Fatal Collision Times of Day IMPACT Special Study
Fatal Daytime Crashes (FDCs) vs Fatal Nighttime Crashes (FNCs)

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See http://www.safehomealabama.gov/caps-special-studies/ for all CAPS Special Studies.

0.0 Introduction

This document is based upon the results of a number of IMPACT comparisons of Fatal Daytime Crashes (FDCs) compared to Fatal Nighttime Crashes (FNCs) over a recent five-year period (CY2018-2022). The purpose of these comparisons is to determine the causes of fatal crashes that might distinguish those in the daytime from those that occur in the nighttime. This different from most of the special IMPACT studies that have been performed, which have had the goal of reducing all of a particular type of crash regardless of severity, not just those that were fatal.

The analytical technique employed to generate most of the displays 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:
http://www.caps.ua.edu/software/care/

The main objective of performing IMPACT comparisons is to surface "over-representations." An *over-represented* attribute is found in this study when that attribute has a greater share of Fatal Daytime Crashes (FDC) than would be expected if its proportion were the same as that for Fatal Nighttime Crashes (FNCs). That is, the FNC crashes are serving as a *control* to which the FDCs are being compared to determine over-representations that indicate causes.

As an example, we found that FDCs for the Day-of-the-Week attribute value of Monday had a 36.9% higher proportion of crashes than did the Monday FNCs (Section 2.3; Odds Ratio = 1.369). 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 FDCs causes (e.g., excessive speed and Impaired Driving) might be performed for Monday and other days that have the highest over-representations. The Time of Day attribute (Section 5.5) is also used to focus optimal times for enforcement implementation.

Unless otherwise stated, the tables given above the charts in the IMPACT displays are ordered by *Max Gain*. *Max Gain* is the improvement in FDC reduction that could be obtained if a countermeasure could be applied to reduce the proportion of the Fatal Daytime Crashes (FDCs) to the proportion of Fatal Nighttime Crashes (FNCs) within that particular attribute (i.e., reduce the 15.79 to 11.53 in the Monday example).

This report continues with two sections that provide a high-level summary of the IMPACT results and a more detailed explanation of their specifics. These first two sections are called: (1.0) Summary of Findings and Recommendations, and (2.0) Filter and IMPACT Set-ups. Section 3 is also introductory in that it provides analytics results for Fatal Crashes by Year.

After Section 3, the comparison between FDCs and FNCs 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

A summary of findings and recommendations of this special study are presented here first for two reasons (1) for those who do not have time to go through all of the IMPACT analyses, and/or (2) as an introduction to 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. Section numbers (1.1), (1.2), and (1.3) in the section numbers below have been omitted to maintain consistency with 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. The more 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 should 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 Fatal Crashes (both FDCs and FNCs) in Alabama. They are in the same ordering as the IMPACT displays to facilitate references to Sections 4.0-8.0.

Terminology: *Expected proportions* (AKA *expectations*) of either the FDCs or FNCs here and below are obtained from the comparison of FDC proportions with the proportions for their corresponding Nighttime Crashes (FNCs).

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. The following findings are from the IMPACT analysis in Sections 4-8 that compare FDCs vs FNCs over the five years of the study (CY2018-2022):

- **1.4 Geographical Factors (4.0)**
    - County (4.1, C001) - Generally, the daytime over-represented counties are rural with large population centers. The large population centers increase the traffic and thus the crashes, while the rural areas make a larger proportion of these crashes fatal. Placed in Max Gain order, the FDC-over-represented counties with the highest potential for fatality reduction with their frequencies are: Cullman 61, Morgan 52, Dekalb 49, Blount 39, Geneva 22, and Jackson 35. The FNC-over-represented counties with the highest potential for fatality reduction with their frequencies are: Jefferson 165, Mobile 127, Madison 81, Baldwin 63, and Montgomery 86. It is recommended that these and other over-represented counties be given special attention for fatality reduction. Generally, the countermeasures recommended to be applied to specific geographical areas, determined by hotspot analysis, are selective enforcement for Speed and Impaired Driving.
    - City Comparisons of FDCs to FNCs, viewing rural areas of counties as separate virtual cities (4.2, C002). There is little surprise in the number of rural areas in this output. City (and rural virtual city) comparisons are presented for all areas that had Max Gains greater than 6. The top 6 FDC-over-represented Cities with Max Gains in excess of 10 FDCs over their expected numbers are: Guntersville 16, Rural Morgan, 28, Rural Dekalb 33, Rural Blount 32, Rural Clay 13, and Rural Fayette 13. The top 6 FNC-over-represented Cities with their expected numbers are: Birmingham 71, Huntsville, 39, Rural Jefferson 50, Montgomery 51, Mobile 51, and Rural Mobile 61. Those cities with a high frequency of fatal crashes should be given special guidance, and perhaps additional funding. Many such large city areas have a considerable amount of Open Country (see Locale, Section 4.6) that tends to increase their fatality count.
    - Rural/Urban (4.3, C010) Fatal Daytime Crash (FDC) Proportion– FDCs occurred in 61.24% rural and 38.76% urban areas. These differences between the Daytime and Nighttime (FNCs) were not significant for either the rural or and the urban areas. However, the rural areas for both were significantly higher than the urban areas. Concentration for fatality reduction is recommended in Rural areas where hotspot analyses determines that there are concentrations of fatal crashes. Note: these city and county comparisons are, of necessity, a selection of the total outputs that could be generated from all cities (including those virtual). They are given to illustrate the capabilities as much as to present the numerical results. Recommendations to reduce fatalities within any of these areas include:
        - Whatever can be done to reduce the need for motor vehicle travel;
        - Promote shorter distances per trip;
        - Larger police presence in 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 brown@cs.ua.edu.

- Locale (4.4, C033) – Open Country shows a high level of over-representation in both the FDCs (1353) and the FNCs (1363). Those countermeasures recommended to 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.
- Locale (4.5, C033) by Rural/Urban (C010) for FDCs. See the narrative in Section 4.5 for more information.
- Highway Classifications (4.6, C011) – State and Federal routes were the only ones over-represented in the Daytime, State being significantly over-represented in Daytime crashes. The others were over-represented in Nighttime crashes (Interstate having a significantly higher proportion in Nighttime crashes). It is obvious that the greatest reduction On all of these roadways would come from a general speed reduction. It may also help to promote the use of those routes that avoid the over-represented, i.e., avoid State and Federal during the daytime, and Interstate and Municipal road in the nighttime. An analysis of Highway Classifications is planned for the next Special Study.
- Most Harmful Event (4.7, C019) – ordered by Max Gain. The following items had the largest number of fatality occurrences in the five years (listed with their frequencies):

  DAYTIME OVER-REPRESENTED

Collision with Vehicle in Traffic	968
Collision or In/From Other Roadway	39
Ran Off Road Left	17
Ran Off Road Right	17

  NIGHTTME OVER-REPRESENTED

Collision with Non-Motorist Pedestrian	262
Collision with Tree	379
Overturned/Rollover	320

  The greatest proportion over-representation was in the 262 fatal Pedestrian crashes in the Nighttime. 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. This would include a strong prohibition of walking while intoxicated with either alcohol or other drugs.
- Roadway Curvature and Grade (4.8, C407). The following items were the most over-represented (given with frequencies):

  DAYTIME OVER-REPRESENTED

Straight with Up Grade	158
Straight and Level	1020
Curve Right and Up Grade	48

Curve Right and Level 113
Straight with Down Grade 212

NIGHTTIME OVER-REPRESENTED

Curve Left and Down Grade 96
Curve Left and Level 104

Recommendations include selective enforcement and speed-limit-reduction (e.g., advisory speed and curve warning signs) concentrating on left curves first. 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 on: http://www.safehomealbama.gov/tag/road-improvements

- **1.5 Time Factors (5.0)**
  - Year (3.1, C003) – no recommendations to address any FDC or FNC annual variations.
  - Month (5.2, C004) – The only fatality over-representation by month was for a FNC in July (219 frequency, 0.707 Odds Ratio). The number of FDCs and FNCs correlated very closely in the other months. July might be given special selective enforcement concentration, with specific locations determined by hotspot analyses.
  - Day of the Week (2.3, 5.7 C006) – Since the day of the week distribution is quite comparable to that of Impaired Driving (ID, DUI), the countermeasures for ID should be emphasized in the times and places indicated by hotspot analysis. Consideration might be given to using Nighttime fatalities as a proxy measure to improve ID countermeasure decisions. See Sections 8.3 and 8.4.
  - Time of Day (5.5-5.6, C008) – In *Natural Order for all fatal crashes.* The extent to which night-time hours are over-represented is quite striking. Optimal times for FNC enforcement would start immediately following any previous day rush hour details, and would continue through at least 4:00 AM to 4:59 AM. Some of the late-night FNCs will also 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) above for the similarity of this distribution with that of Impaired Driving (ID, DUI). The ID recommendations effectively apply to these over-represented times. For more ID information, See Sections 8.3 and 8.4.
  - Time of Day by Day of the Week (5.7, C008 x C006) – *For all fatal crashes.* This quantifies the extent of the fatal crash concentrations on Fridays, Saturday mornings and nights, and Sunday mornings and Sunday Evenings. This is a very useful summary for deploying selective enforcement details, especially during the weekend hours.

1.6 Factors Affecting Severity (6.0)

- Speed at Impact (6.1, C224) – Impact speeds below 75 MPH are generally over-represented for FDCs. FNCs are over-represented at speeds 75 MPH and above. So it is clear that speed is a larger problem in the Nighttime than in the Daytime. Several analyses have found the general rule of thumb that for every 10 MPH increase in impact speeds, the probability of the crash being fatal doubles. This was validated in the discussion below of the cross-tabulation of impact speeds by severity (6.4a and b). The obvious 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. Clearing the roadsides in some areas may help reduce severity, although our roadside study data showed that in many cases the distance to the hit object was directly proportional to the vehicle travel speed.
- Highway Classifications by Impact Speed (6.3, C224) for different Highway Classifications (C011). *For all fatal crashes.* This cross-tabulation gives an idea of the risks on the various highway classifications. The red backgrounds indicate those that had a relatively higher number of fatal crashes. If drivers have the option, this chart will be helpful in assisting them in choosing the safest routes for their trips.
- Severity by Impact Speed (6.4a and b. C025, C244). The speed to death relationship was further validated in the discussion of this cross-tabulation. This discussion was given elaboration in the Section 6.4b, which is a discussion of the Probability of Being Killed 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.
- Restraint Use by Drivers in Fatal Collisions (6.5, C323) – Restraint use programs have been quite successful in Alabama. Consideration should be given to increasing financial support to these programs to assure that their effectiveness will continue. 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 about 8.0 times more likely if the involved occupants are not using proper restraints (see text under the cross-tabulation in Section 6.6). Because current restraint-use programs are quite effective, consideration should be given to increase their funding to make them even more universal and effective. Restraint effectiveness information should be part of all traffic safety educational programs.

- Number of Vehicles Involved (6.7, C052) – the number of single vehicle fatal crashes is over-represented for FNCs by an Odds Ratio of 1/0.682, indicating that its proportion was 47% more than expected. Over half (64.61%) of the FNCs were single vehicle crashes. This is consistent with the other findings of causality. It is recommended that PI&E efforts give top priority to single vehicle crashes. The following is potentially useful information from a list of the highest Primary Contributing Circumstances *for all single vehicle crashes* with more than five occurrences in 2018-2022: DUI (34); Aggressive Operation (23); Over the Speed Limit (37), Ran Off Road (24); Unseen Object/Person/Vehicle (12); and Improper Crossing (20 pedestrian crashes). This reflects the "unforced errors" of single vehicle crashes, and it provides additional reasons that they are over-represented in the nighttime hours.
- Police Arrival Delay (6.8, C036) – Generally, the police response times to FNCs were greater than expected, with delays over 20 minutes being over-represented, most of which were significant. There can be little doubt that this has to do with so many of them occurring in rural areas (see Section 4.3) and at night.
- EMS Arrival Delay (6.9, C039) – Probably because of (1) the severity of the crashes (all fatal in this study), (2) the swiftness 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. No recommendations are made for any of the Arrival Delays in that it is recognized that first responders are currently doing an excellent job in getting to the scene of the crash. Delays, if any, are usually caused be a failure to report the crash immediately, and encouraging quicker notification might be worked into some of the PI&E efforts.

- **1.7 Driver and Vehicle Demographics (7.0)**
  - Driver Raw Age (7.1, C107) –A comparison of FNC causal driver age with the FDCs shows the most over-represented in the nighttime are 21-40 years of age, while the most over-represented during the daytime are 51-85 years of age. Clearly from the chart it can be seen that the nighttime fatalities have higher age proportions than do those in the daytime. Optimization of the times of selective enforcement can be improved by the application of information given in Section 5.7.
  - Crash Driver Gender (7.2, C109) – the breakdown in FDC causal drivers is 68.23% male and 26.80% female. For FNC cashes, the percentage is 65.80 male and 15.75 female. These gender differences certainly indicate that males are a greater cause of the fatal crashes, 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). 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 speed (limit on most Intertates) in 20.5% of their fatal crashes, while comparable speeds for females was only at 10.7%. Thus, all of the recommendations for speed reduction apply doubly to males over females.
- Causal Unit (Vehicle) Type (7.4, C101) – This analysis was based on a comparison of FDC Causal Unit Type against the same for FNCs. It is recommended that countermeasure programs that are currently in effect be continued and augmented so that part of it will emphasize the special issues during the nighttime hours. Pedestrian programs should include warnings against Impaired Walking (walking along the roadway after drinking), and the many other errors addressed in most pedestrian safety programs.
- Number of Pedestrians (7.5, C058) – Nighttime fatal pedestrian crashes occur about four times greater than their daytime counterparts. This is consistent with what has been found in most pedestrian studies. Both ID and Impaired Walking, contribute to this, as well as pedestrians not taking the maximum means for being seen at night. Wearing reflective clothing, and carrying (and using) a flashlight to be seen of vehicle drivers are two of the most important recommendations in that lack of visibility was cited for several fatal crashes. Pedestrian programs need to be emphasized in the lower school grades and continue to be emphasized through the young adult years.
- Driver License Status (7.6, C114) – FDCs were significantly over-represented in their causal drivers having legitimate licenses. Suspended was the only status over-represented in for FNCs. License status issues do not seem to be a significant factor in prevention. No recommendations were seen to be feasible for deficient licenses except to maintain the watch on this attribute in the future.
- Driver Employment Status (7.7, C120) – This analysis indicated that the unemployment rate for the FDCs was about 15.54%, while that for FNCs was 12.33%. Higher than average unemployment 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 daytime fatal crashes might provide alternatives for countermeasure development. Those behaviors that had over 50 fatal crashes are:

	FDCs	FNCs
▪ Over Speed Limit	183	259
▪ Aggressive Operation	141	172
▪ Crossed Centerline	136	86
▪ DUI	133	292
▪ Ran off Road	133	119
▪ Failed to Yield Right-of-Way from Stop Sign	126	36
▪ Driving too Fast for Conditions	103	75
▪ Failed to Yield Right-of-Way Making Left or U-Turn	83	31
▪ Traveling Wrong Way/Wrong Side	57	76
▪ Improper Lane Change/Use	51	52
▪ Improper Crossing (Pedestrians)	33	133
▪ Unseen Object/Person/Vehicle	33	87

No additional recommendations are given for these behaviors since most of them are covered by Speed, ID, Pedestrian and other countermeasures.

- 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 2.451 times as many for FNCs as for FDCs. For drugs this multiplier was 1.200. This was sufficient to verify that the FDC and FNC time over-representations reported above, were correlated very closely with ID. Recommended countermeasures to reduce ID are:
  - 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, continued officer training to produce more complete reporting is recommended.
  - 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).
  - 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 or displayed these problems, or who are taking other prescription drugs. Legalized recreational drugs are not a good alternative to alcohol use and 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.
  - It should be recognized that (unlike alcohol) non-alcohol drug use is as pervasive during the daytime as in the nighttime hours.

2.0 Filter and IMPACT Set-ups

Generally, the analyses performed in this study will use IMPACT (See Section 2.1) to compare Fatal Daytime Crashes (FDCs) against Fatal Nighttime Crashes (FNCs) over the same 5-year time period (FY2018-2022). The objective is 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 to assess strategies 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 planning the large variety of countermeasures that exist to reduce both the crash frequency and severity.

Sections 2 and 3 of this report contain information that will be useful in obtaining an overall orientation toward the IMPACT results that will 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 (2.4) Overall Fatal Crashes by Severity. The section after that (Sections 3) will present another IMPACT example (Fatal Crash Comparison by Year) 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 countermeasure development, and especially Fatal Crashes. 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 ordered by 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 (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 of crashes in the Daytime than would be expected from that given in the Nighttime. 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 FDCs against their FNC counterparts. In summary, the Nighttime Crashes (FNCs) are serving as a control to which the FDCs are being compared. In this way any inconsistencies related to the FDCs surfaces and can be subjected to further analyses. For a detailed description of the meaning of each element of the IMPACT outputs, see:

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

The IMPACT analses will be grouped by five general attribute categories as follow in Sections: 4. Geographical and Harmful Events, 5. Time, 6. Severity, 7. Demographics, and 8. Driver Behavior.

2.2 Filter Definitions: Fatal Day Crashes (FDCs) vs Fatal Night Crashes (FNCs)

Filter for only the Preliminary IMPACT Analyses: All Fatal Crashes.

The standard filter for all fatal crashes based on C025 Crash Severity was applied, and separate filters for the FDCs and FNCs were obtained as shown in the IMPACT displays in the next few pages. Both of these IMPACT displays (those in 2.2.1 and 2.2.2) are essentially the same, the only difference being the times indicated as applicable. For nighttime crashes, the normally-shown over-represented hours apply, and those hours that had an over-representation of fatal crashes were 7:00 PM through 6:59 AM (essentially all night). The highly significant over-represented hours generally have a red background with the two exceptions of 7:00 PM thru 9:59 PM, which also have high over-representation values.

Because (for these IMPACTs only) we are using the all-fatal crashes filter, it is possible to get the FNCs from the high blue bars, which would ordinarily be viewed as being under-represented. However, being significantly under-represented in this particular all-fatality analysis gives the hours that are over-represented in fatal crashes during the daytime. For the FDCs the over-represented fatal crashes during the daytime hours were selected to form the FDC filter.

These hours were from 7:00 AM until 5:59 PM, all of which were significantly under-represented in fatal crashes in the general analysis. Since the filter being applied limited all crashes to fatal crashes, those significantly under-represented during the daytime hours would be the fatal crashes that occurred during the daytime hours, given by the blue bars at these times.

When the blue bars are taller than the red bars, they may be viewed as be under-represented. However, because both red and blue bars are showing the relative frequencies (proportions) of fatal crashes, these under-representations could equally be viewed as fatal crash over-represented for the night-time hours. This is effectively what will be done in most of the IMPACT displays that are in and after Section 4.

2.2.1 Seven PM-6:59 AM – 1,026 FNCs Significantly Over-Represented

CARE 10.2.1.3 - [IMPACT Results - 2018-2022 Alabama Integrated eCrash Crash Data - Fatal Crashes vs. Not Fatal Crashes]

File Dashboard Filters Analysis Impact Locations Tools Window Help

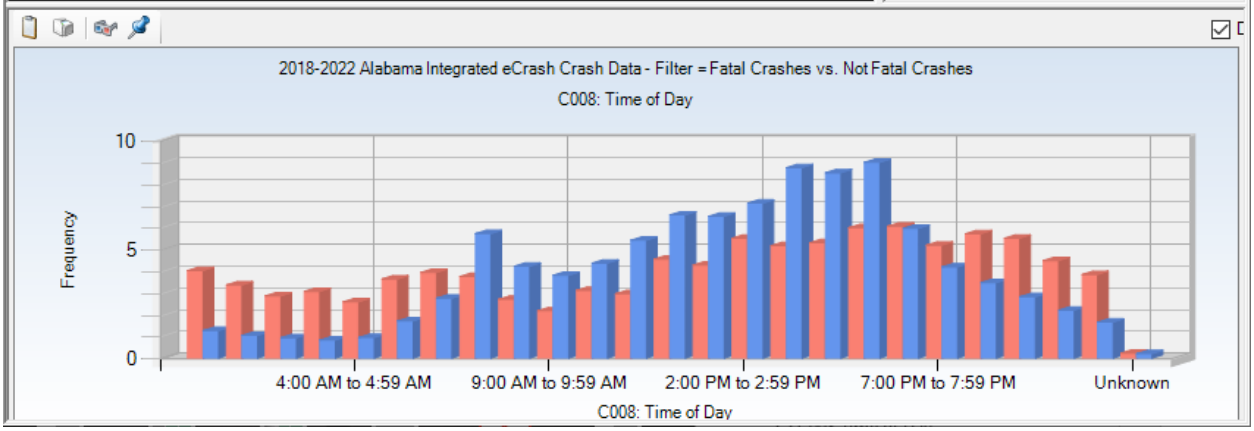
2018-2022 Alabama Integrated eCrash Crash Data | Fatal Crashes | 1/ 1/2018

Order: Max Gain | Descending | Suppress Zero-Valued Rows | Significance: Over Representation | Threshold: 2.0

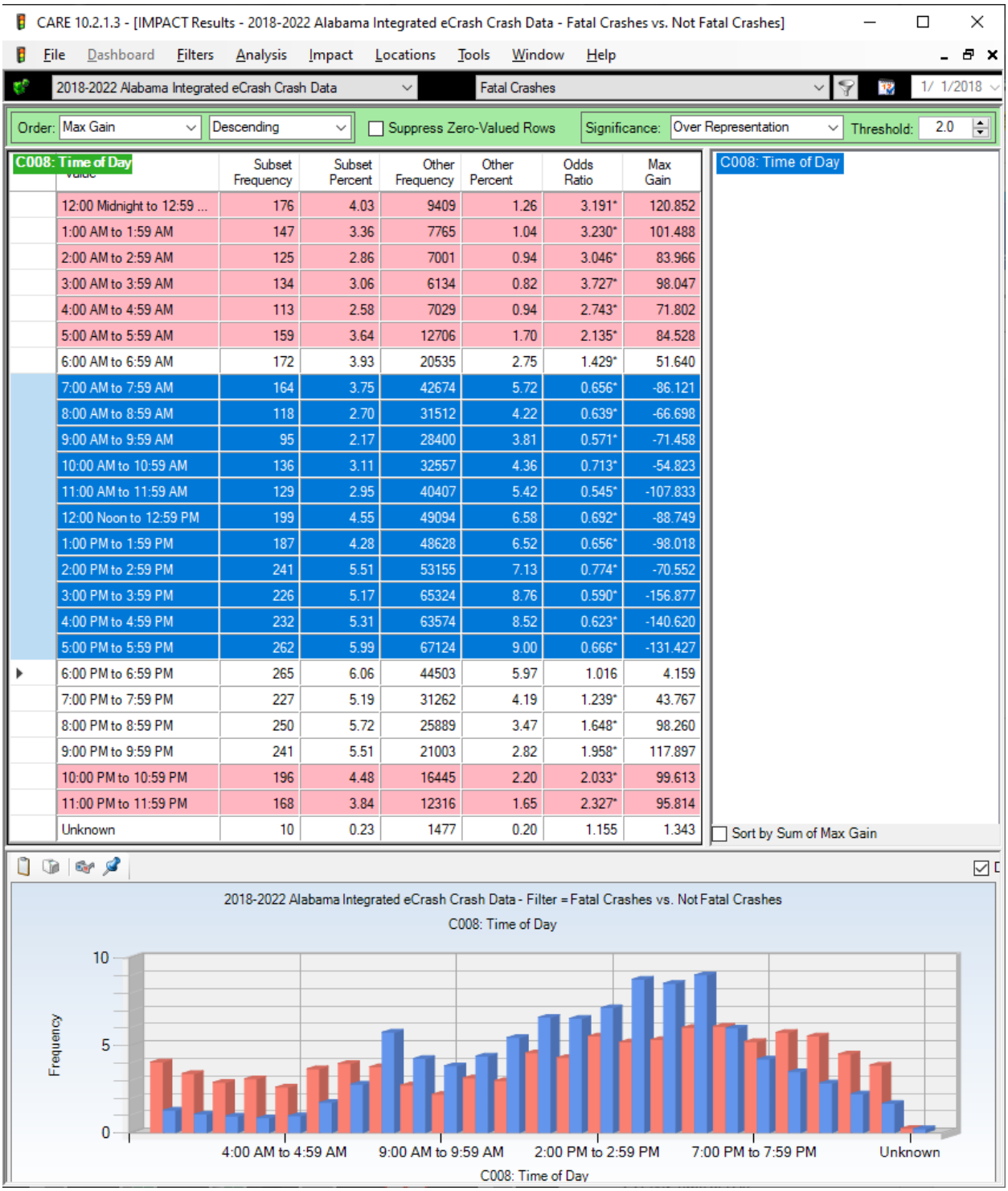
C008: Time of Day	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
12:00 Midnight to 12:59 ...	176	4.03	9409	1.26	3.191*	120.852
1:00 AM to 1:59 AM	147	3.36	7765	1.04	3.230*	101.488
2:00 AM to 2:59 AM	125	2.86	7001	0.94	3.046*	83.966
3:00 AM to 3:59 AM	134	3.06	6134	0.82	3.727*	98.047
4:00 AM to 4:59 AM	113	2.58	7029	0.94	2.743*	71.802
5:00 AM to 5:59 AM	159	3.64	12706	1.70	2.135*	84.528
6:00 AM to 6:59 AM	172	3.93	20535	2.75	1.429*	51.640
7:00 AM to 7:59 AM	164	3.75	42674	5.72	0.656*	-86.121
8:00 AM to 8:59 AM	118	2.70	31512	4.22	0.639*	-66.698
9:00 AM to 9:59 AM	95	2.17	28400	3.81	0.571*	-71.458
10:00 AM to 10:59 AM	136	3.11	32557	4.36	0.713*	-54.823
11:00 AM to 11:59 AM	129	2.95	40407	5.42	0.545*	-107.833
12:00 Noon to 12:59 PM	199	4.55	49094	6.58	0.692*	-88.749
1:00 PM to 1:59 PM	187	4.28	48628	6.52	0.656*	-98.018
2:00 PM to 2:59 PM	241	5.51	53155	7.13	0.774*	-70.552
3:00 PM to 3:59 PM	226	5.17	65324	8.76	0.590*	-156.877
4:00 PM to 4:59 PM	232	5.31	63574	8.52	0.623*	-140.620
5:00 PM to 5:59 PM	262	5.99	67124	9.00	0.666*	-131.427
6:00 PM to 6:59 PM	265	6.06	44503	5.97	1.016	4.159
7:00 PM to 7:59 PM	227	5.19	31262	4.19	1.239*	43.767
8:00 PM to 8:59 PM	250	5.72	25889	3.47	1.648*	98.260
9:00 PM to 9:59 PM	241	5.51	21003	2.82	1.958*	117.897
10:00 PM to 10:59 PM	196	4.48	16445	2.20	2.033*	99.613
11:00 PM to 11:59 PM	168	3.84	12316	1.65	2.327*	95.814
Unknown	10	0.23	1477	0.20	1.155	1.343

C008: Time of Day

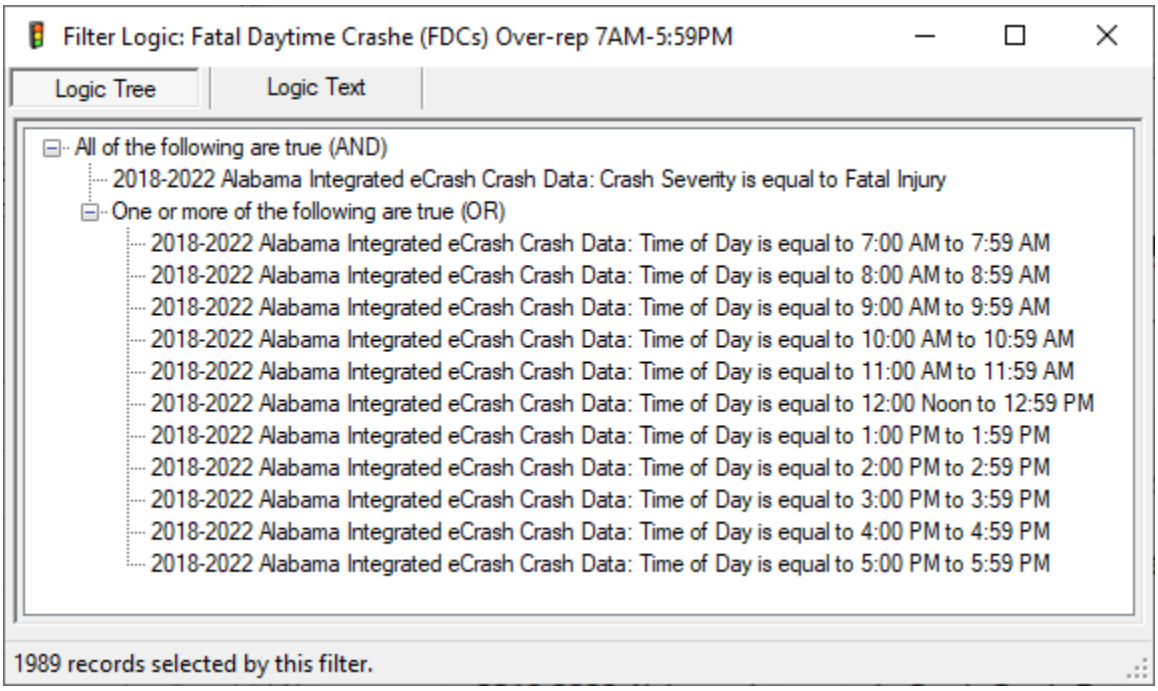
Sort by Sum of Max Gain



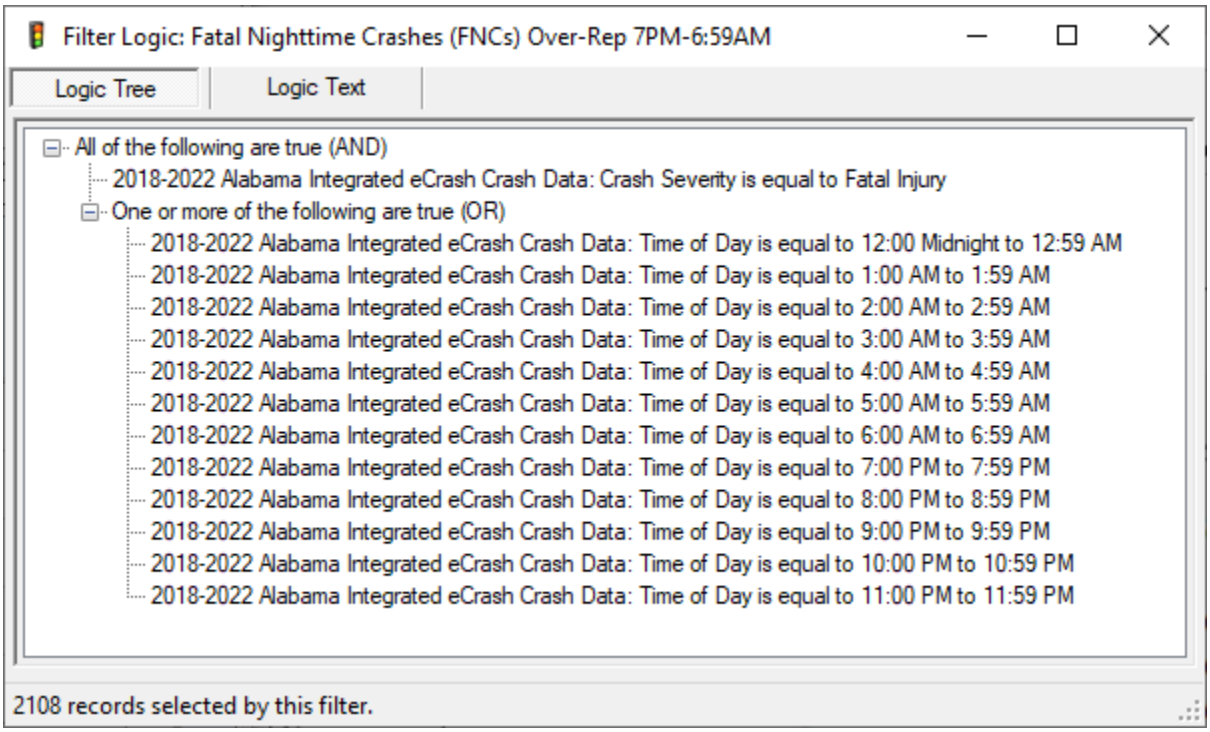
2.2.2 Seven AM-5:59 PM – 1,989 FDCs Significantly Under-Represented



Formal Definition of Over-Represented Fatal Daytime Crashes 7 AM to 5:59 PM



Formal Definition for Over-Represented Fatal Nighttime Crashes 7 PM to 6:59 AM

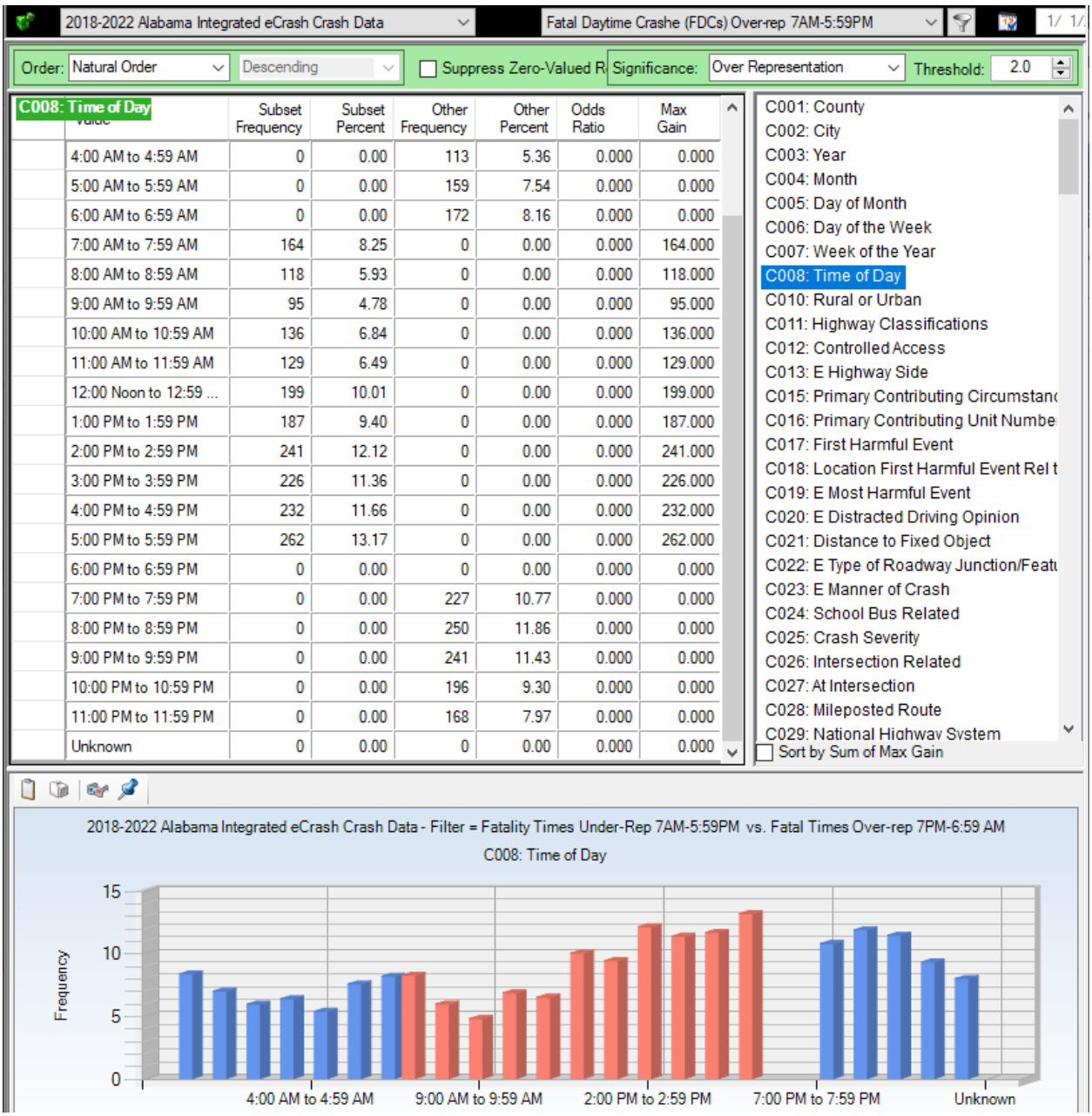


The two formal definitions above come directly from the two same IMPACT analyses of Sections 2.2.1 and 2.2.2. Observe in 2.2.1 that the over-represented nighttime hours have Odds Ratios greater than one in the nighttime hours. Most of these are highly significant and thus have a red background. Exceptions (given with Odds Ratios) are 6:00 AM to 6:59 AM (1.016), 7:00 PM to 7:59 PM (1.239), 8:00 PM to 8:59 PM (1.648), and 9:00 PM to 9:59 PM (1.958). Although these Odds Ratios are not 2 or greater, there is no doubt that they indicate that the proportion of crashes in their hour time frames are greater than those in the complement time frame. All of these can be considered in the nighttime times for the further IMPACT comparisons.

The formal definition in Section 2.2.2 is analogous to that of 2.2.1, but for the daytime hours. It can be seen that the Odds Ratios for these hours are all significant (*), showing that the proportion of fatal crashes in their times are significantly higher than the comparison. The filter for the IMPACT of 2.2.1 and 2.2.2 were all fatal crashes.

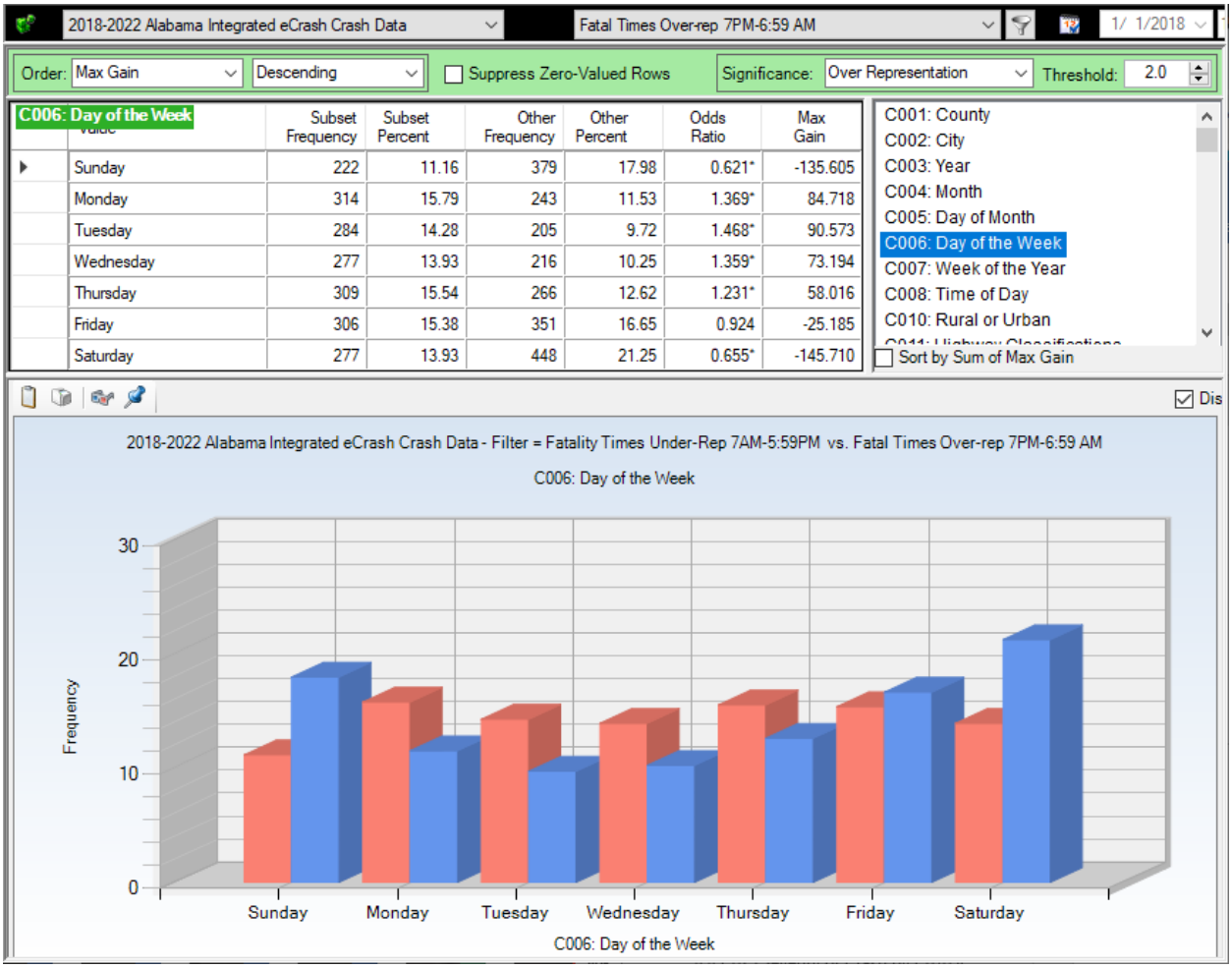
The following display (Section 2.2.3) shows the time of day for both the over-represented daytime hours (red bars) and the over-represented night-time hours (blue bars). It should be recognized at the outset that the daytime and nighttime representations are mutually exclusive. Notice the corresponding zeros. This will change when we get to comparing specific attributes, as exemplified in Section 2.3.

2.2.3 Summary of the Hours of the Day Being Compared



Note the filter of this IMPACT is FDCs and the comparative "Other" subset it FNCs. These comparisons are different from most IMPACT runs we have done in the past, because here both the Subset crashes and the "Other" crashes consist only of fatal crashes. Thus, they are comparable to each other. This is illustrated by the example in Section 2.3, immediately below.

2.3 Day of the Week (C006); Comparison of FDCs and FNCs



Quick reminder: FDCs=Daytime=**Red bars**; FNCs=Nighttime=**Blue bars**.

In this IMPACT display, as well of those in Sections 4-8, the Subset (given by the red bars) is the daytime fatal crashes. The "Other" crashes are those that occurred in the nighttime hours. Both of these are defined by their hours in the filter definitions above. With the general fatal crash filter in effect, the daytime fatal crashes will be significantly over-represented, while the nighttime fatal crashes are significantly under-represented. This IMPACT (and those below) will use both filters to compare the FDCs directly with the FNCs. The above shows that Saturday and Sunday, and to some extent Friday, are over-represented in FNCs. Weekdays (with the exception of Friday) are over-represented in daytime fatal crashes. Impaired Driving has

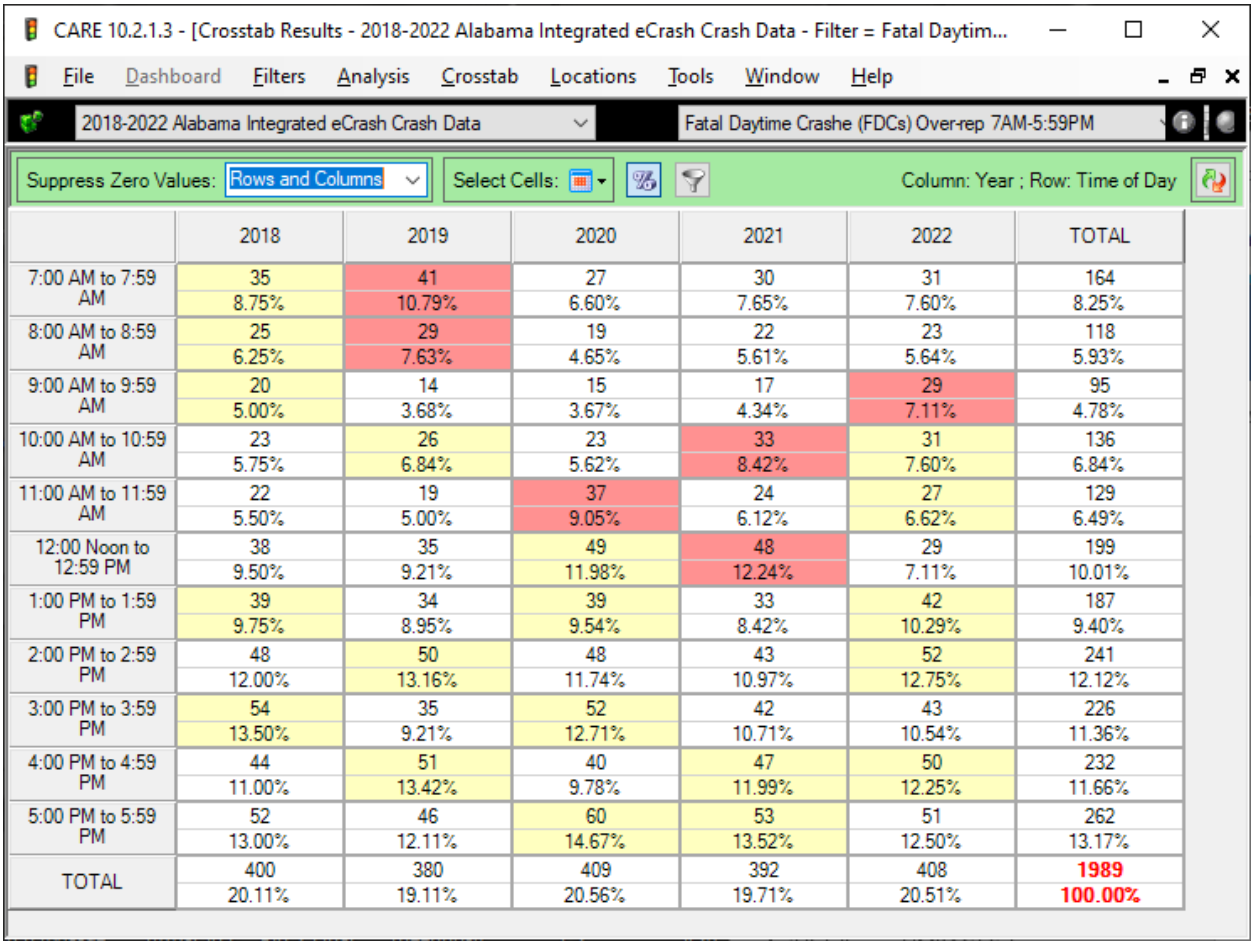
resulted in extensive study of nighttime fatal crashes, so the emphasis below will focus primarily on FDCs. FDCs will be used to define the "Subset," while FNCs will define the "Other."

2.4 Overall Fatal Crashes by Severity and Year; 2018-2022 Data

2.4.1 Fatal Daytime Crashes (FDCs) by C008 Time of Day

It is good to get a feel for their overall difference in the crash frequencies by times over recent years. The following gives a comparison of all Fatal Daytime Crashes (FDCs) by their Times of Day in CY2018-2022.

FDCs by Times of Day for Calendar Years 2018-2022



	2018	2019	2020	2021	2022	TOTAL
7:00 AM to 7:59 AM	35 8.75%	41 10.79%	27 6.60%	30 7.65%	31 7.60%	164 8.25%
8:00 AM to 8:59 AM	25 6.25%	29 7.63%	19 4.65%	22 5.61%	23 5.64%	118 5.93%
9:00 AM to 9:59 AM	20 5.00%	14 3.68%	15 3.67%	17 4.34%	29 7.11%	95 4.78%
10:00 AM to 10:59 AM	23 5.75%	26 6.84%	23 5.62%	33 8.42%	31 7.60%	136 6.84%
11:00 AM to 11:59 AM	22 5.50%	19 5.00%	37 9.05%	24 6.12%	27 6.62%	129 6.49%
12:00 Noon to 12:59 PM	38 9.50%	35 9.21%	49 11.98%	48 12.24%	29 7.11%	199 10.01%
1:00 PM to 1:59 PM	39 9.75%	34 8.95%	39 9.54%	33 8.42%	42 10.29%	187 9.40%
2:00 PM to 2:59 PM	48 12.00%	50 13.16%	48 11.74%	43 10.97%	52 12.75%	241 12.12%
3:00 PM to 3:59 PM	54 13.50%	35 9.21%	52 12.71%	42 10.71%	43 10.54%	226 11.36%
4:00 PM to 4:59 PM	44 11.00%	51 13.42%	40 9.78%	47 11.99%	50 12.25%	232 11.66%
5:00 PM to 5:59 PM	52 13.00%	46 12.11%	60 14.67%	53 13.52%	51 12.50%	262 13.17%
TOTAL	400 20.11%	380 19.11%	409 20.56%	392 19.71%	408 20.51%	**1989** **100.00%**

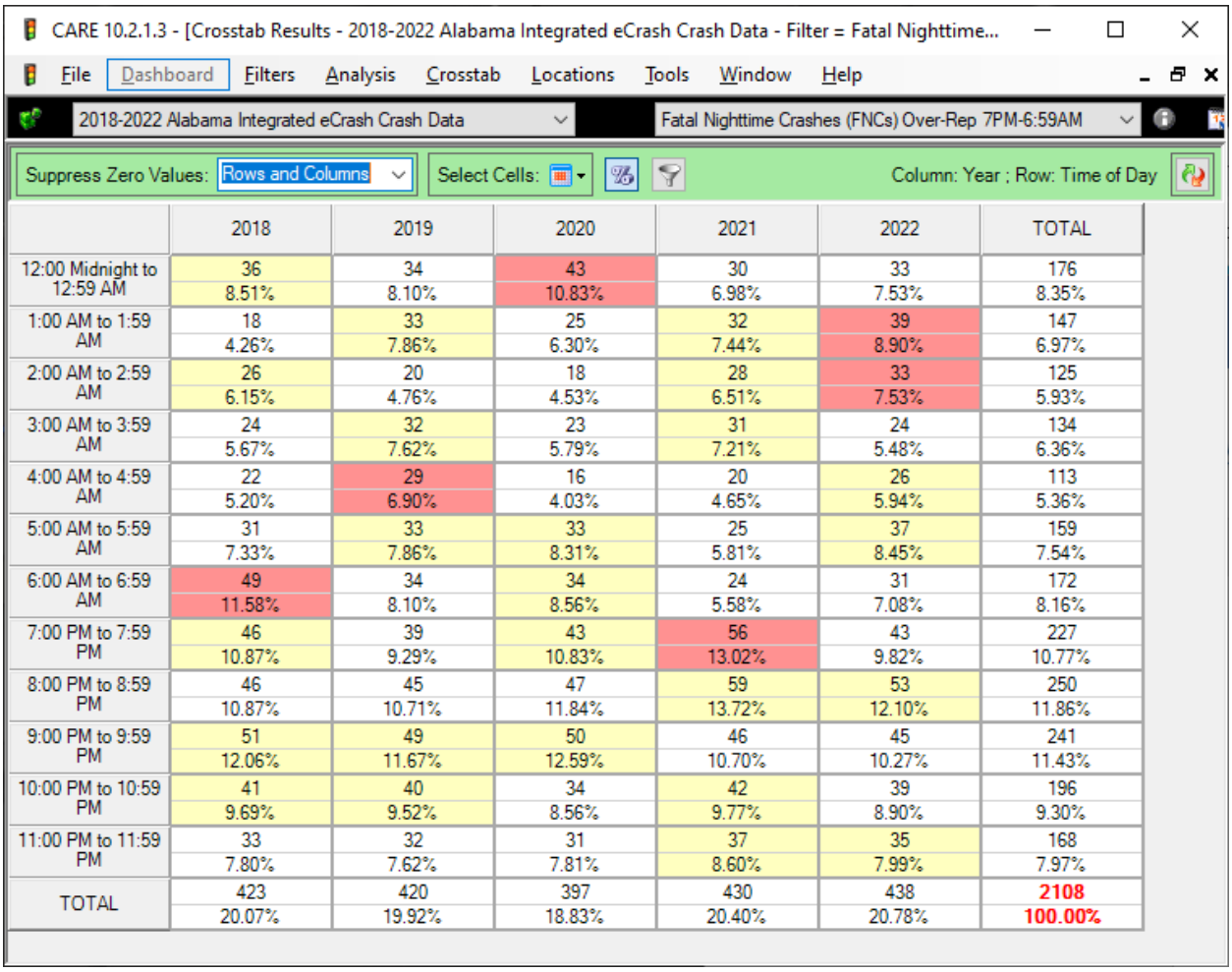
We conclude from considering the percentage numbers at the bottom of the table that 2019 was the only year significantly lower in total FDCs than those in the other years. Fatal Daytime

Crashes (FDCs) were quite stable, with this one exception. The sum total of this crosstab also indicates that there were 1,989 over-represented FDCs.

2.4.2 Fatal Nighttime Crashes (FNCs) by C008 Time of Day

Similarly, the following gives a comparison of all Fatal Nighttime Crashes (FNCs) by times in CY2018-2022.

FNCs by Times of Day for Calendar Years 2018-2022



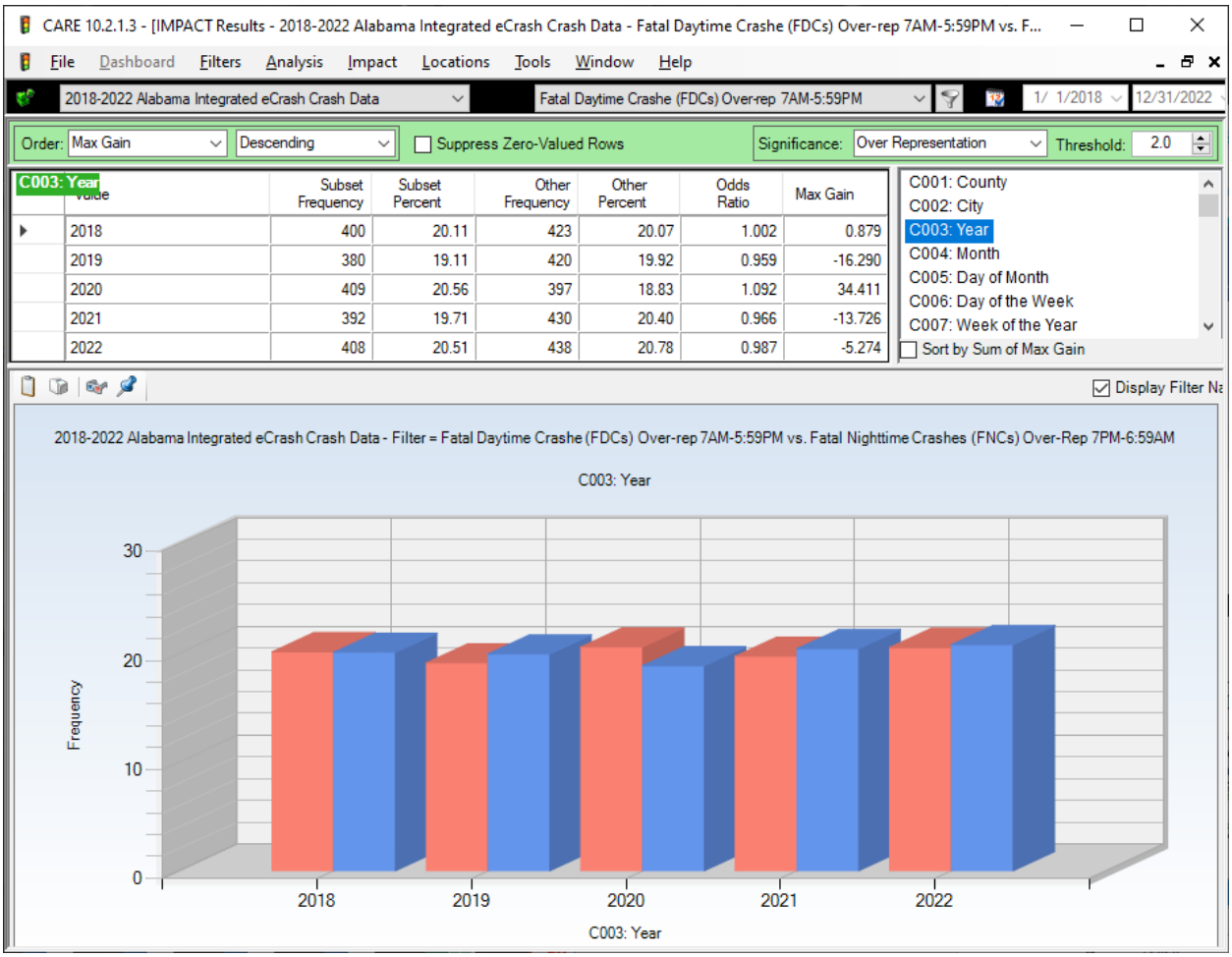
	2018	2019	2020	2021	2022	TOTAL
12:00 Midnight to 12:59 AM	36 8.51%	34 8.10%	43 10.83%	30 6.98%	33 7.53%	176 8.35%
1:00 AM to 1:59 AM	18 4.26%	33 7.86%	25 6.30%	32 7.44%	39 8.90%	147 6.97%
2:00 AM to 2:59 AM	26 6.15%	20 4.76%	18 4.53%	28 6.51%	33 7.53%	125 5.93%
3:00 AM to 3:59 AM	24 5.67%	32 7.62%	23 5.79%	31 7.21%	24 5.48%	134 6.36%
4:00 AM to 4:59 AM	22 5.20%	29 6.90%	16 4.03%	20 4.65%	26 5.94%	113 5.36%
5:00 AM to 5:59 AM	31 7.33%	33 7.86%	33 8.31%	25 5.81%	37 8.45%	159 7.54%
6:00 AM to 6:59 AM	49 11.58%	34 8.10%	34 8.56%	24 5.58%	31 7.08%	172 8.16%
7:00 PM to 7:59 PM	46 10.87%	39 9.29%	43 10.83%	56 13.02%	43 9.82%	227 10.77%
8:00 PM to 8:59 PM	46 10.87%	45 10.71%	47 11.84%	59 13.72%	53 12.10%	250 11.86%
9:00 PM to 9:59 PM	51 12.06%	49 11.67%	50 12.59%	46 10.70%	45 10.27%	241 11.43%
10:00 PM to 10:59 PM	41 9.69%	40 9.52%	34 8.56%	42 9.77%	39 8.90%	196 9.30%
11:00 PM to 11:59 PM	33 7.80%	32 7.62%	31 7.81%	37 8.60%	35 7.99%	168 7.97%
TOTAL	423 20.07%	420 19.92%	397 18.83%	430 20.40%	438 20.78%	**2108** **100.00%**

Notice that the PM times (7 PM until Midnight) are at the bottom of this table (bottom five), while the later AM hours are at the top (seven after midnight hours). The only year that stands

out is 2020, with a total much lower than the other years. Generally, the FNC frequencies do not have any other significant changes from year to year. Sum totals for the two crosstabs above:
FDC total fatal crashes = 1,989
FNC total fatal crashes = 2,108
Thus, there are 119 more FNCs than there are FDCs. But this will not affect our ability to compare FDCs and FNCs, since they are being compared by their proportions.

3.0 Fatal Crash Comparison by Year

Fatal Daytime Crashes (FDCs) vs Fatal Nighttime Crashes (FNCs) by Year



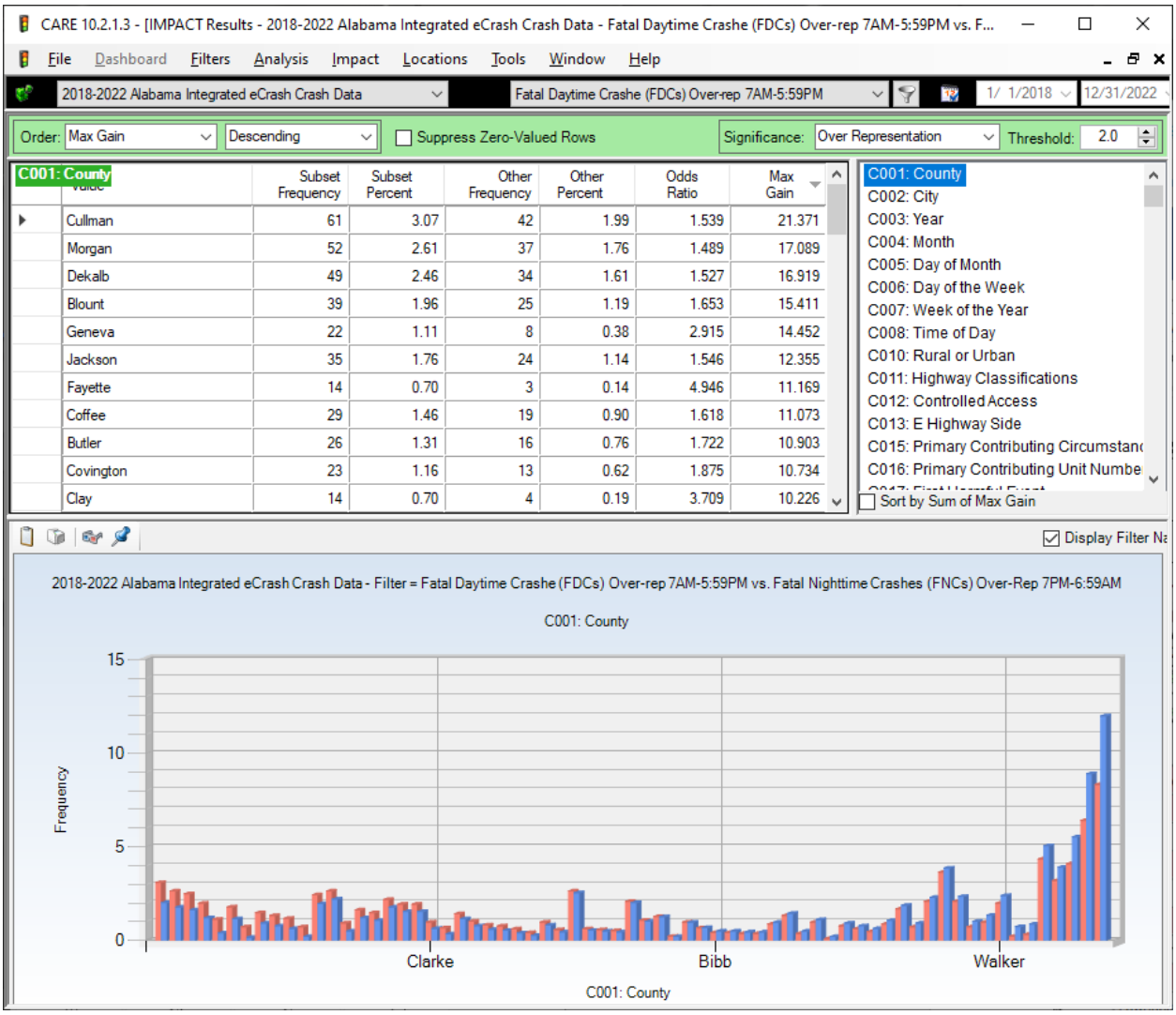
Quick reminder: FDCs=Daytime=**Red bars**; FNCs=Nighttime=**Blue bars**.

This is an example that further demonstrates the color conventions. As shown in the cross-tabulation, daytime crashes were slightly over-represented in 2020 and 2022, but the statistical

analysis did not find any of the years' differences to be significant in the FDC to FNC comparisons.

4.0 Geographic and Harmful Event Factors

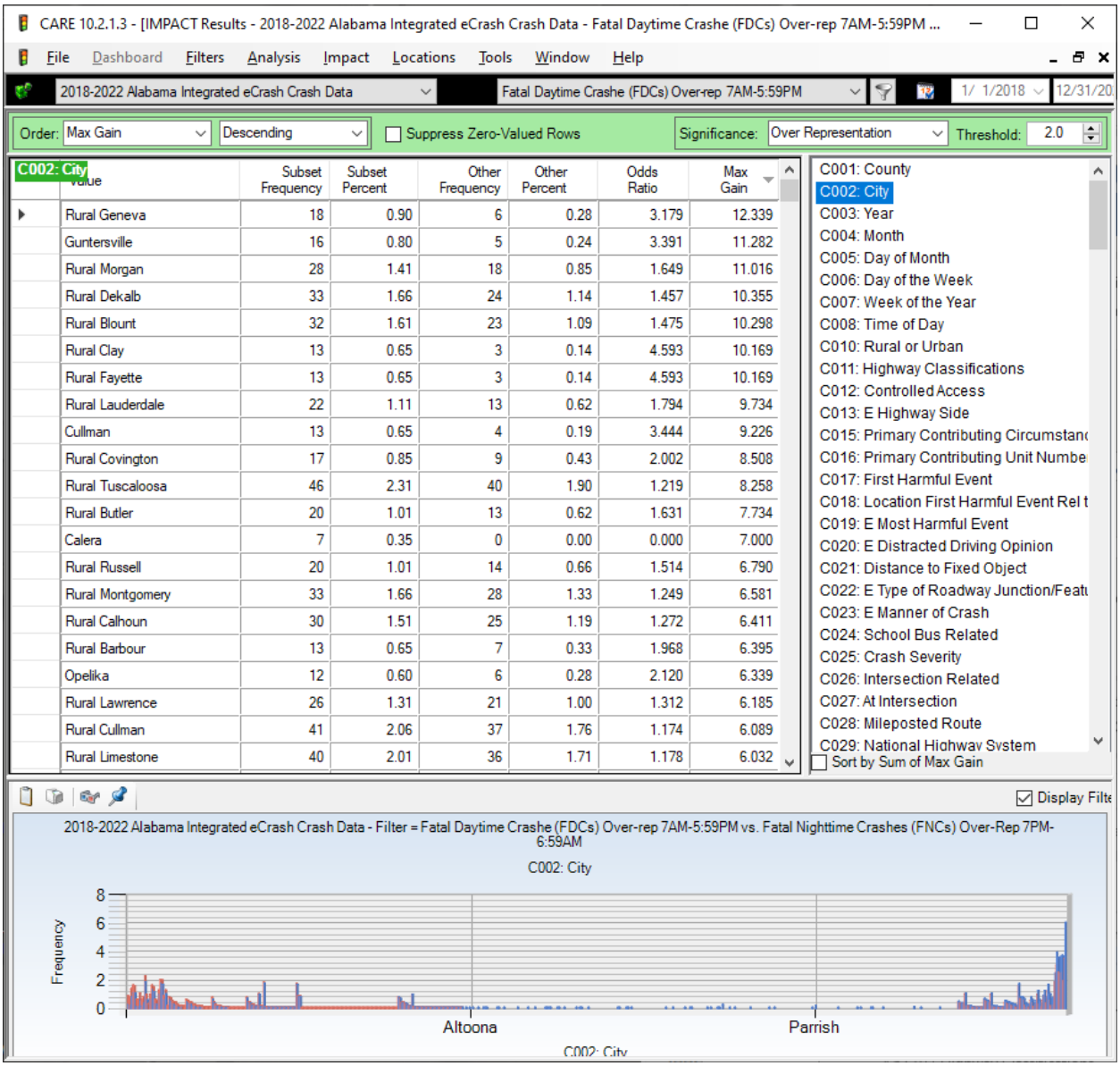
4.1 C001 County (top 11 counties) ordered by Max Gain



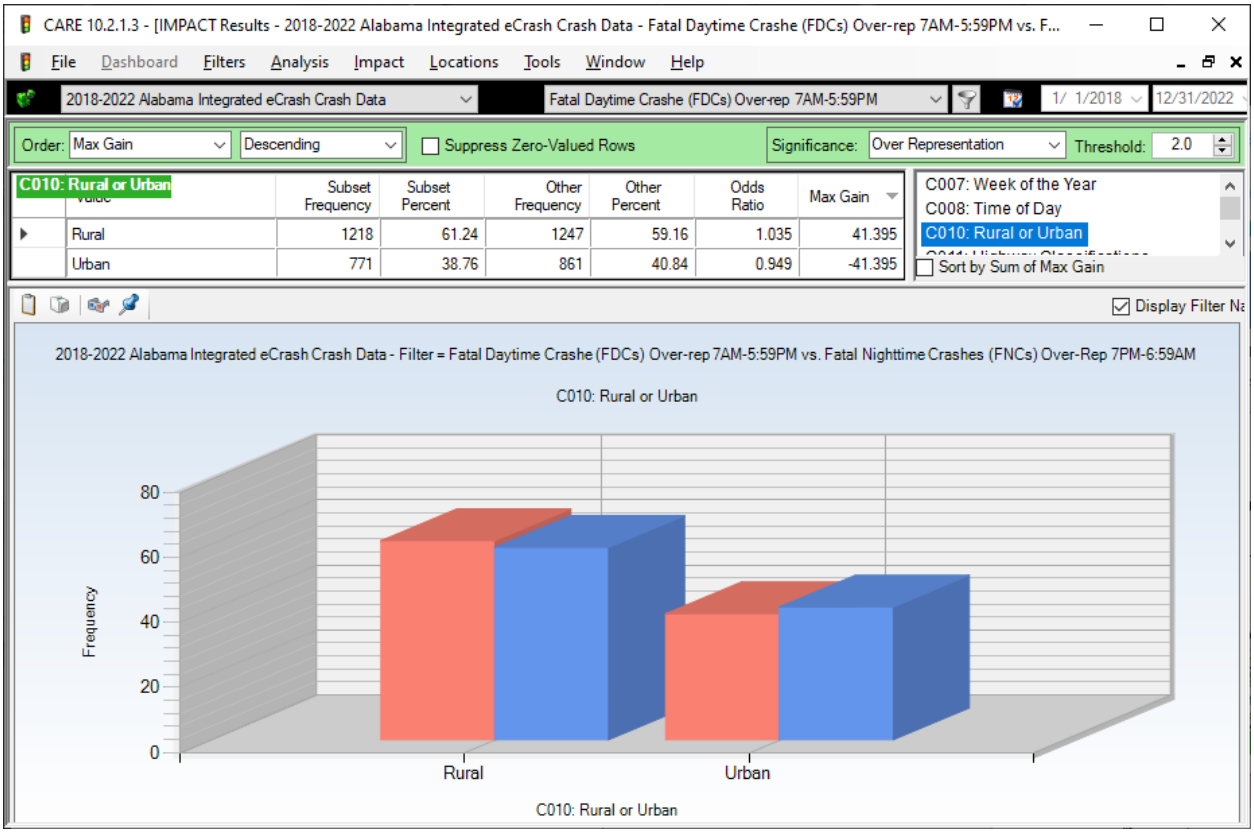
Again, recognize that each line of table above gives both the daytime and nighttime fatal crashes. So, Cullman at the top had 61 daytime fatal crashes and 42 nighttime fatal crashes. The respective proportions (3.07 and 1.99) are compared to obtain the Odds Ratio of 1.539. The Max Gain is the number of daytime fatal crashes that would be reduced if somehow the 3.07 was reduced to 1.99, which for Cullman is 21.371 fatal day Crashes (FDCs). 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 FDC proportions as opposed to their FNC proportions. The display above contains all of the counties with Max Gains greater than 10.000.

4.2 C002 Cities (top 15) with Highest Max Gains (Rural Areas = Virtual Cities)

For comparison purposes, the rural area of a county is considered to be a "virtual city" and crashes that occur there are listed as "Rural [County Name] Crashes" 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 higher traffic density. This display is in Max Gain ordering to put those (possibly virtual) cities that have the highest potential for Fatal Daytime Crash (FDC) reduction at the top. The display below is for all Max Gains > 6.

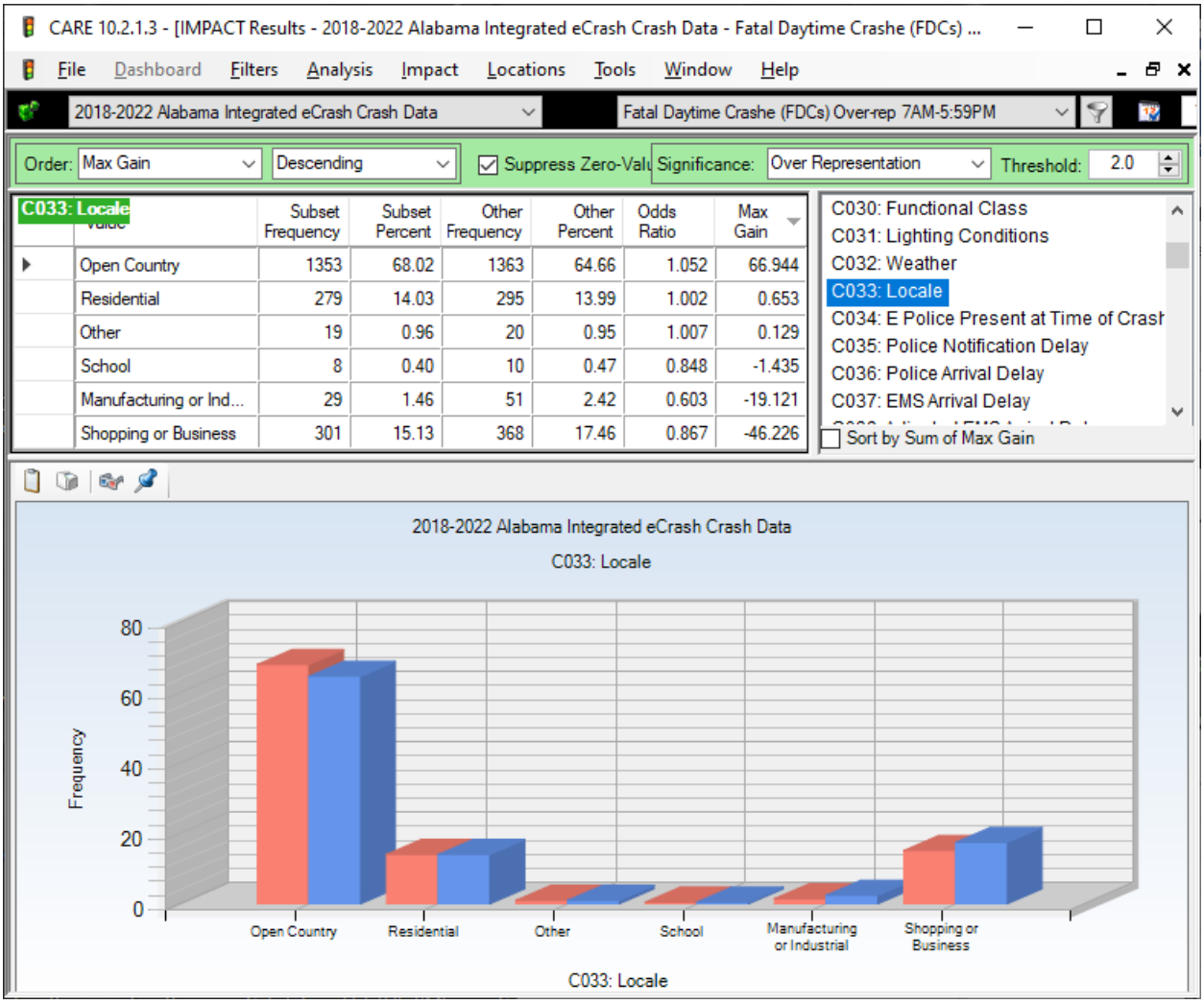


4.3 C010 Rural or Urban



The Daytime crashes had about 61% (61.24%) of the FDCs were in rural areas, while this percentage was 59.16% for the Nighttime crashes. Both illustrate how much more lethal rural crashes are then those on urban roadways. Urban crashes were 38.76% and 40.84%, respectively. This is attributed to the comparative speed at impact on the rural roads, both in daytime and nighttime. This 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). No significant differences were found between the Daytime and Nighttime fatal crashes.

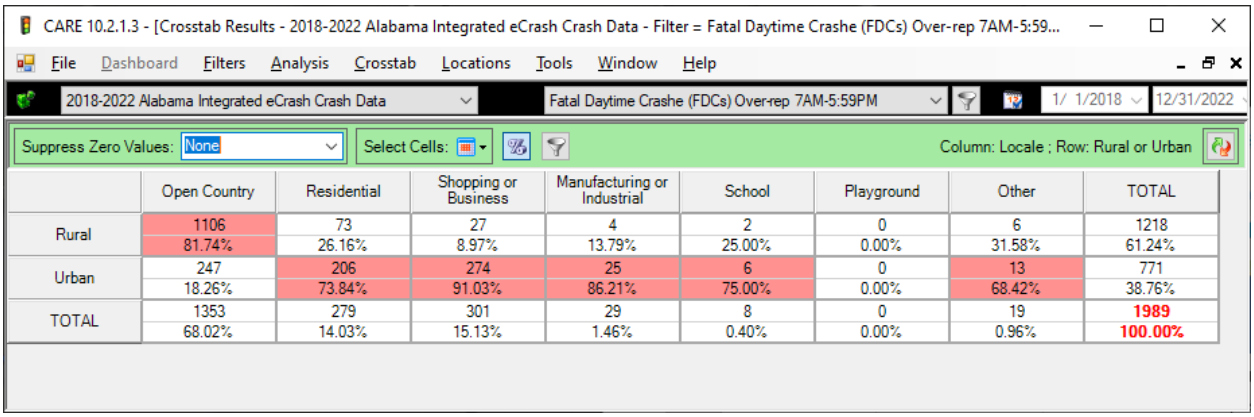
4.4 C033 Locale



Open Country roadways show the highest level of over-representation for both FDCs and FNCs, which are not significantly different from each other as far as their proportions are concerned. This metric is more useful than the rural/urban specification, which we have found to be not as definitive. This is because there are considerable "Open Country" areas within the formal city limits of most cities, and this seems to be where a large number of "urban" fatal crashes are occurring (both day and night). For example, while the rural number for the FDCs was found to be 1,218 (61.24%), the Open Country Locale number indicates 1,353 (64.66%). This difference occurs because the collection of all areas within a city limits are considered to be urban in the urban-rural analysis, as opposed to the Locale attribute that specifies the environment of the area around the crash.

4.5 C033 Locale by C010 Rural-Urban for FDCs

It is obvious in the above outputs that both FDCs and FNCs are greatly over-represented in the rural areas. It is interesting to perform a cross-tabulation for FDC crashes over the Rural and Urban areas to determine to what extent their crashes might be resulting in more fatalities than would be expected. The following, *which is only for FDCs*, gives this analysis.

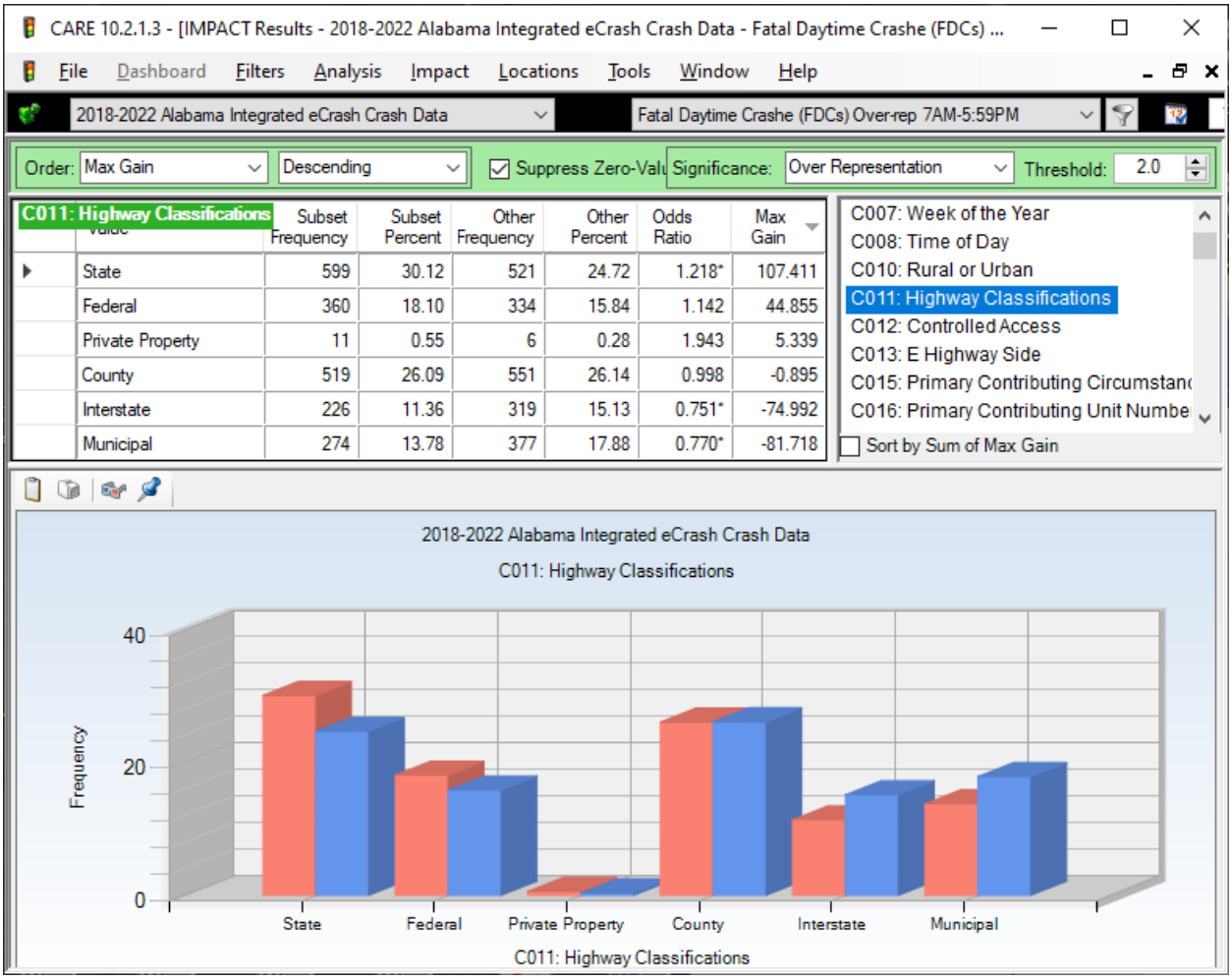


	Open Country	Residential	Shopping or Business	Manufacturing or Industrial	School	Playground	Other	TOTAL
Rural	1106 81.74%	73 26.16%	27 8.97%	4 13.79%	2 25.00%	0 0.00%	6 31.58%	1218 61.24%
Urban	247 18.26%	206 73.84%	274 91.03%	25 86.21%	6 75.00%	0 0.00%	13 68.42%	771 38.76%
TOTAL	1353 68.02%	279 14.03%	301 15.13%	29 1.46%	8 0.40%	0 0.00%	19 0.96%	**1989** **100.00%**

The red-backed cells in the cross-tabulation above indicate over-representation by more than 10%. If there were those that were over-represented, but by less than 10%, they would have a yellow background. If under-represented, there will be a white background. For example, while 61.24% of all FDCs were Rural, 81.74% occurred in Open Country. Since this is greater than a 10% difference, it has a red background.

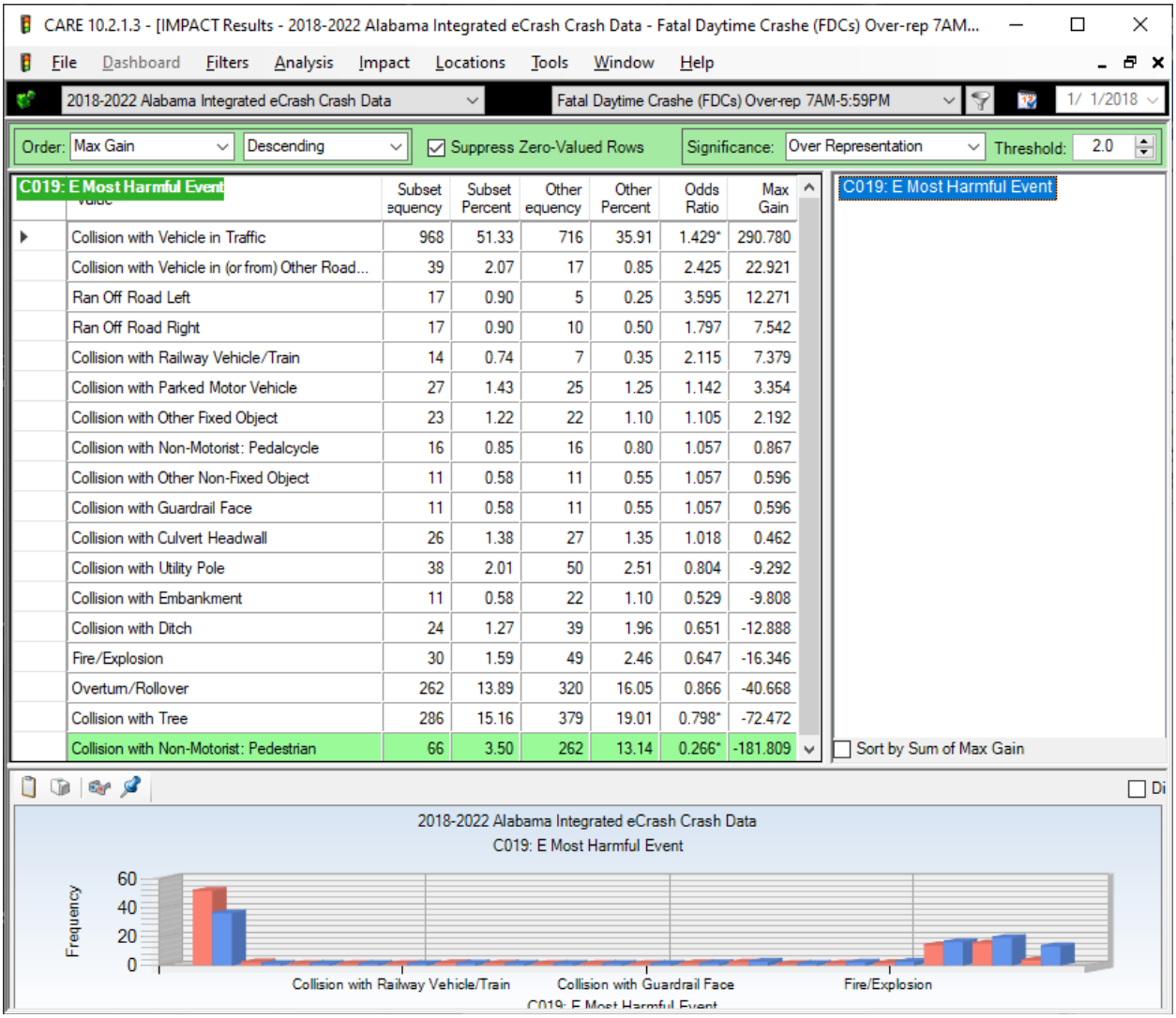
This shows that rural/urban may not be a definitive way of classifying crash locations, and in this case, the Locale attribute may be more precise.

4.6 C011 Highway Classifications



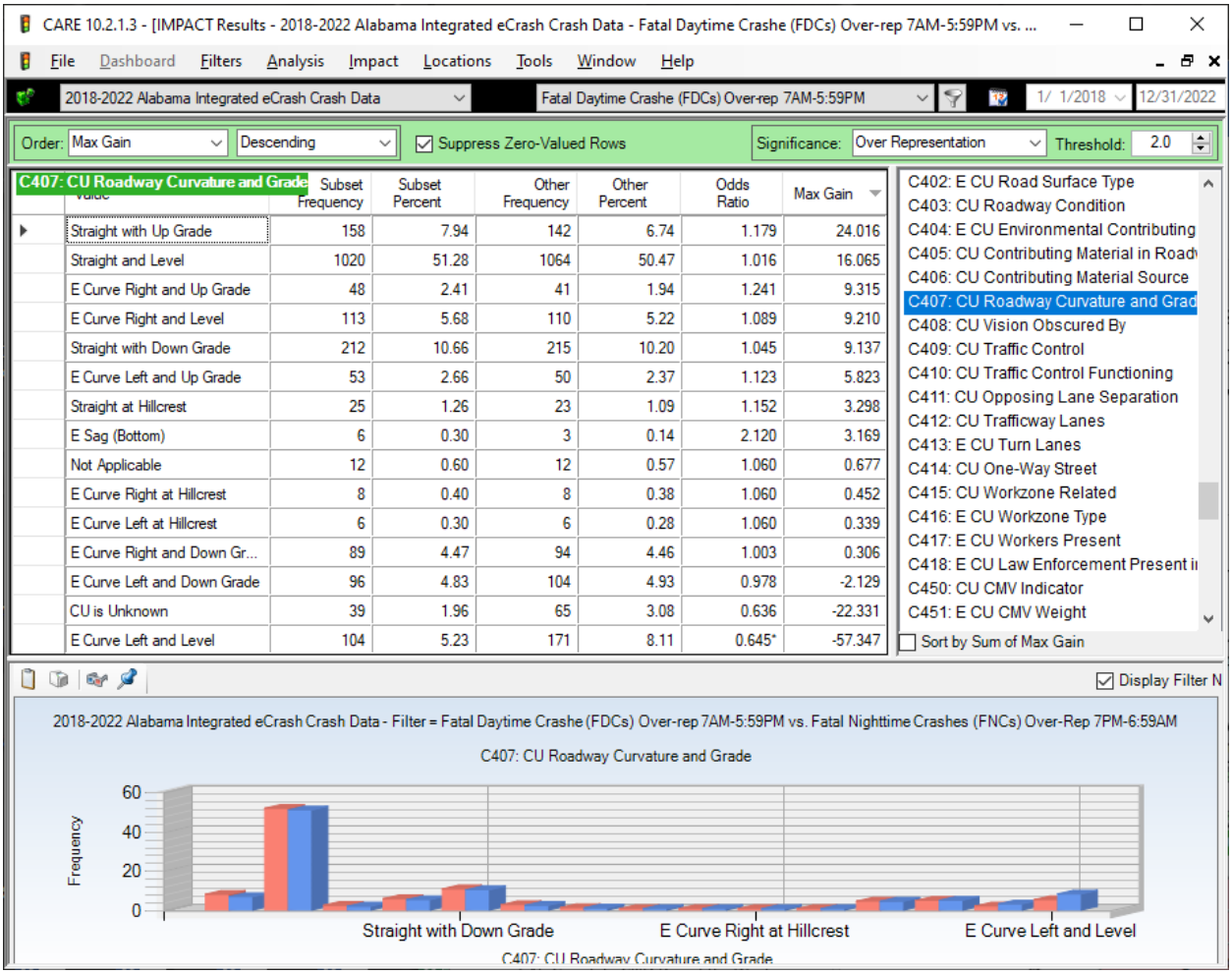
State routes are significantly over-represented in fatal crashes during the day (FDCs). Interstate and municipal roads are significantly over-represented in the nighttime hours. Generally pedestrian fatalities occur on the municipal roads. We will check that out further below in Section 4.7 C019, Most Harmful Event.

4.7 C019 Most Harmful Event (>10 in MaxGain order)



This display is intended to show safety engineers obstacles that are being hit most often in Fatal Crashes, with a differential between daytime and nighttime fatal crashes. The most over-represented FDC is Collision with Vehicle in Traffic (968 daytime as opposed to 716 nighttime). The algorithm does not consider items with frequencies less than 20, so there could be other significant differences in the list. At the bottom of the table it can be seen that for nighttime over-representations, Pedestrian collisions (66 – reference Section 4.5), Collisions with Trees (286) and Overturn/Rollover (262) fatal crashes are all over-represented.

4.8 C407 CU Roadway Curvature and Grade

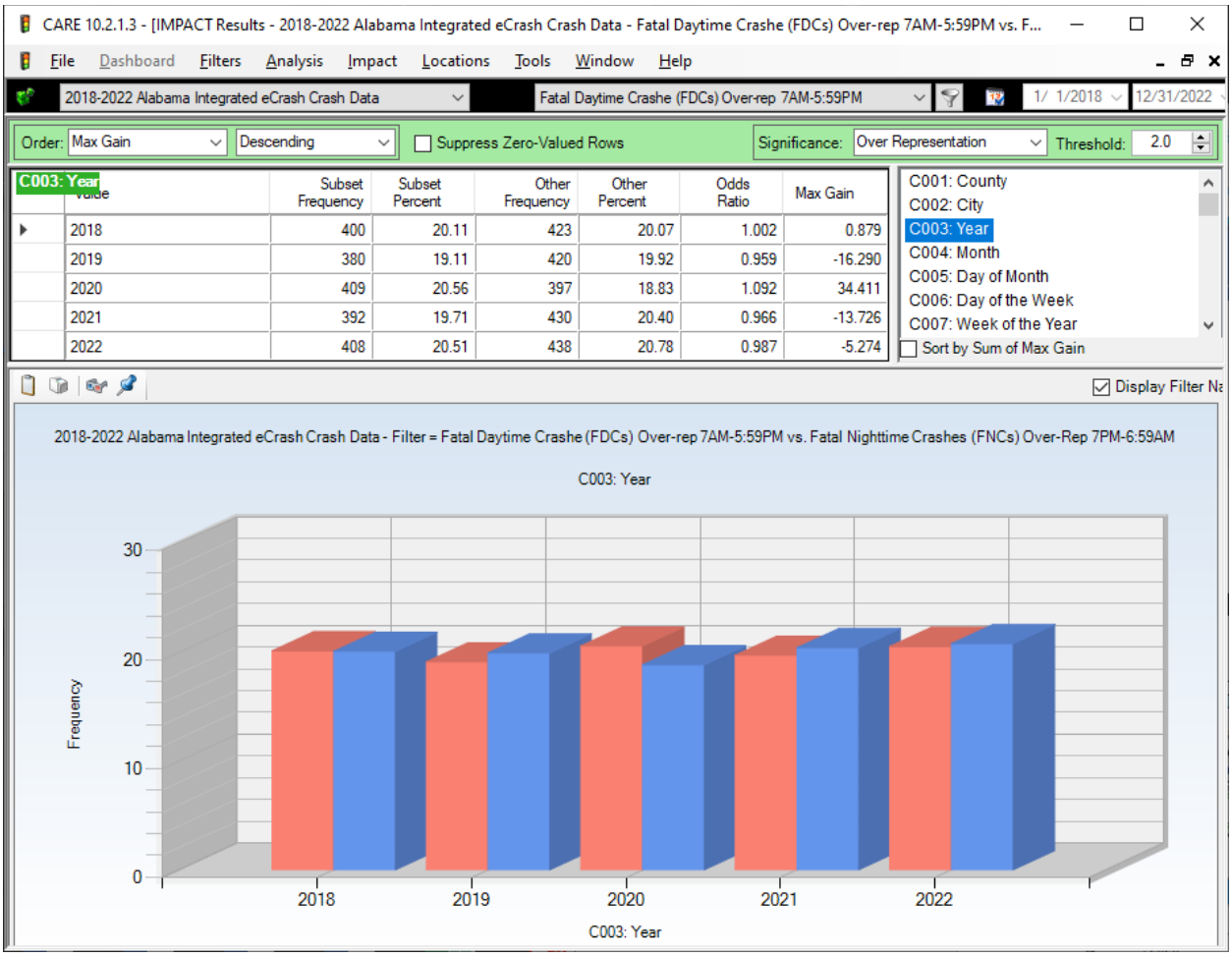


FDCs are over-represented on most types of curves, but their difference from FNCs were not seen to be significant. There was one FNC item that was significantly higher than its FDC counterpart, and that was the one at the bottom of the list, Curve Left and Level, which had 171 nighttime crashes but only 104 Daytime crashes.

5.0 Time Factors

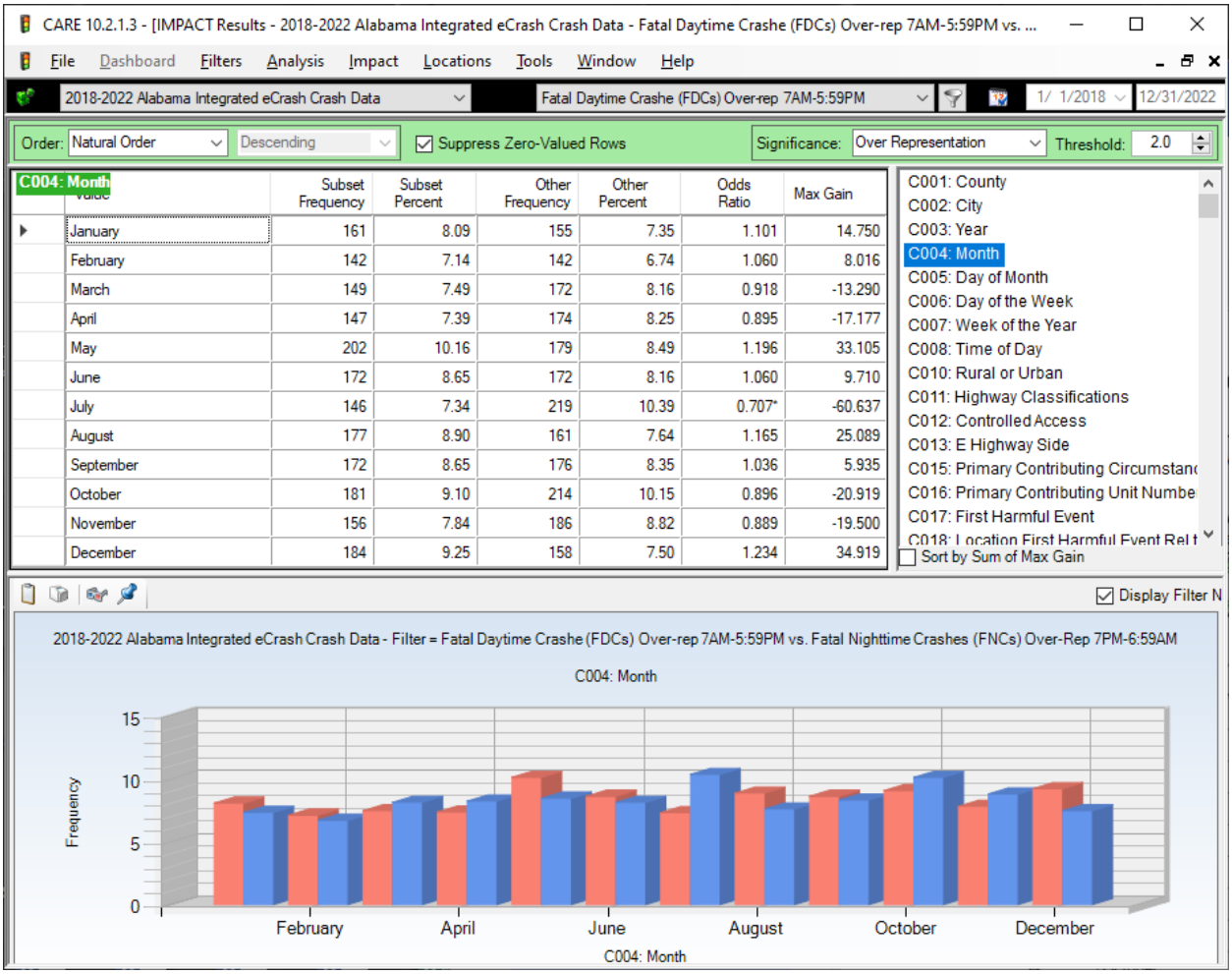
5.1 C003 Year – copied from Section 3.0 for completeness

Fatal Daytime Crashes (FDCs) vs Fatal Nighttime Crashes (FNCs) by Year



Variations from year to year were not determined to be significant. With the possible exception of 2020, the yearly variation of the FDCs are quite comparable to those of the FNCs.

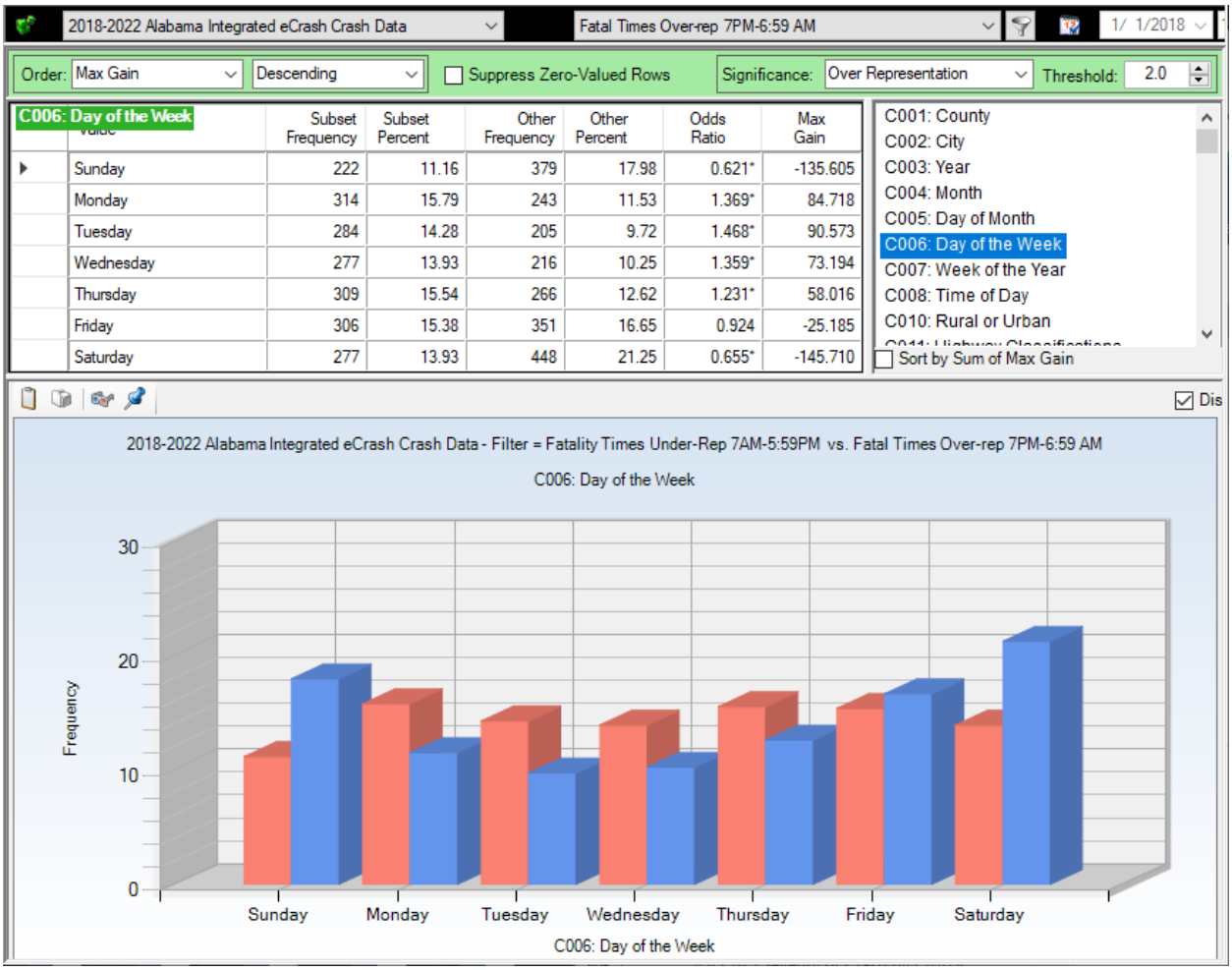
5.2 C004 Month



The ordering of the displays above is according to the natural ordering of months. July is the only month that has statistical significant in its over-representation (Odds Ratio = 0.707). The other months generally fall in line with their Nighttime counterparts. The following presents all months with more than 10% over-representations divided by Daytime and Nighttime.

Over-represented Daytime	Over-represented Nighttime
January 1.101	April 0.895
May 1.196	July 0.707*
August 1.165	October 0.896
December 1.234	November 0.889
	*Statistically Significant

5.3 C006 Day of the Week Comparison FDCs and FNCs (same as Section 2.3)



The following presents Days of the Week with more than 10% over-representations displayed (exception: Friday) by Daytime and Nighttime.

Over-represented Daytime	Over-represented Nighttime
Monday 1.369*	Saturday 0.655*
Tuesday 1.468*	Sunday 0.621*
Wednesday 1.359*	Friday 0.924
Thursday 1.231*	
	*Statistically Significant

5.4 [Omitted to Maintain Previous IMPACT Ordering]

5.5 C008 Time of Day – see Section 2.2

Time of day was used to define the filters used in this study.

5.6 C008 Discussion on Time of Day

Refer to the Day of the Week by Time of Day cross-tabulation *for all fatal crashes* given immediately below in Section 5.7.

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) 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 FDCs to FNCs.

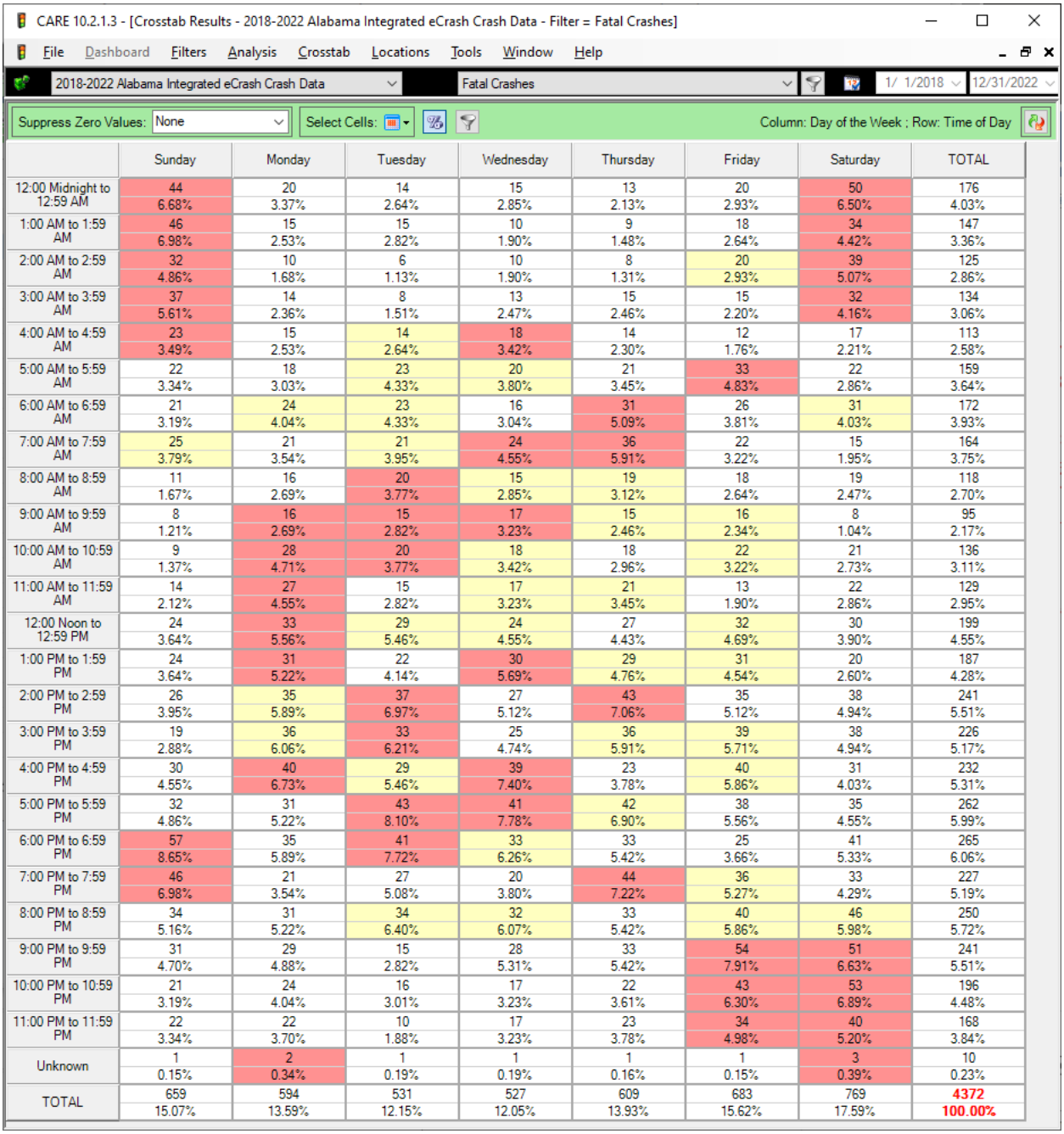
Typical traffic patterns of high traffic results on more crashes in the morning and afternoon rush hours. IDs, and especially the IDs that occur at night, are just getting started in the afternoon rush hours, and they continue to grow through midnight and the early morning hours, not tapering off until about 7:00 AM. 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 fatalities* shows the optimal times for selective enforcement. Generally, 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. Notice for example, the 2 AM to 2:59 AM row has a total percentage value of 2.86% for these fatal crashes. The red cells to the left have percentages of 4.86% and 5.07%. The one yellow cell has a percentage of 2.93%, only slightly higher than the average. All the rest of the cells have white background indicating that their percentages are less than 2.86%.

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.

5.7 C008 Time of Day x C005 Day of the Week (all fatal crashes)



CARE 10.2.1.3 - [Crosstab Results - 2018-2022 Alabama Integrated eCrash Crash Data - Filter = Fatal Crashes]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2018-2022 Alabama Integrated eCrash Crash Data | Fatal Crashes | 1/ 1/2018 | 12/31/2022

Suppress Zero Values: None | Select Cells: | Column: Day of the Week ; Row: Time of Day

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
12:00 Midnight to 12:59 AM	44 6.68%	20 3.37%	14 2.64%	15 2.85%	13 2.13%	20 2.93%	50 6.50%	176 4.03%
1:00 AM to 1:59 AM	46 6.98%	15 2.53%	15 2.82%	10 1.90%	9 1.48%	18 2.64%	34 4.42%	147 3.36%
2:00 AM to 2:59 AM	32 4.86%	10 1.68%	6 1.13%	10 1.90%	8 1.31%	20 2.93%	39 5.07%	125 2.86%
3:00 AM to 3:59 AM	37 5.61%	14 2.36%	8 1.51%	13 2.47%	15 2.46%	15 2.20%	32 4.16%	134 3.06%
4:00 AM to 4:59 AM	23 3.49%	15 2.53%	14 2.64%	18 3.42%	14 2.30%	12 1.76%	17 2.21%	113 2.58%
5:00 AM to 5:59 AM	22 3.34%	18 3.03%	23 4.33%	20 3.80%	21 3.45%	33 4.83%	22 2.86%	159 3.64%
6:00 AM to 6:59 AM	21 3.19%	24 4.04%	23 4.33%	16 3.04%	31 5.09%	26 3.81%	31 4.03%	172 3.93%
7:00 AM to 7:59 AM	25 3.79%	21 3.54%	21 3.95%	24 4.55%	36 5.91%	22 3.22%	15 1.95%	164 3.75%
8:00 AM to 8:59 AM	11 1.67%	16 2.69%	20 3.77%	15 2.85%	19 3.12%	18 2.64%	19 2.47%	118 2.70%
9:00 AM to 9:59 AM	8 1.21%	16 2.69%	15 2.82%	17 3.23%	15 2.46%	16 2.34%	8 1.04%	95 2.17%
10:00 AM to 10:59 AM	9 1.37%	28 4.71%	20 3.77%	18 3.42%	18 2.96%	22 3.22%	21 2.73%	136 3.11%
11:00 AM to 11:59 AM	14 2.12%	27 4.55%	15 2.82%	17 3.23%	21 3.45%	13 1.90%	22 2.86%	129 2.95%
12:00 Noon to 12:59 PM	24 3.64%	33 5.56%	29 5.46%	24 4.55%	27 4.43%	32 4.69%	30 3.90%	199 4.55%
1:00 PM to 1:59 PM	24 3.64%	31 5.22%	22 4.14%	30 5.69%	29 4.76%	31 4.54%	20 2.60%	187 4.28%
2:00 PM to 2:59 PM	26 3.95%	35 5.89%	37 6.97%	27 5.12%	43 7.06%	35 5.12%	38 4.94%	241 5.51%
3:00 PM to 3:59 PM	19 2.88%	36 6.06%	33 6.21%	25 4.74%	36 5.91%	39 5.71%	38 4.94%	226 5.17%
4:00 PM to 4:59 PM	30 4.55%	40 6.73%	29 5.46%	39 7.40%	23 3.78%	40 5.86%	31 4.03%	232 5.31%
5:00 PM to 5:59 PM	32 4.86%	31 5.22%	43 8.10%	41 7.78%	42 6.90%	38 5.56%	35 4.55%	262 5.99%
6:00 PM to 6:59 PM	57 8.65%	35 5.89%	41 7.72%	33 6.26%	33 5.42%	25 3.66%	41 5.33%	265 6.06%
7:00 PM to 7:59 PM	46 6.98%	21 3.54%	27 5.08%	20 3.80%	44 7.22%	36 5.27%	33 4.29%	227 5.19%
8:00 PM to 8:59 PM	34 5.16%	31 5.22%	34 6.40%	32 6.07%	33 5.42%	40 5.86%	46 5.98%	250 5.72%
9:00 PM to 9:59 PM	31 4.70%	29 4.88%	15 2.82%	28 5.31%	33 5.42%	54 7.91%	51 6.63%	241 5.51%
10:00 PM to 10:59 PM	21 3.19%	24 4.04%	16 3.01%	17 3.23%	22 3.61%	43 6.30%	53 6.89%	196 4.48%
11:00 PM to 11:59 PM	22 3.34%	22 3.70%	10 1.88%	17 3.23%	23 3.78%	34 4.98%	40 5.20%	168 3.84%
Unknown	1 0.15%	2 0.34%	1 0.19%	1 0.19%	1 0.16%	1 0.15%	3 0.39%	10 0.23%
TOTAL	659 15.07%	594 13.59%	531 12.15%	527 12.05%	609 13.93%	683 15.62%	769 17.59%	4372 100.00%

6.0 Factors Affecting Severity
6.1 IMPACT: FDCs vs FNCs for C224 Speed at Impact

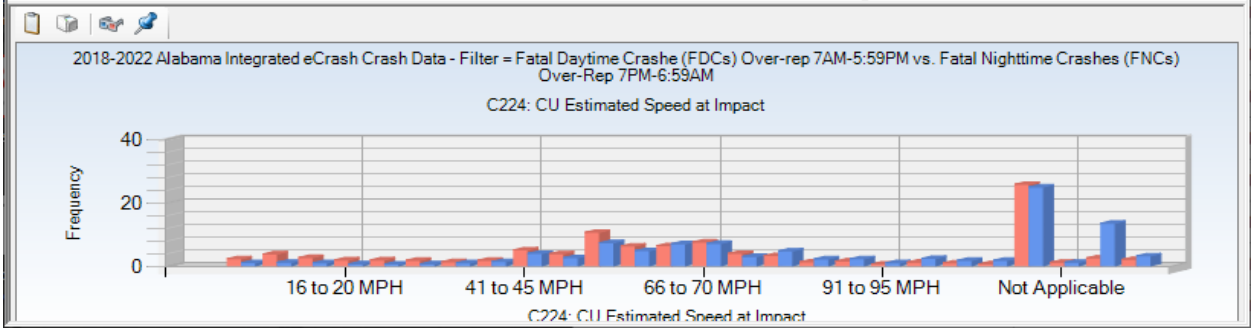
2018-2022 Alabama Integrated eCrash Crash Data | Fatal Daytime Crashe (FDCs) Over-rep 7AM-5:59PM

Order: Max Gain | Descending | Suppress Zero-Valued Ro | Significance: Over Representation | Threshold: 2.0

C224: CU Estimated Speed at Impact	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
1 to 5 MPH	43	2.16	20	0.95	2.279*	24.129
6 to 10 MPH	73	3.67	22	1.04	3.517*	52.242
11 to 15 MPH	51	2.56	19	0.90	2.845	33.073
16 to 20 MPH	36	1.81	12	0.57	3.179	24.677
21 to 25 MPH	36	1.81	11	0.52	3.469	25.621
26 to 30 MPH	34	1.71	12	0.57	3.003	22.677
31 to 35 MPH	25	1.26	19	0.90	1.395	7.073
36 to 40 MPH	34	1.71	27	1.28	1.335	8.524
41 to 45 MPH	99	4.98	82	3.89	1.280	21.629
46 to 50 MPH	75	3.77	53	2.51	1.500	24.992
51 to 55 MPH	210	10.56	153	7.26	1.455*	65.637
56 to 60 MPH	124	6.23	100	4.74	1.314	29.645
61 to 65 MPH	126	6.33	146	6.93	0.915	-11.758
66 to 70 MPH	149	7.49	148	7.02	1.067	9.355
71 to 75 MPH	77	3.87	61	2.89	1.338	19.444
76 to 80 MPH	63	3.17	98	4.65	0.681*	-29.468
81 to 85 MPH	24	1.21	45	2.13	0.565	-18.460
86 to 90 MPH	29	1.46	46	2.18	0.668	-14.403
91 to 95 MPH	10	0.50	19	0.90	0.558	-7.927
96 to 100 MPH	22	1.11	48	2.28	0.486*	-23.290
Over 100 MPH	17	0.85	36	1.71	0.500	-16.968
E Stationary	11	0.55	35	1.66	0.333	-22.024
Unknown	513	25.79	526	24.95	1.034	16.694
Not Applicable	21	1.06	22	1.04	1.012	0.242
CU is Not a Vehicle	48	2.41	283	13.43	0.180*	-219.024
CU is Unknown	39	1.96	65	3.08	0.636	-22.331

C224: CU Estimated Speed at Impact

Sort by Sum of Max Gain



Daytime speeds of 0-75 MPH are over-represented, while the Nighttime speeds are over-represented in the higher speeds (above 75 MPH). The comparison above is Fatal Daytime Crashes (FDCs) against Fatal Nighttime Crashes (FNCs). The speed limit on County roads is generally 45 MPH, and it is generally lower on Municipal roads.

6.2 Section Number Not used to preserve ordering

6.3 Highway Classification (C011) by Speed at Impact (C224) All Fatal Crashes

2018-2022 Alabama Integrated eCrash Crash Data | Fatal Crashes | 1/ 1/2018 | 12/31/2022

Suppress Zero Values: Rows and Columns | Select Cells: | Column: Highway Classifications ; Row: CU Estimated Speed at Impact

	Interstate	Federal	State	County	Municipal	Private Property	TOTAL
1 to 5 MPH	3 0.52%	16 2.17%	27 2.27%	15 1.31%	3 0.42%	1 5.88%	65 1.49%
6 to 10 MPH	1 0.17%	28 3.80%	39 3.27%	26 2.27%	7 0.99%	1 5.88%	102 2.33%
11 to 15 MPH	2 0.35%	22 2.99%	27 2.27%	20 1.75%	5 0.71%	0 0.00%	76 1.74%
16 to 20 MPH	1 0.17%	17 2.31%	21 1.76%	11 0.96%	3 0.42%	0 0.00%	53 1.21%
21 to 25 MPH	0 0.00%	10 1.36%	22 1.85%	13 1.13%	5 0.71%	0 0.00%	50 1.14%
26 to 30 MPH	1 0.17%	5 0.68%	12 1.01%	23 2.01%	8 1.13%	0 0.00%	49 1.12%
31 to 35 MPH	1 0.17%	5 0.68%	9 0.76%	25 2.18%	8 1.13%	0 0.00%	48 1.10%
36 to 40 MPH	1 0.17%	10 1.36%	13 1.09%	33 2.88%	8 1.13%	1 5.88%	66 1.51%
41 to 45 MPH	2 0.35%	14 1.90%	38 3.19%	124 10.82%	11 1.56%	0 0.00%	189 4.32%
46 to 50 MPH	5 0.87%	23 3.12%	46 3.86%	47 4.10%	14 1.98%	0 0.00%	135 3.09%
51 to 55 MPH	4 0.70%	86 11.67%	186 15.62%	96 8.38%	7 0.99%	0 0.00%	379 8.67%
56 to 60 MPH	16 2.78%	34 4.61%	61 5.12%	118 10.30%	11 1.56%	0 0.00%	240 5.49%
61 to 65 MPH	33 5.74%	66 8.96%	83 6.97%	105 9.16%	4 0.57%	0 0.00%	291 6.66%
66 to 70 MPH	114 19.83%	29 3.93%	63 5.29%	93 8.12%	13 1.84%	0 0.00%	312 7.14%
71 to 75 MPH	20 3.48%	30 4.07%	44 3.69%	38 3.32%	10 1.42%	0 0.00%	142 3.25%
76 to 80 MPH	44 7.65%	23 3.12%	53 4.45%	50 4.36%	5 0.71%	0 0.00%	175 4.00%
81 to 85 MPH	18 3.13%	13 1.76%	22 1.85%	14 1.22%	4 0.57%	0 0.00%	71 1.62%
86 to 90 MPH	21 3.65%	11 1.49%	29 2.43%	16 1.40%	3 0.42%	0 0.00%	80 1.83%
91 to 95 MPH	14 2.43%	6 0.81%	1 0.08%	5 0.44%	3 0.42%	0 0.00%	29 0.66%
96 to 100 MPH	15 2.61%	13 1.76%	21 1.76%	24 2.09%	4 0.57%	0 0.00%	77 1.76%
Over 100 MPH	12 2.09%	11 1.49%	16 1.34%	11 0.96%	5 0.71%	0 0.00%	55 1.26%
E Stationary	26 4.52%	8 1.09%	5 0.42%	4 0.35%	5 0.71%	1 5.88%	49 1.12%
Unknown	136 23.65%	157 21.30%	257 21.58%	165 14.40%	389 55.10%	10 58.82%	1114 25.48%
Not Applicable	3 0.52%	4 0.54%	5 0.42%	4 0.35%	30 4.25%	1 5.88%	47 1.08%
CU is Not a Vehicle	60 10.43%	83 11.26%	77 6.47%	56 4.89%	86 12.18%	0 0.00%	362 8.28%
CU is Unknown	22 3.83%	13 1.76%	14 1.18%	10 0.87%	55 7.79%	2 11.76%	116 2.65%
TOTAL	575 13.15%	737 16.86%	1191 27.24%	1146 26.21%	706 16.15%	17 0.39%	4372 100.00%

All Fatal Crashes. This shows fatal crashes are caused by a combination of higher speeds, Impaired Driving (ID). and causal vehicles pulling out on the roadway at slow speeds.

6.4a Cross-tabulation: C025 Severity by C224 Speed at Impact (all crashes)

2018-2022 Alabama Integrated eCrash Crash Data | All records (do not apply a filter) | 1/ 1/2018

Suppress Zero Values: | Select Cells: | Column: Crash Severity ; Row: CU Estimated Speed at Impact

	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL
1 to 5 MPH	65 1.49%	524 2.58%	2241 3.72%	3645 5.68%	49446 8.50%	836 4.30%	56757 7.56%
6 to 10 MPH	102 2.33%	729 3.59%	2943 4.88%	3498 5.45%	33991 5.84%	518 2.67%	41781 5.57%
11 to 15 MPH	76 1.74%	636 3.14%	2294 3.80%	2651 4.13%	22655 3.89%	351 1.81%	28663 3.82%
16 to 20 MPH	53 1.21%	398 1.96%	1581 2.62%	1839 2.87%	16005 2.75%	263 1.35%	20139 2.68%
21 to 25 MPH	50 1.14%	371 1.83%	1422 2.36%	1667 2.60%	13901 2.39%	296 1.52%	17707 2.36%
26 to 30 MPH	49 1.12%	340 1.68%	1577 2.62%	1825 2.84%	14131 2.43%	252 1.30%	18174 2.42%
31 to 35 MPH	48 1.10%	564 2.78%	2151 3.57%	2172 3.38%	16511 2.84%	378 1.95%	21824 2.91%
36 to 40 MPH	66 1.51%	660 3.25%	2284 3.79%	2161 3.37%	15169 2.61%	307 1.58%	20647 2.75%
41 to 45 MPH	189 4.32%	1710 8.43%	4547 7.54%	3181 4.96%	24518 4.21%	459 2.36%	34604 4.61%
46 to 50 MPH	135 3.09%	934 4.60%	2350 3.90%	1639 2.55%	11883 2.04%	220 1.13%	17161 2.29%
51 to 55 MPH	379 8.67%	2111 10.41%	4061 6.73%	2333 3.64%	18413 3.17%	291 1.50%	27588 3.68%
56 to 60 MPH	240 5.49%	1168 5.76%	1994 3.31%	1127 1.76%	8707 1.50%	173 0.89%	13409 1.79%
61 to 65 MPH	291 6.66%	1259 6.21%	2069 3.43%	1123 1.75%	10958 1.88%	154 0.79%	15854 2.11%
66 to 70 MPH	312 7.14%	1208 5.96%	1968 3.26%	1217 1.90%	13973 2.40%	108 0.56%	18786 2.50%
71 to 75 MPH	142 3.25%	375 1.85%	563 0.93%	304 0.47%	3147 0.54%	31 0.16%	4562 0.61%
76 to 80 MPH	175 4.00%	343 1.69%	426 0.71%	231 0.36%	1645 0.28%	31 0.16%	2851 0.38%
81 to 85 MPH	71 1.62%	138 0.68%	151 0.25%	86 0.13%	455 0.08%	3 0.02%	904 0.12%
86 to 90 MPH	80 1.83%	148 0.73%	118 0.20%	58 0.09%	289 0.05%	7 0.04%	700 0.09%
91 to 95 MPH	29 0.66%	38 0.19%	22 0.04%	10 0.02%	51 0.01%	4 0.02%	154 0.02%
96 to 100 MPH	77 1.76%	93 0.46%	58 0.10%	30 0.05%	148 0.03%	12 0.06%	418 0.06%
Over 100 MPH	55 1.26%	45 0.22%	35 0.06%	24 0.04%	83 0.01%	4 0.02%	246 0.03%
E Stationary	49 1.12%	146 0.72%	425 0.70%	392 0.61%	4533 0.78%	157 0.81%	5702 0.76%
Unknown	1114 25.48%	5095 25.12%	21062 34.93%	28798 44.88%	257736 44.30%	11824 60.88%	325629 43.40%
Not Applicable	47 1.08%	273 1.35%	1340 2.22%	1302 2.03%	19553 3.36%	1486 7.65%	24001 3.20%
CU is Not a Vehicle	362 8.28%	540 2.66%	670 1.11%	305 0.48%	175 0.03%	60 0.31%	2112 0.28%
CU is Unknown	116 2.65%	437 2.15%	1948 3.23%	2554 3.98%	23669 4.07%	1198 6.17%	29922 3.99%
TOTAL	4372 0.58%	20283 2.70%	60300 8.04%	64172 8.55%	581745 77.54%	19423 2.59%	750295 100.00%

6.4b 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 all crashes. 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 as the speeds increase.

Speed at Impact	Fatality Odds (1 in …)	Increase Probability above 31-35
31 to 35 MPH	102.8	1
36 to 40 MPH	78.3	1.3
41 to 45 MPH	50.9	2.0
46 to 50 MPH	37.5	2.7
51 to 55 MPH	23.4	4.4
56 to 60 MPH	18.9	5.4
61 to 65 MPH	16.3	6.3
66 to 70 MPH	15.1	6.8
71 to 75 MPH	9.7	10.5
76 to 80 MPH	6.7	15.3
81 to 85 MPH	6.3	16.4
86 to 90 MPH	5.1	20.4
91 to 95 MPH	3.4	30.1
96 to 100 MPH	3.4	30.7
Over 100 MPH	2.9	35.6

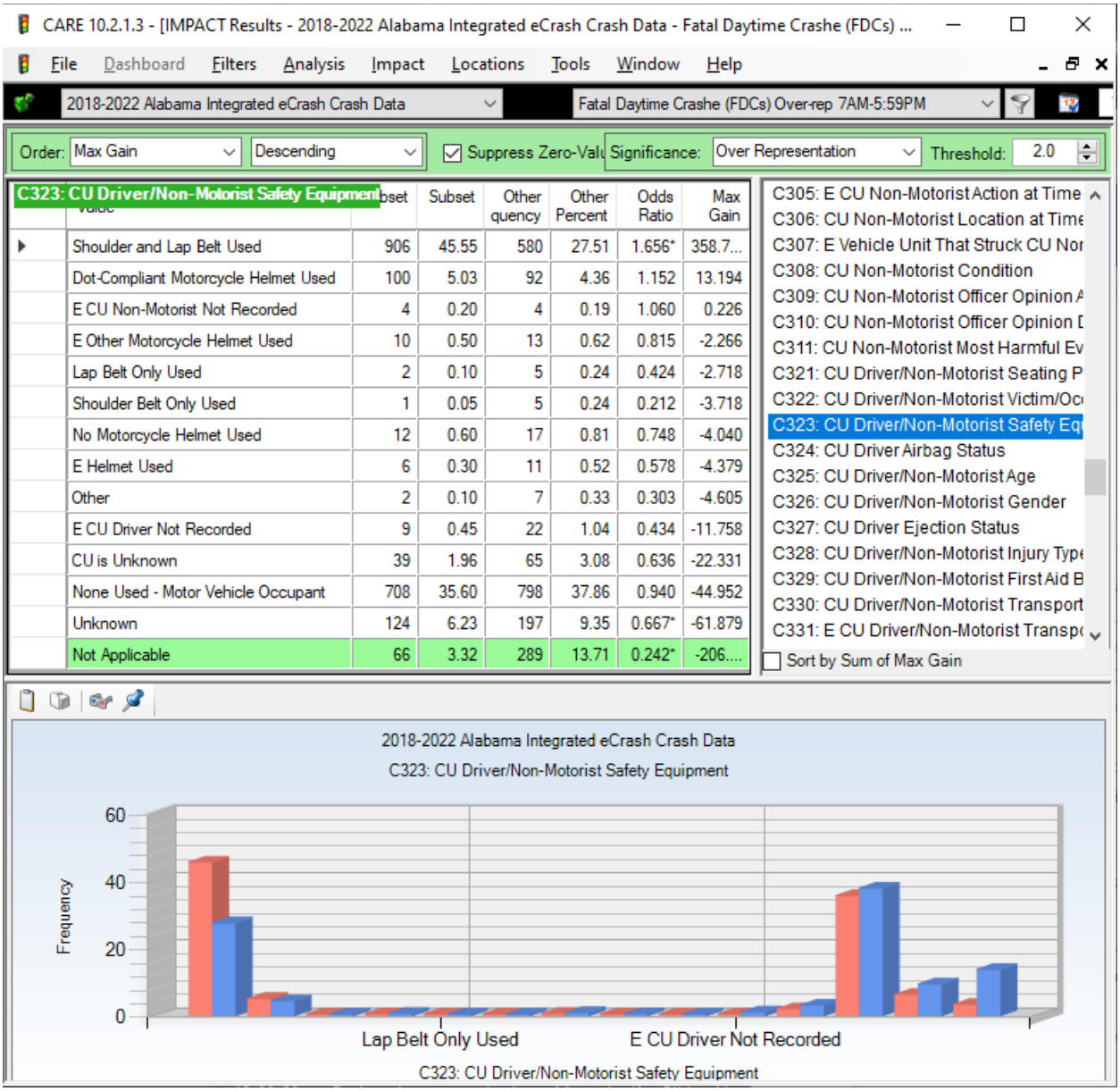
The last column of the above table gives the fatality probability multiplier based on the lowest probability (31-35 MPH), to which was assigned a relative value of 1.0 (not a probability). The probabilities in the form of "**1 in X"** are given in the middle column. For example, the probability of a crash at 46-55 MPH being fatal is one in 37.5. This is 2.7 times that probability if the impact speed were 31 to 35.

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 FDC and FNC 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 a much lower restraint use than those not impaired.

6.5 C323 Restraint Use by Drivers in Fatal Collisions (FDCs and FNCs)

The following display presents a restraint-use comparison of FDC driver safety belt use compared to all FNC, over the same five-year time period.



The proportion of use of proper restraints is 65.6% higher during the day than at night according the comparable fatal crash statistics. None used is over-represented in FNCs by about 6%,

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

CARE 10.2.1.3 - [Crosstab Results - 2018-2022 Alabama Integrated eCrash Crash Data - Filter = Injury C...

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2018-2022 Alabama Integrated eCrash Crash Data | Injury Crashes (including Fatalities)

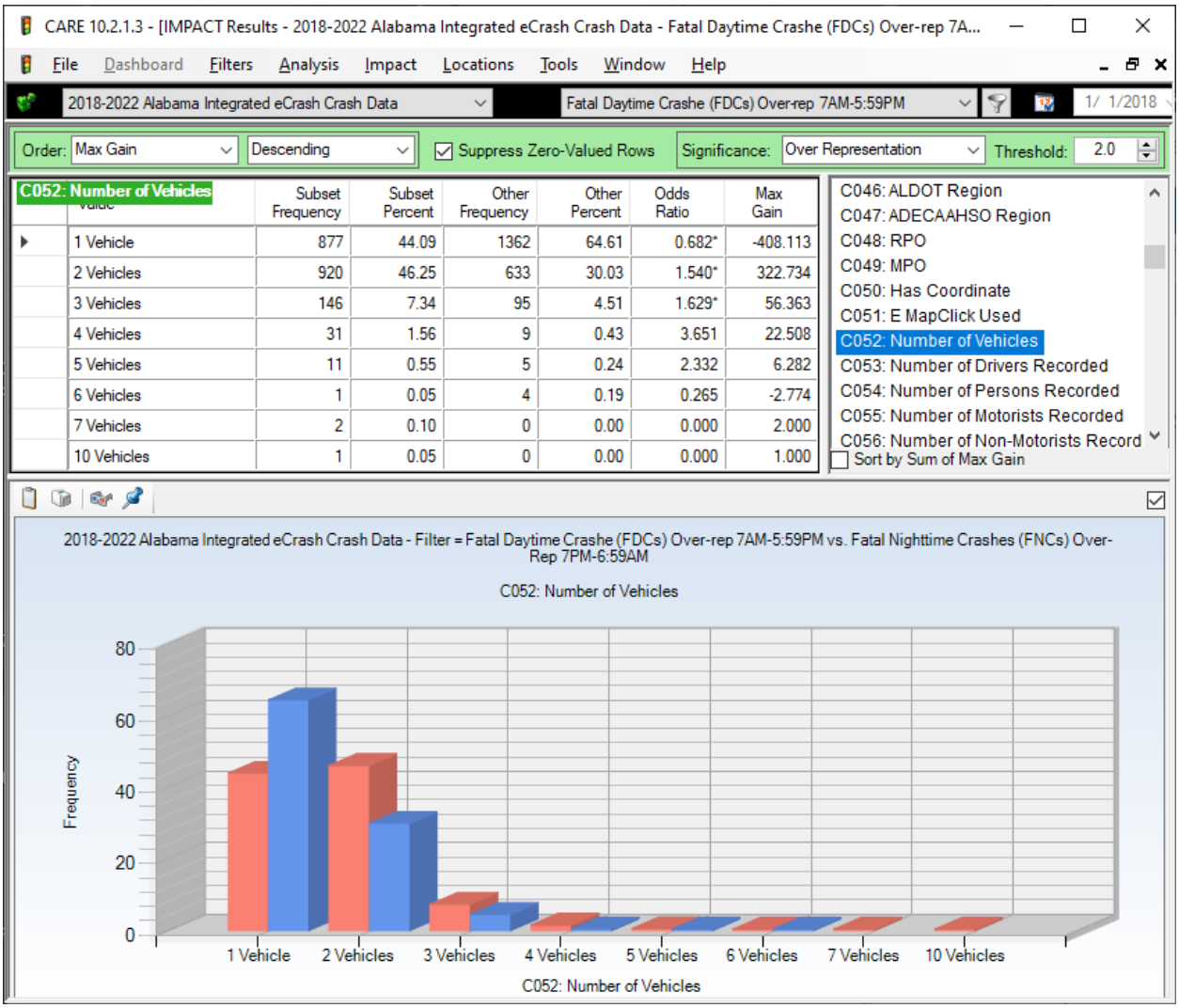
Suppress Zero Values: Rows and Columns | Select Cells: | Column: Crash Severity ; Row: CU Driver/Non-Motorist Safety Equipment

	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	TOTAL
None Used - Motor Vehicle Oc	1596	4412	5240	2510	13758
Shoulder and Lap Belt Used	1581	11626	44825	51783	109815
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	1	3	0	4
E Rear Facing Child Safety Seat	0	0	0	3	3
E Rear Facing Child Safety Seat	0	0	2	0	2
E Child in Arms of Restrained Adult	0	0	2	0	2
Dot-Compliant Motorcycle Helme	201	955	1118	351	2625
E Helmet Used	18	102	177	51	348
E Protective Pads Used (Elbows/Kn	0	1	0	0	1
Reflective Clothing (Jacket/B	1	6	7	0	14
E Lighting Used by Non-Motorist	1	3	3	2	9
E Other Safety Equipment Used	1	5	10	8	24
E Other Motorcycle Helme	24	69	62	13	168
No Motorcycle Helmet Used	32	111	94	26	263
Other	9	23	56	38	126
Unknown	351	1581	4982	5459	12373
Not Applicable	385	716	1066	546	2713
CU is Unknown	116	437	1948	2554	5055
E CU Driver Not Recorded	32	110	340	414	896
E CU Non-Motorist Not Reco	10	51	86	72	219
TOTAL	4372	20283	60300	64172	149127

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

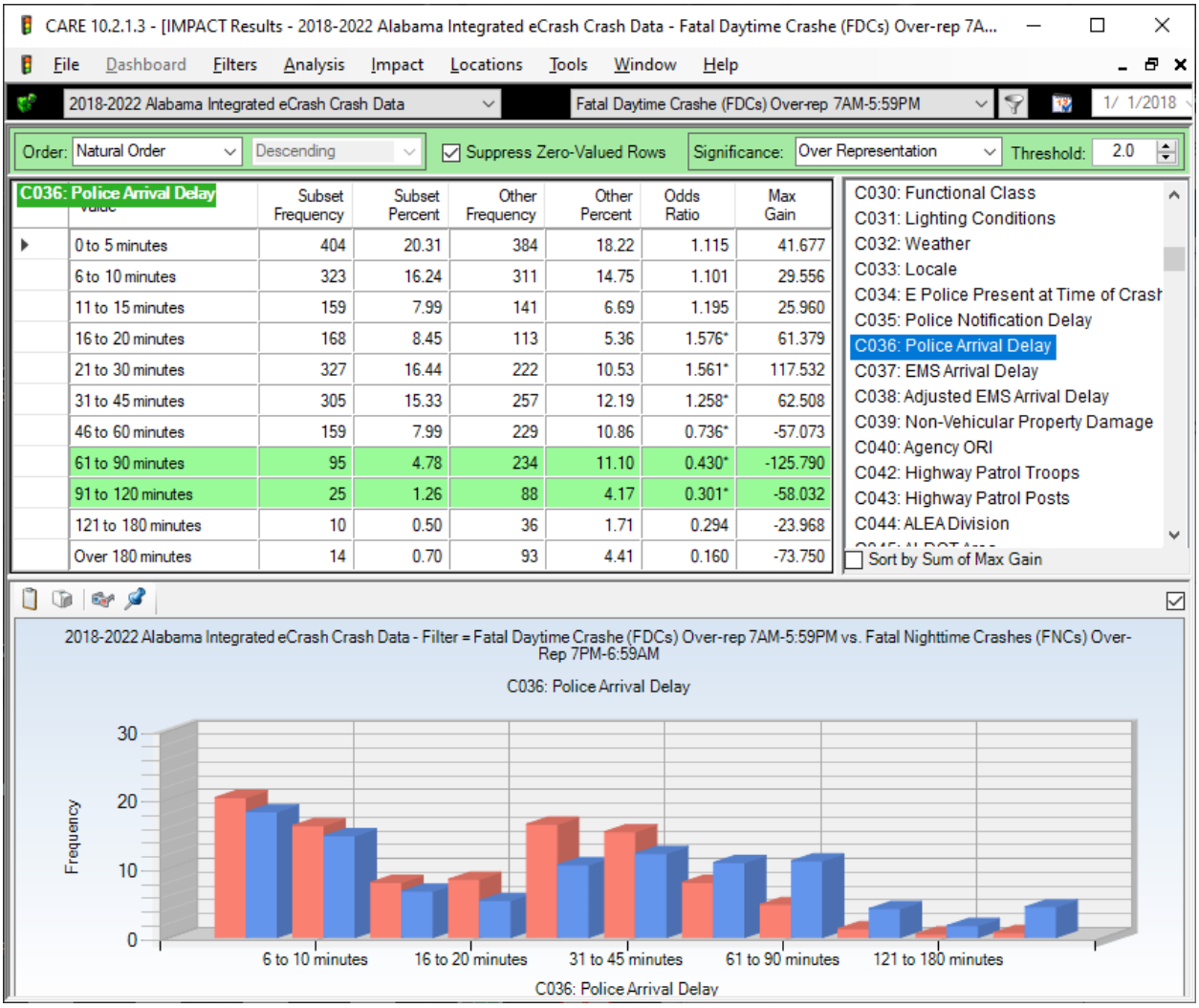
6.7 C052 Number of Vehicles Involved

The following display presents a comparison of the number of vehicles in FDCs against number of vehicles FNCs over the five-year time period of the study.



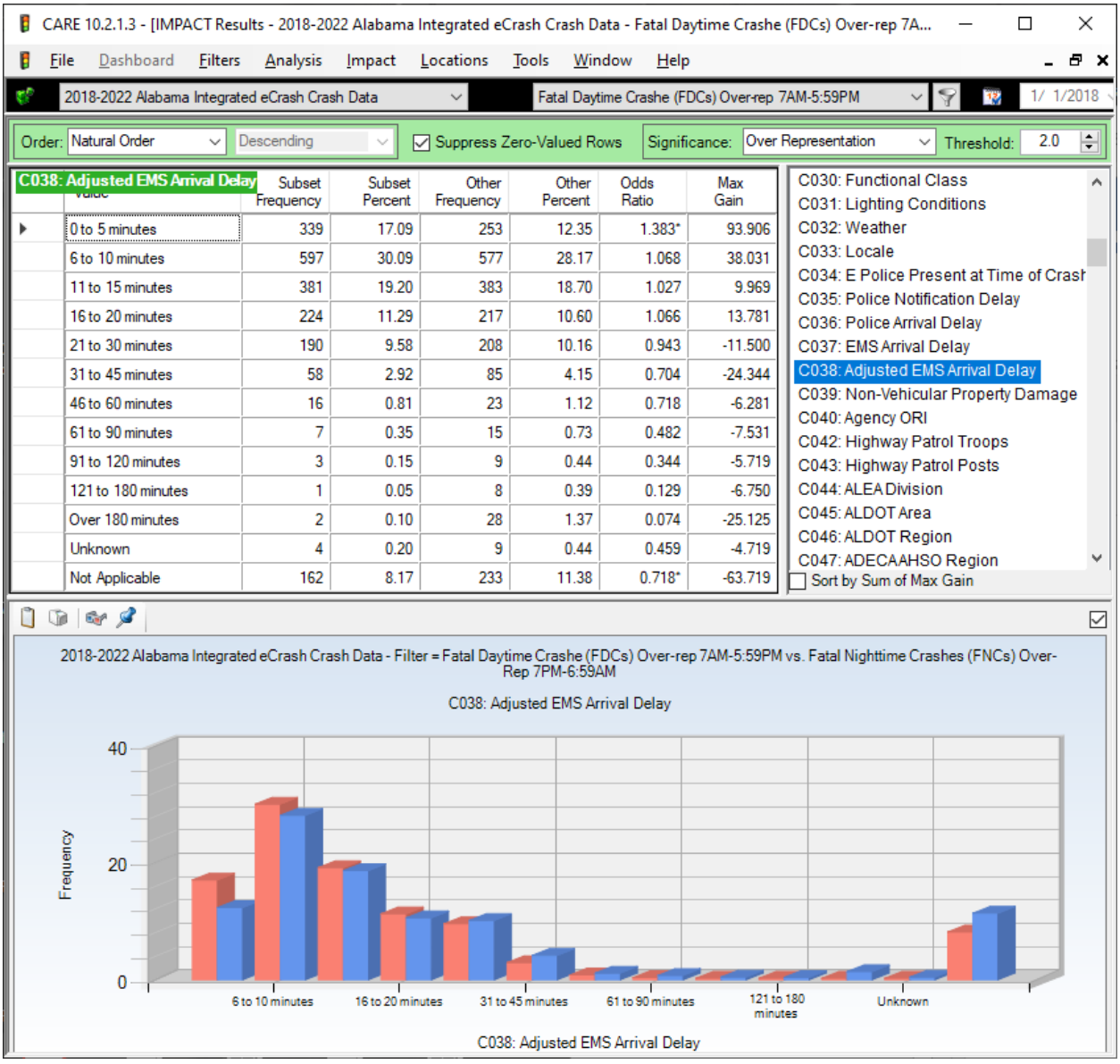
Single vehicle FNC crashes are over-represented by a factor of 1/0.682 = 1.466, or close to 50% higher than expected. The two- and three-vehicle crashes are over-represented in FDCs by factors of 1.540 and 1.629, respectively. This illustrates that unforced errors (i.e., single vehicle crashes) are much more prevalent at nighttime than daytime.

6.8 C036 Police Arrival Delay (FDCs vs FNCs)



FNC police arrival delays reflect the issues in learning about the crash and getting to the scene at night. All delay times above 45 minutes are over-represented for FNCs with high Odds Ratios. The analysis below shows how this contrasts with EMS arrival times.

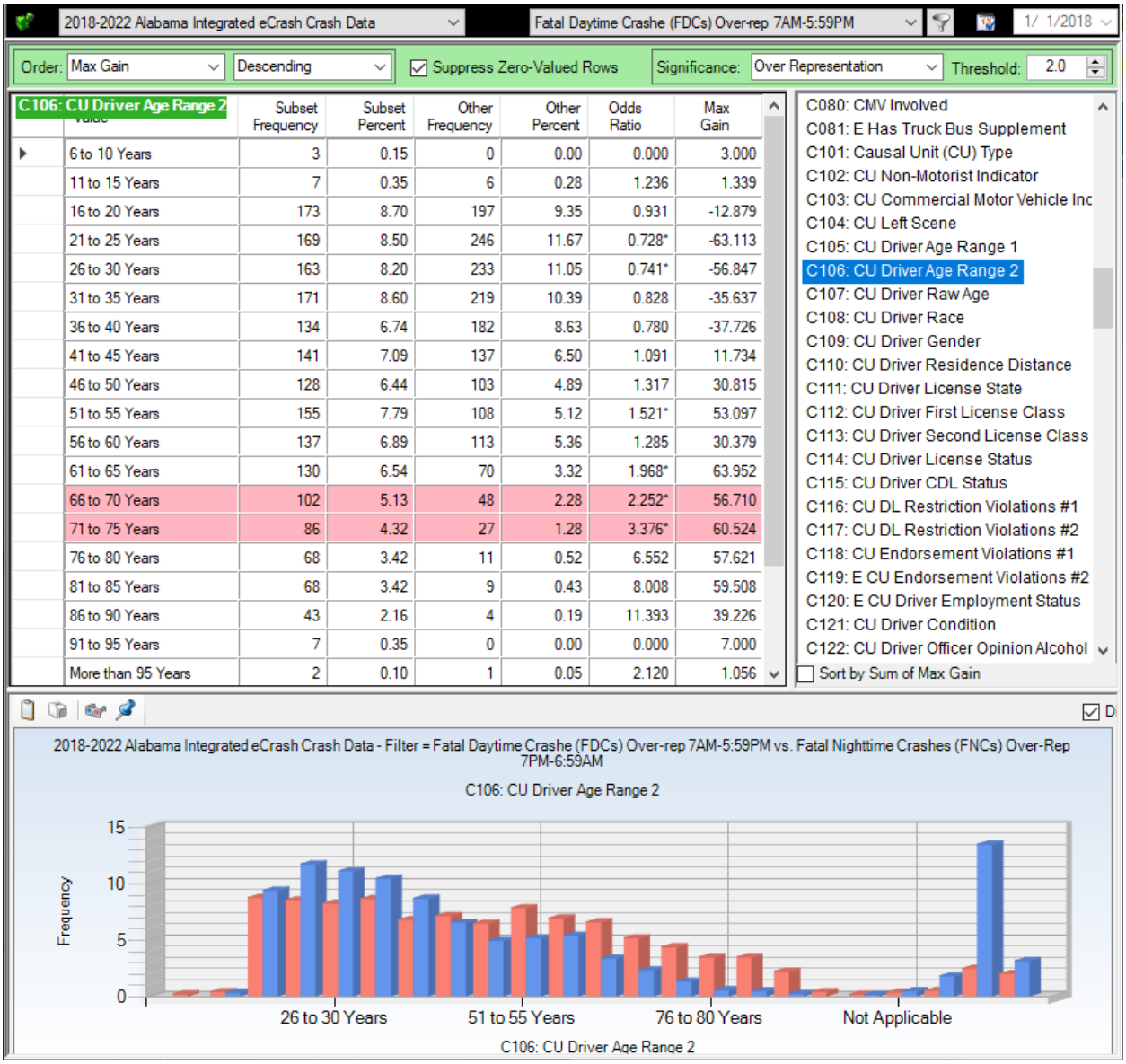
6.9 C038 Adjusted EMS Arrival Delay



Since fatal crashes tend to generate a much faster response in reporting and response, the 1 to 20-minute delay times are all highly over-represented for FDCs. The longer times are over-represented in the FNCs.

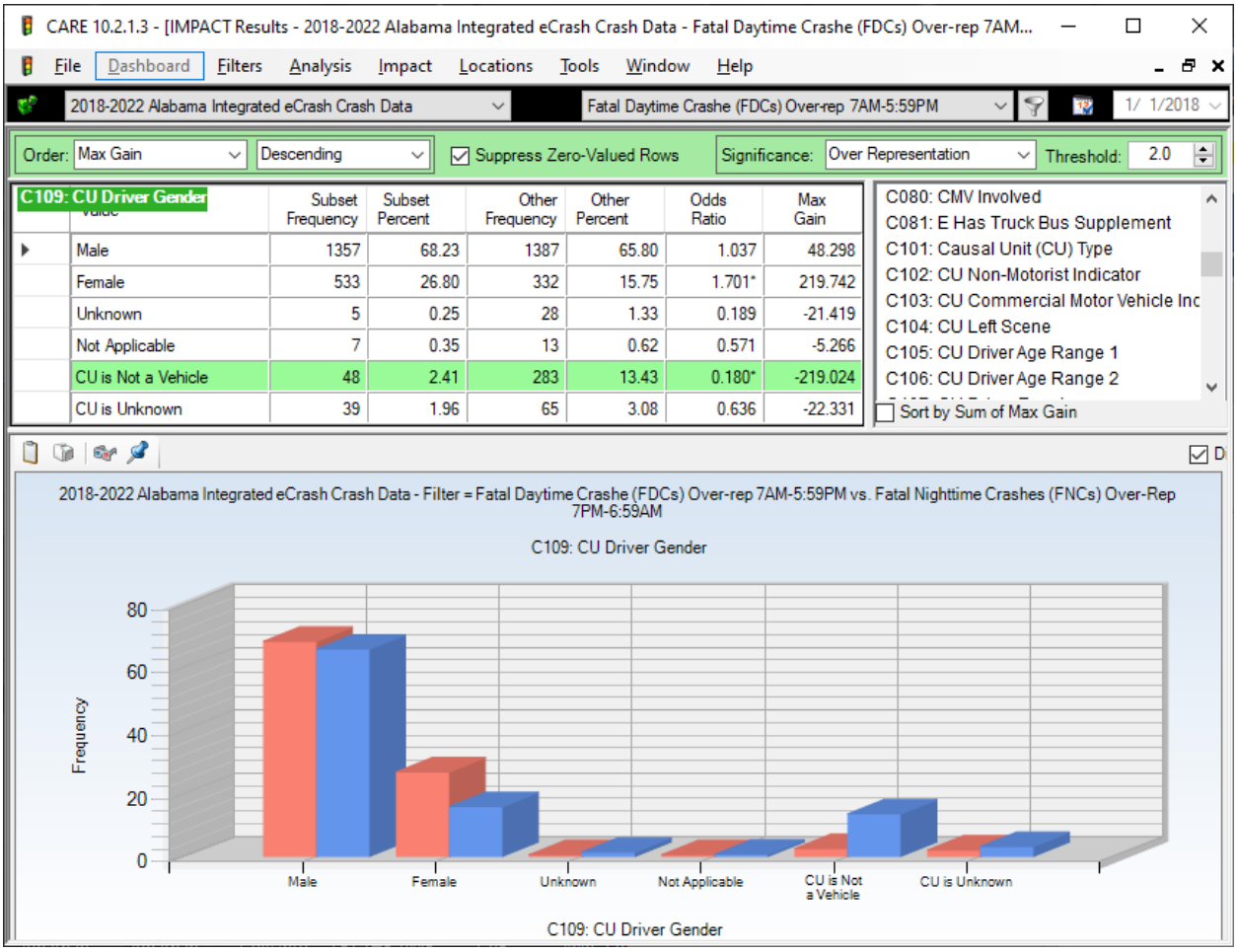
7.0 C107 Driver and Vehicle Demographics

7.1 C107 Driver Raw Age



The table display above presents a comparison of FDCs compared to FNCs by 5-year age increments. The blue (FNC) bars illustrate the problems that 21-40-year-old drivers have in their nighttime driving, potentially due to ID (see Sections 8.3 and 8.4). The most over-represented age interval is in ages from 51-90 (red bars), in the daytime. Older drivers tend to drive more during the day for safety reasons.

7.2 C109 Driver Gender FDCs vs FNCs

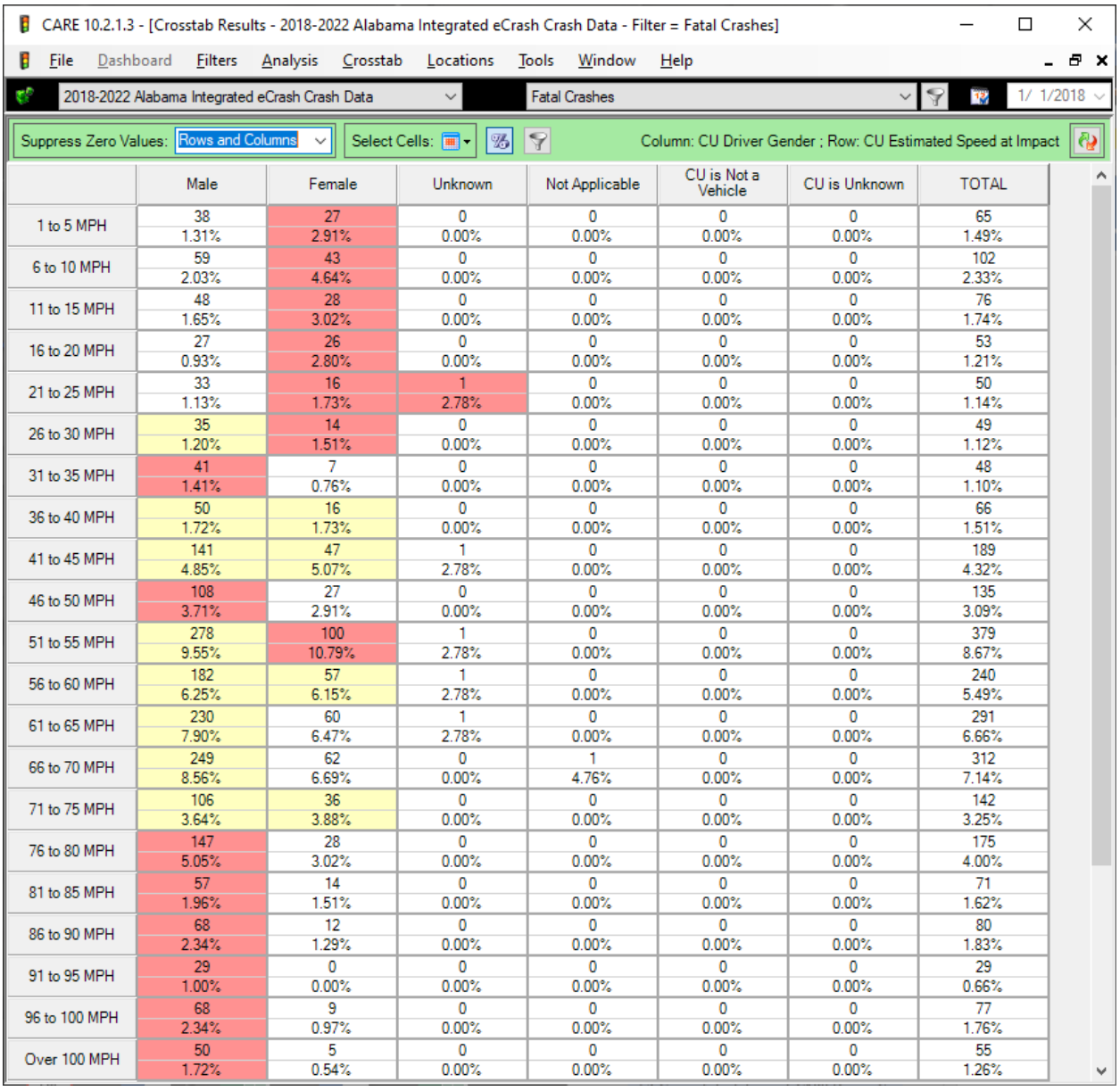


The male red and blue bars and the female red and blue bars each individually sum to 100%. So the breakdown in FDCs causal drivers is 68.23% male and 26.80% female. For "Other," FDCs, the percentage is 65.80% male and 15.75% female. These differences in proportions certainly indicate that males are a greater cause of fatal crashes both daytime and nighttime. 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 significant over-representation in "CU is Not a Vehicle" is largely due to pedestrians being coded in this category. 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.

7.3 Cross-tabulation of C109 Driver Gender x C224 Speed at Impact (all fatals)



	Male	Female	Unknown	Not Applicable	CU is Not a Vehicle	CU is Unknown	TOTAL
1 to 5 MPH	38 1.31%	27 2.91%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	65 1.49%
6 to 10 MPH	59 2.03%	43 4.64%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	102 2.33%
11 to 15 MPH	48 1.65%	28 3.02%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	76 1.74%
16 to 20 MPH	27 0.93%	26 2.80%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	53 1.21%
21 to 25 MPH	33 1.13%	16 1.73%	1 2.78%	0 0.00%	0 0.00%	0 0.00%	50 1.14%
26 to 30 MPH	35 1.20%	14 1.51%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	49 1.12%
31 to 35 MPH	41 1.41%	7 0.76%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	48 1.10%
36 to 40 MPH	50 1.72%	16 1.73%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	66 1.51%
41 to 45 MPH	141 4.85%	47 5.07%	1 2.78%	0 0.00%	0 0.00%	0 0.00%	189 4.32%
46 to 50 MPH	108 3.71%	27 2.91%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	135 3.09%
51 to 55 MPH	278 9.55%	100 10.79%	1 2.78%	0 0.00%	0 0.00%	0 0.00%	379 8.67%
56 to 60 MPH	182 6.25%	57 6.15%	1 2.78%	0 0.00%	0 0.00%	0 0.00%	240 5.49%
61 to 65 MPH	230 7.90%	60 6.47%	1 2.78%	0 0.00%	0 0.00%	0 0.00%	291 6.66%
66 to 70 MPH	249 8.56%	62 6.69%	0 0.00%	1 4.76%	0 0.00%	0 0.00%	312 7.14%
71 to 75 MPH	106 3.64%	36 3.88%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	142 3.25%
76 to 80 MPH	147 5.05%	28 3.02%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	175 4.00%
81 to 85 MPH	57 1.96%	14 1.51%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	71 1.62%
86 to 90 MPH	68 2.34%	12 1.29%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	80 1.83%
91 to 95 MPH	29 1.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	29 0.66%
96 to 100 MPH	68 2.34%	9 0.97%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	77 1.76%
Over 100 MPH	50 1.72%	5 0.54%	0 0.00%	0 0.00%	0 0.00%	0 0.00%	55 1.26%

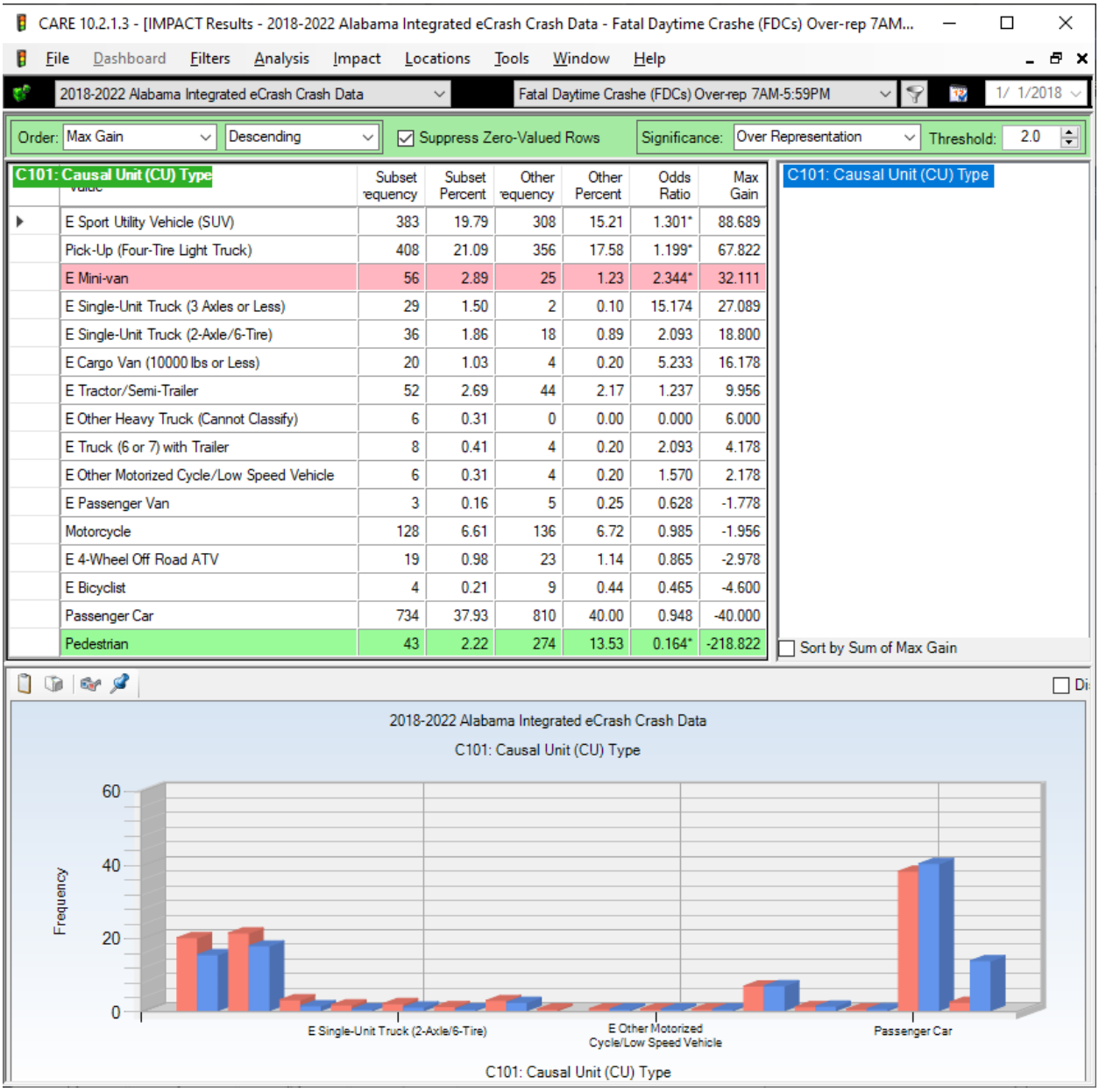
Number and Percent males and females involved in fatal crashes over 75 MPH:

419 Male = 419/2044 20.5%

68 Female = 68/633 10.7%.

The proportion of male fatal crashes over 75 MPH is practically double that of the female.

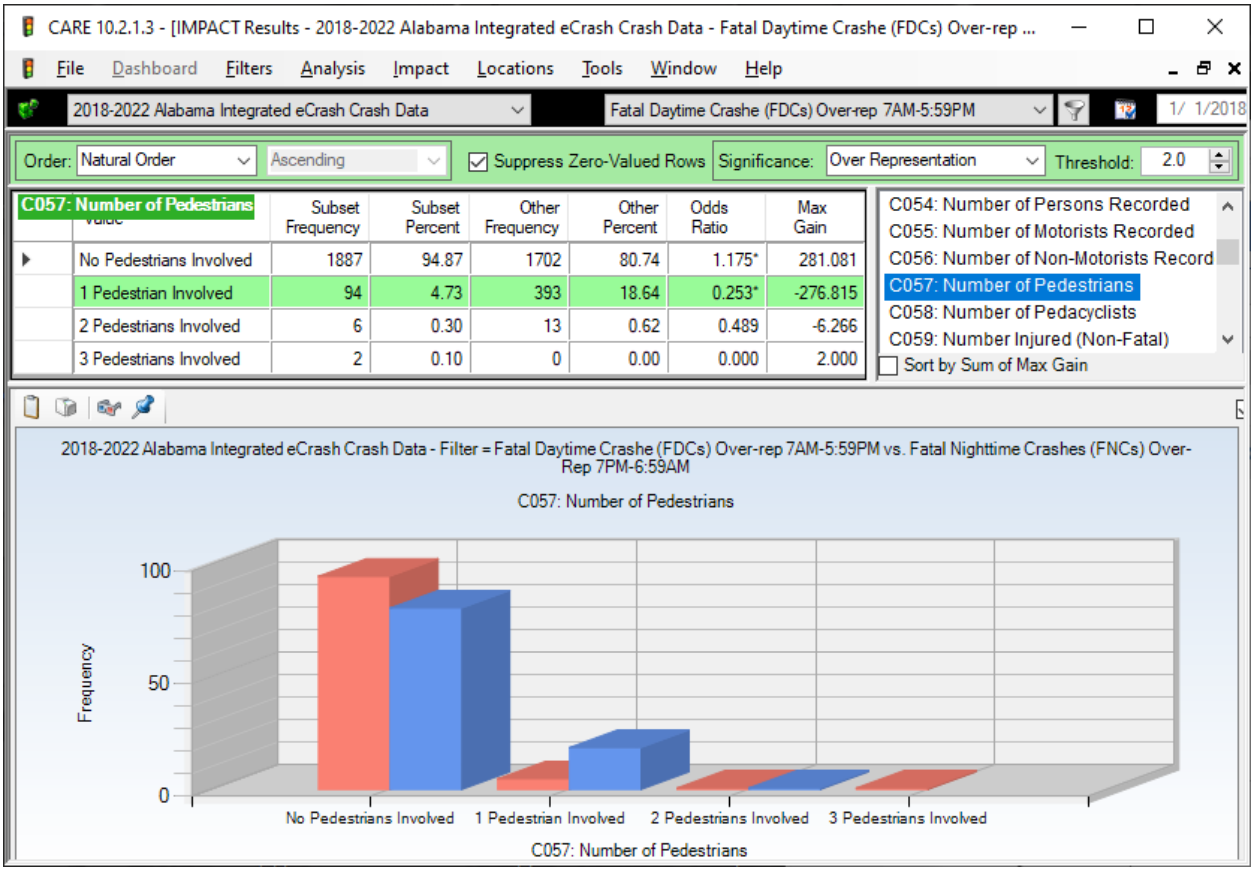
7.4 C101 Causal Vehicle Type (> 2 or more crashes) FDCs vs FNCs



C101: Causal Unit (CU) Type	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
E Sport Utility Vehicle (SUV)	383	19.79	308	15.21	1.301*	88.689
Pick-Up (Four-Tire Light Truck)	408	21.09	356	17.58	1.199*	67.822
E Mini-van	56	2.89	25	1.23	2.344*	32.111
E Single-Unit Truck (3 Axles or Less)	29	1.50	2	0.10	15.174	27.089
E Single-Unit Truck (2-Axle/6-Tire)	36	1.86	18	0.89	2.093	18.800
E Cargo Van (10000 lbs or Less)	20	1.03	4	0.20	5.233	16.178
E Tractor/Semi-Trailer	52	2.69	44	2.17	1.237	9.956
E Other Heavy Truck (Cannot Classify)	6	0.31	0	0.00	0.000	6.000
E Truck (6 or 7) with Trailer	8	0.41	4	0.20	2.093	4.178
E Other Motorized Cycle/Low Speed Vehicle	6	0.31	4	0.20	1.570	2.178
E Passenger Van	3	0.16	5	0.25	0.628	-1.778
Motorcycle	128	6.61	136	6.72	0.985	-1.956
E 4-Wheel Off Road ATV	19	0.98	23	1.14	0.865	-2.978
E Bicyclist	4	0.21	9	0.44	0.465	-4.600
Passenger Car	734	37.93	810	40.00	0.948	-40.000
Pedestrian	43	2.22	274	13.53	0.164*	-218.822

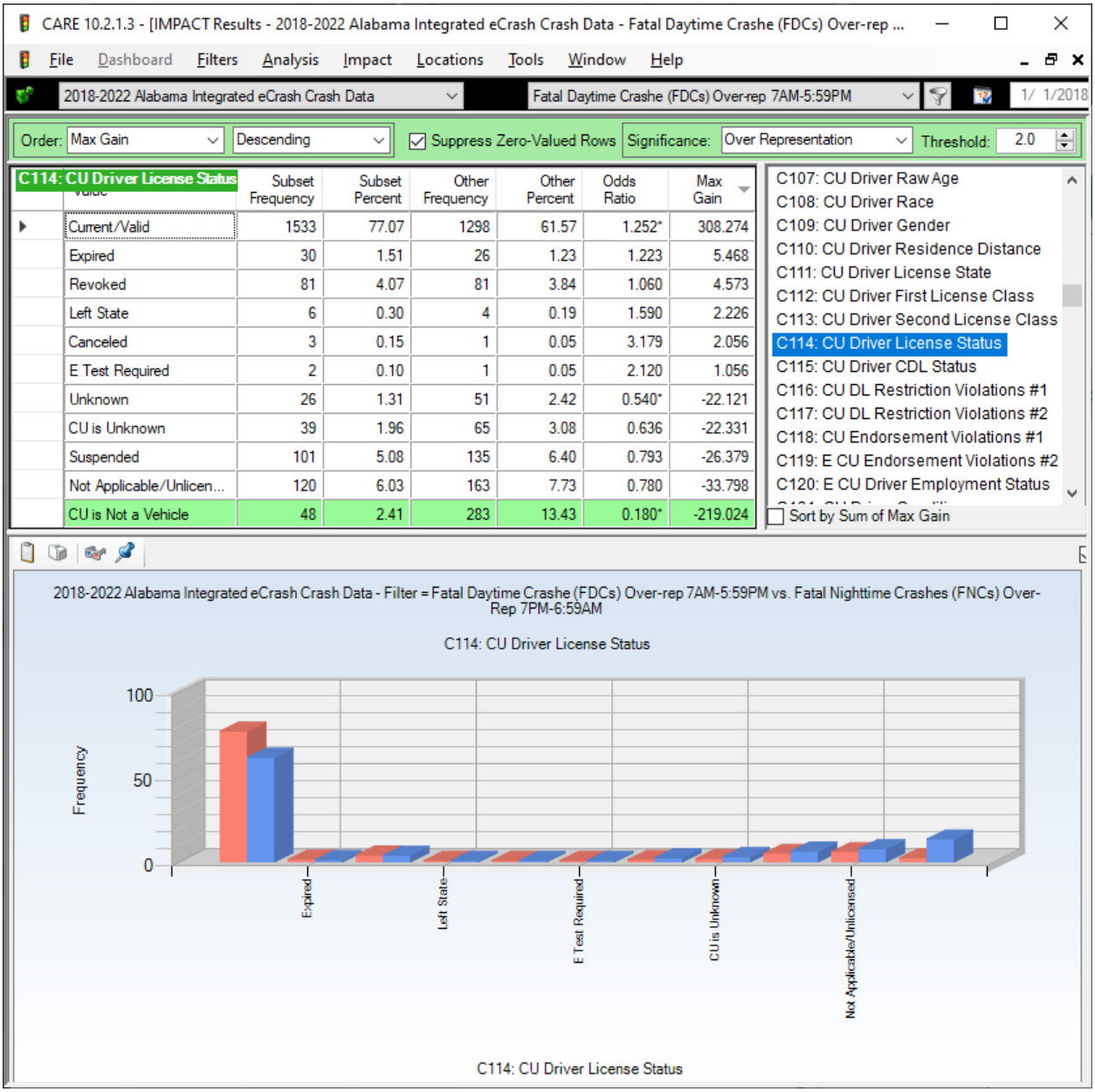
Pedestrians had the highest nighttime over-representation (43 FDCs and 274 FNCs, Odds Ratio = 13.53/2.22 = 6.09). Significant daytime over-representations were found for Sport Utility Vehicle 383, Pick-Up 408, Mini-van 56, Single-Unit Truck (3 Axles or Less) 29, Single-Unit Truck 36 (2 Axels), Cargo Van 20, and Tractor/Semi-Trailer 52. Passenger Cars had the highest frequencies 734 FDCS and 810 FDCs. Motorcycles were only slightly over-represented in FNCs, 128 FDCs and 136 FNCs.

7.5 C058 Number of Pedestrians



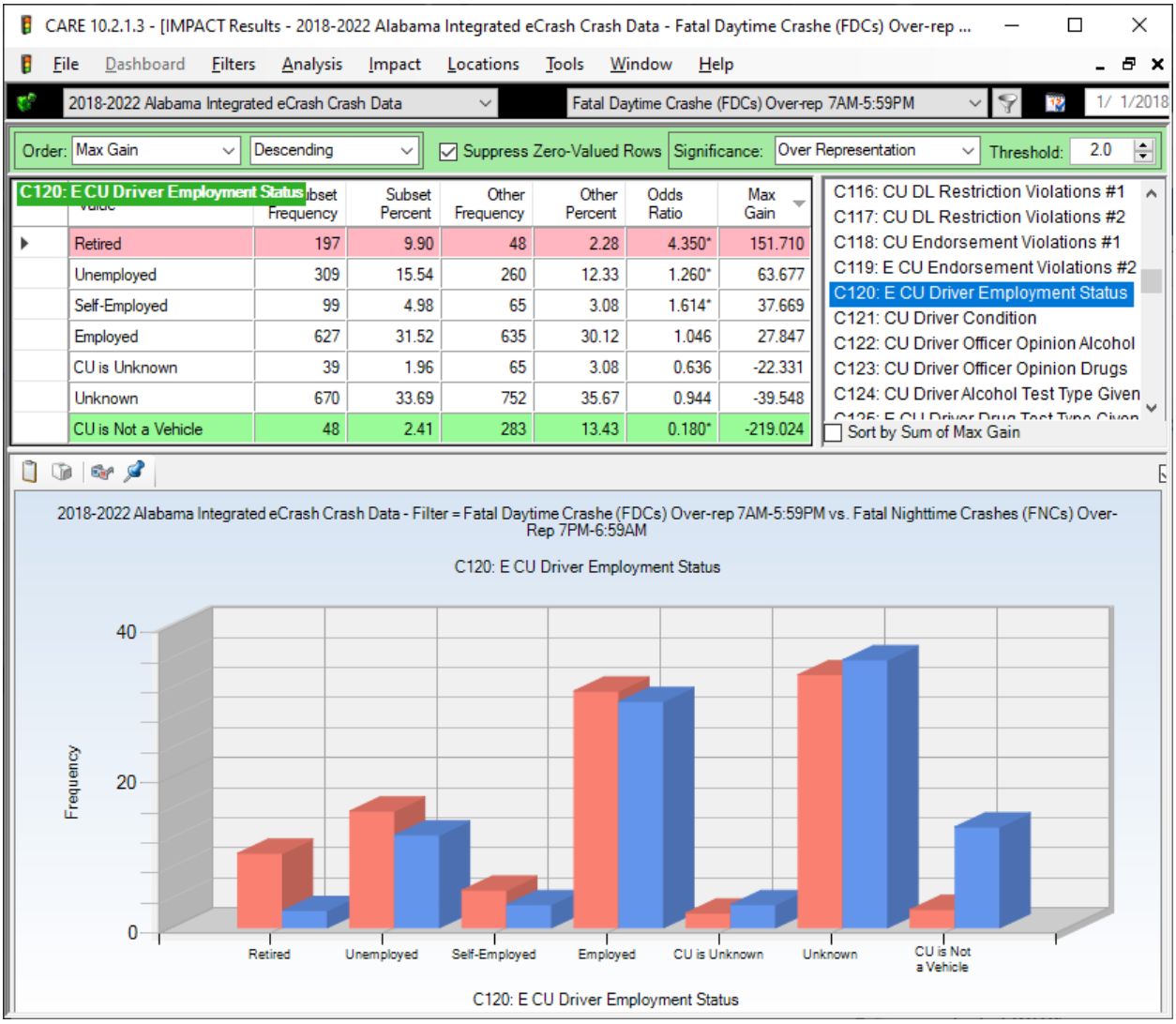
Nighttime fatal pedestrian crashes occur in about four times greater proportion than their daytime counterparts. This is consistent with what has been found in most pedestrian studies. Both ID and Impaired Walking, contribute to this, as well as pedestrians not taking the maximum means for being seen at night.

7.6 C114 Driver License Status



FDCs were significantly over-represented in their causal drivers having legitimate licenses. Suspended was the only status over-represented in for FNCs. License status issues do not seem to be a significant factor in prevention.

7.7 C120 Driver Employment Status



This analysis indicated that the unemployment rate for the FDCs was about 15.54%, while that for FNCs was 12.33%. Higher than average unemployment rates are not surprising because of the underlying drug/alcohol root cause of many fatal crashes (see Sections 8.3-8.4). The following were all over-represented in FDCs:

Retired*	197
Unemployed*	309
Self-Employed*	99
Employed	627

* Statistically significant.

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

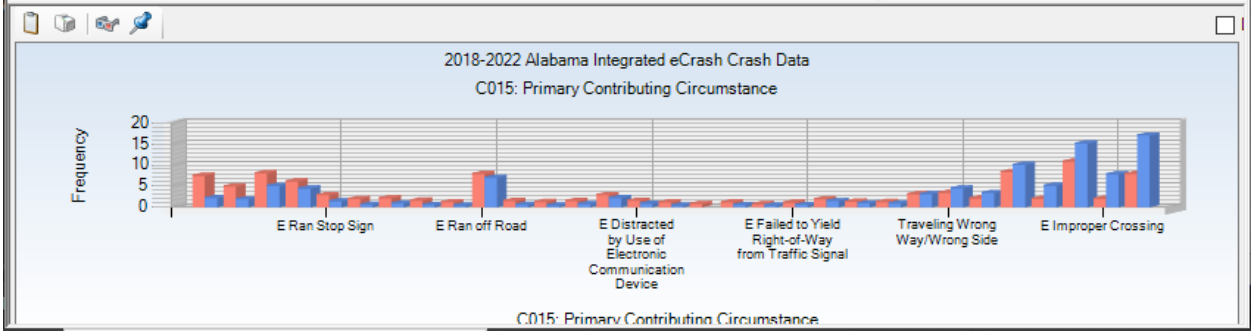
2018-2022 Alabama Integrated eCrash Crash Data | Fatal Daytime Crashe (FDCs) Over-rep 7AM-5:59PM | 1/ 1/2018

Order: Max Gain | Descending | Suppress Zero-Valued Rows | Significance: Over Representation | Threshold: 2.0

C015: Primary Contributing Circumstance	Subset equency	Subset Percent	Other equency	Other Percent	Odds Ratio	Max Gain
E Failed to Yield Right-of-Way from Stop Sign	126	7.43	36	2.10	3.543*	90.441
E Failed to Yield Right-of-Way Making Left or U-...	83	4.90	31	1.81	2.711*	52.379
E Crossed Centerline	136	8.02	86	5.01	1.601*	51.052
Driving too Fast for Conditions	103	6.08	75	4.37	1.390	28.918
E Ran Stop Sign	48	2.83	23	1.34	2.113*	25.281
E Other Distraction Inside the Vehicle	32	1.89	9	0.52	3.600	23.110
E Other - No Improper Driving	35	2.06	14	0.82	2.531	21.171
E Failed to Yield Right-of-Way from Driveway	26	1.53	8	0.47	3.290	18.098
E Crossed Median	19	1.12	3	0.17	6.412	16.037
E Ran off Road	133	7.85	119	6.93	1.131	15.456
Defective Equipment	24	1.42	9	0.52	2.700	15.110
Followed too Close	20	1.18	5	0.29	4.050	15.061
Improper Passing	24	1.42	11	0.64	2.209	13.135
E Over Correcting/Over Steering	48	2.83	36	2.10	1.350	12.441
E Distracted by Use of Electronic Communicatio...	25	1.47	13	0.76	1.947	12.159
E Swerved to Avoid Vehicle	18	1.06	6	0.35	3.037	12.073
E Failed to Yield Right-of-Way at Uncontrolled In...	12	0.71	0	0.00	0.000	12.000
Misjudge Stopping Distance	18	1.06	8	0.47	2.278	10.098
E Other Distraction Outside the Vehicle	11	0.65	1	0.06	11.136	10.012
E Failed to Yield Right-of-Way from Traffic Signal	17	1.00	8	0.47	2.151	9.098
E Ran Traffic Signal	31	1.83	24	1.40	1.308	7.294
E Other Improper Action	21	1.24	15	0.87	1.417	6.184
E Other Failed to Yield	20	1.18	14	0.82	1.446	6.171
Improper Lane Change/Use	51	3.01	52	3.03	0.993	-0.364
Traveling Wrong Way/Wrong Side	57	3.36	76	4.43	0.759	-18.070
E Fatigued/Asleep	34	2.01	57	3.32	0.604*	-22.302
E Aggressive Operation	141	8.32	172	10.02	0.830	-28.895
Unseen Object/Person/Vehicle	33	1.95	87	5.07	0.384*	-52.935
Over Speed Limit	183	10.80	259	15.09	0.715*	-72.830
E Improper Crossing	33	1.95	133	7.75	0.251*	-98.372
DUI	133	7.85	292	17.02	0.461*	-155.4...

C015: Primary Contributing Circumstance

Sort by Sum of Max Gain



8.2 Discussion of Primary Contributing Circumstances (PCC) Results Above

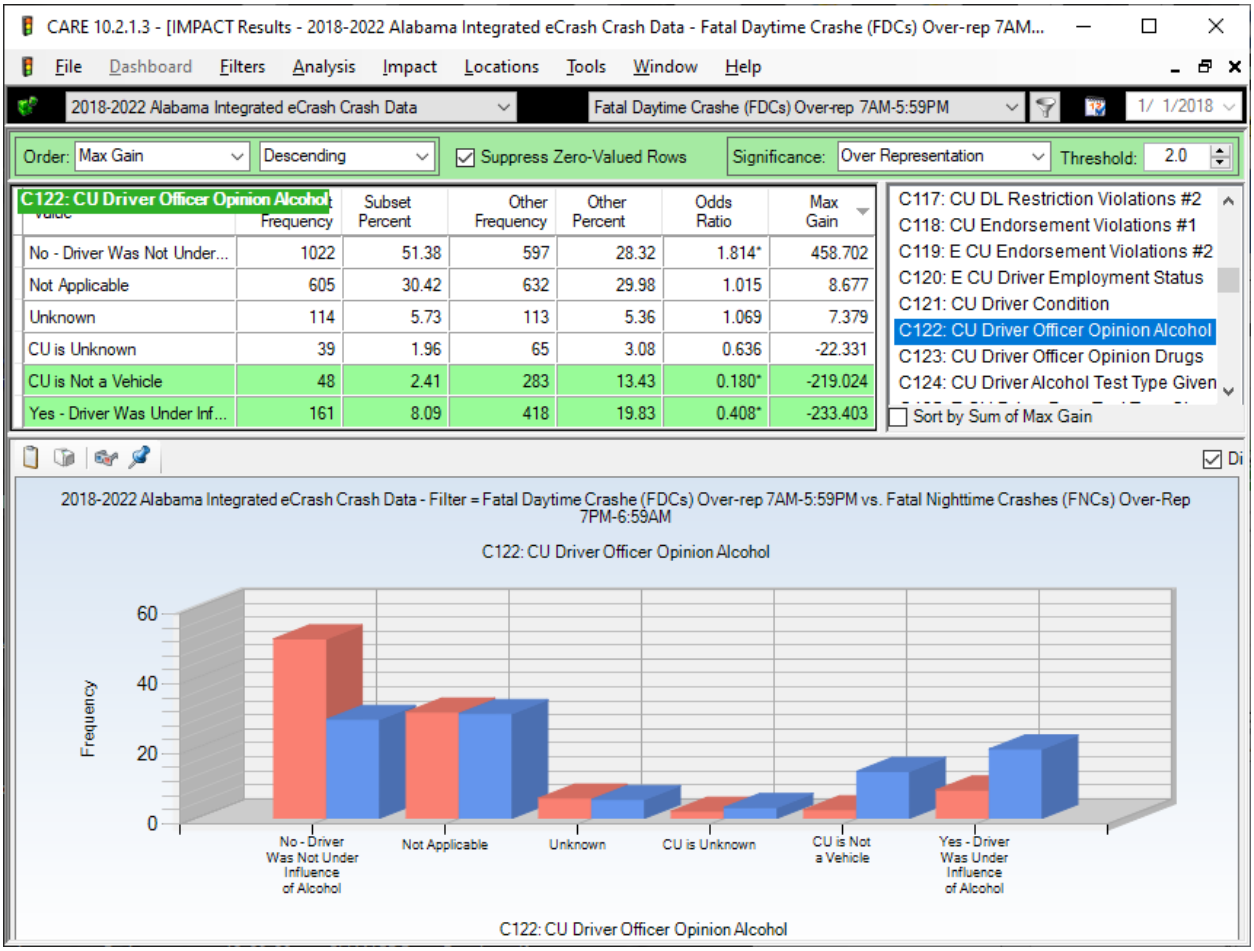
These results demonstrate the driver behaviors as they were defined by the C015, Primary Contributing Circumstances (PCCs), which accompanied FDCs and FNCs. Items over-represented in their expected proportion (when compared to their complementary times) are as follows, with frequencies:

Daytime Overrepresented	**FDCs**	**FNCs**
o Failed to Yield ROW at STOP Sign	126	36
o Failed to Yield ROW Left or U Turn	83	31
o Crossed Centerline	136	86
o Driving too Fast for Conditions	103	75
o Ran STOP Sign	48	23
o Other Distractions Inside Vehicle	32	9
o Ran Off Road	133	119

Nighttime Overrepresented	**FDCs**	**FNCs**
o ID/DUI (Impaired Driving)	133	292
o Improper Crossing – Pedestrians	33	133
o Over Speed Limit	183	259
o Unseen Object/Persons/Vehicle	33	87
o Aggressive Operation	141	172
o Fatigued/Asleep	34	57
o Traveling wrong Way/Wrong Side	57	76
o Improper Lane Change/Use	51	52

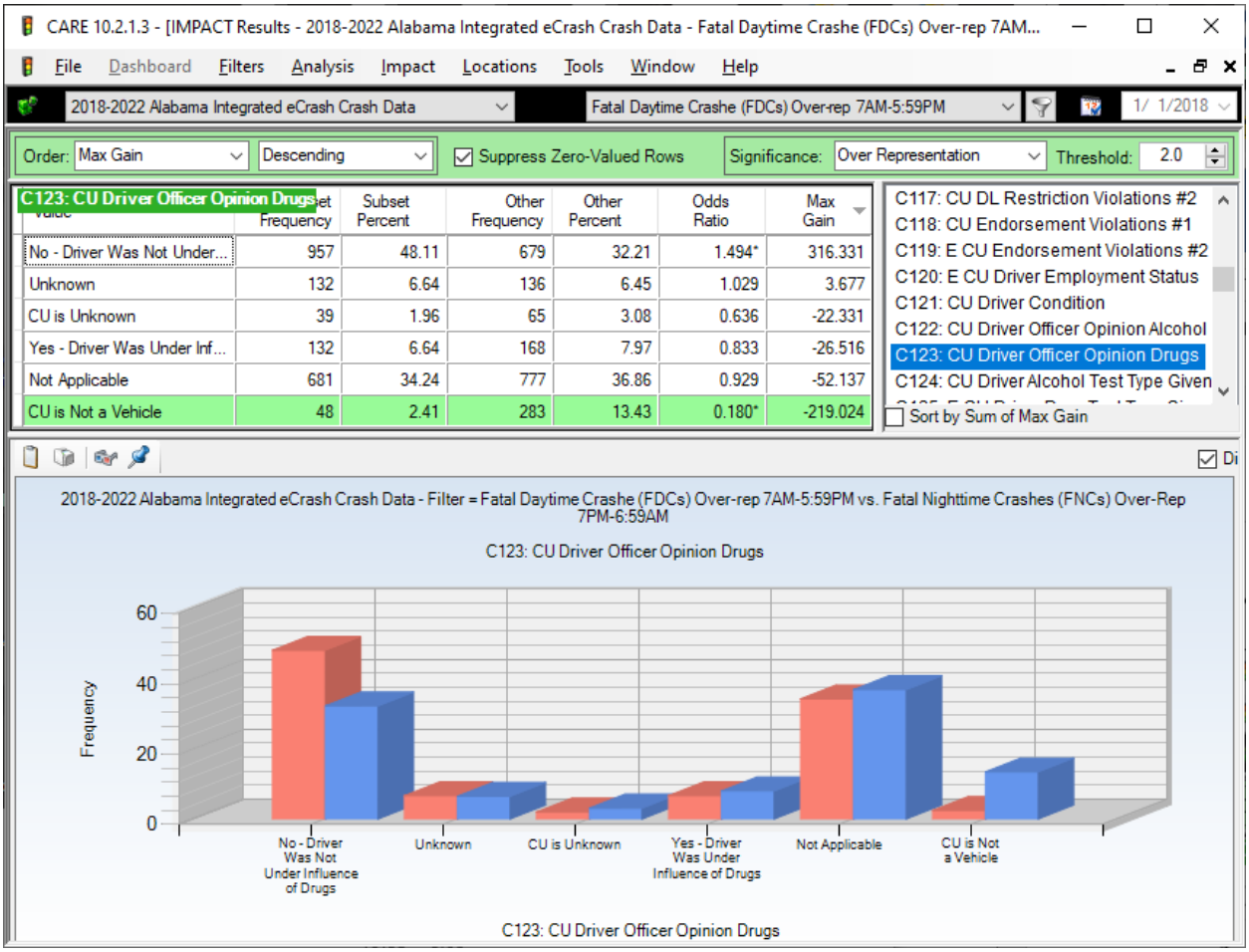
None of the items listed here or in the IMPACT table is necessarily mutually exclusive from the others. Each should be viewed in terms of their relative positions in the table as opposed to any one of them being the absolute cause.

8.3 C122 CU Driver Officer's Opinion Alcohol



Impaired Driving/Alcohol was indicated as one cause of the crash for 8.09% of the FDCs, and 19.83 of the FNCs. This is a Nighttime Odds Ratio of 2.45. 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.

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



The reported non-alcohol drug use in FNCs is about two-thirds (0.677) of that for alcohol. However, the Odds Ratio (13.43/2.41 = 5.572) indicates that it is potentially set to be an even larger problem than that of alcohol, since drug use continues to rise, especially with legalization.

In both cases (FDCs and FNCs), 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 fatal crashes at all times, and their use is further compounded if they choose to avoid detection by using county roads, or they choose to speed or fail to use proper restraints. The total proportion of crashes from the sum or alcohol and non-alcohol drugs for both daytime and nighttime is 43.76%.