THE VIRTUAL CHECK RIDE AS A DIAGNOSTIC AND REMEDIATION SYSTEM

Ron Tarr, James D. Whitmire II & Kamini Gupta

The Florida and U.S. Departments of Transportation have identified safety and operator performance as major objectives in addressing the inter-modal transportation needs of the state and nation. The Florida Department of Highway Safety and Motor Vehicles is working diligently to address the issue of safety on Florida’s roads by developing and enforcing standards and certification of Commercial Driver License (CDL) training and issuance, as well as continual monitoring via enforcement (Sanders, 1994). The Florida Trucking Association (FTA), representing the commercial industry side of the community, is likewise very concerned and is also taking steps to deal with these challenges. Clearly the issue of safety and the proper training of persons who will be operating a heavy truck are of great concern to all of us in the community. Driver training, safety, security, performance enhancements and accident reduction are priority issues in the truck driving industry. The VCR (Tarr, Kincaid, Long & McCloy, 2002) is a simulated knowledge and skilled-based diagnostic and remediation system for professional truck drivers, using multimedia blended simulation that includes computer-based training (CBT) elements. While the implications of the VCR are rich with possibilities, the goal of this research is to validate and verify the VCR system within the trucking community.

Virtual Check Ride Overview

The VCR System and computer-based training section reflects the requirements set forth by the CDL testing process for the class A, B and C driver’s license. In addition, the class E driver’s license test is being incorporated into the diagnostic and remediation system. However, the thrust of this paper explores the class A driver’s test which consists of three test categories: the Knowledge test, Endorsements and the Virtual Pre-Trip Inspection. When an individual sits down at the computer to take the test, they start with the Knowledge Test and flow linearly though the three different sections as they would in the actual CDL test. The CBT system tracks the scores for each section and provides a percentage for each section as well as an overall score. The overall score must be 80% or higher in order to move on to the Virtual Pre-Trip Inspection. Should the overall score of 80% not be achieved, the individual must retake the sections of the knowledge test where deficiencies were noted in order to proceed. Upon completion of the Knowledge Test, the driver will continue to the Virtual Pre-Trip.

The Virtual Pre-Trip Inspection is a ‘part identification’ test that assesses the driver’s knowledge on part location and name. After the part identification is addressed, a series of questions on possible defects pertaining to that particular part are presented to the driver trainee. The test is comprised of 117 inspection points and a driver must match the part with its correct name. To pass the Virtual Pre-Trip Inspection, a driver must identify a minimum of 83 inspection points. Should the driver not identify at least 83 inspection points a report will be generated identifying the parts that were not named correctly and
that can be utilized as a study guide focusing on areas of concern. Figure 1 illustrates a sample page from the Virtual Pre-Trip part identification test.

![Virtual Pre-Trip Inspection](image)

**Figure 1: Virtual Pre-Trip**

Upon completion, the driver will move on to the previously validated simulated driving scenarios and their driving performance will be assessed during the test scenario by a third party examiner. The third party examiner will perform their duties as they would in an actual truck and the driver will be asked to drive though the different types of driving conditions mandated by the CDL process. The different areas are: on-pad driving maneuvers and off-pad driving skills assessment, which consist of urban driving, city driving and rural driving. The third party examiner will assess the driver as they would in an actual real world driving environment and pass or fail the driver. Should the driver fail, they will have to re-do the entire simulated driving scenarios at a latter time.

**Virtual Check Ride Remediation**

The current CDL driver’s manual (State of Florida, 1998) questions are designed to test drivers in select skill areas; however, at the conclusion of the test no feedback is given to the potential CDL driver. The VCR diagnostic and remediation system identifies weaknesses (Table 1) in various skill areas through specific questions and takes the driver through web-based links to the specific area in the CDL manual that addresses the driver’s weakness.

<table>
<thead>
<tr>
<th>Table 1: Skill Areas</th>
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<td>Vehicle Inspection</td>
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[Diagram of Vehicle Inspection]
Sample Questions: Skill Areas

The following questions are examples from skill areas within the VCR. If a driver scores below 80% in any of these areas he will be directed to remediate his or her weakness. This is accomplished by hyperlinks that direct the user to the actual CDL manual.

**Basic Control of Your Vehicle**
- Why should you back toward the driver's side?
- If stopped on a hill, how can you start moving without rolling back?
- When backing, why is it important to use a helper?
- What's the most important hand signal that you and the helper should agree on?

**Shifting Gears**
- What are the two special conditions where you should downshift?
- When should you downshift automatic transmissions?
- Retarders keep you from skidding when the road is slippery. True or False?
- What are the two ways to know when to shift?

**VCR Remediation Interface**

Figure 2 illustrates the user interface for CDL remediation. It gives the driver trainee feedback on what sections the test questions originated from as well as the skill area within that particular domain. The skill areas are hyperlinked to the appropriate topics in the CDL manual. Further remediation is being developed to address skill areas by directing the driver trainee to appropriate training modules.
Validation Process

The validation process has been a continuous progression requiring constant review. We have collected more data than can possibly be discussed or presented within the confines of this paper. For this reason we will address two areas, steering technique and the alley dock procedure as it pertains level of experience. Steering technique refers to the use of both hands during a particular time period within the test scenario. The alley dock (Figure 3) is a backing procedure that includes a proper set-up and backing towards a delivery dock for the off loading of freight.
Apparatus

The apparatus for this validation included, the TransSim VSIII 3-Channel simulator (Figure 4) consisting of three channel plasma screens with resolutions of 1024 * 768. The Field of View (FOV) is 180 degrees. The simulator is equipped with real time simulator-controller that loads and executes scenarios at an update rate of 70 Hz. Own cab vehicle consists of audio, special sounds effects and playback for After Action Review (AAR). The TransSim VSII 1-Channel simulator (Figure 4) consists of one plasma screen with the resolution of 640 * 480. The simulator controller loads and executes scenarios. It is equipped with audio, sound effects and play back for AAR. This 1-channel simulator has FOV of 52 degrees.

![Figure 4: Three-Channel & One-Channel Simulators](image)

Participants

There were three groups of participants (126 total) included in this study. The first group included 26 drivers with a mean age of 35, with a mean of 17 days of driving experience. The second group included 50 drivers, also with a mean age of 35 years and a mean of 7 days of driving experience. The third group included 50 drivers with a mean age of 42 and a mean of 13 years of driving experience.

Procedure

This experiment was conducted at three different locations, two truck driving schools and one large company. Truck driving school one is located in Orlando, Florida, school number two is in Greenbay, Wisconsin, and the third is a nationwide company that is also located in Orlando. Truck driving school one (Novice 1-Channel Simulator Group) is a three week program for CDL test preparation and the students were in the second week of
School number two (Novice 3-Channel Simulator Group) is a two week CDL preparation program and the drivers were in the first week of training. The company drivers (Experienced 1-Channel Simulator) all have multiple years of driving experience (Mean = 13 Years). Data collection was done by third party examiners (state certified for CDL testing) and took up to two weeks to complete. Data collection score sheets were developed by subject matter experts and driver’s performance was judged and recorded by the third party examiners.

**Steering Technique**

The research question for steering technique: Is there a relationship between the amount of experience and the use of both hands for novice and experienced truck drivers. The mean changes in performance can be found in Figure 5. An ANOVA was significant, $F(2,112) = 14.32, p = .01$. The effect size was strong, $N^2 = .20$. Follow-up tests were conducted and the Games-Howell procedure was used. The results of this analysis indicate that there is a significant drop in the use of both hands in the experienced group as compared to both novice groups.

![Group Means](chart.png)

**Alley Dock**

The research question for alley dock: Is there a relationship in the population between the amount of experience and successful execution of an alley dock. The mean changes in performance can be found in Figure 6. An ANOVA was significant, $F(2,105) = 12.72, p = .01$. The effect size was strong, $N^2 = .20$. Follow-up tests were conducted and the
Games-Howell procedure was used. The results of this analysis indicate that there is a significant rise in alley dock success for the experienced drivers.

![Figure 6: Means for Alley Dock Success](image)

**Discussion and Conclusion**

The VCR has advanced and is evolving into a highly sensitive diagnostic and remediation system. The amount of data this system can generate is astounding. However, validation must begin with smaller components such as steering technique and alley dock. The results for the steering technique (use of both hands) indicate that the company drivers significantly reduce the use of both hands and may be a result of relaxing their attitude toward safety over the years. The use of both hands is given a high priority within truck driving schools during training. Likewise, the results for alley dock success indicate that early in the training cycle there may not be a need for a 3-Channel simulator, which is an important cost consideration when incorporating simulation into a training program. Examining this from the point of the experienced drivers, there was indeed a moderate rate of success for the drivers using the 1-channel simulator. In future studies we will be testing experienced drivers on the 3-Channel simulator and would expect an even higher rate of achievement. Other issues that we are looking at are tasks across fidelity levels. Future research will include a wider variety of simulators, including SUV, light and heavy truck simulators, to further expand the findings. The aviation community has type-classified various levels of part-task trainers and simulator devices for their contribution to achieving experience and equivalent flight time. Such a classification process would be very useful for driving training (Thomas & Hooper, 1991) and is a long term goal of this research, i.e. the establishment of a matrix of skills and types of learners against various levels of fidelity components and features.
References


