Shorter TL-3 MASH W-Beam Transition

Shorter TL-3 MASH W-Beam Transition

Purpose

- Investigate the crashworthiness of a shorter W-beam to parapet transition system under MASH TL-3 criteria.

Status

- Finalizing the preliminary design and the crash test CIP

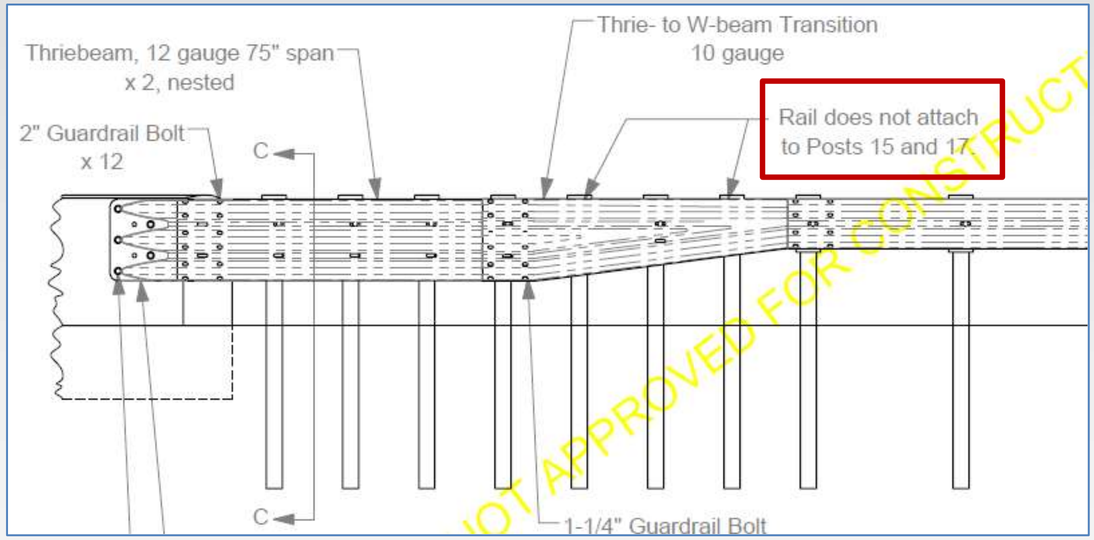
Preferred System Design Limits

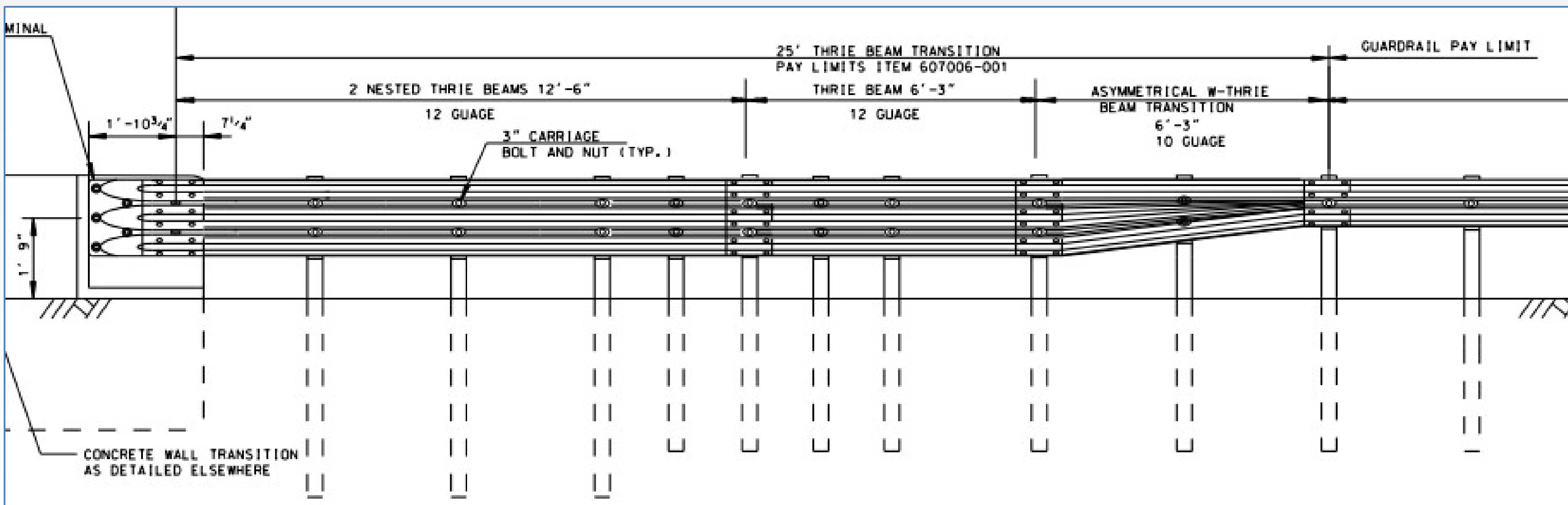
- Shortest transition length possible
- No rub rail/curb
- Use off-the-shelf standard W-beam and Thrie-beam parts
- Same size posts and blockouts all through the transition
- Preferably no change of post height/embedment
- Least amount of change in post spacing
- Easy field customizations are okay

Shorter TL-3 MASH W-Beam Transition

Transition System Design

- W6x8.5 posts
- 72” post height
- Same post embedment
- 8” blockouts

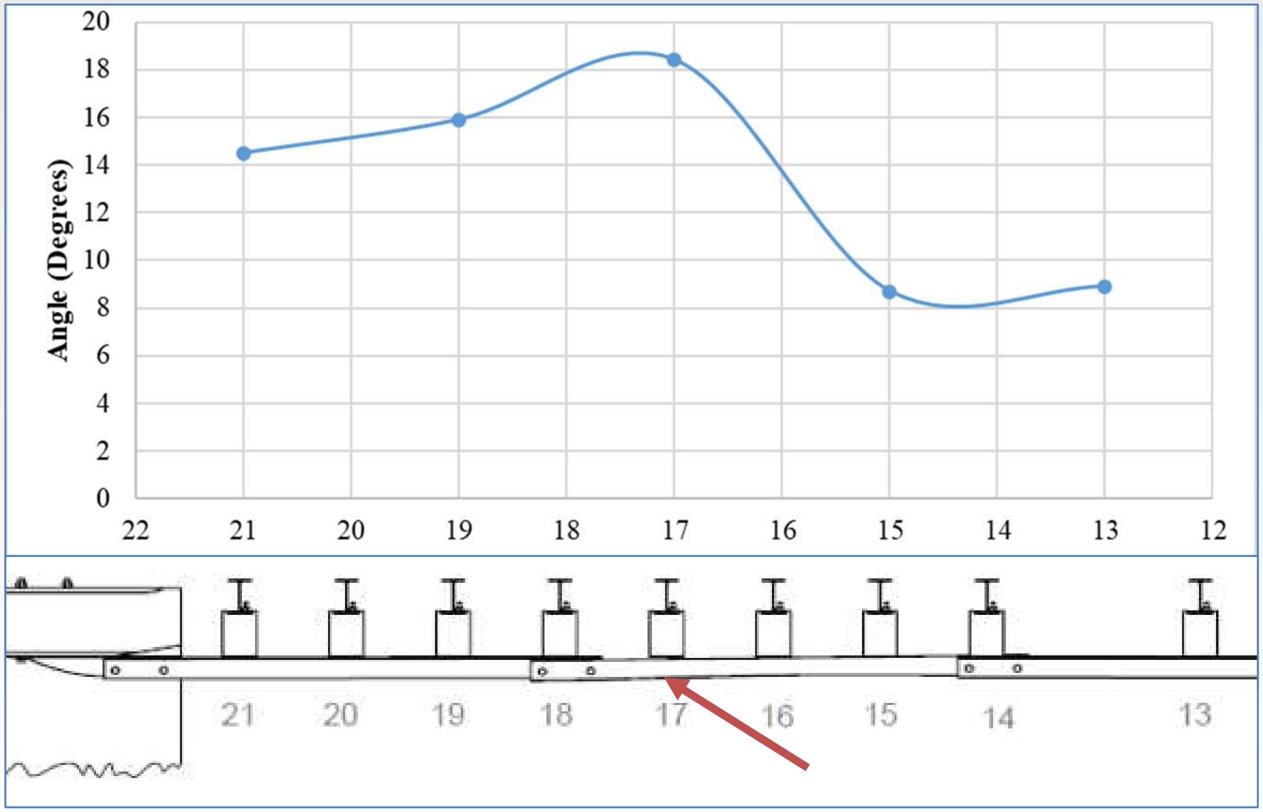




Shorter TL-3 MASH W-Beam Transition

Maximum Roll Angle vs. Impact Location (post number)

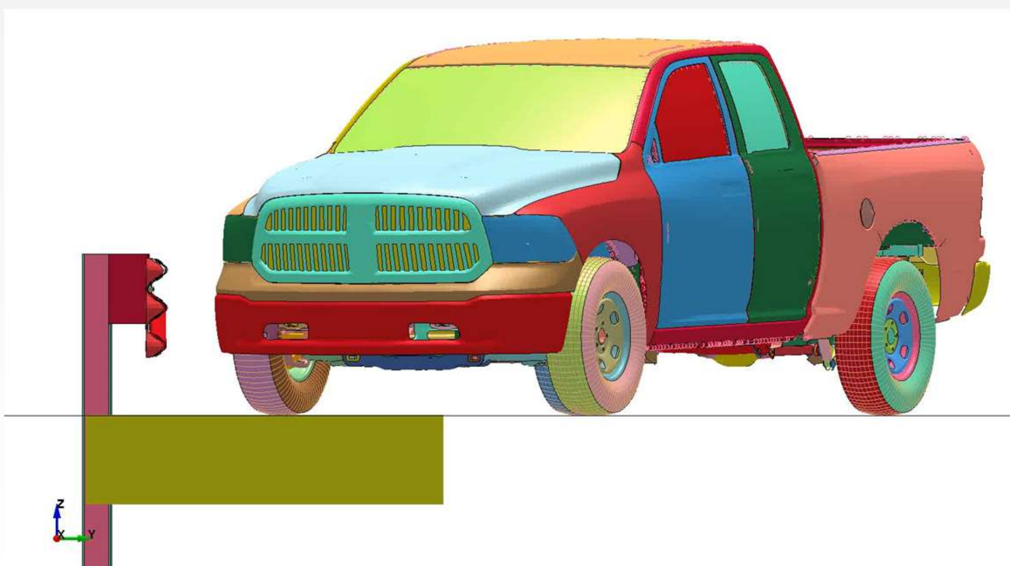
- Impacting to post #17 showed the maximum roll angle and comparably higher occupant risk (still within MASH limits)

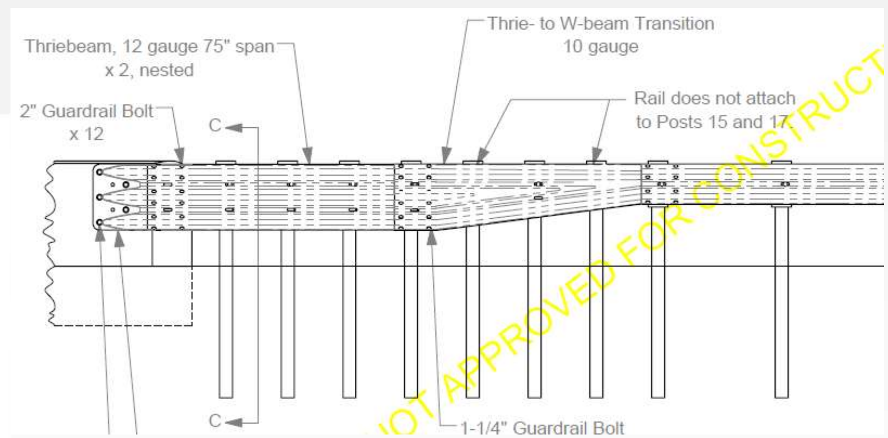


Shorter TL-3 MASH W-Beam Transition

Impacting to post #17

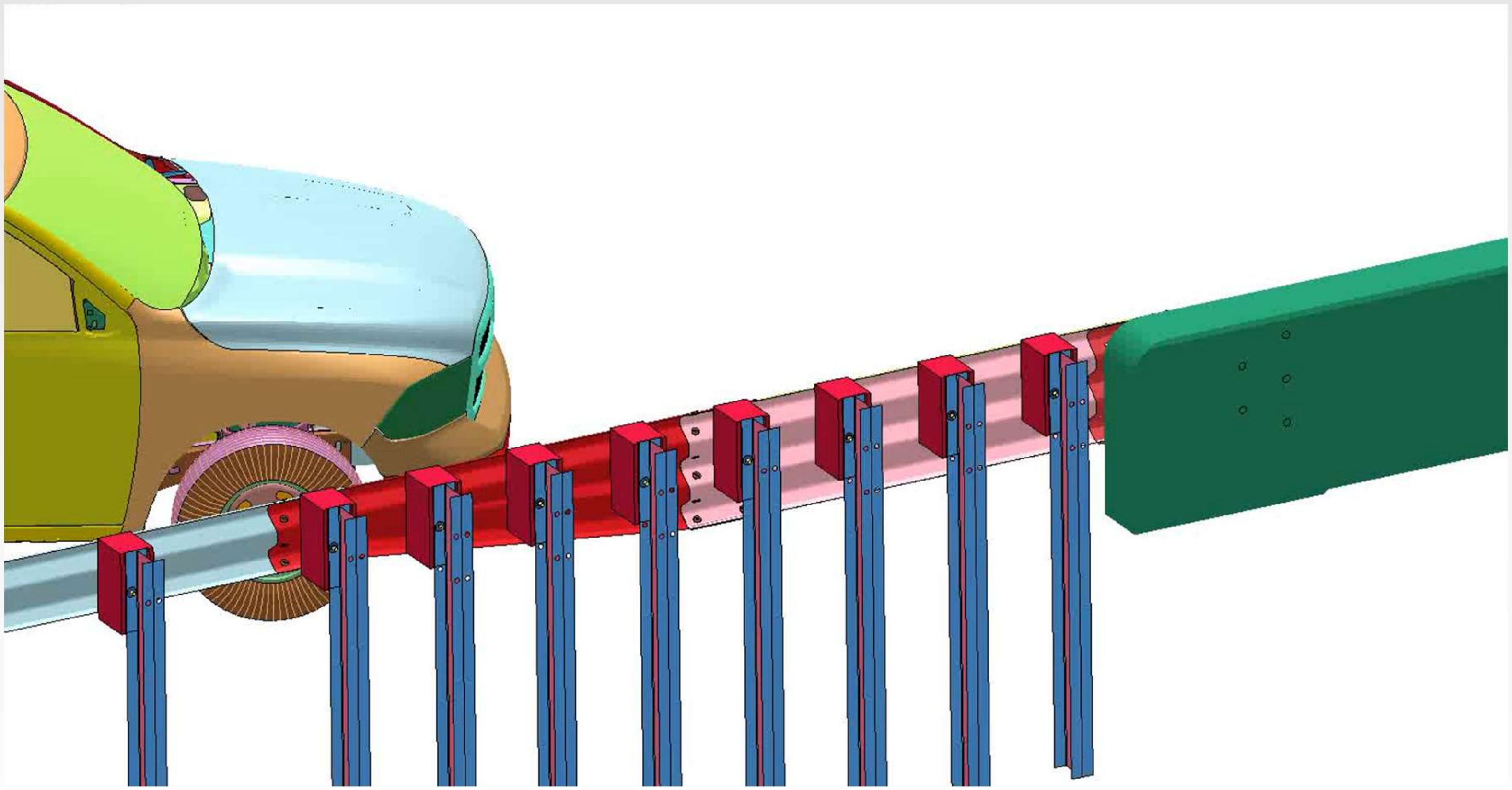
- Using shorter blockouts behind Thrie-beam helped with the stability of the vehicle by reducing the roll angle.
- However, when the deflection is high, there is a higher possibility of tires snagging to the posts.
- The two extra posts behind the asymmetric piece are added to reduce the deflection and at the same time they are not bolted through the rail so they get out of the way in case of any possible tire interaction.





Shorter TL-3 MASH W-Beam Transition

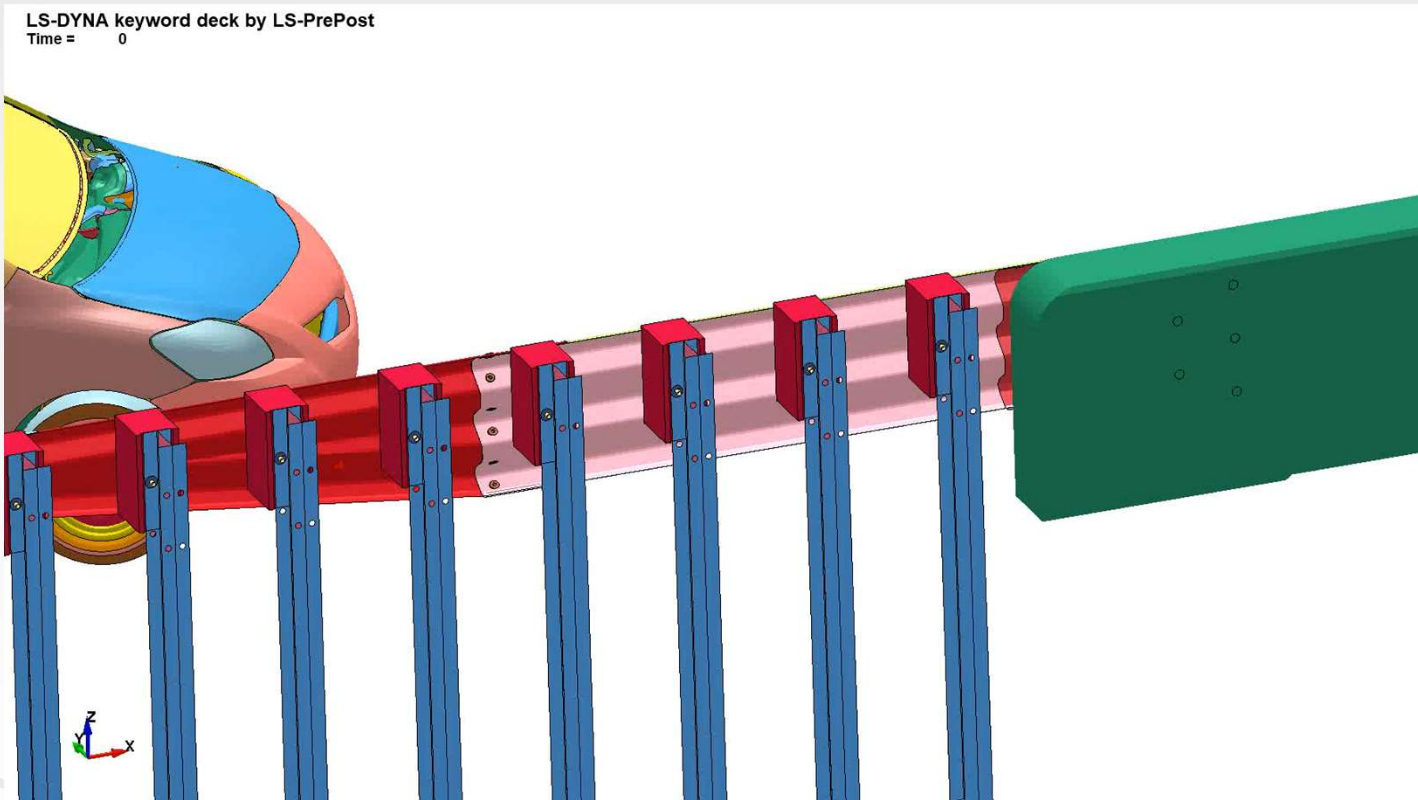
Impacting to post #17



Shorter TL-3 MASH W-Beam Transition

Evaluating Small Car Impact

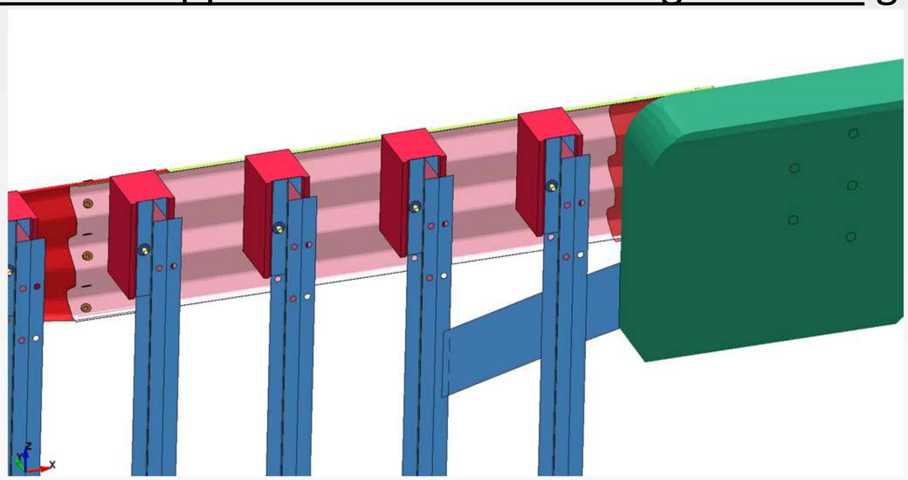
- The project is only budgeted for a pickup crash test, but the system still needs to be evaluated under impact with a small car.
- The main issue is the parapet's blunt end which causes high occupant risk factors.



Shorter TL-3 MASH W-Beam Transition

Evaluating Small Car Impact

- Various design modifications were investigated but the method that worked best and can be done as a simple field customization is adding a plate to cover the blunt end.
- This can be further investigated if the problem statement on Exploration into Variations in Guardrail Approach Transitions to Rigid Barrier gets funded.



Next

- Full-scale crash test (3-21) will be conducted in mid-spring.

Anticipated Completion Date:

August 2021

Thrie-Beam for Roadside and Median Application

Thrie-Beam for Roadside and Median Application

Purpose

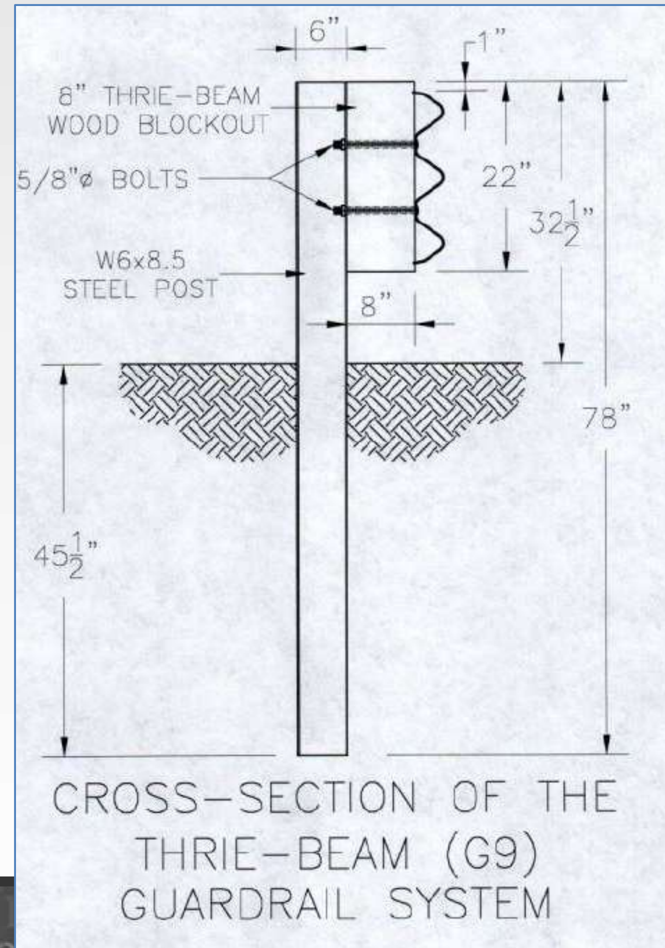
- Developing a cost-effective Thrie-beam guardrail system (TGS) for roadside and median application

Work Done

- Design development using computer simulation
  - Model verification (by the G9 crash test)
  - G9 with 14” wood blockouts
  - Increasing rail mounting height with 14” blockouts

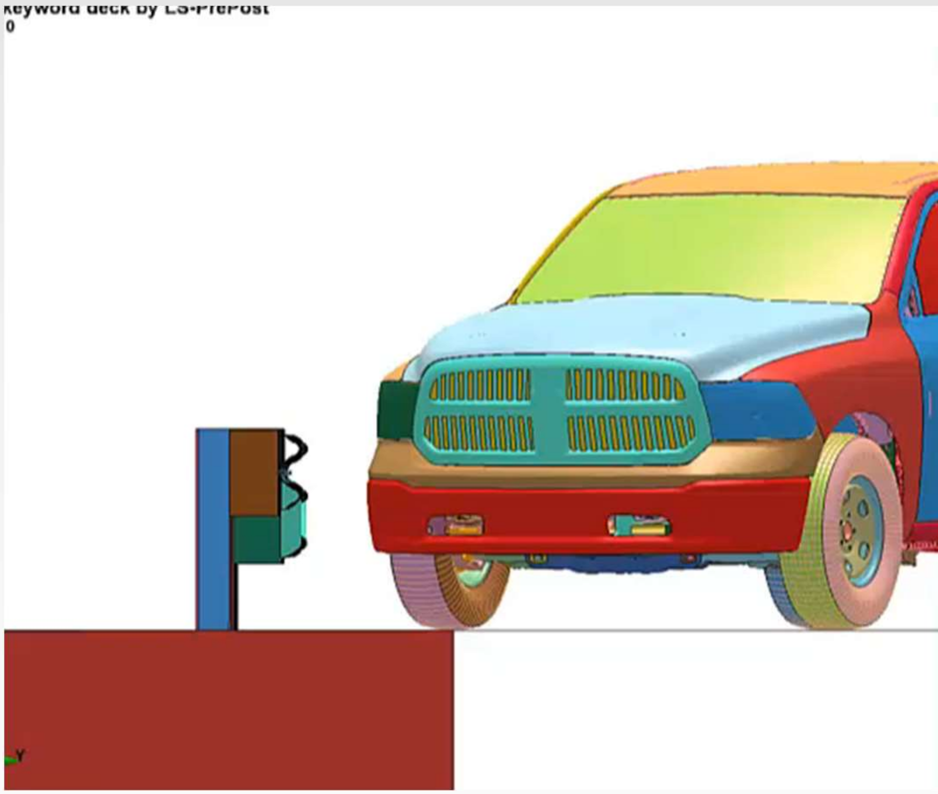
Status

- Design development using computer simulation
  - Modeling small car simulation on the latest Roadside TGS and redesign if needed.



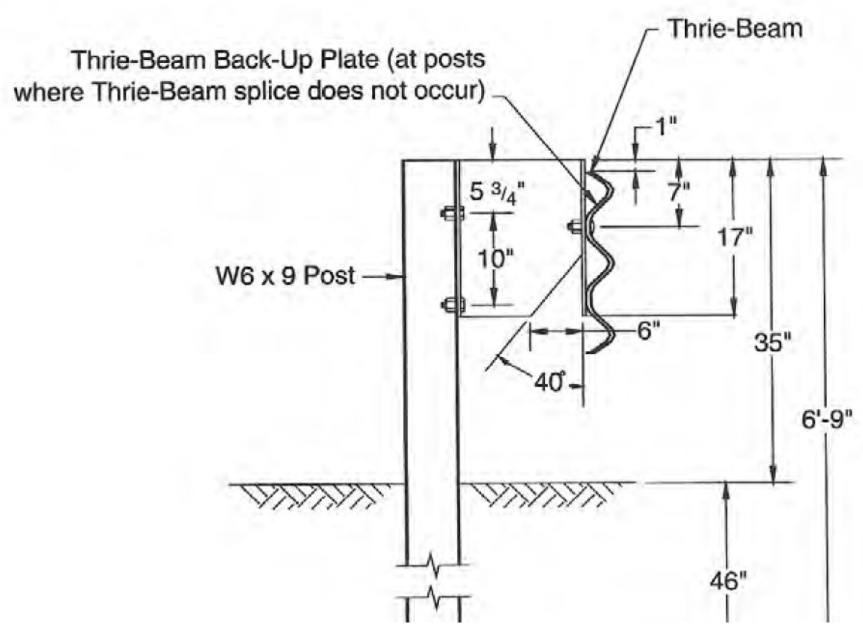
Thrie-Beam for Roadside and Median Application

Verifying the baseline model by the G9 crash test



Mak, Blight, Menges, Testing of state roadside safety systems, Volume I: Technical Report, 1999

Thrie-Beam for Roadside and Median Application



Bullard et. al, NCHRP 22-14(03), Volume I: Evaluation of Existing Roadside Safety Hardware Using Updated Criteria—Technical Report, 2010

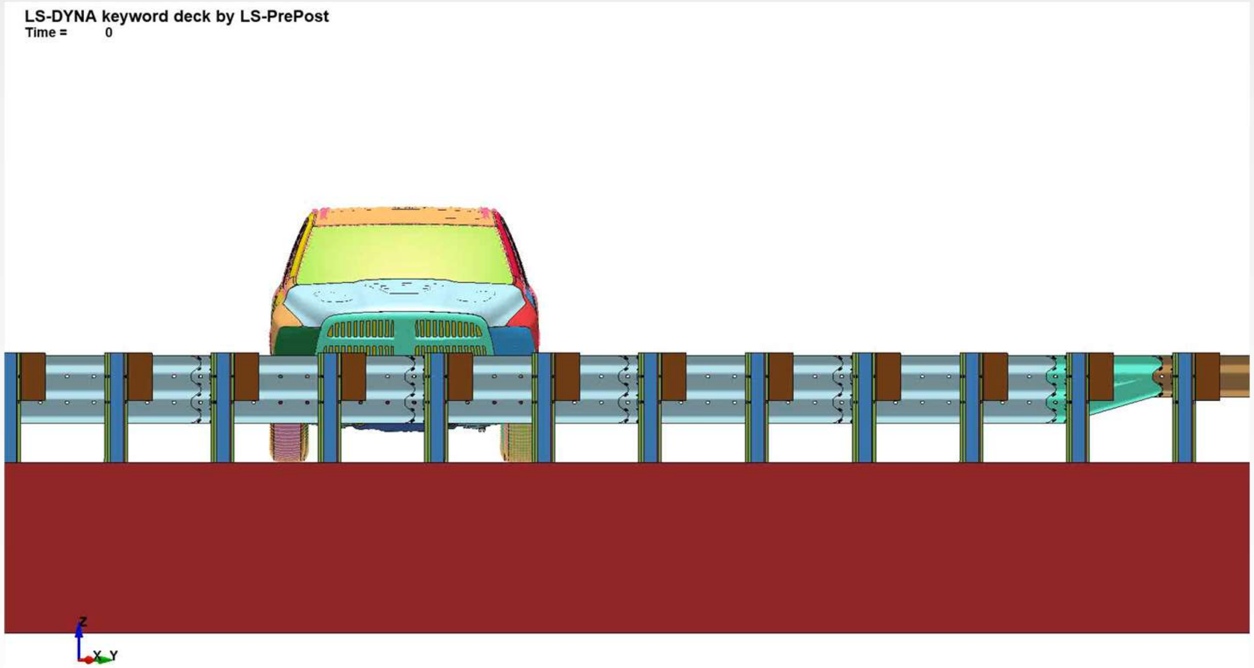
Original modified thrie-beam system developed at TTI in mid-1980s and passed for TL-4 under NCHRP Report 350

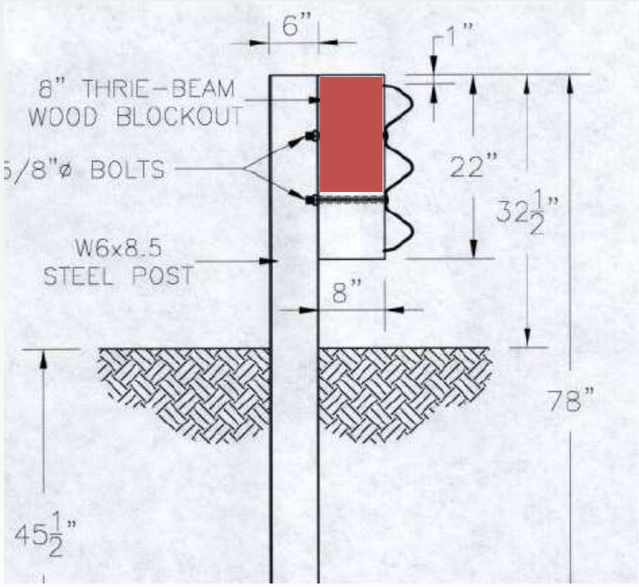
The modified thrie-beam system was recently crash tested for TL-3 under MASH by MwRSF

Bielenberg et. al, MASH 2016 Evaluation of the Modified Thrie Beam System, 2020

Thrie-Beam for Roadside and Median Application

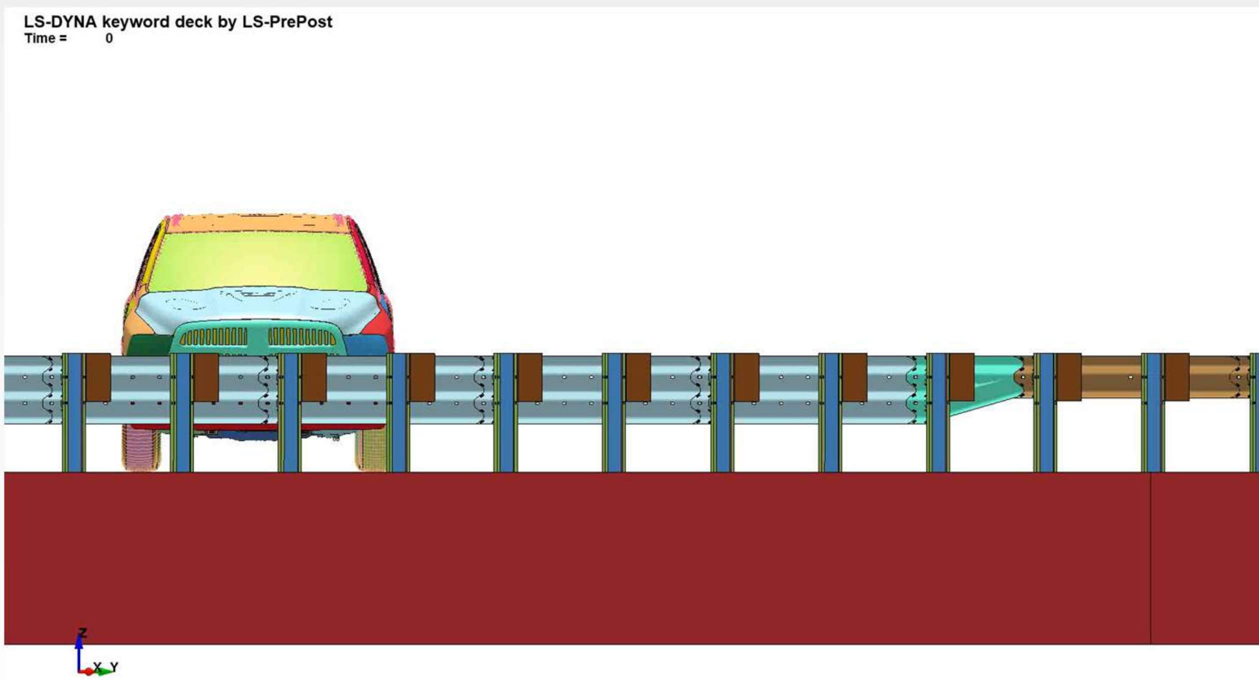
- Key design feature of the modified Thrie-beam system is:
  - using modified blockouts (to let the bottom of the vehicle to go under the rail to increase vehicular stability by reducing roll angle)
- Using 14” blockout on G9 system

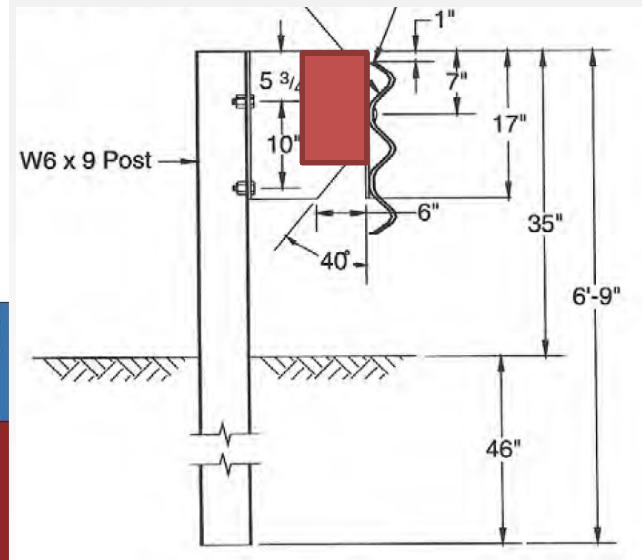




Thrie-Beam for Roadside and Median Application

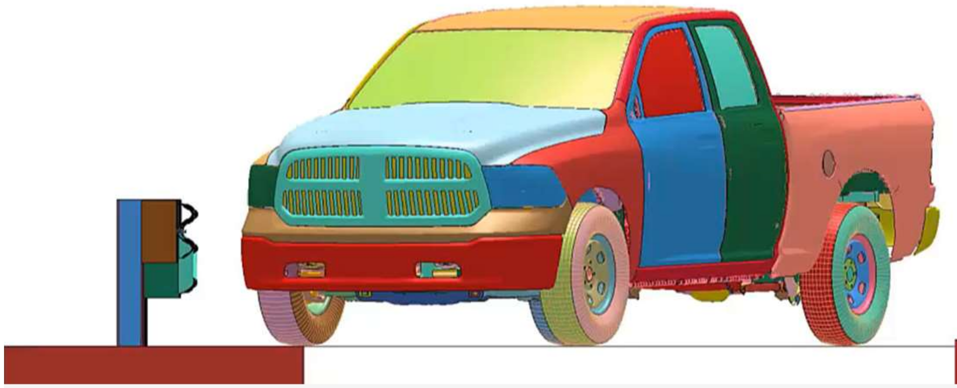
- Key design feature of the modified Thrie-beam system was:
  - higher mounting height for the rail (to reduce the tire interaction with the bottom of the rail so the tire can't get a grip of the rail to climb it)
- Using 14" blockout on modified thrie-beam system (34" mounting height, 72" tall posts, and 14" blockouts)

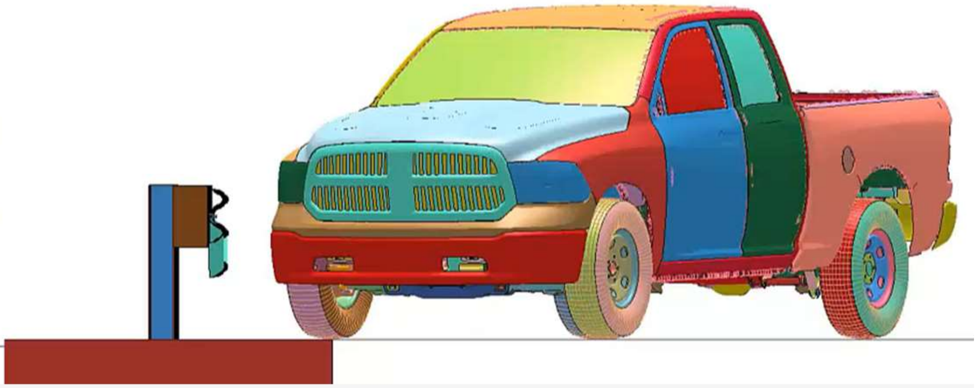




Thrie-Beam for Roadside and Median Application

- G9
  - 22” blockouts
  - Mounting height of 31-1/2”
  - Max. roll angle = 52 deg.
- TGS
  - 14” blockouts
  - Mounting height of 34”
  - Max. roll angle = 12 deg.





Thrie-Beam for Roadside and Median Application

Next

- Modeling small car simulation on the latest Roadside TGS and redesign if needed.
- Creating the Median version of the Roadside TGS model
- Running more parametric analysis
  - Find the critical impact points
  - Decide which system (Roadside or Median) is the critical one to be crash tested
- Full-scale crash tests (3-10, 3-11, and 3-21).

Anticipated Completion Date:

July 2021

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

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

Purpose

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

Status

- Finalizing the design and CIPs

link

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

State Survey Summary

For high speed application:

- Min Flared Length = 5 ft (TxDOT)
- Max Flare Rate = 20:1
- Min Fixed Object Offset = 2"

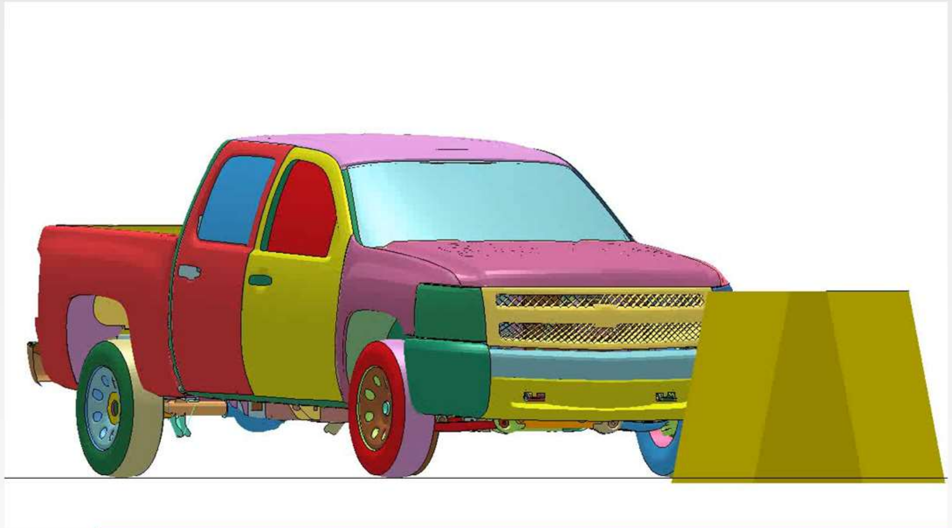
Assumptions

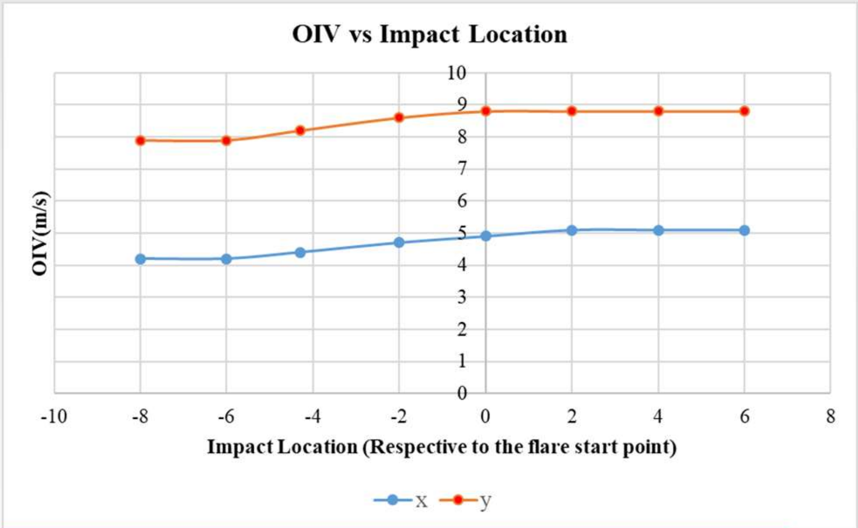
- 42" and 36" Single Slope
- 5-ft and 30-ft length flare
- 20:1 flare rate
- No fixed object

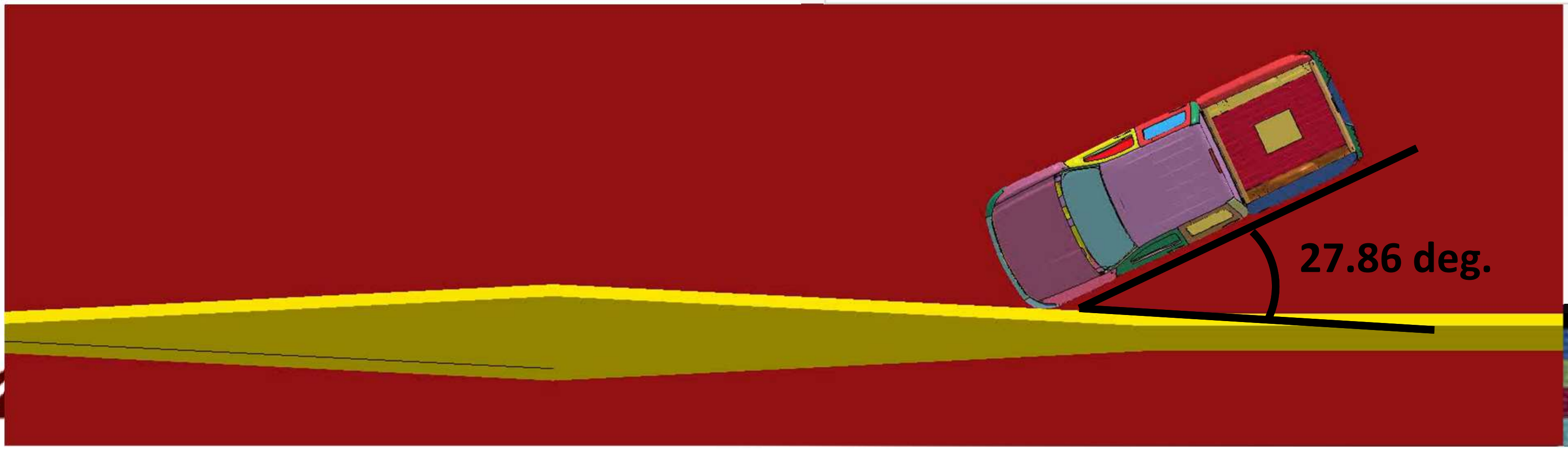
	Member State	Min Flared Length	Fixed Object Min Distance	Max Flare Rate	Min Fixed Object Offset
1	Alabama	Varies	Varies	20:1	4"
2	Alaska	Not specified	Determined by designers	20:1	No standard
3	California				
4	Colorado				
5	Connecticut				
6	Delaware				
7	Florida	15 feet	N/A	20:1	Depends on Barrier Height
8	Idaho				
9	Illinois	No standard	No standard	No standard	No standard
10	Iowa	No minimum	Determined by designers	20:1	15"
11	Louisiana	Based on RDG	No minimum	Based on RDG	6"
12	Maryland				
13	Massachusetts				
14	Michigan	N/A	N/A	24:1	11"
15	Minnesota				
16	Mississippi				
17	Missouri				
18	Oklahoma				
19	Ontario	Depends on speed	Depends on length of object	18:1 - 32:1	165 mm
20	Oregon				
21	Pennsylvania	see RC-58m	see RC-58m	8:1 - 20:1	see RC-58m
22	Tennessee				
23	Texas	5 feet	We don't specify	20:1	4-3/4", 4"
24	Utah	20:1	No minimum	30:1	2"
25	Washington	9'-3" (light standard)	No standard	25:1	8"
26	West Virginia	No standard	No standard	20:1	No standard
27	Wisconsin	Based on RDG	No minimum	Based on RDG	4" (+1" polystyrene)

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

- 2.86 deg. higher effective impact angle results in a 22% increase in impact severity.







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

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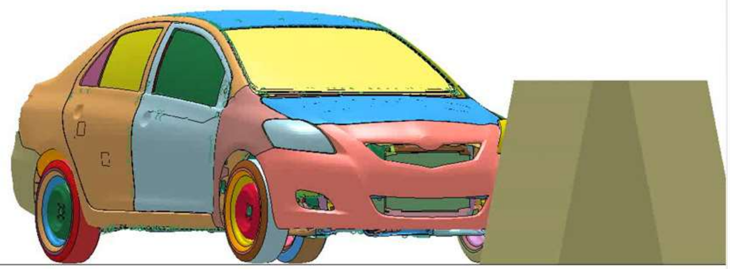
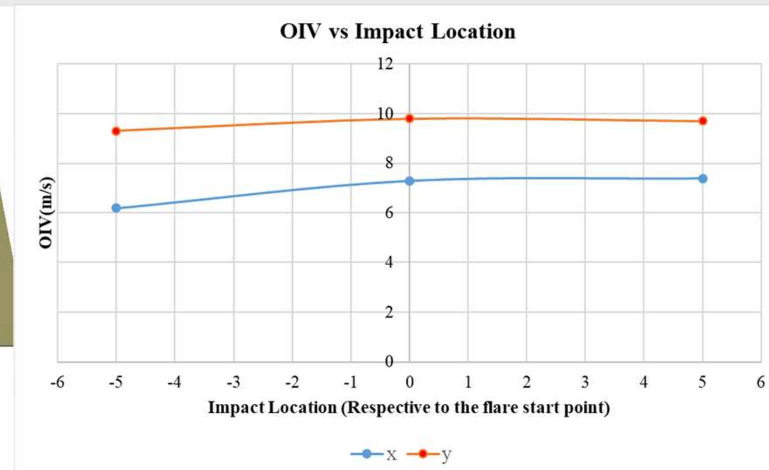
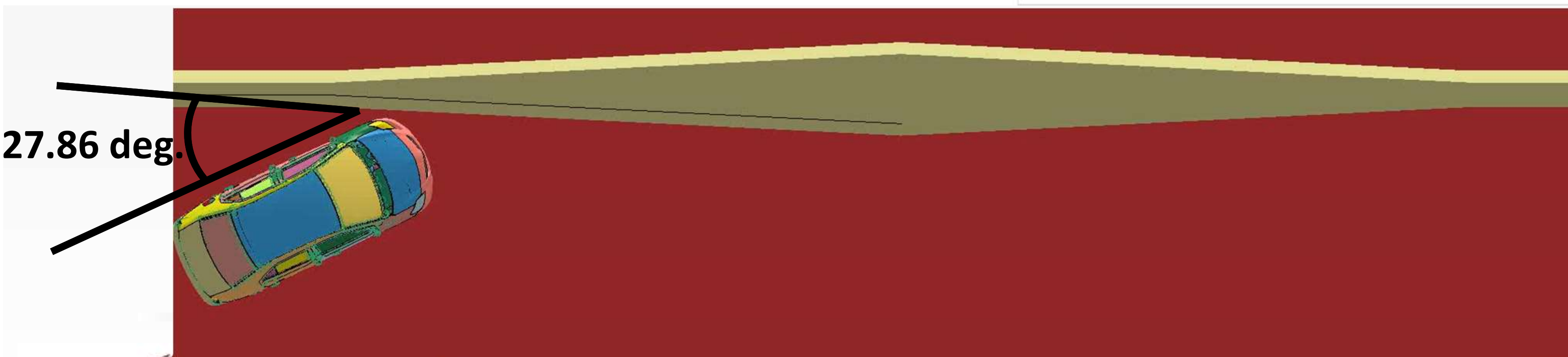
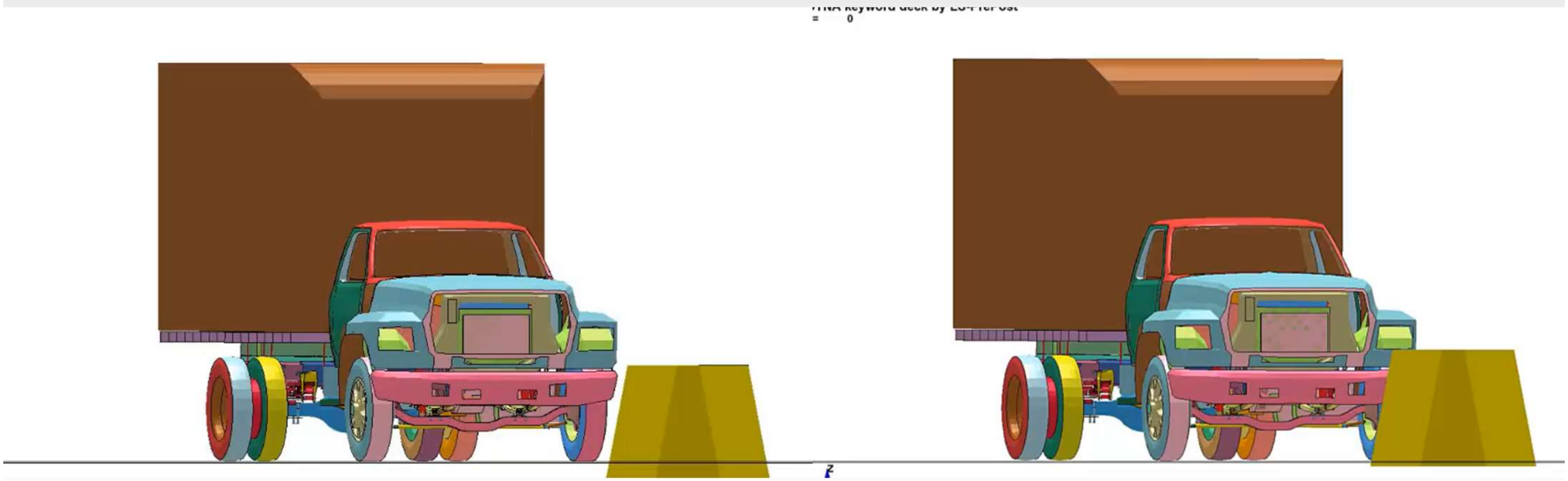






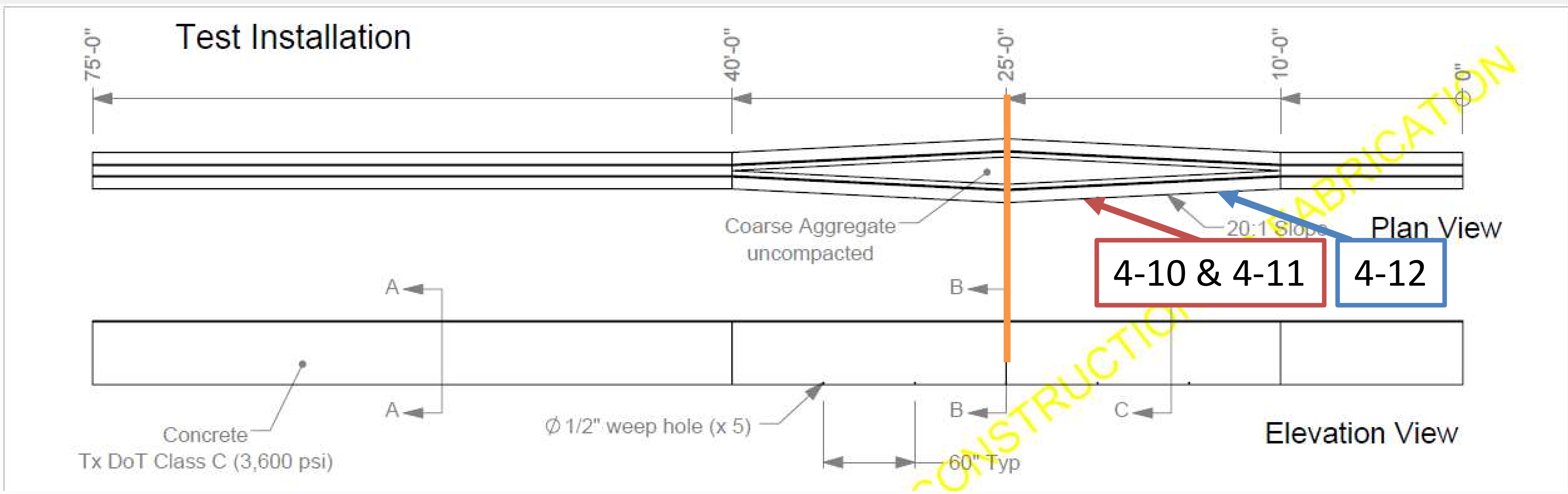
MASH TL-4 Testing of Critical Flare Rate for CIP Concrete Barrier Flaring around Fixed Object

- The impact simulation of SUT on 20:1 flared 36” Single Slope barrier showed excessive roll angle and consequently flipping over the barrier (w/o fixed object).
- 36” vs. 40” single slope



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

- Impact points for crash tests to assure full interaction of the vehicle with the flared part
  - Small car and pickup truck: minimum 5 ft before end of the flare
  - Single unit truck: minimum 10 ft before end of the flare



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

- Crash test options:
  1. Constructing the flared barrier and perform test level 4 (original plan, needs additional budget)
  2. Constructing the flared barrier and perform test level 3 (won't need any additional budget)
  3. Performing the crash tests on a straight barrier with increased effective impact angle (we're looking into this option)
     - Using an already available single slope barrier assuming anything comes up in the following 6 months (won't need any additional budget)
     - Constructing a straight single slope barrier (need additional budget but it may be less than the first option)
- **Next**
  - Construction
  - Full-scale crash tests (Tests 4-10, 4-11 and 4-12)

Anticipated Completion Date:

August 2021