

Advanced Crash Avoidance Technologies (ACAT) GM-VTTI Backing Countermeasure Project

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ACAT I

■ Two OBJECTIVES

- Formulate and “exercise” a “Safety Impact Methodology” (SIM) tool to evaluate the ability of advanced technology applications in full vehicle systems to solve specific motor vehicle safety problems.
- Demonstrate how the results of Objective Tests can be used by the SIM to establish the safety impact of a real system (i.e. estimate safety benefits).

ACAT | SOW

■ Task areas

- Task 1 - Safety Impact Methodology
 - Preliminary SIM Analysis
- Task 2 - Safety Area and Countermeasures
 - Crashes and Technology
 - Scenarios and Performance
- Task 3 - Objective Test Development
 - Identify set of tests scenarios
 - System and HF
- Task 4 – Conduct Objective Tests
 - Input to calibrate and validate model
 - Test track, simulator, roads, lab
- Task 5 – Estimate Safety Benefits
 - Final report safety benefits and final SIM

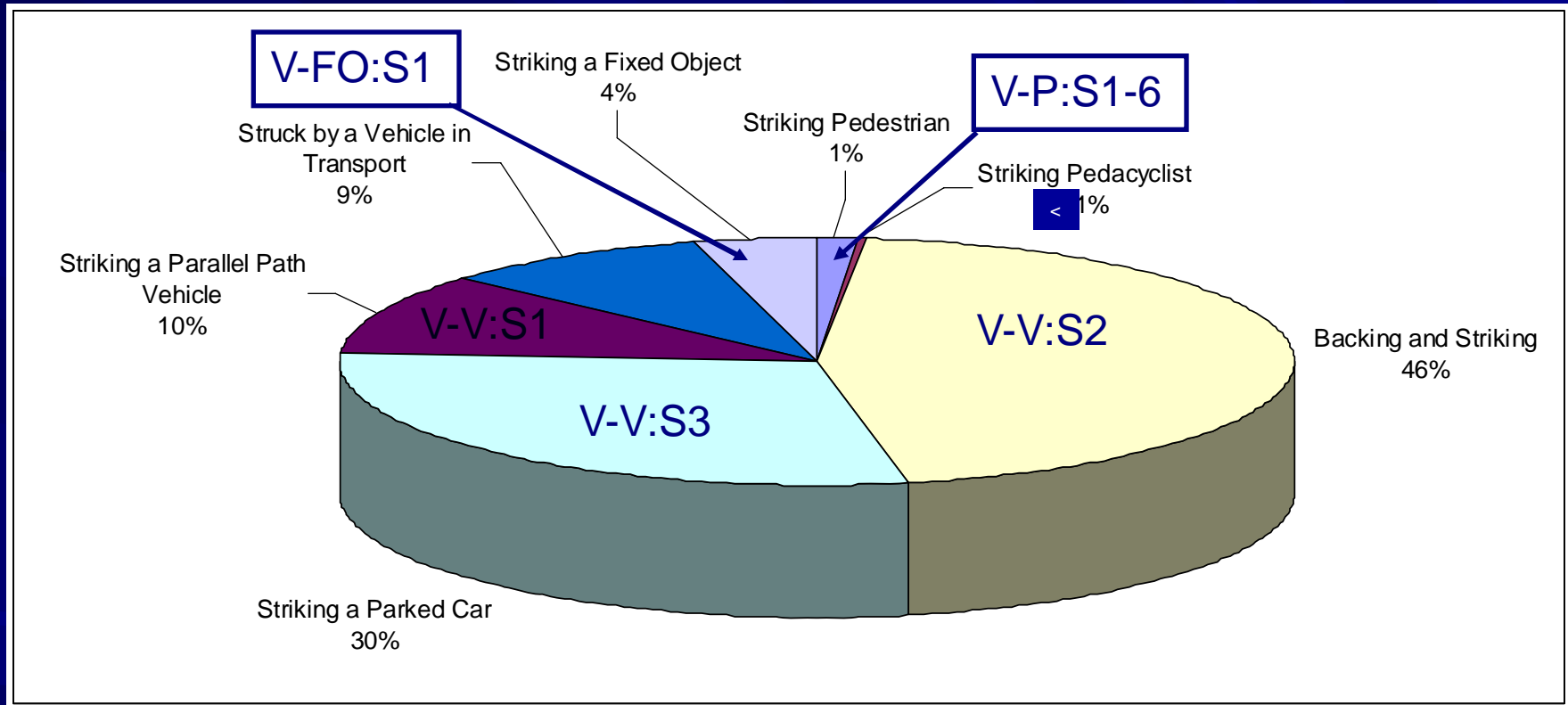
ACAT Backing Countermeasure Project



- General Motors Corporation and Virginia Tech Transportation Institute
- Federal Share \$1 Million
- Technology: A Next-Generation Backing-Collision countermeasure that provides levels of automated control to avoid backing collisions.

Traffic Related Backing Crash Types

Scenarios by Eberhard Classification
(GES 2005 Data)



V-V = Vehicle - Vehicle Crash Scenario (3 scenarios)
V-P = Vehicle - Pedestrian Crash Scenario (6 scenarios)
V-FO = Vehicle - Fixed Object Scenario (1 scenario)

Scope

■ Backing Crashes

- All **backing-related crashes** where an object, vehicle, or person is struck will be considered
- **Emphasis on backing crashes involving pedestrians**

■ Countermeasure System Comprised Of:

- Rear Vision (“Enhanced View” function)
- Rear Park Assist (“Proximity Information” function)
- Backing Warning (Cautionary & Imminent)
 - Audio warnings
 - Visual warnings inside the vehicle
 - color-coded lights
 - potential threat highlighted on rear vision display
 - Brake pulse
- Rear Emergency Braking
 - Autonomous braking up to the full capability of the system

Scenario Descriptions

[consistent with Najm et al (2007) framework]

■ Crash Type

- Backing vehicle strikes pedestrian
- Backing vehicle strikes another vehicle
- Backing vehicle strikes an object

■ Pre-Event Maneuver

- Backing during parking ingress/egress
- Driving in reverse

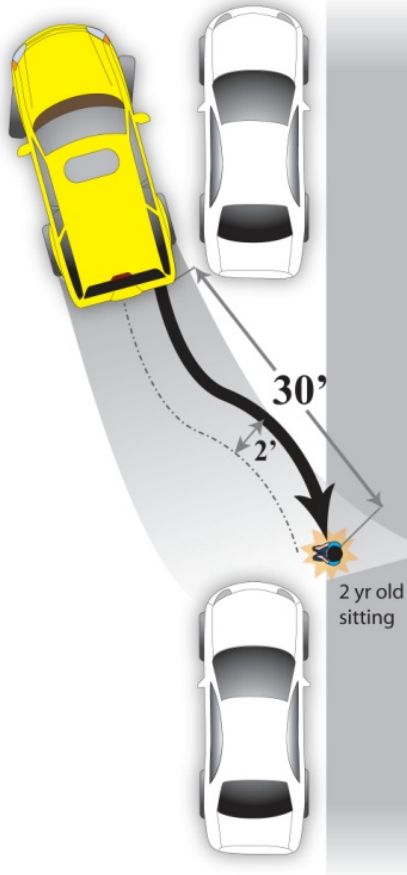
■ Critical Event

- Vehicle contacts stationary obstacle located in path
- Vehicle contacts obstacle moving/incurring into path

Parking Scenarios

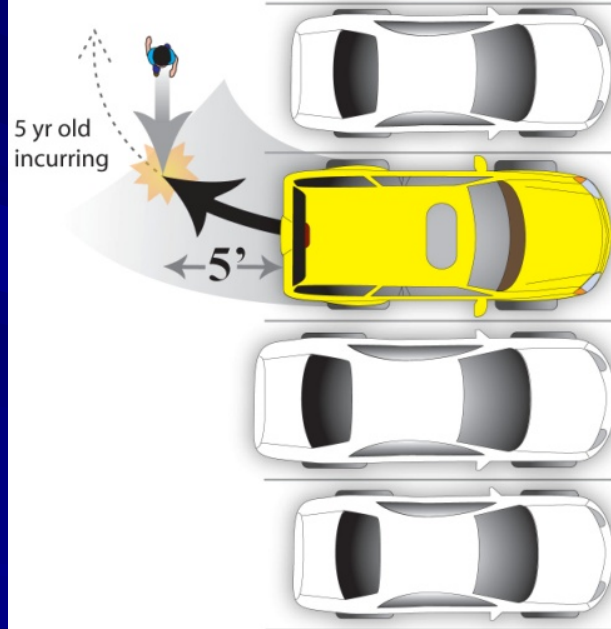
Pedestrian Scenario 2

Environment: Roadway
Activity: Parallel Parking



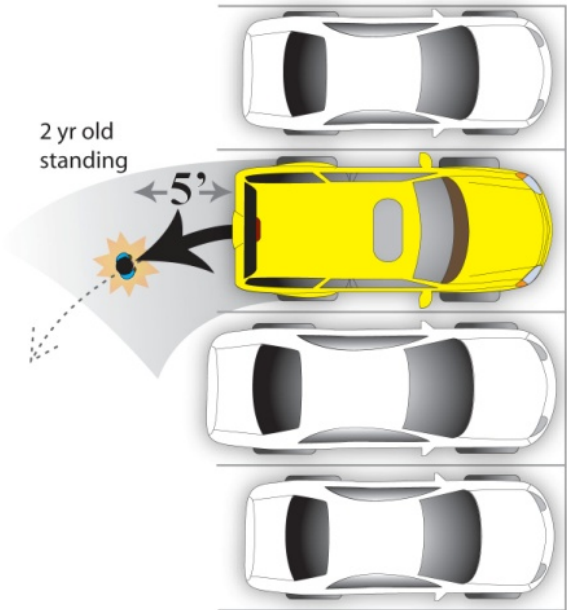
Pedestrian Scenario 5

Environment: Parking Lot
Activity: Backing Out



Pedestrian Scenario 1

Environment: Parking Lot
Activity: Backing Out

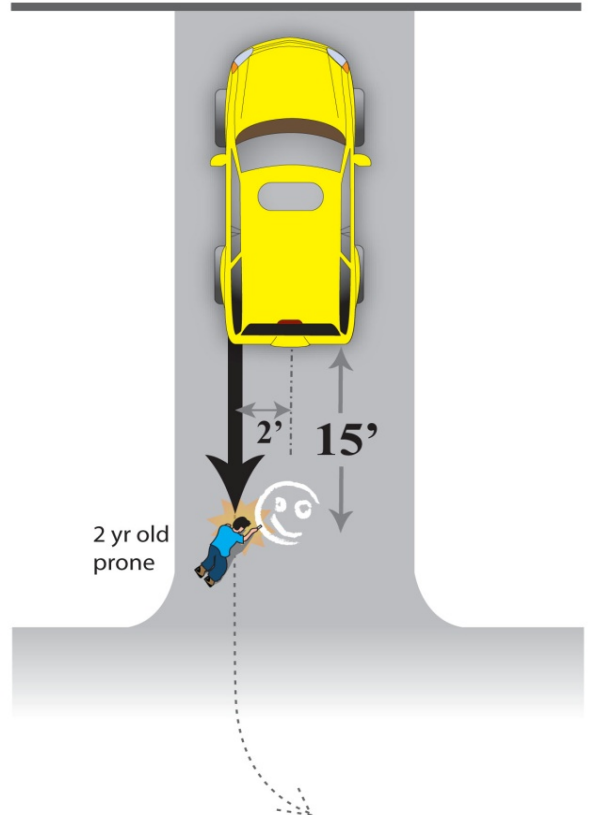


Backing out of Driveway

Pedestrian Scenario 3

Environment: Driveway

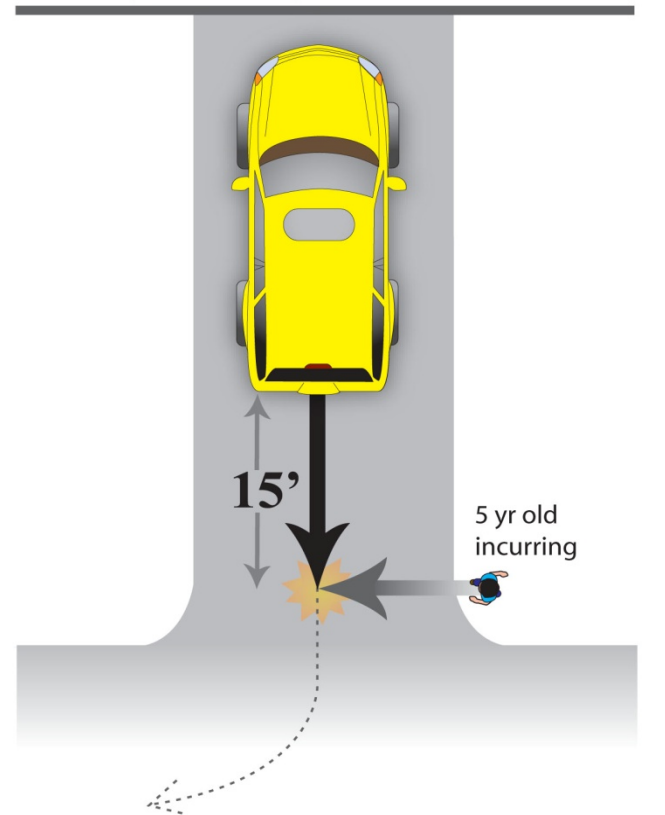
Activity: Backing Out



Pedestrian Scenario 4

Environment: Driveway

Activity: Backing Out

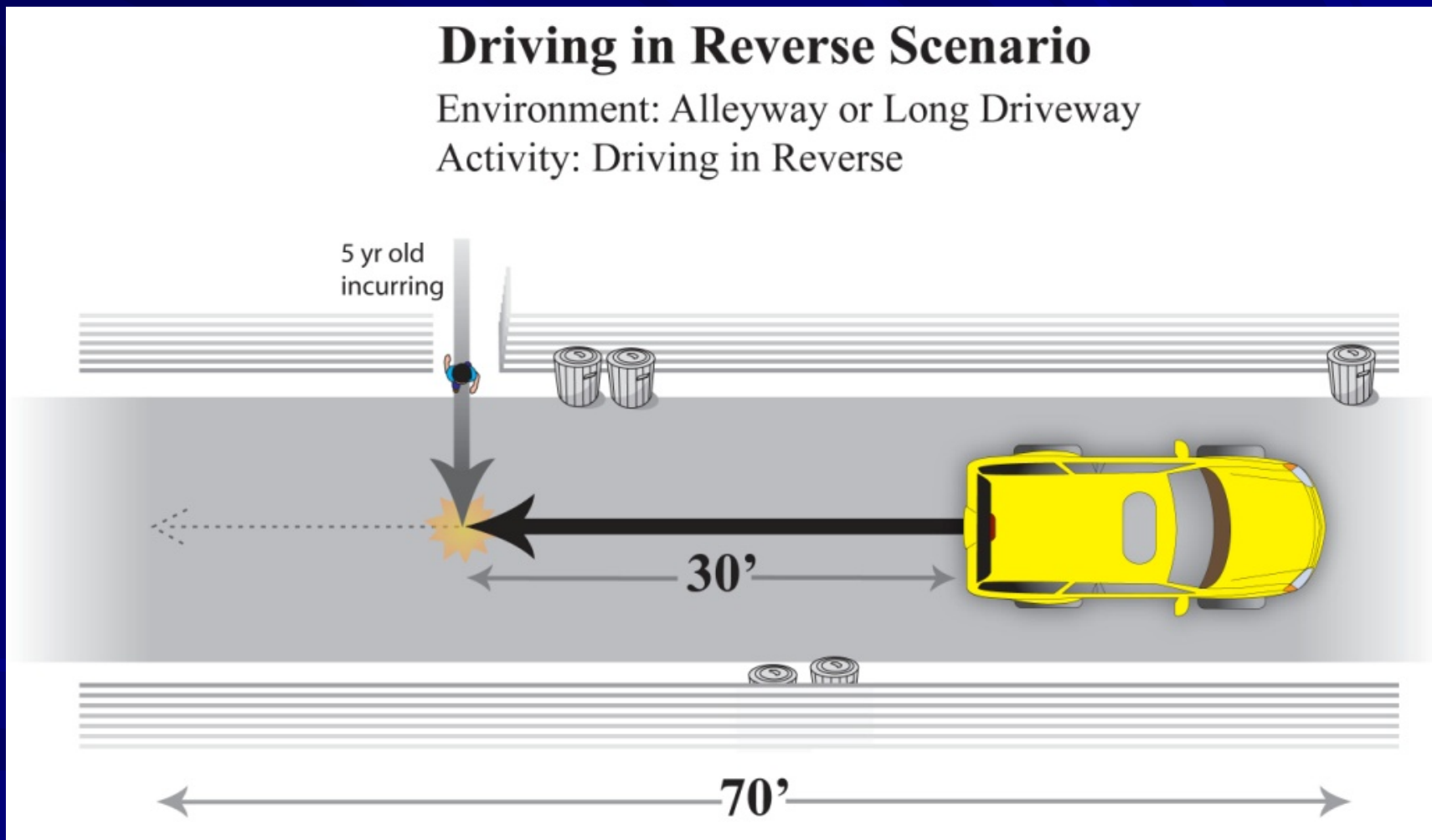


Driving in Reverse

Driving in Reverse Scenario

Environment: Alleyway or Long Driveway

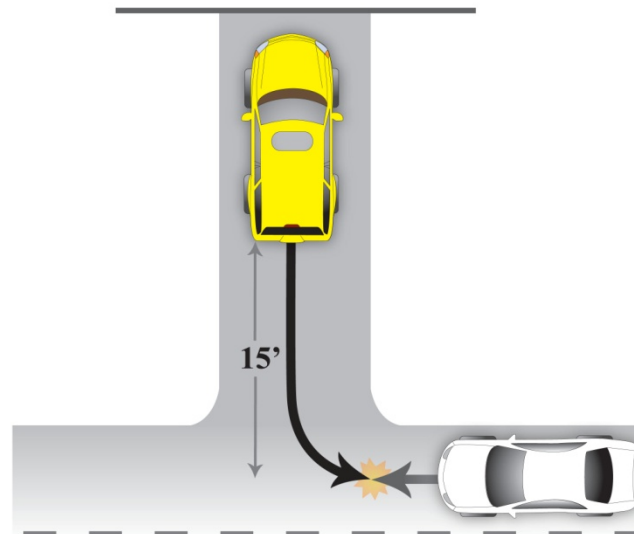
Activity: Driving in Reverse



Vehicle to Vehicle Scenarios

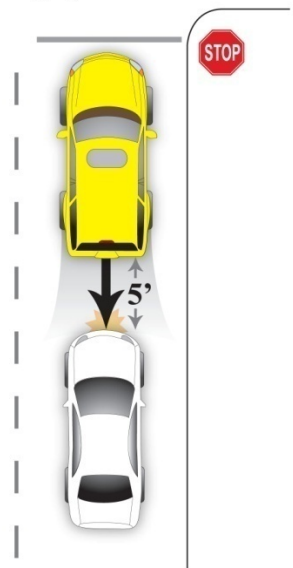
Vehicle Scenario 2

Environment: Driveway
Activity: Backing Out



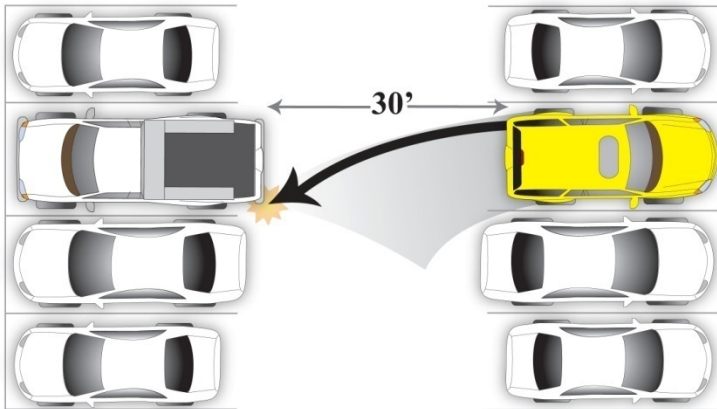
Vehicle Scenario 1

Environment: Roadway
Activity: Backing Up



Vehicle Scenario 3

Environment: Parking Lot
Activity: Backing Out

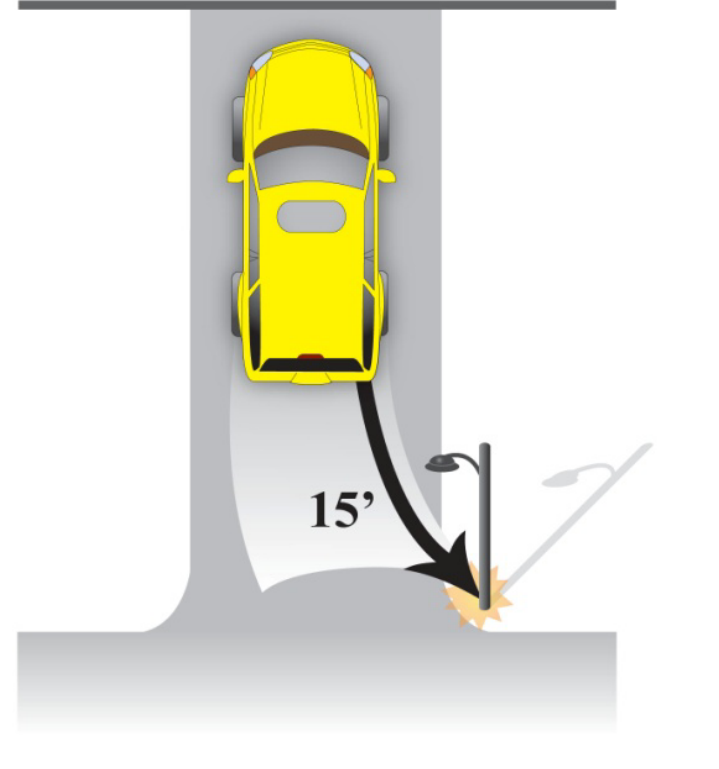


Fixed Object Scenario

Fixed Object Scenario

Environment: Driveway / Roadside Junction

Activity: Backing Out



Backing Objective Tests

Grid Test	Trained Observer	Test of System Response over Coverage Zone	<ul style="list-style-type: none"> ■ Proximity based & warning based ■ Static & dynamic vehicles and objects ■ Evaluate performance detection system ■ Establish zone of coverage
False Alarm	Trained Test Driver	Determine false alarm rate performance	<ul style="list-style-type: none"> ■ Driveway, garage, parking lot ■ Test against items commonly found in test environments ■ Assess false alarms
Driver In Loop	Naïve Subjects	Evaluate countermeasure effectiveness for conflict scenarios	<ul style="list-style-type: none"> ■ Static and incurring objects ■ Evaluate drivers interaction with system ■ Evaluate crash avoidance performance ■ Data and result support SIM

Test Objects – The Surrogates

■ Surrogate Pedestrian

- Designed to have same signature as real life equivalents
- 5 yr old, 2 yr old
- Different positions (standing, sitting, lying down)



■ Pole

- Surrogate vehicle

■ Static and dynamic situations



ACAT Backing Summary

- Task 1
 - Preliminary SIM developed and tested
- Task 2
 - Draft Crash Scenarios and Countermeasure descriptions
- Task 3
 - Objective tests indentified
- Task 4
 - Testing being conducted