



WRONG WAY

BE SAFE. DRIVE SMART.

TxDOT Motorcycle Safety

Design, Engineering, Public Awareness

April 2, 2024



- Worked for the TxDOT Design Division doing statewide engineering review for design plans and geometrics since 2001.
- Motorcyclist since I was 17.
- Served on the FHWA Motorcyclist Advisory Council (MAC) 2017-2020.
- Member of the FHWA Motorcyclist Safety Project - TTI Stakeholder Engagement Group
- Motorcycle Pooled Fund member (in progress)
- Serve on TxDOT Research and Technology Implementation Division – “Retrofit Design of Guard Fence System to Accommodate Motorcycle Safety” (in progress)



Jane Lundquist, P.E.

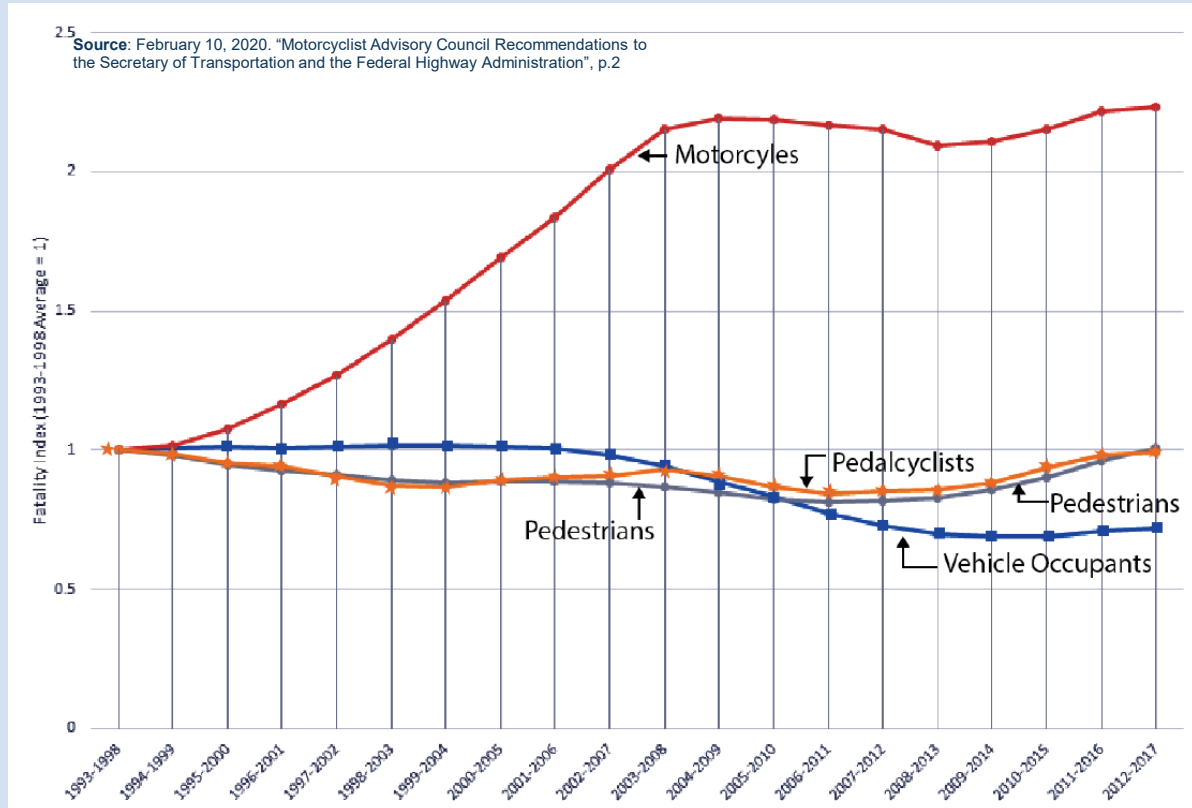
Motorcycle Fatalities



Motorcycle fatalities have increased while vehicle fatalities have decreased.

The increase in motorcycle fatalities correlates to the increase of motorcycle sales beginning in the late 1990s.

In 2020, 14% of all traffic fatalities were motorcyclists. This is the highest number of killed motorcyclists since 1975.



Additional Concerns for Safety and Impact to Fatalities



Since automakers have begun designing super-size vehicles that have morphed into “scowling brick walls” as one writer wrote about the trend. The large front and back blind spots have also contributed to the rise in bicycle, pedestrian, and motorcycle fatalities.

In the past, it was a concern to have a big rig following a motorcyclist, but the trend in vehicle sizes is more concerning since these vehicles are roaming our city streets and moving through our communities. This is no longer a major highway or interstate problem. Widths of these monsters can be measured at 8 ft (incl. mirrors); hood heights are near to 5 ft making the frontend of one of these heavy moving vehicles a sure fatal encounter.





The MAC was tasked with providing advice and recommendations concerning infrastructure issues related to:

1. Barrier Design;
2. Roadway Design, construction, and maintenance practices; and
3. Architecture and implementation of intelligent transportation systems.

The MAC identified **11** areas specifically related to infrastructure maintenance and construction that affect motorcycle safety.

- Pothole maintenance
- Open milled road surfaces
- Steel plates
- Uneven pavement
- Gravel and debris
- Traffic barrel sight distance
- Raised manhole covers
- Chip seals
- Excessive over-band crack fillers and joint sealants
- Low-friction pavement markings
- Traffic-actuated signals that don't detect motorcycles



Problem:

Barriers were designed to protect passenger vehicles and larger commercial vehicles. Motorcycles were never considered in design. Barriers are placed to prevent vehicles hitting a roadside obstacle; however, motorcyclists impacting a barrier can have more severe injuries than if they had hit the obstacle.

Recommendations:

- a. Secondary rail systems to prevent a motorcyclist from sliding under existing guardrail and into a support post.
- b. Impact mitigation devices that can be installed on existing support posts to reduce impact force and deceleration while easier to install on curved road sections than a second rail.
- c. New systems are to mitigate impacts for riders in either an upright “ejected” position or a sliding rider who has fallen.



In 2021, TxDOT became the Lead Agency for the Transportation Motorcycle Pooled Fund Program for the “Development and Evaluation of Roadside Safety System for Motorcyclists” in cooperation with other State DOTs. Research is being done by A&M Texas Transportation Institute (TTI). This multi-state team of participants is sharing experience in practice and design to address motorcycle safety solutions. There is no existing US guidance for roadway safety and design for motorcyclists.

Research needs:

- Shoulder widths and applicable sideslopes to allow better recovery for motorcyclists
- Passive methods that decrease roadway departure
- Barrier design for motorcyclist safety
- Develop guidance to determine locations for motorcycle safety design elements
- Investigate critical geometry of roadway elements
- Signal detection



There was a need to develop an appropriate use of retrofit motorcycle barriers designed to be used on standard flexible guard fence systems and rigid concrete barriers.

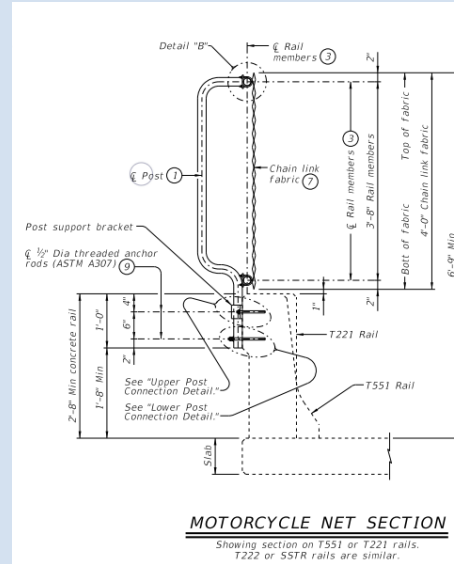
In 2019, TxDOT selected TTI to perform research for the “Retrofit Design of Guard Fence System to Accommodate Motorcycle Safety”. At that time there were no guidelines to address motorcycle retrofit for flexible guard fence barriers.

Through TTI, Bridge Division designed a Motorcycle Net in 2019, to be installed on rigid concrete barriers to prevent ejected riders from leaving an elevated roadway.

TxDOT Bridge Division Motorcycle Net Design



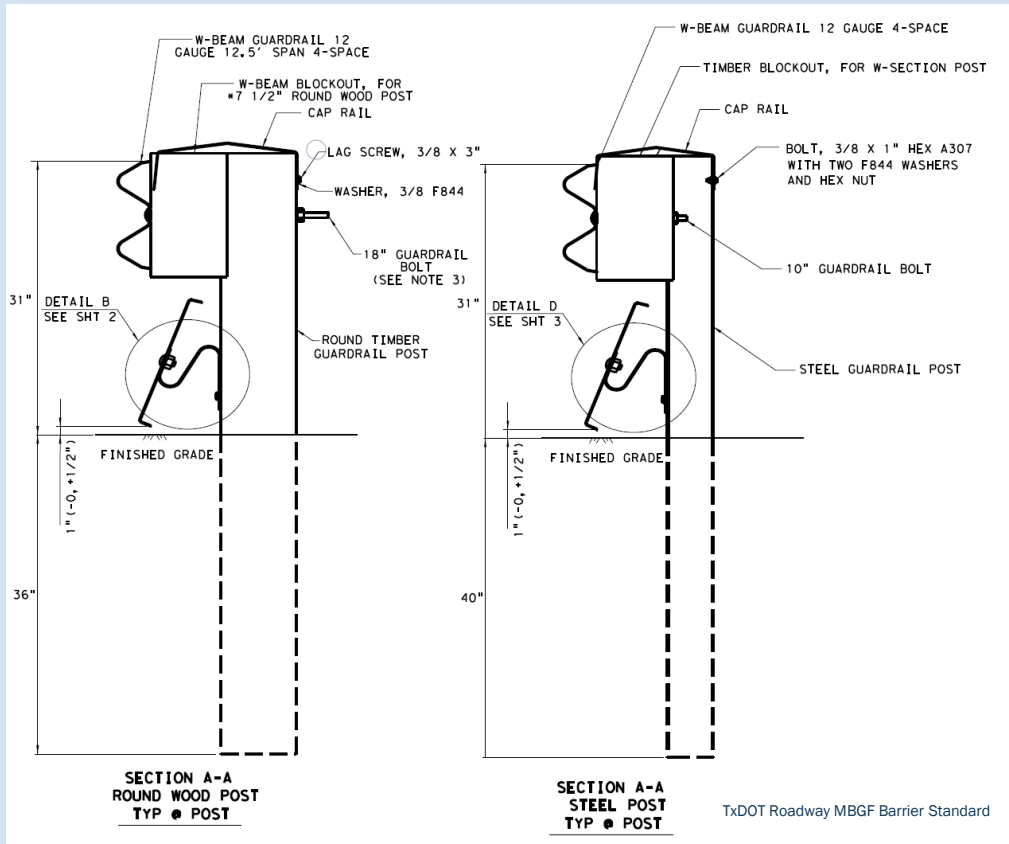
TxDOT Motorcycle Net Standard



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Through TTI research and testing, TxDOT developed a standard for rigid concrete barriers. State and Federal DOT resources have used data mining to identify potential locations for installation of these systems based on potential high-risk sites and geographical characteristics.

Roadside Barrier Research – Flexible Metal Beam Guard Fence (MBGF)



Profile of a wood and a steel post MBGF. Extensive design and testing has resulted in a Cap Rail and Rub Rail design.

The Rub Rail bracket was designed and tested until the optimal shape and angle were developed.

Rub Rail is intended to prevent a rider from sliding under the W-beam and catastrophic snagging with the posts.

TxDOT MBGF design standards are pending completion of research and approval.

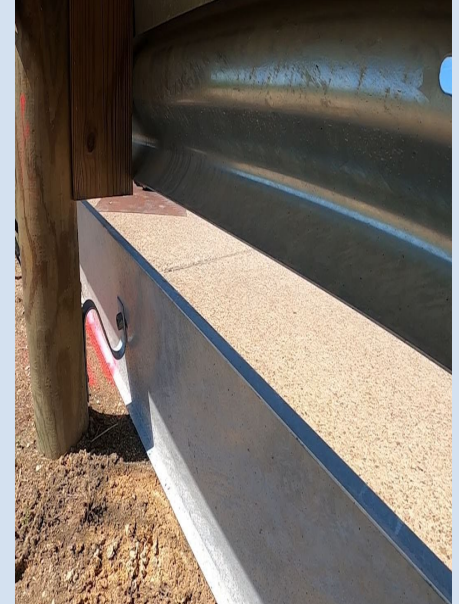


Barrier Cap Rail

Picture at the left is a demonstration of a barrier Cap Rail.

Picture on the right is a view from the back of a roadside barrier and the Rub Rail connected below the W-beam.

Pictures obtained from TTI crash tests for the TxDOT research project, “Retrofit Design of Guard Fence System to Accommodate Motorcycle Safety”



Rub Rail connection to post

TTI Sliding Rider Rub Rail Test



TTI Testing Photos





Problem:

Motorcycles have unique characteristics and behavior. The word “motorcycle” is often absent from design manuals and guidance. Cars, trucks, pedestrians, and bicyclists are accommodated in design criteria, but motorcycles and motorcyclist safety need to be accommodated.

Recommendation:

1. Do pavement friction testing using a motorcycle tire where appropriate.
2. Due to unfamiliarity with motorcycles, recommend manuals, design guides, and training include specific modules for motorcycle design practice.
3. Recommend motorcycles be adopted as a minimum reference vehicle design where appropriate in design guidance.
4. Limit bumps, uneven edges or drop-offs, and milled surfaces during construction.



High friction surface treatments (HFST) have exceptional skid resistance. It is a site-specific bonded treatment applied to the pavement surface. The aggregate used is highly abrasion resistant.

These treatments have been used in areas where there are horizontal curves, steep grades, and intersections where skidding and heavy braking can occur. It has been successful in reducing lane departures and crashes and has demonstrated a good service life.

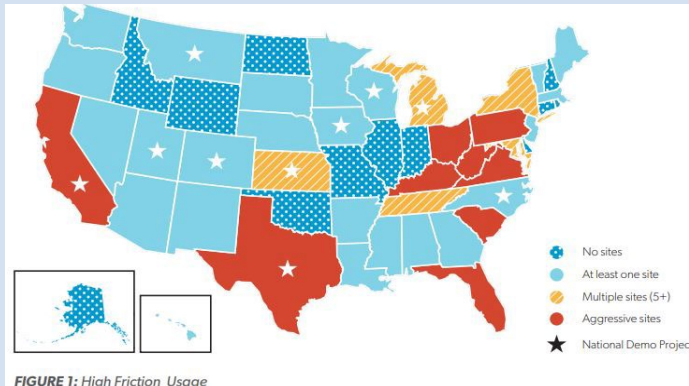


FIGURE 1: High Friction Usage

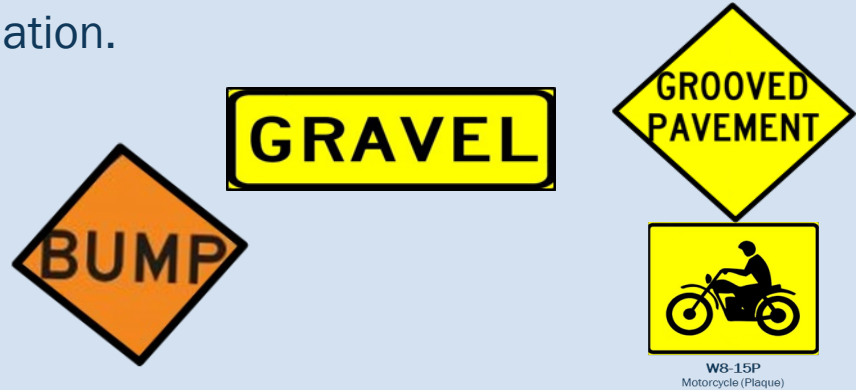
Map from EDC-2:

Every Day Counts (EDC), a State-based initiative of FHWA's Center for Accelerating Innovation. Works with State, local, and private sector partners to encourage the adoption of proven technologies and innovations aimed at shortening and enhancing project delivery. Texas is an aggressive user of HFST.



The MUTCD is approved by the FHWA and recognized as the national standard for traffic control on all public roads. The MUTCD is the manual that regulates the specifications of signage, pavement markings, work zone controls that make users understand the roadway information anywhere in the nation.

Communicating roadway design constraints to the rider mitigates the potential for adverse traveling results.



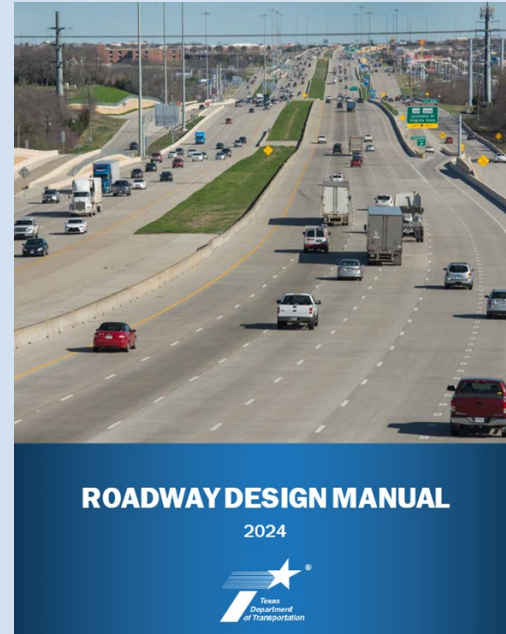
Prior to the MAC conclusion. The MUTCD mentioned motorcycles about 4 times. In the 2022 version there are 22 references to motorcycle regulatory and warning signage, and modified pavement marking to allow riders to maximize wheel traction with the road surface in inclement weather conditions.



The updated TxDOT Roadway Design Manual is in review. The pending Manual will incorporate a chapter for motorcycles. This is a new chapter for the TxDOT Design Manual. Motorcycle design considerations were omitted in earlier TxDOT manuals.

An overview of topics considered for inclusion:

- Pavement features
- Roadside features
- Signage and other road furniture
- Longitudinal Barriers
- Shoulders
- Horizontal curves
- Intersections
- Work zone safety



Intelligent Transportation Systems



Connected vehicle technology, known as V2X, communicates with the infrastructure and between other vehicles.

Auto-piloted vehicles are on the road. Some are large trucks and required to have a human able to take control.

Auto-piloted cars, SUVs, and trucks have various claims for self-driving, but none are fully automated for all conditions.



Motorcycles need to be visible to other users. I am unaware of any research to include motorcycle vehicles along with other vulnerable users.

The discussions in which I have been involved are concerned about self-driving motorcycles due to the inherent danger of startling a rider and causing a crash.





Motorcycle Safety Awareness



Before Every Ride

Make sure your ride's:

- Tires and wheels have proper inflation and safe rotation
- Chains and cables are intact with appropriate lubrication and are crack and chip-free
- Fluids are at proper levels and are leak-free
- Functions such as controls, horn, and lights work correctly
- Body condition is sound: Your motorcycle should be free of structural damage, including cables, hoses, and kick stands
- On a manufacturer-recommended maintenance schedule



Motorcycle Safety Awareness



Before Every Ride

Make sure you're wearing protective clothing:

- DOT-compliant helmet
- Full-coverage jackets
- Full-fingered gloves
- Riding pants
- Riding boots





Motorcycle Safety Awareness



Before Every Ride

If you're carrying a passenger, they should:

- Mount the motorcycle only after the engine has started
- Sit behind you as far forward as possible
- Keep both feet on the footrests at all times, even when stopped
- Keep their legs and feet away from the muffler
- Hold firmly to your waist, hips, or belt and keep movement to a minimum
- Lean at the same time and in the same direction as the driver
- Not dismount the motorcycle until the driver says it's safe

Passengers can influence the handling of the motorcycle.

Inform a new passenger how to enjoy a safe ride.





Behavioral issues are the highest cause of MC crashes and fatalities.

- Riding under the influence of alcohol or drugs
- Riding beyond ability and experience with the MC
- Lack of motorcycle training – driving a car and riding a motorcycle require two different skillsets and knowledge.



DOT.GOV Interactive Motorcycle Statistics

https://explore.dot.gov/views/DV_FARS_MC/Home?%3Aiid=1&%3AisGuestRedirectFromVizportal=y&%3Aembed=y

The website provides motorcycle statistics from all 50 States on Geography, Land Use (rural/urban), Gender, Crash Characteristics, Fatalities, Riders, Environmental, Helmets, and Alcohol.



HELP #EndTheStreakTX

End the streak of daily deaths on Texas roadways.

[TxDOT.gov](https://www.txdot.gov) (Keyword: #EndTheStreakTX)



#EndTheStreakTX Toolkit

