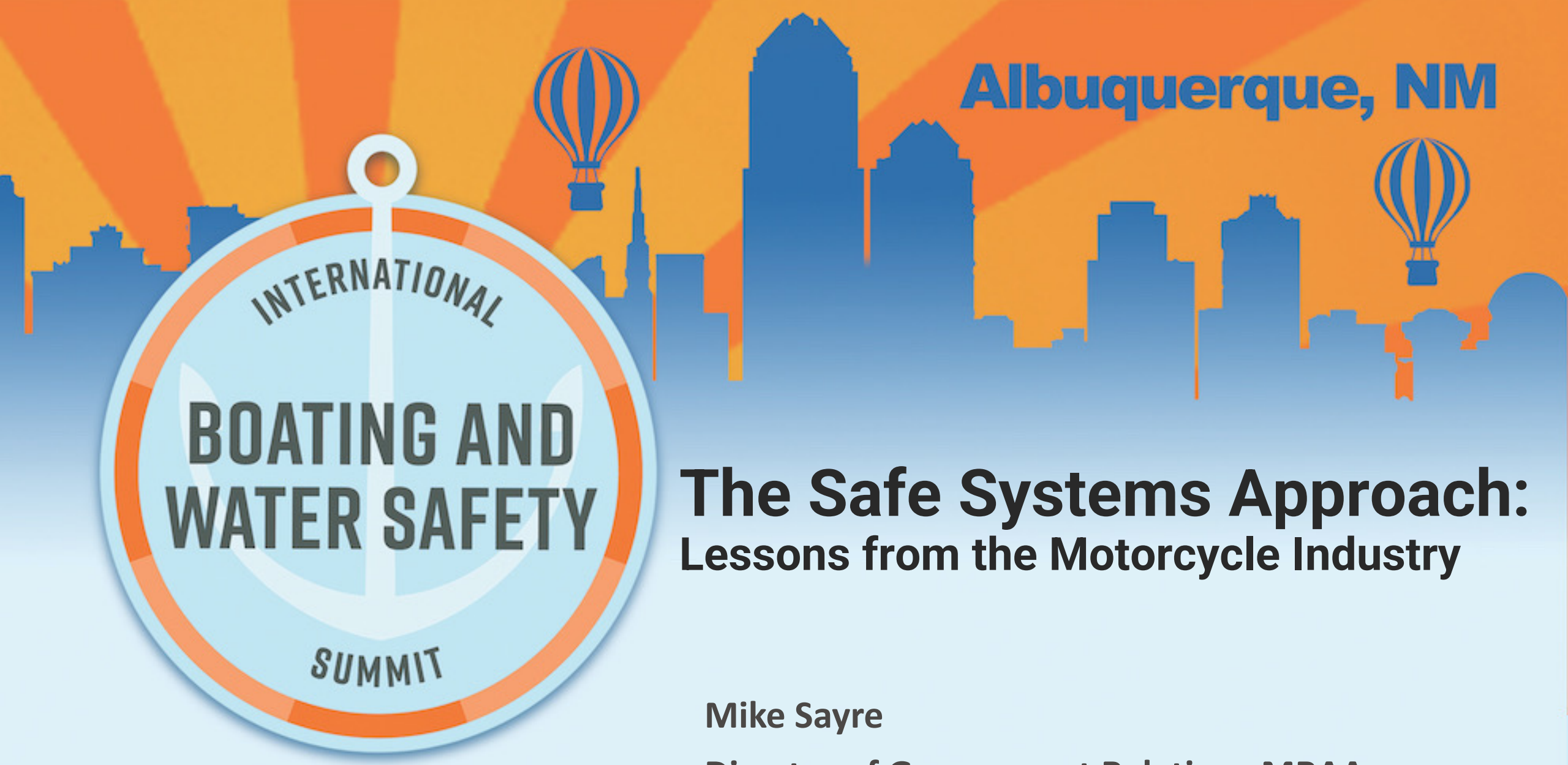

The Safe Systems Approach:
Lessons from the Motorcycle Industry

Mike Sayre

Director of Government Relations MRAA

4/9/2024

What is a Safe System Approach?

- A method to address and mitigate risks in a large and complex system
  - In this case, surface transportation
- Seeks to build and reinforce multiple layers of protection to both prevent crashes in the first place and minimize harm when crashes occur
- A holistic and comprehensive approach that provides a guiding framework to make transportation safer for all users
- Recognizes human mistakes and vulnerability

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Principles of the Safe System Approach

- Death and serious injuries are unacceptable
  - Prevent as many crashes as possible, mitigate the harm of those that happen
- Humans make mistakes
  - We will always make mistakes, but the system can be designed and operated to accommodate some errors and avoid serious harm when they occur
- Humans are vulnerable
  - The human body has a physical limit for tolerating crash forces before serious injury or death are inevitable, making it critical to design a system that is human-centric and accommodates those vulnerabilities
- Responsibility is shared
  - All stakeholders, including government at all levels, industry, researchers, non-profits, and the general public are needed to prevent death and serious injuries on our roadways
- Safety is proactive
  - Proactive tools to identify safety issues must be used rather than waiting for crashes to occur and reacting afterwards
- Redundancy is crucial
  - Reducing risks requires that all parts of the transportation system be effective enough so that if one part fails, another will still be capable of protecting people in a crash

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Main components of the Safe System Approach

- Safer People
  - Encourage safe and responsible behavior by people who use our roads
- Safer Vehicles
  - Technology to prevent crashes minimize impact of crashes on occupants and non-occupants
- Safer Speeds
  - Context appropriate roadway design and speed limit setting, education and enforcement
- Safer Roads
  - Design to mitigate human mistakes and vulnerability while facilitating travel by vulnerable users
- Post-Crash Care
  - Enhance survivability and prevent secondary crashes

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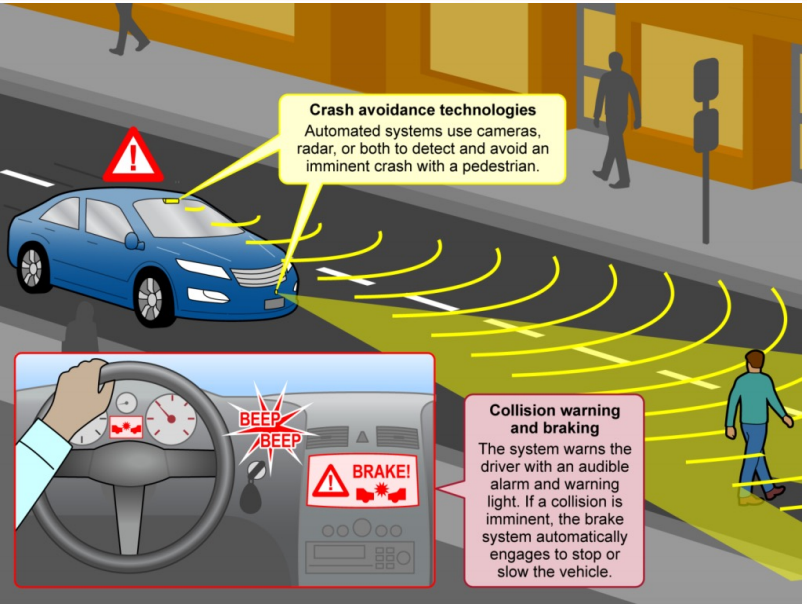
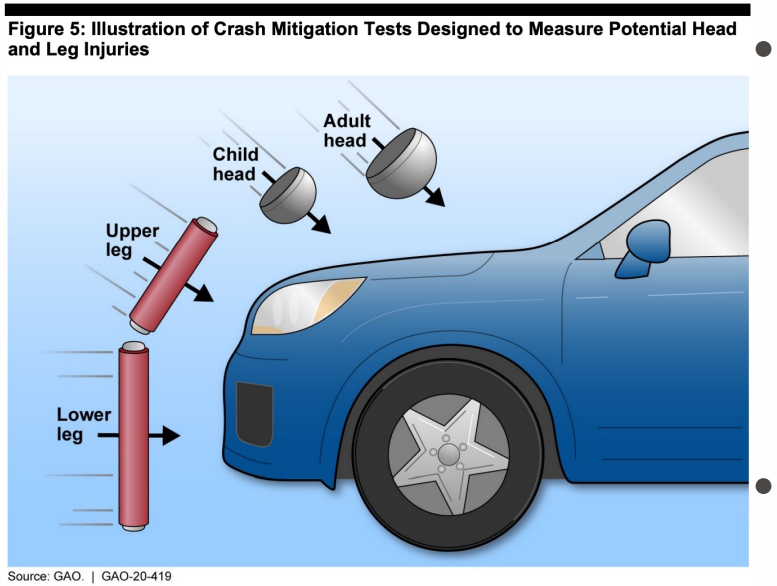
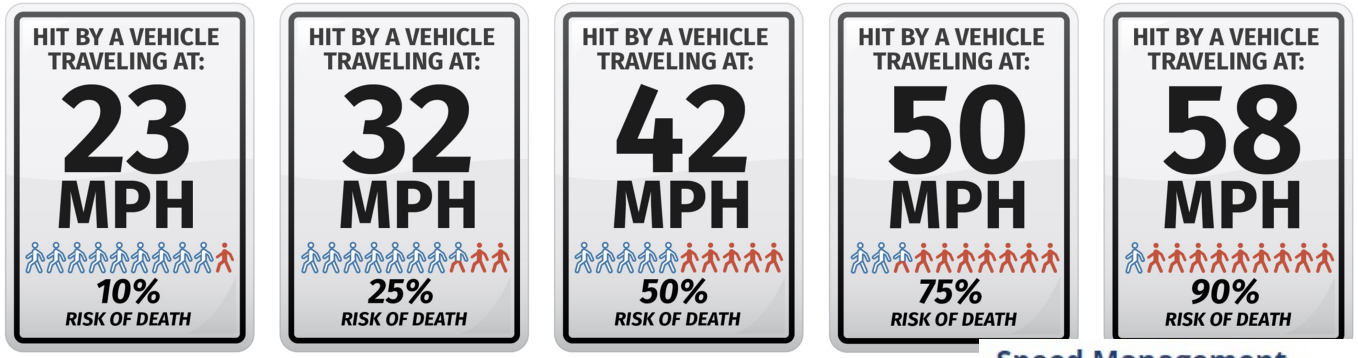
Safer Vehicles / Safer Speeds







- Safer Vehicles
  - Crash avoidance technology – THAT WORKS
  - Non-occupant crash ratings
  - Driver monitoring – distraction and DU
  - Underride protection on trailers
- Safer Speeds
  - Speeding increases frequency and severity of crashes
  - Road design for context appropriate speed
  - Automated enforcement

Speed Management

Appropriate Speed Limits for All Road Users

Speed Safety Cameras

Variable Speed Limits

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Safer Roads / Post-Crash Care

- Safer Roads
  - Roadway design influences road user behavior for better or worse
  - Design should create redundancy so one mistake won't lead to a deadly crash
- Post-Crash Care
  - Enhance survivability and prevent secondary crashes

Pedestrian/Bicyclist

- Bicycle Lanes
- Crosswalk Visibility Enhancements
- Leading Pedestrian Interval
- Medians and Pedestrian Refuge Islands in Urban and Suburban Areas
- Pedestrian Hybrid Beacons
- Rectangular Rapid Flashing Beacons (RRFB)
- Road Diets (Roadway Reconfiguration)
- Walkways

Roadway Departure

- Enhanced Delineation for Horizontal Curves
- Longitudinal Rumble Strips and Stripes on Two-Lane Roads
- Median Barriers
- Roadside Design Improvements at Curves
- SafetyEdge[SM]
- Wider Edge Lines

Intersections

- Backplates with Retroreflective Borders
- Corridor Access Management
- Dedicated Left- and Right-Turn Lanes at Intersections
- Reduced Left-Turn Conflict Intersections
- Roundabouts
- Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections
- Yellow Change Intervals

Crosscutting

- Lighting
- Local Road Safety Plans
- Pavement Friction Management
- Road Safety Audit

POST-CRASH CARE

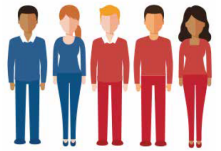
PROBLEM IDENTIFICATION

911 DISPATCHED EMS TO **1.5 MILLION CRASHES**[1]

National EMS Information System (NEMSIS)

40%
WERE ALIVE
WHEN FIRST RESPONDERS ARRIVED, BUT LATER DIED[3]

FARS



42,939
PEOPLE DIED
IN TRAFFIC CRASHES IN 2021[2]

Fatality Analysis Reporting System (FARS)

8,747
EMS RESPONSES TO CRASHES IN WHICH A VEHICLE OCCUPANT WAS PARTIALLY OR **COMPLETELY EJECTED**[4]

NEMSIS

48,517
INCIDENTS INVOLVED VEHICLE **EXTRICATION**[5]

National Fire Incident Reporting System (NFIRS)

169,462
EMS RESPONSES TO SERIOUSLY INJURED **CRASH PATIENTS**[6]

NEMSIS

COUNTERMEASURES

EMERGENCY MEDICAL DISPATCH (EMD) 911 PROTOCOLS

TIMELY ON-SCENE CARE USING MODEL EMS CLINICAL GUIDELINES

TRANSPORTATION TO A TRAUMA CENTER BASED ON NATIONAL FIELD TRAUMA TRIAGE GUIDELINES

PERFORMANCE MEASUREMENT FOR CONTINUOUS QUALITY IMPROVEMENT AND SEAMLESS, LINKED AND DATA-DRIVEN CARE

HIGHWAY SAFETY PLANNING

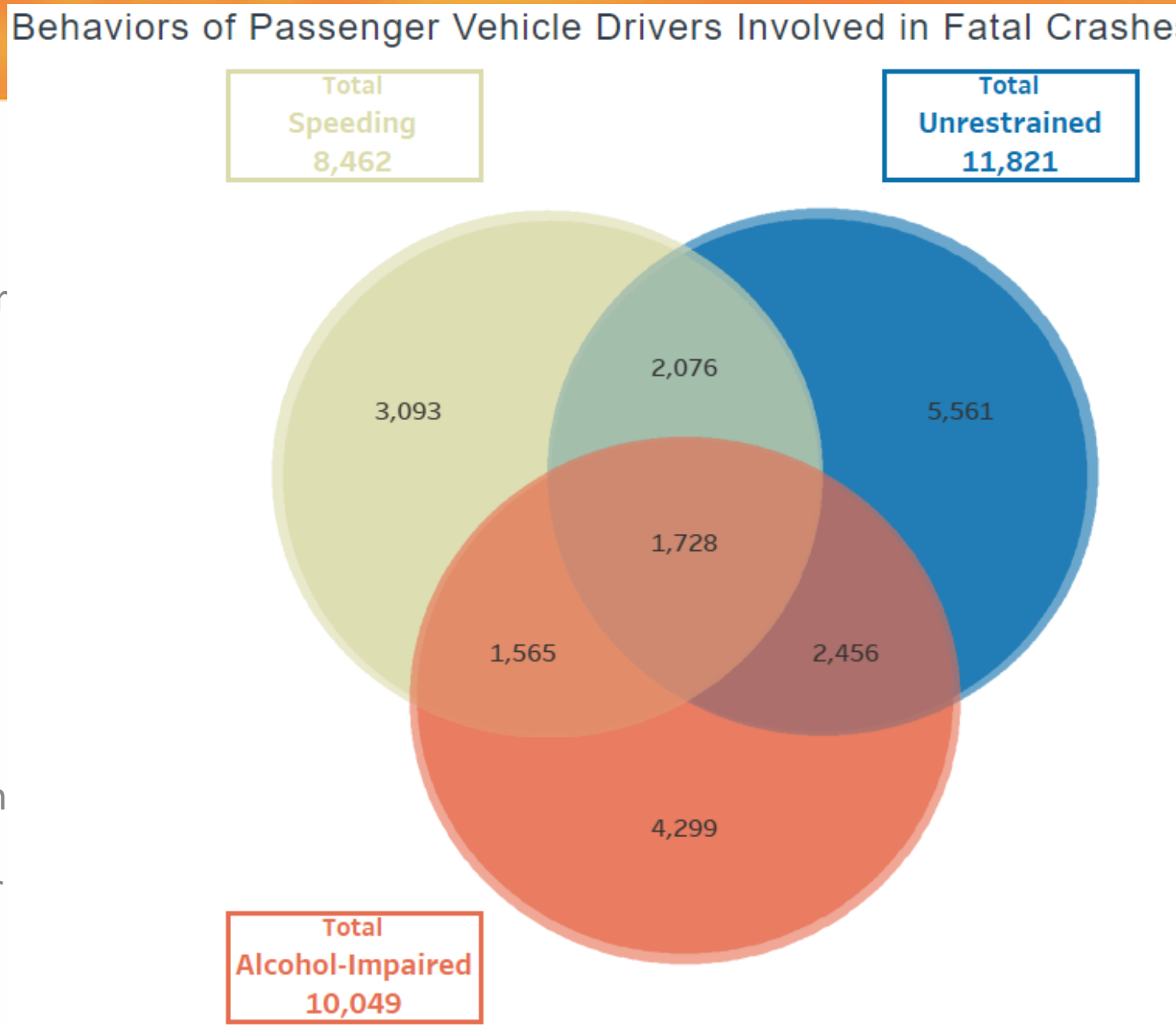
1. ACCESS 911 AND EMS DATA THROUGH YOUR STATE'S EMS DATABASE
2. COORDINATE POST-CRASH CARE BETWEEN HIGHWAY SAFETY, EMS AND 911
3. INTEGRATE POST-CRASH CARE INTO YOUR HIGHWAY SAFETY PLAN

References
1. NEMSIS Database, 2022 data. Report generated 5/2023.
2. FARS 2021 Annual Report File (ARF). Report generated 5/2023, Version 5.5, released 4/2023.
3. FARS 2021 ARF. Report generated 5/2023, Version 5.5, released 4/2023.
4. NEMSIS Database, 2022 data. Report generated 5/16/23. Number of EMS Responses to Crashes in which a Vehicle Occupant was Partially or Completely Ejected includes EMS activations with injury (1 equal to ICD-10-CM codes within the following ranges: T40-V49, V50-V59, V60-69, or V70-79.
Note: NEMSIS continuously receives data from clinical electronic patient care reports. These data may change as records are received or corrected.
5. Preliminary data from NFIRS Data Warehouse as of 4/25/23. Note: NFIRS is not a repository of all incidents that occur in the United States.
6. NEMSIS Database, 2022 data. Report generated 5/2023.

NHTSA NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Safer People

- Safer People
  - Encourage safe, responsible driving and behavior by people who use our roads and create conditions that prioritize their ability to reach their destination unharmed.
  - The three most frequent and persistent behavioral safety factors in fatal crashes are:
    1. People in motor vehicles not wearing seat belts
    2. Driving while impaired from alcohol
    3. Speeding
  - People generally use the roadway system in a safe manner on any given trip, but mistakes, lapses in judgement, and other more significant risky behaviors still occur.



What Does the Safe System Approach Mean for Motorcyclist Safety?

How can safer people, roads, speeds, and vehicles apply to motorcycles and riders?

Is this a square peg trying to fit in a round hole?

How can this approach be adapted to address the challenges of boating and water safety?

Motorcycles the Safe System Approach

- Safer People
  - Rider skill in negotiating curves and emergency braking
  - Alcohol and other impairments
  - Safety gear – more than just a helmet
- Safer Vehicles
  - Advanced anti-lock brakes on motorcycles
  - Crash avoidance technology on other vehicles being able to detect motorcycles
  - Visibility of motorcycles to other drivers
  - Vehicle design to mitigate injury to non-occupants
- Safer Speeds
  - Opportunities for riders to test their limits on closed courses or anywhere but a public road
- Safer Roads
  - Design roads to improve visibility of vulnerable users
  - Ensure barriers are designed with motorcycles in mind
  - Ensure construction and maintenance practices don't endanger motorcyclists or bicyclists
- Post-Crash Care
  - Specific needs in the event of a motorcycle crash

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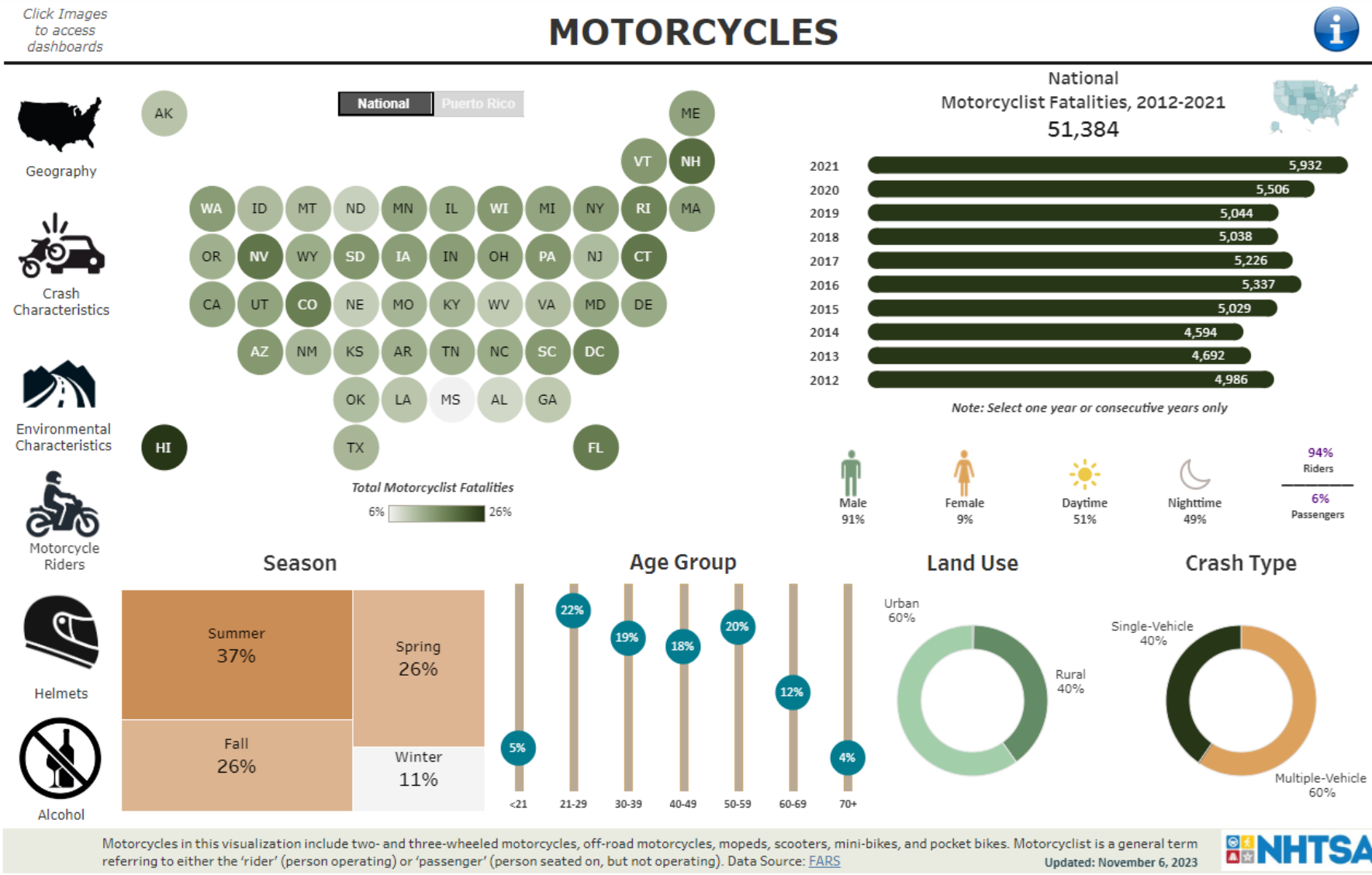
What does the universe of motorcycle crashes look like?

Dashboards at: www.transportation.gov/NRSS/SaferPeople

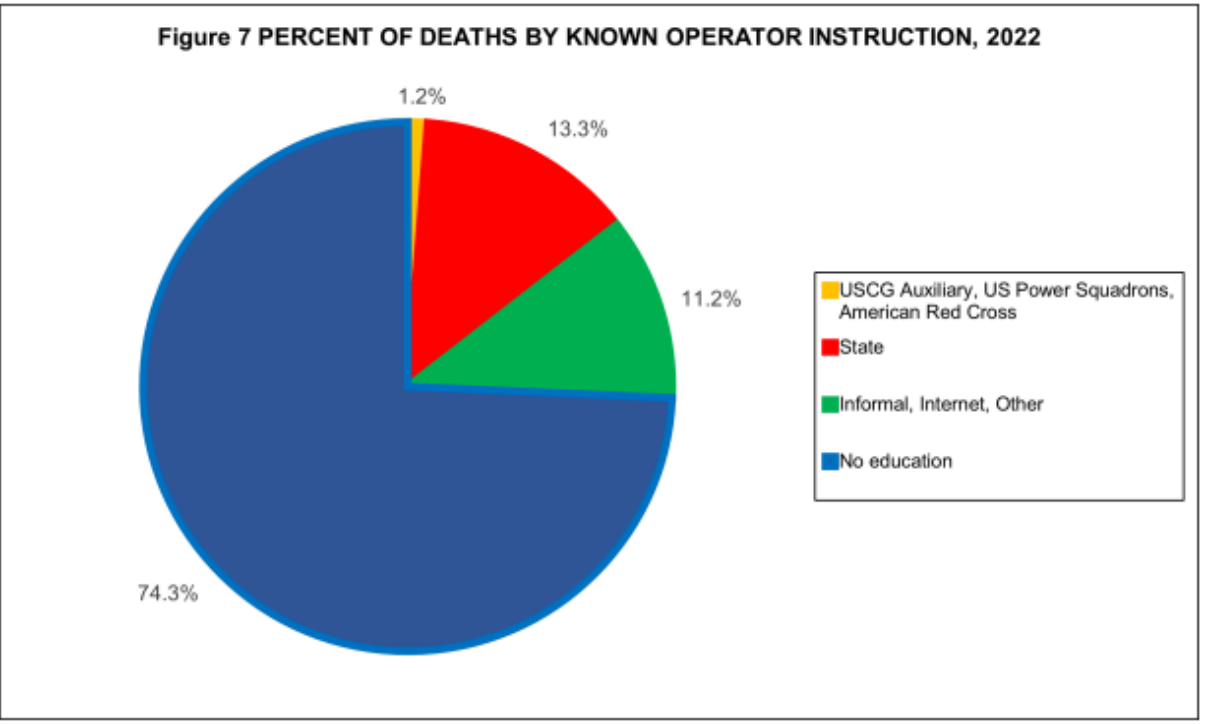
- 42,939 roadway fatalities in 2021
- 5,932 motorcyclist fatalities
  - Or 13.8% of all fatalities
  - 8% increase over 2020 which was 11% increase over 2019
  - 40% are single-vehicle crashes
  - 29% of motorcyclists were impaired
    - 24% for passenger vehicles
    - 43% of single vehicle motorcycle fatalities were impaired
    - 42% of nighttime fatalities were impaired
  - 65% wore a DOT-compliant helmet
    - 45% in states with no universal helmet law
    - 91% in states with a universal helmet law
  - 36% did not have proper license

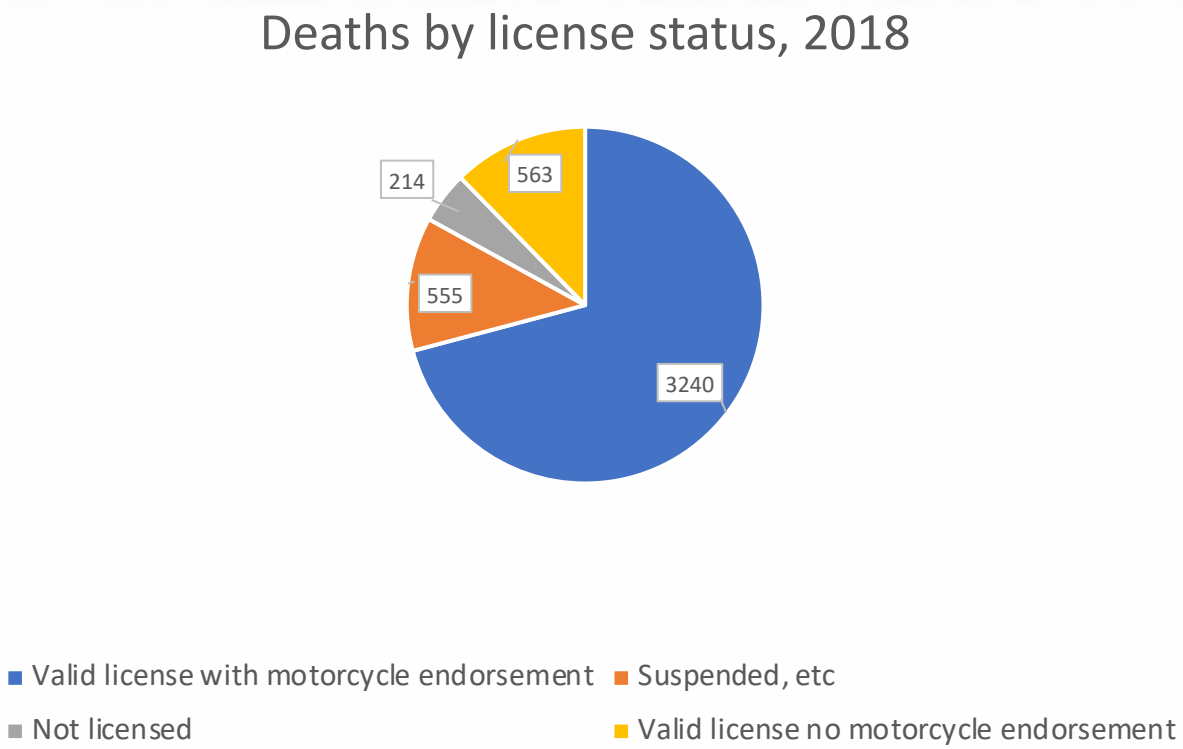


What challenges are shared between boating safety and motorcyclist safety?

Operator skill, training, and knowledge
Operating under the influence
Excessive speed
Use of safety equipment

Operator training and experience





- Having a motorcycle endorsement does not mean the rider took a training course
  - In most states, a riding test at the DMV is a means to get an endorsement
- Most training is 2-3 course over a weekend (plus Friday afternoon) that combines on-range riding and classroom learning
- What exercises should be repeated after completing a basic course? What are ideal for seasonal refreshers?

Operator training and experience

How do you sell training to existing motorcyclists and boaters? Assuming they have already taken a basic course, how do you incentivize further training?

- Training as something other than a safety exercise – building skills, more options to explore with increased skill
  - Advanced training in motorcycling is largely promoted as a means to increase rider skill in closed course settings
  - Efforts to promote the use of advanced training as a road safety effort face challenges
    - On-road intermediate/advanced exists, some programs to ride with law enforcement motorcycle units
    - Using existing training facilities means displacing basic courses AND keeping speeds low

For experienced operators, emphasize the importance of a near-miss. Near-misses a skilled operator should be taken as a chance to reflect and determine what caused the near-miss

Operating under the influence

- Operating under the influence of alcohol is a persistent contributing factor in many boating and roadway fatalities
- Strategies to create peer pressure amongst operators to support sober-operation have potential but require important lessons in bystander intervention
  - Bystander intervention is challenging in any situation but having safe NA alternatives or post-trip plans to drink while parked for the day or back on shore
  - Bystander intervention can be helpful in other situations, like speeding or inattention, is it part of your training?

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Excessive speed

Speed Management

- Appropriate Speed Limits for All Road Users
- Speed Safety Cameras
- Variable Speed Limits

The Safe System Approach considers speed to be an enforcement AND design issue

- Speeding becomes a behavior issue when infrastructure isn't effective at lower speeds
- Why do people make the choice to speed?
  - Is there a knowledge issue when it comes to deciding what speed is safe for which conditions?
  - Again, peer-pressure and bystander intervention can help when riding in a group
    - Pre-ride discussion on expectations on pace, stopping, and red flags for the whole group
- For motorcyclists trying to test their limits, the only appropriate location is a closed course

TOP TEN KNOWN PRIMARY CONTRIBUTING FACTORS OF ACCIDENTS

Accident Rank	Contributing Factor	Number of Accidents	Number of Deaths	Number of Injuries
1	Operator inattention	602	45	308
2	Operator inexperience	464	69	249
3	Improper lookout	387	22	234
4	Excessive speed	320	35	288
5	Machinery failure	289	13	69
6	Weather	221	44	77
7	Alcohol	215	88	148
8	Navigation rules violation	205	26	128
9	Hazardous waters	184	48	75
10	Force of wake/wave	137	5	118

Using personal safety equipment: Helmets and Life Jackets

Helmets are most directly comparable to life jackets, the first and most important piece of safety equipment

The decision to wear a helmet or not is a personal one in states that allow that choice, and no single message will work for all riders and other riders still believe some helmet related myths i.e. increased risk of neck injury

There is no scientifically valid reason to not wear a helmet, only the personal decision to wear one or not

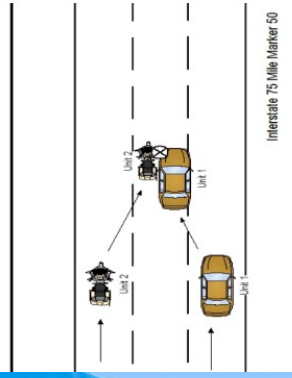
- What messaging can influence that choice?
- What messaging at the launch, dock, etc. can influence the choice to bring and WEAR a life jacket?

Graham Hunter - Clayton, Ohio

Alive Day: 6/19/2020

"I was traveling north on Interstate 75 in left lane and when attempting to change to the middle lane of traffic and was side-swiped by a car. I was wearing full protective gear and walked out of ER 3 hours later. The crash destroyed my helmet."

Graham suffered a severe concussion and vertigo as a result of the crash. Having ridden previously in the United Kingdom, he has been riding in Ohio with an endorsement since 2021.



Other personal safety equipment

While a helmet is the most important piece of safety equipment, head-to-toe protection is ideal

- How to get riders to chose to wear as much protection as possible?
  - Many brands have greatly expanded their “casual” options that pass as regular clothing
  - Other brands have created protective versions of commonly worn apparel
  - You probably won’t get many riders to wear a one-piece race suit, full gauntlet gloves, and racing boots, they may wear an armored hoody

There is less data about the use of safety gear other than a helmet and most of that data relates to conspicuity

- high visibility colors and reflective panels are effective but not always popular
  - “Stealth” reflective panels have been incorporated into many pieces of gear – only effective at night

Peer-pressure and firsthand experiences with crashing are often what leads a rider to make the safer choice and wear more protective gear – how do we get people to not learn the hard way?

A challenge to the motorcycle and boating industry – does your marketing imagery support best safety practices?

SEAL OF SAFE BOATING PRACTICES
NASBLA

How can the Safe System Approach components and principals be applied to boating and water safety?

- Death and serious injuries are unacceptable
  - Prevent as many crashes as possible, mitigate the harm of those that happen
- Humans make mistakes
  - We will always make mistakes, but the system can be designed and operated to accommodate some errors and avoid serious harm when they occur
- Humans are vulnerable
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- Redundancy is crucial
  - Reducing risks requires that all parts of the transportation system be effective enough so that if one part fails, another will still be capable of protecting people in a crash

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Thank you!

Questions?

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