

# THE ROLE OF SYSTEM TRAINING AND EXPOSURE ON CRASH WARNING EVALUATION

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## Study Aim

Examine how differences in familiarity with the FCW and LDW systems affect the ability to evaluate a system DVI.

This was accomplished through different levels of training on the system and associated alert modality and whether participants were exposed to the alert in the vehicle prior to receiving it during an FCW or LDW event.

Two components of system familiarity:

- system training (awareness of the presence of the system)
- prior exposure to the system warning

Data collected on the National Advanced Driving Simulator's NADS-1



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## METHODS AND MATERIALS

Two levels of training on the systems:

- **No training** on a system being present
- **Training** on material similar to that included in a vehicle owner's manual

Two levels of exposure:

- **No exposure** prior to the imminent event
- **Exposure** at the beginning of the drive

Three levels of alert modality:

- Haptic (FCW seatbelt tensioner, LDW steering wheel vibration)
- Auditory (FCW repeated beeps, LDW acoustic alert)
- Haptic/active (FCW = brake pulse, LDW steering wheel torque)

Two secondary tasks:

- Number recall task - presented to the driver to take attention from the forward roadway that would allow LDW and FCW events to be triggered.
  - 15 instance throughout drive without an FCW or LDW event
  - 3 coupled with LDW event
  - 2 coupled with FCW event
- Headway maintenance task – participants maintained a specified headway to a lead vehicle by keeping the needle of a headway gauge in a green zone

96 enrolled participants between the ages of 35 and 55 completed all study procedures.

## PROCEDURES

Participants were told that the goal of the research was to evaluate several new in-vehicle technologies, when in fact their response to surprise LDW and FCW events was being evaluated.

Two different training presentations were used.

- With a description of the FCW and LDW systems
  - Without a description of the FCW and LDW systems
- Both provided detail on the secondary tasks to be performed. Participants practiced the number recall task before going into the simulator.

Exposure to system alerts occurred in first few minutes of drive if provided to participants.

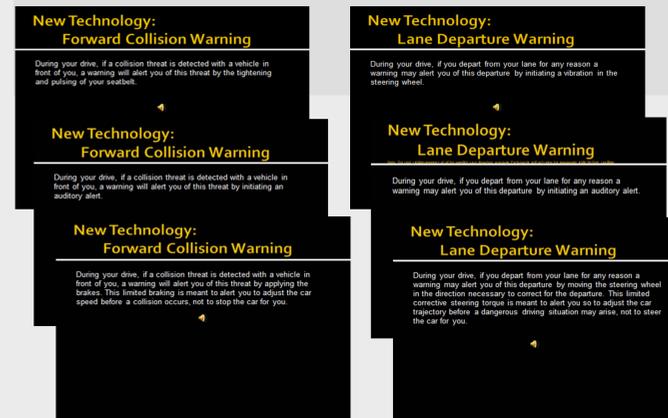
## SCENARIOS

The drive:

- Practice portion - a low-speed urban environment
- Data collection - two-lane rural roadway with intersections where the speed limit alternated between 40 and 55 mph
- Daytime, dry roads, fair weather

Events:

- FCW events
  - Stopped lead vehicle was revealed by the lead vehicle changing lanes to pass
  - Warning sounded at a TTC of 2.1 seconds
- LDW event
  - Lateral push was provided toward the closest lane boundary with no motion feedback
  - Alert was provided at 4 inches from the lane boundary.



Training Slides



Number Recall Task

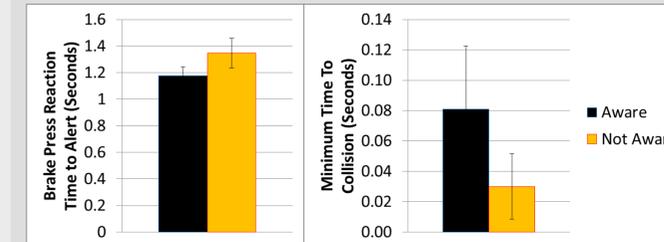


Headway Display.

## RESULTS

Safety - Response to the alert

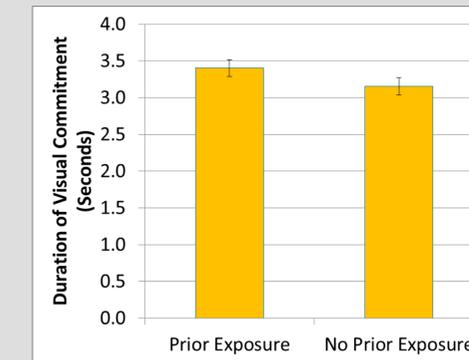
- Lane departure events
  - Training – no significant effects
  - Exposure – no significant effects
- Forward crash events
  - Training - two significant effects
  - Exposure – no significant effects



Training Effect for FCW

Ability to execute events - Visual commitment

- Lane departure events
  - Training - no significant effects
  - Exposure – visual commitment to secondary task durations were longer by ~250 ms with prior exposure



Exposure Effect for LDW

Protocol efficiency – Participant attrition due to invalid events: i.e., did not have at least one valid lateral and longitudinal event.

- Training – no differences
- Exposure – more attrition without exposure

	Additional Participants Needed	
	Training	No Training
Exposure	2	6
No Exposure	13	7

## CONCLUSIONS

Training

- No benefit or dis-benefit

Exposure

- Providing exposure resulted in
  - Longer visual commitments to secondary task allowing execution of event
  - Lower participant attrition resulting in a more efficient experimental protocol

## ACKNOWLEDGEMENTS

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