




The graphic features a collage of images related to bicycle and pedestrian safety. At the top, a cyclist is shown on a path. Below, a city street scene includes a pedestrian crossing sign, a 'TURNING VEHICLES YIELD TO PEDESTRIANS' sign, and a 'BIKE LANE' sign. Two inset photos show a pedestrian crossing a street and a cyclist on a path.

Bicycle & Pedestrian Safety

*Safety Workshop - Gold Coast Chapter ITE
June 19, 2009*



Kimley-Horn
and Associates, Inc.



The graphic has a background image of a road with a 'Bicycle & Pedestrian Safety' logo in the top right corner.

Traffic Safety Facts

U.S.

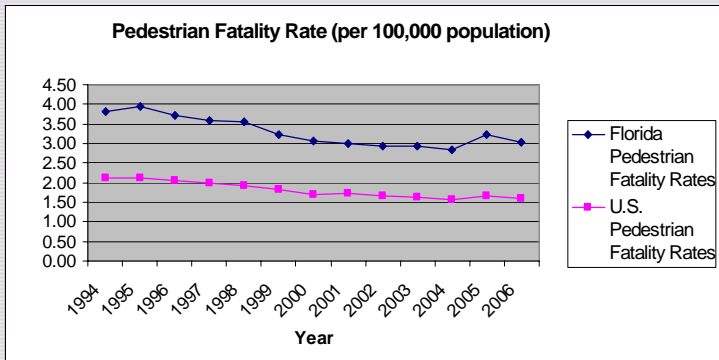
- Approx. 41,000 deaths in 2007
- 13% of deaths (5,350) were pedestrians or bicyclists

Florida

- Approx. 3,215 deaths in 2007
- Bicycle and pedestrian crashes ~ 5% of total crashes
- 20% of deaths (650) were pedestrians or bicyclists

Florida's Pedestrian Safety Problem

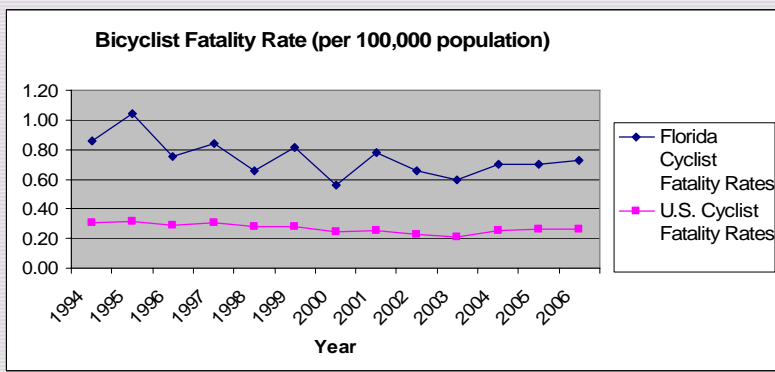
- Pedestrian Fatality Rate **x2** vs. National
- Florida Highest in the Nation Most Years



Source: NHTSA Traffic Safety Facts.

Florida's Bicycle Safety Problem

- Bicyclist Fatality Rate **x3** vs. National
- Florida Highest in the Nation Most Years



Source: NHTSA Traffic Safety Facts


Florida Strategic Highway Safety Plan

- To focus resources where opportunities for safety improvements are greatest
- To achieve a 5 percent annual reduction in rates of fatalities and severe injuries
- **Emphasis areas**
 - Aggressive driving
 - Intersection crashes
 - Vulnerable road users (pedestrians, bicyclists, and motorcyclists)
 - Lane departure crashes

Modal Share of Walking and Bicycling

<i>Location</i>	<i>Walking</i>	<i>Bicycling</i>
Florida	6.9	1.2
Minnesota	7.0	1.2
Georgia	5.6	0.7
New York	20.4	0.7
Oregon	8.7	2.3
United States	8.7	0.8


Source: National Household Travel Survey, 2001



FDOT IV Bike/Ped Safety Study


- To identify causal factors of fatal crashes involving pedestrians and bicyclists
- Bicycle and pedestrian crashes on State Highways within Broward, Palm Beach, Martin, St. Lucie, and Indian River Counties
- Crashes reported between 2001 and 2005
- Statistical methods to identify significant correlations
 - Binary logistic regression analysis using Minitab software
 - 95 percent confidence level using p-value





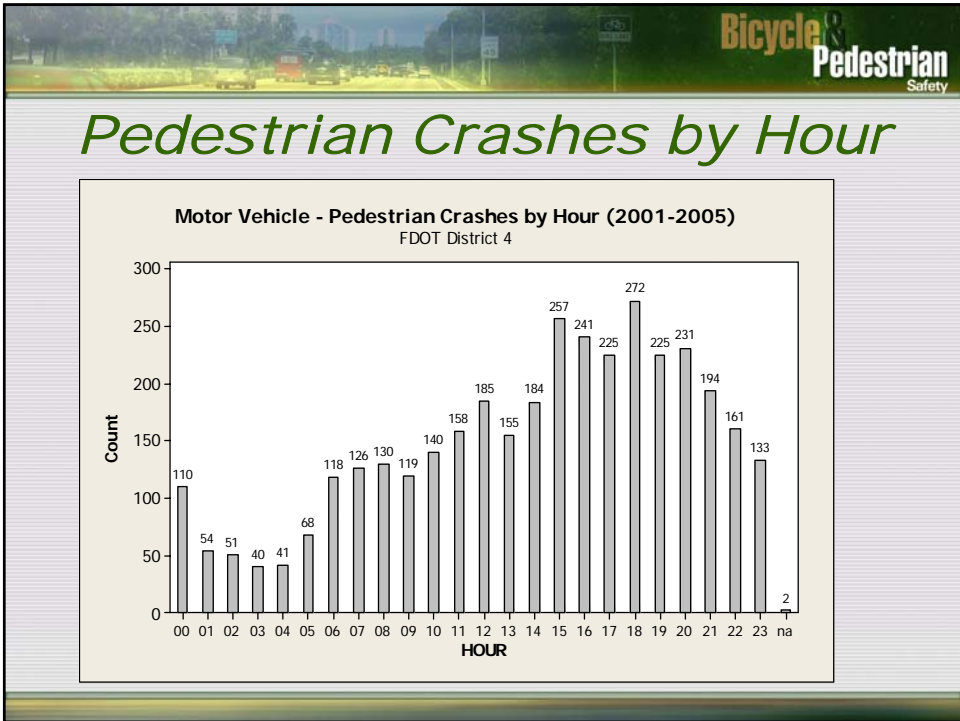
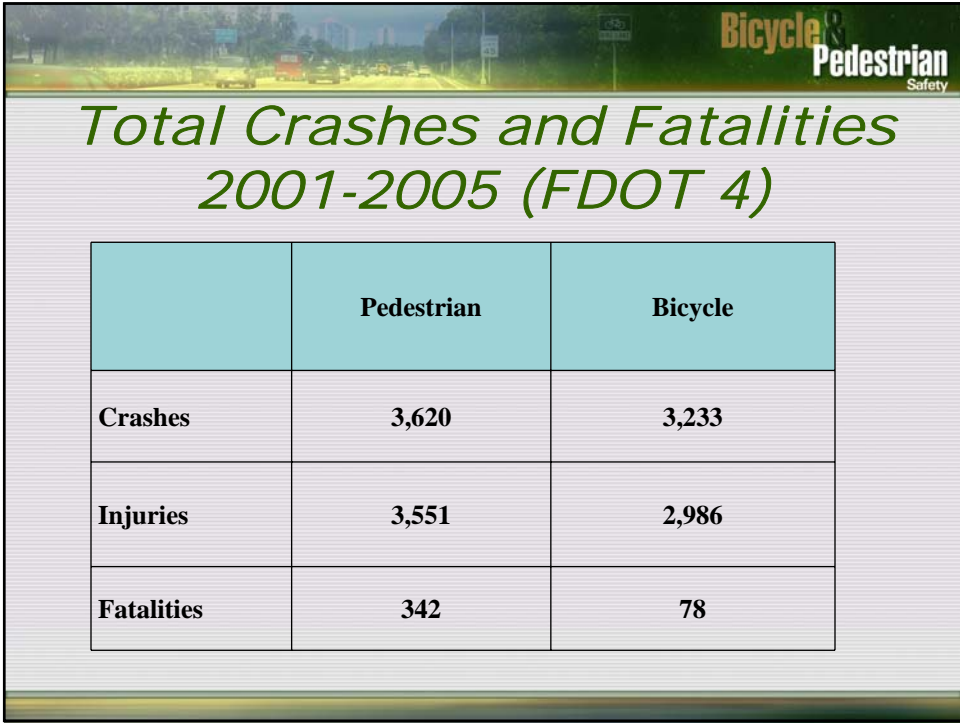
Factors Considered

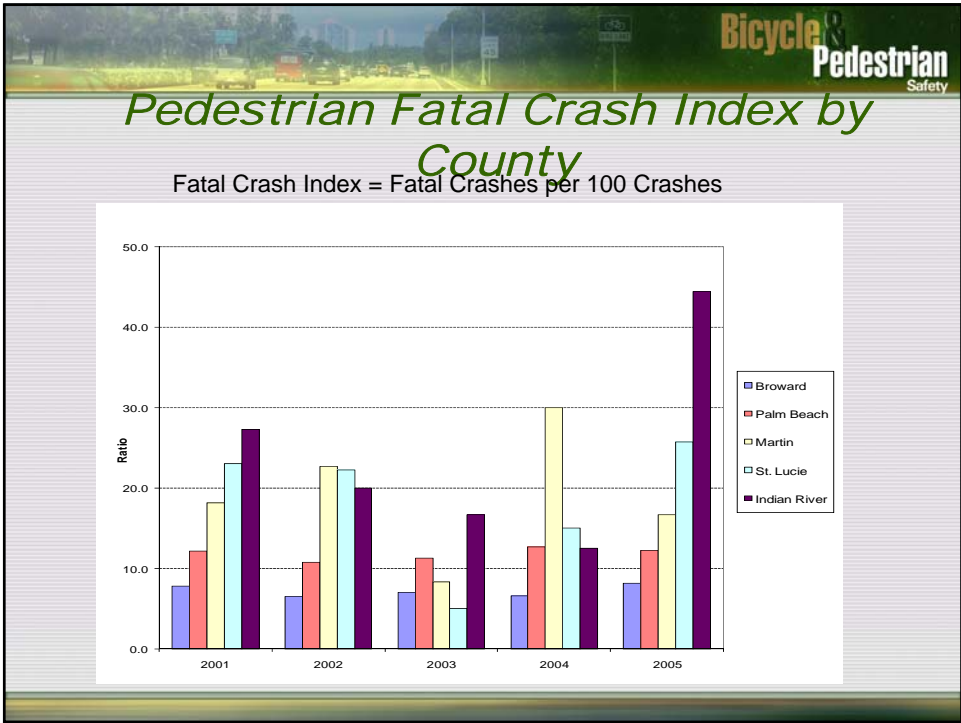
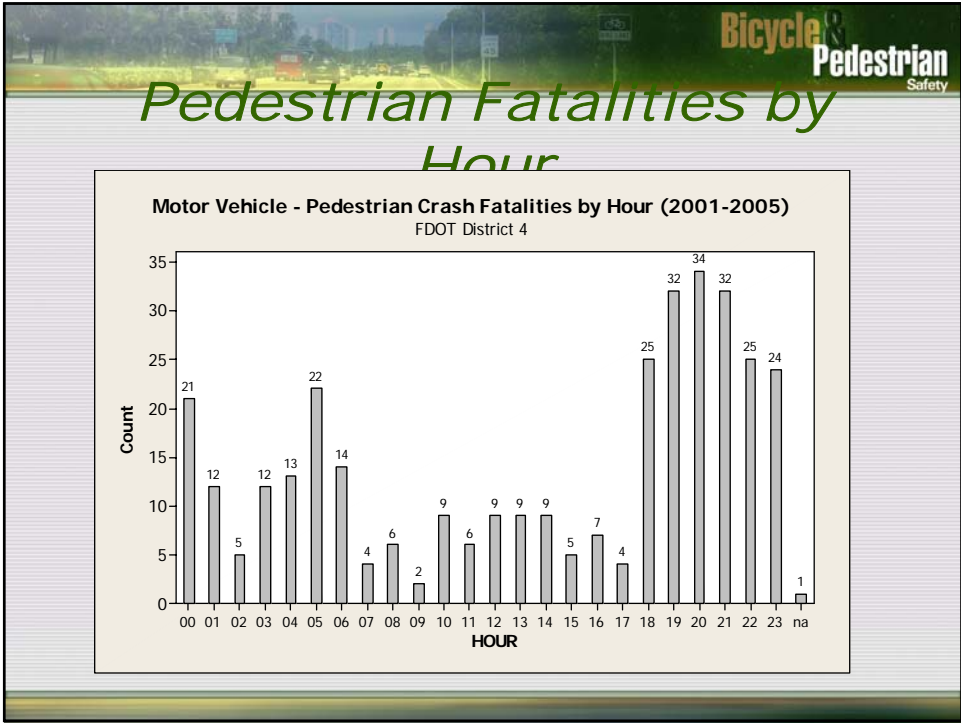
- Year
- County by Year
- Month
- Day of Week
- Hour
- Age of Pedestrian/Bicyclist
- Alcohol/Drug Use
- Lighting Condition
- Road Surface Condition
- Site Location
- Area Type
- Traffic Control Type
- Vehicular Movement
- Roadway Classification
- Number of Lanes
- Average Daily Traffic
- Bike Lanes



Information Missing in Database

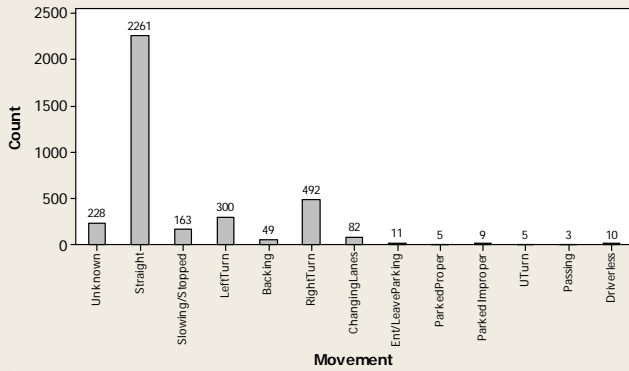
- Gender of driver/pedestrian/cyclist
- Pedestrian/cyclist action
- At-fault party
- Posted speed limit
- Distance from nearest intersection





Pedestrian Crashes by Vehicular Movement

Motor Vehicle-Pedestrian Crashes by Vehicular Movement (2001-2005)
FDOT District 4

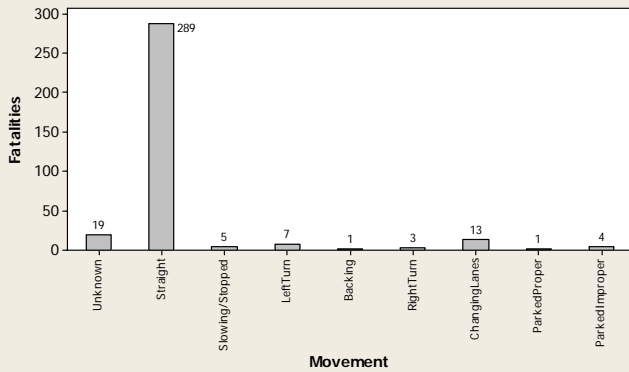


Observations

- 62 percent of crashes involved vehicle moving Straight Ahead
- 14 percent of crashes involved vehicle marking Right Turn

Pedestrian Fatalities by Vehicular Movement

Motor Vehicle-Pedestrian Crash Fatalities by Vehicular Movement (2001-2005)
FDOT District 4

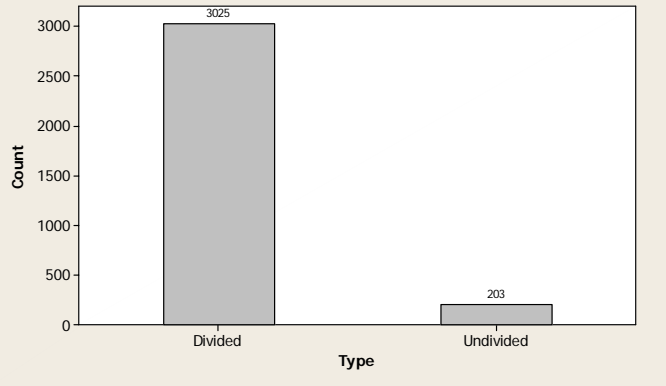


Observations

- 85 percent of fatalities involved a vehicle moving Straight Ahead

Pedestrian Crashes by Roadway Classification

Motor Vehicle-Pedestrian Crashes by Divided and Undivided Roadways (2001-2005)
FDOT District 4

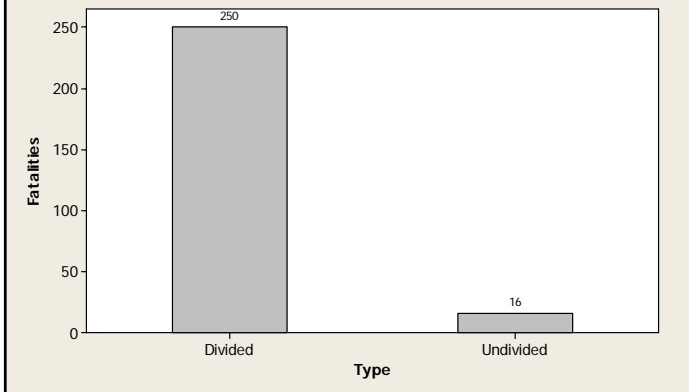


Observations

- 94 percent of crashes on Divided roadways

Pedestrian Fatalities by Roadway Classification

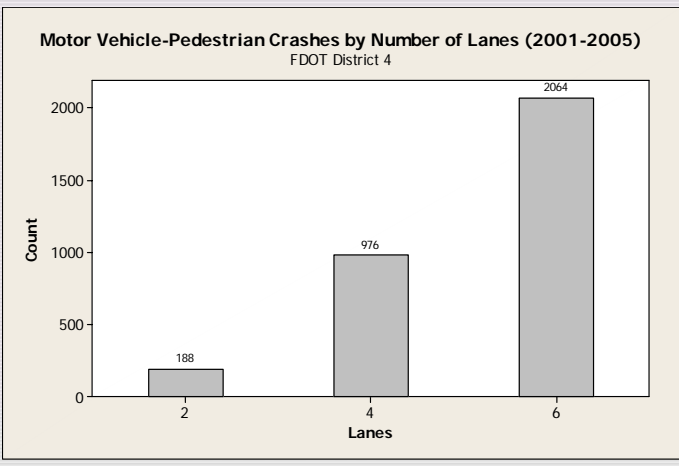
Motor Vehicle-Pedestrian Crash Fatalities by Divided and Undivided Roads (2001-2005)
FDOT District 4



Observations

- 95 percent of fatalities on Divided roadways

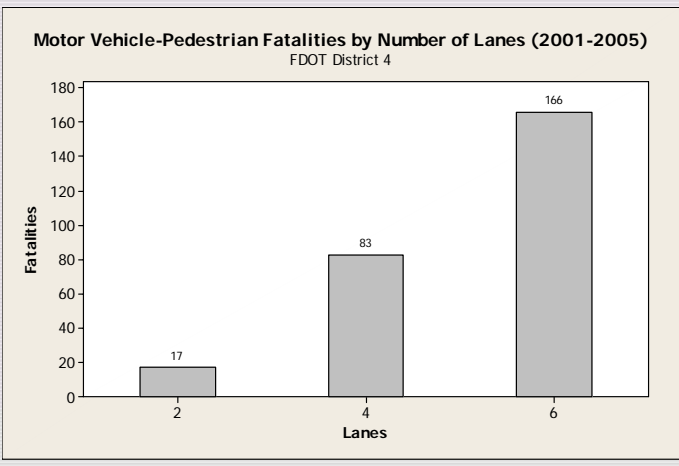
Pedestrian Crashes by Number of Lanes



Observations

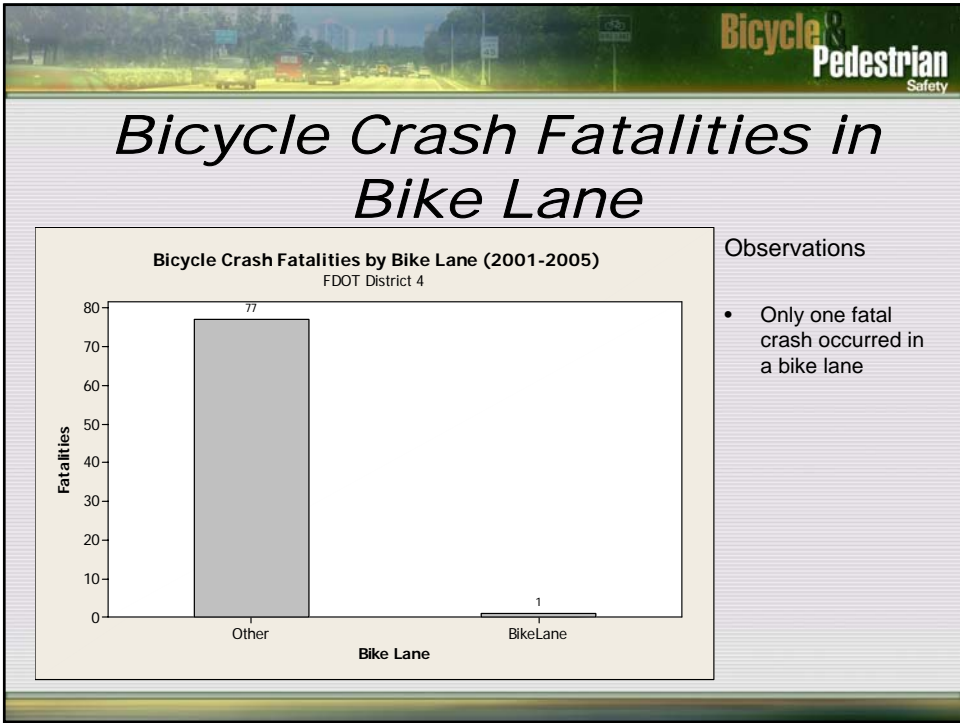
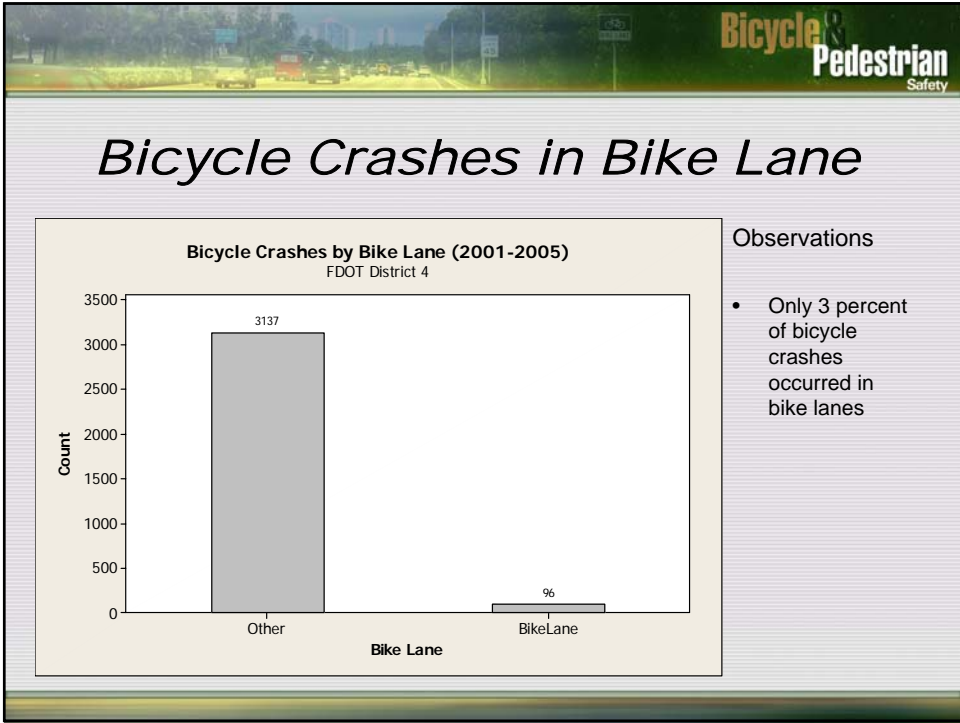
- 64 percent of crashes on six-lane roadways


Pedestrian Fatalities by Number of Lanes



Observations


- 62 percent of fatalities on six-lane roadways






Statistical Terms

- 95 Percent Confidence Level – An indicator of certainty of the result. At 95 percent C.L., the probability of obtaining a given result by chance is 5 percent.
- Binary logistic regression – A statistical method used when the outcome is binary (has only two possible values). Regression analysis establishes correlations between the outcome and its causal factors.
- Odds ratio – It is the probability of an event occurring in comparison to a second event



Analysis Summary


- Primary significant factors for fatal pedestrian and bicycle crashes
 - Time of day
 - Lighting condition
 - Alcohol/drug use
 - Mid-block
- Fatality occurrence tends to follow dark conditions, mid-block locations, and alcohol/drug use
- Some factors appear to be intuitively associated with higher speed



Significant Correlations


Example

- Key Factors Linked to Cyclist Fatalities
 - **Lighting Condition**
 - Likelihood of a fatal crash is 13 times greater in **dark no street light** conditions than in daylight
 - Likelihood of a fatal crash is 6 times greater in **dark with street light** conditions than in daylight




Pedestrian Survival Rate vs. Vehicle Speed

Vehicle Speed (MPH)	Pedestrian Survival Rate
20	95%
30	60%
40	10%



Significant Correlations

- Key Factors Linked to Cyclist Fatalities
 - Not at Intersections
(Mid-block locations with no traffic control)
 - Likelihood of a fatal crash is 4 times greater in **not at intersection** conditions than at intersections



Significant Correlations

- Key Factors Linked to Cyclist Fatalities
 - Alcohol / Drug Use
 - Likelihood of a fatal crash is 8 times greater if bicyclist or driver was **under the influence**


Significant Correlations

- Key Factors Linked to Cyclist Fatalities
 - Time of Day
 - Deadliest Time – Risk of a fatal crash is 4 to 8 times higher **after 6:00 PM** than during the daytime

Number of Lanes

Lanes	Non-Fatal Crashes	Fatal Crashes	Odds Ratio*	% of Non-Fatal Crashes	Significance Value (p)	Statistically Significant at p = 0.05?
Two	171	17	0.099	91.0%	0.000	Yes
Four	893	83	0.093	91.5%	0.809	No
Six	1900	164	0.086	92.1%	0.597	No

*Odds ratio: number of fatal crashes per non-fatal crash



Literature Review

- Similar crash patterns as statewide data
- Consistent significant factors
 - Lighting
 - Unsignalized mid-block crossings
 - Alcohol/drug use
 - Vehicle speed
 - Pedestrian age
- Before/after intervention studies are rare



Sample Countermeasures

- Mid-block pedestrian crosswalk active warning systems
- Lighting enhancements
- HAWK (High-intensity activated crosswalk) signal
- Automated detection of pedestrians and bicyclists

Potential Countermeasures

In-Pavement Lighting *



* Added to
the MUTCD
in 2000,
Chapter 4L

Potential Countermeasures

HAWK Signal



	What Drivers See	What Pedestrians See
1.	DARK	Push the button.
2.	FLASHING	
3.	STEADY	
4.	STEADY	Start crossing.
5.	ALTERNATING (like RXR) Stop. Then go if clear.	FLASHING Continue crossing.
6.	DARK	

Potential Countermeasures

Crosswalk Flashers



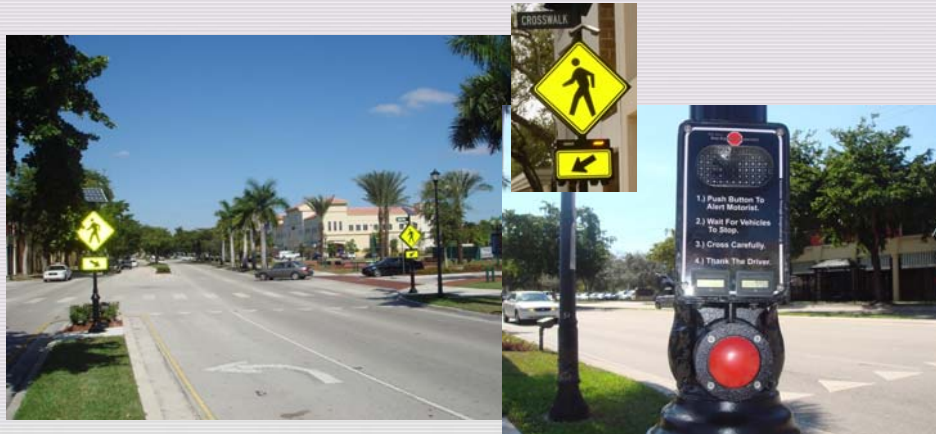
Hindsight.
20/20.

Foresight.
866-CROSSALERT.

The Cross Alert System is a motion-activated, solar-powered, radio-controlled active warning system.

Potential Countermeasures

Enhancer



Potential Countermeasures

Enhancer

- 1.) Push Button To Alert Motorists
- 2.) Wait For Vehicles To Stop
- 3.) Cross Carefully
- 4.) Thank The Driver

Potential Countermeasures

Pedestrian Level Lighting





Pedestrian Level Lighting to Supplement Standard Street Lighting

Highway Safety Information System

- **GIS Based Crash Data Mapping and Safety Analysis Tools**
- **Pedestrian and Bicycle Crash Analysis Tool (PBCAT)**
 - **Recommendations by crash type**

<http://www.hsisinfo.org/>



Implementation Challenges

- Reducing frequency of crashes vs. reducing fatal crashes
 - Intersection vs. mid-block crashes
 - Daytime vs. nighttime crashes
- Success of a countermeasure depends on the method of implementation



Recommendations

- Implement countermeasures and conduct “before” and “after” evaluations
- Consider developing mode specific crash rates for roadway segments
- Work with Community Traffic Safety Teams to focus on education
- Targeted enforcement
 - Nighttime
 - Focus on pedestrians/cyclists as well as drivers



DISCUSSION