Special Study
Weekend Fatal Collisions IMPACT Study
Fatal Weekend Crashes (FWCs) vs All Non-Weekend (NWCs)

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Data Comparisons: Fatal Weekend Crashes (FWCs) vs All Non-Weekend Crashes (NWCs)
Study Performed in September 2023

Table of Contents

0.0 Introduction 3
1.0 Summary of Findings and Recommendations 4
2.0 Filter and IMPACT Set-up 13
2.1 Introduction to IMPACT 13
2.2 Filter Definitions: Fatal Weekend Crashes (FWCs) and Non-Weekend Crashes (NWCs) 15
2.3 Day of the Week (C006) for Fatal Crashes 17
2.4 Overall Weekend Crashes (WCs) by Severity and Year; 2018-2022 Data 18
3.0 Overall High-Level View of Fatal Weekend Crashes 19
3.1 Fatal Weekend Crashes (FWCs) vs Non-Weekend Crashes (NWCs) by Year 19
3.2 Weekend Crash (WC) Severity Comparisons (WCs vs NWCs) 20
4.0 Geographic and Harmful Event Factors 21
4.1 C001 County (top 13 counties) 21
4.2 C002 Cities (top 15) with Highest Max Gains (Rural Areas = Virtual Cities) 22
4.3 C010 Rural or Urban 23
4.4 C025 Severity of Crash by C010 Rural-Urban (all Weekend crashes) 24
4.5 C011 Highway Classifications 25
4.6 C033 Locale 26
4.7 C019 Most Harmful Event (>3 in MaxGain order) 27
4.8 C407 CU Roadway Curvature and Grade 28
5.0 Time Factors 29
5.1 C003 Year – see Section 3.1 29

5.2 C004 Month 29
5.3 C006 Day of the Week – see Section 2.3 30
5.4 [Omitted to Maintain Previous IMPACT Ordering] 30
5.5 C008 Time of Day 31
5.6 C008 Discussion on Time of Day 32
5.7 C008 Time of Day x C005 Day of the Week 33
6.0 Factors Affecting Severity 34
6.1a/3.2 C025 Weekend Crash Severity (All Weekend vs. All Non-Weekend) 34
6.1b Crosstab: C004 Day of the Week x Speed at Impact 34
6.2 C224 Speed at Impact (FWCs vs Non-Weekend Crashes (NWCs)) 35
6.3 Highway Classification (C011) by Speed at Impact (C224) Cross-Tabulation 36
6.3a Cross-tabulation: C025 Severity by C224 Speed at Impact 37
6.4 Dicussion: C025 Probability of being killed x C224 Speed at Impact 38
6.5 C323 Restraint Use by Drivers in Fatal Weekend Collisions 39
6.6 Crosstabulation: C025 Crash Severity x C323 Restraint Use (all weekend) 40
6.7 C052 Number of Vehicles Involved 41
6.8 C036 Police Arrival Delay (FWCs) 42
6.9 C038 Adjusted EMS Arrival Delay 43
7.0 C107 Driver and Vehicle Demographics 44
7.1 C107 Driver Raw Age 44
7.2 C109 Fatal Weekend Crash (FWC) Driver Gender 45
7.3 Cross-tabulation of C109 Driver Gender x C224 Speed at Impact 46
7.4 C101 Causal Vehicle Type 47
7.5 C114 Driver License Status 48
7.6 C120 Driver Employment Status 49
8.0 Driver Behavior 50
8.1 C015 Primary Contributing Circumstances (Items < 10 Crashes Removed) 50
8.2 Discussion of Primary Contributing Circumstances (PCC) Results Above 51
8.3 C122 CU Driver Officer's Opinion Alcohol 52
8.4 C123 CU Driver Officer's Opinion Drugs (other than alcohol) 53

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0.0 Introduction

This document is based upon the results of a number of IMPACT comparisons of Fatal Weekend Crashes (FWCs) compared to all Non-Weekend Crashes (NWCs) over a recent five-year period (CY2018-2022). The purpose of these comparisons is to determine the causes of these fatal crashes, and then recommend countermeasures to reduce fatalities caused by Weekend crashes. This is a bit 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.

The analytical technique employed to generate most of the displays below is a component within the Critical Analysis Reporting Environment (CARE) called Information Mining Performance Analysis Control Technique (IMPACT). For a detailed description of the meaning of each element of the IMPACT outputs, please see: 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 when that attribute has a greater share of Fatal Weekend Crashes (FWC) than would be expected if its proportion were the same as that for the non-Weekend Crashes (NWCs). That is, the non-Weekend crashes are serving as a *control* to which the Fatal Weekend Crashes (FWCs) are being compared to determine over-representations that indicate causes.

As an example, we found that FWCs for the Day-of-the-Week attribute value of Sunday had a 52.8% higher proportion of crashes than did the Non-Weekend crashes (Section 2.3; Odds Ratio = 1.528). 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 FWC causes (e.g., excessive speed and Impaired Driving) might be performed for Sunday 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 countermeasure 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 FWC reduction that could be obtained if a countermeasure could be applied to reduce the proportion of the Fatal Weekend Crashes (FWCs) to the proportion of non-Weekend Crashes (NWCs) within that particular attribute (i.e., reduce the 15.07 to 9.86 in the Sunday 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) Summary of Findings and Recommendations, and (2) Filter and IMPACT Set-up.. Section 3 is also introductory in that it provides analytics results for Year and Severity. After Section 3, the

comparison between FWCs and Non-Weekend Crashes (NWCs) will be presented under the following headings, given here with their section numbers:

- 4. Geographic Factors,
- 5. Time Factors,
- 6. Factors Affecting Severity,
- 7. Driver and Vehicle Demographics, and
- 8. Driver Behavior.

See the Table of Contents 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 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 theis sources can be accessed easily. Section numbers (1.1), (1.2), and (1.3) 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) Factors Affecting Severity, (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 the summaries below are given in parenthesis). Recommendations are for the reduction of frequency and/or severity of Fatal Weekend Crashes (FWCs) in Alabama. They are in the same ordering as the IMPACT displays to facilitate references to Sections 4.0-8.0.

Terminology: *Expected proportion* (AKA *expectation*) of FWCs here and below are obtained from the comparison of FWCs proportions with the proportions for their corresponding Non-Weekend Crashes (NWCs).

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 FWCs vs NWCs over the five years of the study (CY2018-2022):

- **1.4 Geographical Factors (4.0)**
    - County (4.1, C001) - Generally, the over-represented counties are those with combined fairly large population centers bordering on rural areas, as opposed to

the highly urbanized counties or the extremely rural counties. One reason that the highly urbanized counties might be under-represented is the large number of low-speed and low-severity crashes that occur in the Non-Weekend Crashes (NWCs). See the rural-urban comparison below (Section 4.3). Placed in Max Gain order, the counties with the highest potential for reduction with their frequencies were: Limestone 38, Macon 22, St Clair 34, Dekalb 23, Sumter 15, Dallas 23, Randolph 15, and Jackson 21. It is recommended that these and other high frequency counties be given special attention for Weekend 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 FWCs to NWCs, viewing rural areas of counties as separate virtual cities (4.2, C002). There is little surprise in this output, which tracks the areas by population (traffic density). City (and rural area) comparisons are presented for all areas that had Max Gains greater than 10. The top 8 (virtual) Cities with Max Gains in excess of 10 FWCs over their expected numbers are: Rural Mobile 61, Rural Baldwin, 38, Rural Limestone 31, Rural Jefferson 59, Rural St. Clair 37, Rural Montgomery 24, Rural Dallas 18, and Rural Cullman 23. Those cities with a high frequency of Weekend fatal crashes should be given special guidance, and perhaps additional funding, to address their Weekend crash problems. Many such large city areas have a considerable amount of Open Country (see Locale, Section 4.6) that tends to multiply their Weekend fatality count.
- Overall Area Comparisons Conclusions (4.1-4.2, C002) – Generally those rural areas that are adjacent to (or contain) significant urbanized areas are over-represented, since their urban areas generate more traffic in the rural areas. Possible factors for *relatively* fewer FWCs within urban areas include:
  - Less need for motor vehicle travel and shorter distances;
  - Larger police presence in the metropolitan areas; and
  - Lower speeds in urban areas.

  Note: The city, county, and area 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 FWCs within urban 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 speed limits in frequent crash areas.

  Anyone wishing analysis of additional cities, counties, or other areas, please contact CAPS – email brown@cs.ua.edu.
- Rural/Urban (4.3, C010) Fatal Weekend Crash Proportion– FWCs occurred in 60.92% rural and 39.08% urban areas. These differences between the Fatal and

all Non-Weekend Crashes (NWCs) were significant in both the rural (over-represented) and the urban (under-represented) areas. Concentration for fatality reduction is recommended in Rural areas where hotspot analyses determines that there are concentrations of fatal crashes.

- Severity of Crash by Rural-Urban (4.4, C025 x C010) – 60.92% of the FWCs occurred in rural areas, while those in the urban areas, while only 39.08% of the FWCs occurred there. Similar results are found for the highest severity non-Fatal crashes (Suspected Serious Injury). This seems clearly the result of higher travel speeds (and thus impact speeds) in the rural areas. Note that additional causes of increased severity are given in the Factors Affecting Severity, see Section 6, below. Similar results were found for the highest severity non-Fatal crashes (i.e., Suspected Serious Injury and Suspected Minor Injury). This seems clearly the result of higher speeds (and thus impact speeds) in the rural areas. The presence of police units in over-represented rural areas is recommended, since this presence alone has been found in some cases to produce an average reduction of up to 10 MPH, which would cut the number of fatalities in half.
- Highway Classifications (4.5, C011) – County roads had a proportion of FWCs that was over two (2.197) times higher than their expected proportion of crashes as given by the Non-Weekend Crashes (NWCs). State routes had about 26% (odds ratio 1.259) more FWCs than expected. Federal and Interstate routes were also over-represented. County road characteristics no doubt contribute to the rural crash frequency (see Section 4.3). County roads are also known to be less "crashworthy" (i.e., they result in more severe crashes at comparable impact speeds). Also, their potential remote locations tend to make EMS delays longer. It is recommended that County and State routes, with the highest frequencies of 425 and 339 FWCs, respectively, be given top priority for countermeasures. It is obvious that the greatest reduction will come from a general speed reduction. It may also help to promote the use of those routes that avoid county roads.
- Locale (4.6, C033) – Open Country FWCs show a high level of over-representation (2.309 Odds Ratio) as compared with the more urbanized area types, especially Residential, which only had about 0.774% of the FWC proportion. The Shopping or Business locale was significantly under-represented, with only about a third (0.328) of expectation. Those countermeasures recommended to rural areas would be applicable to Open Country areas within city limits.
- 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):

  Collision with Tree 271

Overturn/Rollover	224
Collisions with Non-Motorist Pedestrian	108
Fire Explosion	36
Collision with Culvert Headwall	24
Collision with Utility Pole	35

Overturned/Rollover was second with 224 Fatal Weekend crashes and an Odds Ratio of 6.997, which showed this to be a much higher proportion than the control subset (all NWCs). However, the greatest proportion over-representation was in the 46 Pedestrian crashes, which had 17.583 (Odds Ratio) times the pedestrian proportion of the control subset. This also reflects heavily on the proportion of pedestrian crashes that are fatal. Recommended is the most effective countermeasure that will reduce all three of these, which is a reduction in speed brought about by selective enforcement as well as general law enforcement presence. Pedestrian training also needs to include the advantages of walking against traffic and that reflective clothing is essential at night, along with all of the other rules for safe pedestrian activity.

- Roadway Curvature and Grade (4.8, C407). FWCs are over-represented on most types of curves. The following were highly significant: Curve Left and Level 114, Curve Left and Down Grade 73, and Curve Right and Down Grade 69, Curve Right and Level 74, Straight with Downgrade 149, Curve Left and Up Grade 39, and Curve Right with Up Grade 30. The one exception, not being highly significant, was Straight with Downgrade because it was also high for the Non-Weekend Crashes (NWCs). Selective enforcement and other speed-limit-reduction tactics (e.g., advisory speed and curve warning signs) should concentrate 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) – Fatal Weekend Crashes (FWCs) frequencies were significantly lower in 2018, and significantly higher in 2022. There were no significantly different in the other years, 2019-2021. The 2020 year was over-represented, but not significantly so. Generally, over the five years, the number of fatal weekend crashes increased by 51 (19.5%). This increasing trend further strengthens the goal of continuing to perform this weekend fatality analysis. There are no new recommendations based on this time trend other than those given for other attributes.

- Month (5.2, C004) – The highest (and only) fatality over-representation by month was in June (1.236 Odds Ratio). The number of FWCs correlated very closely with the with Non-Weekend Crashes, in the other months, with the exception of May, June and July, which were all over-represented. These three months should be given special selective enforcement concentration with geographical emphasis 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 weekend fatalities as a proxy measure to improve the decisions within ID countermeasures. See Sections 8.3 and 8.4.
- Time of Day (5.5-5.6, C008) – In *Natural Order*. The extent to which night-time hours are over-represented is quite striking. Optimal times for FWC enforcement would start immediately following any previous day rush hour details, and would continue through at least 4:00 AM to 4:59 AM (Odds Ratio 3.660). Some of the late-night FWCs 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. See Sections 8.3 and 8.4.
- Time of Day by Day of the Week (5.7, C008 x C006) – This quantifies the extent of the Fatal Weekend 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)**
  - Weekend Crash Severity (6.1a and b/3.2, C025) – Of necessity, the filter used for this attribute were all crashes during the Weekends, as opposed to Weekend fatalities. The rate of severe injuries and fatalities are higher in Weekend crashes than that in non-Weekend crashes. These results show that Weekend days are the prime time for fatality reduction. The crosstab in 6.1b shows the times when speed has the most effect.
  - Speed at Impact (6.2, C224) – All impact speeds above 40 MPH are over-represented with most Odds Ratios indicating increasing statistical significance. The over-representations of FWCs increase, as expected, with increased speeds with 41-45 MPH having an odds ratio or 1.263, while 96-100 MPH being 51.796. 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 (6.4). The obvious recommendation here is to perform selective enforcement and 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 the 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). This cross-tabulation gives an idea of the risks on the various highway classifications.
- Severity by Impact Speed (6.3a. 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 6.4 that 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 Fatal Weekend Crash Causal Drivers (6.5, C323) – The FWC unrestrained occupants have a probability of a fatal crash of one in 146 crashes, while those who are restrained are one in 3414 crashes. This means that those who are unrestrained are over 23 (23.4) times more likely to be killed than the FWC passengers who are properly restrained. Clearly drivers involved in FWCs lose a good part of their concept of risk when they drive impaired and/or at speeds that result in deadly crashes. The numerical results of the following cross-tabulation analysis are slightly different because of the underlying numbers upon which they are based. However, their nearly identical results reinforce this conclusion. Restraint use programs have been quite successful in Alabama. Consideration should be given to increase of financial support to these programs to assure that their effectiveness will continue.
- Cross tabulation: Crash Severity (6.6, C025) by Restraint Use (C323) for All Weekend Crashes. A comparison of the probability of a fatal crash indicates that a fatality is about 21.3 times more likely if the involved occupants are not using proper restraints (see text under the cross-tabulation in Section 6.6). Generally, one in 280.7 crashes are fatal if restraints are used; but without restraints, the fatal crash ratio is 1 in about 13.2 crashes, an increase in probability of about 21.3 times. So the combined effect of lower restraint usage and higher speeds is a devastating combination that accounts for much of the high lethality of Weekend crashes. Because current restraint-use programs are quite effective, consideration should be given to increase their funding to make them even more universal and effective.
- Number of Vehicles Involved (6.7, C052) – the number of single vehicle FWCs is over-represented by an Odds Ratio of 3.155 (its proportion was over three times

more than expected). Over half (60.50%) of the FWCs 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. Here is potentially useful information: a list of the 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).

- Police Arrival Delay (6.8, C036) – Generally, the police response times to FWCs were greater than expected, with delays over 20 minutes being over-represented, most of which were highly significant. There can be little doubt that this has to do with so many of them occurring in rural areas (see Section 4.3). The solution may be in having more 9-11 operators as opposed to changes in law enforcement operations, since a delay in reporting the crash is equally problematic.
- EMS Arrival Delay (6.9, C039) – Probably because of (1) the severity of the FWCs (all fatal), (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 first responders are currently doing an excellent job in getting the scene of a crash. Delays, if any, are usually caused be a failure to report the crash immediately, and this 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 FWC causal driver age with the NWCs shows the most over-represented are in the age bracket 24 to 41 year olds. Statistical significance is not computed when sample sizes are less than 20. The most over-represented age interval can be seen in both the table and the chart. Ages are so random that few patterns can be seen upon which to base recommendations for specific age groups, and thus we have no recommendation to focus on except the younger drivers aged 24 to 41.
  - Crash Driver Gender (7.2, C109) – the breakdown in FWC causal drivers is 69.12% male and 18.42% female. For non-Fatal Weekend cashes, the percentage is 50.14 male and 38.40 female, which is also a good estimate for male/female crashes in general. These differences in proportions certainly indicate that males are a greater cause of the problems of FWCs, 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 being in more FWCs, this analysis shows that males had impact speeds in excess of the 70 MPH speed limit in 21.68% of their fatal crashes, while comparable speeds for females was only at 14.45%. 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 FWC Causal Unit Type against the same for Non-Weekend Crashes (NWCs). Motorcycles have the highest motor vehicle over-representation (Odds Ratio 15.418) and Max Gain (112.217), indicating over 15 times their expected proportion in comparison with the control subset. This reflects the general vulnerability of motorcycle driver/passengers for all crashes in which they are involved. Pedestrians had the second highest frequency (102) and a huge Odds Ratio of 37.764, due to the relative absence of pedestrian crashes in the Non-Weekend Crashes (NWCs) used for the control. The other vehicle types with the highest frequency is Pick-Ups (267), but with a low Odds Ratio (1.084), showing very little difference from the NWCs. Passenger Cars (152) and Sports Utility Vehicles – SUVs, (71) were under-represented indicating their tendency to avoid the more severe Weekend crashes. 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 Weekends. Pedestrian programs should include warnings against walking after drinking and the many other errors committed by pedestrians.
- Driver License Status (7.5, C114) – FWCs are significantly over-represented in being caused by drivers without legitimate licenses. Over 10% (10.64%) of the Fatal Weekend crash causal drivers did not have a legitimate driver's license. The following gives the highest over-represented categories along with the number of crashes (in parenthesis) that were attributed to the DL Status: Suspended (77), Unlicensed (114), Revoked (56), and Expired (19). No recommendations were seen to be feasible for deficient licenses except to maintain the watch on this attribute in the future.
- Driver Employment Status (7.6, C120) – This analysis indicated that the employment rate for the FWCs was about 28.15%, while that for NWCs was 49.90%. This relationship is not surprising because of the underlying drug/alcohol root cause of many Weekend crashes (see Sections 8.3-8.4). The correlation between not having a job and being involved in Weekend crash should be watched carefully going forward in that it could affect the type and location of countermeasures, and also recommended is research to determine if there is some countermeasure that could be implemented in conjunction with their unemployment payments.

- **1.8 Driver Behavior (8.0)**
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    - Primary Contributing Circumstances – PCC (8.1 and 8.2, C015) Driver behaviors that are correlated with Weekend fatal crashes might provide alternatives for countermeasure development. Those behaviors that had over 50% more (Odds Ratio > 2) than their expected PCC proportion for FWCs when compared to NWCs are:
        - Impaired Driving (DUI)
        - Over Speed Limit
        - Aggressive Operation
        - Ran Off Road
        - Improper Crossing and Not Visible (pedestrian)
        - Crossed Centerline
        - Traveling Wrong Way/Wrong Side

      No additional recommendations are given for these behaviors since they are covered in Speed, ID and Pedestrian 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 Weekend 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 Weekend fatal crashes as opposed to non-Weekend crashes. For alcohol, the proportion of ID crashes was 10.736 times as many for FWCs as for NWCs. For drugs this multiplier was almost as great at 8.927. This was sufficient to verify that the Fatal Weekend crash time over-representations reported above, were correlated very closely with ID. Recommended countermeasures to counter 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 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* (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 should not be advertised as such. PI&E programs should take the opposite approach to warn drivers that legalization does not relax their responsibilities.

2.0 Filter and IMPACT Set-up

Generally, (with certain limited exceptions) the analyses performed in this study will use IMPACT (See Section 2.1) to compare Fatal Weekend Crashes against all Non-Weekend Crashes 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 Weekend fatality crash causes (who, what, where, when, how, and causal driver demographics). 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 frequency and severity of Weekend crashes.

This preliminary section of the report contains information that will be useful in obtaining an overall orientation toward the IMPACT results that will follow. This will consist of: (1) Introduction to IMPACT, (2) Filter Definitions, and (3) Overview of Weekend crashes by Severity and Year. The section after this one (Sections 3) will present some general IMPACT analysis for purposes of orientation.

2.1 Introduction to IMPACT

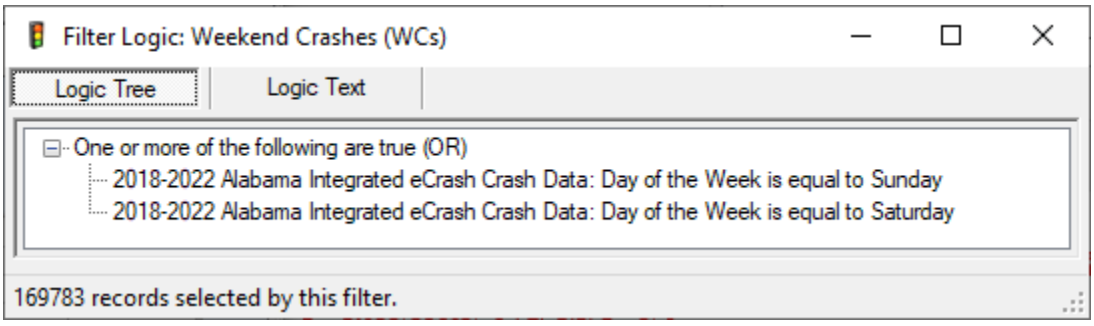
The findings of Sections 4.0-8.0 are from displays of comparisons for the various attributes that might have an influence on crash countermeasure development, and especially Fatal Weekend Crashes (FWCs.) The CARE analytical technique employed to generate most of these comparisons is called Information Mining Performance Analysis Control Technique (IMPACT). Unless otherwise indicated in the "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 Weekend than would be expected of that attribute in Non-Weekend Crashes (NWCs). Similarly, an *under-represented* value of an attribute is a situation found where that attribute has a smaller share of crashes in Weekend than would be expected if it were the same as that attribute in Non-Weekend Crashes (NWCs). IMPACT will display comparisons of FWCs against their NWC counterparts. In summary, the Non-Weekend Crashes (NWCs) are serving as a control to which the FWCs are being compared. In this way any inconsistencies related to the FWCs 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: 1. Geographical and Harmful Events, 2. Time, 3. Severity, 4. Demographics, and 5. Driver Behavior.

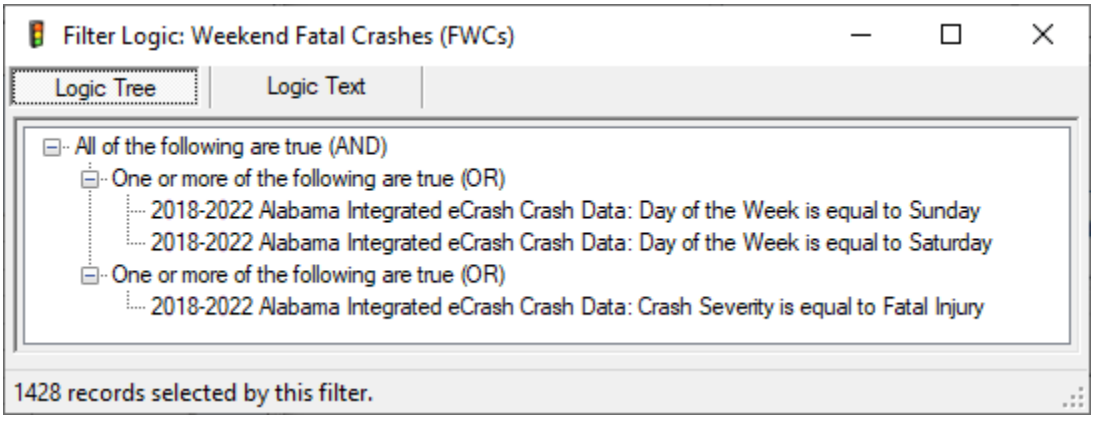
2.2 Filter Definitions: Fatal Weekend Crashes (FWCs) and Non-Weekend Crashes (NWCs)

The following is the formal filter definition for all Weekend crashes:

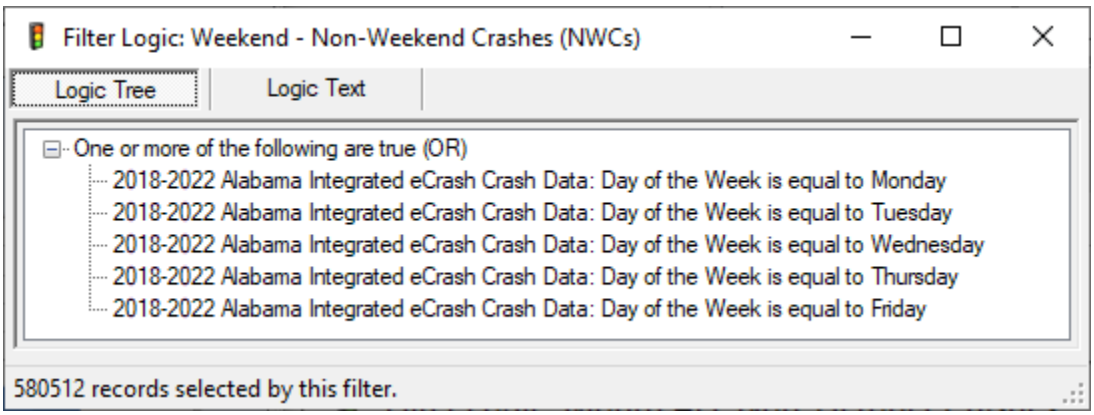


This formalizes the definition of the crashes on Weekends subset of crash reports being considered in this study. IMPACT will only use this subset when needed. For the most part it will be comparing Fatal Weekend Cashes (FWCs) against all crashes for the other days of the week using the filter defined below. The time frame for the analyses is calendar years 2018-2022.

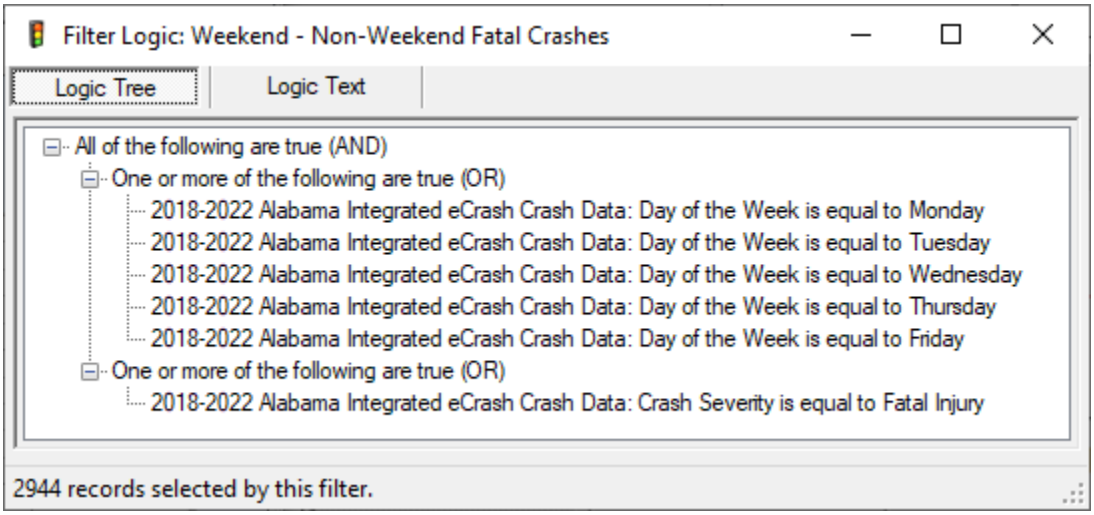
Fatal Weekend Crash (FWC) filter:



Non-Weekend Crashes (NWCs), all crashes on the Non-Weekend days regardless of severity:

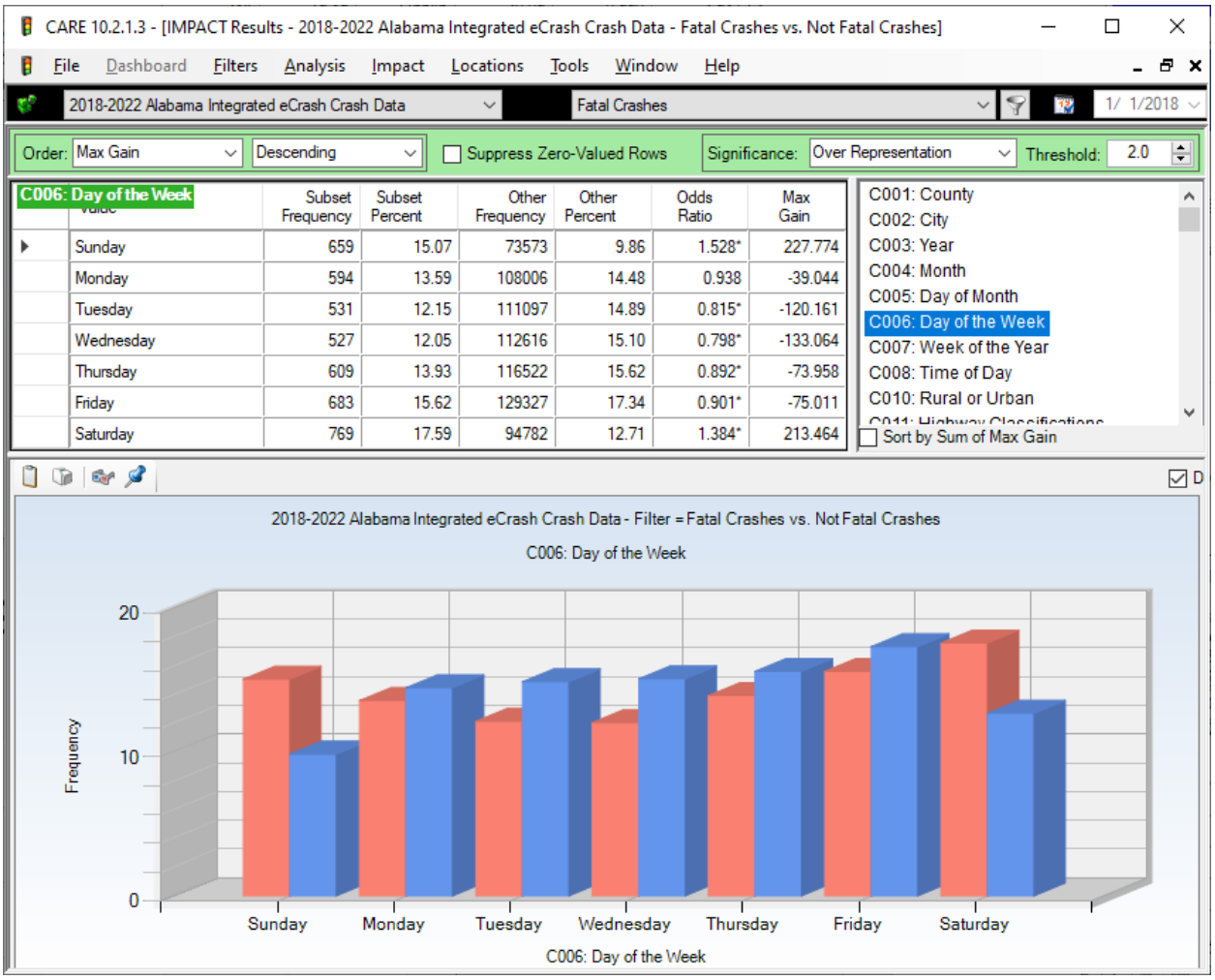


Also of interests in a few cases will be Non-Weekend Fatal Crashes, all fatal crashes in the non-Weekend days:



Using the filters above, the next sections will get an overall introduction to the crash and/or fatality effects before getting into the large number of IMPACT analyses.

2.3 Day of the Week (C006) for Fatal Crashes

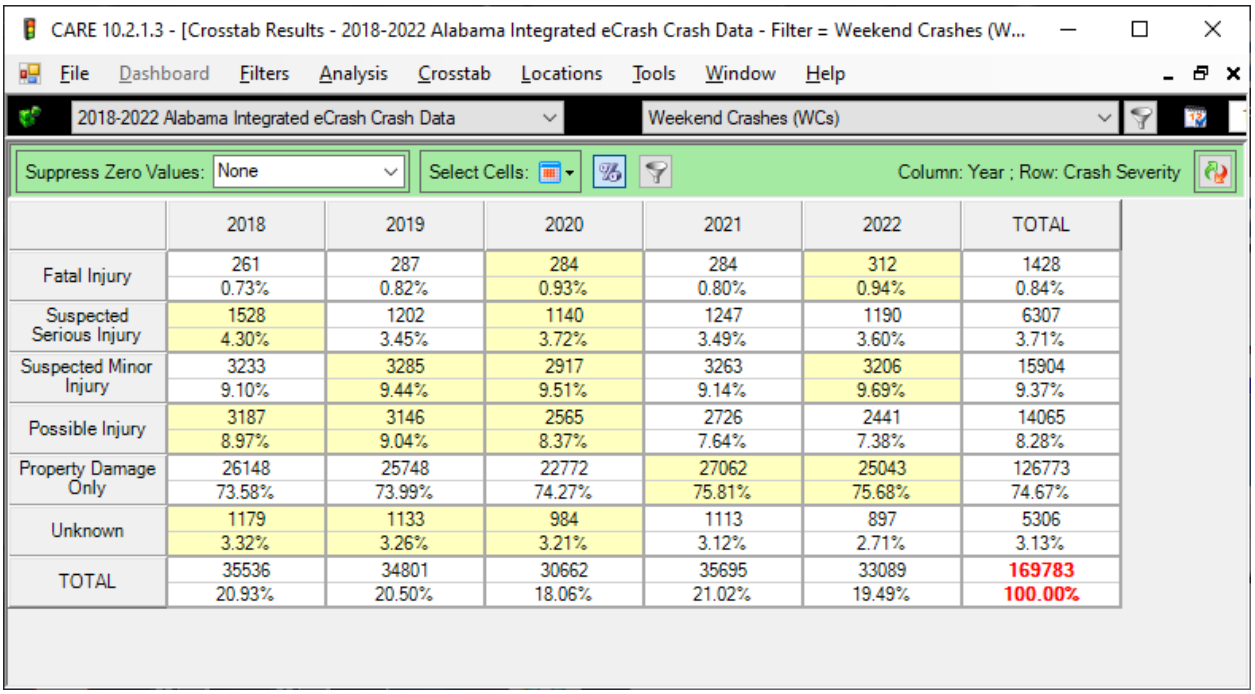


This IMPACT output makes is clear as to why we chose the Weekend days (Saturday and Sunday) for further analysis. Saturday has an over-representation of Fatal crashes given by its Odds Ratio of 1.384. Sunday is even higher with 1.528. Friday would seem to be the next candidate, but it is under-represented, which can be seen in the chart and table (Odds Ratio = 0.901). The main cause of this under-representation is the high number of non-fatal crashes that occur on Friday (blue bar).

2.4 Overall Weekend Crashes (WCs) by Severity and Year; 2018-2022 Data

It is good to get a feel for their overall difference in the crash frequencies by severity over recent years. The following gives a comparison of all Weekend crashes by severity in CY2018-2022.

Weekend Crashes by Severity for Calendar Years 2018-2022

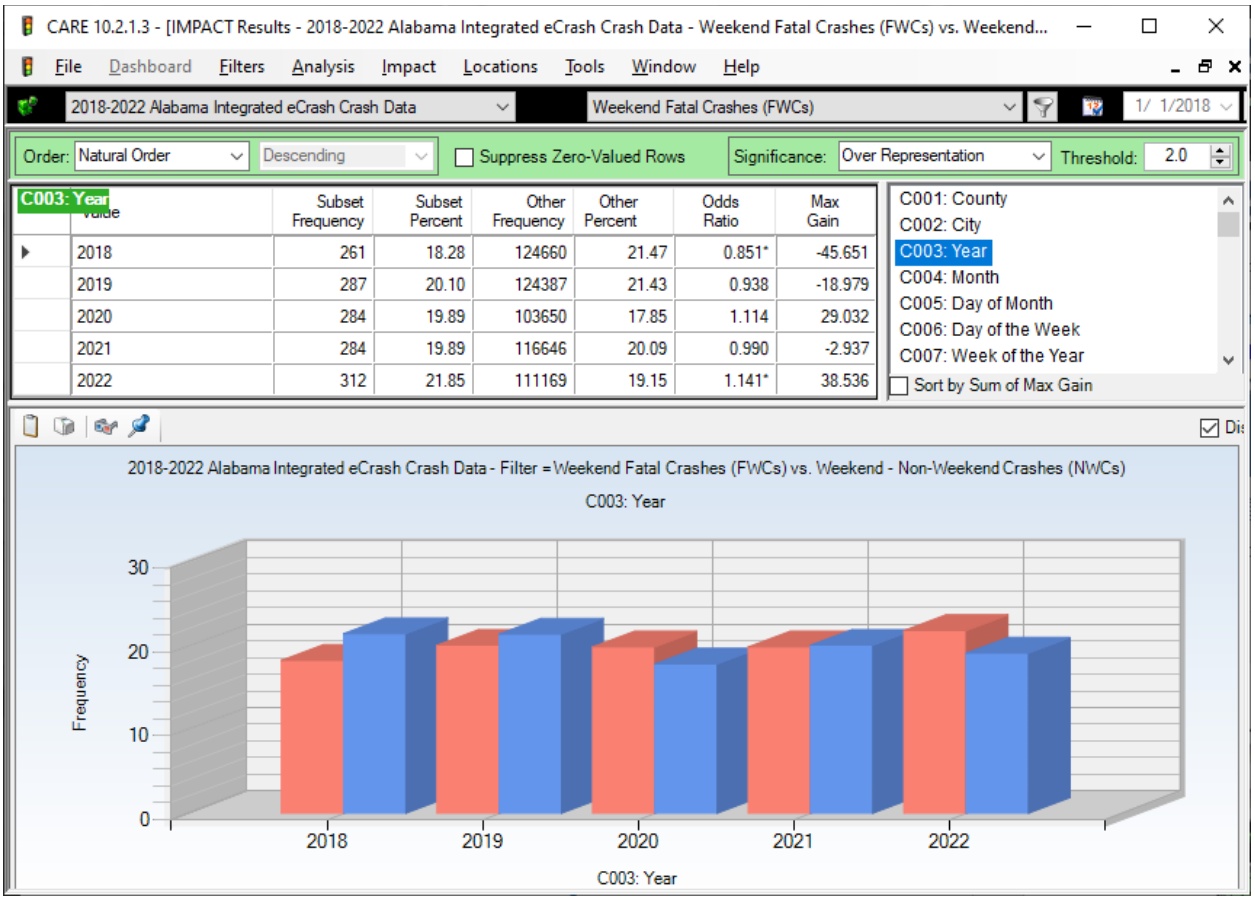


	2018	2019	2020	2021	2022	TOTAL
Fatal Injury	261 0.73%	287 0.82%	284 0.93%	284 0.80%	312 0.94%	1428 0.84%
Suspected Serious Injury	1528 4.30%	1202 3.45%	1140 3.72%	1247 3.49%	1190 3.60%	6307 3.71%
Suspected Minor Injury	3233 9.10%	3285 9.44%	2917 9.51%	3263 9.14%	3206 9.69%	15904 9.37%
Possible Injury	3187 8.97%	3146 9.04%	2565 8.37%	2726 7.64%	2441 7.38%	14065 8.28%
Property Damage Only	26148 73.58%	25748 73.99%	22772 74.27%	27062 75.81%	25043 75.68%	126773 74.67%
Unknown	1179 3.32%	1133 3.26%	984 3.21%	1113 3.12%	897 2.71%	5306 3.13%
TOTAL	35536 20.93%	34801 20.50%	30662 18.06%	35695 21.02%	33089 19.49%	169783 100.00%

We conclude from considering the percentage numbers at the bottom of the table that 2020 and perhaps 2022 were significantly lower in total Weekend crashes than those in the other years. Fatal Weekend Crashes (FWCs) were quite stable, but had a noticeable increase in 2022.

3.0 Overall High-Level View of Fatal Weekend Crashes

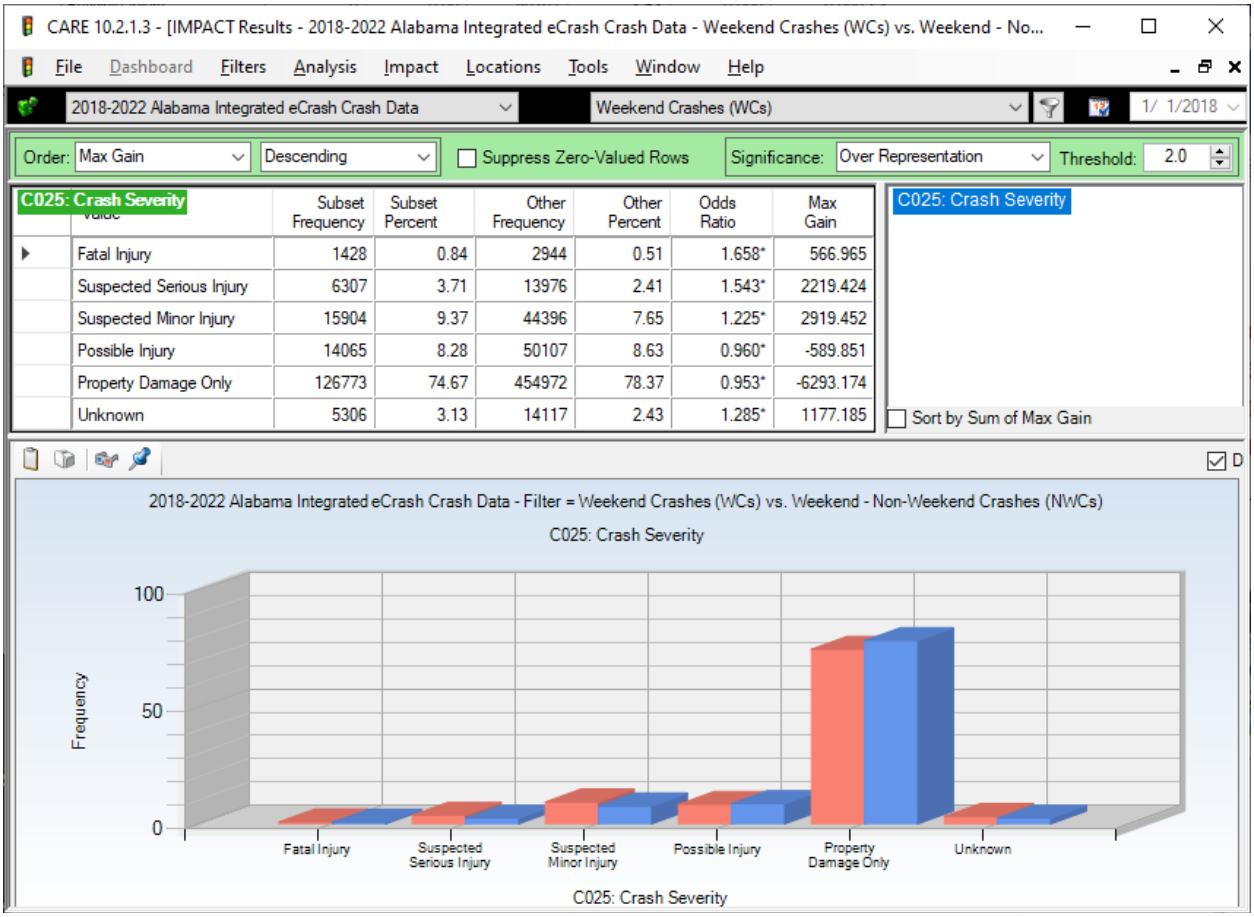
3.1 Fatal Weekend Crashes (FWCs) vs Non-Weekend Crashes (NWCs) by Year



Fatal Weekend Crashes (FWCs) frequencies were significantly lower in 2018, and significantly higher in 2022. They were no significantly different in the other years, 2019-2021. The 2020 year was over-represented, but not significantly so. Generally, over the five years, the number of fatal weekend crashes increased by 51 (19.5%). This increasing trend further strengthens the goal of continuing to perform this weekend fatality analysis.

3.2 Weekend Crash (WC) Severity Comparisons (WCs vs NWCs)

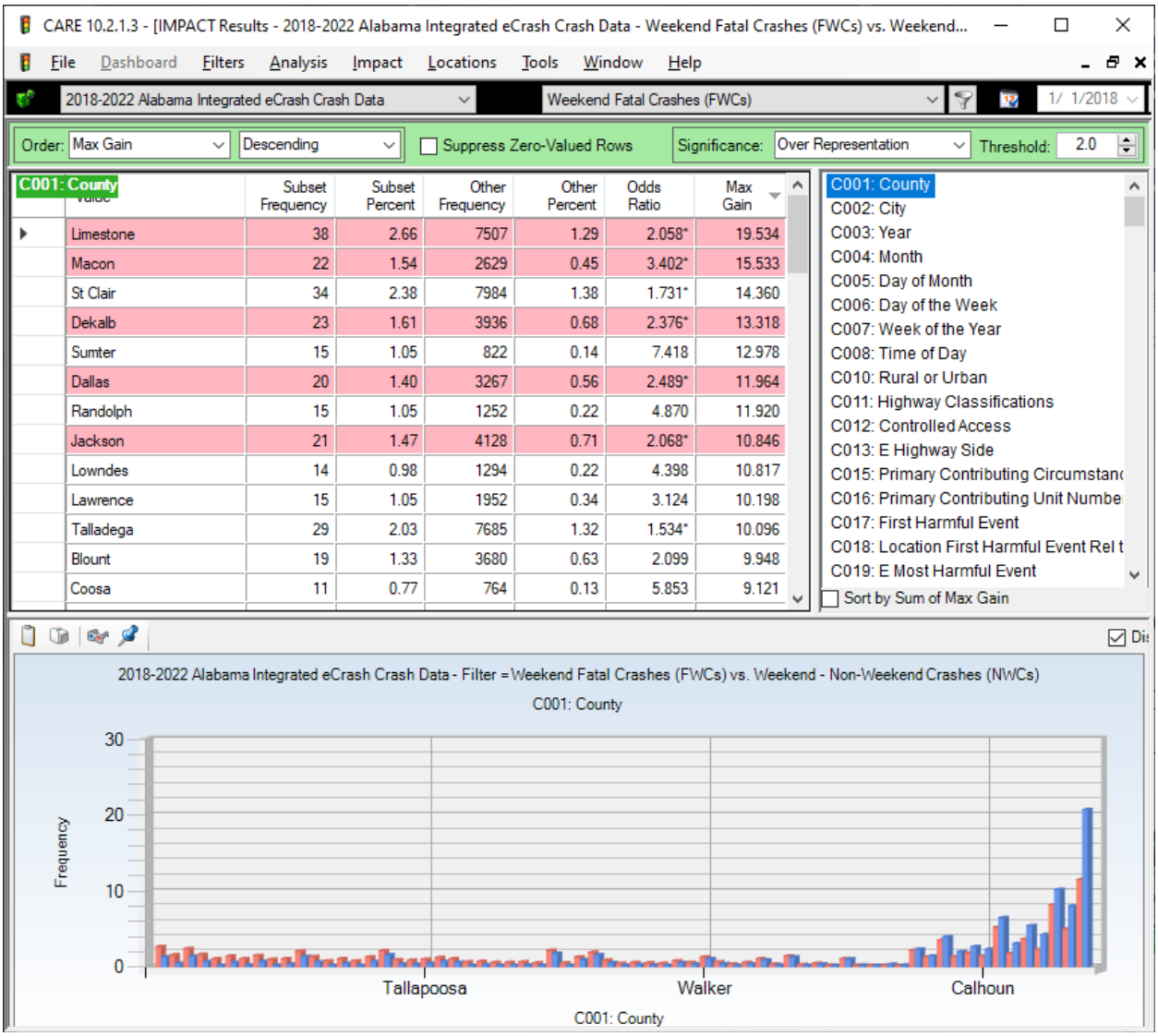
The following presents a comparison by severity of the of Weekend and non-Weekend crashes over the five-year period (2018-2022). The *Subset Frequency* and *Percent* columns are for Weekend crashes, while the *Other Frequency* and *Percent* columns are for all crashes for all other days. Comparisons must be against the percentage proportions to determine if Weekend crashes (OCs) are more or less severe than Non-Weekend Crashes in general.



It is clear that there are significant severity differences between FWCs and NWCs. The three highest severity classifications had significant over-representations, while the two lowest (Possible Injury and Property Damage Only) were significantly under-represented.

4.0 Geographic and Harmful Event Factors

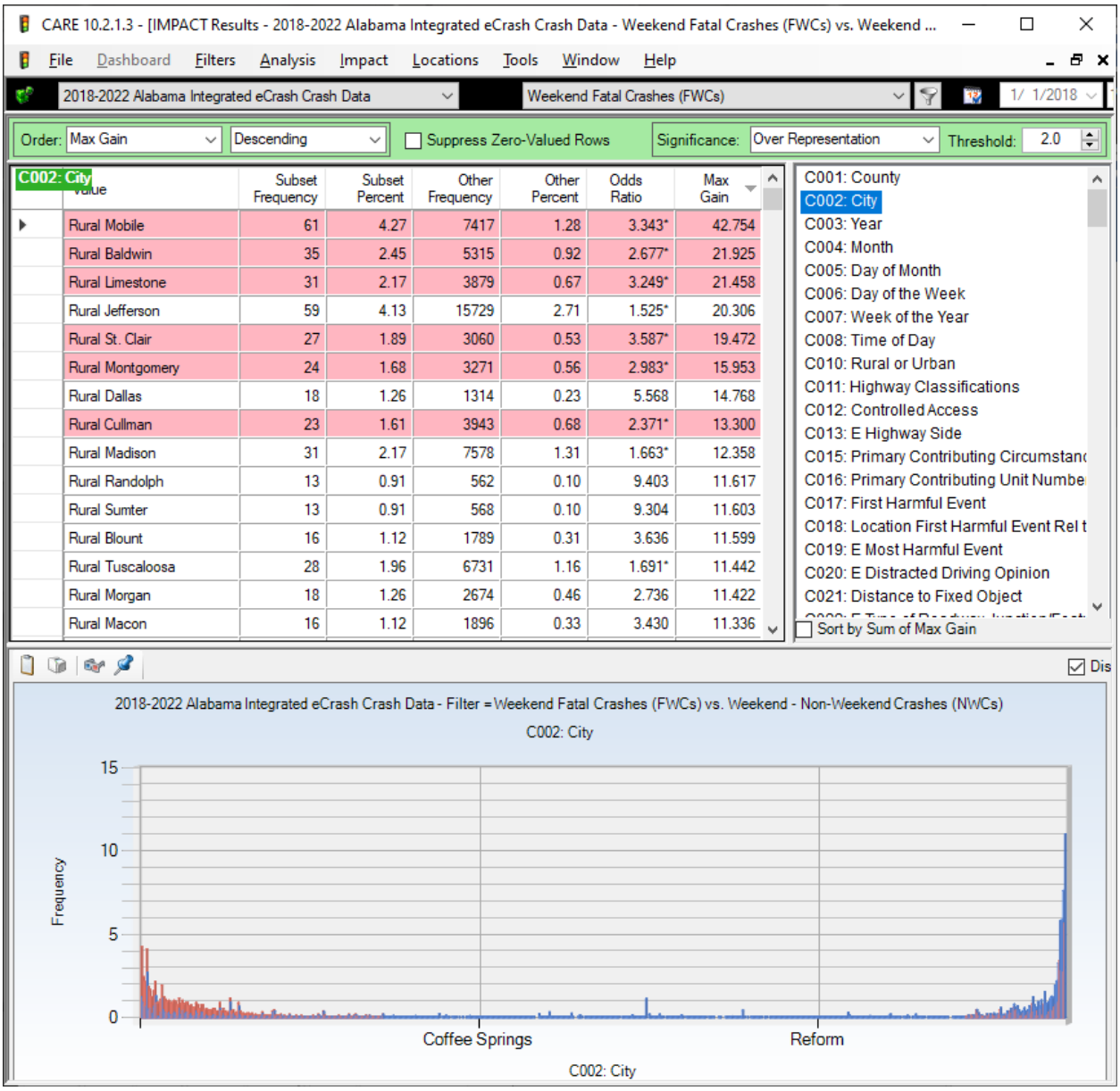
4.1 C001 County (top 13 counties)



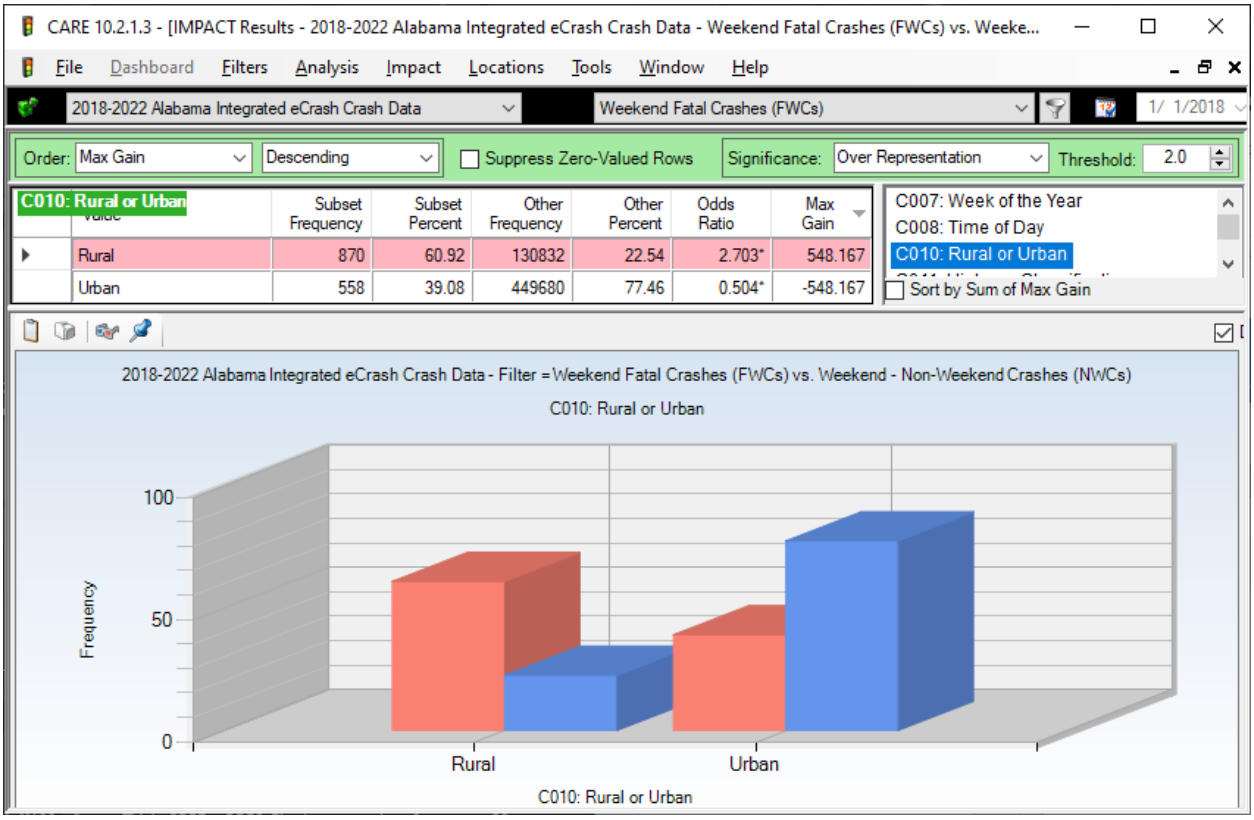
The above display has been arranged in highest Max Gain order to indicate the counties that have the highest potential for gain in reducing their Weekend fatal over-representations. Limestone 38, Macon 22, St Clair 34, Dekalb 23, Sumter 15, Dallas 20, Randolph 15, Jackson 21, Lowndes 14, Lawrence 15, and Talladega 29 have the highest potentials for Weekend fatality reductions, each with Max Gains greater than 10 fatal crashes. The display above contains all of the counties with Max Gains greater than 9.000.

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. Generally, these rural areas are adjacent to (or partially contain) significant urban areas that have a higher traffic density. This display is in Max Gain ordering to put those (virtual) cities that have the highest potential for Fatal Weekend Crash (FWC) reduction at the top. The display below is for all Max Gains > 10.



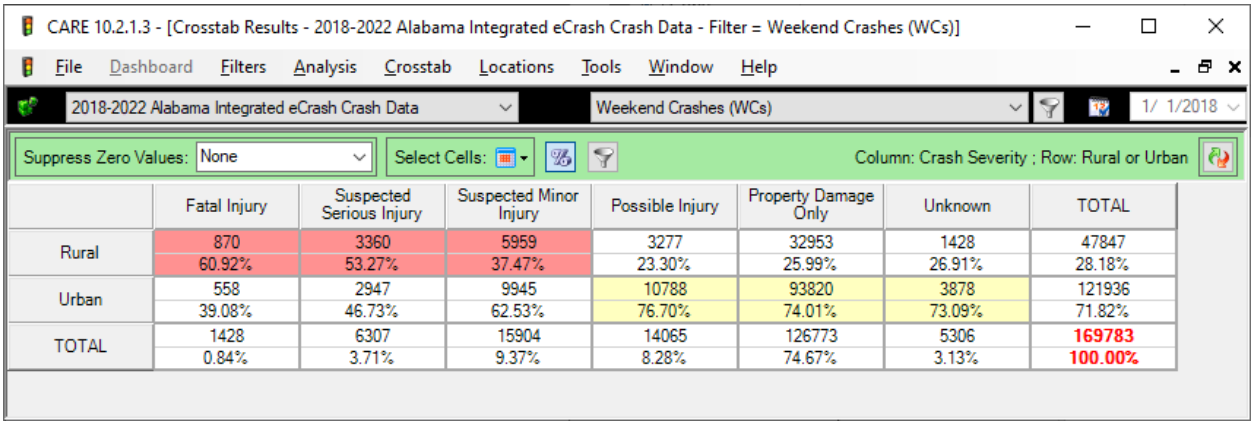
4.3 C010 Rural or Urban



About 61% (60.92%) of the FWCs were in rural areas. This is attributed to the comparative speed at impact in the rural areas, which 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 6.0, as well as 4.4 below).

4.4 C025 Severity of Crash by C010 Rural-Urban (all Weekend crashes)

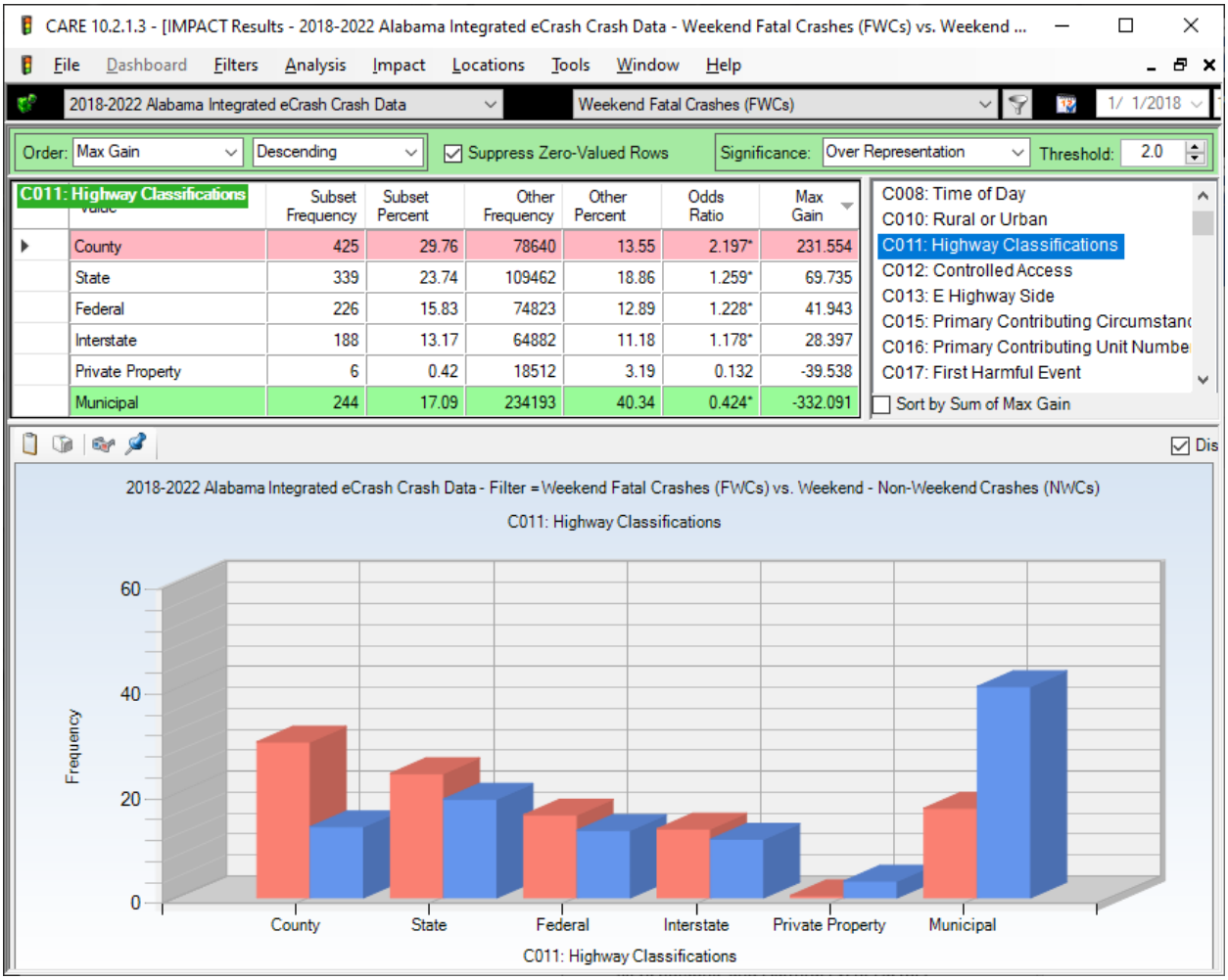
It is obvious in the above outputs that the proportion of FWCs tends to be greatly over-represented in the rural areas. It is interesting to perform a cross-tabulation for all Weekend crashes over the Rural and Urban areas to determine to what extent their crashes might be resulting in more fatalities than would be expected. The following, *which is for <u>all</u> Weekend crashes*, gives this analysis.



	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL
Rural	870	3360	5959	3277	32953	1428	47847
	60.92%	53.27%	37.47%	23.30%	25.99%	26.91%	28.18%
Urban	558	2947	9945	10788	93820	3878	121936
	39.08%	46.73%	62.53%	76.70%	74.01%	73.09%	71.82%
TOTAL	1428	6307	15904	14065	126773	5306	169783
	0.84%	3.71%	9.37%	8.28%	74.67%	3.13%	100.00%

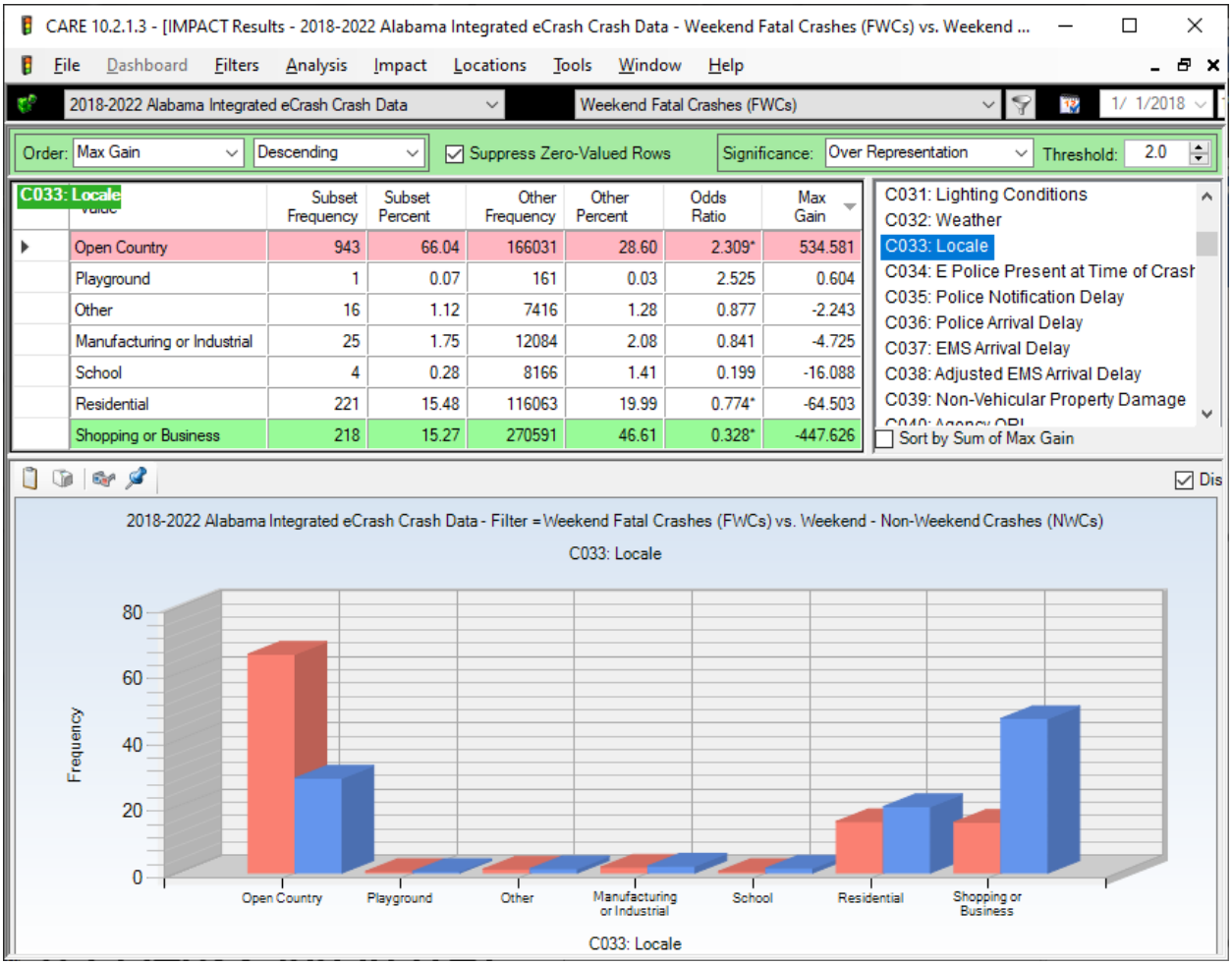
The red-backed cells in the cross-tabulation above indicate over-representation by more than 10%. Those that are over-represented, but by less than 10%, have a yellow background. For example, while 28.18% of all Weekend crashes occurred in rural areas, 60.92% of the FWCs occurred there. It is imperative to take into consideration crash severity when making geographical decisions regarding countermeasure implementation. Clearly, FWCs had their fatalities and highest severity injuries in the rural areas, since all three of the most severe crash types are over-represented.

4.5 C011 Highway Classifications



Analysis of highway classifications indicates that FWCs had their greatest over-representation on county roads (29.76, Odds Ratio =2.197, over twice that expected). State, Federal and Interstate routes were also significantly over-represented. It is recommended that hotspot analysis be performed to identify the specific roadway location concentrations that are most highly over-represented. Law enforcement presence alone could have a large effect here, since a major problem is speed, as will be shown below (Section 6.2).

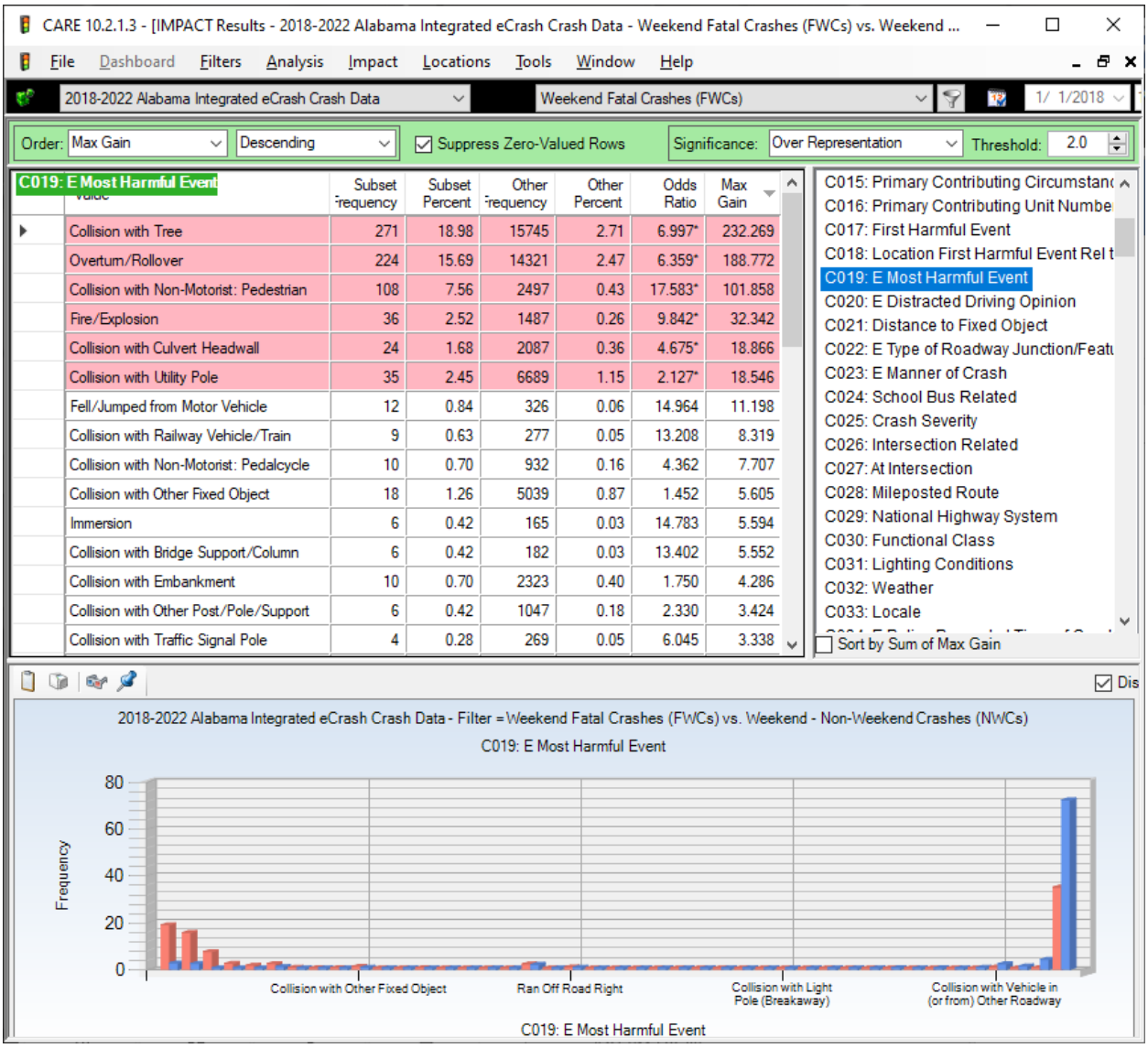
4.6 C033 Locale



Open Country roadways show the highest level of over-representation in FWCs as compared to the more urbanized locales. This might be more useful than the rural/urban specification, which we have found to be not as definitive. There are considerable "Open Country" areas within the formal city limits of most cities, and this seems to be where a large number of the FWCs are occurring. For example, while the rural number for these crashes was found to be 870 (60.92%) (see Section 4.5), the Open Country Locale number indicates 943 (66.04%).

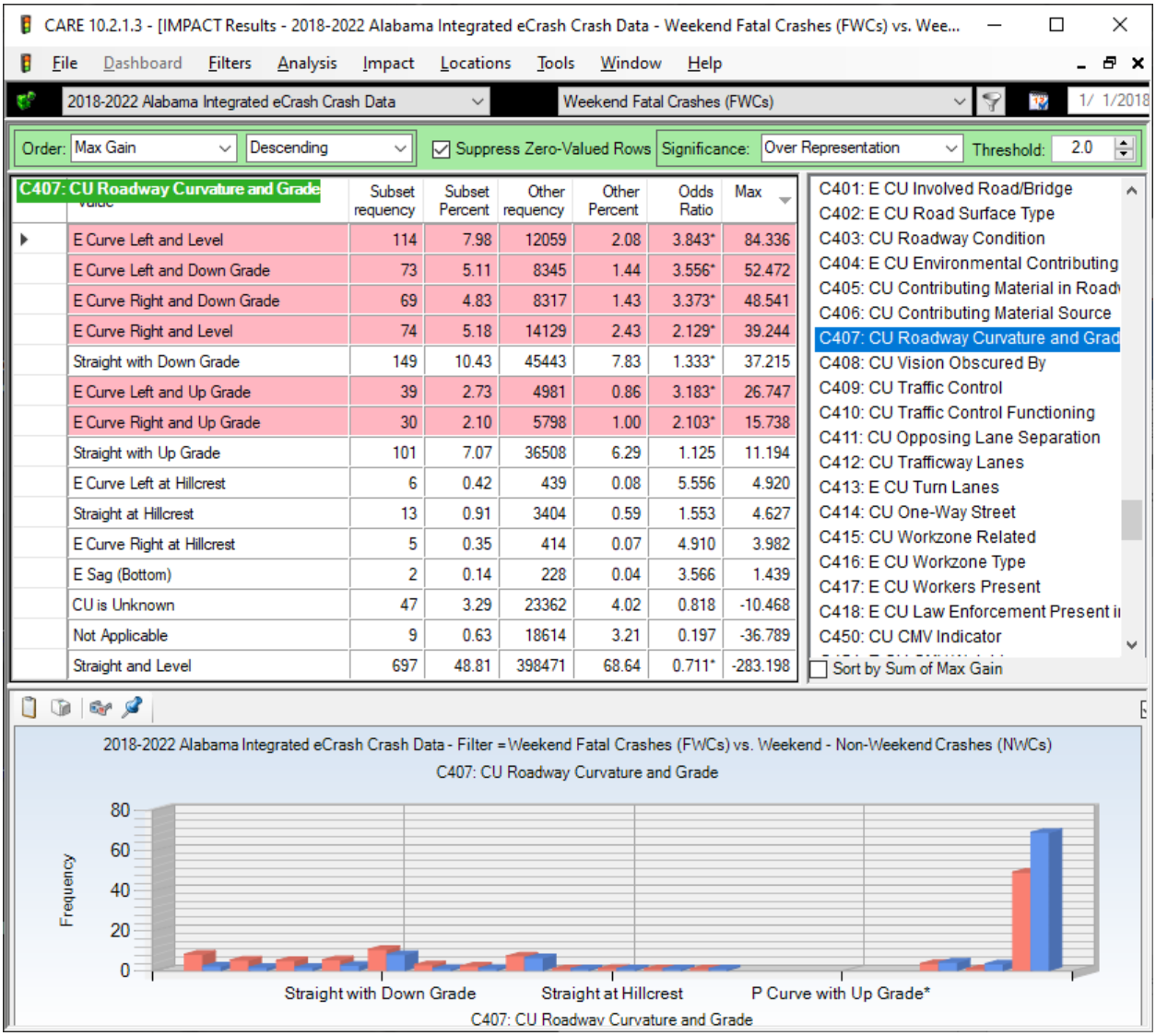
The collection of all areas within a city limits is considered to be urban in the urban-rural analysis, as opposed to the presence or absence of buildings and traffic signals.

4.7 C019 Most Harmful Event (>3 in MaxGain order)



This display is intended to show safety engineers obstacles that are being hit most often in Fatal Weekend Crashes (FWCs). This shows that Collisions with Trees (271 fatal crashes), Overturn/Rollovers (224), Collisions with non-Motorist Pedestrians (108), Fire/Explosion (36), Collisions with Culvert Headwall (24) and Collision with Utility Poles (35), all with Max Gains greater than 18, and all with from 2 to 17 times their expected proportions.

4.8 C407 CU Roadway Curvature and Grade

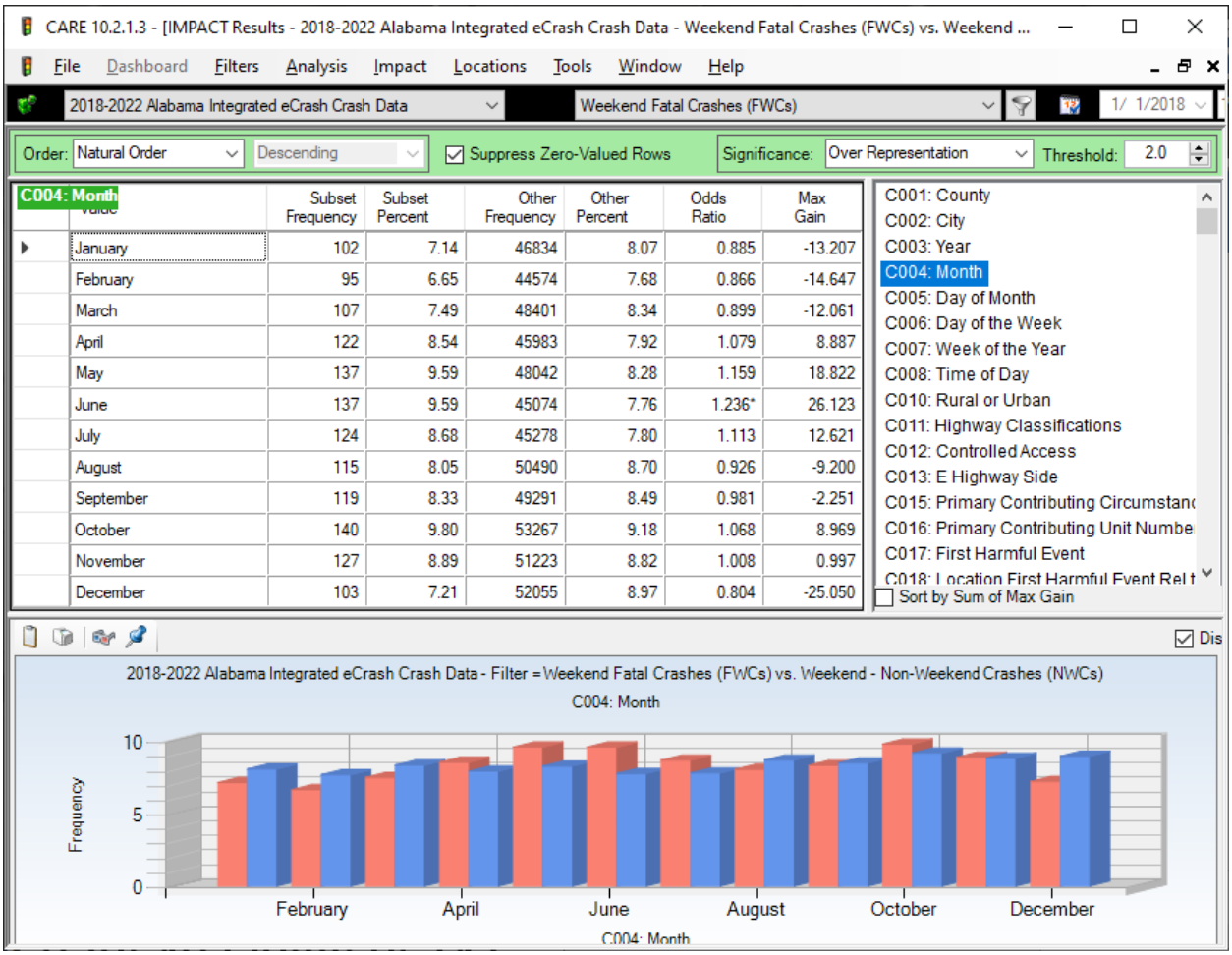


FWCs are over-represented on most types of curves. The following were highly significant: Curve Left and Level 114, Curve Left and Down Grade 73, and Curve Right and Down Grade 69, Curve Right and Level 74, Straight with Downgrade 149, Curve Left and Up Grade 39, and Curve Right with Up Grade 30. The one exception not being highly significant was Straight with Downgrade because it was also high for the Non-Weekend Crashes (NWCs).

5.0 Time Factors

5.1 C003 Year – see Section 3.1

5.2 C004 Month

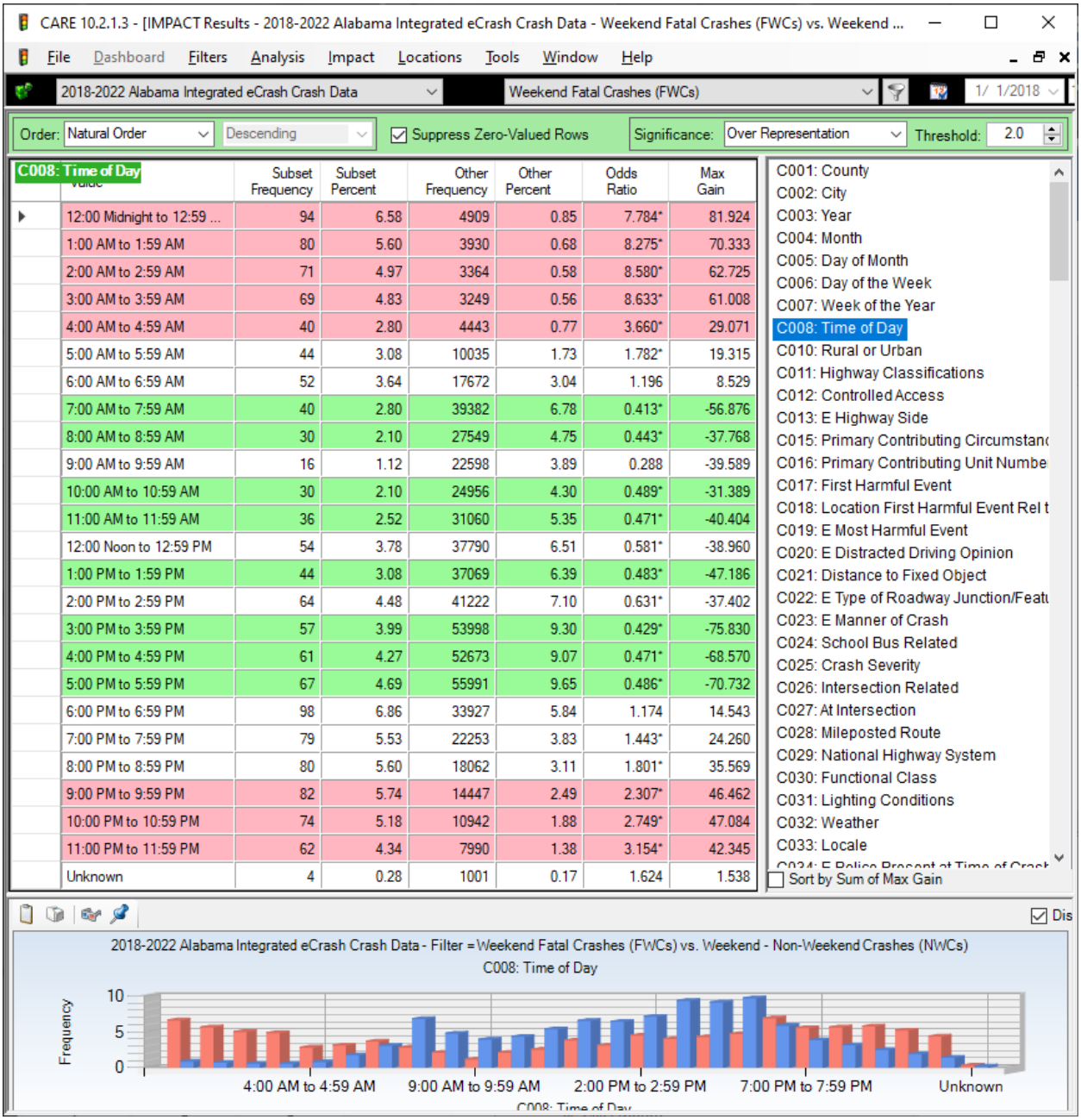


The ordering of the displays above is according to the natural ordering of months. June is the only month that has statistical significance in its over-representation (Odds Ratio = 1.236). The other months generally fall in line with their Non-Weekend counterparts.

5.3 C006 Day of the Week – see Section 2.3

5.4 [Omitted to Maintain Previous IMPACT Ordering]

5.5 C008 Time of Day



The morning and afternoon rush hours are under-represented, while the late evening and all-night hours are consistently over-represented, generally following the Impaired Driving (ID) pattern.

5.6 C008 Discussion on Time of Day

Refer to the Day of the Week by Time of Day cross-tabulation given immediately below in Section 5.7.

It is no surprise to find Fatal Weekend Crashes (FWCs) over-represented during the late night/early morning hours, since their other correlations with aspects of Impaired Driving (ID) are clear. Not only have we restricted this subset to fatal crashes (the plurality of which are caused by ID), but restricting the days to Saturday and Sunday also focuses on those times when crashes are most often caused by ID. 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 Fatal Weekend Crashes (FWCs).

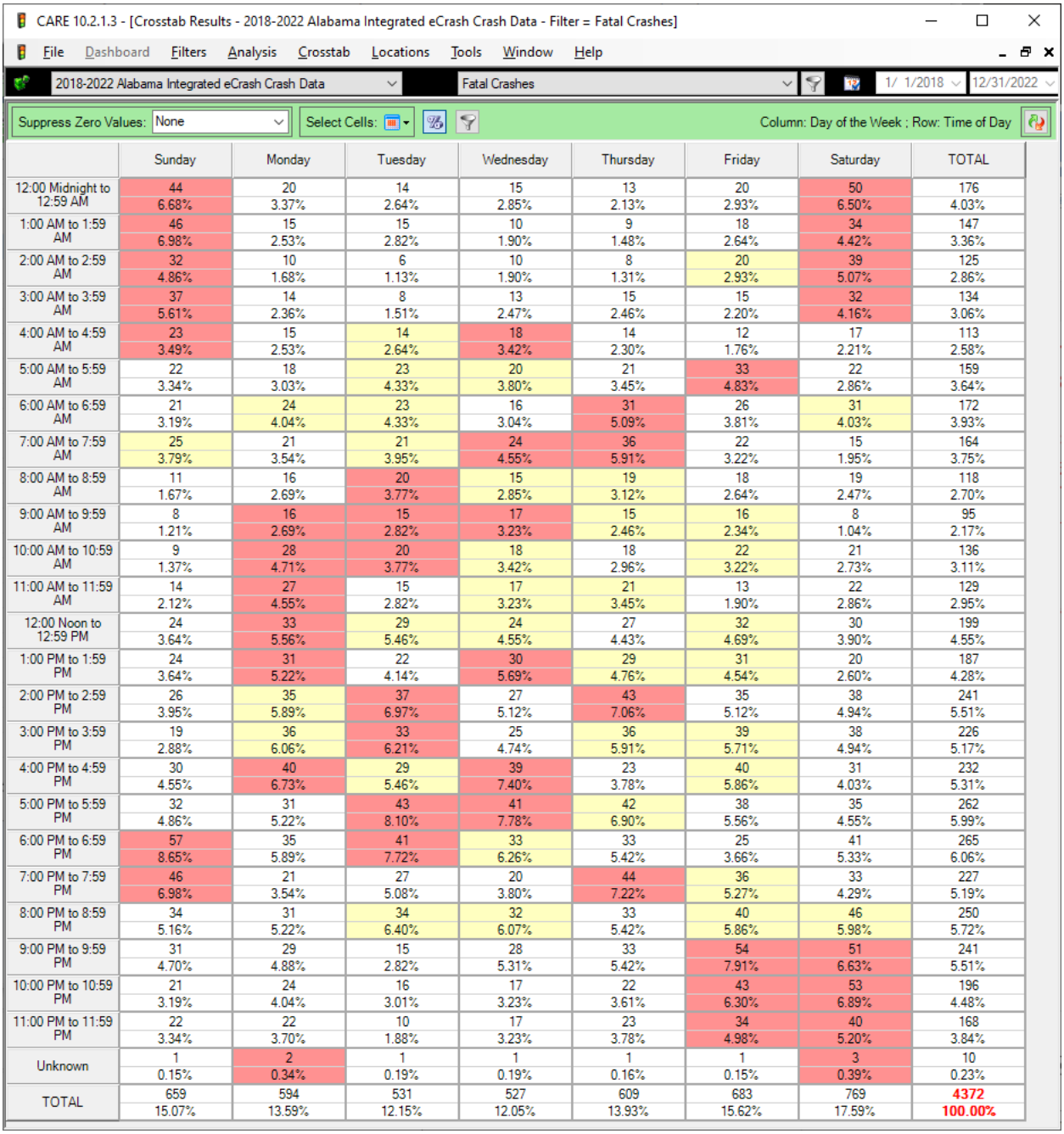
The extent of these time over-representations should not be surprising. Typical traffic patterns of high traffic results on more crashes in the morning and afternoon rush hours. IDs, and especially the IDs that occur on Weekends, are just getting started in the afternoon rush hours and they continue 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 Weekend Crashes (FWCs), 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



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

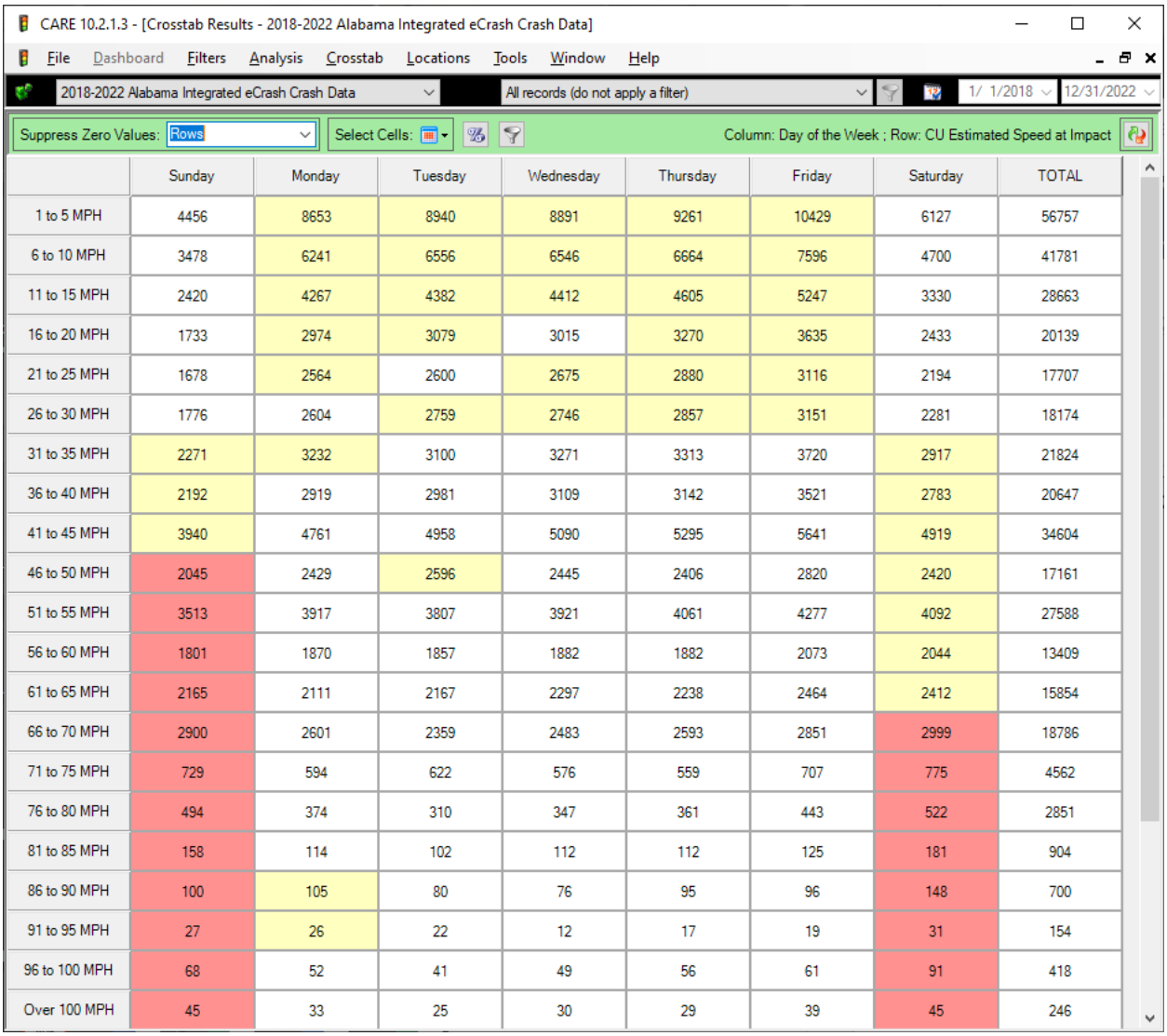
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
12:00 Midnight to 12:59 AM	44 6.68%	20 3.37%	14 2.64%	15 2.85%	13 2.13%	20 2.93%	50 6.50%	176 4.03%
1:00 AM to 1:59 AM	46 6.98%	15 2.53%	15 2.82%	10 1.90%	9 1.48%	18 2.64%	34 4.42%	147 3.36%
2:00 AM to 2:59 AM	32 4.86%	10 1.68%	6 1.13%	10 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

6.1a/3.2 C025 Weekend Crash Severity (All Weekend vs. All Non-Weekend)

See Section 3.2 for the overall statistics that indicate that the reason Weekend Fatal Crashes were chosen for this study had to do with their relatively high number of fatal crashes.

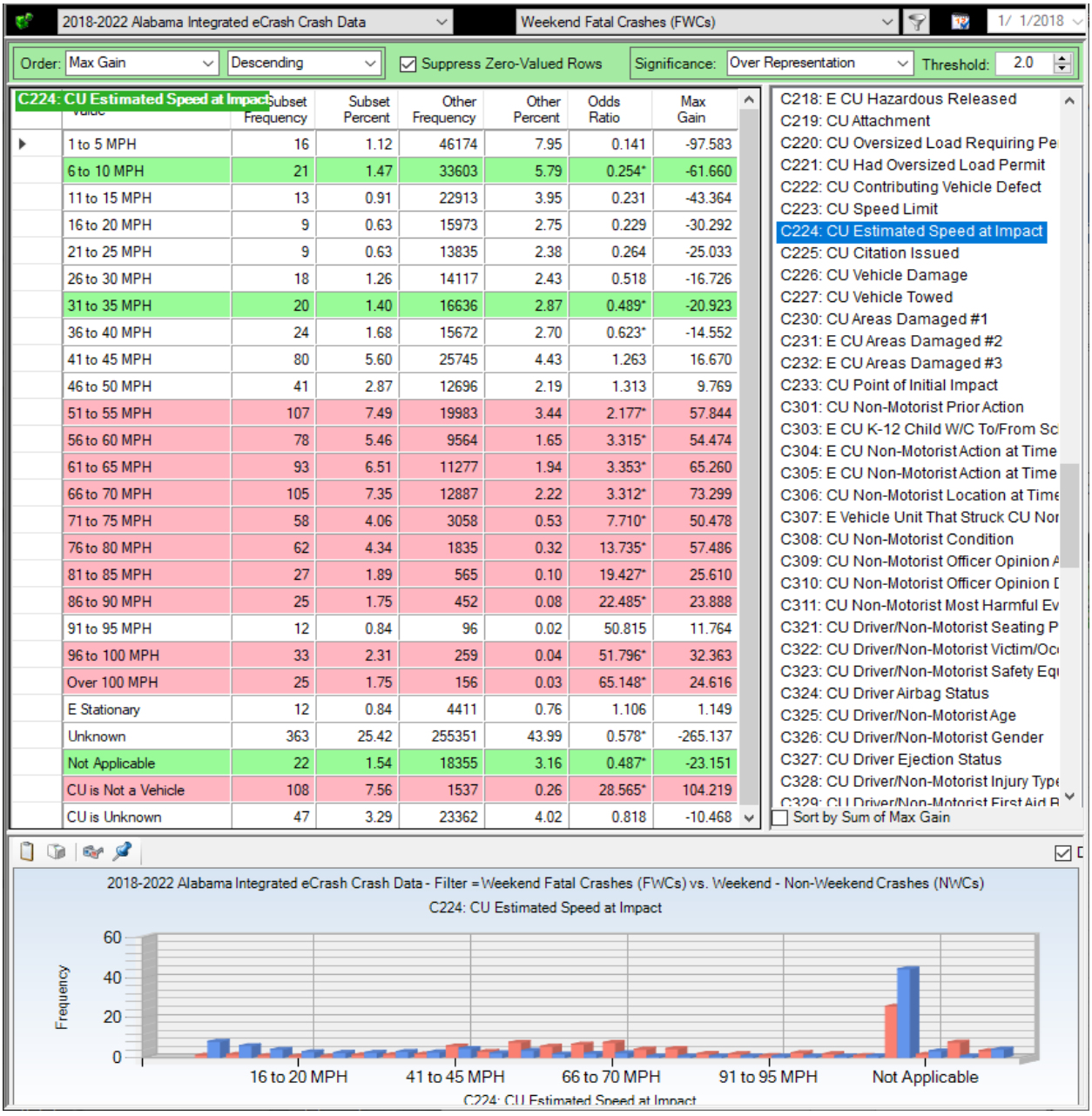
6.1b Crosstab: C004 Day of the Week x Speed at Impact



	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	TOTAL
1 to 5 MPH	4456	8653	8940	8891	9261	10429	6127	56757
6 to 10 MPH	3478	6241	6556	6546	6664	7596	4700	41781
11 to 15 MPH	2420	4267	4382	4412	4605	5247	3330	28663
16 to 20 MPH	1733	2974	3079	3015	3270	3635	2433	20139
21 to 25 MPH	1678	2564	2600	2675	2880	3116	2194	17707
26 to 30 MPH	1776	2604	2759	2746	2857	3151	2281	18174
31 to 35 MPH	2271	3232	3100	3271	3313	3720	2917	21824
36 to 40 MPH	2192	2919	2981	3109	3142	3521	2783	20647
41 to 45 MPH	3940	4761	4958	5090	5295	5641	4919	34604
46 to 50 MPH	2045	2429	2596	2445	2406	2820	2420	17161
51 to 55 MPH	3513	3917	3807	3921	4061	4277	4092	27588
56 to 60 MPH	1801	1870	1857	1882	1882	2073	2044	13409
61 to 65 MPH	2165	2111	2167	2297	2238	2464	2412	15854
66 to 70 MPH	2900	2601	2359	2483	2593	2851	2999	18786
71 to 75 MPH	729	594	622	576	559	707	775	4562
76 to 80 MPH	494	374	310	347	361	443	522	2851
81 to 85 MPH	158	114	102	112	112	125	181	904
86 to 90 MPH	100	105	80	76	95	96	148	700
91 to 95 MPH	27	26	22	12	17	19	31	154
96 to 100 MPH	68	52	41	49	56	61	91	418
Over 100 MPH	45	33	25	30	29	39	45	246
TOTAL	74232	108600	111628	113143	117121	130010	95551	7502596

Speed and ID are the main reason that there are more fatal crashes over the weekends.

6.2 C224 Speed at Impact (FWCs vs Non-Weekend Crashes (NWCs))



The comparison above is Fatal Weekend Crashes (FWCs) against all Non-Weekend Crashes (NECs), some of which were fatal. It should be noted that the speed limit on County roads is generally 45 MPH, and it is generally lower on Municipal roads. For the Fatal Weekend Crashes (FWCs), all impact speeds above 40 MPH are over-represented, with the 51 to 70 being highly significant. This trend continues as the probabilities of fatal injury generally to rise with impact speeds.

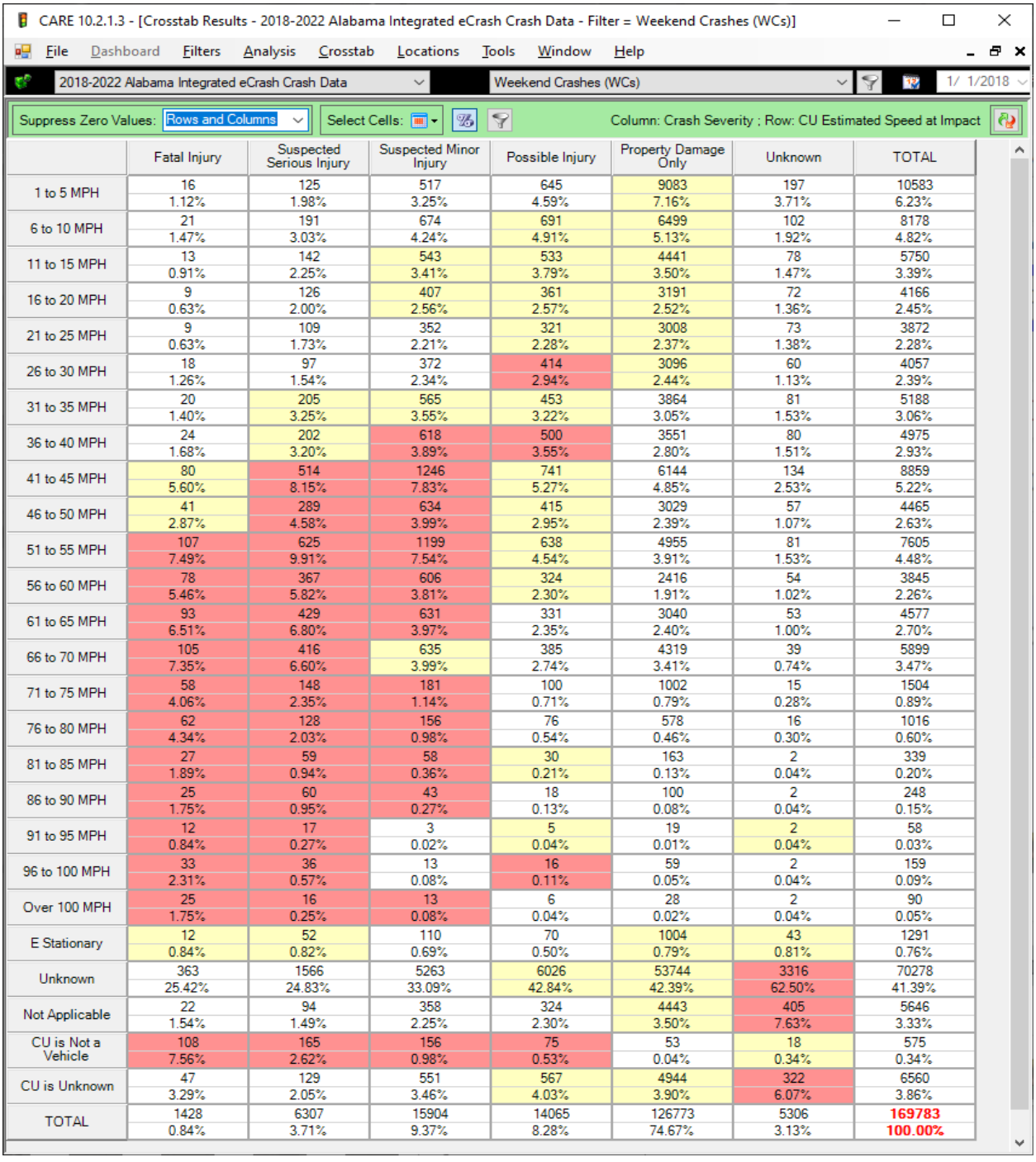
6.3 Highway Classification (C011) by Speed at Impact (C224) Cross-Tabulation

2018-2022 Alabama Integrated eCrash Crash Data | Weekend Fatal Crashes (FWCs) | 1/ 1/2018

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	0	3	8	3	1	1	16
6 to 10 MPH	1	7	6	4	2	1	21
11 to 15 MPH	0	5	3	5	0	0	13
16 to 20 MPH	0	3	3	3	0	0	9
21 to 25 MPH	0	3	3	3	0	0	9
26 to 30 MPH	0	4	2	9	3	0	18
31 to 35 MPH	1	1	4	10	4	0	20
36 to 40 MPH	0	4	5	13	2	0	24
41 to 45 MPH	0	5	15	53	7	0	80
46 to 50 MPH	3	5	11	16	6	0	41
51 to 55 MPH	0	27	43	36	1	0	107
56 to 60 MPH	2	10	17	46	3	0	78
61 to 65 MPH	7	20	29	37	0	0	93
66 to 70 MPH	38	7	18	34	8	0	105
71 to 75 MPH	4	7	19	21	7	0	58
76 to 80 MPH	13	8	17	21	3	0	62
81 to 85 MPH	6	6	7	6	2	0	27
86 to 90 MPH	10	2	7	6	0	0	25
91 to 95 MPH	7	0	0	2	3	0	12
96 to 100 MPH	7	6	10	8	2	0	33
Over 100 MPH	7	8	6	3	1	0	25
E Stationary	8	1	0	2	1	0	12
Unknown	44	44	79	62	130	4	363
Not Applicable	2	4	2	0	14	0	22
CU is Not a Vehicle	20	30	19	18	21	0	108
CU is Unknown	8	6	6	4	23	0	47
TOTAL	188	226	339	425	244	6	1428

6.3a Cross-tabulation: C025 Severity by C224 Speed at Impact



CARE 10.2.1.3 - [Crosstab Results - 2018-2022 Alabama Integrated eCrash Crash Data - Filter = Weekend Crashes (WCs)]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2018-2022 Alabama Integrated eCrash Crash Data | Weekend Crashes (WCs) | 1/ 1/2018

Suppress Zero Values: Rows and Columns | 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	16 1.12%	125 1.98%	517 3.25%	645 4.59%	9083 7.16%	197 3.71%	10583 6.23%
6 to 10 MPH	21 1.47%	191 3.03%	674 4.24%	691 4.91%	6499 5.13%	102 1.92%	8178 4.82%
11 to 15 MPH	13 0.91%	142 2.25%	543 3.41%	533 3.79%	4441 3.50%	78 1.47%	5750 3.39%
16 to 20 MPH	9 0.63%	126 2.00%	407 2.56%	361 2.57%	3191 2.52%	72 1.36%	4166 2.45%
21 to 25 MPH	9 0.63%	109 1.73%	352 2.21%	321 2.28%	3008 2.37%	73 1.38%	3872 2.28%
26 to 30 MPH	18 1.26%	97 1.54%	372 2.34%	414 2.94%	3096 2.44%	60 1.13%	4057 2.39%
31 to 35 MPH	20 1.40%	205 3.25%	565 3.55%	453 3.22%	3864 3.05%	81 1.53%	5188 3.06%
36 to 40 MPH	24 1.68%	202 3.20%	618 3.89%	500 3.55%	3551 2.80%	80 1.51%	4975 2.93%
41 to 45 MPH	80 5.60%	514 8.15%	1246 7.83%	741 5.27%	6144 4.85%	134 2.53%	8859 5.22%
46 to 50 MPH	41 2.87%	289 4.58%	634 3.99%	415 2.95%	3029 2.39%	57 1.07%	4465 2.63%
51 to 55 MPH	107 7.49%	625 9.91%	1199 7.54%	638 4.54%	4955 3.91%	81 1.53%	7605 4.48%
56 to 60 MPH	78 5.46%	367 5.82%	606 3.81%	324 2.30%	2416 1.91%	54 1.02%	3845 2.26%
61 to 65 MPH	93 6.51%	429 6.80%	631 3.97%	331 2.35%	3040 2.40%	53 1.00%	4577 2.70%
66 to 70 MPH	105 7.35%	416 6.60%	635 3.99%	385 2.74%	4319 3.41%	39 0.74%	5899 3.47%
71 to 75 MPH	58 4.06%	148 2.35%	181 1.14%	100 0.71%	1002 0.79%	15 0.28%	1504 0.89%
76 to 80 MPH	62 4.34%	128 2.03%	156 0.98%	76 0.54%	578 0.46%	16 0.30%	1016 0.60%
81 to 85 MPH	27 1.89%	59 0.94%	58 0.36%	30 0.21%	163 0.13%	2 0.04%	339 0.20%
86 to 90 MPH	25 1.75%	60 0.95%	43 0.27%	18 0.13%	100 0.08%	2 0.04%	248 0.15%
91 to 95 MPH	12 0.84%	17 0.27%	3 0.02%	5 0.04%	19 0.01%	2 0.04%	58 0.03%
96 to 100 MPH	33 2.31%	36 0.57%	13 0.08%	16 0.11%	59 0.05%	2 0.04%	159 0.09%
Over 100 MPH	25 1.75%	16 0.25%	13 0.08%	6 0.04%	28 0.02%	2 0.04%	90 0.05%
E Stationary	12 0.84%	52 0.82%	110 0.69%	70 0.50%	1004 0.79%	43 0.81%	1291 0.76%
Unknown	363 25.42%	1566 24.83%	5263 33.09%	6026 42.84%	53744 42.39%	3316 62.50%	70278 41.39%
Not Applicable	22 1.54%	94 1.49%	358 2.25%	324 2.30%	4443 3.50%	405 7.63%	5646 3.33%
CU is Not a Vehicle	108 7.56%	165 2.62%	156 0.98%	75 0.53%	53 0.04%	18 0.34%	575 0.34%
CU is Unknown	47 3.29%	129 2.05%	551 3.46%	567 4.03%	4944 3.90%	322 6.07%	6560 3.86%
TOTAL	1428 0.84%	6307 3.71%	15904 9.37%	14065 8.28%	126773 74.67%	5306 3.13%	169783 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 all Weekend crashes. Notice the red in the Fatality and Serious Injury cells as speeds increase. What is more interesting is the probability that the 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
31-35	5188/20 = 259.4	1 in 259 = 1.0
36-45	13834/104 = 133.0	1 in 259/133.0= 1.9
46-55	12070/148 = 81.6	1 in 259//81.6= 3.2
56-65	11450/171 = 67.0	1 in 259/67.0= 3.9
66-75	7403/163 = 45.4	259/42.8 = 6.1
76-85	1366/89 = 15.3	259/15.4 = 16.8
86-95	306/37 = 8.3	259/9.5 = 27.3
Above 95	249/58 = 4.3	259/3.3= 78.5

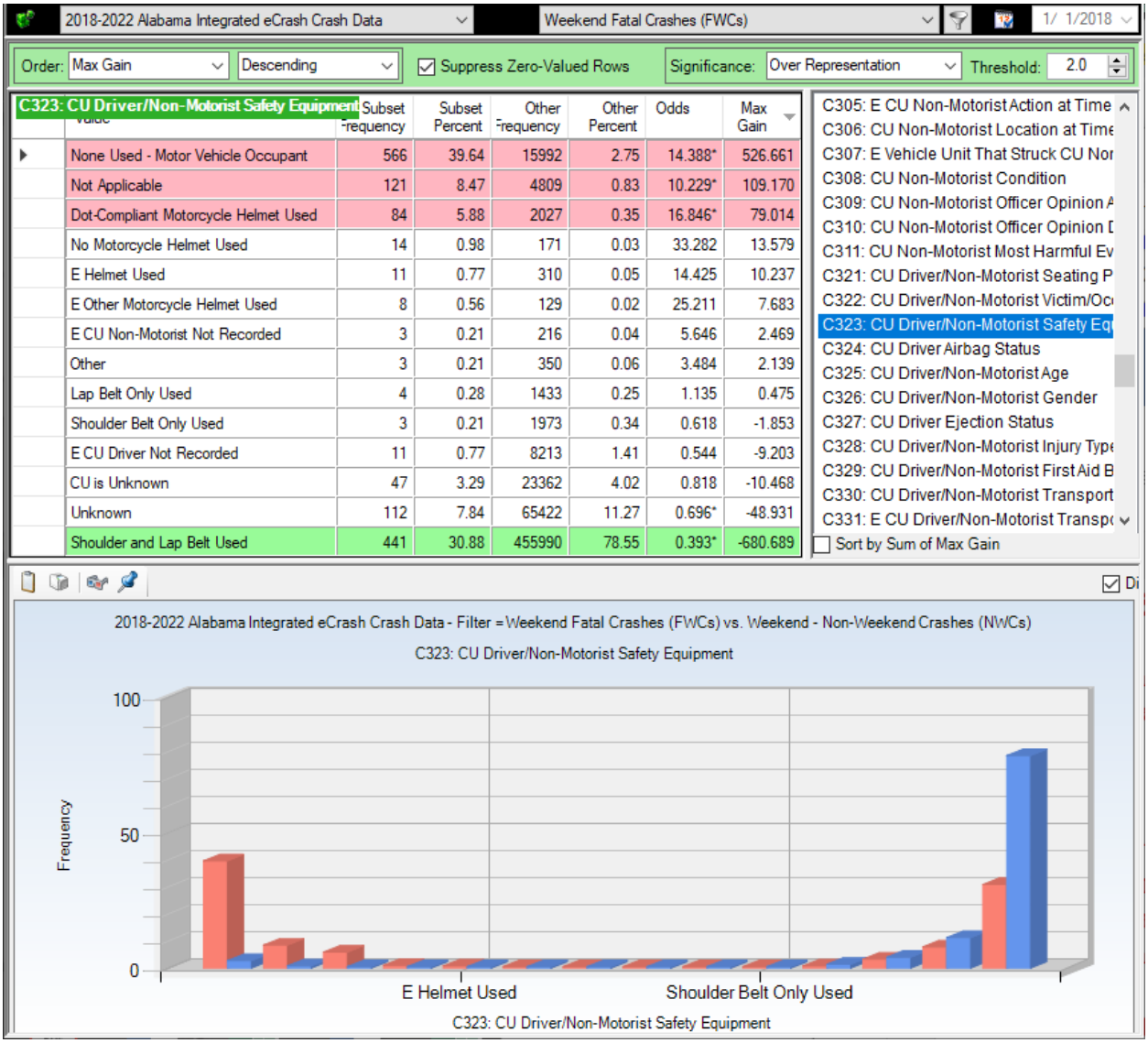
The last column of the above table gives the fatality probability multiplier based on the lowest probability (31-35 MPH), to which was assigned a relative value of 1.0 (not a probability). The probabilities in the form of 1 in X are given in the middle column. For example, the probability of a crash at 46-55 MPH being fatal is one in 81.6 crashes at this speed. In the extreme case of crashes Above 95 MPH, the chances of being killed are one in 4.3, which is 78.5 times the probability for 31-35 MPH. The final column transforms the second column into a multiplier of the 31-35 MPH probability. For the examples that we gave, the 46-45 MPH probability is 3.2 times that of the 31-35 MPH probability, and the "Above 95" is 78.5 times that of the 31-35 MPH probability.

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. A reduction in impact speeds by 10 MPH would 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 FWC drivers to be properly restrained, which will be covered in the next separate attribute below (6.5; Restraint Use by Causal Drivers in Weekend Crashes), which 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 Weekend Collisions

The following display presents a comparison of FWC driver safety belt use compared to all Non-Weekend Crashes (NWCs), over the same five-year time period.



Fatal risk-taking involved in most of the Weekend crashes does not stop with excess speed; it extends to being not properly restrained. The next analysis demonstrates the extent to which not being properly restrained contributes to crashes becoming fatal.

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

2018-2022 Alabama Integrated eCrash Crash Data | Weekend Crashes (WCs) | 1/ 1/20

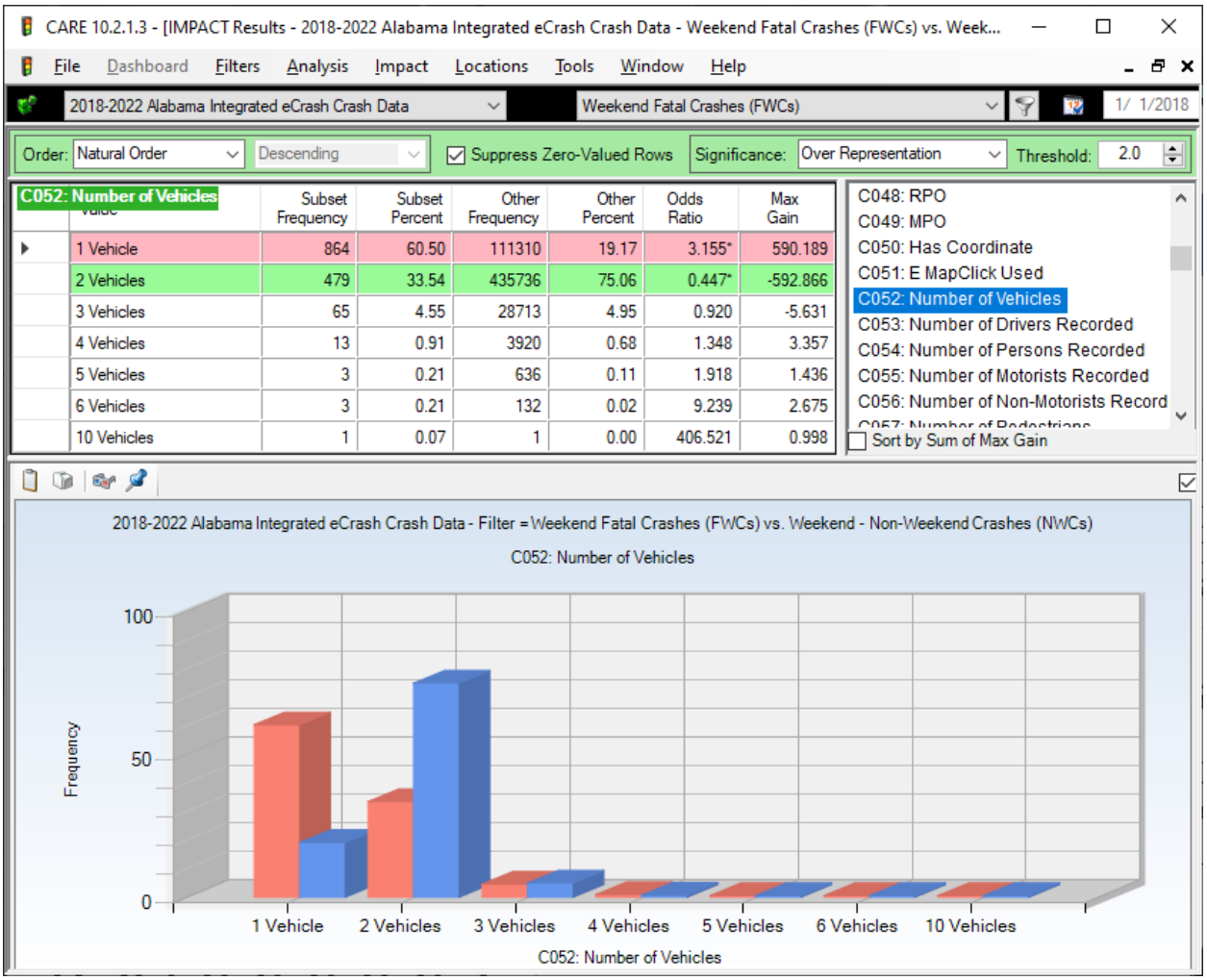
Suppress Zero Values: Rows and Columns | Select Cells: | Column: Crash Severity ; Row: CU Driver/Non-Motorist Safety Equipment

	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL
None Used - Motor Vehicle Oc	566	1580	1644	712	2795	196	7493
Shoulder and Lap Belt Used	441	3183	11064	10816	95620	2706	123830
Lap Belt Only Used	4	14	27	36	306	22	409
Shoulder Belt Only Used	3	13	44	30	376	44	510
E Forward Facing Child Safety Seat	0	0	0	0	8	0	8
E Rear Facing Child Safety Seat	0	0	0	0	3	1	4
E Child Booster Seat Used Proper	0	0	0	0	1	0	1
E Rear Facing Child Safety Seat	0	0	1	0	0	0	1
E Unknown Child Restraint Type	0	0	0	0	4	2	6
E Child in Arms of Restrained Adult	0	0	0	0	1	0	1
Dot-Compliant Motorcycle Helme	84	422	467	122	296	19	1410
E Helmet Used	11	37	74	17	48	16	203
E Protective Pads Used (Elbows/Kn	0	1	0	0	0	0	1
Reflective Clothing (Jacket/B	0	3	0	0	0	1	4
E Lighting Used by Non-Motorist	0	0	1	1	5	0	7
E Other Safety Equipment Used	0	2	1	0	4	0	7
E Other Motorcycle Helme	8	25	27	6	17	0	83
No Motorcycle Helmet Used	14	53	46	11	13	2	139
Other	3	7	14	11	64	12	111
Unknown	112	532	1495	1439	18338	1434	23350
Not Applicable	121	241	309	161	977	101	1910
CU is Unknown	47	129	551	567	4944	322	6560
E CU Driver Not Recorded	11	45	120	120	2928	427	3651
E CU Non-Motorist Not Reco	3	20	19	16	25	1	84
TOTAL	1428	6307	15904	14065	126773	5306	169783

Odds of death not using restraints = 7,493/crashes/566 deaths = one in 13.2 crashes.
Odds of death using restraints = 123,830 crashes/441 deaths = one in 280.7 crashes.
Risk of death is approximately increased by a factor of 21.3 when not using proper restraints.

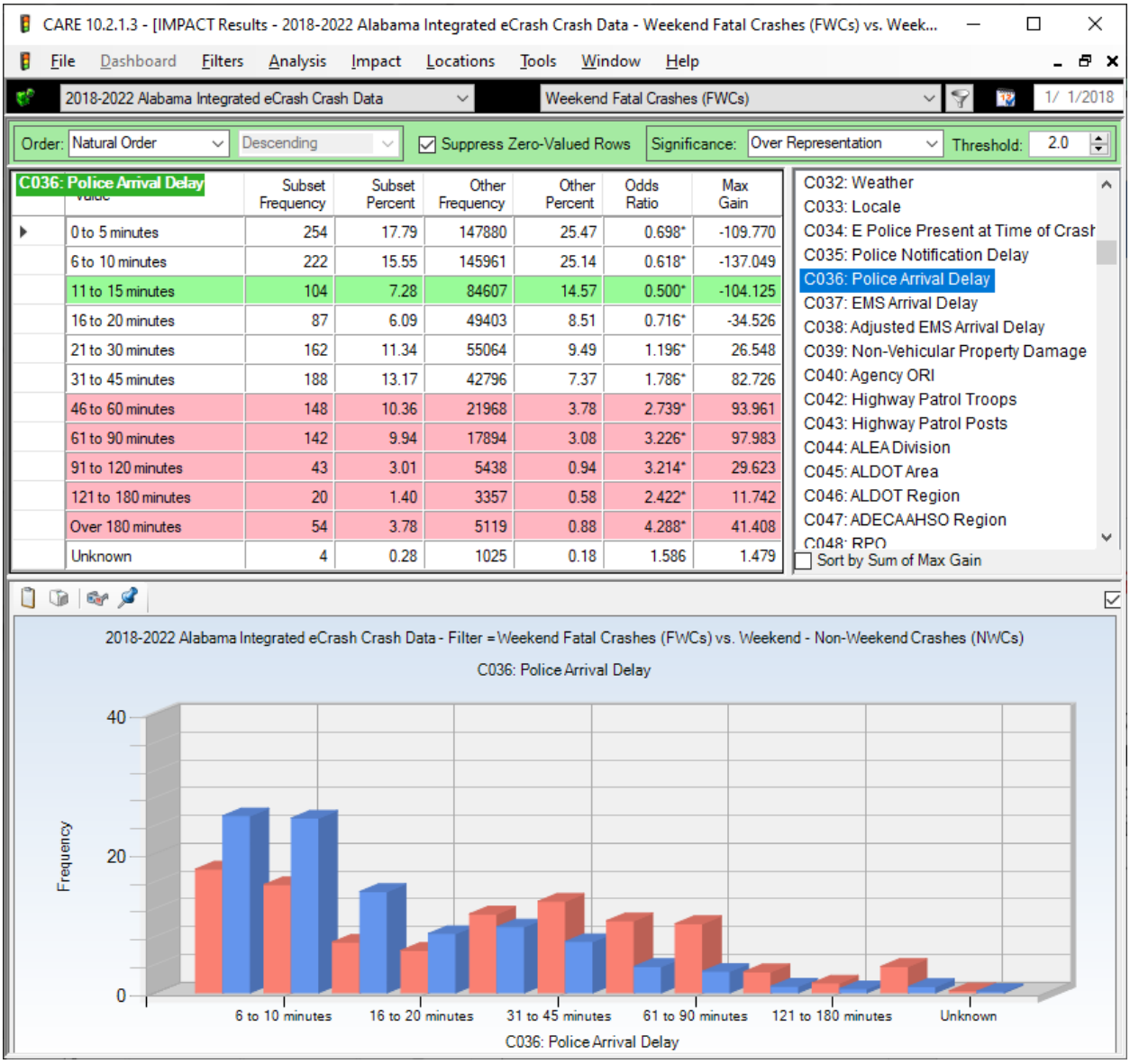
6.7 C052 Number of Vehicles Involved

The following display presents a comparison of the number of vehicles in FWCs against number of vehicles in non-Weekend crashes (NWCs) over the five-year time period of the study.



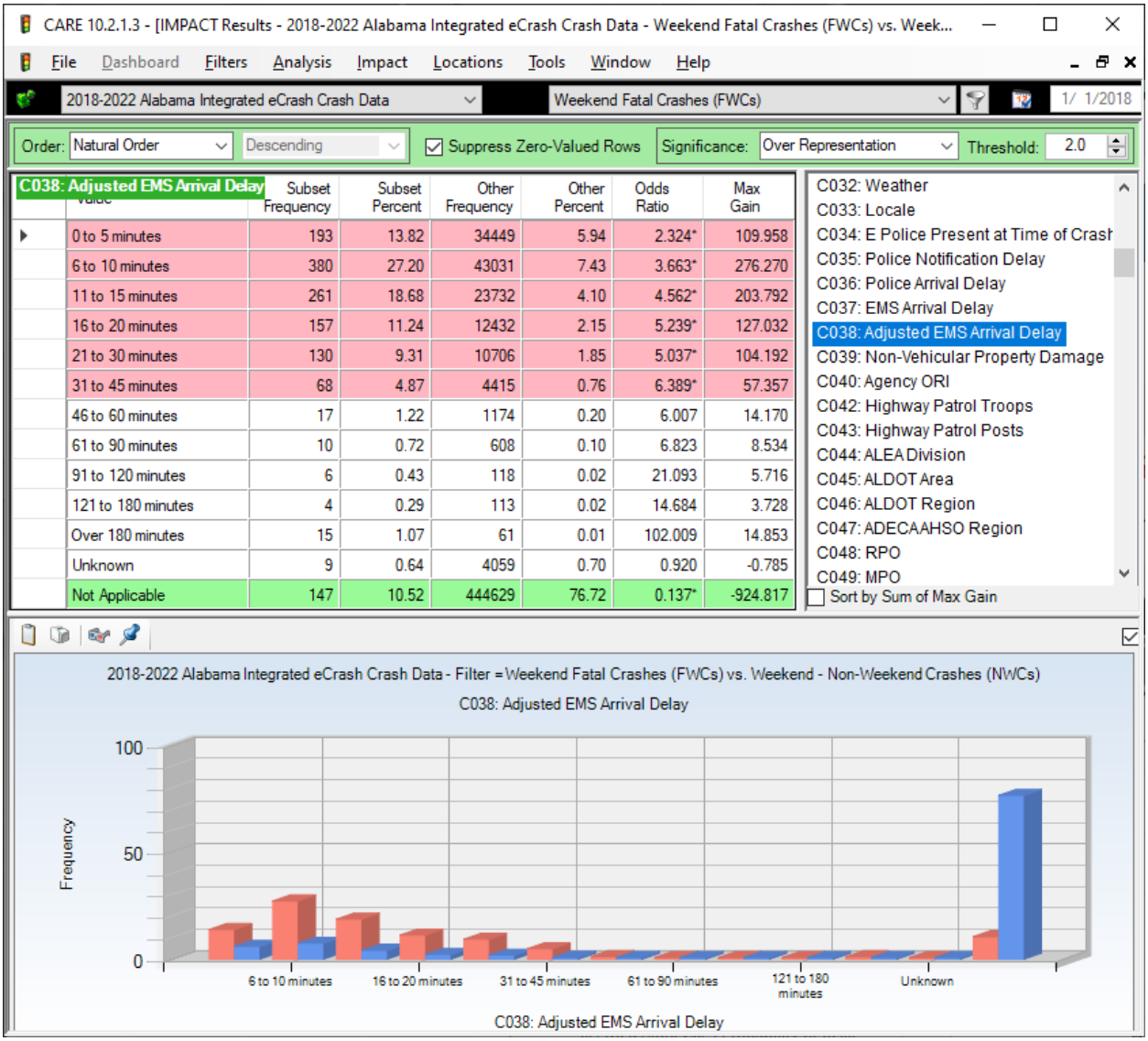
Single vehicle fatal Weekend crashes are over-represented by a factor over three (3.155). Two-vehicle crashes are under-represented by a factor less than one-half (0.447).

6.8 C036 Police Arrival Delay (FWCs)



Weekend Fatal Crash police arrival delays reflect the rural nature of Weekend fatal crashes. All delay times above 45 minutes are over-represented with high Odds Ratios (more than 2 as indicated by the red background). The analysis below shows how this correlates with EMS arrival times, which is a comparison of only those crashes that included injuries, and thus would generally call for a quicker EMS response.

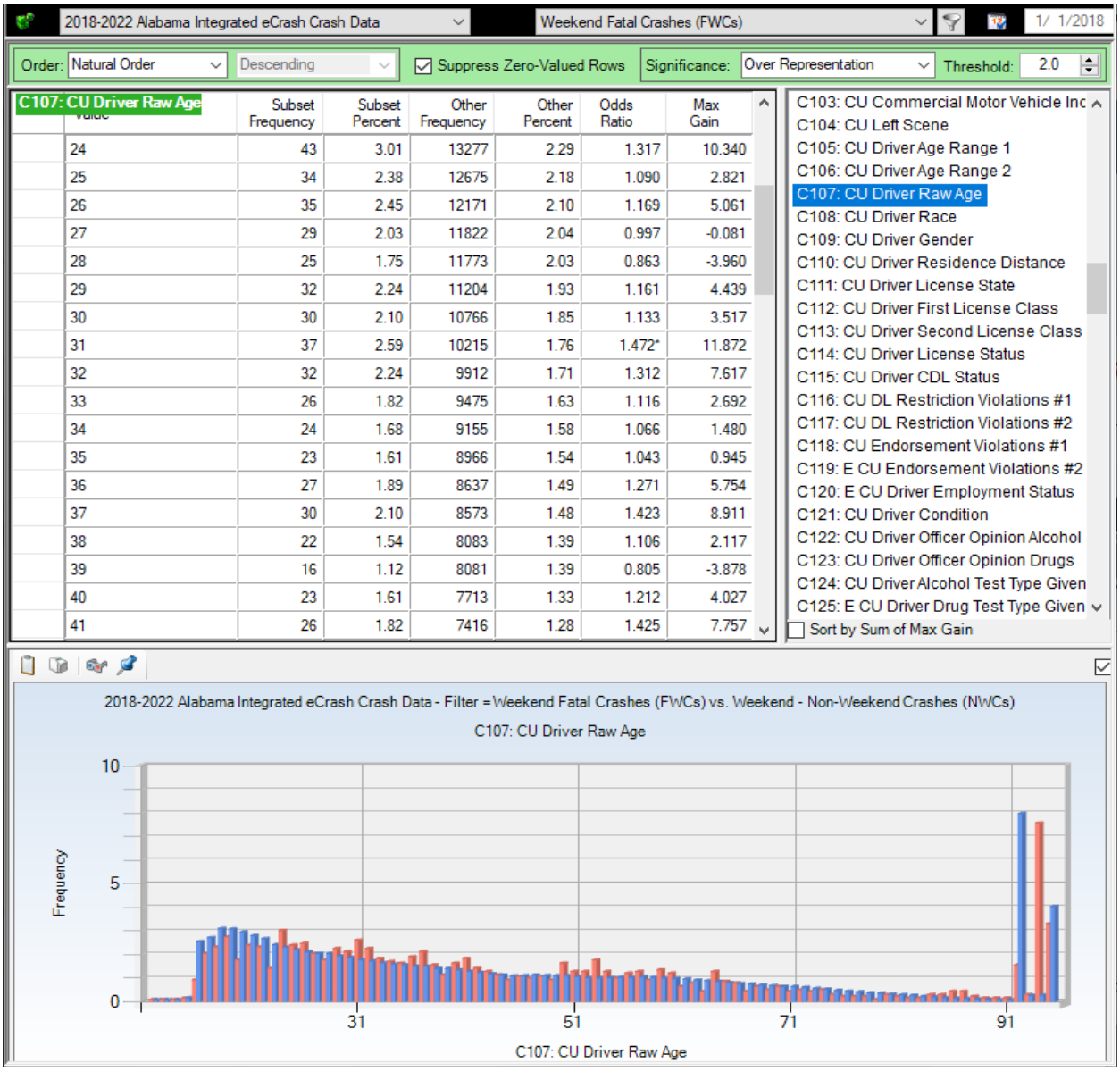
6.9 C038 Adjusted EMS Arrival Delay



All of the Weekend crashes were fatal, as opposed to the comparison subset that reflected injury crashes in general for the rest of the year. Since fatal crashes tend to generate a much faster response in reporting and response, the 1-30 delay times are all highly over-represented. It is clear that any increases in fatalities in Weekend are not the fault of delayed response times.

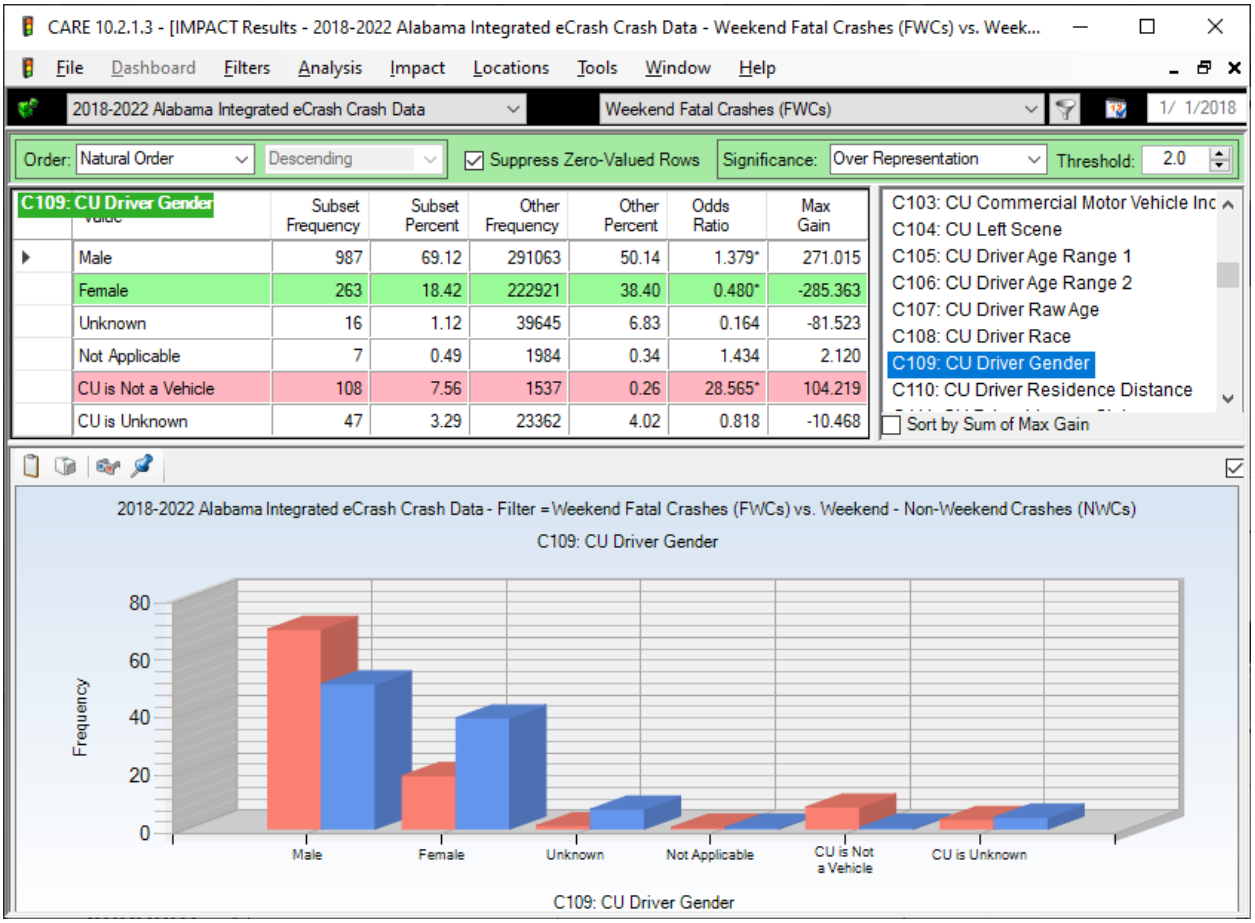
7.0 C107 Driver and Vehicle Demographics

7.1 C107 Driver Raw Age



The table display above presents a comparison of Fatal Weekend crash causal driver ages against the same for all Non-Weekend Crashes (NWCs). The blue (Non-Weekend) bars illustrate the problems that 16-20-year-old drivers have in all crashes, but we can see that these are generally not over-represented in FWCs. The most over-represented age interval is in ages from 24-41, which are also shown in the table above.

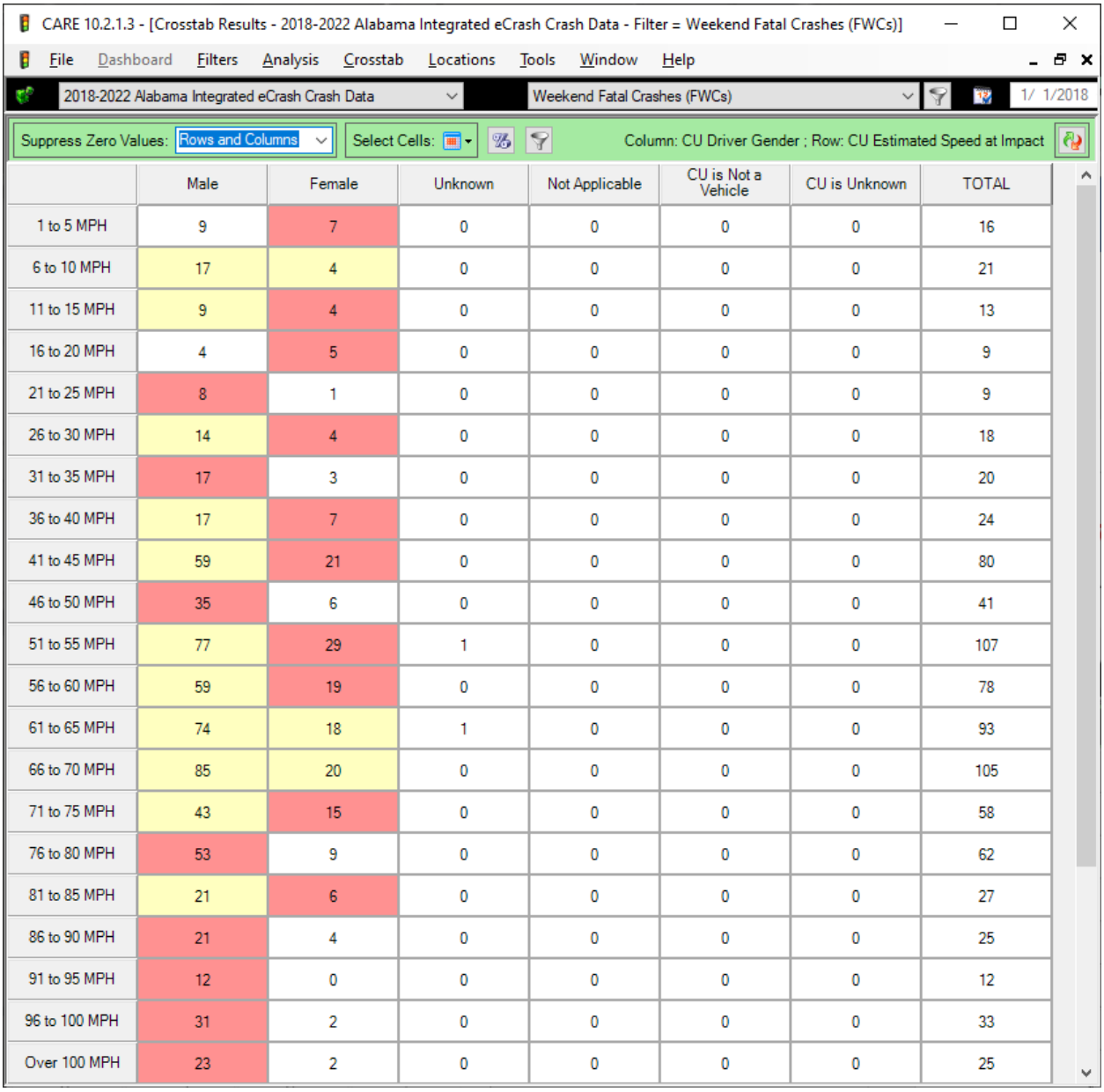
7.2 C109 Fatal Weekend Crash (FWC) Driver Gender



The male red and blue bars and the female red and blue bars each sum to 100%. So the breakdown in FWC causal drivers is 69.12% male and 18.42% female. For other than Weekend crashes, the percentage is 50.14% male and 38.40% female. These differences in proportions certainly indicate that males are a greater cause of FWCs than their crashes in general. If there are countermeasures that can be directed toward them, doing so would be much more cost-effective than those directed toward all drivers.

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



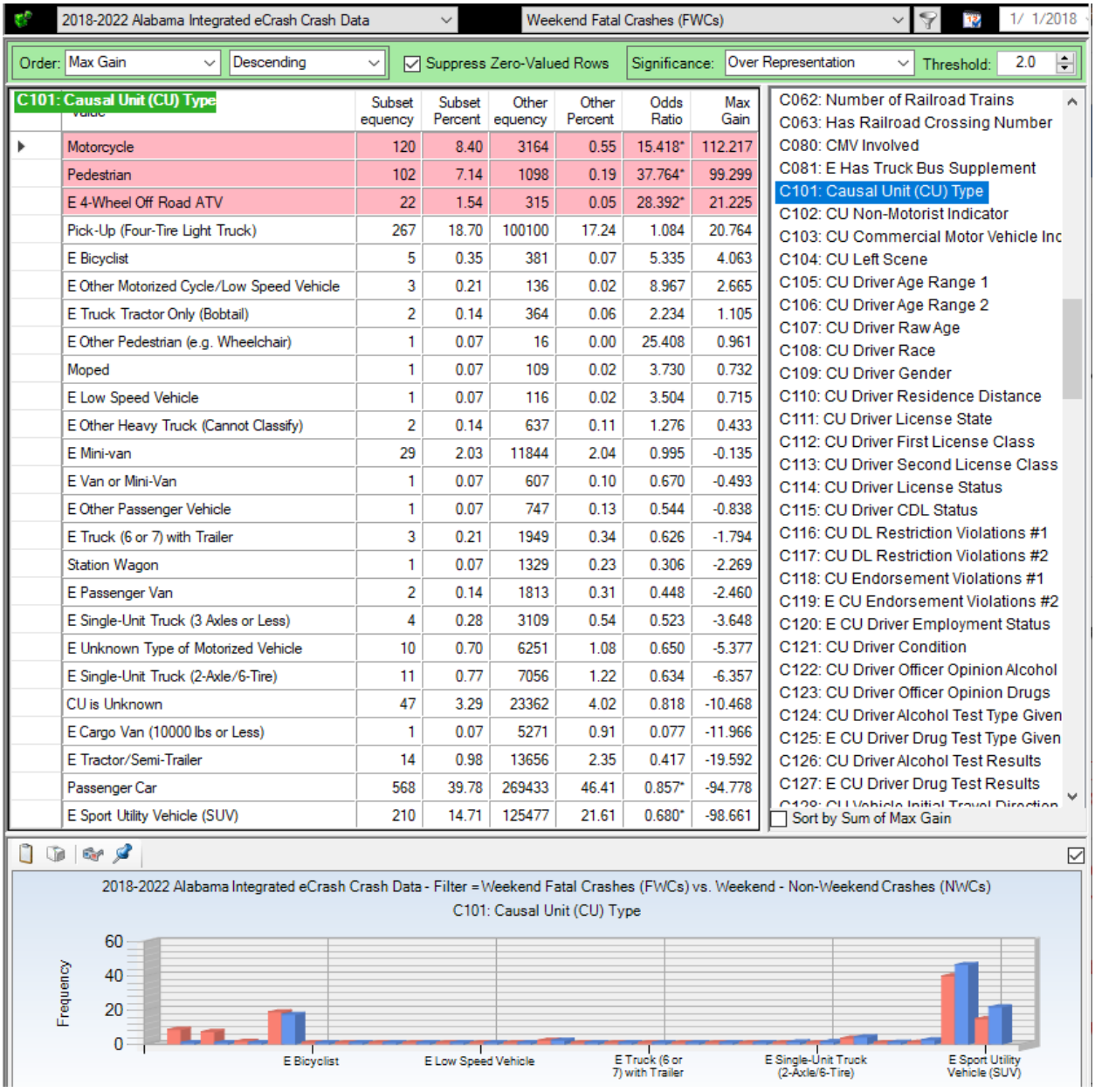
	Male	Female	Unknown	Not Applicable	CU is Not a Vehicle	CU is Unknown	TOTAL
1 to 5 MPH	9	7	0	0	0	0	16
6 to 10 MPH	17	4	0	0	0	0	21
11 to 15 MPH	9	4	0	0	0	0	13
16 to 20 MPH	4	5	0	0	0	0	9
21 to 25 MPH	8	1	0	0	0	0	9
26 to 30 MPH	14	4	0	0	0	0	18
31 to 35 MPH	17	3	0	0	0	0	20
36 to 40 MPH	17	7	0	0	0	0	24
41 to 45 MPH	59	21	0	0	0	0	80
46 to 50 MPH	35	6	0	0	0	0	41
51 to 55 MPH	77	29	1	0	0	0	107
56 to 60 MPH	59	19	0	0	0	0	78
61 to 65 MPH	74	18	1	0	0	0	93
66 to 70 MPH	85	20	0	0	0	0	105
71 to 75 MPH	43	15	0	0	0	0	58
76 to 80 MPH	53	9	0	0	0	0	62
81 to 85 MPH	21	6	0	0	0	0	27
86 to 90 MPH	21	4	0	0	0	0	25
91 to 95 MPH	12	0	0	0	0	0	12
96 to 100 MPH	31	2	0	0	0	0	33
Over 100 MPH	23	2	0	0	0	0	25

Number and Percent male and female over the 70 MPH speed limit:

214 Male = 214/987 21.68%

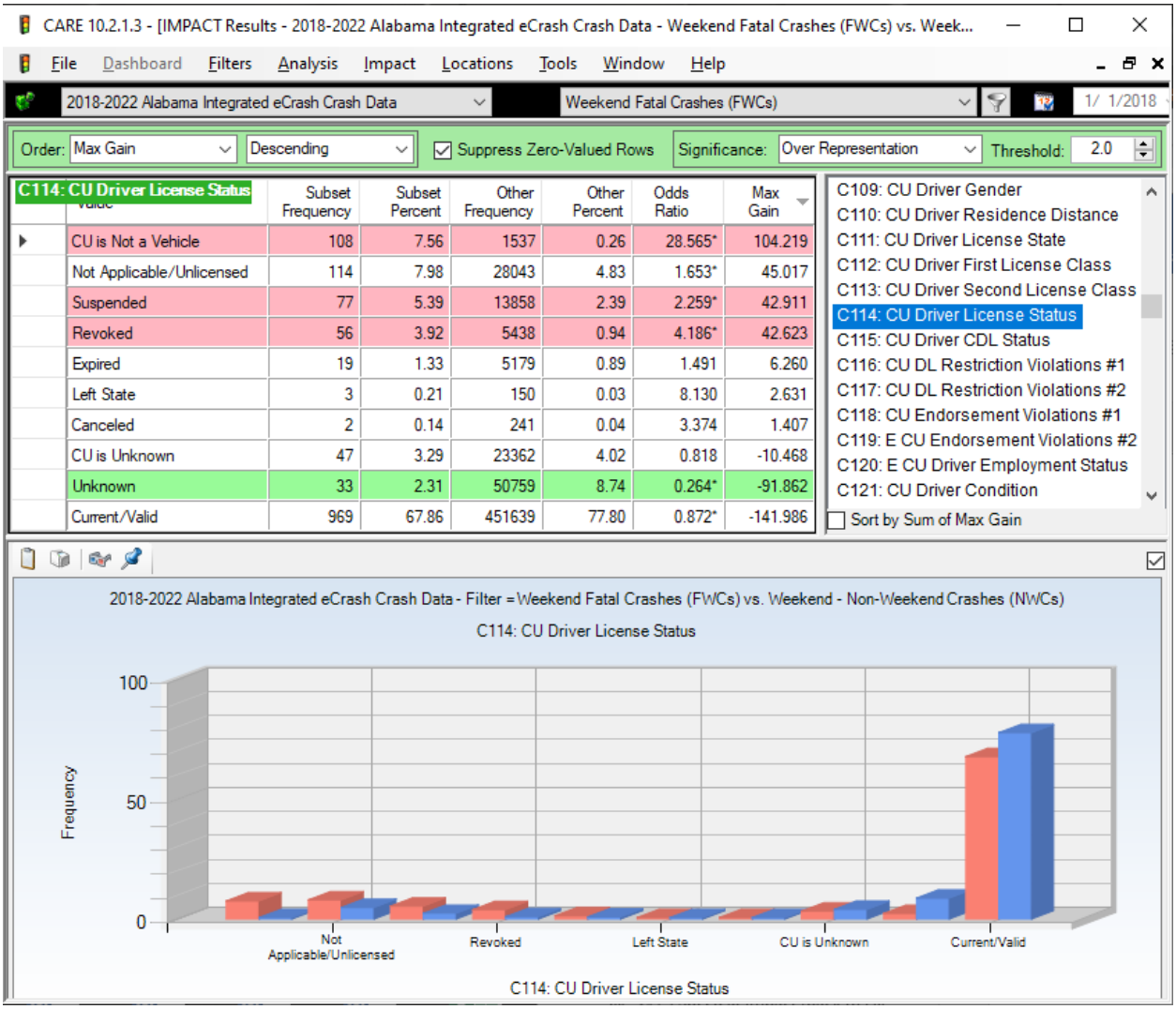
38 Female = 38/263 14.45%.

7.4 C101 Causal Vehicle Type



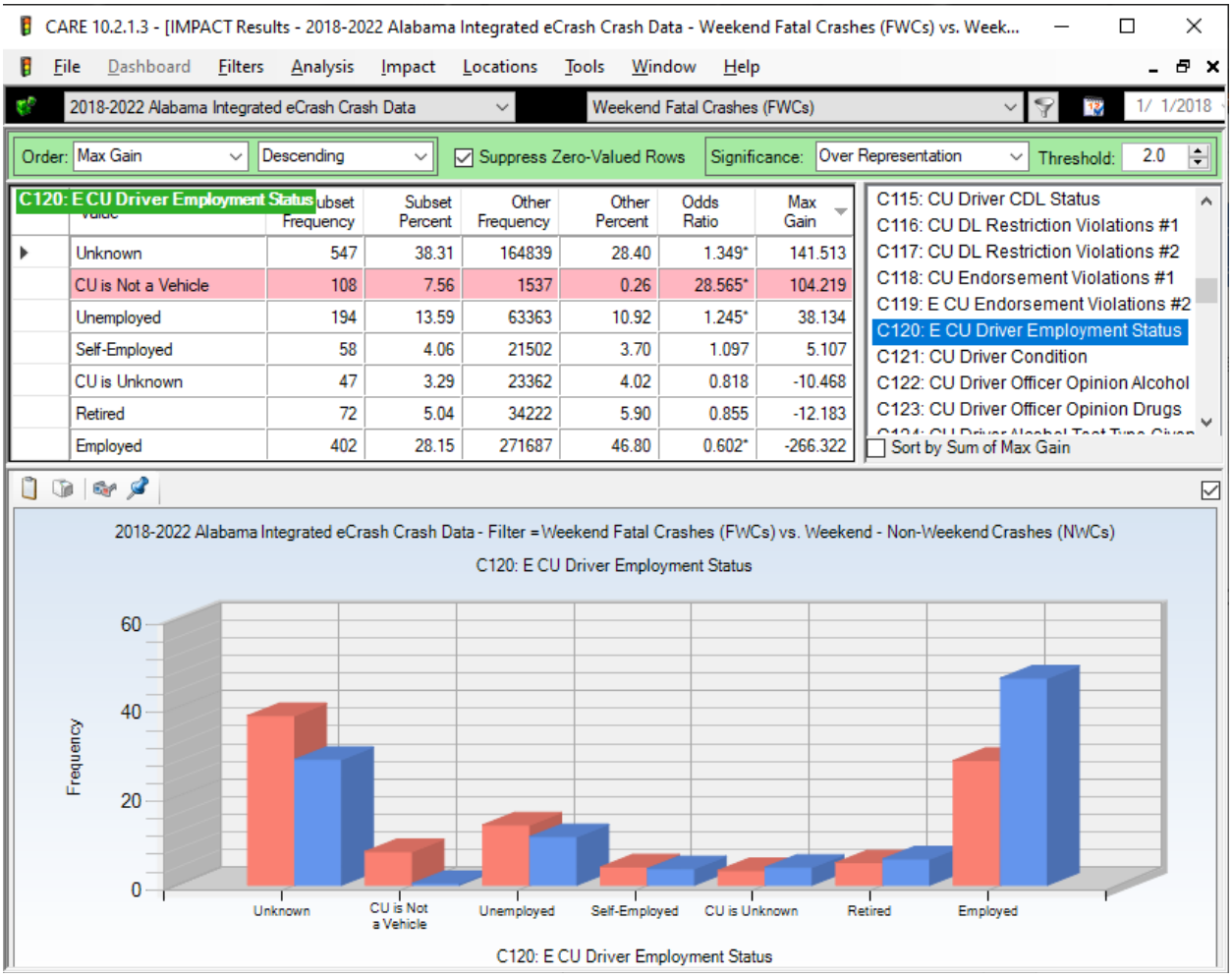
The display above presents a comparison of FWC causal unit types against the same for non-Weekend crashes (all severities). Pedestrians have the highest Odds Ratio (102 crashes, 37.764 Odds Ratio), indicating over 37 times their expected proportion in comparison to all non-Weekend crashes. Motorcycle (120, Odds Ratio 15.418) and 4-Wheel Off Road ATVs (22, 28.392) are also at the top of the list. Some vehicles, notably Sport Utility Vehicles (SUVs) and Passenger Cars, were under-represented indicating their tendency to avoid fatal Weekend crashes despite their high frequency numbers.

7.5 C114 Driver License Status



FWCs are over-represented in their causal drivers not having legitimate licenses. They make up 152 of the fatal crashes, which comes out to over 10% (10.64%) of FWCs, as compared to only 4.22% of the crashes not on Weekend days.

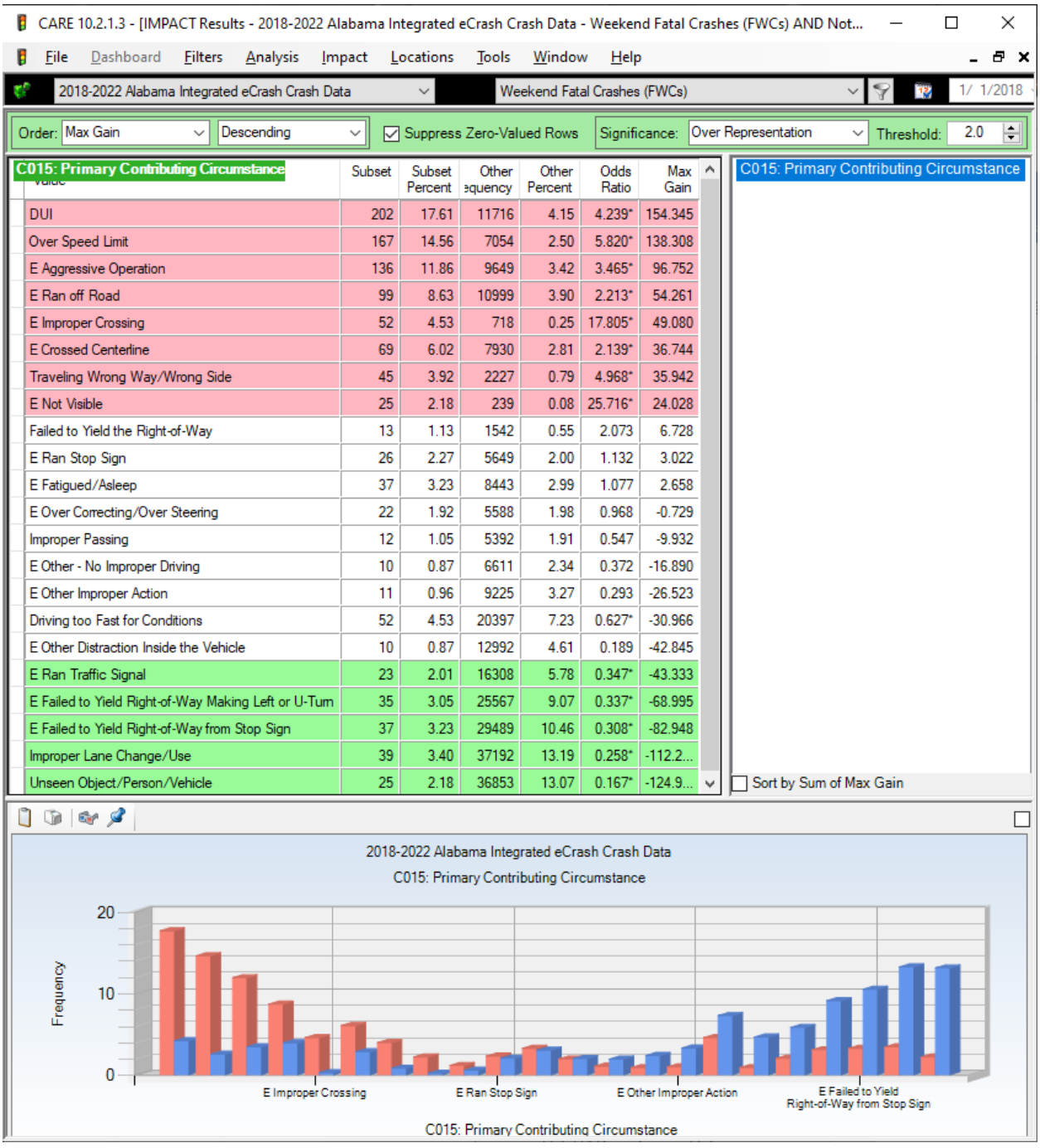
7.6 C120 Driver Employment Status



In our current era when the economy is playing such a big role in traffic safety, the quantification and tracking of the employment proportion of drivers involved in all types of crashes is important. The above indicates that their employment rate is 60.2% lower than expected (Odds Ratio = 0.602). Unemployment is about 24.5% higher than expected (Odds Ratio = 1.245). These relationships are not surprising because of the underlying drug/alcohol root cause of many Weekend crashes (8.3-8.4). The correlation between not having a job and being involved in a Weekend crash should be watched carefully, in that it could affect the type and location of future countermeasures.

8.0 Driver Behavior

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



C015: Primary Contributing Circumstance	Subset	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
DUI	202	17.61	11716	4.15	4.239*	154.345
Over Speed Limit	167	14.56	7054	2.50	5.820*	138.308
E Aggressive Operation	136	11.86	9649	3.42	3.465*	96.752
E Ran off Road	99	8.63	10999	3.90	2.213*	54.261
E Improper Crossing	52	4.53	718	0.25	17.805*	49.080
E Crossed Centerline	69	6.02	7930	2.81	2.139*	36.744
Traveling Wrong Way/Wrong Side	45	3.92	2227	0.79	4.968*	35.942
E Not Visible	25	2.18	239	0.08	25.716*	24.028
Failed to Yield the Right-of-Way	13	1.13	1542	0.55	2.073	6.728
E Ran Stop Sign	26	2.27	5649	2.00	1.132	3.022
E Fatigued/Asleep	37	3.23	8443	2.99	1.077	2.658
E Over Correcting/Over Steering	22	1.92	5588	1.98	0.968	-0.729
Improper Passing	12	1.05	5392	1.91	0.547	-9.932
E Other - No Improper Driving	10	0.87	6611	2.34	0.372	-16.890
E Other Improper Action	11	0.96	9225	3.27	0.293	-26.523
Driving too Fast for Conditions	52	4.53	20397	7.23	0.627*	-30.966
E Other Distraction Inside the Vehicle	10	0.87	12992	4.61	0.189	-42.845
E Ran Traffic Signal	23	2.01	16308	5.78	0.347*	-43.333
E Failed to Yield Right-of-Way Making Left or U-Tum	35	3.05	25567	9.07	0.337*	-68.995
E Failed to Yield Right-of-Way from Stop Sign	37	3.23	29489	10.46	0.308*	-82.948
Improper Lane Change/Use	39	3.40	37192	13.19	0.258*	-112.2...
Unseen Object/Person/Vehicle	25	2.18	36853	13.07	0.167*	-124.9...

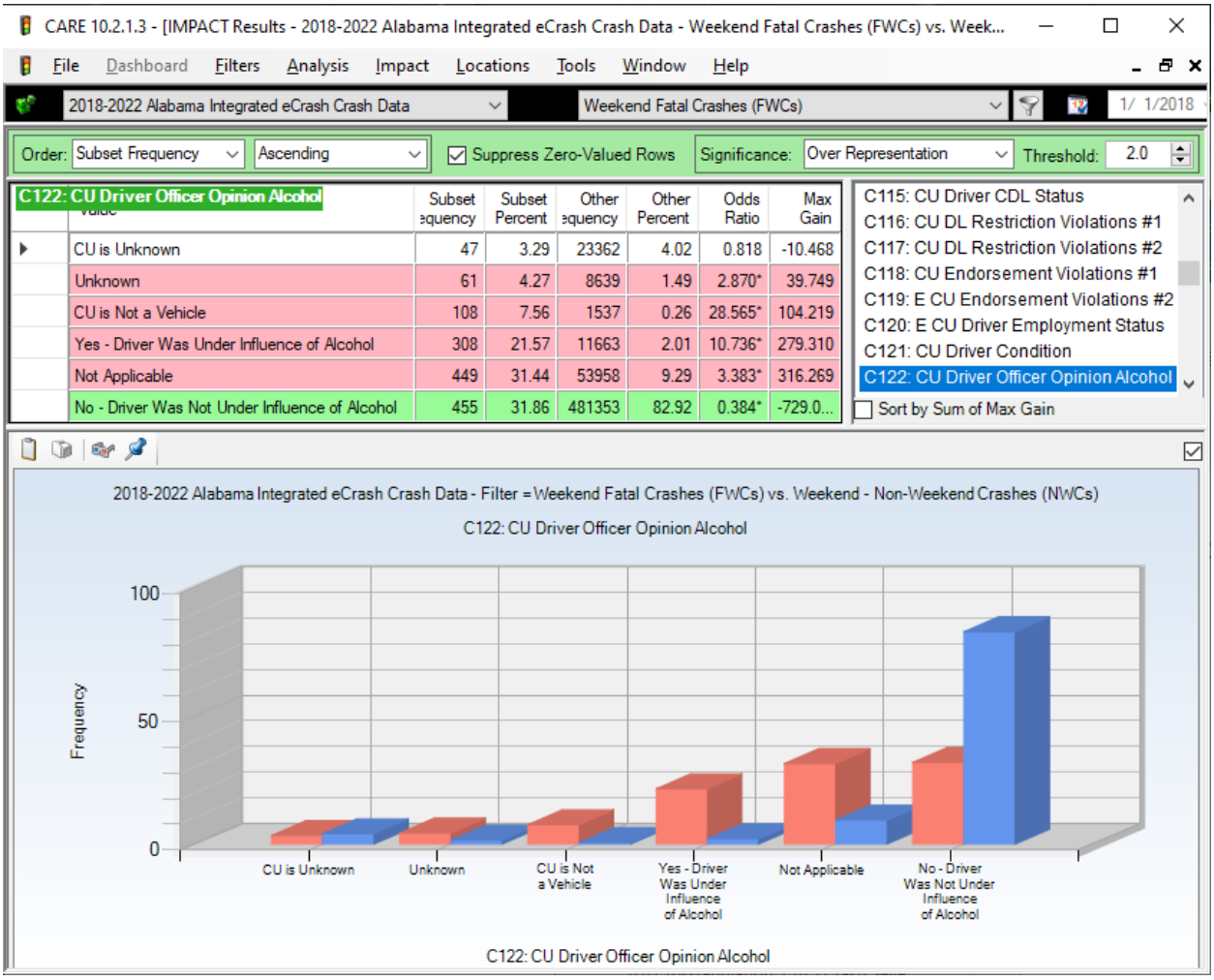
8.2 Discussion of Primary Contributing Circumstances (PCC) Results Above

These results demonstrate the driver behaviors that accompanied FWCs as they were defined by the C015, Primary Contributing Circumstances. FWC items over-represented in their expected proportion (when compared to non-Weekend crashes) are ordered by Max Gain as follows, with frequencies:

- ID/DUI (Impaired Driving) 202
- Over Speed Limit 167
- Aggressive Operation 136
- Ran off Road, and 99
- Improper Crossing – Pedestrians 52
- Crossed Centerline. 69
- Traveling wrong Way/Wrong Side 45
- Not Visible 25

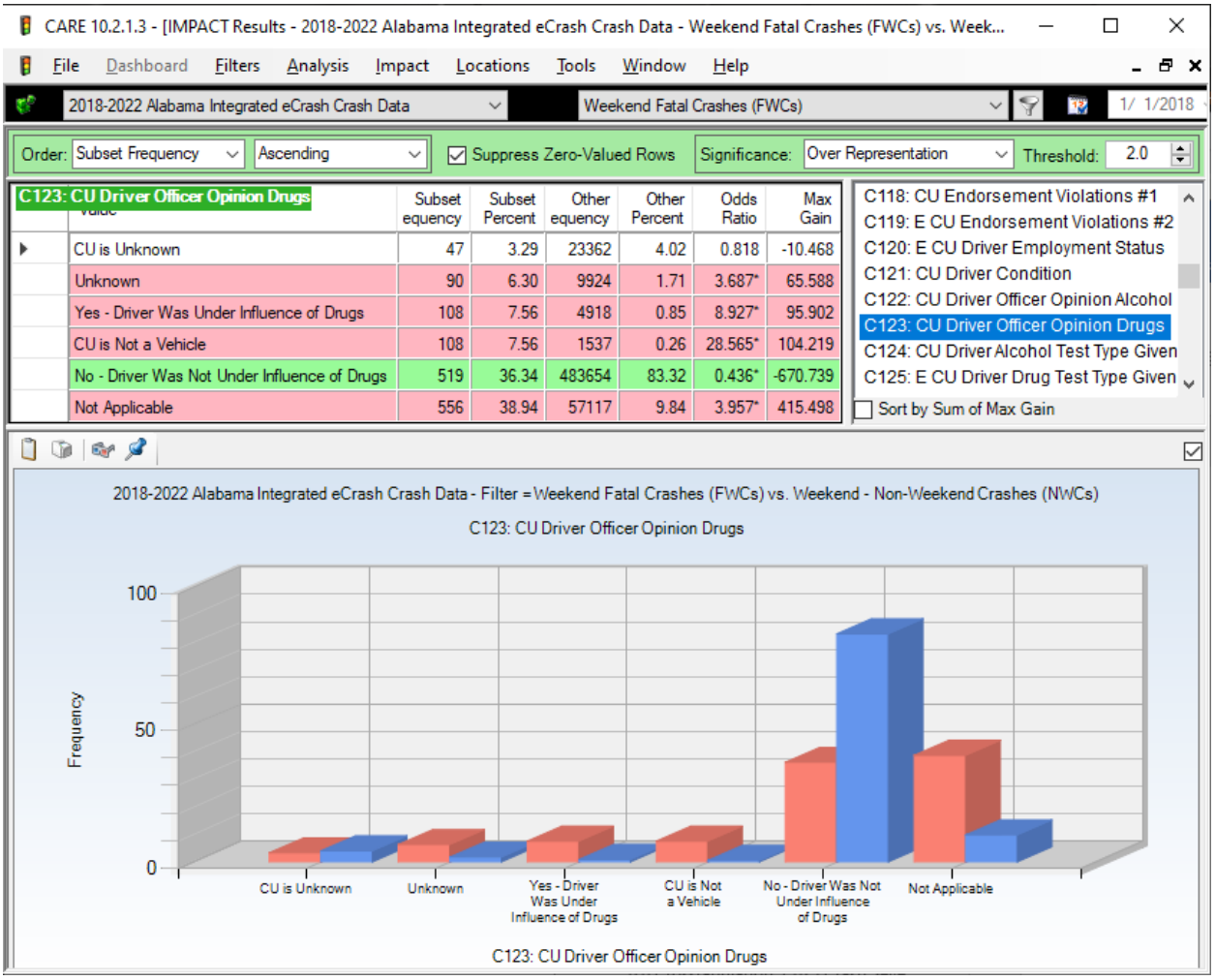
Most of the above are reasonably associated with the effects of Impaired Driving (ID). None is necessarily mutually exclusive from the others. Each should be viewed in terms of their relative positions in the table as opposed to any one of them being the absolute cause.

8.3 C122 CU Driver Officer's Opinion Alcohol



While Impaired Driving/Alcohol was indicated as the cause of the crash for 21.57% of the FWCs, the fact that this proportion was over-represented by a factor of 10.736 indicates its importance. 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 FWCs.

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



The reported non-alcohol drug use in FWCs is slightly less than half of that for alcohol. The 108 cases are only about 7.56% of all FWCs. However, the Odds Ratio (8.927) indicates that it has an over-representation almost the same as that of alcohol. In both cases (FWCs and NWCs), 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 FWCs, and their use is further compounded if they choose to avoid detection by using county roads. The total number of crashes from the sum or alcohol and non-alcohol drugs is 29.14%.