Indirect Visibility Safety Research for Heavy Vehicles

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Background

- Large trucks involved in over 28,000 lane change/merge crashes between April 2001 – December 2003 (Starnes, 2006).

- Data from crash data base studies and naturalistic studies indicate lane change/merge crashes to be a big problem, particularly between light vehicles and heavy vehicles.

- Camera/Video Imaging Systems (C/VISs) are becoming more prevalent on heavy vehicles.
Indirect Visibility Safety Research

Three research phases in this program:

1. Development of a Performance Specification for Indirect Visibility Systems on Heavy Trucks
2. Enhanced Camera/Video Imaging Systems (E-C/VISs) for Heavy Trucks
3. Field Demonstration of an Advanced Heavy Vehicle Indirect Visibility System
Camera/Video Imaging Systems

- Enhancements & Surrogates
- Daytime
- Highway and Backing Tasks
- Investigated 9 Configurations
VTI
Driving Transportation with Technology
Highway Task

Light Vehicle Alongside With Overlap

Rear of Trailer
Clearance/Overlap Task

Percent Correct (%)

Baseline
CVIS

Enhancement
Summary

- Great promise for the enhancements tested and show that surrogates are by-and-large capable of competing with mirrors
- Enhancements generally provided improvements
- Convex C/VISs can be recommended without hesitation because they are capable of producing results similar to actual convex mirrors
- Systems were well-accepted and received high ratings
Enhanced Camera/Video Imaging Systems

- Objective: Better visibility and better situation awareness for heavy vehicle drivers, along sides and to the rear, using Enhanced Camera/Video Imaging systems. Emphasis on nighttime and inclement weather.
Nighttime and Inclement Weather?

- Nearly 35% during low ambient light conditions
- 15.2% during inclement weather
Static Testing

VTI Driving Transportation with Technology
Outdoor Facility Video
Static Tests

Illuminator Mounting Positions and Camera Placement
Dynamic Testing
A three-channel E-C/VIS is feasible.

Rear camera should be a wide-angle multipurpose look-down camera.

System operates from total darkness (B/W) to bright daylight (color).

IR illuminators work well at night for dark objects, 940nm.

Cameras must be capable of switching from B/W to color, must be sensitive to near IR.

Image processing producing outlines of objects is helpful.

All performance, eye glance, and ratings data appear promising.
Field Demonstration of an Advanced Camera/Video Imaging System

Assess safety and driver performance benefits of enhancing the west coast style mirrors with an Advanced Camera/Video Imaging System (A-C/VIS) in a real-world, revenue producing, driving environment.
Driving Transportation with Technology
## Project Goals

- Identify and evaluate a commercially available system and compare with baseline
- Develop and evaluate an A-C/VIS and compare to baseline
  - Approximate the performance specs developed in previous phases
  - Smaller, weatherproof camera assemblies with anti-bloom technology
  - In-line machine vision processing modules
  - IR illumination from tractor and trailer
  - DVI for control of display brightness and processing level
- Showcase the technology in a field demo
Method Highlights

- **Independent Variables**
  - System Type: Commercial System, A-C/VIS
  - Condition: Displays Off - Baseline (4 wks), Displays On (12 wks)

- **Study Implementation**
  - 6 vehicle (3 per system type): Married tractor and trailer
  - 12 CDL-A drivers (6 per system type)
  - Daily out-and-back drivers
Reduce and Analyze Data

- Identify the number of safety critical events (SCE)
  - Sample eye glance

- Characterize LCs performed w/wo systems
  - Identify 1000 lane changes (500 w, 500 wo)
  - Single Vehicle Lane Change Behavior
    - Duration, direction, type, turn signal use
  - Other Vehicle Behavior
    - Distance, approach rate, location, type
  - Environmental Variables
  - Sample eye glance

- Driver Ratings
Timeline

- 30 months
- Started in August, 2008
Thank You!!

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