Special Study Wrong Way Driving (WWD) Crashes IMPACT Study By David B. Brown (brown@cs.ua.edu) University of Alabama Center for Advanced Public Safety (CAPS) and Alabama Transportation Institute (ATI) Data Comparisons: CY2016-2020 WWD vs Non-WWD April 2022

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0.0 Introduction

This document presents the results of a comparison of Wrong Way Driving (WWD) crashes compared to non-WWD crashes over a recent five-year period (CY2016-2020). The determination of whether a crash was a WWD or not is given by the filter definition in Section 3.1. Three attributes were examined: Primary Contributing Circumstances, CU Contributing Circumstances and V2 Contributing Circumstances. If any one of these showed "Traveling Wrong Way/Wrong Side" or "Wrong Side of Road," the crash was considered to be WWD.

The analytical technique employed to generate most of the displays below is a component within the Critical Analysis Reporting Environment (CARE) called Information Mining Performance Analysis Control Technique (IMPACT). For a detailed description of the meaning of each element of the IMPACT outputs, please see: <u>http://www.caps.ua.edu/software/care/</u>

The main objective of performing IMPACT comparisons is to surface "over-representations." An *over-represented value* of an attribute is found (for this study) when that attribute has a greater share of WWD crashes than would be expected if its proportion were the same as for the non-WWD crashes. Thus, the non-WWD crashes are serving as a *control group* to which the WWD crashes are being compared.

As an example, we found that WWD crashes for the Day-of-the-Week attribute value of Sunday had almost 31% higher proportion of crashes than did the non-WWD crashes (Section 5.3; Odds Ratio = 1.308). When such differences are statistically significant (as in this case), this surfaces characteristics that should be given attention, and in some cases, further analyses performed for countermeasure development. For example, additional selective enforcement for WWD causes (e.g., excessive speed, drowsiness, DUI, etc.) might be performed on Sunday and other days at times where they have their highest over-representations. Unless otherwise stated, the output tables given above the charts are in *Max Gain* order. The *Max Gain* is the gain (in crash reduction) that could be obtained if some countermeasure could be applied to reduce the proportion of the WWD crashes to equal the proportion of non-WWD crashes within the corresponding attribute.

This report continues with two short sections that provide a high-level summary of recommendations and findings for those who just need an executive summary. The sections are called: (1) Executive Summary and Recommendations, and (2) Summary of Findings. Section 3 is also introductory in that it provides a detailed definition of the filter that was used to define WWD crashes in the analytical sections that follow. After Section 3, the comparison between WWD and non-WWD crashes will be presented under the following headings with section numbers:

- 4. Geographic Factors,
- 5. Time Factors,
- 6. Factors Affecting Severity,

- 7. Driver and Vehicle Demographics, and
- 8. Driver Behavior.

See the Table of Contents for a guide to the sections of interest.

1.0 Executive Summary and Recommendations

The recommendations of this special study are presented first for two reasons (1) for those who do not have time to go through all of the IMPACT analyses, and/or (2) as an introduction to these more detailed analyses. Recommendations are referenced to the more detailed analyses sections so that questions regarding the source of any given recommendation can be easily accessed.

Recommendations are organized into the three areas of: (1) Law enforcement concentration and direction, (2) Legal and judicial countermeasure development, and (3) PI&E information on WWD content. The ordering of these, either generally or within their respective categories, is not meant to imply priority. However, the more detailed information given is useful in the further prioritization and allocation of traffic safety resources. This process should consider all of the recommendations, which should be validated against the information presented in the IMPACT sections 4.0-7.0 (referenced sections will be given in parenthesis).

The following recommendations are made to reduce the frequency and/or severity of Wrong Way Driving (WWD) crashes in Alabama:

• Law enforcement concentration and direction

- Increased recognition is essential, both on the part of law enforcement and the general public, that the relatively high deadly combination in WWD crashes is caused by their comparatively high impact speeds (6.1, 6.2) coupled with a failure of all drivers and passengers involved in WWD crashes to use restraints (6.5, 6.6). Because of the doubling of the impact speed effect in WWD crashes excessively high speeds by the causal vehicles are not essential to causing death.
- Seek out new ways to increase law enforcement methods to address these issues, both of which stem from the acceptance of risk-taking behaviors, especially on the part of younger drivers of age less than 35.
- Identify vehicles/drivers that give indications that they are not stable in their lanes. This is something that officers are looking for at all times, but increased attentiveness may be required in areas where several vehicles have had problems maintaining their lane discipline in the past.
- Since a relatively large proportion of WWD crashes are caused by Impaired Driving (ID), all of the ID countermeasures (8.3, 8.4) should be increased. Hotspot analyses should be performed to determine where WWD selective enforcement will be most effective, and consideration should be given to using WWD as an additional proxy for ID. Since ID crashes tend to result in higher severity, this countermeasure will have the effect of reducing fatalities.

- More effective drug detection techniques (8.4) should be identified, especially for law enforcement officers who have nor had training in their use.
- Law enforcement training should focus on the concentration on the times of day, days of the week (5.3-5.7, generally similar to ID), and the particular overrepresented vehicle types e.g., Pick-up Trucks, Bicyclists, Pedestrians and Passenger Cars (7.3).
- Training needs to focus on the specific driver over-representations: 1) males (7.2),
 2) age groups (7.1), ages 24-35, 3) the locations that these over-represented groups (determined by hotspot analyses); and 4) over-represented times, generally night-time (5.4).
- Counties with a combination of medium to large metropolitan areas and fairly large rural areas (4.3, 4.6) should generally be given additional emphasis in WWD selective enforcement programs (4.1, 4.2). These should be evaluated on a county-by-county basis taking the population and traffic volume crash rates into consideration. Over-represented cities and counties should be subjected to Hotspot analyses, recognizing the high correlation between ID and WWD.
- The rural areas (4.6) of these counties, and especially the County Roads (4.5) should be given special consideration for enforcement, since that is where increased fatalities occur (4.4).
- Those cities with a high frequency of WWD crashes (4.2) should be given special guidance and perhaps additional funding to address their WWD crash problems. Many such large city areas have a considerable amount of Open Country (4.6) that would tend to multiply their WWD crash severity. It should be recognized that Residential areas of these cities also have a significant WWD over-representation (4.6), probably stemming from their larger pedestrian and bicycle travel.
- Additional hotspot analysis needs to be done to surface those County Roads (4.5), which account for their overall 31.59% of the WWD crashes and have an over-representation of over twice (2.310) their expected number. It is possible that impaired causal drivers may be using the county roads in attempts to avoid being apprehended, and their intoxication result in WWD crashes.
- Time for enforcement might be optimized by local culture, but for the average statewide picture, if workers are typically "off" the following day, the optimal times for enforcement would begin shortly after the Friday afternoon rush hour and continue through at least 3 AM (5.3-5.6). Friday here being any day before a holiday off-day.

• Legal and judicial countermeasure development

Since WWD is so correlated with ID, Drug/Alcohol Diversion Programs should continue (or new programs adopted) that concentrate on keeping the age 25 through 35 (typically *social users*) from becoming habitual to the point where they become part of the 36-60-year old over-representation of predominantly *problem users* (7.1).

- The role that unemployment plays should be considered in formulating remedial measures (7.7). Methods should be explored to communicate with appropriate individuals through their respective unemployment offices. The relationship between WWD crashes and unemployment is not surprising because of the underlying drug/alcohol root cause of many WWD crashes (8.2-8.5). The correlation between not having a job and being involved in an WWD crash should be watched carefully going forward in that it could affect the type and location for countermeasures.
- Because of the high correlation of WWD and ID crashes, breath-alcohol ignition interlock devices are recommended for reducing the WWD problem caused by problem drinkers in Alabama. Conduct an in-depth study to improve and expand the current program. While the data do not show a high level of drugs/alcohol causing WWD crashes directly, (8.2, 8.4) the fact that they are over-represented is an indication that this could be a cause even if the presence of drugs/alcohol do not reach the reporting threshold, especially in cases involving prescription drugs.

• PI&E information content on WWD crashes

- Combinations of recreational or medical drugs and alcohol can be particularly lethal, and medical practitioners should warn against such problems and discourage all alcohol use for their patients who are taking prescription drugs. Additional programs to publicize these dangers are recommended.
- Legalized recreational drugs are not a good alternative to alcohol use and should not be advertised as such. PI&E programs should take the opposite approach to warn drivers that legalization in no way relaxes their responsibilities.
- Promote the use of those routes that avoid county roads, which have over twice their expected proportion of WWD crashes. The largest cause of County Road fatalities is Driving Too Fast for Conditions and other speed-related behaviors. These are driver errors that can be easily avoided. The promotion of Interstates should contain warnings against speeding.
- One of the most critical needs is for all drivers and their passengers to buckle up (6.6). There is little hope of surviving a crash for a large proportion of them if they fail to realize this, especially a head-on crash.
- While clearly the problems found in this study are those of WWD, other driver behaviors (8.1) that are correlated with WWD might provide alternatives for countermeasure development. These behaviors are:
 - DUI 221
 - Crossed Centerline 93
 - Made Improper Turn 59
 - Improper Lane Change/Use 41
 - Fatigued/Asleep 41
 - Improper Passing 37
 - Aggressive Operation 35
 - Swerved to Avoid Vehicle 30

These were the Primary Contributing Circumstances that had high frequencies exclusive of WWD even though the standard WWD filter was in effect (indicating a high correlation with WWD).

2.0 Summary of Findings

Note: subsections 2.1, 2.2 and 2.3 have been omitted in order to keep the numbering system in this Section consistent with that of the IMPACT displays that follow. The following findings are mainly from the IMPACT analysis below that compared WWD vs Non-WWD crashes for all five years (CY2016-2020):

• 2.4 Geographical Factors (4.0)

- County (4.1) Generally, the over-represented counties are those with combined fairly large population centers bordering on rural areas, as opposed to the highly urbanized counties or the extremely rural counties. One reason that the highly urbanized counties are under-represented is the large number of low severity crashes that occur there that are separate and apart from WWD crashes. See the rural-urban comparison in Section 4.3. Placed in Max Gain order, the ones with the highest potential for reduction were: Cullman, DeKalb, Marshall, Talladega, Blount and Chilton.
- City Comparisons (4.2) of WWD to Non-WWD crashes, include rural areas of counties (virtual cities). There is little surprise in this output, which tracks the rural areas by county population. Traffic safety professionals should look for any locations that fall counter to this trend. City (and rural area) comparisons are presented for all areas that had a Max Gain in excess of 100 WWD crashes over the five-year period of the study. The county rural areas (virtual cities) with Max Gains in excess of 160 WWD crashes over their expected numbers are: Rural Jefferson, Rural Mobile, Rural Cullman, Rural DeKalb and Rural Madison.
- Overall Area Comparisons Conclusions (4.1-4.2) Generally those rural areas that are adjacent to (or contain) significant urbanized areas are over-represented, since their large urban areas generate more traffic in the rural areas. Possible factors for *relatively fewer severe WWD crashes* within urban areas include:
 - Less need for motor vehicle travel and shorter distances;
 - Larger police presence in the metropolitan areas; and
 - Lower speeds in urban areas.

Note: These city, county, and area comparisons are, of necessity, a selection of the total outputs that could be generated. They are given to illustrate CARE capabilities as much as to present the numerical results. Anyone wishing additional cities, counties, or other areas, please contact CAPS – brown@cs.ua.edu.

- Rural/Urban WWD Crash Proportion (4.3) WWD crashes appear in a proportion that is quite different from their non-WWD counterparts. WWD crashes occurred in 41.81% rural and 58.19% urban areas, while the non-WWD proportions were 22.77% rural and 77.07% urban. Thus we conclude that the number of WWD crashes is mainly determined by traffic volumes as opposed to the rural/urban environments per se.
- Severity of Crash by Rural-Urban (4.4) See Section 3.3 which shows that WWD crashes have about 8 times the fatal crashes as do non-WWD crashes. While only 41.81 of WWD crashes occurred in rural areas, 68.97% of the fatal crashes occurred there. Similar results are found for the highest severity non-fatal crashes. This is obviously the result of higher impact speeds in the rural areas. Note that additional causes of increased severity are given in the Factors Affecting Severity, Section 6, below.
- Highway Classifications (4.5) County roads had a proportion of WWD crashes that was well over twice that of non-WWD crashes.
- All other roadway classifications were under-represented. County road characteristics no doubt contribute to the crash frequency (see 4.4). County roads are also known to be less "crashworthy" (i.e., they result in more severe crashes at comparable impact speeds).
- Locale (4.6) Residential and Open Country roadways show a high level of overrepresentation (1.427 and 1.558 Odds Ratios, respectively) as compared with the more urbanized area types, especially Shopping or Business, which only has a little over half of its expected proportion.
- Most Harmful Event (4.7). All positive Max Gains are shown. Collision with Vehicle in Traffic is, by far, the most catastrophic of WWD crashes. The following items were obstacles that have over 20 occurrences in five years (at least 4 per year):

Collision with Vehicle in Traffic	3682
Crossed Centerline	54
Collision with Vehicle in (or from) Other Roadway	132
Collision with Non-Motorist: Pedestrian	42
Collision with Non-Motorist: Pedalcycle	23

 Roadway curvature and Grade (4.8). WWD crashes are dramatically overrepresented on all curve types, and especially right curves. Right curves tend to throw the vehicles into the oncoming traffic lane on two-lane roads (almost all County Roads – see Section 4.5). For example, someone dozing would have a much larger problem on a right curve than on a left curve. The numbers do not show a great variation in this regard since for every vehicle on a right curve that has a WWD crash, there is a corresponding (causal or victim) vehicle on a left curve. Thus the frequency of right and left curves is nearly equal.

• 2.5 Time Factors (5.0)

- Year (5.1) The years 2017, 2018 and 2020 were over-represented. Years 2016, 2017 and 2018 had a significantly larger proportion than the non-WWD. The other two, 2019 and 2020, had a smaller proportion than expected. So the general trend would seem to be a reducing number of WWD crashes in 2019 and 2020.
- Month (5.2) No significant over- or under-representations by month were found, and it is reasonable that WWD crash frequencies are not dependent on the time of the year.
- Day of the Week (5.3-5.4) This analysis is not only useful for the typical work week, but it also reflects the typical "holiday weekend" patterns. Traffic safety professional will notice that the distribution throughout the week is quite similar to that of impaired driving. Since many WWD crashes are caused by ID, that would create this distribution for WWD as well. However, this pattern is further reinforced by drivers who are not familiar with the new roads that they might be traveling, especially if they are in any way deficient in design. Assuming that a significant number of WWD crashes are caused by ID, the days can be classified as follows:
 - Typical work weekday (Monday through Thursday) these days are under-represented in WWD crashes due to the need for many users to go to work the following day.
 - Friday this pattern is also reflected in the day before a weekend (or holiday), i.e., before a day off. The high WWD frequency on this day is due to those who are getting an early substance abuse start to the weekend, recognizing that they have no work responsibilities the following day. However, the large numbers of non-WWD crashes on Fridays causes Friday to be statistically under-represented in WWD crash proportion compared to non-WWD crashes. This is the typical Friday general increase due to the normal rush hours coupled with individuals leaving for vacations and weekend activities.
 - Saturday the "Saturday" pattern is the worse for WWD crashes in that it has both an early morning component (like Sunday) and a late night component (like Friday). So, it could be viewed as a combination of the typical Friday and Sunday.
 - Sunday since this is the last day of a holiday sequence or weekend, its over-representation comes mainly from those who start on Saturday night and do not complete their use of alcohol/drugs until after midnight. Sunday is the most over-represented day with over twice its expected number of WWD crashes; however, the low number of non-WWD crashes on Sunday also contributes to this proportional over-representation.

- Time of Day (5.4-5.5) The extent to which night-time hours are over-represented is quite striking. Optimal times for WWD enforcement would start immediately following any rush hour details on Friday (or its equivalent preholiday), and would continue through at least 1:00 to 1:59 AM (odds ratio 1.720). The 2-4 AM hours are also significantly over-represented, but with lower odds ratios, and then it increases again at 4:00 to 4:59 AM. Some of the late-night WWD crashes will also be due to drowsiness and/or the diminished ability to see road edge lines.
- Time of Day by Day of the Week (5.6) This quantifies the extent of the crash concentrations on Friday nights, Saturday mornings and Saturday nights and early Sunday mornings. This is a very useful summary for deploying selective enforcement details, especially during the weekend hours.

• 2.6 Factors Affecting Severity (6.0)

- WWD Crash Severity (6.1) -- The rate of injuries and fatalities are consistently higher in WWD crashes than that of non-WWD crashes. Fatality crashes are nearly 7.883 (Odds Ratio) times their expected proportion, while the two highest non-fatal injury classifications also have high proportions when compared with non-WWD crashes.
- Speed at Impact (6.2) All impact speeds from 21-55 MPH are highly over-represented with Odds Ratios above 1.30. See the next attribute for the effect this has on fatalities. Speeds above 55 MPH are generally under-represented, probably reflecting the lower speed requirements of County roads. Of course, in a head-on collision, the speed of either one of the vehicles is not as important as the combined speeds of both vehicles. This is the reason for the extremely high severity of these types or crashes, as shown in Section 6.1. Past analyses have found the general rule of thumb that for every 10 MPH increase in impact speeds, the probability of the crash being fatal doubles. This was validated in the discussion below of the cross-tabulation of impact speeds by severity (6.4).
- Severity by Impact Speed (6.3-6.4) –Past analyses have found the general rule of thumb that for every 10 MPH increase in speeds, the probability of the crash being fatal doubles. This was further validated in the discussion of this cross-tabulation. In the 31-35 MPH impact speed the probability is only a little over one in every 70 crashes. As impact speeds climb to the 46-55 MPH, this probability more than doubles to one in about 22 crashes. At 76-85 MPH it increases again (exponentially) to one in about every 2 crashes. For above 100 MPH, effectively all crashes proved fatal. While not 100%, in most cases the driver at the higher of the two vehicle speeds is the causal driver. Assuming this to be the case, approximately 38% of the fatalities were in the victim vehicle as opposed to the causal vehicle.

- Restraint Use by WWD Crash Causal Drivers (6.5) The WWD causal drivers are over 3 times more likely to be unrestrained than non-WWD causal drivers. Clearly WWD drivers lose a good part of their concept of risk when they do not realize that they are in a lane with oncoming traffic. This rate is about the same as run-off-the-road crashes. In both cases alcohol/drug abuse is a major factor (see Sections 8.2 and 8.3.
- Fatality Crashes by Restraint Use for WWD crashes (6.6) A comparison of the probability of a fatal crash indicates that a fatality is almost seven (6.90) times more likely if the WWD causal driver is not using proper restraints. Generally, one in 34.5 WWD crashes are fatal; but without restraints, the fatal crash ratio is 1 in about 5, an increase in probability of close to seven times. So the combined effect of lower restraint use and higher speeds is a devastating combination that accounts for much of the high lethality of WWD crashes.
- Number of Vehicles Involved (6.7) the number of single vehicle WWD crashes is only about a third (0.365) of crashes in general. Close to 9 out of 10 (86.98%) of the crashes were two-vehicle. This is expected since most of the crashes involved one vehicle running off their lane and crashing into a second vehicle, usually coming in the opposite direction.
- Police Arrival Delay (6.8) WWD crashes generally did not have good police response times. Arrival delay times of ten minutes or less occurred only 40% of the time. All arrival delays over 12 minutes or above were significantly over-represented. There can be little doubt that this has to do with so many of them being in rural areas (41.81%, see Section 4.3). The next analysis below shows how this impacts EMS arrival time, which is a comparison of those crashes that only include injuries, and thus would generally call for an EMS response.
- EMS Arrival Delay (6.9) For much the same reasons as the police arrival delays, EMS delays were under-represented for Wrong Way Driving (WWD) crashes in the 0-5 and 6-10 minute categories. All longer delay times were over-represented. There were relatively few in these very long categories, which were probably caused by the crash not be discovered late night.

• 2.7 Driver and Vehicle Demographics (7.0)

- Driver Age (7.1) Younger (16-20 year old) drivers have proportions of WWD crashes that are lower than their non-WWD crashes. Ages 31 and above are generally over-represented, perhaps due to problem impairments (alcohol/drugs). Several ages tend to be over-represented above the age of 55, with very little consistency.
- WWD Crash Driver Gender (7.2) the breakdown in WWD causal drivers is
 60.91% male and 39.09% female. For non-RC, the percentage is 56.15 male and
 43.85 female, which also gives a good estimate for male/female drivers in

general. These differences in proportions certainly indicate that males are a greater cause of the WWD problems, and if there are countermeasures that can be directed toward them, doing so would be much more cost-effective than those directed toward all drivers, all other things being equal.

- Causal Vehicle Type (7.3) Pickup Trucks have the highest for potential crash reduction according to the Max Gain, but Passenger Cars have about the same Odds Ratio with a much higher frequency. So both need to be given top consideration. Pedestrian and Bicyclists have relatively much higher proportions than most other vehicles, which is counter to both legal requirements and common warnings for these transportation modes. Several of the other classifications have significant over-representations, indicating from their proportions that they need to be given additional consideration. Some vehicles, notably Tractor/Semi-Trailers, Mini-vans, Pick-Ups and Sport Utility Vehicles (SUVs) are <u>under</u>-represented indicating their tendency to avoid WWD crashes.
- Number of Pedestrians (7.4). Pedestrians are quite over-represented in WWD crashes (actually, Wrong Way Walking), indicating that many pedestrian crashes occur when pedestrians walk with the traffic as opposed to against it. This is useful information for pedestrian crash reduction. Pedestrians need to be educated as to the advantages of being able to see oncoming traffic, and the need at night to have a flashlight, or at least reflective clothing, is essential to being seen.
- Number of Pedalcycles involved (7.5). The number of pedalcycle crashes is very close to that of pedestrians. Unlike pedestrian WWD, Pedalcycle WWD would be riding against traffic. Traffic laws require that bicycles and other similar vehicles travel with the traffic as opposed to against it. These data indicate that these laws are consistent with crash prevention.
- Driver License Status (7.6) WWD crashes are significantly over-represented in being caused by drivers without legitimate licenses. About 15% of the WWD causal drivers did not have a legitimate driver's license. The following gives the highest over-represented categories along with the number of crashes (in parenthesis) that were attributed to the DL Status: Suspended (1,815), Revoked (893), Expired (814), and Cancelled (33).
- Driver Employment Status (7.7) WWD driver unemployment rate at 27.32%, and its proportion is about 50% higher than expected. This factor should be watched carefully going forward, especially to determine if there is not some countermeasure that could be implemented in conjunction with their unemployment payments.

• 2.8 Driver Behavior (8.0)

• Primary Contributing Circumstances (8.1). This was introduced at the end of Section 1.0. While clearly the problems found in this study are those of WWD,

other driver behaviors (8.2) that are correlated with WWD might provide alternatives for countermeasure development. Those behaviors that had over twice their expected PCC proportion when compared to non-WWD crashes are:

- Driving too Fast for Conditions
- Impaired Driving (DUI)
- Swerved to Avoid Vehicle
- Fatigued/Asleep,
- Aggressive Operation,
- Over Correcting/Over Steering
- Swerved to Avoid Animal [most often deer]
- Over Speed Limit
- Swerved to Avoid Object.

These were the Primary Contributing Circumstances that were at least doubly over-represented even though the standard WWD filter was in effect (indicating that WWD was identified by attributes other than that of PCC).

- CU Officer's Opinion Impaired Driving Alcohol (8.3). We saw ample evidence for WWD crashes being caused by Impaired Driving (ID) in the time of day and day of the week. The two ID attributes (C122 and C123) indicate the degree that ID was involved in WWD crashes as opposed to non-WWD crashes. For alcohol, the proportion of ID crashes was 3.619 times as many for WWD crashes as for non-WWD crashes. For drugs this multiplier was even greater at 3.894. This was sufficient to verify that the WWD time over-representations reported above, were correlated very closely to ID.
- CU Officer's Opinion Impaired Driving Non-alcohol Drugs (8.4). The reported non-alcohol drug cases for WWD crashes is less than half of that for alcohol. The 1,464 cases are only about 4.00% of all WWD crashes. However, the Odds Ratio indicates that it has an over-representation comparable to alcohol. In both cases (WWD and non-WWD), drug use is difficult to detect compared to alcohol, which has well-established tests for the blood-alcohol level that are relatively easy to administer. Our conclusion is that both alcohol and non-alcohol drug use are major contributors to increasing the frequency of WWD crashes, and their use and severity is further compounded by trying to avoid detection by using county roads.

3.0 Wrong Way Driving (WWD) crashes CY2016-2020

As part of the ongoing Alabama Office of Traffic Safety (AOTS) problem identification efforts, UA-CAPS and ATI compared FY2016-2020 (WWD) crashes against non-WWD crashes over this same 5-year time period. The goal was to determine all significant differences between these two subsets of data, and to pinpoint common factors to assess strategies that could be used to combat any major inconsistencies between these two subsets of the crash data. The findings are presented to be taken into consideration when planning the large variety of countermeasures that exist to reduce the frequency and/or severity of these crashes.

3.1 WWD Filter Definition

The following is the formal filter definition for Wrong Way Driving (WWD) crashes:

Filter Logic: Wrong Way Driving - WWD	_		\times
Logic Tree Logic Text			
 One or more of the following are true (OR) Alabama Integrated Crash Data: Primary Contributing Circumstance is equal to Traveling Wrong Way Alabama Integrated Crash Data: CU Contributing Circumstance is equal to Traveling Wrong Way Alabama Integrated Crash Data: CU Contributing Circumstance is equal to Traveling Wrong Way Alabama Integrated Crash Data: CU Contributing Circumstance is equal to E Wrong Side of Road Alabama Integrated Crash Data: V2 Contributing Circumstance is equal to Traveling Wrong Way Alabama Integrated Crash Data: V2 Contributing Circumstance is equal to Traveling Wrong Way Alabama Integrated Crash Data: V2 Contributing Circumstance is equal to E Wrong Side of Road 	Way/Wro Road /Wrong S J /Wrong S	ng Side ìide ide	
4559 records selected by this filter.			:

This formalizes the definition of the crashes in the WWD subset of crash reports being considered here. As mentioned above, these crashes are those reported to have either: (1) a Primary Contributing Circumstance, (2) a Causal Unit Contributing Circumstance, or (3) a V2 (second vehicle often called the Victim Vehicle) Contribution Circumstance of either: (a) Wrong Way/Wrong Side, or (b) Wrong Side of the Road.

With this filter in effect, we will now present the frequency distributions for each of the attributes that appear in the filter. These attributes are ORed together, so if any one of them showed WWD, the record will be included in the WWD subset. These three Frequency displays essentially show in a nutshell those non-WWD attributes that are highly correlated with WWD crashes. They are arranged with those of the highest at the top. The reason that non-WWD crashes are included in some displays is that the WWD requirement was met by one or two of the other Contributing Circumstance variables.



3.1.1 C015 Primary Contributing Circumstances with WWD Filter in Effect

Items with less than 20 occurrences over the five years have been omitted from the above. See Section 8.1 for more details on the use of this attribute within this context of WWD.



3.1.2 C202 Causal Unit (CU) Contributing Circumstances with WWD Filter in Effect

Items with less than 20 occurrences have been omitted from the above.



3.1.3 C542 V2 Contributing Circumstances with WWD Filter in Effect

Items with less than 4 occurrences have been omitted from the above.

3.2 Overall WWD Crashes by Year 2016-2020 Data

Before analyzing the WWD subset, it is good to get a feel for the overall difference in the crash frequencies over the past years. The following table gives a comparison of total crashes over CY2016-2020 by severity.

CARE 10.2.1.3	- [Crosstab Results	- 2016-2020 Alabar	na Integrated Crasl	h Data - Filter = Wr	ong Way Driving - V	VWD] —	
🚦 <u>F</u> ile <u>D</u> ashb	ooard <u>F</u> ilters <u>/</u>	<u>A</u> nalysis <u>C</u> rosstat	<u>L</u> ocations <u>T</u>	ools <u>W</u> indow	<u>H</u> elp		_ 8 ×
2016-2020	Nabama Integrated C	irash Data	\sim	Wrong Way Driving	- WWD	~	9
Suppress Zero Va	lues: None	✓ Select €	Cells: 🔳 🗸 🔀	9	Column:	Year ; Row: Crash 3	Severity 👰
	2016	2017	2018	2019	2020	TOTAL	
Estal Jaiway	43	43	40	38	39	203	1
Fatal Injury	4.31%	4.20%	4.08%	4.30%	5.08%	4.36%	
Suspected	108	108	96	73	77	462	
Serious Injury	10.82%	10.54%	9.80%	8.27%	10.03%	9.93%]
Suspected Minor	109	136	134	118	88	585	
Injury	10.92%	13.27%	13.67%	13.36%	11.46%	12.57%	
Pasaible Injuny	87	101	87	93	76	444	
Possible injury	8.72%	9.85%	8.88%	10.53%	9.90%	9.54%	
Property Damage	637	606	604	540	457	2844	
Only	63.83%	59.12%	61.63%	61.16%	59.51%	61.11%	
Heleeure	14	31	19	21	31	116	
UNKNOWN	1.40%	3.02%	1.94%	2.38%	4.04%	2.49%	
τοται	998	1025	980	883	768	4654	
TOTAL	21.44%	22.02%	21.06%	18.97%	16.50%	100.00%	
							-

WWD Crashes by Severity for Calendar Years 2016-2020

We conclude from considering the percentage numbers at the bottom of the table that 2016-1018 were significantly higher in total WWD crashes than 2019 and 2020. However, there was a general reduction in crashes in 2020 due to the COVid-19 restrictions. Fatal crashes were fairly stable over these years, while Suspected Serious Injury followed the pattern of total WWD crashes.

3.3 Overall Severity Comparisons: WWD vs nonWWD

The following presents a comparison of the severities of WWD crashes over the five-year period (2016-2020) against non-WWD crashes. The *Subset Frequency* and *Subset Percent* are for WWD crashes, while the *Other Frequency* and *Other Percent* are for non-WWD crashes. Comparisons must be against the percentage columns because the large disparity in the sample sizes between the WWD and non-WWD crashes makes their frequencies not comparable.



It is clear (and certainly no surprise) that WWD crashes are generally more severe than their non-WWD counterparts. The top three injury values are significantly over-represented, and the two top most severe have at least twice the proportion of the non-WWD crashes. For fatal crashes the Odds Ratio multiplier is almost eight times (7.883) the non-WWD crashes. In the other injury severities, there is a very significant increase in the Suspected Serious Injury category with an Odds Ratio indicating over 3 times the proportion of the non-WWD crashes. The Suspected Serious Injury difference tends to confirm the increase in the fatal crashes, since quite often the characteristics of Serious Injury crashes are not at that different from those crashes that are fatal.

The following sections (4.0-8.0) provide the IMPACT displays for the various attributes that could have an influence on countermeasure development. The outputs are ordered by highest Max Gain first unless otherwise indicated in the IMPACT "Order" box (located upper left just under the data description). *Max Gain* is a term that CARE users have assigned to indicate *the number of crashes that would be reduced if the respective proportion value was not at all over-represented* (i.e., it had an Odds Ratio of 1.000). An over-represented value of an attribute is the situation where that attribute has a greater share (proportion) of WWD crashes than its non-WWD counterpart. Thus, the non-WWD attribute proportion are serving as the control to which the WWD crash attributes are being compared. In this way anything different about WWD crashes surfaces, and they can be subjected to further analyses. The analytical technique employed to generate most of the displays below is called Information Mining Performance Analysis Control Technique (IMPACT). For a detailed description of the meaning of each element of the IMPACT outputs, see:

http://www.caps.ua.edu/software/care/

4.0 Geographic and Harmful Event Factors

4.1 County

🚦 CA	RE 10.2.1.3 - [IMPACT Res	ults - 2016-20	20 Alabama	Integrated C	rash Data - W	rong Way Dr	iving - WWD vs.	Not Wrong Way Dri — 🗆 🗙
🖡 Ei	le <u>D</u> ashboard <mark>Filters</mark>	<u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>W</u> in	ndow <u>H</u> elp	p	_ & ×
۴	2016-2020 Alabama Integrat	ed Crash Data		\sim	Wrong W	ay Driving - W	/WD	✓ ♥ 1/ 1/2016 ∨
Order:	Max Gain 🗸 🗸	Descending	~ [Suppress 2	Zero-Valued R	ows Sig	nificance: Over	Representation V Threshold: 2.0
C001:	County	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max 🚽 ^	C001: County C002: City
•	Cullman	142	3.05	11563	1.52	2.010*	71.337	C003: Year
	Dekalb	97	2.08	5197	0.68	3.054*	65.240	C004: Month
	Marshall	117	2.51	12921	1.70	1.482*	38.038	C006: Day of the Week
	Talladega	94	2.02	10054	1.32	1.530*	32.559	C007: Week of the Year
	Blount	59	1.27	4611	0.61	2.094*	30.821	C008: Time of Day
	Chilton	62	1.33	5245	0.69	1.934*	29.947	C010: Rural or Urban
	Walker	77	1.65	7817	1.03	1.612*	29.229	C011: Highway Classifications
	Choctaw	31	0.67	929	0.12	5.460*	25.323	C012: Controlled Access
	Cherokee	37	0.80	2580	0.34	2.347*	21.233	C015: Primary Contributing Circumstanc
	Washington	26	0.56	1062	0.14	4.006*	19.510	C016: Primary Contributing Unit Numbe
	Calhoun	127	2.73	17733	2.33	1.172	18.631	C017: First Harmful Event
	Clarke	32	0.69	2226	0.29	2.352*	18.397	C018: Location First Harmful Event Rel t
	Covington	38	0.82	3257	0.43	1.909*	18.096	C020: E Distracted Driving Opinion
	Fayette	26	0.56	1303	0.17	3.265*	18.037	C021: Distance to Fixed Object
	Tallapoosa	37	0.80	3442	0.45	1.759*	15.965	C022: E Type of Roadway Junction/Featu
	Winston	25	0.54	1508	0.20	2.713*	15.784	C023: E Manner of Crash
	Bibb	26	0.56	1715	0.23	2.481*	15.519	C024: School Bus Related
	Limestone	69	1.48	8753	1.15	1.290	15.509	C026: Intersection Related
	Lawrence	30	0.64	2597	0.34	1.890*	14.129	C027: At Intersection
	Jackson	47	1.01	5443	0.71	1.413*	13.737	C028: Mileposted Route
	Dallas	42	0.90	4650	0.61	1.478*	13.583	C029: National Highway System
	Randolph	23	0.49	1637	0.21	2.299*	12.996	C030: Functional Class
	Autauga	53	1.14	6888	0.90	1.259	10.906	C032: Weather
	Monroe	21	0.45	1710	0.22	2.010*	10.550 🗸	Sort by Sum of Max Gain
0) @ <i>\$</i>							, , ☑ Dia
	2016-2	020 Alabama I	ntegrated Cra	ash Data - Filt	er = Wrong Wa	ay Driving - W	WD vs. Not Wron	ng Way Driving - WWD
					C001: Coun	ty		
	30							
	_							
,	20							
	10							
								h.d.
	- Baltman	Incoller		Dia Dia Tra				
	0-1		Jac	kson		Ba	rbour	Houston
					C001	: Countv		

The above has omitted all items with a Max Gain of less than 10. It is arranged in highest Max Gain order to indicate the counties that have the highest potential for gain if they were to eliminate their over-representations. Cullman, DeKalb, Marshall, Talladega, Blount and Chilton have the highest potentials for WWD reductions, with Max Gains over 30 crashes each. The display above contains all of the counties with Odds Ratios greater than 2.000 (red backgrounds).

At the other end of the spectrum, the counties with large cities (e.g., Shelby, Madison, Tuscaloosa, Montgomery, Jefferson, and Baldwin) were the most under-represented counties. Although some of their numbers of WWD crashes are quite large, the number of non-WWD crashes are even larger

4.2 Cities Over-represented by Highest Max Gains (Including Rural Areas)

For comparison purposes, the rural areas of counties are considered to be "virtual cities" in that crashes that occur there are listed as "Rural County Crashes" so that these crashes can be effectively accounted for and compared. Generally, these rural areas are adjacent to (or contain) significant urban areas. Contrasted with this finding, there was significant under-representation for Wrong Way Driving (WWD) crashes in the largest cities themselves (e.g., Huntsville, Birmingham, Mobile, Tuscaloosa, Hoover, etc.).

The output display below is a list of what are considered to be the most critical cities and county rural areas (virtual cities) because of their high Max Gains, which indicate the potential for crash reduction. The criterion for this list was a Max Gain of 13 or more crashes. The red background indicates those (virtual) city areas that had over twice their expected proportion of WWD crashes (Odds Ratio).

[Terminology: The *Expected proportions* here and below are obtained from the proportion for non-WWD crashes. The non-WWD proportions are those that are *expected* of the WWD crashes. Thus, any significant positive deviation from this expected value would show that the attribute is over-represented.]

🚦 CA	RE 10.2.1.3 - [IMPA	ACT Res	ults - 2016-20	20 Alabama	Integrated Ci	rash Data - W	rong Way Dr	iving - WWD	vs. Not Wrong W	ay Dri —		×
🖡 Ei	le <u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>W</u> ir	ndow <u>H</u> elp	р			-	ð ×
6	2016-2020 Alabama	Integrat	ed Crash Data		~	Wrong W	'ay Driving - W	/WD		· ~ 💡 🏆	1/ 1/20)16 $ \smallsetminus $
Order:	Max Gain	~ [Descending	~ [Suppress 2	Zero-Valued R	ows Sig	gnificance: Ov	er Representation	✓ Thresh	old: 2.0	÷
C002:	City		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max 🚽	C001: Cou C002: City	nty		^
•	Rural Jefferson		206	4.43	18561	2.44	1.817*	92.631	C003: Year			
	Rural Mobile		142	3.05	9947	1.31	2.337*	81.244	C004: Mon	th of Month		
	Rural Cullman		103	2.21	5388	0.71	3.130*	70.090	C005. Day	of the Week		
	Rural Dekalb		73	1.57	2169	0.28	5.510*	59.752	C007: Wee	k of the Year		
	Rural Madison		118	2.54	9640	1.27	2.004*	59.119	C008: Tim	e of Day		
	Rural Marshall		58	1.25	2747	0.36	3.457*	41.221	C010: Rura	al or Urban		
	Rural Walker		57	1.23	3366	0.44	2.772*	36.441	C011: High	way Classificati	ons	
	Rural Chilton		48	1.03	2883	0.38	2.726*	30.391	C012: C01	ahway Side		
	Rural Calhoun		60	1.29	5132	0.67	1.914*	28.654	C015: Prin	ary Contributing	Circumst	tanc
	Rural Blount		44	0.95	2564	0.34	2.810*	28.339	C016: Prin	ary Contributing	Unit Num	ibe
	Rural Limestone		58	1.25	4908	0.64	1.935*	28.022	C017: First	Harmful Event		
	Rural Talladega		54	1.16	4346	0.57	2.034*	27.455	C018: Loca	ation First Harmf	ul Event R	leit
	Rural Choctaw		30	0.65	560	0.07	8.771*	26.580	C020: E Di	stracted Driving	Opinion	
	Rural Etowah		37	0.80	2476	0.33	2.447*	21.877	C021: Dist	ance to Fixed Ot	oject	
	Rural Fayette		23	0.49	602	0.08	6.255*	19.323	C022: E Ty	pe of Roadway J	lunction/Fe	eati
	Rural Washington		24	0.52	811	0.11	4.845*	19.046	C023: E Ma	anner of Crash		
	Rural Cherokee		28	0.60	1512	0.20	3.032*	18.765	C024: Sch	00 BUS Related		
	Rural Autauga		33	0.71	2478	0.33	2.180*	17.865	C025: Cras	section Related		
	Bessemer		69	1.48	8738	1.15	1.293	15.629	C027: At In	tersection		
	Rural Lauderdale		32	0.69	2856	0.38	1.834*	14.556	C028: Mile	posted Route		
	Rural Dallas		26	0.56	1874	0.25	2.271*	14.554	C029: Nati	onal Highway Sy	stem	
	Rural Monroe		18	0.39	751	0.10	3.924	13.413	C030: Fun	ting Conditions		
	Rural Lawrence		25	0.54	1906	0.25	2.147*	13.358	C032: Wea	ther		
	Rural Winston		18	0.39	791	0.10	3.726	13.169	Sort by Su	m of Max Gain		× 1
1			í í									
		2016.2	020 Alabama I	ntonrated C-	ash Data - Eile		Driving Ar		opa May Driving	1444/D		
		2016-2	UZU Alabama I	ntegrated Cra	ash Data - Filt	er = wrong wa	ay Driving - w	IVVD VS. NOT VVI	ong way Driving	WWD		
	15					0002. 01	,					
	10											
2	10											
<u>ل</u> 1												
	0	whenever	harantaraaaaa							أست المست	daught	
					Ashlan	d			Union			
						C.0	02: City					

This display is in Max Gain ordering to put those cities that have the highest potential for WWD crash reduction at the top.

4.3 Rural or Urban



The rural areas of the counties (considered as virtual cities above) demonstrated how WWD is more of a rural than an urban problem. The difference (between WWD and non-WWD) in the Urban proportions is 0.753, and for the Rural proportion difference, it is 1.836 (see their Odds Ratios). So, it is clear that the rural/urban mix is different in the WWD and non-WWD crashes. It will be interesting to study other similar attributes, such as Locale. The severity comparison immediately below indicates that the Rural area crashes were *much more lethal* in their severity than were the Urban area crashes.

4.4 Severity of Crash by Rural-Urban

In the above output the proportion of WWD to non-WWD crashes tends to be nearly twice as much in the rural as in the urban areas. It is interesting to perform a cross-tabulation over the rural and urban areas to determine the extent to which rural crashes might be causing more fatalities (and more severe injuries) than would be expected from just a comparison of their crash frequency proportions. The following, *which is strictly for WWD crashes*, answers this question.

CARE 10.2.1.	3 - [Crosstab Resul	ts - 2016-2020 Alaba	ma Integrated Cras	h Data - Filter = Wr	ong Way Driving - \	WWD]	_		×		
File Dast	hboard <u>F</u> ilters	<u>A</u> nalysis <u>C</u> rossta	b <u>L</u> ocations]	ools <u>W</u> indow	<u>H</u> elp			-	đΧ		
2016-2020) Alabama Integrated	Crash Data	\sim	Wrong Way Driving	- WWD	~	9	1/ 1/20	$16 \sim$		
Suppress Zero V	/alues: None	∽ Select	Cells: 🔳 🛛 🌃	9	Co	lumn: Crash Severit	y ; Row: Rural o	r Urban			
	Fatal Injury Suspected Serious Injury Suspected Minor Injury Possible Injury Property Damage Only Unknown T										
Pural	140	276	273	138	1060	59	1946				
Nulai	68.97%	59.74%	46.67%	31.08%	37.27%	50.86%	41.81%				
Urban	63	186	312	306	1784	57	2708				
Orban	31.03%	40.26%	53.33%	68.92%	62.73%	49.14%	58.19%				
τοτοι	203	462	585	444	2844	116	4654				
TOTAL	4.36%	9.93%	12.57%	9.54%	61.11%	2.49%	100.00%				

The red cells in the cross-tabulation above indicate over-representation by more than 10%. For example, while 41.81% of all the crashes were in the Rural areas, 68.97% of the fatal crashes occurred there. It is imperative to take into consideration crash severity when making geographical decisions regarding countermeasure implementation. Any of the geographic analyses shown in this report could be restricted to fatal crashes or some combination of fatal and severe injury crashes for this purpose.

Clearly fatalities and the highest severity of injuries are over-represented in the rural areas, since all three of the most severe crashes are significantly over-represented there. The reason for this is the higher speeds in the rural areas that result in higher impact speeds (see Section 6.2).

4.5 Highway Classification

🖡 C	ARE 1	10.2.1.3 - [IMP/	ACT Resu	lts - 2016-202	0 Alabama li	ntegrated Cras	sh Data - Wro	ng Way Drivin	g - WWD vs.	Not Wrong Way Dri — 🗆 🗙		
	<u>F</u> ile	<u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact <u>I</u>	Locations <u>T</u>	ools <u>W</u> ind	ow <u>H</u> elp		_ & ×		
¢?	201	6-2020 Alabama	a Integrate	ed Crash Data		\sim	Wrong Way	Driving - WWD)	✓ ♥ 1/ 1/2016 ∨		
Orde	er: Ma	x Gain	~ 0	escending	~ 2	Suppress Zer	o-Valued Row	/s Signifi	cance: Over	Representation V Threshold: 2.0		
C011	1: Hig	hway Classific	cations	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C007: Week of the Year C008: Time of Day		
	Соц	unty		1470	31.59	104131	13.67	2.310*	833.640	C010: Rural or Urban		
	Mu	nicipal		1819	39.08	307502	40.38	0.968	-60.190	C011: Highway Classifications		
	Priv	ate Property		100	2.15	26775	3.52	0.611*	-63.626	C012: Controlled Access C013: E Highway Side		
	Sta	te		719	15.45	137189	18.01	0.858*	-119.382	C015: Primary Contributing Circumstanc		
	Fee	leral		417	8.96	101040	13.27	0.675*	-200.470	C016: Primary Contributing Unit Number		
	Inte	erstate		129	2.77	84922	11.15	0.249*	-389.971	Sort by Sum of Max Gain		
	0	sy 🖉 🚽								🖂 Die		
	2016-2020 Alabama Integrated Crash Data - Filter = Wrong Way Driving - WWD vs. Not Wrong Way Driving - WWD C011: Highway Classifications											
		60	_									
	Frequency	4020		1		1						
				County	Municipa	al Private	Property	State	Federal	Interstate		
						C011:	Highway Clas	sincations				

Analysis of highway classifications indicates that WWD crashes had their greatest overrepresentation on county roads (Odds Ration 2.310 is over twice that that expected). None of the other road types are over-represented, and Private Property, State, Federal and Interstate are all significantly under-represented. Municipal roadways were very close to that expected from the non-WWD proportion.

It is recommended that hotspot analysis be performed to identify the specific county roads that are most highly over-represented, and that some enforcement activities be conducted on the county roads in an attempt to move this traffic onto the safer (more forgiving) roadways. Law enforcement presence alone could have a major effect here, since a major problem is speed, and will be shown below (Section 6.2).

4.6 Locale

🖡 C	ARE 1	0.2.1.3 - [IMP/	ACT Resu	lts - 2016-202	0 Alabama lı	ntegrated Cra	sh Data - Wror	ng Way Drivin	g - WWD vs.	Not Wrong Way Dri —		<
	<u>F</u> ile	<u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact <u>I</u>	ocations <u>1</u>	ools <u>W</u> indo	ow <u>H</u> elp			_ 8	×
6	2016	6-2020 Alabama	a Integrate	d Crash Data		~	Wrong Way	Driving - WWD)	~ 💡 😨	1/ 1/2016	\sim
Orde	er: Max	x Gain	∼ D	lescending	~ 2] Suppress Ze	ro-Valued Row	s Signific	cance: Over	Representation ~ Thres	hold: 2.0	÷
C033	3: Loc	ale		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C029: National Highway S C030: Functional Class	lystem	^
▶	Оре	en Country		1886	40.54	216306	28.41	1.427*	564.591	C031: Lighting Conditions	3	
	Res	sidential		1505	32.35	158172	20.77	1.558*	538.731	C032: Weather		
	Play	yground		3	0.06	214	0.03	2.295	1.693	C034: E Police Present at	Time of Crash	,
	Sch	lool		62	1.33	10294	1.35	0.986	-0.886	C035: Police Notification E	Delay	
	Mar	nufacturing or li	ndustrial	63	1.35	14080	1.85	0.732*	-23.014	C036: Police Arrival Delay		
	Oth	er		24	0.52	8233	1.08	0.477*	-26.295	C037: EMS Arrival Delay	Dalay	~
Ļ	Sho	opping or Busin	ess	1109	23.84	354203	46.51	0.513*	-1054.819	Sort by Sum of Max Gain		
		¥ 🖉 📃									\checkmark] Die
		60	2016-20	20 Alabama Ir	Itegrated Cras	sn Data - Filter	= Wrong Way L C033: Locale		vs. Not Wrony	g Way Driving - WWD		
	Frequency	402000	Oper	n Country	Residential	Playground	School	Manufact	uring Or	ther Shopping or Business		
							C033: Loca	le				

Open Country and Residential roadways show a higher level of over-representation as compared to the more urbanized classifications. This is quite consistent with the rural/urban comparison given above. There are considerable "Open Country" areas within the formal city limits of most cities, and this seems to be where many of the WWD crashes are occurring.

4.7 Most Harmful Event

🖡 CA	RE 10.2.1.3 - [IMF	ACT Resu	llts - 2016-202	0 Alabaı	ma Integra	ated Cras	h Data - V	Vrong Way	Driving	- WWD vs	s. No	t Wrong Way Dr	ivi	_		×
🖡 Ei	le <u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocati	ions <u>T</u> a	ools <u>W</u> i	ndow <u>I</u>	<u>H</u> elp						-	₽×
¢?	2016-2020 Alabam	na Integrate	ed Crash Data		~		Wrong V	Vay Driving	- WWD			~	${\bf \bigtriangledown}$	12 1/	1/2016	~ 12
Order:	Max Gain	~ D	escending	~	🛛 🔽 Sup	press Zer	o-Valued F	Rows	Signifi	cance: C)ver F	Representation	~ 1	Threshold	: 2.0	-
C019:	E Most Harmful	Event			Subset equency	Subset Percent	Other equency	Other Percent	Odds Ratio	Max Gain	>	C011: Highwa C012: Control	iy Class led Acc	ification ess	S	^
•	Collision with Vehi	icle in Traff	ìc		3682	79.11	529812	69.57	1.137*	444.240		C013: E Highv	way Sid	е		
	Record from Pape	er System			60	1.29	1620	0.21	6.061*	50.100		C015: Primary	/ Contri	buting C	ircumst nit Num	anc
	Crossed Centerlin	e			54	1.16	1202	0.16	7.351*	46.654		C010: Finnary C017: First Ha	armful E	Event	munum	be
	Collision with Vehi	icle in (or fr	om) Other Road	lway	132	2.84	16698	2.19	1.294*	29.956		C018: Locatio	n First	Harmful	Event R	elt
	Collision with Non	-Motorist: P	edestrian		42	0.90	3351	0.44	2.051*	21.522		C019: E Most	Harmfu	I Event		
	Collision with Non	-Motorist: P	edalcycle		23	0.49	1266	0.17	2.973*	15.263		C020: E Distra	acted D	riving Op	oinion at	
	Evasive Action (S	werve/Bra	ke)		14	0.30	1155	0.15	1.983	6.942		C021: Distant	ofRoad	leu Obje Iway Jur	ction/Fe	ati
	Crossed Median				6	0.13	226	0.03	4.344	4.619		C023: E Mann	er of C	rash		
	Non-Contact Vehi	icle			5	0.11	307	0.04	2.665	3.124		C024: School	Bus Re	elated		
	Collision with Wor	k Zone/Ma	aintenance Equ	ipment	5	0.11	555	0.07	1.474	1.608		C025: Crash S	Severity			
	Re-entering Road	way			3	0.06	326	0.04	1.506	1.008		C026: Interse	ction Re	elated		
	Not Applicable				1	0.02	17	0.00	9.626	0.896		C028: Milepos	sted Ro	ute		
	Collision with Traf	fic Signal P	ole		3	0.06	376	0.05	1.306	0.702		C029: Nationa	al Highv	vay Syst	em	
	Collision with Impa	act Attenua	tor		1	0.02	53	0.01	3.087	0.676		C030: Functio	nal Cla	SS		
	Collision with Bridg	ge Support.	/Column		2	0.04	278	0.04	1.177	0.301		C031: Lighting Conditions				
	Collision with Othe	er Traffic Ba	amier		2	0.04	315	0.04	1.039	0.075		C032: Weathe	:1			~
	Separation of Unit	ts			1	0.02	162	0.02	1.010	0.010	\checkmark	Sort by Sum of	of Max G	iain		
) 🗞 🖉] Displ
					201	6-2020 Al	abama Inte	grated Cra	ish Data							
						C019:	E Most Ha	armful Ever	nt							
	100															
	_															
7	· -															
	50-															
L 1	Ē	_														
	0			-						-	L				-11	
	,		Collisio Zone/M	n with Wor laintenanc	rk e	Co Railwa	llision with y Vehicle/Tra	in	Coll Falling/S	ision with Shifting Care	10	Collisio Utility	on with / Pole			
			Equ	uipment					-							
							C019: E M	Aost Harm	ul Event							

The display above is for all positive Max Gains. Head-on collisions are the most deadly, and this display indicates that WWD often ends up in such crashes. In the majority of crashes involving pedestrians and pedacycles, it is the non-motorist that is on the wrong side of the roadway. Note how both of these are very highly over-represented in WWD and WWWalking.



4.8 CU Roadway Curvature and Grade

The display above is in Max Gain order. It is not surprising that WWD crashes are dramatically over-represented on all types of curves. The most under-represented item is Straight and Level, and the high bars to the right represent 511,200 (67.13%) of non-WWD crashes and 2521 (54.18%) WWD crashes. Right curves tend to throw these vehicles into the oncoming traffic lane on two-lane roads (almost all County Roads – see Section 4.5). For example, someone dozing would have a more difficulty staying in their lane on a right curve than on a left curve, although the numbers above do not show a great variation in this regard. The close frequencies illustrate the reality that for every right curve there is an accompanying left curve.

5.0 Time Factors

5.1 Year



The chart above is useful for tracking the relative changes by directly comparing the number of WWD crashes to the non-WWD crashes by year. Years 2016, 2017 and 2018 had a significantly larger proportion than the non-WWD. The other two, 2019 and 2020, had a smaller proportion than expected. So the general trend based on these gross numbers would seem to be a reducing number of WWD crashes with time in 2019 and 2020.

5.2 Month

🚦 CA	RE 10.2.1.3 - [IMPACTI	Results - 2016	5-2020 Alab	ama Integr	ated Crash	Data - Wron	ig Way Drivi	ing - WWD vs. No	ot —		×
🖡 Ei	le <u>D</u> ashboard <u>F</u> ilt	ters <u>A</u> naly	sis <u>I</u> mpa	ct <u>L</u> ocat	ions <u>T</u> oo	ls <u>W</u> indo	w <u>H</u> elp			- 1	s ×
6 °	2016-2020 Alabama Inte	grated Crash [Data	~		Wrong Way I	Driving - WW	'D	~	9	2
Order	Max Gain 🗸		a ~] _ su	press Zero-V		ance: Over	Representation	× Threehold:	20	
			,		press 2010				· meshold.	2.0	
C004:	Volce	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County C002: City			
•	January	367	7.89	61333	8.05	0.979	-7.815	C003: Year			
	February	359	7.71	60073	7.89	0.978	-8.115	C004: Month			
	March	407	8.75	64353	8.45	1.035	13.729	C005: Day of I	Month		
	April	349	7.50	60140	7.90	0.950	-18.524	C007: Week o	of the Year		
	May	384	8.25	64010	8.41	0.982	-7.175	C008: Time of	fDay		
	June	411	8.83	61064	8.02	1.101	37.829	C010: Rural o	r Urban		
	July	373	8.01	59846	7.86	1.020	7.272	C011: Highwa	y Classifications	3	
	August	385	8.27	66188	8.69	0.952	-19.485	C012: Control	led Access		
	September	379	8.14	63035	8.28	0.984	-6.216	C015: Primar	Contributing Ci	rcumsta	inc
	October	412	8.85	68932	9.05	0.978	-9.254	C016: Priman	nit Numb	be	
	November	411	8.83	65202	8.56	1.031	12.541	C017: First Ha	armful Event		
	December	417	8.96	67383	8.85	1.013	5.212	Sort by Sum	n First Harmful F of Max Gain	Event Re	4 1 *
00) 🗞 🖉							,			
	1			2016-2020 4	Jahama Inte	grated Crash	Data				
				2010 2020 /	C004: Mo	onth	10010				
	10										
	-										
∥ ,											
										-	
"	·										
	0										
		February	A	pril	June	A	lugust	October	December		
					C004	Month					

No significant over- or under-representations by month were found, and it is reasonable that WWD crash frequencies are not dependent on the time of the year.

5.3 Day of the Week

🖡 C	🔋 CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Wrong Way Driving - WWD vs. Not 🛛 🗌 🗙											
	<u>F</u> ile <u>D</u> ashboar	d <u>F</u> ilte	ers <u>A</u> naly	ysis <u>I</u> mpa	ict <u>L</u> ocat	ions <u>T</u> oo	ls <u>W</u> indo	w <u>H</u> elp			-	8×
¢?	2016-2020 Alaba	ama Integ	rated Crash	Data	~	/	Wrong Way	Driving - WV	VD		~ 💡	12
Orde	er: Max Gain	~	Descendi	ng ·	Sup	press Zero-	Valı Signific	ance: Over	Representation	✓ Thresh	old: 2.0	÷
C00	6: Day of the Wee	ek	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: Count C002: City	y		^
	Sunday		589	12.66	73662	9.67	1.308*	138.841	C003: Year			
	Monday		632	13.58	110022	14.45	0.940	-40.361	C004: Month	Manth		
	Tuesday		683	14.68	114305	15.01	0.978	-15.535	C005: Day of	the Week		
	Wednesday		628	13.49	114287	15.01	0.899*	-70.425	C007: Week	of the Year		
	Thursday		683	14.68	119259	15.66	0.937	-45.809	C008: Time of	of Day		
	Friday		764	16.42	134425	17.65	0.930	-57.491	C010: Rural	or Urban		~
	Saturday		675	14.50	95599	12.55	1.155*	90.780	Sort by Sum	of Max Gain	000	
) & P				2016-2020 /	Alabama Inte	grated Crasi	h Data				
					C	JUO. Day of t	ne week					
	20											
	-											
		-										
	Ledneucy									Î		
	0	0	undav.	Monday	Tuesda	v Wedn	eday Ti	ureday	Eriday 9	Saturday		
		5	unday	Honday	1 uesua	C006: Day (of the Week	laraday	i nuay - c	Julur day		

Weekend days and nights (especially Sundays) are over-represented in DDW crashes. The above is a well-established and recognized pattern for Impaired Driving (ID) crashes, with their concentrations on the weekend periods. This indicates that ID is a major central cause for WWD crashes, which will be explored in more detail below (Sections 8.2-8.5).

5.4 Time of Day

CA	RE 10.2.1.3 - [IMPACT	Results - 20	16-2020 Al	abama Inte	grated Cras	sh Data - W	rong Way I	Drivi	ng - WWD vs. Not 🗕 🗆 🗙
E Ei	le <u>D</u> ashboard <u>F</u> il	ters <u>A</u> na	lysis <u>I</u> m	pact <u>L</u> oc	ations <u>T</u>	ools <u>W</u> ir	ndow <u>H</u> e	elp	- 8 x
\$	2016-2020 Alabama Inte	grated Crash	Data		~	Wrong W	ay Driving -	ww	D ~ 7 3
Order:	Max Gain 🕓	Descend	ling	⊻ ⊡s	uppress Zer	ro-Valı Signi	ificance:	Over	Representation V Threshold: 2.0 🛓
C008:	Time of Day	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds	Max Gain	^	C001: County A C002: City
•	12:00 Midnight to 12	99	2.13	9360	1.23	1.731*	41.800		C003: Year
	1:00 AM to 1:59 AM	81	1.74	7705	1.01	1.720*	33.914		C004: Month
	2:00 AM to 2:59 AM	63	1.35	7057	0.93	1.461*	19.874		C005: Day of the Week
	3:00 AM to 3:59 AM	62	1.33	6261	0.82	1.620*	23.738		C007: Week of the Year
	4:00 AM to 4:59 AM	85	1.83	7039	0.92	1.976*	41.984		C008: Time of Day
	5:00 AM to 5:59 AM	120	2.58	12330	1.62	1.593*	44.650		C010: Rural or Urban
	6:00 AM to 6:59 AM	146	3.14	20296	2.67	1.177	21.968		C011: Highway Classifications
	7:00 AM to 7:59 AM	239	5.14	44985	5.91	0.869	-35.910		C012: Controlled Access C013: E Highway Side
	8:00 AM to 8:59 AM	189	4.06	32939	4.33	0.939	-12.295		C015: Primary Contributing Circumstance
	9:00 AM to 9:59 AM	160	3.44	29109	3.82	0.899	-17.889	-	C016: Primary Contributing Unit Numbe
	10:00 AM to 10:59 AM	202	4.34	33636	4.42	0.983	-3.555	-	C017: First Harmful Event
	11:00 AM to 11:59 AM	236	5.07	41274	5.42	0.936	-16.232	-	C018: Location First Harmful Event Rel t
	12:00 Noon to 12:59	225	4.83	50144	6.58	0.734*	-81.437	-	C020: E Distracted Driving Opinion
	1:00 PM to 1:59 PM	282	6.06	49556	6.51	0.931	-20.844	-	C021: Distance to Fixed Object
	2:00 PM to 2:59 PM	254	5.46	53971	7.09	0.770*	-75.825	-	C022: E Type of Roadway Junction/Featu
	3:00 PM to 3:59 PM	351	7.54	67381	8.85	0.852*	-60.775	-	C023: E Manner of Crash
	4:00 PM to 4:59 PM	299	6.42	65124	8.55	0.751*	-98.982		C024: School Bus Related
	5:00 PM to 5:59 PM	335	7.20	69461	9.12	0.789*	-89.486	-	C026: Intersection Related
	6:00 PM to 6:59 PM	280	6.02	45417	5.96	1.009	2.450	-	C027: At Intersection
	7:00 PM to 7:59 PM	221	4.75	31023	4.07	1.166	31.414		C028: Mileposted Route
	8:00 PM to 8:59 PM	232	4.98	25862	3.40	1.468*	73.953		C029: National Highway System
	9:00 PM to 9:59 PM	203	4.36	21358	2.80	1.555*	72.478		C031: Lighting Conditions
	10:00 PM to 10:59 PM	147	3.16	16538	2.17	1.454*	45.934		C032: Weather
	11:00 PM to 11:59 PM	135	2.90	12309	1.62	1.795*	59.778	~	Sort by Sum of Max Gain
0) 🕼 🖉								
				2016-2020) Alabama Ir	ntegrated Cr	ash Data		
					C008: Tin	ne of Day			
	10								
								1	
			_			- 14			

4:00 AM to 4:59 AM 9:00 AM to 9:59 AM 2:00 PM to 2:59 PM 7:00 PM to 7:59 PM Unknown C008: Time of Dav

5.5 Discussion on Time of Day by Day of the Week (Section 5.6)

It is no surprise to find WWD crashes over-represented during the late night/early morning hours, since their other correlations with aspects of Impaired Driving (ID) is clear. In addition, night-time darkness itself may well increase the number of WWD crashes.

The following narrative was developed with regard to a special study that was done for ID. We include it here because of it relevance to WWD crashes. These considerations are also applicable to drowsiness and falling asleep at the wheel, which we will see are also quite relevant.

The extent of these over-representations is quite amazing. The blue bars above follow the typical traffic patterns of high traffic in the morning and afternoon rush hours. ID, and thus WWD crashes, are just getting started in the afternoon rush hours and they continue to grow in their proportions through midnight and the early morning hours, not tapering off until about 7:00 AM. It is clear that if selective enforcement is going to have an effect on ID (indirectly on WWD) crashes, it would have to be conducted at the times when these crashes are most occurring. Optimal times for Friday enforcement would start immediately following any rush hour details, and would continue through at least 2:00 AM.

The *Time of Day by Day of the Week* cross-tabulation (given in the next section for WWD crashes only) shows the optimal times for selective enforcement. <u>Generally</u>, the highest WWD times in any day are given in red for that day. This works well for Saturday and Sunday mornings, but not too well for Friday night. The reason is that proportions on Saturday night, eclipsed the Friday numbers, even though they were higher than any other day except Saturday.

This is an excellent example to demonstrate how the color coding of CARE cross-tabulations can be misleading in some special cases. The red background indicates that the over-representation of the cell is greater than expected. The expected proportion for all cells in a given row is given at the extreme right in the total row percentage for that row. If there were absolutely no over-representations across the columns, then all of the proportions for those cells would be identical to the one for the total. Notice for example, the 7 AM to 7:59 AM row has a total percentage value of 4.50%. Those that are under this value have a neutral (white) background. Those that are higher, but not more than 10% of the proportion are yellow; and those above 10% of the proportion are red.

CARE 10.2.1.3	🔋 CARE 10.2.1.3 - [Crosstab Results - 2016-2020 Alabama Integrated Crash Data - Filter = Wrong Way Driving - WWD] - 🛛 🗙										
File Dashb	oard <u>F</u> ilters	<u>A</u> nalysis <u>C</u> rossta	b <u>L</u> ocations <u>T</u>	ools <u>W</u> indow	<u>H</u> elp			- 8			
2016-2020	Nabama Integrated (Crash Data	\sim	Wrong Way Driving	- WWD	~	9 1/ 1	/2016 ~ 12/31/202			
Suppress Zero Va	lues: None	~ Select	Cells: 🔳 🗸 🛞	9		Column	: Day of the Week ; I	Row: Time of Day [
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL			
12:00 Midnight to	36	8	8	5	9	9	24	99			
12:59 AM	6.11%	1.27%	1.17%	0.80%	1.32%	1.18%	3.56%	2.13%			
1:00 AM to 1:59 AM	21	/ 111%	0.29%	11	10	1.05%	22	81 1 74%			
2:00 AM to 2:59	23	5	5	4	4	8	14	63			
AM	3.90%	0.79%	0.73%	0.64%	0.59%	1.05%	2.07%	1.35%			
3:00 AM to 3:59	24	6	3	2	4	6	17	62			
AM	4.07%	0.95%	0.44%	0.32%	0.59%	0.79%	2.52%	1.33%			
4:00 AM to 4:59	16	12	7	8	15	11	16	85			
5:00 AM to 5:50	2.72%	1.90%	1.02%	1.2/%	2.20%	1.44%	2.3/%	1.83%			
5:00 AM to 5:59 AM	2.55%	2.85%	1.76%	2 39%	23	20	2.52%	2.58%			
6:00 AM to 6:59	16	2.00%	22	2.3378	20	23	19	146			
AM	2.72%	3.48%	3.22%	3.82%	2.93%	3.01%	2.81%	3.14%			
7:00 AM to 7:59	14	35	41	49	44	34	22	239			
AM	2.38%	5.54%	6.00%	7.80%	6.44%	4.45%	3.26%	5.14%			
8:00 AM to 8:59	14	24	36	34	30	33	18	189			
AM	2.38%	3.80%	5.27%	5.41%	4.39%	4.32%	2.67%	4.06%			
9:00 AM to 9:59	13	35	31	18	24	18	21	160			
	2.21%	5.54%	4.54%	2.8/%	3.51%	2.36%	3.11%	3.44%			
AM to 10:59	27	21	22	31	32	3/	32	202			
11:00 AM to 11:59	4.00%	2.32 %	3.22%	4.34%	4.03%	4.04%	4.74%	4.34%			
AM	3.57%	4.43%	5.42%	5.89%	6.59%	4.58%	4.89%	5.07%			
12:00 Noon to	22	33	39	35	30	28	38	225			
12:59 PM	3.74%	5.22%	5.71%	5.57%	4.39%	3.66%	5.63%	4.83%			
1:00 PM to 1:59	28	42	42	38	38	46	48	282			
PM	4.75%	6.65%	6.15%	6.05%	5.56%	6.02%	7.11%	6.06%			
2:00 PM to 2:59	33	39	39	34	28	51	30	254			
	5.60%	6.17%	5.71%	5.41%	4.10%	6.68%	4.44%	5.46%			
3:00 PM to 3:59 PM	28	dC \v28.8	51	50 7.96%	54 7 91%	10.08%	35 5 19%	351			
4:00 PM to 4:59	4.75%	40	7.47%	/.30%	1.31%	10.00%	20	299			
PM	4.58%	6.33%	7.61%	7.80%	6.44%	6.41%	5.63%	6.42%			
5:00 PM to 5:59	37	54	59	45	51	57	32	335			
PM	6.28%	8.54%	8.64%	7.17%	7.47%	7.46%	4.74%	7.20%			
6:00 PM to 6:59	35	36	48	28	45	42	46	280			
РМ	5.94%	5.70%	7.03%	4.46%	6.59%	5.50%	6.81%	6.02%			
7:00 PM to 7:59	43	32	25	22	30	43	26	221			
0.00 PM - 0.50	7.30%	5.06%	3.66%	3.50%	4.39%	5.63%	3.85%	4./5%			
PM 10 8:59	526%	23	39 5.71%	32 5.10%	5.56%	5 10%	3U 4.44%	4 98%			
9:00 PM to 9:59	27	18	25	25	32	37	39	203			
PM	4.58%	2.85%	3.66%	3.98%	4.69%	4.84%	5.78%	4.36%			
10:00 PM to 10:59	16	17	23	15	19	25	32	147			
PM	2.72%	2.69%	3.37%	2.39%	2.78%	3.27%	4.74%	3.16%			
11:00 PM to 11:59	22	17	14	17	14	26	25	135			
PM	3.74%	2.69%	2.05%	2.71%	2.05%	3.40%	3.70%	2.90%			
Unknown	0	4	1	0	0	2	1	8			
	0.00%	0.63%	0.15%	0.00%	0.00%	0.26%	0.15%	U.1/%			
TOTAL	589 12.66%	13.58%	14 68%	13/19%	14 68%	16.42%	6/5 14.50%	4604			
	12.00%	13.30 %	14.00%	13.43%	14.00 %	10.42 %	14.00%	100.00%			

5.6 Time of Day by Day of the Week

6.0 Factors Affecting Severity

6.1 WWD Crash Severity Compared to Non-WWD

See Section 4.7 for the most harmful events in WWD crashes. The following compares crash severities for WWD (Subset, red bars) vs. Non-WWD crashes (Other, blue bars).



The rate of fatal injury crashes and the two highest injury classifications are consistently higher in WWD crashes than that of non-WWD crashes. Fatality crashes have almost eight (7.883) times their expected proportion, while the next highest non-fatal injury classifications has 3.158 times their expected proportions when compared with non-Wrong Way Driving (non-WWD) crashes. The Speed-at-Impact variable, considered next, indicates one of the primary reasons for this. However, the greatest cause of WWD increased severity and death is the vicious nature of the WWD crash itself, since the speed at impact is essentially the sum of the speed of both vehicles.

6.2 Speed at Impact



It should be noted that the speed limit on County roads is generally 45 MPH, and it is generally lower on Municipal roads, where these two roadway types combined account for about 70% of WWD crashes. All impact speeds 21 to 55 MPH are significantly over-represented, and they are under-representation at higher impact speeds. The next cross-tabulation quantifies how this relates to the severity in the special case of WWD crashes.

CARE 10.2.1.3 - [Crosstab Results - 2016-2020 Alabama Integrated Crash Data - Filter = Wrong Way Driving - WWD] -											
🚦 <u>F</u> ile <u>D</u> ashb	board <u>F</u> ilters <u>/</u>	<u>A</u> nalysis <u>C</u> rossta	b <u>L</u> ocations]	ools <u>W</u> indow	<u>H</u> elp			-	đΧ		
2016-2020	Alabama Integrated C	rash Data	\sim	Wrong Way Driving	- WWD	~	9 1/ 1	/2016 ∨	12/31/2		
Suppress Zero Va	Ilues: None	✓ Select	Cells: 🔳 🛛 🔣	9	Column: Cr	ash Severity ; Row	: CU Estimated Speed	d at Impact	@		
	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL				
0 MPH	0 00%	0 00%	1	1	3 0.11%	0	5				
1 to 5 MPH	0.00%	2	11	9	129	0	151				
6 to 10 MPH	0.00%	2	12	6	140	3	163				
11 to 15 MPH	2	6	8	1.35%	4.92%	0	3.50%				
16 to 20 MPH	0.99%	1.30%	1.3/%	3.16%	5.21% 116	0.00%	3.83%				
21 to 25 MPU	0.49%	1.30% 9	2.91%	2.26%	4.08% 149	1.72%	3.27%				
21 to 25 MPH	0.00%	1.95% 12	3.93% 17	4.06%	5.24% 122	1.72%	4.32%				
26 to 30 MPH	1.97%	2.60%	2.91%	3.84%	4.29%	0.86%	3.72%				
31 to 35 MPH	1.48%	3.68%	5.98%	6.32%	5.28%	2.59%	5.07%				
36 to 40 MPH	2.46%	25 5.41%	30 5.13%	24 5.42%	3.94%	0.86%	4.23%				
41 to 45 MPH	9 4.43%	61 13.20%	68 11.62%	23 5.19%	178 6.26%	5 4.31%	344 7.39%				
46 to 50 MPH	12 5.91%	27 5.84%	39 6.67%	11 2.48%	53 1.86%	1 0.86%	143 3.07%				
51 to 55 MPH	40 19.70%	84 18.18%	53 9.06%	17 3.84%	115 4.05%	4 3.45%	313 6.73%				
56 to 60 MPH	12 5.91%	16 3.46%	12	8 1.81%	27	0	75				
61 to 65 MPH	20	38	8	7	16	1	90				
66 to 70 MPH	14	14	6	2	0.06%	0.86%	39				
71 to 75 MPH	6.90% 3	3.03%	1.03%	0.45%	0.11% 3	0.00%	0.84%				
70 to 00 MDU	1.48% 7	1.30% 3	0.17%	0.00%	0.11%	0.00%	0.28%				
76 to 80 MPH	3.45% 0	0.65%	0.17%	0.00%	0.11%	0.00%	0.30%				
81 to 85 MPH	0.00%	0.00%	0.17%	0.00%	0.00%	0.00%	0.02%				
86 to 90 MPH	0.49%	0.00%	0.00%	0.23%	0.00%	0.00%	0.04%				
91 to 95 MPH	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
96 to 100 MPH	0.00%	0.00%	0.00%	1 0.23%	0 0.00%	1 0.86%	2 0.04%				
Over 100 MPH	2 0.99%	0.00%	0.00%	0.00%	0	0.00%	2 0.04%				
E Stationary	0	5	6 1.03%	3 0.68%	34 1.20%	0	48				
Unknown	54 26.60%	98 21,21%	197 33.68%	211 47,63%	1187 41.75%	84 72.41%	1831 39,36%				
Not Applicable	1	5	5	10	54 1 90%	6 5.17%	81 1.74%				
CU is Not a	12	25	27	15	18	1	98				
CU is Unknown	5.91%	5.41%	4.62%	3.39%	0.63%	0.86%	2.11%				
ΤΟΤΛΙ	0.49%	0.22%	1.20%	1.58% 443	2.92% 2843	0.86%	2.15% 4652				
TOTAL	4.36%	9.93%	12.58%	9.52%	61.11%	2.49%	100.00%				

6.3 Severity by Impact Speed Cross-Tabulation

6.4 Discussion of Severity vs Speed at Impact Cross-Tabulation

The display above presents information on the effect of increased impact speed on the severity of WWD crashes. Notice the red in the Fatality and Serious Injury cells as speeds increase. More enlightening is the probability that the crash results in a fatality as a function of impact speed of the causal driver, which is most often the vehicle of the higher speed. This is given in the following table:

Speed at Impact	Fatality Odds (1 in)	Increase Probability above 31-35
31-35	79	1.0
36-45	39	2.0
46-55	9	8.7
56-65	5	15.8
66-75	3	26.3
76-85	2.14	36.9
86-95 and above	2.00	39.5

Obviously, speed kills, and a reduction in speed at impact by as little as 5 MPH can have a major effect on whether or not that crash will be fatal. A reduction in impact speeds by 10 MPH has generally been found to cut the number of fatal crashes in half. This is the reason that selective enforcement is effective, since it has the effect of reducing a major proportion of speeding vehicles in addition to those ticketed. Interestingly, the fatal probabilities for WWD crashes were effectively the same as those of comparable speeds for causal drivers in single-vehicle crashes. However, approximately 38% of the fatalities were in the victim vehicle as opposed to the causal vehicle.

There is another major factor in effect here as well – the failure of WWD drivers to be properly restrained, which will be covered in the next separate attribute below (6.5; Restraint Use by Causal Drivers in WWD Crashes), which is also a major problem with Impaired Drivers, since ID drivers fail to buckle up about half the time.

6.5 Restraint Use by Drivers in WWD Crashes

The following display presents a comparison of WWD-crash driver safety belt use against those who were not WWD over the same five-year time period.



Risk-taking involved in most of the WWD causes does not stop with excess speed; it extends to not being properly restrained. The above analysis demonstrates that the causal driver in a WWD crash is over three (3.062) times more likely to be unrestrained than in the non-WWD crash. The next analysis demonstrates how this contributes to crashes becoming fatal.

6.6 Crash Severity by Restraint Use (C323) for WWD Crash CU Drivers

CARE 10.2.1.3 - [Crosstab Results - 2016-2020 Alabama Integrated Crash Data - Filter = Wrong Way Driving - WWD]													
🚦 <u>F</u> ile <u>D</u> a	shboard <u>F</u> ilters	<u>A</u> nalysis <u>C</u> rossta	b <u>L</u> ocations	<u>T</u> ools <u>W</u> indow	<u>H</u> elp			-	₽×				
2016-20	😵 2016-2020 Alabama Integrated Crash Data 🗸 Wrong Way Driving - WWD V V 🖓 🔞 1/ 1/2016 V 12/31/2												
Suppress Zero Values: None Select Cells: 🔳 🗸 🌠 😭 Column: Crash Severity ; Row: CU Driver/Non-Motorist Safety Equ													
	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL		^				
None Used -	78	90	66	29	99	7	369	1	_				
Motor Vehicle Oc 38.61% 19.74% 11.32% 6.61% 3.53% 6.03%							8.02%						
Shoulder and La	p 85	276	394	299	1818	60	2932						
Belt Used	42.08%	60.53%	67.58%	68.11%	64.79%	51.72%	63.71%		~				

A comparison of the probability of a fatal crash for the two restraint categories of WWD crashes indicates that a fatality is about seven times (7.34) more likely if the WWD causal driver is not properly restrainted. The probability is estimated by 75 fatality crashes out of 369 when restraints were not used (1 in 4.7 crashes), as opposed to only 85 fatal crashes out of 2,932 crashes when restraints were used (1 in about 34.5 crashes). So the combined effect of lower restraint use and higher speed is a devastating combination that accounts for some of the high lethality of WWD crashes. Of course, it is the devastating "double impact" of a head-on collision that could kill even when a driver is properly restrained.

6.7 Number of Vehicles Involved

The following display presents a comparison of WWD crash number of vehicles against number of vehicles in non-WWD crashes over the five year time period of the study.



The above shows that the number of single vehicle WWD crashes is under-represented by an Odds Ratio of 0.368 (proportion was only a little over a third of that expected). Close to 9 out of 10 (86.98%) of the WWD crashes were single vehicle. This would be expected when most of the crashes involved the causal vehicle intruding into the opposing traffic lane and crashing into an oncoming vehicle.

6.8 Police Arrival Delay

🚦 CA	RE 10.2.1.3 - [IMPACT R	lesults - 2016-2020 A	labama Integr	rated Crash Da	ita - Wrong Wa	ay Driving - W\	WD vs. Not Wr	ong Way Driving	— C	ב	×
E Ei	le <u>D</u> ashboard <u>F</u> ilte	ers <u>A</u> nalysis <u>I</u> n	npact <u>L</u> ocat	ions <u>T</u> ools	<u>W</u> indow	<u>H</u> elp				- (5 ×
<u></u>	2016-2020 Alabama Integ	grated Crash Data	~	W	rong Way Drivin	g - WWD		~ 9	1/ 1/201	6 v 1	2/31//
Order:	Natural Order 🗸 🗸	Descending	🖂 🗹 Sup	opress Zero-Va	lued Rows	Signif	icance: Over	Representation ~	Threshold:	2.0	-
C036:	Police Arrival Delay	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C033: Locale C034: E Police Pr	esent at Time	of Cra	st
•	0 to 5 minutes	969	20.85	195835	25.72	0.811*	-226.328	C035: Police Notif	ication Delay		
	6 to 10 minutes	907	19.52	192180	25.24	0.773*	-266.019	C036: Police Arrival	al Delay Delay		
	11 to 15 minutes	518	11.15	109520	14.39	0.775*	-150.483	C038: Adjusted EM	IS Arrival Dela	ay	
	16 to 20 minutes	346	7.45	62492	8.21	0.907	-35.436	C039: Non-Vehicu	lar Property D	amage	e
	21 to 30 minutes	478	10.29	67919	8.92	1.153*	63.439	C040: Agency ORI			
	31 to 45 minutes	564	12.14	54370	7.14	1.700*	232.139	C042: Highway Pa	atrol Troops		
	46 to 60 minutes	348	7.49	29636	3.89	1.924*	167.109	C043: Highway Pa	on		
	61 to 90 minutes	309	6.65	25966	3.41	1.950*	150.510	C045: ALDOT Area	1		
	91 to 120 minutes	85	1.83	8330	1.09	1.672*	34.156	C046: ALDOT Reg	ion		
	121 to 180 minutes	54	1.16	5409	0.71	1.636*	20.985	C047: ADECAAHS	O Region		
	Over 180 minutes	61	1.31	8230	1.08	1.214	10.766	C049: MPO			~
	Unknown	8	0.17	1448	0.19	0.905	-0.838	Sort by Sum of Ma	x Gain		
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		2016-2020 Alabama lı	ntegrated Crash	h Data - Filter = C036: F	Wrong Way Dr Police Arrival D	iving - WWD vs elay	a. Not Wrong Wa	ay Driving - WWD			
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	°	6 to 10 minutes	16 to 20 mi	nutes 31 t	to 45 minutes	61 to 90 mir	nutes 121 to	o 180 minutes l	Jnknown		
				C0	36: Police Arriv	al Delay					

WWD crashes police arrival delays were significantly longer up until 20 minutes. As would be expected, all arrival delays over 20 minutes were over-represented, most of them significantly. There can be little doubt that this has to do with the late-night timing of these crashes.

6.9 EMS Arrival Delay

🖡 CA	RE 10.2.1.3 - [IMPACT Res	ults - 2016-2020 /	Alabama Inte	grated Crash [ata - Wrong	Way Driving -	WWD AND Not	Adjusted EMS Arr	ival — 🗆	×			
🛃 Ei	le <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> r	npact <u>L</u> oc	ations <u>T</u> ool	s <u>W</u> indow	<u>H</u> elp			-	8×			
6	2016-2020 Alabama Integra	ted Crash Data		\sim 1	Wrong Way Driv	ving - WWD		~ 9	1/ 1/2016 🗸 1	12/31/2			
Order:	Max Gain 🗸 🗸	Descending	~	uppress Zero-\	alued Rows	Sig	gnificance: Ove	r Representation	✓ Threshold: 2.0	•			
C038:	Adjusted EMS Arrival De	a <mark>y</mark> Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max ^ Gain	C038: Adjuste	ed EMS Arrival Delay				
•	0 to 5 minutes	391	21.72	47977	26.57	0.818*	-87.179						
	6 to 10 minutes	545	30.28	58642	32.47	0.932	-39.475						
	11 to 15 minutes	374	20.78	32775	18.15	1.145*	47.337						
	16 to 20 minutes	204	11.33	17309	9.58	1.182*	31.484						
	21 to 30 minutes	174	9.67	14924	8.26	1.170	25.255						
	31 to 45 minutes	75	4.17	6027	3.34	1.249	14.930						
	46 to 60 minutes	20	1.11	1620	0.90	1.239	3.854						
	61 to 90 minutes	12	0.67	852	0.47	1.413	3.508						
	91 to 120 minutes	2	0.11	178	0.10	1.127	0.226	11					
	121 to 180 minutes	2	0.11	166	0.09	1.209	0.346 🗸	Sort by Sum	of Max Gain				
0) 😪 🖉								🗌 Dis	play Fil			
				2016 2020 4	-hama lataarai	ad Crack Data							
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				C038: Ad	justed EMS Ari	rival Delay							
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	1	6 to 10 minutes	16 to	20 minutes	31 to 45 m	inutes 6	1 to 90 minutes	121 to 180 min	nutes				
			C038: Adjusted EMS Arrival Delay										

For much the same reasons as the police arrival delays, EMS delays were significantly overrepresented for Wrong Way Driving (WWD) crashes in the 0-5 and 6-10 minute categories. All longer delay times were over-represented. There were relatively few in these very long categories, which were probably caused by some of the vehicles not being discovered late at night.

7.0 Driver and Vehicle Demographics



7.1 Driver Age for WWD Crashes

The table display above presents a comparison of WWD crash causal driver age against the same for crashes that were not WWD. The blue (non-RC) bars illustrate the problems that 16-20-year-

old drivers have in general, and the red bars show that older drivers are over-represented in WWD crashes over a broad range.



7.2 Driver Gender for WWD Crashes

The percentages for the red bars and the blue bars each sum to 100%. So the breakdown in WWD causal drivers is 60.91% male and 39.09% female. For non-RC, the percentage is 56.54 male and 43.46 female, which also gives a good estimate for male/female drivers in general. These differences in proportions certainly indicate that males are a greater cause of the WWD problems. If there are countermeasures that can be directed toward male drivers, doing so would be much more cost-effective than those directed toward all drivers, all other things being equal.

CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Wrong Way Driving - WWD AND Not Causal Unit (CU) Typ												
🖳 <u>E</u>	🛃 Eile Dashboard Eilters Analysis Impact Locations Tools Window Help 🗕 🗗 🗙											
6 2	2016-2020 Alabama Integrated Crash Data		\sim	Wrong Way	Driving - WWI	D		~ 9	1/ 1/2016	~ 12/31/2		
Order	Max Gain V Descending	~ 2] Suppress Ze	ro-Valued Row	/5	Significance	Over Repres	entation	✓ Threshold:	2.0 😫		
C101	Causal Unit (CU) Type	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C101: 0	Causal Unit (CU) Ty	pe		
•	Pick-Up (Four-Tire Light Truck)	885	19.86	130254	18.05	1.100*	80.600					
	E Bicyclist	53	1.19	505	0.07	16.994*	49.881					
	Pedestrian	41	0.92	1516	0.21	4.379*	31.638					
	Passenger Car	2304	51.69	370315	51.31	1.007	17.072					
	E 4-Wheel Off Road ATV	20	0.45	561	0.08	5.773*	16.535					
	Moped	6	0.13	140	0.02	6.940	5.135					
	E Other Motorized Cycle/Low Speed V	6	0.13	157	0.02	6.188	5.030					
	E Low Speed Vehicle	5	0.11	132	0.02	6.134	4.185					
	E Van or Mini-Van	7	0.16	736	0.10	1.540	2.455					
	Motorcycle	35	0.79	5407	0.75	1.048	1.608					
	Station Wagon	13	0.29	1887	0.26	1.116	1.347					
	E Other Bus (Seats More than 15)	7	0.16	1153	0.16	0.983	-0.120					
	E Truck (6 or 7) with Trailer	9	0.20	2088	0.29	0.698	-3.895					
	E Single-Unit Truck (3 Axles or Less)	13	0.29	3025	0.42	0.696	-5.681					
	E Cargo Van (10000 lbs or Less)	28	0.63	5553	0.77	0.816	-6.293					
	E Single-Unit Truck (2-Axle/6-Tire)	37	0.83	7090	0.98	0.845	-6.785					
	E Passenger Van	8	0.18	2453	0.34	0.528	-7.149					
	E Mini-van	80	1.79	16510	2.29	0.785	-21.960					
	E Tractor/Semi-Trailer	59	1.32	14755	2.04	0.647*	-32.121					
	E Sport Utility Vehicle (SUV)	841	18.87	156164	21.64	0.872*	-123.411	Sort b	y Sum of Max Gain			
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			2016-202	0 Alabama Inte	grated Crash I	Data						
			C1	01: Causal Uni	t (CU) Type							
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	0			_		_		_				
	E 4-W	heel Off Road /	ATV	Motorcyc	le	E Cargo Van (1	0000 lbs or Les	ss) ES	port Utility Vehicle (SU	V)		
				C101: Causal I	Jnit (CU) Type	1						

7.3 Causal Vehicle Types with 5 or more Crashes

The display above presents a comparison of WWD crash causal unit type against the same for crashes that were non-WWD. Vehicles types with less than 5 crashes in the WWD dataset were removed for the above display. Pick-ups have the highest for potential crash reduction according to the Max Gain. However, Bicycles, Pedestrians and 4-Wheel Off Road ATVs all have much higher Odds Ratios. Passenger Cars are by far the highest frequency that pushes their Max Gain up, but their Odds Ratio (1.007) indicates that their overall frequency on the roadway makes this degree of involvement about as expected. The extremely high odds ratios for bicyclists and pedestrians should make quite clear the danger of not following the law is this regard.

7.4 Number of Pedestrians



WWD here is actually Wrong Way Walking. Pedestrians are generally over-represented in WWD crashes, indicating that a large proportion of pedestrian crashes involved them walking on the wrong side of the roadway. This finding may be useful in pedestrian countermeasures. More intensive enforcement of laws against pedestrians walking in the same direction as traffic should be considered. These crashes resulted in 14 pedestrian fatalities.

7.5 Number of Pedalcycles

🖡 C	ARE 1	0.2.1.3 - [IMP/	ACT Resu	lts - 2016-20	20 Alabama	a Integrated (Crash Data - '	Wrong Way	Driving - WW	D vs. Not Wrong W	- 🗆	×
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6	2010	5-2020 Alabama	a Integrate	d Crash Data		~	Wrong	Way Driving -	WWD	~	9	1/ 1/2016
Orde	r: Sub	oset Frequency	~ A	scending	~	Suppress	Zero-Valued	Rows Signifi	icance: Over	Representation V	hreshold:	2.0 🜩
C058	B: Nur	nber of Pedac	yclists	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C057: Number of Ped C058: Number of Ped	estrians acyclists	^
	1 P	edacyclist Invol	ved	58	1.25	1214	0.16	7.818*	50.581	C059: Number Injured	l (Non-Fata	D 🗸
	No	Pedacyclists In	volved	4596	98.75	760331	99.84	0.989*	-50.496	Sort by Sum of Max Ga	ain	Cotolitiy
		¥ 🖉										[
						2016-2020 Al	abama Integra	ated Crash D	ata			
						C058: 1	Number of Per	dacyclists				
		100										
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		0-			1 Pedacy	clist Involve	ed No	Pedacyclis	sts Involved			
						C058: N	umber of Ped	acvelists				

The number of crashes here is very close to that of pedestrians. However, none of pedalcycle WWD crashes resulted in a fatality. Pedalcycle WWD would be riding against traffic (as opposed to pedestrian WW Walking). While not fatal, high severities of injuries were significantly greater than expected with 15 Suspected Serious Injury, 20 Suspected Minor Injury, and 12 Possible Injury Crashes.

7.6 Driver License Status

C/	🛿 CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Wrong Way Driving - WWD AND Not CU Driver Lice — 🛛 🛛 🗙													
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6	2016-2020 Alabama	a Integrate	d Crash Data		\sim	Wrong Way	Driving - WWD)	✓ ♀ 〒 1/ 1/2016 ∨					
Orde	r: Max Gain	~ D	escending	~ ~] Suppress Zer	o-Valued Rows	s Signifi	icance: Over I	Representation V Threshold: 2.0					
C114	: CU Driver Licens	e Status	Subset	Subset	Other	Other	Odds	Max -	C114: CU Driver License Status					
•	Revoked		119	3.77	7898	1.29	2.912*	78.130						
	Expired		52	1.65	6778	1.11	1.483*	16.926						
	Canceled		5	0.16	310	0.05	3.117	3.396						
	Left State		4	0.13	259	0.04	2.985	2.660						
	Denied		3	0.10	283	0.05	2.049	1.536						
	E Test Required		1	0.03	120	0.02	1.610	0.379						
	Current/Valid		2973	94.17	594415	97.43	0.967*	-102.908	Sort by Sum of Max Gain					
] 🕼 🗇 🖉													
					2016-2020 Ala	abama Integrate	ed Crash Data	I						
					C114: Cl	J Driver Licens	se Status							
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	0-1-	F	Revoked	Expired	Canceled	Left State	e Deni	ied E Test	Required Current/Valid					
					C114	: CU Driver Lie	cense Status							

Clearly WWD crashes are over-represented in WWD causal drivers being without legitimate licenses. They make up about 15% of WWD causal drivers. Items with less than 20 crashes in either "Subset" or "Other" are not subjected to statistical tests because of the low sample sizes. WWD drivers were highly significantly over-represented in having Revoked licenses, being close to three times its expected value (in comparison with non-WWD crashes). It is expected that the same infractions that cause them to be deficient in their licensing would cause them to drive the wrong way (e.g., a history of DUI Drugs/Alcohol).



7.7 Driver Employment Status

Why would the employment status of the driver be of concern? In our current era when the economy and gas prices are playing such a big role in traffic safety, the quantification and tracking of the employment proportion of drivers involved in WWD crashes is important. This indicates that their unemployment rate proportion is close to 50% higher than expected in comparison with non-WWD crashes. This relationship is not surprising because of the underlying drug/alcohol root cause of many WWD crashes (see 8.3-8.4). The correlation between not having a job and being involved in an WWD crash should be watched carefully going forward in that it could affect the type and location for countermeasures. Some of these could be suicides, but no detailed investigations for this are typically performed.

8.0 Driver Behavior

8.1 Primary Contributing Circumstances (RS & Items < 10 Crashes Removed)

CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Wrong Way Driving - WWD vs. Not																	
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6 2	2016-2020 Alabama Inte	egrated Cras	h Data		\sim	Wrong	Way Driving	g - W	wD ~ 🖓 (😨								
Order	Subset Frequency	 Descender 	ding		Suppress Ze	ero-Va Signi	ificance:	Over	Representation V Threshold: 2.0 🖨								
C015	Primary Contributing	Circumstan	ce Subset	Other	Other	Odds Batio	Max	^	C008: Time of Day								
┢╴	Traveling Wrong W	3297	70.84	0	0.00	0.000	3297 000		C010. Rural of Orban C011: Highway Classifications								
<u> </u>	E Wrong Side of Ro	399	8.57	0	0.00	0.000	399.000		C012: Controlled Access								
	DUI	214	4.60	20363	2.67	1.720*	89.559		C013: E Highway Side								
	E Crossed Centerline	90	1.93	9864	1.30	1.493*	29.720		C015: Primary Contributing Circumstant								
	Made Improper Turn	70	1.50	14717	1.93	0.778	-19.938		C017: First Harmful Event								
	E Fatigued/Asleep	47	1.01	12963	1.70	0.593*	-32.219		C018: Location First Harmful Event Rel t								
	Improper Passing	41	0.88	6529	0.86	1.028	1.100		C019: E Most Harmful Event								
	Improper Lane Cha	41	0.88	42129	5.53	0.159*	-216.457	,	C020: E Distracted Driving Opinion								
	E Aggressive Opera	34	0.73	12999	1.71	0.428*	-45.439		C022: E Type of Roadway Junction/Featu								
	Over Speed Limit	33	0.71	10906	1.43	0.495*	-33.648		C022: E Type of Roadway Junction/Feat C023: E Manner of Crash								
	Unknown	29	0.62	41045	5.39	0.116*	-221.832	2	C024: School Bus Related								
	E Swerved to Avoid	28	0.60	18600	2.44	0.246*	-85.667	,	C025: Crash Severity								
	E Other Distraction I	27	0.58	16974	2.23	0.260*	-76.731		C025: Intersection Related								
	Improper Backing	24	0.52	19517	2.56	0.201*	-95.271		C028: Mileposted Route								
	Unseen Object/Per	24	0.52	48156	6.32	0.082*	-270.288		C029: National Highway System								
	Other	24	0.52	25369	3.33	0.155*	-131.034		C030: Functional Class								
	Driving too Fast for	20	0.43	29120	3.82	0.112*	-157.957	~	Sort by Sum of Max Gain								
00) 😪 🖉						,										
				2016-202	0 Alabama I	ntegrated C	rash Data										
				C015: Pr	imary Contri	buting Circ	umstance										
	80																
į	60																
	40																
d d	20																
	0		E Failed to	Yield Right-of	-Way from Dri	veway		P Driv	er Not in Control								
				C0	15: Primary	Contributing	n Circumst	ance									

The highest two items were "filtered in." The others show what was highly correlated in those that were not WWD in the *Primary* Contributing Circumstances (the attribute given above), but were found to be WWD in the *Causal Unit* Contributing Circumstances and the *V2* Contributing Circumstances. DUI is by far the highest of these attributes found, with several times the frequency of the other items below it.

8.2 CU Driver Officer's Opinion Alcohol

B	CARE 1	10.2.1.3 - [IMP/	ACT Resu	lts - 2016-202	0 Alabama In	tegrated Cra	sh Data - Wroi	ng Way Drivin	ig - WWD AN	D Not CU Driver O	ffi —		×
ľ	<u>F</u> ile	<u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact <u>L</u>	ocations]	ools <u>W</u> indo	ow <u>H</u> elp				-	₽×
😵 2016-2020 Alabama Integrated Crash Data V Wrong Way Driving - WWD V 🖓 😨 1/ 1/2016 V												016 🗸 1	
Order: Max Gain V Descending V Suppress Zero-Valued Rows Significance: Over Representation V								✓ Thresh	old: 2.) 🛊			
C1	22: CU	Driver Office	r Opinion /	Alcohol <mark>ubset</mark> Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C122: CU Driv	er Officer Op	inion Alco	bhol
►	Yes	s - Driver Was U	Inder I	304	9.07	21619	3.34	2.715*	192.047				
	No	- Driver Was No	ot Und	3046	90.93	625291	96.66	0.941*	-192.042	Sort by Sum of	f Max Gain		
	□ 0												
	2016-2020 Alabama Integrated Crash Data C122: CU Driver Officer Opinion Alcohol												
		100											
	L	Support 50											
	Yes - Driver Was Under Influence of No - Driver Was Not Under Influence of Alcohol Alcohol Alcohol C122: CU Driver Officer Opinion Alcohol												

While Impaired Driving/Alcohol was indicated as the cause of the crash for only 9.07% of the WWD crashes, the fact that this proportion was over-represented by a factor of 2.715 (close to 3 times the expected from the non-WWD crashes indicates its importance. ID/DUI reports tend to be under-reported, but there is no doubt that its reduction would have a major impact on reducing the number of WWD crashes.

CARE 10.2.1.3	- [Crosstab Results	s - 2016-2020 Alabar	ma Integrated Cras	h Data - Filter = Wr	ong Way Driving - V	VWD]	- 0	×
🛃 <u>F</u> ile <u>D</u> ashb	oard <u>Filters</u>	<u>A</u> nalysis <u>C</u> rosstal	b <u>L</u> ocations <u>1</u>	ools <u>W</u> indow	<u>H</u> elp		-	- 8 :
2016-2020 A	Nabama Integrated C	Crash Data	\sim	Wrong Way Driving	- WWD	~	· 💡 🛐 1/ 1	/2016
Suppress Zero Val	ues: None	 ✓ Select 	Cells: 🔳 🔻 🌃	Sec. Col	umn: Crash Severity	; Row: CU Driver (Officer Opinion Alcoh	ol 役
	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL	
Yes - Driver Was	36	52	42	29	144	1	304	1
Under Influence o	17.73%	11.26%	7.18%	6.53%	5.06%	0.86%	6.53%	
No - Driver Was	64	304	416	311	1880	71	3046	
Not Under Influen	31.53%	65.80%	71.11%	70.05%	66.10%	61.21%	65.45%	
Unknown	6	12	24	12	44	3	101]
UTKHOWH	2.96%	2.60%	4.10%	2.70%	1.55%	2.59%	2.17%	
Net Applicable	84	68	69	70	675	39	1005	1
Not Applicable	41.38%	14.72%	11.79%	15.77%	23.73%	33.62%	21.59%	1
CU is Not a	12	25	27	15	18	1	98	1
Vehicle	5.91%	5.41%	4.62%	3.38%	0.63%	0.86%	2.11%	1
CU12-11-1	1	1	7	7	83	1	100	1
CO IS UNKNOWN	0.49%	0.22%	1.20%	1.58%	2.92%	0.86%	2.15%	1
P Both Alcohol	0	0	0	0	0	0	0	1
and Drugs	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1
TOTAL	203	462	585	444	2844	116	4654	1
TOTAL	4.36%	9.93%	12.57%	9.54%	61.11%	2.49%	100.00%	1

8.3 Severity of CU Driver by Officer's Opinion Alcohol Results

This cross-tabulation shows that those under the influence of alcohol have a one in 8.44 chance of being killed, while those who were sober had a one in 53.22 chance of being killed. This is a very highly significant difference and should discourage anyone who has had any alcohol at all from driving a motor vehicle.



8.4 CU Driver Officer's Opinion Drugs

While Impaired Driving/Drugs (non-alcohol drug) was indicated as the cause of the crash for only 5.74% of the WWD crashes, the fact that this proportion was over-represented by a factor of 4.880 (close to 5 times the expected from the non-WWD crashes) indicates its importance. While WWD ID-Drugs is only about half the frequency of WWD ID-Alcohol crashes, the over-representation is alarming, and it generally shows one reason there are as many WWD crashes as there are. In both cases (WWD and non-WWD), drug use is difficult to detect compared to alcohol, which has well-established tests for the blood-alcohol level that are relatively easy to administer. Our conclusion is that both alcohol and non-alcohol drug use are major contributors to increasing the frequency of WWD crashes, and their use is further compounded if they choose to avoid detection by using county roads. This is detailed further in the next display.

CARE 10.2.1.3	- [Crosstab Results	s - 2016-2020 Alabar	ma Integrated Crasł	n Data - Filter = Wro	ong Way Driving - V	VWD]	- 0	×
🛃 <u>F</u> ile <u>D</u> ashb	ooard <u>F</u> ilters	<u>A</u> nalysis <u>C</u> rosstal	b <u>L</u> ocations <u>T</u>	ools <u>W</u> indow	<u>H</u> elp		-	. 8 >
2016-2020	Alabama Integrated C	Crash Data	\sim	Wrong Way Driving	- WWD	~	9 1/1	/2016 \
Suppress Zero Va	lues: None	 ✓ Select 	Cells: 🔳 🗸 🌃	ବୁ Ca	olumn: Crash Severit	y ; Row: CU Driver	Officer Opinion Drug	s 没
	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL	
Yes - Driver Was Under Influence o	20 9.85%	53 11.47%	40 6.84% 409 69.91%	17 3.83%	52 1.83%	3 2.59% 68 58.62%	185 3.98%	
No - Driver Was Not Under Influen	58 28.57%	281 60.82%		309 69.59%	1911 67.19%		3036 65.23%	
Unknown	5 2.46%	11 2.38%	20 3.42%	9 2.03%	62 2.18%	4 3.45%	111 2.39%	
Not Applicable	107 52.71%	91 19.70%	82 14.02%	87 19.59%	718 25.25%	39 33.62%	1124 24.15%	
CU is Not a Vehicle	12 5.91%	25 5.41%	27 4.62%	15 3.38%	18 0.63%	1 0.86%	98 2.11%	
CU is Unknown	1 0.49%	1 0.22%	7 1.20%	7 1.58%	83 2.92%	1 0.86%	100 2.15%	
P Both Alcohol and Drugs	0	0	0	0	0	0 0.00%	0	
TOTAL	203 4.36%	462 9.93%	585 12.57%	444 9.54%	2844 61.11%	116 2.49%	4654 100.00%	
		-		-			-	

8.5 Severity of CU Drug Results

The probability of driver death in any crash in which the driver been indulging in recognized drug use is one is 9.25. The death rate of those not under the influence of drugs is one in 52.34 DWD crashes, quite comparable to the results discussed in Section 8.3 for alcohol use.