

# Texas Roadway Design Considering Motorcycles



## JANE LUNDQUIST, P.E., M.ASCE

I am a Transportation Engineer in the Design Division of the Texas Department of Transportation in Austin.

- I worked in the private sector before coming to TxDOT.
- I have worked for the TxDOT Design Division for over 20 years doing plan reviews, design, research, specification and TxDOT manual writing, and planning activities.
- I have been a motorcyclist since I was 17 years old.
- I took a break from riding while I raised two sons.
- I went to school to train for my life's next career as an engineer.
- When I got my first job after graduation, I told my family I was going to buy a motorcycle.
- I made good on that promise to myself. Made long trips on my own and enjoyed the people I met.



Baby Blue – Just washed.  
'98 Harley Davidson Dyna Lowrider

## FEDERAL HIGHWAY ADMINISTRATION - MOTORCYCLIST ADVISORY COUNCIL

Congress re-established the Motorcyclist Advisory Council (MAC) through the Fixing America's Surface Transportation Act (FAST Act) of 2015

The US DOT designated the Federal Highway Administration (FHWA) as the agency responsible for the administration of the MAC. The MAC was charged with issues regarding:

- Barrier design;
- Road design, construction, and maintenance practices; and,
- Architecture and implementation of intelligent transportation system technologies

I was one of nine people from different backgrounds appointed to a three-year term as a Federal Special Government Employee to the MAC.

At the conclusion of the MAC, FHWA contracted TTI to investigate and conduct background research for infrastructure safety solutions with respect to the Motorcyclist Advisory Council recommendations. I have served as a stakeholder in this engagement group of professionals.





## FHWA MAC TOPICS THAT WERE RAISED AND DEBATED EXTENSIVELY:

**AASHTO** (American Association of State Highway and Transportation Officials) design publications:

- *Manual for Assessing Safety Hardware* commonly known as MASH lacks protocols for addressing motorcyclist barrier safety.
- *Geometric Design of Highways and Streets* commonly known as the “Green Book” is the foundation of roadway design in the United States and lacks recognition of motorcycles as a vehicle class.
- *Roadside Design Guide* does not address motorcyclist roadside safety issues.

Lack of national guidance and designs for state transportation agencies to find remedies for motorcyclist safety. This has resulted in independent action by states to find improvised solutions.

Roadway friction tests performed with automobile tires and not done with motorcycle tires which have different profiles and pavement contact surface patches. No existing single track vehicle testing.

Work zone safety with multiple dangers to riders; e.g. loose material, dust, flying debris, steel plates, poor or no signage for motorcyclist hazards, no alternate routes for riders, pavement drop-offs, grooved pavement.

Concerns for V2X technology and how motorcycles will be included in the conversation.



# WHAT IS TXDOT DOING FOR MOTORCYCLE SAFETY?

## Research, Design, Media Campaigns

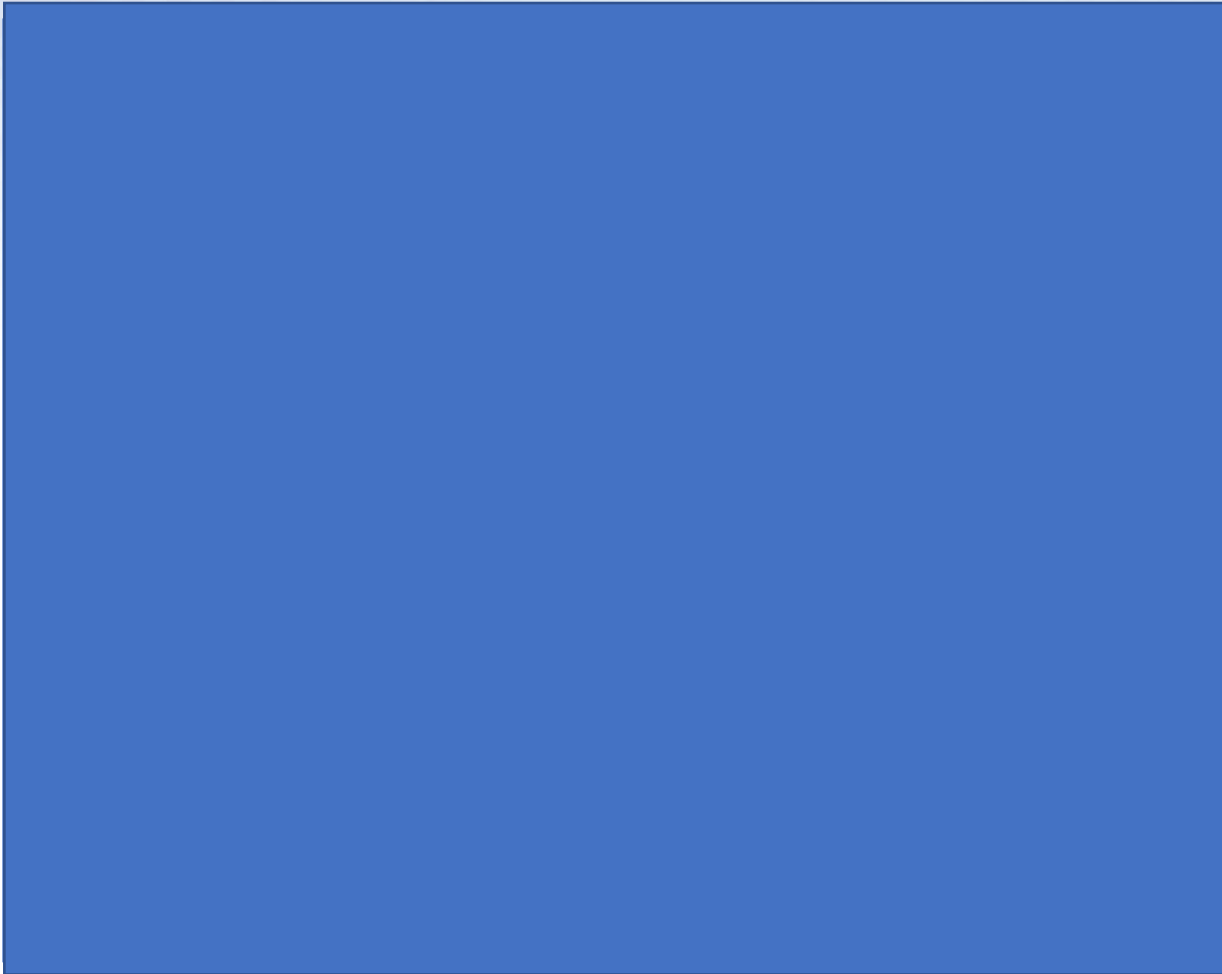


- TxDOT Research Project with contracted researchers to “Develop a Retrofit Design for Guard Fence System to Enhance Motorcycle Safety.”
- TxDOT is the Lead Organization for a National Pooled Fund Motorcycle Study, which has been cleared by the Federal Highway Administration (FHWA), with commitments from state transportation agencies (CO, IL, LA, MA, UT) for “Development and Evaluation of Roadside Safety Systems for Motorcyclists.” TTI has been contracted to do research for this pooled fund effort.
- Roadway pavements
- Roadway signage
- Public Service Announcements, commitment to Vision Zero, billboards



## TXDOT RESEARCH PROJECT

### “DEVELOP A RETROFIT DESIGN FOR GUARD FENCE SYSTEM TO ENHANCE MOTORCYCLE SAFETY.”



Crash diagram from FDOT

We are doing a research project to mitigate crash injury with metal beam guard fence impacts.

A crash involving this type of roadside barrier causes severe injuries or death. In the example, the rider is on a superelevated horizontal curve (this means this roadway has a -5 deg. cross slope downward to the left of travel direction in this scene).

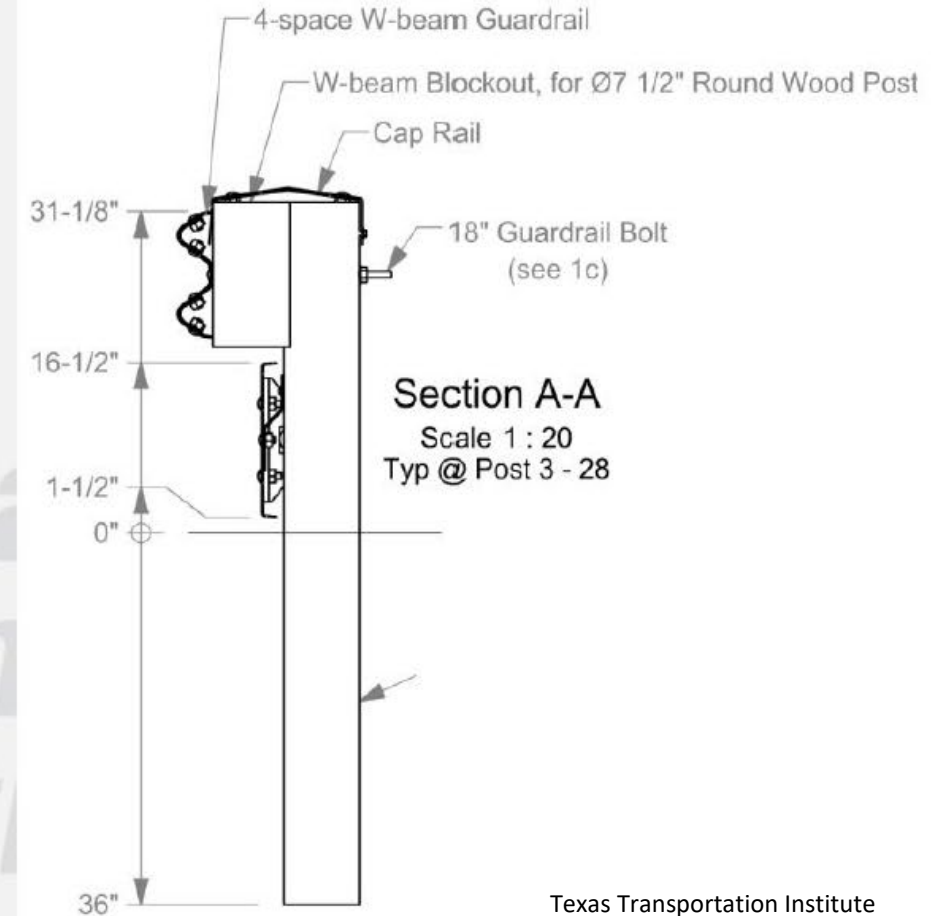
The rider hits muffler debris on the roadway and loses control. The rider and passenger are ejected from the motorcycle. The motorcycle continues in an arc after hitting the rail and slides downhill into next lane.

The rider and passenger are ejected from the motorcycle and suffer life-threatening trauma by hitting the post and rail.





# ORIGINAL MOTORCYCLIST SAFETY DESIGN BARRIER TREATMENT TESTED AT TTI TEST FACILITY



Texas Transportation Institute



## TTI TESTING FACILITY - TESTING THE CAP RAIL DESIGN (upright rider approaching at left)





## TTI TESTING FACILITY - TESTING THE CAP RAIL DESIGN FOR UPRIGHT RIDER (rail front view)



## RUBRAIL TESTING

Crash dummy has multiple sensors and is dressed as a rider wearing protective apparel. Test results passed for the **upright rider** impacts on the cap rail.



Texas Transportation Institute

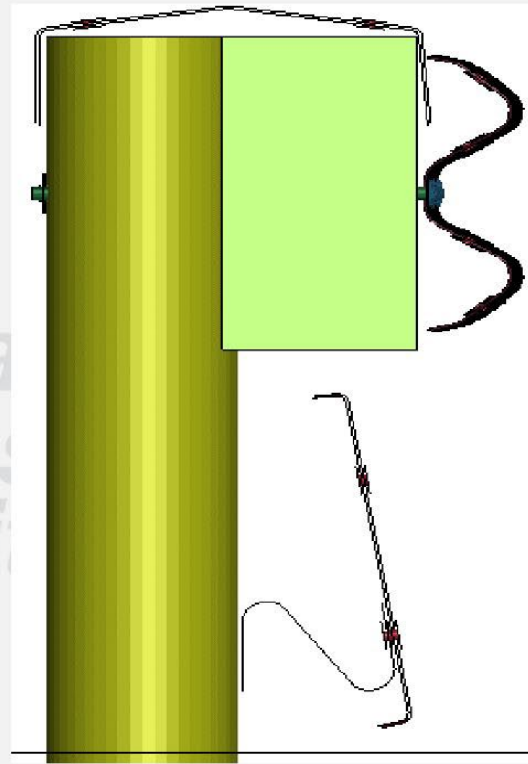
However, the **ejected sliding rider** impact simulation did not meet injury limitations used for testing the rubrail. A new rubrail design had to be created and tested.



## RUBRAIL REDESIGN

### Channel Rubrail

- 12-gauge thickness
- Energy absorbing bracket
- Offset from post
- 10° Incline



Materials used for the rubrail need to be easily sourced.

A rubrail “Z” bracket to absorb energy of a moving mass was designed. By moving the rubrail off the posts and using an inclined rubrail made an improvement in the effectiveness and testing results.

Since this research project and testing have had progress delays due to COVID-19 protocols, TTI has been able to do some computer simulations that may be tested this spring using the outdoor test area.

Texas Transportation Institute



## **TXDOT IS THE LEAD ORGANIZATION FOR A NATIONAL POOLED FUND MOTORCYCLE STUDY**

This is a motorcycle study, which has been cleared by the Federal Highway Administration (FHWA), with commitments and investment from state transportation agencies (CO, IL, LA, MA, UT) for “Development and Evaluation of Roadside Safety Systems for Motorcyclists.” TTI has been contracted to do research for this pooled fund effort.

Although this study is similar to the TxDOT research, it is a cooperative approach to finding safety solutions and keep an up-to-date examination of best practices for motorcyclist roadside safety.

Each partner state has had to find solutions for their state. Solutions have been similar, but inconsistent throughout the US.

By doing this pooled approach it allows states to have access to an excellent accredited research testing facility and the ability to collaborate on motorcyclist roadside safety treatments.

As stated previously, international crash testing standards such as EN1317 include motorcyclists; however, the *AASHTO Manual for Assessing Safety Hardware* (MASH) lacks protocols to evaluate motorcyclist safety.



## TXDOT PAVEMENTS

The **Texas Wet Surface Crash Reduction Program (WSCRP)** – Surface texture types are based on speed, geometry, traffic, climate, materials and cost-effective treatments.

TxDOT skid tests are held annually on a percentage of roadways. Tests can be requested by TxDOT Districts in addition to the list of annual candidates.

Designers review crash history to focus design attention on areas that may require greater skid resistance and maintenance needs.



## ROADWAY SKID TESTING

Pavement skid testing done in the US is performed to ASTM (American Society for Testing and Materials) standards. An example of a locked wheel tester used to obtain ASTM Standard Test Method E-274 measurements is shown in the picture.

The trailer is towed behind a truck. There is a tank of water that feeds sprayers aimed at the tires.

The skid numbers obtained from the test are defined in AASHTO terms as “friction numbers.” Since AASHTO provides the comprehensive design guidance for US streets and highways, the friction numbers are used for geometric design of our roadways. As stated previously, this is a tester that uses vehicle tires and is dual track.

These friction measurements provide a “reasonably” safe roadway for all users.

Motorcycles are single track with a rounded profile versus an auto or truck tire that has a “rectangular” flat profile. At this time, there is no simulation for motorcycle-specific testing. This has been brought to the attention of FHWA and AASHTO.





## SIGNS

TxDOT uses the Texas Manual on Uniform Traffic Control Devices (TMUTCD) for all signage and pavement markings. Well-placed signs can help all motorists make safety decisions.

Signage that help motorcyclists are generally indications of road geometry or work zone issues. Work zone signage can provide riders information to avoid areas or use caution.



Inside TxDOT - Districts



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## WHAT DO I DO IF I HAVE A QUESTION ABOUT AN ISSUE ON A ROAD I RIDE?

### Districts

[Texas Department of Transportation](#) > [Inside TxDOT](#)

Our 25 districts oversee the construction and maintenance of state highways. Contact your district with any questions or concerns about a TxDOT project in your area.



Locate a District by County:

Select a County... ▾

<https://www.txdot.gov/inside-txdot/district.html>

TxDOT has a hierarchy and locations for help.

Divisions in Austin are responsible for meeting federal guidelines, providing guidance, manuals, testing, and policy, letting, as well as directives from the Texas Transportation Commission. This information and support is provided to the 25 TxDOT Districts.

TxDOT 25 Districts vary in size, geography, and climate. They are multi-county, responsible for design and maintenance of roadways within their District.

### TO REPORT A ROADWAY PROBLEM :

Go online to **Inside TxDOT** and Select **Districts**. Find the District where you have a roadway issue and send details in email to the District Engineer. That person will send to appropriate District Area Office to make an examination of the issue.



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# There's a life riding on it.

**A motorcycle's best safety feature is you.**



Be aware of motorcycles, especially at intersections. Always check your mirrors before changing lanes, and use your turn signals. Give motorcycles a full lane and never follow too closely. Look twice to avoid a tragedy.

**LOOK TWICE  
FOR MOTORCYCLES**

**Share the Road.**  
#EndTheStreakTX **TxDOT**

TxDOT does public service announcements and advertising to get *drivers* to “Look Twice for Motorcycles.”

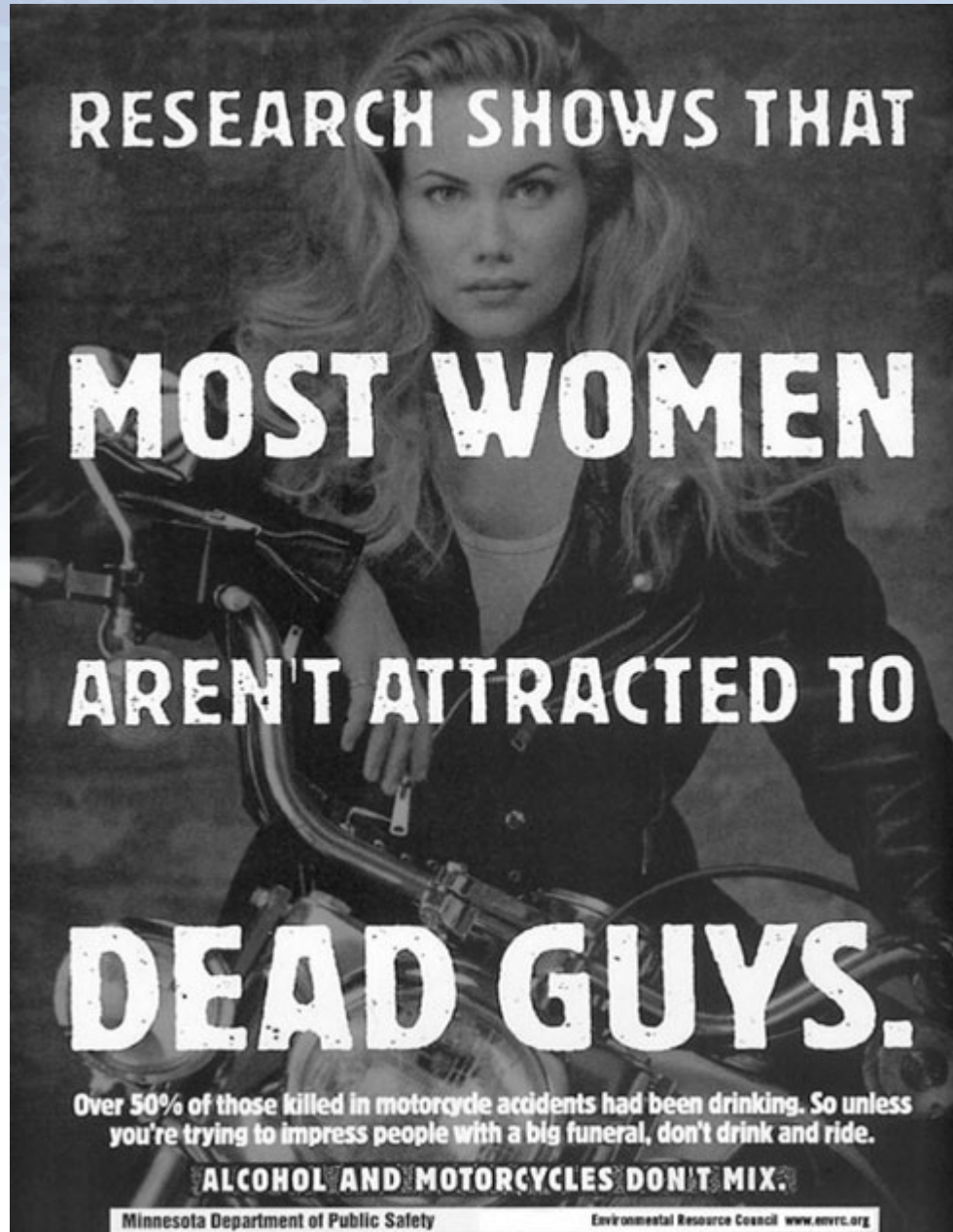
Motorcycle training and personal safety equipment are the best way to protect your safety.

Each of us is responsible for our own safety and those who ride with us.



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For many years, Minnesota Department of Public Safety has been using provocative posters to get the *motorcyclist's* attention to safety.

This poster has a message for those who want to drink and ride.

“Over 50% of those killed in motorcycle accidents had been drinking. So, unless you’re trying to impress people with a big funeral, don’t drink and ride.”



# #EndTheStreakTX

End the streak of daily deaths on Texas roadways.



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