Overview of the MSF 100 Naturalistic Riding Study

Who is VTTI?

- VTTI is a transportation research institute located at Virginia Tech
- Blacksburg VA
- Established in 1988
- Research for public and private clients
  - Cars
  - Trucks
  - Motorcycles
  - Roadways
  - Bicycles
Types of Research

Experimental
- Controlled Experiments
- Manipulate an independent variable
- Measure a dependent variable
- Lab, Test Track, Simulator

Naturalistic
Some of both

Epidemiological
- Passive Collection
- Naturally occurring events
- Sampling Strategies
- Health sciences

Naturalistic Methodology
- Identifies factors in crashes using time-series video and numeric data.
- Reveals factors not detectable through crash investigation.
- Compares crash involved rider to himself/herself at all other times.
- Provides pre-event data.
- Permits study of how crashes are successfully avoided.
- Permits quantification of rider performance and behavior in non-critical and critical riding.
- Provides flexible and accurate analysis of risk exposure.
- Permits systems development and testing with real-world data.
- Can be used to answer research questions that arise in the future.
Contents:

General Overview
- Objectives of the MSF 100
- Participants in the MSF 100
- Equipment and Data Views

Preliminary Findings
- Mileage and Riding Times
- Weather
- Riding Frequency
- Personalities of the Riders
- Speed and Acceleration
- Preliminary Crash Findings
Objectives and Areas of Interest

- Understanding:
  - Natural riding
  - Causes of crashes, near-crashes, incidents
- Guide development of MSF Curriculum
- Identifying strategies for avoiding crashes
- Areas of Interest
  - Rider demographics, history, personality
  - Rider behavior in normal situations
  - Environmental factors
- Events
  - Factors
  - Behaviors
  - Sequence
- Rider Differences

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
Their 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

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

- Arizona (Phoenix)

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

- California (Irvine)
- Arizona (Phoenix)
- Florida (Orlando)
Bike Type by Installation Location

Motorcycle Type by Location

Participant Experience Riding by Bike Type
The Equipment

- GPS
- Machine vision lane tracker
- Accelerometers (3 axes)
- Gyro (3 axes)
- Forward radar
- Turn Signals
- Brake lever inputs
- Continuous collection
- 8-12 mo capacity
- Cellular communication from bikes back to VTI

- Five color cameras
  - forward
  - rear
  - left
  - right
  - rider

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Advancing Transportation Through Innovation
Mileage and Riding Time in the MSF dataset

• Riders combined for approximately 350,000 miles of travel over 8,776 hours in the saddle

• The average rider in the dataset rode 4,300 miles per year
  – Low of 89 miles
  – High of 16,228 miles

• Average trip covers 11.7 miles over 17.75 minutes with no differences between low and high frequency riders

The impact of weather on riding

• Roughly 95 percent of rides were found to occur between 47.5°F and 93.5°F.

• 66% of rides occurred between 61 and 81°F

• Riders were rarely found to ride in precipitation (3% of trips)

• Riders in Virginia demonstrate a more pronounced riding season than those in the California group.
  ▪ Virginia riders took 80% of their trips between the months of April and October, a seven month window.
  ▪ California riders took 66% of their trips over the same time period.
High and Low Frequency Riders, when they ride

- Frequent riders were found to ride, on average, 145 days per year.
- Infrequent riders were found to ride, on average 30 days out of the year.
- Range from two days to 306 days of riding per year
Personality Comparisons

- When we compared Sport, Touring, and Cruiser riders in the study on all those questionnaire results, we found almost no difference.

- Touring riders had slightly lower measures on the neuroticism scale than sport bike riders.

- No differences found in any of the others – risky behaviors, conscientiousness, dangerous driving.
Analyses of Speed and Acceleration\Deceleration

- Maximum trip speeds, as expected were massed around 30 and 60 mph
  - Range < 5mph to 150+

- Observed 95\textsuperscript{th} percentile accelerations (0.4\textit{g}) are stronger than 95\textsuperscript{th} percentile decelerations (-0.32\textit{g})

- There seems to be a trend for riders to brake harder as experience increases (at least among sport bike riders).

PRELIMINARY CRASH ANALYSIS

- Out of >38,000 trips, preliminary analysis discovered 22 “crashes”

- 18\% of 100 riders experienced at least one crash

- Each location, age group, gender, and bike class were represented

- Majority of crashes (16 of 22) were low-speed ground impact

- MSF is currently sponsoring a full crash and near crash investigation of over the 38,000 trips, 350,000 miles, and 100 years worth of riding in the MSF 100 Dataset.
**EVENTS CLASSIFIED AS “CRASH”**

Precipitating Event and Incident Type

- Subject lost control, no other vehicles involved
- Lead or subject vehicle slowed or stopped
- Other vehicle entering intersection - left turn across path
- Other vehicle entering intersection - straight across path
- Subject in intersection - turning right

![Graph showing frequency of different types of crashes](image)

- Rear-end, striking or struck
- Ground impact - underway
- Turn across path
- Ground impact - low speed

**Rider Response prior to crash**

![Graph showing rider responses](image)

- No front brake or lateral input
- Front brake only
- Lateral input only
- Front brake and lateral input

· NOTE: Only responses with clear video evidence are included
Summary

- Average Rider rides approximately 4,300 miles per year.
- Riders tend to ride when the weather is nice, and when the weather is nice riders will ride.
- Early investigations reveal few statistical differences between personalities or reported risky behaviors of riders of differing bike types.
- Riders tend to accelerate at a higher rate than they decelerate.
- 22 Crashes discovered so far.
  - MSF Sponsoring full Crash and Near Crash Analysis of the data.

Questions and Contact Information

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