Analysis of Bicyclist Involvement in Indiana Motor Vehicle Collisions

Partnership with
the Indiana Criminal Justice Institute

Presented by Dona Sapp, Principal Investigator and Senior Researcher
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Today's Discussion

- Background on traffic safety research project
- Select research findings on bicyclists involved in collisions
- Innovative approaches to improving bicycle safety

Background on traffic safety research project

PPI now entering 10th year partnering with ICJI on statewide traffic safety collaboration. Federal support provided by National Highway Traffic Safety Administration (NHTSA), and much of our work follows NHTSA guidelines

PPI traffic safety research team

- Dona Sapp, Principal Investigator
- Dr. Seth Payton
- Rachel Thelin
- Dr. Sam Nunn

Indiana Traffic safety partners

- ICJI
- Governor's Council on Impaired and Dangerous Driving
- Other state agencies (ISP, BMV, INDOT, JTAC)
- Local law enforcement agencies
- Other (AAA, SADD, Bicycle Indiana, Riley Automotive Safety Program, Purdue Center for Road Safety)

Background on traffic safety research project

Traffic safety data sets

- Indiana State Police Automated Reporting Information Exchange System (ARIES) (crash report data – collisions, vehicles, people)
- Indiana Bureau of Motor Vehicles (driver history, licensed drivers, registered vehicles, citations)
- Indiana Department of Transportation (Indiana county level VMT)
- Indiana Supreme Court, Judicial Technology and Automation Committee (JTAC) (Electronic Citation and Warning System (eCWS) data)
- Bureau of Transportation Statistics, State Transportation Statistics (State VMT)
- Fatality Analysis Reporting System (FARS), National Highway Traffic Safety Administration (fatal traffic crashes)
- Federal Highway Administration, Traffic Volume Trends (national VMT)
- U.S. Census Bureau (State and county population data)

Background on traffic safety research project

ARIES crash database overview

- ARIES – "Automated Reporting and Information Exchange System"
- Owned by Indiana State Police, managed by Appriss
- IC 9-26-2-1

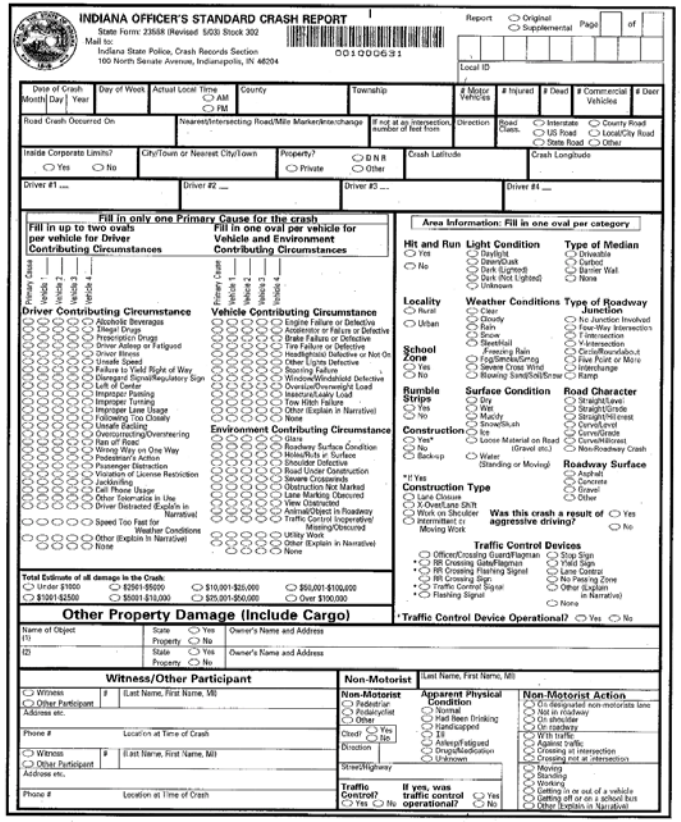
Sec. 1. A law enforcement officer shall investigate each motor vehicle accident that results in any of the following:
(1) The injury or death of a person.
(2) Total property damage to an apparent extent of at least one thousand dollars ($1,000).

Background on traffic safety research project

ARIES crash data entry and database structure

Officer completes crash report

(As of 2015, nearly 100% of law enforcement agencies submit reports electronically, 94% are timely (within 5 days of crash))



INDIANA OFFICER'S STANDARD CRASH REPORT

State Form: 23568 (Revised 5/03) Stock 302

Mail to: Indiana State Police, Crash Records Section, 100 North Senate Avenue, Indianapolis, IN 46204

Fill in only one Primary Cause for the crash

Fill in up to two ovals per vehicle for Driver Contributing Circumstances

Fill in one oval per vehicle for Vehicle and Environment Contributing Circumstances

Driver Contributing Circumstance

Vehicle Contributing Circumstance

Environment Contributing Circumstance

Area Information: Fill in one oval per category

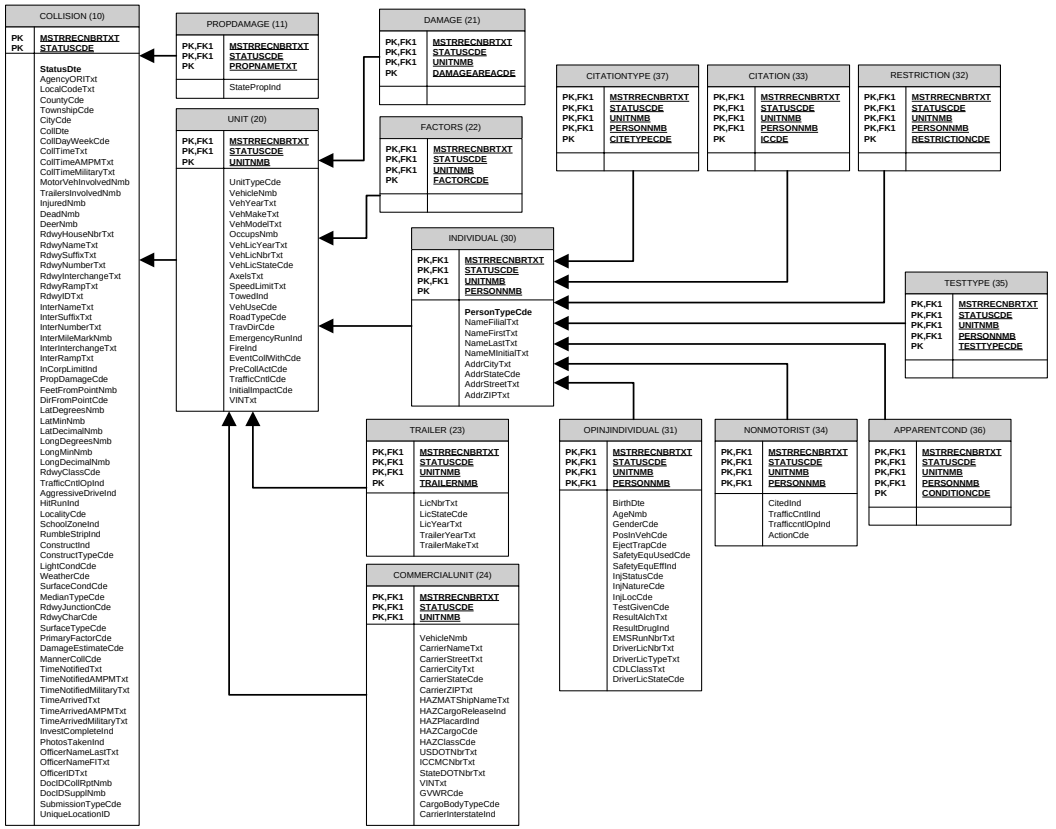
Other Property Damage (Include Cargo)

Witness/Other Participant

Non-Motorist

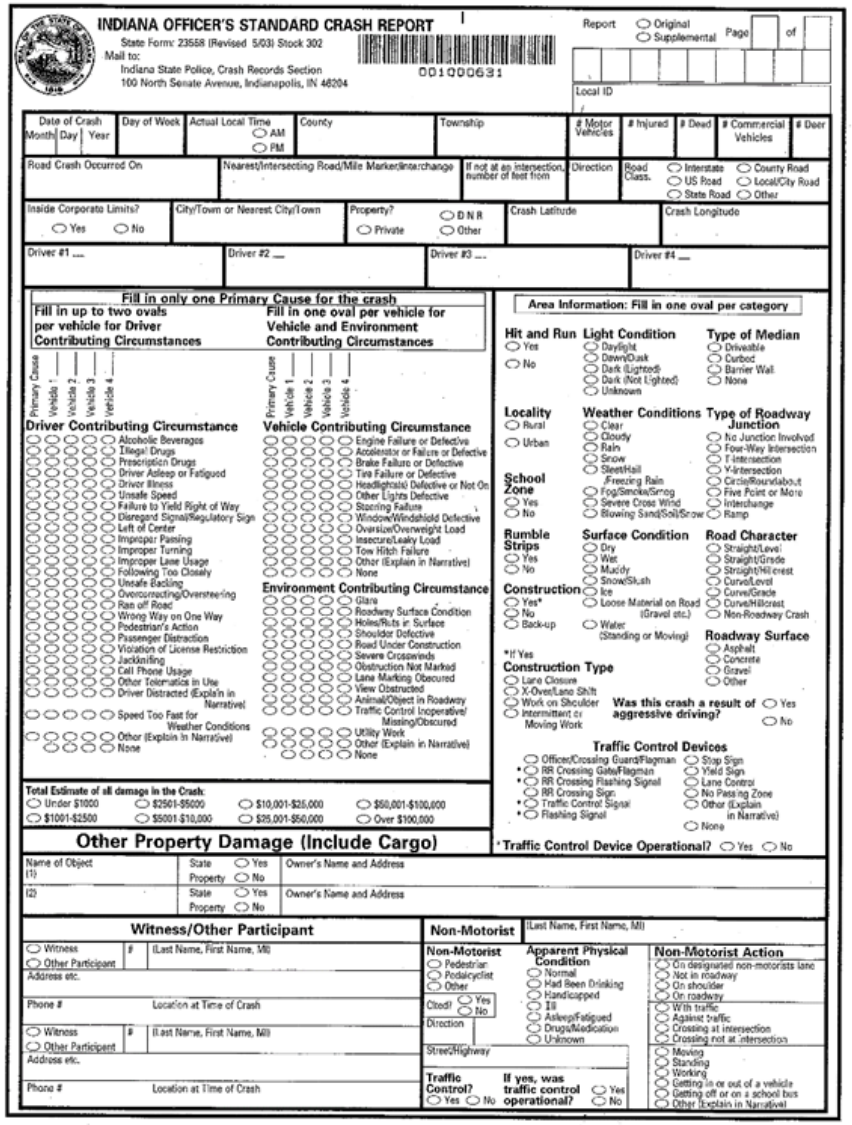
Data stored in relational database

(includes 15 core tables, more than 200 fields, ~4 million records annually)



ARIES crash data entry and database structure

Officer completes crash report



INDIANA OFFICER'S STANDARD CRASH REPORT

State Form: 23558 (Revised 5/03) Stock 302

Mail to: Indiana State Police, Crash Records Section, 100 North Senate Avenue, Indianapolis, IN 46204

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Report ○ Original ○ Supplemental Page of

Local ID

Date of Crash Month Day Year | Day of Week | Actual Local Time ○ AM ○ PM | County | Township | # Motor Vehicles | # Injured | # Dead | # Commercial Vehicles | # Deer

Road Crash Occurred On | Nearest/Intersecting Road/Mile Marker/Interchange | If not at an intersection, number of feet from | Direction | Road Class. ○ Interstate ○ County Road ○ US Road ○ Local/City Road ○ State Road ○ Other

Inside Corporate Limits? ○ Yes ○ No | City/Town or Nearest City/Town | Property? ○ Private ○ DNR ○ Other | Crash Latitude | Crash Longitude

Driver #1 | Driver #2 | Driver #3 | Driver #4

Fill in only one Primary Cause for the crash

Fill in up to two ovals per vehicle for Driver Contributing Circumstances

Fill in one oval per vehicle for Vehicle and Environment Contributing Circumstances

Primary Cause | Vehicle 1 | Vehicle 2 | Vehicle 3 | Vehicle 4

Driver Contributing Circumstance

○ Alcoholic Beverages
○ Illegal Drugs
○ Prescription Drugs
○ Driver Asleep or Fatigued
○ Driver Illness
○ Unsafe Speed
○ Failure to Yield Right of Way
○ Disregard Signal/Regulatory Sign
○ Left of Center
○ Improper Passing
○ Improper Turning
○ Improper Lane Usage
○ Following Too Closely
○ Unsafe Backing
○ Overcorrecting/Oversteering
○ Ran off Road
○ Wrong Way on One Way
○ Pedestrian's Action
○ Passenger Distraction
○ Violation of License Restriction
○ Jackknifing
○ Cell Phone Usage
○ Other Telematics in Use
○ Driver Distracted (Explain in Narrative)
○ Speed Too Fast for Weather Conditions
○ Other (Explain in Narrative)
○ None

Vehicle Contributing Circumstance

○ Engine Failure or Defective
○ Accelerator or Failure or Defective
○ Brake Failure or Defective
○ Tire Failure or Defective
○ Headlight(s) Defective or Not On
○ Other Lights Defective
○ Steering Failure
○ Window/Windshield Defective
○ Oversize/Overweight Load
○ Insecure/Leaky Load
○ Tow Hitch Failure
○ Other (Explain in Narrative)
○ None

Environment Contributing Circumstance

○ Glare
○ Roadway Surface Condition
○ Holes/Ruts in Surface
○ Shoulder Defective
○ Road Under Construction
○ Severe Crosswinds
○ Obstruction Not Marked
○ Lane Marking Obscured
○ View Obstructed
○ Animal/Object in Roadway
○ Traffic Control Inoperative/Missing/Obscured
○ Utility Work
○ Other (Explain in Narrative)
○ None

Total Estimate of all damage in the Crash:
○ Under $1000 ○ $1001-$2500 ○ $2501-$5000 ○ $5001-$10,000 ○ $10,001-$25,000 ○ $25,001-$50,000 ○ $50,001-$100,000 ○ Over $100,000

Area Information: Fill in one oval per category

Hit and Run ○ Yes ○ No

Light Condition ○ Daylight ○ Dawn/Dusk ○ Dark (Lighted) ○ Dark (Not Lighted) ○ Unknown

Type of Median ○ Driveable ○ Curbed ○ Barrier Wall ○ None

Locality ○ Rural ○ Urban

Weather Conditions ○ Clear ○ Cloudy ○ Rain ○ Snow ○ Sleet/Hail /Freezing Rain ○ Fog/Smoke/Smog ○ Severe Cross Wind ○ Blowing Sand/Soil/Snow

Type of Roadway Junction ○ No Junction Involved ○ Four-Way Intersection ○ T-Intersection ○ Y-Intersection ○ Circle/Roundabout ○ Five Point or More ○ Interchange ○ Ramp

School Zone ○ Yes ○ No

Rumble Strips ○ Yes ○ No

Surface Condition ○ Dry ○ Wet ○ Muddy ○ Snow/Slush ○ Ice ○ Loose Material on Road (Gravel etc.) ○ Water (Standing or Moving)

Road Character ○ Straight/Level ○ Straight/Grade ○ Straight/Hillcrest ○ Curve/Level ○ Curve/Grade ○ Curve/Hillcrest ○ Non-Roadway Crash

Construction ○ Yes* ○ No ○ Back-up

*If Yes

Construction Type ○ Lane Closure ○ X-Over/Lane Shift ○ Work on Shoulder ○ Intermittent or Moving Work

Roadway Surface ○ Asphalt ○ Concrete ○ Gravel ○ Other

Was this crash a result of aggressive driving? ○ Yes ○ No

Traffic Control Devices

○ Officer/Crossing Guard/Flagman
* ○ RR Crossing Gate/Flagman
* ○ RR Crossing Flashing Signal
○ RR Crossing Sign
* ○ Traffic Control Signal
* ○ Flashing Signal
○ Stop Sign
○ Yield Sign
○ Lane Control
○ No Passing Zone
○ Other (Explain in Narrative)
○ None

* Traffic Control Device Operational? ○ Yes ○ No

Other Property Damage (Include Cargo)

Name of Object	State Property	Owner's Name and Address
(1)	○ Yes ○ No	
(2)	○ Yes ○ No	

Witness/Other Participant

○ Witness ○ Other Participant | # | (Last Name, First Name, MI)

Address etc.

Phone # | Location at Time of Crash

○ Witness ○ Other Participant | # | (Last Name, First Name, MI)

Address etc.

Phone # | Location at Time of Crash

Non-Motorist (Last Name, First Name, MI)

Non-Motorist ○ Pedestrian ○ Pedalcyclist ○ Other

Apparent Physical Condition ○ Normal ○ Had Been Drinking ○ Handicapped ○ Ill ○ Asleep/Fatigued ○ Drugs/Medication ○ Unknown

Non-Motorist Action

○ On designated non-motorists lane
○ Not in roadway
○ On shoulder
○ On roadway
○ With traffic
○ Against traffic
○ Crossing at intersection
○ Crossing not at intersection
○ Moving
○ Standing
○ Working
○ Getting in or out of a vehicle
○ Getting off or on a school bus
○ Other (Explain in Narrative)

Cited? ○ Yes ○ No

Direction

Street/Highway

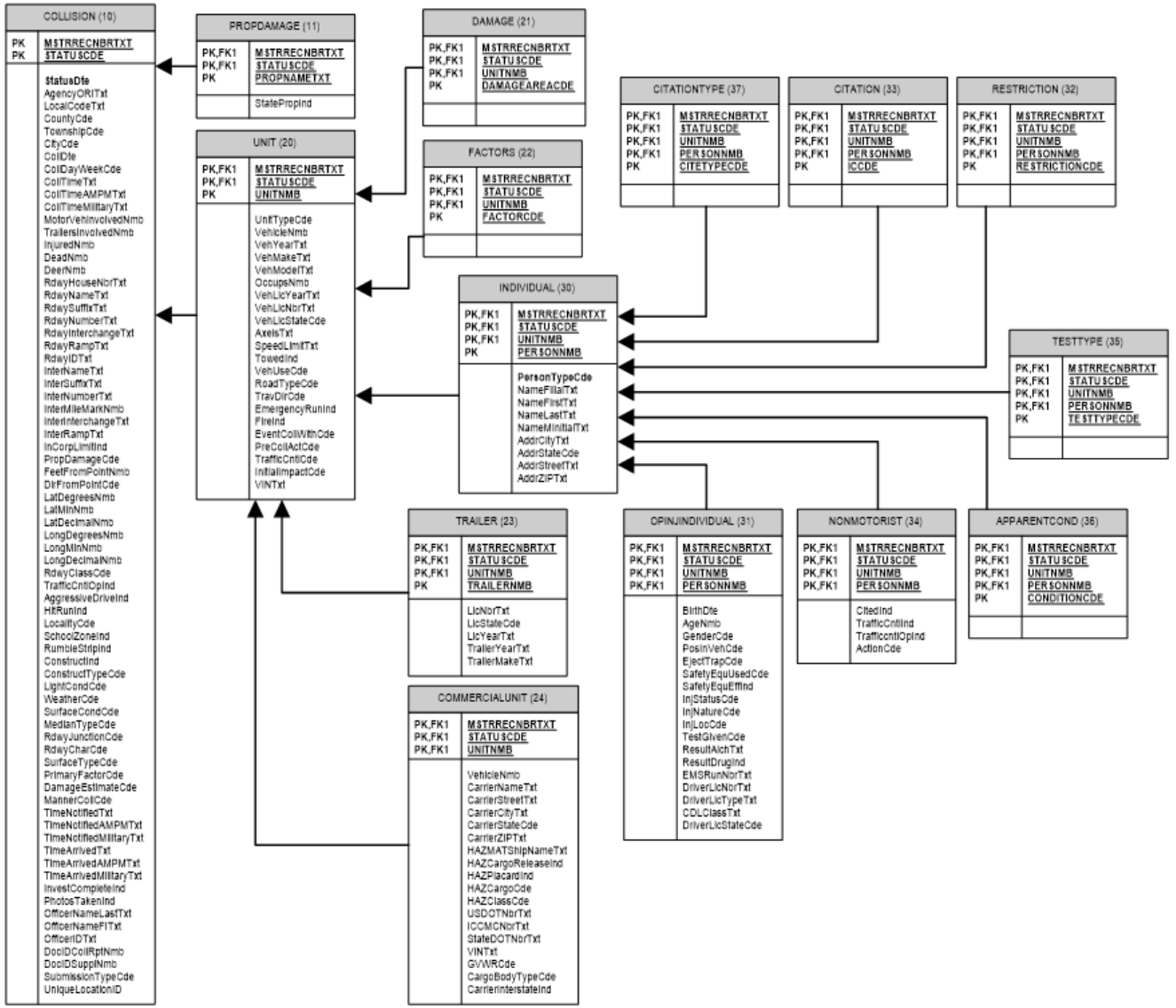
Traffic Control? ○ Yes ○ No

If yes, was traffic control operational? ○ Yes ○ No

ARIES crash data entry and database structure

ARIES database organization

- Replicated ARIES DB structure: 15 core tables…added views (virtual tables) to simplify querying, added additional data sets to enhance analysis
- Created functions as needed from Core ARIES data (locale, impaired driving, dangerous intersections
- PPI is one of 3 entities with full ARIES access and as a result has the greatest analytical capabilities.



Background on traffic safety research project

PPI research process

- PPI receives ARIES data extract from Appriss
- Data management partner, Department of Biostatistics, IUPUI
- Import ARIES and other data sets into SQL
  - Reconcile fatality counts with FARS team, Indiana State Police
- Research team queries and analyzes data
- Create data visualizations for use in publications, presentations, infographics, etc. to assist law enforcement and community partners with enforcement and public awareness campaigns

Background on traffic safety research project

PPI annual traffic safety publications

Spring fact sheets (February thru June)

- Alcohol
- Children (child passenger safety)
- Dangerous driving
- Non-motorists (bikes, pedestrians)
- Motorcycles
- Occupant protection
- Trucks
- Young drivers
- County/municipality profiles book (2 pages per county)

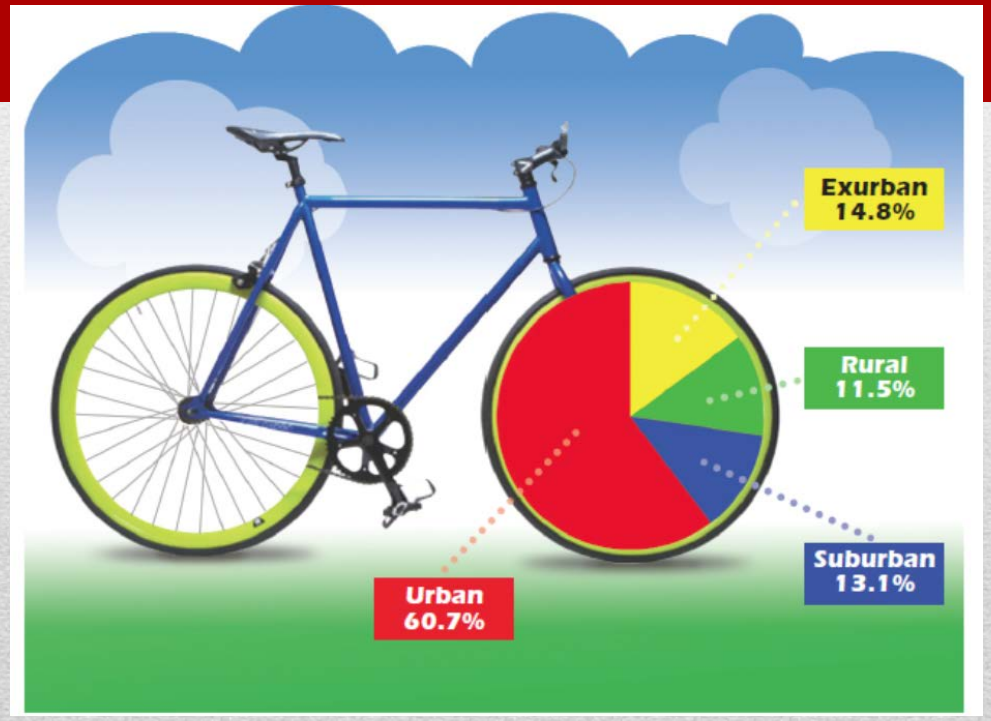
Annual *Indiana Crash Facts* book

(July thru September)

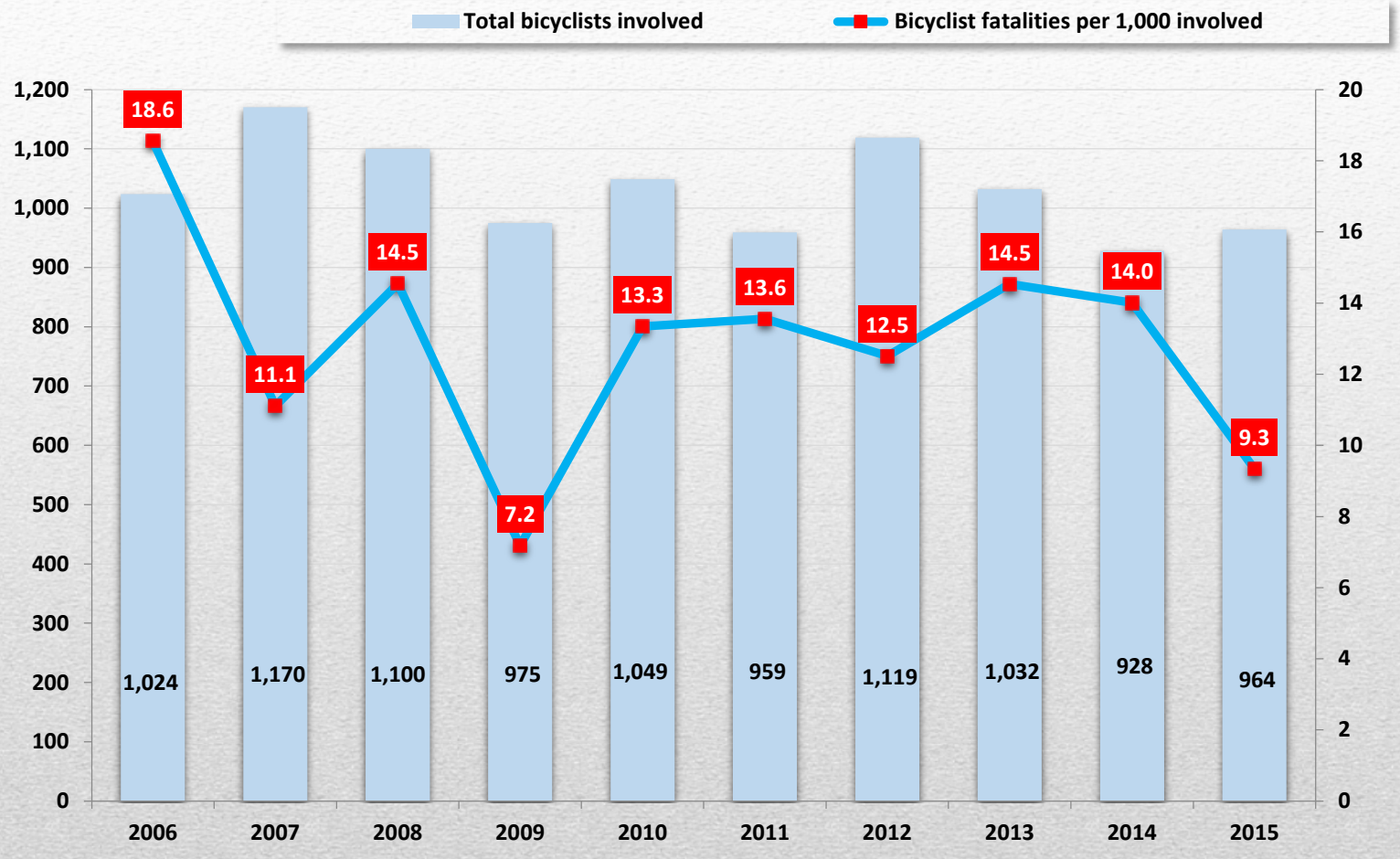
- Problem ID (in accordance with Indiana's Highway Safety Plan)
- General Trends
- Collisions (including work zones)
- Vehicles
- Motorcycles
- People
- Alcohol
- Speed
- Counties

Note: Focus from October thru January of each year is on presenting results to stakeholder groups; debriefing and planning priorities and changes for coming year; project management activities including file clean up, establishing work assignments and schedules, and obtaining updates to all necessary data sets prior to beginning analysis. Committee meetings take place year round.

Select Research Findings on Bicyclists Involved in Collisions

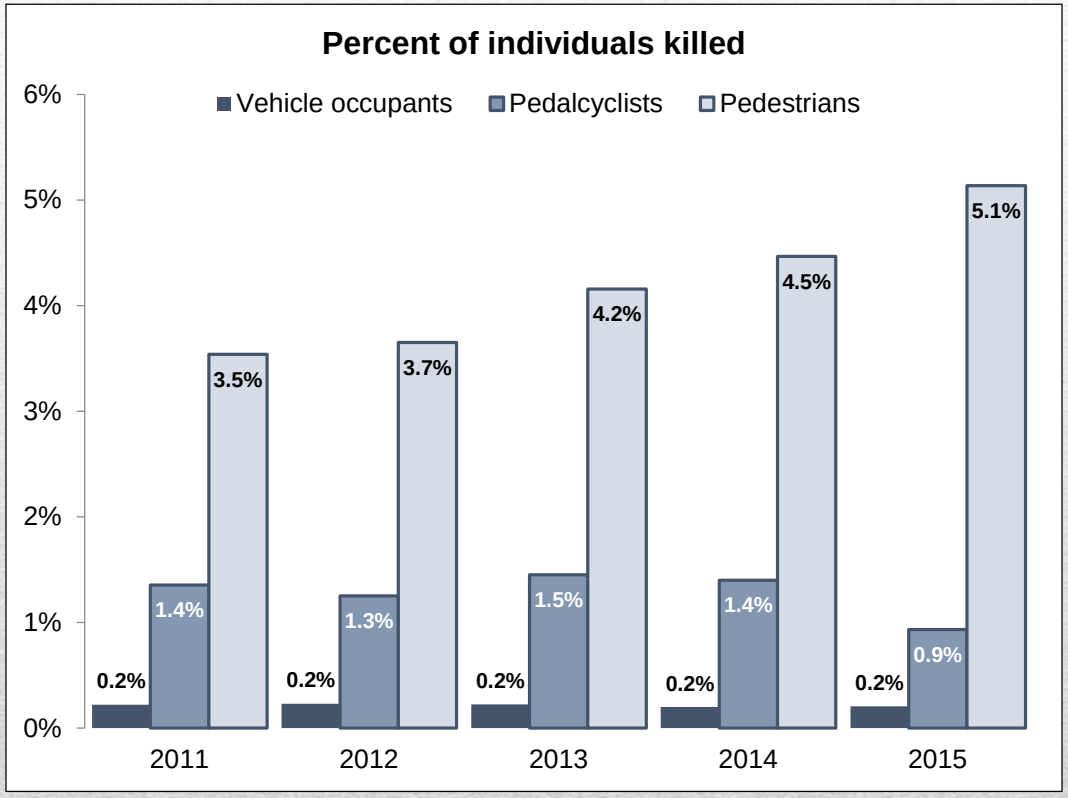


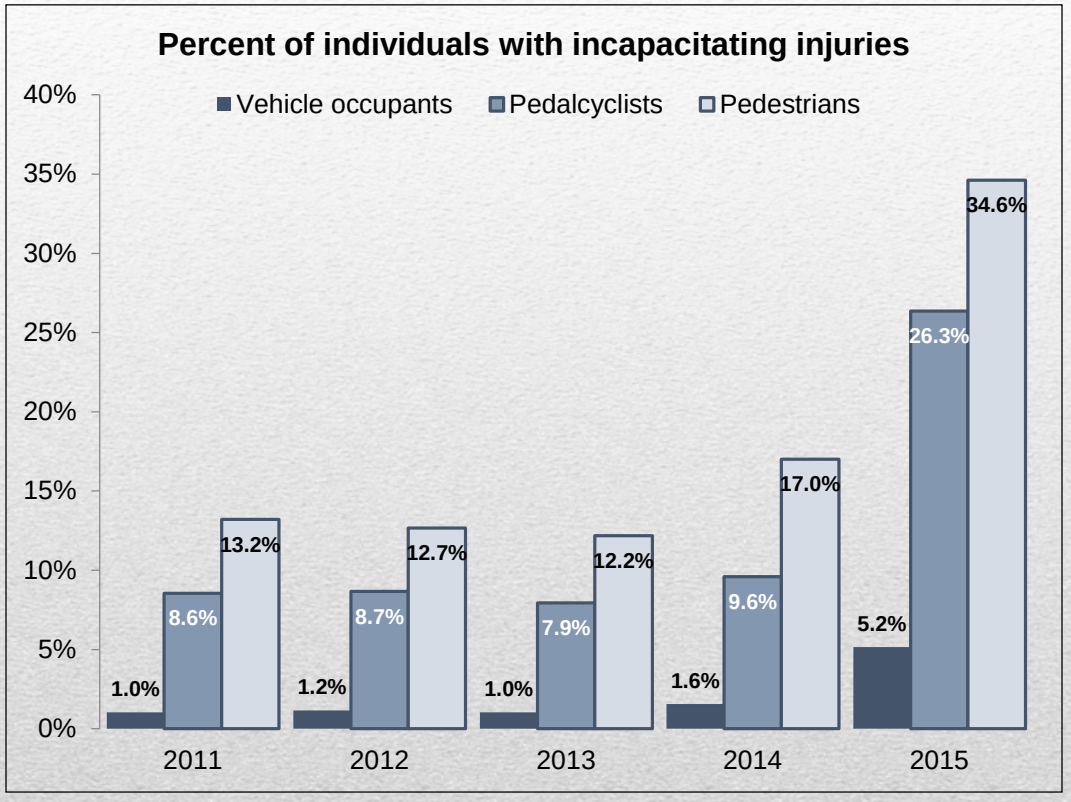
Bicyclists in Indiana collisions, injury status and year, 2006-2015



Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

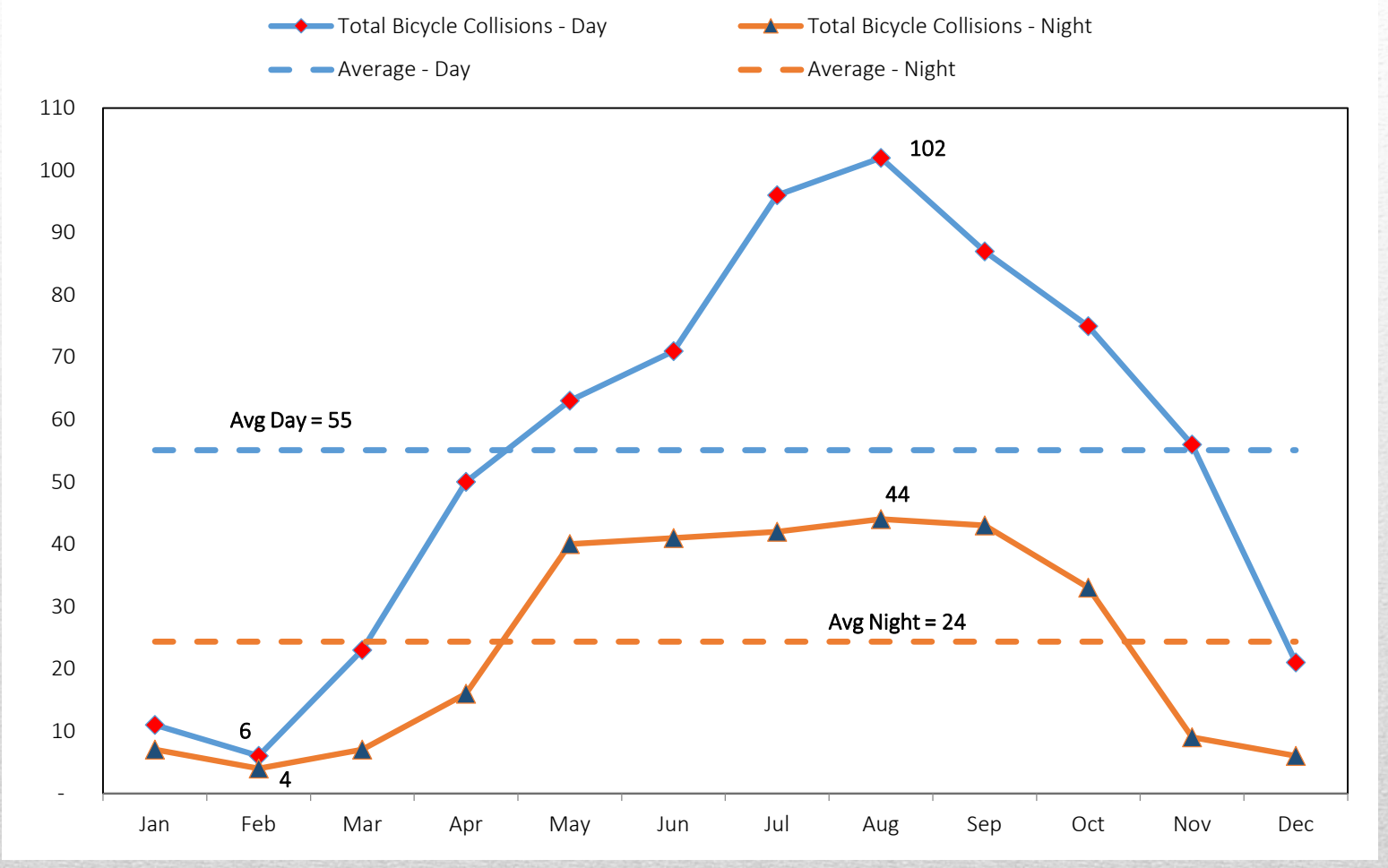
Fatal and incapacitating injuries in Indiana collisions as a percent of all involved, by person type, 2011-2015





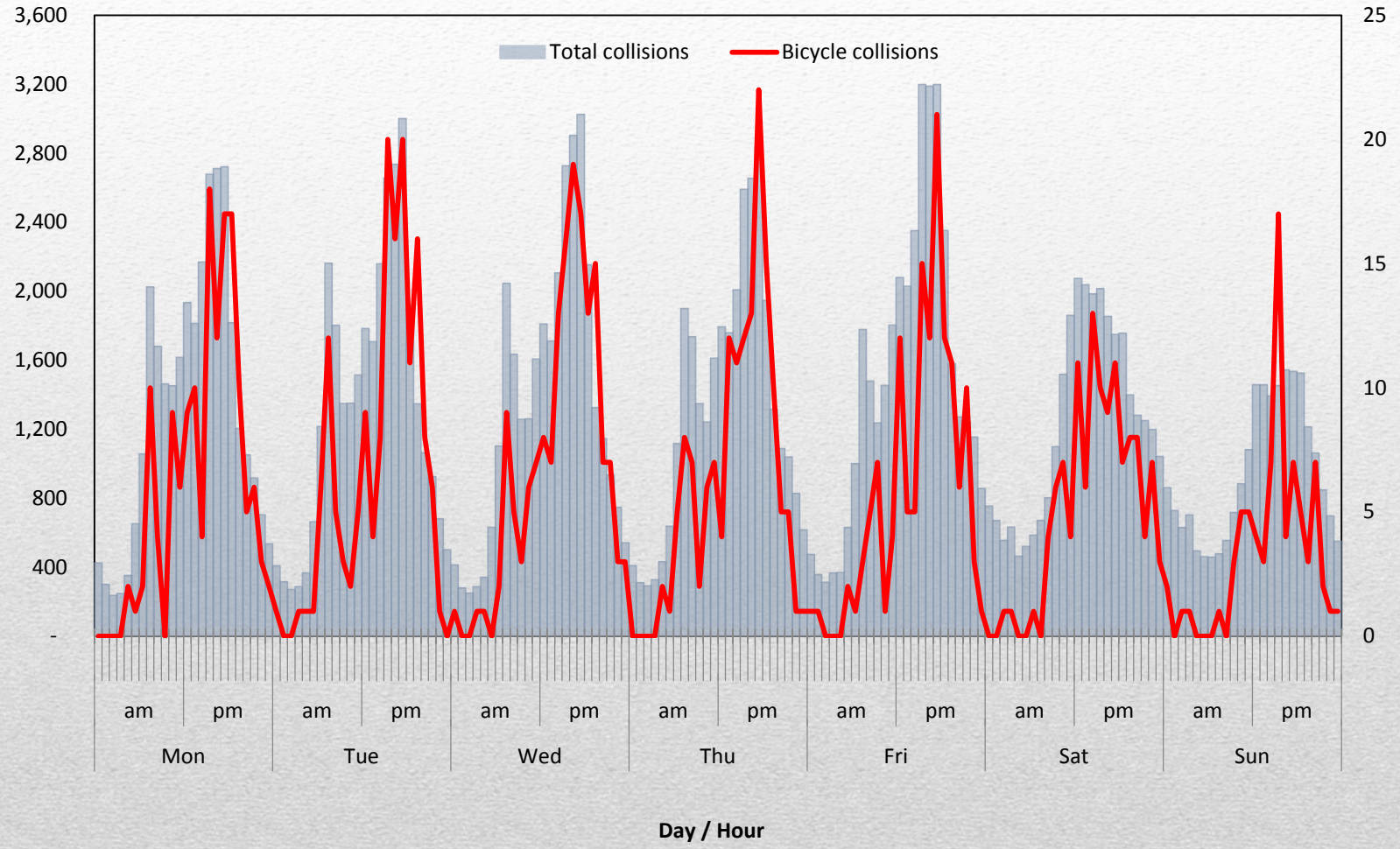
Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

Indiana traffic collisions involving bicycles by month and day/night, 2015



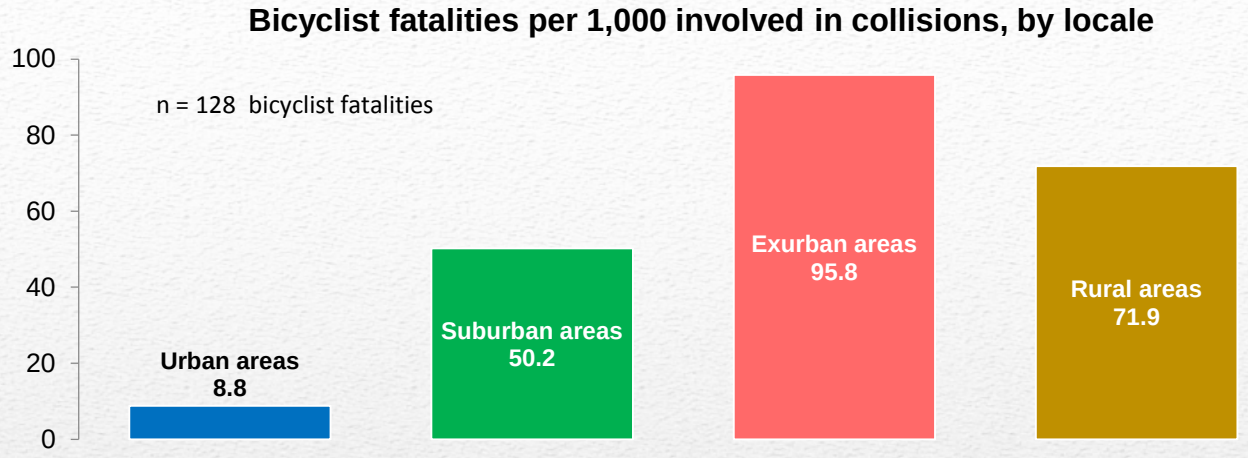
Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

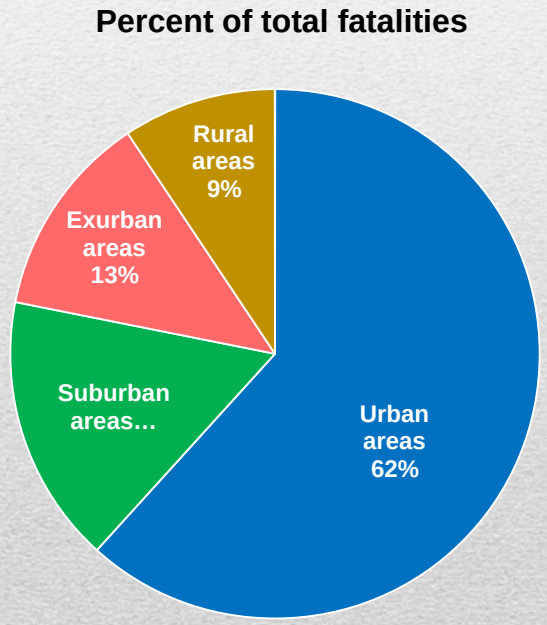
Indiana collisions, by bicycle involvement, hour, and day of week, 2015

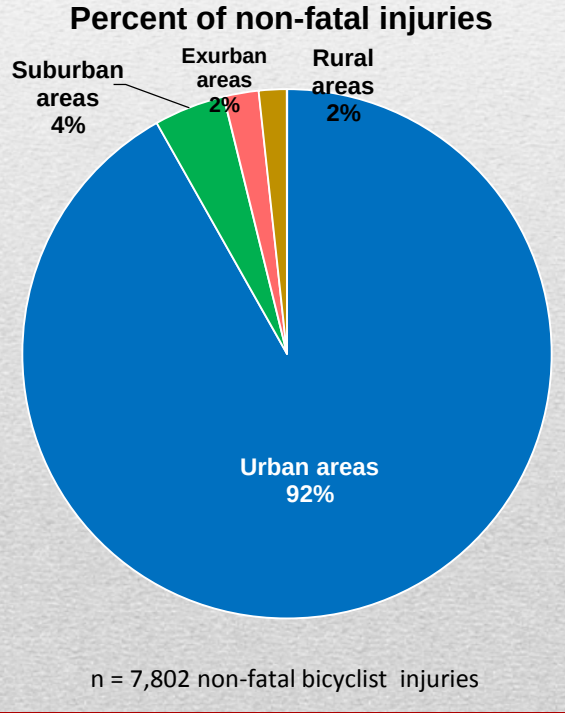


Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

Bicyclist fatality rates and geographic distribution of bicyclist fatalities and non-fatal injuries in Indiana collisions, by Census locale, 2006-2015

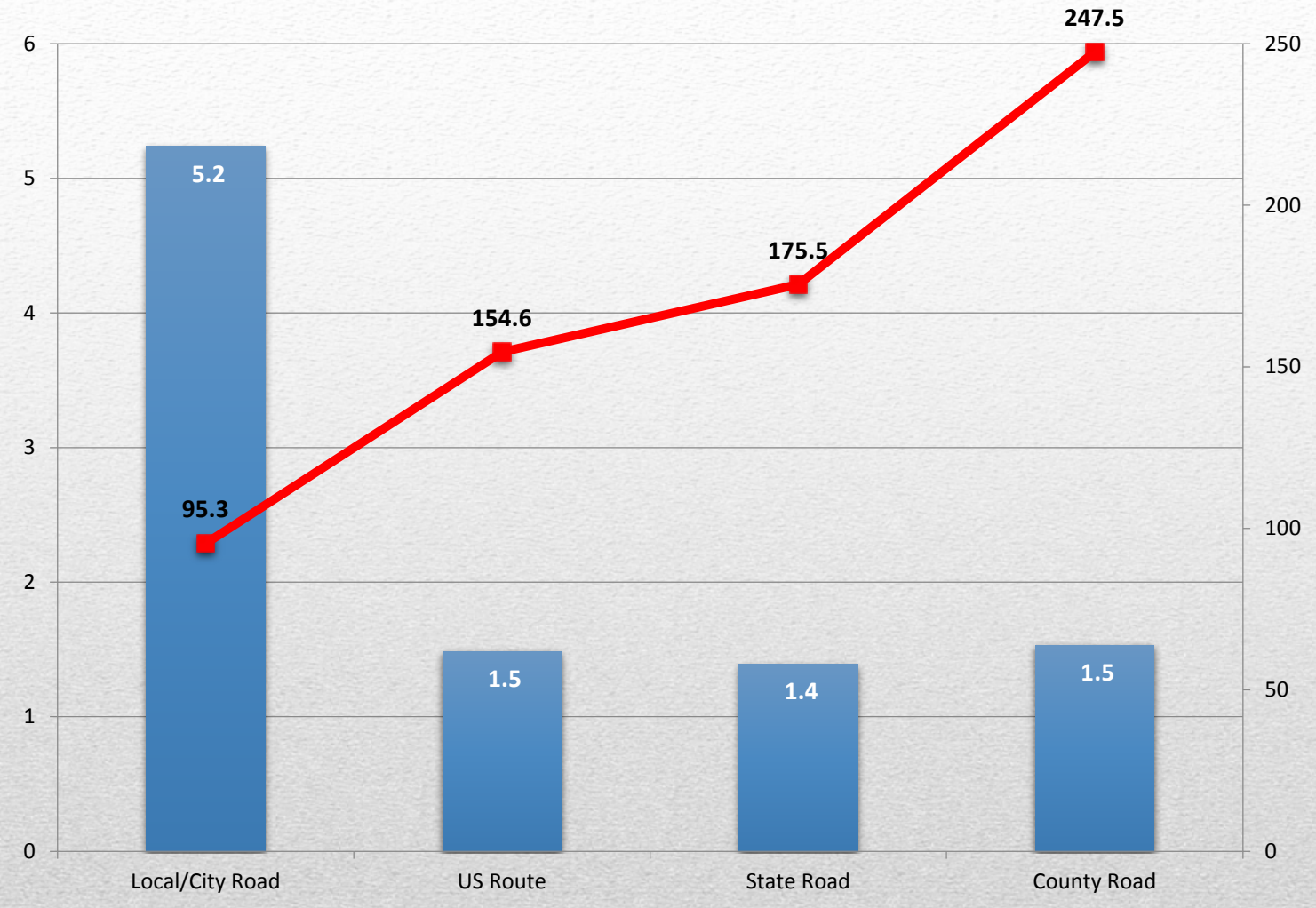






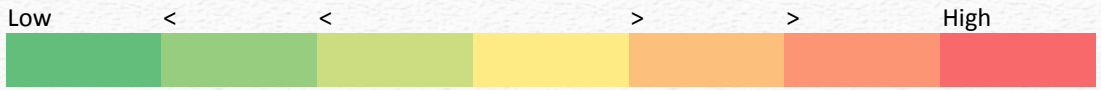
Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

Bicyclists involved Indiana traffic collisions, by road class and injury status, 2006-2015



Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

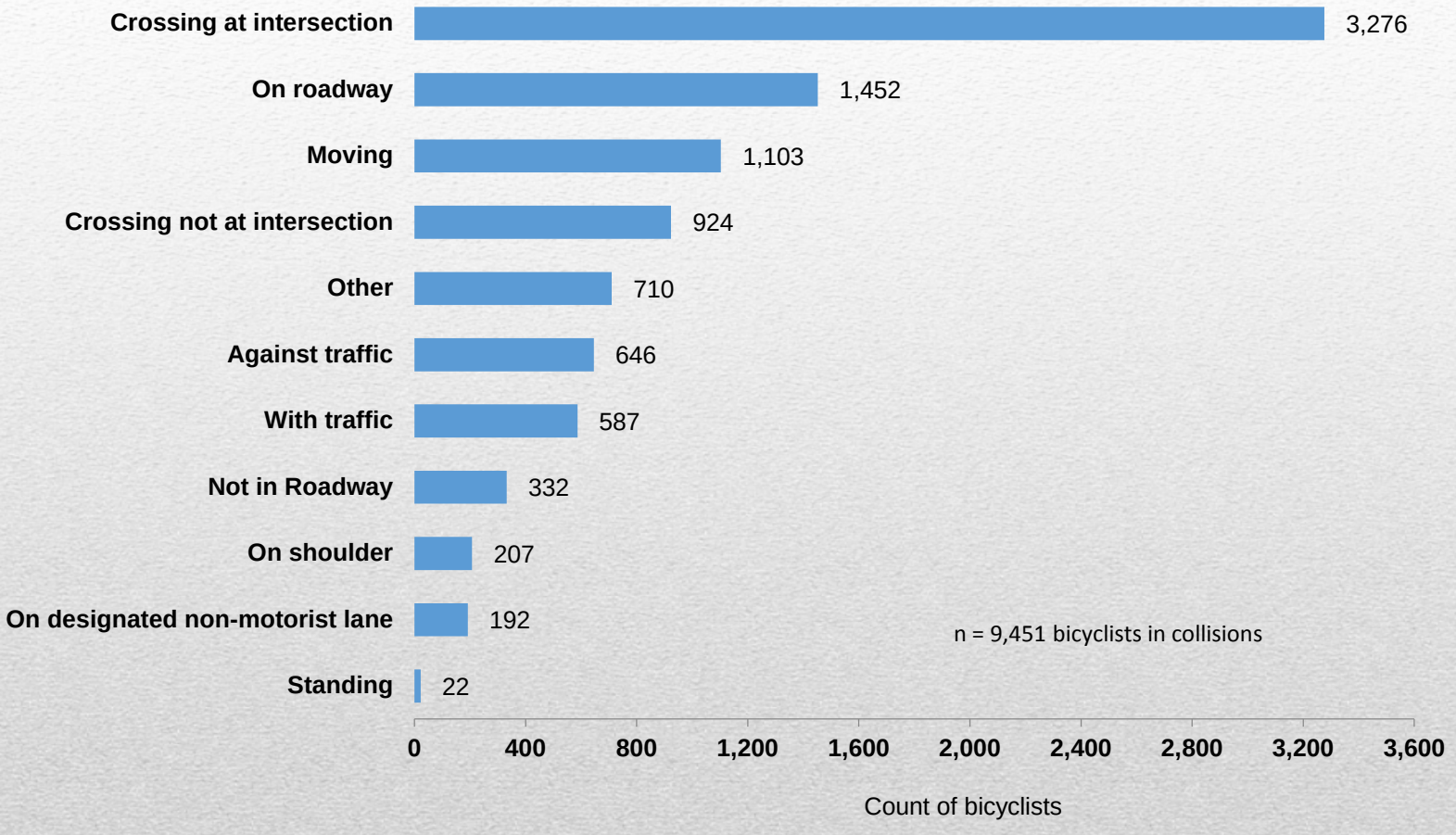
Proportion of bicyclists in Indiana collisions, by age group and gender, 2011-2015



	2011		2012		2013		2014		2015	
Age group	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
1-3	0.3%	0.1%	0.3%	0.0%	0%	0%	0.0%	0.0%	0.2%	0.1%
4-7	3.0%	0.9%	2.1%	0.7%	3%	1%	2.4%	0.9%	2.9%	1.7%
8-14	16.4%	4.4%	15.4%	3.1%	14%	3%	15.9%	3.6%	14.4%	5.0%
15-20	16.6%	5.1%	16.2%	4.2%	15%	4%	14.6%	3.9%	12.9%	4.5%
21-24	8.6%	1.8%	8.3%	3.1%	10%	2%	7.8%	4.2%	7.5%	1.8%
25-34	9.0%	2.1%	11.0%	3.1%	11%	3%	11.1%	3.1%	10.7%	2.1%
35-44	6.5%	1.5%	8.4%	1.3%	7%	2%	7.2%	1.3%	7.4%	1.8%
45-54	11.8%	2.0%	10.8%	2.7%	11%	2%	9.8%	1.3%	10.0%	2.6%
55-64	5.9%	0.7%	6.0%	0.5%	7%	1%	7.0%	1.5%	8.2%	1.5%
65-74	1.7%	0.2%	1.7%	0.4%	2%	0%	3.0%	0.4%	3.1%	0.7%
75 +	1.1%	0.0%	0.5%	0.1%	1%	0%	0.9%	0.2%	0.8%	0.3%
All ages	**81.2%**	**18.8%**	**80.7%**	**19.3%**	**81.1%**	**18.9%**	**79.6%**	**20.4%**	**78.1%**	**21.9%**

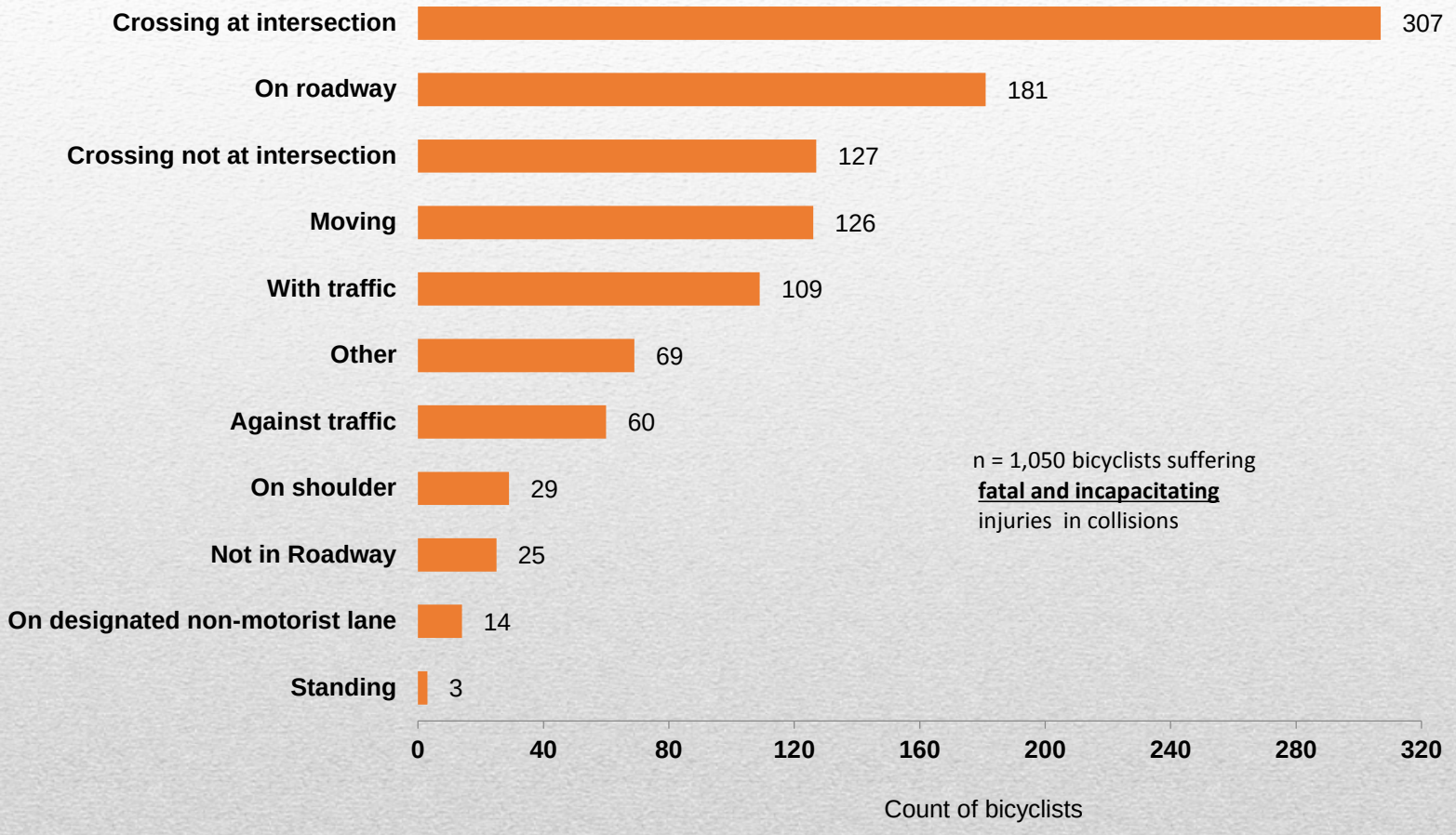
Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

Bicyclists in Indiana collisions, by bicyclist action as a contributing factor, 2006-2015



Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

Fatal and incapacitating injuries among bicyclists in Indiana collisions, by bicyclist action as a contributing factor, 2006-2015



Source: Indiana State Police Automated Reporting Information Exchange System (ARIES), as of March 17, 2016

Innovative approaches to studying and improving bicycle safety

Public policy - informing change to policy and program activities

Results are presented to many stakeholder groups including:

- **Governor's Council on Impaired and Dangerous Driving**
- **Traffic Records Coordinating Committee (TRCC)**
- **Law Enforcement Liaisons**
- **Legislators**
- **Chronic Disease Integrated Epidemiology Group, ISDH (bicycle collision findings – Bicycle Indiana)**

Innovative approaches to studying and improving bicycle safety

Estimating bicyclist exposure to risk of injury in crashes

Indiana bicycle crash data analysis has been limited by the lack of bicyclist exposure to risk data. Implementing the Minneapolis model to gathering exposure data in Indianapolis will address this need and may lead to applications of this model in other Indiana bicycle-friendly communities over time.

Pedalcyclist Fatalities in Region V states, 2013 (DOT HS 812 151)		
Region V State	Pedalcyclist Fatalities 2013	Pedalcyclist Fatalities / 100,000 population
Illinois	30	0.23
Indiana	14	0.21
Michigan	27	0.27
Minnesota	6	0.11
Ohio	19	0.16
Wisconsin	10	0.17

Innovative approaches to studying and improving bicycle safety

Estimating bicyclist exposure to risk of injury in crashes

Collaborating with Dr. Greg Lindsey, University of Minnesota, to replicate methods used in Minneapolis to collect bicycle count data and model bicycle traffic volume estimates in Indianapolis.

- **Student capstone, service learning, or graduate assistant research project to collect the bicycle count data.**
- **Conduct surveys to assess awareness of the recent addition of bicycle lanes on Indianapolis roadways and appropriate driver and bicyclist behaviors related to bicycle lanes.**
- **Utilize spatial analysis tools to overlay Indianapolis crash data with bicycle lanes and greenways to determine the impacts of the addition of bicycling infrastructure on bicyclist involvement in collisions.**

Innovative approaches to studying and improving bicycle safety

Estimating bicyclist exposure to risk of injury in crashes

Planned Case studies: Use of monitoring, modeling, and analytic procedures developed in Minneapolis to analyze crashes in Indianapolis, Columbus, and Milwaukee. The specific objectives of the research are to:

- **Use recent estimates of bicyclist exposure to risk in Minneapolis in analyses of factors associated with bicycle crashes in Minneapolis;**
- **Assemble bicycle counts and estimate bicycle traffic demand models and exposure to risk in Indianapolis, Columbus, and Milwaukee;**
- **Use estimates of bicycle traffic volumes to analyze needs for traffic controls and factors affecting bicycle crashes in Indianapolis, Columbus, and Milwaukee.**

Indiana University Public Policy Institute

Presented by

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