Human Factor Issues of Driving Assistance Systems

Forum on Advanced Vehicle Safety Technology

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Human Factor Issues of Driving Assistance System

- Background
- Assessment of Pre-Collision Driver Factors
- Current Pre-collision System Capabilities
- Development of a Driver Monitor System
- Development Challenges
- Future Research Needs

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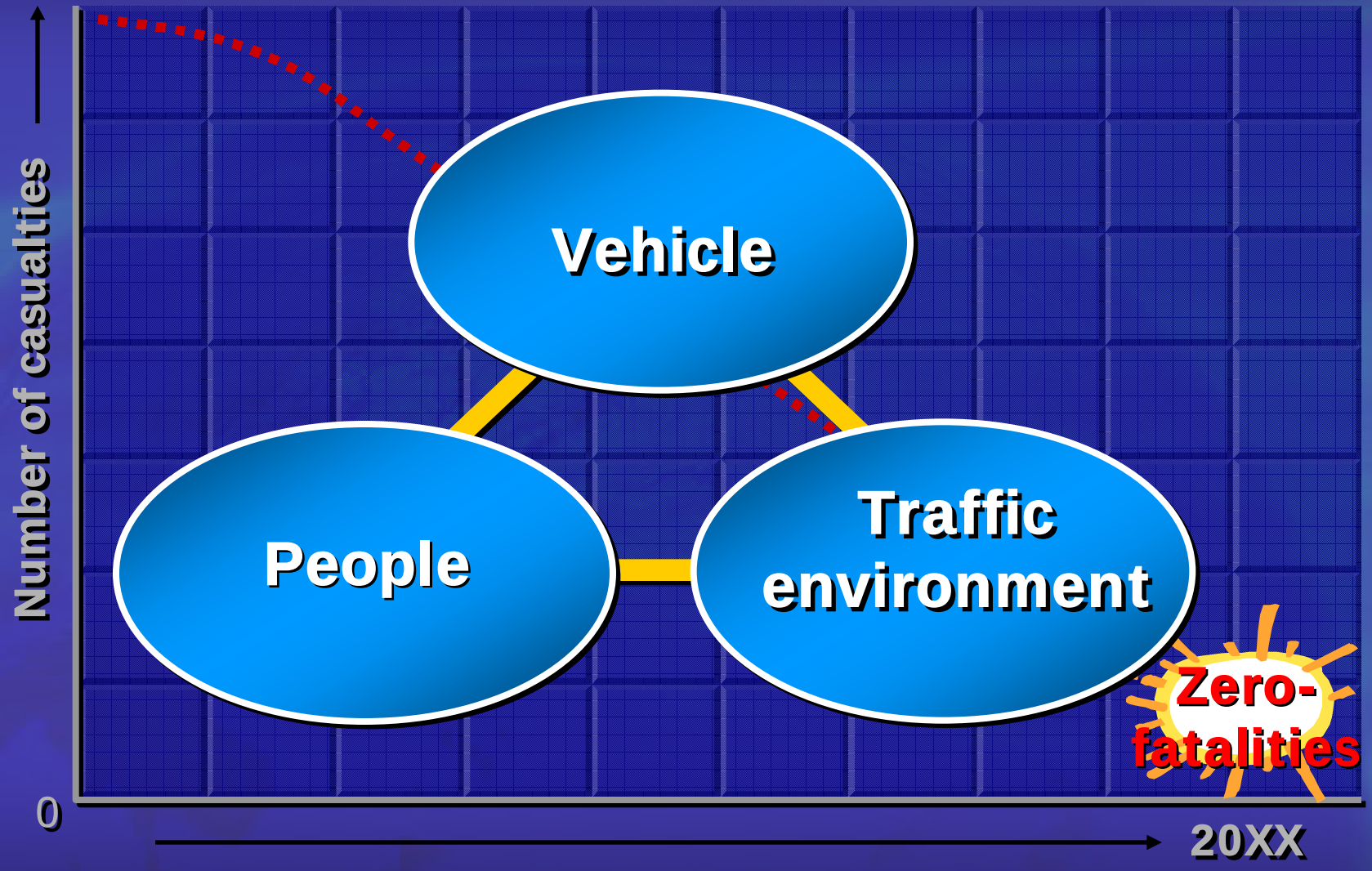
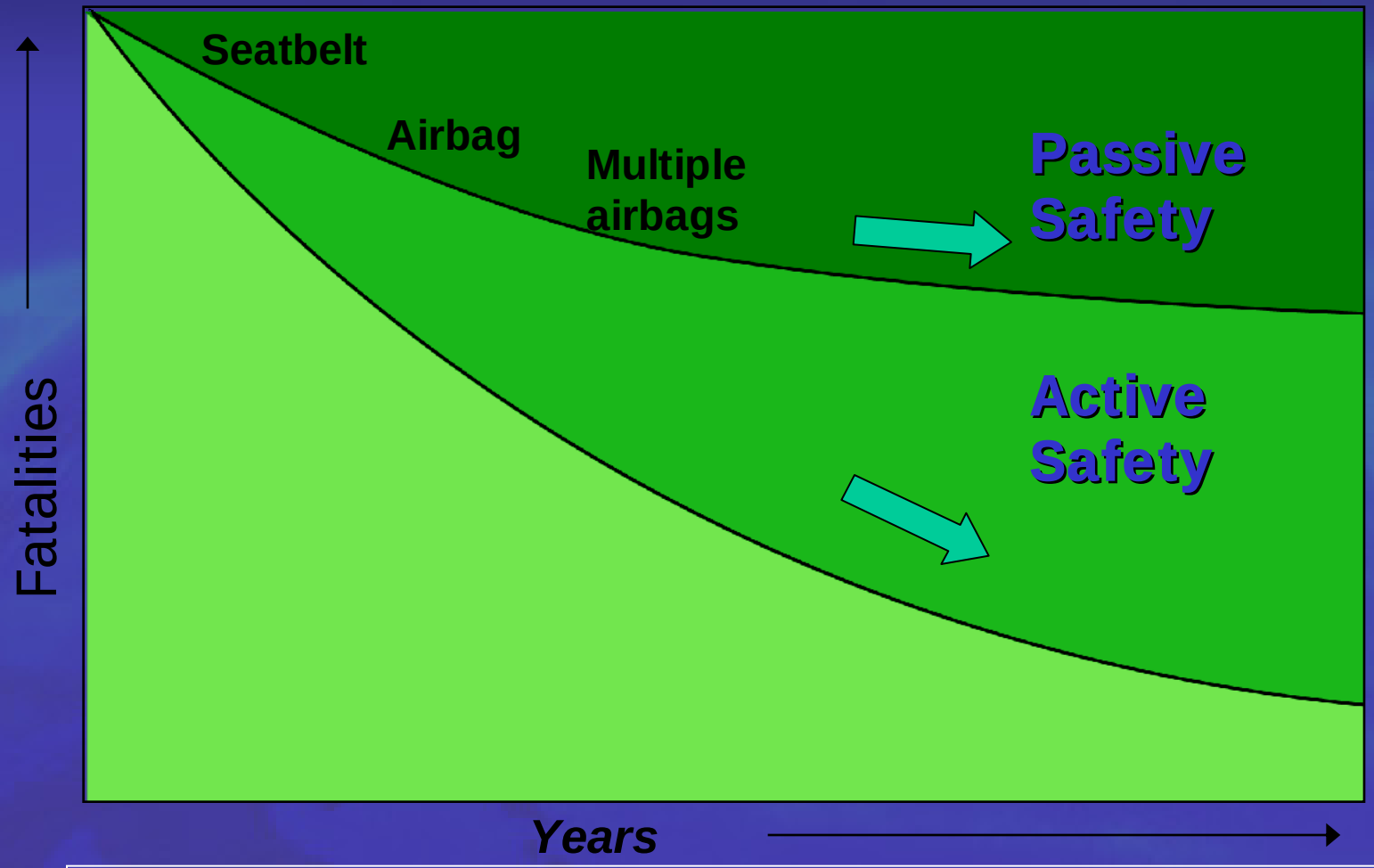
Background


Number of casualties
0
Vehicle
People
Traffic environment
Zero-fatalities
20XX

Potential Fatality Reduction by Safety Devices



Active Safety has a significant potential to reduce fatalities

Advancement of Active Safety Systems

Active safety

Safe driving

Accident avoidance

Crash prediction

Accident occurs

Driver visibility assistance
-Adaptive Front light system
-Blind corner monitor

Driver assistance
-Lane Keeping assist
-Lane departure warning

Integrated control
-Navigation-coordinated shift control
-VD I M

Autonomous safety support
-Forward collision avoidance assist system

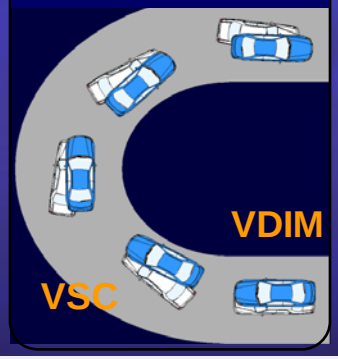
V –V & V – I Coop. Safety

Dynamic Limit control
-ABS -Brake assist
-TRC
-VSC

2000

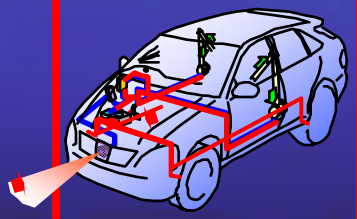
Improvement of passive safety by prognostication
-Pre-collision safety system

VSC & VDIM

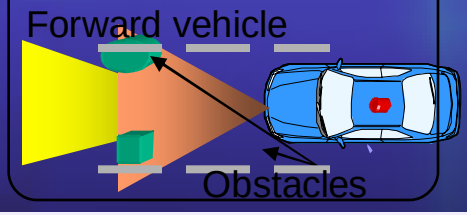


Lane keeping assist

Pre-collision safety



Forward collision avoidance assist system



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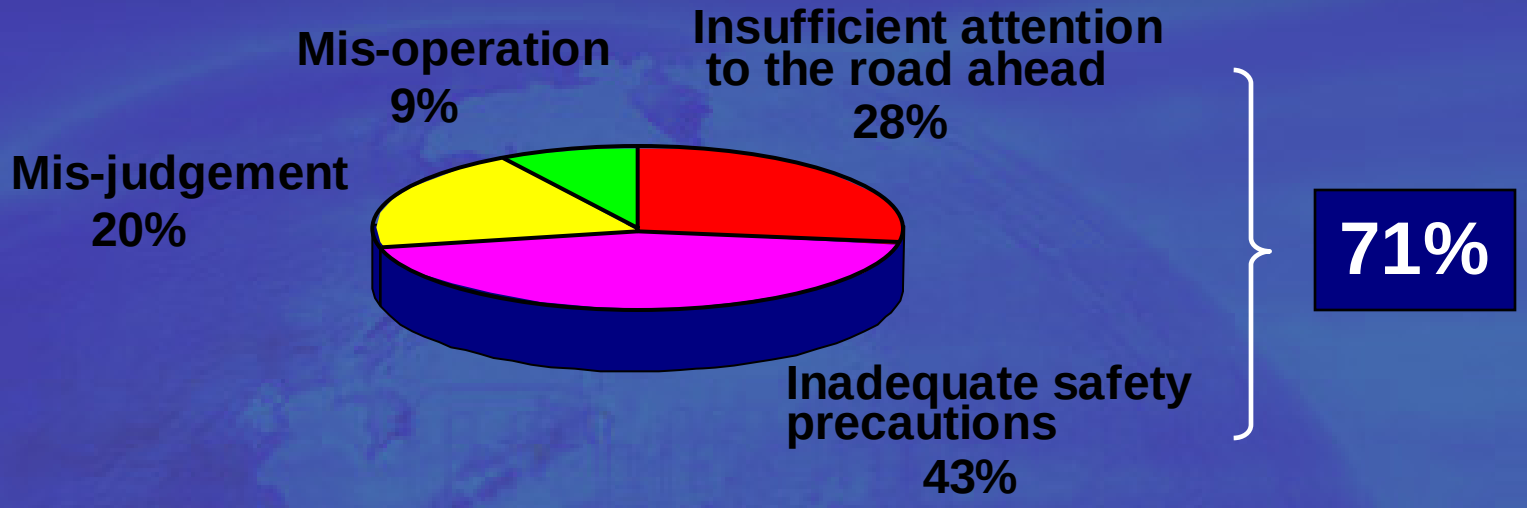
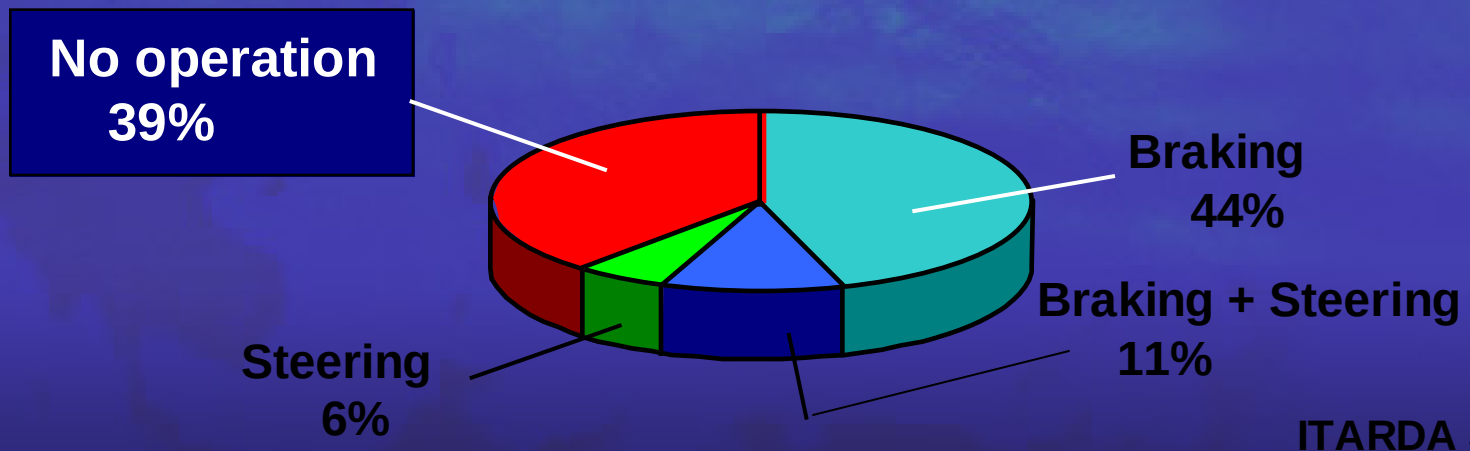
Accident Cause Analysis in Japan

Total fatal/serious injury accidents (61,531 cases)

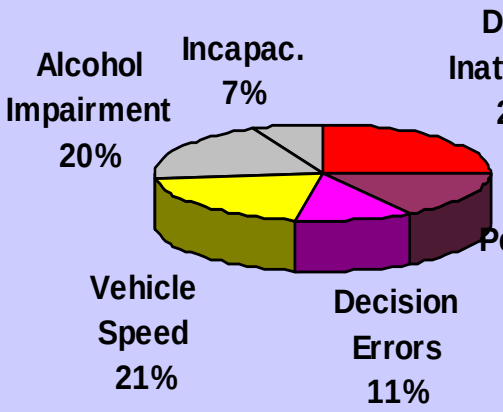


(Frontal crash ; 1,031 vehicles)



ITARDA Japan 2001

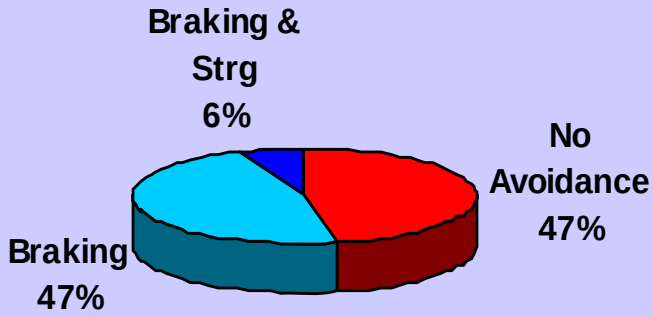
Relevant U.S Accident Data



n= 732 (NASS)

"Relative Frequency of Unsafe Driving Acts…"

Veridian/ NHTSA



n= 15

"100 Car Study"

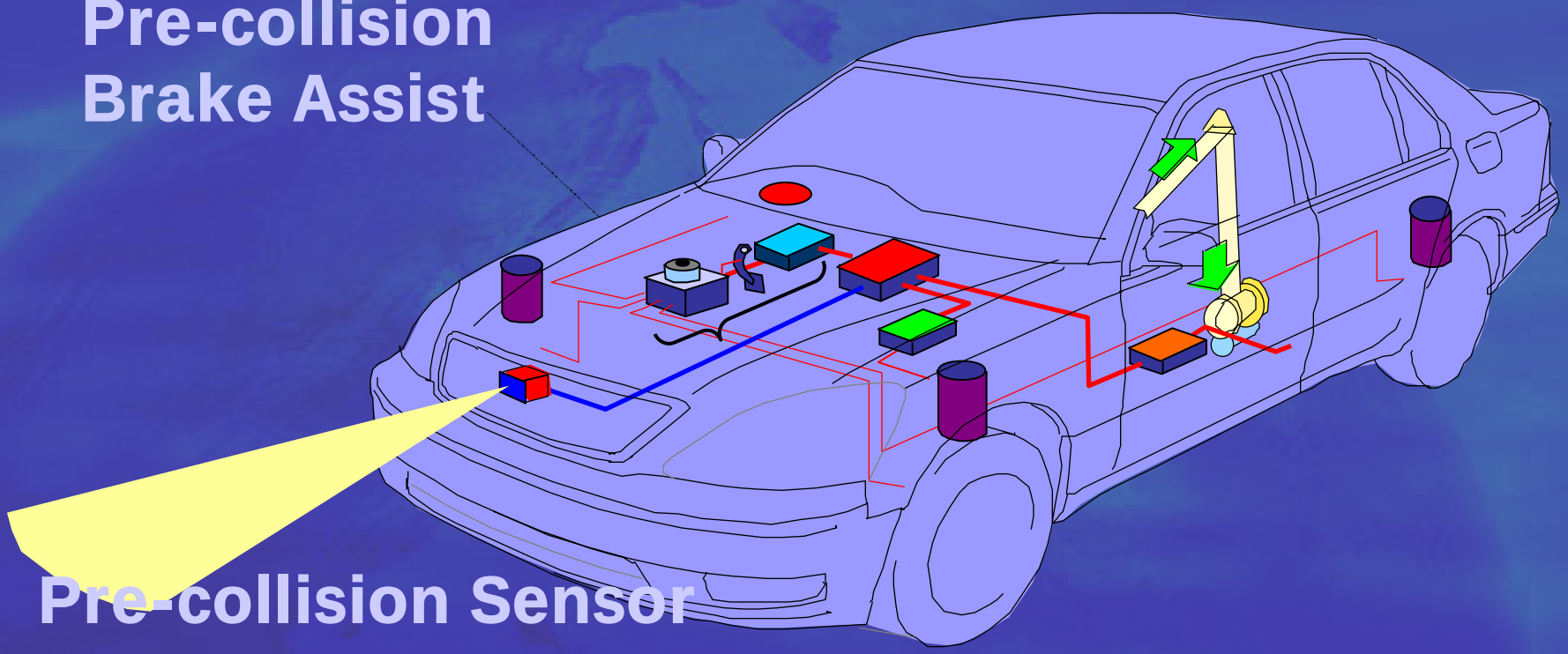
VTTI/ NHTSA

HMI Principle of Pre-Collision Safety

1. The warning system should only be activated when a collision is imminent.

2. Warnings should be provided at the appropriate time so that the driver can perform an evasive maneuver

Pre-Collision System – Reducing collision damage



The pre-collision sensor detects forward obstacles and determines in advance whether a crash is imminent.

Driver face direction sensor

Warning Timing of Advanced PCS

Monitoring the driver

Non-Front

Front

Advance warning

Collision

4 3 2 1 0

Time to collision

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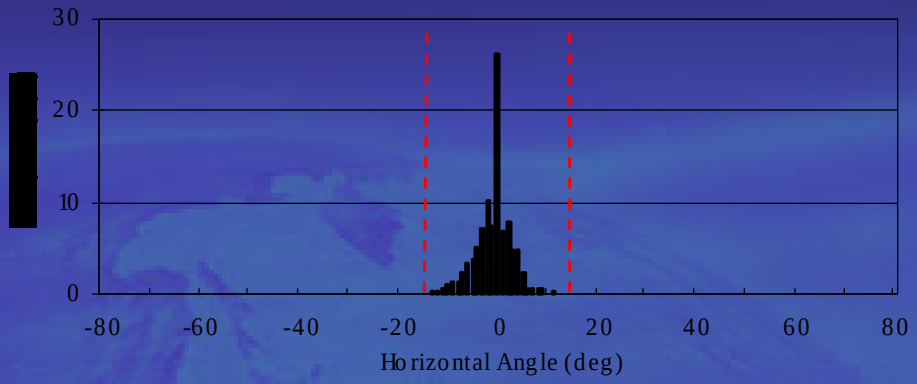
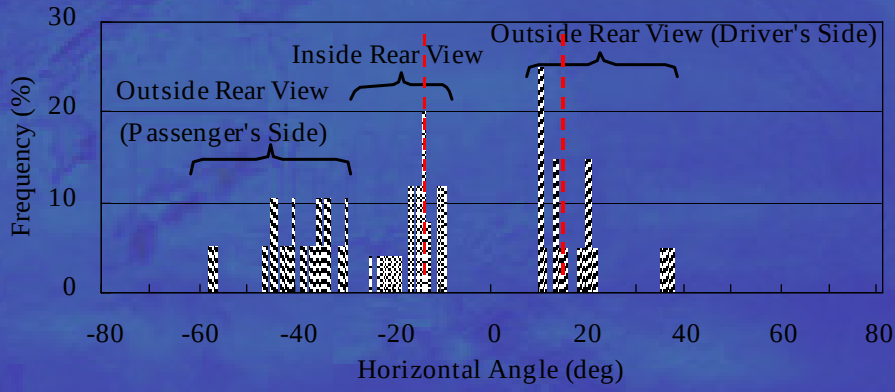
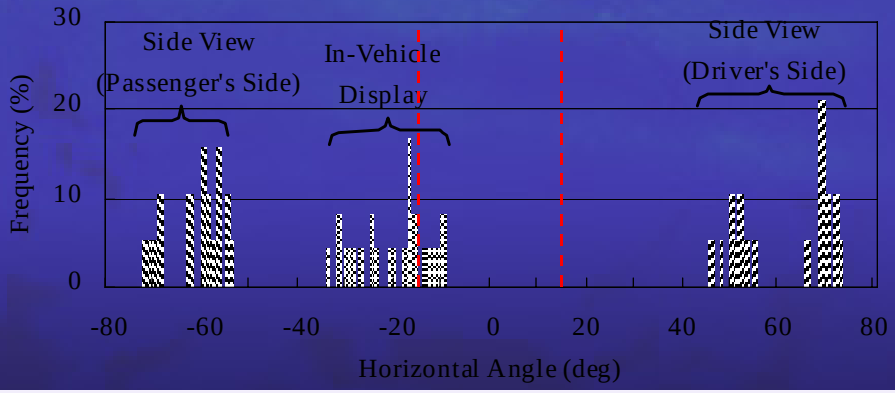
Example of Human Factor Research

Front status

Non-front status







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Some Challenges of Developing a Driver Face Monitor

- Robust driving scenarios
- Differentiation of mirror checks and secondary task or outside glances.
- Repeatable, accurate visual images
  - Facial differences
  - Varying lighting conditions
  - Corrective or sunglasses

Future HMI Research Needs Related to AVST

- Improved human models to more accurately define driver mental/physical condition (inattention, drowsiness, drunk,)
- Data regarding human behavior & information needs with cooperative safety systems (V-V, V-I, etc.)
- Pre-collision driver behavior data and interaction with AVST
- Recommendations for optimal stimulus for restoration of drivers' attention (voice, vibration, smell, etc).
- Enhanced & accessible research databases


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moving forward
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END

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