

## The MSF100 Motorcyclists Naturalistic Study: Preliminary Results

Sherry Williams, Ph.D.

Director, Quality Assurance & Research  
Motorcycle Safety Foundation

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The paper summarizes the groundbreaking MSF100 research study where motorcyclists' personal motorcycles were instrumented with an array of kinematic data gathering instruments and asked to ride as they normally would for one year. Preliminary results are described including overview summaries of the demographic, psychographic, and geographic profiles of the riders.

# *The MSF* **100 Motorcyclists Naturalistic Study**

*Conducted by Virginia Tech  
Transportation Institute*



New York Safety Summit  
October 2013

**DO NOT DISTRIBUTE**  
Preliminary results only



# Status and Outline

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- MSF is the proud sponsor of the first and largest naturalistic motorcyclist study ever.
- Data collection nearing completion
  - Expect last bike off the road in November.
- Analyses are underway
- Recap of the Study
- Demographics
- Four analyses nearing completion
  - Waiting for incorporation of final participants.

# Motorcycle Instrumentation

- Video cameras
- Lane tracking
- Helmet / Gaze tracking
- Front and rear brake
- Accelerometers (3 axes)
- Gyro (3 axes)
- Speed
- Turn signals
- GPS
- Forward radar (speed to lead vehicle/object; distance to lead vehicle – up to 255)
- Continuous collection
- 8-12 month capacity



# Instrumentation: Unobtrusive Integration



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## 100 Motorcyclists Naturalistic Study

conducted  
by



# Study Operations

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- 100 motorcyclists recruited, instrumented.
  - ~55 completed participation
  - ~45 still on the road in all four states
- Currently de-instrumenting
  - Targeting all off road in the next 4-6 weeks.

# Data Accumulation

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- Retrieved (in-house) data
  - Data for 85 participants in-house
    - 29,595 trips
  - Over 42,000 trips collected  
In-house and in the field
- The Data
  - More than 400,000 miles of riding so far
  - Expecting approximately 35,000 days of participation, ~ 95 years.
  - At least 40 billion data points not including the video streams

# Participant Demographic Summary

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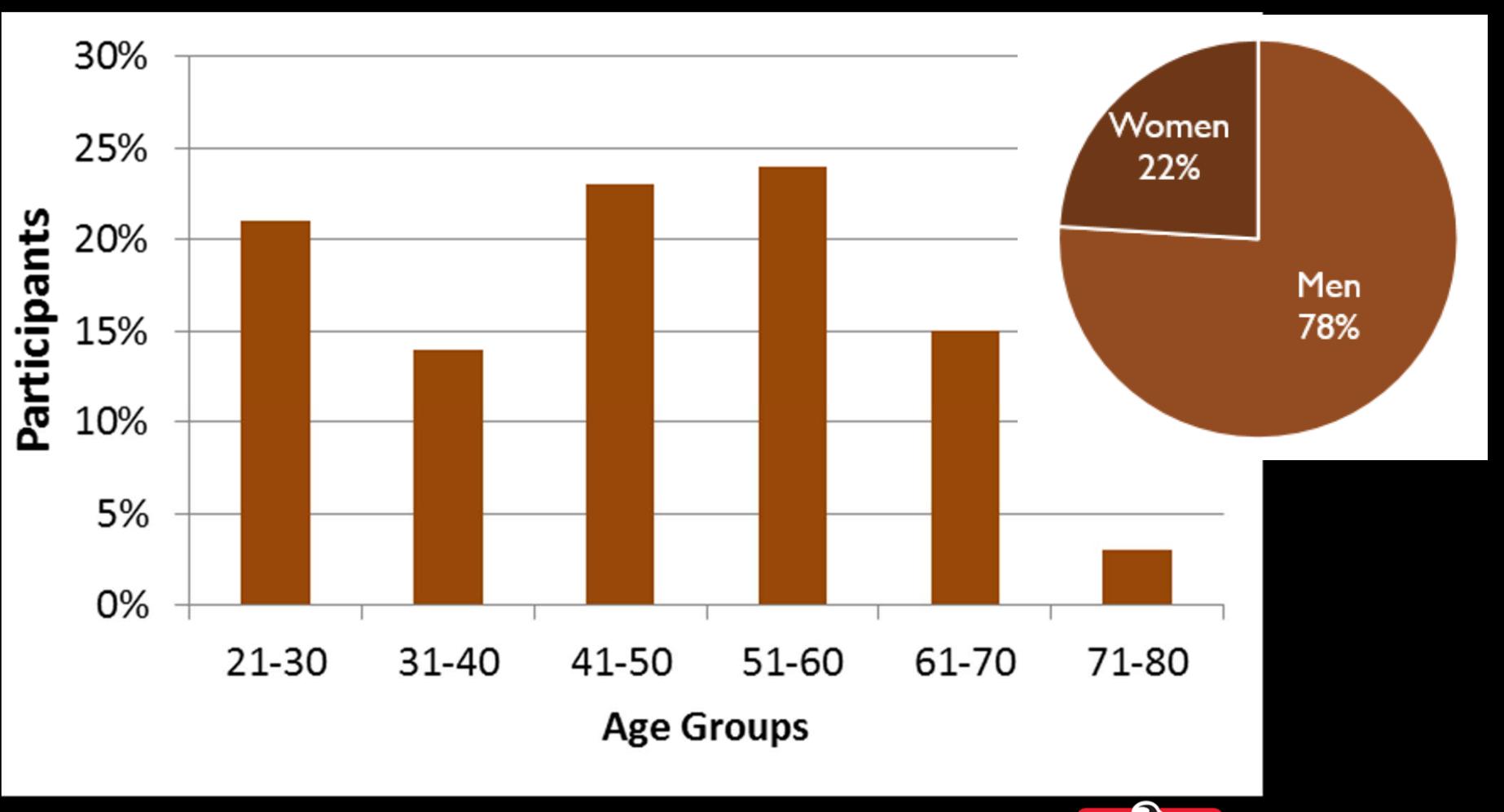
# Number of Participants in Four Regions



- Irvine, California
  - Year-round riding
  - Mixed traffic densities
  - Geographic overlap with past studies
- Phoenix, AZ
  - Sports bikes
  - Riding characteristics TBD
- Blacksburg, Virginia
  - Fall and Winter
  - Two-lane with hills and curves
  - Geographic overlap with automotive studies
- Orlando Florida
  - Conditioned helmet law
  - Mandatory training
  - Flat and straight roads



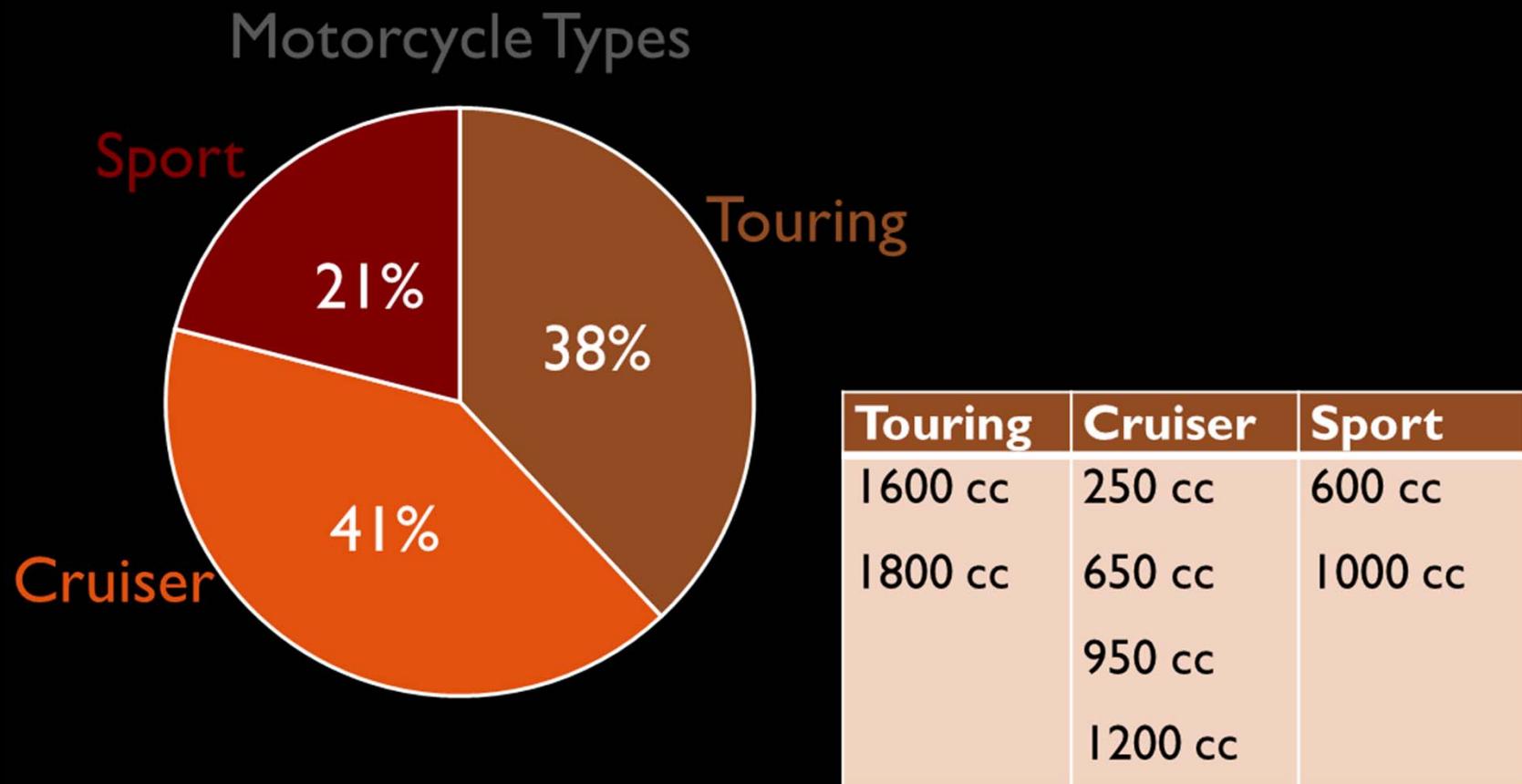
# Age and Gender



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# Motorcycle Types

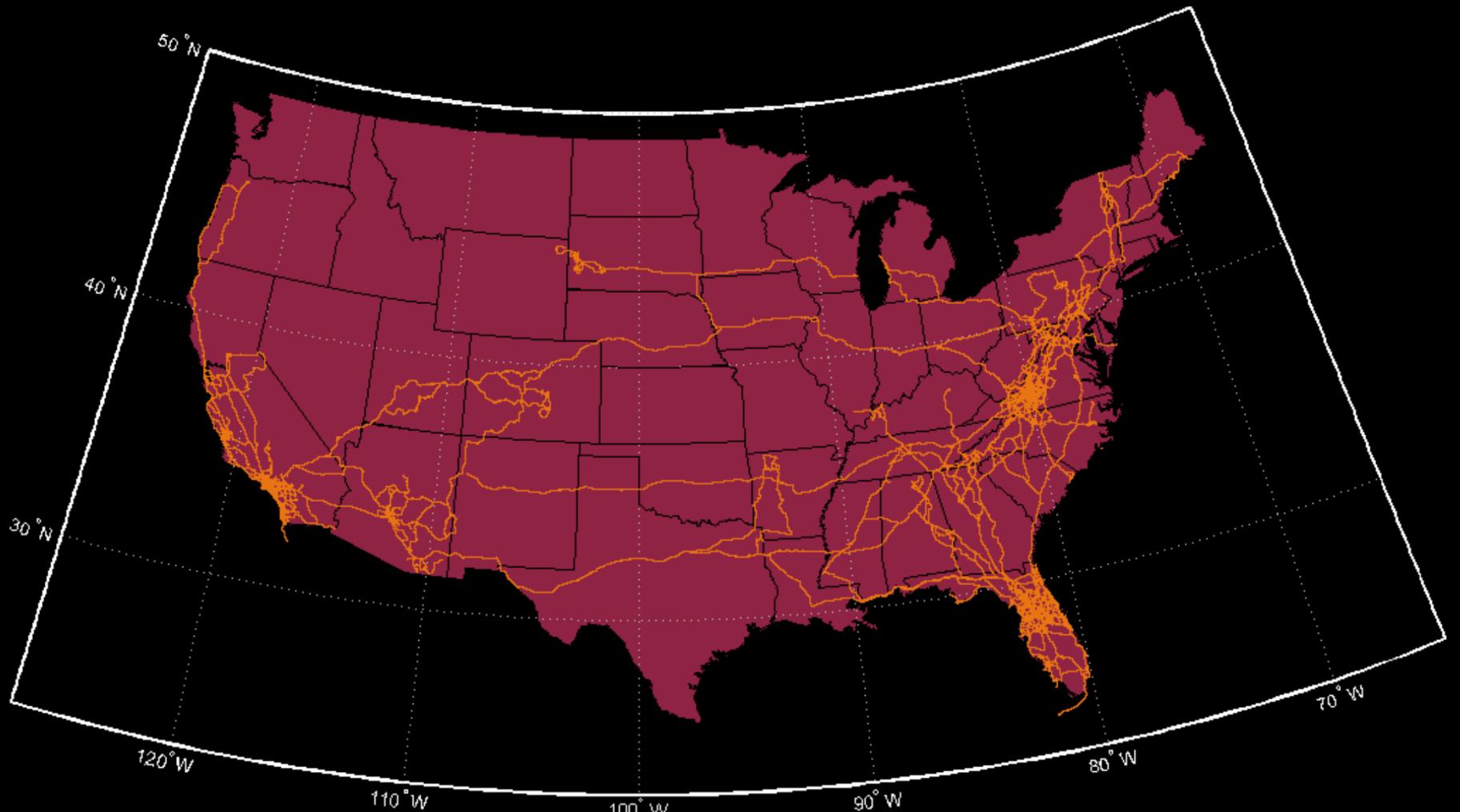


# Four Initial Analysis

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- Trip Descriptions
  - Geographic / Roadway Identification / Time of Day
- Personality Measures
- Weather
- Apparel Analysis

# Sample Includes a Wide Geographic Range



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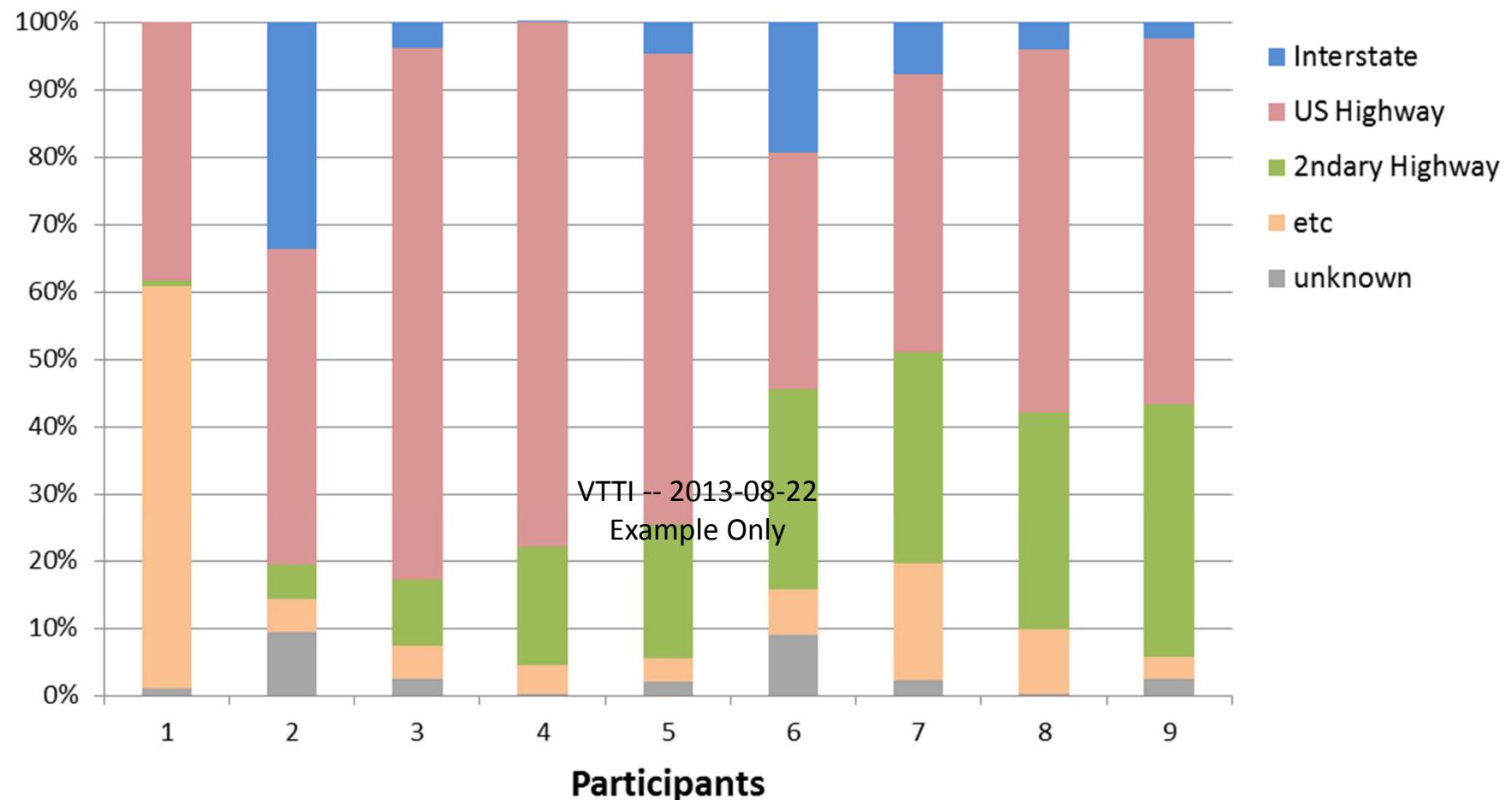
# Sample Descriptors

## Trip and Participant Distribution

Time of Day	Number of Trips	Percentage of Trips	Number of Participants	Percentage of Participants
Twilight AM	51	4.2%		
Day	653			
Twilight PM				84.8%
Night			36	78.3%
	1211	100%		

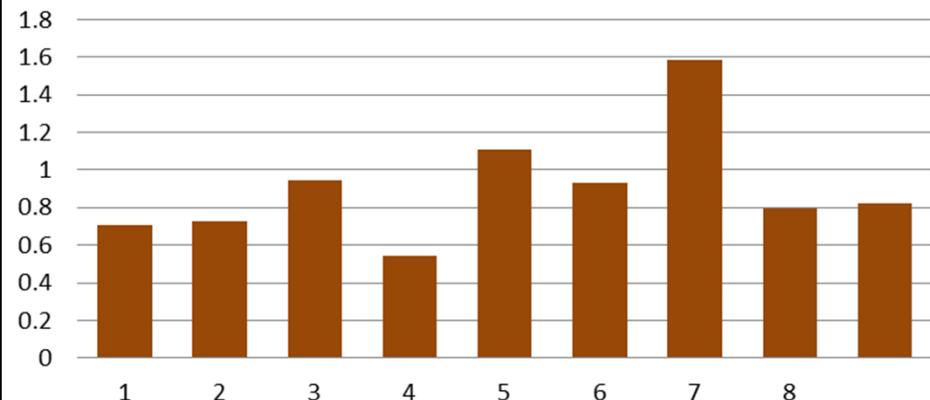
Majority of the participants (43 of 46) tended to ride more during the day

## Virginia - Time on Road Class



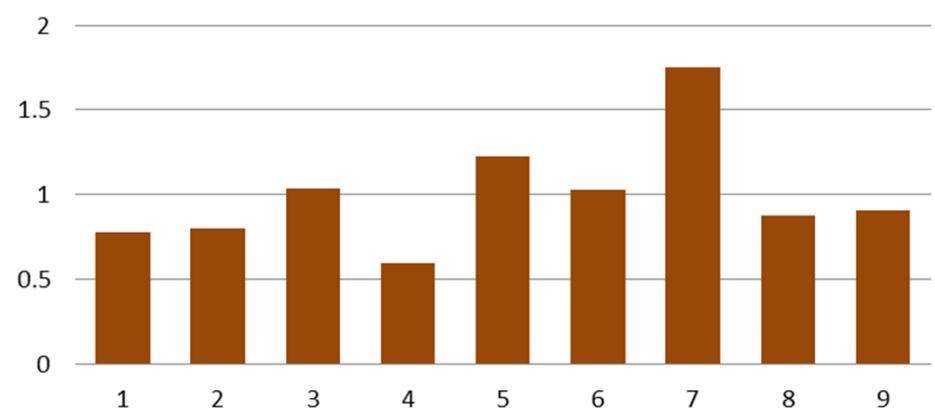
# Phase II Sample Analysis

**Estimated Number of Intersections  
per mile**



VTTI -- 2013-08-22  
Example Only

**Intersection Traversal Frequency  
Relative to Each Other**



# Personality Measures

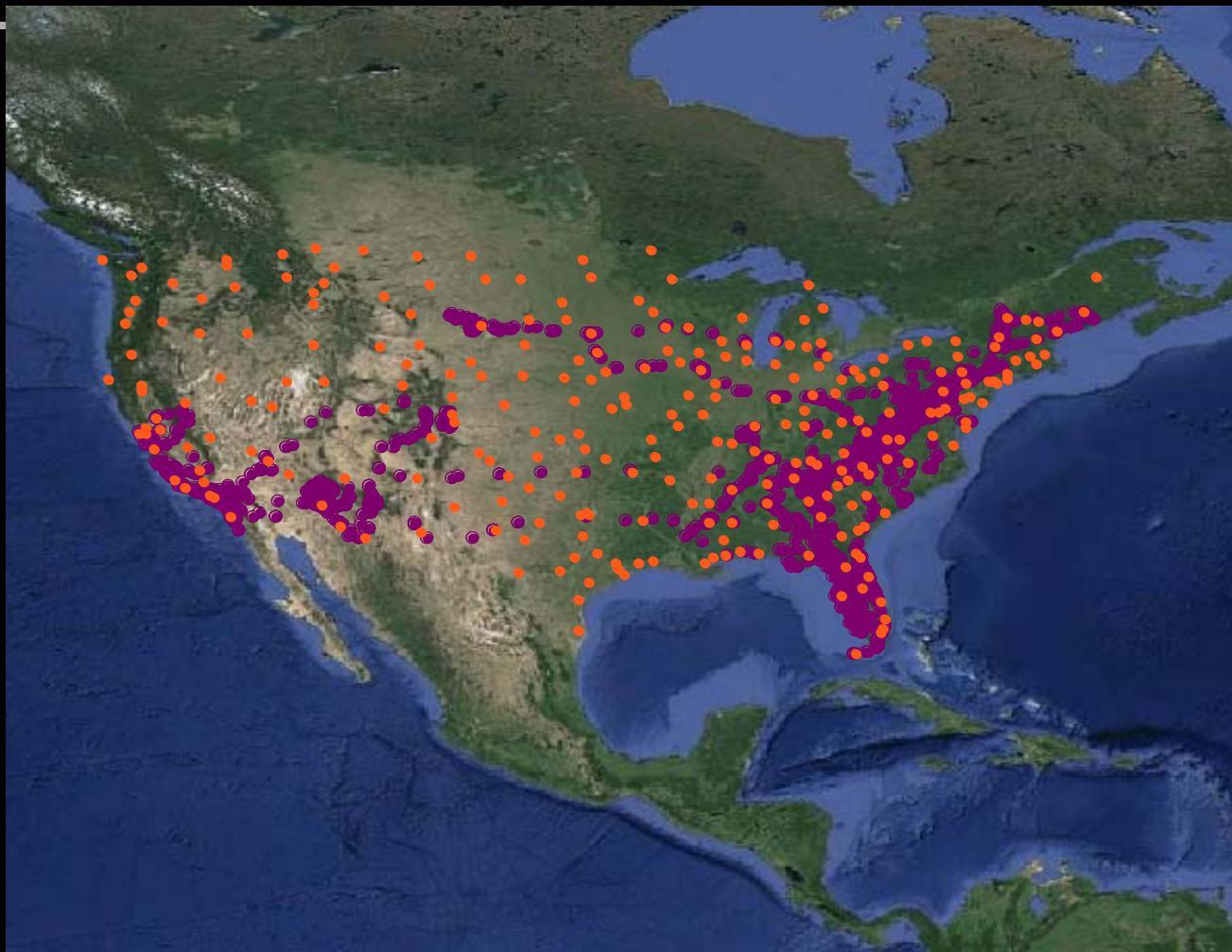
NEO Five-Factor Inventory-3	Measures "Big Five" personality constructs of Neuroticism (N), Extraversion (E), Openness to Experience (O), Agreeableness (A), and Conscientiousness (C)
Dula's Dangerous Driving Index	Measures the likelihood to drive dangerously, expressed as three subscales: a) intentional acts of aggression, b) negative cognitive/emotional experiences, and c) risk-taking.
Frequency of Risky Behavior	Measures the frequency of risky and perceived risks riders undertake
Barkley's Adult ADHD scale-IV	Measures if a person is likely to have Adult Attention Deficient Hyperactive Disorder (ADHD)
Motorcycle Safety Foundation Rider Survey	Used to identify the demographics and riding related backgrounds of the participant sample including gender, age, miles ridden, riding experience, and types of courses and training

# Personality Comparisons

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- Looked at Bike Type
  - There don't appear to be differences between bike types except for Touring bike riders had slightly lower levels on the Neuroticism Scale of the NEO-FFI
- These measures may become more interesting when considered along with riding data.

# Temperatures and Precipitation



NOAA  
Weather  
Stations  
  
&  
Participant  
Trips

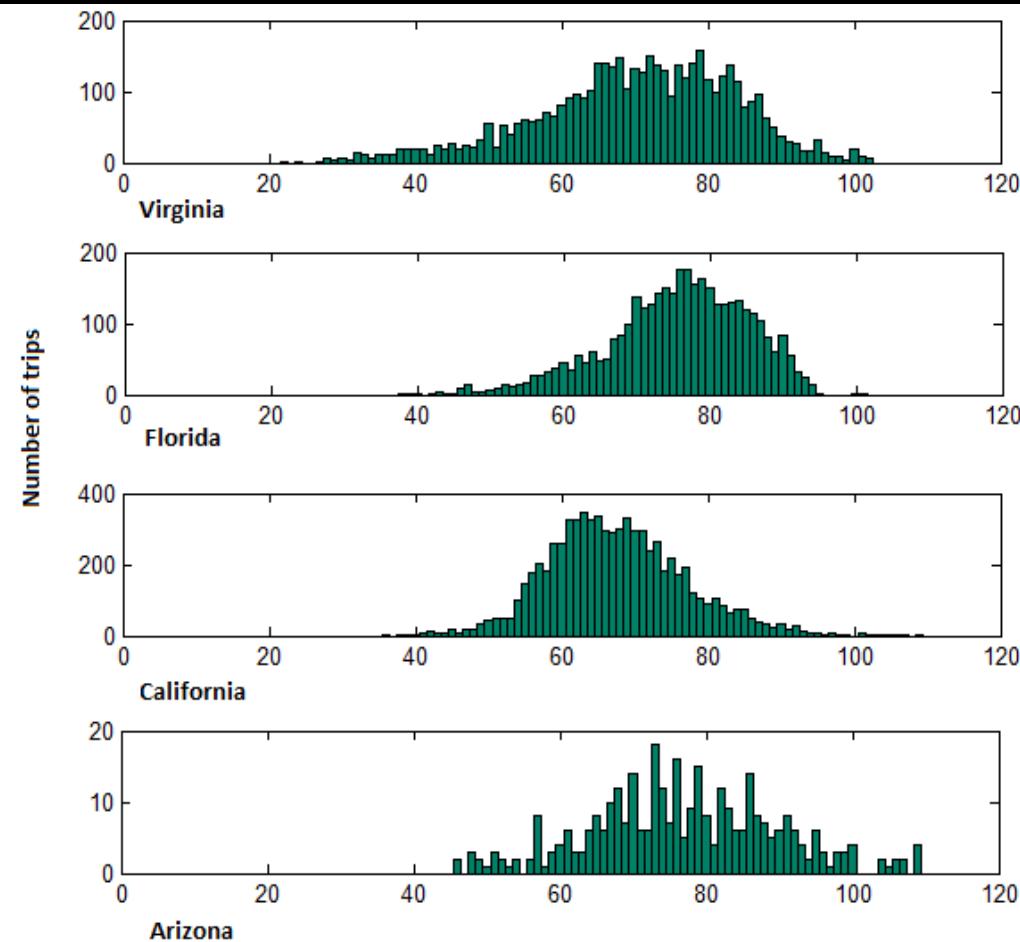
# Temperatures and Precipitation

Virginia

Florida

California

Arizona



20

40

60

80

100

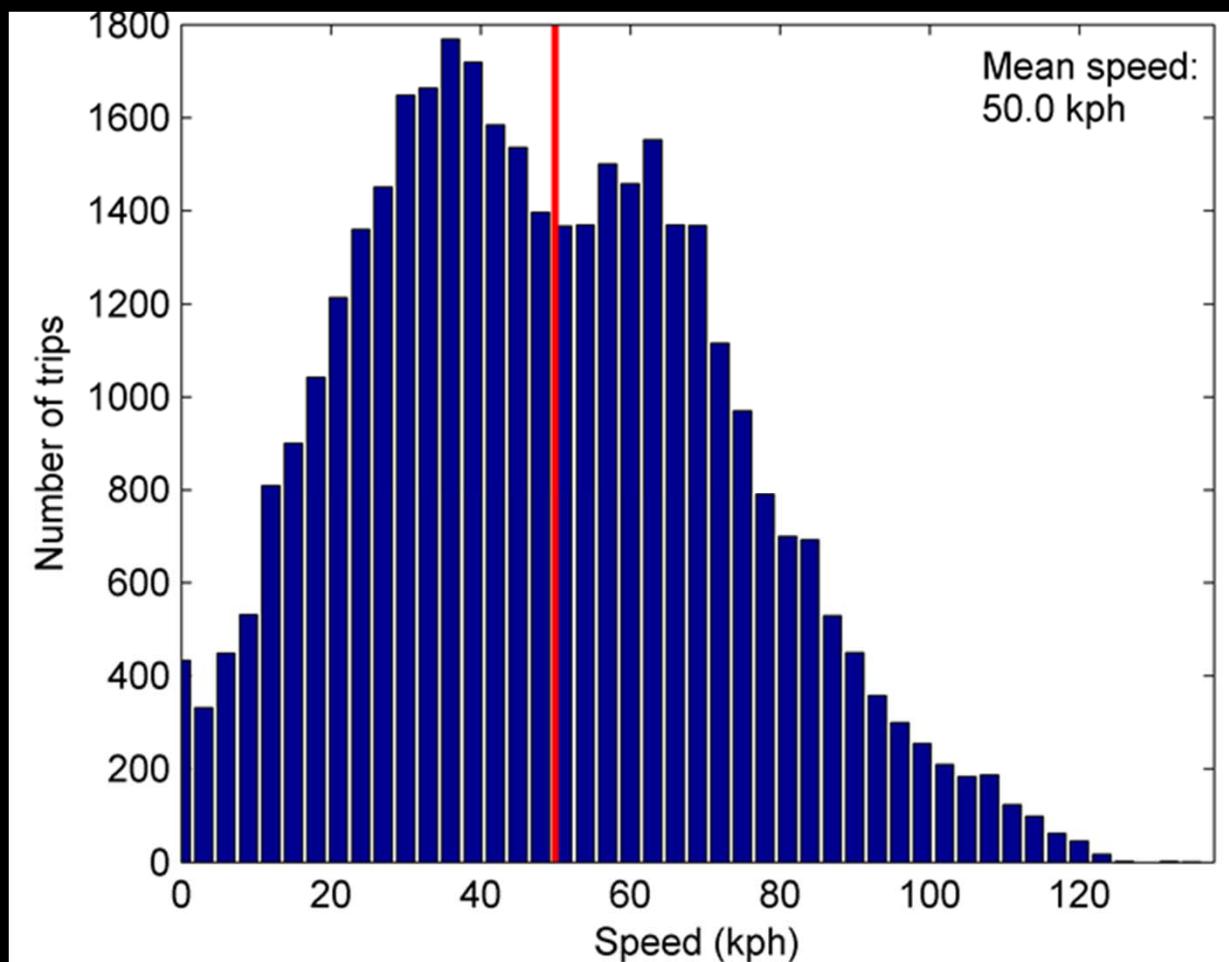
Temperature ( $^{\circ}\text{F}$ )

# Preliminary Findings

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- Location has strongest influence
- 95% of rides occurred between 50°F and 90°F
- $\bar{x}=70^{\circ}\text{F}$
- Extreme warmest rides in data set
  - 2.5% of trips between 90°F and 109°F
- Extreme coldest rides in data set
  - 2.5% of trips 50°F and 15.8°F
- 3% of trips at time of nearby precipitation.
  
- Future: Analysis of extremes

# Mean Trip Speed

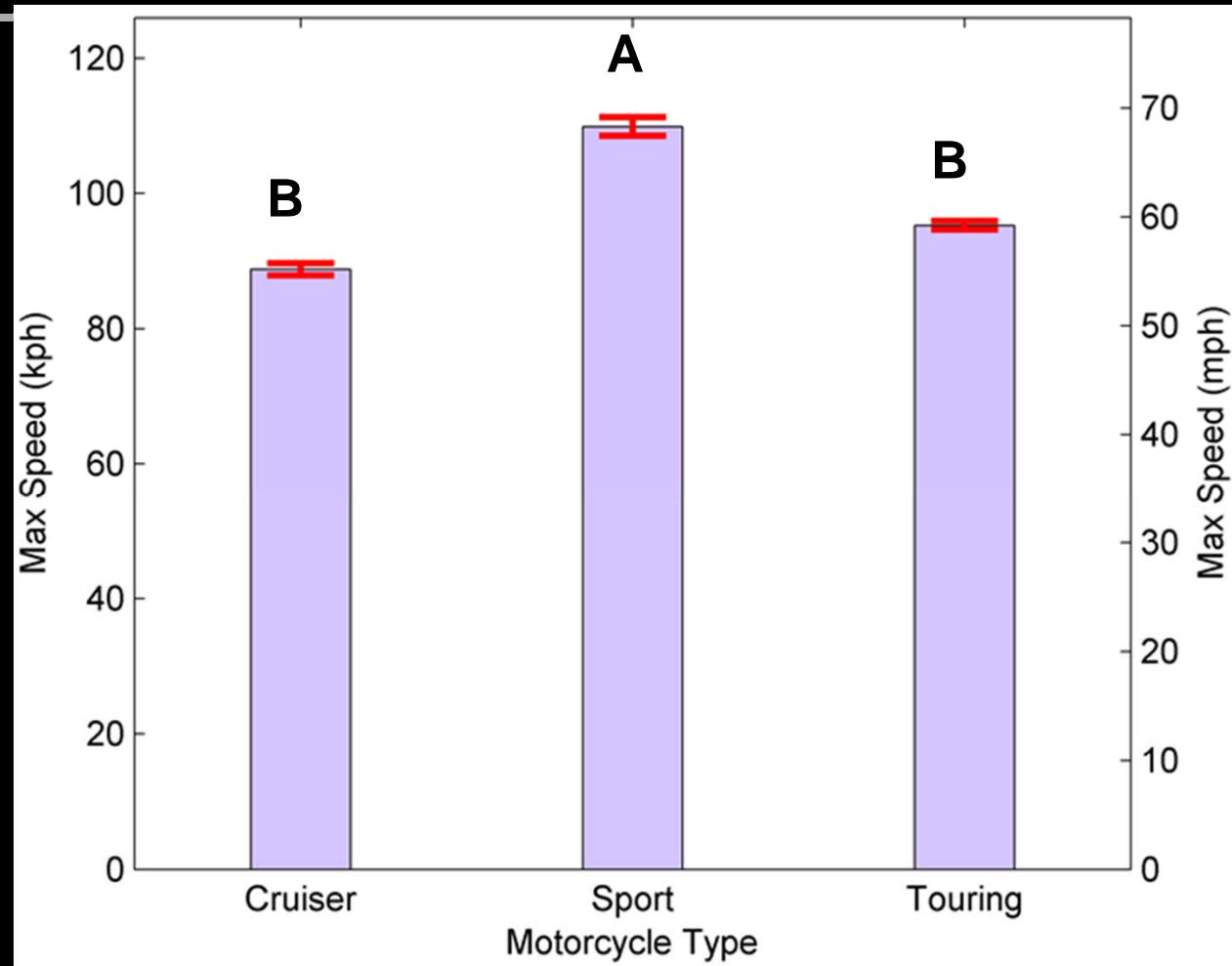


# Preliminary Findings

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- Maximum trip speeds
- Looking at Bike Type and Gender
  - No statistical differences.
- Maximum trip speeds
  - Looking at Bike Type and Gender
  - Sport bike speeds were higher than Cruiser or Touring. 68 mph compared to 59 mph and 55 mph
  - No differences by gender or age.

# Maximum Trip Speed

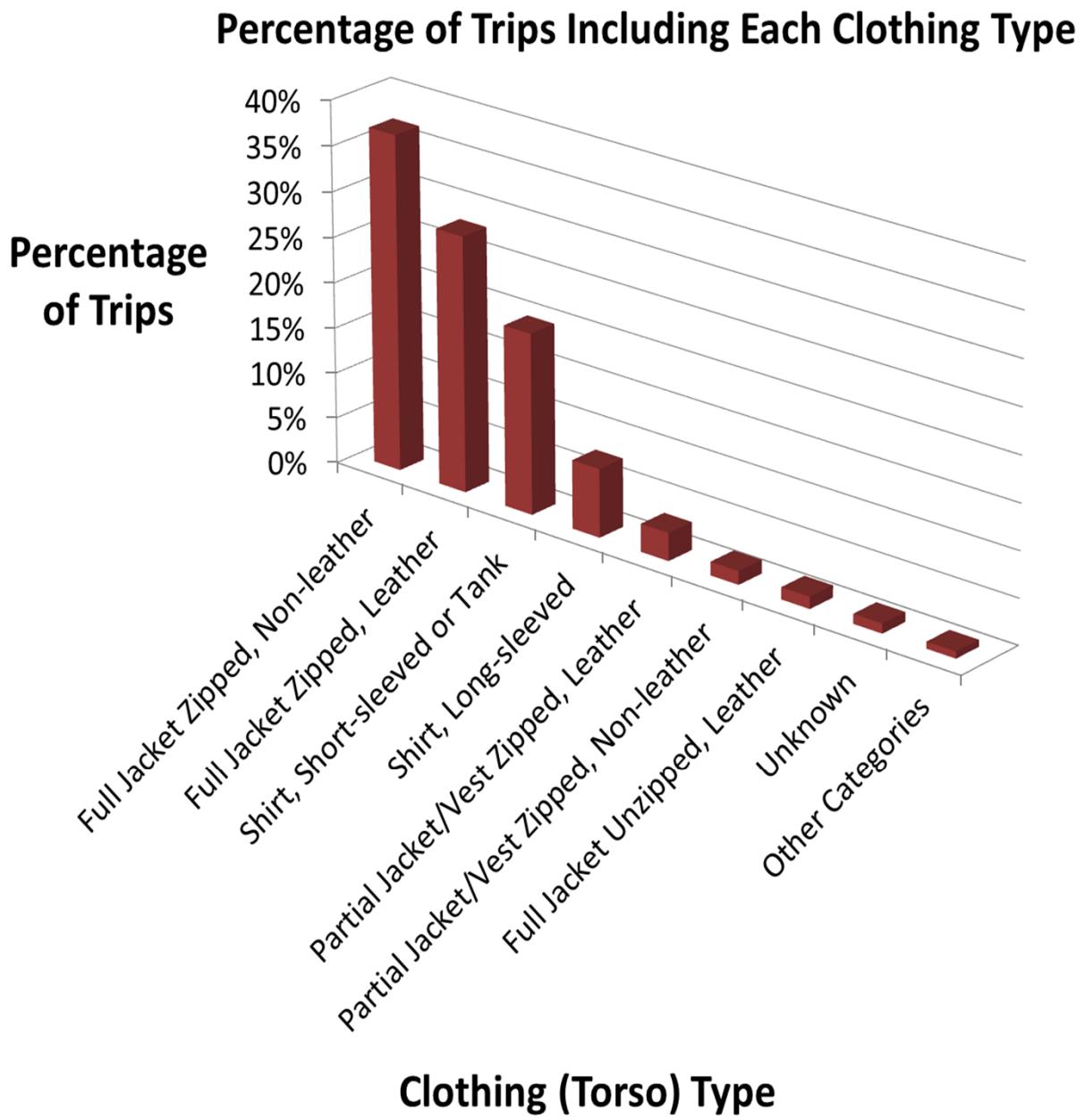


Extremes  
will be  
analyzed.

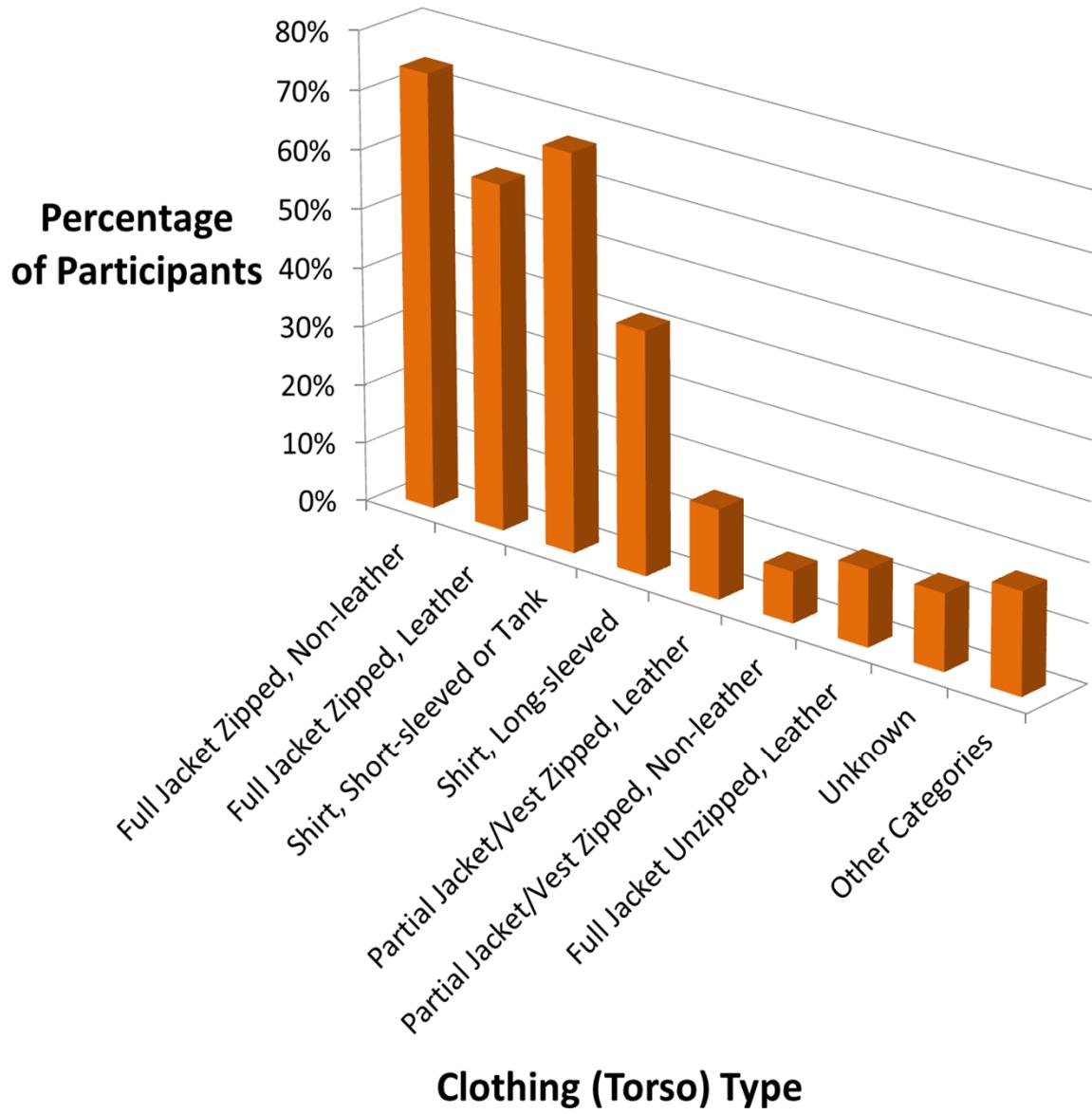
# Video Reduction

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- Five video views (rider's face, forward, rear, left, right)
- Video review to characterize rider clothing
  - Torso clothing / apparel
  - Helmet
  - Gloves
  - Eyewear
- Reductionist coded conditions that existed for most of the trip

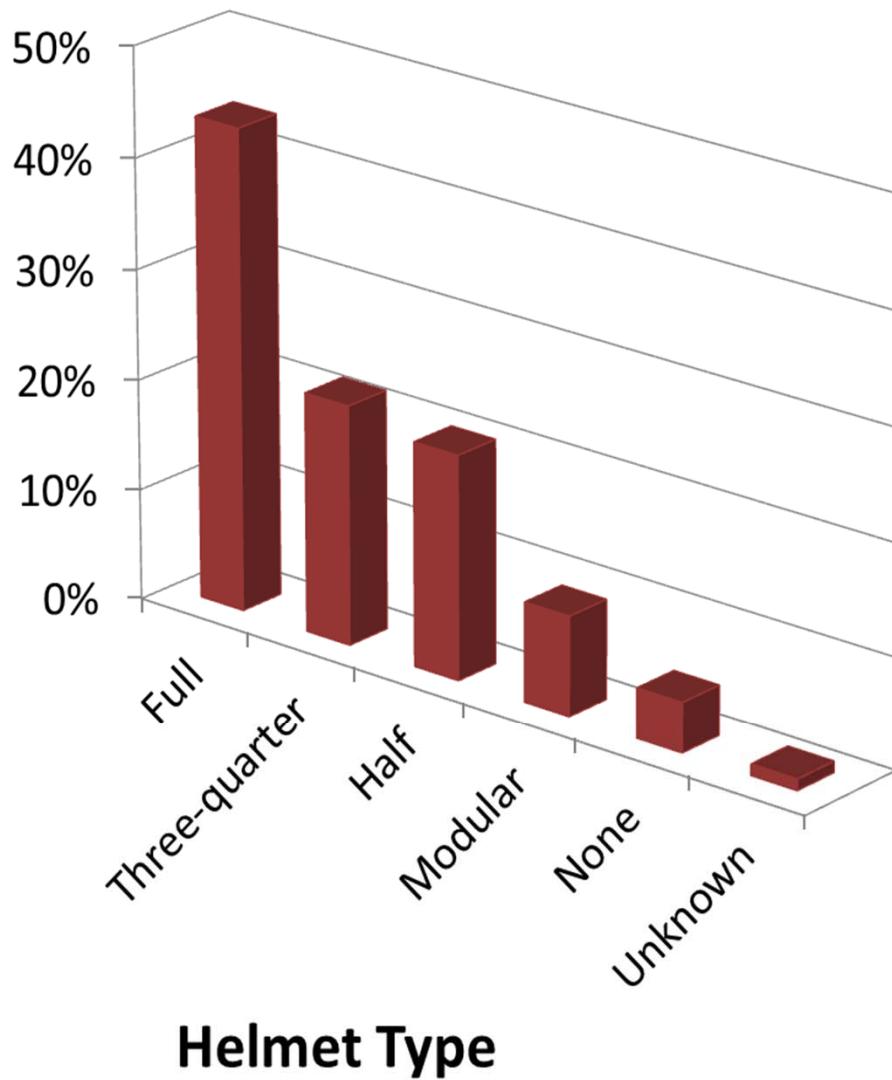


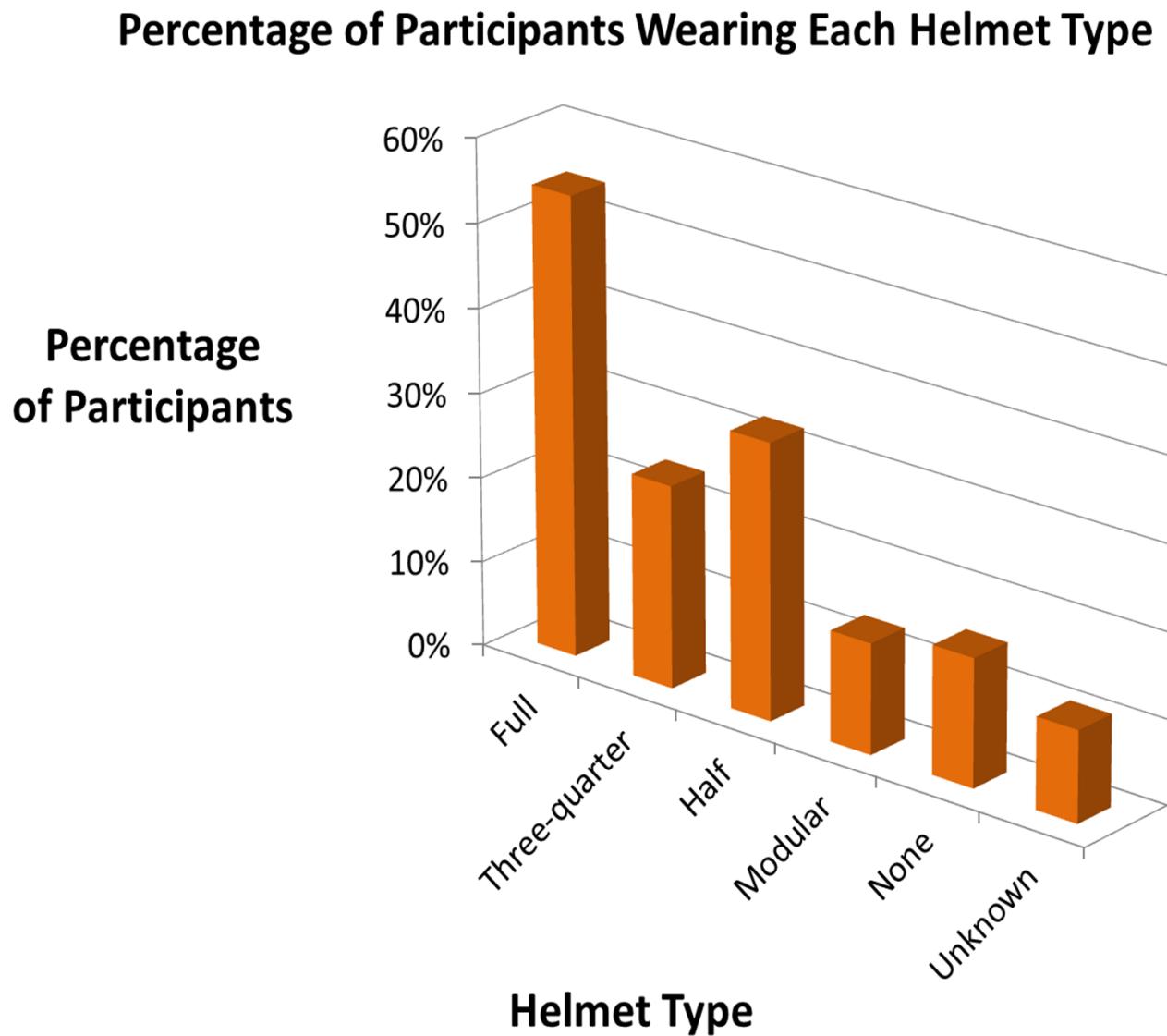
## Percentage of Participants Observed Wearing Each Clothing Type



## Percentage of Trips Including Each Helmet Type

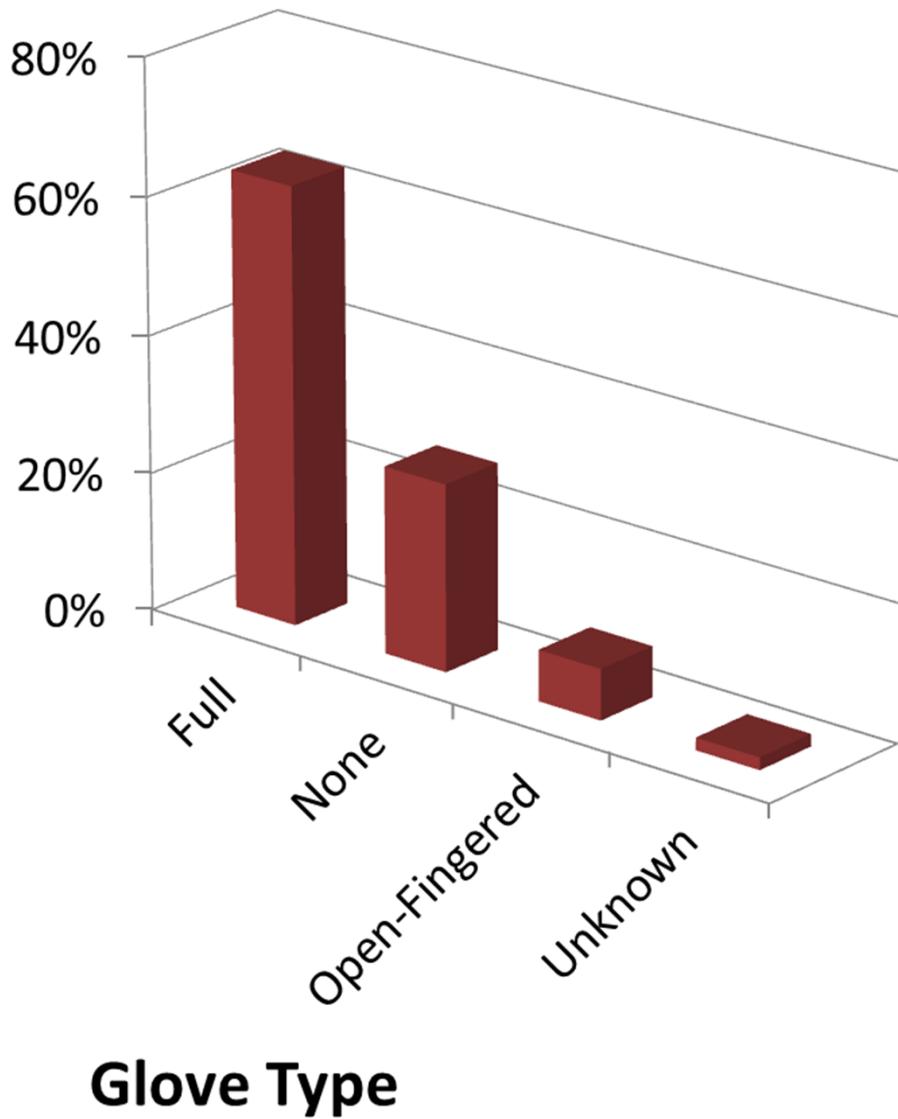
Percentage  
of Trips



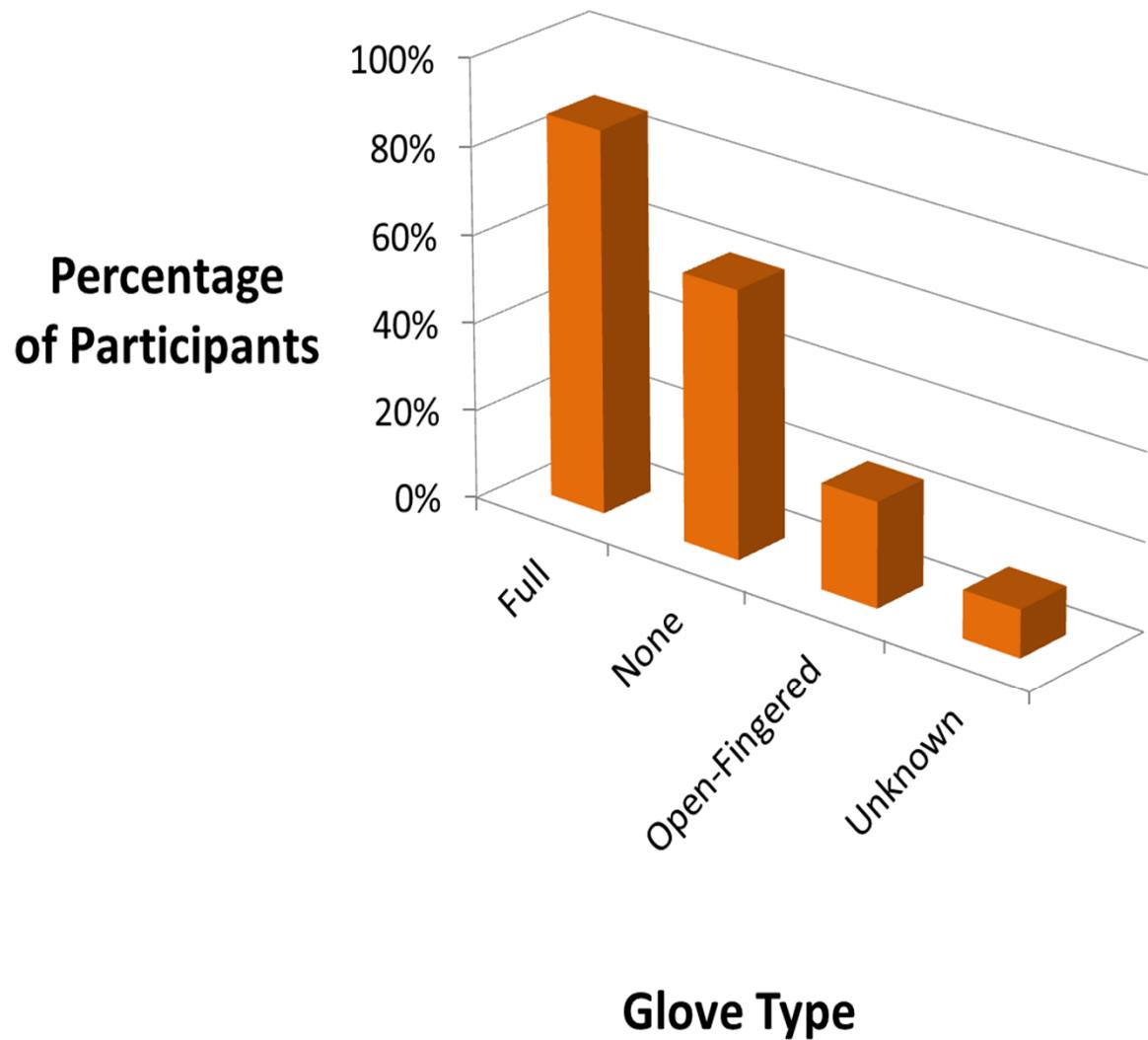


## Percentage of Trips Including Glove Type

Percentage  
of Trips



## Percentage of Participants Observed Wearing Glove Type



# Preliminary Findings

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- Wide variation in torso clothing
  - 93% of riders at some point wore full zipped jackets; 67% at some point wore short-sleeved shirts or tank tops

# Preliminary Findings

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- 33% of participants always wore gloves; 11% never wore gloves
- Helmet usage, even in states with no helmet law, was common
  - 78% of participants always wore helmets; no participant was always without a helmet
  - Only 4 out of the 10 riders based in states with no helmet law were observed at some point without a helmet

- Observational data indicate that participants tended to vary their choices in clothing and protective gear

# Summary

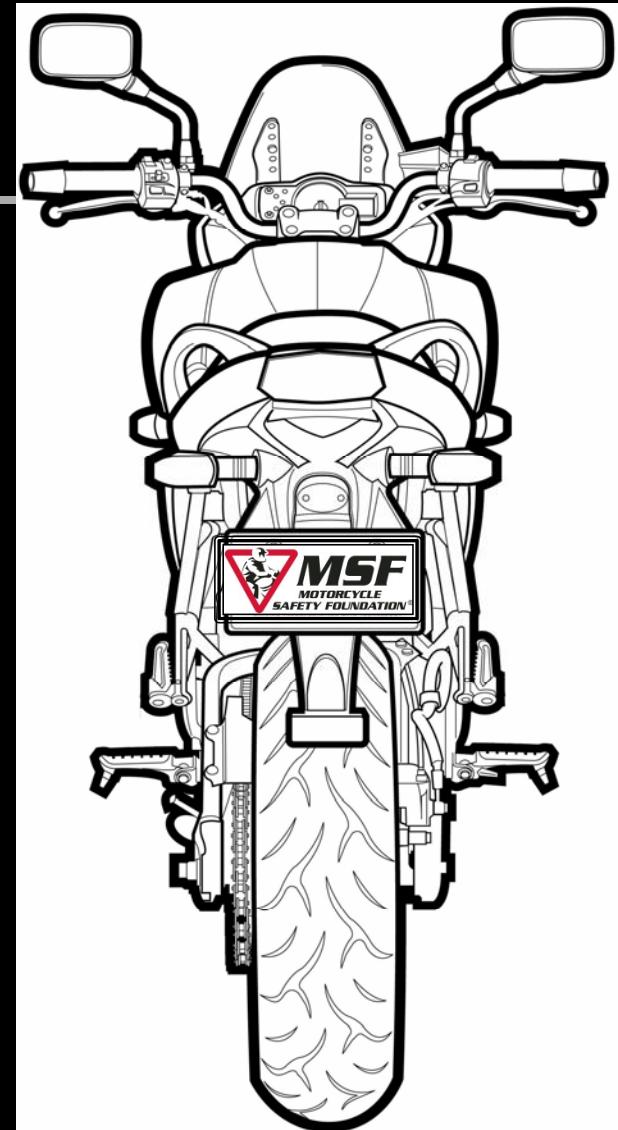
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- Complex data set requires layered approach
- Presented four examples.
- Many more will be coming.
  - Over the next many years. e.g., The 100 Car Study was conducted in 2003/2004 and still being used to answer research questions.

# Questions?

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[sWilliams@msf-usa.org](mailto:sWilliams@msf-usa.org)



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