Using Driver Simulators to Measure the Impact of Distracted Driving on Commercial Motor Vehicle Operators

This study addresses the impact of various distractions on commercial motor vehicle (CMV) operators. Using state-of-the-art driving simulators in realistic traffic, this project focused on CMV operator performance as drivers experienced distractions in several driving scenarios. Scenarios placed drivers in situations such as congested traffic, highway driving, and work zones. These situations were combined with various distractions that competed for drivers' attention.

PROCESS

This report describes research completed to study driver distraction among CMV operators. Instead of engaging in crash analysis or naturalistic driving studies, the research team used a motion-based driving simulator to ensure driver immersion and the reduction of simulation adaptation syndrome (SAS), or motion sickness. To keep the study as realistic as possible, researchers conducted a thorough front-end analysis (with trucking companies) of common complaints and issues related to distracted driving.

The team chose two common handheld devices that are major issues for today's CMV operators: touchscreen audio (Mp3 players) and cell phones. The study required drivers to use these devices at different points on the simulated highway scenario. In addition, some scenarios included external distractions. This experimental design provided accurate results about the use of the two devices, both alone and in a variety of combinations. The results of these interactions were measured using simulator data output, trained observers, and an electroencephalography/ electrocardiography (EEG/ECG) device.

Figure 1. Grouped photograph. Screenshots of the simulator, simulated vehicle, and participant.

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STUDY OVERVIEW

All 25 drivers who voluntarily participated in this study were professionals from commercial and independent companies who had at least 5 years of CMV driving experience. The researchers collected performance and physiological data. The equipment was chosen to guarantee that the experiment was conducted in a controlled and safe fashion. Researchers provided participants with an Mp3 player to use during the simulation, along with instructions on how to use the Mp3 player. By doing this, the research team was able to control variability in Mp3 player use among skill sets. Participants were required to bring their own cell phones to ensure familiarity with those particular handheld devices and to reduce the need for additional training. Table 1 shows the different driving scenarios and their conditions used in the study.

Table 1. Driving scenarios and driver distractions.

Scenario	Distractions Used in Driving Scenario
1	No devices used; this was the control scenario
2	Cell phone alone
3	Mp3 player alone
4	Cell phone and Mp3 player
5	External event only
6	Cell phone and external event
7	Mp3 player and external event
8	Cell phone, Mp3 player, and external event

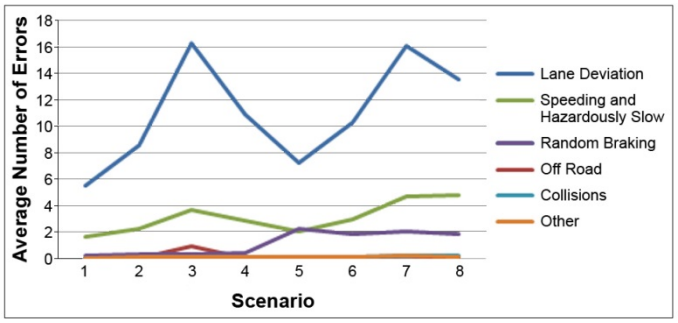
STUDY FINDINGS

The types of distracted driver errors and their percentage of total driver errors are summarized in Table 2. Figure 1 displays the average number of driver errors per error type per scenario.

Table 2. Types of distracted driver errors.

Type of Driver Error	Percent of Total Errors
Lane deviation	71%
Speeding violations (e.g., too slow or too fast)	20%
Off-road and/or dangerous braking violations.	8%
Collisions or other	1%

Figure 1. Line chart. Average number of errors per type for every scenario.



The results of this investigation show that the use of a cell phone, the use of a touchscreen Mp3 player, the presence of external distraction(s), or any combination of the three causes deficits in driving performance. Overall, both performance and physiological measures showed evidence of driver distraction. Performance measures suggested that the largest performance deficiencies came from actively using a touchscreen Mp3 player. Physiological measures (e.g., EEG) showed that both Mp3 players and cell phones increased workload and decreased attention.

RECOMMENDATIONS

To influence and change drivers' behavior, the research team believes that distracted driving studies should be accompanied by awareness campaigns that include outreach to influence not just CMV operators, but the general public, as well.

After the experiment, drivers provided testimonials that were recorded on video for use in outreach activities. Outreach efforts were focused on the following:

- Presentations by the researcher at local college campuses.
- Advertisements, news stories televised by local news stations, and video-sharing Web sites.
- Articles were submitted to the Transportation Review Board, as well as several other non-academic publications.

This study was completed by Ronald W. Tarr, Senior Research Faculty, at the University of Central Florida, using State Motor Carrier Safety Assistance Program (MCSAP) grant funds.

For more information, please visit: http://ntl.bts.gov/lib/55000/55100/55167/13-048_Distracted_Driving_-_FINAL_-_June_2015.pdf.