Understanding Bicycle and Pedestrian Safety Using Crash Types

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April 30, 2018

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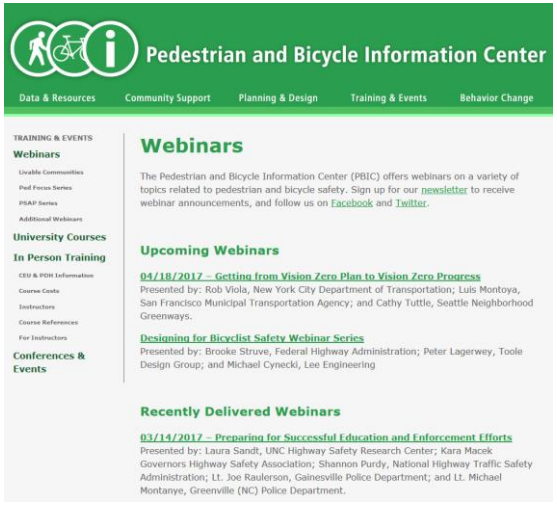
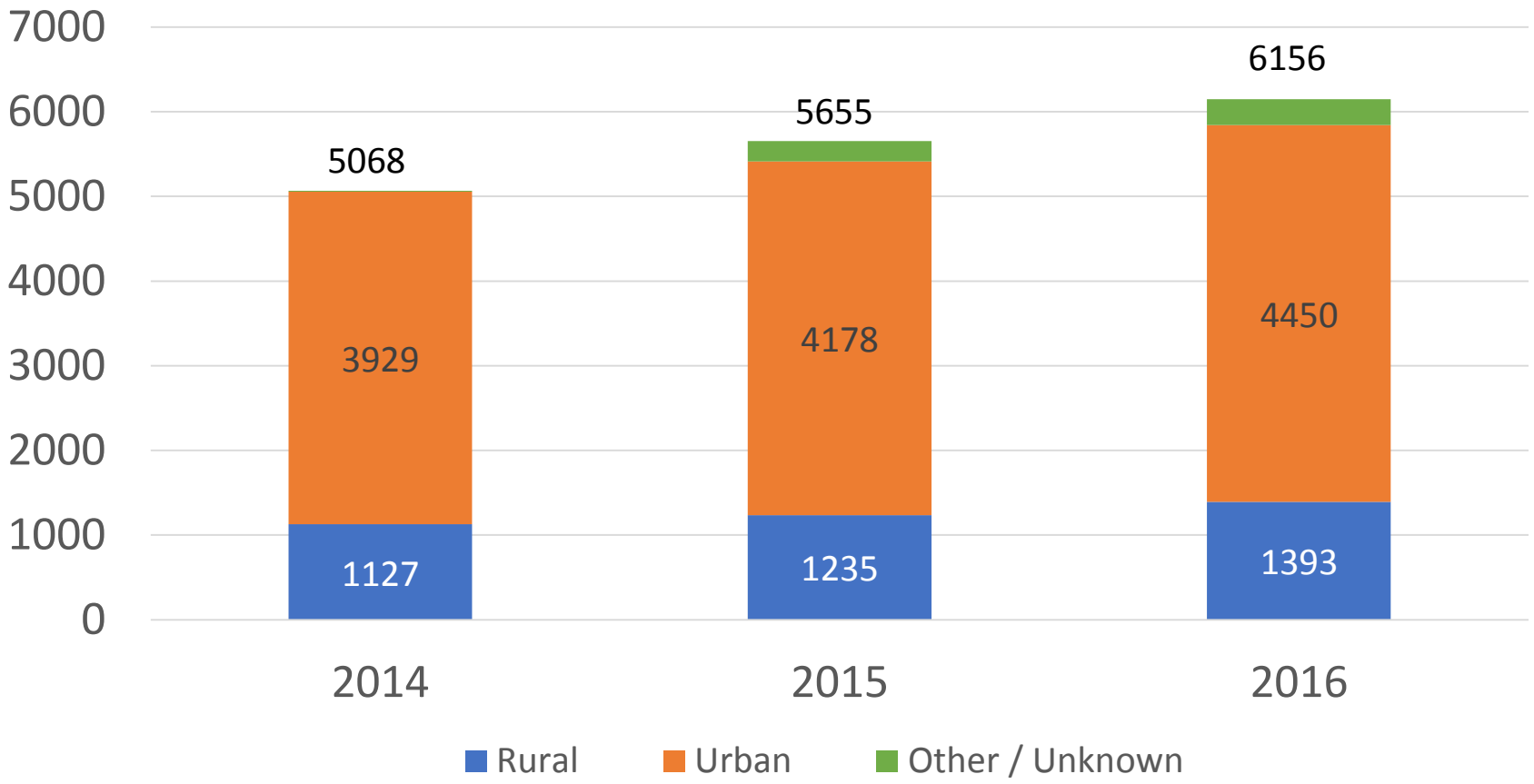


U.S. Pedestrian Fatalities



Data from Fatality Analysis Reporting System (FARS)
https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars

Top 7 Ped Fatality Crash Type Groups

	Crash Date (Year)			
Pedestrian Crash Group	*2014*	*2015*	*2016*	*Total*
Crossing Roadway - Vehicle Not Turning	1,728	1,978	2,245	5,951
	34.1%	35.0%	36.5%	35.3%
Walking/Running Along Roadway	669	763	787	2,219
	13.2%	13.5%	12.8%	13.1%
Unusual Circumstances	510	547	576	1,633
	10.1%	9.7%	9.4%	9.7%
Dash / Dart-Out	444	448	455	1,347
	8.8%	7.9%	7.4%	8.0%
Pedestrian in Roadway - Circumstances Unknown	393	389	457	1,239
	7.8%	6.9%	7.4%	7.3%
Crossing Roadway - Vehicle Turning	242	266	271	779
	4.8%	4.7%	4.4%	4.6%
Crossing Expressway	233	261	276	770
	4.6%	4.6%	4.5%	4.6%
Top 7 Crash Groups subtotal	4,220	4,653	5,068	13,939
	83.3%	82.3%	82.3%	82.6%
All Others (Backing, Working/Playing in Road, Bus-related, Non-trafficway &	849	1,003	1,089	2,941
	16.8%	17.7%	17.7%	17.4%
Total	5,068	5,655	6,156	16,879

Data from Fatality Analysis Reporting System (FARS)
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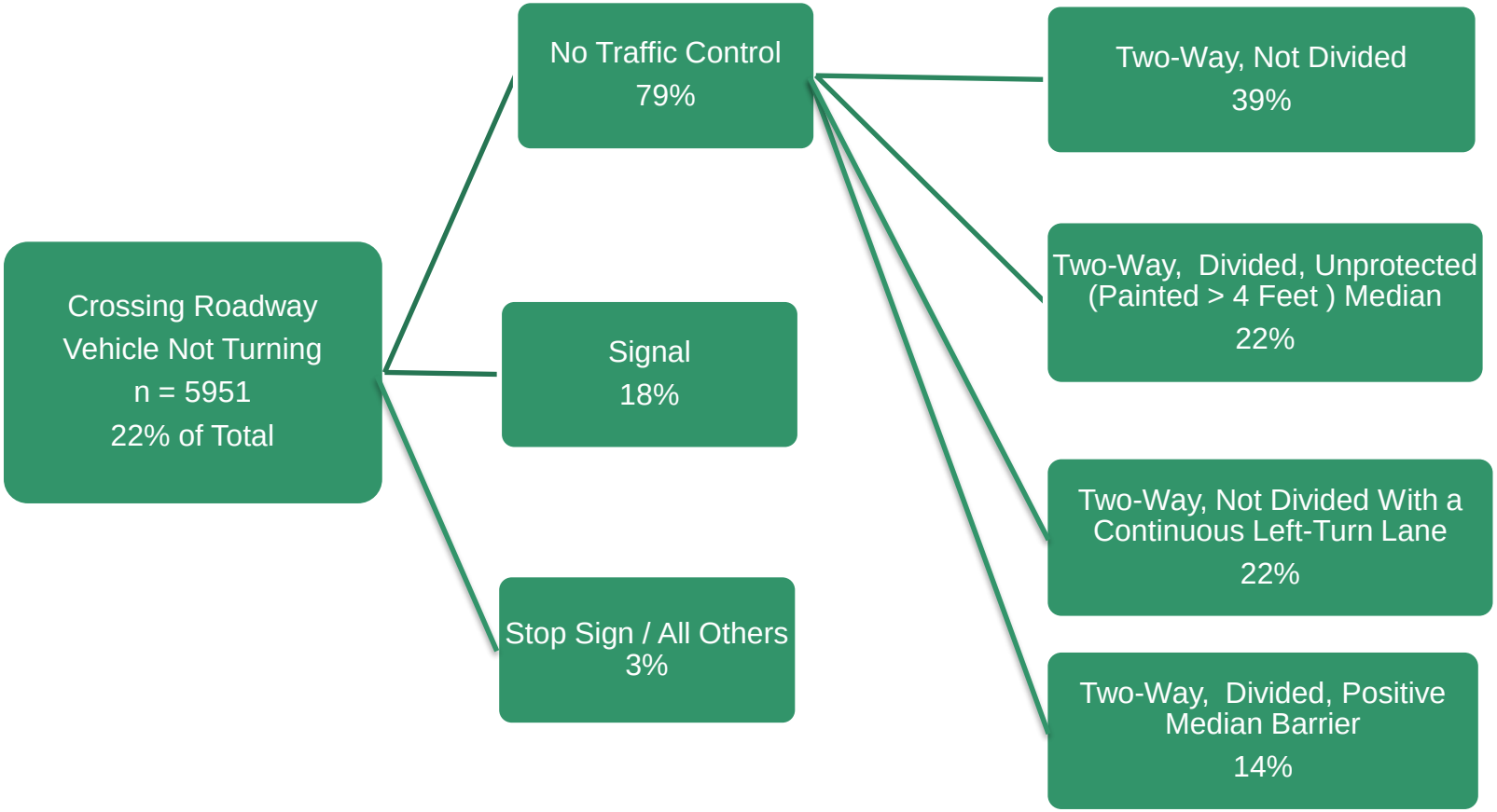
U.S. Pedestrian Fatalities



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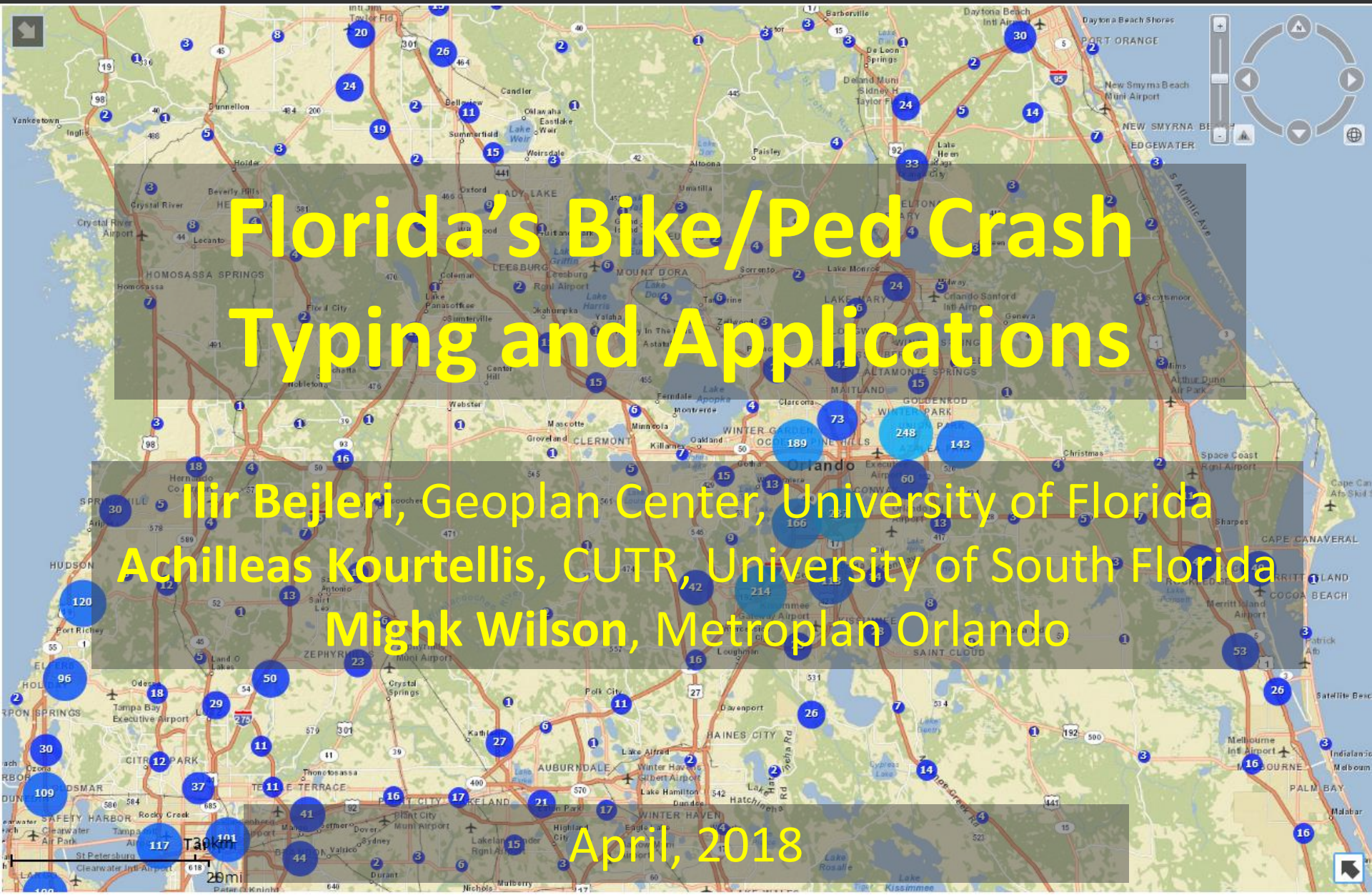


Florida's Bike/Ped Crash Typing and Applications

Ilir Bejleri, Geoplan Center, University of Florida
Achilleas Kourtellis, CUTR, University of South Florida
Mighk Wilson, Metroplan Orlando

April, 2018

Outline

- Florida's web-based bike/ped crash typing system (Web-based PBCAT)
- Using the system for typing of statewide bike/ped crashes
- Application of crash typing in safety analysis - Metroplan Orlando case study

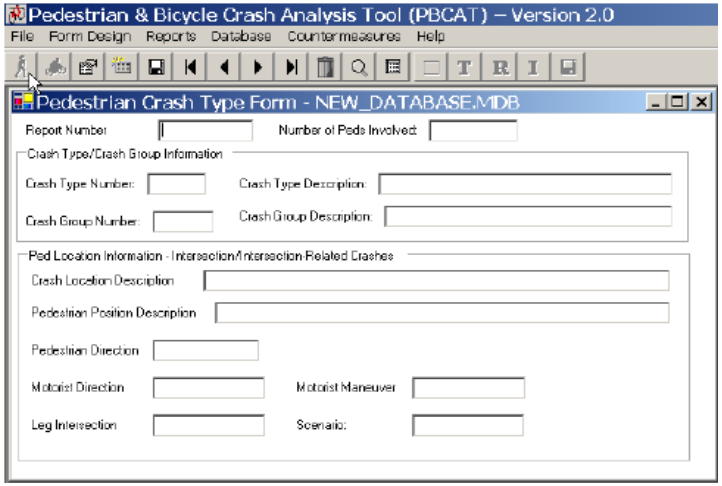
The Need for Pedestrian and Bicycle Crash Typing

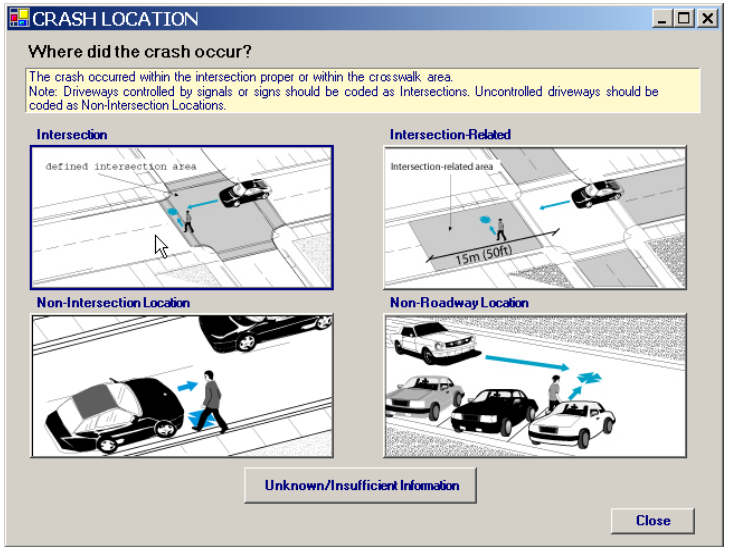
- Typically detailed crash types are not available in crash reports
- Need to relate crashes to ped/bike, driver behavior and location characteristics
- Pedestrian and Bicycle Crash Analytical Tool (PBCAT) - FHWA

U.S. Department of Transportation
Federal Highway Administration

PBCAT Overview

- It's a standalone software – requires installation and setup
- Requires key in or import of data PBCAT local database
- Import involve matching of local crash data fields to PBCAT fields
- Lack of seamless GIS Integration
- Requires Windows XP
- No longer supported





Considerations for Florida

- Large number of bike/ped crashes
- Many local/regional/state agencies and contractors needing the same data
- Need for easy data sharing
- Existence of a statewide web-based crash data system available to all agencies
- Limitations of standalone PBCAT

Florida's Alternative Solution to PBCAT

- Based on existing PBCAT method but programmed from scratch
- Different paradigm: plug the method into the existing database system using a **web-based** approach
- Accessible to all relevant stakeholders
  - DOT, MPO, local governments, contractors etc

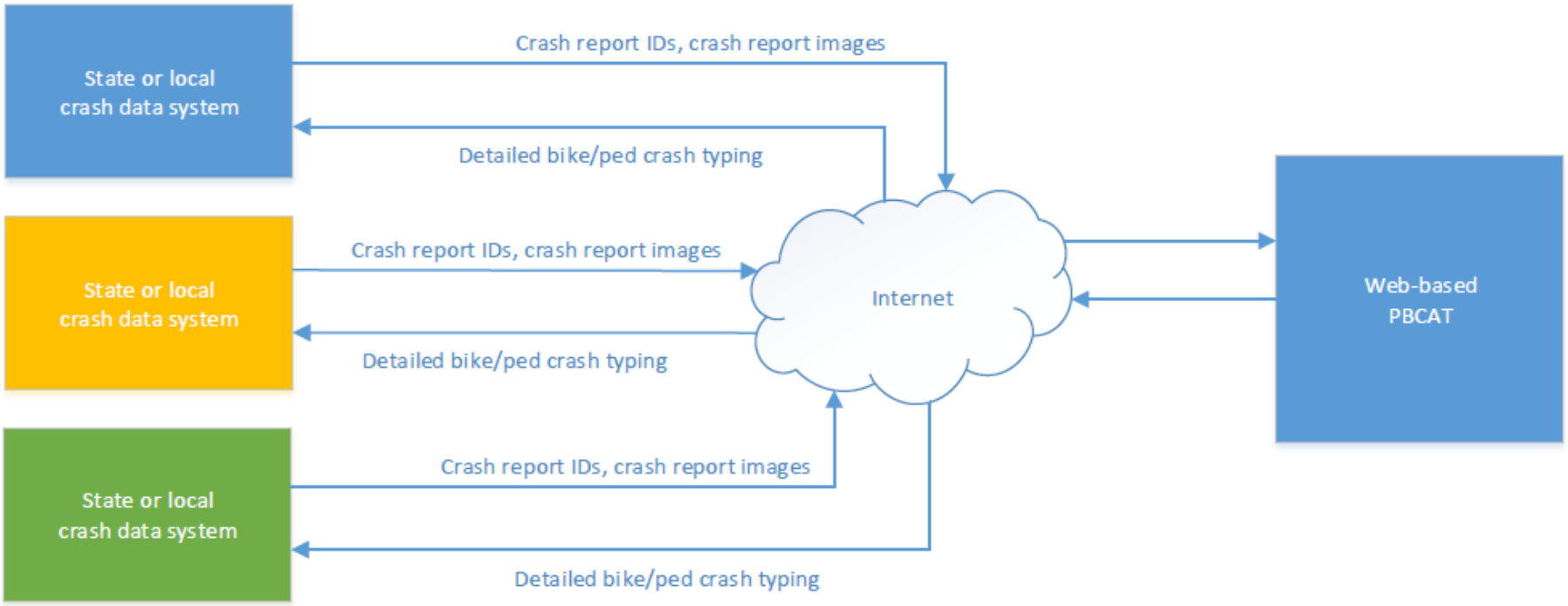
Live Demonstration of the Web-based PBCAT

Advantages of the Web-based PBCAT

- Centralized Engine
  - Over 350 crash types
  - Complex paths to get to the crash type
  - A single server-based engine to compute the crash type
  - Easier to update in one place, transparent to the user
- Web based client interface
  - Client crash typing interface linked to existing local crash database

Broader Applicability – PBCAT as Service

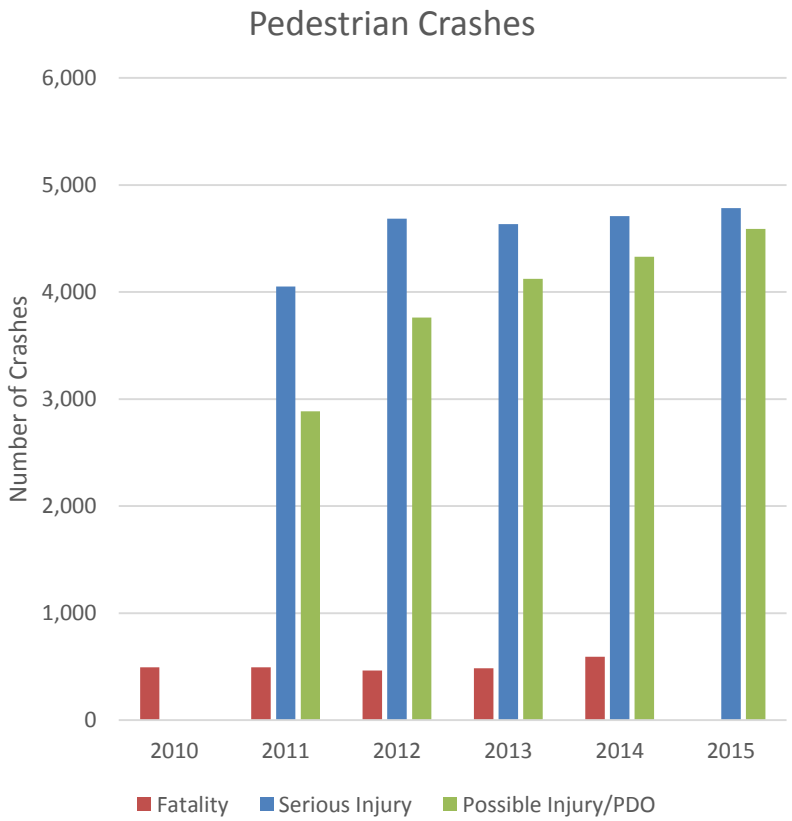
- Developed as a service, which can be plugged into other crash data systems
- Requires access to a list of crash record IDs and the individual crash reports
- Returns detailed bike/ped crash typing data elements

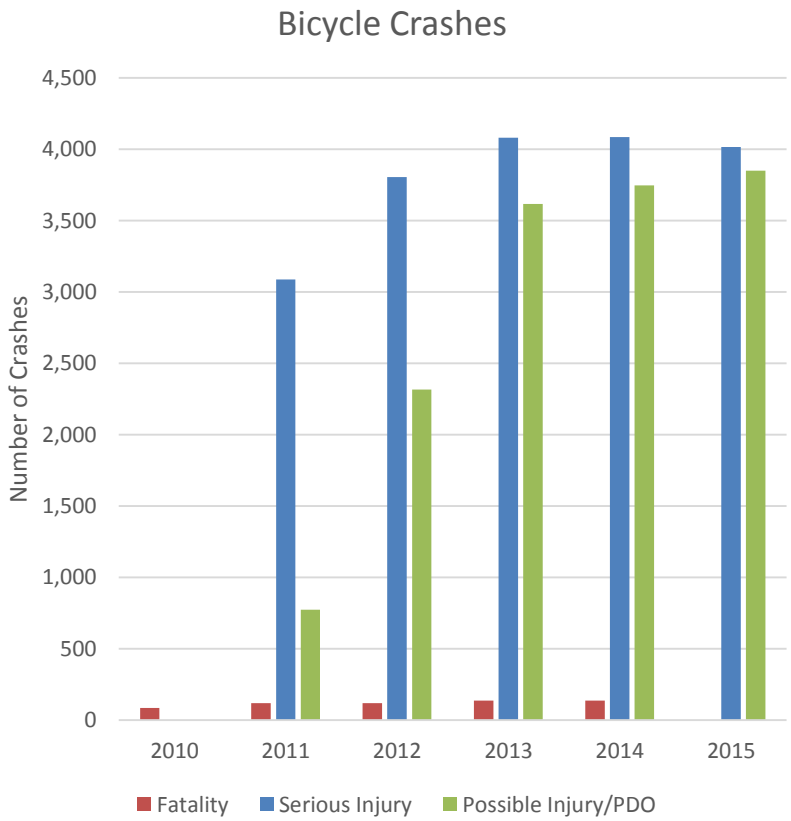


Crash Typing using the Web-based PBCAT in Signal Four Analytics

Achilleas Kourtellis, CUTR, University of South Florida
kourtellis@cutr.usf.edu

Typed Bicycle and Pedestrian Crashes





Pedestrian Serious Injury Crashes

CRASH GROUP	Count	%
Crossing Roadway - Vehicle Not Turning	6,803	30%
Dash/Dart-Out	3,057	13%
Unusual Circumstances	2,676	12%
Off Roadway	2,328	10%
Backing Vehicle	2,008	9%
Crossing Roadway - Vehicle Turning	1,507	7%
Walking Along Roadway	1,440	6%
Pedestrian in Roadway - Circumstances Unknown	1,334	6%
Crossing Driveway or Alley	386	2%
(blank)	339	1%
Multiple Threat/Trapped	251	1%
Other/Unknown - Insufficient Details	210	1%
Working or Playing in Roadway	206	1%
Bus-Related	145	1%
Unique Midblock	135	1%
Waiting to Cross	102	0%
Crossing Expressway	5	0%
Grand Total	22,932	100%

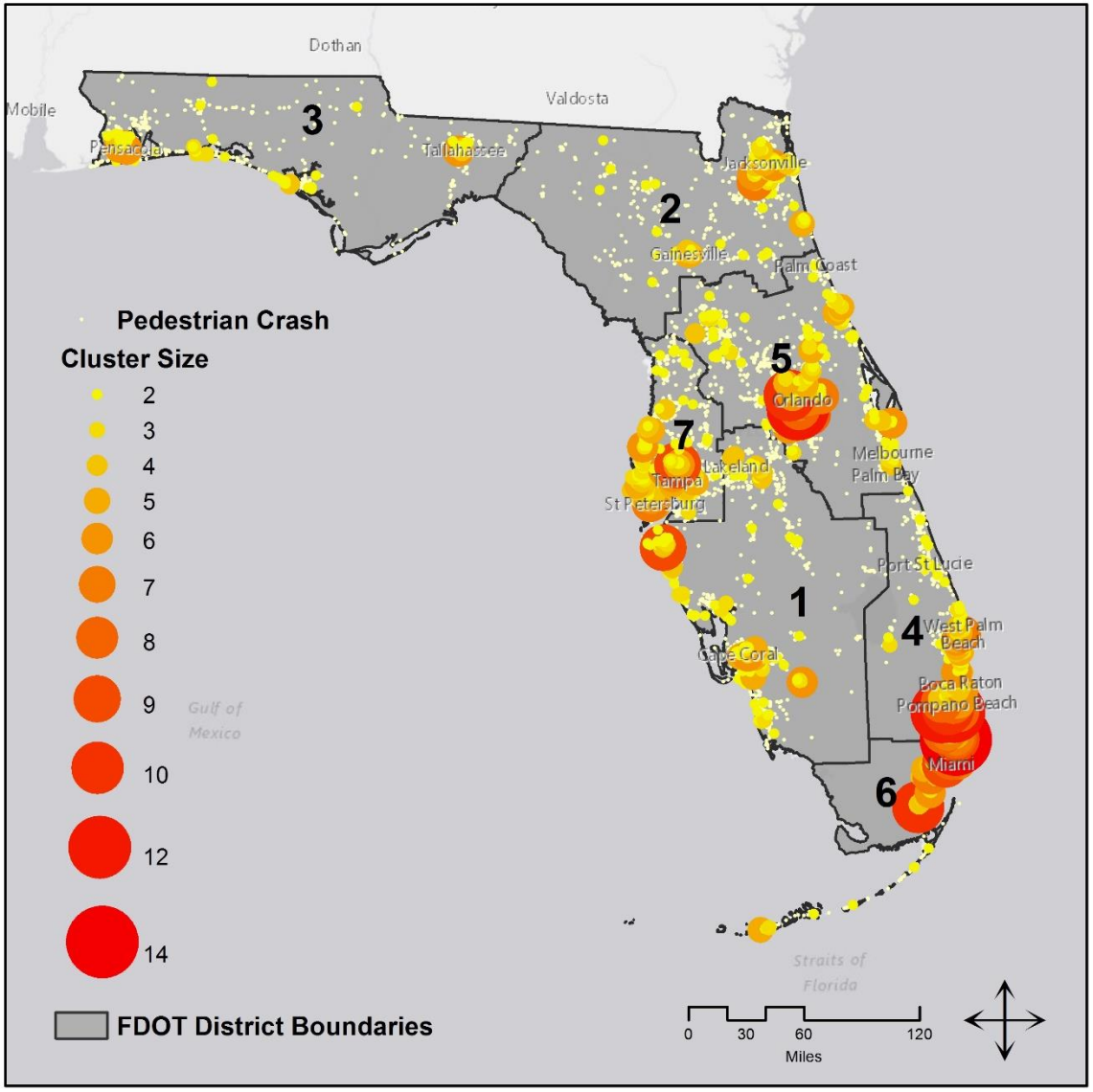
PEDESTRIAN POSITION	Count	%
On a roadway, in a travel lane	11,781	51%
Other non-roadway areas	4,136	18%
Within a crosswalk, marked or unmarked	4,015	18%
On a sidewalk, shared use path, or driveway crossing	727	3%
On a roadway, in a paved shoulder, bike lane, or parking lane	623	3%
On a driveway or alley	554	2%
Other road right-of-way	418	2%
(blank)	339	1%
Within intersection proper	182	1%
Other / unknown	157	1%
Grant Total	22,932	100%

CRASH LOCATION	Count	%
Non-Intersection Location	13,049	57%
Non-Roadway Location	4,723	21%
Intersection	3,718	16%
Intersection-Related	1,065	5%
(blank)	339	1%
Unknown/Insufficient Information	38	0%
Grand Total	22,932	100%

Pedestrian Serious Injury Crashes

PEDESTRIAN MOVEMENT	Count	%
Pedestrian within crosswalk area, traveled from motorist's right	635	21%
Pedestrian within crosswalk area, approached from opposite direction as motorist	515	17%
Pedestrian within crosswalk area, traveled from motorist's left	441	14%
Pedestrian within crosswalk area, approached from same direction as motorist	401	13%
Pedestrian outside crosswalk area, traveled from motorist's right	311	10%
Pedestrian outside crosswalk area, approach direction unknown	258	8%
Pedestrian outside crosswalk area, traveled from motorist's left	221	7%
Pedestrian within crosswalk area, approach direction unknown	167	5%
Pedestrian outside crosswalk area, approached from opposite direction as motorist	88	3%
Pedestrian outside crosswalk area, approached from same direction as motorist	49	2%
Grand Total	3,086	100%

Pedestrian Crash Cluster Map



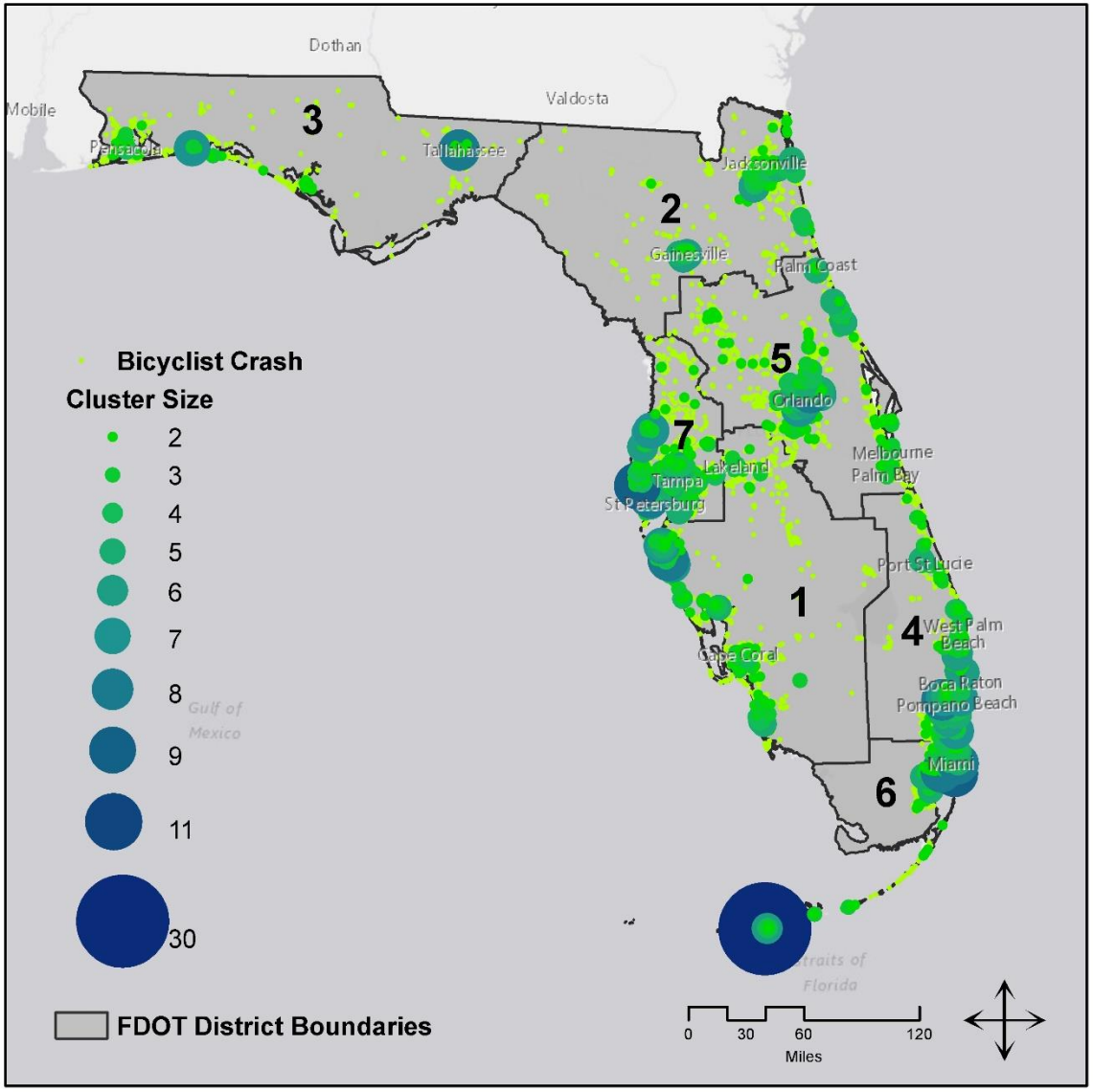
Bicycle Serious Injury Crashes

CRASH GROUP	Count	%
Motorist Failed to Yield - Sign-Controlled Intersect.	2,740	14%
Motorist Failed to Yield - Midblock	2,299	12%
Motorist Overtaking Bicyclist	1,662	9%
Bicyclist Failed to Yield - Signalized Intersection	1,533	8%
Bicyclist Failed to Yield - Midblock	1,284	7%
Motorist Left Turn/Merge	1,279	7%
Crossing Paths - Other Circumstances	1,264	7%
Motorist Failed to Yield - Signalized Intersection	1,195	6%
Motorist Right Turn/Merge	1,174	6%
Bicyclist Failed to Yield - Sign-Controlled Intersect.	1,080	6%
Loss of Control/Turning Error	798	4%
Parallel Paths - Other Circumstances	584	3%
Bicyclist Left Turn/Merge	515	3%
Non-roadway	404	2%
Head-On	285	1%
Bicyclist Overtaking Motorist	248	1%
Other/Unusual Circumstances	235	1%
Other/Unknown - Insufficient Details	152	1%
Backing Vehicle	149	1%
Bicyclist Right Turn/Merge	92	0%
(blank)	85	0%
Parking/Bus-Related	17	0%
Grand Total	19,074	100%

CRASH LOCATION	Count	%
Intersection	10,109	53%
Non-Intersection Location	7,947	42%
Intersection-Related	491	3%
Non-Roadway Location	404	2%
Unknown/Insufficient Information	38	0%
(blank)	85	0%
Grand Total	19,074	100%

BICYCLIST POSITION	Count	%
On a sidewalk, crosswalk, or driveway crossing	9,638	51%
On a roadway, in a shared travel lane	5,676	30%
On a roadway, in a bicycle lane or on a paved shoulder	2,349	12%
Other non-roadway areas	486	3%
Other	302	2%
On a driveway or alley	256	1%
Unknown	166	1%
(blank)	123	1%
On a separate bicycle/multi-use path	78	0%
Grand Total	19,074	100%

Bicycle Crash Cluster Map



MetroPlan Orlando Crash Typing Analysis and Application

Mighk Wilson
MWilson@metroplanorlando.org

All Pedestrian Injury Crashes

12%

Pedestrian Fatalities

44%

Increase:
2011-13 to 2015-17

Pedestrian Mid-Block Failure to Yield

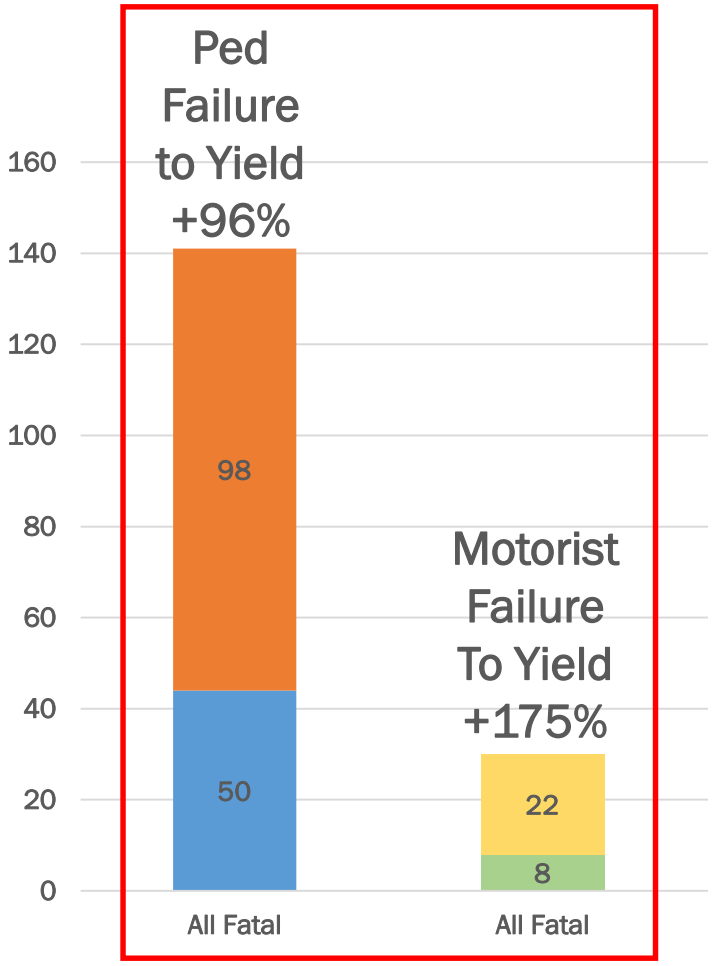
13%

Motorist Failure to Yield

60%

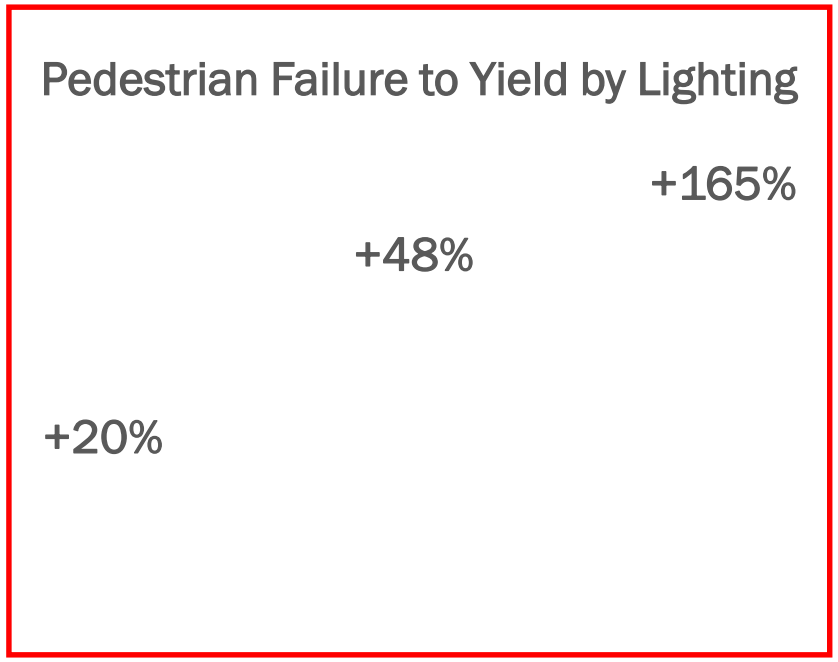
Increase:
2011-13 to 2015-17

Pedestrian Fatalities

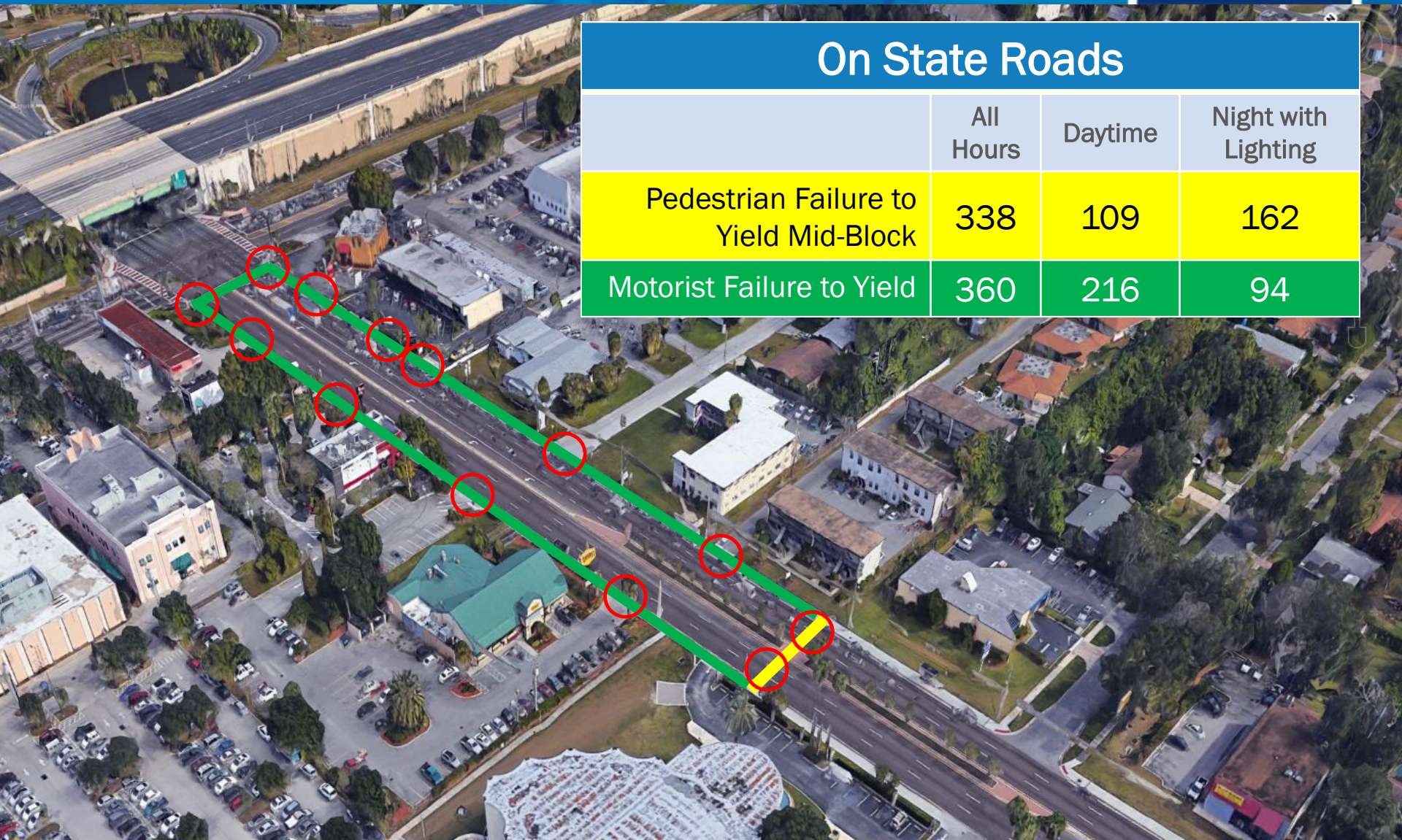


Fatal Crashes: Pedestrian Failure to Yield Mid-Block Versus Motorist Failure to Yield at Intersection or Driveway

Overall Fatality Increase: 44%

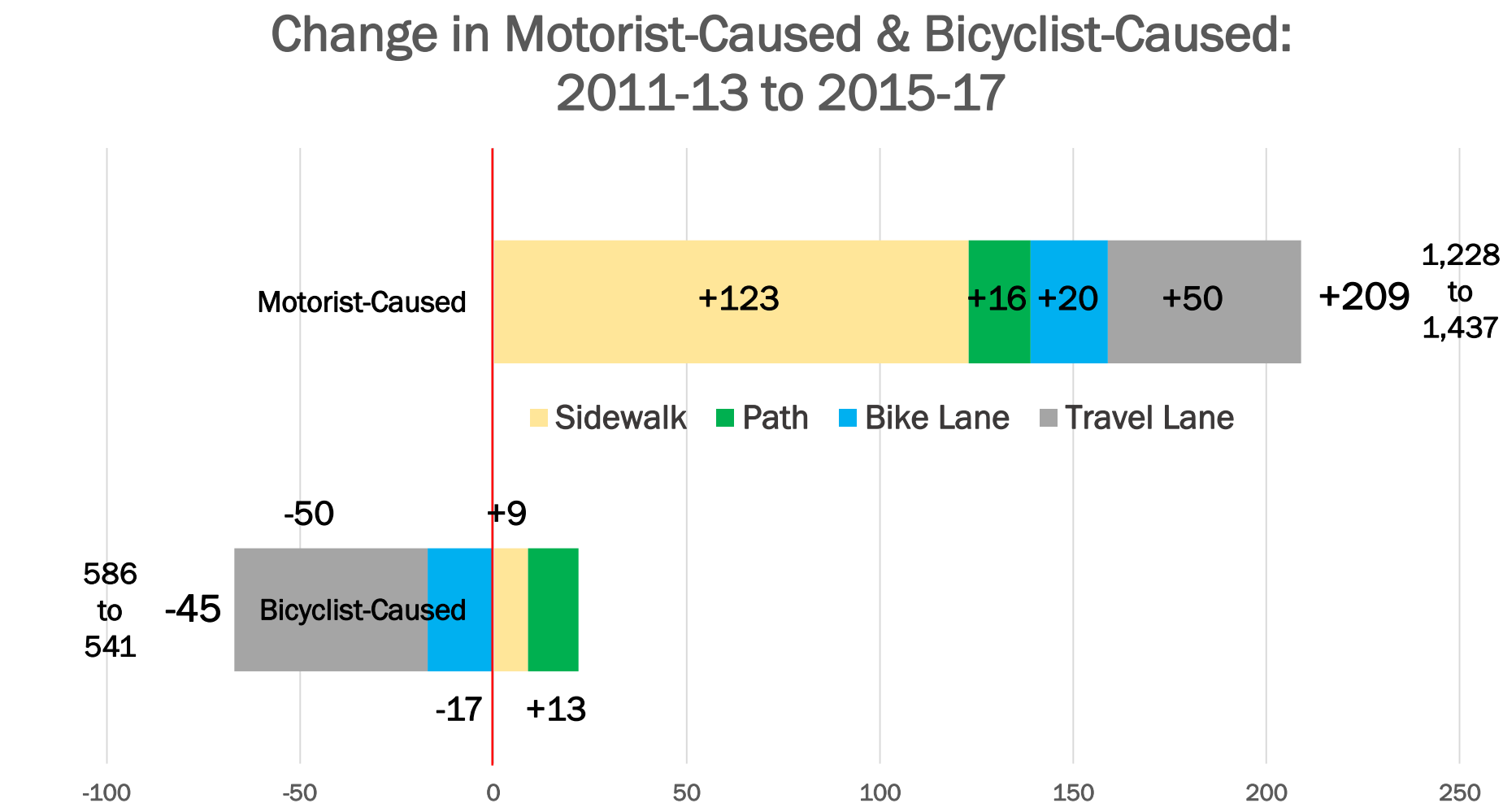


Which is Safer?



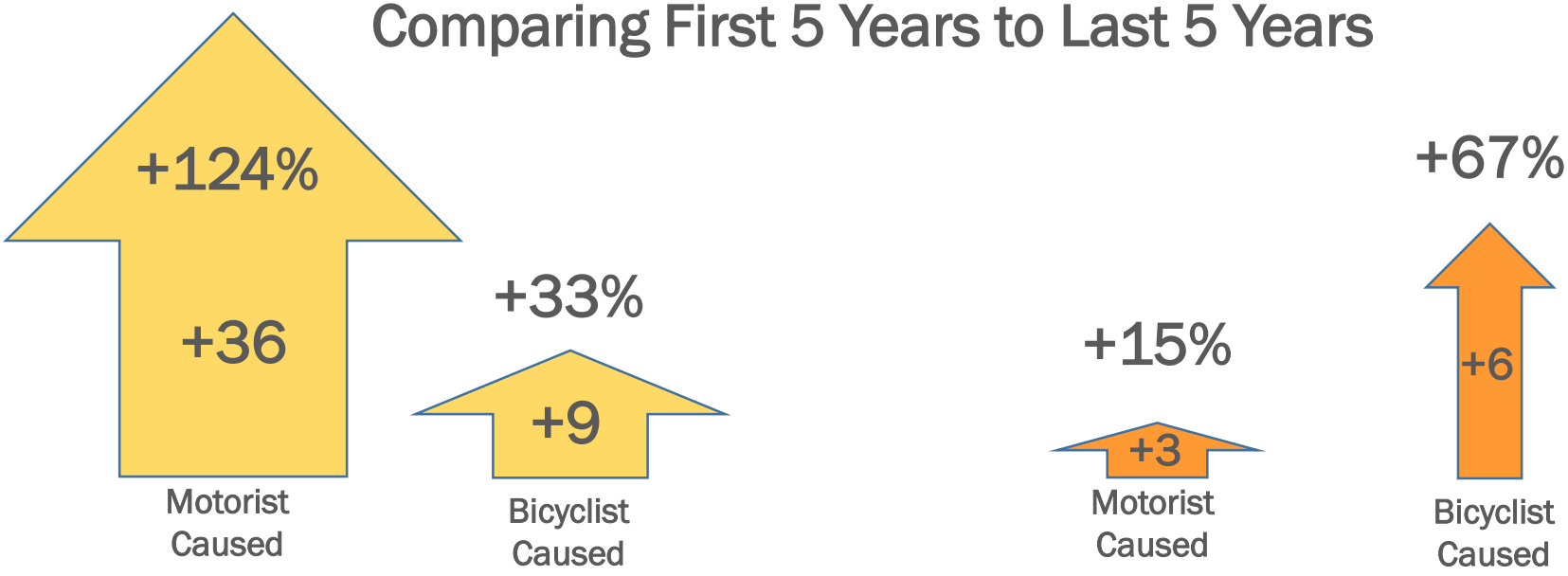
On State Roads			
	All Hours	Daytime	Night with Lighting
Pedestrian Failure to Yield Mid-Block	338	109	162
Motorist Failure to Yield	360	216	94

Bicyclist Trends



Safety In Numbers?

10 Years of Crash Data (2007 to 2016)
70 Miles of Roads With Bike Lanes
67 Miles of Comparable Roads Without Bike Lanes
Comparing First 5 Years to Last 5 Years



Safety In Numbers?

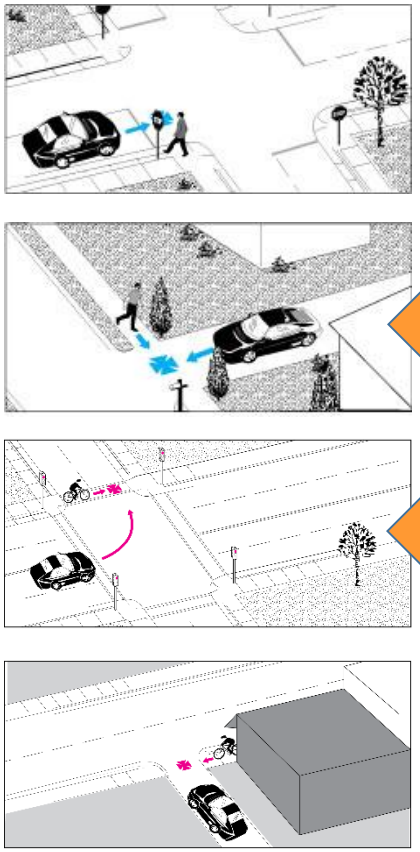
Comparison: 10 Years of Crash Data (2007 to 2016)
70 Miles of Roads With Bike Lanes
67 Miles of Comparable Roads Without Bike Lanes

% Change by Type (First 5 Years to Last 5 Years)				
Key Crash Types	Cyclist in Bike Lane		Cyclist in Travel Lane	
	Number Change	% Change	Number Change	% Change
Overtaking Motorist	7 to 8	+120%	10 to 12	-10%
Drive-Out	18 to 47		11 to 7	
Right Hook				
Left Cross				
Wrong-Way Cyclist	20 to 28	40%	4 to 15	275%

Safety Action Plans

Crash Types		Crash Countermeasures
~~Engineering~~		Design
~~Education~~		Behavioral
~~Enforcement~~		Control

Safety Action Plans

Crash Types	Critical Success Factor Types	Countermeasure Types
	Visibility Predictability Conflicts Speed	Behavioral Changes Design Changes Control Changes

Thank You

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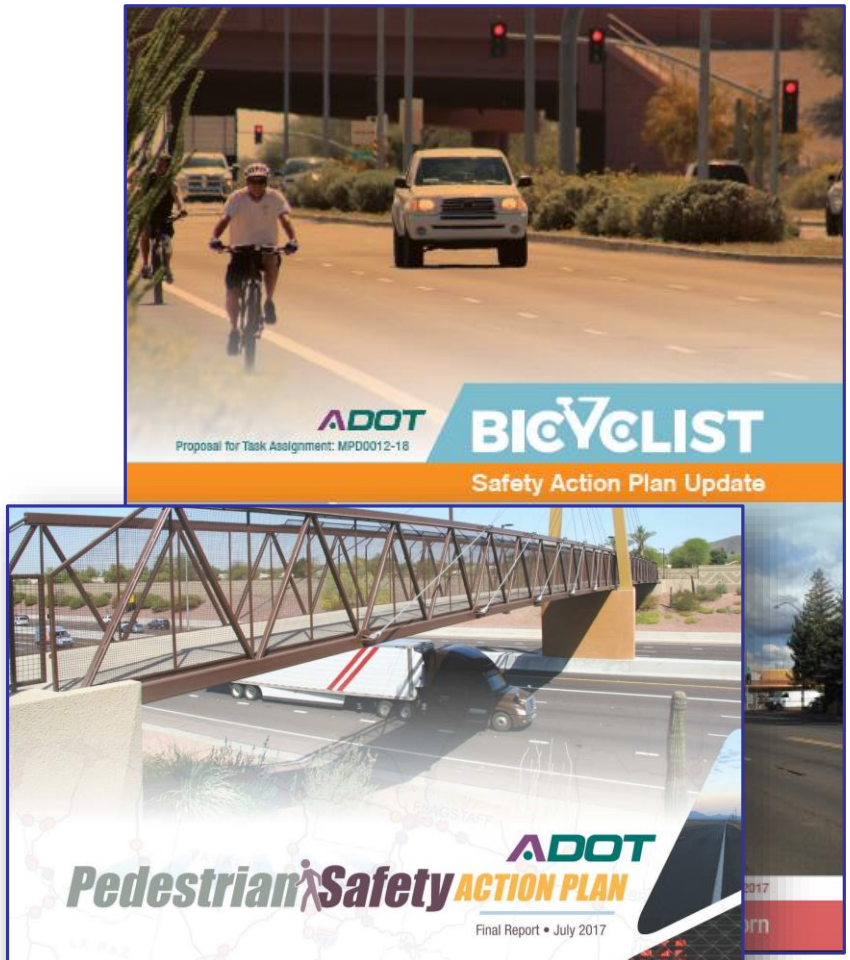
Mighk Wilson(Metroplan): MWilson@metroplanorlando.org

ADOT PEDESTRIAN AND BICYCLE SAFETY ACTION PLANS



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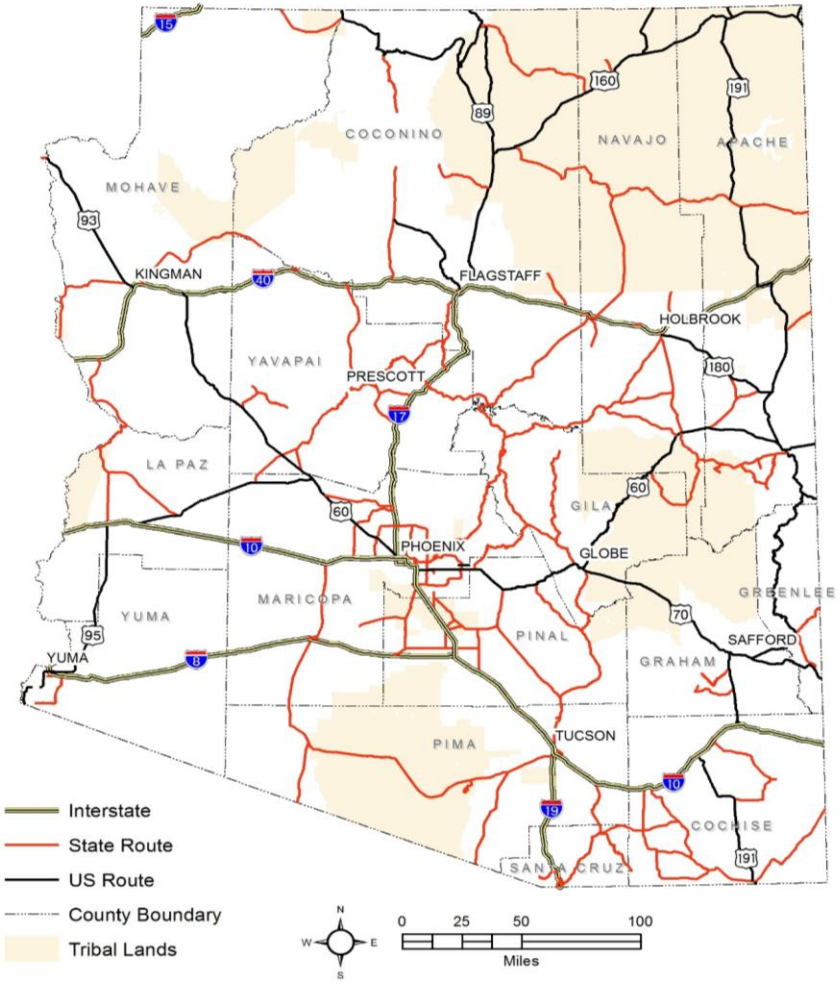
Pedestrian and Bicycle Safety Action Plans



EVALUATE…

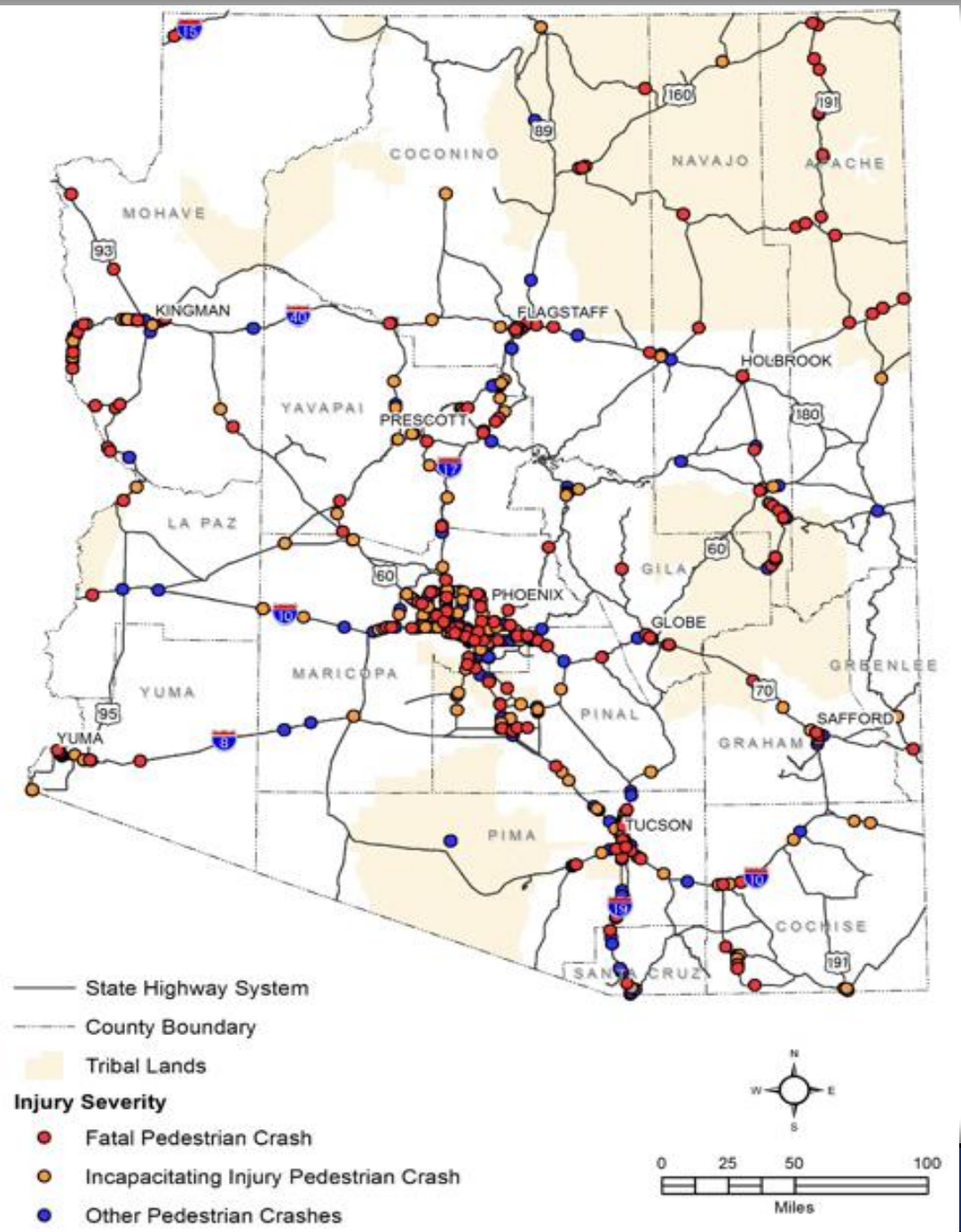
effectiveness of ADOT efforts to reduce the frequency of pedestrian and bicycle crashes with motor vehicles.

ANALYZE…

State Highway System (SHS) pedestrian and bicycle crash data (5-year periods).

IDENTIFY…

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



Crashes on State Highway System

- **824 pedestrian** and **778 bicycle** related crashes on SHS (5-year period)
- Represents **10.7 %** of state-wide pedestrian related crashes (7,633 crashes), **8.8%** of total state-wide bicycle related crashes

Detailed Analysis of Pedestrian and Bicycle Crash Data

- Pedestrian Safety Action Plan (PSAP), 2009
- *PSAP Update, 2017*
- *Bicycle Safety Action Plan (BSAP), 2012*
- *BSAP Update, 2018*

Detailed Analysis of Pedestrian and Bicycle Crash Data

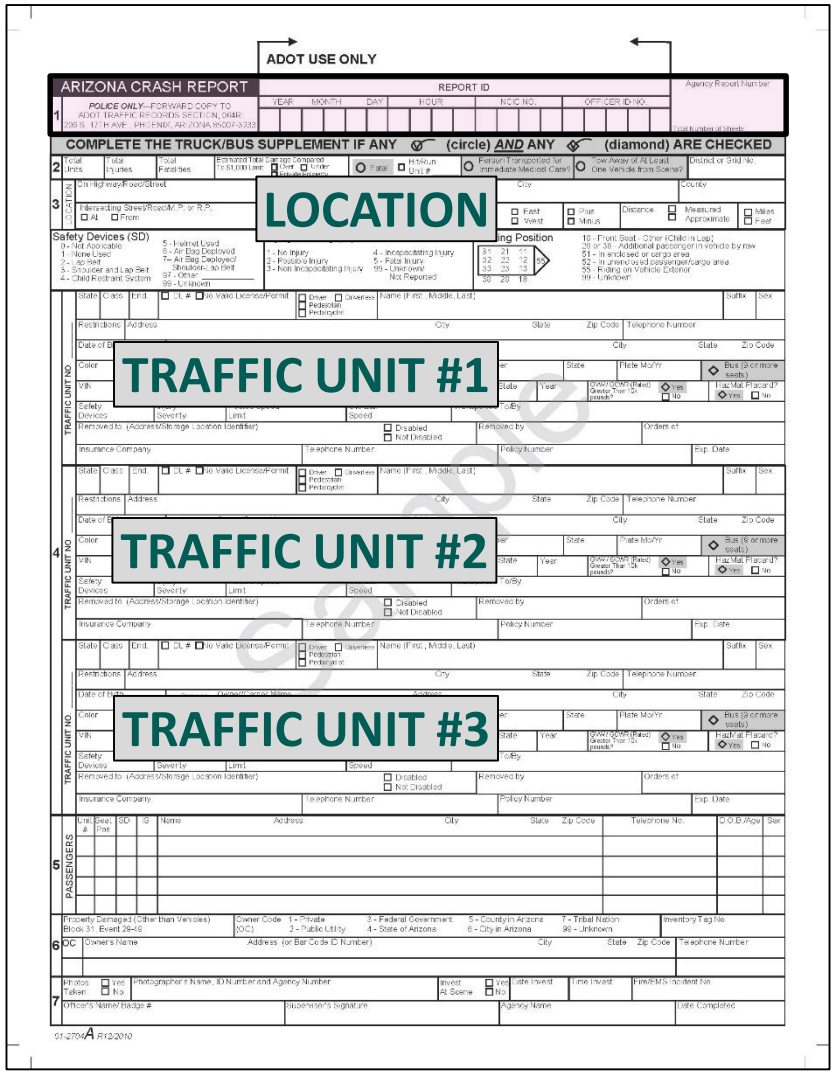
THE PROCESS:

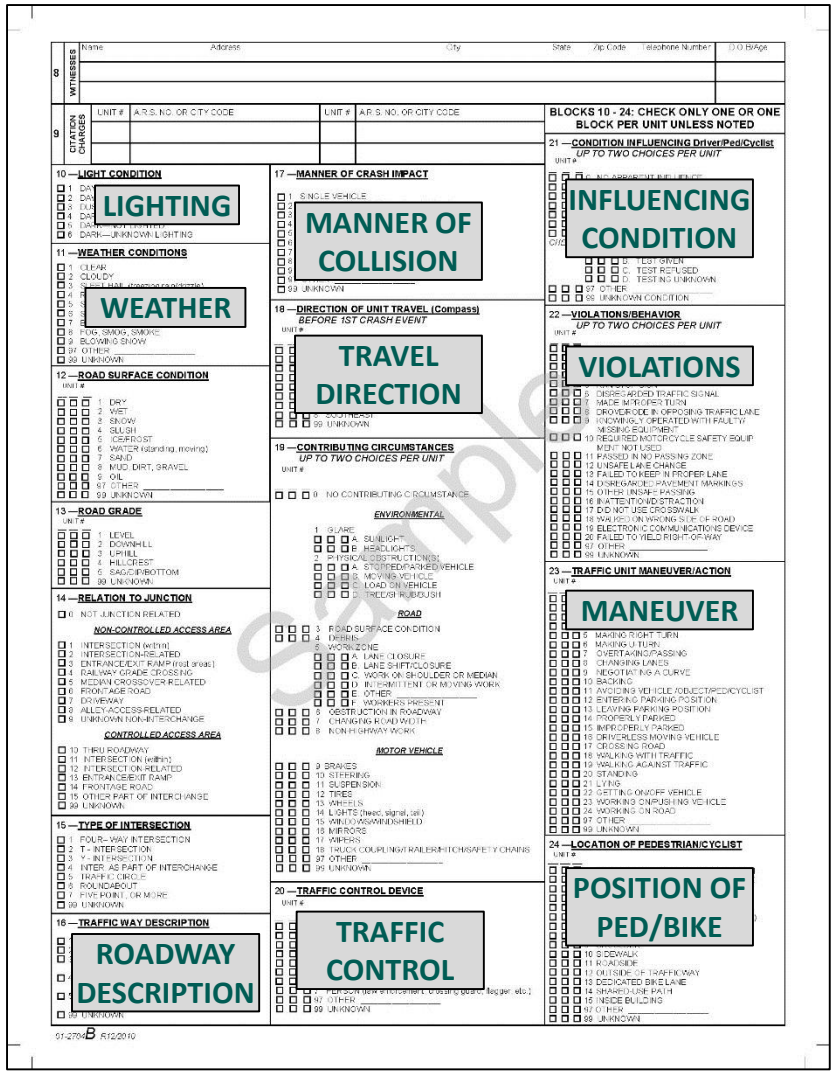
1. **Obtain** pedestrian crash reports
2. **Enter data** into PBCAT – used to crash type each SHS crash
3. **Identify:**
   - Hot spot locations
   - High risk locations

     Examples: five-lane roadway, 45 mph + , urbanizing / suburban locations

www.pedbikeinfo.org/pbcat_us/

Arizona Crash Report Form





SUPPLEMENTAL GUIDANCE DOCUMENT

CREATED INTERNALLY, FOR DATA ENTRY CONSISTENCY

- Excluding crash records
- Location of data on crash report form
- Roadway type and coding based on position of bicyclist

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ARIZONA BICYCLE SAFETY ACTION PLAN

DATA ENTRY GUIDE

The purpose of this document is to serve as a guide for data entry associated with the ADOT Arizona Bicyclist Safety Action Plan Update. The Bicyclist Data Entry Form was created by Kimley-Horn for the purposes of this project. The Data Entry Form, https://extsites.kimley-horn.com/BSAP2018/, requires a unique username and password for each user. A significant amount of the data for each crash has been pre-filled from tabular data, but this data should be confirmed by the person responsible for the data entry, and changes to the pre-filled data should be made, where appropriate.

We anticipate a small percentage of crashes to be miscoded, that do not belong in this dataset. In these cases, enter all data and make a note in the 'Data Manifest' spreadsheet that it should be excluded for one of the following reasons:

- Officer coding error – indicates one of the units as a "pedacyclist", while both units were motor vehicles
- Officer coding error – indicates one of the units as a "pedacyclist", when the unit was a pedestrian (code as a pedestrian if the person was *walking* their bike)
- Crashes not related to the state highway system – the system pulls all crashes within 500 feet of the state highway system, regardless of context to the highway. Several examples that should be excluded include:
  A. Neighborhood street behind highway
  B. Overpass road (without connection to highway)

- Crashes located more than 500 feet from the state highway/ramp
- Crashes located less than 500 feet from the state highway/ramp, but otherwise unrelated

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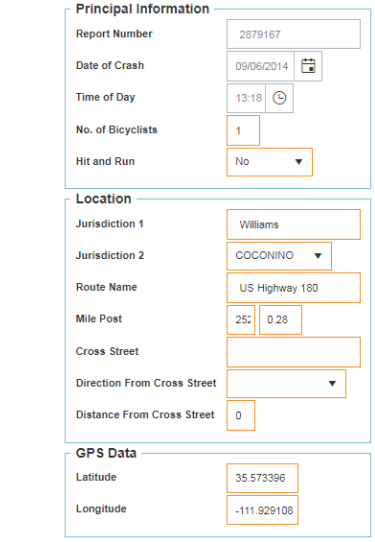
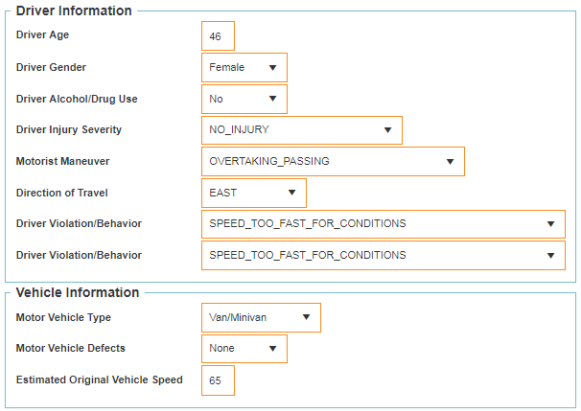
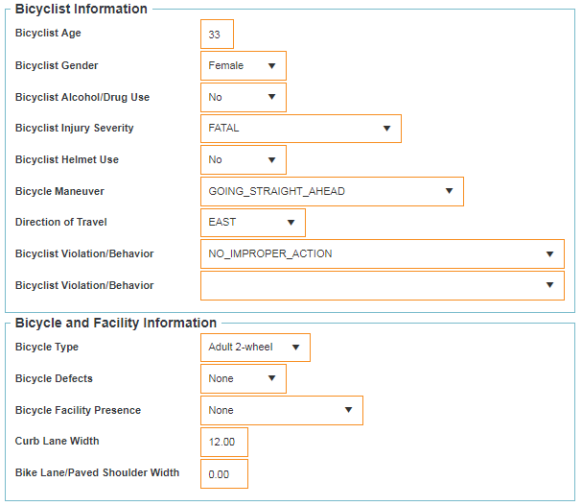
OVERVIEW OF WEB-BASED PBCAT TOOL

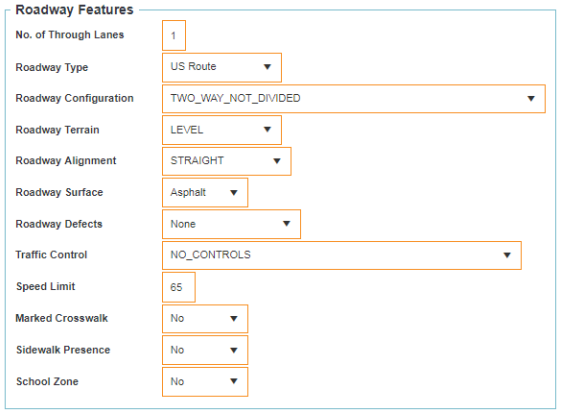
BICYCLIST Safety Action Plan Update

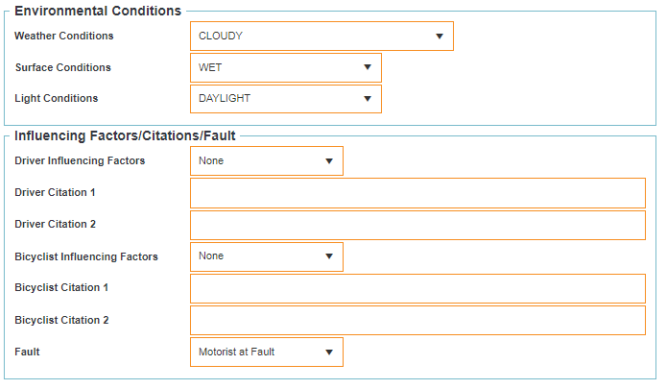
- *DEVELOPED BY* Kimley»Horn

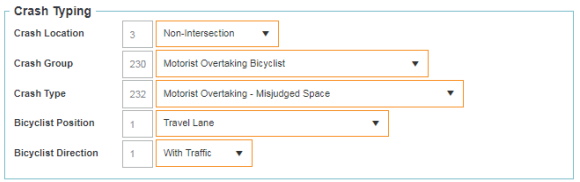






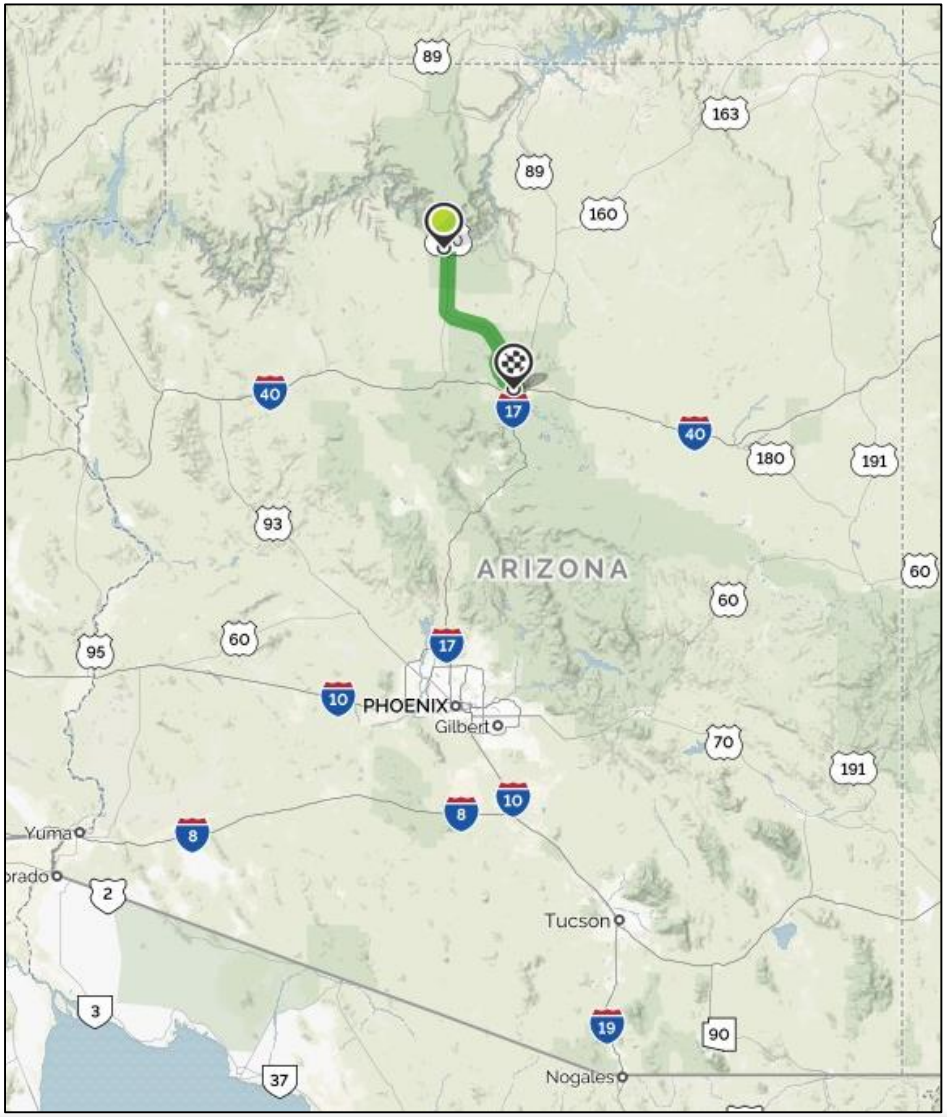






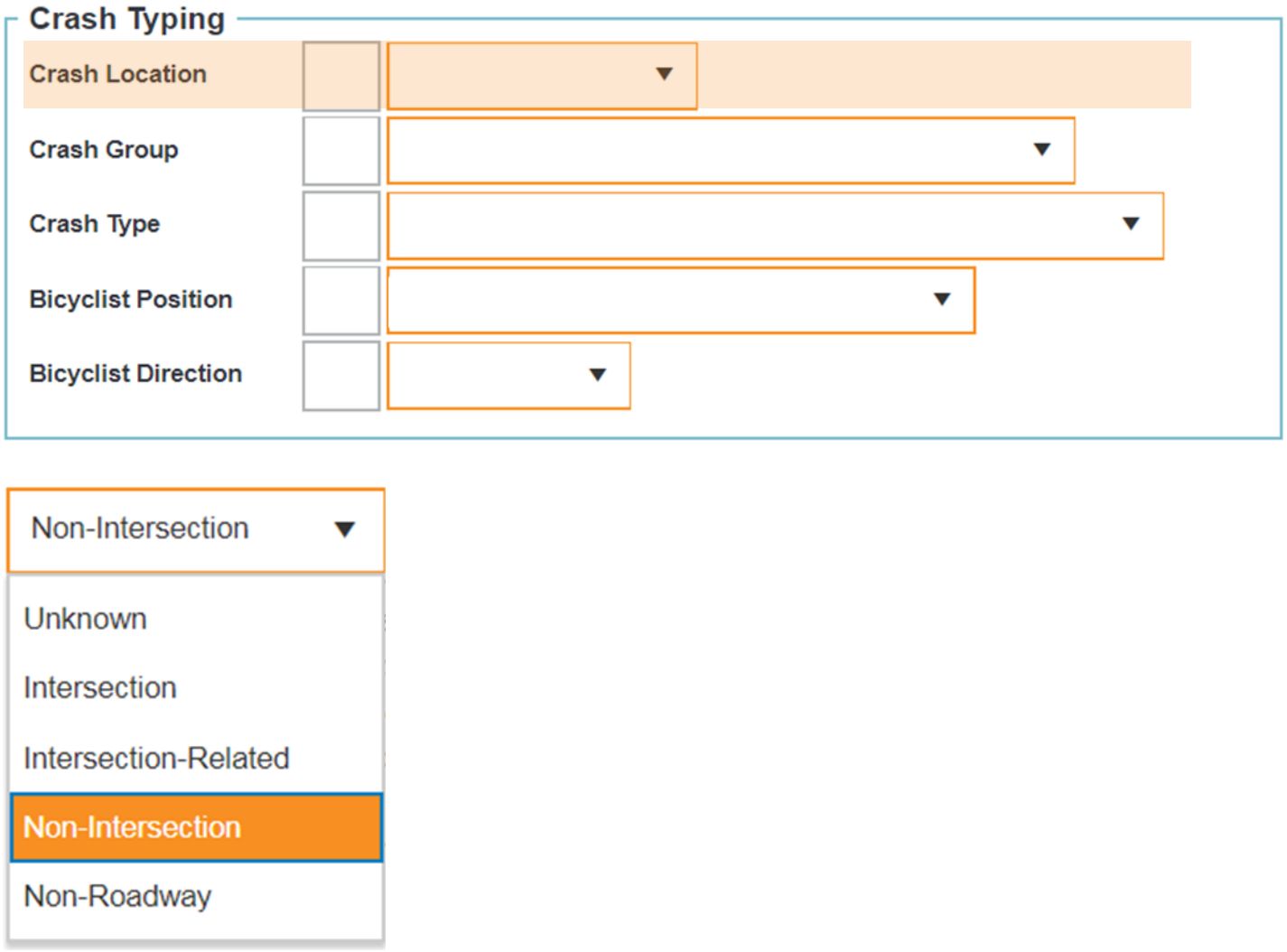
PBCAT TOOL CRASH TYPING

CASE STUDY 1

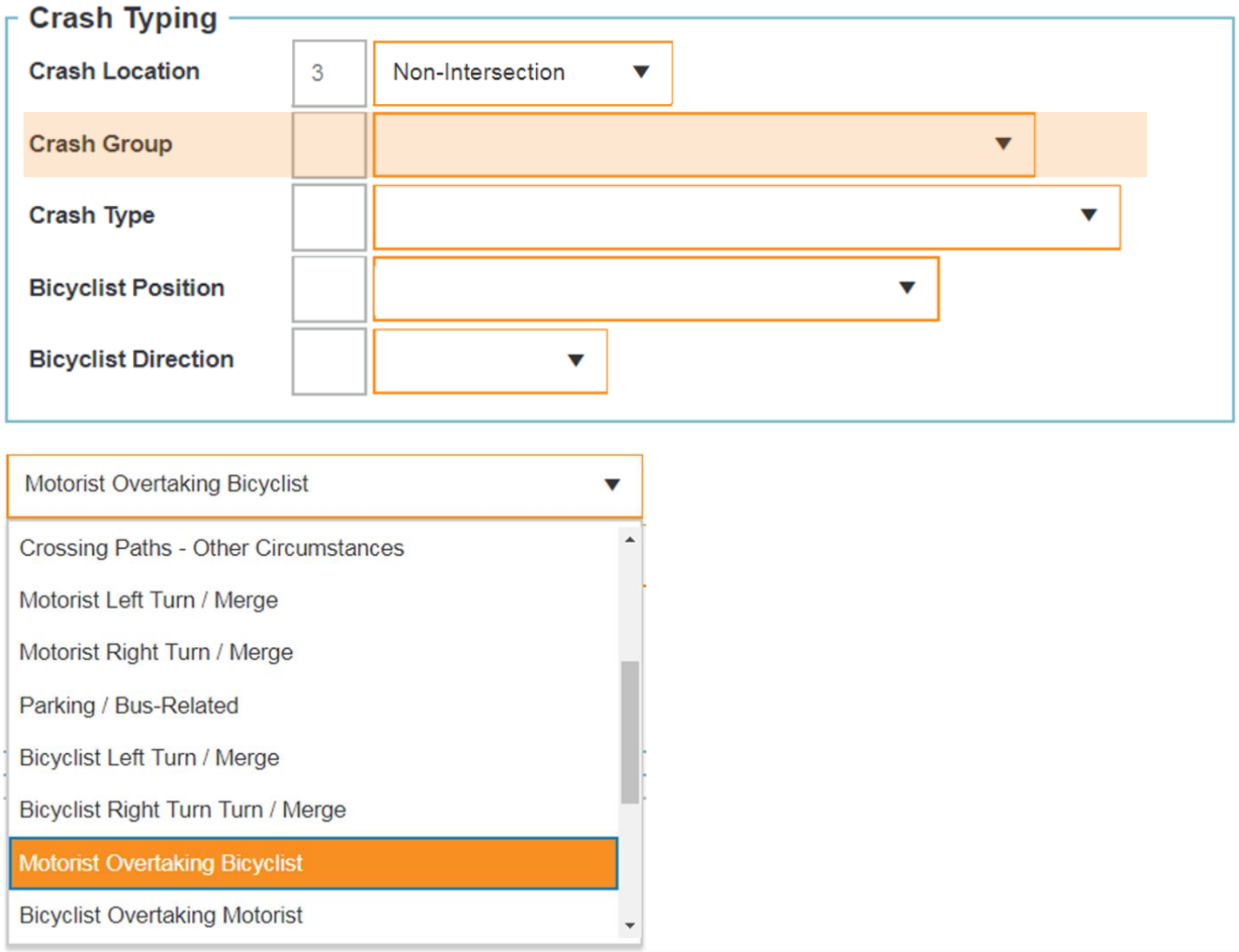


PBCAT TOOL CRASH TYPING

PBCAT TOOL CRASH TYPING



PBCAT TOOL CRASH TYPING

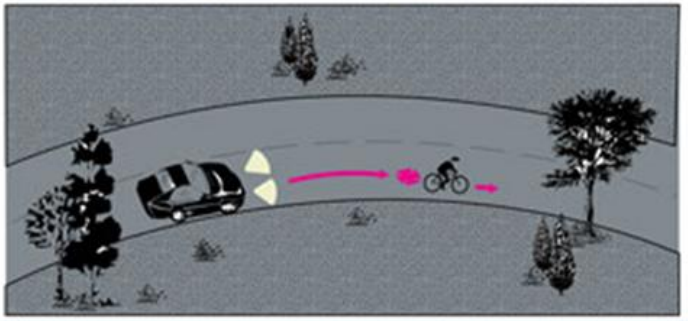


PBCAT TOOL CRASH TYPING

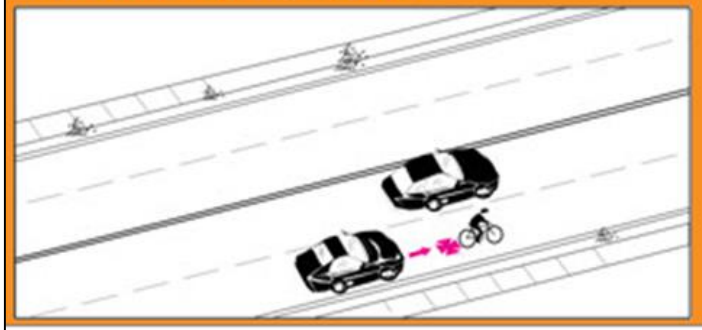
Crash Typing

Crash Location	3	Non-Intersection
Crash Group	230	Motorist Overtaking Bicyclist
Crash Type		
Bicyclist Position		
Bicyclist Direction		

Motorist Overtaking - Undetected Bicyclist



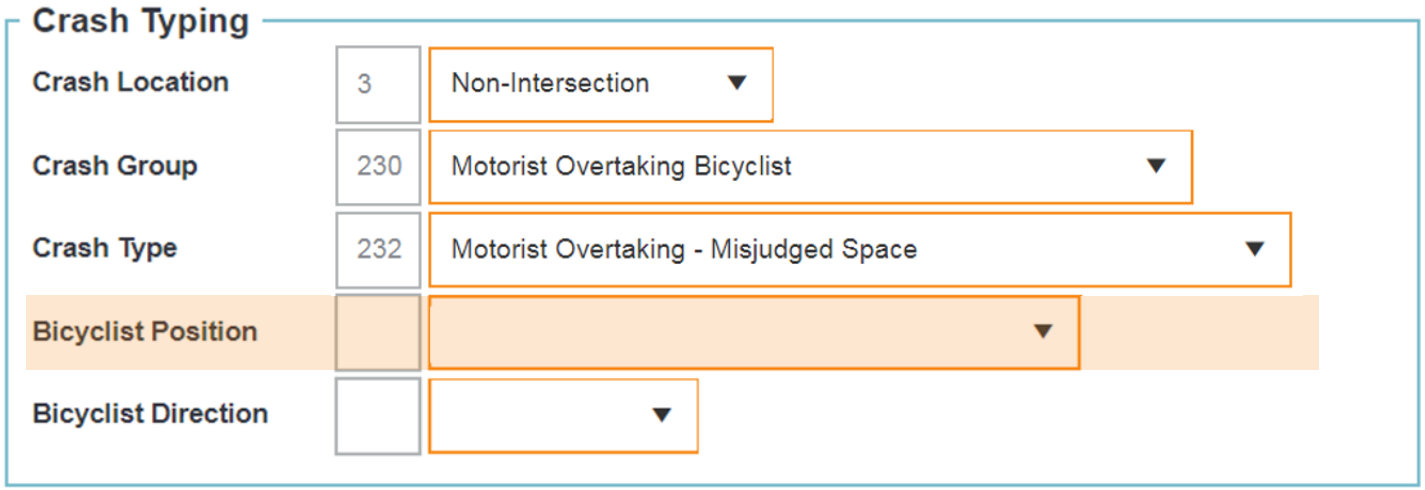
Motorist Overtaking - Misjudged Space

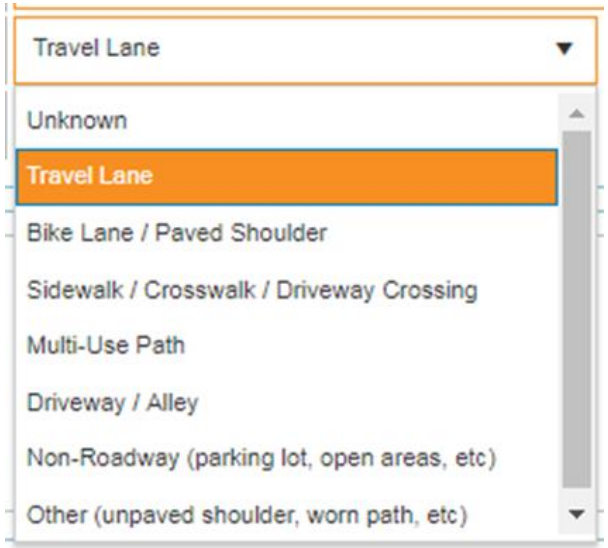


Motorist Overtaking - Bicyclist Swerved

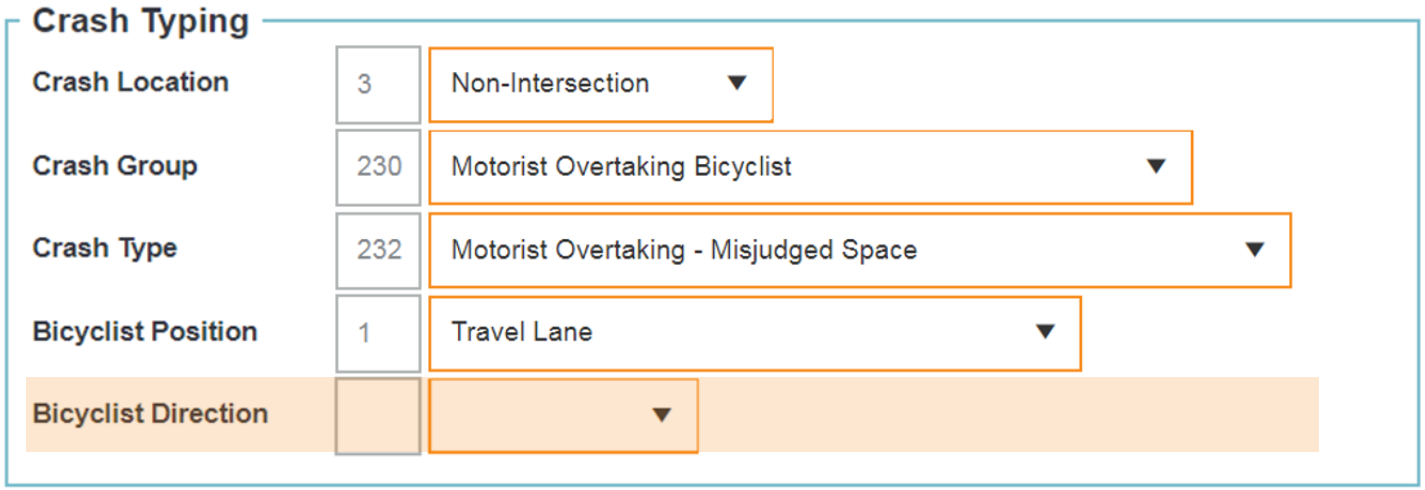
Motorist Overtaking - Other/ Unknown

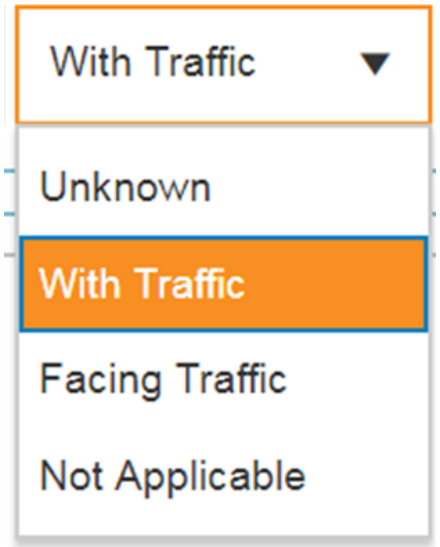
PBCAT TOOL CRASH TYPING





PBCAT TOOL CRASH TYPING





PBCAT TOOL CRASH TYPING - LOCATION

Crash_Location_Desc (Crash Location)	Crash_Location (Crash Location)	Definition
		Where did the crash occur?
Intersection	1	Intersection—The crash occurred within the intersection proper or within the crosswalk area. **Note: Driveways are considered to be nonintersection locations. The exception is signalized commercial driveways which should be coded as intersections.**
Intersection-Related	2	Intersection-Related—The crash occurred outside the intersection proper or crosswalk area but was the related to the presence of the intersection (e.g., the result of queueing traffic).
Nonintersection	3	Nonintersection Location—The crash occurred outside the intersection proper or crosswalk area and was **not** related to the presence of any intersection.
Nonroadway	4	Nonroadway Location—The crash occurred off the street network; this includes parking lots, driveways, alleys, and other open areas. **Note: crashes occurring on paved shoulders, sidewalks, or driveway crossings are considered to be "roadway" crashes and should not be placed in the nonroadway classification.**
Unknown Location	9	Unknown/Insufficient Information—There is insufficient information to determine where the crash occurred.
		Bicyclist Position Definitions
Bicyclist_Position_Desc (Bicyclist Position)	**Bicyclist_Position (Bicyclist Position)**	**Definition**
Travel Lane	1	On a roadway, in a shared travel lane
Bike Lane/Paved Shoulder	2	On a roadway, in a bicycle lane or on a paved shoulder
Sidewalk/Crosswalk/Driveway Crossing	3	On a sidewalk, crosswalk, or driveway crossing
Driveway/Alley	4	On a separate bicycle/multi-use path
Multi-use Path	5	On a driveway or alley
Nonroadway	6	Other nonroadway areas (parking lot, open areas, etc.)
Other	8	Other (e.g., unpaved shoulder, worn path, etc.)
Unknown	9	Unknown

PBCAT TOOL CRASH TYPING - CRASH GROUP

Crash_Group_Basic (Crash Group Number)	Crash_Group_Desc (Crash Group Description)
110	Loss of Control/Turning Error
140	Motorist Failed to Yield—Sign-Controlled Intersection
145	Bicyclist Failed to Yield—Sign-Controlled Intersection
150	Motorist Failed to Yield—Signalized Intersection
158	Bicyclist Failed to Yield—Signalized Intersection
190	Crossing Paths—Other Circumstances
210	Motorist Left Turn/Merge
215	Motorist Right Turn/Merge
219	Parking/Bus-Related
220	Bicyclist Left Turn/Merge

Crash_Group_Basic (Crash Group Number)	Crash_Group_Desc (Crash Group Description)
225	Bicyclist Right Turn/Merge
230	Motorist Overtaking Bicyclist
240	Bicyclist Overtaking Motorist
258	Head-On
290	Parallel Paths—Other Circumstances
310	Bicyclist Failed to Yield—Midblock
320	Motorist Failed to Yield—Midblock
600	Backing Vehicle
850	Other/Unusual Circumstances
910	Nonroadway
990	Other/Unknown—Insufficient Details

PBCAT TOOL CRASH TYPING - CRASH TYPE

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
216	Bus/Delivery Vehicle Pullover
217	Motorist Right Turn on Red—Same Direction
218	Motorist Right Turn on Red—Opposite Direction
219	Motorist Turn/Merge—Other/Unknown
221	Bicyclist Left Turn—Same Direction
222	Bicyclist Left Turn—Opposite Direction
223	Bicyclist Right Turn—Same Direction
224	Bicyclist Right Turn—Opposite Direction
225	Bicyclist Ride-out—Parallel Path
231	Motorist Overtaking—Undetected Bicyclist
232	Motorist Overtaking—Misjudged Space
235	Motorist Overtaking—Bicyclist Swerved
239	Motorist Overtaking—Other/Unknown

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
111	Motorist Turning Error—Left Turn
112	Motorist Turning Error—Right Turn
113	Motorist Turning Error—Other
114	Bicyclist Turning Error—Left Turn
115	Bicyclist Turning Error—Right Turn
116	Bicyclist Turning Error—Other
121	Bicyclist Lost Control—Mechanical Problems
122	Bicyclist Lost Control—Oversteering, Improper Braking, Speed
123	Bicylist Lost Control—Alcohol/Drug Impairment
124	Bicyclist Lost Control—Surface Conditions
129	Bicyclist Lost Control—Other/Unknown
131	Motorist Lost Control—Mechanical Problems
132	Motorist Lost Control—Oversteering, Improper Braking, Speed

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
133	Motorist Lost Control—Alcohol/Drug Impairment
134	Motorist Lost Control—Surface Conditions
139	Motorist Lost Control—Other/Unknown
141	Motorist Drive-out Sign-Controlled Intersection
142	Bicyclist Ride-out—Sign-Controlled Intersection
143	Motorist Drive-through—Sign-Controlled Intersection
144	Bicyclist Ride Through Sign-Controlled Intersection
147	Multiple Threat—Sign-Controlled Intersection
148	Sign-Controlled Intersection—Other/Unknown
151	Motorist Drive-out—Right Turn on Red
152	Motorist Drive-out—Signalized Intersection
153	Bicyclist Ride-out—Signalized Intersection
154	Motorist Drive-through—Signalized Intersection

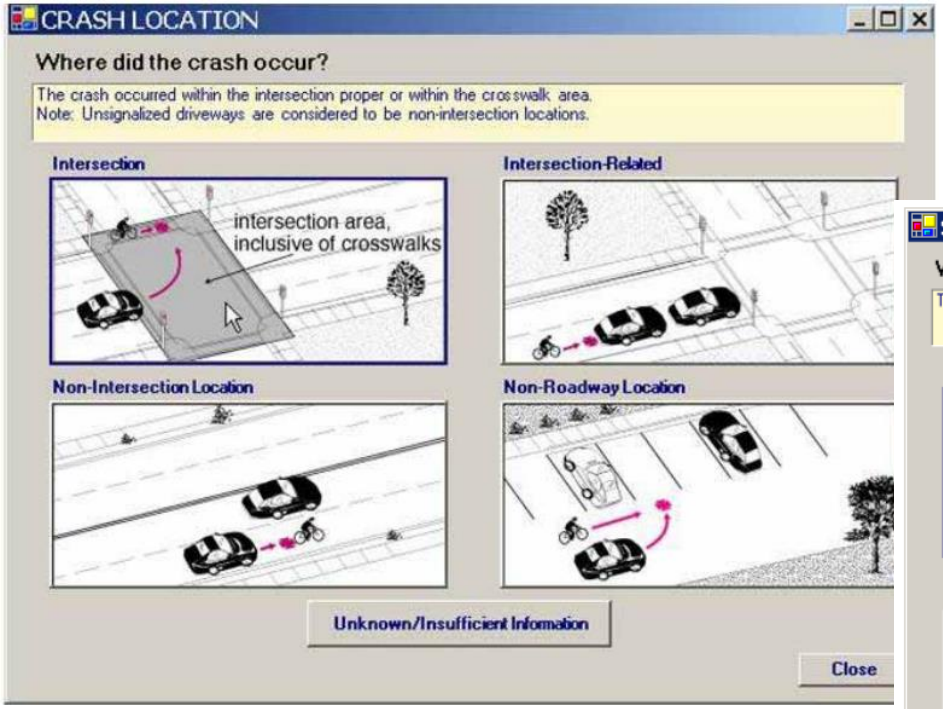
Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
155	Bicyclist Ride Through—Signalized Intersection
156	Bicyclist Failed to Clear—Trapped
157	Bicyclist Failed to Clear—Multiple Threat
158	Signalized Intersection—Other/Unknown
159	Bicyclist Failed to Clear—Unknown
160	Crossing Paths—Uncontrolled Intersection
180	Crossing Paths—Intersection—Other/Unknown
211	Motorist Left Turn—Same Direction
212	Motorist Left Turn—Opposite Direction
213	Motorist Right Turn—Same Direction
214	Motorist Right Turn—Opposite Direction
215	Motorist Drive-in/Out—Parking

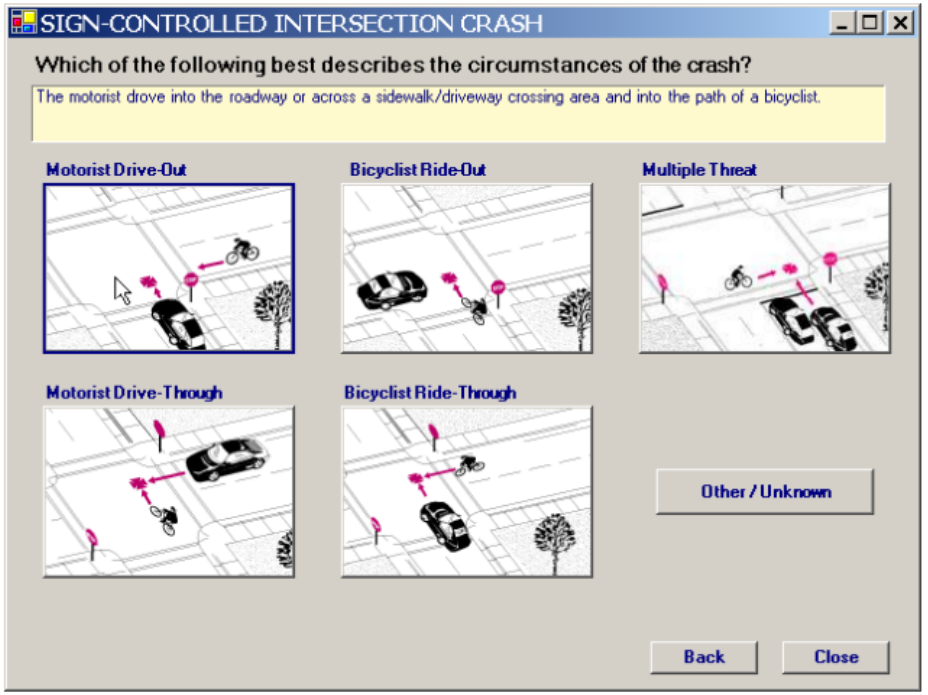
Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
216	Bus/Delivery Vehicle Pullover
217	Motorist Right Turn on Red—Same Direction
218	Motorist Right Turn on Red—Opposite Direction
219	Motorist Turn/Merge—Other/Unknown
221	Bicyclist Left Turn—Same Direction
222	Bicyclist Left Turn—Opposite Direction
223	Bicyclist Right Turn—Same Direction
224	Bicyclist Right Turn—Opposite Direction
225	Bicyclist Ride-out—Parallel Path
231	Motorist Overtaking—Undetected Bicyclist
232	Motorist Overtaking—Misjudged Space
235	Motorist Overtaking—Bicyclist Swerved
239	Motorist Overtaking—Other/Unknown

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
241	Bicyclist Overtaking—Passing on Right
242	Bicyclist Overtaking—Passing on Left
243	Bicyclist Overtaking—Parked Vehicle
244	Bicyclist Overtaking—Extended Door
249	Bicyclist Overtaking—Other/Unknown
250	Head-On—Bicyclist
255	Head-On—Motorist
259	Head-On—Unknown
280	Parallel Paths—Other/Unknown
311	Bicyclist Ride-out—Residential Driveway
312	Bicyclist Ride-out—Commercial Driveway/Alley
318	Bicyclist Ride-out—Other Midblock
319	Bicyclist Ride-out—Midblock—Unknown
321	Motorist Drive-out—Residential Driveway

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
322	Motorist Drive-out—Commercial Driveway/Alley
328	Motorist Drive-out—Other Midblock
329	Motorist Drive-out—Midblock—Unknown
357	Multiple Threat—Midblock
380	Crossing Paths—Midblock—Other/Unknown
400	Bicycle Only
510	Motorist Intentionally Caused
520	Bicyclist Intentionally Caused
600	Backing Vehicle
700	Play Vehicle-Related
800	Unusual Circumstances
910	Nonroadway
970	Unknown Approach Paths
980	Unknown Location

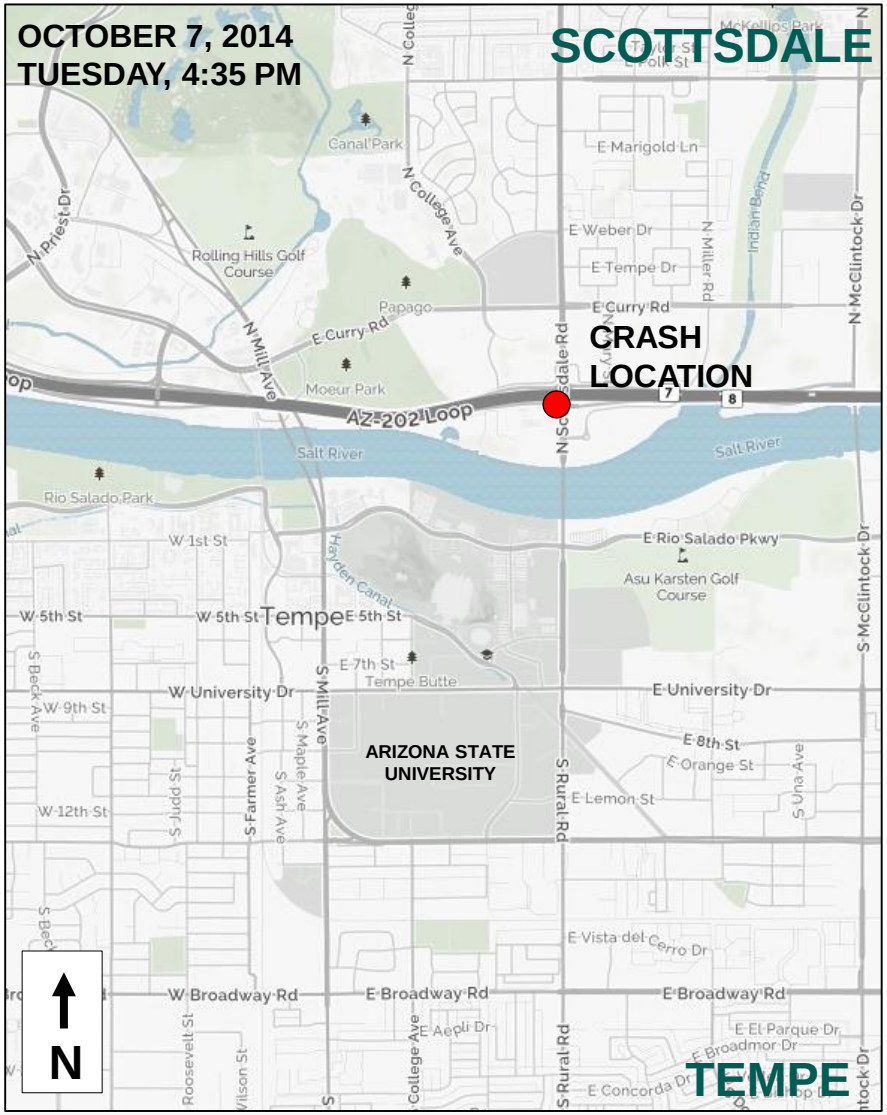
PBCAT TOOL CRASH TYPING – EXAMPLES OF CRASH TYPING FIGURES





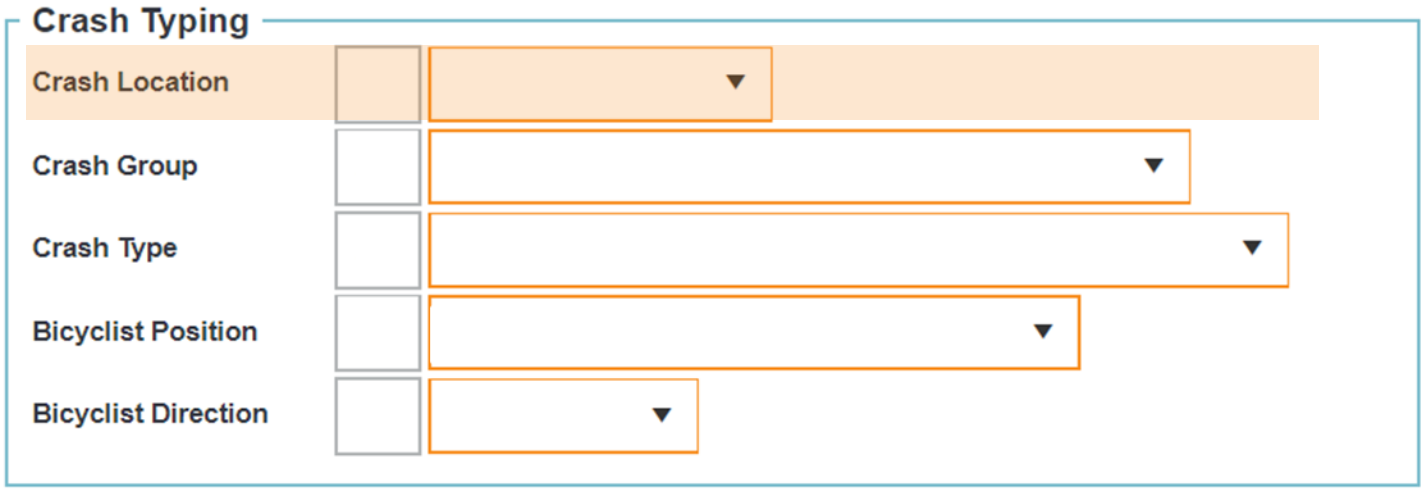
PBCAT TOOL CRASH TYPING

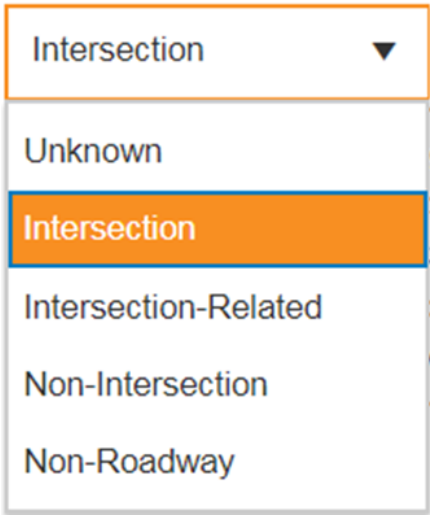
CASE STUDY 2



PBCAT TOOL CRASH TYPING

PBCAT TOOL CRASH TYPING





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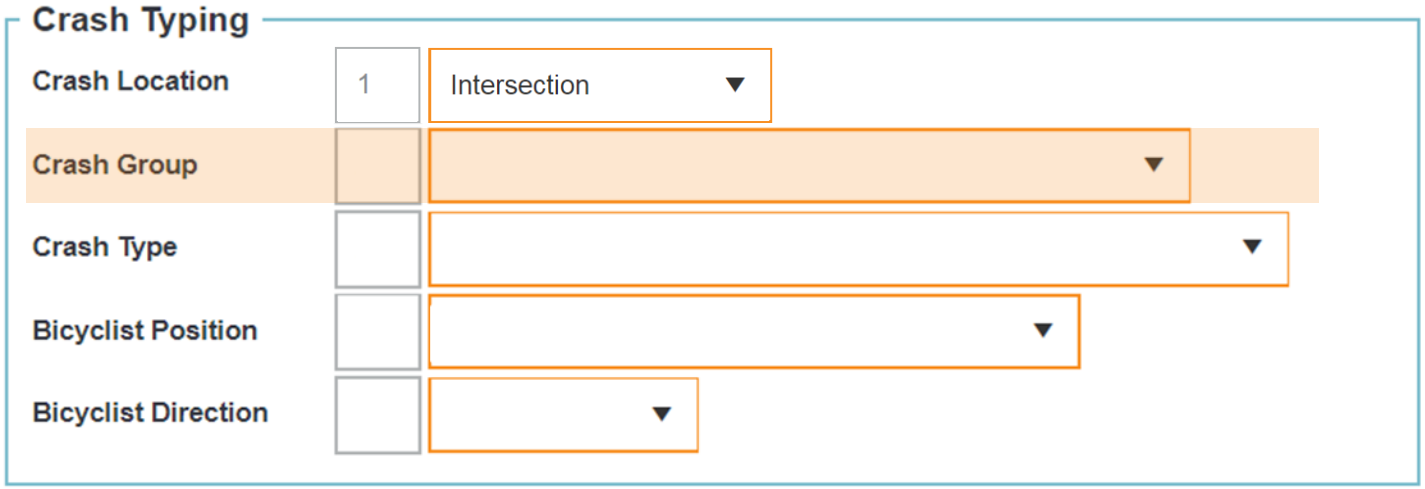
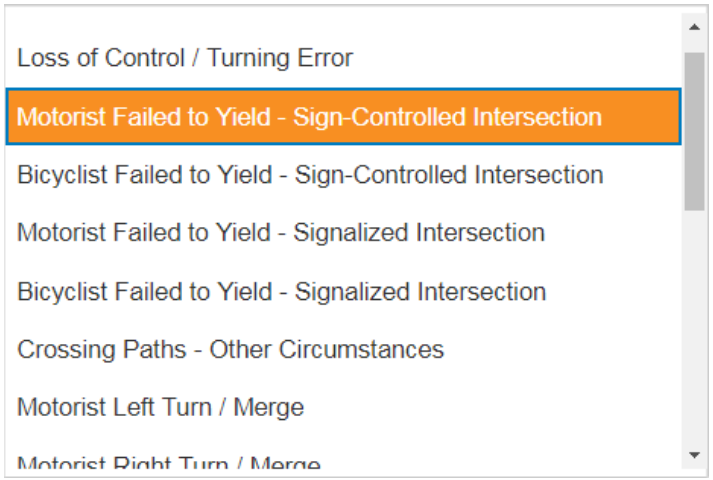


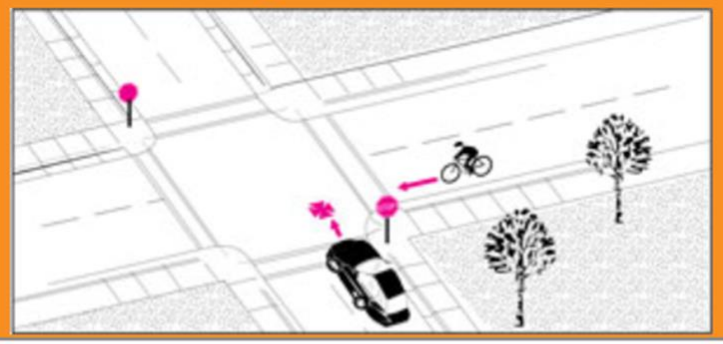


PBCAT TOOL CRASH TYPING

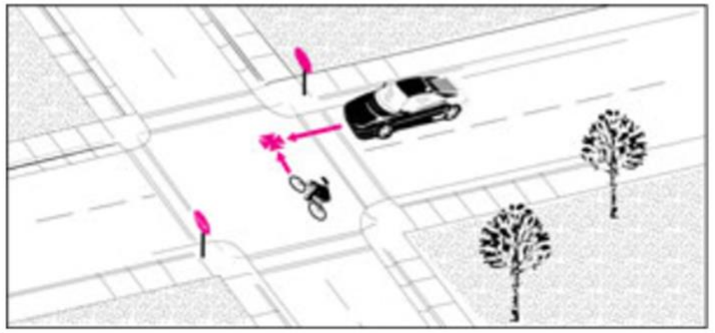
Crash Typing

Crash Location	1	Intersection
Crash Group	140	Motorist Failed to Yield - Sign-Controlled Intersection
Crash Type		
Bicyclist Position		
Bicyclist Direction		

Motorist Drive Out - Sign-Controlled Intersection

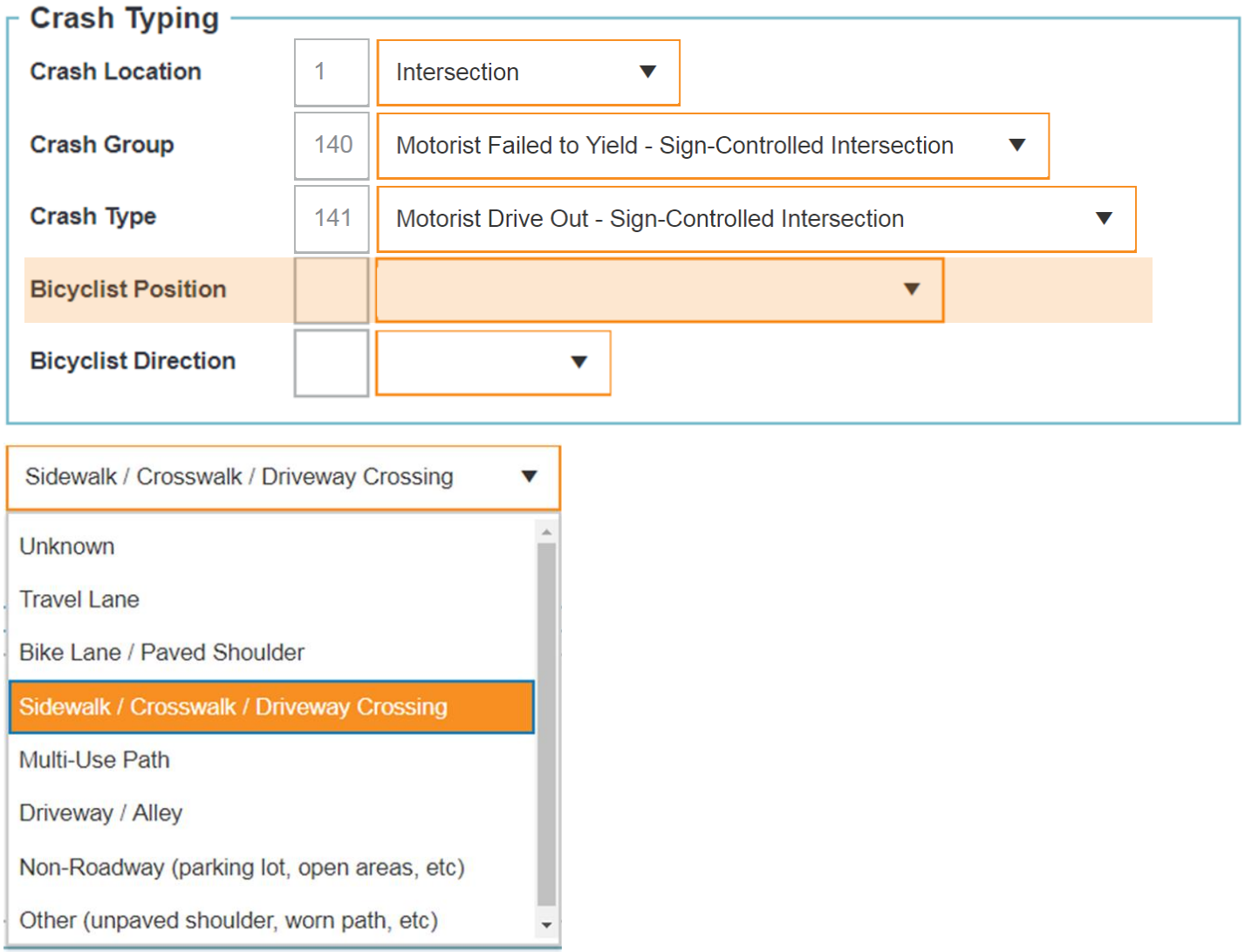


Motorist Drive Through - Sign-Controlled Intersection



Motorist Drive Out - Sign-Controlled Intersection

PBCAT TOOL CRASH TYPING



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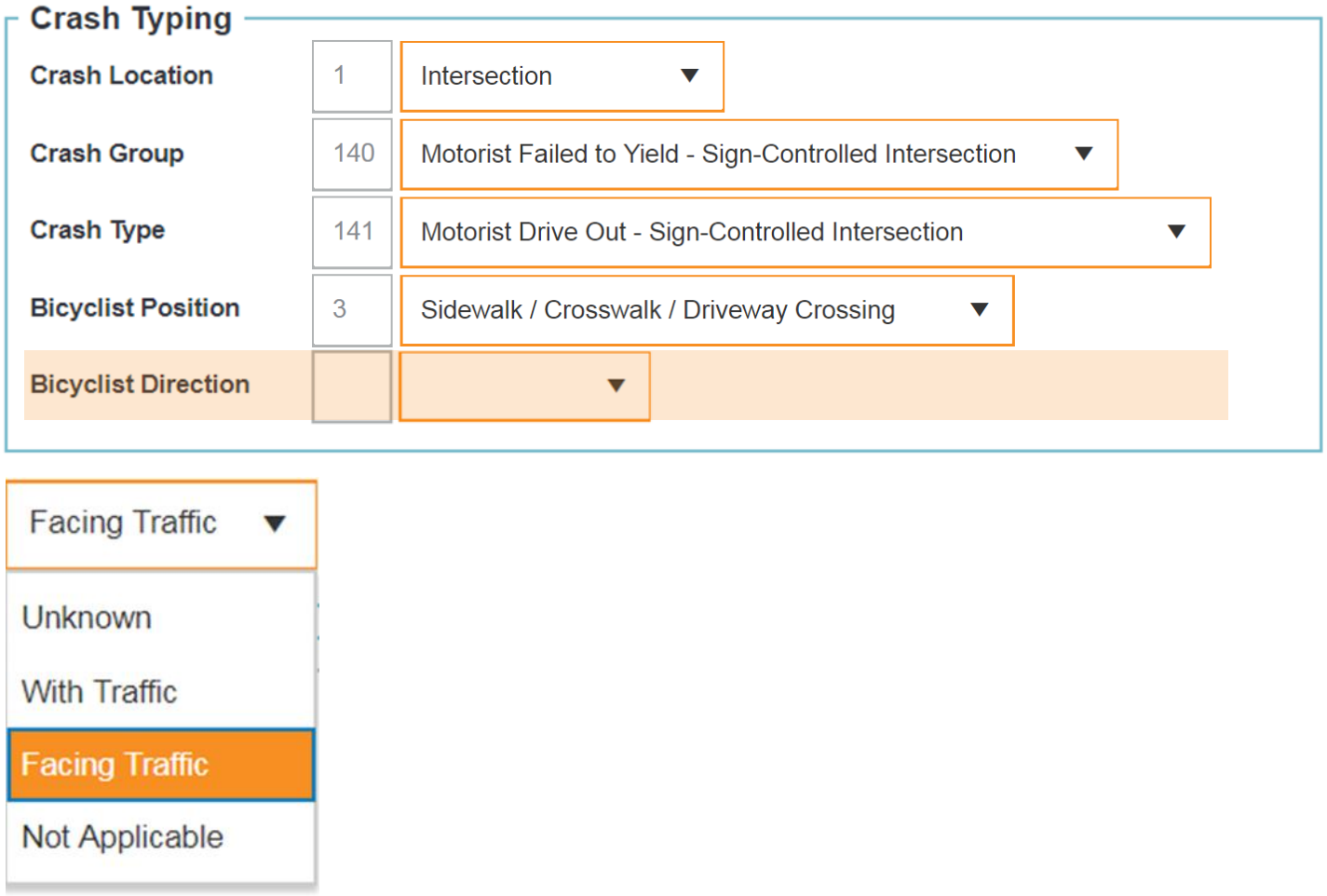


PBCAT TOOL CRASH TYPING - LOCATION

Crash_Location_Desc (Crash Location)	Crash_Location (Crash Location)	Definition
		Where did the crash occur?
Intersection	1	Intersection—The crash occurred within the intersection proper or within the crosswalk area. **Note: Driveways are considered to be nonintersection locations. The exception is signalized commercial driveways which should be coded as intersections.**
Intersection-Related	2	Intersection-Related—The crash occurred outside the intersection proper or crosswalk area but was the related to the presence of the intersection (e.g., the result of queueing traffic).
Nonintersection	3	Nonintersection Location—The crash occurred outside the intersection proper or crosswalk area and was **not** related to the presence of any intersection.
Nonroadway	4	Nonroadway Location—The crash occurred off the street network; this includes parking lots, driveways, alleys, and other open areas. **Note: crashes occurring on paved shoulders, sidewalks, or driveway crossings are considered to be "roadway" crashes and should not be placed in the nonroadway classification.**
Unknown Location	9	Unknown/Insufficient Information—There is insufficient information to determine where the crash occurred.
		Bicyclist Position Definitions
Bicyclist_Position_Desc (Bicyclist Position)	**Bicyclist_Position (Bicyclist Position)**	**Definition**
Travel Lane	1	On a roadway, in a shared travel lane
Bike Lane/Paved Shoulder	2	On a roadway, in a bicycle lane or on a paved shoulder
Sidewalk/Crosswalk/Driveway Crossing	3	On a sidewalk, crosswalk, or driveway crossing
Driveway/Alley	4	On a separate bicycle/multi-use path
Multi-use Path	5	On a driveway or alley
Nonroadway	6	Other nonroadway areas (parking lot, open areas, etc.)
Other	8	Other (e.g., unpaved shoulder, worn path, etc.)
Unknown	9	Unknown

PBCAT TOOL CRASH TYPING - CRASH GROUP

Crash_Group_Basic (Crash Group Number)	Crash_Group_Desc (Crash Group Description)
110	Loss of Control/Turning Error
140	Motorist Failed to Yield—Sign-Controlled Intersection
145	Bicyclist Failed to Yield—Sign-Controlled Intersection
150	Motorist Failed to Yield—Signalized Intersection
158	Bicyclist Failed to Yield—Signalized Intersection
190	Crossing Paths—Other Circumstances
210	Motorist Left Turn/Merge
215	Motorist Right Turn/Merge
219	Parking/Bus-Related
220	Bicyclist Left Turn/Merge

Crash_Group_Basic (Crash Group Number)	Crash_Group_Desc (Crash Group Description)
225	Bicyclist Right Turn/Merge
230	Motorist Overtaking Bicyclist
240	Bicyclist Overtaking Motorist
258	Head-On
290	Parallel Paths—Other Circumstances
310	Bicyclist Failed to Yield—Midblock
320	Motorist Failed to Yield—Midblock
600	Backing Vehicle
850	Other/Unusual Circumstances
910	Nonroadway
990	Other/Unknown—Insufficient Details

PBCAT TOOL CRASH TYPING - CRASH TYPE

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
133	Motorist Lost Control—Alcohol/Drug Impairment
134	Motorist Lost Control—Surface Conditions
139	Motorist Lost Control—Other/Unknown
141	Motorist Drive-out Sign-Controlled Intersection
142	Bicyclist Ride-out—Sign-Controlled Intersection
143	Motorist Drive-through—Sign-Controlled Intersection
144	Bicyclist Ride Through Sign-Controlled Intersection
147	Multiple Threat—Sign-Controlled Intersection
148	Sign-Controlled Intersection—Other/Unknown
151	Motorist Drive-out—Right Turn on Red
152	Motorist Drive-out—Signalized Intersection
153	Bicyclist Ride-out—Signalized Intersection
154	Motorist Drive-through—Signalized Intersection

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
111	Motorist Turning Error—Left Turn
112	Motorist Turning Error—Right Turn
113	Motorist Turning Error—Other
114	Bicyclist Turning Error—Left Turn
115	Bicyclist Turning Error—Right Turn
116	Bicyclist T…
121	…
	…ost Control—…versteering, Improper Braking, Speed
123	Bicylist Lost Control—Alcohol/Drug Impairment
124	Bicyclist Lost Control—Surface Conditions
129	Bicyclist Lost Control—Other/Unknown
131	Motorist Lost Control—Mechanical Problems
132	Motorist Lost Control—Oversteering, Improper Braking, Speed

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
133	Motorist Lost Control—Alcohol/Drug Impairment
134	Motorist Lost Control—Surface Conditions
139	Motorist Lost Control—Other/Unknown
141	Motorist Drive-out Sign-Controlled Intersection
142	Bicyclist Ride-out—Sign-Controlled Intersection
143	Motorist Drive-through—Sign-Controlled Intersection
144	Bicyclist Ride Through Sign-Controlled Intersection
147	Multiple Threat—Sign-Controlled Intersection
148	Sign-Controlled Intersection—Other/Unknown
151	Motorist Drive-out—Right Turn on Red
152	Motorist Drive-out—Signalized Intersection
153	Bicyclist Ride-out—Signalized Intersection
154	Motorist Drive-through—Signalized Intersection

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
155	Bicyclist Ride Through—Signalized Intersection
156	Bicyclist Failed to Clear—Trapped
157	Bicyclist Failed to Clear—Multiple Threat
158	Signalized Intersection—Other/Unknown
159	Bicyclist Failed to Clear—Unknown
160	Crossing Paths—Uncontrolled Intersection
180	Crossing Paths—Intersection—Other/Unknown
211	Motorist Left Turn—Same Direction
212	Motorist Left Turn—Opposite Direction
213	Motorist Right Turn—Same Direction
214	Motorist Right Turn—Opposite Direction
215	Motorist Drive-in/Out—Parking

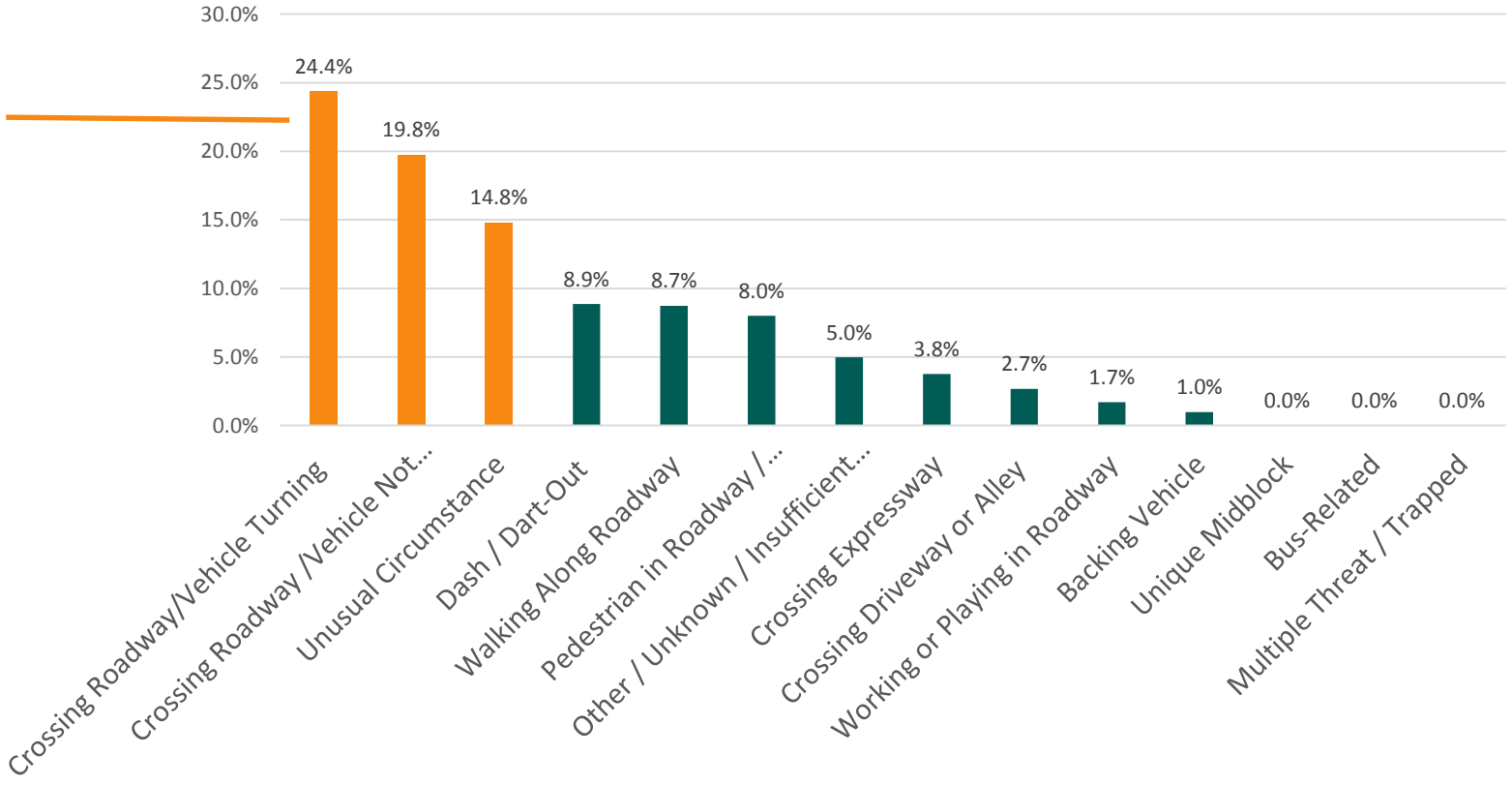
Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
216	Bus/Delivery Vehicle Pullover
217	Motorist Right Turn on Red—Same Direction
218	Motorist Right Turn on Red—Opposite Direction
219	Motorist Turn/Merge—Other/Unknown
221	Bicyclist Left Turn—Same Direction
222	Bicyclist Left Turn—Opposite Direction
223	Bicyclist Right Turn—Same Direction
224	Bicyclist Right Turn—Opposite Direction
225	Bicyclist Ride-out—Parallel Path
231	Motorist Overtaking—Undetected Bicyclist
232	Motorist Overtaking—Misjudged Space
235	Motorist Overtaking—Bicyclist Swerved
239	Motorist Overtaking—Other/Unknown

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
241	Bicyclist Overtaking—Passing on Right
242	Bicyclist Overtaking—Passing on Left
243	Bicyclist Overtaking—Parked Vehicle
244	Bicyclist Overtaking—Extended Door
249	Bicyclist Overtaking—Other/Unknown
250	Head-On—Bicyclist
255	Head-On—Motorist
259	Head-On—Unknown
280	Parallel Paths—Other/Unknown
311	Bicyclist Ride-out—Residential Driveway
312	Bicyclist Ride-out—Commercial Driveway/Alley
318	Bicyclist Ride-out—Other Midblock
319	Bicyclist Ride-out—Midblock—Unknown
321	Motorist Drive-out—Residential Driveway

Crash_Type_Basic (Crash Type Number)	Crash_Type_Desc (Crash Type Description)
322	Motorist Drive-out—Commercial Driveway/Alley
328	Motorist Drive-out—Other Midblock
329	Motorist Drive-out—Midblock—Unknown
357	Multiple Threat—Midblock
380	Crossing Paths—Midblock—Other/Unknown
400	Bicycle Only
510	Motorist Intentionally Caused
520	Bicyclist Intentionally Caused
600	Backing Vehicle
700	Play Vehicle-Related
800	Unusual Circumstances
910	Nonroadway
970	Unknown Approach Paths
980	Unknown Location

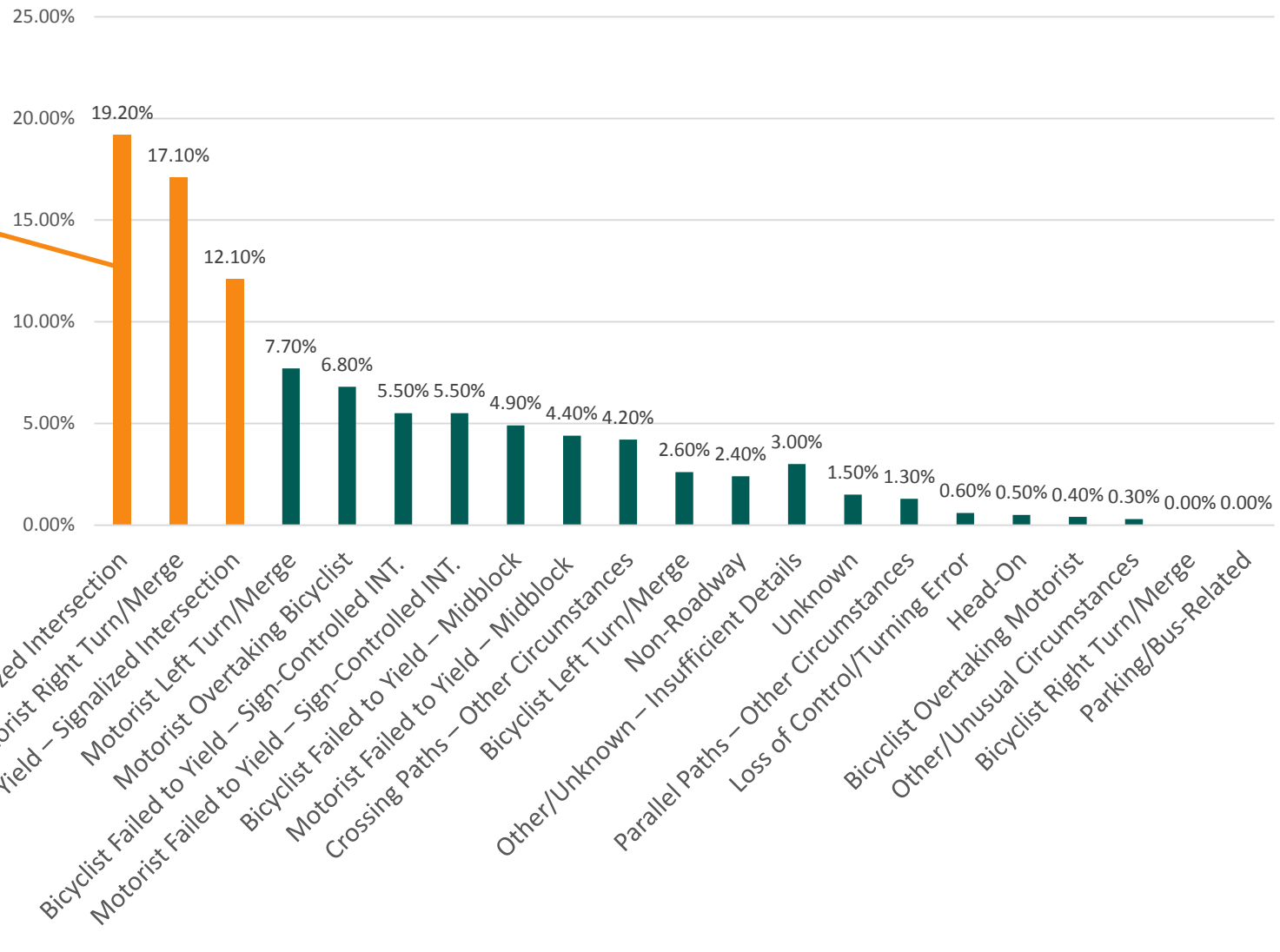
Crash Groups Distribution – Pedestrian Crashes

59 % of crashes in 3 crash groups



Crash Groups Distribution – Bicycle Crashes

48 % of crashes in 3 crash groups



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 and bicycle pedestrian facilities*
2. **Identify** potential countermeasures – PEDSAFE, BIKESAFE, others

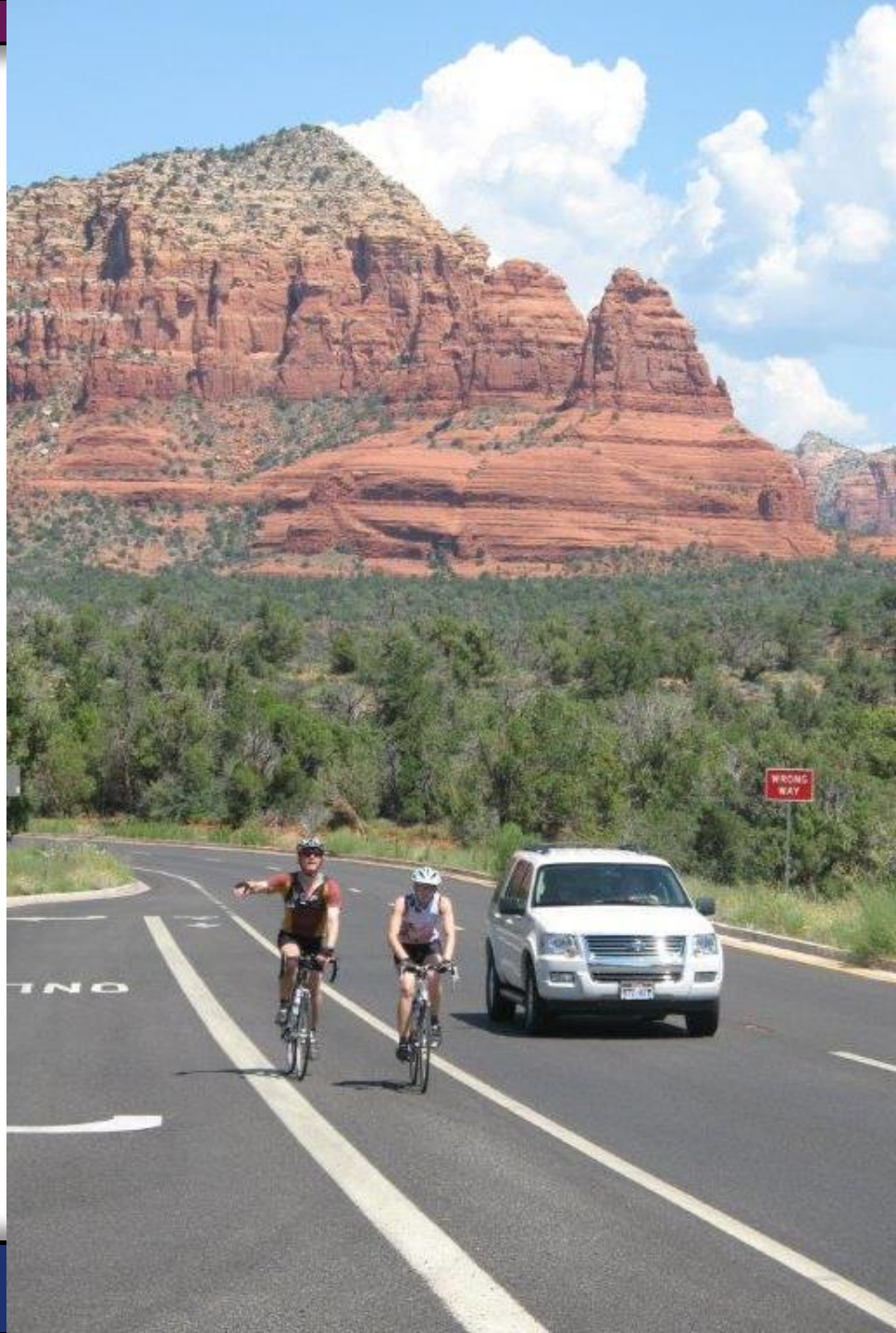
Examples of Countermeasures:

- Interchange modifications
- Crossing treatments
- Lane reduction, speed limit reduction
- Sidewalks, striped shoulders, bicycle lanes
- Pedestrian and Bicycle safety education campaign
- Install pedestrian refuge islands
- Access management improvements
- Roadway Safety Assessments

Conclusions

- Crash typing provided insight to identification of most common factors and behaviors leading to bicycle and pedestrian crashes
- Connects those factors to countermeasures that most effectively address the crashes

Questions?



Discussion

- Send us your questions 
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