Development and Testing of Structurally Independent Foundations for a 54” Tall High-Speed Containment Single Slope Concrete Barrier

Texas A&M Transportation Institute

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Presentation Outline

1. PROBLEM STATEMENT
2. DESIGN DETAILS
3. FINITE ELEMENT MODELING AND MASH 5-12 SIMULATIONS
4. MASH 5-12 CRASH TEST
5. RESULTS

1.Problem Statement

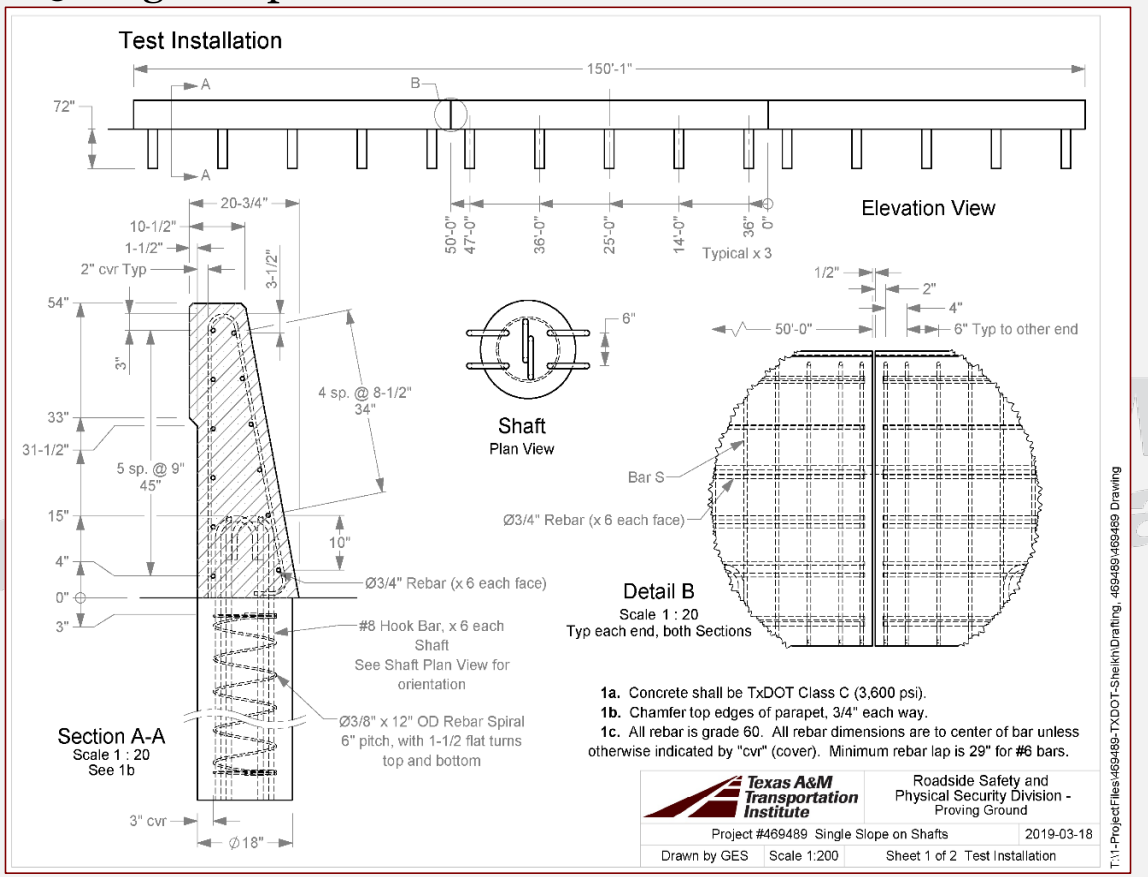
- TxDOT Bridge Design Manual Section 2.2 requires that “bridge columns adjacent to roadways that exceed specific annual traffic frequency to be designed for impacts from heavy trucks, or be shielded with a barrier.”
- The barrier must be 54” tall and mounted on a structurally independent foundation (SIF).
- The 54’’ tall Single Slope Concrete Barrier (SSCB) must pass Manual Assessment of Safety Hardware (MASH) Test Level 5 and be installed for piers located 10-ft from the edge of roadway.

Dallas, Texas 2007 - TxDOT

Tyler, Texas 2008 - TxDOT

2.Design Details

MASH TL-5 Single Slope Concrete Barrier with 6-ft Drilled Shaft Foundation

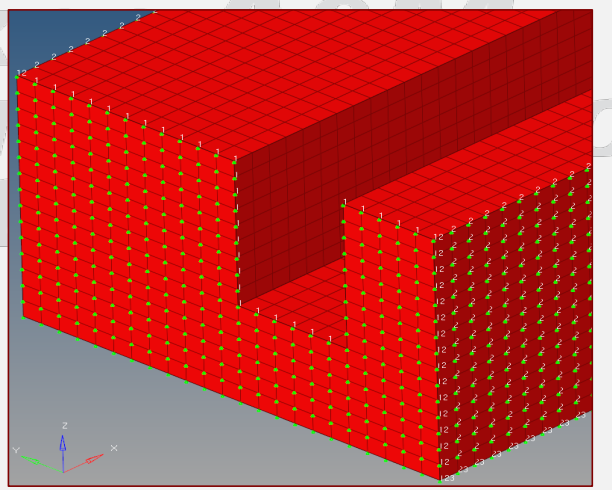


3. Finite Element Modeling and MASH 5-12 Simulations

- Software
  - The research team used Hypermesh for Finite Element (FE) modeling and LS-DYNA for solving.
  - The research team used the Texas A&M University's supercomputer (HPRC) to compute the simulations.

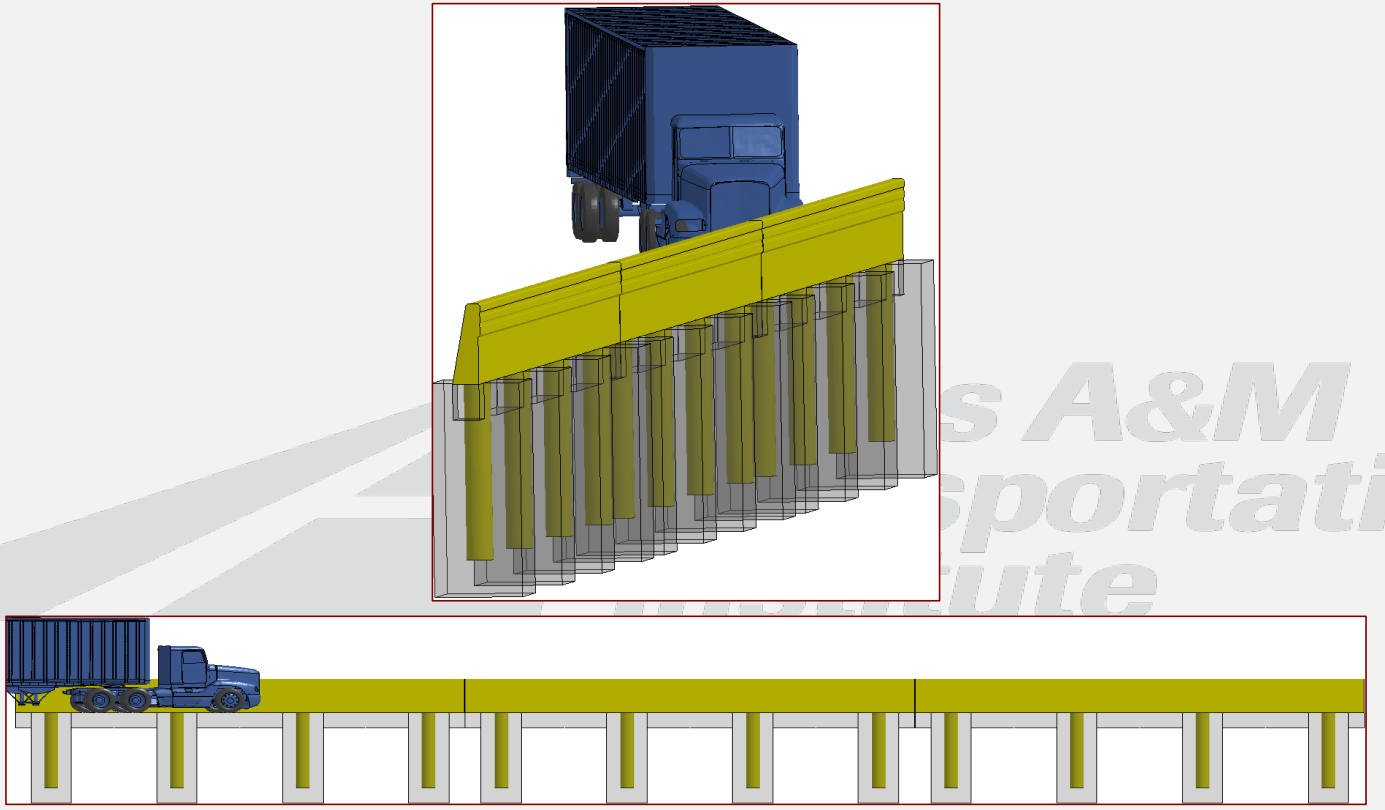
- Rigid Material
  - Since concrete failure was not an expected outcome, the barrier and the foundation were modeled with rigid material.

- Boundary Conditions
  - The foundations were modeled inside a soil continuum that was built with deformable soil material properties. The soil was constrained only to maintain shape and was free to "flow" inside the external boundaries.



3. Finite Element Modeling and MASH 5-12 Simulations

FE Model of 54” Tall SSCB System with 6-ft Drilled Shaft Foundation



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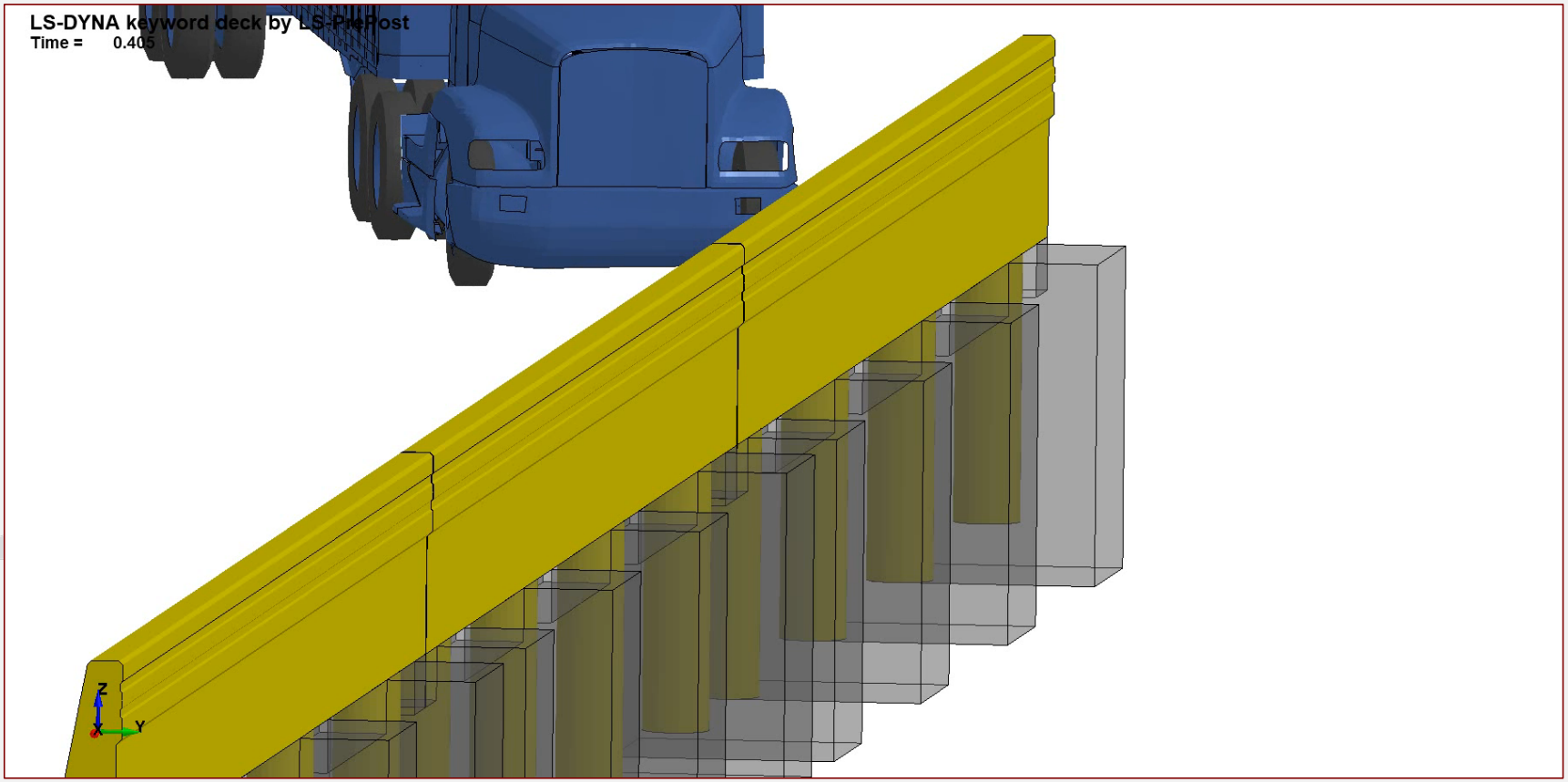
MASH 5-12 – Tractor-Trailer Impacting Barrier System with 50 mi/h at 15 degrees



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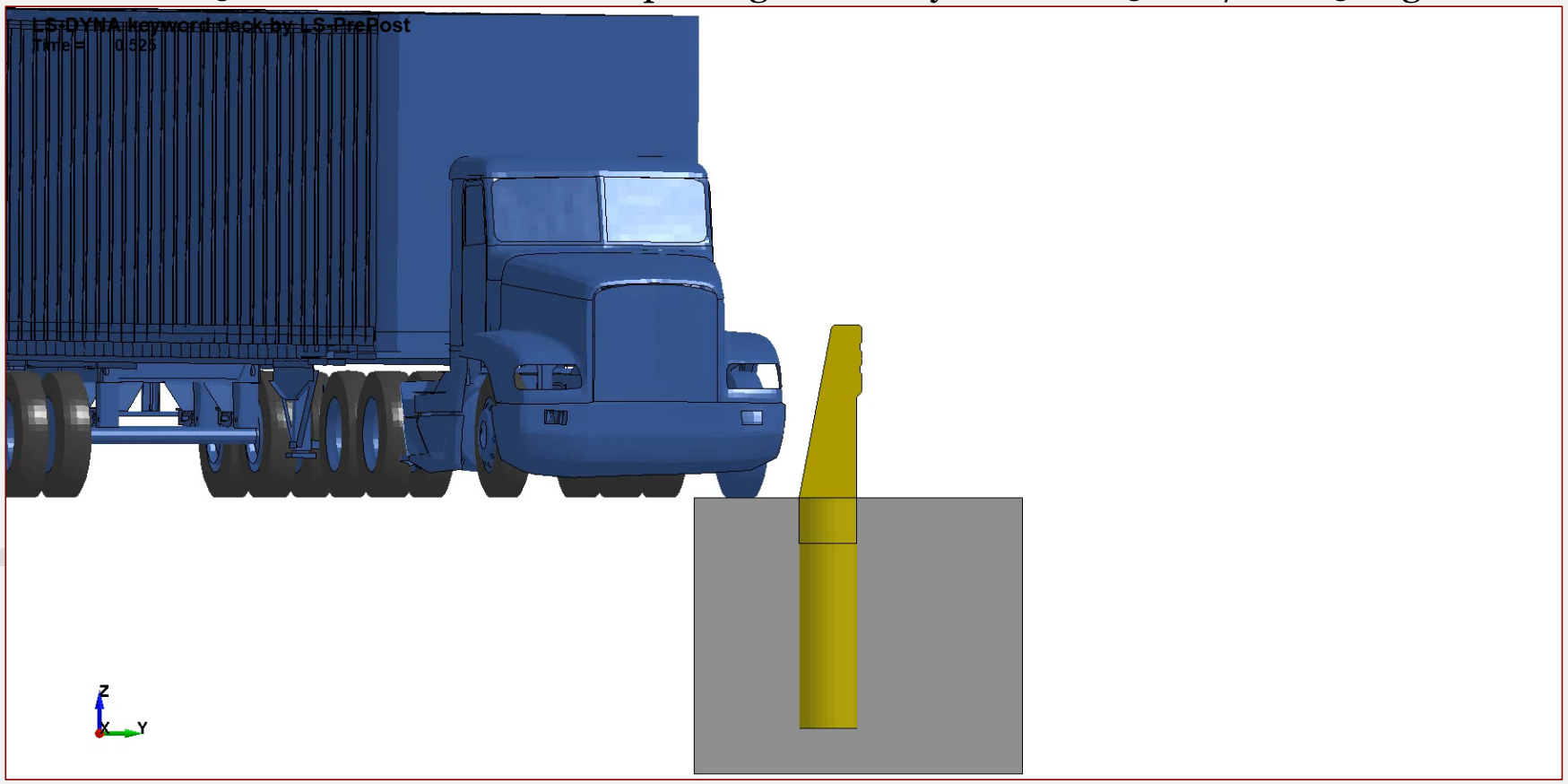

4.MASH 5-12 Crash Test

3. Results

Comparison of Simulation and Crash Test Results

	MASH 5-12 Simulation (in)	MASH 5-12 Crash Test (in)
Permanent Deflection	1.22	0.6
Maximum Dynamic Deflection	3.75	2.9
Working Width	31.8	40.2
Working Width Height	148.6	147.1
Pass/Fail	Pass	Pass