Distracted Driving Problem Identification for ADECA 2023 HSP Using 2017-2021 Crash Data

Overview and Description of the Data

Distracted Driving recording in Alabama may be different from many other states. This section will explain the last available five years of Distracted Driving data (CY2017-2021), and it will provide the rationale for the methods that are applied to process it for the 2023 HSP problem identification.

The following are the values found from the Distracted Driving Officer's Opinion in the order from the smallest to the largest frequency (directly from the crash report database):

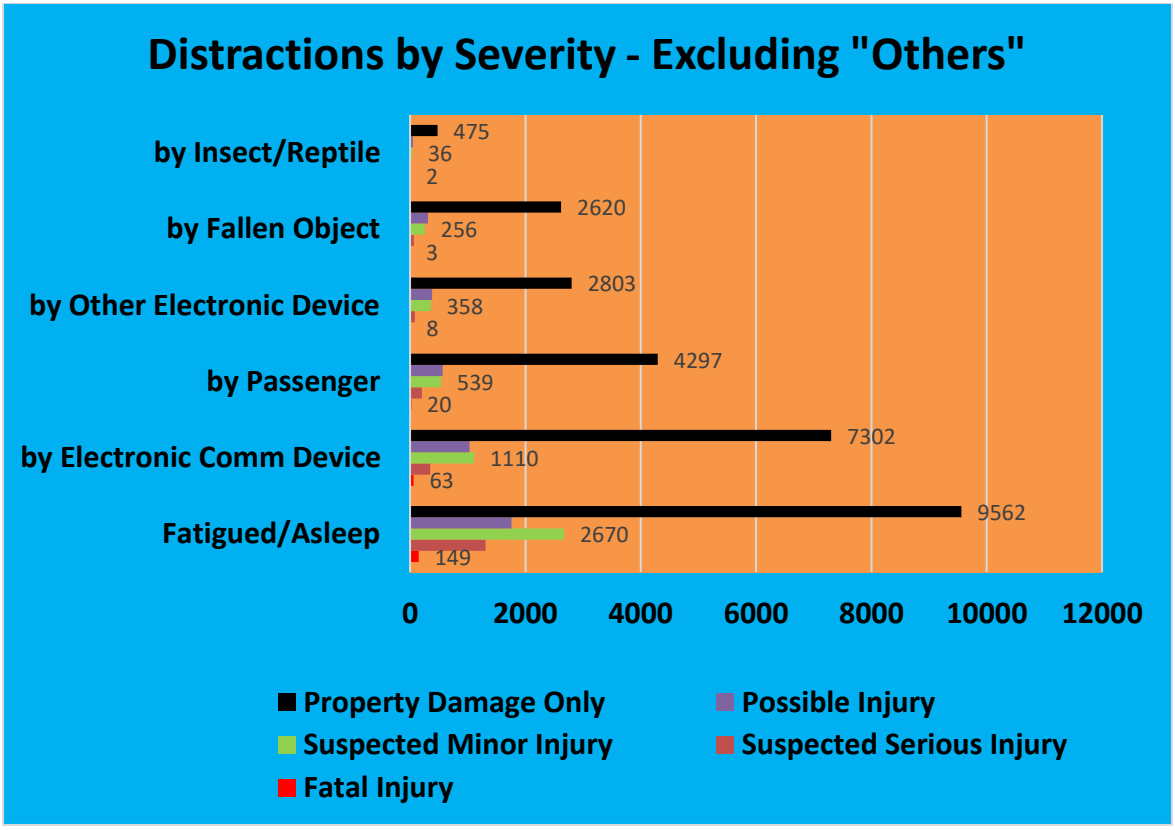
Value Entered by Officer	Frequency	Cum Freq	%	Cum %
Record from Paper System	19	19	0.00	0.00
by Insect/Reptile	590	609	0.08	0.08
by Fallen Object	3322	3931	0.44	0.52
by Other Electronic Device	3686	7617	0.48	1.00
by Passenger	5766	13383	0.76	1.75
by Communication Device	10024	23407	1.31	3.07
Fatigued/Asleep	15770	39177	2.07	5.14
Other Distraction Outside the Veh	22130	61307	2.90	8.04
Other Distraction Inside the Vehicle	23706	85013	3.11	11.15
Null value	28831	113844	3.78	14.93
Unknown	245400	359244	32.18	47.10
Not Applicable (Not Distracted)	403413	762657	52.90	100.00

Certain of the above responses will not be considered further for processing because they do not contain relevant information. The following were excluded for this reason:

Record from Paper System	19	19	0.00	0.00
Other Distraction Outside the Veh	22130	61307	2.90	8.04
Other Distraction Inside the Vehicle	23706	85013	3.11	11.15
Null value	28831	113844	3.78	14.93
Unknown	245400	359244	32.18	47.10

This resulted in the data elements given in the next table and chart.

Distraction Descriptor	Frequency	Percent (Non-Other)
Distracted by Insect/Reptile	590	1.5
Distracted by Fallen Object	3322	8.5
Distracted by Other Electronic Device	3686	9.4
Distracted by Passenger	5766	14.7
Distracted by Communication Device	10024	25.6
Fatigued/Asleep	15770	40.3
TOTAL USABLE VALUES	**39158**	**100.0**



Five analyses will be performed from these six categories: (D1) Insect/Reptile, (D2) Fallen Object, (D3) Passenger, (D4) Fatigued/Asleep, and (D5) A combination of the two Electronic Devices categories.

D1. Insect/Reptile (2 fatal, 13 Suspected Serious, 36 Suspected Minor)

This is the lowest frequency distraction, but it should not be discounted. While insects do not usually cause crashes, imagine looking in your rear view mirror to see a snake. So while these are few, they are potentially lethal and thus, should be addressed.

The months of April through September were over-represented, with a high point in June (as would be expected). Preventative actions (e.g., warnings) should be taken issued during these months as well as the morning and early afternoon hours. County roads showed the expected significant over-representation in the rural areas.

The largest crash problem drivers had with this distraction was with collisions with other vehicles (over half; 56.95%). The second crash problem resulted from Running Off the Road, where collisions were essentially with whatever obstacle was closest on the roadside. The largest vehicle collision type (nearly half; 48.47%) was that of Rear Ends (front to rear). About a third of the crashes were single vehicle.

D2. Fallen Object (3 fatal, 65 Suspected Serious, 256 Suspected Minor)

Generally, this distraction will occur from some object being dropped within the vehicle. Exceptions are impossible to determine, but there is an "Other" code for distractions outside of the vehicle that would probably be used if an object fell outside the vehicle. It is important that drivers maintain discipline and pull off the roadway in a safe manner if they or one of their passengers has lost control of an object. Most (74.74%) of the crashes involve collisions with other vehicles. Of these, the majority (64.39%) are Rear End (front to rear) crashes, and only about 17.55% were single vehicle crashes.

D3. Passenger (20 fatal, 205 Suspected Serious, 539 Suspected Minor)

Saturday and Sunday are over-represented in passenger-caused distractions, probably because weekend travel tends to be less formal. The late afternoon rush hours (3 PM through 5:59 PM) are over-represented as well. Federal, State, and County roads had significant over-representations, while Interstate highways were significantly under-represented. There is a correlation between this distraction and disregarding traffic signs and signals. A very large majority (72.98%) of these crashes involve "Collisions with Vehicles in Traffic." Drivers who tend to tailgate need to be particularly aware of issues with this distraction, in that slightly more than 50% of these crashes were Rear End (front to rear). A large number of correlated crashes involved Following Too Close (496) and Misjudged Stopping Distance (292).

The next section will cover Fatigued/Asleep (F/A) distractions. It will be followed by discussions of distractions caused by a combination of the following two electronic device distractions: (1) Electronic Communication Devices or (2) Any other Electronic Device. These electronic devices will be referenced collectively as Electronic Devices (EDs). We will spend more time and space on these two sections because these particular distractions have a significantly higher number of fatalities and serious injuries than the other distraction items considered above.

D4. Fatigued/Asleep (149 fatal, 1308 Suspected Serious, 2670 Suspected Minor)

The following presents a summary of Fatigued/Asleep (F/A) crashes by year.

Frequency of F/A Crashes by Year

Year	Number	% of Total
2017	3229	20.48
2018	3336	21.15
2019	3255	20.64
2020	2797	17.74
2021	3153	19.99
TOTAL	**15,770**	**100.0%**

Major F/A Findings and Recommendations

This Section will continue by presenting the major findings for the Fatigue/Asleep (F/A) Distraction item organized by the following major attribute groupings: Geographical, Time and Weather, Driver Related, Severity and Vehicles.

F/A Geographical Findings

- C010 Rural or Urban. Rural areas had over twice their expected proportion with over half of the F/A crashes being in rural areas, while the non-F/A crashes only had about 23% in the rural areas. The reason for this is fairly obvious – roadside views tend to get uninteresting when the roadside scenery is not changing, and rural areas tend to involve longer potentially more boring trips. The recommendation here would be to place some type of diversion on those highways that are exhibiting excessive F/A crashes. Notifying drivers of the fact that these roads exhibit more than their expected F/A crashes would seem to be a way to reduce F/A crashes on them.
- C011 Highway Classification. This reflects the rural/urban finding above. Interstates have been found to be particularly vulnerable to F/A-caused crashes, and they have the highest over-representation. However, in Alabama, State and County roads are also significantly over-represented, probably for different reasons. The boring nature of

driving on Interstates is obvious; however, they may be much more forgiving than State and County roads when it comes to vehicles veering off the roadway.

- C027 At Intersection. Intersections occur much more often in urban areas, so the rural tendency of F/A crashes is supported by the finding of under-representation at intersections. It might also be reasoned that the intersection itself provides a "wake-up call" for the driver.
- C028 Mileposted Routes. This is one of the most important findings in that it differentiates the particular roadways that exhibit a proclivity toward F/A. It is reasonable that some roadway types and specific roads are more prone to create the conditions for F/A than others. Findings from Alabama confirm this result, showing that some roadways have up to five times the relative proportion of F/A crashes than those of their non-F/A crashes. The highest route for potential F/A crash reduction was I-65, which had a reduction potential of over 500 crashes (over the five-year period of the study). Other busy Interstates also had high reduction potentials.
- C033 Locale. As expected, Open Country is the only Locale that is significantly over-represented. Note that some Open Country areas occur within town or city limits, which would classify them as urban in C010.
- C110 Driver Residence Distance. The Greater than 25 Miles (from home) is about 60% higher than what would be expected from the proportion of non-F/A crashes, which is statistically significant at a very high level.

F/ATime and Weather Findings

- C003 Year. The proportion of F/A to non-F/A crashes has remained stable at effectively the same levels, with no statistically significant differences over the past five years. This indicates neither improvement nor deterioration in the degree or F/A caused crashes.
- C004 Month. It would be expected that the months in which longer trips occur would be over-represented in F/A crashes. This over-representation starts in April, and it becomes significant for May, June, July and August, (collectively) which are the expected vacation months. Public PI&E warnings regarding the dangers of drowsy driving should be timed appropriately. However, even the lowest F/A crash months have over 1000 F/A crashes, so it is important to not marginalize any month, and to keep the recognition of this problem before the public all year round.
- C006 Day of the Week. Clearly Saturday and Sunday are the bad days for F/A crashes, which would be expected since the bulk of the traffic during the week is for commuting and delivery. Also, see C122 and C123, which show the high correlation of F/A with Impaired Driving (ID/DUI).
- C008 Time of Day. Ten PM and after, and the later hours, including late early morning until 8 AM. F/A crashes happen during the day, but not nearly as much as in the late night and early morning (dark) hours. This also illustrates the correlation with ID/DUI.
- C031 Lighting Conditions. It is not just the time, but also the presence or absence of light. Most of the Dark-Roadways that are Lighted do not show over-representations. But this must be qualified by the fact that these conditions exist mainly in the urban

rather than the rural areas. Lighting and environmental conditions all work together, and it is difficult to analyze each of them independently.

- C032 Weather. There appears to be something about rain that keeps drivers awake. Perhaps it is the fear of the obvious consequences of dozing off. It would be good if we could move this fear into clear weather as well. For now, it appears that bad weather is a positive factor in reducing the number of F/A crashes.

F/A Driver Related Findings

- C017 First Harmful Event. There is nothing unexpected in these results. When a person drifts off to sleep behind the wheel, the results are random. If there happens to be a vehicle in its path, the crash may be avoided only by evasive action on the part of the victim driver. Any evasive action would be expected to avoid the perceived worst case scenario, even if it resulting in an alternative crash. Thus, this attribute generally identifies the objects that are the first things encountered by a vehicle that randomly departs the roadway and is effectively driverless.
- C023 Manner of Crash. The major finding here is obviously that F/A crashes are dominated (66.35%) by single-vehicle crashes, which is consistent with many of the findings above. Even though there are some large numbers on some of the two-vehicle Manner of Crash types, most of them are under-represented.
- C052 Number of Vehicles. This quantifies the dominance of single-vehicle crashes at 69.31% of all F/A crashes. Those that do involve more than one vehicle are distributed over the number of vehicles involved.
- C104 Causal Unit (CU) Left Scene. The proportion of F/A crashes where the causal driver left the scene is one of the lowest found for all crash types. Perhaps this is due to their not being fully cognizant of what went on prior to the crash. Also, the severity of most F/A crashes would make many of them impossible to drive away from.
- C107 CU Driver Raw Age. The youngest drivers (aged 16-17) are significantly under-represented (16-17). Ages 18 and above are significantly over-represented up until age 46. Ages above 60 are generally under-represented. This is evidence of a correlation with alcohol and drugs, and it also indicates that the 16-17 year olds are typically not driving on the longer trips in which F/A becomes problematic. We would also expect the very youngest drivers to have a high level of excitement from driving that would make sleep and fatigue less likely.
- C109 CU Driver Gender. Very clearly, males are significantly over-represented in F/A crashes, with their proportion being over 40% higher than expected. The reason for this is not clear, but it probably is related to males being the primary drivers both on longer trips and those that go late into the night.
- C122 CU Officer Opinion Alcohol. The effect of alcohol and drugs on creating drowsy drivers cannot be disputed. Here the proportion of F/A drivers who were using alcohol is over 70% higher for F/A crashes than for non-F/A crashes.
- C123 CU Officer Opinion Drugs. (Non-alcohol) drugs are even more over-represented than is alcohol. The proportion of F/A drivers using drugs is estimated to be close to four times that of non-F/A drivers.

- C129 Vehicle Maneuvers. Falling asleep at the wheel can be described as an unforced error (in tennis terminology). After that, what happens are random occurrences. It seems that if that event is at a curve, there is an excellent chance (over 60% higher proportion) that it will result in a crash. Even worse is if the vehicle departs the roadway where the probability of a crash is increased by over a factor of three. However, the overwhelming proportion of F/A crashes (81.18%) are on straight and level roadways, attesting to the effects of boredom.

F/A Findings Related to Severity

- C025 Crash Severity. The highest non-fatal injury categories (Incapacitation and Non-Incapacitating) are highly over-represented by over twice the proportion that occurs for non-F/A crashes. The fatal proportion is smaller than these, but its proportion is still 69.1% higher than non F/A crashes. Some possible reasons for these higher severities will be given in the next attributes considered in this section. We also postulate that the consequences of crashes are more severe when drivers do not have awareness to take defensive actions once the inevitable crash event sequences are in process.
- C038 Adjusted EMS Arrival Delay Time. The 0 to 5-minute delay from crash time to ambulance arrival is significantly under-represented, as is the 6-10-minute delay. After that, all of the delay categories are over-represented. All of the delay times above 10 minutes and under 90 minutes are significantly over-represented. We expect that this is due to the rural nature of the large majority of these crashes. The times being analyzed here are from the crash report to the time that the ambulance arrives. There is no accounting for the delay between the crash itself and when it is reported. This is especially relevant in late night times, which characterize F/A crashes. Certainly rural roads that have relatively few vehicles late at night would be susceptible to this increased delay problem.
- C060 Number Injured Including Fatalities. Single injury crashes have the highest over-representation. However, all of the multiple injury classifications are over-represented up to and including 7 injuries. Twelve crashes had multiple fatalities.
- C224 CU Estimated Speed at Impact. This is the largest single factor that determines whether a crash results in a fatality or not. In this case the average speed at impact of the F/A crashes was 49.96 MPH, while that of the non-F/A crashes was 30.04 MPH. It has been determined in a large number of former studies within Alabama that, above 40 MPH, each increase in the impact speed of 10 MPH doubles the probability of that given crash being fatal. Since this doubling is from its next lower 10 MPH-lower speed estimate, this is an exponential increase. So, for example, if the probability of a crash being fatal at 40 MPH is 1%, the probability at 50 MPH would be 2%, the probability at 60 MPH would be 4% , and the probability at 70 MPH would be 8%, doubling from its previous value for each increase in 10 MPH (hypothetical numbers are used here for illustration only). This reflects the laws of physics and kinetic energy. Severity display C025 shows that the probability of a F/A crash being fatal is 0.94%, while that same probability for a non-F/A crash is only 0.56%. This explains the major cause of the increased severity of F/A crashes.

F/A Findings Related to Vehicles

- C101 Causal Unit (CU) Type. Pick-ups (21.34%) and Passenger Cars (51.00%) were the only two vehicle types over-represented in F/A crashes. If anything, it would be the drivers that are prone to use these vehicles that might be over-represented, as opposed to the vehicles themselves.
- C208 CU Model Year. Vehicle years that are over-represented start at 1992 and go through 2005. Under-representation starts at 2006 and continues through 2019. Above that, only 2020 is statistically significant above expectations (1.260).

F/A Hotspot Analysis

These high crash locations are quite important since it has been determined that characteristics of *the roadway itself can tend to produce an affinity toward drowsiness.* The following guidance is given for these analyses:

- Hotspot analyses can be performed using a F/A filter for any type of roadway in Alabama. Such a filter will only allow F/A crashes to be considered in the analysis.
- Since Interstate, State and County Roads tend to have more F/A crashes, hotspot analyses on these roadway types will be the most fruitful for Hotspot Analyses.
- As an example, the first F/A hotspot (criteria: more than 50 F/A crashes in a ten mile segment) was not found on I-65 until about the 100 mile marker.
- Theabove does not indicate that no F/A crashes occurred; only that they were not of such a concentration to qualify according to the noted hotspot criterion (50 F/A crashes in a ten-mile segment).
- Clearly, it will usually take most drivers some time and distance before they become drowsy. The Hotspot analyses that are performed should have the goal of determining where such criteria are met in order to establish potential countermeasures at critical mile markers.
- Taking a break more frequently than every hour or 80 miles would be an excellent recommendation.

D5. Electronic Device Distractions (71 fatal, 431 Suspected Serious, 1468 Suspected Minor) Combined Electronic Communication Device (e.g., phone) and Other Electronic Device

The following is a summary of Electronic Communication and Electronic Other Device Distraction (ED) crashes by year.

Frequency of ED Crashes by Year

Year	Electronic Communication	Other Electronic	Total ED	% of Total
2017	2019	834	2853	20.81
2018	1953	767	2720	19.84
2019	1975	759	2734	19.94
2020	1851	614	2465	17.98
2021	2226	712	2938	21.43
TOTAL	**10024**	**3686**	**13,710**	**100.0%**

Major ED Findings and Recommendations

This Section will continue by presenting the major findings for the Electronic Communication and Other Electronic Devices (ED) Distraction items organized by the following major groupings of the attributes: Geographical, Time and Weather, Driver Related, Severity and Vehicles.

ED Geographical Findings

- C001 County. Counties with moderately large cities and large traffic in the rural areas tend to be the most over-represented. For example, counties with the highest potential ED reductions (> 80 ED crashes over the five years) are Baldwin, Lee, Shelby, Cullman, Houston, and Madison.
- C010 Rural or Urban. Rural areas are over-represented in ED crashes by a proportion that is about 25.7% higher than the non-ED rural crash areas. The overall rural-urban breakdown for ED crashes is 29.39% Rural and 70.61% Urban.
- C011 Highway Classification. In comparison with their non-ED crashes, County, State and Federal roads ED crashes are significantly over-represented. Interstates and Municipal roads are significantly under-represented.
- C026 Intersection Related. Intersection related crashes were significantly under-represented. Only 23.53% of all ED crashes were Intersection Related. This is clearly an indication that drivers put the electronic devices away when encountering cross traffic.
- C033 Locale. The open country locale had about a 17.1% higher ED proportion than expected, in comparison with the comparable non-ED crashes. Other significantly over-represented locales included Residential (11.9%) and School Zones (2.29%).

ED Time and Weather Findings

- C004 Month. October through February are under-represented, while the spring and summer months are generally over-represented. This would be a good indication of the time of year when more people are using their electronic devices in the vehicles.
- C006 Day of the Week. Weekends are significantly over-represented. All of the week days are under-represented, Wednesday, significantly so. The use of EDs seems not a prevalent on business as opposed to pleasure trips.
- C008 Time of Day. All of the hours after 4.59 PM are over-represented, right through the midnight hour. Hours after 3:59 AM are under-represented until 5-5:59 PM. The rest of the hours are all significantly under-represented.
- C032 Weather. Crashes in the rain are only about 0.578% of what is expected, showing that there is a greater concentration on driving (as opposed to the use of EDs) during inclement weather conditions.

ED Driver Related Findings

- C017 First Harmful Event. The following are the highest First Harmful Events, in general order of their frequency:
    - Ran Off Road Right
    - Collision with Ditch
    - Collision with Mailbox
    - Collision with Utility Pole
    - Collision with Culvert Headwall
    - Collision with Tree
    - Crossed Centerline
    - Collision with Sign Post
    - Overturn/Rollover
    - Collision with Fence
    - Collision with Guardrail End
    - Collision with Embankment
    - Ran Off Road Left
- C107. Driver Raw Ages. Ages from 16-40 are all significantly over-represented. Most of those 55 and above are significantly under-represented (where there were enough cases to determine statistical significance). Thus, ED crashes seem to be highly correlated with the younger ages, i.e., the younger the causal driver age, the greater their involvement in ED crashes.
- C109 Driver Gender. Male drivers are significantly higher in their proportion of ED crashes (58.50%) than in non-ED crashes (50.15%), a factor of nearly 17% higher ED proportion than expected.
- C120 Driver Employment Status. Drivers who cause ED crashes are much more likely to be employed (57.64%) than those involved in non-ED crashes (45.85%); the proportion

being about 26% higher than expected. This is probably related to their vehicle ownership.

- C122 Officer Opinion Alcohol. The proportion of DUI drivers who cause ED crashes (4.38%) is significantly higher in the crash being caused by alcohol than in the non-ED crashes (3.35%), a proportion increase of about 31%.
- C123 Officer Opinion Drugs. The proportion of drivers under the influence of drugs who cause ED crashes (1.48%) is significantly greater than those involved in non-ED crashes (1.24%), a proportion increase of about 24%.

ED Findings Related to Severity

- C025 Crash Severity. Comparing ED with non-ED crashes, fatal crashes are only about 91.3% of what would be expected. The ED proportion of fatal crashes is 0.52%, while the non-ED proportion of fatal crashes is 0.57%. However, all of the other injury classifications are over-represented, which results in Property Damage Only crashes being significantly under-represented.
- C038 Adjusted EMS Arrival Delay. Due to the ED occurrences in the rural areas, ambulance delay times when ED crashes occur have longer delay times. They are under-represented in both the 0-5 and 6-10 delay times. With only a few exceptions, all of the other (longer) delay times are over-represented.
- C052 Number of Vehicles. The number of 2-vehicle ED crashes is only about 90% of that for non-ED crashes. ED crashes are over-represented in single-vehicle, but also in most of the multiple vehicle crashes above 2 vehicles. Three-, 4- and 5-vehicle vehicle crashes are all over 40% higher than expected if they were the same as non-ED crashes.

ED Findings Related to Vehicles

- C057 Number of Pedestrians. Reflecting the under-representation in urban areas, ED crashes are also under-represented in pedestrian collisions. The single pedestrian involved proportion for ED crashes was 0.44% (one pedestrian in every 227.3 ED crashes), while the non-ED proportion was 0.69% (one in every 144.9 non-ED crashes). This demonstrates that drivers pay more attention when pedestrians are present.
- C058 Number of Pedalcycles. A quite comparable effect appears to occur when drivers encounter riders on bicycles. They wake up and are much less likely to allow their fatigue or drowsiness to cause a crash. Because of the relatively few bicycle (the most common pedalcycle) crashes, it is not accurate to compare ED with non-ED as we did with pedestrian crashes above. The general crash rate of bicycles as given by the most recent five years of data was 0.16% for non-ED crashes, and it was 0.13% for ED crashes. There is no reason to think that drivers would not respond to the presence of bicycle riders similarly to the way that they respond to the presence of pedestrians.
- C080 CMV Involved. CMVs are involved in about 64.6% fewer crashes that would be expected from the proportion occurring in non-ED crash population. The proportion for ED crashes is 3.57%, while the proportion for non-ED crashes is 5.52%.

- C101 Causal Unit Type. The causal vehicle types that are most over-represented in order of worst first (% higher than expected from non-ED crashes): Passenger Cars (11.1%), Sport Utility Vehicles (9.6%), and Pick Ups (6.0%). While the causal unit type per se obviously has little impact on causing ED crashes, the personality types of the drivers of these vehicles may lead to certain drivers engaging in dangerous distracting activities more than drivers of other vehicle types.
- C208 Causal Unit Model Year. Vehicle model years 2009 through 2015 are over-represented in their proportions of ED crashes, showing that those who are inclined to be distracted are driving neither brand new vehicles, nor those that will shortly be in need of replacement.