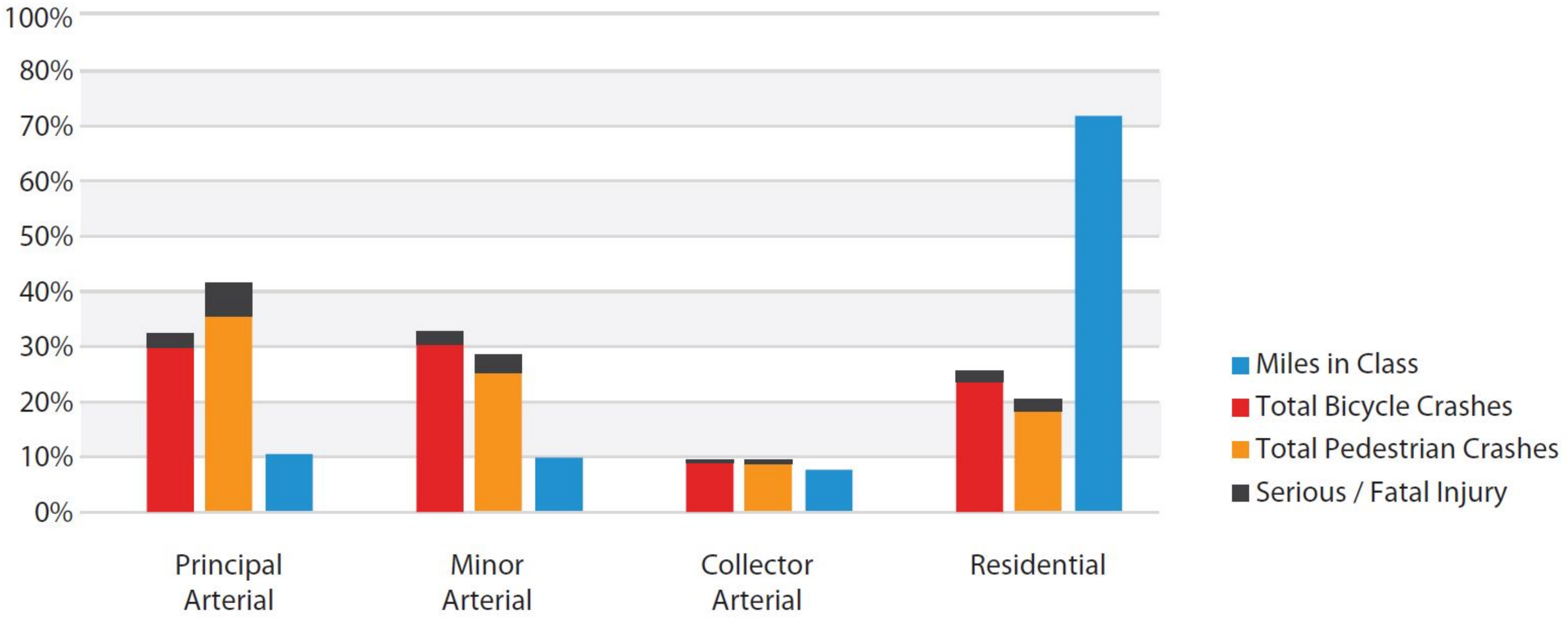


Pedestrian Collision Rates



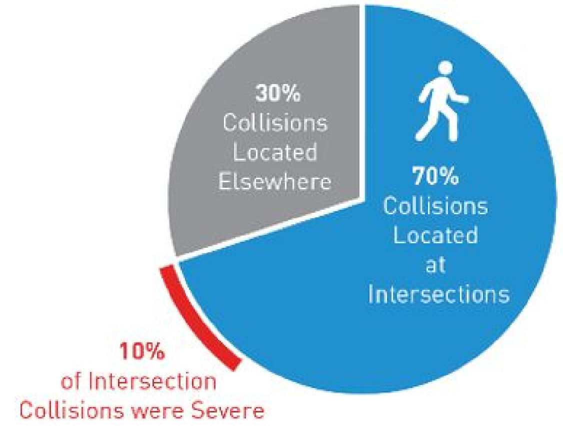
Exploratory Analysis

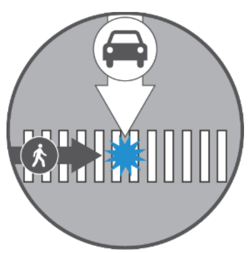
74.5% OF BICYCLE CRASHES
AND NEARLY 80% OF PEDESTRIAN CRASHES
HAPPEN ON ARTERIAL STREETS.

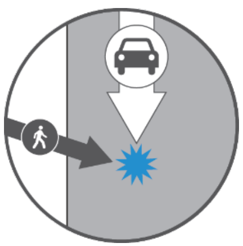


Exploratory Analysis - Pedestrian

Collision Type	% of Total	% of Severe/Fatal
Left hook at crossing (controlled)	29.1	20.7
Angle at crossing (controlled)	23.0	31.0
Angle at midblock (uncontrolled)	21.7	33.8

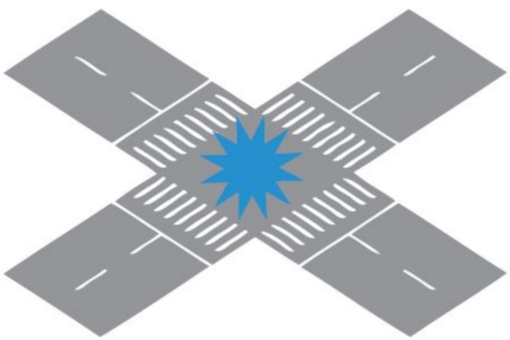


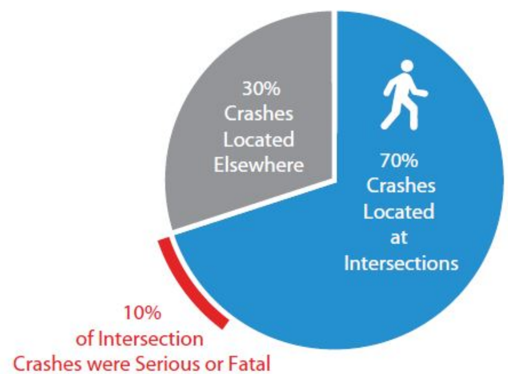


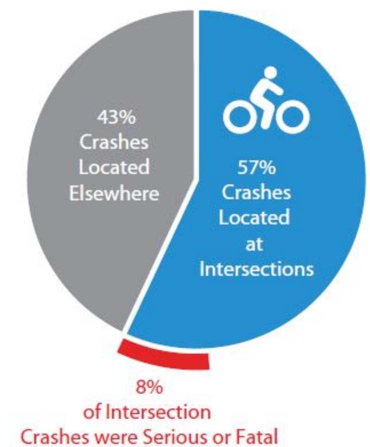


Exploratory Analysis

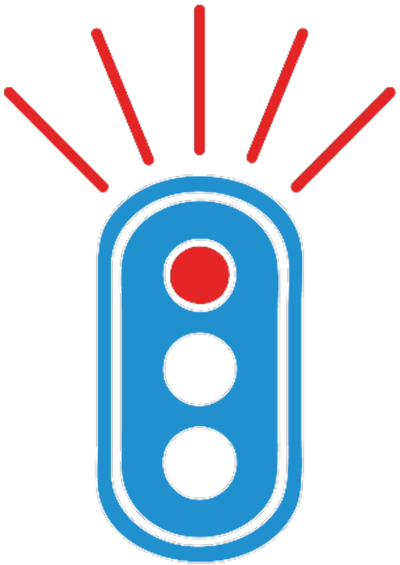
THE MAJORITY OF BICYCLE AND PEDESTRIAN CRASHES HAPPEN AT INTERSECTIONS



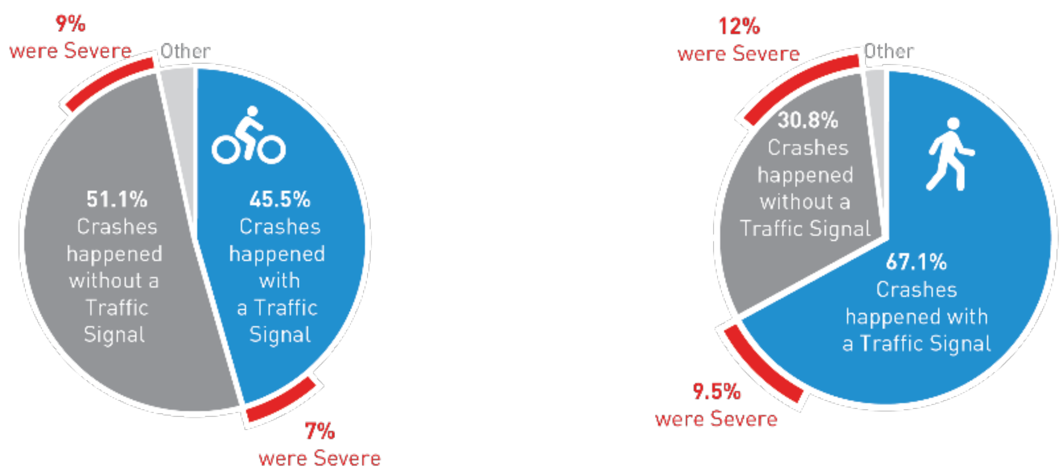




Exploratory Analysis



PEDESTRIAN INTERSECTION CRASHES MORE LIKELY TO HAPPEN AT LOCATIONS WITH TRAFFIC SIGNALS



Accounting for Exposure

Exposure = level of pedestrian/bicycling activity

Pedestrian Activity

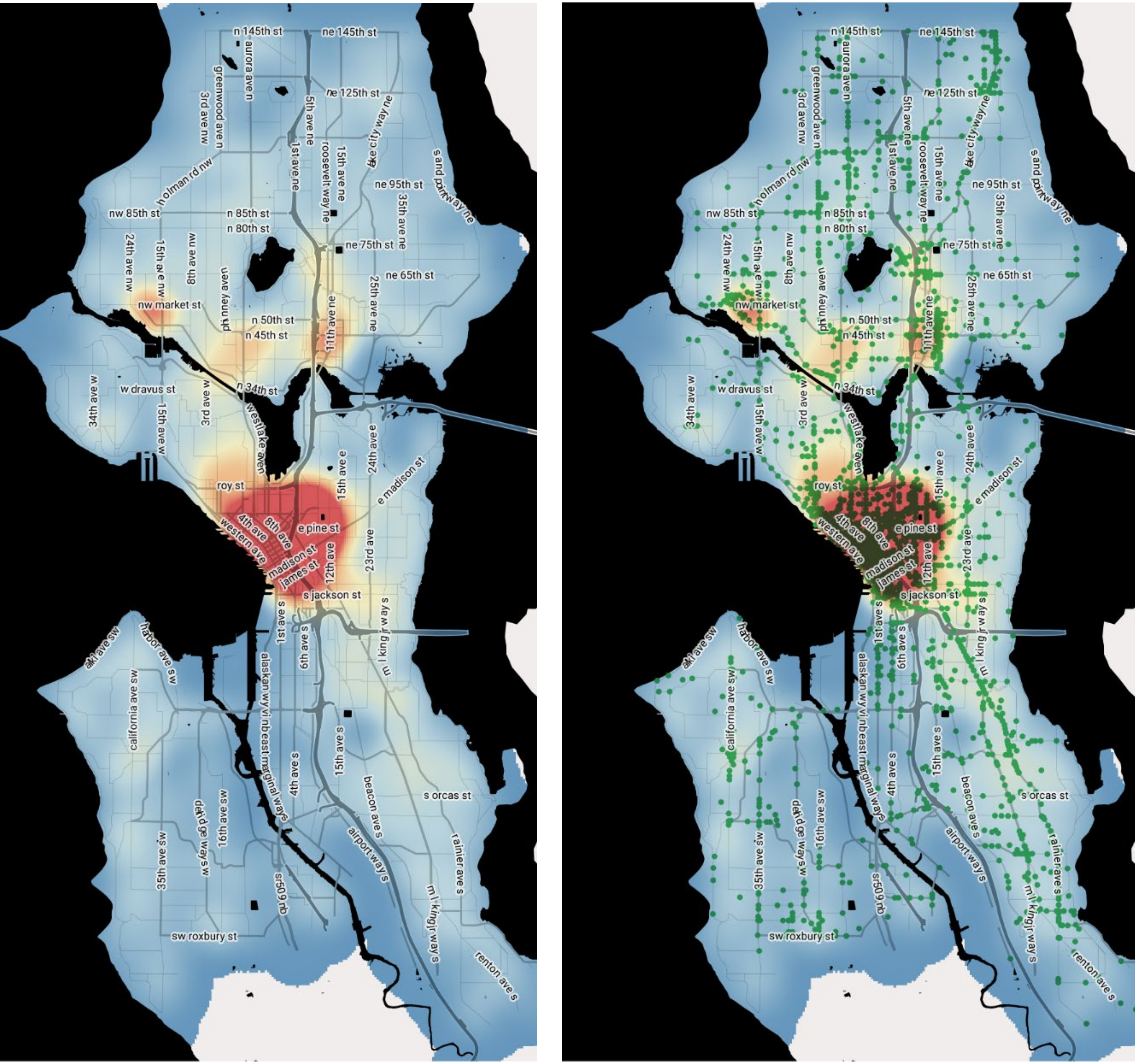
- Annualized count data
- Trip generators

Bicycle Activity

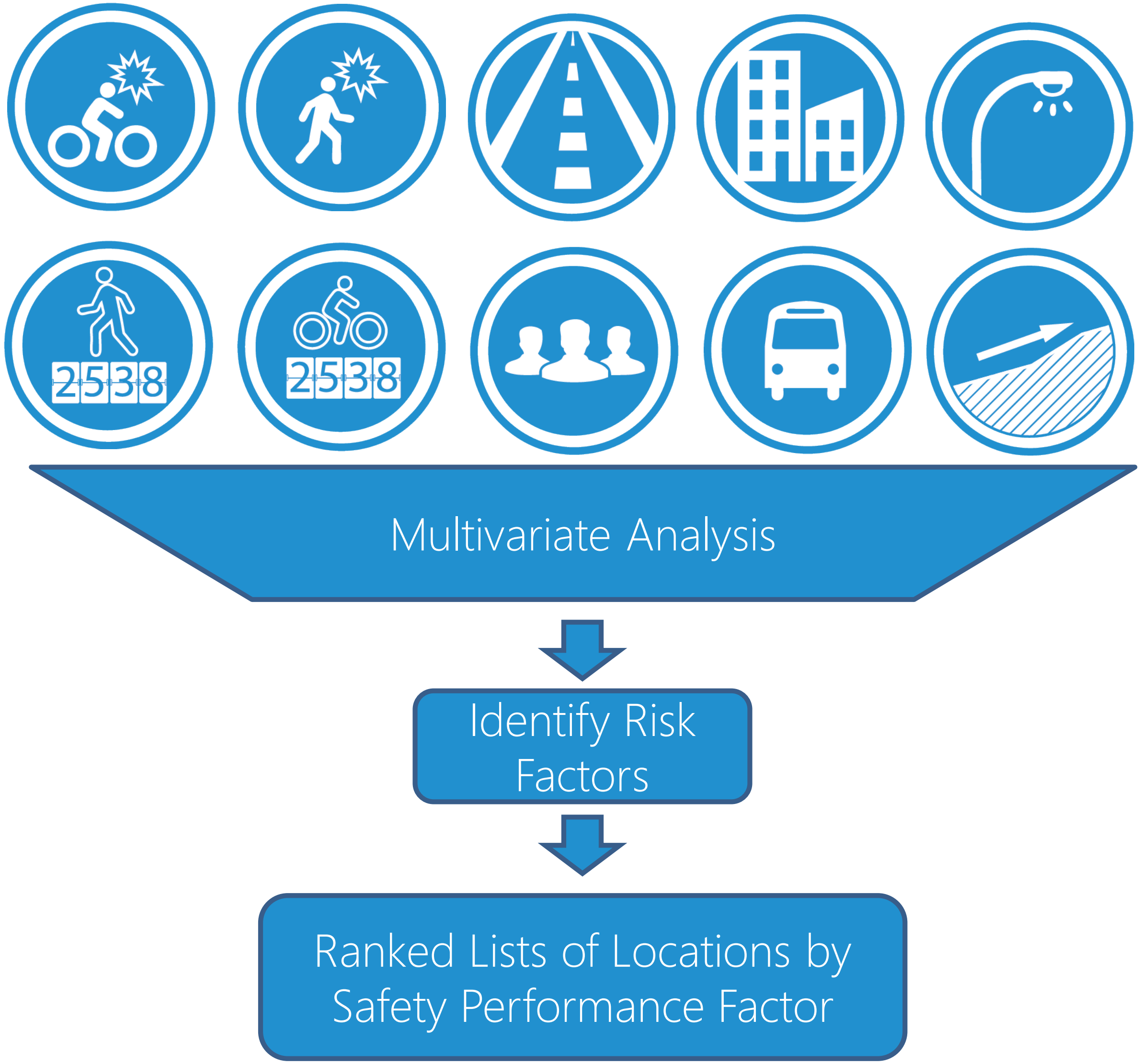
- Annualized count data
- Trip generators
- Strava data
- Bicycle Network

Trip generators: housing units (single family or multifamily), commercial destinations, transit locations, and universities or schools.

Pedestrian Volumes



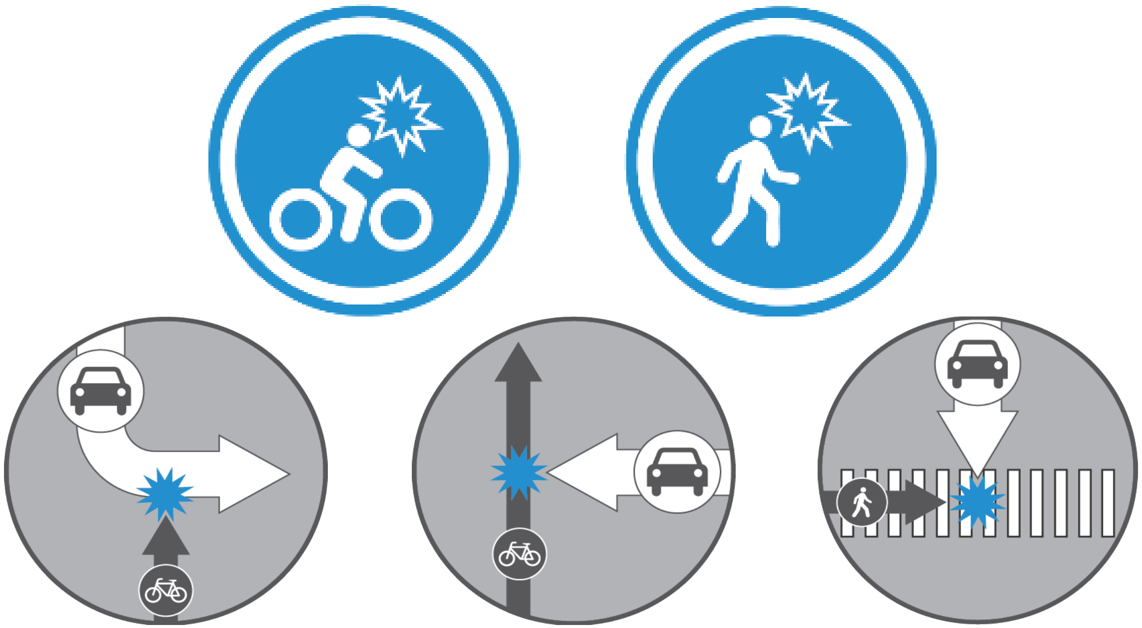
Leading Edge Analysis



A Proactive, Systemic Approach

Focusing on modeled collision rates at **intersection locations** based on the 5 following prioritized collision types:

- Total bicycle collisions
- Total pedestrian collisions
- Opposite direction bicycle collisions
- Angle bicycle collisions
- Angle pedestrian collisions



How is Seattle Using These Findings?

- Identify locations where street or signal design changes may be needed
- Make informed decisions around prioritizing safety improvements
- Proactively treat locations with the intention of mitigating potential crashes

The Value of Good Data

- Quality vs quantity of collision data
- Geospatially located data's benefit to local and systemic trend analyses
- Simple statistical and spatial analysis can reveal informative patterns that may not be apparent
- Understanding exposure is key to understanding risk, prioritizing safety improvements

BPSA Phase 2

- Additional 3 years of collision data
- Evaluate additional Safety Performance Factors for new collision types
- Develop a more robust exposure model for bicycle and pedestrian activity
- Video analysis of potential near-miss locations for pedestrian collision patterns
- Promote education and enforcement

Questions?

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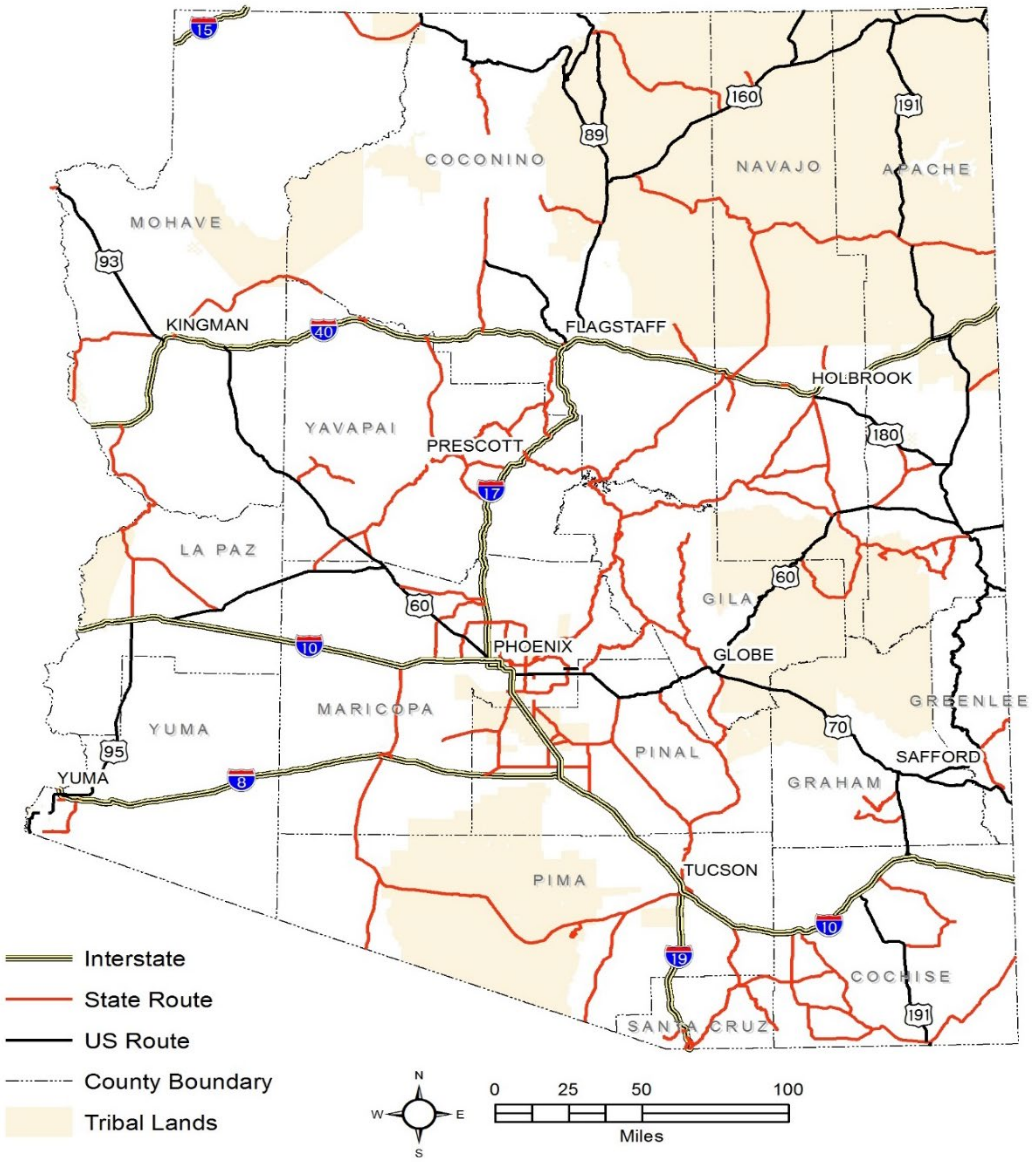
http://www.seattle.gov/visionzero

ADOT PEDESTRIAN SAFETY ACTION PLAN

Prepared by:
Kimley-Horn and Associates, Inc.

Pedestrian Safety Action Plan Objectives



EVALUATE…

effectiveness of 2009 PSAP to reduce the frequency of pedestrian crashes.

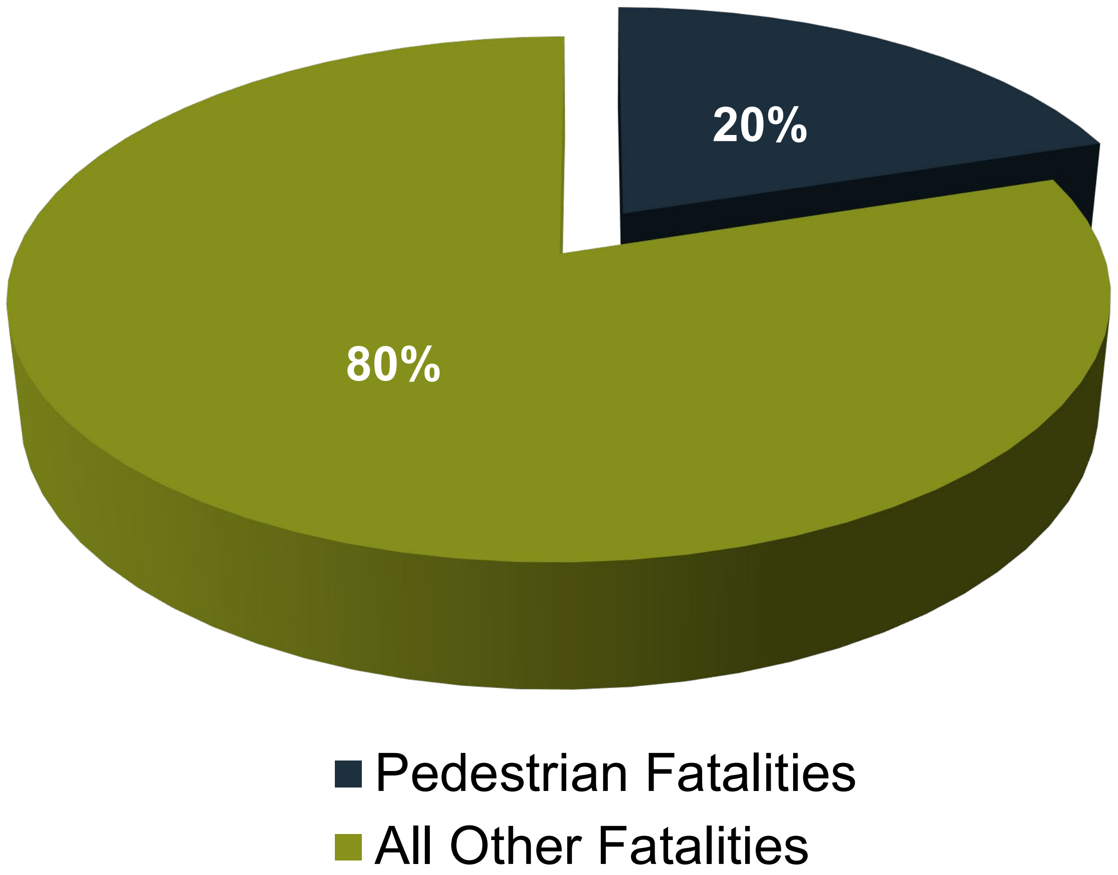
ANALYZE…

State Highway System (SHS) pedestrian crash data (2011-2015).

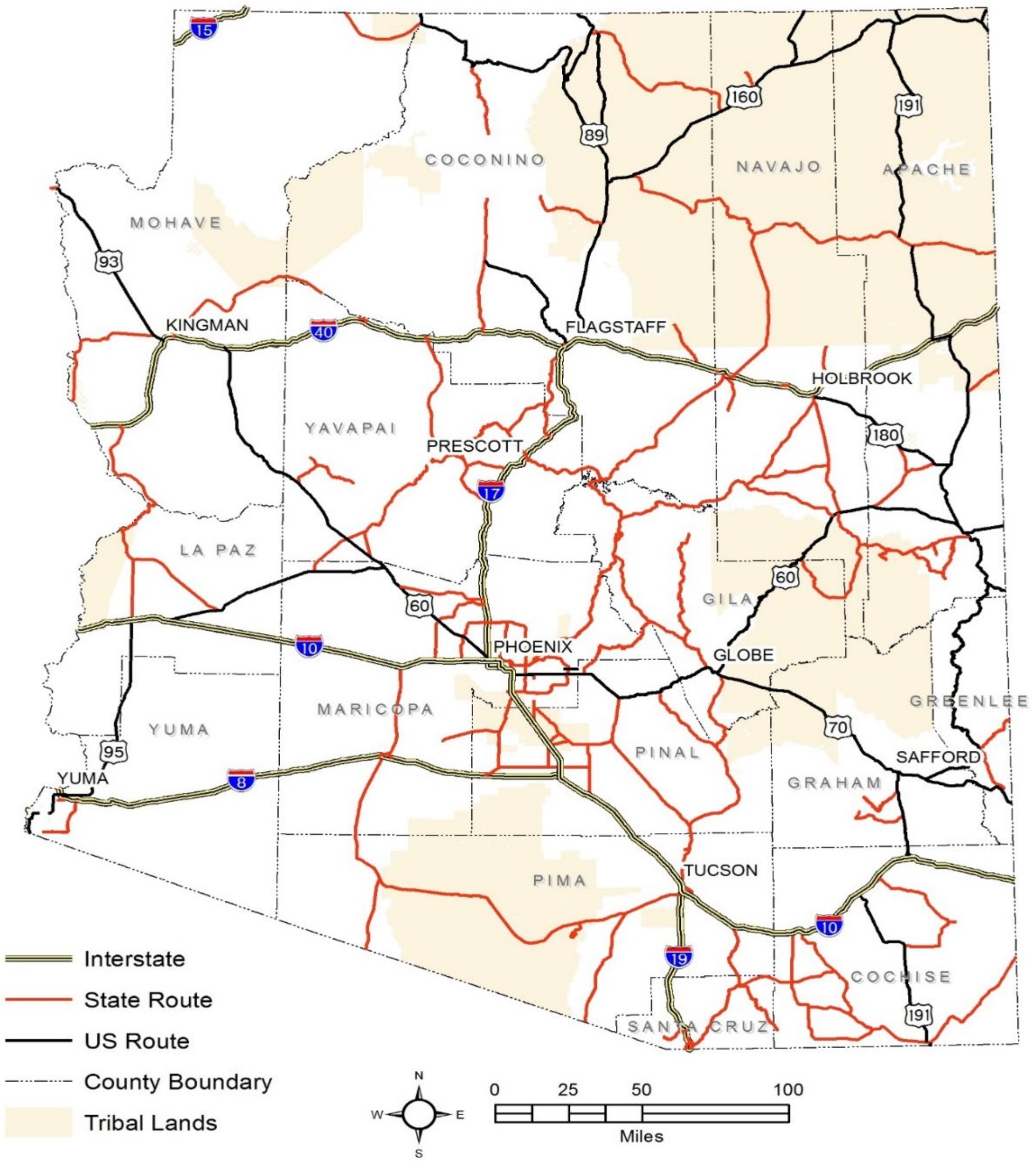
IDENTIFY…

steps, actions, and countermeasures to reduce pedestrian crashes, injuries, and fatalities on SHS.

Pedestrian Fatalities in Arizona



- 20 percent of all traffic fatalities in Arizona are pedestrians



Pedestrian Crashes on State Highway System

- **824 pedestrian** related crashes on State Highway System (2011 – 2015)
- Represents **10.7 %** of state-wide (all public roads) pedestrian related incidents

Pedestrian Safety Action Plan Goal

REDUCE THE FREQUENCY
of all pedestrian crashes *(including fatal, injury, and non-injury)*
on the
STATE HIGHWAY SYSTEM
BY 25%
BY THE YEAR 2025

The 2011–2015 annual average of pedestrian-involved crashes is 165 crashes/year. The target is to reduce these to 125 crashes/year by the year 2025.

Detailed Analysis of Pedestrian Crash Data (2011-2015)

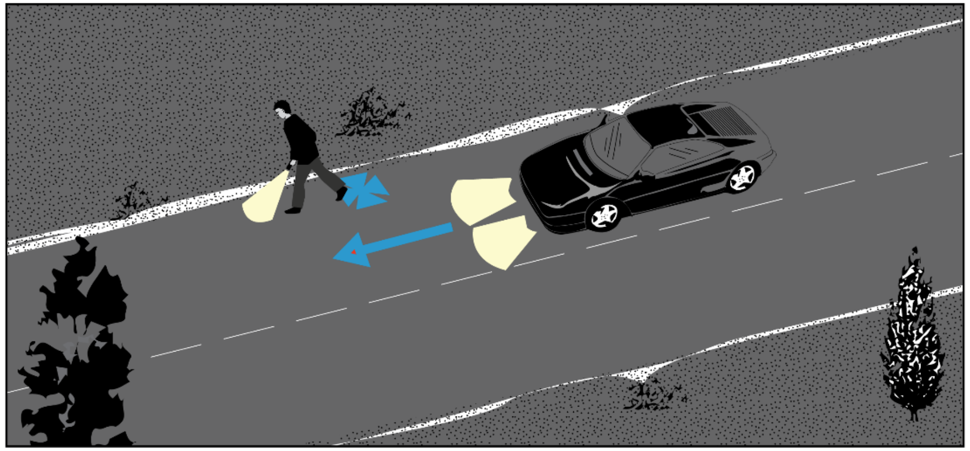
THE PROCESS:

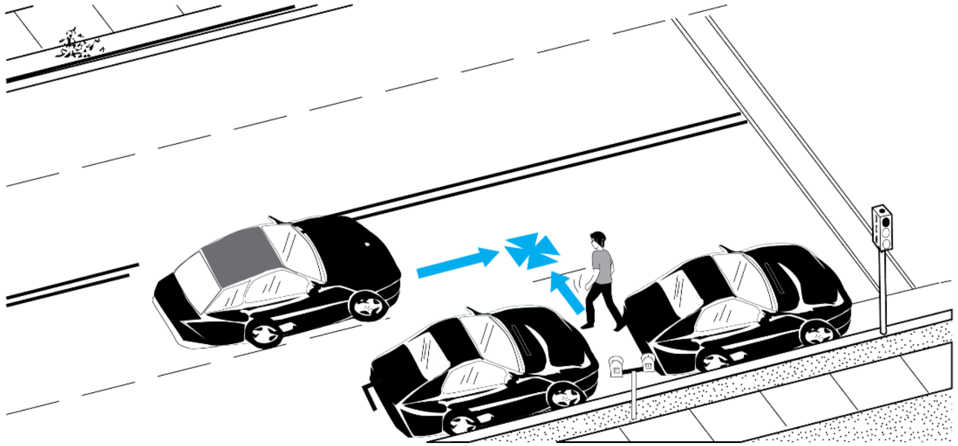
1. **Obtain** pedestrian crash reports
2. **Enter data** into PBCAT – crash type each State Highway System crash
3. **Identify:**
   - Hot spot locations
   - High risk locations
     - Examples: five-lane roadway, 45 mph + , urbanizing / suburban locations

Pedestrian Crash Data Analysis

MOST PREVALENT CRASH-TYPES

- **Crossing Roadway**
  364 crashes (44%)
- **Disabled Vehicle**
  91 crashes (11%)
- **Dash / Dart-Out**
  73 crashes (9%)
- **Walking Along Roadway**
  72 crashes (9%)

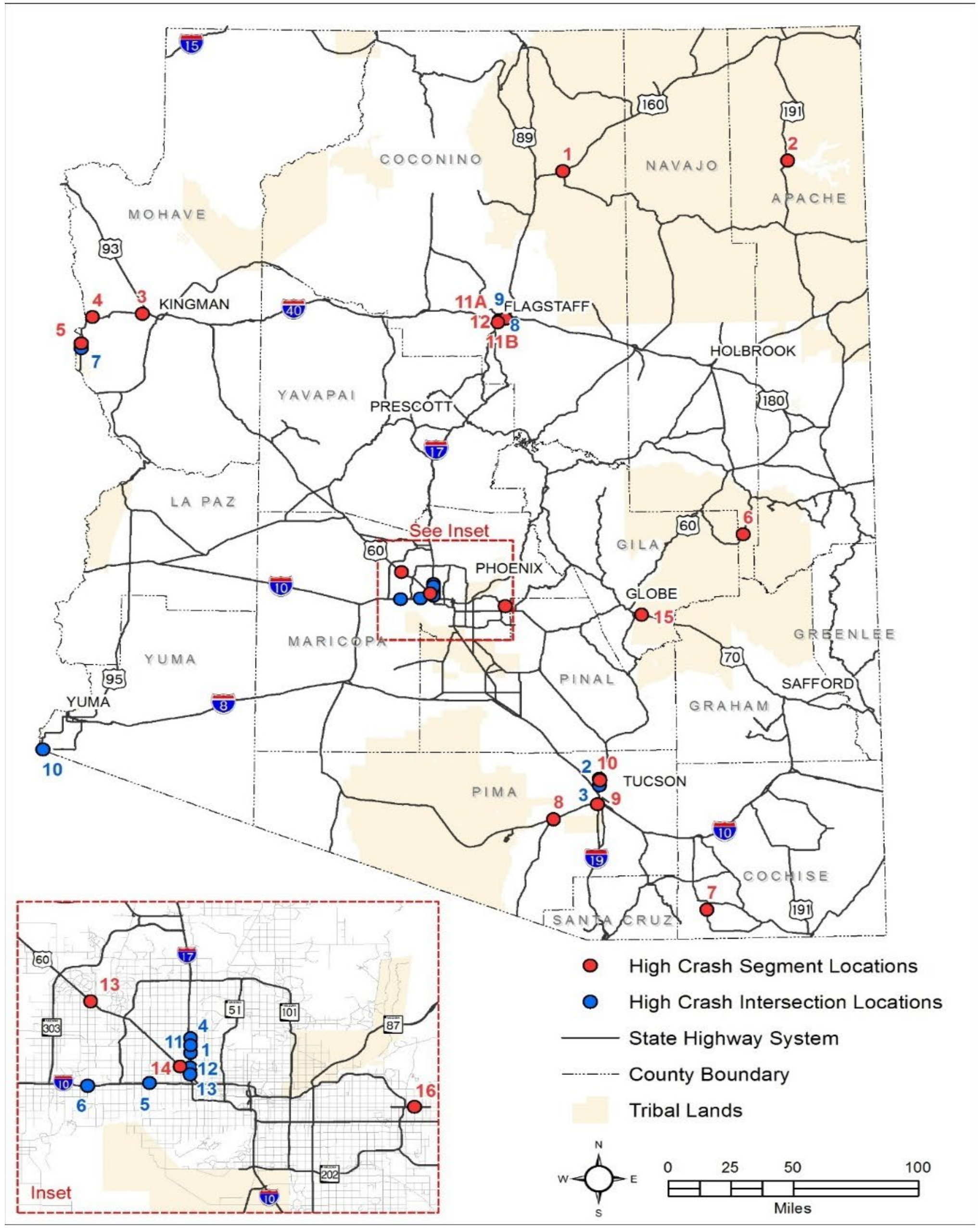




High-Crash Locations

30 high-pedestrian crash locations on the State Highway System

Identified based on visual density review



Analysis: Risk Assessment Process

- Identify state highway locations where investment can lower risk of pedestrian crashes
- Proactive approach: identify high-probability locations and address them *before* pedestrian crashes occur
  - Existing Conditions
  - Pedestrian Demand
  - At-Risk Groups

TWO-STEP APPROACH:

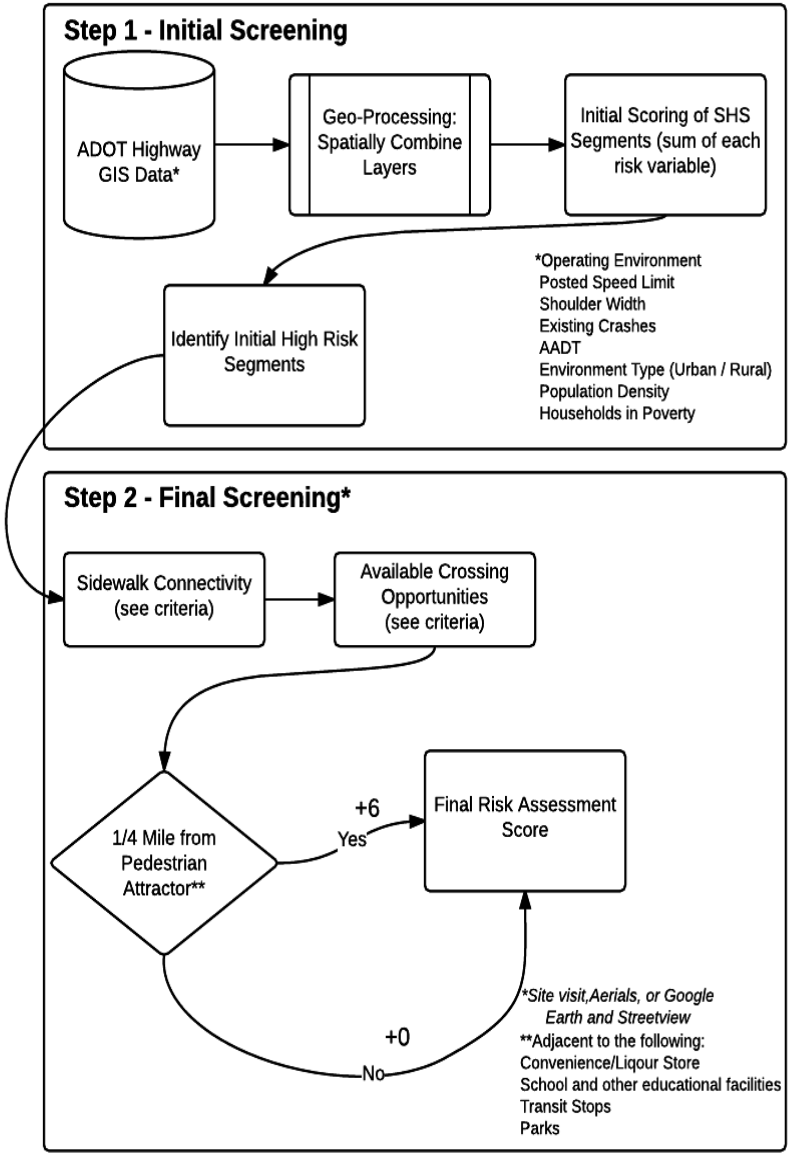
STEP 1

Step 1 – **Initial Screening:** GIS data, to identify locations where pedestrian facilities should be considered. (70 locations)

STEP 2

Final Screening

Use visual resources to review Step 1 locations. (17 locations)



Risk Assessment Factors and Variables

Factor	Variable	Data Source
Existing Conditions	Posted Speed Limit	ADOT GIS
	Operating Environment /Number of lanes /Roadway width	ADOT GIS
	Missing Sidewalk Link	ADOT GIS/Visual Inspection/Google Earth/Street View
	Paved Shoulder Width	ADOT GIS
	Prior Crashes	ADOT Safety Data Mart / ALISS Database
	Traffic Volume	ADOT GIS
	Signalized Intersection Spacing	ADOT GIS
Pedestrian Demand	Population Density	U.S. Census Bureau
	Attractors (convenience/liquor stores, schools and education facilities, parks, transit stops)	This data may not be available at the macro/statewide level; it is available at the corridor level from land use maps and visual inspection.
	Land Use (commercial and high-density housing)	This data may not be available at the macro/statewide level; it is available at the corridor level from land use maps and visual inspection.
At-Risk Groups	% Households in Poverty	U.S. Census Bureau
	% Households with No Vehicle	U.S. Census Bureau
	At-Risk Groups: Children, Elderly, Handicapped	This data may not be available at the macro/statewide level; it is available at the corridor level from land use maps and visual inspection.

Risk Assessment Factors and Variables

Factor	Points
Operating Environment/Width of Roadway	
• 6 Lane Highway	6
• 4 or 5 Lane Undivided Highway	3
• 2 or 3 Lane Undivided Highway	2
• 2 or 3 or 4 Lane Divided Highway	1
Posted Travel Speed	
• >45 mph	6
• 35-45 mph	4
• 25-35 mph	2
• <25 mph	0

Scale	Risk Level
1 – 15	Very Low Risk
16 – 25	Low Risk
27 – 31	Medium Risk
> 32	High Risk

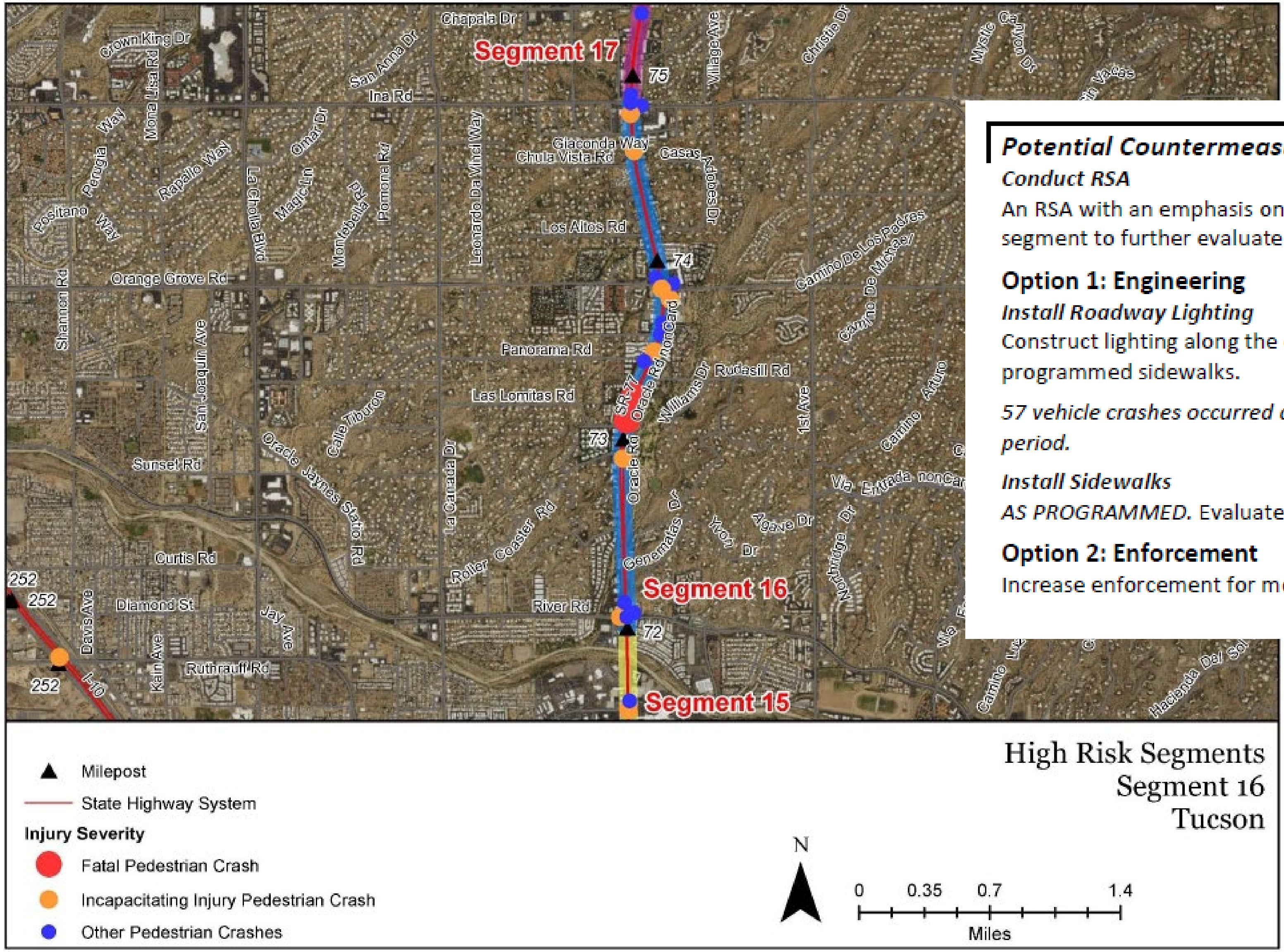
Countermeasure Selection Process

1. **Review** location context and site characteristics:
   - *ADOT GIS data, ADOT Photo Log, and Google Street View*
   - *Cross-section, posted speed limit, existing pedestrian facilities*
2. **Identify** potential countermeasures
3. **Develop** unit costs
4. **Identify** Crash Modification Factor (CMF) a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site.

Examples of Countermeasures:

- Install Barrier fencing
- Install crossing treatments
- Lane reduction
- Install sidewalks
- Pedestrian education campaign
- Install pedestrian refuge islands
- Access management improvements

Example of Countermeasure Identification by Location



Potential Countermeasures	***Conceptual Cost***
Conduct RSA	$20,000

An RSA with an emphasis on pedestrian safety should be conducted along the high-risk segment to further evaluate safety issues.

Option 1: Engineering

Install Roadway Lighting	$1,126,400

Construct lighting along the corridor segment to supplement the construction of the programmed sidewalks.

57 vehicle crashes occurred during dark-not lighted conditions during the five-year study period.

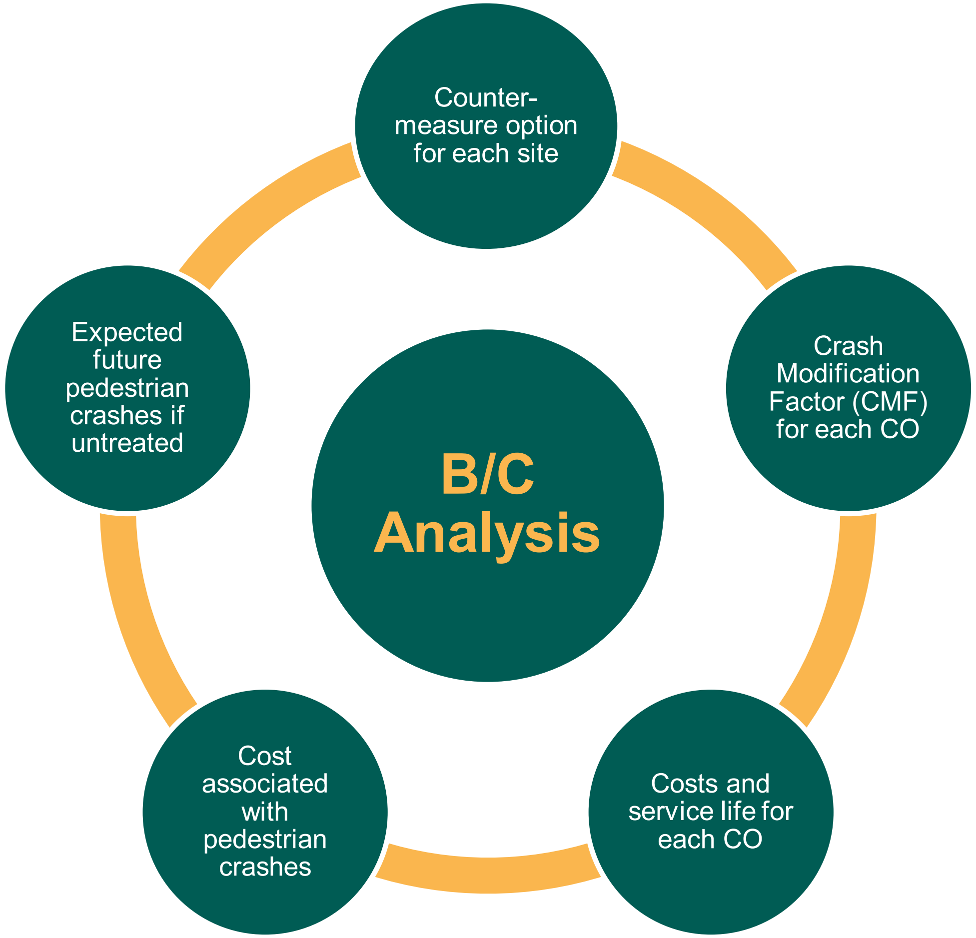
Install Sidewalks	—

AS PROGRAMMED. Evaluate the need to extend sidewalks up to MP 79.1.

Option 2: Enforcement	—

Increase enforcement for motorists failing to yield the right-of way at the intersection.

Benefit/Cost Analysis Process



Inputs needed for applying Benefit/Cost analysis

Annualized benefit prepared considering statewide SHS average severity cost calculated for each pedestrian crash type.

Table 5: Average SHS Injury Severity Cost by Pedestrian Crash Type

Pedestrian Crash Type	Fatal (K)		Incapacitating Injury (A)		Non-Incapacitating Injury (B)		Possible Injury (C)		No Injury (O)*		Average SHS Pedestrian Crash Cost
	SHS Crashes	Total Cost	SHS Crashes	Total Cost	SHS Crashes	Total Cost	SHS Crashes	Total Cost	SHS Crashes	Total Cost	
Backing Vehicle	0	$0	2	$800,000	3	$240,000	3	$126,000	0	$0	$145,750
Bus-Related	0	$0	2	$800,000	1	$80,000	1	$42,000	0	$0	$230,500
Crossing Driveway or Alley	0	$0	4	$1,600,000	10	$800,000	5	$210,000	3	$12,000	$119,182
Crossing Expressway	17	$98,600,000	8	$3,200,000	3	$240,000	2	$84,000	1	$4,000	$3,294,452
Crossing Roadway - Vehicle Not Turning	39	$226,200,000	62	$24,800,000	29	$2,320,000	22	$924,000	11	$44,000	$1,560,049
Crossing Roadway - Vehicle Turning	3	$17,400,000	36	$14,400,000	81	$6,480,000	58	$2,436,000	23	$92,000	$203,025
Dash / Dart-Out	17	$98,600,000	28	$11,200,000	16	$1,280,000	8	$336,000	4	$16,000	$1,526,466
Multiple Threat / Trapped	0	$0	0	$0	0	$0	1	$42,000	0	$0	$42,000
Other / Unknown - Insufficient Details	22	$127,600,000	5	$2,000,000	10	$800,000	1	$42,000	3	$12,000	$3,181,805
Pedestrian in Roadway - Circumstances Unknown	38	$220,400,000	10	$4,000,000	12	$960,000	5	$210,000	1	$4,000	$3,417,788
Unique Midblock	0	$0	2	$800,000	3	$240,000	1	$42,000	0	$0	$180,333
Unusual Circumstances	19	$110,200,000	44	$17,600,000	38	$3,040,000	13	$546,000	8	$32,000	$1,077,197
Walking Along Roadway	24	$139,200,000	14	$5,600,000	20	$1,600,000	9	$378,000	5	$20,000	$2,038,861
Working or Playing in Roadway	0	$0	6	$2,400,000	4	$320,000	2	$84,000	2	$8,000	$200,857
Other Applicable Crash Descriptions											
Dark (Not Lighted) Conditions	103	$597,400,000	56	$22,400,000	45	$3,600,000	12	$504,000	8	$32,000	$2,785,429

*No Injury includes crash severities classified as "Unknown"

Projects Prioritization

High-Crash Segment	Location	Project Description	Estimated Total Project Cost	Annualized Cost	Total Pedestrian Crashes (5-Year Period)	Estimated Pedestrian Crashes with Improvement (5-Year Period)	Annual Benefit	Benefit-Cost Ratio (Pedestrian Crashes)	Benefit-Cost Ratio (Vehicle Crashes)
Project 1: SR 95 Pedestrian Safety Improvement, MP 237. 4 - MP 239.2									
H-C Segment 5	MP 237.4 - MP 239.2	• Construct sidewalks between Valencia Rd and Courtney Pl. • Provide roadway lighting • Provide a PHB between Aztec Rd and Camp Mohave Rd	$3,888,754	$297,649	5	4	$513,256	1.7	0.5

Today's Speakers

THE UNIVERSITY OF NORTH CAROLINA HIGHWAY SAFETY RESEARCH CENTER

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- Libby Thomas, *University of North Carolina Highway Safety Research Center*, thomas@hsrc.unc.edu
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