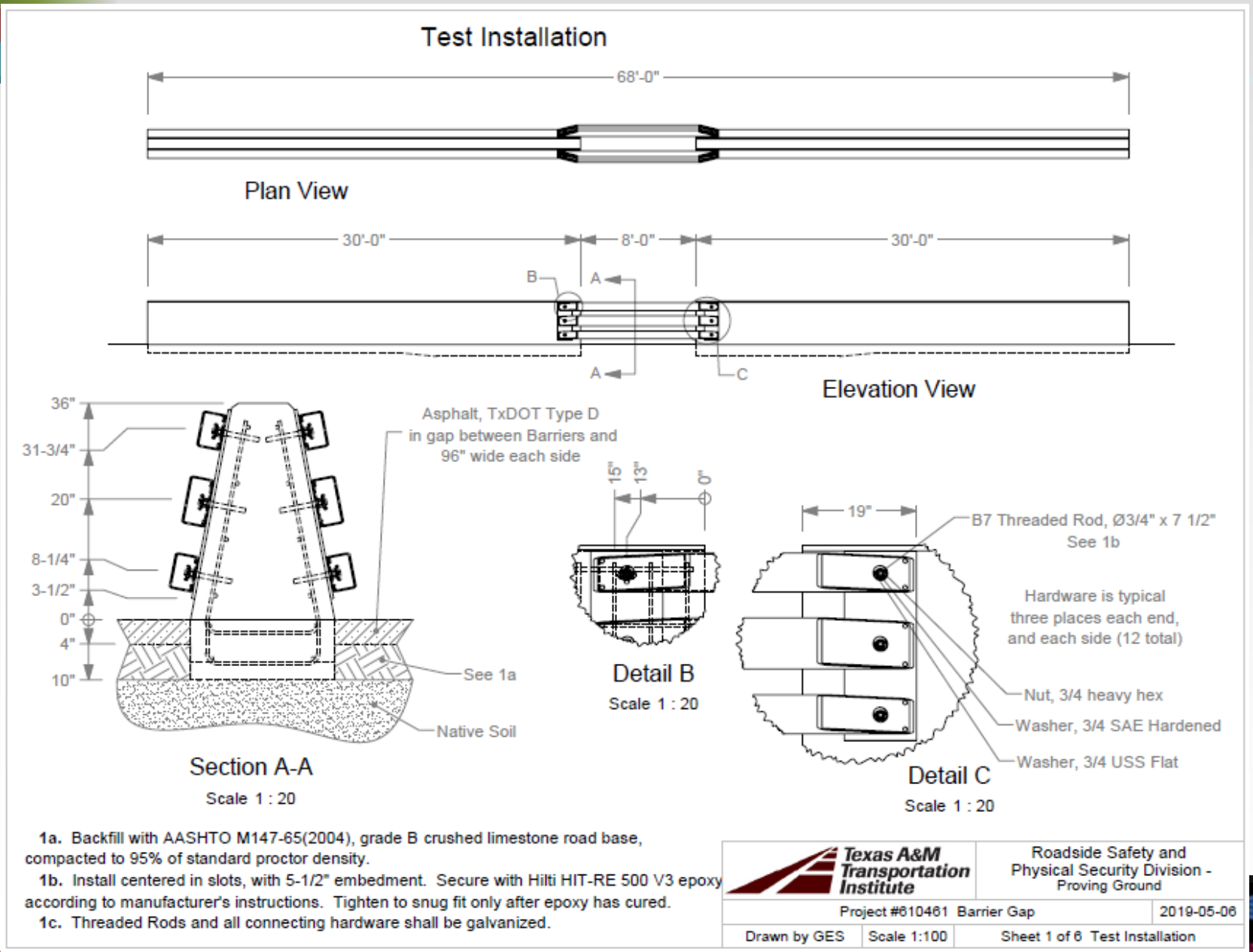
Thrie/W-Beam/Tubular Barrier Gap Rail for MASH TL-3

- Problem
  - Sometimes manholes and other features in the alignment of barriers
  - Need to provide 8-foot maximum wide gap to access manhole/features
  - Need to provide structural barrier that is removable for access
  - Removable barrier needs to meet crash requirements of MASH TL-3

Thrie/W-Beam/Tubular Barrier Gap Rail for MASH TL-3

- Work Plan
  - Task 1 – Engineering Analyses & Detailing
    - Option 1 – W-beams with brace frames
    - Option 2 – Steel Tubes with Slotted Plates
  - Task 2 – Construction & Drafting
  - Task 3 – Perform Full Scale Crash Test
    - Perform Mash Test 3-10 (1100C, 25 degs., 100km/hr.)
    - Perform Mash Test 3-11 (2270P, 25 degs., 100 km/hr.)

Details For Full-Scale Crash Testing



1a. Backfill with AASHTO M147-65(2004), grade B crushed limestone road base, compacted to 95% of standard proctor density.

1b. Install centered in slots, with 5-1/2" embedment. Secure with Hilti HIT-RE 500 V3 epoxy according to manufacturer's instructions. Tighten to snug fit only after epoxy has cured.

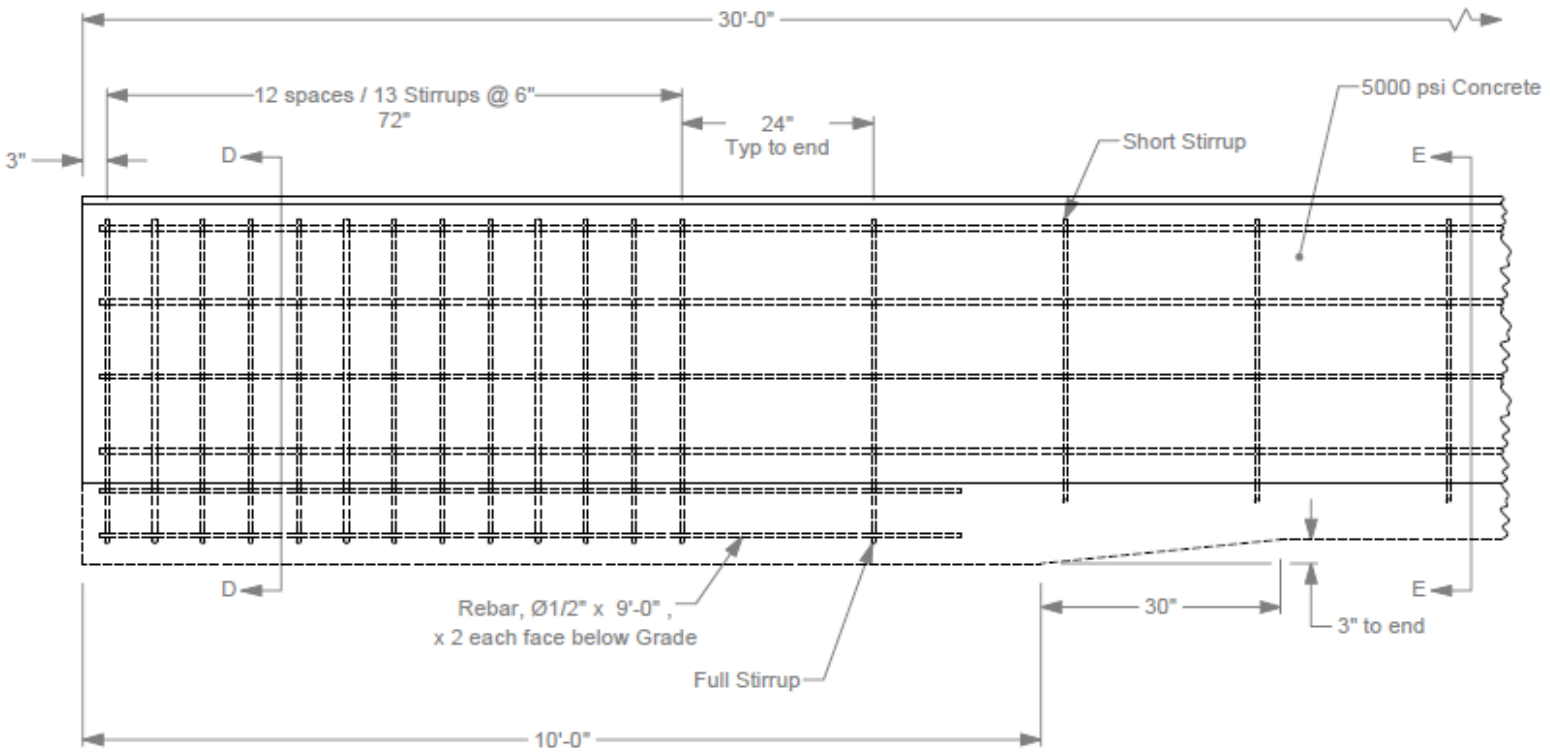
1c. Threaded Rods and all connecting hardware shall be galvanized.

Texas A&M Transportation Institute	Roadside Safety and Physical Security Division - Proving Ground	
Project #610461 Barrier Gap		2019-05-06
Drawn by GES	Scale 1:100	Sheet 1 of 6 Test Installation

Details For Full-Scale Crash Testing

Concrete and Rebar Details

See next sheet for Section Views



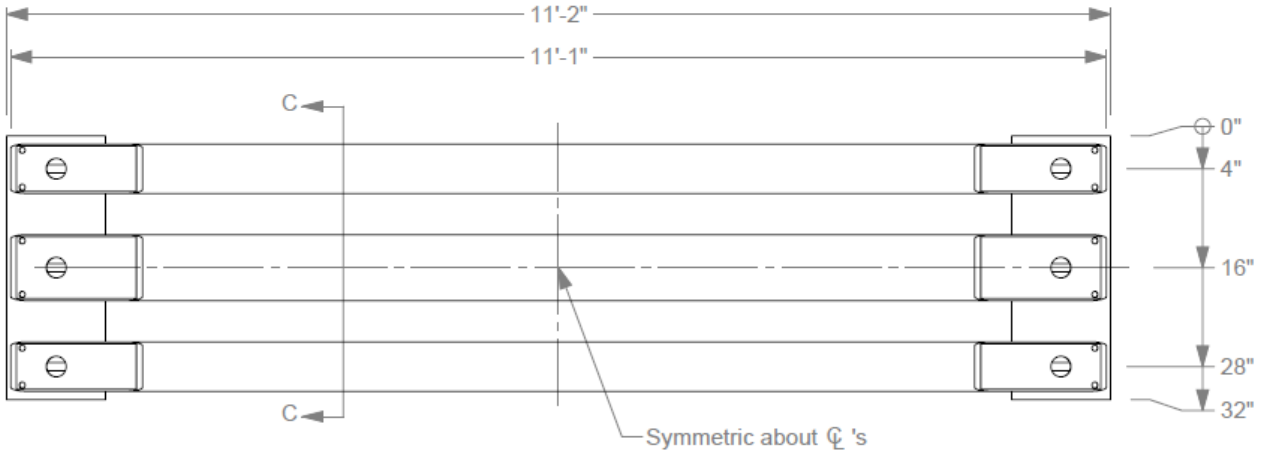
5a. All rebar is grade 60, and epoxy coated.
5b. Chamfer exposed edges, 3/4" each way.
5c. All rebar dimensions are to center of bar unless otherwise indicated by "cvr" (cover).

Texas A&M Transportation Institute	Roadside Safety and Physical Security Division - Proving Ground	
Project #610461 Barrier Gap		2019-05-06
Drawn by GES	Scale 1:20	Sheet 5 of 6 Concrete and Rebar Details

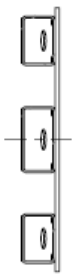
Details For Full-Scale Crash Testing

Rail Assembly

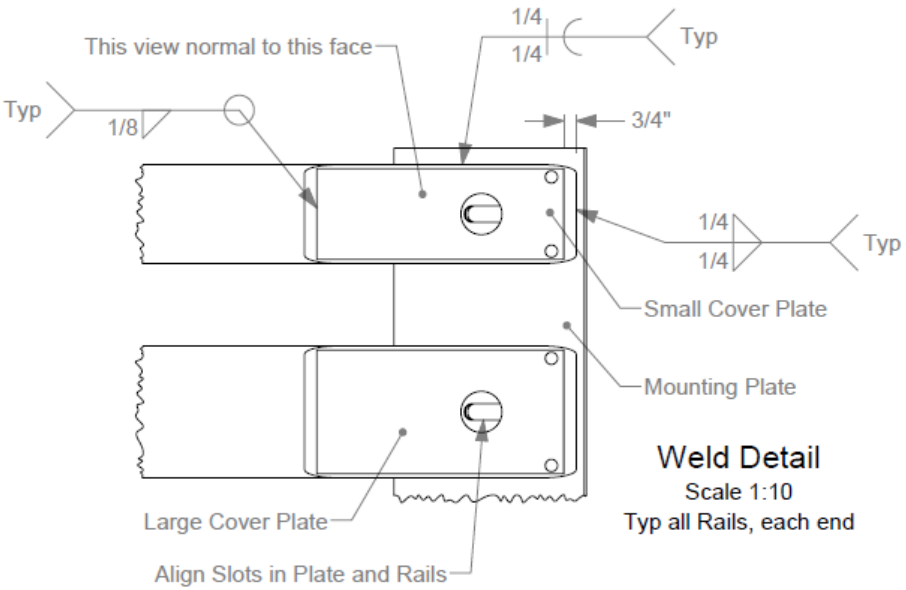
Plan View



Elevation View



Section C-C



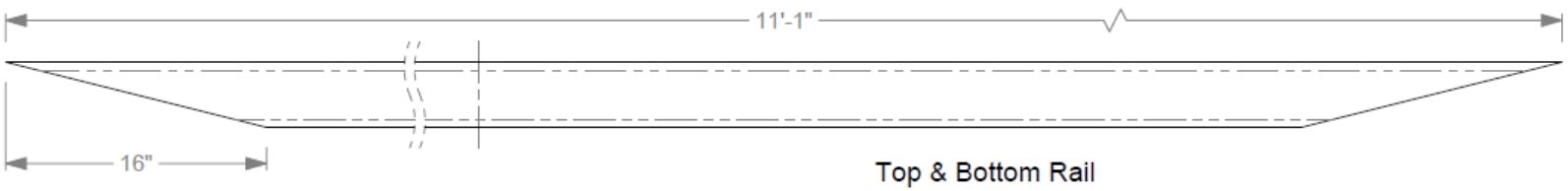
Weld Detail
Scale 1:10
Typ all Rails, each end

2a. All welding must be performed by certified welders using industry standard practices.
2b. Galvanize after fabrication is complete.

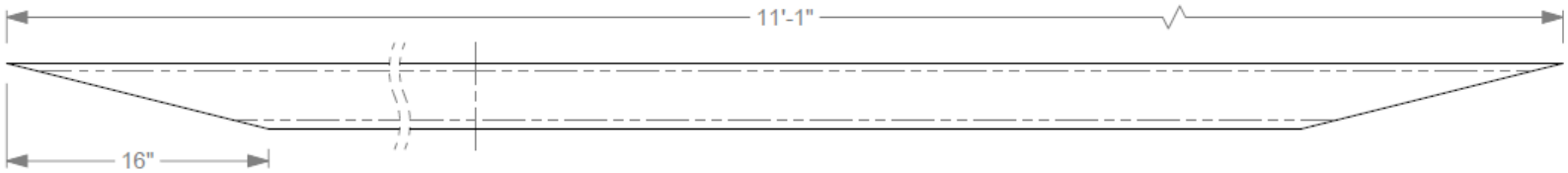
Texas A&M Transportation Institute	Roadside Safety and Physical Security Division - Proving Ground	
Project #610461 Barrier Gap		2019-05-06
Drawn by GES	Scale 1:20	Sheet 2 of 6 Rail Assembly

Details For Full-Scale Crash Testing

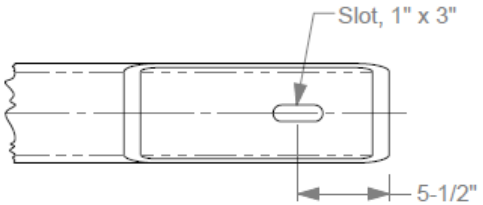
Rail Details



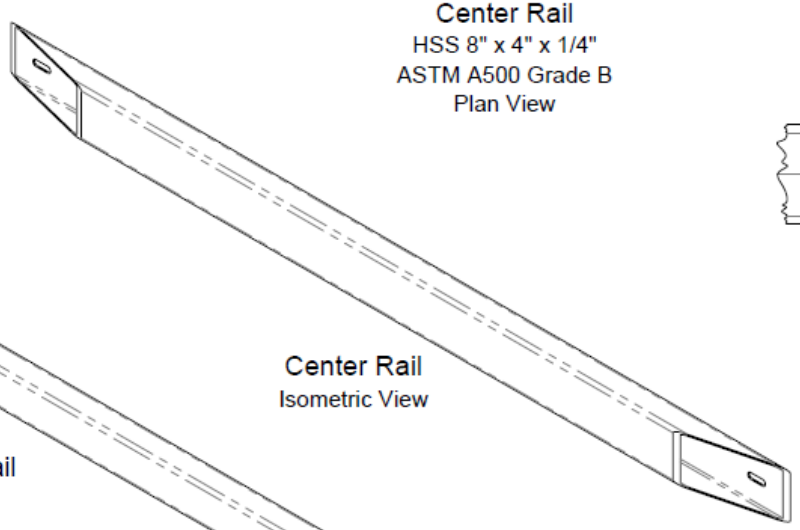
Top & Bottom Rail
HSS 6 x 4 x 1/4
ASTM A500 Grade B
Plan View



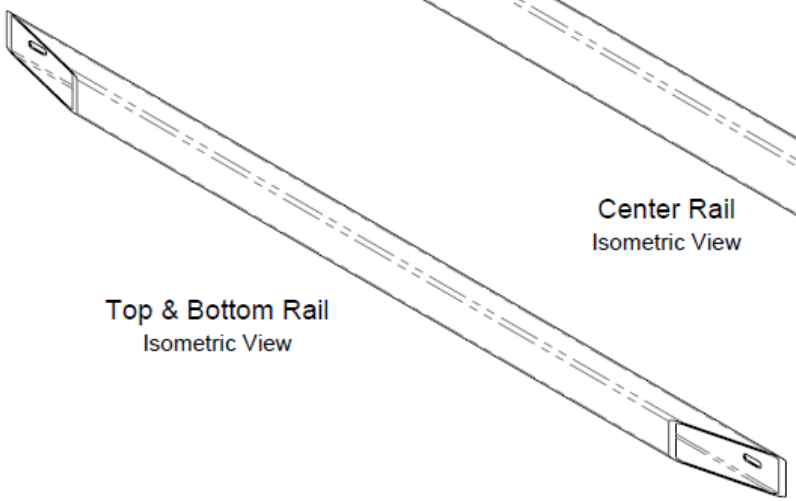
Center Rail
HSS 8" x 4" x 1/4"
ASTM A500 Grade B
Plan View



Slot Details
Typ both ends, all Rails



Center Rail
Isometric View



Top & Bottom Rail
Isometric View

Texas A&M Transportation Institute	Roadside Safety and Physical Security Division - Proving Ground	
Project #610461 Barrier Gap		2019-05-06
Drawn by GES	Scale 1:10	Sheet 4 of 6 Rail Details

Photos of Completed Test Installation

Thrie/W-Beam/Tubular Barrier Gap Rail for MASH TL-3

- Test 3-10 Scheduled for October 9, 2019, CIP = 3.6 ft. upstream of end of tapered edge of rail connection
- Test 3-11 Scheduled for October 30, 2019, CIP = 4.3 ft. upstream of center of barrier gap

Professional Opinion Project

- Problem
  - Provide engineering support services and recommendations for roadside safety barrier hardware and barrier systems with respect to MASH performance criteria

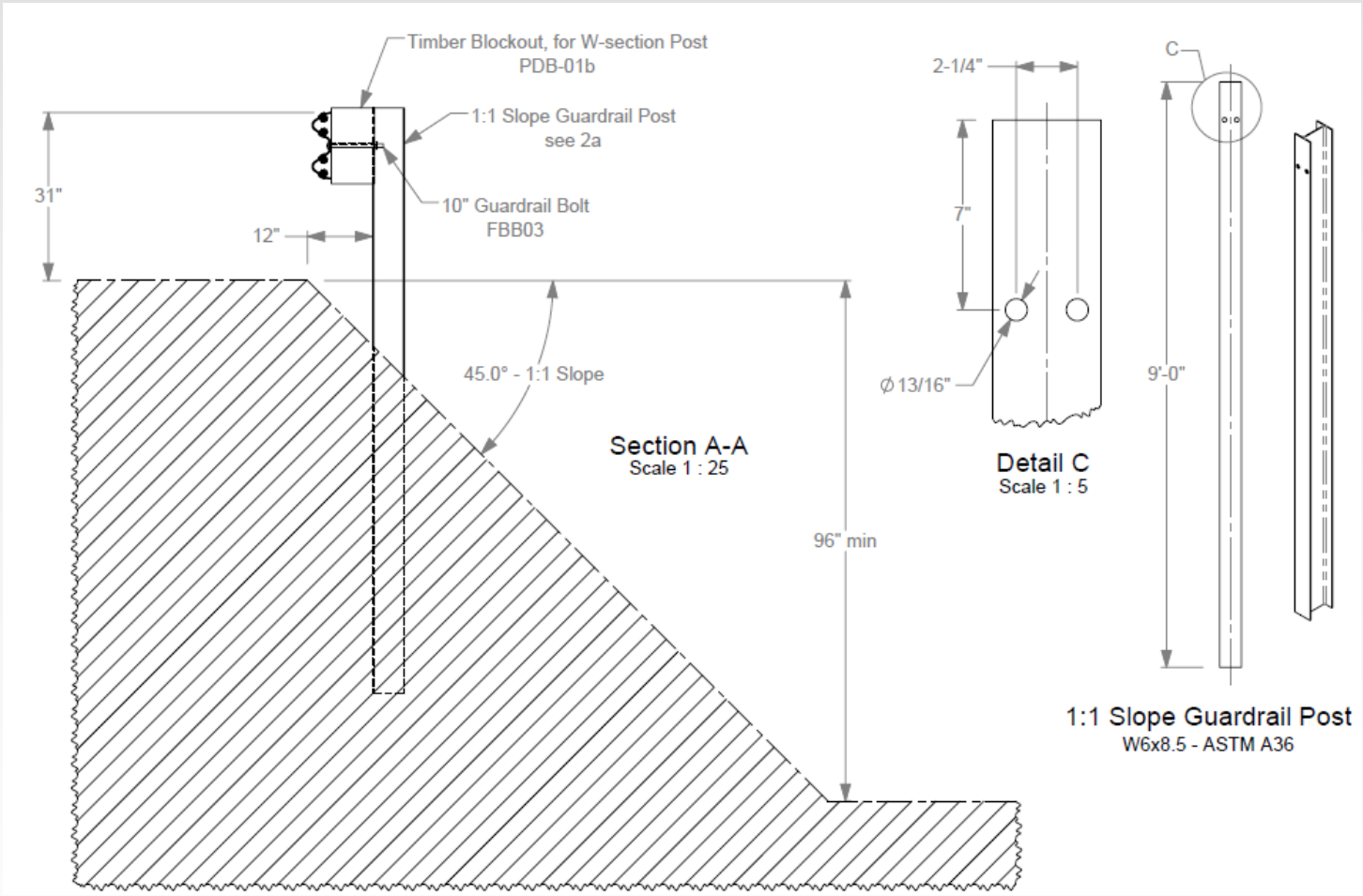
2017 & 2018 Prioritized List & Assignments

Project No.	Project	Engineer Assigned	Posted To Website?
17-1	MGS Median Barrier MASH TL-3	Nathan Schulz	
17-2	Does 32" F-Shape Cast-in-Place Barrier Meet MASH TL-3?	Sana Moran	Yes
17-3	18'-9" Thrie Beam Transition Design for MASH TL-3	Sana Moran	Yes
17-5	Michigan Temporary Concrete Barrier Limited Deflection	William Williams	
17-6	Concrete Barrier Shape Transitions	William Williams	
18-05	Thrie Beam System at Bridge Column	Nathan Schulz	Yes
18-23	In-Line Anchor (in Length of Need)	Sana Moran	Yes
18-08	Concrete Height Transitions	William Williams	
18-09	W-Beam to Concrete	Sana Moran	
18-30	42" 10.8 Degree Parapet	Sana Moran	
18-27	F-Shape Temporary Concrete Barrier for MASH TL-3	Sana Moran	
18-26	Omitted Post	Jim Kovar	Yes
18-28 & 29	Roadside Sign Supports Topics	Nathan Schulz	
18-02	MASH Compliant Bridge Rail Design (Colorado 2-Tube)	William Williams	Yes
18-04	Single Slope Embedded Barrier	Sana Moran	
18-03	A Field Varation on a Steeper F-Shape Barrier	William Williams	
18-22	Painted Guardrail	Maysim Kiana	
18-01	Mash Compliant Bridge Rail Design (Colorado Single SLope)	William Williams	Yes

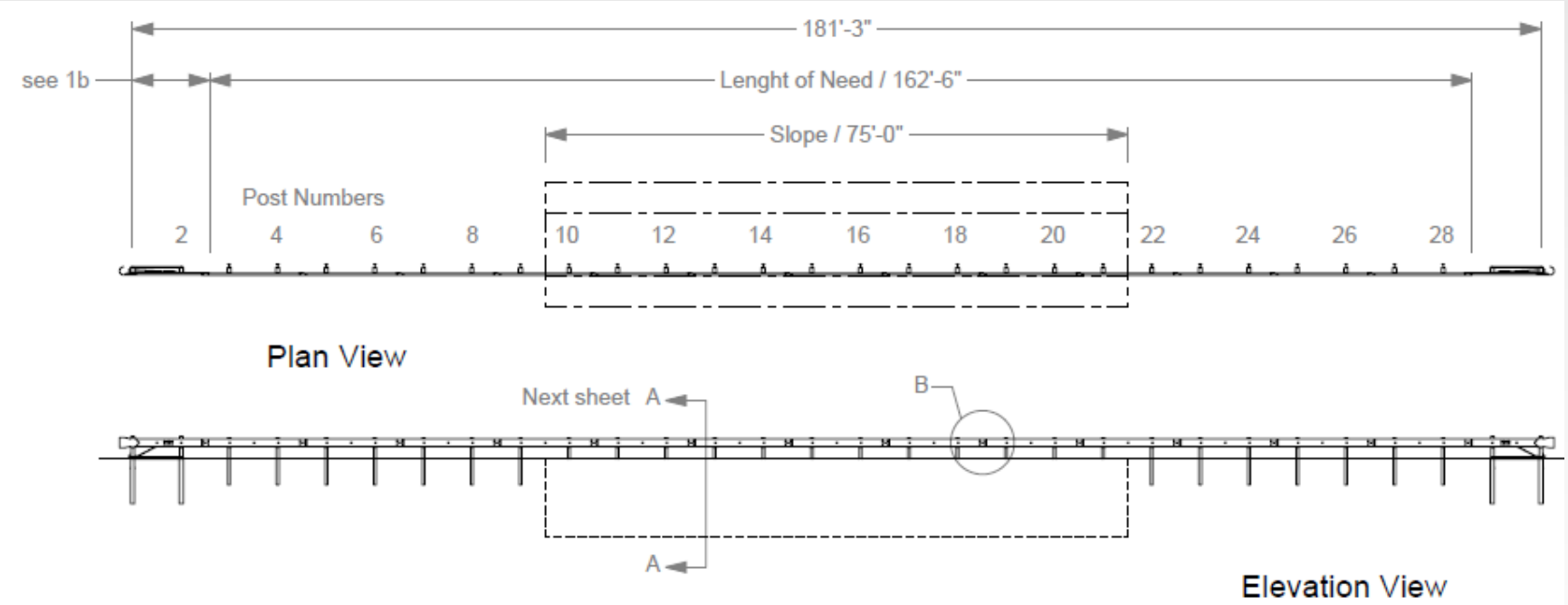
MASH TL-3 Guardrail on 1:1 Slope

- A new guardrail design to be evaluated under MASH TL-3 test conditions
- 31-inch w-beam system.
- Splices are in between posts with standard post spacing.
- 9-ft posts are installed on the slope so the face of the guardrail aligned with the slope break.

MASH TL-3 Guardrail on 1:1 Slope



MASH TL-3 Guardrail on 1:1 Slope



MASH TL-3 Guardrail on 1:1 Slope

MASH Test 3-10

MASH TL-3 Guardrail on 1:1 Slope

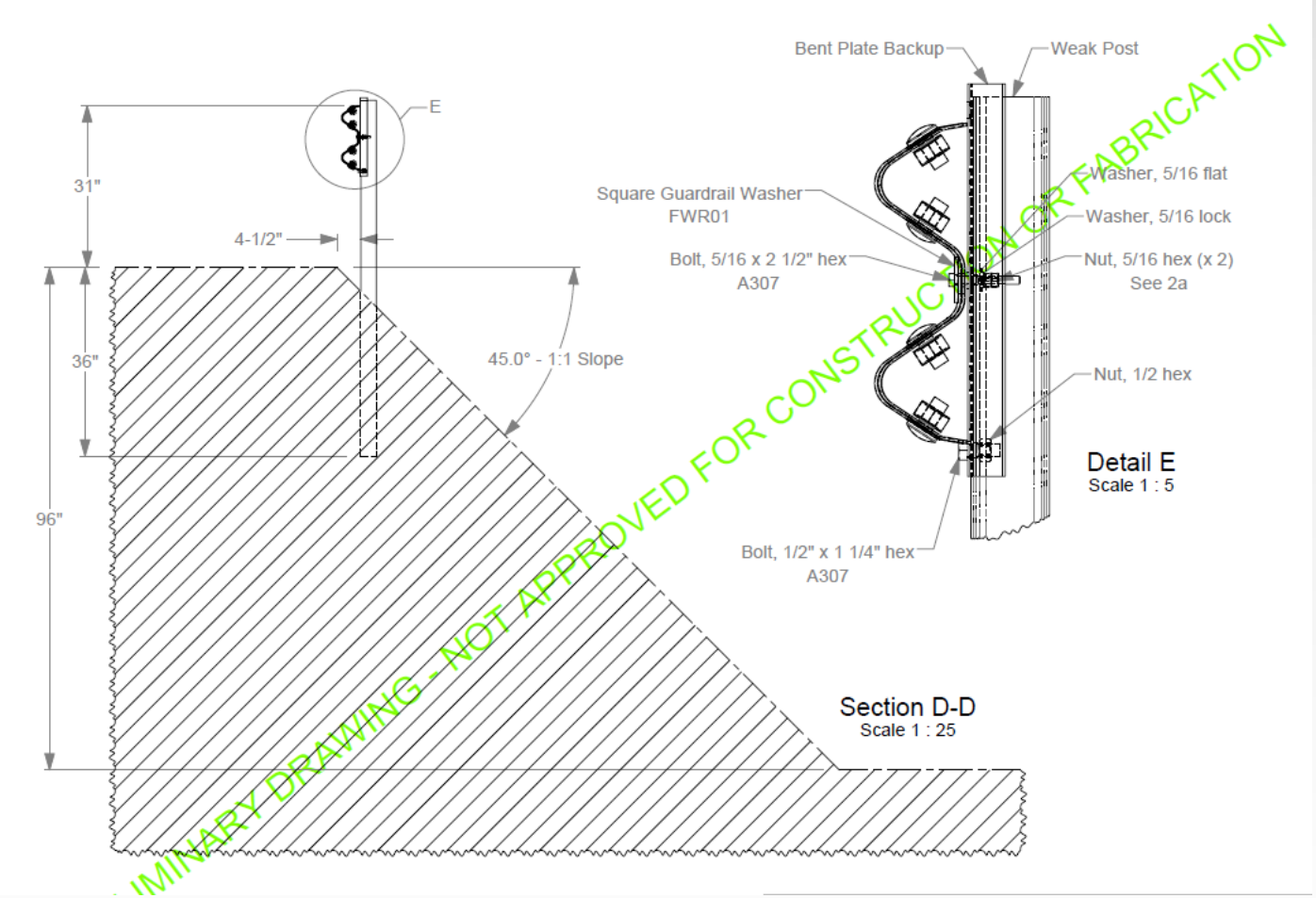
MASH TL-3 Guardrail on 1:1 Slope

- *The rail system seems to be stiffer than desired*
- Two recommended ways for reducing the rail stiffness
  - Shortening rail embedment
  - Using weaker posts

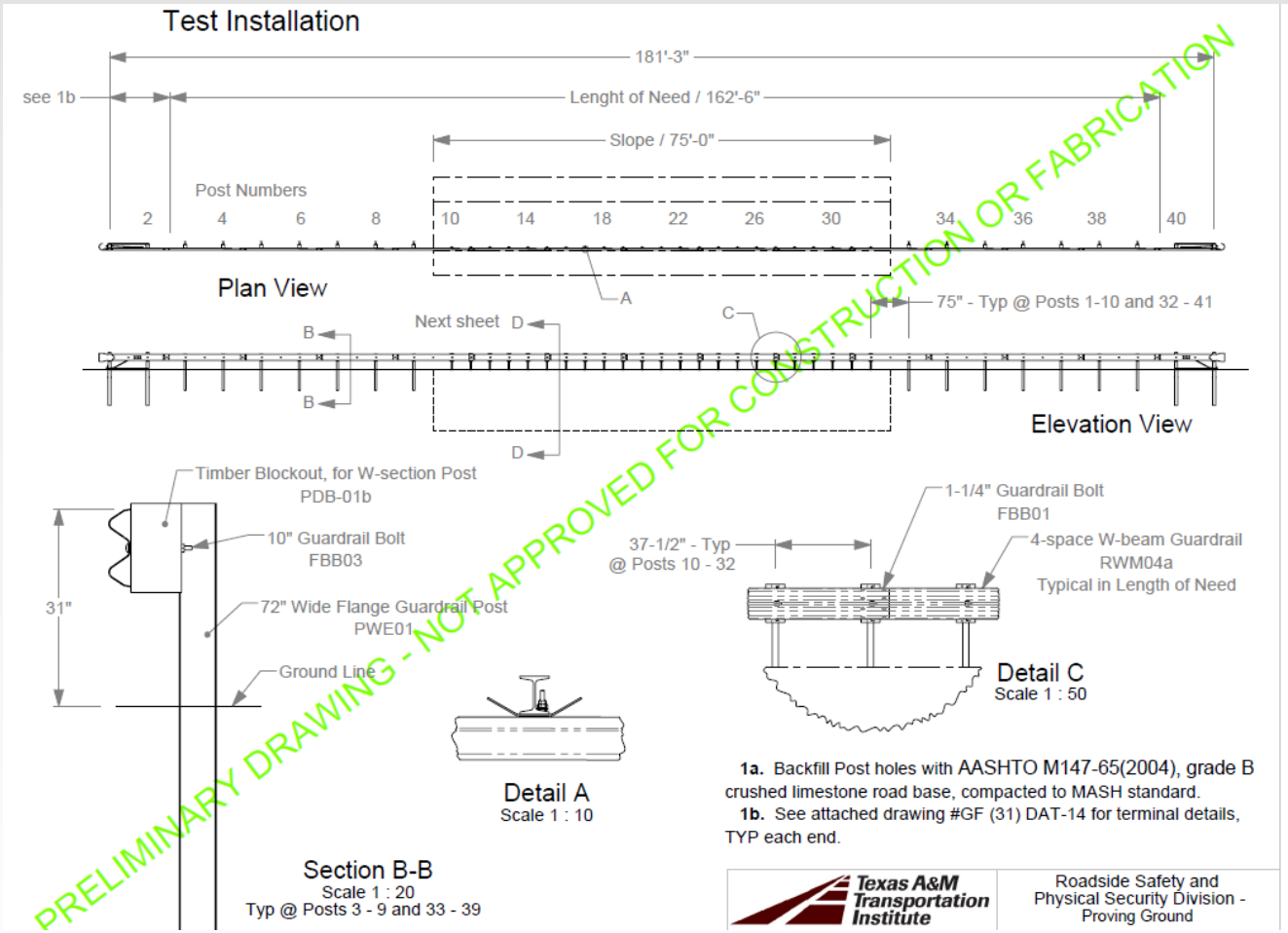
MASH TL-3 Guardrail on 1:1 Slope

- Using weak post system seems to be more practical
  - Easier and consistent in terms of installation (S3 x 5.7), especially given the mountainous rock formations
  - Less embedment depth
  - Reduced soil dependency
  - Closer the slope break

MASH TL-3 Guardrail on 1:1 Slope



MASH TL-3 Guardrail on 1:1 Slope



MASH TL-3 Guardrail on 1:1 Slope

- Items left to complete the project
  - Request time extension
  - LS-DYNA analysis with pickup truck
  - Request additional funds to test the truck and potential the small car
  - The testing could be in an extension to the current project or a new testing project for the weak post system

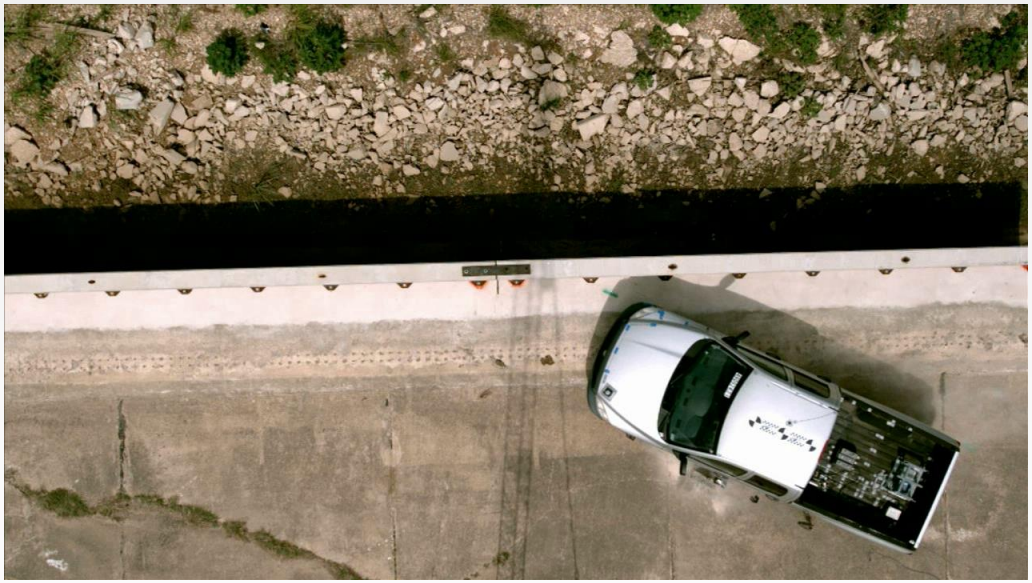
Determination of Pedestrian Rail Offset Requirements to Eliminate Vehicle Interaction

Purpose

- Determine offset requirements for mounting pedestrian rails on concrete barriers

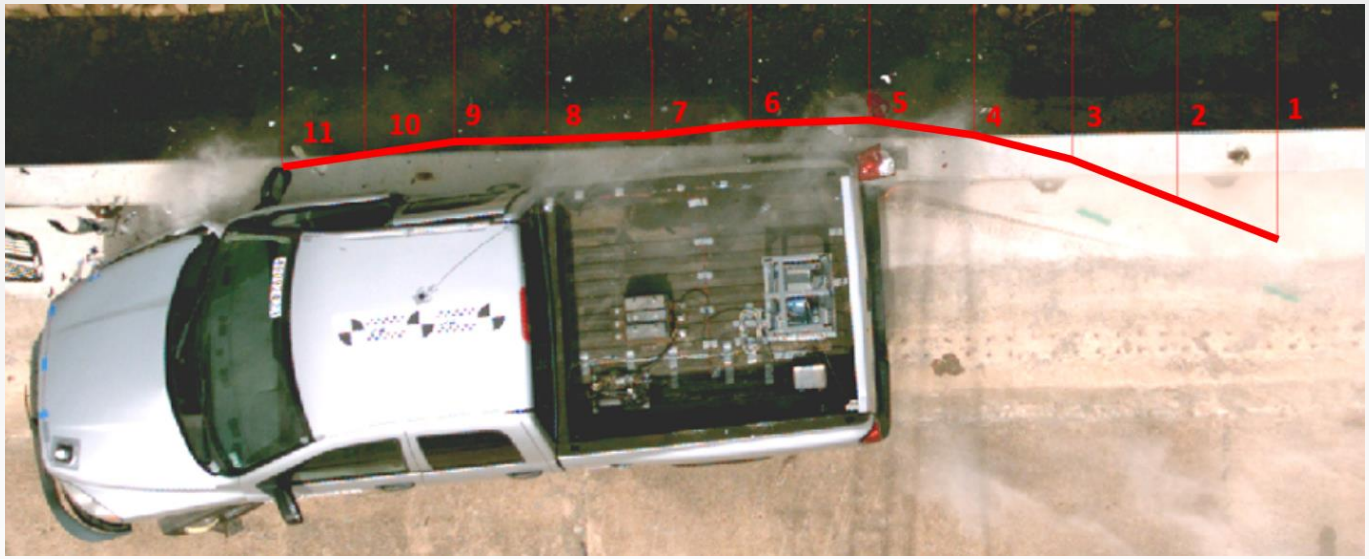
Status

- **Ongoing Project; nearing completion and finalizing report**



Determination of Pedestrian Rail Offset Requirements to Eliminate Vehicle Interaction

- Review previous MASH 3-11 tests on concrete barriers
  - Vertical wall, single slope, and jersey shape
- Measuring extension of vehicle over the traffic side face of barrier
- Measuring both the side view mirror extension and the extension of a “structural component”



Testing of Midwest Guardrail Systems with Reduced Post Spacing for MASH Compliance

Purpose

- Test quarter-post spacing, half-post spacing, and a transition system to MASH compliance
- Because of failed tests, computer simulation and retesting of modified systems added to scope

Status

- **Ongoing Project; computer simulation underway**

Testing of Midwest Guardrail Systems with Reduced Post Spacing for MASH Compliance

Testing of Midwest Guardrail Systems with Reduced Post Spacing for MASH Compliance

Texas A&M Transportation Institute

Roadside Safety Pooled Fund

Lives, Time and Resources

Testing of Midwest Guardrail Systems with Reduced Post Spacing for MASH Compliance

Testing of Midwest Guardrail Systems with Reduced Post Spacing for MASH Compliance

Review and Investigation of W-Beam Guardrail Terminals with Curbs

Purpose

- Compile current literature and practices on w-beam guardrail terminals when located near a curb
- Complete a state survey reviewing current state practices regarding w-beam terminals near curbs
- Coordinate with MwRSF on their current study

Status

- **Ongoing Project; drafting of survey underway**

MASH TL3 Testing of Flared MGS System

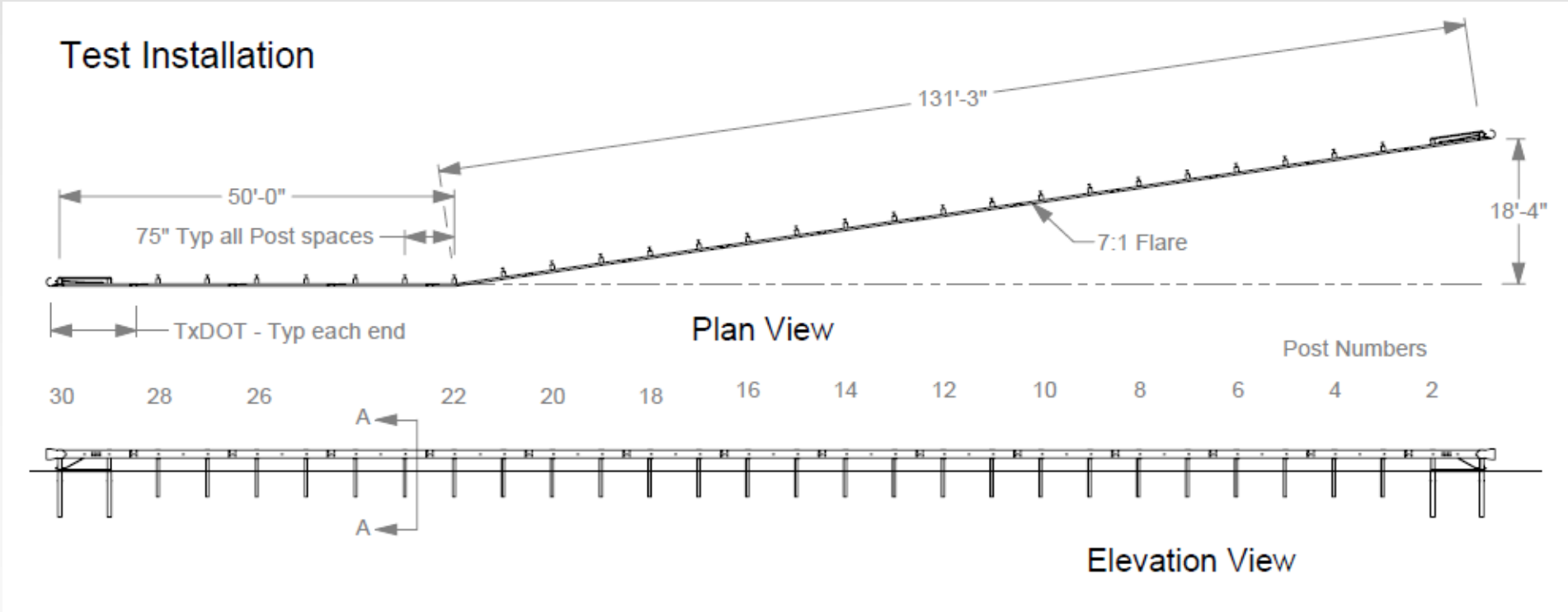
Purpose

- Investigate performance of MGS system when installed with a flare
- Initially intended to investigate critical flare for MGS
- Purpose was modified to investigate most used MGS flare rate for high-speed

Status

- **Decision Point (on how to continue…)**

MASH TL3 Testing of Flared MGS System



Tests 3-10 & 3-11: 62 mph, 25 deg. (effective angle 33.1 deg.)

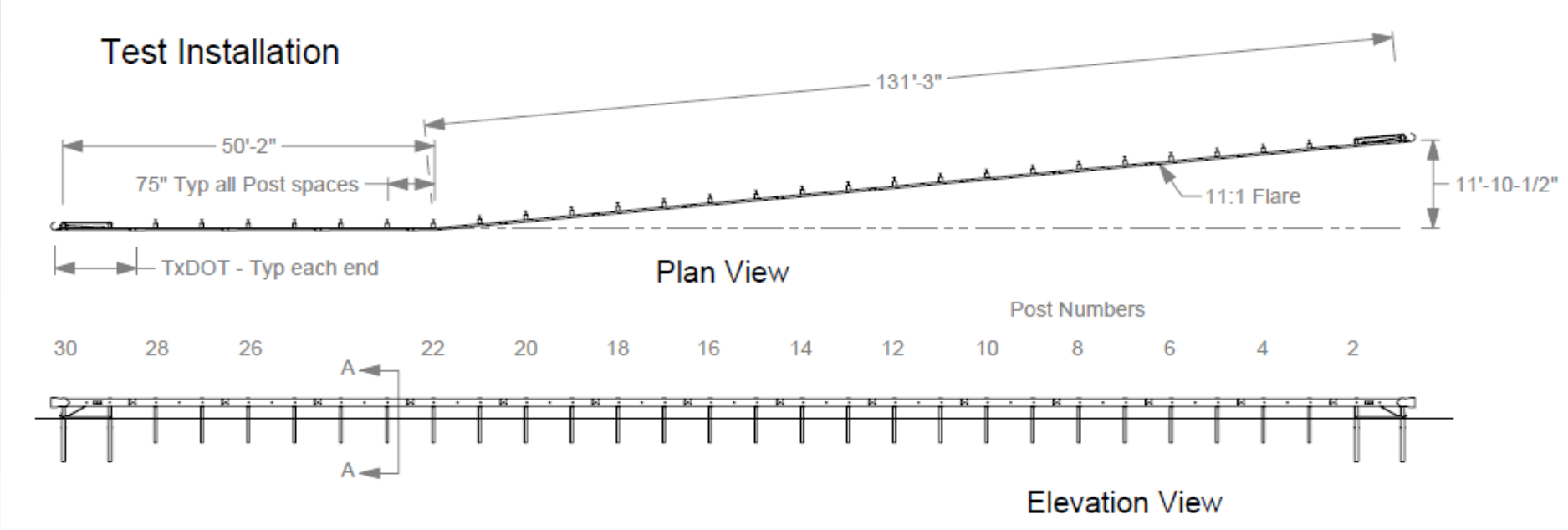
MASH TL3 Testing of Flared MGS System

Test 3-10: 62 mph, 25 deg. (effective angle 33.1 deg.)

MASH TL3 Testing of Flared MGS System

Test 3-10: 62 mph, 25 deg. (effective angle 33.1 deg.)

MASH TL3 Testing of Flared MGS System



Tests 3-10 & 3-11: 62 mph, 25 deg.

MASH TL3 Testing of Flared MGS System

Test 3-11: 62 mph, 25 deg.

MASH TL3 Testing of Flared MGS System

Test 3-11: 62 mph, 25 deg.

MASH Coordination Effort

Purpose

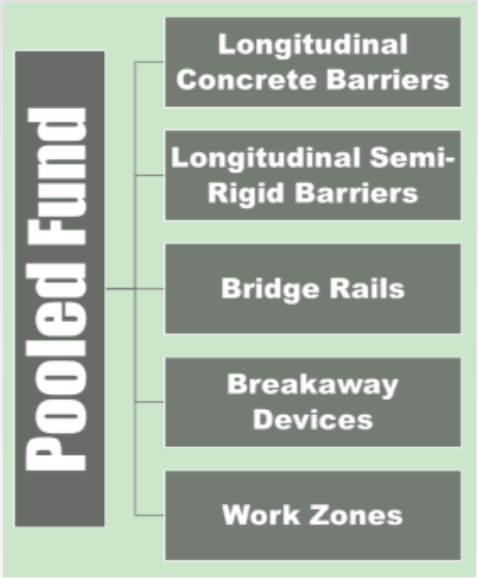
- Maintain and Update Pooled Fund Website, MASH Testing and Needs Databases;
- Provide Support for Webinars Development /Conduction;
- Facilitate Communication among Members through Q&A, Listserv;
- Coordinate on MASH Activities;
- Support for Yearly Meeting Preparation.

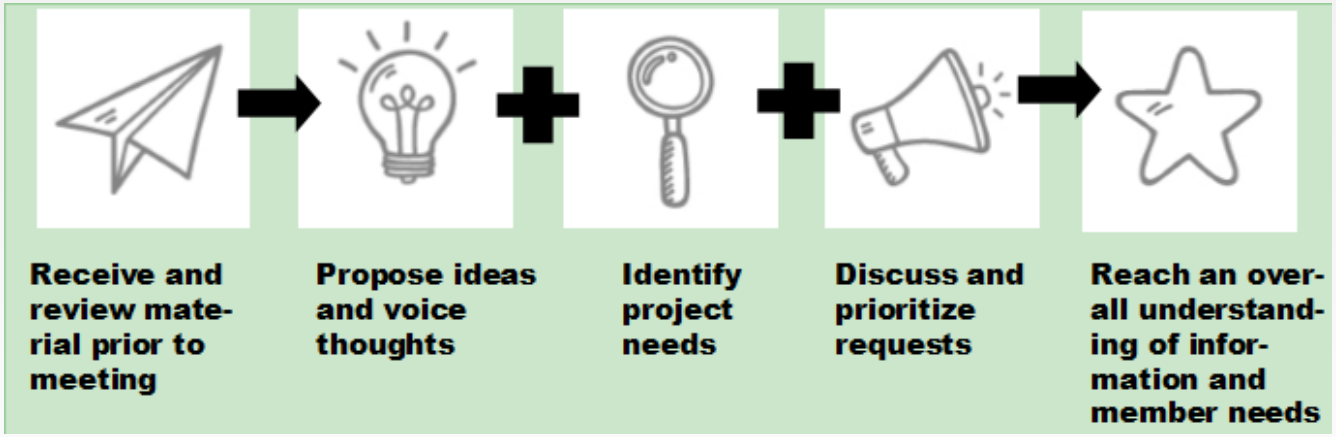
Status

- **Continuous Project**

MASH Coordination Effort

- Listserv
- Developed Webinars (as needed, ~ every other month)
- Developed Working Groups (preparation for yearly meeting);
  a) Collect Individual Member's MASH testing needs
  b) Prioritize Member's Needs
  c) Draft Problem Statements for Priority Needs
  d) Develop partnerships among DOT Members





MASH Coordination Effort

- MASH database revision & input addition

Device Types

- Guardrails

Test Level

All

FHWA Eligibility Letter

All

Proprietary/Non-proprietary

All

Pass/Fail

All

Evaluation

All

Searchable Options

Report Number:

search keyword

MASH Test Number:

search keyword

Sponsor:

search keyword

Description:

search keyword

Guardrail Options

Rail Type:

Box-Beam Thrie Beam W-Beam Wood Other

Post Material:

Steel Wood Other

Blockout Type:

Composite Steel Wood None Other

Special Configuration:

Slope Curb Culvert Median Flare Other

Height (inches):

0 130

0' 0" ≤ x ≤ 10' 10"

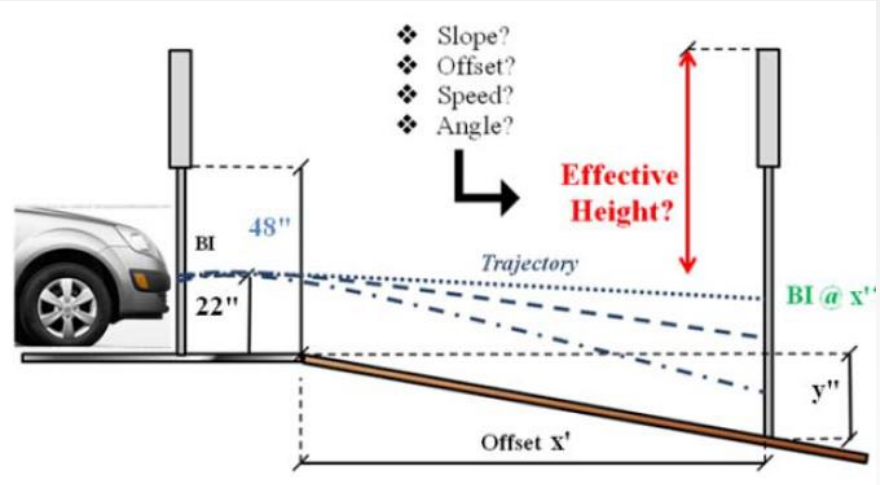
57 items found

Image	Title	Description	Proprietary/ Non-proprietary	FHWA Eligibility Letter	Pass/ Fail	Evaluation
	31-Inch W-Beam Guardrail With Steel Post In Concrete Mow Strip	A 31-inch tall W-beam guardrail with structural steel posts in concrete mow strip.	Non-proprietary	No	Pass	Full-Scale Crash Testing
	FAILED - 31-Inch W-Beam Guardrail With Wood Post In Concrete Mow Strip	**[FAILED]** - A 31-inch tall W-beam guardrail with timber posts in concrete mow strip. MASH Test 3-10 passed but MASH Test 3-11 failed due to the penetration of the vehicle. Another MASH Test 3-11 with posts at a reduced embedment depth failed due to the vehicle rollover.	Non-proprietary	No	Fail	Full-Scale Crash Testing

Testing and Evaluation of Large Signs Slipbase Support on Slope at MASH Test Level 3 impact Conditions

Purpose

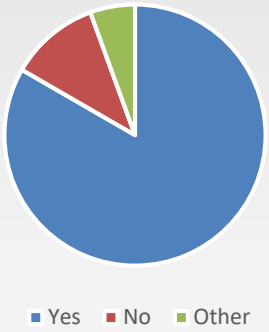
- Assessment of a Large Breakaway Sign support per MASH Test level 3 conditions on flat level ground and on sloped terrain.
- Determination of the most critical characteristics within this envelope of conditions.



Testing and Evaluation of Large Signs Slipbase Support on Slope at MASH Test Level 3 impact Conditions

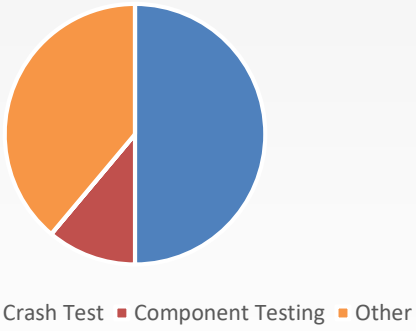
Survey Results

Maintaining Standard as MASH compliant

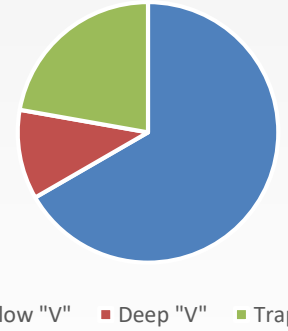


Criteria for Large Sign Support Evaluation

Evaluation of Large sign support

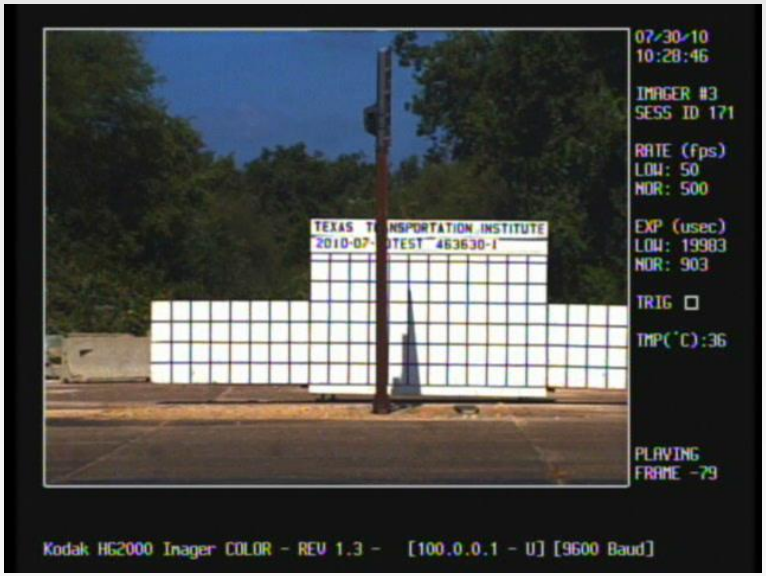


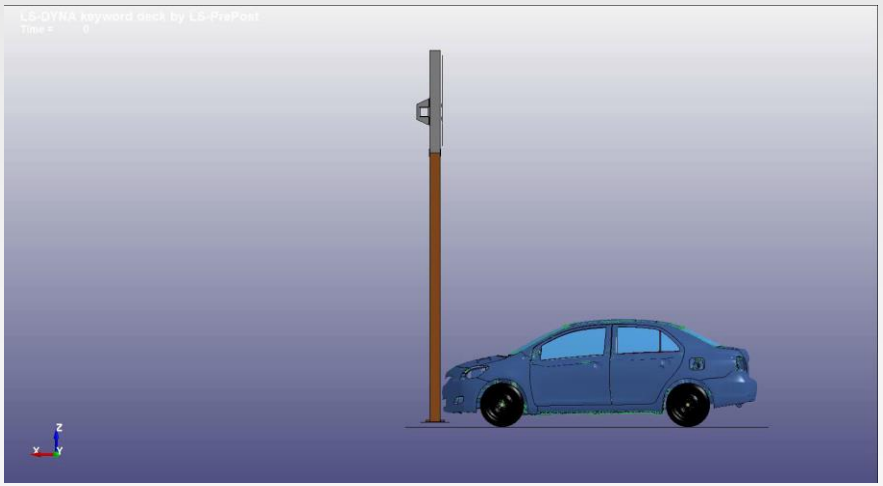
Type of Ditch



Testing and Evaluation of Large Signs Slipbase Support on Slope at MASH Test Level 3 impact Conditions

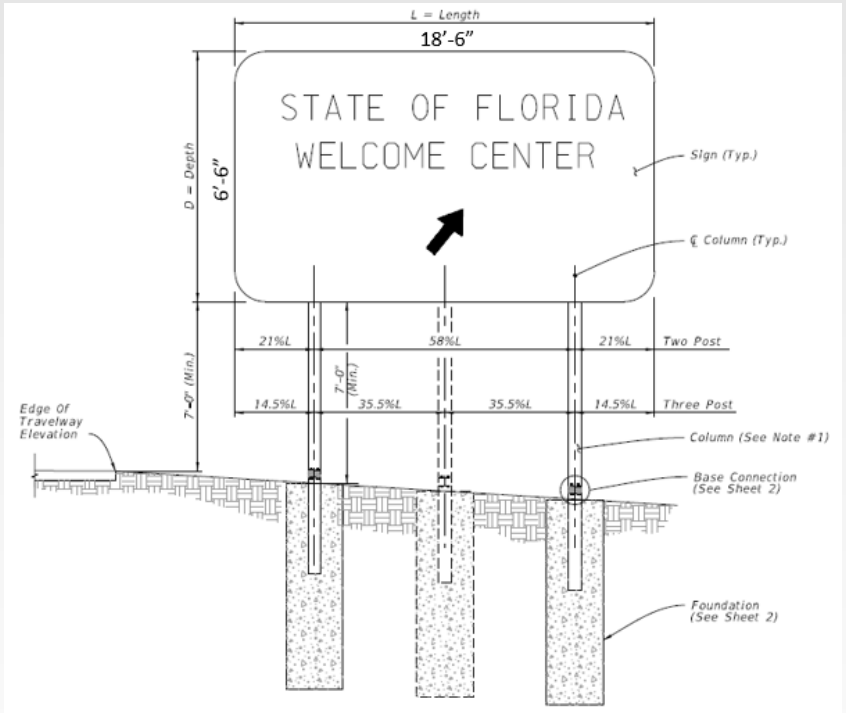
FEM Validation

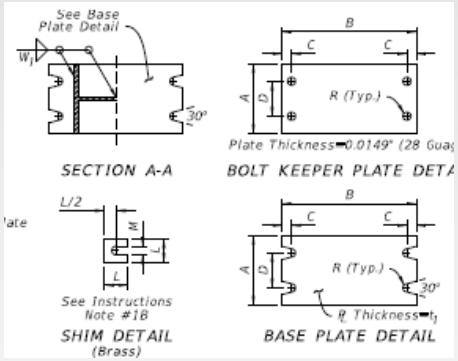


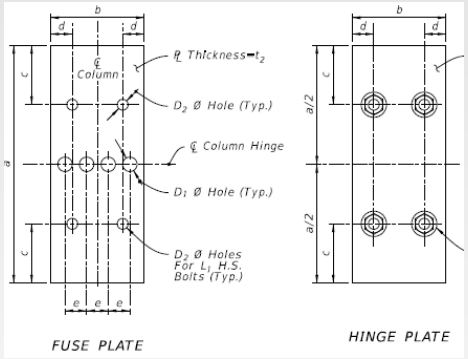


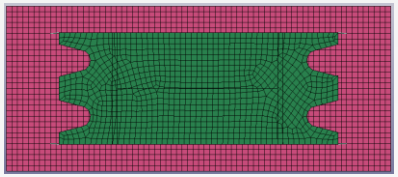
Testing and Evaluation of Large Signs Slipbase Support on Slope at MASH Test Level 3 impact Conditions

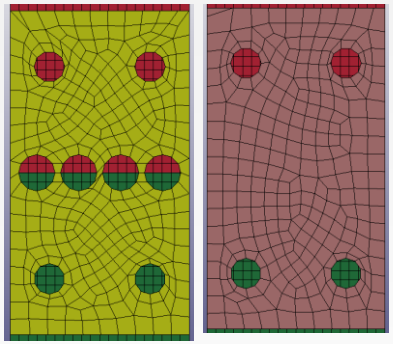
Florida Test Article







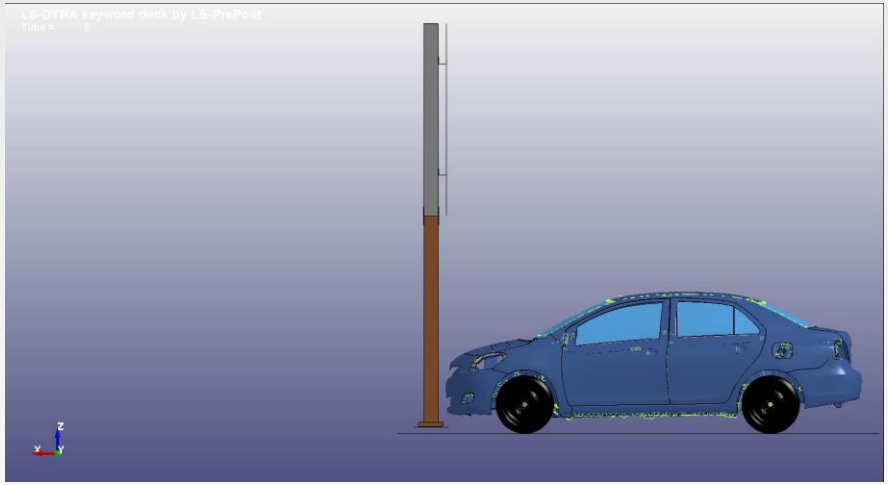




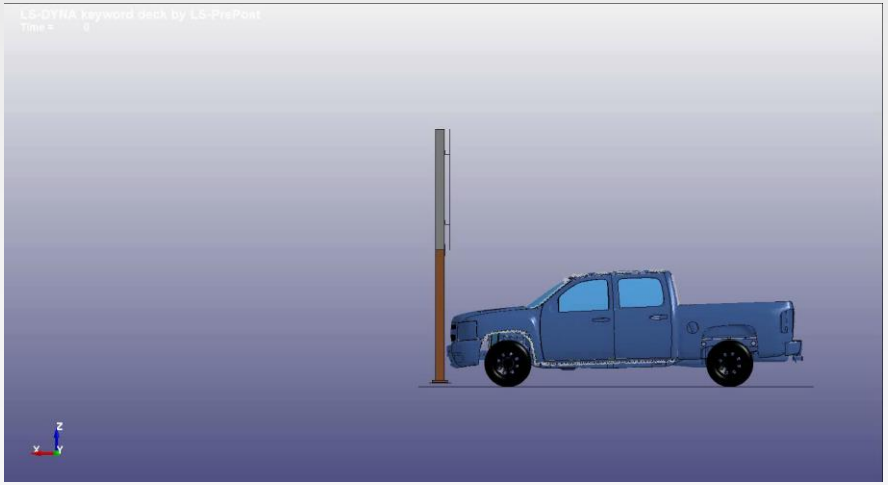
Base and Fuse Connections

Testing and Evaluation of Large Signs Slipbase Support on Slope at MASH Test Level 3 impact Conditions

Florida FEM Crash Analysis (Flat level)



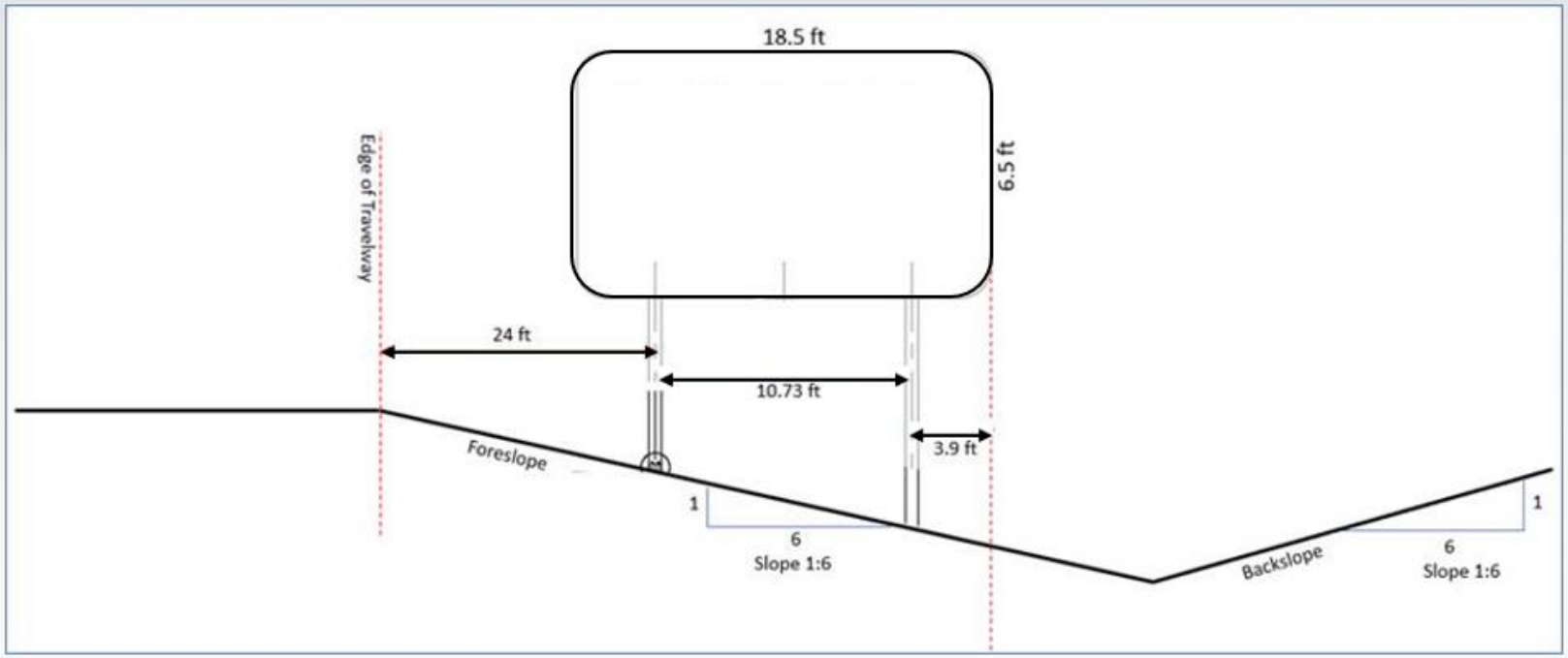
1100C Vehicle



2270P Vehicle

Testing and Evaluation of Large Signs Slipbase Support on Slope at MASH Test Level 3 impact Conditions

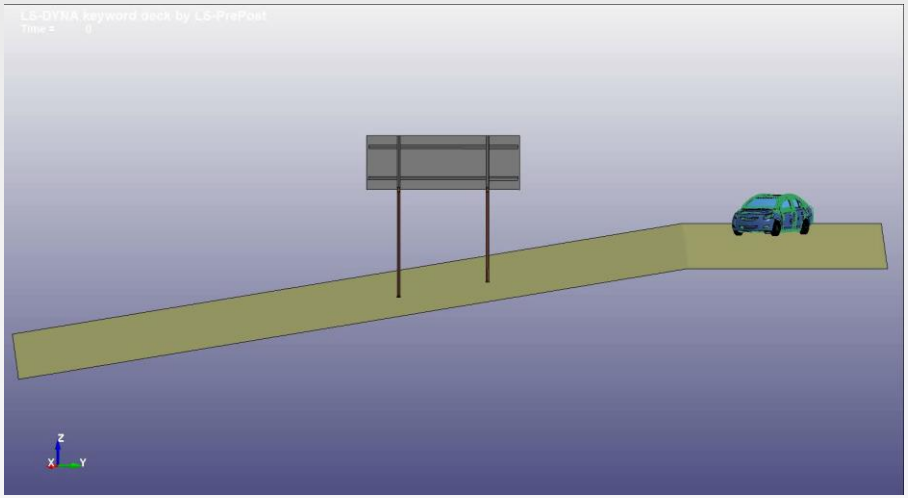
Florida FEM Crash Analysis (Sloped terrain)



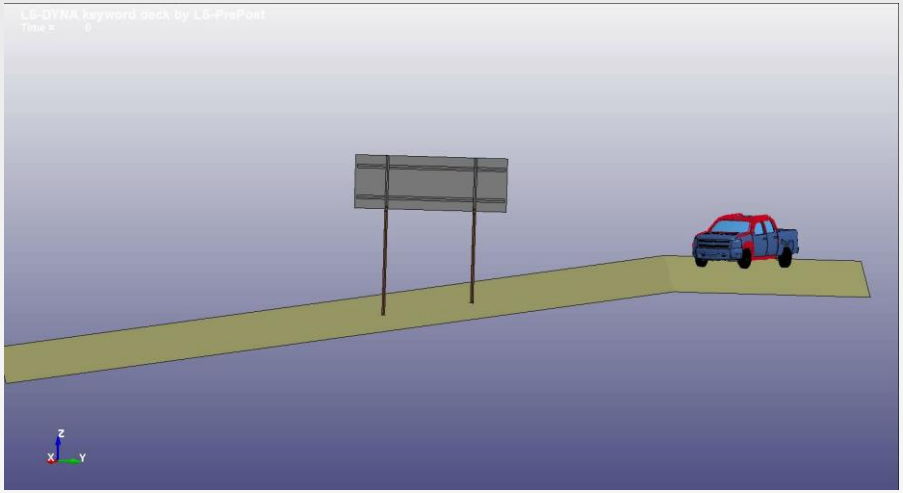
Impact Angle: 25°

Testing and Evaluation of Large Signs Slipbase Support on Slope at MASH Test Level 3 impact Conditions

Florida FEM Crash Analysis (Sloped terrain)



1100C Vehicle



2270P Vehicle

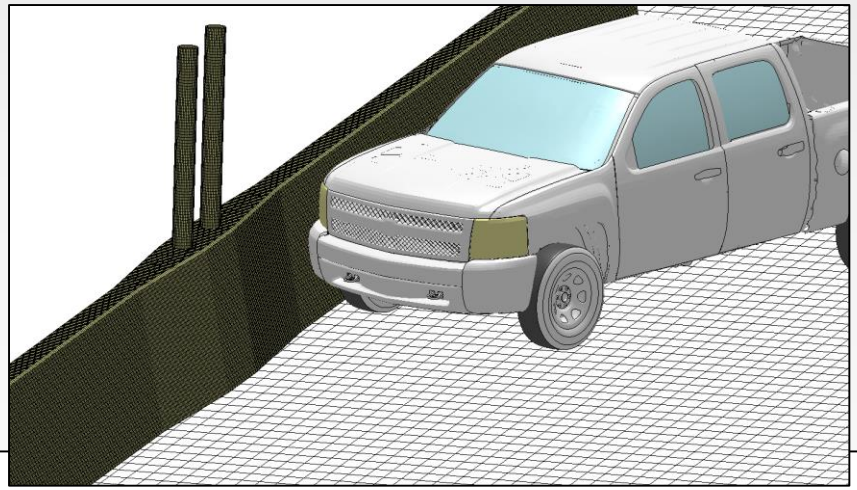
MASH TL-4 Testing of Critical Flare Rate for CIP Concrete Barrier Flaring around Fixed Object

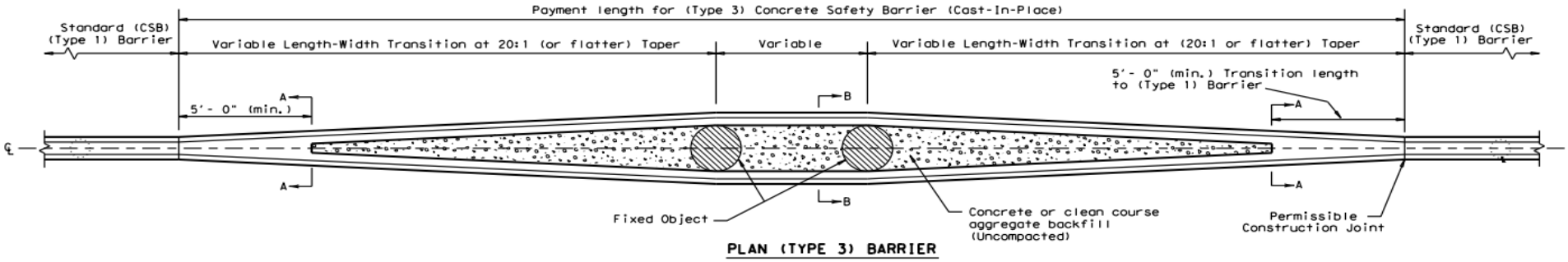
Purpose

Investigate and test critical flare for cast-in-place concrete system under MASH TL-4 criteria (full matrix).

Status

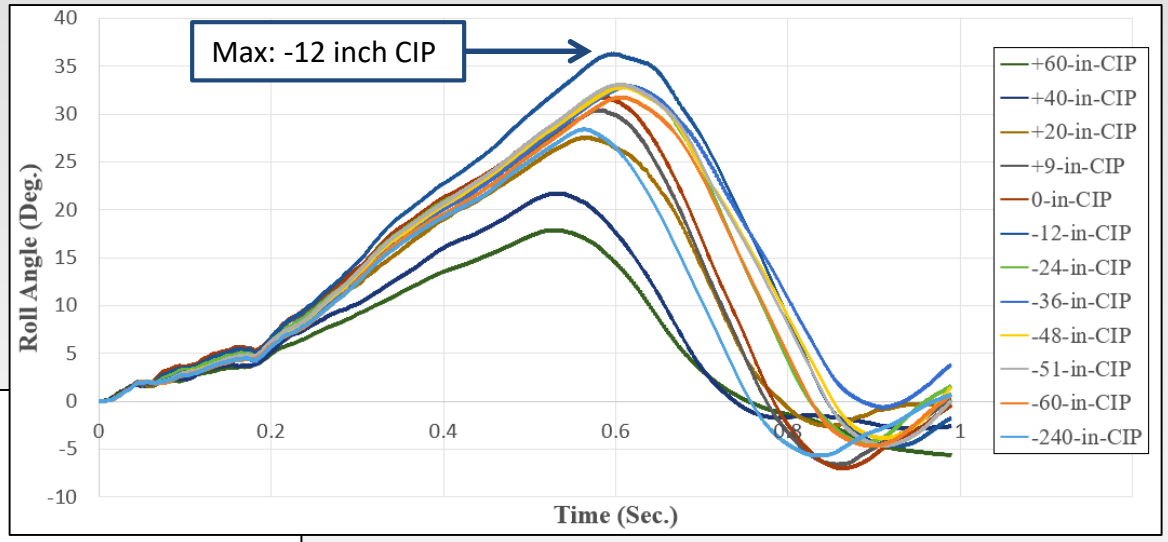
- Investigating barrier performance (shape, height, critical flare rate) through FEA simulations (full Test Level 4 matrix).
  - State Survey
  - FEA
    - Pickup truck
    - 42” Single Slope
    - 5-ft length
    - 20:1 flare rate
    - Two 6-in diameter poles, 30 inches apart

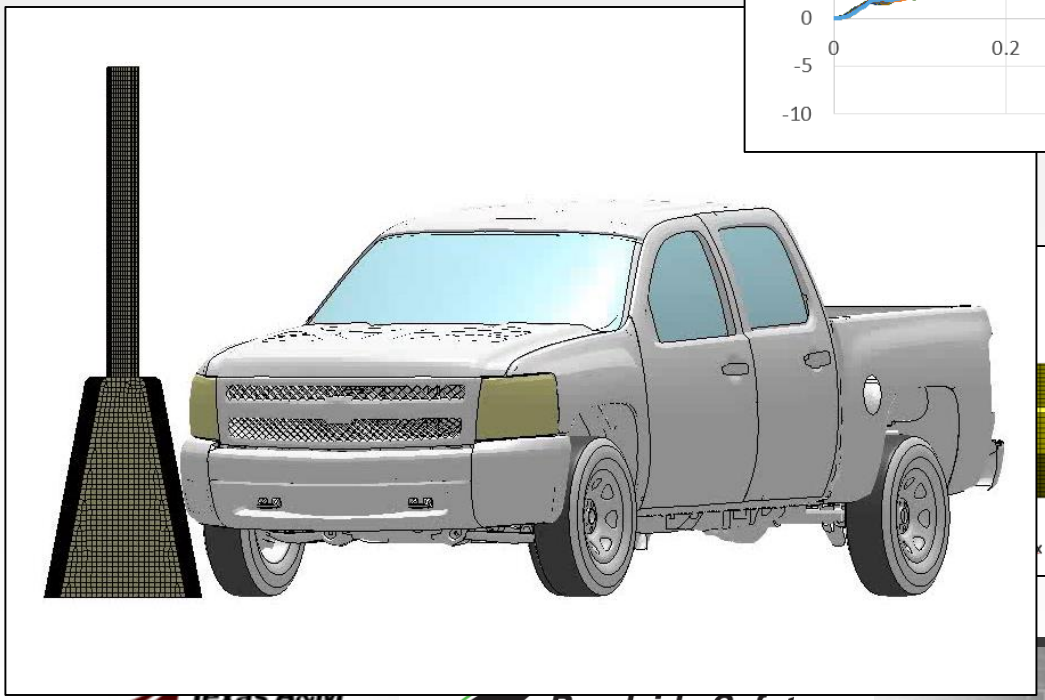


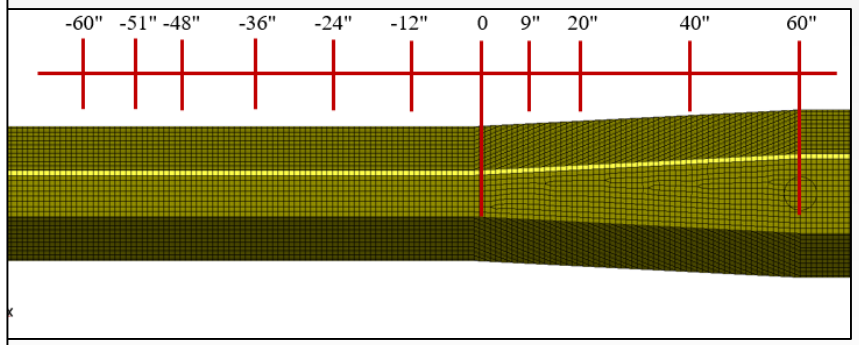


MASH TL-4 Testing of Critical Flare Rate for CIP Concrete Barrier Flaring around Fixed Object

Roll Angle Comparison

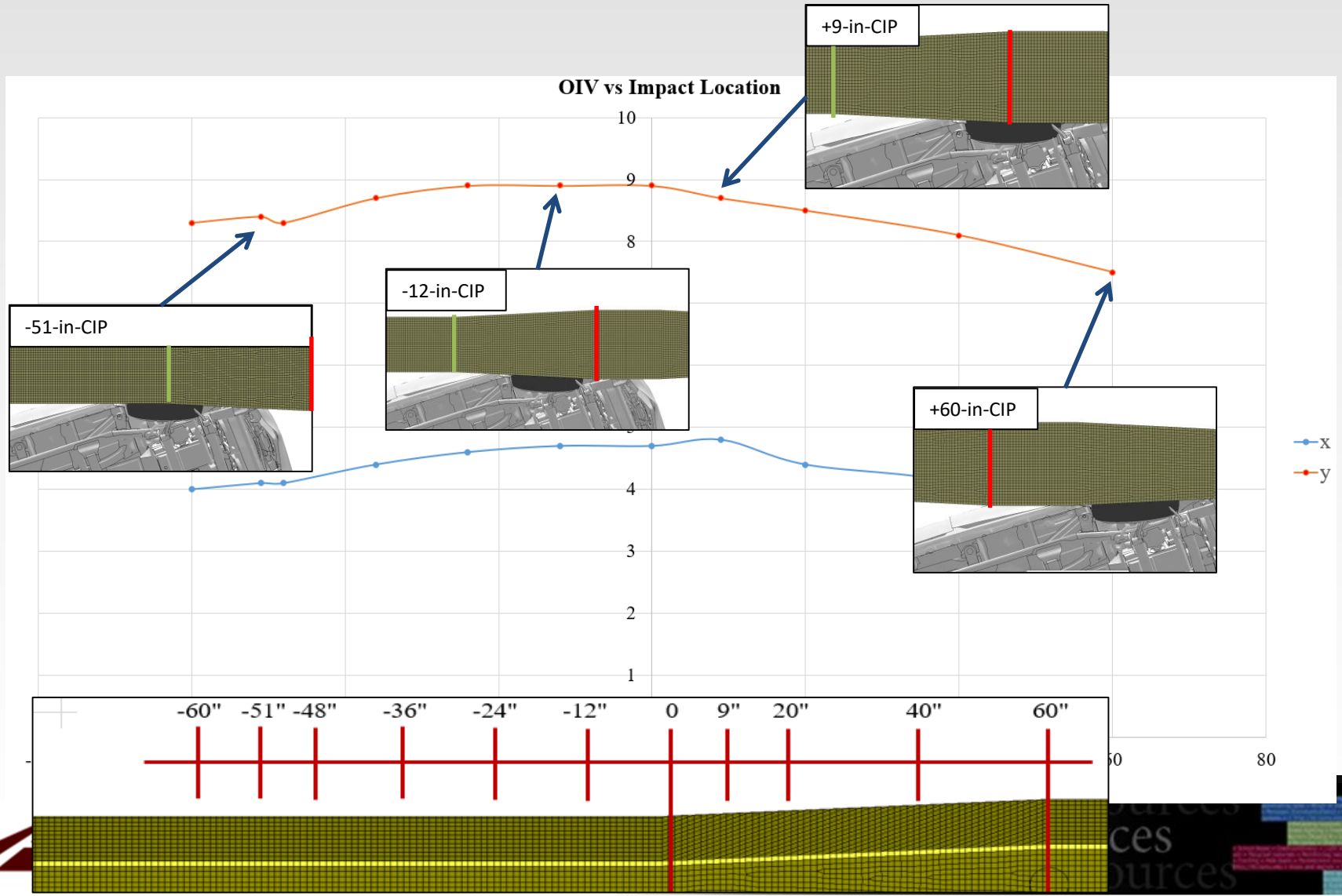






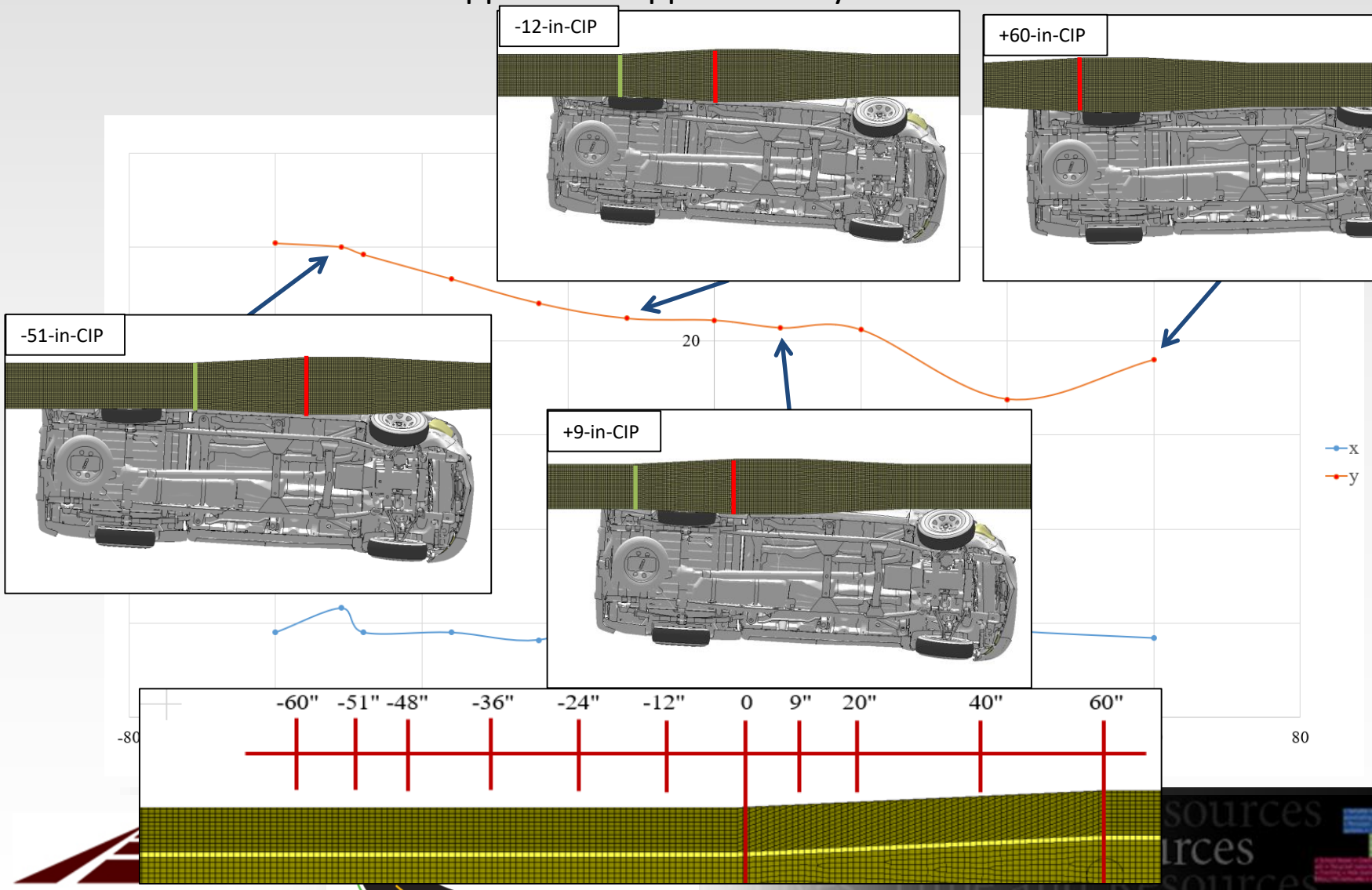
MASH TL-4 Testing of Critical Flare Rate for CIP Concrete Barrier Flaring around Fixed Object

- All maximum OIVs happened at approximately 0.08 sec.



MASH TL-4 Testing of Critical Flare Rate for CIP Concrete Barrier Flaring around Fixed Object

- All maximum ORAs happened at approximately 0.17-0.18 sec.

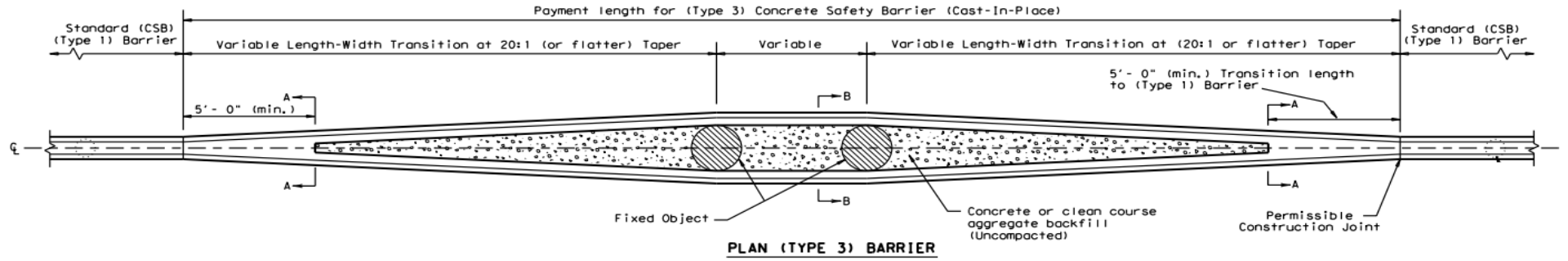


MASH TL-4 Testing of Critical Flare Rate for CIP Concrete Barrier Flaring around Fixed Object

Next

- Finalizing parametric analysis to provide the CIPs.
- Full-scale crash tests (Tests 4-10, 4-11 and 4-12).

Anticipated Completion Date: Summer 2020



PLAN (TYPE 3) BARRIER