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OFFICE OF ANALYSIS, RESEARCH, AND TECHNOLOGY

Driver Distraction in Commercial Vehicle Operations

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Webinar Transcript

Presenters

- Terri Hallquist, Mathematical Statistician, FMCSA Office of Analysis, Research, and Technology (ART)

Speakers

- Dr. Richard Hanowski, Director, Center for Truck & Bus Safety, Virginia Technical Transportation Institute (VTTI)
- Kirse Kelly, Web Conference Coordinator, FMCSA ART

Description:

The purpose of this study was to investigate the impact of driver distraction in commercial motor vehicle (CMV) operations. To accomplish this, data from two large-scale naturalistic studies were combined creating a data set that included over 200 CMV drivers and seven trucking fleets operating at 16 locations, accounting for approximately 3 million miles of continuous driving. Naturalistic data collection involves the instrumentation of in-service trucks with kinematic sensors, video cameras, and other equipment. CMV drivers use these equipped trucks while they operate their normal revenue-producing runs. A total of 4,452 safety-critical events (i.e., crashes, near-crashes, crash-relevant conflicts, and unintended lane deviations) were identified in the data set, along with 19,888 baseline (non-event) epochs. Key findings were that highly complex tasks, including those involving the use of technology while driving, lead to a significant increase in risk. Eye glance analyses were also conducted to examine driver eye location while performing tasks while driving. Tasks associated with high odds ratios (increased risk) were also associated with high eyes off forward road times. Based on the results of the analyses, a number of recommendations are presented that may help address the issue of driver distraction in CMV operations.

PRESENTATION—DRIVER DISTRACTION IN COMMERCIAL VEHICLE OPERATIONS

PRESENTATION TITLE SLIDE: DRIVER DISTRACTION IN COMMERCIAL VEHICLE OPERATIONS

Julie-Ann (Operator):

Good morning, and thank you for standing by. At this time all participants are in a listen-only mode. After today's presentation we will conduct Q&A session. To ask a question, you may press ***1** on your touch tone phone. Today's conference is being recorded and if anyone has any objections, you may disconnect at this time. I would now like to turn the conference call over to today's host, Ms. Kirse Kelly. Ma'am you may begin.

Kirse Kelly (Web Conference Coordinator, FMCSA ART):

Thank you, Julie-Ann. Thanks to all of you participating in our webinar about Driver Distraction in Commercial Vehicle Operations. This webinar is part of a series put on by the FMCSA Office of Analysis, Research and Technology. As Julie-Ann mentioned, time permitting, all questions will be answered at the end of the call. You can submit questions in the **Q&A Box** which is on the left-hand side of your screen throughout the presentation. At the end of the call you will be able to both submit questions online and ask questions over the phone line.

Please note you will be able to download a copy of the presentation at the end of the webinar. If you have to leave early, you can return to this Website at a later time and the slides will be available. They'll also be available online on our FMCSA Website tomorrow or no later than Friday.

The members of the trade or local media who are participating in the call today are asked to contact the FMCSA Office of Communications. That's at 202-366-9999. Contact them at the conclusion of the webinar if you have questions.

Finally, for anyone who may have a smaller screen and perhaps this screen is only at the upper left-hand side of your computer screen, you can click on **Meeting** at the very top-left side of the screen, click on **Manage my Settings** and then choose **Full Screen**.

Let me turn you over to Terri Hallquist who is part of the ART or the Analysis, Research and Technology, Research Division. Terri?

Terri Hallquist (Mathematical Statistician, FMCSA ART):

Thanks, Kirse. Hello, my name is Terri Hallquist from the Federal Motor Carrier Safety Administration's Research Division. I would like to introduce Dr. Rich Hanowski from Virginia Tech Transportation Institute. Rich will be speaking about a study to investigate Driver Distraction in Commercial Motor Vehicle Drivers. The purpose of the study was to characterize driver inattention in safety critical events and baseline, and to determine relative risk of driving while distracted. This study was sponsored by FMCSAs Research Division and conducted by Virginia Tech Transportation Institute.

SLIDE 2: ACKNOWLEDGEMENTS

Dr. Richard Hanowski (Director, Center for Truck & Bus Safety, Virginia Technical Transportation Institute)

Thanks, Terri. This webinar highlights the findings of a study that was completed about a month ago. At this time, we're finalizing the technical report and will be sending it to FMCSA and it will eventually be published through the FMCSA publishing process, and be available in the upcoming months. The study focused on driver distraction with commercial vehicle drivers. Before I get into the details of the study, there are a few acknowledgements I'd like to make. As Terri mentioned, this was a FMCSA-funded project. Dr. Martin Walker was the Task Order Manager for the project, but I would like to acknowledge Bob Carroll who is no longer with FMCSA—he's retired. He served as the Task Order Manager early on in the project. Terri Hallquist provided technical comments and advice throughout.

This is a study that deals with a very large data set we have at Virginia Tech, a naturalistic data set. It involved a number of different trucking fleets and a couple of hundred drivers. Without the data set we certainly could not have looked at this particular issue.

SLIDE 3: PRESENTATION OVERVIEW

To give you a high-level overview of what I am going to talk about for the next 30-minutes or so, I am going to go over, again, at a very high-level, some objectives of the project, provide some background of why we think it's an important topic, and highlight some of the key literature in the area that preceded this study. Because the research I am going to talk about involved naturalistic driving, I want to highlight what I mean by naturalistic truck studies for those that don't know what that means. Then I will talk about the analysis approach we used and some key methods/concepts, highlight the research questions and then get to the results.

The final technical report is several hundred pages long—a lot of results and a lot of detail. Obviously, in the timeframe I have now, this is more like an executive summary type presentation. I picked and chose some key findings; what I think are the key findings. I will end with some recommendations I think fall out of the results and then some conclusions.

SLIDE 4: PROJECT OBJECTIVES

The objective of the project was to look at and characterize safety critical events—these are essentially crashes and near crashes, and baseline epochs. A baseline epoch is a non-event; a non-driving event. We will characterize these events and non-events that were recorded in two of our naturalistic truck driving studies. One was a study that looked at a Drowsy Driver Warning System. Another was a study we called the *Naturalistic Truck Driving Study*. I will explain the studies in a few slides from now.

As part of the analysis effort for this specific project, what we were doing was we were looking at driver tasks, or driver behaviors. We broke them up into essentially two categories of tasks. One we called "secondary tasks". These are tasks drivers engage in that are related to the driving task, like turn signal use, checking mirrors, checking the speedometer, any kind of interaction with the instrument pane, for example, that's related to driving. A second group of tasks we called "tertiary tasks". These are tasks that are not directly related to lane keeping, speed, the driving task itself, things like talking on a cell phone, interacting with dispatching devices, eating, so on and so forth. Those, we are classifying as tertiary tasks. What we did was that when drivers were involved in these tasks, we looked at their level of attention or inattention by conducting eye glance analysis. As you will see, the data set we have has video. We're able to look at the driver's face and the driver's eyes and know where he was looking before these events occurred.

SLIDE 5: TEXTING NEWS CLIPS

Is distraction a hot topic? If you have read the press lately you know that it certainly is, especially now with professional drivers. Here are just a few clips from different articles. You can look at the dates there. The first one, on the top, April 8, 2009; "A texting truck driver was arrested after hitting a school bus." The one down below, although not trucking related, it is certainly classified as a professional driver, "An engineer apparently sent text message before crash"; that was in September of last year.

SLIDE 6: TEXTING NEWS CLIPS

Most recently in Boston, the headline is "Official: Trolley Driver in Crash Texting." And just recently, a week or two ago, there was a study that came out that said "One in four Americans is texting while driving," and that was through a poll. It's certainly an area that is more prominent and has obviously led to really high-profile crashes. In that respect the timing of this particular study is really right on the mark.

SLIDE 7: BACKGROUND

In terms of background, we know that in 2007, over 41,000 people were killed in crashes and about 12 percent of those involved large trucks. If you look at cause and effect, and attributes, if you will, contributing factors to these crashes, one of the better data sets we have is from the *Large Truck Crash Causation Study*. In that study, it was noted that nine percent of crashes in that particular data set were attributed to driver inattention. That kind of gives you an idea of the problem scope. Other studies say the same thing; maybe it is 10 to 15 percent—that is the estimated percent range for driver inattention as a contributing factor or cause for crashes.

Something to keep in mind though with a lot of the studies, including the LTCCS, is they're based on site visits or police accident reports and we know these are limited, because the data is retrieved after the fact. You may have a situation where you have a crash and the driver may not remember details or they might not want to say what they were doing. There's always been this underlying concept or belief with people that do this kind of database analysis that maybe distraction-related crashes are underreported.

SLIDE 8: WHAT IS DRIVER DISTRACTION?

The concept of driver distraction—I think probably everybody's listening in has an idea of what I'm talking about. If you look back at the literature, it's really defined in a lot of different ways. You can see some of them there listed on the bullets—misallocated attention, any activity that takes the driver's attention away from the task of driving, something that distracts the attention and prevents concentration, and attention given to a non-driving related activity, typically to the detriment of driving performance. Again, all of the definitions have something in common, but it's worthwhile to point out they're not exactly the same.

SLIDE 9: DRIVER DISTRACTION CONTINUED

As we scoured the literature before we got into the study we found a definition we really liked and it was very comprehensive—I have given the reference there by Pettitt, Burnett and Stevens. Again, a very comprehensive definition and looks at a number of different concepts within driver distraction. What they say is that there needs to be some type of impact related to distraction. That means an impact on the driving tasks—so whether that is a crash or near crash, or some type of performance error—that results from driver distraction.

Second, there needs to be an agent involved. This would refer to secondary or tertiary tasks. There needs to be something that the driver is doing to distract them, essentially. There needs to be a mechanism, something with regards to that task or device that is compelling the driver to shift attention away from the primary task of driving. They can fit into a number of different categories or types. Visual attention is really recognized as being the most important in terms of driving, but you also hear about cognitive distraction and maybe some other types of detriments in terms of sensory and perceptual functions.

We did a study seven or eight years ago and we came up with our own definition. We really based it on what Pettitt, Burnett and Stevens were doing at the time. We incorporated a lot of those four areas, but we were dealing with naturalistic driving data. You have to come back from a theoretical level to something that you can apply and use when you are evaluating video data. We came up with this definition of if you have an inattention of some sort, there needs to be a critical event, whether it's a crash or a near crash or a lane deviation, that's the impact, there has to be some detriment in performance. That's how we then defined distraction. Those two definitions really set the stage for the research we did.

SLIDE10: KEY LITERATURE

I will just highlight a few studies. There's really been a lot of research, especially lately on driver distraction. Maybe one of the earliest ones was back in the late '70s, *The Indiana Tri-Level Study* by Treat. They used, a very novel approach, used police scanners to identify crashes and they went to the scene of the crash afterwards to collect information. They came up with the finding that the driver is most likely the cause of somewhere between 70 and 93 percent of crashes.

Mike Goodman from NHTSA did a study in ’99 that was one of the first studies that I know about that was focused on cell phone distraction—again, he looked at at North Carolina police reports, looking at the cell phones as a contributing factor in crashes.

I mention LTTCS, again a crash investigation effort; I mentioned some of the statistics with regard to inattention, but, again, it was a study collected after the fact. That’s really what a lot of these—if you are dealing with crash databases, or epidemiological studies—these are studies and analyses that look at crash a data set and then try to assess *why* did a crash happened.

One of the first studies and really the precursor, driving force for our current study was the *100-Car Study*, which many of you may be familiar with. It was one of the first really large-scale naturalistic data collection studies. One hundred cars had a number of instrumented sensors and video cameras. They collected data over 18 months. If you are looking at the news now and looking at what various states are doing in terms of banning texting or making sure there needs to be hands-free devices, for instance, a lot of that comes from that *100 Car Study* results. They found really a very high number; I’m not talking nine percent anymore or ten percent, but closer to 80 percent of all crashes involve some form of inattention just before the event occurred.

SLIDE 11: WHAT ABOUT TRUCKING?

A lot of these studies, you will note, one common dominator here, they’re all car-related studies, light vehicle studies. There’s really not a lot of research directed at the trucking industry. That was really what we saw as a real limitation and something that needed to be done. The other thing was, the light-vehicle part aside, a lot of these studies with the exception of the *100 Car Study*, used data from police accident reports. The driving force behind the current effort where we aimed to fill some of these holes—we wanted to look at trucks and heavy vehicles, and wanted to use naturalistic data. The naturalistic data is nice because it has video of the driver’s face and the forward view. You will see this in a little bit. You can really find out what the driver was doing. Really, it’s an instant replay. We all know how instant replay, you can think of a sports analogy, how important that is to really determine what happened. This is really what we have now with the naturalistic method.

SLIDE 12: OVERVIEW OF NATURALISTIC TRUCK STUDIES

Just to give you a highlight of the data set we were using—I have done a couple of these webinars where we talked about these studies before, so I will go over this relatively quickly. In 2004, we did a study with a Drowsy Driver Warning System, evaluating its effectiveness in a field operational test. We collected data from a little over one hundred drivers, again for 18 months. These were fleets, in-service vehicles, revenue-producing runs. Basically, we went in and we put cameras and data collection equipment inside these fleet trucks and had drivers use them as part of their normal drives. Each of the drivers participated for about 12 weeks. We collected over 2 million miles of driving data in that study.

That followed up with the study we call *Naturalistic Truck Driving Study*. That was funded by FMCSA. It finished last year, so it is relatively a new data set, again collecting data from about one hundred drivers. It was a little bit less as far as the total amount of data collected. Each driver drove for about four weeks and we had a little over 700,000 miles of driving data.

If you take these two data sets together, which we did for this distraction analysis, we're talking about 200 drivers and about 3 million miles of driving data with a number of different fleets and a number of different sites—what we feel is a pretty strong data set.

You can see there, again, I mentioned earlier, the key to doing any distraction analysis was naturalistic data is the video. You can see on the slide the views that are typical in these naturalistic studies. You see the driver's face, the forward view, I'm just going clockwise here, and in the bottom-right quadrant that's a split screen, those are cameras on the west coast mirrors pointing backwards against the trailer, so you know what's going on at the side of the vehicle. For the *Naturalistic Truck Driving Study* we also had this over-the-shoulder view. You can see where drivers were interacting with different technologies or the instrument panel—what they were doing.

SLIDE 13: FILTERED DATA SET

We have this data set of 200 drivers and 3 million miles. We used a software program to run through the data set and look for spikes in different sensor data. For instance, to maybe look at hard braking events. Again, the report is really going to detail all the trigger thresholds we used for this, but hard braking is typical. If the driver slammed on the brake with enough negative acceleration, we would be able to go look at the video and see what happened there. Did a crash occur? Did the driver have a really close call? You can see when we did that we ran all our triggers—they were based on braking, both lateral and longitudinal acceleration, and there were a number of other sensors we used. We came up with an event, a safety critical event data set where we had about 20 crashes, about 200 near crashes, about 3,000 crash relevant conflicts—that's essentially a little less severe than a near crash. We also looked at unintended lane deviations. We had about 1200 of those, not a lane change obviously, but where the drivers may have engaged in another task and they drift outside of the lane into the oncoming lane or off on to the shoulder of the road. That's what that represents.

To do our analyses, we needed baseline data. That's really the beauty, I think, of naturalistic data. We're collecting data whenever the vehicle is on and in motion. When you have a data set like that probably 99 percent of it is just normal driving. Then you have these sporadic, relatively rare types of events like crashes and near crashes. Most of the time it's just normal driving.

Using a random sampling method based on the drivers that participated and how long they participated in the study, we came up with about 20,000 baseline epochs. These are normal driving type situations. We used that to compare against the crashes. Were drivers, for instance, doing something different in a safety critical event as compared when they're not involved in a safety critical event, just normal driving? With these two data sets, safety critical event data set and baseline normal driving data set we can then make these really nice comparisons.

SLIDE 14: VIDEO REVIEW

We had 25,000, roughly, events across these two data sets and we looked at them. We looked at all the video and the associated kinematic sensor data. What we were looking for was what was the driver doing in terms of distraction-type of events, again the secondary tasks, tertiary tasks—were they involved in any of those prior to the event onset? For example, maybe a lead vehicle hit the brakes, the driver had to also hit the brakes and that flagged our trigger. We knew the driver had a hard braking event. We looked at just a few seconds beforehand of the initiation of the hard brake to find out what the driver was doing and where was he looking? Some of the events, you can imagine, and baseline epochs as well, involved drivers engaged in these secondary or tertiary tasks, non-primary related driving tasks. I want to underline this point: the work effort was really focused on following the analysis path of the *100 Car Study*. There are different ways you can conduct these analyses, but we were focused on following what the *100 Car Study* did so that later on we could make comparisons between light vehicles and heavy vehicles. There's an example there. We used some of the same definitions in terms of tertiary tasks based on their complexity level. That's really all I need to say on that.

SLIDE 15: DATA ANALYSIS METHODS

Those events, in both the safety critical events and the baseline epochs that had some type of secondary or tertiary task we really analyzed that in a lot of detail, and I'll show you that. The two primary analyses we conducted were based on epidemiological research, and odds ratio analysis is one of them. It's pretty common. You will see a lot of studies using a statistic called odds ratios. Basically, what it tells you is the possibility of some outcome, for instance a crash, occurring when comparing it to the presence of a condition, like the driver is using a CB, to when the driver isn't using the CB. You can really tease out the risk associated with engaging in some of these tasks with this analysis approach.

Another statistic that goes along with the odds ratios is one called population attributable risk, taken from epidemiological research, which is the study of disease. In this sense, we're looking at the incidence of a crash in the population that would be eliminated if exposure was eliminated. For example, if the population attributable risk for eating while driving was five percent, then you could say there would be five percent fewer crashes if no one ate while they drove. You could call it a sister statistic to odds ratios. There could be tasks, there could be things that drivers are doing that are really, really risky, but they don't happen very often. This kind of grounds that odds ratio statistic.

SLIDE 16: ODDS RATIO CALCULATIONS

These next two slides give a little more detail. As Terri mentioned earlier, these slides are going to available for you afterwards, so you don't have to quickly jot down any notes here. What I want to just point out to you for those who aren't familiar with odds ratios, is that last bullet. It says odds ratios greater than one indicate some kind of an increased risk of safety critical event involvement. Numbers greater than one are the ones you are really looking for.

We also calculate confidence limits. I don't want to get too technical here. The confidence limit also needs to not include the number one to know that it's statistically significant.

SLIDE 17: PAR CALCULATIONS

Here, kind of the death of a presentation, if you start putting up formulas like this, so I am not going to go into a lot of detail here. Essentially, we calculated these population attributable risks for anytime we had an odds ratio greater than one. Just for those significant odds ratios we calculated the PAR for.

SLIDE 18: RESEARCH QUESTIONS

Here are our research questions.

- **Research Question 1:** What types of distraction tasks (or behaviors) do CMV drivers engage in? And, are these tasks risky leading to involvement of safety-critical events?

- **Research Question 2:** Do environmental driving conditions impact the engagement of tasks?

- **Research Question 3:** What is the impact of distraction tasks on drawing the driver's eyes away from the forward roadway?

We are really focusing on this concept of visual distraction.

SLIDE 19: SUMMARY RESULTS

Here are summaries of key results that we found.

SLIDE 20: OVERVIEW FINDING: IS DISTRACTION AN ISSUE?

The number one question: Is distraction an issue? Absolutely. In our study we found 81 percent of all the safety critical events have some type of driver distraction. You can see it broken down by different event types, but, again, a very shocking type of a result.

SLIDE 21: RQ#1- KEY DISTRACTING TASKS (COMPLEX)

Here are some of the key distracting tasks we found when we conducted those odd ratios. Again, this was really not expected at all. The number one, that first one there, text messaging on a cell phone, this is in its own universe, having an odds ratio of over 23—very, very risky, associated with a very significant number of safety critical events in our study. You can go down the list and see what some of the other high risk, high-odds ratio tasks were. There is a catch all category there called other complex. You can see—there are more examples in the report—but it's odd types, not real frequent, regularly occurring tasks like cleaning the side mirror or rummaging through a grocery bag are two examples provided.

The next one was a surprise we weren't expecting. When the drivers were interacting with or looking at their dispatching devices, again very high odds ratio associated with that, almost 10. You can see the others, writing on a note pad had an odds ratio of nine, using a calculator had about eight, looking at a map had an odds ratio of seven and dialing a cell phone had an odds ratio of about six—all statistically significant.

SLIDE 22: RQ#1- POPULATION ATTRIBUTABLE RISK

As I mentioned, odds ratios are one statistic. You really have to look at it in terms of population attributable risk because some tasks may have a high odds ratio may not occur very often. This is what this statistic looks at then. You can see the text message on the cell phone, the fourth from the bottom there. You can see that the population attributable risk percentage is .67 percent. Less than one percent, .67 of a percent, of the crashes attributable to text messaging would be removed if no text messaging was allowed. What that really means is it's a very high-risk behavior, but in our data set it didn't happen that often. Now, compare that to interact with/looking at the dispatching device had over three percent. That's a task drivers do fairly frequently and if drivers didn't do this we could reduce crashes, safety critical events, by this percentage. Dialing the cell phone, you can see is about 2.5 percent. You can look at some of these other tasks as we go through here.

SLIDE 23: RQ#3- EYE GLANCE ANALYSIS METHODS

That outlines what happened at a very high level. Then we wanted to really find out the "why." Why are these particular tasks, why are they risky? Why are they leading to these very high odds ratios?

We conducted an eye glance analyses to measure, essentially, visual inattention. For the safety critical events, we looked at five seconds prior to the trigger, prior to the onset event and one second afterwards and that's really a six-second window, prior to the trigger. You can see the picture down below of the video reduction. We looked at whether the driver was looking forward or out the left window—whatever he was looking at we marked that. The video was at 30 hertz and we did these at a tenth of second intervals.

For the baseline epochs we also did the same thing. We looked at these random snippets of normal driving. We looked at six seconds of the video and looked at again where were they looking? We were focused on looking at were the driver's eyes off of the forward roadway? That was a key measure looked at in the *100 Car Study*.

SLIDE 24: GLANCE DEFINITIONS

Anytime the driver wasn't looking forward, regardless of where he or she was looking—that was a key measure for us.

We also looked at the number of glances away from the forward roadway. How many times in this six-second window do drivers glance around, take their eyes off the forward roadway?

Finally, we were looking at the length of the longest glance in this window where the driver wasn't looking forward.

SLIDE 25: OVERVIEW FINDING: SHORT AND LONG GLANCES

Here's an overview of this analysis. It's really interesting. Let's start at the bottom; I want to start at the greater-than-two-seconds glances, because this is something that makes a lot of sense. It's consistent with *100 Car Study*. Basically very long glances away from the forward roadway are high-risk type behaviors. If you look anyplace other that forward for more than two seconds your odds ratio is nearly three. A glance that was greater than 1.5 seconds, but less than 2.0 had an odds ratio of 1.29. The two in the middle are not significant. Greater than one second, but less than 1.5 seconds wasn't statistically significant for us. But then you look at the top one, this was again a bit of a surprising result, less than or equal to a half second. Basically, for the six seconds the driver's eyes are on the forward road the whole time, the whole period of time the drivers looking forward. That was associated with an increased risk, 1.36. How we talk about that in the report, we generate a hypothesis of why that's the case. What we think is going on there is that drivers aren't scanning their environment very well. They have tunnel vision almost, just focused forward and not scanning their mirrors as they need to be. When they are focused and mesmerized on the forward roadway and not glancing around that was associated with an increase in risk.

SLIDE 26: TEXT MESSAGING ON CELL PHONE

I wanted to highlight some of the real shockers here—text messaging on a cell phone. What you have here is a plot on the Y axis that says the mean duration of eyes off of the forward roadway, this is the mean time. Remember we have a six-second window we're talking about here. You can see along the bottom, you can see events with text messaging. This is a critical event when the driver was text messaging. You see the next one over is the baseline, this is a nonevent, but the driver was text messaging. Then you can see another comparison we did. We did other events, just in general, other safety critical events, but did not include text messaging. You can see the baseline again without text messaging, in making these different comparisons. The baseline without text messaging is probably more the purest type of baseline driving. You can see the mean duration of eyes forward is 1.2 seconds. The driver is scanning around in a six-second window; 1.2 seconds of those, he's looking probably to the mirrors. When involved in a critical event his eyes are off of the road for almost five seconds in a six-second window. That's really kind of scary. We talk about that in the report. If the driver is driving 55 miles per hour how much distance that is, it's over a football field basically with his eyes off the forward roadway.

SLIDE 27: VIDEO

I will show you a video, an example of that type of event. I will also show you a link afterwards where you can look at some naturalistic videos to get an idea of what these studies are all about. This will show you one example here. I clicked play. It may be choppy on your machine, I apologize for that. Every machine is going to run this a little bit differently. This is a typical event. You can see the driver in the over-the-shoulder-view, text messaging. He's swerving all over the road onto the shoulder. His eyes are down. You can see that in five seconds out of the six-second time period, his eyes are off the road—a very distracting type of a task.

SLIDE 28: DIALING CELL PHONE

Dialing a cell phone was also a pretty interesting one; it gets a lot of press. The question is, we saw in the odds ratio, that it again had a high risk associated with it. This really shows why. It is because when drivers are dialing a cell phone they're not looking at the forward roadway almost four seconds out of six second window they're not looking forward, compared to baseline driving.

SLIDE 29: VIDEO

This is a real interesting video where you can see the driver dialing, he just hangs up, now he's going to dial, then you will see him talk. You can see as he is dialing he's going off onto the shoulder there. He's swerving around. His eyes are off the road, you can clearly see that. Now he's going to start to talk. When he's talking, now look at his lane keeping. You can see he's pretty much inside the lane and his eyes are forward. Those are two key take-aways I'm going to get into in a little bit.

SLIDE 30: TALK/LISTEN TO CB RADIO

This gets to the point of talking and listening. What we found was the odds ratios when you're dialing, a task that forced the driver to look away from the forward roadway, like the dialing and texting tasks, has high odds ratios. But something that was somewhat surprising, when the driver was talking or listening to the hands-free phone or CB radios, they actually had a protective effect. That means they didn't have an increased risk. As a matter of fact, they made drivers less risky. You can look at the mean duration of eyes off the forward roadway; you can see when there was an event where the driver was talking or listening, to a CB radio in this case, 1.3 seconds—compare that to the baseline without talking or listening to the CB, 1.2 seconds. Basically, they are the same.

The CB, talking on a hands-free phone those were all similar results.

SLIDE 31: VIDEO

This guy is going to talk on the CB, watch his eyes, where his eyes are, they're forward now. Obviously, this is a busy traffic situation, he holds down the CB, has a brief conversation, and continues to look forward. There's really no impact on drawing his eyes away from the forward roadway and he continues on with his CB conversation. With hands-free cell phone conversations we found really the same thing. It was the dialing component of the cell phone or texting that was really where the risk was associated.

SLIDE 32: INTERACT WITH DISPATCHING DEVICE

The last one I want to highlight is interacting with dispatching devices. This is, again, a bit of a surprise. I'm going to show you a video of this, but again, it had a high odds ratio. Why this one is particularly problematic, I think, because the PAR, populations attributable risk, is also very high, meaning that drivers did this a lot in our study anyway. You can see where the green arrow is, over four seconds of a six-second window; the eyes are off of the forward roadway.

SLIDE 33: VIDEO

I will play a video here, just an example of that.

Depending on where you are in the video, he's interacting with this keyboard, he's all over the road, the keyboard is placed on the steering wheel, eyes are down—that was a five or six second glance down, at least. Driving a really great distance without looking at all at where he's going.

SLIDE 34: 100-CAR COMPARISONS

As I mentioned, the analysis we selected—you could do regression analysis and there are other sophisticated epidemiological analyses that you could do. For this study, again, I want to point out, we were following the *100 Car Study* approach, so we could make similar comparisons after the fact, with regards to light vehicles and heavy vehicles. This slide summarizes that.

In both studies we found that these tertiary tasks, non-complex tasks that don't have anything to with driving, had the highest percentage of occurrence or risk in the safety critical events and the total eyes off the road time—that's what we found. Why is that happening? It's because these devices draw the driver's eyes away from the forward roadway. The *100 Car Study* reported that drivers were over two times more likely to be involved in crashes when the eyes off road time was greater than two seconds. We found something very similar. We found that drivers were three times more likely to be involved in a safety critical event when the total eyes off road time was greater than two seconds. Why is that a difference of almost a factor of 50 percent there, from two to three? It could be that trucks are more difficult to maneuver, so if you are not watching where you are going; it's a lot more difficult to keep the vehicle in a lane, as compared to a car. It could be because the events we saw in the last trucking study, the *Naturalistic Truck Driving Study* that just ended last year, is where we saw most of the texting. It wasn't in the earlier study which was about the same era as the *100 Car Study*, but it was more recent. It seems to me this is becoming a more prevalent phenomenon. These drivers taking these, people call these nomadic devices, these texting devices, into their vehicle with them and using them while they drive.

SLIDE 35: CONCLUSIONS

Some conclusions—generally consistent with the *100 Car Study*, distraction plays a major role in the occurrence of safety events; on the order of about 80 percent in all critical incidents.

SLIDE 36: VISION IS KING

This highlights the part that vision is really the key component. Whatever you are doing behind the wheel, your eyes better be forward. A lot of the tasks, the complex tasks that were associated with very high odds ratios and PAR estimates were those that drew the driver's eyes away from the road. The eye glance analysis provided the "why" for certain tasks being high risk. For example, texting had by far the highest odds ratios. It also had the highest percentage of time when the drivers were not looking forward—almost five seconds out of a six-second window. That's a lot of time looking away from the forward roadway.

SLIDE 37: RECOMMENDATIONS

The report goes into more details. We pulled out ten recommendations—at a very high level, things that might help drivers, fleet safety managers, and others interested in this to avoid the kind of events that we saw. These are just based on this study—on the results we found. You can take that for what it is.

We think there needs to be some kind of education highlighting the importance of eyes forward, and scanning because we had that finding where if drivers are not scanning enough that's associated with high risk, as well.

A lot of tasks we do that might not seem very high tech—reading, writing, using maps—again draw the eyes away and can be very dangerous.

Perhaps, if fleets are not doing this already—if I were a fleet safety manager, I would probably have a policy saying no texting, no in-vehicle devices that would draw attention away from the forward roadway. That's number four. There shouldn't be texting while you are driving a truck, a car, or anything else, in my opinion.

The whole manual dialing, again, this reiterated what some of the other studies found. Again, it was associated with very high risk—the manual dialing.

SLIDE 38: RECOMMENDATIONS

Perhaps a little more controversial is the talking finding—that talking was okay whether it's on a CB, a cell phone, the hands-free concept. It seemed to be a positive thing. In the report we talk about why that might be the case. You talk to drivers and a lot of drivers use it as almost an alerting feature. It helps them stay alert if they're engaged in a CB or other conversation. The other thing I would just like to point out about that, is that there have been some new studies that haven't been published yet, but I've just been made aware of in the last week or so, that will report similar findings. Really the key point of this is that it had a protective effect.

Drivers should not be using dispatching devices while driving. You saw the video of that. There should be some redesign and I think most of the time drivers are told not to use it while they drive, but they do. That may be for designers, can you design a voice activated Bluetooth type system, lock out features and what have you. I didn't mention this, show the result, a lot of times drivers were interacting with their instrument panel, working with the radio, other buttons and knobs on the IP that also was associated with high risk. There may be opportunities for designers, OEMs, to consider that in terms of looking at the human factors associated with and the ease of use of drivers interacting with their instrument panel.

Again, I am first to admit, more research is needed on these protective effects. Did these provide an alerting feature for these drivers? What made these drivers safer in those cases where they were doing certain tasks?

SLIDE 39: RECOMMENDATIONS SUMMARY

Recommendations are included in the report. I just presented several recommendations. Some of them deal with fleet policies or driver education. There's a link you could go to that will be provided. We did a study that showed a lot of these videos. It's off of FMCSA's main Website; it's called "Driving Tips." That might be something you want to take a look at with your drivers for those fleet managers out there.

Some of the recommendations, you could go so far as to say, support some type of regulation. That's certainly happening in states with regards to texting bans and hands-free requirements. We just have to leave that to policy makers on that to interpret this data how they see fit. With texting to me it seems very obvious. Other recommendations, we looked at redesign. Can you make the truck a little bit more user-friendly and have drivers be able to interact with these devices, dispatching devices, the IP a little easier? I'm personally convinced by linking these two data sets, one was from '04 to '05, the other one was approximately '06 to '07, as technologies become more complex, and that's what we saw in that second study, when they involve more interaction from drivers, we're talking about video that you can get on your phone, checking stock tickers . . . As they become more involving, engaging or compelling, I expect that distraction-related crashes are only going to increase.

SLIDE 40: CONTACT INFORMATION

That's the last slide that I have. It looks like we're bumped right up to our time here. Kirse, I will turn it over to you for a minute.

[53:17]

QUESTIONS AND ANSWERS

Kirse Kelly: Yes, thanks, Rich. Again, this is Kirse. We can open for questions. I think we could probably go 15 or 20 minutes over. There's a lot of interest in this and there are quite a few questions. If you would like to ask a question you can submit questions in the **Q&A Box** on the left side of you screen. Or if you want to ask a question over the phone just press ***1** and state your name to the recorded message. When your line is opened, Julie-Ann, our phone operator, will announce you by name, so please state your name clearly for proper pronunciation.

As mentioned at the beginning of the call, you will be given an opportunity to download a copy of the presentation (minus the videos) at the end of the webinar. If you leave early you can come back to this Website or to the FMCSA, Analysis, Research, and Technology Website and you will be able to download the slides from there.

Julie-Ann we'll keep checking back with you to see if there are questions over the phone lines.

Julie-Ann: Thank you.

Kirse Kelly: Go ahead, Rich.

Dr. Richard Hanowski: There are a lot of questions here. I will go through a bunch of them here and answer them as I go. A lot of them are duplicates. The first one…

Question: ***Is there a correlation to time of day and distraction?***

Dr. Richard Hanowski: What we did is we looked at, not time of day per se, but we looked at gross categories of time of day, if it was daylight or dark, dawn or dusk—more general categories. We really didn't find anything, for instance where drivers were using devices or were distracted more based on those broad categories. We didn't look through time of day like we did with hours-of-service, like you may be familiar with. I hope that answers that question.

Question: ***Does the fact that drivers know they're being monitored affect the results?***

Dr. Richard Hanowski: This is a question we get quite a bit. Drivers do know. They volunteer to participate. They sign an informed consent. They know what we're doing as part of this study; they know they're being videotaped. Some of the results we see make you think there's no difference or change in behavior. I would encourage you to go to the Driving Tips Website. You can see drivers engaged in a number of different behaviors on that Website. Again, those are taken from naturalistic driving. As a researcher who has, I don't do it so much anymore, but has been involved in the data collection part, I know when there's a car/truck and you are putting in the camera, you really forget about it over time. These are not really big cameras that are pointed in your nose. They're meant to be unobtrusive. We want the driver to know they're in a study, but at the same time, there's nothing that's really noticeable if you would just go into an instrumented truck, per se, unless you really knew what you were looking at.

Question: ***Do you have any data comparing the driver's prior experience and safety record?***

Dr. Richard Hanowski: That's a really good question, and unfortunately we don't. We don't have any previous data. How these studies are typically set up is that we go into a fleet and ask for volunteers. Typically, the drivers have to volunteer to participate in the study. We really don't go back and look at their prior data or for that matter, follow them after the fact. That would be a neat data set to be able to find that out. You could group drivers, for instance, some drivers that have been involved in crashes or near crashes before or had particular types of violations, and look at their prior safety record, and how they did during the study to see if you could find out why they were having those problems before. We have not done that study, but that's a really good idea.

Kirse Kelly: Julie-Ann, do we have any questions over the phone at this time?

Julie-Ann: I have no questions in the queue at this time.

Question: ***Do you think there's a positive effect of hands-free talking on devices in the area of drowsy driving?***

Dr. Richard Hanowski: That's a really good question. Based on the results of this study talking was positive. Again, we make the hypothesis in the report that it does provide the driver with an alerting mechanism. It keeps them aware by engaging in this conversation. That would then perhaps mitigate or alert drivers, and so the drowsing driving area would certainly be relevant there.

Question: ***Were the impacts of EOBR use considered?***

Dr. Richard Hanowski: I'm not absolutely sure what the question means. I can tell you if you're talking about the electronic onboard recorder, some device measuring drivers hours and maybe other hours-of-service related metrics, none of the vehicles that I'm aware of in any of the studies, there were probably 60 vehicles we instrumented over the course of those two studies, none of them had EOBRs. I guess they were not considered.

Kirse Kelly: If you want to follow-up on that question you can just hit ***1** and get on the phone, if you want to explain that any further.

Question: ***Will there be a link to look at the videos presented?***

Dr. Richard Hanowski: The videos presented today—unfortunately no. The issue is the videos I showed, those drivers agreed I could present those videos as part of presenting the methods and the results, and for conferences and webinars like this, but we can't, based on confidentiality, allow them to be copied. However, the Website you are going to see a link to later does show maybe 10, 11 or 12 different videos from these studies, I don't think any of the ones I showed you today are on there, there are others. There are other distraction ones in this Driving Tips Website. You can see these naturalistic videos and you can play them at your own speed and replay them and look at different facets of them. That's what that is there for.

Question: ***How did eating in the cab impact safety?***

Dr. Richard Hanowski: I'm looking over to my colleagues here. I didn't present that finding. They're looking through the report right now. I'm pretty sure it wasn't negative, it wasn't a high risk. It wasn't associated with an additional risk, if my memory serves. She is telling me that as well. It wasn't significant.

Kirse Kelly: Julie-Ann, do we have any questions on the phone?

Julie-Ann: I have no questions in the queue at this time, ma'am.

Question: ***Does the dispatching device include a GPS? Wouldn't using a GPS be safer than using maps?***

Dr. Richard Hanowski: None of the drivers had the TomTom, the Nuvi or the different brands of navigation type systems. I use one. If that's what you mean by GPS. I believe they're safer than maps. I'm not up on that research though. None of the drivers we had used them in this study. I couldn't pull that out as a task, a device per se.

Question: ***Was talking on a cell phone looked at within this study?***

Dr. Richard Hanowski: Yeah, it was. I spent some time going over that one specifically. It was the dialing component, the manual manipulation of the phone that drew the eyes off of the forward roadway. It wasn't the talking that seemed to increase risk. As a matter of fact, talking provided a protective effect for hands-free phones as well as CBs.

Question: ***Was dialing a cell phone restricted to full phone numbers? Or is speed dialing one key included? What is the proportion of each?***

Dr. Richard Hanowski: Essentially it was any type of manipulation with the phone. They put the phone down like in the video you saw, they were punching numbers, and during the number punching is where they are looking down. That's was really where the risk derived from.

Question: ***Was fatigue ever found to be a catalyst for a triggered event versus a distracting task?***

Dr. Richard Hanowski: For this particular study—I think that's interesting. You could go back and you could test that hypothesis in terms of drowsy driving. Were drivers talking or using their CB or engaging in some of these tasks to—was it alerting? Was it in fact alerting? Did it help them in a drowsy state? We didn't look at that for this study, but that's really interesting. You could certainly go back and reanalyze that. There are a number of different measures that can be used to abstract fatigue metrics from the video. There's manual PERCLOS and ORD—observer rating of drowsiness. There are a number of tools to do that. You could classify drivers into various levels of drowsiness and look at the impact of that state on the propensity to be involved in some of these other tasks. We didn't do that, but that's a really good question.

Question: ***The study shows singular tasks being performed. Is there any information on the incidence of multitasking and these outcomes?***

Dr. Richard Hanowski: We set up the data analysis to look at, again, following the *100 Car Study*, to look at singular tasks. That's an analysis that could certainly be done. You are thinking if the driver is dialing and having a sandwich, is there an increased risk when you add tasks? We could certainly do that and look at that. This was more to look at, in and of itself, a particular task.

Kirse Kelly: Are there any questions on the phone, Julie-Ann?

Julie-Ann: No questions at this time.

Question: Did any specific age group stand out?

Dr. Richard Hanowski: We didn't really look at age as a factor. That's interesting in regard to—especially with texting. That would be a fairly easy analysis to go back and do. In terms of company policy…that's an interesting question. If you think about recommendations or helping out a fleet manager, you probably wouldn't have a no texting policy for only younger drivers or only older drivers. We looked at, collectively, truck drivers as a whole. But that is something that would be interesting. My guess is that probably younger drivers engage in these activities more frequently—but that would be just my guess on that.

Kirse Kelly: That answer would be the same, Rich, the same answer as for the question that was "Was there a difference between males and females?"

Dr. Richard Hanowski: Yeah, yeah. I'm going through the different questions and there are a lot of really good questions. That question is kind of the same thing. I can tell you that, of the 200 drivers that we had, there were probably five or less females. As a matter of fact, that's pretty close to the distribution of males and females in the trucking industry. I thought I saw it around three or four percent of truckers. It just so happened that our study was just about the same proportion.

Question: Do you see any difference in the results based on the length of the conversation? Is there more likelihood of distraction from longer conversations as opposed to a short one?

Dr. Richard Hanowski: How we set up this study, we were just looking at this six second window around the event. Because it is a naturalistic study that is certainly something you could look at, the time length associated with that. The study I mentioned early on my fourth or fifth slide probably, referenced one of my studies in 2001. We did that. We looked at the length of the call and did find that was significant, but we did not look at it in this particular study. You can just imagine, the more time you're taking on the phone, the more engaged you are, the more mileage you are covering, the more opportunities you have to get into a safety critical event.

Question: Did you analyze the frequency and severity of distractions on rural versus urban roads?

Dr. Richard Hanowski: We did. That was in the report. We looked at divided versus undivided roadways. Nothing really kind of stood out in that respect. Again, the final report will have a lot of tables. There may be things that people that are involved in infrastructure design or the interaction with trucks and the infrastructure may be able to pick some of that stuff out. Nothing at a high level jumped out in that regard.

Question: ***When will the full study be published? Kirse can you answer that one?***

Kirse Kelly: No really, we can't answer it yet. It depends on when it gets through all of our reviewers which goes all of the way up to the top, basically.

Dr. Richard Hanowski: In my experience, FMCSA office has really done a great job—Karen Robin and Kirse, in terms of getting these reports published really quickly. Our contract is still going on, so we're still finalizing the report. FMCSA will see the final report in a couple of weeks, and then it will go through that process. It's probably, if I had to guess, it would be in the fall sometime that it would be available. I'm sure because of the interest in this and because of the findings, there will be a link, probably to the report, I'm guessing, on the FMCSA Website if people check back?

Kirse Kelly: Yes. Like I said, it is a long process, not so much the formatting, just getting it through all of the people that need to approve it. You will be able to check back at our Website for more information on this webinar, and of course they'll be able to contact you, Rich with questions.

Dr. Richard Hanowski: That's right. You can see now on your screen the different contact information—Terri and my e-mail addresses. Any really hard questions you can send to Rebecca Olson, a colleague of mine. And then there's the Driving Tips Website if you want to see some of these naturalistic videos and hopefully you can get your drivers. If there are fleet safety managers, I encourage you to do that. I would like your feedback on that. We would really like to see if it's getting used, if it should be changed or altered. Ultimately, the bottom line is it's about safety, improving safety, safety with truckers. The Driving Tips Website is really aimed at making drivers aware of these videos, these kinds of errors that can happen. Any feedback on that would be greatly appreciated. I think that concludes—Kirse you want to say anything else?

[1:13:20]

Kirse Kelly: Thanks a lot, Rich. This concludes the presentation part of our webinar. We ask that, before you sign off, if you could please complete the evaluation you see on your screen.

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Also, on July 24 we will host a webinar entitled, Integrating Performance and Registration Information Systems Management (PRISM) and Commercial Vehicle Information Systems and Networks (CVISN). Registration will open by the end of this week. If you just want to check our Website—it's shown there www.fmcsa.dot.gov/art**.** You can go there to register later this week. We will also send out announcements of this and other webinars. If you are not yet on our e-mail list, please contact me, the web conference coordinator at Kirse.Kelly@dot.gov to request your name be added to our list.

That concludes this webinar. Once again, thank you all for participating. Thank you Rich and thanks also to Julie-Ann, our phone operator.

[1:16:08]