DRIVER DISTRACTION ANALYSIS ON NATURALISTIC HEAVY VEHICLE DATA

TASK 2: ANALYSIS OF SLEEPER BERTH DATA FOR DISTRACTION EVENTS DRAFT FINAL REPORT

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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INTRODUCTION

Data from 41 long-haul truck drivers were collected and analyzed for the Federal Motor Carriers Safety Administration (FMCSA) sponsored project entitled, "Impact of Sleeper Berth Usage on Driver Fatigue" (Dingus *et al.,* 2001). This data was collected *in situ*, or naturalistically as drivers worked their normal routes. The purpose of this study was to investigate driver fatigue during long-haul trucking operations. More specifically, analyses on the data were collected to examine a variety of fatigue-related factors including the relationship of driver sleep quantity and quality to: sleeper berth design, environmental factors, team vs. single operations, and length of trip.

The critical incident analysis approach was used to examine the field data. Briefly, this approach involves recording and then analyzing the data stream surrounding a crash or near-crash (i.e., critical incident). As part of this process, all critical incidents captured in the study were assigned an "incident type" classification. One such classification category was "driver distraction." For these incident types, analysts identified "driver distraction" as a causal factor for the incident.

The current effort involves the conduct of a detailed analysis on the distraction-related incidents collected during the Sleeper Berth study. As outlined in Table 1, there were three main parts to this analysis effort. First, taxonomies were developed to classify the distraction events. It must be noted that the taxonomies that were developed do not represent the entire spectrum of distraction types; rather, only those distractions represented in the data set were identified.

Second, an eye glance analysis was conducted for the distraction events and for a sample of baseline events (i.e., non-incidents). The eye glance analysis involved carefully reviewing the videotape of the events, and determining the proportion of time drivers spent looking at various locations for a 20 second duration surrounding the event trigger. The eye glance analysts were able to discriminate between eight locations: (i) forward roadway; (ii) passenger-side mirror/window; (iii) driver-side mirror/window; (iv) instrument panel; (v) passenger; (vi) eyes closed for prolonged period, not a blink; (vii) undetermined, due to darkness or poor video; and

(viii) other. Once all the events had been reviewed and the time for each eye glance location noted, researchers determined the proportion of time the drivers looked at each location for each event (dividing the total glance time for each location by the total glance time for all locations).

The third step was to conduct statistical analyses on relevant variables included in the data stream for the distraction events and a sample of baseline events. Each of the three parts to the analysis effort is detailed in the next section.

Table 1. Overview of analyses being conducted on the driver distraction incidents recorded in the Sleeper Berth study.

Distraction Analysis	Overview
Step 1: Develop Taxonomy of Distraction Events	• Review the video for each distraction incident. • Determine the driver behavior associated with each incident (e.g., cell phone call, eating, etc.). Classify each incident accordingly. • Develop frequency histogram as a function of each category. • Determine the time duration for each incident.
Step 2: Conduct Eye Glance Analysis	• For each distraction incident, and for s sample of non-incidents (i.e., baseline events), determine the incident start point (T=0). • Determine the eye glance analysis start point by rewinding the tape 10 seconds prior to T=0 (i.e., T=-10). • Determine the eye glance analysis end point by finding the end of the incident or the point in the tape 10 seconds past T=0 (i.e., T=+10), whichever comes first. • For the time period of T=-10 to T=+10, identify the proportion of time the driver glances at each of the eight locations. • Conduct analyses on the eye glance proportions as a function of the taxonomy categories (including baseline events).
Step 3: Conduct Distraction Analyses	• Conduct analyses on the driver performance measures (measures collected from the truck instrumentation) comparing baseline events and distraction incidents.

DATA REDUCTION

For the Sleeper Berth study, trained video reduction analysts reviewed all events triggered by the data collection systems. The trigger types are outlined in Table 2. As shown, thresholds were set for sensors within the data collection system such that if a threshold was met, the system identified the event as a potential critical incident. Video analysts reviewed all potential incidents in the lab to determine if an incident was genuine or a false alarm. In addition to critical incidents, the data collection system also periodically collected baseline data (timed trigger). Baseline data were collected every 45 to 75 minutes.

Table 2. Trigger types and descriptions.

Trigger Type	Description
Steering	Driver turned steering wheel faster than 3.64 radians/sec.
Lateral acceleration	Lateral motion equal or greater than 0.3 g.
Longitudinal acceleration	Acceleration or deceleration equal or greater than 0.25 g.
Critical Incident Button	Activated by the driver upon pressing a button located on the dashboard when an incident occurred that he/she deemed critical.
Lane Deviation	Activated if the driver crossed the solid lane border (Boolean occurrence).
Time-to-Collision	Activated if the driver followed the preceding vehicle at a closing rate of 4 seconds or less.
Perclos	Activated if the Perclos monitor detected that eyes were closed 8.0% of any given one minute period.
Karolinska Sleepiness Rating	Activated if driver subjectively assessed own drowsiness as extremely fatigued/difficult to stay awake (rating of 7 or above on sleepiness scale).
Karolinska Sleepiness Rating, No Response	Activated if the driver did not respond to the Karolinska rating query.
Timed Trigger	Baseline data for which the data collection system triggered randomly every 45 to 75 minutes.
Lane Departure and Steering	Activated if a lane departure was immediately followed by a steering event.

For each triggered event, the video analysts began the analysis process by providing a description of the event. A software program was developed to assist the analysts in this effort (Figure 1). Analysts assessed what they believed to have been the cause of the incident (Table 3) and the severity of the incident (Table 4). Eight possible causes of triggered events were identified, and each incident was coded with one of these eight causes. In addition, each incident was coded with one of five possible severity types.

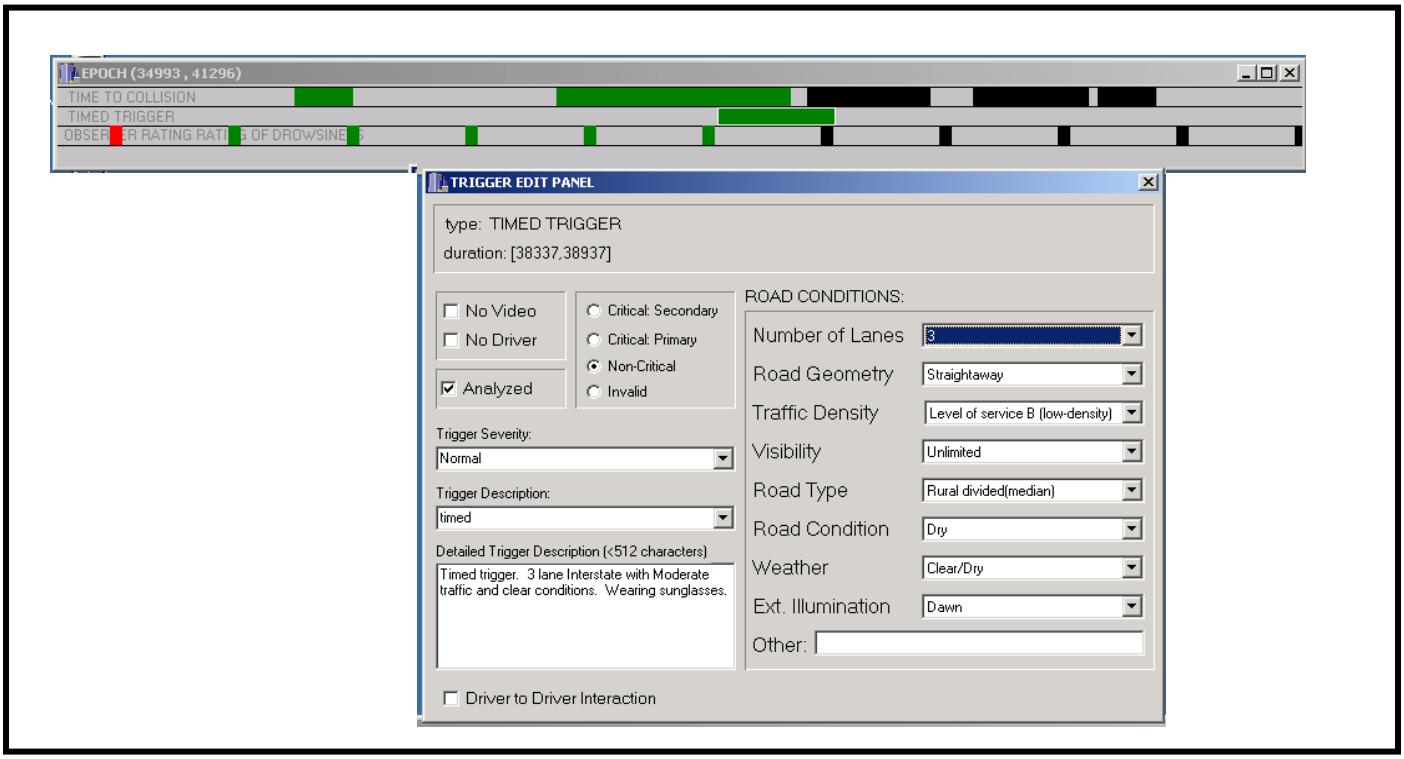

Figure 1. Data reduction interface screen.

Table 3. Trigger Description definitions.

Trigger Description	Definition
Undetermined	The cause of the event cannot be determined from the video. May be due to equipment failure, the event being out of camera view, etc.
Normal Driving	The driver is exhibiting safe driving behavior and is following all rules of the road. Must only used to describe a non-critical or invalid trigger.
Obstacle Present	There is an unexpected obstacle in the driver's path, *excluding other vehicles*. May be used when the driver reacts to a pedestrian, debris, or an animal in his/her path.
Other Vehicle Present	*Another vehicle* obstructs the driver's path and the driver is not at fault.
Impediment Present	The driver must react to an unexpected but deliberate traffic obstruction such as construction zone traffic cones, a police officer directing traffic, or a speed bump.
Driver Distraction	The event is the result of the driver's inattention from the primary driving task.
Judgment Error	The driver exhibits poor judgment in driving in an otherwise safe situation. For example, cuts off another driver or follows another vehicle too closely.
Other	Any event that cannot be categorized by the above descriptions.

Table 4. Trigger Severity definitions.

Trigger Severity Type	Description
Other Driver	Driver is exhibiting safe driving behavior and is following all rules of the road. Must be used to describe non-critical or invalid triggers. May also be used if the driver is reacting normally to a hazard (i.e., defensive driving).
Collision	Either property damage or physical injury results from the event.
Near Collision	The driver must take evasive action to avoid a collision.
Driver Error with Hazard Present	The subject performs an unsafe maneuver while there is a *potential* danger of collision (with another vehicle, pedestrian, etc.) or loss of vehicle control (i.e. driving too fast around a turn). The drivers involved take little or no evasive action.
Driver Error without Hazard Present	The subject performs an inappropriate maneuver but there is no apparent risk of a collision or loss of control. For example, deviating into the adjacent lane while no traffic is present.

Analysts also characterized the road conditions at the time the event was recorded, the number of lanes on the roadway, the traffic density (as defined by the level-of-service), the road geometry, visibility, road type, weather, and exterior illumination. Because the Sleeper Berth study was directed at driver fatigue, video analysts conducted an assessment of the driver's level of drowsiness at the time of the event. Once the analyst processed an incident, the measures from the analysis were saved into a database that was later used to conduct statistical analyses.

RESULTS

CLASSIFICATION OF DISTRACTION-RELATED CRITICAL INCIDENTS

There were a total of 2,737 critical incidents recorded in the Sleeper Berth study. Of these, 178 were attributed to driver distraction. By far, the cause that was indicated most frequently was "judgment error" (i.e., error by the sleeper berth driver); judgment error was the assessed cause for 2108 critical incidents (77%). The second most frequent cause was "other vehicle," where the driver of another vehicle was judged to be at fault; other vehicle was the assessed cause for 265 incidents (9.7%). "Driver distraction" was the third highest assessed cause with 178 (6.5%) incidents. Appendix 1 provides the narrative descriptions for all distraction incidents and the sampled baseline tasks that were included in several of the analyses (detail on the selection criteria used for the sampled baseline tasks is presented later in this report).

The Sleeper Berth study involved 56 long-haul truck drivers; 41 of whom were analyzed in terms of driving performance. As shown in Figure 2, the distraction events were attributed to 33 different drivers. The incident frequency of occurrence varied substantially as a function of driver number. Figure 3 shows the percentage of incidents attributed to each driver. Two of the drivers (Driver 20 and Driver 22) accounted for 24% of all distraction incidents recorded (N=43). Seven drivers had 10 distraction-related incidents or more. These seven drivers accounted for 58% of all distraction incidents. Putting these findings another way, 6% of the drivers accounted for 24% of the distraction incidents, and 21% of the drivers accounted for 58% of the incidents. This result is consistent with the findings from a study conducted with local/short haul drivers, which found that a large number of recorded critical incidents were caused by a small number of drivers (Hanowski, Wierwille, Garness, and Dingus, 2000).

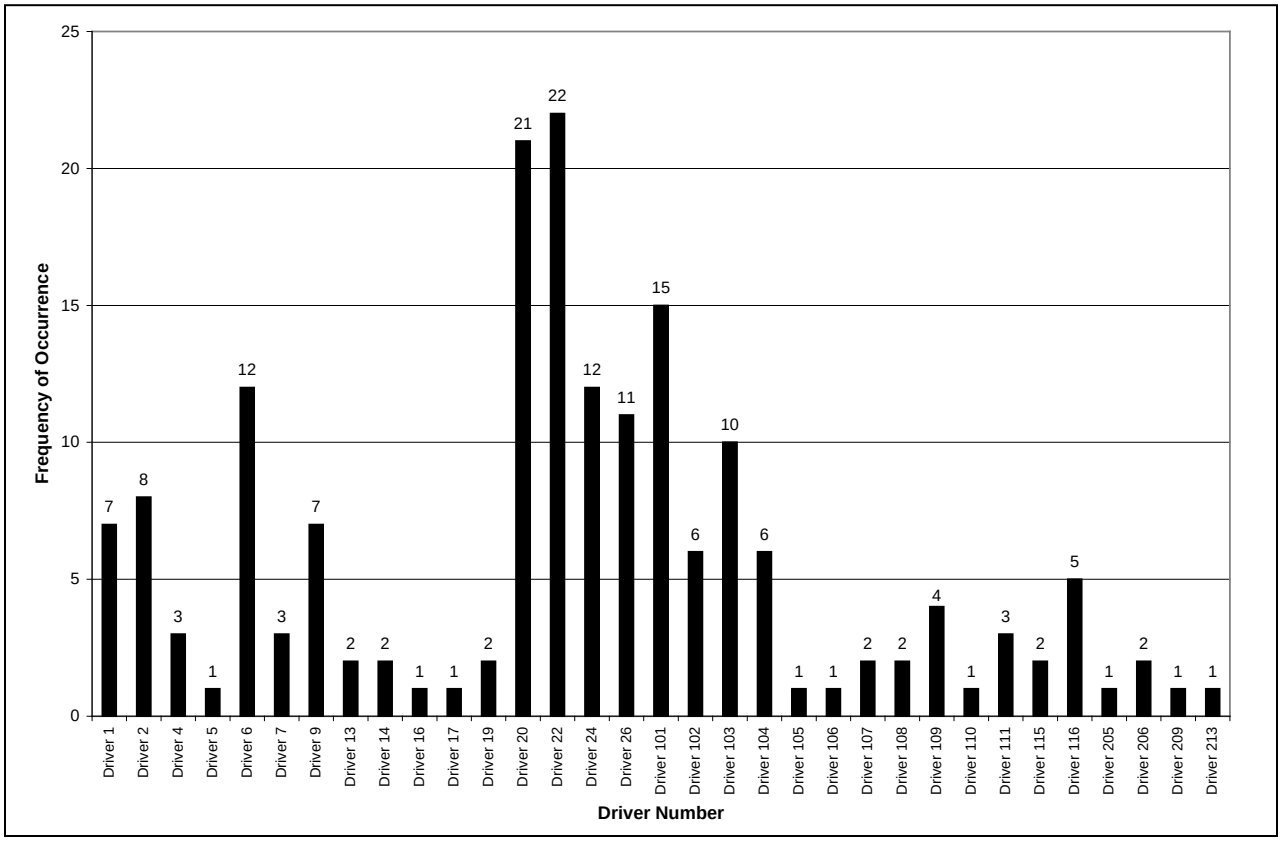

Figure 2. Frequency of distraction-related incidents for each driver involved in a distraction incident.

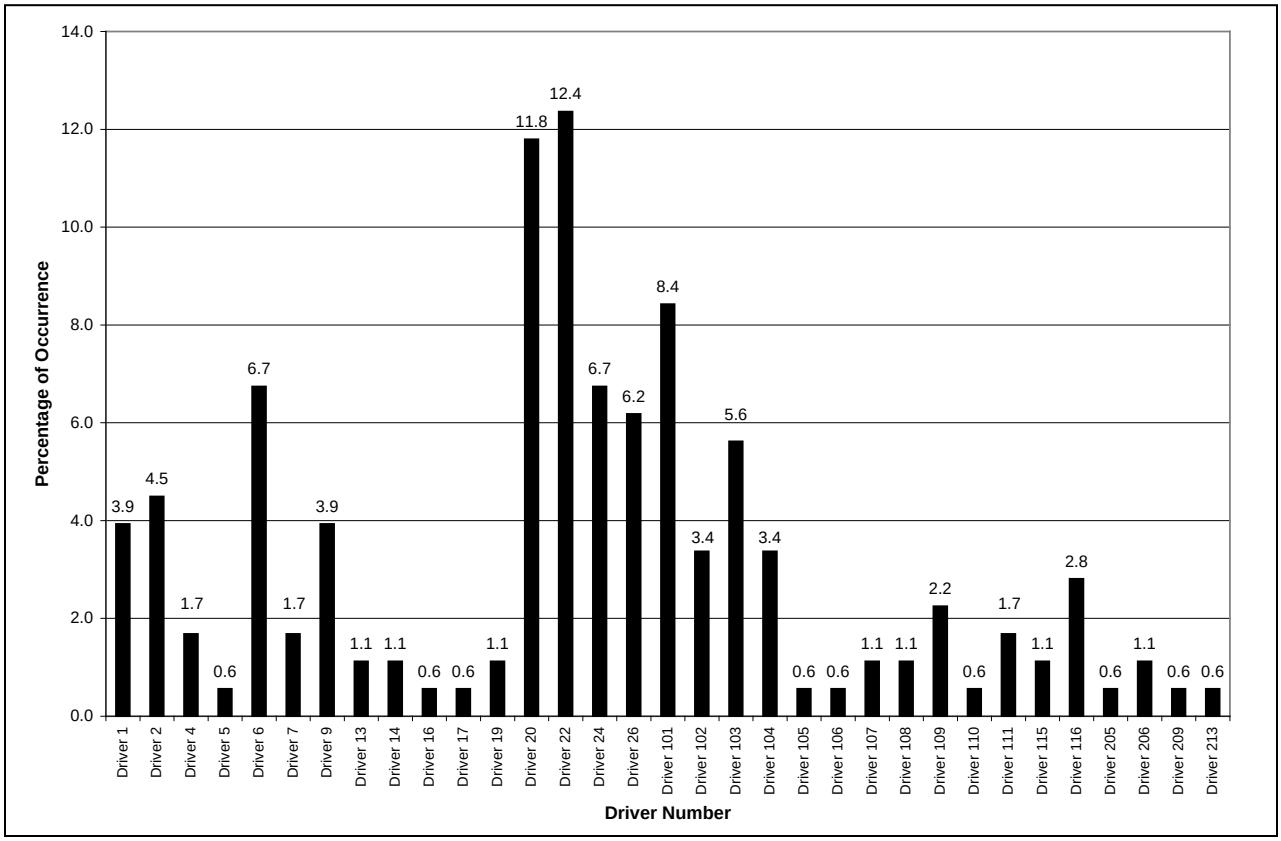

Figure 3. Percentage of distraction-related incidents for each driver involved in a distraction incident.

DRIVER AGE, GENDER, AND TYPE OF DRIVING OPERATION

The age, gender, and operation-type of the 33 drivers who had distraction-related incidents are shown in Table 5. (Note that there are missing values in the age column indicating that these drivers did not provide their age on a demographics questionnaire administered during the Sleeper Berth study.) The mean age of the drivers who did provide this information was 41.7 years (range of 28-63 years). The mean age of the two drivers who had the majority of distraction-related incidents was 48.5 years. The mean age was 40.0 years for the seven drivers who had 10 or more incidents.

Table 5. Driver gender, age, team operation-type, and incident frequency.

Subject Number	Gender	Age	Incident Frequency
1	M	33	7
2	M	62	8
4	M	40	3
5	M	36	1
6	M	35	12
7	M	63	3
9	M	40	7
13	M	61	2
14	M	.	2
16	M	38	1
17	M		1
19	M	30	2
20	F	49	21
22	M	48	22
24	M	.	12
26	M	.	11
101	M	40	15
102	M	37	6
103	M	28	10
104	M	34	6
105	M	63	1
106	M	36	1
107	M	39	2
108	F	48	2
109	M	37	4
110	M	37	1
111	M	51	3
115	F	39	2
116	M	40	5
205	M	33	1
206	F	29	2
209	F	.	1
213	M	.	1

Of the 33 drivers, 28 were male and 5 were female (85% male/15% female). Of the two drivers who had the highest frequency of incidents, one was male and the other female. When looking at the gender of the 7 drivers with 10 or more incidents, it can be seen that 6 were male and 1 was female. Percentage-wise, this is equivalent to the gender distribution across the sample of drivers (86% male/14% female). For comparison, the mean age for the 41 drivers who comprised the entire driver group in the Sleeper Berth study was 42.6 years (range of 28-63 years). Of these 41 drivers, 34 were male and 7 were female (83%male/17% female).

It should be noted that driver numbers (in Table 5) with two digits represent drivers who drove in a single operation (i.e., no team driver was present) while driver numbers with three digits refer to team operations. Though there were nearly equal numbers of single and team drivers represented in the data set (16 single drivers and 17 team drivers), single drivers accounted for 115 of the 178 recorded distraction-related incidents (65%). This finding is consistent with the overall results of the Sleeper Berth study that indicated single drivers had many more critical incidents than did team drivers (Dingus *et al.*, 2001). More specifically, Dingus *et al*. indicated that single drivers accounted for 77% of the critical incidents that were recorded.

TAXONOMIES OF DISTRACTION EVENTS

The videotapes that recorded the 178 distraction events were carefully reviewed. One of the goals of this review was to identify the cause of the distraction. As shown in Table 6, 36 unique distractions were identified. The definition for each distraction highlights the relevant task/activity and indicates where the driver tended to look during the task (the associated visual demand) and the typical status of the driver's hands on the steering wheel during the task (the associated manual demand).

Table 6. Taxonomy of distractions and the associated definitions.

Code	Distraction	Definition
1	Talking on CB	Driver is holding CB to mouth and talking; usually looking forward; one hand off the wheel
2	Adjusting CB	Driver is adjusting knobs, with right arm extended up, on CB receiver located on ceiling at the front and center of cab; glancing at CB periodically; one hand off the wheel
3	Looking at CB	Driver is looking up at CB receiver located on ceiling at the front and center of cab; both hands on the wheel
4	Adjusting radio	Driver is reaching to the music radio, on center console of cab, adjusting station or volume; glancing at radio periodically; one hand off the wheel
5	Looking at radio	Driver is looking at the music radio, down and to the right, on center console of cab; both hands on the wheel
6	Dialing cell phone	Driver is looking down at cell phone in hands, dialing number; one had off the wheel
7	Plugging in cell phone	Driver is plugging in battery charger to bottom of cell phone; usually looking at the phone; one hand off the wheel
8	Talking on cell phone	Driver is holding cell phone up to ear and talking on it; usually looking forward; one hand off the wheel
9	Answering ringing cell phone/Looking at cell phone display	Driver is answering ringing cell phone; reaches to middle console, picks up phone, looks down at phone several times, but never puts it to ear; one hand off the wheel
10	Phone Call/Hanging up cell phone	Driver makes phone call and is hanging up cell phone; reaches down to floor to put phone back; usually looks down; one hand off the wheel
11	Lighting cigarette	Driver is lighting a cigarette; often looking at cigarette; one or both hands off the wheel
12	Getting cigarette	Driver is removing a cigarette from rest of pack; often looking at pack; one hand off the wheel
13	Blowing smoke	Driver has head turned, blowing smoke out the window; usually holding cigarette with one hand off the wheel
14	Drinking	Driver is drinking out of a soda bottle or mug; usually looking forward; one hand off the wheel
15	Getting Food	Driver is getting food out of a bag in their lap; often looking at bag/food; one or both hands off the wheel
16	Eating/Talking	Driver is eating food and looking at passenger; one hand off the wheel
17	Talking to passenger	Driver is talking to another person in the cab; sometimes looking to the right at passenger; both hands on the wheel
18	Reaching in pocket	Driver is reaching for something in either front shirt pocket, or back pant pocket; usually looking forward but moving around in seat; one hand off the wheel
19	Reaching to floor	Driver is reaching for something either on the floor of the cab (down and to the right) or somewhere in the cab; usually looking forward; takes one hand off the wheel
20	Looking at paperwork	Driver is holding paperwork on steering wheel and is looking down at it; one or both hands off the wheel
21	Looking at floor	Driver is looking at/for something on the floor (down and to the right); both hands on the wheel
22	Looking at IP	Driver is looking down, through steering wheel, at instrument panel containing speedometer and gauges; both hands on the wheel

Code	Distraction	Definition
23	Looking down	Driver is looking down; either in lap at something unknown, or at hands; may have one or both hands off the wheel
24	Looking up	Driver is looking up at the visor; both hands on the wheel
25	Toothpick/Visor mirror	Driver is looking up in the visor mirror, while picking teeth with a toothpick; one hand off the wheel
26	Looking right - outside	Driver has head turned to the right, either looking in passenger side mirror, or out passenger window; usually both hands are on the wheel
27	Looking left - outside	Driver has head turned to the left, either looking in driver side mirror, or out driver window; usually both hands are on the wheel
28	Looking outside	Driver is looking at a road sign, something along side of the road, or another car, but is still looking out front window; both hands on the wheel
29	Adjusting in seat	Driver is adjusting himself/herself in driver seat; usually looking forward; both hands on the wheel
30	Taking off jacket	Driver is taking off jacket; usually looking forward; one hand off the wheel
31	Lets go of wheel	Driver is looking forward but does not have either hand on wheel while dancing in seat; is not holding anything
32	Wiping dash	Driver is wiping off dash of cab with a cloth; usually looking at dash; one hand off the wheel
33	Rubbing face	Driver is wiping face off or rubbing eyes; usually looking forward but eyes may close for a few moments; one hand off the wheel
34	Brushing hair	Driver is using a hairbrush to brush hair; looking forward; one hand off the wheel
35	Coughing	Driver is coughing; usually closes eyes for a short period of time; both hands on the wheel
36	Yawning	Driver is yawning; usually closes eyes for a short period of time; both hands on the wheel

When looking through the list of 36 distraction types, the reader will notice that some of the types share common characteristics on a number of different dimensions. In an attempt to capture these commonalities, various grouping strategies were used. Analyses were then conducted using these groups. Tables 7A and 7B outline four of the grouping strategies that were used and the taxonomies that were developed based on these groups. As can be seen, the first "strategy," which was actually the absence of any grouping method, was to individually examine (compare) each of the 36 specific distractions. The second strategy involved grouping common tasks at a "high level," with 36 distractions grouped into 7 general categories. This compares with the "detailed task group," which produced 14 different categories. The fourth strategy grouped distraction tasks/activities with common "resource demands." That is, categories were developed based upon the primary driver resource demand(s) required to conduct the task/activity. In addition to the four grouping strategies shown in Table 7A, a fifth strategy was used where all distraction events were grouped together. The results from analyses conducted using each grouping strategy is highlighted in the following sections.

Table 7A. Grouping strategies used to capture common characteristics of distraction types.

Code	Distraction	Specific Distractions	High-Level Task Group	Detailed Task Group	Driver Resource Used
1	Talking on CB	1	2	1	4
2	Adjusting CB	2	1	1	3
3	Looking at CB	3	7	1	1
4	Adjusting radio	4	1	2	3
5	Looking at radio	5	7	2	1
6	Dialing cell phone	6	1	3	3
7	Plugging in cell phone	7	1	3	3
8	Talking on cell phone	8	2	3	4
9	Answering ringing cell phone/Looking at cell phone display	9	1	3	3
10	Phone Call/Hanging up cell phone	10	1	3	3
11	Lighting cigarette	11	5	4	3
12	Getting cigarette	12	3	4	3
13	Blowing smoke	13	5	4	1
14	Drinking	14	5	5	2
15	Getting Food	15	3	5	3
16	Eating/Talking	16	5	5	3
17	Talking to passenger	17	2	6	4
18	Reaching in pocket	18	3	7	2
19	Reaching to floor	19	3	7	2
20	Looking at paperwork	20	7	8	1
21	Looking at floor	21	7	8	1
22	Looking at IP	22	7	8	1
23	Looking down	23	7	8	1
24	Looking up	24	7	8	1
25	Toothpick/Visor mirror	25	4	14	3
26	Looking right - outside	26	6	9	1
27	Looking left - outside	27	6	9	1
28	Looking outside	28	6	9	1
29	Adjusting in seat	29	3	10	2
30	Taking off jacket	30	3	7	2
31	Lets go of wheel	31	3	7	2
32	Wiping dash	32	3	11	3
33	Rubbing face	33	4	12	3
34	Brushing hair	34	4	12	2

Table 7B. Grouping strategy codes.

High-Level Task Group	Detailed Task Group	Driver Resource Used
1=Manual/Device	1=CB	1=Primarily Visual
2=Talking	2=Radio	2=Primarily Manual
3=Bio-mechanical	3=Cell Phone	3=Primarily Visual + Manual
4=Personal/Grooming	4=Cigarette	4=Primarily Speech
5=Consuming/Put into mouth	5=Eating/Drinking	*Note: It is assumed that each task has supplemental information processing of unknown degree.
6=Look away/outside	6=Talk to Passenger	
7=Look away/inside	7=Miscellaneous tasks with one or both hands off the wheel, and driver usually looking forward	
	8=Glances to miscellaneous locations inside cab	
	9=Glances to locations outside of vehicle other than forward roadway	
	10=Adjusting in seat	
	11=Wiping dash	
	12=Grooming	
	13=Cough/Yawn	
	14=Toothpick use while looking in visor mirror	

Specific Distractions

Figure 4 shows the frequency of incident occurrence for each of the 36 distraction types, while Figure 5 shows the same data converted to percentages. As can be seen, distractions involving the driver looking at an unknown object outside of the vehicle contributed to the largest number of distraction-related incidents.

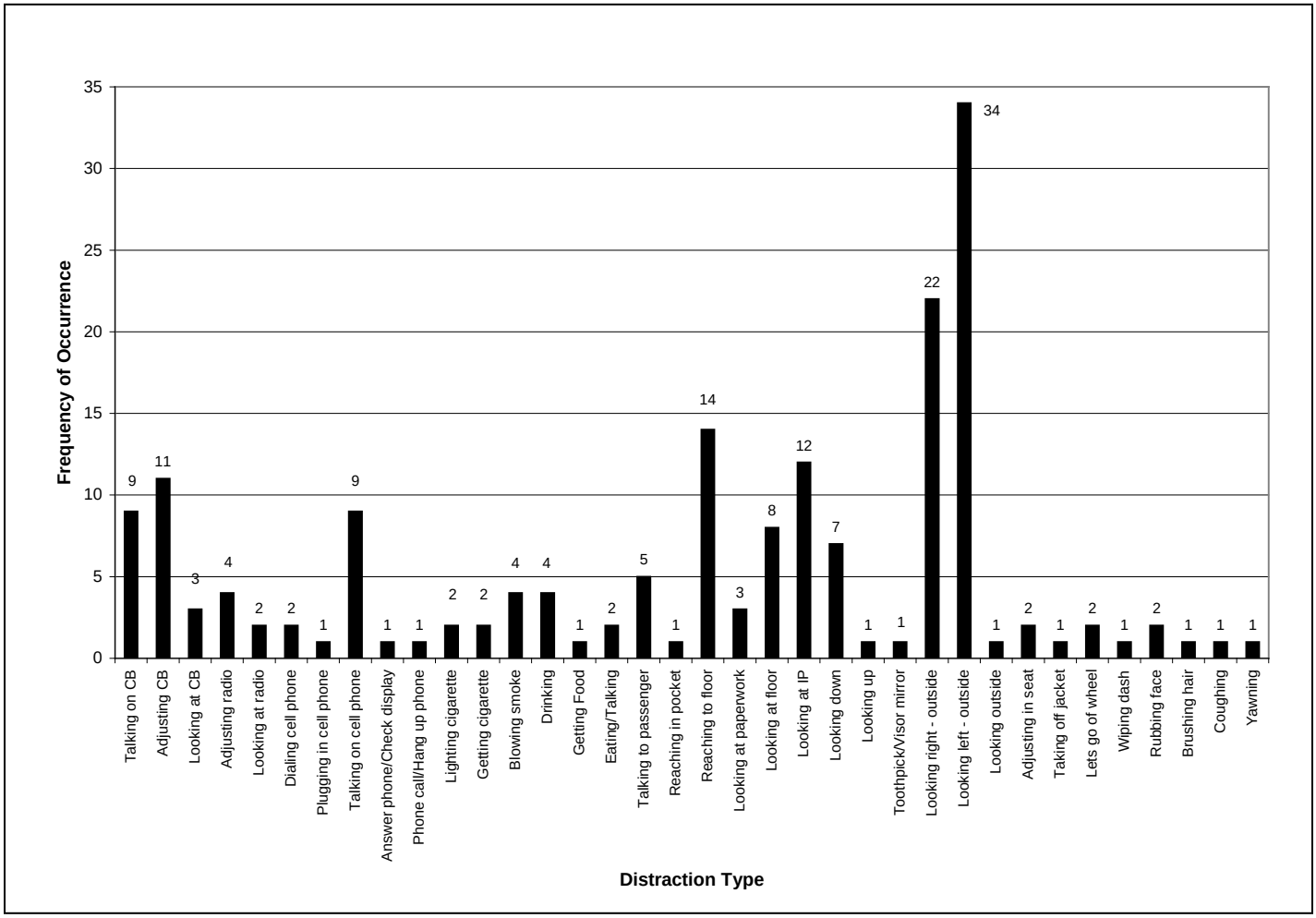

Figure 4. Frequency of critical incidents for each of the 36 distraction types.

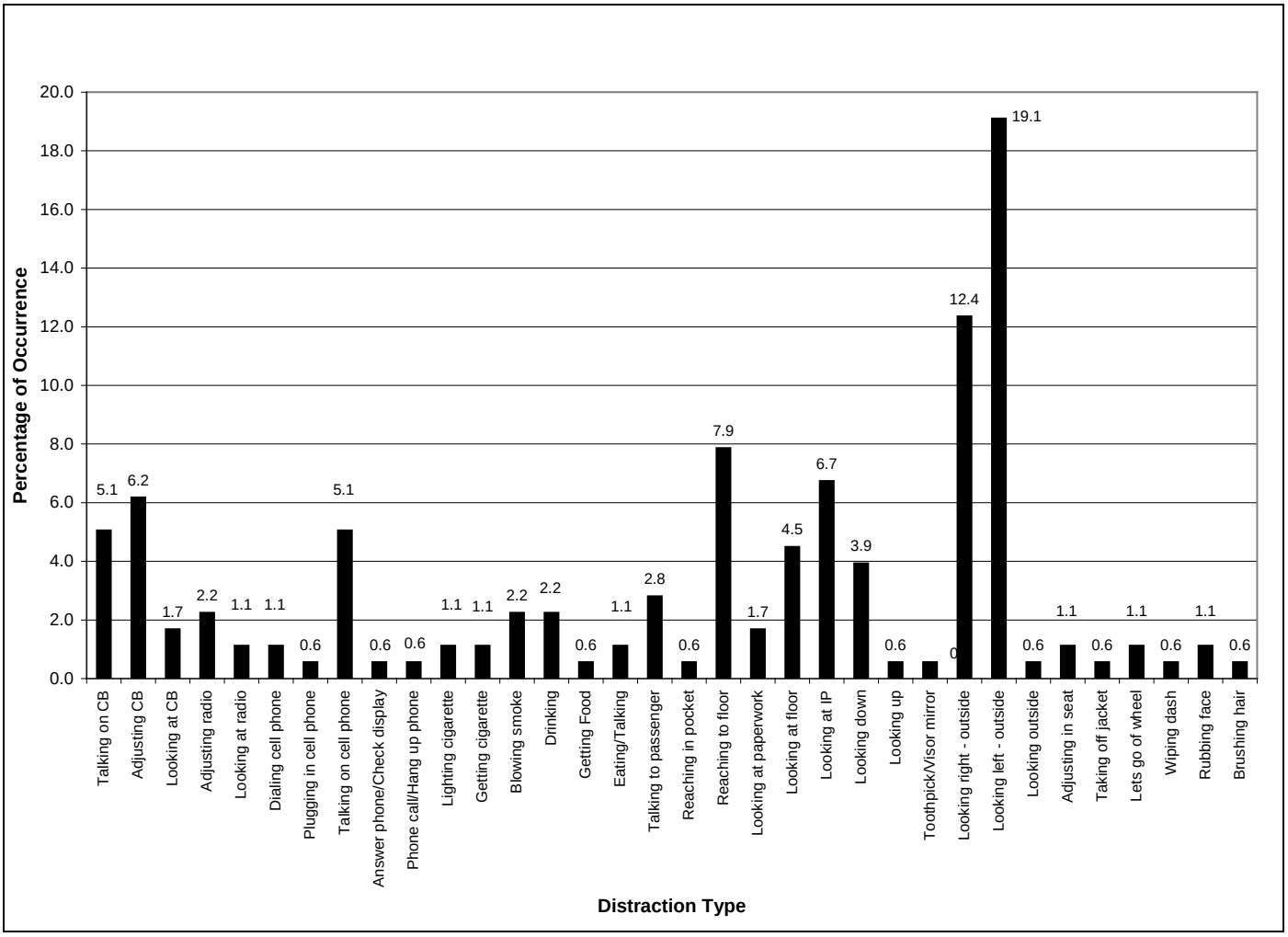

Figure 5. Percentage of critical incidents for each of the 36 distraction types.

It must be strongly stressed that the *exposure due to total frequency of occurrence* is not directly accounted for in these data, and this would be expected to have a substantial impact on the results. For example, the number of times that the driver glanced at an outside object is likely to be far greater than the number of times that he/she talked on a CB radio. As such, simply as a function of exposure frequency, one would expect incidents to occur more frequently with activities/tasks that drivers perform more frequently. Because only critical incidents were recorded in this research, the true extent to which a driver talked on a CB, for example, and ***did not*** have an incident is unknown. Rather, only the tasks/activities that drivers were engaged in during an incident are known.

Even without knowing this frequency exposure information, there are estimates of exposure that can be made. One such estimate is by determining *time exposure,* or the time it takes to perform a task/activity multiplied by the frequency of occurrence. One might expect that tasks/activities with a large time exposure may be less safe than those with a small time exposure. Put another way, tasks that drivers engage in more frequently and for a longer period of time may serve to divert more of the driver's attention away from operating the vehicle. To calculate time exposure, the mean duration of the task/activity is needed. Figure 6 shows the mean duration of each task/activity for each distraction type. Time exposure is then calculated by multiplying the mean duration by the frequency for a given distraction type. The results from this calculation are shown in Figure 7. By far, talking on the cell phone had the largest time exposure than any of the other tasks. The tasks with the largest time exposures were (i) Talk on Cell Phone, (ii) Talk on CB, (iii) Answer Phone/Check Display, (iv) Complete Phone Call/Hang Up Phone, and (v) Dial Cell Phone.

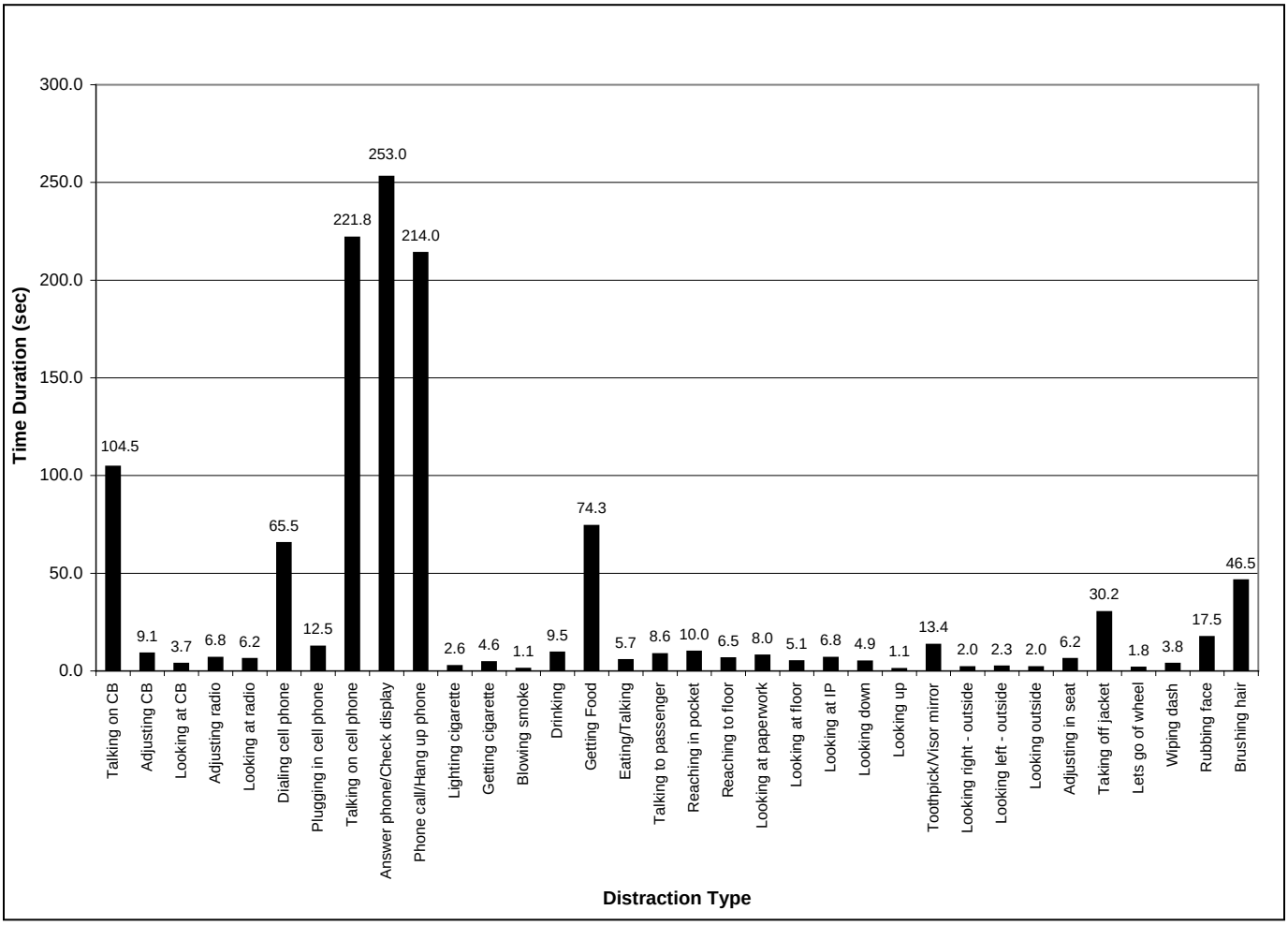

Figure 6. Mean duration for each of the 36 distraction types (in seconds and tenths of second).

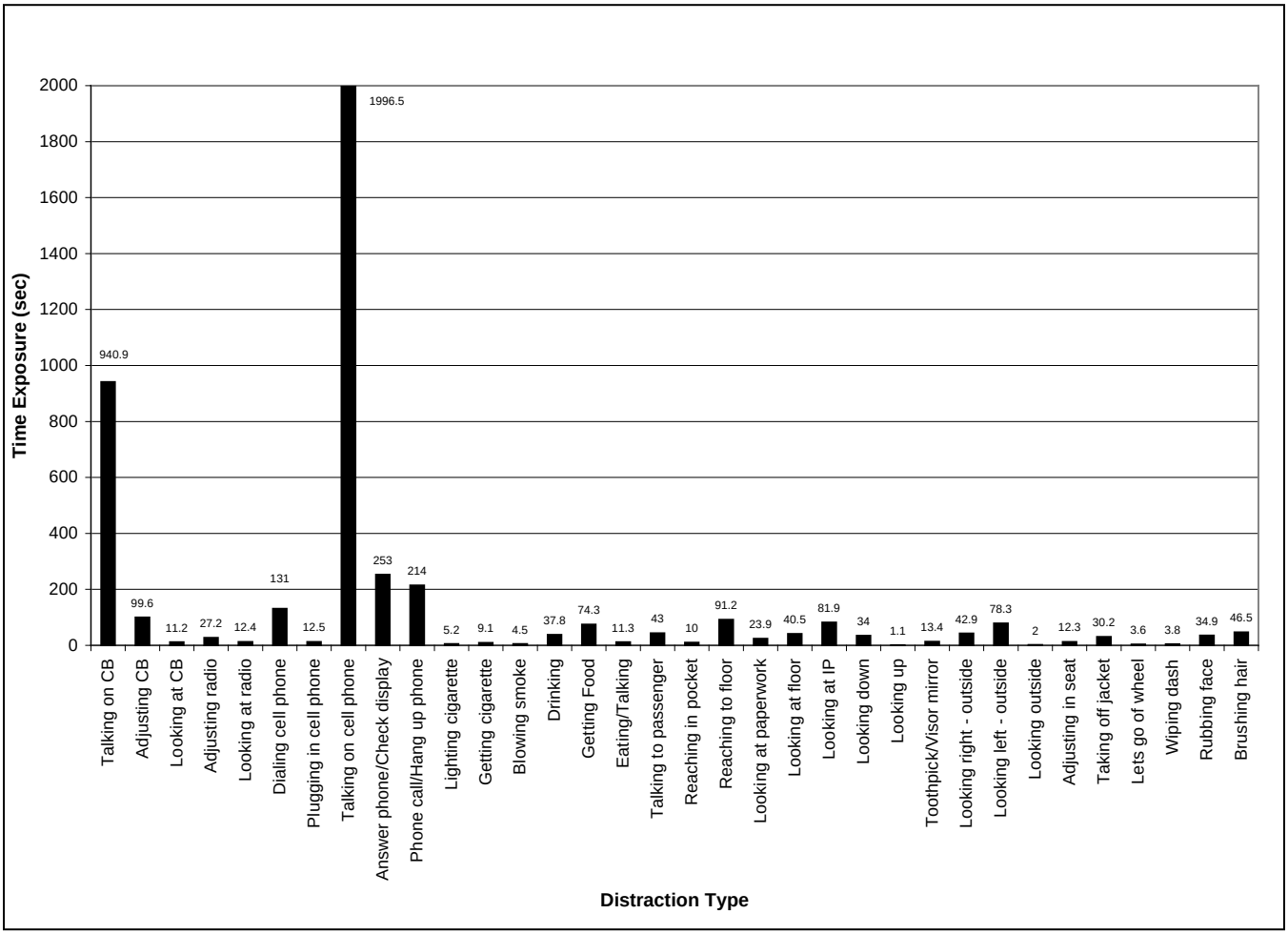

Figure 7. Time exposure for each of the 36 distraction types (Frequency * Duration).

Driving is primarily a visual task. As such, an important measure to assess the "risk" or relative safety associated with performing a task/activity is the total time that the eyes are off the forward roadway. Tasks/activities that direct the drivers' eyes away from the forward roadway for a comparatively longer period of time may be assumed to be less safe. The proportion of time that the drivers' eyes were not directed at the forward roadway was determined for each task/activity by conducting eye glance analyses for a 20 second epoch surrounding the incident trigger (this procedure is detailed later in the report). Figure 8 shows, for each distraction type, the mean proportion of time that drivers spent looking forward and not looking forward.

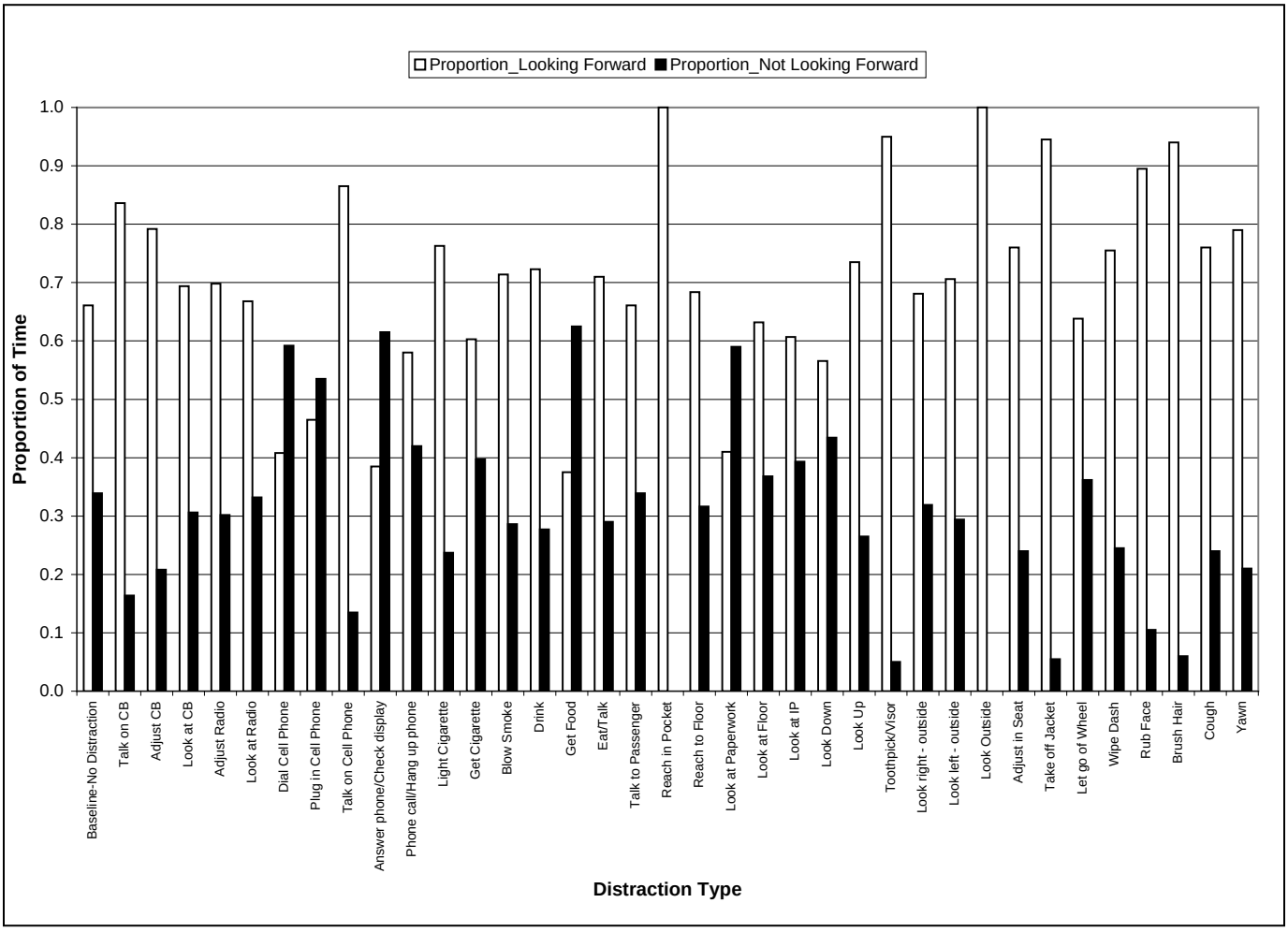

Figure 8. Mean proportion of time looking forward and not-forward for each of the 36 distraction types.

It seems reasonable to assume that the more frequently a driver engages in a particular task/activity, the longer that task/activity takes to complete, and the less time that that task/activity allows the driver to spend looking at the forward roadway, the greater the potential risk (to safe driving) of performing that task/activity. To determine the estimated[1] total time that all the drivers' eyes were off of the forward roadway, the mean proportion of time not looking

[1] The calculation for proportion of time is based on the eye glance measures that were taken for a 20-second period surrounding the event trigger. As such, the total time that the drivers' eyes were off of the road is an estimated value.

forward is multiplied by the task/activity frequency and the task/activity duration. The results of this calculation are shown in Figure 9.

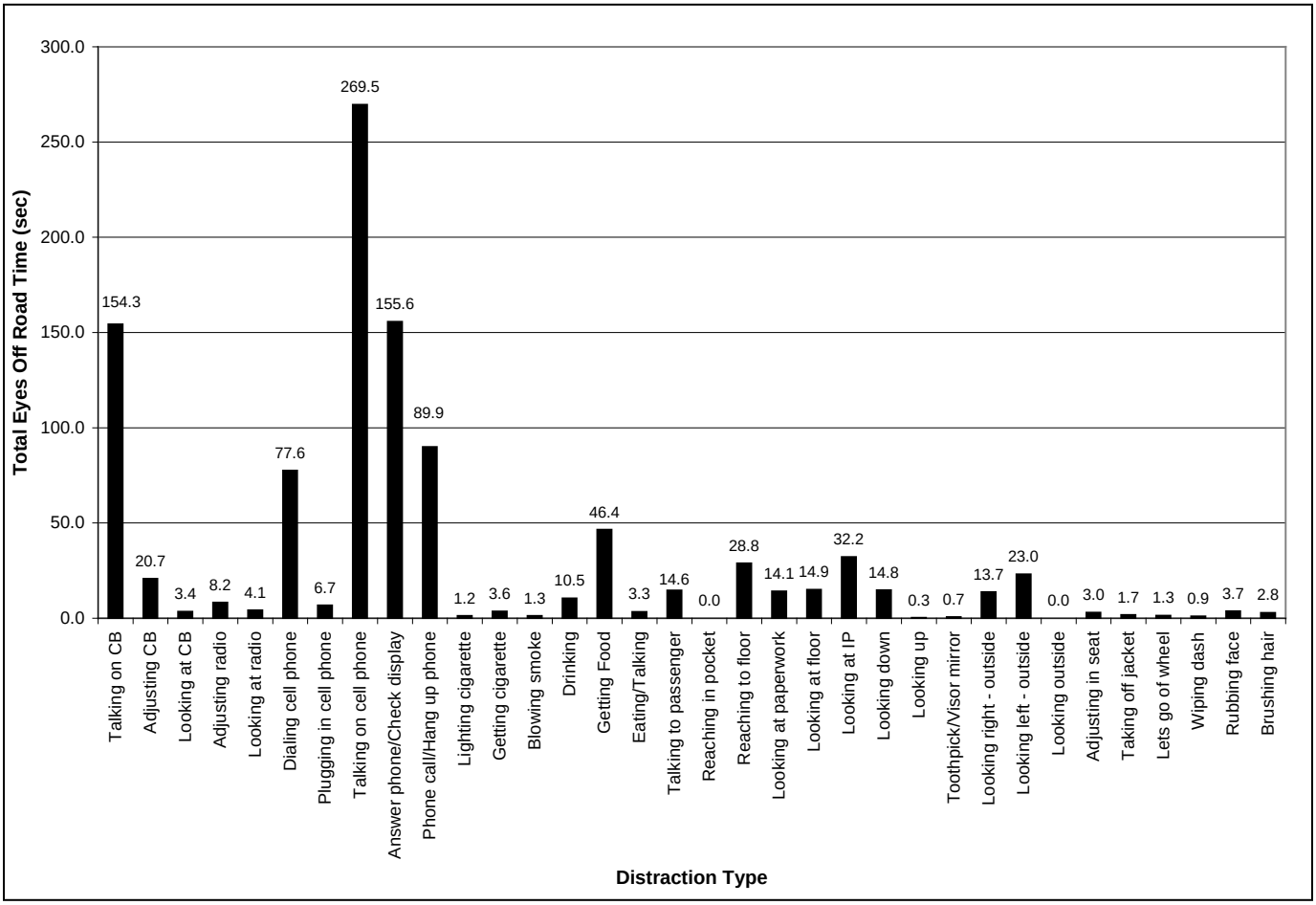

Figure 9. Total Eyes Off Road Time for each of the 36 distraction types (Frequency * Duration * Proportion Not Forward).

As can be seen from Figure 9, the tasks with the largest Total Eyes Off Road Time were (i) Talk on Cell Phone, (ii) Answer Cell Phone/Check Display, (iii) Talk on CB, (iv) Complete Phone Call/Hang Up Phone (put phone away), and (iv) Dial Cell Phone. The high Total Eyes Off Road Time values for the talking-related tasks (i.e., talk on cell phone and talk on CB) are a bit surprising as it may be assumed that during a talking task, the driver spends a predominant amount of time looking at the forward roadway. As will be detailed in the *Eye Glance Analysis Results* section presented later, the mean proportion of time that the drivers were looking forward

during a Talk on Cell Phone task was 0.865, while the same measure for a Talk on CB task was 0.836. As such, it is indeed true that during "talking" tasks, the driver primarily looks at the forward roadway. However, because the duration of these tasks was so long (i.e., on a task by task comparison, drivers spent more time talking on the cell phone and talking on the CB than any other task), the relatively small proportion of time not looking at the forward roadway (i.e., approximately 0.15) is magnified.

A second interesting result shown in Figure 9 is that four of the five tasks that the drivers spent the most amount of time looking at locations other than the forward roadway were cell phone-related tasks. As indicated, details on the locations that drivers were looking while conducting distraction tasks/activities are presented in the *Eye Glance Analysis Results* section. As mentioned above, the proportion of time looking at the forward roadway for the talking-related cell phone task was 0.865. Regarding the non-talking cell phone-related tasks, the proportion of time spent looking forward was as follows:

- Answering Cell Phone/Checking the Display = 0.580
- Dialing Cell Phone = 0.408
- Completing Phone Call/Hanging Up Phone = 0.385

While not listed as a task with the highest Total Eyes Off Road Time, the fifth cell phone-related task, Plugging in Cell Phone, had a proportion of time looking at the forward roadway of 0.465. From these results, it can be seen that for three cell phone-related tasks, drivers spent less than 50% of their time looking at the forward roadway. With the exception of Talk on the Cell Phone, the cell phone tasks that had the highest Total Eyes Off Road Time involved both a visual and a manual component; that is, to perform the task, the driver had to look away from the road *and* take one hand off of the steering wheel. It is suggested that these findings will give support to design solutions that reduce a driver's necessity to look away from the roadway and manually manipulate the phone. For example, hands-free phones would be expected to substantially reduce the visual and manual demands associated with dialing, answering, or hanging up a cell phone.

Again focusing on the talking-related tasks, one conclusion that might be drawn from these results is that in order to maximize safety and avoid critical incidents while driving, drivers should keep cell phone and CB conversations to a short duration. What might be a recommended duration for such a talking-task? Knowing the frequency with which these tasks lead to critical incidents, and the proportion of time that drivers spent looking at the forward roadway during these tasks, we can "back calculate" to a recommendation by modeling the Total Eyes Off Road Time of another "acceptable" task. For example, if we use the Adjusting the Radio task as our model task,[2] we see that the Total Eyes Off Road Time for this task was 8.21 seconds: 4 (frequency) * 0.302 (proportion not looking forward) * 6.8 sec (duration). If we want our cell phone task to have a similar Total Eyes Off Road Time measure, we would divide the accepted time (8.21 seconds) by the product of the frequency (9) * proportion not looking forward (0.135). This exercise produces a recommended cell phone call length of 6.8 seconds. This compares with the mean cell phone call (talking) of over 3.5 minutes[3] that was recorded in this study. For the CB task, the recommended duration would be 5.6 seconds.

The "model" task of Looking at the Instrument Panel is another task that drivers routinely perform. As noted in Figure 9, the Total Eyes Off Road Time for this task was 32.19 seconds. Using the same calculation as outlined with the Adjust the Radio task, the cell phone call duration would be 26.5 seconds to achieve relatively equal Total Eyes Off Road Time. For a CB conversation, the duration would be 21.8 seconds.

Based on this analysis, and using the two relatively common tasks that were performed, a general recommendation might be to keep cell phone and CB conversations to less than 30 seconds. Of course, using other "model" tasks would result in different values. However, a "30 seconds or less" time frame seems like a reasonable estimate.

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[2] As radios are standard features in most automobiles, Adjust the Radio might be viewed as a relatively common task that has with it an "acceptable" level of risk.

[3] It must be noted that video for five of the nine cell phone calls recorded ended prior to the driver completing the phone call. As such, the call duration values used are likely lower than actuality. That is, the mean talking time on the cell phone was likely larger than the 3 ½ minute estimate.

The important point to be made from this exercise is that despite the fact that drivers' eyes are on the forward roadway for much of a talking task, long duration calls on cell phones or CBs produce a safety-critical situation for the driver, and to minimize the dangers associated with these tasks, calls on these devices should be kept relatively short. Based on these findings, it is recommended that cell phone and CB calls should only be made if absolutely necessary, and then for short durations (e.g., calls should not exceed about 30 seconds).

High-Level Task Group

Figure 10 shows the frequency of incident occurrence when using the high-level task grouping strategy (see Table 7A). Figure 11 shows the same data converted to percentages. As can be seen, distractions involving the driver looking away both outside and inside the vehicle accounted for approximately 50% of the incidents.

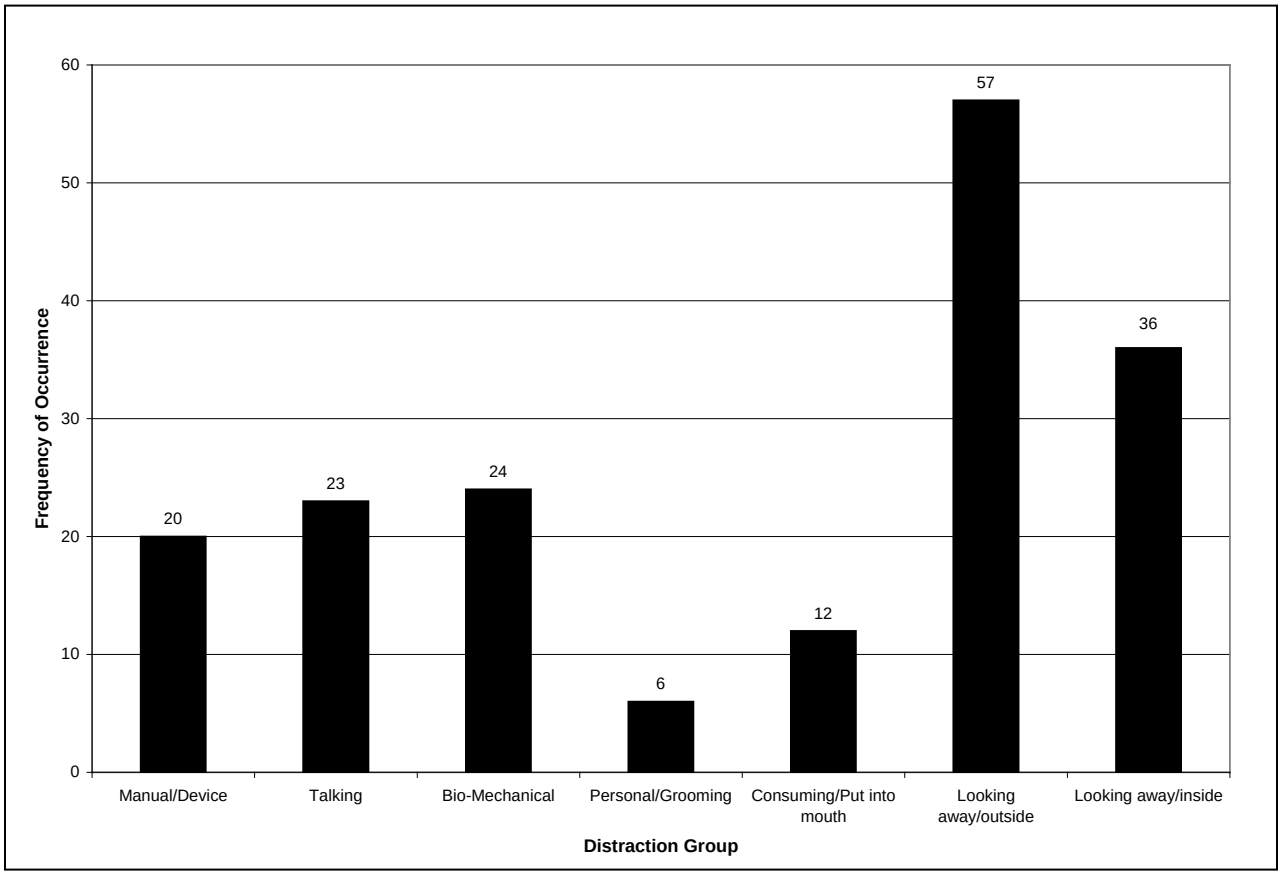

Figure 10. Frequency of critical incidents as a function of task grouping (high-level).

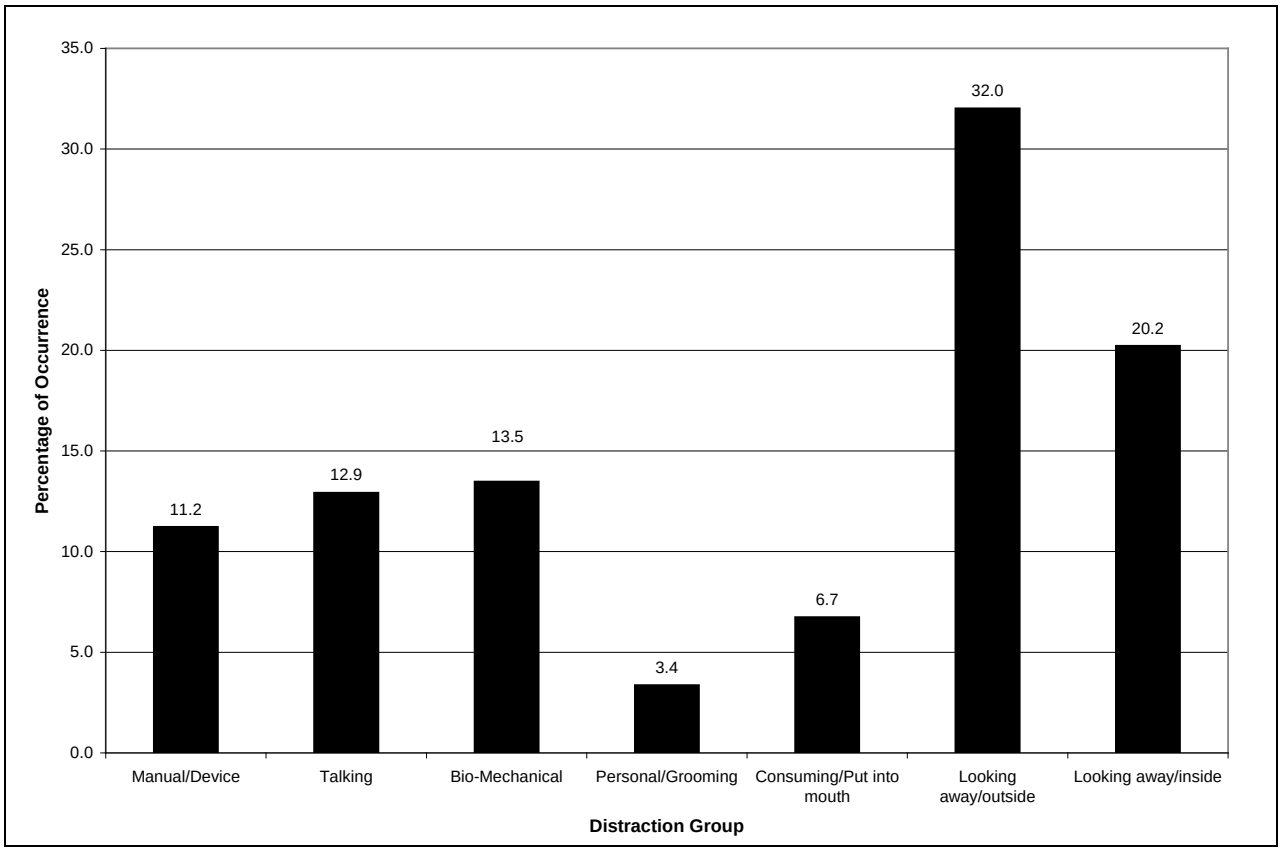

Figure 11. Percentage of critical incidents as a function of task group (high-level).

As outlined in the previous section with the ungrouped distraction types, assessments were made for Task Duration, Time Exposure, Proportion of Time Looking Forward/Not Looking Forward, and Total Eyes Off Road Time. Plots of these three measures are shown in Figures 12, 13, 14, and 15.

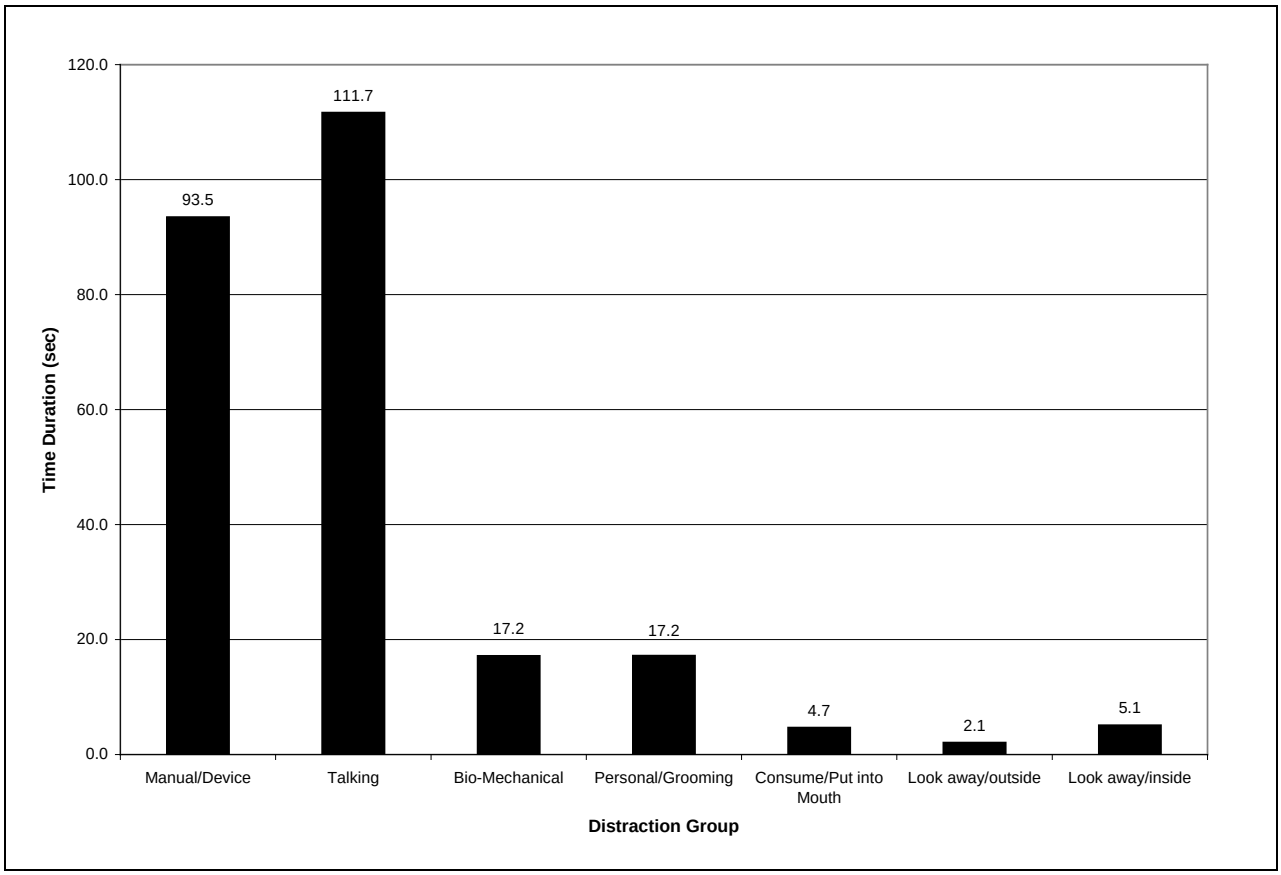

Figure 12. Mean task duration as a function of task group (high-level) (in seconds and tenths of seconds).

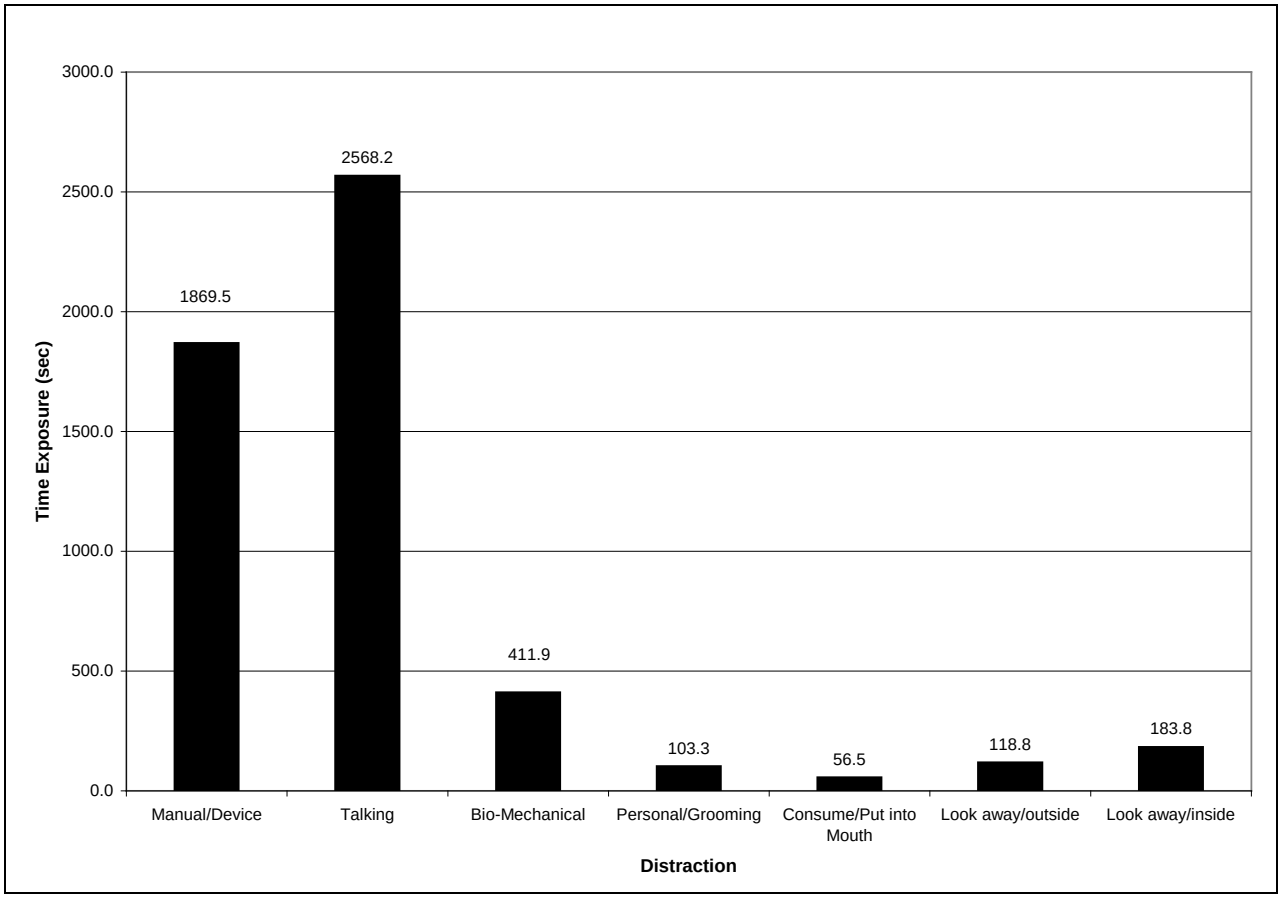

Figure 13. Time exposure as a function of task group (high-level) (Frequency * Duration).

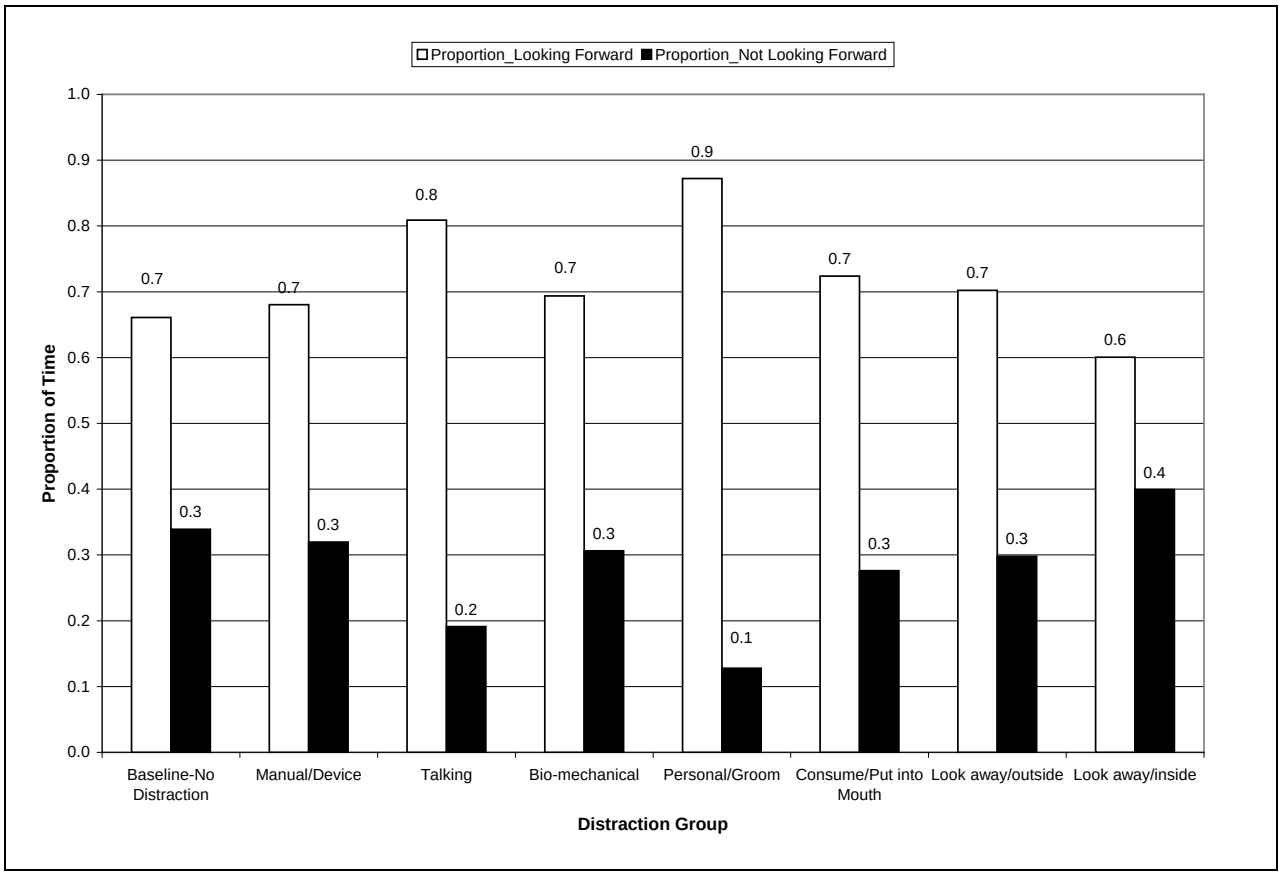

Figure 14. Mean proportion of time looking forward and not-forward as a function of task group (high-level).

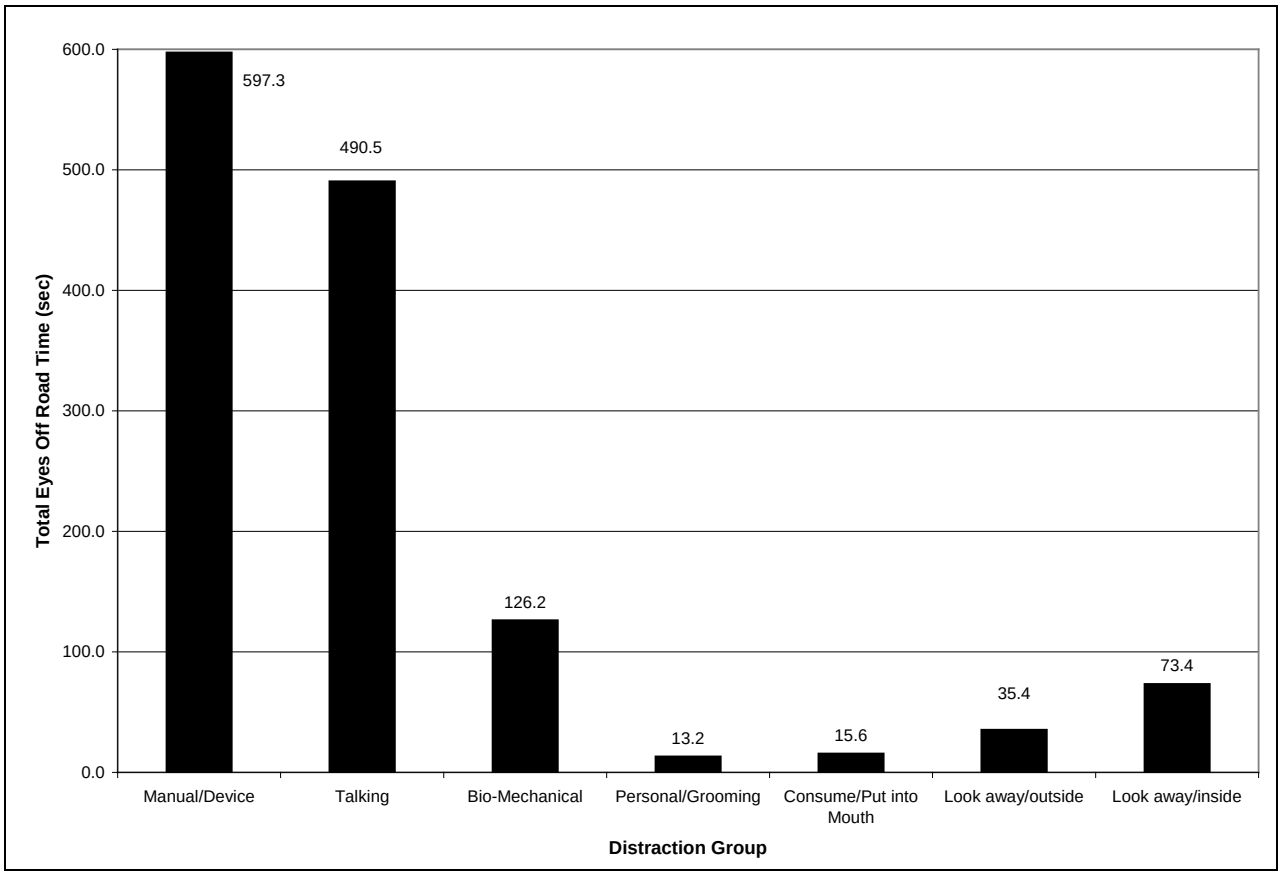

Figure 15. Total Eyes Off Road Time as a function of task group (high-level) (Frequency * Duration * Proportion Not Forward).

Using this task grouping strategy, the Total Eyes Off Road Time was highest for tasks where the drivers were using a manual device (e.g., radio, CB, cell phone). The group of talking tasks had the second highest amount of Total Eyes Off Road Time.

Detailed Task Group

Figure 16 shows the frequency of incident occurrence using the detailed task grouping strategy (see Table 7B). Figure 17 shows the same data converted to percentages.

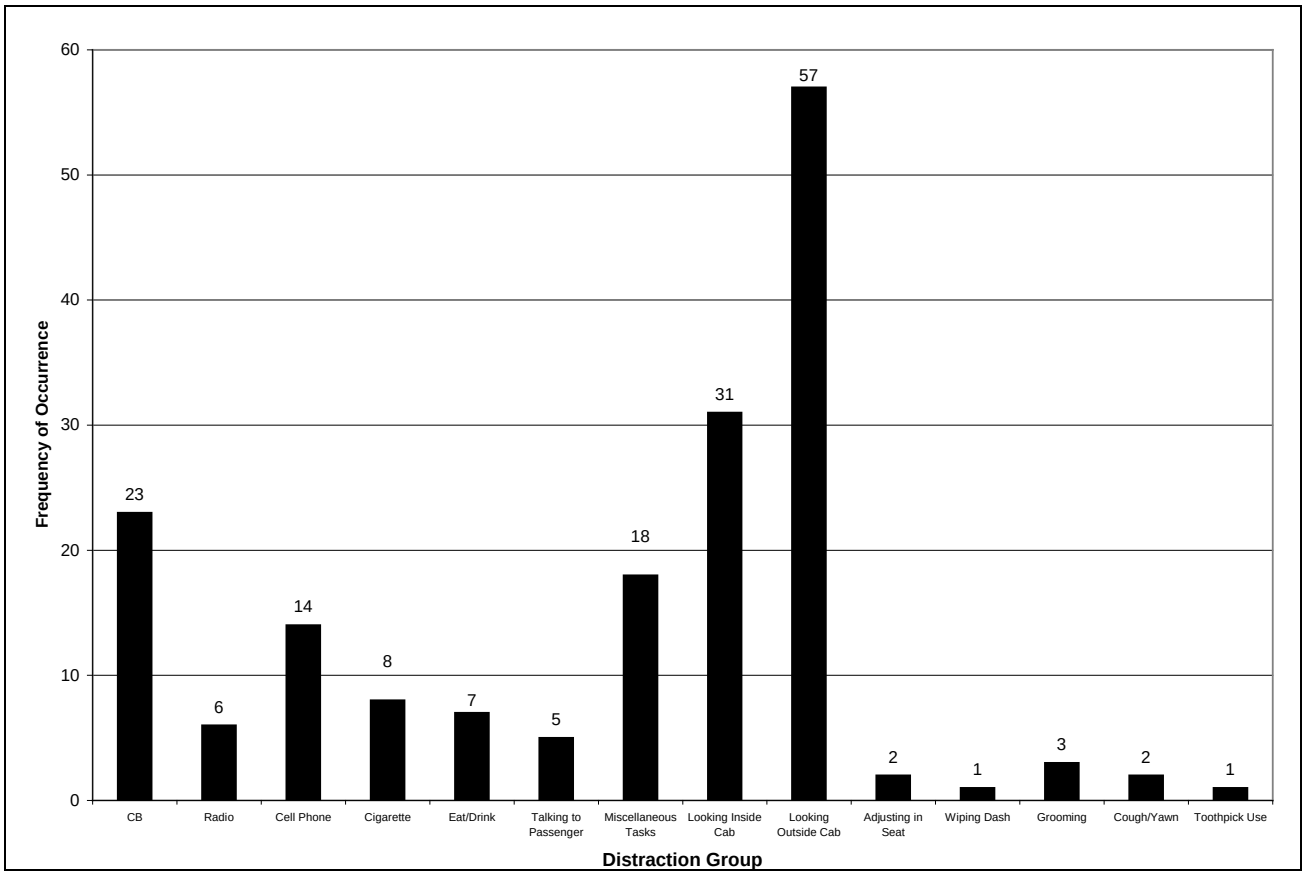

Figure 16. Frequency of critical incidents as a function of task group (detailed).

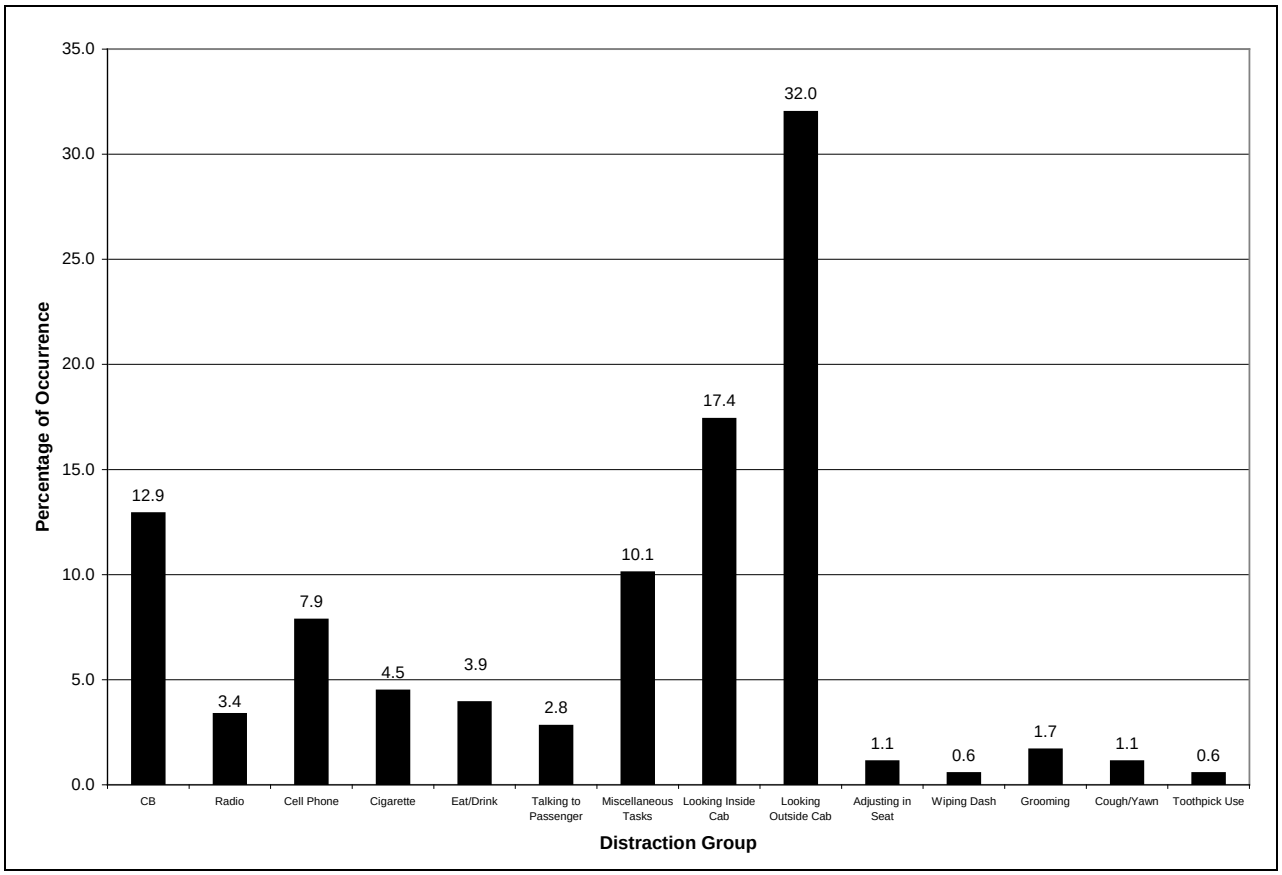

Figure 17. Percentage of critical incidents as a function of task group (detailed).

Consistent with the previously presented grouping strategies, assessments were made for Task Duration, Time Exposure, Proportion of Time Looking Forward/Not Looking Forward, and Total Eyes Off Road Time. Plots of these three measures are shown in Figures 18, 19, 20, and 21.

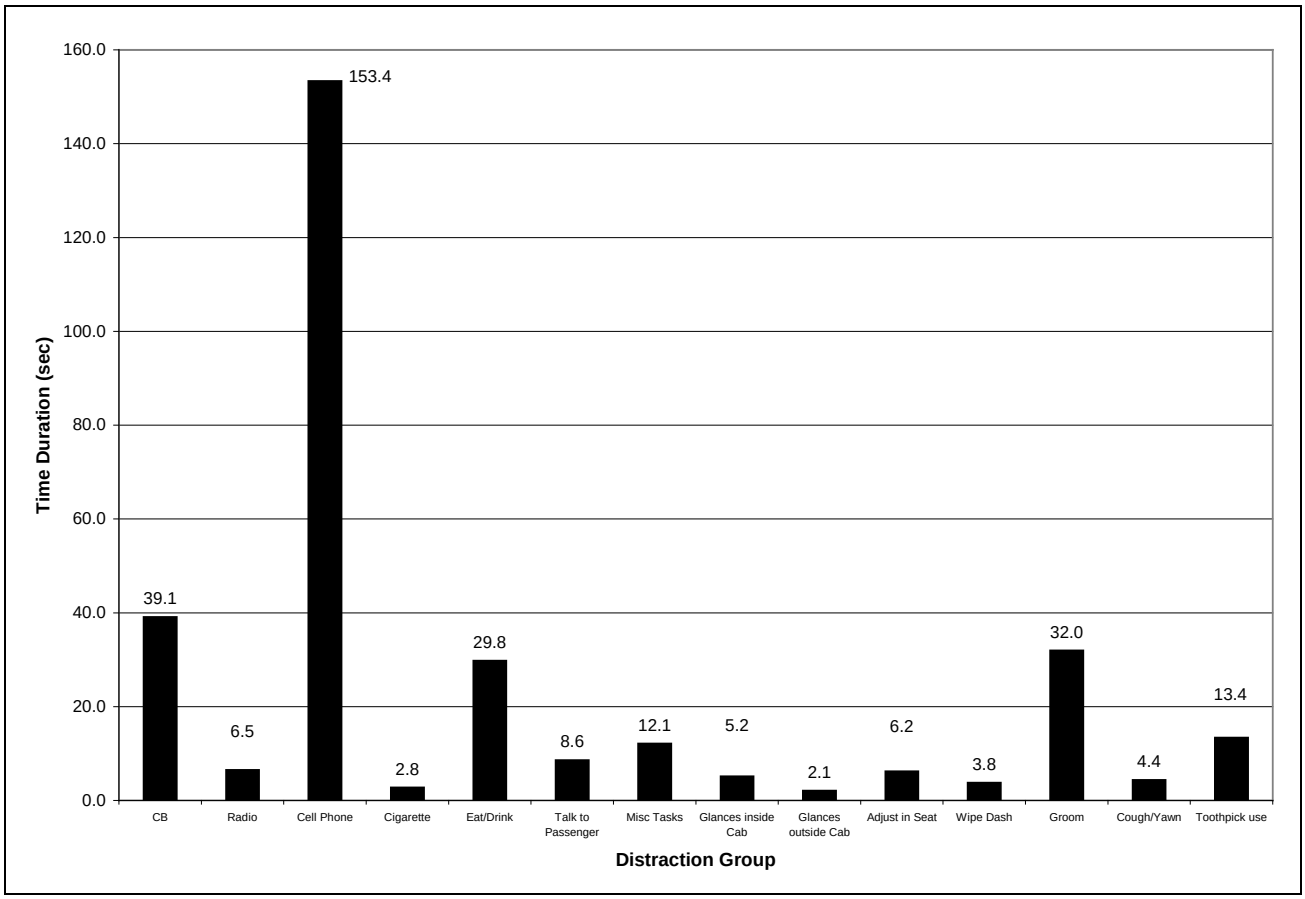

Figure 18. Mean duration as a function of task group (detailed) (in seconds and tenths of seconds).

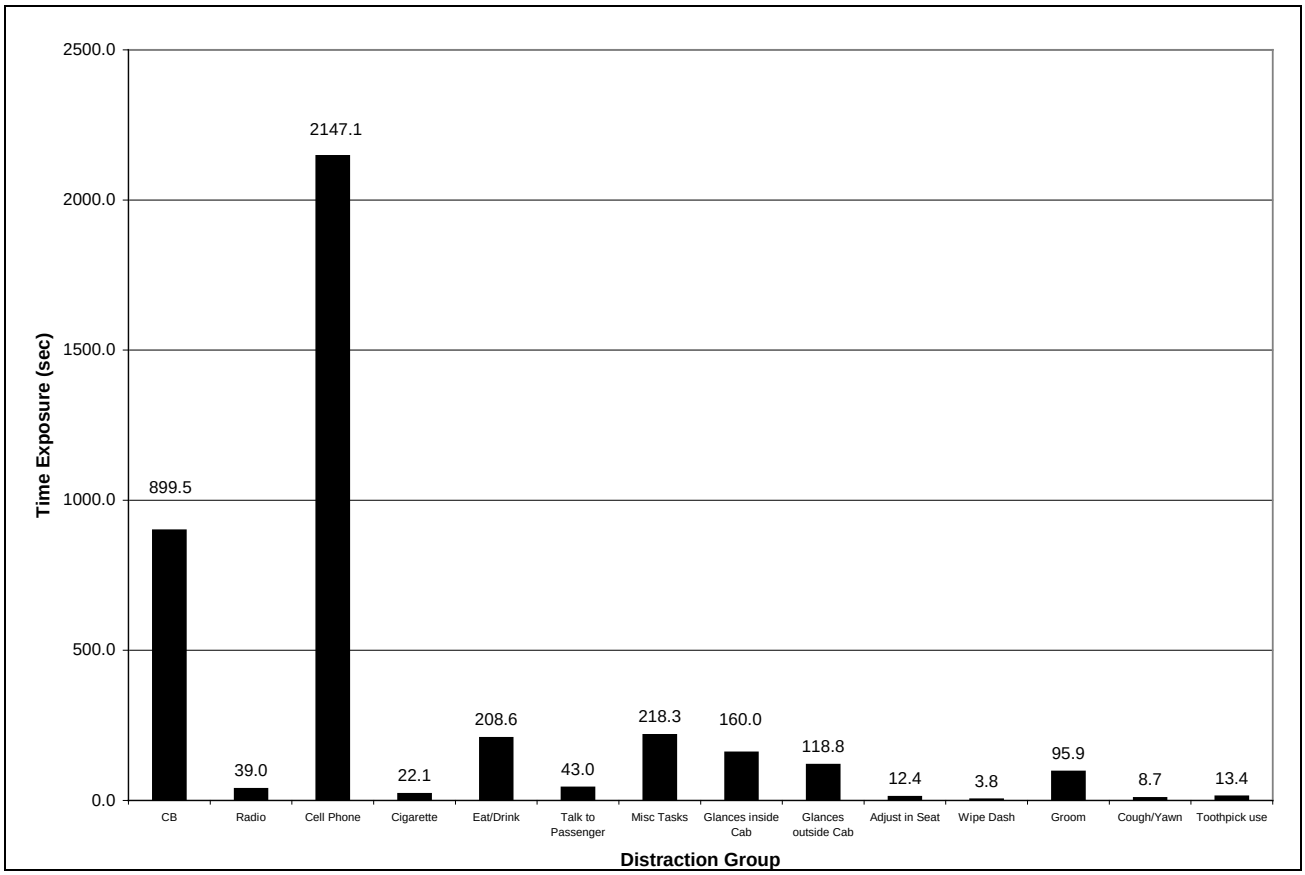

Figure 19. Time exposure as a function of task group (detailed) (Frequency * Duration).

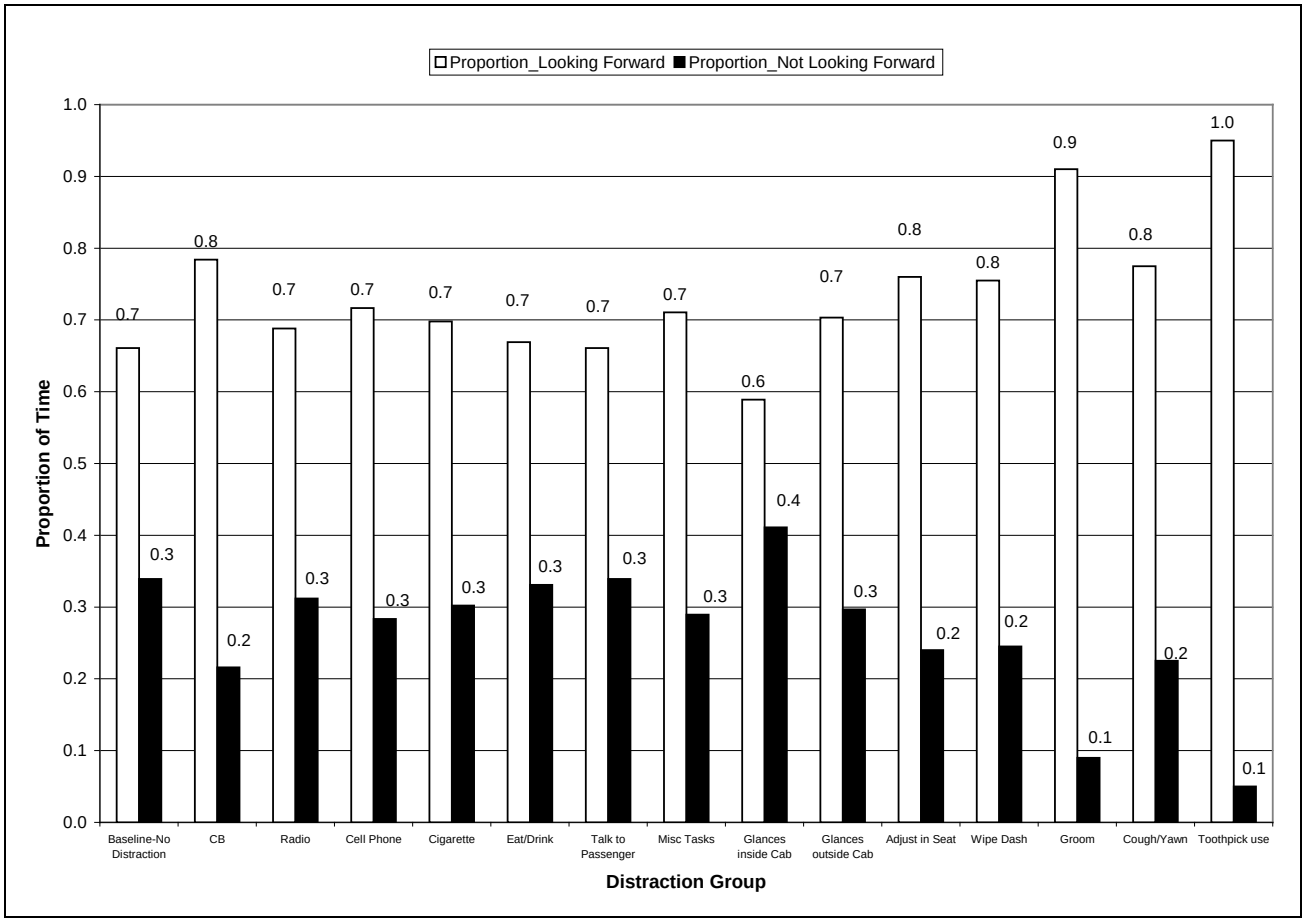

Figure 20. Mean proportion of time looking forward and not-forward as a function of task group (detailed).

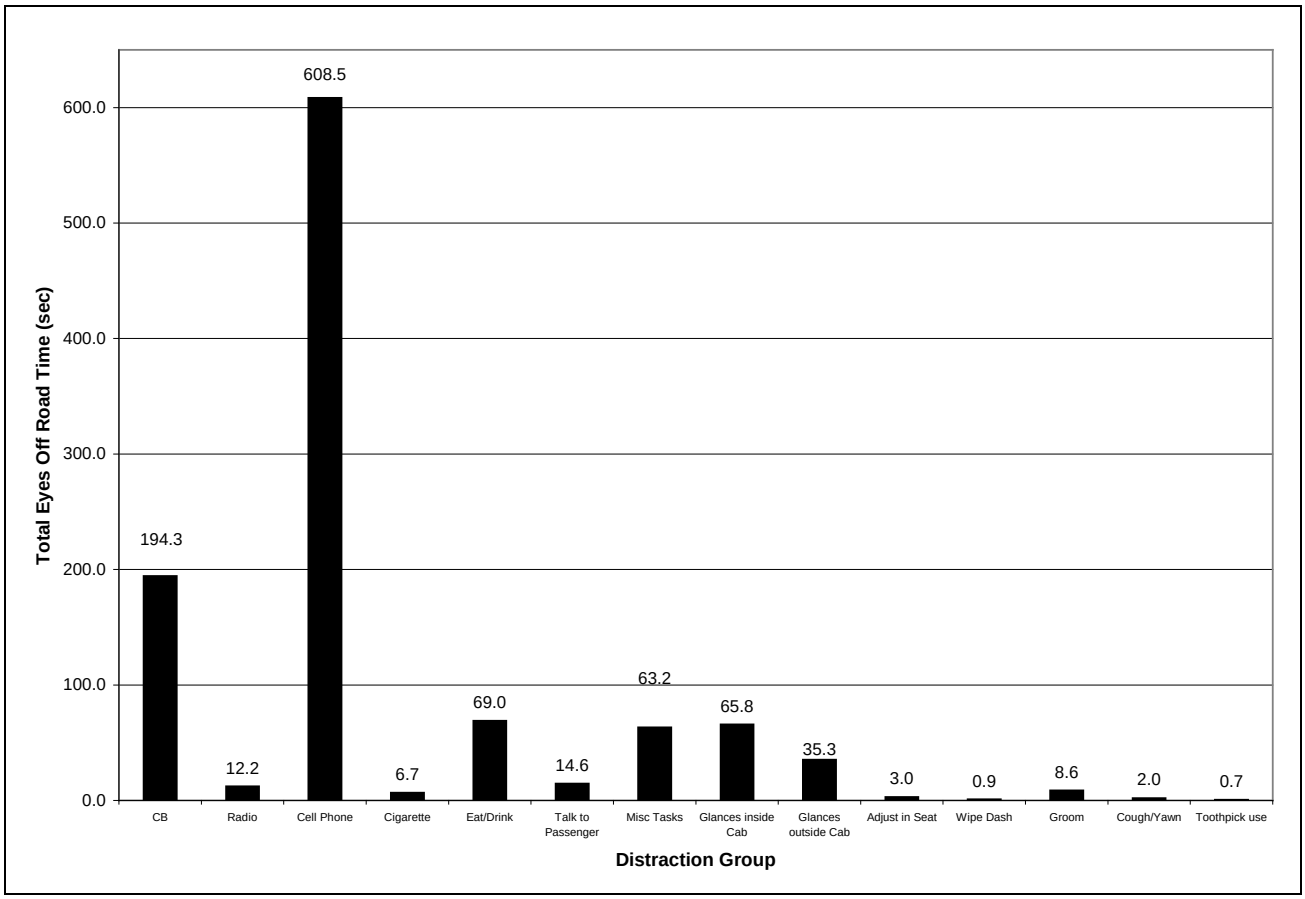

Figure 21. Total Eyes Off Road Time as a function of task group (detailed) (Frequency * Duration * Proportion Not Forward).

Consistent with the previous findings, the results using the detailed grouping strategy highlight the apparent safety implications of cell phone and CB tasks. More than any other group, cell phone tasks were found to divert the drivers' eyes from the forward roadway to the greatest degree, followed next by the CB task. As highlighted in Figure 18, the reason for this is the relatively long durations associated with cell phone tasks.

Although both cell phone and CB tasks can be considered "talking tasks," when the two task types were compared, cell phone tasks had a Total Eyes Off Road Time of 608.5 seconds as compared to CB tasks that had 194.3 seconds. Put another way, cell phone tasks were associated with three-times as much eyes off road time as compared to CB tasks. This, despite the fact that there were 23 CB tasks and 14 cell phone tasks in the entire data set.

Driver Resource Group

Figure 22 shows the frequency of incident occurrence using the driver resource grouping strategy (see Table 7B). Figure 23 shows the same data converted to percentages. In terms of the frequency associated with the different resource groups, it can be seen that visual tasks accounted for most of the incidents that were recorded.

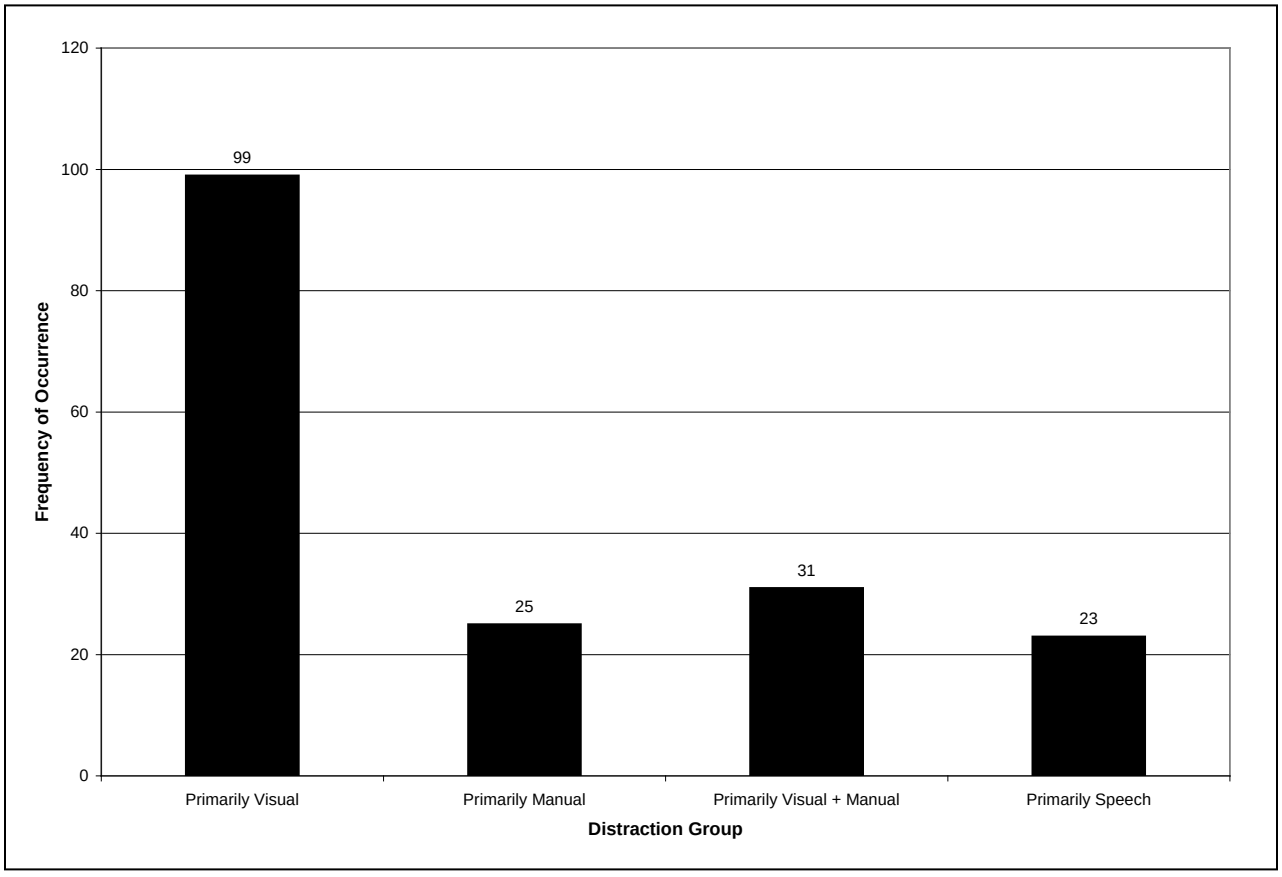

Figure 22. Frequency of critical incidents as a function of driver resource grouping strategy.

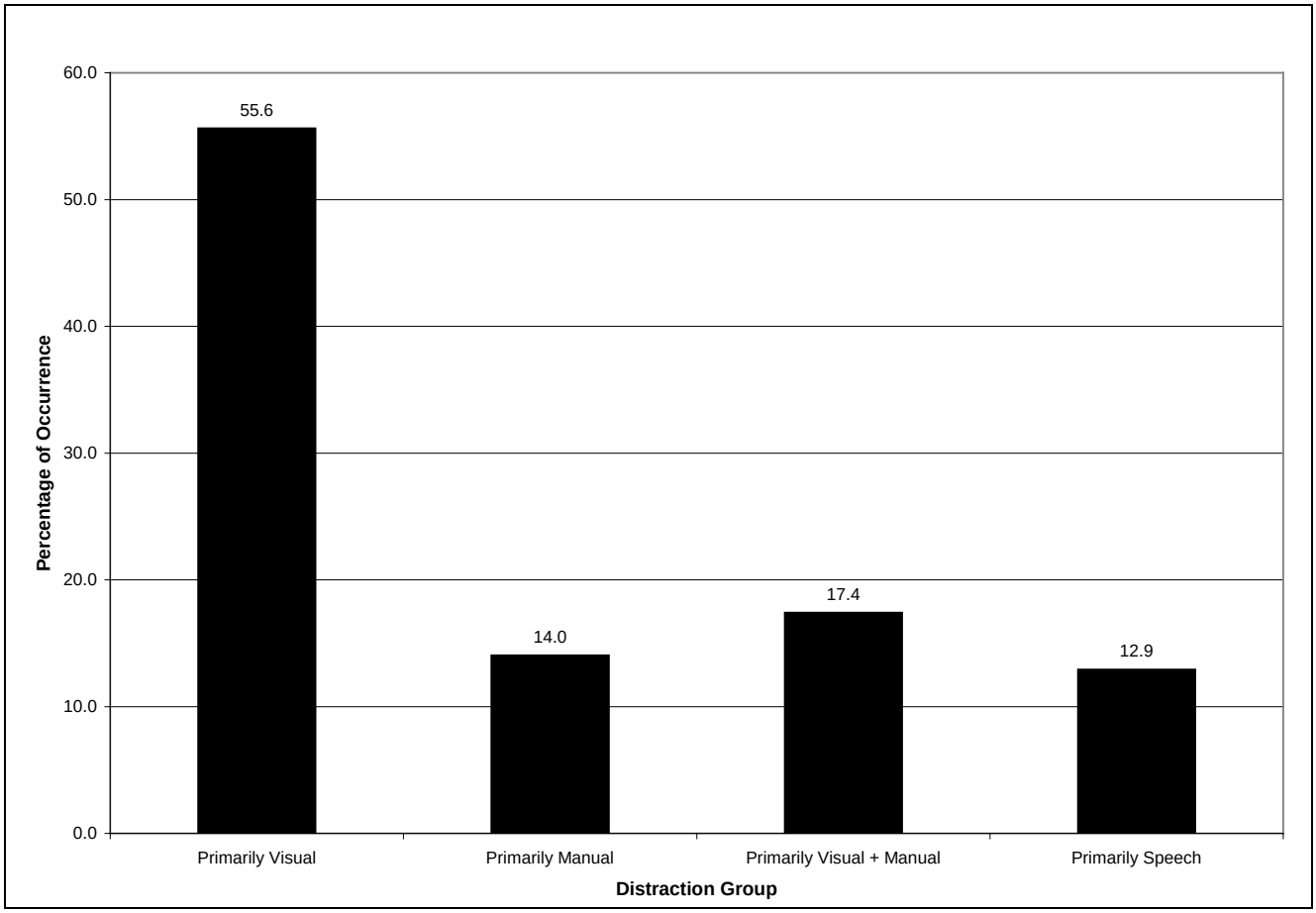

Figure 23. Percentage of critical incidents as a function of driver resource grouping strategy.

Figures 24, 25, 26, and 27 show histograms for the various driver resource groups for Task Duration, Time Exposure, Proportion of Time Looking Forward/Not Looking Forward, and Total Eyes Off Road Time.

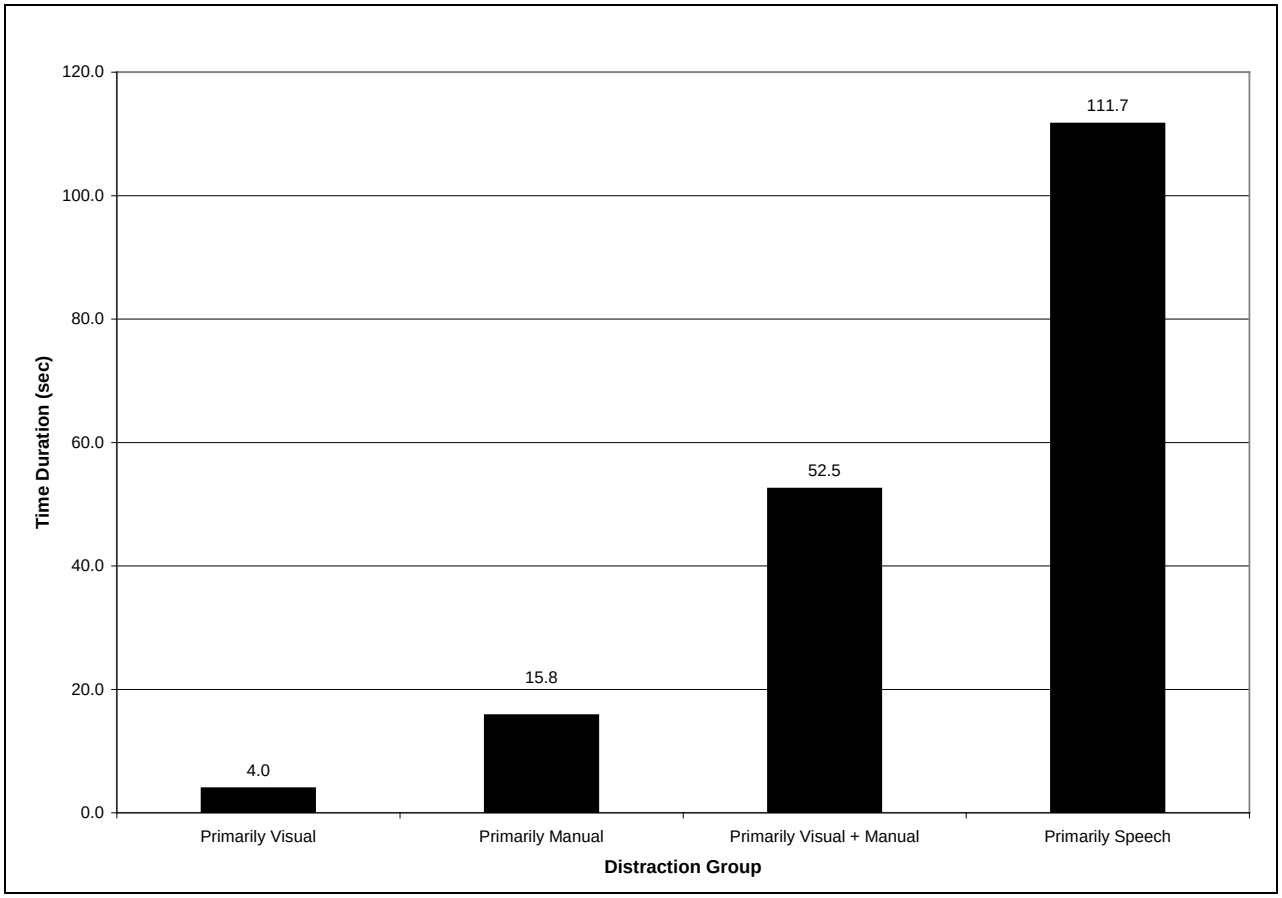

Figure 24. Mean duration as a function of driver resource grouping strategy (in seconds and tenths of seconds).

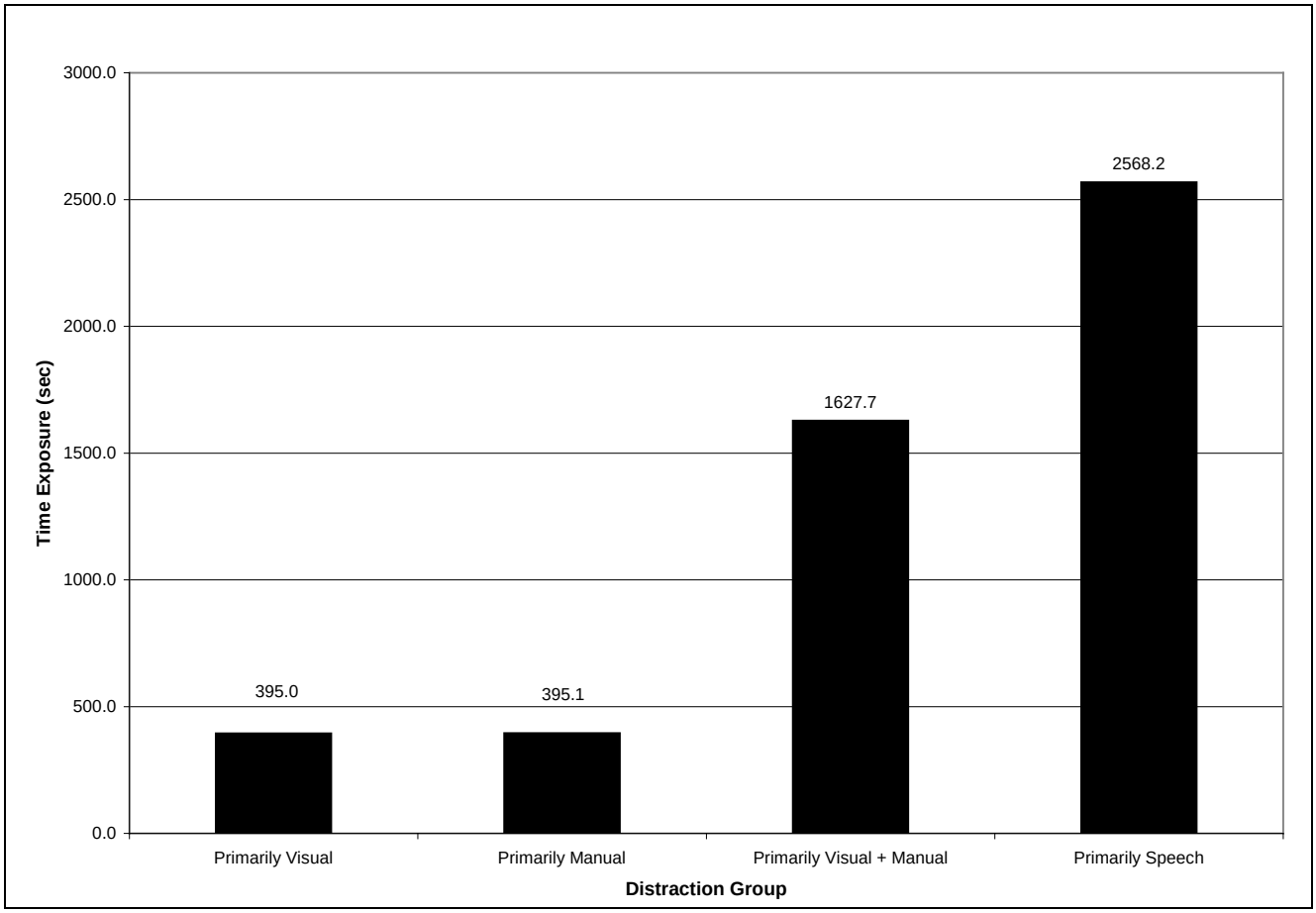

Figure 25. Time exposure as a function driver resource grouping strategy (Frequency * Duration).

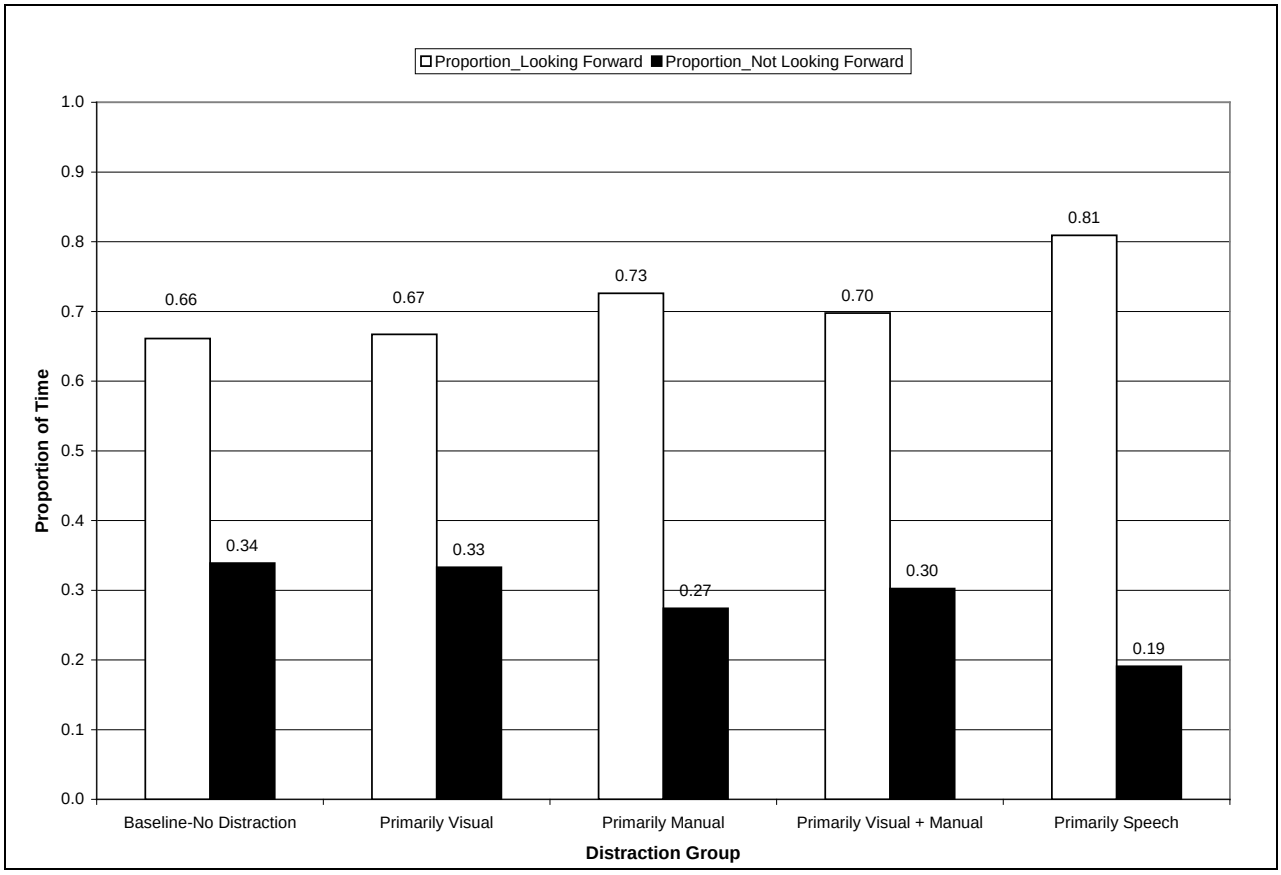

Figure 26. Mean proportion of time looking forward and not-forward as a function of driver resource grouping strategy.

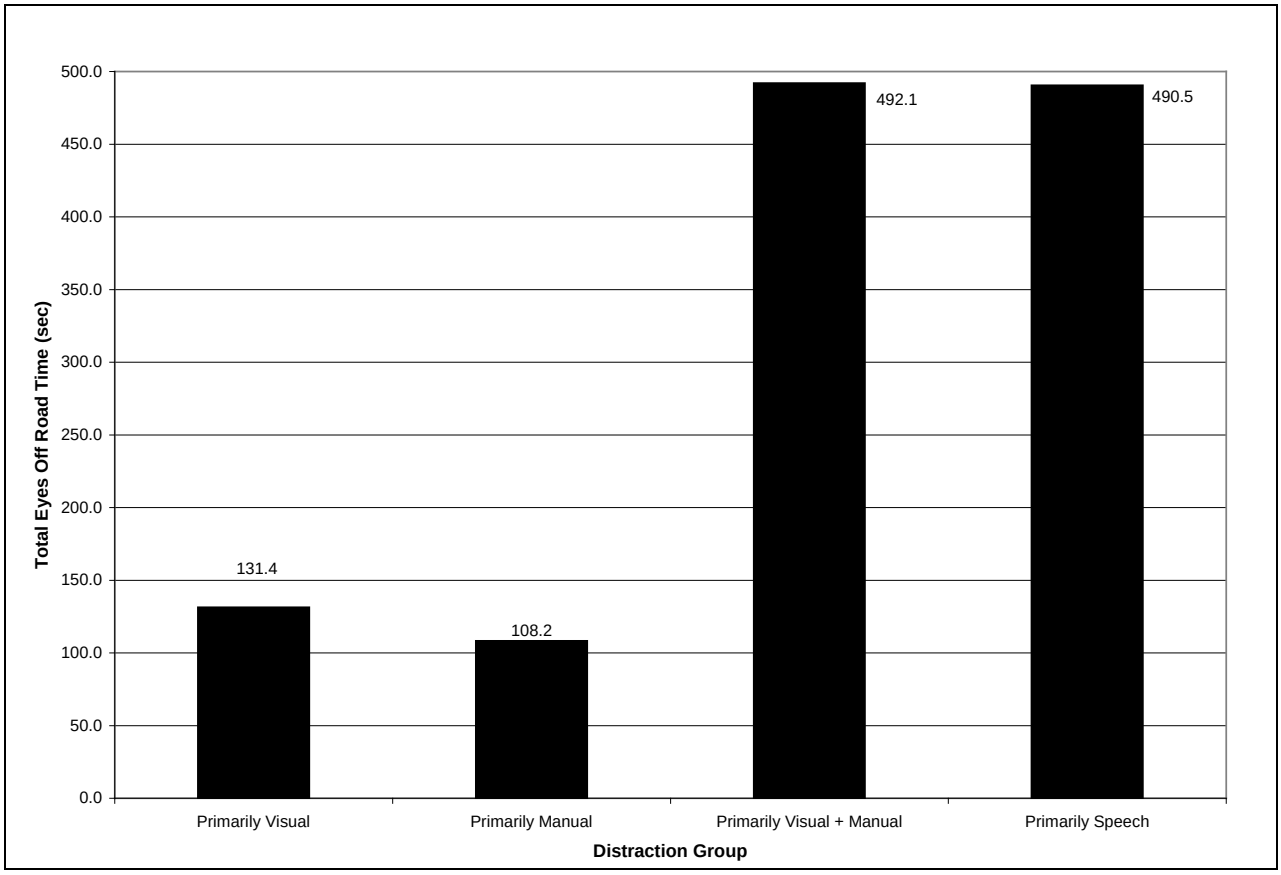

Figure 27. Total Eyes Off Road Time as a function of driver resource grouping strategy (Frequency * Duration * Proportion Not Forward).

The results using the driver resource grouping strategy indicates the following: (i) most incidents were associated with a visual task/demand, while the fewest incidents were associated with tasks that involved speech; (ii) the mean duration of visual tasks (and the overall mean duration as determined by time exposure of visual tasks) was the lowest, while the mean duration and overall duration for speech tasks was highest; (iii) the proportion of time drivers spent looking forward was highest for speech tasks and lowest for Primarily Visual tasks; and (iv) the Total Eyes Off Road Time was substantially higher for the Primarily Visual + Manual tasks, and the Primarily Speech tasks.

These results suggest that tasks requiring the driver to look at a system or display (visual component), and remove a hand from the steering wheel to operate that same system (manual component), can substantially distract the driver from the forward roadway. With regard to the

high Total Eyes Off Road Time for Speech tasks, this result again leads to the same conclusion presented previously: the fundamental downside to speech tasks is their duration. As such, it is suggested that speech tasks would likely be less safety-critical if they were kept short.

EYE GLANCE ANALYSIS

An eye glance analysis was conducted on the data set of distraction incidents and a subset of baseline (non-incident) events. The process of conducting the eye glance analysis was as follows:

- For each distraction incident, and the sample of baseline events, the event start point was determined. The start point can be referred to as Time (T)=0.
- Once T=0 had been identified on the videotape through the use of sync numbers, the analyst rewound the tape 10 seconds. This point on the tape, T=-10, was marked.
- The analyst then forwarded the tape 10 seconds from T=0. This point was marked as T=+10.
- The eye glance analysis was conducted on the 20 second epoch surrounding T=0.
- The video analyst conducted the eye glance analysis by identifying the location and duration of all glances in the epoch. The locations that were identified were: (i) forward roadway, (ii) passenger-side mirror/window, (iii) driver-side mirror/window, (iv) instrument panel, (v) passenger, (vi) eyes closed for prolonged period, not a blink, (vii) undetermined, due to darkness or poor video, and (viii) other.

The location and duration of the glances in each event were entered into a database. Each incident was given a unique numeric identifier and coded with a tag number so that all the incidents could be classified according to the six grouping strategies (taxonomies) outlined previously. The proportion of time spent looking at each of the eight locations was determined for each event, and as a function of each taxonomic category.

Before presenting the results of the eye glance analyses, it is worthwhile to discuss the baseline events that were used. Twenty-three baseline events were selected to be included in the data set.

Baseline events were selected for the analysis based on the incident frequency driver number distribution shown in Figure 2. A strategy for selecting baseline events was implemented such that the frequency distribution of baseline events approximated the incident frequency driver number distribution. More specifically, 1 baseline event was selected from drivers who had between 4 and 9 distraction-related incidents; 2 baseline events were selected from drivers who had between 10 and 20 distraction-related incidents; 3 baseline events were selected from drivers who had 21 or more distraction-related incidents. Once the required number of baseline events was known for each driver, a distraction incident was randomly selected from that driver and the analyst selected the timed-triggered event that was closest in time to that incident.

Table 8 shows the means and standard deviations for each eye glance location for the first grouping strategy in which all distraction events were grouped and compared to the baseline events. The mean proportions are plotted in Figure 28. The Analysis of Variance (ANOVA) procedure was conducted on the mean proportion data using the General Linear Model (GLM) in SAS to account for unbalanced data. The results indicated that none of the location proportions were significantly different between the Distraction and No Distraction conditions (all ps > 0.05). As will be shown in the analysis results with the other distraction type groupings, there was much variation in glance location as a function of the task/activity. By grouping all distractions together, as was done here, these differences were lost (i.e., no significant differences). The detailed results from this and all other ANOVAs that examined eye glance proportions for the different taxonomy grouping strategies can be found in Appendix 2.

Table 8. Means and standard deviations for the eye glance locations for the Distraction and No Distraction taxonomic categories.

	Taxonomy Categories	
Eye Glance Locations	No Distraction (Baseline)	Distraction
Forward	M = 0.661	M = 0.699
	S = 0.126	S = 0.184
Pass Window	M = 0.050	M = 0.049
	S = 0.074	S = 0.088
Driver Window	M = 0.087	M = 0.090
	S = 0.091	S = 0.110
IP	M = 0.095	M = 0.049
	S = 0.122	S = 0.120
Other	M = 0.079	M = 0.093
	S = 0.110	S = 0.142
Passenger	M = 0.0	M = 0.007
	S = 0.0	S = 0.041
Eye Closure	M = 0.0	M = 0.003
	S = 0.0	S = 0.017
Undetermined	M = 0.028	M = 0.010
	S = 0.057	S = 0.054

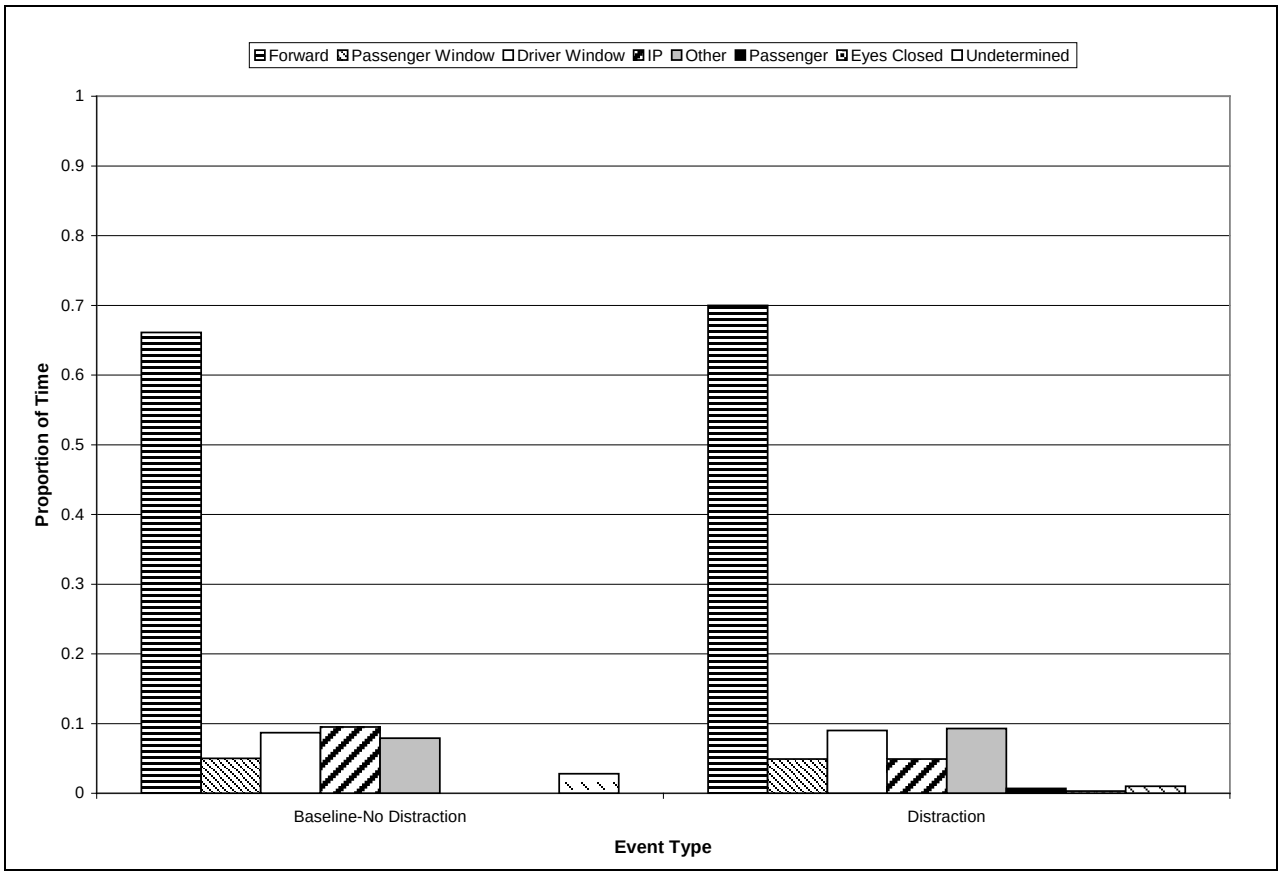

Figure 28. Proportion of time spent looking at each of eight eye glance categories for the Distraction and No Distraction categories.

In the previous section, *Taxonomies of Distraction Events*, histograms were shown where all non-forward eye glance locations were grouped together and compared to the forward location. Figure 29 shows the proportion histogram for all distraction types grouped together and compared with the baseline events. No significant difference was found between the two groups, $p > 0.05$.

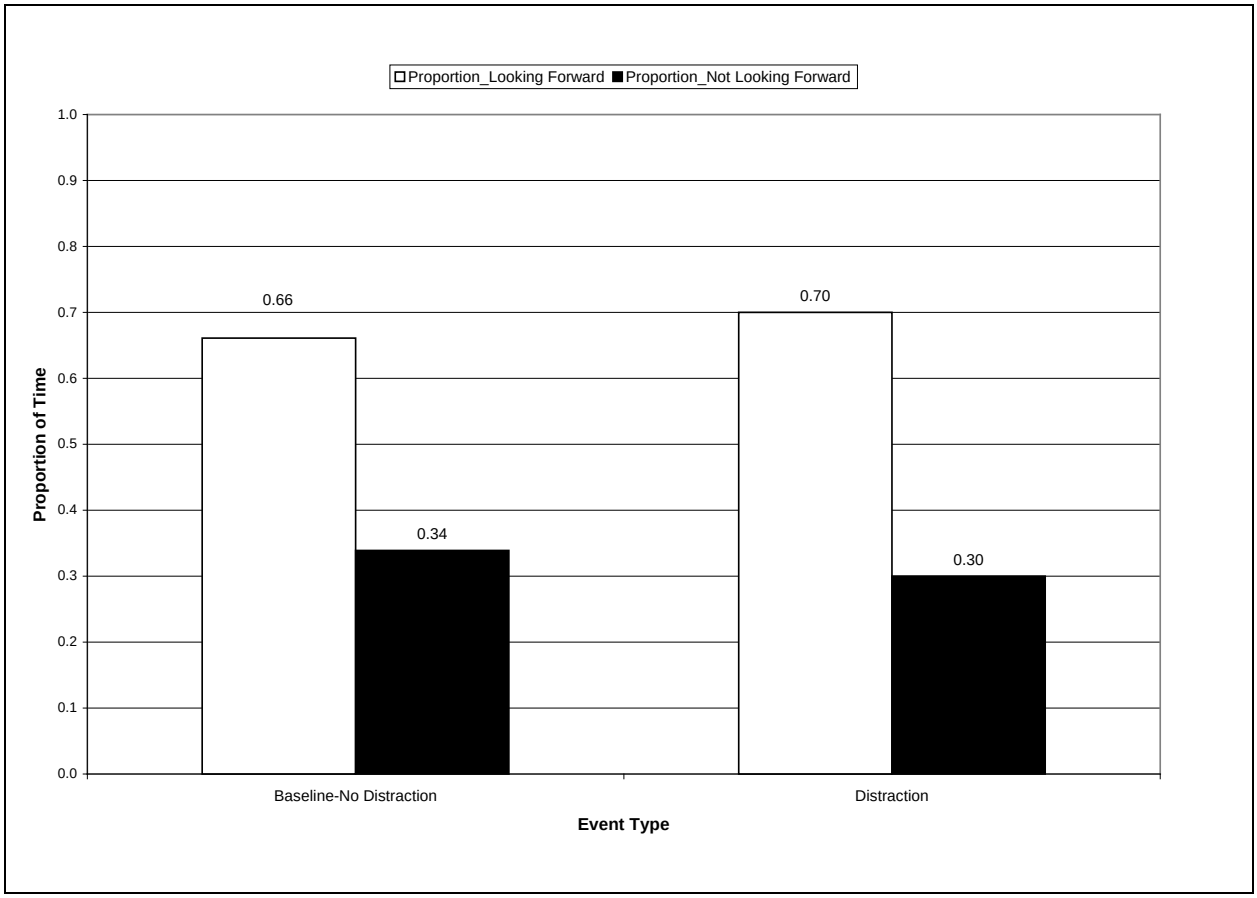

Figure 29. Proportion of time spent looking at the forward and not-forward locations for the Distraction and No Distraction categories.

Table 9 shows the means and standard deviations for the eye glance locations for all 36 distraction types that were identified. A plot of the means is shown in Figure 30. Due to the large number of distraction types, the results of the ANOVAs conducted on the proportion data were, not surprising, all statistically significant (*p*s <0.05) except for the Undetermined category (p>0.05). The ANOVA results and the results of a post-hoc analysis using the Student-Newman-Keuls test on the different dependent variables are provided in Appendix 2. It is noteworthy that for five tasks, the drivers spent less than 50% of their eye glance time on the forward roadway. This suggests that these tasks may pose a relatively greater risk to safety. These five tasks and their associated forward roadway looking proportions were: Plugging in Cell Phone (0.465), Looking at Paperwork (0.410), Dialing Cell Phone (0.408), Phone Call/Hanging Up (0.385), and Getting Food (0.38). Given the recent safety concern with drivers' use of cell phones while driving, and that three cell phone-related tasks lead drivers to spend less than half of their time watching the forward roadway, the data presented here seem to indicate that these concerns are warranted.

Table 9. Means and standard deviations for the eye glance locations for all 36 identified distraction types.

Eye Glance Locations	Taxonomy Categories												
	No Distraction (Baseline)	Talk on CB	Adjust CB	Look at CB	Adjust Radio	Look at Radio	Dial Cell Phone	Plug in Cell Phone	Talk on Cell Phone	Answer/ Look at Phone	Phone call/ Hang up Phone	Light Cigarette	Get Cigarette
Forward	M = 0.661	M = 0.836	M = 0.792	M = 0.694	M = 0.698	M = 0.668	M = 0.408	M = 0.465	M = 0.865	M = 0.580	M = 0.385	M = 0.763	M = 0.603
	S = 0.126	S = 0.163	S = 0.051	S = 0.061	S = 0.146	S = 0.322	S = 0.053	S = N/A	S = 0.136	S = N/A	S = N/A	S = 0.209	S = 0.004
Pass Window	M = 0.050	M = 0.015	M = 0.012	M = 0.055	M = 0.024	M = 0.0	M = 0.0	M = 0.035	M = 0.0	M = 0.095	M = 0.0	M = 0.0	M = 0.015
	S = 0.074	S = 0.023	S = 0.019	S = 0.105	S = 0.029	S = 0.0	S = 0.053	S = N/A	S = 0.0	S = N/A	S = N/A	S = 0.0	S =0.021
Driver Window	M = 0.087	M = 0.043	M = 0.064	M = 0.028	M = 0.044	M = 0.0	M = 0.040	M = 0.070	M = 0.050	M =0.125	M = 0.175	M = 0.080	M = 0.083
	S = 0.091	S = 0.040	S = 0.026	S = 0.029	S = 0.039	S = 0.0	S = 0.014	S = N/A	S = 0.078	S = N/A	S = N/A	S = 0.113	S = 0.004
IP	M = 0.095	M = 0.009	M = 0.013	M = 0.0	M = 0.206	M = 0.333	M = 0.013	M = 0.025	M = 0.031	M = 0.00	M = 0.0	M = 0.0	M = 0.080
	S = 0.122	S = 0.022	S = 0.027	S = 0.0	S = 0.136	S = 0.322	S = 0.018	S = N/A	S = 0.050	S = N/A	S = N/A	S = 0.0	S = 0.113
Other	M = 0.079	M = 0.048	M = 0.109	M = 0.207	M = 0.029	M = 0.0	M = 0.54	M = 0.405	M = 0.054	M = 0.200	M = 0.440	M = 0.158	M = 0.220
	S = 0.110	S = 0.077	S = 0.038	S = 0.061	S = 0.038	S = 0.0	S = 0.49	S = N/A	S = 0.108	S = N/A	S = N/A	S = 0.095	S = 0.092
Passenger	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.00	M = 0.0	M = 0.0	M = 0.0
	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = N/A	S = 0.0	S = N/A	S = N/A	S = 0.0	S = 0.0
Eye Closure	M = 0.0	M = 0.003	M = 0.009	M = 0.016	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.00	M = 0.0	M = 0.0	M = 0.0
	S = 0.0	S = 0.01	S = 0.027	S = 0.036	S = 0.0	S = 0.0	S = 0.0	S = N/A	S = 0.0	S = N/A	S = N/A	S = 0.0	S = 0.0
Undetermined	M = 0.028	M = 0.045	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.00	M = 0.0	M = 0.0	M = 0.0
	S = 0.057	S = 0.103	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = N/A	S = 0.0	S = N/A	S = N/A	S = 0.0	S = 0.0

Eye Glance Locations	Taxonomy Categories												
	Blow Smoke	Drink	Get Food	Eat/Talk	Talk to Passenger	Reach in Pocket	Reach to Floor	Look at Paperwork	Look at Floor	Look at IP	Look Down	Look Up	Toothpick/Visor
Forward	M = 0.714	M = 0.723	M = 0.375	M = 0.710	M = 0.661	M = 1.00	M = 0.684	M = 0.410	M = 0.632	M = 0.607	M = 0.566	M = 0.735	M = 0.950
	S = 0.089	S = 0.259	S = N/A	S = 0.092	S = 0.200	S = N/A	S = 0.184	S = 0.234	S = 0.111	S = 0.260	S = 0.190	S = N/A	S = N/A
Pass Window	M = 0.056	M = 0.0	M = 0.0	M = 0.038	M = 0.023	M = 0.0	M = 0.013	M = 0.0	M = 0.024	M = 0.033	M = 0.079	M = 0.0	M = 0.0
	S = 0.060	S = 0.0	S = N/A	S = 0.053	S = 0.023	S = N/A	S = 0.027	S = 0.0	S = 0.045	S = 0.056	S = 0.080	S = N/A	S = N/A
Driver Window	M = 0.223	M = 0.080	M = 0.0	M = 0.005	M = 0.145	M = 0.0	M = 0.057	M = 0.183	M = 0.058	M = 0.051	M = 0.046	M = 0.060	M = 0.0
	S = 0.067	S = 0.061	S = N/A	S = 0.007	S = 0.150	S = N/A	S = 0.081	S = 0.032	S = 0.051	S = 0.067	S = 0.039	S = N/A	S = N/A
IP	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.005	M = 0.0	M = 0.015	M = 0.015	M = 0.031	M = 0.273	M = 0.140	M = 0.095	M = 0.0
	S = 0.0	S = 0.0	S = N/A	S = 0.0	S = 0.011	S = N/A	S = 0.030	S = 0.026	S = 0.059	S = 0.283	S = 0.170	S = N/A	S = N/A
Other	M = 0.008	M = 0.109	M = 0.570	M = 0.185	M = 0.0	M = 0.0	M = 0.203	M = 0.432	M = 0.255	M = 0.0	M = 0.169	M = 0.055	M = .050
	S = 0.015	S = 0.123	S = N/A	S = 0.134	S = 0.0	S = N/A	S = 0.166	S = 0.050	S = 0.165	S = 0.0	S = 0.196	S = N/A	S = N/A
Passenger	M = 0.0	M = 0.0	M = 0.0	M = 0.063	M = 0.166	M = 0.0	M = 0.013	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.055	M = 0.0
	S = 0.0	S = 0.0	S = N/A	S = 0.089	S = 0.175	S = N/A	S = 0.048	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = N/A	S = N/A
Eye Closure	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0
	S = 0.0	S = 0.0	S = N/A	S = 0.0	S = 0.0	S = N/A	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = N/A	S = N/A
Undetermined	M = 0.0	M =0.089	M = 0.055	M = 0.0	M = 0.0	M = 0.0	M = 0.017	M = 0.125	M = 0.0	M = 0.036	M = 0.0	M = 0.0	M = 0.0
	S = 0.0	S = 0.108	S = N/A	S = 0.0	S = 0.0	S = N/A	S = 0.048	S = 0.217	S = 0.0	S = 0.126	S = 0.0	S = N/A	S = N/A

Eye Glance Locations	Taxonomy Categories										
	Look Right (outside)	Look Left (outside)	Look Outside	Adjust in Seat	Take off Jacket	Let go of Wheel	Wipe Dash	Rub Face	Brush Hair	Cough	Yawn
Forward	M = 0.681	M = 0.706	M = 1.00	M = 0.760	M = 0.945	M = 0.638	M = 0.755	M = 0.895	M = 0.940	M = 0.760	M = 0.790
	S = 0.149	S = 0.163	S = N/A	S = 0.099	S = N/A	S = 0.258	S = N/A	S = 0.028	S = N/A	S = N/A	S = N/A
Pass Window	M = 0.213	M = 0.039	M = 0.0	M = 0.0	M = 0.055	M = 0.035	M = 0.0	M = 0.018	M = 0.0	M = 0.0	M = 0.080
	S = 0.138	S = 0.042	S = N/A	S = 0.0	S = N/A	S = 0.049	S = N/A	S = 0.025	S = N/A	S = N/A	S = N/A
Driver Window	M = 0.071	M = 0.215	M = 0.0	M = 0.063	M = 0.0	M = 0.0	M = 0.0	M = 0.058	M = 0.0	M = 0.040	M = 0.070
	S = 0.078	S = 0.151	S = N/A	S = 0.088	S = N/A	S = 0.0	S = N/A	S = 0.011	S = N/A	S = N/A	S = N/A
IP	M = 0.015	M = 0.022	M = 0.0	M = 0.070	M = 0.0	M = 0.123	M = 0.035	M = 0.0	M = .060	M = 0.0	M = 0.010
	S = 0.027	S = 0.055	S = N/A	S = 0.007	S = N/A	S = 0.173	S = N/A	S = 0.0	S = N/A	S = N/A	S = N/A
Other	M = 0.017	M = 0.015	M = 0.0	M = 0.108	M = 0.0	M = 0.205	M = 0.210	M = 0.030	M = 0.0	M = 0.020	M = 0.0
	S = 0.045	S = 0.030	S = N/A	S = 0.004	S = N/A	S = 0.134	S = N/A	S = 0.042	S = N/A	S = N/A	S = N/A
Passenger	M = 0.0	M = 0.0009	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0
	S = 0.0	S = 0.005	S = N/A	S = 0.0	S = N/A	S = 0.0	S = N/A	S = 0.0	S = N/A	S = N/A	S = N/A
Eye Closure	M = 0.002	M = 0.0007	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.180	M = 0.050
	S = 0.007	S = 0.004	S = N/A	S = 0.0	S = N/A	S = 0.0	S = N/A	S = 0.0	S = N/A	S = N/A	S = N/A
Undetermined	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0
	S = 0.0	S = 0.0	S = N/A	S = 0.0	S = N/A	S = 0.0	S = N/A	S = 0.0	S = N/A	S = N/A	S = N/A

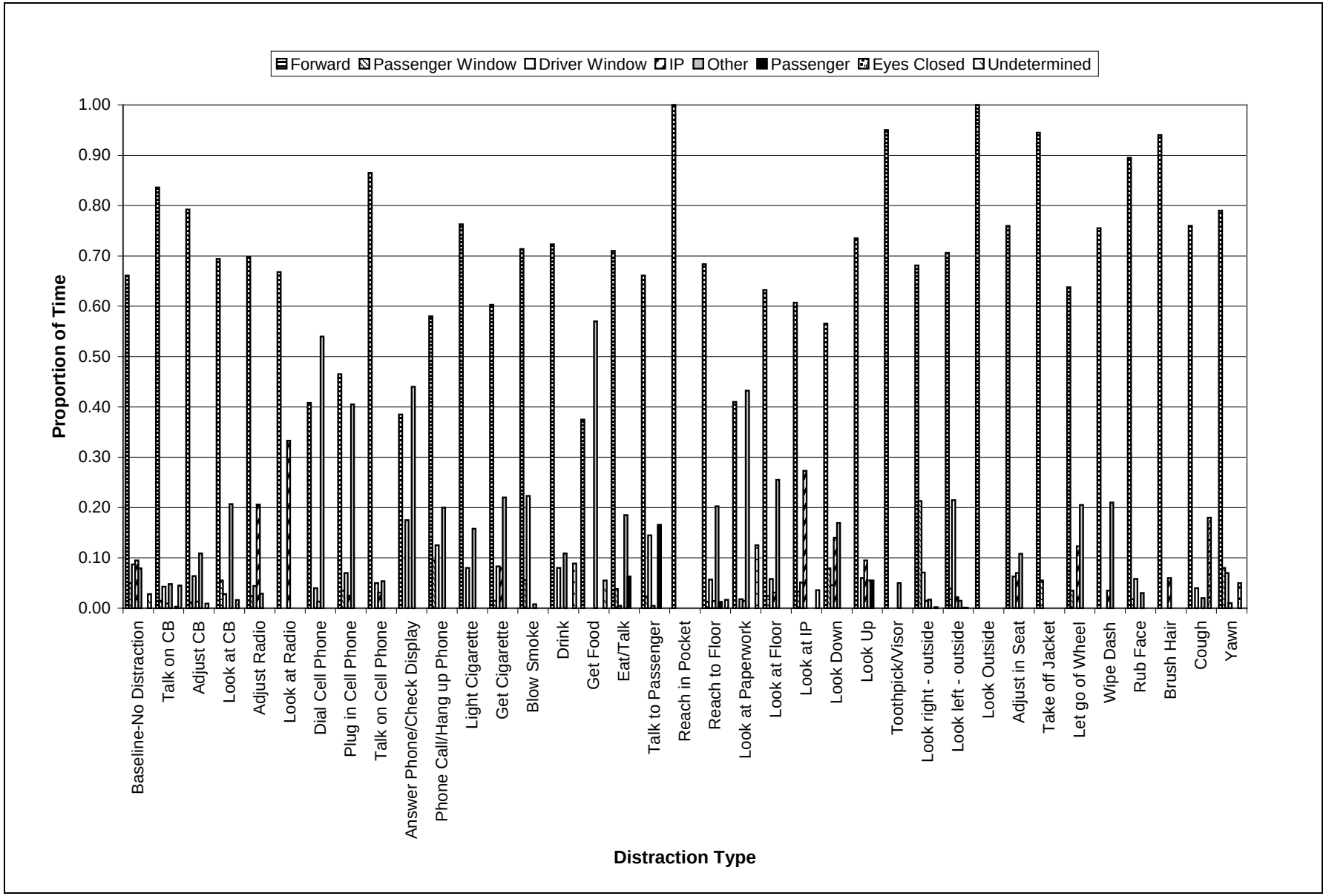

Figure 30. Proportion of time spent looking at each of eight eye glance categories for all distraction types.

In the previous set of analyses presented in the *Taxonomy of Distraction Events* section, where all 36 distraction types were considered individually, the five types that were found to have the most Total Eyes Off Road Time were: (i) Talk on Cell Phone, (ii) Answer Cell Phone/Check Display, (iii) Talk on CB, (iv) Complete a Phone Call/Hanging Up Phone (putting phone away), and (v) Dial Cell Phone. Figure 31 shows a histogram of the eye glance proportions for these five distraction types. As can be seen, Talk on Cell Phone and Talk on CB both had forward looking proportions of approximately 0.85. Answer Cell Phone/Check Display had a forward looking proportion of 0.58. The forward looking proportion for the Complete a Phone Call/Hanging Up Phone task was 0.385, and the Dial Cell Phone task had a forward looking proportion of 0.41. These results indicate that tasks associated with manipulating/operating a cell phone while driving are particularly visually demanding. As such, it might be expected that technologies that assist drivers in these tasks (e.g., voice controlled hands-free dialing) may help alleviate visual demand and improve safety.

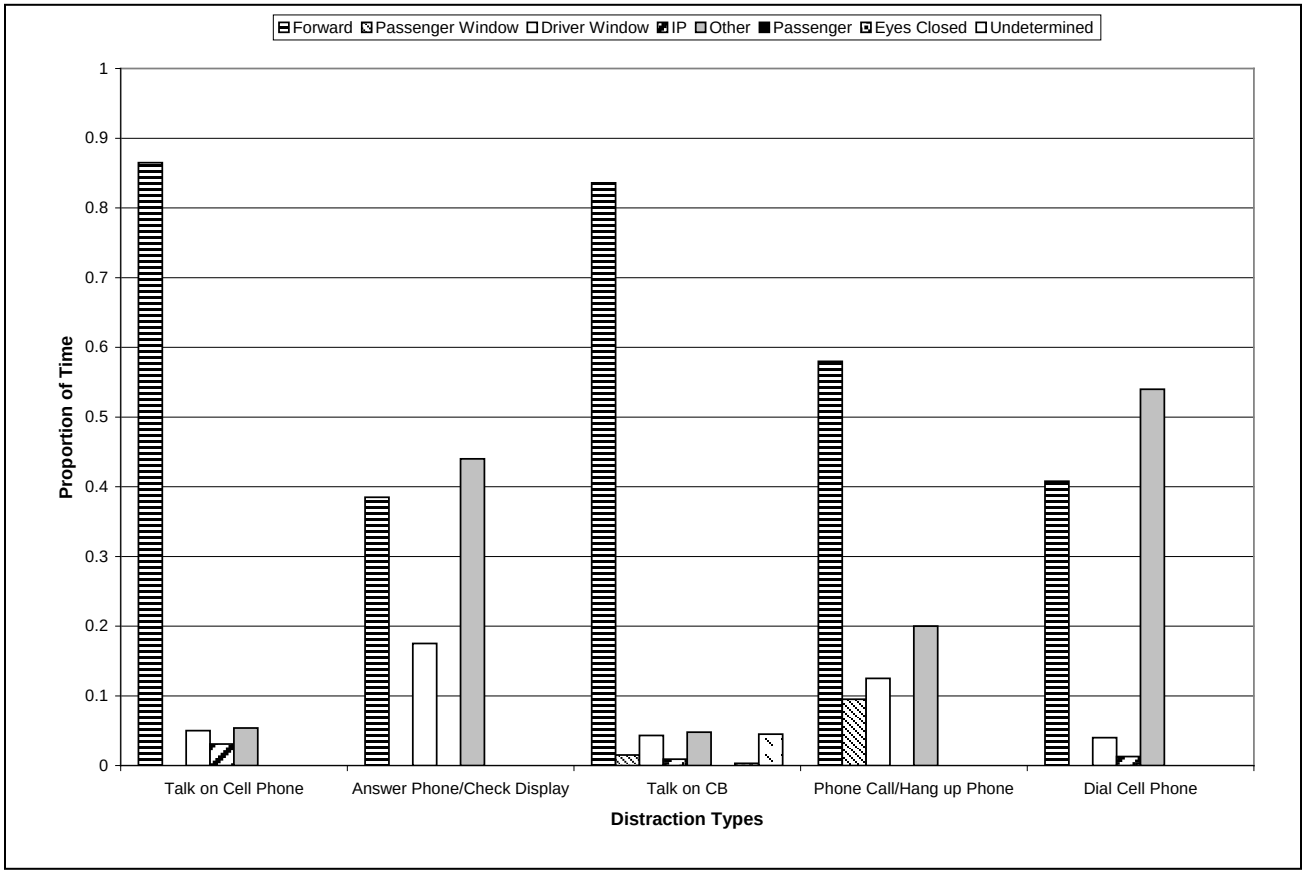

Figure 31. Proportion of time spent looking at each of eight eye glance categories for the five distraction types with the most Total Eyes Off Road Time.

Recall that there were two task-relevant grouping variations used (see Table 7B). Table 10 shows the means and standard deviations for the eye glance locations for the first task grouping variation. The mean proportions are shown plotted in Figure 32. ANOVAs were conducted on the mean proportion data using the distraction group as the independent variable. All but two of the tests were found to be statistically significant. That is, for all but two of the locations, there was a statistically significant difference between the task groups (all ps < 0.05). The two locations that were not significant at p>0.05 were the Passenger and Undetermined locations. Post-hoc comparisons were conducted to determine which levels of the task group variable differed (see Appendix 2).

Table 10. Means and standard deviations for the eye glance locations as a function of task group (high-level).

Eye Glance Locations	Taxonomy Categories							
	No Distraction (Baseline)	Manual/ Device	Talking	Bio-Mechanical	Personal/ Grooming	Consume/ Put into Mouth	Look away/ outside	Look away/ inside
Forward	M = 0.661	M = 0.681	M = 0.809	M = 0.694	M = 0.872	M = 0.724	M = 0.702	M = 0.598
	S = 0.126	S = 0.162	S = 0.174	S = 0.188	S = 0.080	S = 0.160	S = 0.160	S = 0.202
Pass Window	M = 0.050	M = 0.019	M = 0.011	M = 0.014	M = 0.019	M = 0.025	M = 0.106	M = 0.044
	S = 0.074	S = 0.027	S = 0.020	S = 0.026	S = 0.033	S = 0.044	S = 0.125	S = 0.071
Driver Window	M = 0.087	M = 0.064	M = 0.068	M = 0.045	M = 0.038	M = 0.115	M = 0.156	M = 0.045
	S = 0.091	S = 0.042	S = 0.093	S = 0.069	S = 0.031	S = 0.102	S = 0.145	S = 0.050
IP	M = 0.095	M = 0.050	M = 0.017	M = 0.033	M = 0.012	M = 0.0	M = 0.019	M = 0.148
	S = 0.122	S = 0.099	S = 0.035	S = 0.061	S = 0.024	S = 0.0	S = 0.045	S = 0.218
Other	M = 0.079	M = 0.184	M = 0.040	M = 0.195	M = 0.022	M = 0.096	M = 0.016	M = 0.139
	S = 0.110	S = 0.169	S = 0.083	S = 0.164	S = 0.027	S = 0.108	S = 0.040	S = 0.179
Passenger	M = 0.0	M = 0.0	M = 0.036	M = 0.008	M = 0.0	M = 0.010	M = 0.0005	M = 0.002
	S = 0.0	S = 0.0	S = 0.102	S = 0.037	S = 0.0	S = 0.036	S = 0.004	S = 0.009
Eye Closure	M = 0.0	M = 0.004	M = 0.001	M = 0.0	M = 0.038	M = 0.0	M = 0.001	M = 0.001
	S = 0.0	S =0.018	S = 0.006	S = 0.0	S = 0.072	S = 0.0	S = 0.006	S = 0.006
Undetermined	M = 0.028	M = 0.0	M = 0.018	M = 0.012	M = 0.0	M = 0.030	M = 0.0	M = 0.023
	S = 0.057	S = 0.0	S = 0.066	S = 0.038	S = 0.0	S = 0.071	S = 0.0	S = 0.094

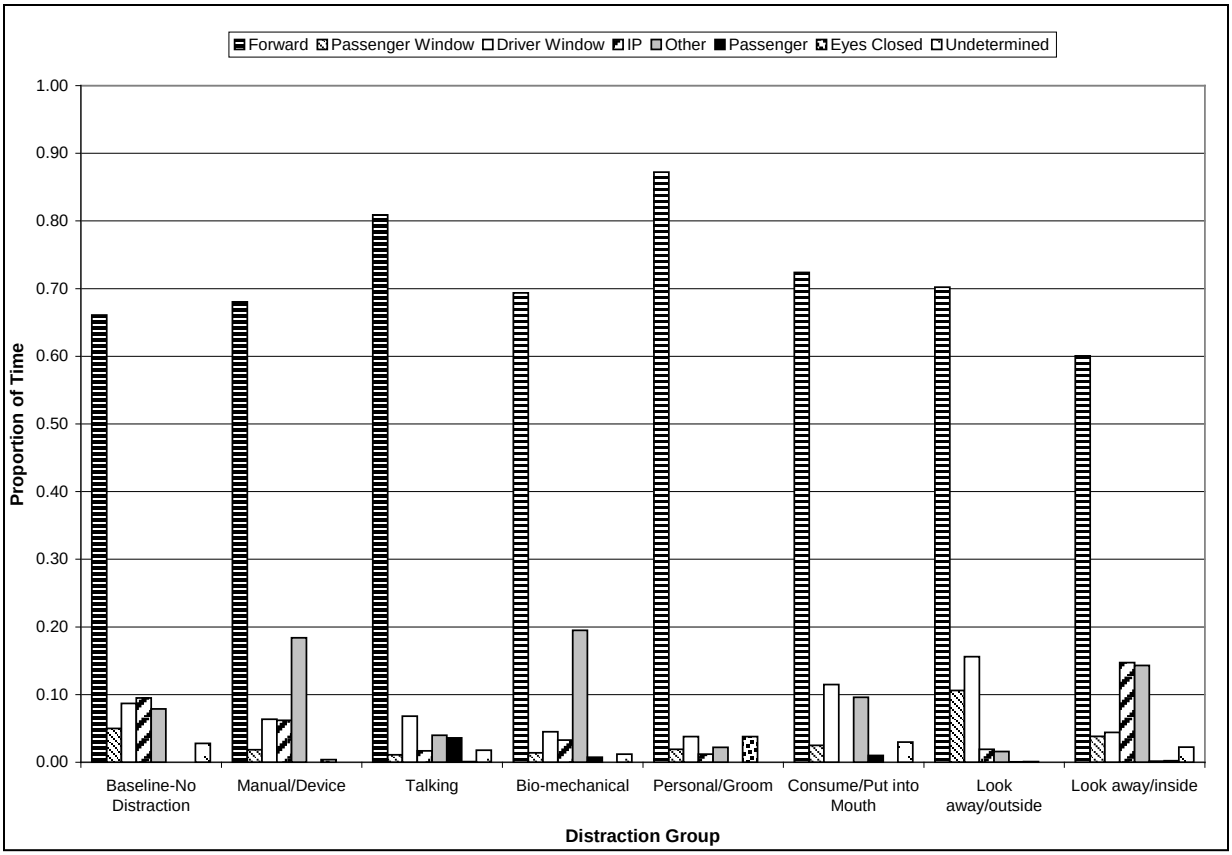

Figure 32. Proportion of time spent looking at each of eight eye glance categories as a function of task group (high level).

Table 11 shows the means and standard deviations for the eye glance proportions for the second task-related grouping strategy that was used. This second task grouping variation was more detailed and had twice the number of categories than did the grouping strategy outlined in the previous set of results. Figure 33 shows a plot of the mean proportions for the various locations as a function of the distraction categories. ANOVAs conducted on the data using the mean proportions as the dependent variable and the 14 distraction groups as levels of the independent variable found a statistically significant difference between groups for all locations except the "Undetermined" location. For those locations that were significant, the significance level was $p<0.05$ (see Appendix 2).

Table 11. Means and standard deviations for the eye glance locations as a function of task group (detailed).

	Taxonomy Categories										
Eye Glance Locations	No Distraction (Baseline)	CB	Radio	Cell Phone	Cigarette	Eat/Drink	Talk to Passenger	Misc Tasks	Glances inside Cab	Glances outside Cab	Adjust in Seat
Forward	M = 0.661	M = 0.788	M = 0.688	M = 0.717	M = 0.698	M = 0.669	M = 0.661	M = 0.711	M = 0.589	M = 0.702	M = 0.760
	S = 0.126	S = 0.119	S = 0.184	S = 0.238	S = 0.116	S = 0.228	S = 0.200	S = 0.198	S = 0.208	S = 0.160	S = 0.099
Pass Window	M = 0.050	M = 0.023	M = 0.156	M = 0.009	M = 0.032	M = 0.011	M = 0.023	M = 0.017	M = 0.037	M = 0.106	M = 0.0
	S = 0.074	S = 0.051	S = 0.026	S = 0.026	S = 0.048	S = 0.028	S = 0.023	S = 0.029	S = 0.060	S = 0.125	S = 0.0
Driver Window	M = 0.087	M = 0.048	M = 0.029	M = 0.064	M = 0.152	M = 0.047	M =0.145	M = 0.044	M = 0.049	M = 0.156	M = 0.063
	S = 0.091	S = 0.034	S = 0.038	S = 0.072	S = 0.097	S = 0.059	S = 0.150	S = 0.075	S = 0.052	S = 0.145	S = 0.088
IP	M = 0.095	M = 0.008	M = 0.248	M = 0.024	M = 0.020	M = 0.0	M = 0.005	M = 0.025	M = 0.150	M = 0.019	M = 0.070
	S = 0.122	S = 0.021	S = 0.189	S = 0.041	S = 0.057	S = 0.0	S = 0.011	S = 0.061	S = 0.218	S = 0.045	S = 0.007
Other	M = 0.079	M = 0.107	M = 0.019	M = 0.186	M = 0.098	M = 0.196	M = 0.0	M = 0.180	M = 0.148	M = 0.016	M = 0.108
	S = 0.110	S = 0.084	S = 0.033	S = 0.218	S = 0.112	S = 0.197	S = 0.0	S = 0.162	S = 0.186	S = 0.036	S = 0.004
Passenger	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.018	M = 0.166	M = 0.010	M = 0.002	M = 0.0005	M = 0.0
	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.047	S = 0.175	S = 0.042	S = 0.009	S = 0.004	S = 0.0
Eye Closure	M = 0.0	M = 0.008	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.0	M = 0.001	M = 0.0
	S = 0.0	S = 0.023	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.0	S = 0.006	S = 0.0
Undetermined	M = 0.028	M = 0.018	M = 0.0	M = 0.0	M = 0.0	M = 0.059	M = 0.0	M = 0.013	M = 0.026	M = 0.0	M = 0.0
	S = 0.057	S = 0.066	S = 0.0	S = 0.0	S = 0.0	S = 0.087	S = 0.0	S = 0.043	S = 0.101	S = 0.0	S = 0.0

Eye Glance Locations	Taxonomy Categories			
	Wipe Dash	Grooming	Cough/ Yawn	Toothpick Use
Forward	M = 0.755	M = 0.910	M = 0.775	M = 0.950
	S = N/A	S = 0.033	S = 0.021	S = N/A
Pass Window	M = 0.0	M = 0.012	M = 0.040	M = 0.0
	S = N/A	S = 0.020	S = 0.057	S = N/A
Driver Window	M = 0.0	M = 0.039	M = 0.055	M = 0.0
	S = N/A	S = 0.034	S = 0.021	S = N/A
IP	M = 0.035	M = 0.020	M = 0.005	M = 0.0
	S = N/A	S = 0.035	S = 0.007	S = N/A
Other	M = 0.210	M = 0.020	M = 0.010	M = 0.050
	S = N/A	S = 0.035	S = 0.014	S = N/A
Passenger	M = 0.0	M = 0.0	M = 0.0	M = 0.0
	S = N/A	S = 0.0	S = 0.0	S = N/A
Eye Closure	M = 0.0	M = 0.0	M = 0.115	M = 0.0
	S = N/A	S = N/A	S = 0.092	S = N/A
Undetermined	M = 0.0	M = 0.0	M = 0.0	M = 0.0
	S = N/A	S = 0.0	S = 0.0	S = N/A

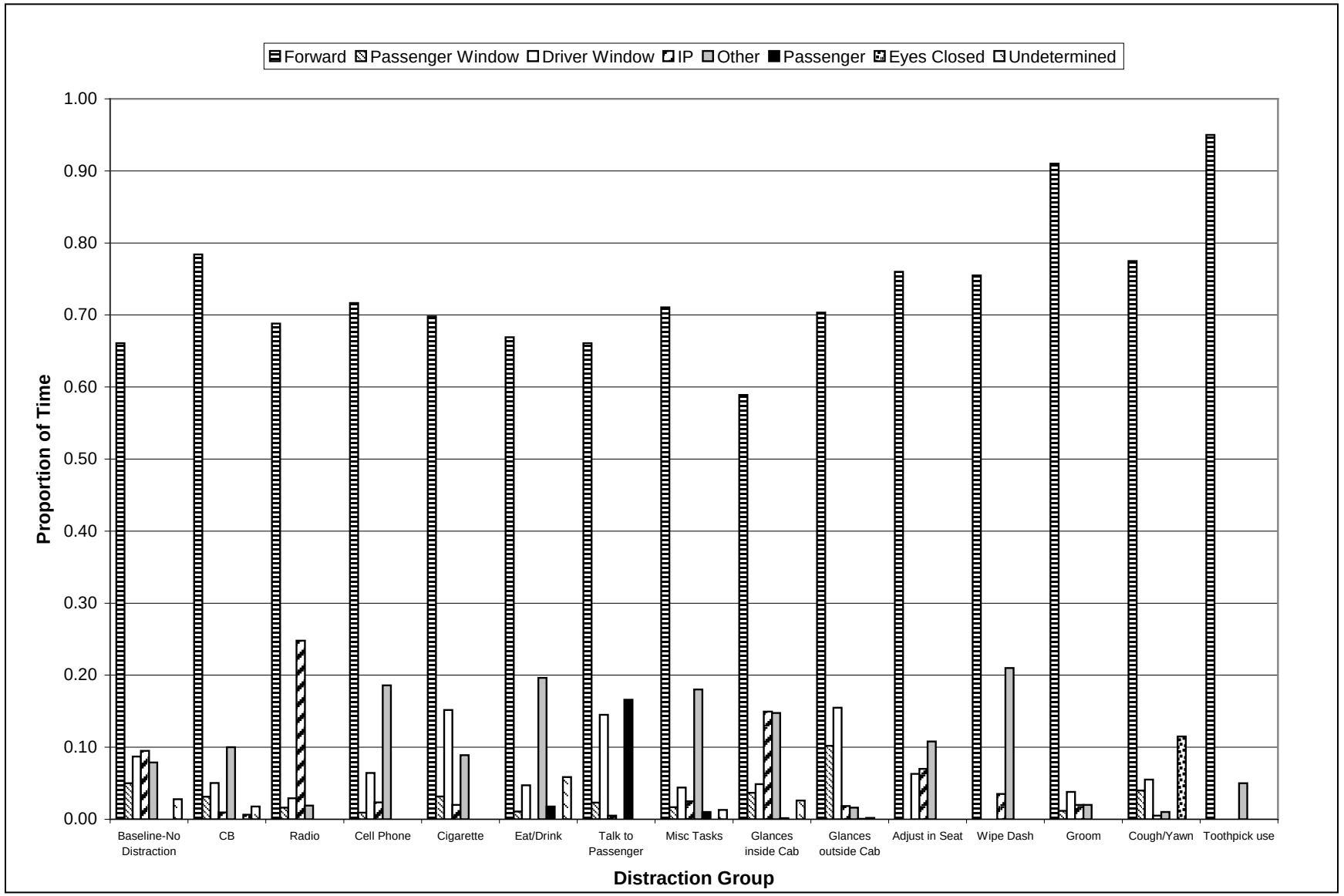

Figure 33. Proportion of time spent looking at each of eight eye glance categories as a function of task group (detailed).

The final strategy used to group distraction types considered the driver resources that were used to perform the distraction-related task or activity. Table 12 shows the means and standard deviations for the various eye glance locations for each of the resource-related categories. The mean proportion data is also plotted in Figure 34. ANOVAs were conducted and the mean proportions were statistically different ($ps<0.05$) for the following locations: Forward, Passenger Window/Mirror, Instrument Panel, and Other. Post-hoc comparisons were conducted on these significant effects to determine which levels of the grouping variable differed from each other (see Appendix 2). Not surprisingly, as indicated in the Student-Newman-Keuls results, distraction tasks involving a visual component had the lowest proportions of time looking forward.

Table 12. Means and standard deviations for the eye glance locations as a function of resource group.

Eye Glance Locations	Taxonomy Categories				
	No Distraction (Baseline)	Primarily Visual	Primarily Manual	Primarily Visual + Manual	Primarily Speech
Forward	M = 0.661	M = 0.667	M = 0.726	M = 0.698	M = 0.809
	S = 0.126	S = 0.179	S = 0.197	S = 0.166	S = 0.174
Pass Window	M = 0.050	M = 0.078	M = 0.012	M = 0.016	M = 0.011
	S = 0.074	S = 0.108	S = 0.026	S = 0.026	S = 0.020
Driver Window	M = 0.087	M = 0.116	M = 0.050	M = 0.055	M = 0.068
	S = 0.091	S = 0.128	S = 0.071	S = 0.046	S = 0.093
IP	M = 0.095	M = 0.065	M = 0.026	M = 0.038	M = 0.017
	S = 0.122	S = 0.149	S = 0.054	S = 0.085	S = 0.035
Other	M = 0.079	M = 0.062	M = 0.156	M = 0.184	M = 0.040
	S = 0.110	S = 0.125	S = 0.150	S = 0.163	S = 0.083
Passenger	M = 0.0	M = 0.0009	M = 0.007	M = 0.004	M = 0.036
	S = 0.0	S = 0.006	S = 0.036	S = 0.022	S = 0.102
Eye Closure	M = 0.0	M = 0.004	M = 0.0	M = 0.003	M = 0.001
	S = 0.0	S = 0.021	S = 0.0	S = 0.014	S = 0.006
Undetermined	M = 0.028	M = 0.008	M = 0.024	M = 0.002	M = 0.018
	S = 0.057	S = 0.057	S = 0.060	S = 0.010	S = 0.066

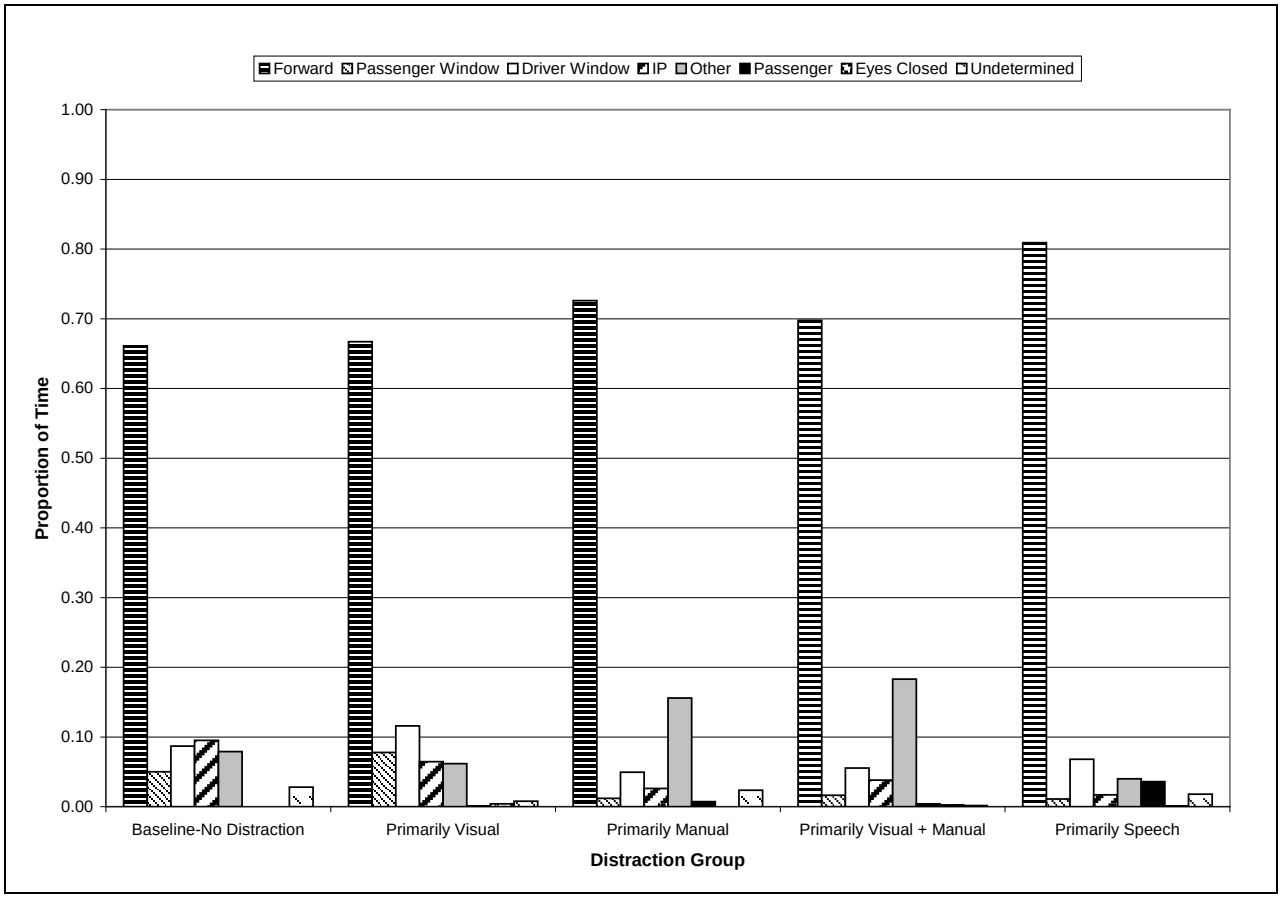

Figure 34. Proportion of time spent looking at each of eight eye glance categories as a function of resource group.

GENERAL DISTRACTION ANALYSES

When an incident occurred, a variety of measures that were collected by the truck were tagged to that incident and then downloaded to a data file. From this data file, researchers could examine characteristics of the incidents, such as the day and time that the incident occurred, the type of operation (single vs. team) that was involved, and the trigger type that flagged the incident. Video analysts for the original Sleeper Berth project reviewed all incidents and manually entered in a variety of other measures for each incident, such as a measure of the apparent drowsiness of the driver at the time of the incident and the severity of the incident.

The results presented in this section were selected from analyses conducted with distraction events and baseline (normal driving) non-incident events. The baseline events were recorded by a "timed-trigger" that collected data for 2 minutes at random intervals every 45 to 75 minutes. As indicated previously, there were 178 distraction-related critical incidents that involved 33 drivers. All of the baseline events for these 33 drivers were used in the general distraction analyses; there were 1,489 baseline events for the 33 drivers. The remainder of this section highlights a sample of the results.

Single Versus Team Operations

A frequency analysis using the Cochran-Mantel-Haenszel (CMH) Statistic was conducted to determine if there were differences in the frequency of distraction and no distraction events as a function of the type of driving operation (see Appendix 3 for a description of this test). Single operations (only one driver in the cab) and team operations (two drivers alternated driving duties) were investigated. For the no distraction (baseline) events, there were nearly an equal number of events for each operation type (735 for singles and 754 for teams); that is, 50.6% of the events were collected in the single operation and 49.4% were collected in the team operation. However, for the distraction events, there were substantially more events for the single operation 115 (65%) as compared to the team operation 63 (35%). The CMH test looks for differences in the frequencies of these four matrix cells: Distraction Type (Baseline vs. Distraction) and Operation Type (Single vs. Team). The difference was significant, $p < 0.001$.

Incident Type

There were a number of sensors instrumented on the truck that were used to trigger the occurrence of a critical incident. When the distraction and no distraction incidents were analyzed, eight unique triggers were identified. Table 13 shows the triggers and the frequency of events for each distraction type.

Table 13. Incident triggers and frequencies for No Distraction and Distraction incidents.

Trigger Code	Trigger Name	No Distraction Frequency	Distraction Frequency
1	Steering Trigger	0	5
2	Lateral Acceleration trigger	0	1
4	Longitudinal trigger	0	15
8	Time to Collision trigger	0	28
64	Lane Departure trigger	0	122
256	Timed trigger	1489	0
512	Sleepiness Rating No Response trigger	0	3
1024	Lane Departure and Steer trigger	0	4

As can be seen from the table, all of the no distraction events were initiated by the timed-trigger. Most (69%) of the distraction incidents were caused by the lane departure trigger; that is, there was a "lane bust" where the vehicle inadvertently went into an adjacent lane or on the shoulder. The CMH statistic was significant, $p < 0.0001$.

Incident Severity

The severity of each incident was recorded using a five-point scale:

0 = Normal (No incident)
1 = Severe (An injury or an accident)
2 = Near Miss
3 = Driver Error with Hazard
4 = Driver Error without Hazard

There were no "Severe" incidents recorded. Examining the frequencies associated with each severity level, it was found that of the 178 distraction incidents that were coded,[4] 139 (78%) were in the "Driver Error with Hazard" category. The severity rating with the second highest number of incidents was "Driver Error without Hazard" with 32 incidents (18%).

Road Type

When reviewing each incident and baseline event, analysts recorded a variety of measures associated with the environment. One such measure was for the Road Type (Table 14). For the distraction events, 146 of the 178 events (82%) occurred on a Rural Divided (Median). Similarly, for the baseline events, 1,327 of the 1,489 events (89%) were recorded on a Rural Divided (Median). With these large frequencies in the Rural Divided (Median) cell, it is not surprising that the CMH frequency analysis was significant, $p < 0.0001$.

Table 14. Sample of the environmental measures that were noted for each distraction incident and baseline event.

Environmental Measure	Levels
Road Type	0 = Parking Lot / Loading Area 1 = Alley Way 2 = One Way Road 3 = Rural Undivided 4 = Rural Divided (Median) 5 = Rural Divided (Lane) 6 = Urban Undivided 7 = Urban Divided (Median) 8 = Urban Divided (Lane) 9 = Other 100 = Undetermined

[4] Though there were 178 distraction incidents, some of the analyses on the various measures had missing data. In this case, one of the distraction incidents was not coded with a severity rating.

Environmental Measure	Levels
Road Condition	0 = Dry 1 = Wet 2 = Icy / Snow 3 = Gravel / Sand on Road 4 = Gravel Road 5 = Other 100 = Undetermined
Traffic Density	0 = Level of Service A (Free Flow) 1 = Level of Service B (Low-Density) 2 = Level of Service C (Medium-Density) 3 = Level of Service D (High-Density) 4 = Level of Service E (Capacity) 5 = Level of Service F (Grid-Lock) 100 = Undetermined
Weather	0 = Clear / Dry 1 = Cloudy 2 = Drizzle 3 = Hard Rain 4 = Light snow 5 = Hard Snow 6 = Sleet 7 = Other 100 = Undetermined
Visibility	0 = Unlimited 1 = Rain 2 = Snow 3 = Fog 4 = Darkness 5 = Glare from Sun 6 = Glare from Headlights 7 = Twilight (Dusk / Dawn) 8 = Other 100 = Undetermined

Road Condition

As with the Road Type measure, analysts noted the Road Condition at the time the event occurred. Table 14 lists the seven Road Condition levels. For the distraction incidents, 159 (89%) occurred in the Dry condition. For baseline events, 1406 (94%) occurred in the Dry Condition. The CMH test that compared frequencies across cells (Distraction Type x Road Condition) proved significant, $p<0.02$.

Traffic Density

The levels of the Traffic Density measure are shown in Table 14. For both distraction and baseline events, the level with the most events was Level of Service B (LOS B). For distraction incidents, there were 105 (59%) incidents classified as LOS B. For the baseline events, there were 1,200 (81%) incidents classified as LOS B. For both distraction and baseline events, the traffic density level with the second highest frequency of events was LOS A; for distraction incidents, the frequency was 59 (33%), while the frequency was 235 (16%) for baseline events. The CMH statistic was significant, $p<0.0001$.

Weather

As shown in Table 14, there were nine levels for the Weather variable. Most distraction and baseline events occurred when it was Clear/Dry. For distraction events, there were 146 (99%) in the Clear/Dry condition. There were 1,331 (89%) in the Clear/Dry condition for baseline events. There was a statistically significant difference found between the frequencies within each Weather category for distraction and baseline events, $p<0.008$.

Visibility

Though 10 levels of Visibility were considered (Table 14), most distraction and baseline events occurred in the Unlimited visibility condition and the Darkness condition. For distraction events, there were 104 (58%) incidents in the Unlimited condition and 54 (30%) in the Darkness condition. For baseline events, there were 1,141 (77%) incidents in the Unlimited condition and 291 (20%) in the Darkness condition. The CMH statistic was significant, $p<0.0001$.

RESULTS SUMMARY

After careful review of the videotapes from the Sleeper Berth study, it was determined that there were 178 critical incidents that were distraction-related. A variety of analyses were conducted and there were several noteworthy results. One of the most interesting findings from this effort was the analysis that examined the total time that the drivers' eyes were off of the road during the conduct of a task/activity. The five tasks that had the highest associated Total Eyes Off Road Times were:

1. Talk on Cell Phone, (269.5 sec.)
2. Answer Cell Phone/Check Display (155.6 sec.)
3. Talk on CB (154.3 sec.)
4. Complete Phone Call/Hang Up Phone (put phone away) (89.9 sec.)
5. Dial Cell Phone (77.6 sec)

When looking at the proportion of time that drivers are looking at the forward roadway while conducting a task, it was found that talking-related tasks, such as talking on the cell phone, had very high forward roadway glance proportions (i.e., while talking on a cell phone call, drivers spent approximately 85% of their time looking forward). However, when the non-forward proportion was multiplied by the frequency and duration of the calls, the Total Eyes Off Road Time became very large. In fact, the cell phone and CB tasks had two of the largest Total Eyes Off Road Times of the 36 distraction types. It is generally assumed that drivers view the forward roadway while on the phone, and this was shown to be accurate in this study. However, when the length of the calls is factored in, this small proportion of time with the eyes off of the forward roadway became magnified leading to a high Total Eyes Off Road Time.

Other than the two talking-related tasks that were in the top five tasks with the highest Total Eyes Off Road Times, the other three tasks all involved a visual and manual component. In addition, all three were cell phone-related tasks. Recently, research (e.g., Redelmeier and Tibshirani, 1997) and articles in the press have reported that cell phone tasks are distracting and present a safety hazard for the driver. Based on the results of this study, these reports seem well-

founded. When similar tasks were grouped, and all cell phone tasks were combined, it became very clear that cell phone tasks required more Total Eyes Off Road Time than any other task type. When comparing cell phone tasks to CB tasks, it was found that drivers' Total Eyes Off Road Time was three-times as large for cell phone tasks than for CB tasks (608.5 seconds for cell phone tasks vs. 194.3 seconds for CB tasks).

Several other interesting result highlights are presented below:

- Thirty-six unique distraction types were identified across the 178 distraction-related critical incidents that were recorded.
- Thirty-three of the 41 drivers who participated in the Sleeper Berth study had one or more distraction-related incidents.
- Two drivers (6% of the 33 driver pool) accounted for 24% of the incidents.
- Seven drivers had 10 or more distraction-related incidents; these seven drivers (21% of the driver pool) accounted for 58% of the distraction incidents.
- The breakdown of single versus team drivers in the pool of 33 drivers was 16 singles and 17 team drivers. However, single driver operations accounted for 115 of the 178 distraction incidents (65%).
- To reduce the Total Eyes Off Road Time associated with cell phone talking tasks, it was suggested that other tasks with accepted Total Eyes Off Road Time values could be modeled to determine a recommended phone call length. Two such tasks (Adjusting the Radio and Looking at the Instrument Panel) were used to determine an equivalent Total Eyes Off Road Time. The result indicated that to be comparable to the Adjusting the Radio and Looking at the Instrument Panel tasks, cell phone calls should last no more than 30 seconds. It should be recognized that if other tasks were substituted in the model, the recommended phone call length could vary substantially.

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APPENDIX 1:

BASLINE EVENT AND DISTRACTION INCIDENT NARRATIVES

BASELINE EVENTS

Event Number	Narrative - Baselines
1-1	Begin Sync: 985810 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
2-1	Begin Sync: 286038 The driver looks out the passenger window, then the driver window. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
6-1	Begin Sync: 1905562 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
6-2	Begin Sync: 1774562 The driver is looking forward most of the time. He takes a couple glances down to the instrument panel and out the driver window. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
9-1	Begin Sync: 3889750 The driver makes several glances out passenger window. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
20-1	Begin Sync: 2711855 The driver is looking forward most of the time. After trigger goes off, she reaches to the Karolinska box to give sleep rating.
20-2	Begin Sync: 2910563 The driver is looking forward most of the time. After trigger goes off, she reaches to the Karolinska box to give sleep rating.
20-3	Begin Sync: 1923308 The driver is looking forward most of the time. After trigger goes off, she reaches to the Karolinska box to give sleep rating.
22-1	Begin Sync: 3442454 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
22-2	Begin Sync: 667252 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
22-3	Begin Sync: 4558640 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
24-1	Begin Sync: 117448 The driver looks out the windows a couple of times. He does not respond when trigger goes off.
24-2	Begin Sync: 89849 The driver looks up at the CB a few times. After trigger goes off, he reaches to the Karolinska box to give sleep rating.

Event Number	Narrative - Baselines
26-1	Begin Sync: 612313 The driver looks out passenger window as he passed another truck. He looks at Karolinska box when trigger goes off, but does not respond. Then he looks out passenger window again at another passing truck.
26-2	Begin Sync: 3374247 The driver takes several glances out his side windows. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
101-1	Begin Sync: 2722815 The driver looks out the driver window at a passing car. After trigger goes off, he reaches to the Karolinska box to give sleep rating. It looks like he is hitting the box when it doesn't work.
101-2	Begin Sync: 3575859 The driver is looking forward most of the time. He is also drinking out of a soda bottle. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
102-1	Begin Sync: 3727661 The driver is looking forward most of the time. He glances out the driver window a few times at oncoming traffic. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
103-1	Begin Sync: 2664656 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
103-2	Begin Sync: 3037733 The driver is drinking from a coffee mug. He weaves within his lane when he reaches to put the mug down. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
104-1	Begin Sync: 453476 The driver reaches down to pick up soda bottle then looks out passenger window several times. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
109-1	Begin Sync: 1017300 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.
116-1	Begin Sync: 3611473 The driver is looking forward most of the time. After trigger goes off, he reaches to the Karolinska box to give sleep rating.

DISTRACTION-RELATED INCIDENTS

Event Number	Narrative - Distractions
1-1	Begin Sync: 1061068 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to cross the dotted line into the left lane.
1-2	Begin Sync: 2028129 Distraction: 11 The driver is distracted when he turns his head to blow smoke out the driver window, while smoking a cigarette. This causes him to cross the solid line onto the right shoulder of the road.
1-3	Begin Sync: 2743225 Distraction: 18 The driver is distracted when he looks down at paperwork that he is holding on the steering wheel. This causes him to cross the solid line onto the right shoulder of the road.
1-4	Begin Sync: 3513180 Distraction: 9 The driver is distracted when he reaches for a box of cigarettes, then lights one. This causes him to cross the solid line onto the right shoulder of the road.
1-5	Begin Sync: 3865828 Distraction: 5 The driver is distracted when he looks at the radio on the center console. This causes him to cross the solid line onto the right shoulder of the road.
1-6	Begin Sync: 3893389 Distraction: 19 The driver is distracted looking down at a cassette tape and tape recorder. This causes him to cross the solid line onto the right shoulder of the road.
1-7	Begin Sync: 4037432 Distraction: 2 There is a glare on the camera lens making it hard to determine exact directions. The driver is distracted while he is adjusting the CB controls. This causes him to cross the solid line onto the right shoulder of the road.
2-1	Begin Sync: 278126 Distraction: 5 The driver is distracted when he looks at the radio on the center console. This causes him to cross the solid line onto the left shoulder of the road; coming too close to the guardrail.
2-2	Begin Sync: 310526 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the dotted line into the left lane.
2-3	Begin Sync: 366957 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to cross the dotted line into the right lane.
2-4	Begin Sync: 404604 Distraction: 2 The driver is distracted while he is adjusting the CB controls. This causes him to cross the solid line onto the right shoulder of the road.

Event Number	Narrative - Distractions
2-5	Begin Sync: 846185 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to cross the dotted line into the left lane.
2-6	Begin Sync: 863063 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to have to brake quickly behind another vehicle.
2-7	Begin Sync: 892738 Distraction: 24 The driver is distracted when he looks repeatedly out the passenger window. This causes him to cross the dotted line into the left lane.
2-8	Begin Sync: 1071777 Distraction: 25 The camera cuts off the driver's eyes, making it hard to tell exact directions. The driver is distracted when he looks out the driver window. This causes him to come too close to the vehicle in front of him.
4-1	Begin Sync: 50044 Distraction: 17 The driver is distracted when he reaches to the floor to put his drink down. This causes him to come too close to the vehicle in front of him
4-2	Begin Sync: 57393 Distraction: 19 The driver is distracted while he is looking for something on the floor. This causes him to have to brake quickly behind another vehicle.
4-3	Begin Sync: 104249 Distraction: 8 The video cuts off the first 9 seconds. The driver is distracted while he is talking on a cell phone. This causes him to have to brake quickly behind another vehicle.
5-1	Begin Sync: 54153 Distraction: 11 The driver is distracted when he turns his head to blow smoke out the driver window, while smoking a cigarette. This causes him to have to steer suddenly to stay within the lane.
6-1	Begin Sync: 1017248 Distraction: 31 The driver is distracted wiping his face with a handkerchief. This causes him to have to steer suddenly to stay within the lane.
6-2	Begin Sync: 1022254 Distraction: 25 This may just be the way this driver drives. The driver is distracted when he looks out his window. This causes him to come too close to the vehicle in front of him.
6-3	Begin Sync: 1781393 Distraction: 3 This may just be the way this driver drives. The driver is distracted when he looks up at the CB. This causes him to come too close the vehicle in front of him.

Event Number	Narrative - Distractions
6-4	Begin Sync: 1800268 Distraction: 25 The driver is distracted when he looks out the driver window while changing lanes. This causes him to come too close to the vehicle in front of him.
6-5	Begin Sync: 2685561 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to have to brake quickly at a stoplight.
6-6	Begin Sync: 2686756 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to have to brake quickly at a stoplight.
6-7	Begin Sync: 2694790 Distraction: 23 The driver is distracted looking in the visor mirror while using a toothpick. This causes him to come too close to the vehicle in front of him.
6-8	Begin Sync: 2713251 Distraction: 24 The driver is distracted looking out the passenger window. This causes him to cross the solid line onto the right shoulder and he has to steer quickly to return to his lane.
6-9	Begin Sync: 2792539 Distraction: 24 The computer picks up the trigger, but the video does not. The driver is distracted when he looks out the passenger window. This causes him to cross the solid line onto the right shoulder of the road.
6-10	Begin Sync: 2820959 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to have to brake quickly at an intersection.
6-11	Begin Sync: 3399550 Distraction: 21 The driver is distracted while he is looking at something that he has just taken out of his pocket. This causes him to come too close to the vehicle in front of him.
6-12	Begin Sync: 3433435 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to come too close to the vehicle in front of him.
7-1	Begin Sync: 511423 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the solid line onto the right shoulder of the road.
7-2	Begin Sync: 555220 Distraction: 4 The driver is distracted while he is adjusting the radio. This causes him to cross the dotted line into the right lane.

Event Number	Narrative - Distractions
7-3	Begin Sync: 1299172 Distraction: 17 The driver is distracted when he reaches to the floor to put his drink down. This causes him to cross the dotted line into the left lane.
9-1	Begin Sync: 862714 Distraction: 24 The driver is distracted when he looks out the passenger window. The causes him to come too close to the vehicle in front of him.
9-2	Begin Sync: 2372632 Distraction: 2 The driver is distracted while he is adjusting the CB controls. This causes him to have to brake quickly for the vehicle in front of him.
9-3	Begin Sync: 3647127 Distraction: 1 The driver is distracted while he is talking on the CB. This causes him to ignore the prompt for a sleep rating.
9-4	Begin Sync: 3966736 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to come too close to the vehicle in front of him.
9-5	Begin Sync: 4856344 Distraction: 21 The driver is distracted looking at a box, with wires on it, which he is trying to put on the dashboard. This causes him to come too close to the vehicle in front of him.
9-6	Begin Sync: 5064647 Distraction: 3 The driver is distracted when he looks up at the CB. This causes him to come too close to the vehicle in front of him.
9-7	Begin Sync: 5064673 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to come too close to the vehicle in front of him
13-1	Begin Sync: 919931 Distraction: 17 The driver is wearing glasses making it hard to see his eyes. The driver is distracted reaching for his food on the dash of the cab. This causes him to cross the solid line onto the right shoulder of the road.
13-2	Begin Sync: 1057774 Distraction: 30 The driver is wearing sunglasses, can't see his eyes. The driver is distracted wiping his dash with a Kleenex. This causes him to cross the solid line onto the right shoulder.
14-1	Begin Sync: 5257808 Distraction: 2 The driver is wearing sunglasses, can't see his eyes. The driver is distracted while he is adjusting the CB controls. This causes him to have to brake quickly at a stoplight.

Event Number	Narrative - Distractions
14-2	Begin Sync: 6753604 Distraction: 1 The driver is wearing sunglasses, can't see his eyes. The driver is distracted while he is talking on the CB. This causes him to come too close to the vehicle in front of him.
16-1	Begin Sync: 312106 Distraction: 1 The driver is distracted while he is talking on the CB. This causes him to come too close to a wall on the left side of his lane.
17-1	Begin Sync: 3472038 Distraction: 25 The driver is distracted when he looks out the driver window. The causes him to begin to veer out of his lane. He has to steer the wheel quickly to correct himself and to stay within the lane.
19-1	Begin Sync: 326829 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the dotted line into the left lane.
19-2	Begin Sync: 1675392 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the solid line onto the right shoulder of the road.
20-1	Begin Sync: 500557 Distraction: 2 The driver is distracted while she is adjusting the CB controls. This causes her to cross the solid line onto the right shoulder of the road.
20-2	Begin Sync: 519745 Distraction: 25 The driver is distracted when she looks out the driver window. This causes her to cross the dotted line into the left lane.
20-3	Begin Sync: 739548 Distraction: 12 The driver is distracted while she is drinking from a large mug. This causes her to cross the solid line onto the right shoulder of the road.
20-4	Begin Sync: 1094344 Distraction: 24 The driver is distracted when she takes several glances out the passenger window. This causes her to cross the dotted line into the left lane.
20-5	Begin Sync: 2439026 Distraction: 19 The driver is looking around the cab a lot. She is distracted when she looks down at the floor. This causes her to cross the solid line onto the right shoulder.
20-6	Begin Sync: 2591680 Distraction: 2 The driver is looking around the cab a lot. She is distracted while she is adjusting the CB controls. This causes her to cross the solid line onto the right shoulder of the road.

Event Number	Narrative - Distractions
20-7	Begin Sync: 2609790 Distraction: 24 The driver is looking out the windows a lot. She is distracted when she looks out the passenger window. This causes her to cross the dotted line into the left lane.
20-8	Begin Sync: 2703081 Distraction: 27 The driver is distracted while she is adjusting herself in her seat. This causes her to cross the dotted line into the left lane.
20-9	Begin Sync: 2895344 Distraction: 24 The driver is looking around a lot. She is distracted when she looks out the passenger window. This causes her to cross the dotted line into the left lane.
20-10	Begin Sync: 2898400 Distraction: 20 The driver is distracted when she looks down at the instrument panel. This causes her to cross the dotted line into the left lane.
20-11	Begin Sync: 2917539 Distraction: 25 The driver is distracted when she looks out the driver window. This causes her to cross the dotted line into the left lane.
20-12	Begin Sync: 3040370 Distraction: 32 The driver is distracted while brushing her hair. This causes her to cross the solid line onto the left shoulder of the road, while passing a car.
20-13	Begin Sync: 3147190 Distraction: 17 The driver is distracted when she reaches down for something on the floor. This causes her to cross the dotted line into the left lane.
20-14	Begin Sync: 3165548 Distraction: 2 The original trigger is delayed from incident; a new sync number was determined. The driver is distracted adjusting the CB controls. This causes her to cross the solid line onto the right shoulder of the road.
20-15	Begin Sync: 5194069 Distraction: 25 The driver is distracted when she looks out the driver window. This causes her to cross the dotted line into the left lane.
20-16	Begin Sync: 3190969 Distraction: 24 The driver is weaving a lot within her lane. She is distracted when she looks out the passenger window. This causes her to come close to the dotted line, but she never crosses it.
20-17	Begin Sync: 5112204 Distraction: 3 The driver is distracted when she looks up at the CB. This causes her to cross the dotted line into the left lane.

Event Number	Narrative - Distractions
20-18	Begin Sync: 5495984 Distraction: 8 The driver is distracted while she is talking on a cell phone. This causes her to cross the dotted line into the left lane.
20-19	Begin Sync: 5677853 Distraction: 24 The driver is looking out the windows a lot. She is distracted when she looks out the passenger window. This causes her to cross the dotted line into the left lane.
20-20	Begin Sync: 5790378 Distraction: 25 The driver is looking around a lot. She is distracted when she looks out the driver window. This causes her to cross the dotted line into the left lane.
20-21	Begin Sync: 5837511 Distraction: 25 The driver is looking to the sides a lot. She is distracted when she looks out the driver window. This causes her to cross the dotted line into the left lane.
22-1	Begin Sync: 360801 Distraction: 4 The driver is distracted while he is adjusting the radio. This causes him to cross the dotted line into the left lane.
22-2	Begin Sync: 666765 Distraction: 25 The driver is distracted when he looks out driver window. This causes him to come too close to the vehicle in front of him.
22-3	Begin Sync: 720964 Distraction: 20 The tape does not work correctly; plays too fast; hard to see the drivers face, esp. eyes. The driver is distracted when he looks down at the instrument panel. This causes him to cross the solid line onto the right shoulder of the road.
22-4	Begin Sync: 729534 Distraction: 25 The driver is wearing sunglasses, can't see his eyes. The driver is distracted when he looks out the driver window. This causes him to come too close to the vehicle in front of him.
22-5	Begin Sync: 770215 Distraction: 21 The driver is wearing sunglasses, can't see his eyes. The driver is distracted when he looks down at his hand. This causes him to come too close to the vehicle in front of him.
22-6	Begin Sync: 2502992 Distraction: 4 The tape does not work correctly; plays too fast; hard to see the drivers face, esp. eyes. The driver is distracted while he is adjusting the radio. This causes him come too close to the vehicle in front of him.

Event Number	Narrative - Distractions
22-7	Begin Sync: 2513967 Distraction: 25 The sun causes a glare on the camera; doesn't produce a clear picture. Can't see driver past 2514073. The driver is wearing glasses making it hard to see his eyes. The driver is distracted when he looks out the driver window. This causes him to cross the dotted line into the left lane.
22-8	Begin Sync: 2518573 Distraction: 24 The driver is wearing glasses making it hard to see his eyes. The driver is distracted when he looks repeatedly out the passenger window. This causes him to come too close to the vehicle in front of him.
22-9	Begin Sync: 3384598 Distraction: 21 The driver is wearing glasses making it hard to see his eyes. The driver is distracted looking at something in his hands that he has just picked up from the floor. This causes him to cross the solid line onto the right shoulder.
22-10	Begin Sync: 2442069 Distraction: 1 Video cuts out during CB use. The driver is distracted while talking on the CB. This causes him to come too close to the vehicle in front of him.
22-11	Begin Sync: 2471856 Distraction: 17 The driver is distracted when he reaches down for a bag of chips. This causes him to cross the center line into the lane going the opposite direction.
22-12	Begin Sync: 3473509 Distraction: 19 The driver is distracted when he looks to the floor while searching for his food. This causes him to come too close to the vehicle in front of him.
22-13	Begin Sync: 3493159 Distraction: 17 The driver is distracted when he reaches to put his mug on the floor. This causes him to cross the center line into the oncoming lane.
22-14	Begin Sync: 4839477 Distraction: 24 The driver is wearing sunglasses, can't see his eyes. The driver is distracted when he takes several glances out the passenger window. This causes him to cross the dotted line into the left lane. He drives in the middle of the road for a few moments before correcting.
22-15	Begin Sync: 4906411 Distraction: 17 The driver is wearing sunglasses, can't see his eyes. The driver is distracted when he reaches for his food on the passengers seat. This causes him to cross the solid line onto the left shoulder of the road.

Event Number	Narrative - Distractions
22-16	Begin Sync: 5077793 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to cross the dotted line into the left lane.
22-17	Begin Sync: 5165492 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to come too close to the vehicle in front of him before he changes lanes.
22-18	Begin Sync: 5463354 Distraction: 21 The driver is wearing sunglasses, can't see his eyes. The driver is distracted when he looks down at his hand. This causes him to cross the solid line onto the right shoulder of the road.
22-19	Begin Sync: 5507756 Distraction: 25 The driver is wearing sunglasses, can't see his eyes. The driver is distracted when he takes several glances in the driver side mirror. This causes him to cross the solid line onto the left shoulder of the road.
22-20	Begin Sync: 6062704 Distraction: 11 The driver is distracted when he turns his head to blow smoke out the driver window, while smoking a cigarette. This causes him to cross the dotted line into the left lane.
22-21	Begin Sync: 6264185 Distraction: 19 The driver is wearing sunglasses, can't see his eyes. The driver is distracted when he looks to the floor while searching for something. This causes him to cross the solid line onto the right shoulder.
22-22	Begin Sync: 6290403 Distraction: 10 The driver is distracted while he is getting a cigarette out of the pack. This causes him to cross the solid line onto the right shoulder of the road.
24-1	Begin Sync: 30345 Distraction: 8 The driver is distracted while he is talking on a cell phone. This causes him to ignore the prompt for a sleep rating.
24-2	Begin Sync: 30625 Distraction: 6 The driver is distracted when he looks down while dialing a cell phone. This causes him to come too close to the vehicle in front of him.
24-3	Begin Sync: 33515 Distraction: 8 The driver is distracted while he is talking on a cell phone. This causes him to come too close to the vehicle in front of him.
24-4	Begin Sync: 52441 Distraction: 25 The driver is distracted when he takes several long glances out the driver window at a passing vehicle. This causes him to come too close to the vehicle in front of him.

Event Number	Narrative - Distractions
24-5	Begin Sync: 63114 Distraction: 2 The driver is distracted while he is adjusting the CB controls. This causes him to cross the solid line onto the left shoulder of the road.
24-6	Begin Sync: 84171 Distraction: 2 The driver is distracted while he is adjusting the CB controls. This causes him to come too close to the vehicle in front of him.
24-7	Begin Sync: 1959209 Distraction: 8 The driver is distracted while he is talking on a cell phone. This causes him to ignore the prompt for a sleep rating.
24-8	Begin Sync: 1973499 Distraction: 6 The computer picks up the trigger, but the video does not. The driver is distracted when he looks down while dialing a cell phone. This causes him to cross the dotted line into the left lane.
24-9	Begin Sync: 1978444 Distraction: 17 The driver is weaving within his lane a lot. He is distracted when he reaches to hang up cell phone. This causes him to have to steer suddenly to stay within his lane.
24-10	Begin Sync: 2012132 Distraction: 8 The computer picks up the trigger, but the video does not. The driver is distracted while talking on a cell phone. This causes him to cross the dotted line into the left lane.
24-11	Begin Sync: 2223152 Distraction: 1 Video cuts out during CB use The driver is distracted while talking on the CB. This causes him to have to stop quickly at a stoplight.
24-12	Begin Sync: 2669265 Distraction: 15 The driver is distracted when he repeatedly turns his head to talk to someone in the back of the cab. This causes him to come too close to the vehicle in front of him.
26-1	Begin Sync: 585840 Distraction: 25 The trigger is a little slow. The driver is distracted when he looks out the driver window. This causes him to cross the solid line onto the right shoulder of the road.
26-2	Begin Sync: 656912 Distraction: 25 The trigger is a little slow. The driver is distracted when he looks out the driver window. This causes him to cross the solid line onto the right shoulder of the road.

Event Number	Narrative - Distractions
26-3	Begin Sync: 675897 Distraction: 1 The driver is distracted while he is talking on the CB. This causes him to cross the solid line onto the left shoulder of the road.
26-4	Begin Sync: 3351287 Distraction: 8 The driver is distracted while he is talking on a cell phone. This causes him to come close to the solid right line, but he never crosses it.
26-5	Begin Sync: 3637418 Distraction: 25 The driver is distracted when he takes several glances out the driver window. This causes him to cross the dotted line into the left lane.
26-6	Begin Sync: 3733763 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to cross the solid line onto the right shoulder.
26-7	Begin Sync: 4374014 Distraction: 12 The driver is distracted while drinking from a bottle. This causes him to cross the dotted line into the left lane.
26-8	Begin Sync: 4489187 Distraction: 2 The driver is distracted when he reaches for the CB. This causes him to come close to the solid right line, but he never crosses it.
26-9	Begin Sync: 5033393 Distraction: 2 The driver is distracted while adjusting the CB controls. This causes him to cross the solid line onto the left shoulder of the road, as he is passing a car.
26-10	Begin Sync: 5381089 Distraction: 29 The driver is distracted when he lets go of the wheel while he is dancing. This causes him to cross over the solid line on to the right shoulder of the road.
26-11	Begin Sync: 5952877 Distraction: 21 The driver is distracted when he reaches to answer ringing cell phone then looks at phone display. This causes him to have to brake quickly behind another vehicle.
101-1	Begin Sync: 2462332 Distraction: 25 The driver is distracted when he takes several glances out the driver window. This causes him to cross the solid line onto the right shoulder of the road.
101-2	Begin Sync: 2715169 Distraction: 21 The driver is distracted looking in his lap while getting some papers out of an envelope. This causes him to cross the solid line onto the right shoulder of the road.
101-3	Begin Sync: 2751517 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to cross the solid line onto the right shoulder of the road.

Event Number	Narrative - Distractions
101-4	Begin Sync: 2779363 Distraction: 7 The driver is distracted when he looks down while plugging in a cell phone. This causes him to cross the solid line onto the right shoulder of the road.
101-5	Begin Sync: 3442385 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to cross the solid line onto the right shoulder of the road.
101-6	Begin Sync: 3551122 Distraction: 18 The driver is distracted when he looks down at paperwork that he is holding on the steering wheel. This causes him to cross the solid line onto the right shoulder.
101-7	Begin Sync: 3575982 Distraction: 4 The driver is distracted while he is adjusting the radio. This causes him to cross the solid line onto the right shoulder of the road.
101-8	Begin Sync: 3594150 Distraction: 8 The driver is distracted talking on a cell phone. This causes him to cross the dotted line into the right lane.
101-9	Begin Sync: 3622291 Distraction: 8 The driver is distracted talking on a cell phone. This causes him to cross the solid line onto the right shoulder.
101-10	Begin Sync: 3791129 Distraction: 19 The driver is distracted when he looks down at the floor. This causes him to cross the solid line onto the right shoulder.
101-11	Begin Sync: 4083613 Distraction: 25 The driver is distracted when he takes several glances out the driver window. This causes him to cross the dotted line into the left lane.
101-12	Begin Sync: 5314307 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the solid line onto the right shoulder of the road.
101-13	Begin Sync: 5491463 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to cross the dotted line
101-14	Begin Sync: 6161975 Distraction: 25 The driver is distracted when he takes several glances out the driver window. This causes him to cross the solid line onto the right shoulder of the road.

Event Number	Narrative - Distractions
101-15	Begin Sync: 6198311 Distraction: 17 The video cuts off right after the trigger. The driver is distracted when he reaches down for something on the floor. This causes him to cross the solid line onto the right shoulder of the road.
102-1	Begin Sync: 2063198 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to cross the solid line onto the right shoulder of the road.
102-2	Begin Sync: 3155097 Distraction: 17 The driver is distracted when he reaches down to put his cup on the floor. This causes him to cross the dotted line into the left lane. He stays there for a few moments before correcting himself.
102-3	Begin Sync: 3765272 Distraction: 31 The driver is distracted while he is rubbing his eye. This causes him to cross the dotted line into the left lane.
102-4	Begin Sync: 3805005 Distraction: 29 The driver is distracted when he looks down at a cassette tape he is holding. This causes him to cross the dotted line, slightly, into the left lane.
102-5	Begin Sync: 4429035 Distraction: 17 The driver is distracted when he reaches down to put his cup on the floor. This causes him to cross the solid line onto the right shoulder of the road.
102-6	Begin Sync: 5600714 Distraction: 33 The driver is distracted when he starts coughing. This causes him to cross the dotted line into the left lane.
103-1	Begin Sync: 62407 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to cross the dotted line into the left lane.
103-2	Begin Sync: 174954 Distraction: 20 The driver is weaving a lot within his lane. He is distracted looking down at the instrument panel. This causes him to cross the dotted line into the left lane.
103-3	Begin Sync: 1274363 Distraction: 17 The driver is distracted when he reaches down for something on the floor, while trying to write on a clipboard. This causes him to cross the solid line onto the right shoulder of the road.
103-4	Begin Sync: 1679012 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the dotted line into the left lane.

Event Number	Narrative - Distractions
103-5	Begin Sync: 1817287 Distraction: 17 The video is gray making it very hard to see the driver. The driver is distracted when he reaches down to put something on the floor. This causes him to cross the dotted line into the left lane.
103-6	Begin Sync: 1960902 Distraction: 15 The video cuts off right after the trigger. The driver is distracted while they are looking at, and talking to, the passenger. This causes him to cross the dotted line into the right lane.
103-7	Begin Sync: 2436549 Distraction: 17 The driver is distracted when he reaches down for something on the floor. This causes him to slightly cross the solid line onto the right shoulder of the road.
103-8	Begin Sync: 2449777 Distraction: 15 The driver is distracted while he is talking to the passenger. This causes him to have to brake quickly while making a left turn.
103-9	Begin Sync: 2565309 Distraction: 1 The driver is distracted while talking on the CB. This causes him to have to brake quickly for the vehicle in front of him.
103-10	Begin Sync: 3093312 Distraction: 25 The driver is distracted when he looks out the driver window. This causes him to cross the solid line onto the right shoulder of the road.
104-1	Begin Sync: 315572 Distraction: 28 The driver is distracted while he is taking off his jacket. This causes him to cross the dotted line in to the left lane.
104-2	Begin Sync: 456156 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to cross the solid line onto the right shoulder of the road.
104-3	Begin Sync: 474248 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the dotted line into the left lane.
104-4	Begin Sync: 512238 Distraction: 34 The driver is distracted while he is yawning. This causes him to cross the solid line onto the right shoulder.
104-5	Begin Sync: 1967916 Distraction: 18 The video is gray making it very hard to see the driver. The driver is distracted when he looks down at paperwork that he is holding on the steering wheel. This causes him to cross the solid line onto the right shoulder of the road.

Event Number	Narrative - Distractions
104-6	Begin Sync: 2873499 Distraction: 27 The driver is distracted while he is trying to adjust himself in his seat. This causes him to cross the dotted line into the left lane.
105-1	Begin Sync: 980511 Distraction: 12 The driver is wearing glasses making it hard to see his eyes. The driver is distracted drinking out of a soda bottle. This causes him to cross the solid line onto the right shoulder of the road.
106-1	Begin Sync: 2847828 Distraction: 25 The driver is wearing glasses making it hard to see his eyes. The driver is distracted when he looks out the window at a passing car. This causes him to cross the solid line onto the right shoulder of the road.
107-1	Begin Sync: 104972 Distraction: 22 The driver is distracted when she looks up while the passenger is trying to get something from the visor. This causes her to cross the solid line onto the right shoulder of the road.
107-2	Begin Sync: 1492171 Distraction: 17 The driver is wearing glasses making it hard to see his eyes. The driver is distracted when she reaches down to put her drink on the floor. This causes her to cross the dotted line into the left lane.
108-1	Begin Sync: 660209 Distraction: 20 The driver is distracted when he looks down at the instrument panel. This causes him to cross the solid line onto the right shoulder of the road.
108-2	Begin Sync: 1825032 Distraction: 14 The driver is distracted while he is eating and talking to the passenger. This causes him to slightly cross the solid line while he is getting into an exit lane.
109-1	Begin Sync: 1048419 Distraction: 19 The driver is distracted while he is looking for something on the floor. This causes him to cross the solid line onto the right shoulder of the road.
109-2	Begin Sync: 1093165 Distraction: 19 The driver is distracted while he is looking down for a cassette tape. This causes him to cross the dotted line into the left lane.
109-3	Begin Sync: 1165062 Distraction: 13 The video cuts off and back on; lose a little bit of tape. The driver is distracted while he is getting food out of a bag and eating it. This causes him to cross the dotted line into the left lane.
109-4	Begin Sync: 1705333 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to cross the solid line onto the left shoulder of the road.

Event Number	Narrative - Distractions
110-1	Begin Sync: 1445046 Distraction: 25 The tape cuts off right after the trigger. The driver is distracted when he looks out the driver window. This causes him to slightly cross the solid line onto the right shoulder of the road.
111-1	Begin Sync: 3834584 Distraction: 1 The driver is distracted while he is talking on the CB. This causes him to cross the dotted line into the left lane.
111-2	Begin Sync: 4335076 Distraction: 12 The driver is wearing sunglasses, can't see his eyes. The driver is distracted trying to take the top off his soda bottle. This causes him to cross the solid line onto the right shoulder of the road.
111-3	Begin Sync: 6532471 Distraction: 24 The driver is distracted when he takes several glances out the passenger window. This causes him to cross the dotted line into the left lane.
115-1	Begin Sync: 1145711 Distraction: 15 The driver is distracted while she is talking to a passenger. This causes her to have to stop quickly behind a turning vehicle.
115-2	Begin Sync: 2510097 Distraction: 1 Cannot see video after 2510245. The driver is distracted while she is talking on the CB. This causes her to have to brake quickly for a turn.
116-1	Begin Sync: 2742715 Distraction: 9 The driver is distracted while he is lighting a cigarette. This causes him to cross the solid line onto the right shoulder of the road.
116-2	Begin Sync: 2772224 Distraction: 26 The driver is distracted looking at road signs along the side of the road. This causes him to cross the solid line onto the right shoulder of the road.
116-3	Begin Sync: 3094515 Distraction: 21 The driver is wearing glasses making it hard to see his eyes. The driver is distracted looking at something on the dashboard. This causes him to cross the solid line onto the right shoulder of the road.
116-4	Begin Sync: 3115591 Distraction: 11 The driver is wearing glasses making it hard to see his eyes. The driver is distracted when he turns his head to blow smoke out the driver window, while smoking a cigarette. This causes him to cross the solid line onto the right shoulder of the road.

Event Number	Narrative - Distractions
116-5	Begin Sync: 3644272 Distraction: 16 The video cuts off right after trigger. The driver is distracted while he is reaching for something in his pocket. This causes him to cross the solid line onto the right shoulder.
205-1	Begin Sync: 1036237 Distraction: 25 The driver is distracted when he looks out the driver window, while changing lanes. This causes him to come too close to the vehicle in front of him.
206-1	Begin Sync: 778647 Distraction: 14 The driver is distracted while he is eating. This causes him to cross the solid line onto the left shoulder of the road while passing a car.
206-2	Begin Sync: 789088 Distraction: 24 The driver is distracted when he looks out the passenger window. This causes him to come too close to the vehicle in front of him.
209-1	Begin Sync: 2558650 Distraction: 15 The driver is distracted while he is talking to the passenger. This causes him to cross the dotted line into the oncoming lane.
213-1	Begin Sync: 350503 Distraction: 10 The sync numbers are hard to read because the tape is bad. The driver is distracted while he is getting a cigarette out of the pack. This causes him to cross the solid line onto the right shoulder.

APPENDIX 2:

ANOVA TABLES AND POST-HOC COMPARISON RESULTS

DISTRACTION VS NO DISTRACTION GROUPS

Dependent Variable: Proportion of Time Looking Forward

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.00797268	0.00797268	0.50	0.4932
Sub_ID * Distraction	13	0.20849664	0.01603820		

Dependent Variable: Proportion of Time Looking Out Passenger Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.00384898	0.00384898	0.38	0.5477
Sub_ID * Distraction	13	0.13132560	0.01010197		

Dependent Variable: Proportion of Time Looking Out Driver Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.00011118	0.00011118	0.02	0.8905
Sub_ID * Distraction	13	0.07326245	0.00563557		

Dependent Variable: Proportion of Time Looking at Instrument Panel

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.04778515	0.04778515	2.69	0.1249
Sub_ID * Distraction	13	0.23094385	0.01776491		

Dependent Variable: Proportion of Time Looking at Other Location

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.02929250	0.02929250	1.97	0.1842
Sub_ID * Distraction	13	0.19364730	0.01489595		

Dependent Variable: Proportion of Time Looking at Passenger

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.00052321	0.0005232	1.52	0.2388
Sub_ID * Distraction	13	0.00446228	0.00034325		

Dependent Variable: Proportion of Time Eyes Closed

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.00028298	0.00028298	3.42	0.0874
Sub_ID * Distraction	13	0.00107645	0.00008280		

Dependent Variable: Proportion of Time Eye Glance Location is Undetermined

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	1	0.00090253	0.00090253	0.18	0.6810
Sub_ID * Distraction	13	0.06636611	0.00510509		

DISTRACTION TYPES NOT GROUPED

Dependent Variable: Proportion of Time Looking Forward

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	36	1.72351409	0.04787539	1.98	0.0072
Sub_ID * Distraction	70	1.69056664	0.02415095		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls[5]

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	1.0000	1	Looking outside
A			
A	1.0000	1	Reaching in pocket
A			
B A	0.9500	1	Toothpick/Visor
B A			
B A	0.9450	1	Taking off jacket
B A			
B A	0.9400	1	Brushing hair
B A			
B A	0.8950	2	Rubbing face
B A			
B A	0.8653	9	Talking on cell phone
B A			
B A	0.8358	9	Talking on CB
B A			
B A	0.7900	1	Yawning
B A			
B A	0.7795	11	Adjusting CB
B A			
B A	0.7625	2	Lighting cigarette
B A			
B A	0.7600	2	Adjusting in seat
B A			
B A	0.7600	1	Coughing
B A			
B A	0.7550	1	Wiping dash
B A			
B A	0.7350	1	Looking up
B A			
B A	0.7225	4	Drinking
B A			
B A	0.7138	4	Blowing smoke
B A			
B A	0.7100	2	Eating/Talking
B A			
B A	0.7042	33	Looking left-outside
B A			
B A	0.6975	4	Adjusting radio
B A			

[5] Post-hoc multiple comparisons were conducted when a statistically significant main effect for Distraction was found at $p<0.05$. Student-Newman-Keuls (SNK) is one of several post-hoc tests that are available. Generally, a post-hoc test will indicate which levels of a variable (i.e., Distraction) are significantly different from each other. However, there are situations where the variable will be statistically significant in the ANOVA, but the post-hoc comparisons will not indicate a significant difference between levels of that variable. This is due to the method in which the error rate is controlled for with the post-hoc test that is used (Ott, 1988).

B	A	0.6889	23	Looking right-outside
B	A			
B	A	0.6837	14	Reaching to floor
B	A			
B	A	0.6675	2	Looking at radio
B	A			
B	A	0.6614	5	Talking to passenger
B	A			
B	A	0.6609	23	No Distraction
B	A			
B	A	0.6483	3	Looking at CB
B	A			
B	A	0.6375	2	Lets go of wheel
B	A			
B	A	0.6319	8	Looking at floor
B	A			
B	A	0.6071	12	Looking at IP
B	A			
B	A	0.6025	2	Getting cigarette
B	A			
B	A	0.5800	1	Answer Phone/Check Display
B	A			
B	A	0.5657	7	Looking down
B	A			
B	A	0.4650	1	Plugging in cell phone
B	A			
B	A	0.4100	3	Looking at paperwork
B	A			
B	A	0.4075	2	Dialing cell phone
B	A			
B	A	0.3850	1	Phone call/Hang up Phone
B				
B		0.3750	1	Getting Food

Dependent Variable: Proportion of Time Looking Out Passenger Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	36	0.52791870	0.01466441	4.06	<0.0001
Sub_ID * Distraction	70	0.25264418	0.00360920		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.19761	23	Looking right-outside
A			
A	0.14667	3	Looking at CB
A			
A	0.09500	1	Answer Phone/Check Display
A			
A	0.08000	1	Yawning
A			
A	0.07929	7	Looking down
A			
A	0.05625	4	Blowing smoke
A			
A	0.05500	1	Taking off jacket
A			
A	0.04978	23	No Distraction
A			
A	0.03870	33	Looking left-outside
A			
A	0.03750	2	Eating/Talking
A			
A	0.03500	1	Plugging in cell phone
A			
A	0.03500	2	Lets go of wheel
A			
A	0.03250	12	Looking at IP
A			
A	0.02438	8	Looking at floor
A			
A	0.02375	4	Adjusting radio
A			
A	0.02280	5	Talking to passenger
A			
A	0.01750	2	Rubbing face
A			
A	0.01522	9	Talking on CB
A			
A	0.01500	2	Getting cigarette
A			
A	0.01318	11	Adjusting CB
A			
A	0.01271	14	Reaching to floor
A			
A	0.00000	1	Coughing
A			
A	0.00000	3	Looking at paperwork
A			
A	0.00000	1	Looking outside
A			
A	0.00000	4	Drinking
A			
A	0.00000	2	Looking at radio
A			
A	0.00000	1	Getting Food
A			
A	0.00000	1	Reaching in pocket
A			

A	0.00000	1	Looking up
A			
A	0.00000	1	Brushing hair
A			
A	0.00000	2	Lighting cigarette
A			
A	0.00000	2	Dialing cell phone
A			
A	0.00000	9	Talking on cell phone
A			
A	0.00000	2	Adjusting in seat
A			
A	0.00000	1	Toothpick/Visor
A			
A	0.00000	1	Wiping dash
A			
A	0.00000	1	Phone call/Hang up phone

Dependent Variable: Proportion of Time Looking Out Driver Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	36	0.46402425	0.01288956	2.06	0.0050
Sub_ID * Distraction	70	0.43901312	0.00627162		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.2225	4	Blowing smoke
A			
A	0.2098	33	Looking left-o
A			
A	0.1750	1	Phone call/Hang up phone
A			
A	0.1448	5	Talking to passenger
A			
A	0.1250	1	Answer phone/Check Display
A			
A	0.0870	23	No Distraction
A			
A	0.0833	23	Looking right-outside
A			
A	0.0825	2	Getting cigarette
A			
A	0.0800	2	Lighting cigarette
A			
A	0.0800	4	Drinking
A			
A	0.0700	1	Plugging in cell phone
A			
A	0.0700	1	Yawning
A			
A	0.0625	2	Adjusting in seat
A			
A	0.0600	1	Looking up
A			
A	0.0586	11	Adjusting CB
A			
A	0.0581	8	Looking at floor
A			
A	0.0575	2	Rubbing face
A			

A	0.0568	14	Reaching to floor
A			
A	0.0513	12	Looking at IP
A			
A	0.0500	9	Talking on cell phone
A			
A	0.0457	7	Looking down
A			
A	0.0438	4	Adjusting radio
A			
A	0.0434	9	Talking on CB
A			
A	0.0400	2	Dialing cell phone
A			
A	0.0400	3	Looking at CB
A			
A	0.0400	1	Coughing
A			
A	0.0183	3	Looking at paperwork
A			
A	0.0050	2	Eating/Talking
A			
A	0.0000	2	Looking at radio
A			
A	0.0000	1	Brushing hair
A			
A	0.0000	1	Looking outside
A			
A	0.0000	1	Reaching in pocket
A			
A	0.0000	1	Getting Food
A			
A	0.0000	2	Lets go of wheel
A			
A	0.0000	1	Taking off jacket
A			
A	0.0000	1	Wiping dash
A			
A	0.0000	1	Toothpick/Visor

Dependent Variable: Proportion of Time Looking at Instrument Panel

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	36	1.00177336	0.02782704	1.90	0.0110
Sub_ID * Distraction	70	1.02538251	0.01464832		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.33250	2	Looking at radio
A			
A	0.27292	12	Looking at instrument panel
A			
A	0.20625	4	Adjusting radio
A			
A	0.14000	7	Looking down
A			
A	0.12250	2	Lets go of wheel
A			
A	0.09500	1	Looking up
A			

A	0.09500	23	No Distraction
A	0.08000	2	Getting cigarette
A	0.07000	2	Adjusting in seat
A	0.06000	1	Brushing hair
A	0.03500	1	Wiping dash
A	0.03111	9	Talking on cell phone
A	0.03063	8	Looking at floor
A	0.02500	1	Plugging in cell phone
A	0.02303	33	Looking left-outside
A	0.01500	3	Looking at paperwork
A	0.01464	14	Reaching to floor
A	0.01370	23	Looking right-outside
A	0.01250	2	Dialing cell phone
A	0.01045	11	Adjusting CB
A	0.01000	1	Yawning
A	0.00889	9	Talking on CB
A	0.00833	3	Looking at CB
A	0.00500	5	Talking to passenger
A	0.00000	1	Coughing
A	0.00000	2	Lighting cigarette
A	0.00000	1	Looking outside
A	0.00000	1	Getting Food
A	0.00000	1	Phone call/Hang up phone
A	0.00000	2	Rubbing face
A	0.00000	1	Taking off jacket
A	0.00000	1	Reaching in pocket
A	0.00000	4	Drinking
A	0.00000	2	Eating/Talking
A	0.00000	1	Toothpick/Visor
A	0.00000	1	Answer phone/Check display
A	0.00000	4	Blowing smoke

Dependent Variable: Proportion of Time Looking at Other Location

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	36	1.70347002	0.04731861	4.28	<0.0001
Sub_ID * Distraction	70	0.77366919	0.01105242		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.57000	1	Getting Food
A			
A	0.54000	2	Dialing cell phone
A			
B A	0.44000	1	Phone call/Hang up phone
B A			
B A C	0.43167	3	Looking at paperwork
B A C			
B A C	0.40500	1	Plugging in cell phone
B C			
B D C	0.25500	8	Looking at floor
B D C			
B D C	0.22000	2	Getting cigarette
B D C			
B D C	0.21000	1	Wiping dash
B D C			
B D C	0.20500	2	Lets go of wheel
B D C			
B D C	0.20250	14	Reaching to floor
B D C			
B D C	0.20000	1	Answer phone/Check display
B D C			
B D C	0.18500	2	Eating/Talking
B D C			
B D C	0.16929	7	Looking down
B D C			
B D C	0.15750	2	Lighting cigarette
B D C			
B D C	0.14500	3	Looking at CB
B D C			
B D C	0.13091	11	Adjusting CB
D C			
D C	0.10875	4	Drinking
D C			
D C	0.10750	2	Adjusting in seat
D			
D	0.07891	23	No Distraction
D			
D	0.05500	1	Looking up
D			
D	0.05356	9	Talking on cell phone
D			
D	0.05000	1	Toothpick/Visor
D			
D	0.04833	9	Talking on CB
D			
D	0.03000	2	Rubbing face
D			
D	0.02875	4	Adjusting radio
D			
D	0.02015	33	Looking left-outside
D			
D	0.02000	1	Coughing
D			
D	0.01652	23	Looking right-outside

D				
D		0.00750	4	Blowing smoke
D				
D		0.00000	12	Looking at IP
D				
D		0.00000	1	Brushing hair
D				
D		0.00000	1	Reaching in pocket
D				
D		0.00000	1	Looking outside
D				
D		0.00000	5	Talking to passenger
D				
D		0.00000	1	Taking off jacket
D				
D		0.00000	2	Looking at radio
D				
D		0.00000	1	Yawning

Dependent Variable: Proportion of Time Looking at Passenger

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	36	0.12803405	0.00355650	3.40	<0.0001
Sub_ID * Distraction	70	0.07317627	0.00104538		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.16600	5	Talking to passenger
B	0.06250	2	Eating/Talking
B	0.05500	1	Looking up
B	0.01286	14	Reaching to floor
B	0.00091	33	Looking left-outside
B	0.00000	4	Adjusting radio
B	0.00000	1	Coughing
B	0.00000	1	Answer phone/Check display
B	0.00000	11	Adjusting CB
B	0.00000	2	Dialing cell phone
B	0.00000	1	Getting Food
B	0.00000	2	Getting cigarette
B	0.00000	4	Blowing smoke
B	0.00000	2	Lets go of wheel
B	0.00000	2	Lighting cigarette
B	0.00000	3	Looking at CB
B	0.00000	8	Looking at floor

B			
B	0.00000	12	Looking at IP
B			
B	0.00000	3	Looking at paperwork
B			
B	0.00000	2	Looking at radio
B			
B	0.00000	7	Looking down
B			
B	0.00000	1	Brushing hair
B			
B	0.00000	1	Looking outside
B			
B	0.00000	23	Looking right-outside
B			
B	0.00000	4	Drinking
B			
B	0.00000	23	No Distraction
B			
B	0.00000	1	Plugging in cell phone
B			
B	0.00000	1	Reaching in pocket
B			
B	0.00000	1	Phone call/Hang up phone
B			
B	0.00000	2	Rubbing face
B			
B	0.00000	1	Taking off jacket
B			
B	0.00000	9	Talking on CB
B			
B	0.00000	9	Talking on cell phone
B			
B	0.00000	2	Adjusting in seat
B			
B	0.00000	1	Toothpick/Visor
B			
B	0.00000	1	Wiping dash
B			
B	0.00000	1	Yawning

Dependent Variable: Proportion of Time Eyes Closed

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	36	0.02943103	0.00081753	12.71	<0.0001
Sub_ID * Distraction	70	0.00450326	0.00006433		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.18000	1	Coughing
B	0.05000	1	Yawning
C	0.01167	3	Looking at CB
C			
C	0.00727	11	Adjusting CB
C			
C	0.00333	9	Talking on CB

C			
C	0.00318	33	Looking left-outside
C			
C	0.00000	4	Adjusting radio
C			
C	0.00000	2	Adjusting in seat
C			
C	0.00000	4	Drinking
C			
C	0.00000	2	Eating/Talking
C			
C	0.00000	1	Getting Food
C			
C	0.00000	1	Answer phone/Check display
C			
C	0.00000	1	Phone call/Hang up phone
C			
C	0.00000	2	Lets go of wheel
C			
C	0.00000	2	Lighting cigarette
C			
C	0.00000	2	Getting cigarette
C			
C	0.00000	8	Looking at floor
C			
C	0.00000	12	Looking at IP
C			
C	0.00000	3	Looking at paperwork
C			
C	0.00000	2	Looking at radio
C			
C	0.00000	7	Looking down
C			
C	0.00000	1	Brushing hair
C			
C	0.00000	1	Looking outside
C			
C	0.00000	2	Dialing cell phone
C			
C	0.00000	1	Looking up
C			
C	0.00000	23	No Distraction
C			
C	0.00000	1	Plugging in cell phone
C			
C	0.00000	1	Reaching in pocket
C			
C	0.00000	14	Reaching to floor
C			
C	0.00000	2	Rubbing face
C			
C	0.00000	1	Taking off jacket
C			
C	0.00000	23	Looking right-outside
C			
C	0.00000	9	Talking on cell phone
C			
C	0.00000	5	Talking to passenger
C			
C	0.00000	1	Toothpick/Visor
C			
C	0.00000	1	Wiping dash
C			
C	0.00000	4	Blowing smoke

Dependent Variable: Proportion of Time Eye Glance Location is Undetermined

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	34	0.12611462	0.00350318	1.10	0.3627
Sub_ID * Distraction	73	0.22347220	0.00319246		

HIGH-LEVEL TASK GROUPING

Dependent Variable: Proportion of Time Looking Forward

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.75314623	0.10759232	4.37	0.0006
Sub_ID * Distraction	61	1.50342389	0.02464629		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.87167	6	Personal/Grooming
A			
B A	0.80943	23	Talking
B			
B C	0.72417	12	Consume/Put into mouth
B C			
B C	0.70325	57	Look away/outside
B C			
B C	0.69363	24	Bio-Mechanical
B C			
B C	0.68050	20	Manual/Device
B C			
B C	0.66087	23	No Distraction
C			
C	0.59847	36	Look away/inside

Dependent Variable: Proportion of Time Looking Out Passenger Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.17493048	0.02499007	4.56	0.0004
Sub_ID * Distraction	61	0.33429971	0.00548032		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.10214	57	Look away/outside
A			
B A	0.04978	23	No Distraction
B A			
B A	0.04389	36	Look away/inside
B A			
B A	0.02500	12	Consume/Put into mouth
B A			
B A	0.01917	6	Personal/Grooming
B A			
B A	0.01850	20	Manual/Device
B			
B	0.01388	24	Bio-Mechanical
B			
B	0.01091	23	Talking

Dependent Variable: Proportion of Time Looking Out Driver Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.18727998	0.02675428	3.51	0.0032
Sub_ID * Distraction	61	0.46531310	0.00762808		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.15505	57	Look away/outside
A			
B A	0.11500	12	Consume/Put into mouth
B A			
B A	0.08696	23	No Distraction
B A			
B A	0.06804	23	Talking
B A			
B A	0.06350	20	Manual/Device
B			
B	0.04542	36	Look away/inside
B			
B	0.04521	24	Bio-Mechanical
B			
B	0.03750	6	Personal/Grooming

Dependent Variable: Proportion of Time Looking at Instrument Panel

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.38135961	0.05447994	2.95	0.0099
Sub_ID * Distraction	61	1.12641267	0.01846578		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.14806	36	Look away/inside
A			
B A	0.09500	23	No Distraction
B			
B	0.04950	20	Manual/Device
B			
B	0.03271	24	Bio-Mechanical
B			
B	0.01886	57	Look away/outside
B			
B	0.01674	23	Talking
B			
B	0.01167	6	Personal/Grooming
B			
B	0.00000	12	Consume/Put into mouth

Dependent Variable: Proportion of Time Looking at Other Location

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.51788595	0.07398371	4.69	0.0003
Sub_ID * Distraction	61	0.96159080	0.01576378v		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.19500	24	Bio-Mechanical
A			
A	0.18400	20	Manual/Device
A			
B A	0.13917	36	Look away/inside
B A			
B A C	0.09583	12	Consume/Put into mouth
B C			
B C	0.07891	23	No Distraction
B C			
B C	0.03987	23	Talking
C			
C	0.02167	6	Personal/Grooming
C			
C	0.01833	57	Look away/outside

Dependent Variable: Proportion of Time Looking at Passenger

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.00394074	0.00056296	1.12	0.3638
Sub_ID * Distraction	61	0.03072156	0.00050363		

Dependent Variable: Proportion of Time Eyes Closed

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.00448635	0.00064091	4.20	0.0008
Sub_ID * Distraction	61	0.00930579	0.00015255		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.038333	6	Personal/Grooming
B	0.004000	20	Manual/Device
B			
B	0.001842	57	Look away/outside
B			
B	0.001304	23	Talking
B			
B	0.000972	36	Look away/inside
B			

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B       0.000000     12    Consume/Put into mouth
B
B       0.000000     24    Bio-Mechanical
B
B       0.000000     23    No Distraction
```

Dependent Variable: Proportion of Time Eye Glance Location is Undetermined

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	7	0.02522449	0.00360350	1.26	0.2865
Sub_ID * Distraction	61	0.17480389	0.00286564		

DETAILED TASK GROUPING

Dependent Variable: Proportion of Time Looking Forward

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.84692098	0.06049436	2.57	0.0055
Sub_ID * Distraction	63	1.48180202	0.02352067		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.9500	1	Toothpick use
A			
A	0.9100	3	Groom
A			
A	0.7844	23	CB
A			
A	0.7750	2	Cough/Yawn
A			
A	0.7600	2	Adjust in Seat
A			
A	0.7550	1	Wipe Dash
A			
A	0.7166	14	Cell Phone
A			
A	0.7107	18	Misc Tasks
A			
A	0.7032	57	Glances outside cab
A			
A	0.6981	8	Cigarette
A			
A	0.6875	6	Radio
A			
A	0.6693	7	Eat/Drink
A			
A	0.6614	5	Talk to Passenger
A			
A	0.6609	23	No Distraction
A			
A	0.5892	31	Glances inside cab

Dependent Variable: Proportion of Time Looking Out Passenger Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.14787642	0.01056260	2.14	0.0207
Sub_ID * Distraction	63	0.31050876	0.00492871		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.10214	57	Glances outside cab
A			
A	0.04978	23	No Distraction
A			
A	0.04000	2	Cough/Yawn
A			
A	0.03677	31	Glances inside cab
A			
A	0.03188	8	Cigarette
A			
A	0.03139	23	CB
A			
A	0.02280	5	Talk to Passenger
A			
A	0.01683	18	Misc Tasks
A			
A	0.01583	6	Radio
A			
A	0.01167	3	Groom
A			
A	0.01071	7	Eat/Drink
A			
A	0.00929	14	Cell Phone

Dependent Variable: Proportion of Time Looking Out Driver Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.26393703	0.01885264	2.49	0.0072
Sub_ID * Distraction	63	0.43739450	0.00694277		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.15505	57	Glances outside cab
A			
A	0.15188	8	Cigarette
A			
A	0.14480	5	Talk to Passenger
A			
A	0.08696	23	No Distraction
A			
A	0.06429	14	Cell Phone
A			
A	0.06250	2	Adjust in Seat
A			
A	0.05500	2	Cough/Yawn
A			
A	0.05026	23	CB
A			
A	0.04887	31	Glances inside cab
A			
A	0.04714	7	Eat/Drink
A			
A	0.04417	18	Misc Tasks
A			
A	0.03833	3	Groom
A			
A	0.02917	6	Radio
A			
A	0.00000	1	Toothpick use
A			
A	0.00000	1	Wipe Dash

Dependent Variable: Proportion of Time Looking at Instrument Panel

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.57894455	0.04135318	2.49	0.0072
Sub_ID * Distraction	63	1.04779720	0.01663170		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.24833	6	Radio
A			
A	0.14968	31	Glances inside cab
A			
A	0.09500	23	No Distraction
A			
A	0.07000	2	Adjust in Seat
A			
A	0.03500	1	Wipe Dash
A			
A	0.02500	18	Misc Tasks
A			
A	0.02357	14	Cell Phone
A			
A	0.02000	8	Cigarette
A			
A	0.02000	3	Groom
A			
A	0.01886	57	Glances outside cab
A			
A	0.00957	23	CB
A			
A	0.00500	2	Cough/Yawn
A			
A	0.00500	5	Talk to Passenger
A			
A	0.00000	7	Eat/Drink
A			
A	0.00000	1	Toothpick use

Dependent Variable: Proportion of Time Looking at Other Location

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.48600694	0.03471478	2.35	0.0111
Sub_ID * Distraction	63	0.93235889	0.01479935		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.21000	1	Wipe Dash
A			
A	0.19643	7	Eat/Drink
A			
A	0.18621	14	Cell Phone
A			
A	0.18028	18	Misc Tasks
A			
A	0.14758	31	Glances inside cab
A			
A	0.10750	2	Adjust in Seat
A			
A	0.10043	23	CB
A			
A	0.09813	8	Cigarette
A			
A	0.07891	23	No Distraction
A			
A	0.05000	1	Toothpick use
A			
A	0.02000	3	Groom
A			
A	0.01917	6	Radio
A			
A	0.01833	57	Glances outside cab
A			
A	0.01000	2	Cough/Yawn
A			
A	0.00000	5	Talk to Passenger

Dependent Variable: Proportion of Time Looking at Passenger

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.11341435	0.00810102	6.33	<0.0001
Sub_ID * Distraction	63	0.08060452	0.00127944		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.16600	5	Talk to Passenger
B	0.01786	7	Eat/Drink
B	0.01000	18	Misc Tasks
B	0.00177	31	Glances inside cab
B	0.00053	57	Glances outside cab
B	0.00000	2	Adjust in Seat
B	0.00000	14	Cell Phone
B	0.00000	8	Cigarette
B	0.00000	3	Groom
B	0.00000	23	CB
B	0.00000	23	No Distraction
B	0.00000	6	Radio
B	0.00000	2	Cough/Yawn
B	0.00000	1	Toothpick use
B	0.00000	1	Wipe Dash

Dependent Variable: Proportion of Time Eyes Closed

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.02109476	0.00150677	9.68	<0.0001
Sub_ID * Distraction	63	0.00980669	0.00015566		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.115000	2	Cough/Yawn
B	0.006304	23	CB
B	0.001842	57	Glances outside cab
B	0.000000	14	Cell Phone
B	0.000000	2	Adjust in Seat
B	0.000000	7	Eat/Drink
B	0.000000	31	Glances inside cab
B	0.000000	8	Cigarette
B	0.000000	3	Groom
B	0.000000	18	Misc Tasks
B	0.000000	23	No Distraction
B	0.000000	6	Radio
B	0.000000	5	Talk to Passenger
B	0.000000	1	Toothpick use
B	0.000000	1	Wipe Dash

Dependent Variable: Proportion of Time Eye Glance Location is Undetermined

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	14	0.04075520	0.00291109	1.09	0.3866
Sub_ID * Distraction	63	0.16875468	0.00267865		

RESOURCE GROUPING

Dependent Variable: Proportion of Time Looking Forward

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.37212269	0.09303067	4.18	0.0056
Sub_ID * Distraction	48	1.06939231	0.02227901		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.80943	23	Primarily Speech
A			
B A	0.72568	25	Primarily Manual
B			
B	0.69774	31	Primarily Vis + Man
B			
B	0.66702	99	Primarily Visual
B			
B	0.66087	23	No Distraction

Dependent Variable: Proportion of Time Looking Out Passenger Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.10223845	0.02555961	4.37	0.0043
Sub_ID * Distraction	48	0.28087723	0.00585161		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.07785	99	Primarily Visual
A			
B A	0.04978	23	No Distraction
B			
B	0.01645	31	Primarily Vis + Man
B			
B	0.01212	25	Primarily Manual
B			
B	0.01091	23	Primarily Speech

Dependent Variable: Proportion of Time Looking Out Driver Window/Mirror

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.08065645	0.02016411	2.23	0.0797
Sub_ID * Distraction	48	0.43414543	0.00904470		

Dependent Variable: Proportion of Time Looking at Instrument Panel

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.12785639	0.03196410	2.57	0.0498
Sub_ID * Distraction	48	0.59739251	0.01244568		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.09500	23	No Distraction
A			
A	0.06480	99	Primarily Visual
A			
A	0.03823	31	Primarily Vis + Man
A			
A	0.02600	25	Primarily Manual
A			
A	0.01674	23	Primarily Speech

Dependent Variable: Proportion of Time Looking at Other Location

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.30147656	0.07536914	4.75	0.0026
Sub_ID * Distraction	48	0.76127751	0.01585995		

Multiple Comparison Post-Hoc Test: Student-Newman-Keuls

Means with the same letter are not significantly different.

SNK Grouping	Mean	N	Distraction
A	0.18371	31	Primarily Vis + Man
A			
A	0.15580	25	Primarily Manual
B	0.07891	23	No Distraction
B			
B	0.06167	99	Primarily Visual
B			
B	0.03987	23	Primarily Speech

Dependent Variable: Proportion of Time Looking at Passenger

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.00314579	0.00078645	1.20	0.3241
Sub_ID * Distraction	48	0.03152614	0.00065679		

Dependent Variable: Proportion of Time Eyes Closed

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.00113352	0.00028338	0.86	0.4951
Sub_ID * Distraction	48	0.01582663	0.00032972		

Dependent Variable: Proportion of Time Eye Glance Location is Undetermined

Source	DF	Type III Sum of Squares	Mean Square	F Value	PR > F
Distraction	4	0.00367747	0.00091937	0.40	0.8099
Sub_ID * Distraction	48	0.11118512	0.00231636		

APPENDIX 3:

COCHRAN-MANTEL-HAENSZEL STATISTICS

The Cochran-Mantel-Haenszel (CMH) Statistics provide a statistical analysis of the relationship between related observations in the rows of a table, based on a set of stratification variables (e.g. columns). Two CMH statistics are of interest in the current application. In the following description, *X* refers to the row variable of a table, while *Y* refers to the column variable.

ANOVA (Row Mean Scores) Statistic

The ANOVA statistic can be used only when the column variable *Y* lies on an ordinal (or interval) scale so that the mean score of *Y* is meaningful. The mean score is computed for each row of the table, and the alternative hypothesis is that, for at least one stratum, the mean scores of the *R* rows are unequal. In other words, the statistic is sensitive to location differences among the *R* distributions of *Y*.

General Association Statistic χ^2

The alternative hypothesis for the general association statistic is that, for at least one stratum, there is *some kind* of association between *X* and *Y*. This statistic is always interpretable because it does not require an ordinal scale for either *X* or *Y*.

APPENDIX REFERENCES

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