

# **Motorcycle Safety and Alcohol**

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Mountains & Minds

# Traffic Fatalities

4,502 Motorcyclist Deaths

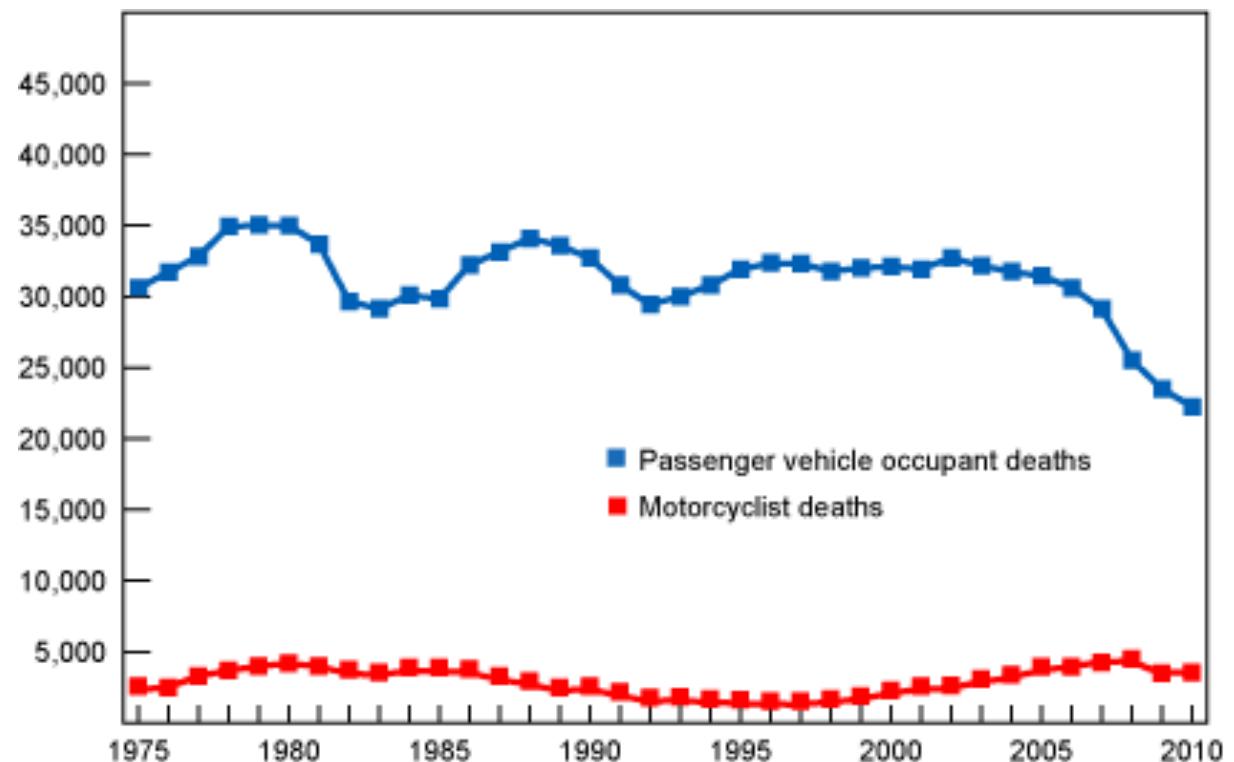
17% All Occupant Fatalities

3% Registered Vehicles

0.6% VMT

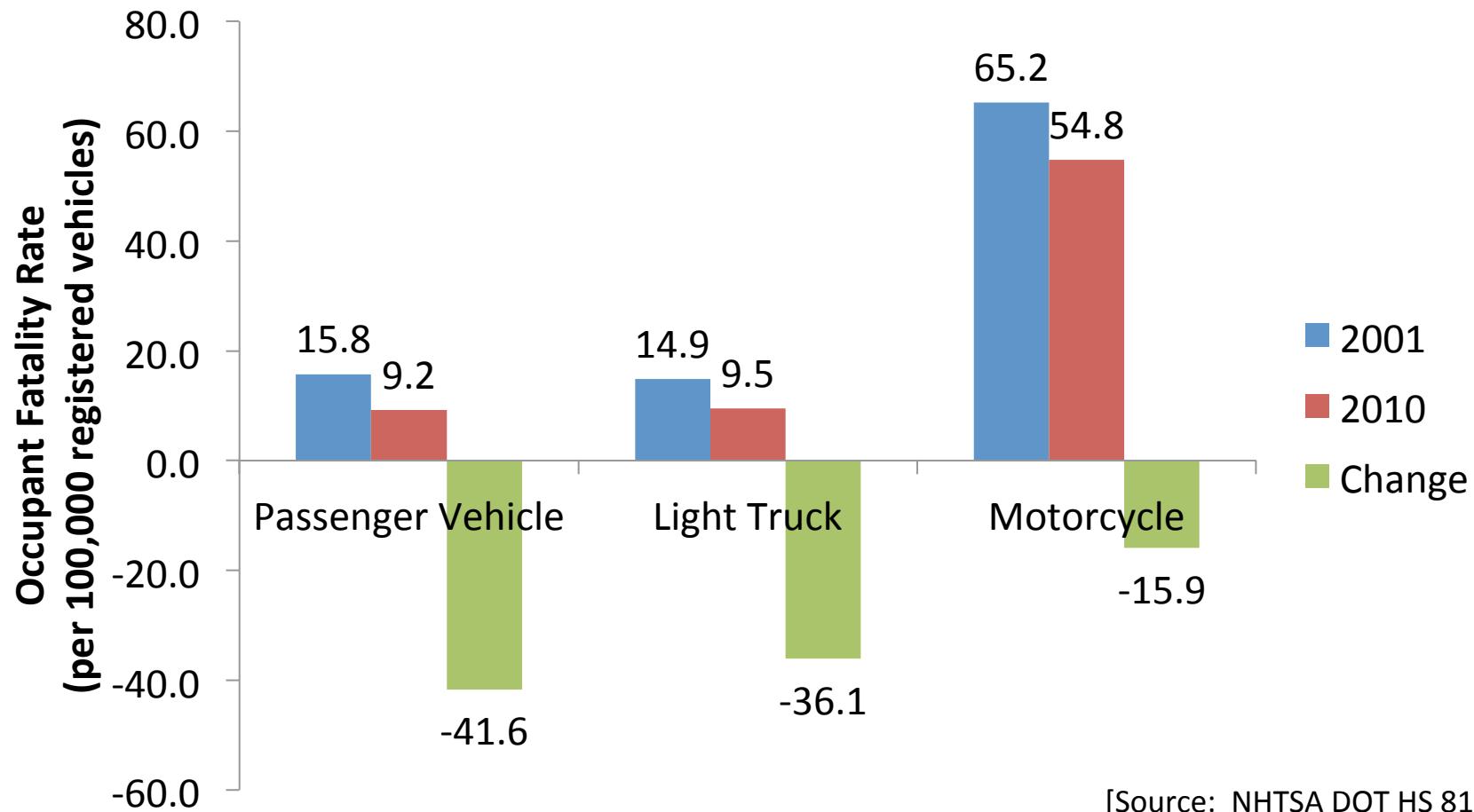
30 x Fatality Risk

\$16 Billion Cost



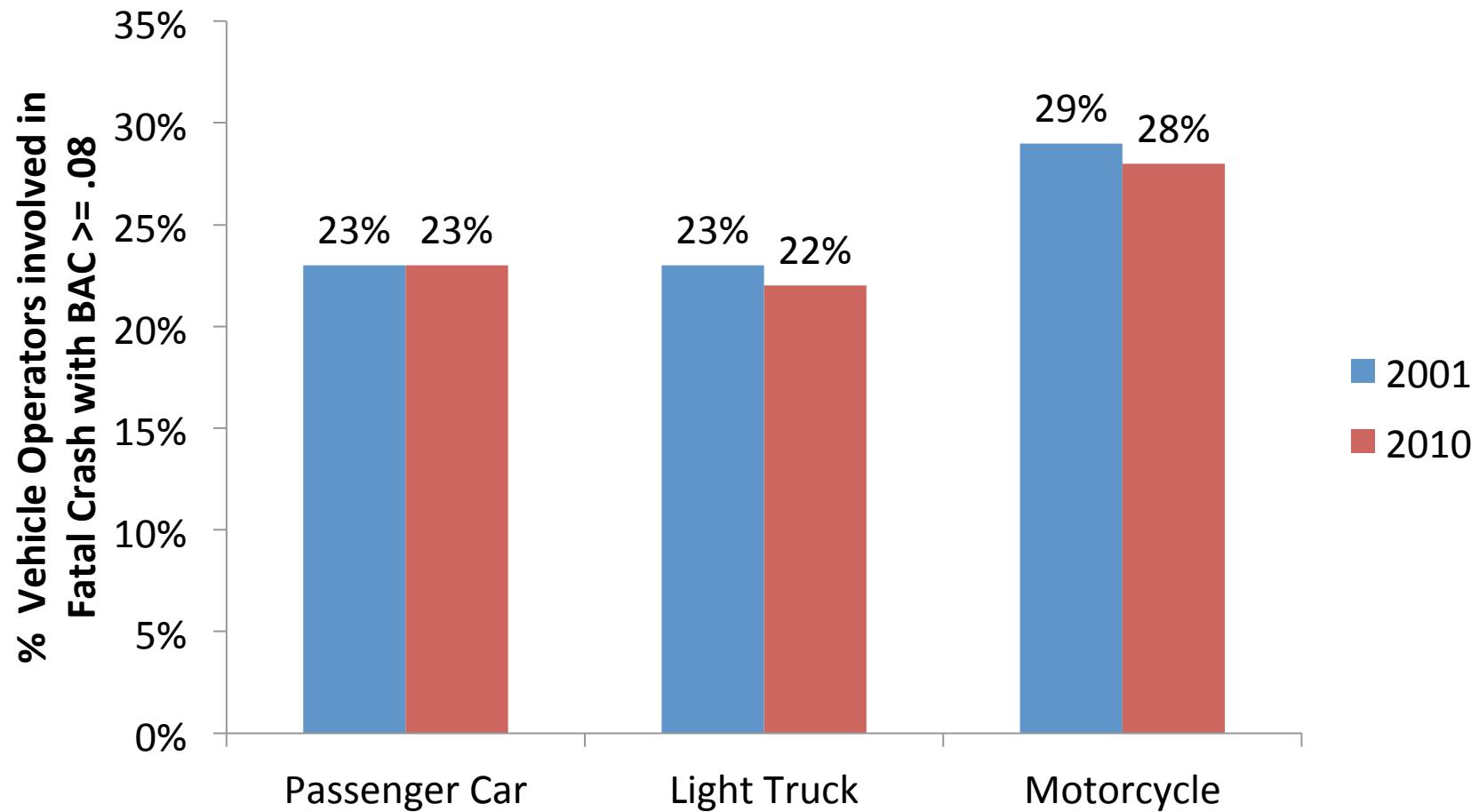
[Source: [www.iihs.org](http://www.iihs.org), GAO-13-42]

# Fatality Risk (vehicles)



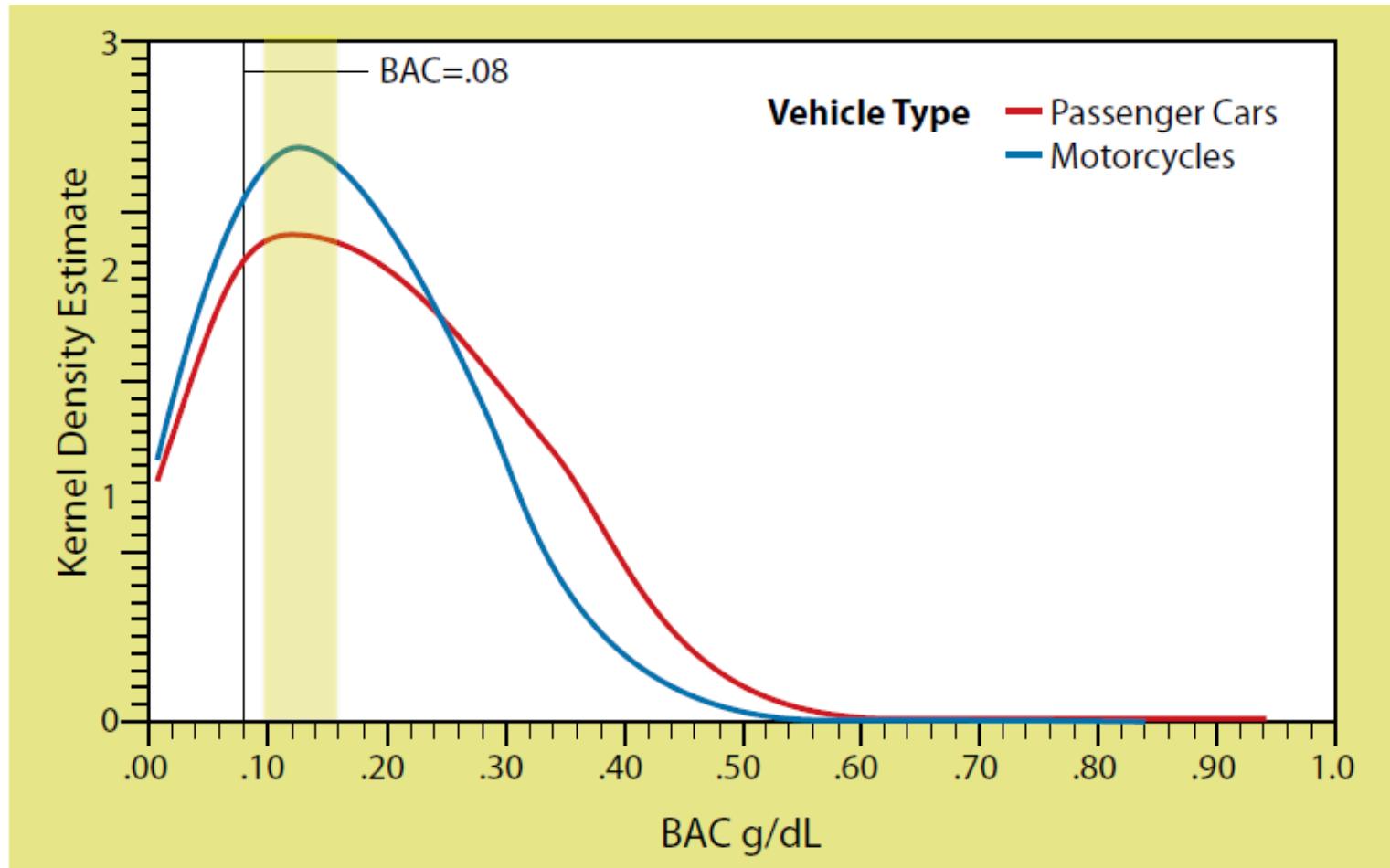
[Source: NHTSA DOT HS 811 639]

# Alcohol Involvement



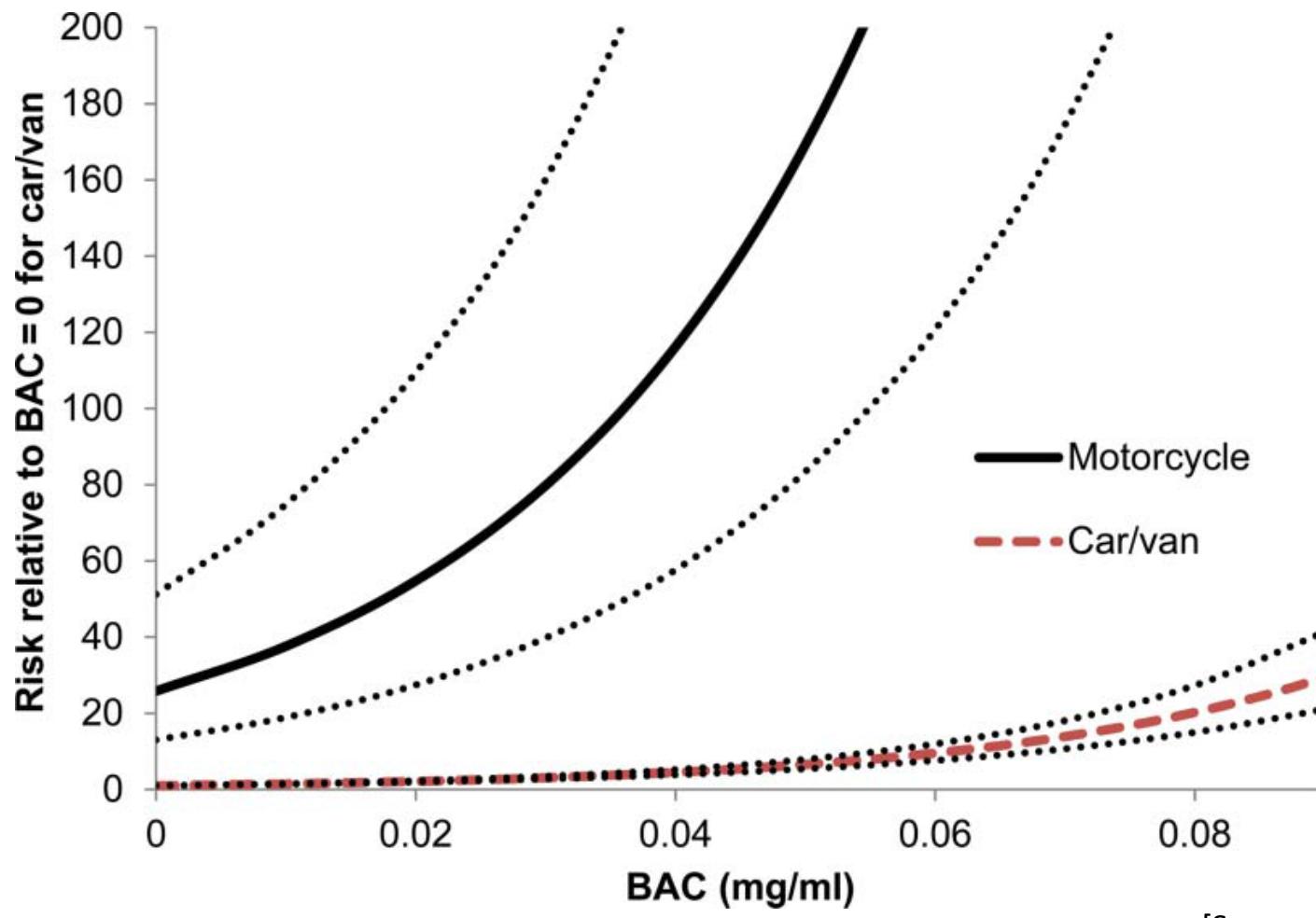
[Source: NHTSA DOT HS 811 606]

# Alcohol Fatalities



[Source (2000-2004): NHTSA DOT HS 810 754]

# BAC Risk Curve



[Source: Keall et al, 2013]

# Operating Skills

## Driving

car  
lane  
make  
may  
must  
road  
stop  
traffic  
turn  
**vehicle**

## Riding

ahead  
behind  
brake  
driver  
may  
front  
**lane**  
**motorcycle**  
see  
road  
rear  
stop  
turn  
space  
traffic

# Alcohol Impairment



# Research Questions

How does alcohol affect riding skills?

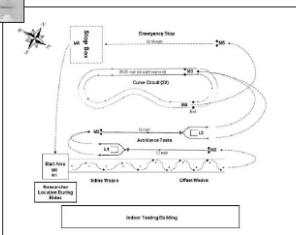
At what level do these effects appear?

# Report

U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

## Effects of Alcohol on Motorcycle Riding Skills

### Final Report



**NHTSA**  
[www.nhtsa.gov](http://www.nhtsa.gov)

# Project

# Summary

**Traffic Safety Facts**  
Traffic Tech – Technology Transfer Series  
Number 345  
April 2008

**Effects of Alcohol on Motorcycle Riding Skills**

Preliminary estimates indicate that there were 4,810 motorcyclist deaths in 2006, an increase of 5.1 percent from 2005. Motorcyclist deaths have increased for the ninth consecutive year and now represent 11.3 percent of all traffic fatalities in the United States. Moreover, the number of motorcyclist fatalities has more than doubled since 1997.

One factor that continues to be associated with motorcyclist fatalities is alcohol. In 2005, a higher percentage of motorcycle operators had blood alcohol concentrations (BACs) of .08 grams per deciliter or higher than any other type of motor vehicle driver. Twenty-seven percent of motorcycle operators were at .08 or higher versus 22 percent for passenger car operators, and 21 percent for light-truck operators.

Despite the relevance of alcohol to motorcycle safety, only limited information on the impairing effects of alcohol on motorcycle operator performance is available. To address this issue, NHTSA sponsored a research study to assess the impairing effects of alcohol (up to the current per se limit of .08 BAC), on rider performance involving a broad set of basic motorcycle riding skills.

**Methods**

Twenty-four male participants age 21 to 50 ( $MEAN=32$  years) completed three test days for this experiment. All participants had a minimum of five years of riding experience ( $MEAN=14.97$  years), drank alcohol at least once a week, and had no history of medical or psychological problems (i.e., alcohol dependence) that would preclude them from participating in the study. The study design consisted of a balanced incomplete block design (BIBD), where participants were randomly assigned to one of four possible conditions. Participants in each condition experienced three out of four possible levels of alcohol presentation (.00, .02, .05, and .08) and completed one level per test day.

A motorcycle test course was developed in conjunction with two certified motorcycle coach instructors from

**NHTSA**  
[www.nhtsa.gov](http://www.nhtsa.gov)



Data was collected for two sober baseline rides and two tests rides each day at one of four conditions (BACs of .00, .02, .05 or .08). Data was also collected for a set of subjective measures that evaluated mental workload for the riding tasks and the riders' perceived levels of intoxication and impairment.

**Results**

The results showed that performance for several dependent measures of riding performance were impaired at different BAC levels.

U.S. Department of Transportation  
National Highway Traffic Safety Administration

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# Acknowledgements

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## Partners

NHTSA

MHSRC

MMSC

St. Cloud State University

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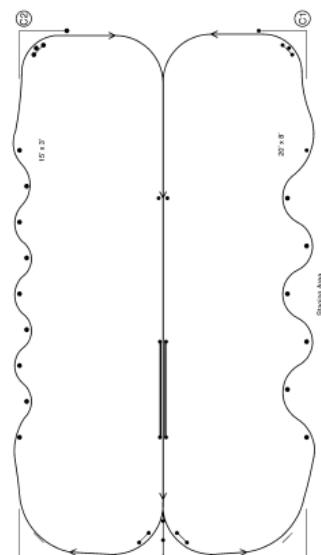
# Skills



## Exercise 6 20 minutes – Riding Demo

1. Read objective
  - To be able to effectively maneuver the motorcycle
2. Explain range setup
  - Down the middle: a pause-n-go, a clutch control lane, and a left and right perimeter turn
  - On the long sides of the range, an offset weave and a perimeter turn
3. Provide instructions
  - Ride down the center of the range for the pause-n-go, the clutch control lane, and a perimeter turn left or right
  - On the long sides, weave around the cones starting on the outside of the first cone
  - Slow at the end and make a perimeter turn
  - Check traffic and repeat up the middle
4. Provide demo
  - Note evaluations and provide signals
    - Coordinate throttle, clutch, and brake use
    - Keep head and eyes up
    - Maintain appropriate following distance
    - Check for traffic
    - Maintain a safety margin
5. Conduct exercise
  - Start riders down middle
  - Have riders work toward very low speeds in clutch control lane
  - Initially distribute riders evenly on long sides
6. Stage riders in parking area
7. Debrief

## Controls-Skills Practice



- Offset Weave
  - Balance (slow speed)
  - Control (turning)
  - Safety Margin



# Skills

## Exercise 16

30 minutes – Riding Demo, Simulated Practice, 2 Parts

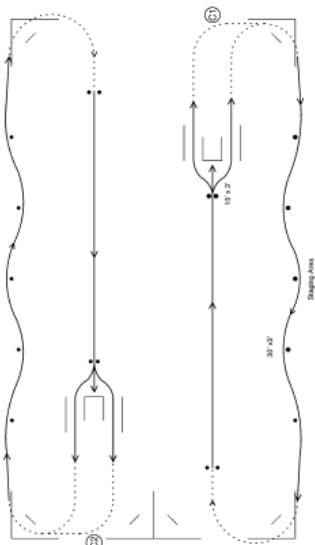
1. Read objective
  - To be able to avoid hazards by swerving or stopping quickly
2. Explain range setup
  - 2 separate barriers and an offset weave on outside perimeter
3. Provide instructions

**Part 1 – Swerve**
  - On signal and one at a time, approach barrier at around 12 mph in 2nd gear
  - Maintain a steady speed
  - Swerve in direction signaled without braking
  - When straight, downshift and stop next to RiderCoach
  - After coaching, practice the offset weave and return to end of same line

**Part 2 – Swerve or Brake**
  - After some time, the RiderCoach will add a stop signal, providing 3 options: swerve left, swerve right, brake in straight line
4. With riders at coach position, provide demo
  - Note evaluations and provide signals
5. Provide *simulated practice*
  - Swerving with upper body straight
6. Conduct exercise
  - Provide early signals, no surprises
  - For Part 2, tell riders that first signal will be a stop signal, then signals will be random

## Avoiding Hazards

7. Stage
    - Keep near-side riders in place
    - Direct far-side riders to turn left after last swerve-stop and join the near group
  8. Debrief
- Notes:**
  - The cue cones are 15' from the barrier and 3' apart
  - The weave cones are 30' apart with a 3' offset



- Hazard Avoidance
  - Reaction Time
  - Control (avoidance)
  - Safety Margin



# Skills

**Exercise 9**  
25 minutes - Riding Demonstration - Reversal

**Multiple Curves**

1. Read Objective  
• To improve skills when negotiating multiple curves

2. Explain Range Setup  
• A circuit consisting of multiple curves with various radii

3. Provide Instructions  
• On signal and in small groups of riders, ride the circuit  
• Maintain a slow, steady speed in curves and use proper cornering techniques  
• Increase speed in long straightaway (20-25 mph) and slow to a suitable entry speed before first curve  
• Keep an adequate safety margin and following distance  
• On signal, the exercise will be reversed

4. Provide Demonstration with Riders in Coach Position and Note Evaluations and Signals  
• Maintain precise control  
• Use a low gear and keep speed low in curves  
• Select an appropriate entry speed for all curves at end of straightaway  
• Use smooth, proper lines to setup and negotiate curves  
• Look well ahead, applying SEE  
• Avoid deceleration in a curve

5. Conduct Exercise, with Reversal (use groups of no more than 3 riders)  
• Start riders by spacing them 6-8 seconds apart  
• Have rider complete 3 or 4 revolutions each direction  
• Move each group of riders to staging area for debrief  
• Do not allow this to become a competitive exercise  
• Do not allow speeds to become excessive  
• Encourage riders to avoid excessive lean angles which cause parts to drag

6. Stage Riders In Staging Area

7. Debrief

Break

Classroom Cards Discussion  
10. Alcohol/Drugs Effects + Fatal Vision Activity  
11. Safety Oval

## Experienced Rider Course

- Curve Circuit
  - Control (speed choice, lane position)



# Skills

**Exercise 9**  
30 minutes – Riding Demo, Simulated Practice,  
2 Parts

1. Read objective
  - To be able to stop quickly
2. Explain range setup
  - 2 lanes on each side of the range
  - 2 crossed pause-n-gos in middle of the range
3. Provide instructions

**Part 1 – Stop using cue cones**
  - On signal, ride down the middle of the range through the crossed pause-n-gos
  - Ride to a start point for stop lane
  - On signal and one at a time, approach stopping area at about 15 mph in 2nd gear
  - Stabilize speed early
  - As front wheel passes the cue cones, downshift keeping the clutch squeezed, and make a quick stop using both brakes
  - Once coached, make the perimeter turn and ride through the crossed pause-n-gos

**Part 2 – Stop on RiderCoach signal**
  - When a RiderCoach moves inside stopping area, stop quickly on command
4. With class at stop point, provide demo
  - Cover evaluations and provide signals
    - Keep head and eyes up
    - Use brakes firmly, not grabbing the front brake or locking the rear brake
      - If rear wheel locks; use less pressure next time
    - Shift with precision
  - Maintain a safety margin
5. Provide simulated practice of stop procedure
6. Conduct exercise
  - To start, distribute riders evenly
  - Part 1: use cue cones
  - Part 2: use stop signal
7. Stage riders in parking area
8. Debrief

**Stopping Quickly**

**End of Level I**



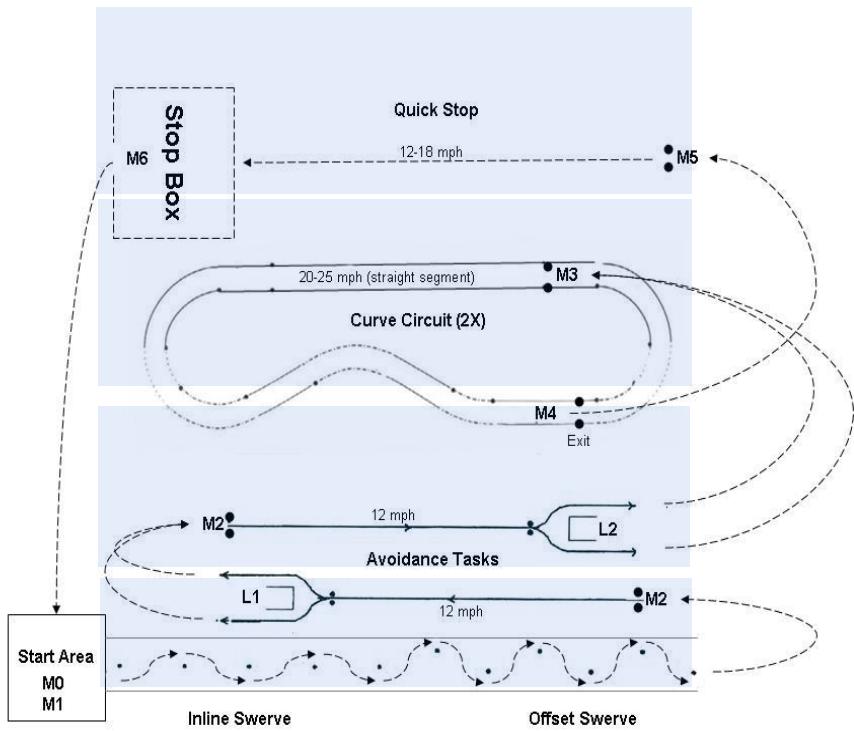
- **Stopping Quickly**
  - Reaction Time
  - Control (braking)

# Environment

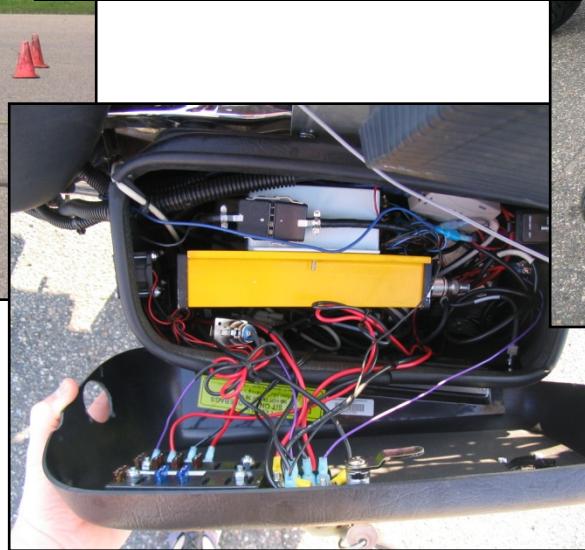
## Track



## Circuit



# Motorcycle



# Method

Day	Order			
	1	2	3	4
1	0.00	0.02	0.05	0.08
2	0.02	0.05	0.08	0.00
3	0.05	0.08	0.00	0.02

- 24 male subjects
  - Moderate drinkers
  - 21-50 years old
  - 5+ years experience
- Three days
- Random BAC order
- Two test laps

# Dosing

Target BAC	Acceptable BAC Ranges	Pre-Ride Mean (SD)	Post-Test Mean (SD)
0.02	0.01-0.03	0.025 (0.007)	0.013 (0.008)
0.05	0.04-0.06	0.052 (0.006)	0.046 (0.009)
0.08	0.07-0.09	0.080 (0.007)	0.079 (0.009)



# Results

## Offset Weave

- BAC 0.08 produced more missed or hit pylons.
- BAC 0.08 resulted in closer passing distance (shorter safety margin).



# Results



## Hazard Avoidance

- BAC 0.08 produced more errors (direction).
- BAC 0.08 and 0.05 produced slower reaction time.
- BAC 0.08 and 0.05 resulted in closer passing distance (shorter safety margin).

# Results



## Curve Circuit

- All alcohol levels produce faster maximum speeds.
- All alcohol levels produce more speed variability.
- BAC 0.08 resulted in more lane boundary violations.

# Results



## Stopping Quickly

- Alcohol increased maximum deceleration rate.
- Higher alcohol (BAC 0.08, 0.05) produce more deviation in stopping path than low alcohol (BAC 0.02).

# Results



## Subjective Reports

	BAC0.02	BAC0.05	BAC0.08
Intoxicated	↑	↑	↑
Impaired		↑	↑
Willing		↓	↓
Effort			↑

# Discussion

- Alcohol effects on rider skills consistent with motorcycle crash types:
  - Speeding
  - Delayed reaction
  - Rider Error
  - Road departure
- Effects apparent at BAC 0.05
- Subjective intoxication at BAC 0.02

# Thank You!

