

Who speeds more often?

Comparisons between motorcyclist and car driver speed selections

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Motivation

- Some drivers believe that motorcyclists ride faster than drivers drive.
- Is this true?
- Hypothesis well suited to exploration and testing using Naturalistic Driving Data
 - Large sample sizes
 - Diverse roadway environments
 - Large number of participants



Summary of the Data Sets

SHRP2 Naturalistic Study

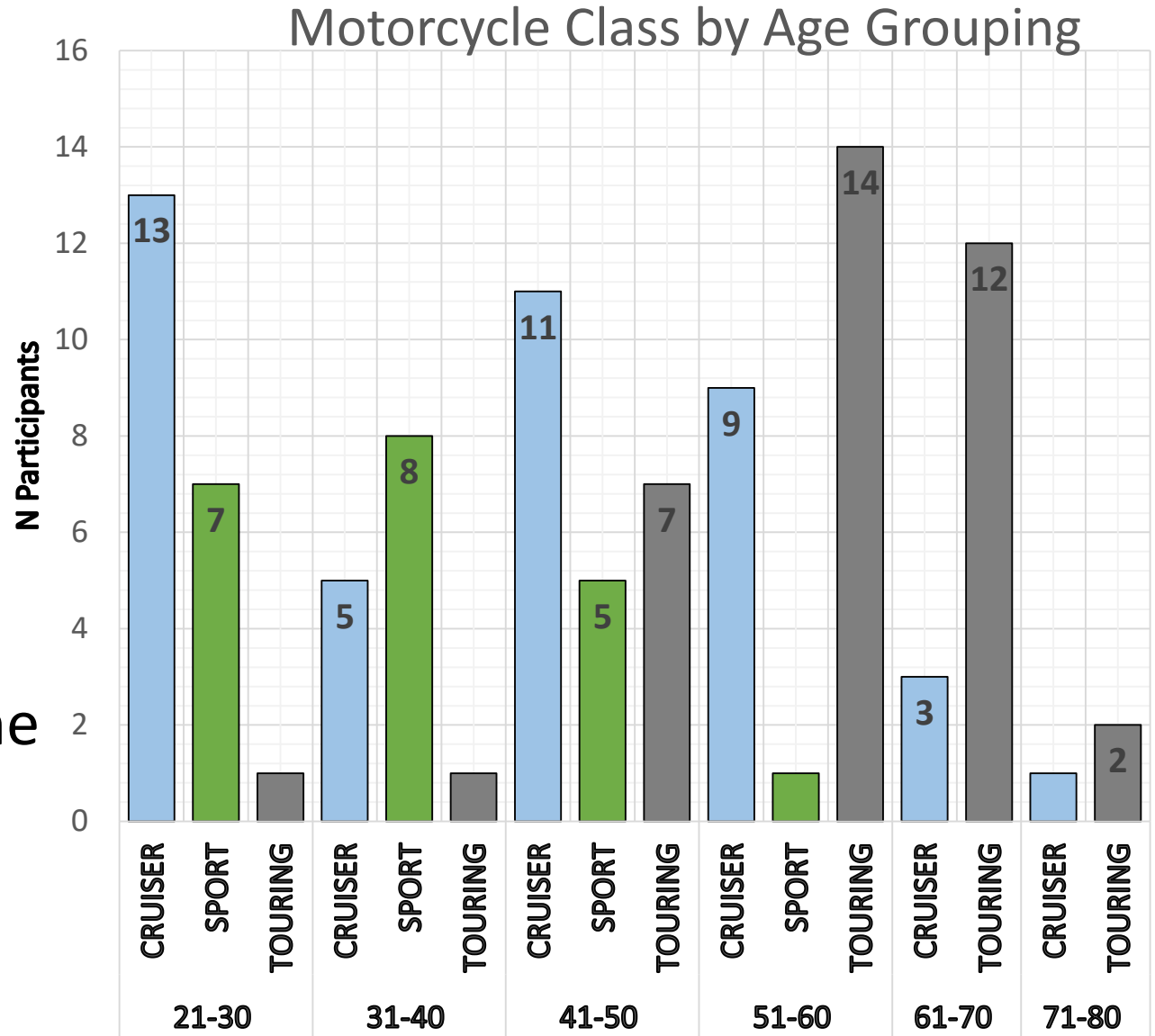
- 3,542 drivers
- Cars, trucks, SUVs
- 6 locations
- ~1yr per participant
- ~6M trips
- 32M miles
- ~1M hours

MSF 100 Motorcyclist Naturalistic Study

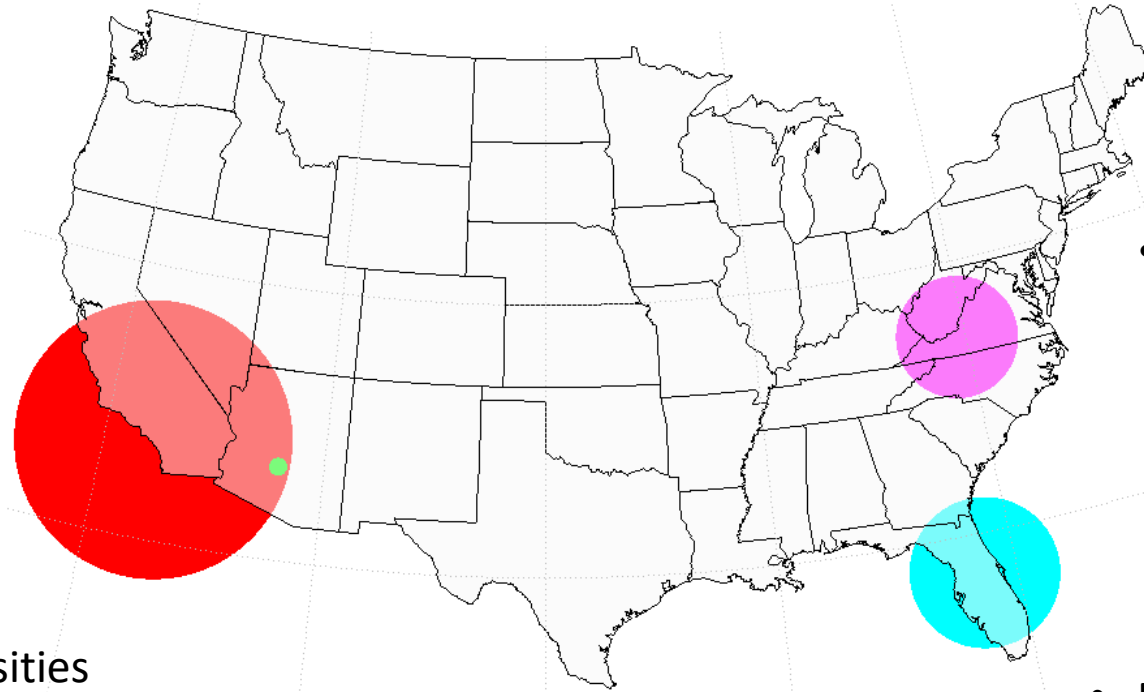
- 100 Riders
- Motorcycles (Cruisers, Sport Bikes, Touring Bikes)
- 4 locations
- ~1yr per participant
- 36k trips
- Approximately 350k miles
- 8,776 hours

The Riders

- 100 Participants (72 male)
- Personal motorcycles instrumented for between two months and two years.
- August 2011 through December 2013
- Personal motorcycles fell into one of three classes
- Participants ranged in age from 21 – 79 years old



MSF 100 Installation Location



- California (Irvine)
 - Year-round riding
 - Mixed traffic densities
 - Geographic overlap with past studies

- Arizona (Phoenix)
 - Year-round riding
 - Mixed traffic densities
 - High concentration of sport bikes

- Virginia (Blacksburg)
 - Fall and Winter
 - Two-lane with hills and curves
 - Geographic overlap with automotive studies

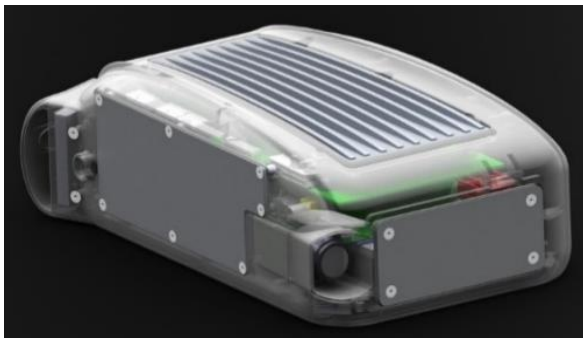
- Florida (Orlando)
 - Conditional helmet law
 - Mandatory training
 - Flat and straight roads

Size of circles proportional to number of miles collected at each install location

Motorcycle Naturalistic



- Machine vision lane tracker
- Accelerometers (3 axes)
- Gyro (3 axes)
- Forward radar
- Speed
- Turn Signals
- Brake lever inputs
- GPS
- Continuous collection
- 8-12 month capacity
- Cellular communication
- Five cameras



Data Selection

MSF 100

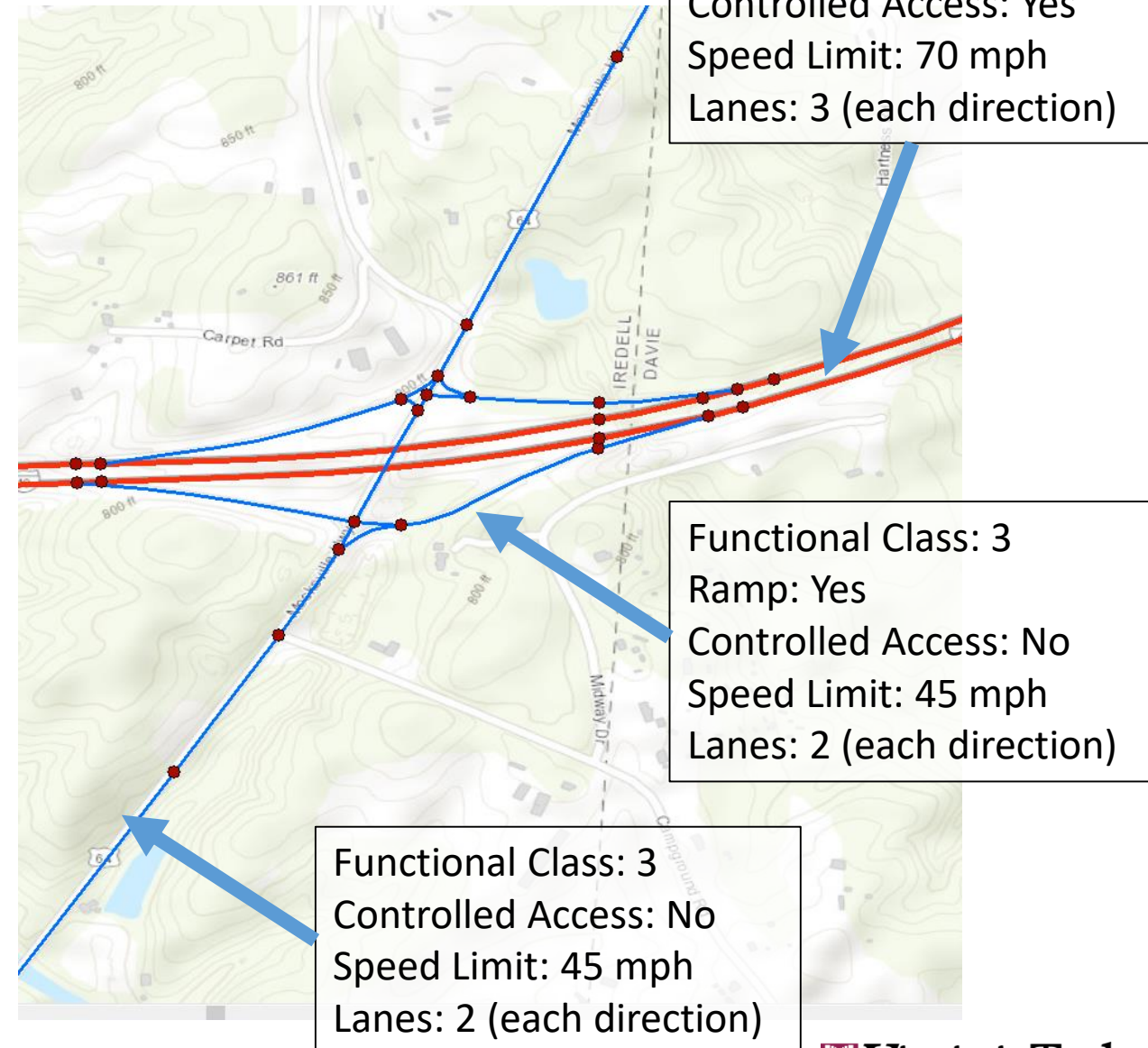
- 90 Motorcyclists
 - Excluded 250cc motorcycles
 - Concern that that vehicle, not rider may be dictating speed
- ~28,000 Trips
 - All map matched trips

SHRP 2 Naturalistic Driving Data

- 270 Drivers
 - 3 SHRP2 Drivers for each rider
 - Randomly selected
 - Matched on age group and gender
 - Cars only
- ~224,000 trips
 - Sample of All Map Matched Trips
 - Beginning and end of each trip removed due to PII

Map Matching

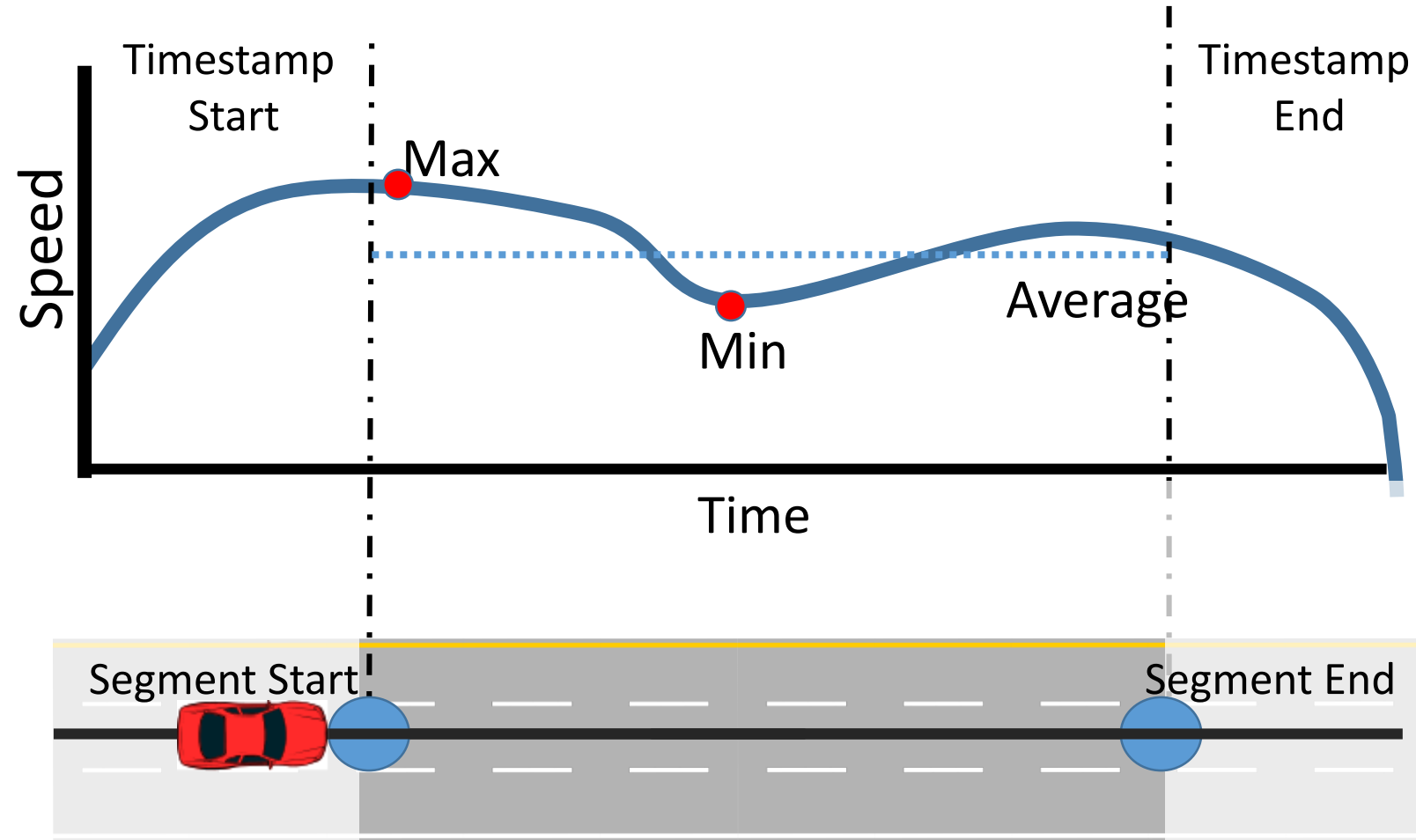
- GPS data from each trip matched to digital map data
- Attributes of roadway segments
 - Speed Limit
 - Functional Class
 - Controlled Access
- Roadway segments mapped to time domain data



Summarizing the Speeds for Comparison

Timestamps from Map Matching segments used to isolate speed

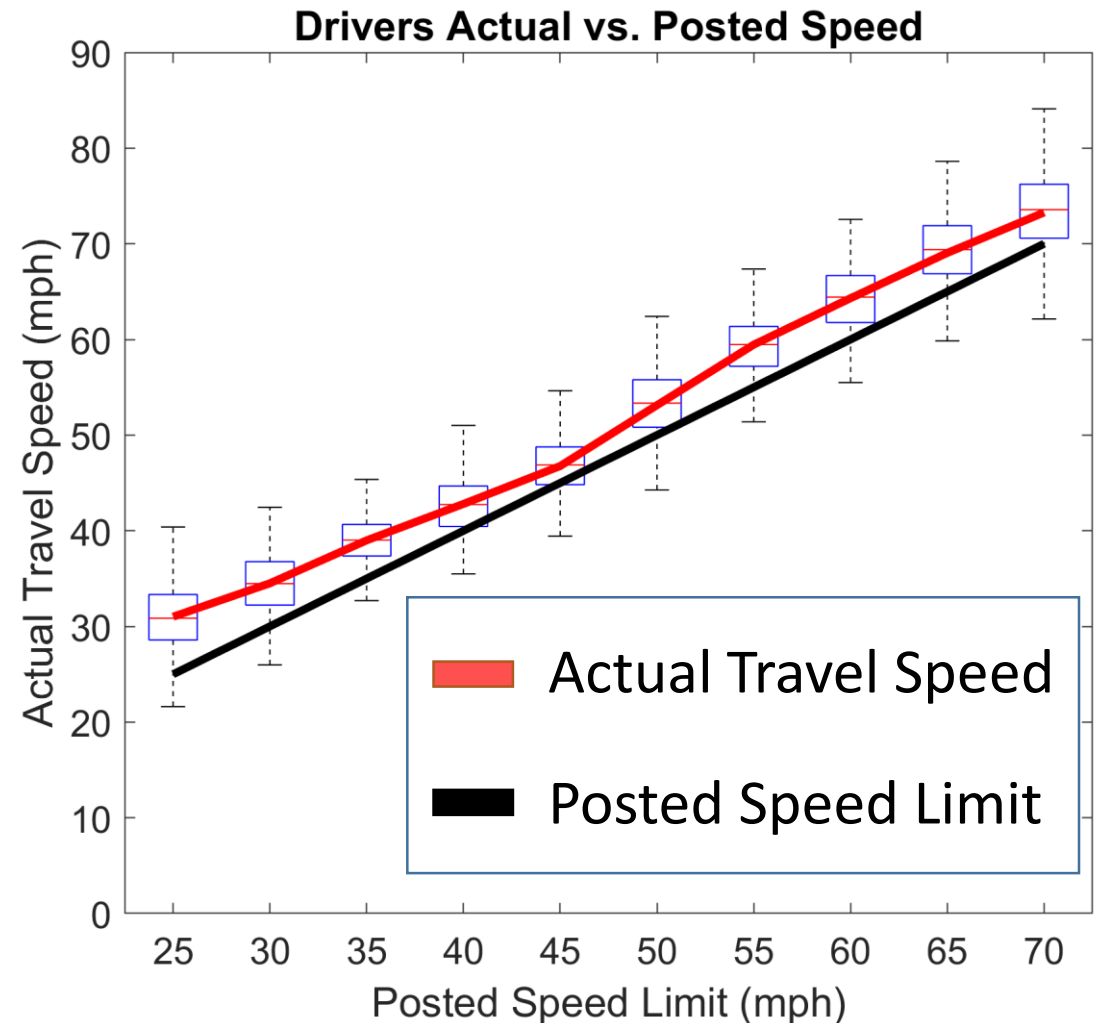
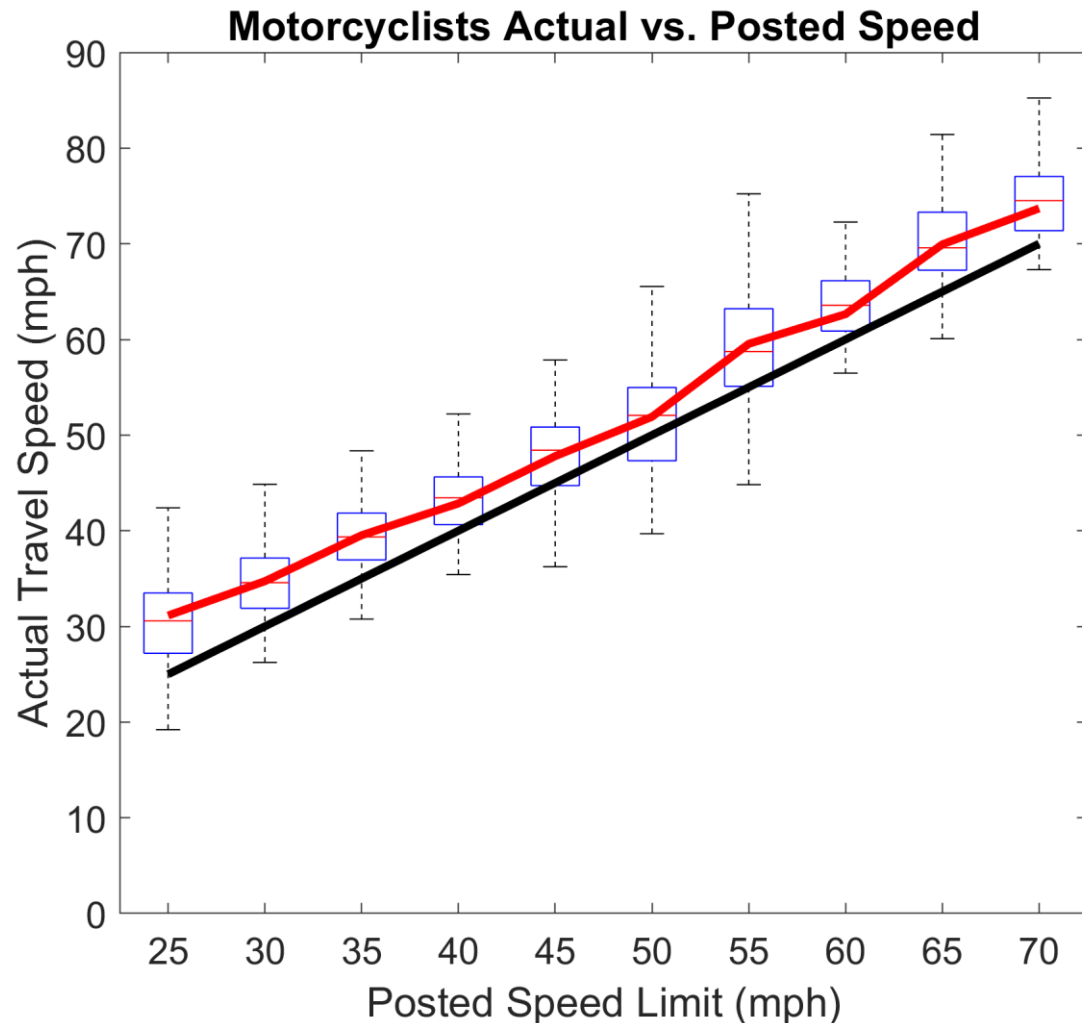
- Find:
 - Maximum Speed
 - Minimum Speed
 - Average Speed



Methods – Data Processing

- Map Matched Data:
 - Speed limits
 - Roadway characteristics
- Speed
 - Calculated mean, maximum and minimum speeds for each roadway segment
- Radar
 - Identified other vehicles using forward radar for each roadway segment
- Participant-level means computed
 - Averaging speed values from all roadway segments
 - Grouped by posted speed limit
 - Weighted average used to correct for differences in segment length

Speeds When Compared to Posted Limit



What are We Measuring?

Are motorcyclists actually speeding more excessively than drivers?

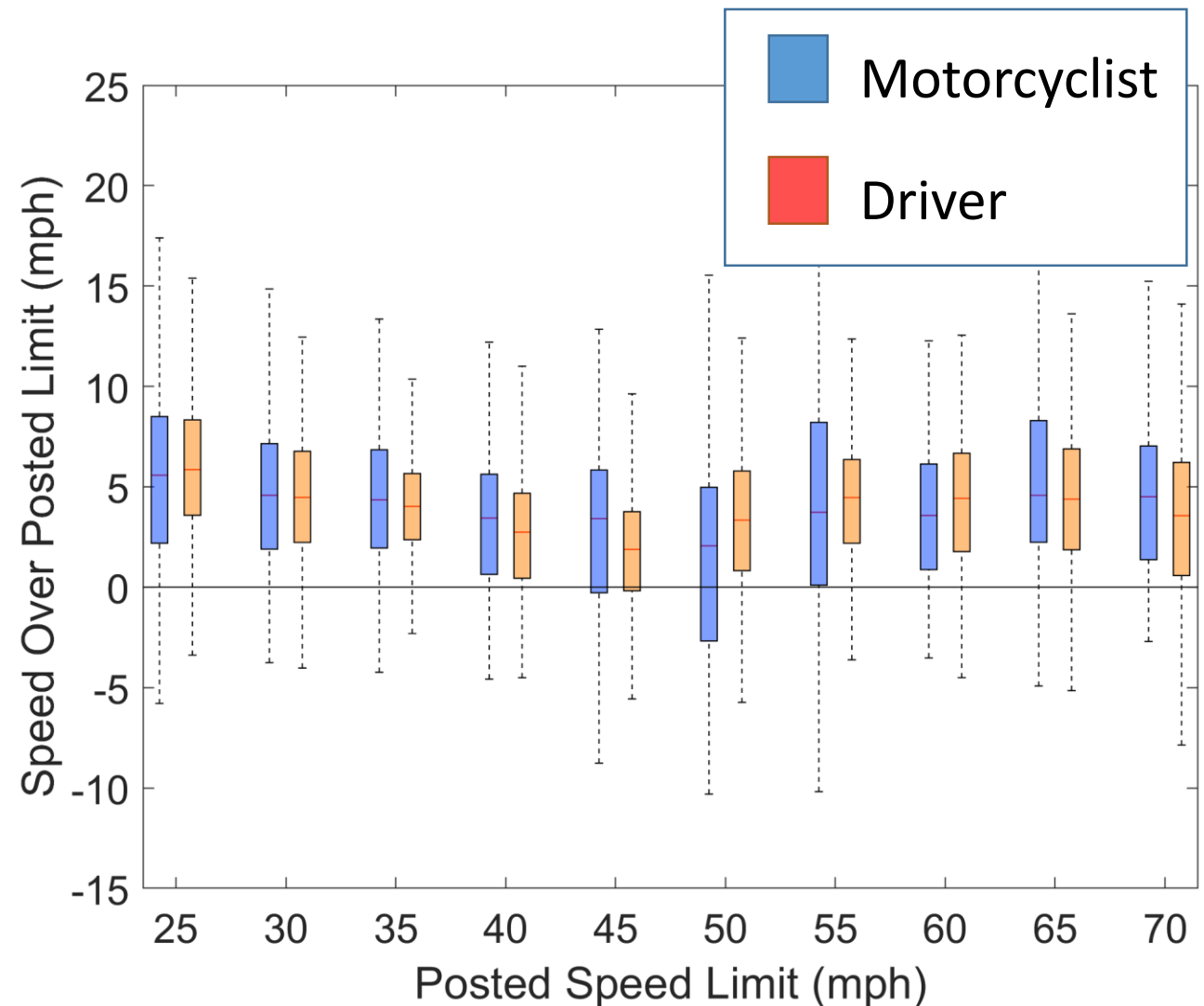
- Difference between the average participant speed and posted speed limit

$$\textit{Speed_Over_Posted_Limit} = \textit{Average_Maximum_Speed} - \textit{Speed_Limit}$$

- This measure tells to what degree motorcyclists or drivers are speeding

Comparisons of Travel Speed Over the Posted Speed Limit

Speed Limit (mph)	Speed Over Posted Limit (mph)	
	Motorcyclist	Driver
25	5.90	5.91
30	4.90	4.68
35	4.53	4.00
40	3.38	2.82
45	2.80	1.77
50	2.05	3.17
55	4.98	4.45
60	4.06	4.29
65	4.99	4.03
70	4.58	3.36
Grand Mean	4.22	3.85



Statistical Methods

- Mixed Model
- Dependent Variable:
 - Speed Over Posted Limit
- Within Subjects Factors :
 - Speed Limit Groups
- Between Subjects Factors:
 - Vehicle Type (Car or Motorcycle)
 - Age Group

Statistical Results

Measuring Differences in Speed Over Posted Limit

- No statistically significant difference found between motorcyclists and drivers
- Statistically significant difference found between different Speed Limits ($p < 0.0001$)
- Statistically significant difference found between different Age Groups ($p = 0.0019$)
 - Differences between 30-39 and 70-79 age groups as well as the 40-49 and 70-79 age groups

Summary

- On average, Motorcyclists and Drivers speed to about the same degree
- Motorcyclists and Drivers of different ages speed to different degrees
 - Differences between younger age groups and the 70-79 age group
- Drivers and Motorcyclists generally average about 4 mph over the speed limit

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