Single Vehicle Fatal Crashes IMPACT Special Study

Single Vehicle Fatal Crashes (SVFCs) vs Single Vehicle Non-Fatal Crashes (SVNFCs) By David B. Brown (<u>brown@cs.ua.edu</u>) University of Alabama Center for Advanced Public Safety (CAPS) and Alabama Transportation Institute (ATI) November 2023

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0.0 Introduction

Over the five years of data (CY2018-2022) used in this study, there were 470,984 motor vehicle crashes that involved only Single Vehicles. These resulted in the following crash severities:

Severity	Single Vehicle	Non-Single Vehicle	Percent of All Crashes
Fatal Injury	1587	4372	36.30%
Suspected Serious Injury	9179	20283	45.25%
Suspected Minor Injury	34733	60300	57.60%
Possible Injury	42297	64172	65.92%
Property Damage Only	368358	581745	63.32%
Unknown	14830	19423	76.35%

Severity of Single Vehicle Crashes

The purpose of this report is to provide information by which the total number of Single Vehicle Fatal Crashes (SVFCs) may be reduced, and to reduce the severity of the potential SVFCs that do occur so that fewer of them result in fatalities. The primary analytical technique employed to generate most of the displays for this purpose (in Sections 4-8) 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>

Sections 4-8 present the results of a number of IMPACT evaluations of Single Vehicle Fatal Crashes (SVFCs) compared to Single Vehicle Non-Fatal Crashes (SVNFCs) over a recent fiveyear period (CY2018-2022). The purpose of these comparisons is to determine the causes of fatal crashes that might distinguish those that involve Single Vehicles from Single Vehicle Non-Fatal Crashes (SVNFCs). This is different from many of the other Special Studies that have been performed, which had the goal of reducing <u>all</u> of a particular type of crash regardless of severity, and not just those that were fatal.

IMPACT works by surfacing "over-representations." An *over-represented* attribute is found when that attribute has a greater share of Single Vehicle Fatal Crashes (SVFCs) than would be expected if its proportion were the same as that for Single Vehicle Non-Fatal Crashes (SVNFCs). That is, the SVNFC crashes are serving as a *control* to which the SVFCs are being compared to determine over-representations that indicate causes.

As a first example, over the five years of the crash data studied (CY2018-2022), we found that SVFCs for the Highway Classification attribute value of "Federal" had a 30.7% higher proportion of crashes than did the Single Vehicle Non-Fatal Crashes (SVNFCs) on Federal roads (details in Section 2.3). When such differences are statistically significant (as in this case), this surfaces characteristics that should be given additional attention, and in some cases, further

analyses are performed for *countermeasure* development. For example, additional *selective enforcement* for SVFC-related violations (e.g., excessive speed and Impaired Driving) might concentrate more on Federal roads. The Time of Day and Day-of-the-Week attributes (as discussed in Sections 5.4-5.6) are also used to focus optimal times for enforcement implementation.

Unless otherwise stated, the items within the tables given above the charts in the IMPACT displays are ordered by *Max Gain*. *Max Gain* is the improvement in SVFC reduction that could be obtained if a countermeasure were applied to reduce the proportion of the Single Vehicle Fatal Crashes (SVFCs) to the proportion of Single Vehicle Non-Fatal Crashes (SVNFCs) for the particular attribute under consideration (i.e., reduce the 12.20% to 9.33% in the Federal Road example; see Section 2.3). This is called Max Gain because it is generally the maximum gain that can be expected by implementing a countermeasure. The Max Gain for each attribute value can be found in the extreme right column of the table.

This report continues with three sections that provide a high-level summary of the IMPACT results and a more detailed explanation of their specifics. These are called: (1.0) Summary of Findings and Recommendations, (2.0) Filter and IMPACT Set-ups, and (3.0) Single Vehicle Fatal Crash Comparison by Year. Section 3 is also introductory in that it provides another IMPACT example -- a comparison for the Year attribute. After Section 3, the IMPACT comparisons between SVFCs and SVNFCs are presented under the following headings, given here with their section numbers:

- 4.0 Geographic Factors,
- 5.0 Time Factors,
- 6.0 Factors Affecting Severity,
- 7.0 Driver and Vehicle Demographics, and
- 8.0 Driver Behavior.

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

1.0 Summary of Findings and Recommendations

This section comes immediately after the Introduction in this report 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 the more detailed IMPACT studies. These summaries are referenced to the more detailed analyses so that any questions regarding their sources can be accessed easily. The following section numbers: (1.1), (1.2), and (1.3), are omitted in Section 1 to maintain consistency with the numbering of the analytical sections (Sections 4-8).

Findings and recommendations are organized into the areas of: (1.4) Geographical Factors, (1.5) Time Factors, (1.6) Severity Factors, (1.7) Driver and Vehicle Demographics, and (1.8) Driver Behavior. The ordering of these recommendations, either generally or within their respective categories, is not meant to imply priority. However, the detailed information given should be

quite useful in the further prioritization and allocation of traffic safety resources. This process of optimization should consider all of the recommendations, which can be validated against the information presented in the IMPACT Sections 4.0-8.0 (source section references for these summaries are given in parenthesis). Recommendations are given for the reduction of frequency and/or severity of Single Vehicle Fatal Crashes (SVFCs) in Alabama. They are in the same ordering as the IMPACT displays to facilitate references to Sections 4.0-8.0. For the special report on traffic safety resource optimization, please see: http://www.safehomealabama.gov/wp-content/uploads/2019/03/Traffic-Safety-Innov-2017-04.pdf

<u>Terminology</u>: *Expected proportions* (AKA *expectations*) of either the SVFCs or SVNFCs are obtained from the comparison of their proportions with the proportions for their corresponding SVNFC control classifications. The IMPACT analyses in this study enables the determination of over-representations in either the SVFCs or the SVNFCs.

Note: subsection numbers 1.1, 1.2 and 1.3 have been omitted below in order to keep the numbering system in this Section consistent with that of the IMPACT displays that follow. Findings are from the IMPACT analyses in Sections 4-8 that compare SVFCs vs SVNFCs over the five years of the study (CY2018-2022). Recommendations, which will be given for each of the findings, are given in the bullet list below:

• 1.4 Geographical Factors (4.0)

- County (4.1, C001) Generally, the over-represented counties are rural with (or near) large population centers. The large population centers increase the traffic and thus the crashes, while being rural generally make a larger proportion of these crashes fatal. Placed in Max Gain order, the SVFC-over-represented counties with the highest potential for fatality reduction are (with their frequencies): Limestone 64, Dallas 41, Dekalb 46, and Montgomery 112. The SVNFC-over-represented counties with the highest potential for fatality reduction with their frequencies are: Madison 102, Jefferson 252, Tuscaloosa 83, and Etowah 43. It is recommended that these and other over-represented counties be given special attention for both fatality and crash reduction. Generally, the countermeasures recommended to be applied to specific geographical areas, determined by hotspot analysis, are selective enforcement for Speed and Impaired Driving, since these two violations have the highest correlation with fatal crashes.
- City (4.2, C002) -- Comparisons of SVFCs to SVNFCs viewing rural areas of counties as separate "virtual cities." There is little surprise in the number of rural areas in this output. In Section 4.2, City (and rural virtual city) comparisons are presented in the IMPACT table for all areas that had Max Gains greater than 7. The top 6 SVFC-over-represented Cities had highly statistically significant Odds Ratios. They are: Rural Mobile 84, Rural Limestone 50, Rural Dallas 33, Rural Dekalb 37, and Rural Butler 25. The top 4 SVNFC-over-represented Cities with their expected fatal crash numbers are: Mobile 66, Huntsville 69, Rural Madison

34, and Dothan14. It is recommended that those cities with a high frequency of fatal crashes be given special guidance, and perhaps additional funding. Many such large city areas have a considerable amount of Open Country that tends to increase their fatality count, as will be discussed in the Locale attribute in Section 4.6.

- Rural/Urban (4.3, C010) Single Vehicle Fatal Crash (SVFC) Proportion SVFCs occurred in 62.41% rural and 37.59% urban areas. This attribute is determined by the city limits boundaries as opposed to the speed limits or other environmental factors (see Locale immediately below). For SVNFCs, these proportions came out to be 52.52% Rural and 47.48% Urban. Concentration for fatality reduction is recommended in Rural areas where hotspot analyses determines that there are concentrations of fatal crashes. Recommendations to reduce fatalities within any of these areas include:
 - Implement a larger police presence in the more critical areas; and
 - Lower the speed limits in frequent crash areas.

Anyone wishing analysis of additional cities, counties, or other areas, please contact CAPS – email <u>brown@cs.ua.edu</u>.

- Locale (4.4, C033) Open Country shows a high level of over-representation in the SVFCs (1618, 67.81%). Those countermeasures recommended for rural areas would be applicable to Open Country areas within city limits, which are effectively rural areas, as illustrated in the next display in Section 4.5. While their proportions were not over-represented, the following had very high frequencies: Shopping or Business 320, and Residential 376.
- Cross-tabulation of Locale (4.5, C033) by Rural/Urban (C010) for SVFCs (fatal crashes). The largest number of fatalities were in the Rural, Open Country specifications, with 1349 fatal single-vehicle crashes. This illustrates that the Locale attribute is more definitive in specifying the surrounding areas of crashes than is the Rural/Urban attribute. Recommendations for rural areas apply equally to Open Country Locales.
- Highway Classifications (4.6, C011) in order of Odds Ratio, the largest was State 1.198*, Federal 1.307, and County 1.048. These results are correlated to the number of Single Vehicle Fatal Crashes (SVFCs) per mile on the respective Highway Classifications, since the Odds Ratios are comparing the Single Vehicle Fatal Crashes (SVFCs) against the Single Vehicle Non-Fatal Crashes (SVNFCs).
- Most Harmful Event (4.7, C019) ordered by Max Gain. The following items had the largest number of fatality occurrences (listed with their frequencies):

SINGLE VEHICLE FATAL CRASH (SVFC)	FREQUENCY
Collision with Non-Motorist: Pedestrian	309
Collision with Tree	675
Collision with Vehicle in Traffic	176
Fire/Explosion	54
Collision with Railway Vehicle/Train	21

Recommendation: Pedestrian training needs to be increased to include the advantages of walking against traffic, wearing of reflective clothing at night, and all the other rules for pedestrian safety, including a strong prohibition of walking while intoxicated with either alcohol or other drugs. For more details on Pedestrian crashes, see:

http://www.safehomealabama.gov/wp-content/uploads/2023/05/Ped-SS-Using-2018-22-Data-v04.pdf

• Roadway Curvature and Grade (4.8, C407). The following items were the most significantly over-represented (given with frequencies):

SINGLE VEHICLE FATAL CRASHES (SVFCs)	FREQUENCY
Curve Left and Level	241
Curve right and Down Grade	129
Straight with Down Grade	256
Curve Right and Level	144

Recommendations include selective enforcement and speed-limit-reduction (e.g., advisory speed and curve warning signs) concentrating most on left curves. The application of Advisory Speed Limits for Curves might be improved by considering the recent release of GDOT_16-31 (trb.org) entitled: *An Enhanced Network-Level Curve Safety Assessment and Monitoring Using Mobile Devices*; GDOT_16-31 (trb.org). This report appears at:

<u>http://www.safehomealbama.gov/tag/road-improvements</u> Other engineering recommendations should evaluate crashes at curves based on hotspot analyses, especially left curves.

• 1.5 Time Factors (5.0)

- Year (3.1, C003) Variations from year to year were not significant in any years except 2022. SVFCs were under-represented in 2018 and 2019, but they became over-represented in 2020-2022. The reason for these increased SVFC proportions is not definitive, but it is recommended that this consistent increase should be watched to determine a cause in future years, since this might be an early indication that the proportions of Single Vehicle Fatal Crashes (SVFCs) per year are increasing over time.
- Month (5.2, C004) The number of SVFCs and SVNFCs correlated with each other closely in all months (no significant over-representations). September, October and November had the highest Odds Ratios, and it is recommended that they be given special selective enforcement concentration, with specific single-vehicle locations determined by hotspot analyses.
- Day of the Week (2.3, 5.7 C006) Sunday was the only significantly over-represented day of the week. Friday and Saturday were also over-represented, although not significantly so. Since this day of the week distribution is quite comparable to that of Impaired Driving (ID, DUI), it is recommended that: (1) the countermeasures for ID should be emphasized in the times and places indicated

by hotspot analysis; and (2) consideration be given to using Single Vehicle Fatal Crashes (SVFCs) as a proxy measure to improve ID decisions. See Sections 8.3 and 8.4 for the ID analyses.

- Time of Day (5.5-5.6, C008) In *Natural Time Order*. In addition to Impaired Driving (ID). some of the late-night crashes will be due to drowsiness causing. among other things, a diminished ability to see road edge lines. See Day of the Week (2.3, 5.7, C006) for the similarity of this distribution with that of Impaired Driving (ID = DUI alcohol and/or drugs). The ID recommendations apply particularly to these over-represented times. See Sections 8.3 and 8.4 for more on ID.
- Time of Day by Day of the Week (5.7, C008 x C006) For all single vehicle fatal crashes. This quantifies the extent of the fatal crash concentrations on Friday nights, Saturday mornings and nights, and Sunday mornings. This is a very useful summary for deploying selective enforcement details, especially during the weekend hours. Recommendations here are to adjust the selective enforcement times to the days of the week and times of day using this cross-tabulation along with hotpot analysis.

• 1.6 Factors Affecting Severity (6.0)

- Severity for All Highway Classifications (6.1, C025, C011) This crosstabulation was performed for <u>all Single Vehicle crash records</u> so that the various severities on the different Highway Classifications could be seen. Note the high fatal over-representations on Interstate, Federal, State and County roads. For Single Vehicle fatality reduction, the enforcement priority is recommended on the State, Federal and County roads. If drivers have the option, this chart will be helpful in assisting them in choosing the safest routes for their trips.
- Speed at Impact (6.2, C224) Impact speeds below 61 MPH are generally over-represented for SVNFCs. SVNFCs are significantly over-represented at slower impact speeds, with 31 to 55 being highly significant. Above 61 MPH, it becomes clear that speed is a major problem. Several analyses over the past decade have found the general rule of thumb that for every 10 MPH increase in impact speeds, the probability of the crash being fatal doubles. Thus, the reduction in just 5-10 MPH impact speed will have a major reduction in fatalities. This was validated in the discussion below of the cross-tabulation of impact speeds by severity (Section 6.4). The recommendation here is to perform selective enforcement along with the various PI&E programs that go with it in other words, use whatever resources are available to bring about an overall speed reduction, and especially those speeds that are violating speed laws. At the same time, additional enforcement is essential to eliminate the other dangerous driver behaviors many of which are discussed in Section 8.

- Crash Severity (C025) by Impact Speed (6.3, C224). <u>for all Single Vehicle</u> <u>crashes</u>. This cross-tabulation gives an idea of the risks involved with increased speed on any of the highway classifications. The red backgrounds in the first column indicates those that had a relatively higher number of fatal crashes.
- Discussion of severity by Impact Speed (6.4. C025, C244). The speed to death relationship was further validated in the discussion of this cross-tabulation. This topic is given elaboration in Section 6.4, which is a discussion of the Probability of Being Killed crossed by Speed at Impact. The recommendation here is that the information of Section 6.4 be an essential part of the training in all traffic safety educational programs, and especially those involving younger drivers. Emphasize: to save lives, slow down to the speed limit and have all passengers fasten their seat belts. Each additional 10 MPH of speed doubles the probability of the crash being a fatality.
- Restraint Use by Drivers in Fatal Collisions (6.5, C323) Restraint use programs have been quite successful in Alabama. It is recommended that the financial support to these programs be increased to assure that their effectiveness will continue. In particular, special concentration needs to be given to convince all drivers of their additional vulnerability, and how severity might be abated by seatbelts when crashes occur. See Section 6.6 for more information on the effectiveness of restraints.
- Cross tabulation: Crash Severity (6.6, C025) by Restraint Use (C323) for All Injury Crashes. A comparison of the probability of a fatal crash indicates that a fatality in an injury crash is on average 8.0 times more likely if the involved occupants are not using proper restraints (see text under the cross-tabulation in Section 6.6). This multiplier would increase as speeds of impact increase. Because current restraint-use programs are quite effective, consideration should be given to increase their funding to make them even more universally effective. Restraint effectiveness information should be part of all traffic safety educational programs, and consideration should be given to increasing the fines of having unrestrained passengers.
- Number of Vehicles Involved (6.7, C052) not relevant, since all subsets were strictly single-vehicle crashes.
- Police Arrival Delay (6.8, C036) Police response times to SVFCs were greater than 20 minutes in 39% of the SVFC police runs. There can be little doubt that this has to do with the large proportion of these that were located in rural areas. The shorter police responses would generally be expected in those responses to crashes in the urban areas.
- EMS Arrival Delay (6.9, C039) Probably because of (1) the severity of the crashes (all being fatal for the test column), (2) the swiftness/urgency in getting called, and (3) the urgency in getting to the scene, much shorter delay times were

recorded than that of the police delays. Generally, we can conclude that very few of the fatalities were caused by excessive EMS delays, since the SVFC frequencies drop off rapidly after 30 minutes. It is recognized that first responders are currently doing an excellent job in getting to the scene of the crash as quickly as possible without jeopardizing safety. Delays, if any, are usually caused by a failure to report the crash immediately. Recommendation: PI&E programs should promote quicker notification to EMS and law enforcement.

• 1.7 Driver and Vehicle Demographics (7.0)

- Driver Age Range 2 (7.1, C106) –A comparison of SVFC causal driver age with those of the SVNFCs shows the most under-represented in the SVFCs are in 16-40 years of age, while the most over-represented SVFC causal driver ages are 51-90 years of age. Although not over-represented, it is clear from the chart that ages 16-45 have a relatively high proportion of SVFCs. It is recommended that, to the extent possible, the PI&E efforts focus on drivers of all ages.
- Crash Driver Gender (7.2, C109) the breakdown in SVFC causal drivers is 65.47% male and 17.23% female. For SVNFC cashes, the percentage is 57.43% male and 25.97% female. These gender differences certainly indicate that males are a greater cause of the fatalities in Single Vehicle Crashes (as they are in most crash types), and the recommendation is that, if there are countermeasures that can be directed toward males, this would be much more cost-effective than those directed equally toward all drivers.
- Cross-tabulation of Driver Gender (7.2, C109) by Speed at Impact (7.3, C224) for <u>All Single Vehicle Fatal Crashes</u>. To get better insight into the reason for male drivers causing more fatal crashes, this analysis shows that males had impact speeds in excess of the 70 MPH in 23.01% of their Single Vehicle Fatal crashes, while comparable speeds for females was about 15.93%. Thus, all of the recommendations for speed reduction apply much more to males than to females.
- Causal Unit (Vehicle) Type (7.4, C101) This analysis was based on a comparison of SVFC Causal Unit Type against the same for SVNFCs. Pedestrians (12.74%, 304) and Pick Ups (18.73%, 447) were significantly overrepresented in SVFCs. The proportion of Sport Utility Vehicles (16.90%, 391) and Passenger Cars (34.85%, 806) resulted in their placement at the bottom of the list, indicating that they were (in this case significantly) under-represented in SVFCs despite their high frequency numbers (reason: the SVNFC frequencies were even greater). Motorcycles also had a high frequency (160), but there were no significant differences in their proportions of SVFCs and SVNFCs, so they were not considered to be significantly over- or under-represented. It is recommended that countermeasure programs that are currently in effect be continued and augmented to emphasize the special issues with the vehicle types

noted above have in Single Vehicle crashes. Pedestrian programs should include warnings against Impaired Walking (walking along the roadway after the use of alcohol or other drugs), and the many other errors addressed in most pedestrian safety programs. Pedestrian fatalities are statistically significantly over-represented in the SVFCs, indicating that more emphasis might be warranted for divided and four-lane roadways. Additional pedestrian fatality study is warranted; see Section 7.5 below.

- Number of Pedestrians (7.5, C058) Single Vehicle Fatal pedestrian crashes occur at a proportion of over three (3.151) times greater than their Single Vehicle Non-Fatal proportion. A total, including multiple pedestrians, of 491 pedestrians were involved in fatal crashes. Single pedestrian fatalities numbered 459. This is consistent with what has been found in most pedestrian studies. Both ID (Impaired Driving) and Impaired Walking, contribute to this, as well as pedestrians not taking the maximum means for being seen at all times, but especially at night. Wearing reflective clothing, and keeping a flashlight lit to be seen of vehicle drivers are two of the most important recommendations since lack of visibility was cited for several pedestrian fatal crashes. Both day and night visibility needs to be emphasized in the lower school grades and continued through the young adult years. Additional pedestrian recommendations are in: http://www.safehomealabama.gov/wp-content/uploads/2023/05/Ped-SS-Using-2018-22-Data-v04.pdf
- Driver License Status (7.6, C114) SVFCs were under-represented in their causal drivers having legitimate licenses by a significant Odds Ratio of 0.817* (with a proportion of about 22.40% lower than the corresponding SVNFC proportion). Revoked, Suspended, and Expired were all similarly over-represented for SVFCs, Revoked significantly so. This would lead us to believe that many of those who caused these fatal crashes are often not operating within the law. It is recommended that special attention be given to all drivers in single-vehicle crashes, and that punitive actions be taken where warranted.
- Driver Employment Status (7.7, C120) This analysis indicated that the employment rate for the SVFCs was about 62.70%, while that for SVNFCs was 76.77%. Lower-than-average employment rates are not surprising because of the underlying drug/alcohol root cause of many fatal crashes (see Sections 8.3-8.4). The correlation between not having a job and being involved in a fatal crash should be watched carefully going forward in that it could affect the type and location of countermeasures. It is also recommended that research be performed to determine if there are some incentives that could be implemented in conjunction with unemployment payments.
- 1.8 Driver Behavior (8.0)
 - Primary Contributing Circumstances PCC (8.1 and 8.2, C015) Driver behaviors that are correlated with Single Vehicle Fatal crashes might provide alternatives

for countermeasure development. Those behaviors that were over-represented in SVFCs are given below with their SVFC and SVNFC percentages:

	SVFCs PCC Overrepresented	SVFCs %	SVNFCs %
0	Over Speed Limit 370	18.89%**	9.34%
0	Improper Crossing (pedestrian) 164	8.37%**	1.80%
0	Aggressive Operation 207	10.57%**	5.03%
0	DUI (aka ID) 298	15.21%	10.49%
0	Not Visible (most often pedestrian) 47	2.40%**	0.042%
0	Failed to Yield the Right-of-Way 39	1.99%**	0.36%
0	Lying/Sitting in Roadway (Pedestrian) 20	1.02*%**	0.09%
0	Pedestrian Under the Influence 20	1.02%**	0.27%
0	Improper Lane Change/Use 50	2.55%*	1.80%
0	Ran off Road 242	12.35%	11.98%
0	Other Failed to Yield 11	0.56%	0.34%
0	Other Improper Action 20	1.02%	1.50%
0	Unseen object/Person/Vehicle 90	4.59%	5.27%
0	Over Correcting/Over Steering 67	3.42%	4.35%
0	Driving too Fast for Conditions 128	6.53%	12.68%*
0	Fatigued/Asleep 67	3.42%	9.43%*

Recommendation: That these behaviors be given special attention for enforcement, especially those that are in violation of state laws.

- CU Officer's Opinion Impaired Driving CU Officer's Opinion Impaired Driving Alcohol (8.3-8.4, C122-C123). We saw ample evidence for fatal crashes being caused by Impaired Driving (ID) in the time of day and day of the week attributes. The two ID attributes (C122 and C123) indicate the degree that ID was involved in fatal crashes. For alcohol, the proportion of ID fatal crashes was 1.783 times as many for SVFCs as for SVNFCs. For drugs this multiplier was close to this at 2.006. It is quite clear that ID dramatically increases the probability of the crash resulting in a fatality. Recommended countermeasures to reduce both ID types are:
 - Perform additional ID enforcement at locations determined by Single Vehicle hotspot analysis as well as general ID hotspot analysis.
 - Mandate breath-alcohol ignition interlock devices for all convicted of ID.
 - Perform an in-depth study to determine if problems exist within the current programs, e.g., how the use of interlock devices can be expanded to be made more generally effective.
 - Since the presence of drugs/alcohol often do not reach the reporting threshold, especially in cases involving prescription drugs, continue officer training to produce more accurate reporting, especially for non-alcohol drugs.
 - 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 36-55-year-old over-representation of predominantly *problem users* (see 7.1 for driver ages).

- Combinations of recreational or medical drugs and alcohol can be particularly lethal, and medical practitioners should warn against such problems and discourage all alcohol and additional drug use for their patients who have indicated either of these combinations, or who are taking other prescription drugs.
- Provide additional publicity on the fact that legalized recreational drugs are not a good alternative to alcohol use. The advertising as such should be outlawed. PI&E programs should take the opposite approach to warn drivers that legalization does not relax their responsibilities.

2.0 Filter and IMPACT Set-ups

Generally, the analyses performed in this study used IMPACT (See Section 2.1) to compare Single Vehicle Fatal Crashes (SVFCs) against Single Vehicle Non-Fatal Crashes (SVNFCs) over a 5-year time period (FY2018-2022). The objective was to determine all significant differences between attributes within these two subsets of data in order to get an improved understanding as to the fatality crash causes (who, what, where, when, how, causal driver demographics, etc.). This is accomplished by pinpointing common factors that could be used to address any major inconsistencies between these two subsets of crash data. The findings that are presented should be taken into consideration when optimizing the large variety of countermeasures that exist to reduce both crash frequency and severity for Single Vehicles.

Sections 2 and 3 of this report contain information that will be useful in obtaining a high level orientation toward the IMPACT results that follow (in Sections 4-8). This introduction will consist of: (2.1) Introduction to IMPACT, (2.2) Definitions of Filters Used, (2.3) Example IMPACT: Day of the Week, and (3.0) Annual Fatal Crashes by Severity. Section 3 presents another IMPACT example for purposes of further orientation.

2.1 Introduction to IMPACT

The findings of Sections 4.0-8.0 are in displays of comparisons for the various attributes that might have an influence on crash, and especially fatal crash, countermeasure development. The CARE analytical technique employed to generate these comparisons is called Information Mining Performance Analysis Control Technique (IMPACT). Unless otherwise indicated in the IMPACT "Order" box, the outputs will be listed in the order of highest *Max Gain* first. *Max Gain* is a term that CARE users have assigned to indicate the number of crashes that would be reduced if the respective attribute proportion was not over-represented (i.e., had an Odds Ratio of 1.000). An *over-represented* value of an attribute is a situation found where that attribute has a greater share (proportion) of crashes in the Single Vehicle (SVFCs) than would be expected from that given in the SVNFCs. Similarly, an *under-represented* value of an attribute is a situation found where that attribute has a smaller share of crashes than what would be expected.

IMPACT will display comparisons of SVFCs against their SVNFC counterparts. In summary, the SVNFC Crashes are serving as a control to which the SVFCs are being compared. In this way any inconsistencies related to the SVFCs surfaces, and this can be subjected to further analyses. For a detailed description of the meaning of each element of the IMPACT outputs, see: <u>http://www.caps.ua.edu/software/care/</u>

The IMPACT analyses are grouped as follow in Sections: 4. Geographical and Harmful Events, 5. Time, 6. Severity, 7. Demographics, and 8. Driver Behavior.

2.2 Filter Definitions for the SVFC IMPACT Analyses

The IMPACT analyses will compare Single Vehicle Fatal Crashes (SVFCs) vs Single Vehicle Non-Fatal Crashes (SVNFCs). The standard filter for all fatal crashes based on C025 Crash Severity was applied, and separate filters for the SVFCs and SVNFCs were obtained, as exemplified in the displays below. The formal definitions for these two filters are given below:

Formal Definition of Single Vehicle Fatal Crashes (SVFCs)

Filter Logic: Single Vehicle Fatal Crashes (SVFCs) -								
Logic Tree Logic Text								
 All of the following are true (AND) 2018-2022 Alabama Integrated eCrash Crash Data: Crash Severity is equal to Fatal Injury One or more of the following are true (OR) 2018-2022 Alabama Integrated eCrash Crash Data: Number of Vehicles is equal to 1 V 	/ehicle							
2386 records selected by this filter.								

In plain English, the above indicates that all of the *test* crashes to be compared by IMPACT have the following characteristics:

- 1. They must all be fatal crashes;
- 2. They must all be Single Vehicle crashes.

2,386 Crashes Qualified as SVFCs for FY2018-2022

CARE 10.2	1.3 - [Crosstab Result	s - 2018-2022 Alaban	na Integrated eC	rash Cra	sh Data - Fil	ter = Single	/ehicle Fatal	I C —		\times
🚦 <u>F</u> ile <u>D</u> a	shboard <u>F</u> ilters	<u>A</u> nalysis <u>C</u> rosstab	<u>L</u> ocations	<u>T</u> ools	<u>W</u> indow	<u>H</u> elp			-	₽×
2018-20	22 Alabama Integrated e	eCrash Crash Data	\sim	Single	e Vehicle Fata	al Crashes (SV	FCs)		$\sim $	12
Suppress Zero	Values: Rows and Co	lumns 🗸 Select (Cells: 🔳 🔻 %	9	С	Column: Crash	Severity ; R	low: Numbe	r of Vehicles	s 🙋
	Fatal Injury	TOTAL								
1 Vehicle	2386	2386								
TOTAL	2386	2386								

Formal Definition of Single Vehicle Non-Fatal Crashes (SVNFCs)

Filter Logic: Single Vehicle Non-Fatal Crashes (SVNFCs) - 🗆 🗙									
Logic Tree	Logic Text								
All of the follow One or mor One or m	ving are true (AND) re of the following are t 2022 Alabama Integrate re of the following are t 2022 Alabama Integrate 2022 Alabama Integrate 2022 Alabama Integrate	rue (OR) ed eCrash Crash Data: Number of Vehicles is equa rue (OR) ed eCrash Crash Data: Crash Severity is equal to S ed eCrash Crash Data: Crash Severity is equal to S ed eCrash Crash Data: Crash Severity is equal to F	il to 1 Vehicle Juspected Serie Juspected Mine Possible Injury	ous Injury or Injury	,				
43586 records selec	ted by this filter.								

In plain English, the above indicates that all of the <u>control</u> (Other) crashes to be compared by IMPACT have the following characteristics:

- 1. They must all be non-fatal *injury* crashes;
- 2. They must all be Single Vehicle Crashes.
- 3. Note that Property Damage Only crashes are not in this subset. Rationale: better contrasts in the IMPACT comparisons will be obtained by disallowing them.

43,586 Crashes Qualified as SVNFCs in FY2018-2022.

🔋 CARE 10.	🔋 CARE 10.2.1.3 - [Crosstab Results - 2018-2022 Alabama Integrated eCrash Crash Data - Filter = Single Vehicle Non-F — 🛛 🛛 🗙									
🔋 <u>F</u> ile 🛽	ashboard <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	-	. 🗗 🗙			
2018-2	022 Alabama Integrated (eCrash Crash Data	\sim	Single Vehicle No	n-Fatal Crashes (SVNFCs)	~ 9	12			
Suppress Zer	Suppress Zero Values: Rows and Columns 🗸 Select Cells: 🗐 🗸 🥳 Column: Crash Severity ; Row: Number of Vehicles 👰									
	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	TOTAL						
1 Vehicle	10232	20800	12554	43586						
TOTAL	10232	20800	12554	43586						

The IMPACT analyses in Section 4-8 below will compare the 2,386 SVFCs with the corresponding attributes of the 43,586 SVNFCs in order to pinpoint the attributes that are most likely to be causing the fatal crashes of Single Vehicles

The following provide reasons for selecting SVFCs as the *test subset* and SVNFCs as the *control subset* (called "Other" in the IMPACTs):

- To determine what causes fatal crashes, the fatal crashes have to be compared against non-fatal crashes.
- The test subset was all single-vehicle fatal crashes.
- The control subset was all single-vehicle non-fatal crashes.

Note the filter of this IMPACT is SVFCs and the comparative "Other" subset is SVNFCs (also called the *control* subset). These comparisons are different from most IMPACT analyses CAPS has done in the past, because here both the Subset crashes and the "Other" crashes consist only of Single Vehicle crashes. Thus, they are quite comparable to each other.

2.3 Highway Classification (4.6, C011); Comparison of SVFCs and SVNFCs

🖡 CA	CARE 10.2.1.3 - [IMPACT Results - 2018-2022 Alabama Integrated eCrash Crash Data - Single Vehicle Fatal Crashes (SVFCs) vs. Single Ve 🛛 🗙												
E E	le <u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	Impact Loca	ations <u>T</u> ools	Window	<u>H</u> elp					- 8	×
6 2	2018-2022 Alabama	a Integrate	d eCrash Crash	Data	∼ Si	ingle Vehicle Fa	atal Crashes (SV	/FCs)	~ 9	12	1/ 1/20	18 🗸 13	2/31
Order	Max Gain	~ D	escending	✓ Ø Si	uppress Zero-Va	alued Rows	Signi	ficance: Over F	Representation	∼ Thr	eshold:	2.0	÷
C011:	Highway Classific	cations	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C007: Week of C008: Time of	the Year Day			^
	State		544	22.80	8296	19.03	1.198*	89.857	C010: Rural or	Urban			
	Federal		291	12.20	4067	9.33	1.307*	68.363	C011: Highway	/ Classifi	cations		
	County		827	34.66	14411	33.06	1.048	38.108	C012: Controll C013: E Highy	ed Acces /av Side	s		
	Interstate		275	11.53	5254	12.05	0.956	-12.616	C015: Primary	Contribu	ting Circ	umstand	c
	Private Property		15	0.63	804	1.84	0.341	-29.013	C016: Primary	Contribu	ting Unit	Numbe	••
	Municipal		434	18.19	10754	24.67	0.737*	-154.699	Sort by Sum o	f Max Gai	n		
00) 🗞 🖉											Disp	lay
	40 20 0		State	Federal	C011: His	phway Classifie	nterstate	Private Property	y Municipal				
					C011:	Highway Class	ifications						

Reminder: SVFCs=Single Vehicle Fatalities=**Red bars**; SVNFCs=Single Vehicle Non-Fatal=**Blue bars**.

In this IMPACT display, as well of those in Sections 4 through 8, the Subset (given by the red bars) is the Single Vehicle Fatal Crashes (SVFCs). The "Other" crashes are those that were Single Vehicle Non-Fatal Crashes (SVNFCs). This IMPACT (and those below) will use both of the filters defined above to compare the SVFCs directly with the SVNFCs. The above shows that State and Federal highway classifications are significantly over-represented in SVFCs. Municipal is significantly under-represented. The SVFC filter will be used to define the "Subset," while SVNFC filter will define the "Other," which is mainly used as a control.

This IMPACT result will be given additional discussion in Section 4.6.

3.0 Fatal to Non-Fatal Crash Comparison by Year



SVFCs vs SVNFCs by Year

Quick reminder: SVFCs= Single Vehicle Fatal=**Red bars**; SVNFCs=Single Vehicle Non-Fatal=**Blue bars**.

This is an example that further demonstrate the IMPACT displays. The only year that has a statistically significant differences between the fatal and non-fatal crashes is 2022. None of the other results for years (2018-2021) show statistically significant differences.

Statistically significant results for a given attribute are indicated by an asterisk (*) that will appear on the Odds Ratio for the attribute value under consideration.

See Section 5.1 for additional comments on changes by year.

4.0 Geographic and Harmful Event Factors

4.1 C001 County SVFCs vs SVNFCs (top 11 counties) ordered by Max Gain

🚦 CA	ARE 10.2.1.3 - [IMPACT Result	ts - 2018-2022	Alabama Int	egrated eCras	h Crash Data -	Single Vehicl	le Fatal Crashes (S	SVFCs) vs. Single Ve — 🗆 🗙
🖡 E	ile <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact <u>L</u> o	cations <u>T</u> oo	ols <u>W</u> indow	<u>H</u> elp		_ @ ×
6	2018-2022 Alabama Integrated	l eCrash Crash	Data	\sim	Single Vehicle	Fatal Crashes ((SVFCs)	✓ ♥ 1/ 1/2018 ∨ 12/31
Order	: Max Gain 🗸 De	escending	~ 🖂	Suppress Zero	-Valued Rows	Sig	gnificance: Over	Representation V Threshold: 2.0 🛓
C001	County	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max 🚽 ^	C001: County C002: City
•	Limestone	64	2.68	814	1.87	1.436*	19.440	C003: Year
	Dallas	41	1.72	405	0.93	1.849*	18.829	C004: Month
	Dekalb	46	1.93	584	1.34	1.439*	14.030	C005: Day of the Week
	Montgomery	112	4.69	1810	4.15	1.130	12.916	C007: Week of the Year
	Butler	29	1.22	301	0.69	1.760*	12.523	C008: Time of Day
	Walker	57	2.39	828	1.90	1.258	11.673	C010: Rural or Urban
	Blount	42	1.76	558	1.28	1.375	11.454	C011: Highway Classifications
	Franklin	25	1.05	263	0.60	1.736*	10.603	C013: E Highway Side
	Talladega	60	2.51	923	2.12	1.187	9.473	C015: Primary Contributing Circumstance
	Lawrence	27	1.13	325	0.75	1.518	9.209	C016: Primary Contributing Unit Numbe
	Bullock	19	0.80	179	0.41	1.939	9.201 🗸	Sort by Sum of Max Gain
1) 😪 🖉							🗸 Display
	2018-2022 Alabama Ir	ntegrated eCra	sh Crash Data	- Filter = Singl	e Vehicle Fatal C001: County	Crashes (SVF	FCs) vs. Single Veł	hicle Non-Fatal Crashes (SVNFCs)
		nlhanai	Inftenti Chilt	Dana Perio n		Russ	Nullean sell	Lee

Each line of table above gives both SVFC and SVNFC crashes. So, Limestone, at the top. had 64 Single Vehicle Fatal Crashes (SVFCs) and 814 Single Vehicle Non-Fatal Crashes (SVNFCs). Their proportions (2.68% and 1.87%) are used to obtain the Odds Ratio of 1.436, which has an asterisk showing that the differences between these proportions is statistically significant. These proportions are calculated from the attribute (Limestone) frequency divided by the total number of crashes in each column. The Max Gain (19.440) is the number of Single Vehicle Fatal Crashes (SVFCs) that would be reduced if the 2.68% was reduced to 1.87%. The above display has been arranged in highest Max Gain order to indicate the counties that have the highest potential for gain in reducing their SVFC proportions to their SVNFC proportions. The display above contains all of the counties with Max Gains greater than 9.000.

4.2 C002 Cities (top	(11) with Highest	Max Gains (Rural	Areas = Virtual Cities)
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🖡 CA	RE 10.2.1.3 - [IMPACT Result	ts - 2018-2022	Alabama Inte	grated eCrash	Crash Data - S	ingle Vehic	le Fatal Crashes (SV	(FCs) vs. Single Vehicl — 🗆 🗙
🖡 Ei	le <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u>	mpact <u>L</u> oc	ations <u>T</u> ool	s <u>W</u> indow	<u>H</u> elp		
¢°	2018-2022 Alabama Integrated	l eCrash Crash I	Data	~	Single Vehicle F	atal Crashes	(SVFCs)	✓ ♥ 1/ 1/2018 ∨ 12/31/2
Order	Max Gain V De	escending	✓ □ Si	uppress Zero-\	/alued Rows	[Significance: Over	Representation V Threshold: 2.0 主
C002:	City value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max - ^	C001: County A C002: City
•	Rural Mobile	84	3.52	898	2.06	1.709	34.838	C003: Year
	Rural Limestone	50	2.10	596	1.37	1.532	2* 17.371	C004: Month
	Rural Dallas	33	1.38	292	0.67	2.064	↓* 17.014	C005: Day of month C006: Day of the Week
	Rural Dekalb	37	1.55	379	0.87	1.783	3* 16.251	C007: Week of the Year
	Rural Blount	37	1.55	419	0.96	1.613	8* 14.061	C008: Time of Day
	Rural Butler	25	1.05	220	0.50	2.076	5* 12.956	C010: Rural or Urban
	Rural St. Clair	39	1.63	503	1.15	1.41	6 11.463	C011: Highway Classifications
	Rural Walker	47	1.97	652	1.50	1.31	7 11.306	C013: E Highway Side
	Rural Montgomery	33	1.38	413	0.95	1.46	0 10.390	C015: Primary Contributing Circumstance
	Rural Lawrence	26	1.09	300	0.69	1.58	3 9.576	C016: Primary Contributing Unit Numbe
	Rural Talladega	42	1.76	621	1.42	1.23	5 8.003 🗸	Sort by Sum of Max Gain
00) 💱 🖉							🖓 Display Fil
	2018-2022 Alabama	Integrated eCra	ish Crash Data	- Filter = Single	e Vehicle Fatal	Crashes (SV	/FCs) vs. Single Vehi	icle Non-Eatal Crashes (SVNECs)
	Loto Lote Augusta	integrated core		i intoi – oinigii	C002: City	0100100 (01	in ooy to: oingio toin	
	6							
	4							
	2							
		للبيباله	dh.			admaal + maaning		
				Castleberry	/		Sum	nmerdale
				-	C002:	Citv		

For comparison purposes, the rural areas of counties are considered to be "virtual cities," and crashes that occur there are listed as "Rural [County Name]" so that these crashes can be effectively accounted for and compared.

The high rural areas are generally adjacent to (or partially contain) significant urban areas that have a high traffic density. This display is in Max Gain ordering to put those (possibly virtual) cities that have the highest potential for Single Vehicle Fatal Crash (SVFC) reduction at the top. The display is for all Max Gains > 7. It is no surprise that the rural areas have relatively more fatal crashes than their urban city counterparts, as will be shown in the next attribute below. The five highest (virtual) cities are: Rural Mobile 84, Rural Limestone 50, Rural Dallas 33, Rural Dekalb 37, Rural Blount 37, Rural Butler 25, Rural St Clair 39, Rural Walker 47, Rural Montgomery 33, Rural Lawrence 26 and Rural Talladega 42.

4.3 C010 Rural or Urban



The Single Vehicle Fatal Crashes (SVFCs) had 62.41% of their fatal crashes in rural areas, while this percentage was also high at 52.52% for Rural SVNFCs. The SVNFCs were also highly urban, with 47.48% of their crashes in the urban areas. Both results illustrate how lethal rural crashes generally are, as compared to urban roadways. This is attributed to the comparative speed at impact on the rural roads. Speed will be considered again in Section 6.2, C224 Speed at Impact. Speed not only can cause a crash, but it also dramatically increases its severity (see Section 4.4 below).

4.4 C033 Locale

🚦 CA	ARE 10.2.1.3 - [IMPACT	Results - 2018-20	22 Alabama	Integrated	eCrash C	rash Data - Sir	ngle Vehicle Fa	atal Crashes (SV	/FCs) vs. Single Vehicl	- 0	Х
🖡 Ei	ile <u>D</u> ashboard <u>F</u> ilt	ters <u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools	<u>W</u> indow	<u>H</u> elp				_ 8 ×
6	2018-2022 Alabama Inte	grated eCrash Cras	sh Data	\sim	Sin	gle Vehicle Fat	al Crashes (SVI	FCs)	~ 💡 😨	1/ 1/2018	~ 12/31/2
Order	: Max Gain 🗸 🗸	Descending	~	Suppress	a Zero-Val	ued Rows	Sig	nificance: Over	r Representation \sim	Threshold:	2.0
C033	Locale	Sub Frequer	set Subs ncy Perce	et nt Fr	Other equency	Other Percent	Odds Ratio	Max Gain	C031: Lighting Con C032: Weather	ditions	^
▶	Open Country	16	618	67.81	26142	59.98	1.131	186.926	C033: Locale		
	Manufacturing or Indust	rial	43	1.80	645	1.48	1.218	3 7.691	C034: E Police Pres	sent at Time o cation Delay	fCrast
	Other		22	0.92	406	0.93	0.990	-0.225	C036: Police Arrival	Delay	
	School		7	0.29	328	0.75	0.390	-10.955	C037: EMS Arrival D	Delay	
	Shopping or Business		320	13.41	6257	14.36	0.934	-22.523	C038: Adjusted EM	S Arrival Delay	~
	Residential		376	15.76	9802	22.49	0.701	-160.584	Sort by Sum of Max	Gain	
0	à 🐼 🖉									\checkmark	Display Fil
	2018-2022 Alai	oama Integrated e	Crash Crash	Data - Filter	= Single \ (/ehicle Fatal C C033: Locale	rashes (SVFCs	s) vs. Single Veh	icle Non-Fatal Crashes (SVNFCs)	
	80 60 40 20 0	Open Country	Manufacturi	ng Play	Iground	Other	Schoo	I Shoppi	ng or ess		

Open Country showed significant differences between SVFCs and SVNFCs. The SVFC proportion for Open Country was 67.81%, and its Odds Ratio was 1.131. Residential and Shopping or Business were significantly under-represented, although both had high frequencies (320 for Shopping or Business and 376 for Residential). But the proportions for these were considerably lower than those of their corresponding SVNFCs. This demonstrates a significantly larger proportion of Open Country in the urban roadway system. The two factors that contribute to the Open Country results are its being proximal to urban areas that increase the traffic flow, and the greater speeds on the rural roads that increase the number of fatalities.

4.5 C033 Locale by C010 Rural-Urban for SVFCs

It is obvious in the above outputs that SVFCs are greatly over-represented in the Rural and Open Country areas. It is interesting to perform a cross-tabulation for Locale over the Rural and Urban areas to further define this relationship. The following, *which is only for <u>SVFCs</u>*, gives one such analysis.

CARE 10.2.1.3	- [Crosstab Results	- 2018-2022 Alabai	ma Integrated eCra	sh Crash Data - Filt	er = Single Vehicle	Fatal Crashes (SVFC:	5)] -	- 🗆 X					
🚦 <u>F</u> ile <u>D</u> ash	board <u>F</u> ilters <u>/</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 ×					
2018-2022	2018-2022 Alabama Integrated eCrash Crash Data V Single Vehicle Fatal Crashes (SVFCs) V 💡 😨 1/ 1/2018 V 12/31/2022												
Suppress Zero Va	Suppress Zero Values: None Select Cells: 🔹 🧭 🍞 Column: Locale ; Row: Rural or Urban 👰												
	Open Country	Residential	Shopping or Business	Manufacturing or Industrial	School	Playground	Other	TOTAL					
Dural	1349	108	22	4	1	0	5	1489					
Kurai	83.37%	28.72%	6.88%	9.30%	14.29%	0.00%	22.73%	62.41%					
Ultra	269	268	298	39	6	0	17	897					
Urban	16.63%	71.28%	93.13%	90.70%	85.71%	0.00%	77.27%	37.59%					
тоти	1618	376	320	43	7	0	22	2386					
TOTAL	67.81%	15.76%	13.41%	1.80%	0.29%	0.00%	0.92%	100.00%					

The red-backed cells in the cross-tabulation above indicate over-representation by more than 10%. Those that are over-represented, but by less than 10% would have a yellow background. If under-represented, there will be a white background. For example, while 37.59% of all SVFCs were Urban, 71.28% (268) occurred at the Residential Locale. Since this is greater than a 10% difference, it has a red background.

This shows that the Rural/Urban attribute may not be as definitive as is Locale in categorizing crash locations by general environmental factors.



4.6 C011 Highway Classifications

This display was introduced in Section 2.3, but little was said of it countermeasure ramifications. Clearly State (544 frequency) routes have the largest number of Single Vehicle Fatal Crashes (SVFCs). The second and third are Federal (291) and County (827), both of which are also overrepresented. Interstates (with fewer single vehicle crashes) had only 275, with a lower Odds Ratio of 0.956. While significantly under-represented (0.737*) from its proportion point of view, Municipal had a large frequency (434).

4.7	C019	Most	Harmful	Event	(>10]	in Ma	xGain	order)
	UU1 /	111000			(or acr,

🔋 C/	ARE 10.2.1.3 - [IMPACT Results - 2018-202	2 Alabama lı	ntegrated eC	Crash Crash [)ata - Single	Vehicle Fata	l Crashes (S	VFCs) AND Not E M 🗆 🗙
E E	ile <u>D</u> ashboard <u>F</u> ilters <u>A</u> nalysis	<u>Impact</u>	ocations	<u>T</u> ools <u>W</u> i	ndow <u>H</u> e	lp		_ & ×
6	2018-2022 Alabama Integrated eCrash Crash	n Data	\sim	Single Ve	hicle Fatal Cr	ashes (SVFC:	s)	✓ ♥ 1/ 1/2018 ∨ 12/31
Order	: Max Gain 🗸 Descending	~ 2] Suppress Z	ero-Valued R	lows	Signific	ance: Over	Representation V Threshold: 2.0
C019	E Most Harmful Event	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain -	C019: E Most Harmful Event
•	Collision with Non-Motorist: Pedestrian	309	13.53	2357	5.99	2.261*	172.322	
	Collision with Tree	675	29.57	8835	22.44	1.318*	162.673	
	Collision with Vehicle in Traffic	176	7.71	965	2.45	3.145*	120.041	
	Fire/Explosion	54	2.37	183	0.46	5.089*	43.388	
	Collision with Railway Vehicle/Train	21	0.92	91	0.23	3.980*	15.723	
	Immersion	14	0.61	29	0.07	8.325	12.318	
	Collision with Bridge Support/Column	13	0.57	82	0.21	2.734	8.245	
	Collision with Non-Motorist: Pedalcycle	37	1.62	566	1.44	1.127	4.179	
	Collision with Light Pole (Non-Breakaway)	21	0.92	298	0.76	1.215	3.719	
	Collision with Other Post/Pole/Support	14	0.61	222	0.56	1.088	1.127	
	Collision with Other Non-Fixed Object	17	0.74	283	0.72	1.036	0.589	
	Fell/Jumped from Motor Vehicle	17	0.74	367	0.93	0.799	-4.282	
	Overtum/Rollover	528	23.13	9219	23.42	0.988	-6.594	
	Collision with Culvert Headwall	53	2.32	1085	2.76	0.842	-9.917	
	Collision with Fence	13	0.57	422	1.07	0.531	-11.471	
	Collision with Guardrail Face	21	0.92	888	2.26	0.408*	-30.494	
	Collision with Other Fixed Object	43	1.88	1338	3.40	0.554*	-34.588	
	Collision with Embankment	35	1.53	1203	3.06	0.502*	-34.760	
	Ran Off Road Left	21	0.92	981	2.49	0.369*	-35.887	
	Collision with Concrete Barrier	20	0.88	1230	3.12	0.280*	-51.326	
	Ran Off Road Right	24	1.05	1494	3.79	0.277*	-62.635	
	Collision with Utility Pole	88	3.85	2694	6.84	0.563*	-68.221	
	Collision with Ditch	69	3.02	4197	10.66	0.284*	-174.377	Sort by Sum of Max Gain
	a 😪 🖉							Display F
			2018-2022 A	labama Integ	rated eCrash	Crash Data		
			C	019: E Most I	Harmful Even	t		
	40							
	8							
	§ 20							
	L							
	0	-				Mar Nam		
	Colli Railway	sion with Vehicle/Train	C	ollision with Othe ost/Pole/Suppor	er t	Collision with	Fence	Collision with Concrete Barrier
				C019: E	Most Harmful	Event		

The display above is intended to show safety engineers the most predominant obstacles that are over-represented in Fatal Single Vehicle Crashes. The most over-represented SVFC is Collision with Non-Motorist Pedestrian 309, Collision with Tree 675, Collision with Vehicle in Traffic 176, and Fire/Explosion 54. The statistical algorithm does not consider items with frequencies less than 20, so there could be other significant differences. At the bottom of the table it can be seen that for SVNFC over-representations, Collisions with Utility Pole 88 and Collisions with Ditch 69. For more details on Pedestrian crashes, please see Section 7.5.



4.8 C407 CU Roadway Curvature and Grade

SVFCs are over-represented in the vast majority of curve types. OVER-REPRESENTED SVFCs with the highest frequencies: Curve Left and Level 241, Curve Right and Down Grade 129, Straight with Down Grade 256, and Curve Right and Level 144.

5.0 Time Factors

5.1 C003 Year – copied from Section 3.0 for ease of reference

Single Vehicle Fatal Crashes (SVFCs) vs Single Vehicle Non-Fatal Crashes (SVNFCs)



Variations from year to year were not significant in any years except 2022. SVFCs were underrepresented in 2018 and 2019, but they became over-represented in 2020-2022. The reason for these increased SVFC proportions is not definitive, but this consistent increase should be watched to determine a cause in future years.

5.2 C004 Month

🚦 CA	ARE 10.2.1.3 - [IMPACT Re	esults - 2018-2022	Alabama Integ	grated eCrash	Crash Data - S	Single Vehicle	Fatal Crashes	(SVFCs) vs. Single V — 🗆 🗙
🚦 Ei	ile <u>D</u> ashboard <u>F</u> ilte	rs <u>A</u> nalysis <u>I</u>	mpact <u>L</u> oca	ations <u>T</u> ool	ls <u>W</u> indow	<u>H</u> elp		_ 8 >
6	2018-2022 Alabama Integr	ated eCrash Crash I	Data	~	Single Vehicle F	atal Crashes (S	VFCs)	✓ ♥ 〒 1/ 1/2018 ∨ 12/
Order	Max Gain	Descending		unnergan Zere V	Valued Paura	Cinnif	opposi Over	
Under.		Descending		uppress zero-	valueu nows	Signin		
C004:	Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County A C002: City
•	January	183	7.67	3390	7.78	0.986	-2.577	C003: Year
	February	176	7.38	3277	7.52	0.981	-3.391	C004: Month
	March	194	8.13	3532	8.10	1.003	0.650	C005: Day of Month
	April	190	7.96	3476	7.98	0.999	-0.284	C007: Week of the Year
	May	201	8.42	3911	8.97	0.939	-13.097	C008: Time of Day
	June	201	8.42	3722	8.54	0.986	-2.751	C010: Rural or Urban
	July	213	8.93	3776	8.66	1.030	6.293	C011: Highway Classifications
	August	180	7.54	3892	8.93	0.845	-33.057	C012: Controlled Access
	September	201	8.42	3585	8.23	1.024	4.749	C015: Primary Contributing Circumstance
	October	240	10.06	3873	8.89	1.132	27.983	C016: Primary Contributing Unit Numbe
	November	205	8.59	3476	7.98	1.077	14.716	C017: First Harmful Event
	December	202	8.47	3676	8.43	1.004	0.767	Sort by Sum of Max Gain
00	è 🕼 🖉							🖂 Displa
	2018-2022 Alabam	a Integrated eCras	h Crash Data - F	Filter = Single \	Vehicle Fatal C	rashes (SVFCs) vs. Single Ve	hicle Non-Fatal Crashes (SVNFCs)
					C004: Month		,	
					CCC1. Monar			
	15							
	20							
Ι,	Lea							
	5							
	0	February	Apri		June	Augus	st	October December
		robradiy	, (pri		C004: Mon	th		Boombon

The ordering of the displays above is according to the natural ordering of months. None of the months had statistically significant over-representations or under-representations. SVFC months generally fell in line with their SVNFC counterparts. The largest over-representation was in October, which had an Odds Ratio of 1.132, which was relatively large, but not large enough to qualify as statistically significant. The collective over-representations of September, October, November and December collectively could qualify.

5.3 C006 Day of the Week Comparison SVFCs and SVNFCs



The above presents Days of the Week with significant over-representations displayed. Sunday was the only day with a significant SVFC. Friday and Saturday were also over-represented, but not to the point of it being statistically significant. These are the days of the week that are over-represented in ID (DUI alcohol and drugs). All of the other days of the week were under-represented in SVFCs (thus over-represented in SVNCs).

5.4 Day of the Week Discussion [covered above.]

Also, relevant Day of the Week information is given in Section 5.6.

5.5 C008 Time of Day

🖡 CA	RE 10.2.1.3 - [IMPACT Result	ts - 2018-2022	Alabama Inte	grated eCrash	Crash Data - S	Single Vehicle I	Fatal Crashes	(SVFCs) vs. Single V — 🗆 🗙
Ei	e <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u>	mpact <u>L</u> oc	ations <u>T</u> ool	s <u>W</u> indow	<u>H</u> elp		_ & ×
6 2	2018-2022 Alabama Integrated	l eCrash Crash I	Data	~	Single Vehicle F	atal Crashes (S\	VFCs)	✓ ♥ 1/ 1/2018 ∨ 12/3
Order:	Max Gain 🗸 De	scending	~ 🗆 S	uppress Zero-\	/alued Rows	Signifi	cance: Over	Representation V Threshold: 2.0 🚖
C008:	Time of Day	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County A C002: City
•	12:00 Midnight to 12:59 AM	128	5.36	1409	3.23	1.659*	50.868	C003: Year
	1:00 AM to 1:59 AM	110	4.61	1297	2.98	1.549*	38.999	C004: Month
	2:00 AM to 2:59 AM	91	3.81	1186	2.72	1.402*	26.076	C006: Day of the Week
	3:00 AM to 3:59 AM	87	3.65	1049	2.41	1.515*	29.575	C007: Week of the Year
	4:00 AM to 4:59 AM	77	3.23	1054	2.42	1.335*	19.302	C008: Time of Day
	5:00 AM to 5:59 AM	97	4.07	1468	3.37	1.207	16.638	C010: Rural or Urban
	6:00 AM to 6:59 AM	93	3.90	1694	3.89	1.003	0.266	C011: Highway Classifications
	7:00 AM to 7:59 AM	68	2.85	1914	4.39	0.649*	-36.777	C013: E Highway Side
	8:00 AM to 8:59 AM	56	2.35	1573	3.61	0.650*	-30.110	C015: Primary Contributing Circumstance
	9:00 AM to 9:59 AM	40	1.68	1523	3.49	0.480*	-43.373	C016: Primary Contributing Unit Numbe
	10:00 AM to 10:59 AM	47	1.97	1714	3.93	0.501*	-46.828	C017: First Harmful Event
	11:00 AM to 11:59 AM	50	2.10	1765	4.05	0.517*	-46.620	C019: E Most Harmful Event
	12:00 Noon to 12:59 PM	77	3.23	1961	4.50	0.717*	-30.350	C020: E Distracted Driving Opinion
	1:00 PM to 1:59 PM	92	3.86	2063	4.73	0.815	-20.933	C021: Distance to Fixed Object
	2:00 PM to 2:59 PM	111	4.65	2205	5.06	0.920	-9.707	C022: E Type of Roadway Junction/Featu
	3:00 PM to 3:59 PM	102	4.27	2513	5.77	0.741*	-35.568	C023: E Manner of Crash
	4:00 PM to 4:59 PM	105	4.40	2339	5.37	0.820	-23.042	C025: Crash Severity
	5:00 PM to 5:59 PM	129	5.41	2541	5.83	0.927	-10.100	C026: Intersection Related
	6:00 PM to 6:59 PM	139	5.83	2386	5.47	1.064	8.385	C027: At Intersection
	7:00 PM to 7:59 PM	141	5.91	2258	5.18	1.141	17.392	C028: Mileposted Route
	8:00 PM to 8:59 PM	144	6.04	2125	4.88	1.238*	27.673	C029: National Highway System
	9:00 PM to 9:59 PM	161	6.75	2044	4.69	1.439*	49.107	C030. Functional Class
	10:00 PM to 10:59 PM	130	5.45	1843	4.23	1.289*	29.110	C032: Weather
	11:00 PM to 11:59 PM	103	4.32	1616	3.71	1.164	14.536	C033: Locale
	Unknown	8	0.34	46	0.11	3.177	5.482	Sort by Sum of Max Gain
0	i 😪 🖉							🖂 Display
	2018-2022 Alabama Int	tegrated eCrasl	h Crash Data -	Filter = Single \	/ehicle Fatal C	rashes (SVFCs) vs. Single Ve	hicle Non-Fatal Crashes (SVNFCs)
				CO	08: Time of Da	y		
	8—							
	2 ⁶							
	4		Lml					
8								
		:00 AM to 4:6	9 AM 9-1	0 AM to 9.5	9 AM 2·0	0 PM to 2:59	PM 7.00	PM to 7:59 PM
	4		3 ANI 3.1	55 ANI 10 5.5	C008: Time c	of Dav	7.00	FINITE 7.55 FINI ORIKIOWI
								· · · · · · · · · · · · · · · · · · ·

5.6 C008 Discussion on Time of Day by Day of the Week

Refer to the Day of the Week by Time of Day cross-tabulation <u>for all fatal crashes</u> given immediately below in Section 5.7. The over-representation of night-time hours and weekend days is further confirmation of the correlation of this attribute with that of Impaired Driving (ID, DUI alcohol and/or non-alcohol drugs). It is no surprise to find Fatal Crashes over-represented during the late night/early morning hours, since their other correlations with aspects of Impaired Driving (ID) and pedestrian collisions are clear. The following narrative was developed with regard to a special study that was done for ID. We include it here because of its relevance to the comparison of SVFCs to SVNFCs.

Typical traffic patterns of high traffic results on more crashes in the morning and afternoon rush hours. However, IDs, and especially the IDs that occur at night, are just getting started in the afternoon rush hours, and they continue to grow through midnight and the early morning hours, often not tapering off until about 7:00 AM the next day. It is clear that if selective enforcement is going to have an effect on Fatal Crashes, it would have to be conducted at the times when these crashes are most occurring. Optimal times that start with Friday enforcement would continue immediately following any rush hour details, and would continue through at least 8:00 AM the following Saturday or Sunday.

The *Time of Day by Day of the Week* cross-tabulation (given in the next section *for all fatal crashes* (not subdivided by SVFCs and SVNFCs) shows the optimal times for Single Vehicle selective enforcement on all roadways. <u>Generally</u>, the highest proportion of times in any day are given in red for that day. Notice that this works well for Friday Nights, Saturday mornings, Saturday nights, and Sunday mornings.

The expected proportion for all cells in a given row is given at the extreme right in the total row percentage column for each row. If there were absolutely no over-representations across the columns (days), then all of the proportions for those cells would be identical to the one for the total.

Cells that are lower than the average value (given in the TOTAL column) have a neutral (white) background. Those that are higher, but not more than 10% of the proportion are yellow; and those above 10% more than that expected from the TOTAL (right column) are red.

For example, the 2 AM to 2:59 AM row has a total percentage value of 3.8[\]% for these fatal crashes. The red cells to the left have percentages of 4.95^{\%} (Sunday) and 6.36^{\%} (Saturday). The yellow cell has a percentage of 3.95^{\%}, which is more than 3.81^{\%} but less than 10^{\%} more than the average. All the rest of the cells have white background indicating that their percentages are less than 3.81^{\%}.

CARE 10.2.1.3	- [Crosstab Results	s - 2018-2022 Alabai	ma Integrated eCra	sh Crash Data - Filt	er = Single Vehicle I	Fatal Crashes (SVFC	s)]	
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			
2018-2022 A	Nabama Integrated e	eCrash Crash Data	~	Single Vehicle Fatal	Crashes (SVFCs)	~	Y 1/ 1	/2018 ~ 12/31/20
Suppress Zero Val	lues: None	 ✓ Select 	Cells: 🔳 🛛 🚳	9		Column	: Day of the Week ; F	low: Time of Day [
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
12:00 Midnight to	33	16	10	10	9	15	35	128
12:59 AM	7.78%	5.57%	3.51%	3.52%	2.88%	4.24%	7.95%	5.36%
1:00 AM to 1:59 AM	35	13	12	10	2.24%	12	21 4 77%	110
2:00 AM to 2:59	21	4.55%	4.21%	3.52%	2.24%	14		91
AM	4.95%	3.14%	1.75%	2.46%	2.24%	3.95%	6.36%	3.81%
3:00 AM to 3:59	26	9	5	10	11	11	15	87
AM	6.13%	3.14%	1.75%	3.52%	3.53%	3.11%	3.41%	3.65%
4:00 AM to 4:59	20	8	11	9	9	7	13	77
	4./2%	2./9%	3.86%	3.17%	2.88%	1.98%	2.95%	3.23%
5:00 AM to 5:59 AM	16 3.77%	2 79%	4.56%	4.23%	14	4.80%	1/	9/
6:00 AM to 6:59	3.77%	12	4.00%	4.23%	4.43%	4.00%	20	4.07%
AM	3.54%	4,18%	4.21%	3.87%	3.85%	3.11%	4.55%	3.90%
7:00 AM to 7:59	18	5	8	9	11	9	8	68
AM	4.25%	1.74%	2.81%	3.17%	3.53%	2.54%	1.82%	2.85%
8:00 AM to 8:59	9	8	12	8	1	7	11	56
AM	2.12%	2.79%	4.21%	2.82%	0.32%	1.98%	2.50%	2.35%
00 AM to 9:59	7	5	7	5	9	7	0	40
AM	1.65%	1.74%	2.46%	1.76%	2.88%	1.98%	0.00%	1.68%
10:00 AM to 10:59	3	2 44%	6	2 40%	5	8	11	4/
11.00 AM to 11.50	0.71%	2.44 %	2.11%	2.46 %	1.60 %	2.26%	2.50 %	1.97 %
AM 6 11.55	1 42%	2 79%	2 11%	2 11%	2.56%	1.69%	2 27%	2 10%
12:00 Noon to	9	12	18	6	8	12	12	77
12:59 PM	2.12%	4.18%	6.32%	2.11%	2.56%	3.39%	2.73%	3.23%
1:00 PM to 1:59	16	12	13	15	15	15	6	92
PM	3.77%	4.18%	4.56%	5.28%	4.81%	4.24%	1.36%	3.86%
2:00 PM to 2:59	19	10	12	11	23	15	21	111
PM	4.48%	3.48%	4.21%	3.87%	7.37%	4.24%	4.77%	4.65%
3:00 PM to 3:59 PM	12	11	1/	10	16	19	1/	102
4:00 PM to 4:59	2.03%	19	0.00%	3.52%	0.13%	15	3.00%	4.27%
PM	3.07%	6.62%	5.26%	8 45%	2.88%	4.24%	2.27%	4 40%
5:00 PM to 5:59	21	13	19	23	22	14	17	129
PM	4.95%	4.53%	6.67%	8.10%	7.05%	3.95%	3.86%	5.41%
6:00 PM to 6:59	26	18	22	19	16	11	27	139
РМ	6.13%	6.27%	7.72%	6.69%	5.13%	3.11%	6.14%	5.83%
7:00 PM to 7:59	31	16	15	9	27	24	19	141
0.00 DM to 0.50	7.31%	5.5/%	5.26%	3.1/%	8.65%	6./8%	4.32%	5.91%
PM	∠1 4.95%	5.92%	6.67%	7.75%	18 5.77%	6.21%	20 5.68%	6.04%
9:00 PM to 9:59	21	15	9	22	21	36	37	161
PM	4.95%	5.23%	3.16%	7.75%	6.73%	10.17%	8.41%	6.75%
10:00 PM to 10:59	16	18	11	11	18	24	32	130
PM	3.77%	6.27%	3.86%	3.87%	5.77%	6.78%	7.27%	5.45%
11:00 PM to 11:59	9	17	7	8	15	22	25	103
PM	2.12%	5.92%	2.46%	2.82%	4.81%	6.21%	5.68%	4.32%
Unknown	1	1	1	0	1	1	3	8
	0.24%	0.35%	0.35%	0.00%	0.32%	0.28%	0.68%	0.34%
TOTAL	424	12 03%	280	284	312	304 14.84%	440 18.44%	2386
	11.1170	12.03%	11.347/6	11.30%	10.00%	17.04%	10.44 /6	100.00%

5.7 C008 Time of Day x C005 Day of the Week for SVFCs

6.0 Factors Affecting Severity

CARE 10.2.1.3	- [Crosstab Results	- 2018-2022 Alabar	ma Integrated eCra	sh Crash Data - Fil	ter = Single Vehicle]		_		×		
🔋 <u>F</u> ile <u>D</u> ashb	ooard <u>F</u> ilters <u>/</u>	<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 >		
2018-2022 /	Alabama Integrated e	Crash Crash Data	~	Single Vehicle		~	? 1/ 1	/2018 ∨	12/31/		
Suppress Zero Values: Rows and Columns 🗸 Select Cells: 🔹 🔀 😪 Column: Highway Classifications ; Row: Crash Severity 👰											
	Interstate	Federal	State	County	Municipal	Private Property	TOTAL				
Estal Jainer	275	291	544	827	434	15	2386	1			
Fatal injury	0.99%	1.95%	1.92%	1.70%	1.11%	0.41%	1.47%	1			
Suspected	1031	1032	2265	3911	1893	100	10232	1			
Serious Injury	3.73%	6.93%	8.00%	8.06%	4.84%	2.76%	6.31%	1			
Suspected Minor	2467	1879	3810	7048	5204	392	20800	1			
Injury	8.92%	12.62%	13.45%	14.52%	13.32%	10.81%	12.83%	1			
Describle Island	1756	1156	2221	3452	3657	312	12554	1			
Possible injury	6.35%	7.76%	7.84%	7.11%	9.36%	8.60%	7.74%	1			
Property Damage	21669	10210	18632	31530	25782	2624	110447	1			
Only	78.33%	68.57%	65.78%	64.97%	65.97%	72.35%	68.13%	1			
University	465	321	853	1765	2111	184	5699	1			
Unknown	1.68%	2.16%	3.01%	3.64%	5.40%	5.07%	3.52%	1			
τοτοι	27663	14889	28325	48533	39081	3627	162118	1			
TOTAL	17.06%	9.18%	17.47%	29.94%	24.11%	2.24%	100.00%				

6.1 C011 Highway Classification by C025 Severity (Single Vehicle crashes)

Notice that the basis for this cross-tabulation is <u>all 162,118 Single Vehicle crashes</u>, for all <u>severities</u>, not just fatal crashes. Fatal Single Vehicle Crashes only would restrict this output to just the top row. This does verify the results presented for fatal Single Vehicle crashes in Section 4.6, but it also shows comparable results for the lesser severities for all of the Highway Classifications.

🚦 CA	RE 10.2.1.3 - [IMPACT Result	ts - 2018-2022 A	labama Integr	ated eCrash C	rash Data - Sir	igle Vehicle Fata	al Crashes (SV	FCs) vs. Single Vehic — 🗆 🗙
Ei Ei	le <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> n	npact <u>L</u> ocat	tions <u>T</u> ools	<u>W</u> indow	<u>H</u> elp		_ & ×
6	2018-2022 Alabama Integrated	l eCrash Crash D	ata 🗸	Sin	igle Vehicle Fat	al Crashes (SVFC	s)	✓ ♥ 〒 1/ 1/2018 ∨ 12/31/2
Order:	Max Gain 🗸 De	escending	✓ ✓ Sup	opress Zero-Va	lued Rows	Signifi	icance: Over	Representation V Threshold: 2.0
C224:	CU Estimated Speed at Imp	pact Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C220: CU Oversized Load Requiring Pe
•	1 to 5 MPH	5	0.21	325	0.75	0.281	-12.791	C222: CU Contributing Vehicle Defect
	6 to 10 MPH	6	0.25	290	0.67	0.378	-9.875	C223: CU Speed Limit
	11 to 15 MPH	5	0.21	340	0.78	0.269	-13.612	C224: CU Estimated Speed at Impact
	16 to 20 MPH	3	0.13	410	0.94	0.134	-19.444	C226: CU Vehicle Damage
	21 to 25 MPH	13	0.54	603	1.38	0.394	-20.010	C227: CU Vehicle Towed
	26 to 30 MPH	25	1.05	852	1.95	0.536*	-21.640	C230: CU Areas Damaged #1
	31 to 35 MPH	25	1.05	1619	3.71	0.282*	-63.628	C231: E CU Areas Damaged #2
	36 to 40 MPH	36	1.51	1912	4.39	0.344*	-68.667	C232: E CU Areas Damaged #3
	41 to 45 MPH	115	4.82	4833	11.09	0.435*	-149.570	C301: CU Non-Motorist Prior Action
	46 to 50 MPH	71	2.98	2528	5.80	0.513*	-67.389	C303: E CU K-12 Child W/C To/From Sc
	51 to 55 MPH	187	7.84	5149	11.81	0.663*	-94.868	C304: E CU Non-Motorist Action at Time
	56 to 60 MPH	147	6.16	2771	6.36	0.969	-4.691	C305: E CU Non-Motorist Action at Time
	61 to 65 MPH	183	7.67	2760	6.33	1.211*	31.911	C306: CU Non-Motorist Location at Time
	66 to 70 MPH	202	8.47	2746	6.30	1.344*	51.678	C308: CU Non-Motorist Condition
	71 to 75 MPH	102	4.27	735	1.69	2.535*	61.764	C309: CU Non-Motorist Officer Opinion A
	76 to 80 MPH	111	4.65	600	1.38	3.379*	78.155	C310: CU Non-Motorist Officer Opinion [
	81 to 85 MPH	44	1.84	205	0.47	3.921*	32.778	C311: CU Non-Motorist Most Harmful Ev
	86 to 90 MPH	51	2.14	180	0.41	5.176*	41.146	C321. CO Driver/Non-Motorist Seating P
	91 to 95 MPH	14	0.59	40	0.09	6.394	11.810	C323: CU Driver/Non-Motorist Safety Equ
	96 to 100 MPH	57	2.39	104	0.24	10.012*	51.307	C324: CU Driver Airbag Status
	Over 100 MPH	31	1.30	70	0.16	8.090*	27.168	C325: CU Driver/Non-Motorist Age
	E Stationary	4	0.17	48	0.11	1.522	1.372	C326: CU Driver/Non-Motorist Gender
	Unknown	540	22.63	11610	26.64	0.850*	-95.559	C328: CU Driver/Non-Motorist Injury Type
	Not Applicable	27	1.13	647	1.48	0.762	-8.418	C329: CU Driver/Non-Motorist First Aid B
	CU is Not a Vehicle	321	13.45	1492	3.42	3.930*	239.324	C330: CU Driver/Non-Motorist Transport
	CU is Unknown	61	2.56	717	1.65	1.554*	21.750	C331: E CU Driver/Non-Motorist Transport
11 0	· • • • •	· · · · · · · · · · · · · · · · · · ·						Display Fi
	2018-2022 Alabama	Integrated eCras	h Crash Data -	Filter = Single \ C224: CU Es	/ehicle Fatal Cr timated Speed	ashes (SVFCs) at Impact	vs. Single Vehi	cle Non-Fatal Crashes (SVNFCs)
L	20 0	16 to 20 MB			66 to	70 MPH	91 to 05	
				C.224	CU Estimated 9	Speed at Impact	0.1000	

6.2 SVFCs vs SVNFCs for C224 Speed at Impact

Generally, the travel speeds at roads that have the most Single Vehicle Crashes have speed limits of 45 MPH or lower, and it is these speeds that are over-represented for the SVNFCs, as are speeds up to 60 MPH. Speeds of 61 and above are over-represented in fatal crashes (SVFCs), and the Odds Ratios generally increase systematically with these increases in speed.

6.3 Cross-tab: C025 Severity by C224 Speed at Impact (Single Vehicle crashes)

CARE 10.2.1.3	- [Crosstab Results	- 2018-2022 Alaba	ama Integrated eCra	ash Crash Data - Filt	er = Single Vehicle]		_	
File Dashb	ooard <u>Filters</u>	<u>A</u> nalysis <u>C</u> rosst	ab <u>L</u> ocations	<u>T</u> ools <u>W</u> indow	<u>H</u> elp			_ & ×
2018-2022	Alabama Integrated e	Crash Crash Data	~	Single Vehicle		~	7 1/ 1	/2018 ~ 12/31/
Suppress Zero Val	lues: Rows and Col	umns 🗸 Selec	t Cells: 🔳 🗸 🔀	9	Column: Cr	ash Severity ; Row	: CU Estimated Spee	d at Impact 👔
	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL	
1 to 5 MPH	5 0.21%	61 0.60%	165 0.79%	99 0.79%	1370 1.24%	50 0.88%	1750 1.08%	
6 to 10 MPH	6 0.25%	44 0.43%	129 0.62%	117 0.93%	1316 1.19%	33 0.58%	1645 1.01%	
11 to 15 MPH	5 0.21%	58 0.57%	175 0.84%	107 0.85%	1325 1.20%	33 0.58%	1703 1.05%	
16 to 20 MPH	3 0.13%	51 0.50%	195 0.94%	164 1.31%	1604 1.45%	36 0.63%	2053 1.27%	
21 to 25 MPH	13 0.54%	108 1.06%	308 1.48%	187 1.49%	2483 2.25%	78 1.37%	3177 1.96%	
26 to 30 MPH	25 1.05%	128 1.25%	450 2.16%	274 2.18%	3035 2.75%	74 1.30%	3986 2.46%	
31 to 35 MPH	25 1.05%	278 2.72%	822 3.95%	519 4.13%	5263 4.77%	178 3.12%	7085 4.37%	
36 to 40 MPH	36 1.51%	362 3.54%	970 4.66%	580 4.62%	5643 5.11%	138 2.42%	7729 4.77%	
41 to 45 MPH	115 4.82%	1091 10.66%	2479 11.92%	1263 10.06%	12617 11.42%	236 4.14%	17801 10.98%	
46 to 50 MPH	71 2.98%	577 5.64%	1243 5.98%	708 5.64%	6065 5.49%	135 2.37%	8799 5.43%	
51 to 55 MPH	187 7.84%	1388 13.57%	2508 12.06%	1253 9.98%	11504 10.42%	189 3.32%	17029 10.50%	
56 to 60 MPH	147 6.16%	815 7.97%	1329 6.39%	627 4.99%	5256 4.76%	114 2.00%	8288 5.11%	
61 to 65 MPH	183 7.67%	841 8.22%	1288 6.19%	631 5.03%	6685 6.05%	106 1.86%	9734 6.00%	
66 to 70 MPH	202 8.47%	840 8.21%	1217 5.85%	689 5.49%	8657 7.84%	80 1.40%	11685 7.21%	
71 to 75 MPH	102 4.27%	265 2.59%	327 1.57%	143 1.14%	1680 1.52%	26 0.46%	2543 1.57%	
76 to 80 MPH	111 4.65%	238 2.33%	242 1.16%	120 0.96%	848 0.77%	24 0.42%	1583 0.98%	
81 to 85 MPH	44 1.84%	100 0.98%	73 0.35%	32 0.25%	214 0.19%	3 0.05%	466 0.29%	
86 to 90 MPH	51 2.14%	88 0.86%	63 0.30%	29 0.23%	152 0.14%	5 0.09%	388 0.24%	
91 to 95 MPH	14 0.59%	20 0.20%	14 0.07%	6 0.05%	25 0.02%	4 0.07%	83 0.05%	
96 to 100 MPH	57 2.39%	60 0.59%	29 0.14%	15 0.12%	77 0.07%	7 0.12%	245 0.15%	
Over 100 MPH	31 1.30%	26 0.25%	24 0.12%	20 0.16%	63 0.06%	3 0.05%	167 0.10%	
E Stationary	4 0.17%	7 0.07%	23 0.11%	18 0.14%	335 0.30%	17 0.30%	404 0.25%	
Unknown	540 22.63%	2029 19.83%	5407 26.00%	4174 33.25%	29299 26.53%	3430 60.19%	44879 27.68%	
Not Applicable	27 1.13%	103 1.01%	320 1.54%	224 1.78%	2217 2.01%	289 5.07%	3180 1.96%	
CU is Not a Vehicle	321 13.45%	526 5.14%	662 3.18%	304 2.42%	173 0.16%	60 1.05%	2046 1.26%	
CU is Unknown	61 2.56%	128 1.25%	338 1.63%	251 2.00%	2541 2.30%	351 6.16%	3670 2.26%	
TOTAL	2386 1.47%	10232 6.31%	20800 12.83%	12554 7.74%	110447 68.13%	5699 3.52%	162118 100.00%	

6.4 Dicussion: C025 Probability of being killed x C224 Speed at Impact

The display above presents information on the effect of increased impact speed on the severity of <u>all crashes</u>. Notice the red in the Fatality and Serious Injury cells as speeds increase. What is more interesting is the probability that an injury crash results in a fatality as a function of impact speed. This is given in the following table using 31-35 MPH as the base speed for the third column, which is the fatality probability multiplier from this base as the speeds increase.

Speed at Impact	Fatality Odds (1 in)	Increase Probability above 31-35
31 to 35 MPH	283.4	1
36 to 40 MPH	214.7	1.3
41 to 45 MPH	154.8	1.8
46 to 50 MPH	123.9	2.3
51 to 55 MPH	91.1	3.1
56 to 60 MPH	56.4	5.0
61 to 65 MPH	53.2	5.3
66 to 70 MPH	57.8	4.9
71 to 75 MPH	24.9	11.4
76 to 80 MPH	14.3	19.9
81 to 85 MPH	10.6	26.8
86 to 90 MPH	7.6	37.3
91 to 95 MPH	5.9	47.8
96 to 100 MPH	4.3	65.9
Over 100 MPH	5.4	*

The last column of the above table gives the fatality probability multiplier based on the lowest probability (31-35 MPH), to which was assigned a <u>relative value</u> of 1.0 (not a probability). The probabilities in the form of "**1 in X**" are given in the middle column. For example, the probability of a crash at 46-50 MPH being fatal is one in 123.9. This is 2.3 times that probability if the impact speed were in the 31 to 35 range, as given in the third column. Speeds 100 and over had too few occurrences to be reliable estimates, and it is assigned an asterisk (*).

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 is fatal. On average, the reduction in impact speeds by 10 MPH cut the number of fatal crashes in half. This is one reason that selective enforcement is effective – even officer presence generally causes some speed reduction. However, there is another major factor in effect here as well – the failure of SVFC and SVNFC drivers to be properly restrained, which will be covered in the next separate attribute below (6.5; Restraint Use by Causal Drivers in Fatal Collisions). This is also correlated with Impaired Driving because Impaired Drivers have been found to have a much lower restraint use than those not impaired

6.5 C323 Restraint Use by Drivers in Single SVFCs vs SVNFCs

The following display presents a restraint-use comparison of SVFCs driver safety belt use compared to that for all drivers in SVNFCs, over the same five-year time period.

CA	CARE 10.2.1.3 - [IMPACT Results - 2018-2022 Alabama Integrated eCrash Crash Data - Single Vehicle Fatal Crashes (SVFCs) vs. Single Vehic												
E E	ile <u>D</u> ashboard <u>F</u> ilters <u>A</u> na	lysis <u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>\</u>	<u>N</u> indow <u>I</u>	<u>H</u> elp		_ & ×					
6 2	2018-2022 Alabama Integrated eCras	h Crash Data	~	Single	Vehicle Fatal	Crashes (SV	/FCs)	✓ ♥ 〒 1/ 1/2018 ∨ 12/31/2					
Order	∵ Max Gain	ing ~	Suppress	Zero-Valued	d Rows	Sig	nificance: Ov	er Representation V Threshold: 2.0					
C323	: CU Driver/Non-Motorist Safety E	quipment Subset	Subset	Other Frequency	Other Percent	Odds Ratio	Max _ /	C310: CU Non-Motorist Officer Opinion [
•	None Used - Motor Vehicle Occupa	nt 1026	43.00	7687	17.64	2.438*	605.196	C321: CU Driver/Non-Motorist Seating P					
	Not Applicable	323	13.54	1658	3.80	3.559*	232.237	C322: CU Driver/Non-Motorist Victim/Oc					
	CU is Unknown	61	2.56	717	1.65	1.554*	21.750	C323: CU Driver/Non-Motorist Safety Equ					
	Dot-Compliant Motorcycle Helmet Us	ed 113	4.74	1753	4.02	1.178	17.037	C325: CU Driver/Non-Motorist Age					
	No Motorcycle Helmet Used	18	0.75	140	0.32	2.349	10.336	C326: CU Driver/Non-Motorist Gender					
	Unknown	192	8.05	3333	7.65	1.052	9.544	C327: CU Driver Ejection Status					
	E Other Motorcycle Helmet Used	13	0.54	101	0.23	2.351	7.471	C328: CU Driver/Non-Motorist Injury Type					
	Other	6	0.25	68	0.16	1.612	2.278	C330: CU Driver/Non-Motorist Transport					
	E CU Driver Not Recorded	11	0.46	173	0.40	1.162	1.530	C331: E CU Driver/Non-Motorist Transpo					
	E Helmet Used	14	0.59	234	0.54	1.093	1.190	C401: E CU Involved Road/Bridge					
	E Lighting Used by Non-Motorist	1	0.04	7	0.02	2.610	0.617	C402: E CU Road Surface Type					
	Reflective Clothing (Jacket/Backpa	ck) 1	0.04	13	0.03	1.405	0.288	C403: CO Roadway Condition					
	Lap Belt Only Used	2	0.08	77	0.18	0.474	-2.215	C405: CU Contributing Material in Road					
	E CU Non-Motorist Not Recorded	9	0.38	207	0.47	0.794	-2.332	C406: CU Contributing Material Source					
	Shoulder Belt Only Used	2	0.08	84	0.19	0.435	-2.598	C407: CU Roadway Curvature and Grad					
L	Shoulder and Lap Belt Used	594	24.90	27308	62.65	0.397*	-900.904	Sort by Sum of Max Gain					
00	a 🐼 🖉							🗹 Display Fi					
	2018-2022 Alabama Integra	ted eCrash Crash	Data - Filter	= Single Vehi	cle Fatal Cra	shes (SVFC	s) vs. Single Ve	shicle Non-Fatal Crashes (SVNFCs)					
			C323: CI	J Driver/Non	-Motorist Saf	ety Equipme	nt						
	80												
	> 60												
	С 00 на 10												
	^{LL} 20												
	0	N. M.											
		No Motorcy	Cie Helmet	Used	E New York	: Helmet Us	sed	Shoulder Belt Unly Used					
<u>н</u>			C34	 CU Driver 	/ivon-motoris	a patery Fon	indment						

The proportion of failure to use proper restraints is 43.00% for Single Vehicle Fatal Crashes. The Odds Ratio is 2.438, showing that their failure to use restraint is well over twice that of the Non-Fatal Single Vehicle crashes. Shoulder and Lap Belt Used is over-represented by SVNFCs in about 62,65% (Odds Ratio 1/0.397 = 2.52 times the expected use in comparison to Fatal Single Vehicle Crash seatbelt usage). Clearly, not being restrained contributes heavily to the SVFC fatalities.

6.6 Crosstabulation: C025 Crash Severity x C323 Restraint Use (all injury)

CARE 10.2.1.3	- [Crosstab Results	; - 2018-2022 Alabar	ma Integrated eCra	sh Crash Data - Filt	ter = Injury Crashes	(including Fatalities)]	- 🗆	Х
File Dashb	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×
2018-2022 A	Nabama Integrated e	Crash Crash Data	\sim	Injury Crashes (inclu	uding Fatalities)	~ 💡	1/ 1/20	18 🗸 1
Suppress Zero Val	lues: Rows and Col	umns 🗸 Select	Cells: 🔳 🗸 🚿	Column:	: Crash Severity ; Ro	ow: CU Driver/Non-Motorist Sa	fety Equipment	
	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	TOTAL			
None Used - Motor Vehicle Oc	1596 36.51%	4412 21.75%	5240 8.69%	2510 3.91%	13758 9.23%	-		
Shoulder and Lap Belt Used	1581 36.16%	11626 57.32%	44825 74.34%	51783 80.69%	109815 73.64%	-		
Lap Belt Only Used	7	42	123	154	326	-		
Shoulder Belt Only Used	7	32	156	188	383	-		
E Forward Facing Child Safety Seat	0.00%	1	3	0	4			
E Rear Facing Child Safety Seat	0	0	0	3	3			
E Rear Facing Child Safety Seat	0 00%	0 00%	2	0.00%	2	-		
E Child in Arms of Restrained Adult	0	0	2	0	2	-		
Dot-Compliant Motorcycle Helme	201 4.60%	955 4 71%	1118 1.85%	351 0.55%	2625 1.76%	-		
E Helmet Used	18 0.41%	102 0.50%	177 0.29%	51 0.08%	348 0.23%	-		
E Protective Pads Used (Elbows/Kn	0 0.00%	1 0.00%	0	0	1			
Reflective Clothing (Jacket/B	1 0.02%	6 0.03%	7 0.01%	0	14 0.01%			
E Lighting Used by Non-Motorist	1 0.02%	3 0.01%	3 0.00%	2 0.00%	9 0.01%			
E Other Safety Equipment Used	1 0.02%	5 0.02%	10 0.02%	8 0.01%	24 0.02%			
E Other Motorcycle Helme	24 0.55%	69 0.34%	62 0.10%	13 0.02%	168 0.11%			
No Motorcycle Helmet Used	32 0.73%	111 0.55%	94 0.16%	26 0.04%	263 0.18%			
Other	9 0.21%	23 0.11%	56 0.09%	38 0.06%	126 0.08%			
Unknown	351 8.03%	1581 7.79%	4982 8.26%	5459 8.51%	12373 8.30%			
Not Applicable	385 8.81%	716 3.53%	1066 1.77%	546 0.85%	2713 1.82%	-		
CU is Unknown	116 2.65%	437 2.15%	1948 3.23%	2554 3.98%	5055 3.39%			
E CU Driver Not Recorded	32 0.73%	110 0.54%	340 0.56%	414 0.65%	896 0.60%			
E CU Non- Motorist Not Reco	10 0.23%	51 0.25%	86 0.14%	72 0.11%	219 0.15%			
TOTAL	4372 2.93%	20283 13.60%	60300 40.44%	64172 43.03%	149127 100.00%			

Calculations are based on <u>all injury</u> (including fatal) crashes.

Odds of death <u>not using</u> restraints = 13,758 fatal crashes/1,596 deaths = one in 8.6 injury crashes. Odds of death <u>using</u> restraints = 109,815 fatal crashes/1,581 deaths = one in 68.8 injury crashes. Risk of death is increased by an average factor of 8.0 when not using proper restraints.

6.7 C052 Number of Vehicles Involved (SVFCs vs SVNFCs)

All crashes under consideration in this study were single vehicle crashes.



6.8 C036 Police Arrival Delay (SVFCs vs SVNFCs)

SVFC police arrival delays reflect the issues in finding out about the crash and getting to the scene, especially at night. All but one of the delay times of 20 minutes or less were over-represented for SVNFCs with high Odds Ratios. SVFCs are over-represented in all delay times above 20 minutes, of which three were statistically significant. The analysis below shows how this correlates with EMS arrival times.



6.9 C038 Adjusted EMS Arrival Delay

There were no significant differences found in the ambulance delay times between the fatal and non-fatal single-vehicle crashes. However, the fact that over 45% had responses less than 10 minutes, and another 40% were between 11 and 30 minutes is quite commendable.

7.0 Driver and Vehicle Demographics

7.1 C106 Driver Age Range 2

CA	RE 10.2.1.3 - [IMPACT Result	s - 2018-2022 A	labama Integr	ated eCrash C	rash Data - Sin	gle Vehicle Fat	al Crashes (SV	FCs) vs. Single Vehic — 🗆 🗙
🖡 Ei	ile <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> m	npact <u>L</u> ocat	ions <u>T</u> ools	<u>W</u> indow	<u>H</u> elp		_ & ×
*	2018-2022 Alabama Integrated	eCrash Crash Da	ata ~	Sir	igle Vehicle Fata	l Crashes (SVFC	ls)	✓ ♥ 〒 1/ 1/2018 ∨ 12/31/2
Order	Natural Order V De	scending	🗸 🔽 Sup	press Zero-Va	lued Rows	Signif	icance: Over	Representation V Threshold: 2.0
C106:	CU Driver Age Range 2	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C060: Number Injured (Includes Fatalitie
•	6 to 10 Years	1	0.04	9	0.02	2.030	0.507	C062: Number of Railroad Trains
	11 to 15 Years	7	0.29	232	0.53	0.551	-5.700	C063: Has Railroad Crossing Number
	16 to 20 Years	224	9.39	7032	16.13	0.582*	-160.948	C080: CMV Involved
	21 to 25 Years	218	9.14	5992	13.75	0.665*	-110.016	C101: Causal Unit (CU) Type
	26 to 30 Years	216	9.05	4919	11.29	0.802*	-53.278	C102: CU Non-Motorist Indicator
	31 to 35 Years	206	8.63	4049	9.29	0.929	-15.652	C103: CU Commercial Motor Vehicle Inc
	36 to 40 Years	185	7.75	3408	7.82	0.992	-1.562	C104: CU Left Scene
	41 to 45 Years	165	6.92	2855	6.55	1.056	8.711	C105: CU Driver Age Range 1
	46 to 50 Years	126	5.28	2658	6.10	0.866	-19.505	C100: CO Driver Age Range 2
	51 to 55 Years	165	6.92	2331	5.35	1.293*	37.396	C108: CU Driver Race
	56 to 60 Years	146	6.12	2103	4.82	1.268*	30.877	C109: CU Driver Gender
	61 to 65 Years	118	4.95	1702	3.90	1.266*	24.829	C110: CU Driver Residence Distance
	66 to 70 Years	79	3.31	1234	2.83	1.169	11.448	C111: CU Driver License State
	71 to 75 Years	45	1.89	997	2.29	0.825	-9.578	C113: CU Driver Second License Class
	76 to 80 Years	32	1.34	527	1.21	1.109	3.151	C114: CU Driver License Status
	81 to 85 Years	22	0.92	269	0.62	1.494	7.274	C115: CU Driver CDL Status
	86 to 90 Years	12	0.50	136	0.31	1.612	4.555	C116: CU DL Restriction Violations #1
	91 to 95 Years	2	0.08	108 34		1.075	0.139	C118: CLI Endorsement Violations #1
	More than 95 Years	1	0.04	9	0.02	2.030	0.507	C119: E CU Endorsement Violations #2
	Unknown	34	1.42	840	1.93	0.739	-11.984	C120: E CU Driver Employment Status
	CU is Not a Vehicle	321	13.45	1492	3.42	3.930*	239.324	C121: CU Driver Condition
	CU is Unknown	61	2.56	717	1.65	1.554*	21.750	C122: CU Driver Officer Opinion Alcohol V
0) 😪 🖉							Display Fi
	2018-2022 Alabama Ir	ntegrated eCras	h Crash Data - I	Filter = Single \	/ehicle Fatal Cra	ashes (SVFCs)	vs. Single Vehi	cle Non-Fatal Crashes (SVNFCs)
				C106: Cl	J Driver Age Ra	nge 2		
	20							
		_						
	ک ¹⁵							
	툴 10		1					
	е 							
	0	26 to 20	Voarc	E1 to	55 Years	76 +-	80 Veero	Linknown
		201030	/ Toulo	C10)6: CU Driver A	de Rande 2	Jou reuis	CHRIDWIT

The table display above presents SVFCs compared to SVNFCs given in 5-year age increments. The significant under-representations in the 16-40 age groups probably occur because of the large numbers of SCNFCs in these age intervals. Above 40 years of age, the SVFCs are over-represented, showing that these ages have more than their share of fatal crashes.



7.2 C109 Driver Gender SVFCs vs SVNFCs

The male and female red and blue bar proportions each individually sum very close to 100%. So the breakdown in SVFCs causal drivers is 65.47% male and 17.23% female. For "Other," SVNFCs, the percentage is 57.43% male and 35.97% female. These differences in proportions certainly indicate that males are a greater cause of Single Vehicle Fatal Crashes (SVFCs) than crashes in general, although their proportion of causing crashes in general is quite high. If there are countermeasures that can be directed toward males, doing so would be much more cost-effective than those directed toward all drivers.

The highly significant over-representation in "CU is Not a Vehicle" is largely due to pedestrians being coded in this category. Obviously, pedestrians are not always the causal unit. For more definitive specifications, see Sections 7.4 and 7.5.

What makes women drivers so much safer in fatal crash comparisons? No doubt it has something to do with speed. See Section 7.3 immediately below.

CARE 10.2.1.3 - [Crosstab Results - 2018-2022 Alabama Integrated eCrash Crash Data - Filter = Single Vehicle Fatal Crashes (S												
File Dashl	board <u>F</u> ilters <u>/</u>	<u>A</u> nalysis <u>C</u> rosstal	b <u>L</u> ocations]	ools <u>W</u> indow	<u>H</u> elp		- ē	9 ×				
2018-2022	Alabama Integrated e	Crash Crash Data	~	Single Vehicle Fatal	Crashes (SVFCs)	~	9 1/ 1	1/201				
Suppress Zero Va	Ilues: Rows and Col	umns 🗸 Select	Cells: 🔳 🕶 %	Second Column	: CU Driver Gender	; Row: CU Estimated	Speed at Impact	Q				
	Male	Female	Unknown	Not Applicable	CU is Not a Vehicle	CU is Unknown	TOTAL	^				
6 to 10 MPH	5	1	0	0	0	0	6					
11 to 15 MPH	2	3	0	0	0	0	5					
16 to 20 MPH	2	1	0	0	0	0	3					
21 to 25 MPH	12	1	0	0	0	0	13					
26 to 30 MPH	20	5	0	0	0	0	25					
31 to 35 MPH	22	3	0	0	0	0	25					
36 to 40 MPH	26	10	0	0	0	0	36					
41 to 45 MPH	87	27	1	0	0	0	115					
46 to 50 MPH	59	12	0	0	0	0	71					
51 to 55 MPH	141	45	1	0	0	0	187					
56 to 60 MPH	109	37	1	0	0	0	147					
61 to 65 MPH	148	34	1	0	0	0	183					
66 to 70 MPH	160	42	0	0	0	0	202					
71 to 75 MPH	75	27	0	0	0	0	102					
76 to 80 MPH	94	17	0	0	0	0	111					
81 to 85 MPH	36	8	0	0	0	0	44					
86 to 90 MPH	42	9	0	0	0	0	51					
91 to 95 MPH	14	0	0	0	0	0	14					
96 to 100 MPH	49	8	0	0	0	0	57					
Over 100 MPH	26	5	0	0	0	0	31	~				

7.3 Cross-tab C109 Driver Gender x C224 Speed at Impact (all SVFCs)

Number and Percent males and females involved in fatal crashes over 75 MPH:

261 Male = 261/1134 = 23.01%

47 Female = 47/295 = 15.93%.

The proportion of male fatal crashes over 75 MPH is 44.46% higher than that of the females.



7.4 C101 Causal Vehicle Type (> 2 or more crashes) SVFCs vs SVNFCs

Pedestrians 304 and Pick Ups 447 were significantly over-represented SVFCs. The proportion of Sport Utility Vehicles (16.90%, 391) and Passenger Cars (34.85%, 806) resulted in their placement at the bottom of the list, indicating that they were (in this case significantly) under-represented in SVFCs. Motorcycle had a high frequency (160), but there were no significant differences in their proportions of SVFCs and SVNFCs.

See Section 7.5 for more information on Pedestrians.



7.5 C057 Number of Pedestrians

There were a total of 491 fatal crashes involving Pedestrians in Single Vehicle crashes. Most (459) of them were single pedestrian incidents.

Both ID and Impaired Walking, contribute to this, as well as pedestrians not taking the maximum provisions for being seen, especially at night.

For a nore detailed study of pedestrian crashes, please see: http://www.safehomealabama.gov/wp-content/uploads/2023/05/Ped-SS-Using-2018-22-Data-v04.pdf

7.6 C114 Driver License Status

SVFCs were under-represented in their causal drivers having legitimate licenses by a significant Odds Ratio of 0.817* (with a proportion of about 22.44% lower than the corresponding SVNFC proportion). Revoked, Suspended, and Expired were all over-represented as well, Revoked significantly so. This would lead us to believe that many of those who caused fatal crashes are often not operating within the law.

🚦 CARE 10.2.1.3 - [IMPACT Results - 2018-2022 Alabama Integrated eCrash Crash Data - Single Vehicle Fatal Crashes (SVFCs) vs. Single Ve... \times **Filters** File Dashboard <u>A</u>nalysis Tools Window <u>H</u>elp 8 Impact Locations × 2018-2022 Alabama Integrated eCrash Crash Data Single Vehicle Fatal Crashes (SVFCs) 12 1/ 1/2018 12/3Order: Max Gain Descending + Suppress Zero-Valued Rows Significance: Over Representation Threshold: 2.0 C120: ECU Driver Emplo nt Status Subset Subset Other Odds C117: CU DL Restriction Violations #2 Other Max equency Percent Frequency Percent Ratio Gain C118: CU Endorsement Violations #1 CU is Not a Vehicle 321 13.45 1492 3.42 3.930* 239.324 C119: E CU Endorsement Violations #2 C120: E CU Driver Employ ent Status 34.24 10803 24.79 1.382* 225.618 817 Unknown C121: CU Driver Condition CU is Unknown 61 2.56 717 1.65 1.554* 21.750 C122: CU Driver Officer Opinion Alcohol Self-Employed 79 3.31 1680 3.85 0.859 -12.967 C123: CU Driver Officer Opinion Drugs -23.375 Retired 101 4.23 2272 5.21 0.812 C124: CU Driver Alcohol Test Type Given C125: E CU Driver Drug Test Type Given Unemployed 356 14.92 8502 19.51 0.765* -109.419 Sort by Sum of Max Gain 651 27.28 18120 41.57 0.656* -340.931 Employed 📋 🕼 🚳 🖉 Display 2018-2022 Alabama Integrated eCrash Crash Data C120: E CU Driver Employment Status 60 40 Frequency 20 0 CU is Not Employed Unknown CU is Unknown Self-Employed Retired Unemployed a Vehicle C120: E CU Driver Employment Status

7.7 C120 Driver Employment Status

The following gives the proportion comparisons for SVFCs and SVNFCs, with overrepresentation indicated by (*):

Status	SVFCs	SVNFCs	ODDS RATIO
Retired	4.23%	5.21%	0.812
Unemployed	14.92%	19.51%	0.765*
Self-Employed	3.31%	3.85%	0.859
Employed	27.28%	41.57%	0.656*

While the records indicated that the unemployment rate was lower for SVFCs than for SVNFCs, it also indicated that the employment rate was higher for SVNFCs than for SVNCs, which would seem to be a contradiction.

8.0 Driver Behavior

8.1 C015 Primary Contributing Circumstances (Items < 10 Crashes Removed)

🔋 CA	RE 10.2.1.3 - [IMPACT Result	s - 2018-2022 A	labama Integr	ated eCrash C	rash Data - Sin	igle Vehicle Fat	tal Crashes (SV	FCs) AND Not Prim —	
🔋 Ei	le <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> n	npact <u>L</u> ocat	tions <u>T</u> ools	<u>W</u> indow	<u>H</u> elp			_ 8 ×
6	2018-2022 Alabama Integrated	eCrash Crash D	ata 🗸	Sin	igle Vehicle Fata	al Crashes (SVF	Cs)	✓	18 ~ 12/31/2
Order	Max Gain 🗸 Des	scending	✓ ✓ Sup	opress Zero-Va	lued Rows	Signi	ficance: Over	Representation V Threshold:	2.0
C015:	Primary Contributing Circum	IstanceSubset	Subset Percent	Other Frequency	Other Percent	Odds Batio	Max 🚽	C015: Primary Contributing Ci	rcumstance
•	Over Speed Limit	370	18.89	3407	9.34	2.021*	186.967		
	E Improper Crossing	164	8.37	655	1.80	4.661*	128.812		
	E Aggressive Operation	207	10.57	1835	5.03	2.100*	108.419		
	DUI	298	15.21	3827	10.49	1.449*	92.403		
	E Not Visible	47	2.40	153	0.42	5.718*	38.780		
	Failed to Yield the Right-of	39	1.99	224	0.61	3.241*	26.966		
	E Lying or Sitting in Roadway	20	1.02	31	0.09	12.009*	18.335		
	Pedestrian Under the Influe	20	1.02	97	0.27	3.838*	14.789		
	Improper Lane Change/Use	50	2.55	657	1.80	1.417*	14.704		
	E Ran off Road	242	12.35	4370	11.98	1.031	7.232		
	E Other Failed to Yield	11	0.56	124	0.34	1.651	4.338		
	E Other Improper Action	20	1.02	547	1.50	0.681	-9.386		
	E Other - No Improper Driving	44	2.25	1042	2.86	0.786	-11.979		
	Unseen Object/Person/Ve	90	4.59	1923	5.27	0.871	-13.309		
	E Distracted by Use of Elec	14	0.71	535	1.47	0.487	-14.742		
	E Over Correcting/Over St	67	3.42	1587	4.35	0.786	-18.258		
	E Other Distraction Inside t	19	0.97	1037	2.84	0.341	-36.710		
	Defective Equipment	18	0.92	1395	3.83	0.240	-56.943		
	E Swerved to Avoid Animal	12	0.61	1899	5.21	0.118	-90.019		
	E Fatigued/Asleep	67	3.42	3437	9.43	0.363*	-117.645		
	Driving too Fast for Conditio	128	6.53	4623	12.68	0.515*	-120.360		
	E Swerved to Avoid Vehicle	12	0.61	2648	7.26	0.084	-130.258	Sort by Sum of Max Gain	
0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1								Display Fi
			201	8-2022 Alabama	a Integrated eC	rash Crash Dat	а		
				C015: Primary	Contributing Ci	rcumstance			
	20								
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	툴 10 	a h							
	ъ.								
	0								
		E Not	Visible	ERa	n off Road	E Distri	acted by Use of Electronic	E Fatigued/Asleep	
				C015: Pri	many Contributi	ng Circumstan	nication Device		
				COID, FI	many contributi	na circumstant	~~		

8.2 Discussion of Primary Contributing Circumstances (PCC) Results Above

These results demonstrate the driver behaviors as they were defined by the C015, Primary Contributing Circumstances (PCCs), which accompanied SVFCs and SVNFCs. All SVFC over-representations in their expected proportion are as follows, with percentages:

	SVFCs PCC Overrepresented/Frequency	SVFC%	SVNFC%
0	Over Speed Limit 370	18.89%**	9.34%
0	Improper Crossing (pedestrian) 164	8.37%**	1.80%
0	Aggressive Operation 207	10.57%**	5.03%
0	DUI (aka ID) 298	15.21%	10.49%
0	Not Visible (most often pedestrian) 47	2.40%**	0.042%
0	Failed to Yield the Right-of-Way 39	1.99%**	0.36%
0	Lying/Sitting in Roadway (Pedestrian) 20	1.02*%**	0.09%
0	Pedestrian Under the Influence 20	1.02%**	0.27%
0	Improper Lane Change/Use 50	2.55%*	1.80%
0	Ran off Road 242	12.35%	11.98%
0	Other Failed to Yield 11	0.56%	0.34%
0	Other Improper Action 20	1.02%	1.50%
0	Unseen object/Person/Vehicle 90	4.59%	5.27%
0	Over Correcting/Over Steering 67	3.42%	4.35%
0	Driving too Fast for Conditions 128	6.53%	12.68%*
0	Fatigued/Asleep 67	3.42%	9.43%*

None of the items listed here or in the IMPACT table are necessarily mutually exclusive from the others. Each should be viewed in terms of their relative positions in the table as opposed to any one of them being the absolute cause.

It is clear that the big killers are speed, improper pedestrian actions and DUI (both alcohol and non-alcohol drugs). Some items with a high frequency have percentages that are close to the SVNFC percentage and are thus further down on the list and not marked as significant (*) or highly significant (**) by more than a 10% difference.

Not that there are several entries for pedestrians – See Section 7.5 for more information on pedestrians.

8.3 C122 CU Driver Officer's Opinion Alcohol

Impaired Driving/Alcohol was indicated as one cause of the crash for 16.72% of the SVFCs, and 9.54% of the SVNFCs. This gives an Odds Ratio of 1.753. ID/DUI tends to be under-reported, and there is no doubt that its reduction would have a major impact on reducing the number of fatal crashes, both day and night. From the positive perspective, 76.05% of the SVNFCS were not ID alcohol, but only 33.74% of the SVFCs were sober in this regard.

8.4 C123 CU Driver Officer's Opinion Drugs (other than alcohol)

🖡 CA	RE 10.2	2.1.3 - [IMP/	ACT Res	ults - 2018-202	22 Alab	ama Integi	rated eCras	h Crash Dat	a - Single V	ehicle Fatal	Crashes (SV	FCs) vs. Single Vehic	. –		Х
🔋 Ei	le <u>D</u>	ashboard	<u>F</u> ilters	s <u>A</u> nalysis	<u>l</u> mpa	ct <u>L</u> ocat	tions <u>T</u> o	ols <u>W</u> ind	ow <u>H</u> elp					-	₽×
6	2018-2	022 Alabama	Integra	ted eCrash Cras	h Data	`	/	Single Vehic	le Fatal Cras	hes (SVFCs))	~ 9	1/ 1/2	018 \sim	12/31/2
Order:	Order: Max Gain V Descending V Suppress Zero-Valued Rows Significance: Over Representation V Threshold; 2.0 🖨														
C123:		river Officer	Opinio	n Drugs		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds	Max Gain	C119: E CU Endor C120: E CU Driver	rsement Vio Employme	olations ent Statu	#2 🔺 JS
<u>ا ا</u>	Not Ap	oplicable				805	33.74	4104	9.42	3.583*	580.337	C121: CU Driver C	ondition		
	CU is	Not a Vehicle	•			321	13.45	1492	3.42	3.930*	239.324	C122: CU Driver C	officer Opini	on Alco	hol
	Yes - I	Driver Was l	Inder Inf	luence of Drugs		171	7.17	1557	3.57	2.006*	85.766	C124: CU Driver A	Icohol Test	Type Gi	iven
	Unkno	own				168	7.04	1588	3.64	1.933*	81.069	C125: E CU Driver	Drug Test	Type Gi	ven
	CU is	Unknown				61	2.56	717	1.65	1.554*	21.750	C126: CU Driver A	Icohol Test	Results	5 v
	No - D	hiver Was N	ot Under	r Influence of Dr	ugs	860	36.04	34128	78.30	0.460*	-1008.247	Sort by Sum of Ma	ix Gain		
0	1	<i>S</i>												🔽 Die	splay Fi
		2018-2022	? Alaban	na Integrated eC	Crash Ci	rash Data -	Filter = Sing C123: CU	gle Vehicle Fa	atal Crashes er Opinion D	(SVFCs) ve Irugs	s. Single Vehi	cle Non-Fatal Crashes	(SVNFCs)		
		100													
	Frequency	50													
		0		Not Applicable	CL	J is Not a Vehi	cle Yes Wa Influer	s - Driver as Under noe of Drugs	Unknow	n C	U is Unknown	No - Driver Was Not Under Influence of Drugs			
							C123: 0	LU Driver Off	ricer Opinior	Drugs					

The reported drug use proportions in SVFCs was less than half (7.17/16.72 = 42,88%) of that for alcohol. In both cases (SVFCs and SVNFCs), drug use is difficult to detect compared to alcohol, which has well-established tests for the blood-alcohol level that are much easier to administer. Our conclusion is that both alcohol and non-alcohol drug use are major contributors to increasing the frequency of single vehicle fatal crashes. Note the Impaired Pedestrians that are noted in Sections 8.1-8.2.

From the positive perspective, 78.30% of the SVNFCS were not Under the Influence of Non-Alcohol Drugs, but only 36.04% of the SVFCs were sober in this regard. This is amazingly consistent to the comparable results for Alcohol. Both cases indicate the increased probability of a crash being fatal if the causal driver is Impaired.