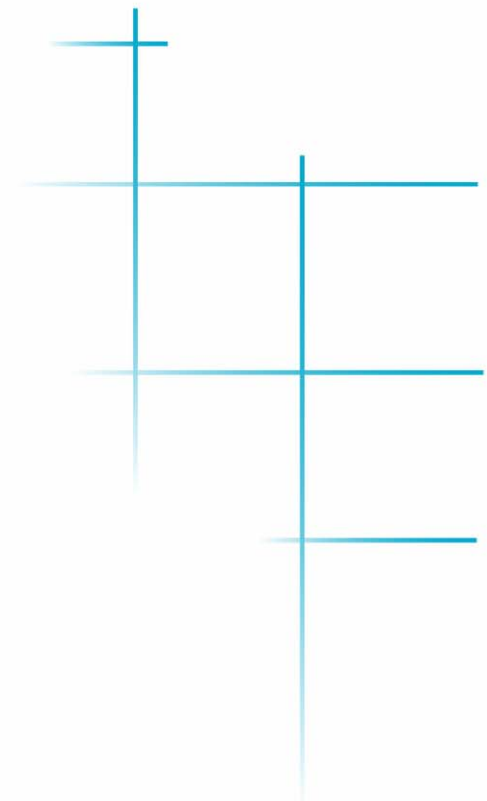


Center of Excellence in Finite Element Crash Analysis



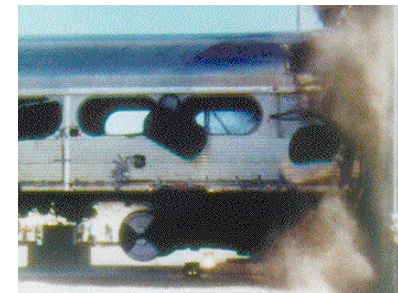
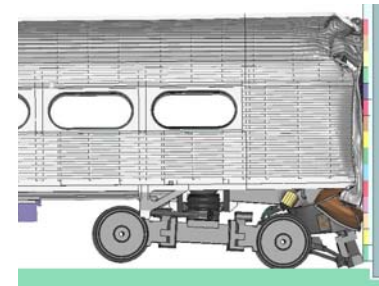
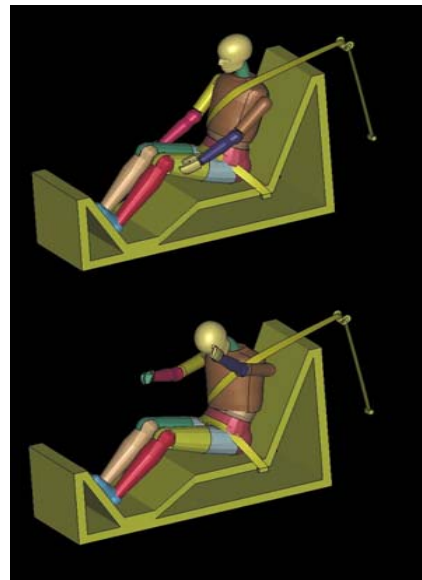
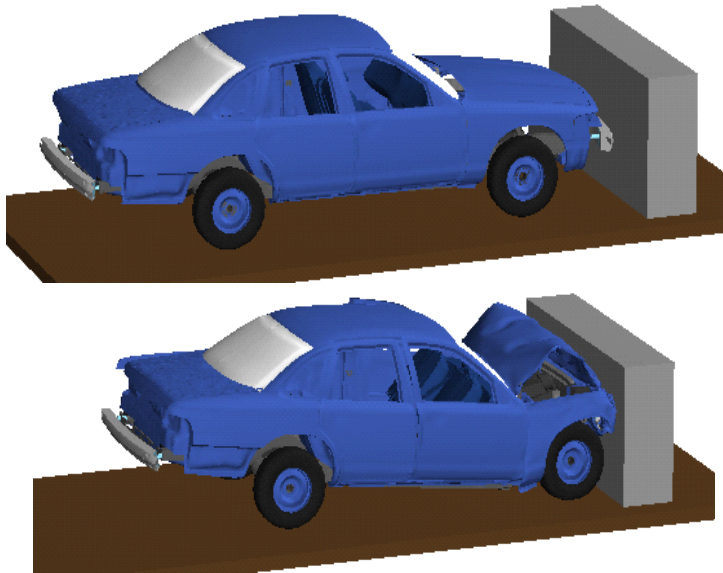
Silicon Valley Office
2672 Bayshore Parkway, Suite 1035
Mountain View, CA 94041
(650) 625-8150



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RESEARCH
ASSOCIATES, INC.**
An Employee-Owned Company

The Research Center

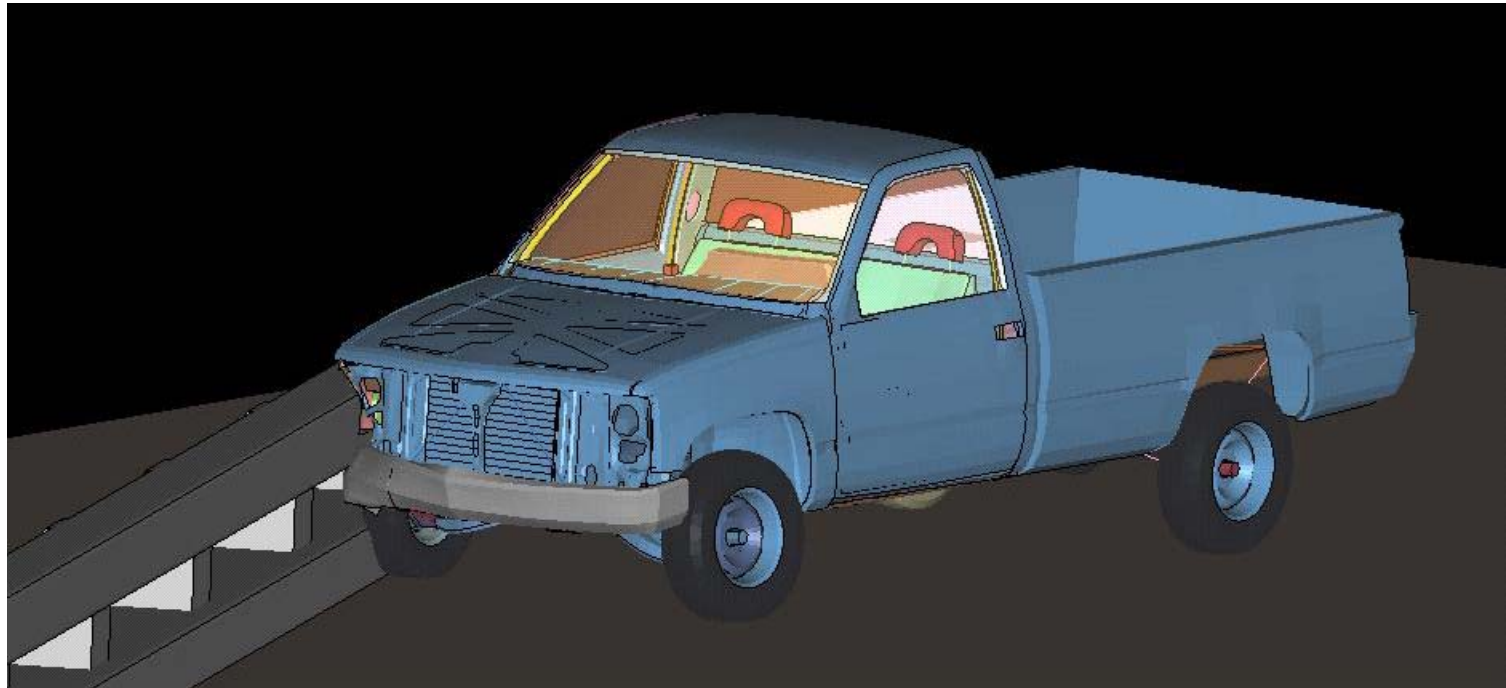
- ARA Personnel have performed a wide range of research on crashworthiness and transportation safety.



- Based on these capabilities, the Federal Highway Administration (FHWA) recently designated the Silicon Valley Office of ARA as a new **Center of Excellence in Finite Element Crash Analysis**.

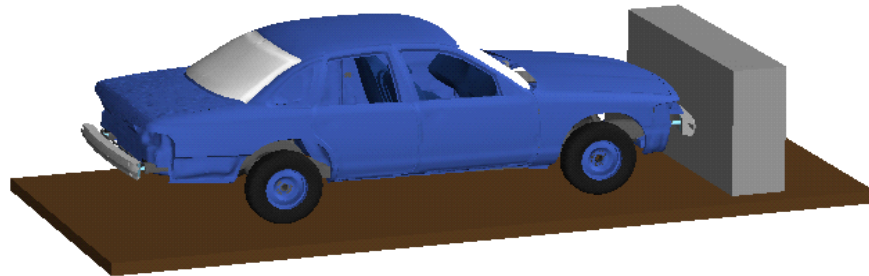
The Research Center

- **Research Center Goal: conduct crashworthiness research on roadside safety structures and geometric features using the finite element code LS-DYNA.**

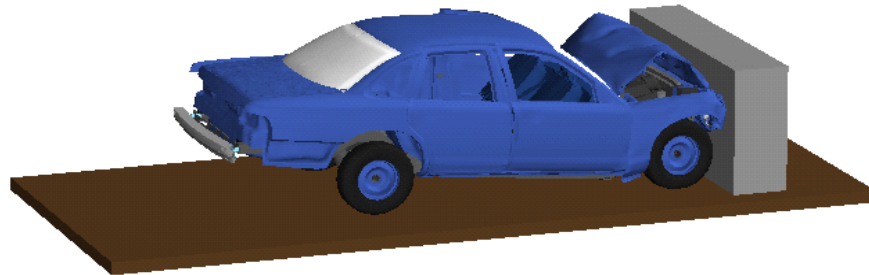


Model Development and Validation

Frontal Crash Response

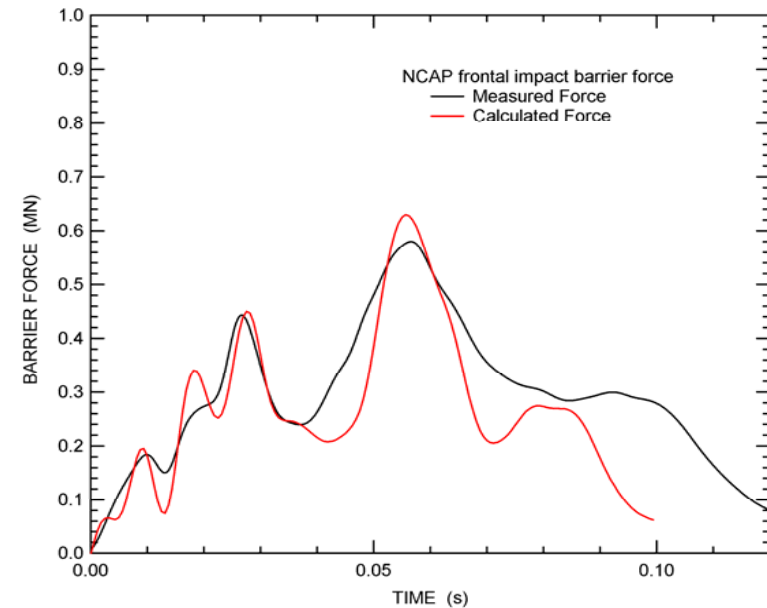


Initial Configuration



Impact deformations

Simulation of the NCAP Frontal Test - 35 mph barrier impact



Comparison of Measured and Calculated Crash Forces

Validation of a Detailed Vehicle Model Developed for the
1997 Ford Crown Victoria

Available Vehicle Models

- Many vehicle models are currently available through the National Crash Analysis Center (NCAC) for crash simulations:



**Chevrolet C1500 & C2500
Pickup**



Dodge Neon



Dodge Caravan



Ford Taurus



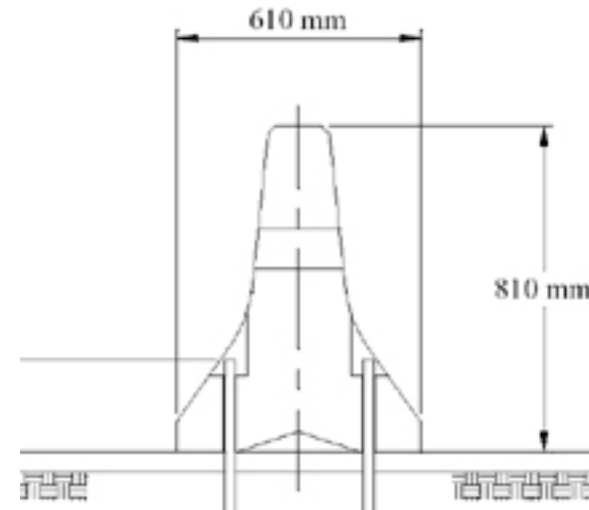
Geo Metro



**Ford F800 Single
Unit Truck**

Crash Barrier Demonstration

Vehicle, Barrier and Impact Conditions



Vehicle Model:

Model ----- 1989 Chevy C2500

Inertial Mass ----- 2016 kg

Impact Conditions:

Velocity ----- 100.6 km/h

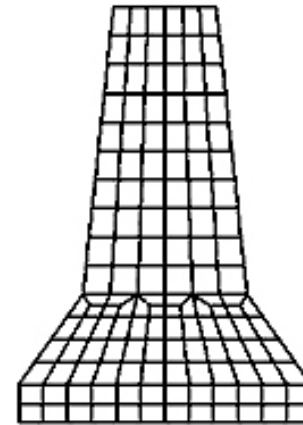
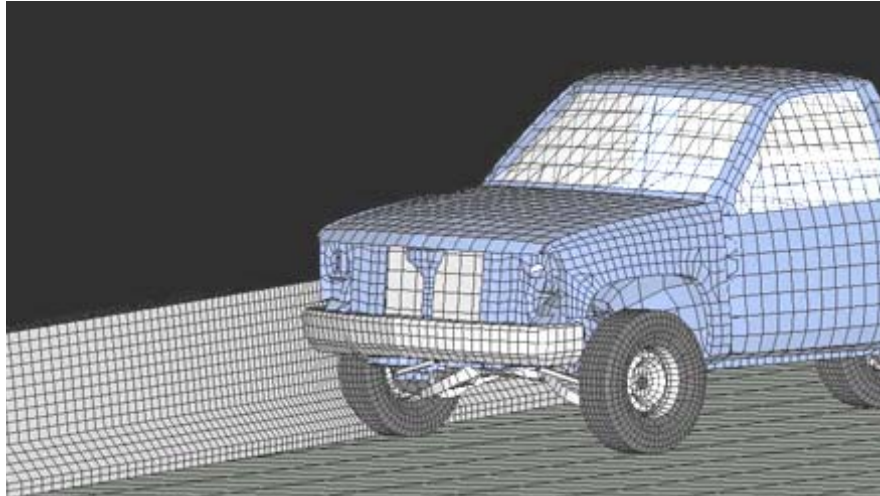
Angle ----- 25°

Jersey Barrier:

- Reinforced Concrete
- 6 m Sections
- Semi-permanent

Compliance Crash Testing of K-Rail Used in Semi-Permanent Installations, State Department of California Department of Transportation Engineering Service Center, Office of Materials and Foundations, October, 1999.

Finite Element Simulation



Vehicle Model:

NCAC Model ----- Chevy C1500

Inertial Mass ----- 2000 kg

Impact Conditions:

Velocity ----- 100.6 km/h

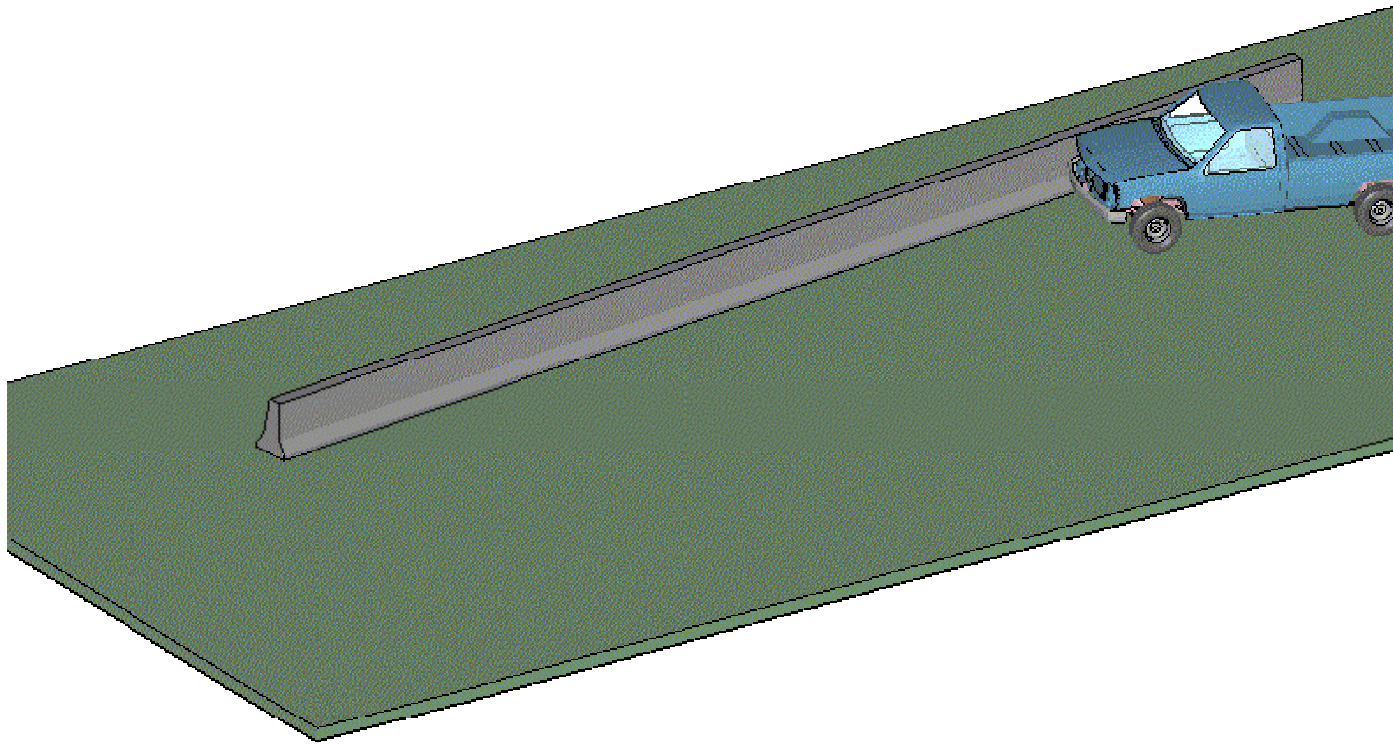
Angle ----- 25°

Barrier Model:

- Reinforced Concrete
- Continuous Barrier
- Rigid attachment to ground

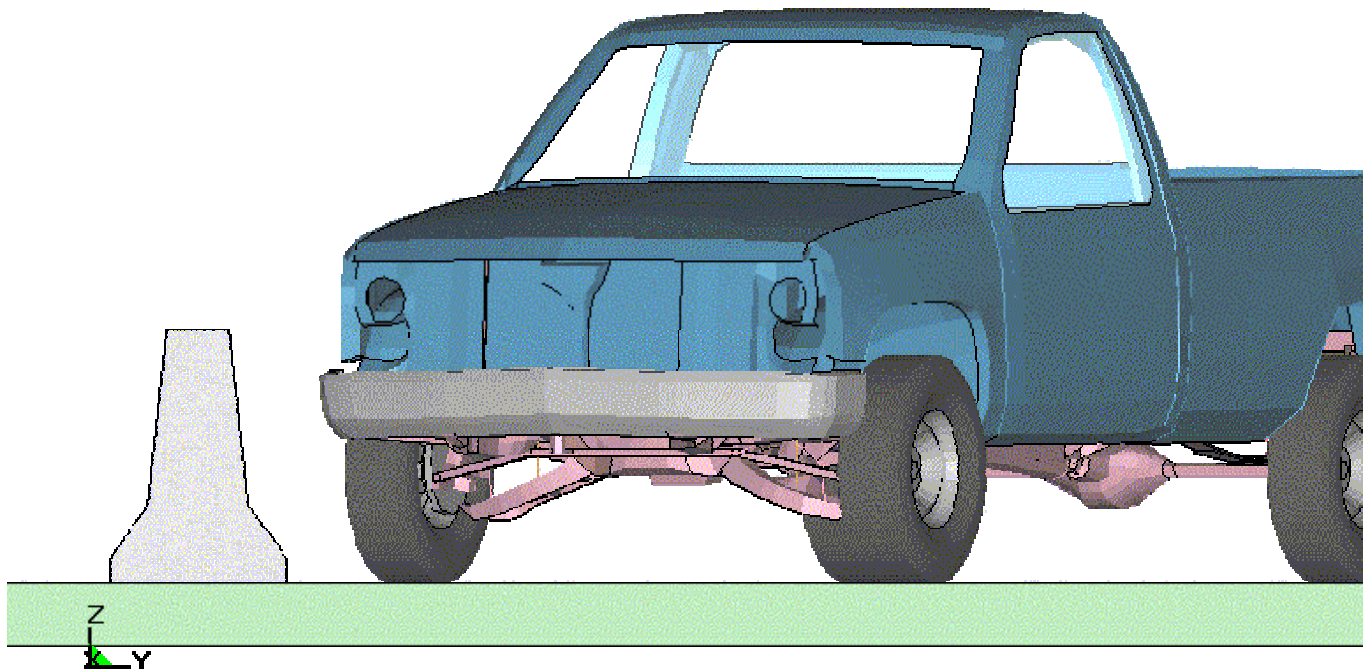
Simulation

JERSEY BARRIER - C1500 PICKUP - 100 KM/HR
Time = 0



Simulation

JERSEY BARRIER - C1500 PICKUP - 100 KM/HR
Time = 0



Simulation Comparison

Front View

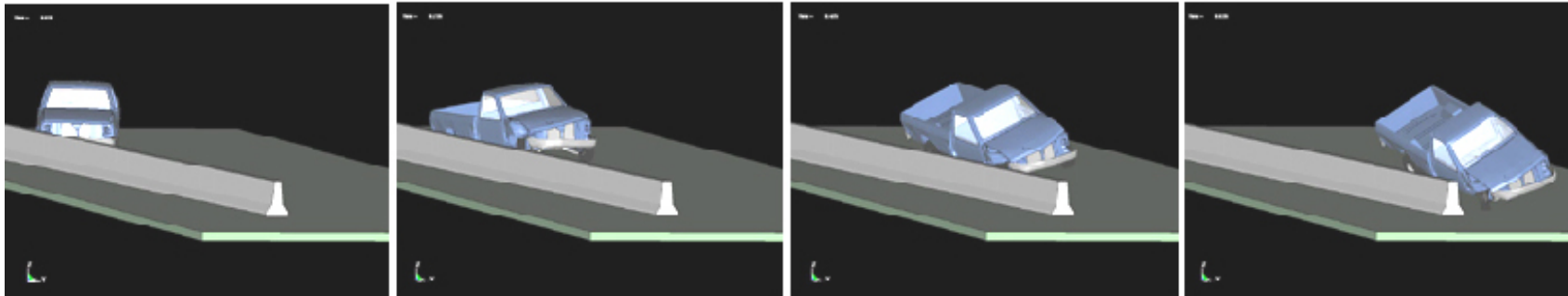


t = 0.000 s

t = 0.200 s

t = 0.400 s

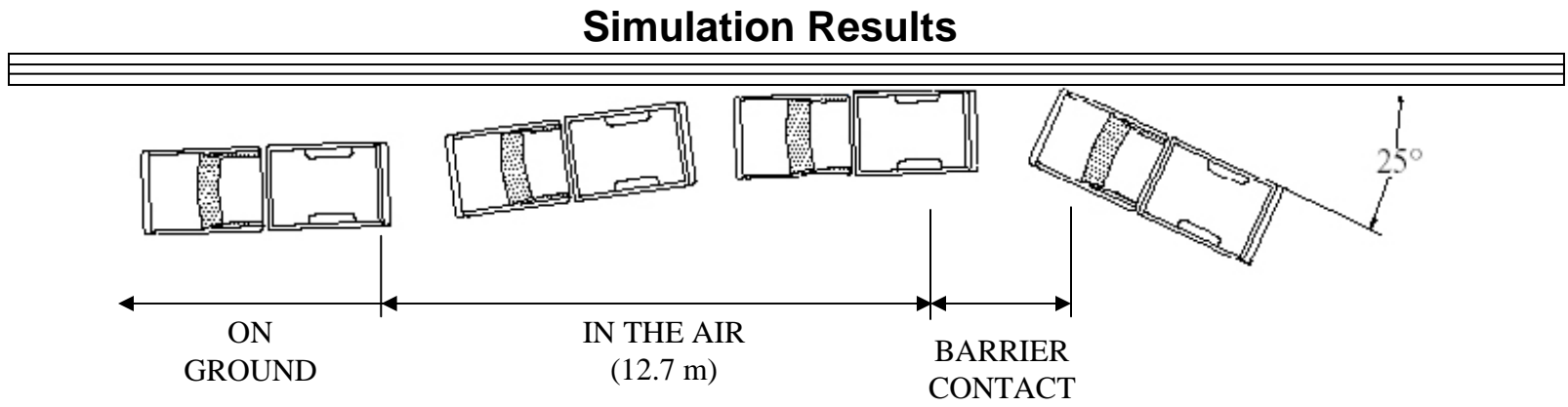
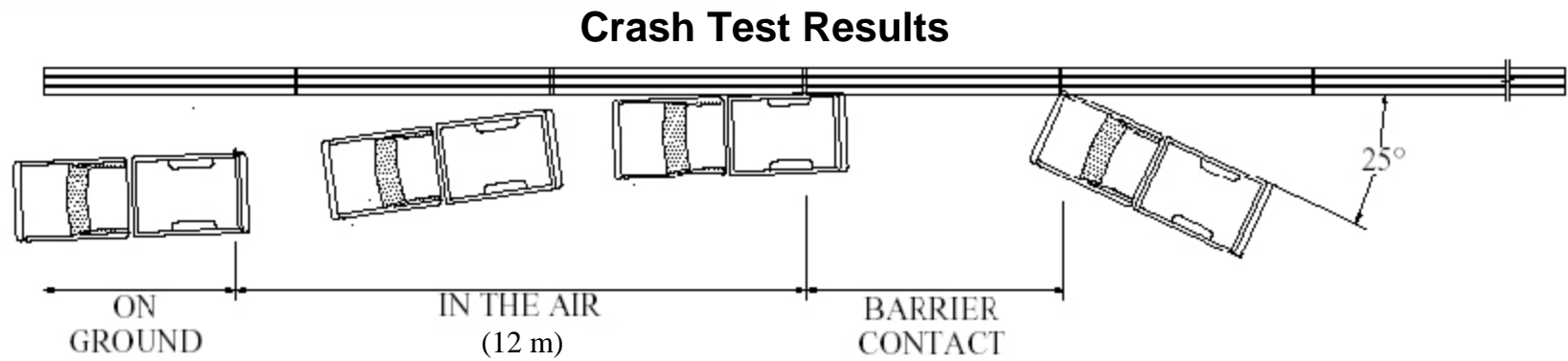
t = 0.600 s



Compliance Crash Testing of K-Rail Used in Semi-Permanent Installations, State Department of California Department of Transportation Engineering Service Center, Office of Materials and Foundations, October, 1999.

Simulation Comparison

Top View



Compliance Crash Testing of K-Rail Used in Semi-Permanent Installations, State Department of California Department of Transportation Engineering Service Center, Office of Materials and Foundations, October, 1999.

Simulation Comparison

- There was good agreement between the crash testing and FE simulation.

	Exit Velocity (km/h)	Exit Angle (deg.)
Crash Test	82	6
FE Simulation	77	5.7

- Differences likely due to
 - Test vehicle and model not identical.
 - Test barrier is semi-permanent and deflected slightly during testing.