

# CARE IMPACT Study of Railroad Involved Crashes

2015-2019 Data

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## Table of Contents

1. Introduction.....	3
2. Major Findings and Recommendations .....	4
Geographical Findings (Section 3) .....	4
Time and Weather Findings (Section 4) .....	4
Driver Related Findings (Section 5) .....	5
Severity Findings (Section 6).....	6
Vehicle Related Findings (Section 7) .....	6
3. Geographical/Roadway IMPACTs – 10, 11, 27, 33 .....	7
C010 Rural or Urban.....	7
C011 Highway Classification .....	7
C027 At Intersection .....	8
C033 Locale .....	9
4. Time, Weather and Lighting IMPACT Displays – 3-4, 6, 8, 31-32 .....	10
C003 Year .....	10
C004 Month .....	11
C006 Day of the Week.....	12
C008 Time of Day .....	13
C031 Lighting Conditions.....	14
C032 Weather .....	14
5. Driver IMPACT Displays – 17, 23, 52, 80, 107, 109, 115, 122-123, 129.....	15
C017 First Harmful Event.....	15
C023 E Manner of Crash .....	16
C052 Number of Vehicles .....	17
C107 CU Driver Raw Age.....	18
C109 CU Driver Gender .....	19

C080 CMV Involved.....	20
C122 CU Driver Officer Opinion Alcohol .....	21
C123 CU Officer Opinion Drugs.....	21
C129 CU Vehicle Maneuvers .....	22
6. Severity IMPACT Displays – 25, 38, 60, 224.....	23
C025 Crash Severity .....	23
C038 Adjusted EMS Arrival Delay .....	24
C060 Number Injured (Including Fatalities).....	25
C224 CU Estimated Speed at Impact.....	26
7. Vehicle IMPACT Displays – 80, 101, 129, 208.....	27
C101 Causal Unit (CU) Type .....	27
C208 CU Model Year .....	28

# 1. Introduction

To review the full impact of RR-Involved crashes over the five calendar years (2015-2019) of this study, there were 21 Fatal Injury crashes; 28 Incapacitating Injury crashes; 49 Non-Incapacitating Injury crashes; 26 Possible Injury crashes; 165 Property Damage Only crashes, and 10 of unknown severity, for a total of 299 crashes over the five-year period. This averages to about 60 RR-Involved crashes in Alabama per year. Additional information on crash severity is given in Section 6 below.

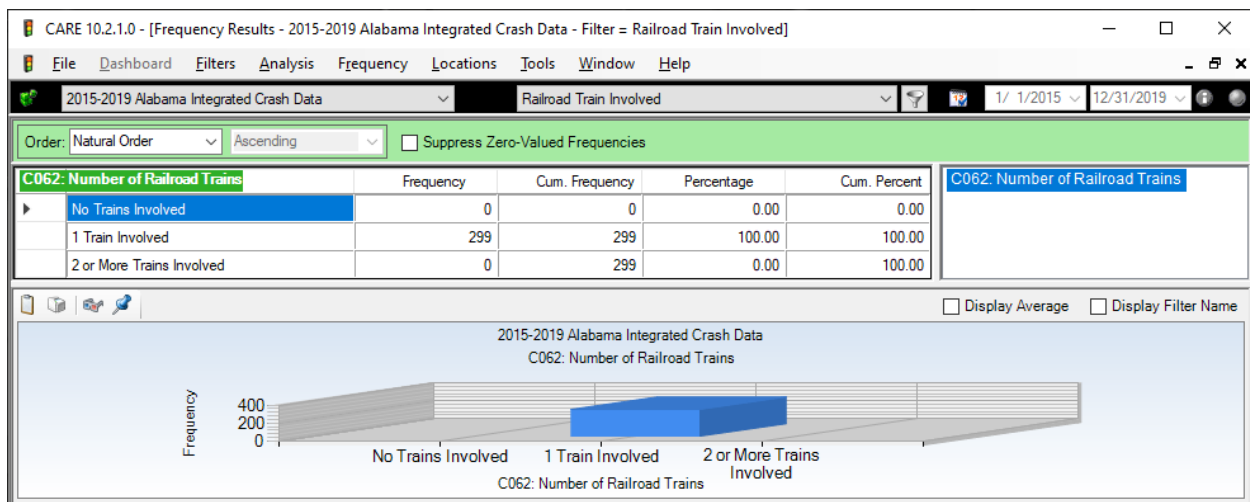
The table below indicates the number of crashes and fatal crashes in each year of the study. This is further discussed in conjunction with attribute C003 (Crashes per Year) within Section 4, and C025 (Crash Severity).

## Frequency of RR Train Involved Crashes by Year

Year	Fatal Crashes	All Crashes	% of Total
2015	4	67	22.4%
2016	5	64	21.4%
2017	4	49	16.4%
2018	4	56	18.7%
<u>2019</u>	<u>4</u>	<u>63</u>	<u>21.1%</u>
Total	21	299	100.00%

These differences in annual results are not beyond those that can be expected from random variation. The following table illustrates the item within the C062, Number of Railroad Trains, that was used to create the filter for this study.

## Frequency Distribution C061 Used to Create Railroad Involved Crashes



## 2. Major Findings and Recommendations

The details for the summaries in this section are given in the several sections that follow, referenced by general classification and crash attribute numbers (Cnnn). The acronym we will use for railroad train involved crashes will be *RR-Involved*.

### Geographical Findings (Section 3)

- C010 Rural or Urban. No significant differences were found compared to non-RR-Involved. The general breakdown is 22.45 rural to 77.55 urban. For RR-Involved it is 26.09 and 73.91. The conclusion is that the proportion of rural and urban crash frequency at railroad crossing is what would be expected for all crashes in rural and urban areas.
- C011 Highway Classification. Close to 50% of the RR-Involved crashes were at Municipal road locations reflecting the traffic density there. However, the more significant finding is that of County roads, which had 2.486 times the expected proportion of crashes. Further analysis indicated that these were generally of higher severity than the municipal crashes, with ten of the fatal crashes and 13 incapacitating injury crashes occurring on county roads.
- C027 At Intersection. The vast majority of RR-Involved crashes will be at or near intersections – this result shows 59.74. Those that are not at intersections would generally be quite close to the crossing, which most officers marked as intersections. Several attributes below will provide more detail.
- C033 Locale. Manufacturing or Industrial have an extremely high Odds Ratio (8.389) primarily because very few crashes in general (less than 2%) occur in these locales. The other locales reflect the densities of the locations where RR crossing exist.
- C110 Driver Residence Distance. There were no significant differences found, indicating that the location of RR-Involved crashes are in the typical driving areas and distances.

### Time and Weather Findings (Section 4)

- C003 Year. While the differences between years can only be viewed as random variations, it is notable that there seems to be a trend toward reduction, with the average of the last four years (58) being a little over 13% reduction from the 2015 count of 67. We would hope that this favorable trend will continue.
- C004 Month. There is no indication that one time of year will produce more RR-Involved crashes than others.
- C006 Day of the Week. Sunday, with 38 RR-Involved crashes, comes closest to be statistically significant (1.317 Odds Ratio). However, it is one of the three lowest days of the week, the other two being Saturday and Tuesday. No general patterns can be inferred.
- C008 Time of Day. Over-represented times are significant collectively throughout the night 8 PM through 9 AM. Trains continue to run at night, the times when other vehicle drivers are most vulnerable. An interesting under-representation occurs around the rush hours. Increased traffic density could contribute to better perception of RR trains.

- C031 Lighting Conditions. This generally is consistent with the time-of-day findings. The dark times are all over-represented, and Dark-Roadway Not Lighted is significant.
- C032 Weather. Weather has no apparent effect on the RR-Involved crashes in this five-year time frame.

### **Driver Related Findings (Section 5)**

- C017 First Harmful Event. The value of this attribute is primarily in recognizing some of the events that did not involve a collision with a train. There were 29 such events recorded. The three highest were (1) Collision with Other Non-Fixed Object-8; (2) Collision with Vehicle in Traffic-6; and (3) Ran Off the Road Left-5. Some of these were probably in the process of avoiding a train that was not initially recognized to be a danger.
- C023 Manner of Crash. The results here are as expected, with the side-impact cases being 73% of those reported.
- C052 Number of Vehicles. It seems clear that most reporting officers do not indicate the RR train to be a highway vehicle. While it appears that there are some exceptions, this finding helps us to interpret several of the other attributes. A crosstab that follows the IMPACT display shows that all of the nine multi-vehicle crashes except one (a 2-vehicle crash) involved collisions with a RR train. See C017 in Section 5 for the first harmful events of the 28 single vehicle crashes that did not involve a train.
- C107 CU Driver Raw Age. The youngest age group (16) is under-represented by about half of what would be expected from the non-RR-Involved crash proportion. The proportions increase after this and become over-represented in many of the ages in the 30-57 range.
- C109 CU Driver Gender. Males are significantly over-represented. A cross-tabulation of age by gender was performed to determine in what age groups these gender differences show themselves. There is little difference in the 16-20, which would tend to lead us to believe that this is a problem is not just attributable to risk-taking. The largest difference of men over women was found to be in the 30-55 age groups, which is where these age groups tend to be over-represented. The exact reason for middle-aged males to be more susceptible to RR-Involved crashes, is difficult to determine since there are only about 32 cases that can be studied. However, countermeasures for these crashes would seem to be much more appropriate if they are targeted toward middle-aged men. The fact that these ages and genders are also over-represented in CMV crashes might also be an indicator – see the next attribute.
- C080 CMV Involved. The proportion of CMVs in RR-Involved crashes is well over three times that of non-RR-Involved crashes. The increase is from about 1 in 20 to almost one in five. No doubt CMVs should be a major concern in RR-Involved countermeasure development.
- C122 CU Officer Opinion Alcohol and C123 CU Officer Opinion Drugs. Because of the very low sample size (13 positives for alcohol, 5 for drugs), no statistical significance results are given. However, it is clear that both alcohol and drugs had proportions indicating a pattern of over-representations. Alcohol was over 60% higher than the control,

while drug use was over 80% higher than expected. This corresponds to the over-represented late-night/early-morning times of day. It is extremely unwise to approach a rail-road crossing inebriated, and especially at night. However, generally those who drive in this condition cannot avoid RR crossings.

- C129 Vehicle Maneuvers. This result is fairly obvious with respect to vehicles getting hit going through RR intersections. The items other than “Movement Essentially Straight” are useful clues in determining what is happening with those crashes where a RR train was not one of the vehicles in the crash.

### **Severity Findings (Section 6)**

- C025 Crash Severity. The fact that so many RR-Involved crashes are so severe is probably the reason that they are given strong attention. Fatal injury crashes occur at 12.632 times the proportion of non-RR-Involved crashes. Next to Fatal Injury Crashes, the two highest severity crashes (Incapacitating Injury and Non-Incapacitating Injury) are all both more than twice their expectations.
- C038 Adjusted EMS Arrival Delay. The low response time (10 minutes or less) in about 65% of the crashes is probably due to the quick notification by railroad personnel. This combined with the absence of traffic late at night time could contribute to quick response.
- C060 There are over-representations seen in all of the injury categories, showing that generally RR-Involved crashes involve injury more than traffic crashes in general. RR-Involved crashes have a highly significant over-representation in the single-injury category. Two things account for the large proportion of injury crashes. First, there is a vast disparity in the relative weights between the two vehicles involved. A second factor in many cases may be the high probability that the driver of the passenger vehicle did not see the train until it was too late to take any effective defensive actions.
- C224 CU Estimated Speed at Impact. The speeds are relatively low for the severity because they do not take into consideration the speed of the trains. We can observe from this result that a significant proportion of the crashes are not the result of a failure to see the train (and “run” the crossing), but the inclination to go through the crossing at a lower speed, not perceiving the true hazard.

### **Vehicle Related Findings (Section 7)**

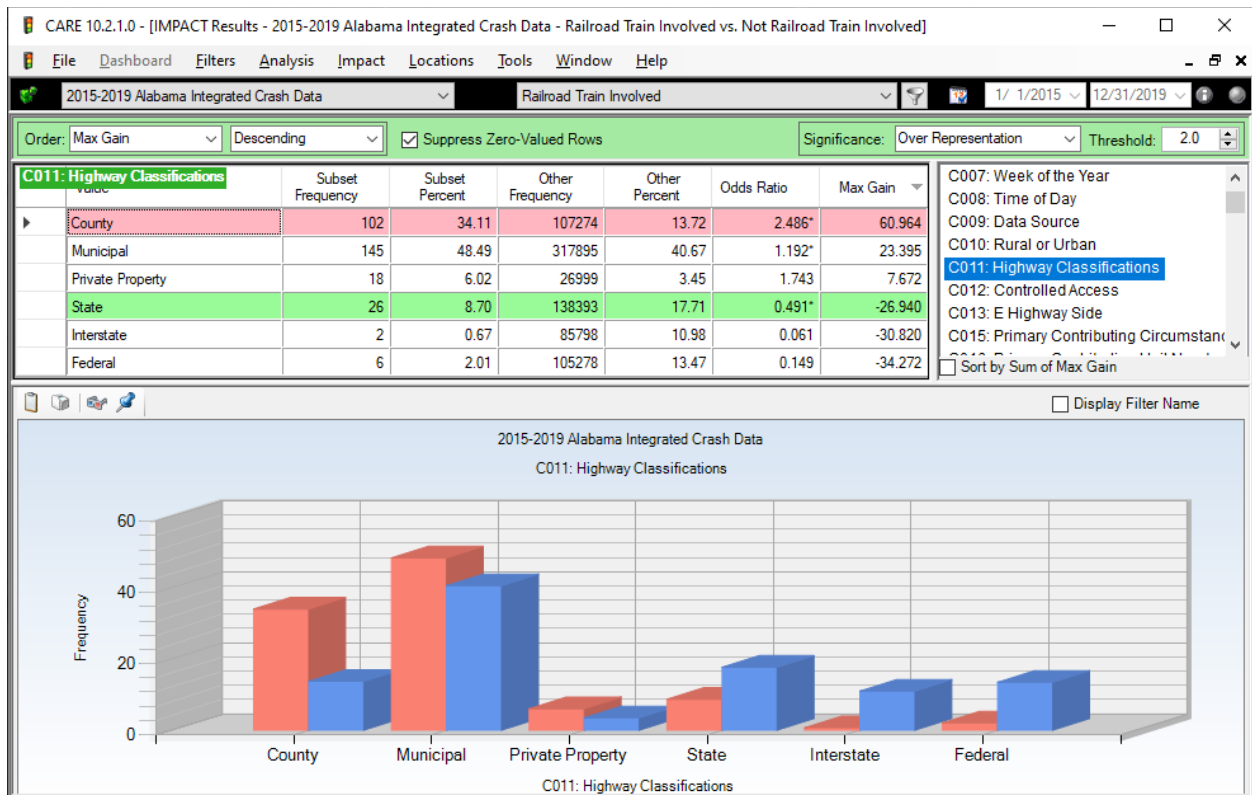
- C101 Causal Unit (CU) Type. The CMV findings in C080 are reflected here in the causal vehicle types. All of the heavy trucks are over-represented by an Odds Ratio of at least 2, and Tractor/Semi Trailer is at the top of the list with an over-representation of 5.170 (over five times the expected when compared with non-RR-Involved crashes. Pick-Ups (Four Tire Light Trucks) have the second largest Max Gain and they are third in the list when it comes to crash frequency. The top frequency vehicle is Passenger Car, but their high frequency in crashes in general moved them toward the bottom of the list, since they are under-represented.
- C208 CU Model Year. There are no recognized patterns in this attribute. Vehicles of various model years seem to have RR-Involved crashes in their proportion to their numbers in the traffic population.

### 3. Geographical/Roadway IMPACTs – 10, 11, 27, 33

#### C010 Rural or Urban

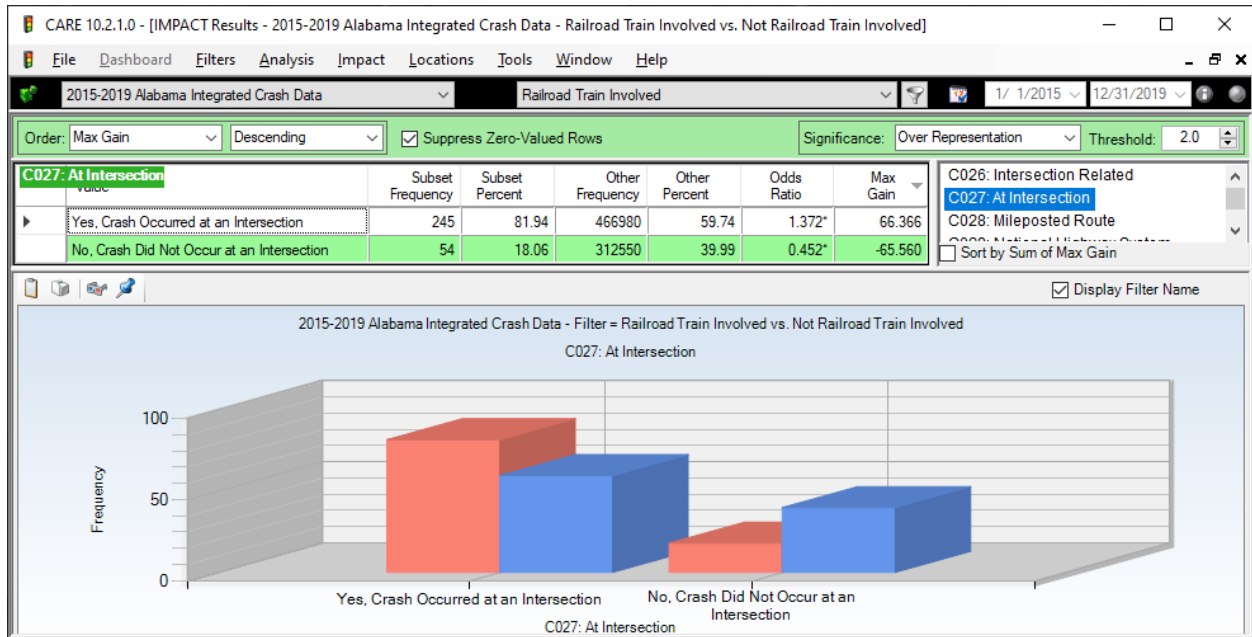
No significant differences were found from normal driving. The general breakdown is 22.45 rural to 77.55 urban. For RR-Involved it is 26.09 and 73.91.

#### C011 Highway Classification



There is a very highly statistically significant difference in the County road locations, with the RR-Involved being well over twice (2.486 times) the proportions of non-RR-Involved County road crashes. Municipal roads are also over-represented, but by not nearly as much.

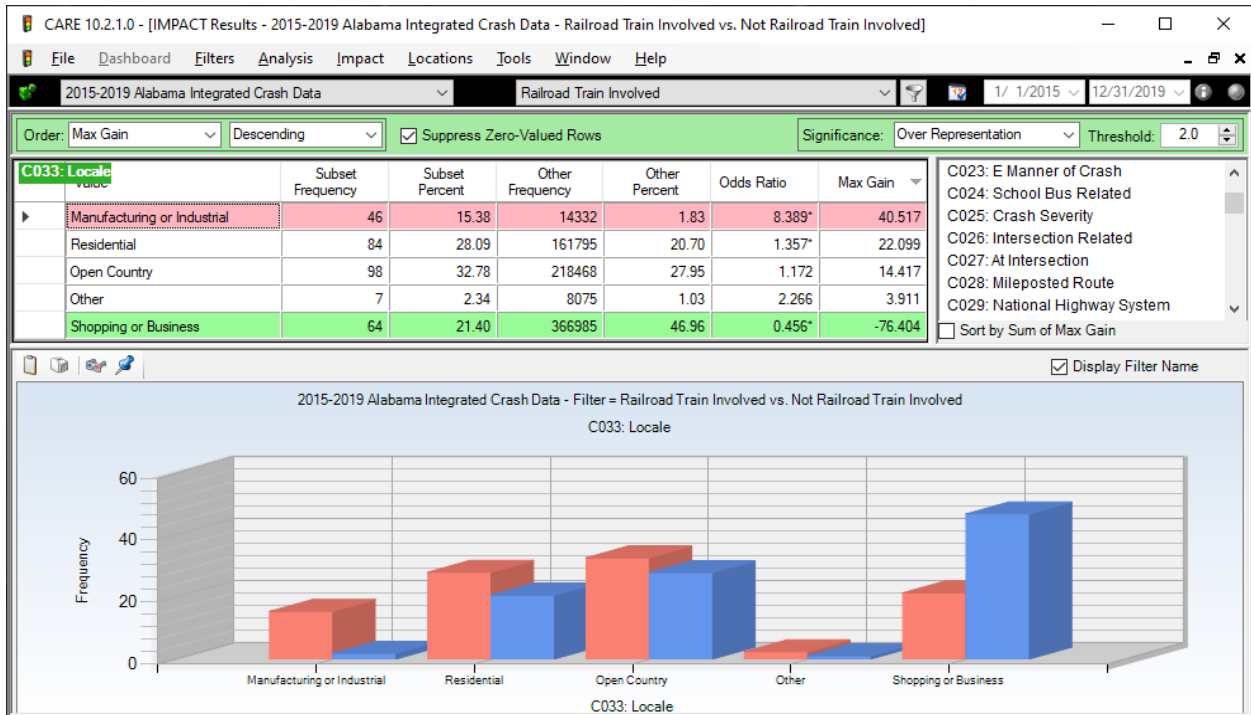
## C027 At Intersection



This attribute is of interest because the “No ...” category gives the number of crashes that occurred near or related to RR Intersections but not right at the crossing. See also C017 First Harmful Event under Driver attributes.

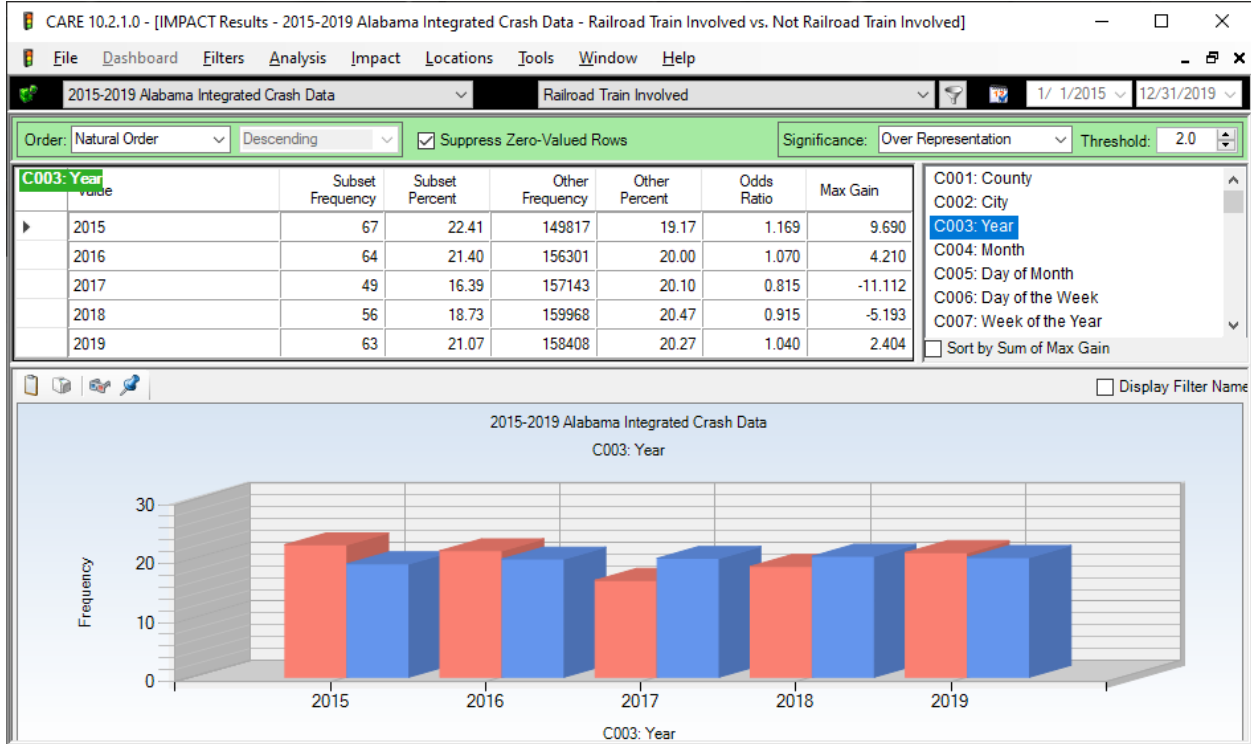


## C033 Locale

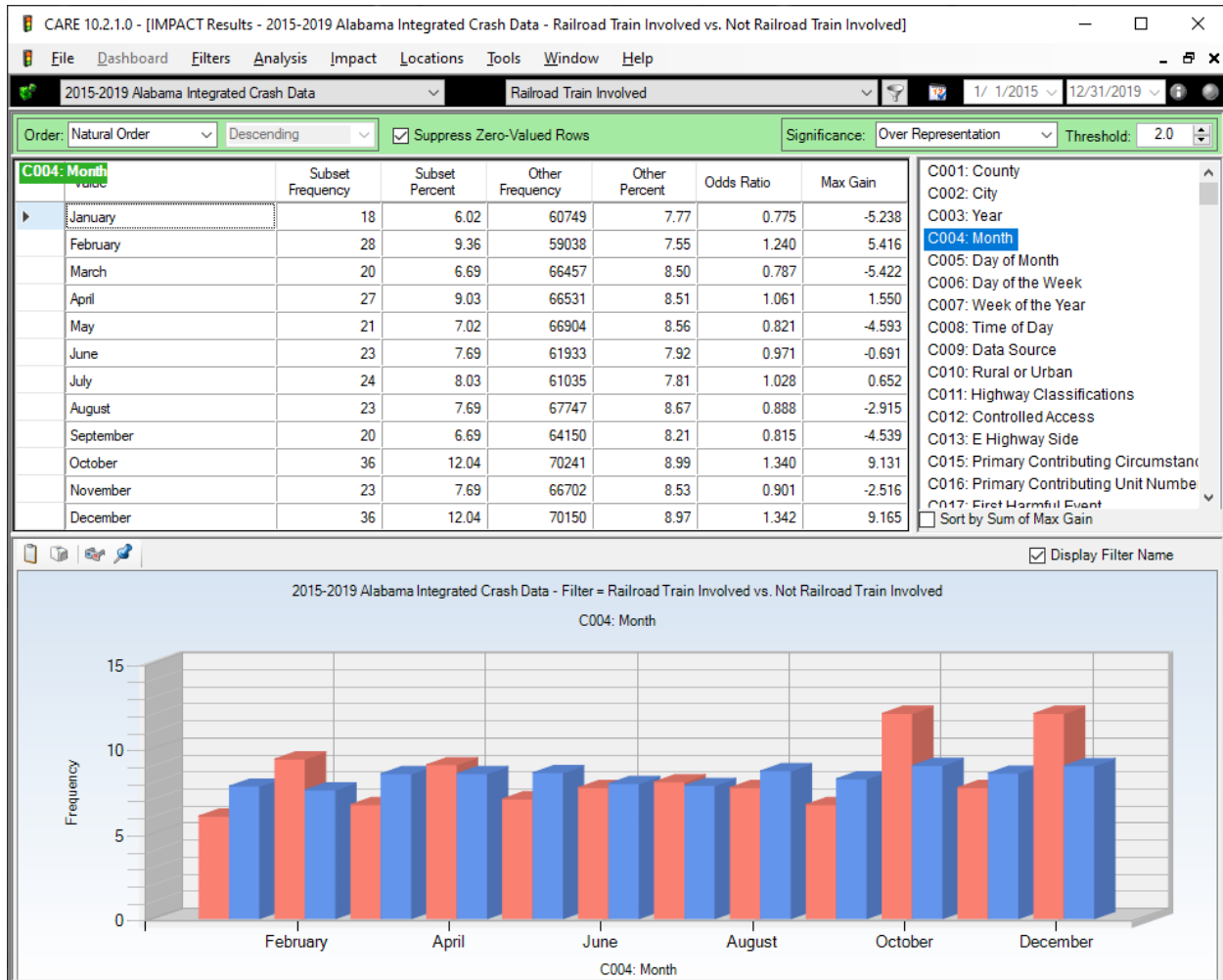


## 4. Time, Weather and Lighting IMPACT Displays – 3-4, 6, 8, 31-32

### C003 Year

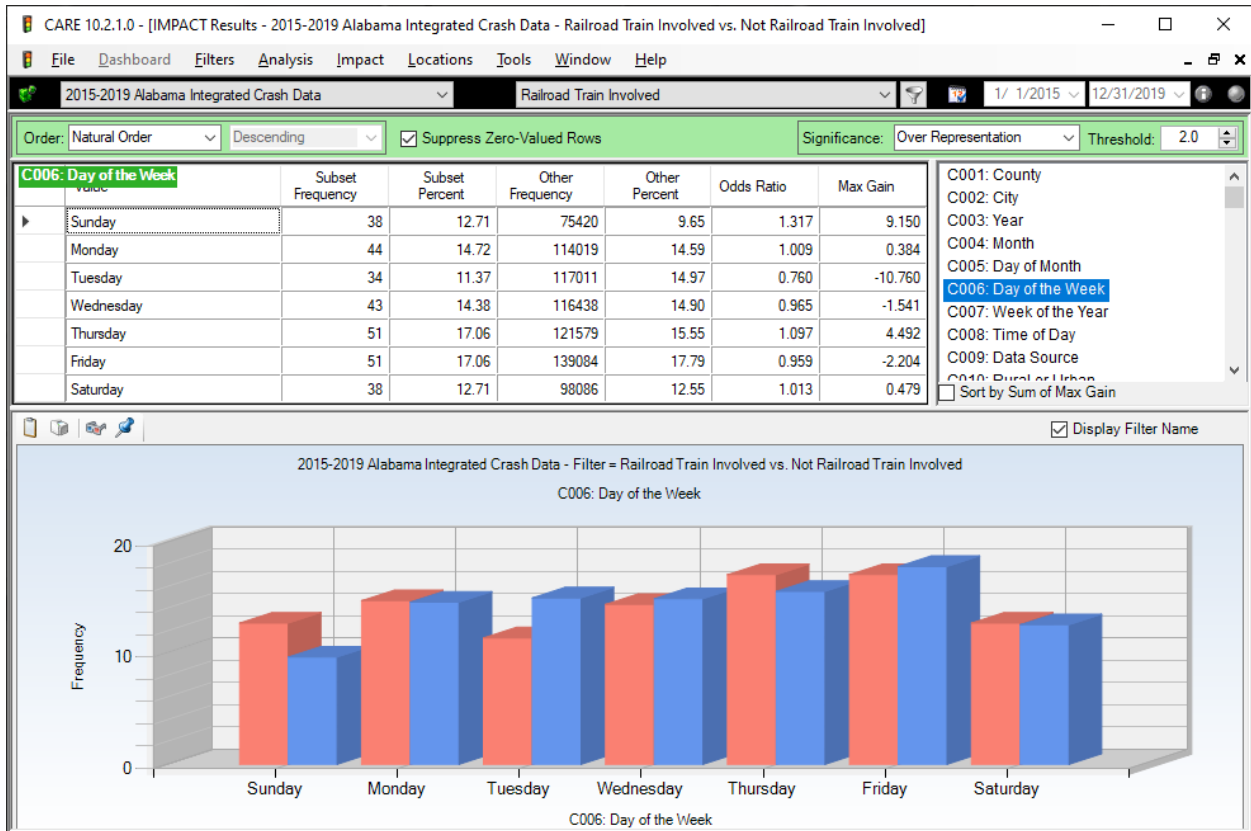


## C004 Month



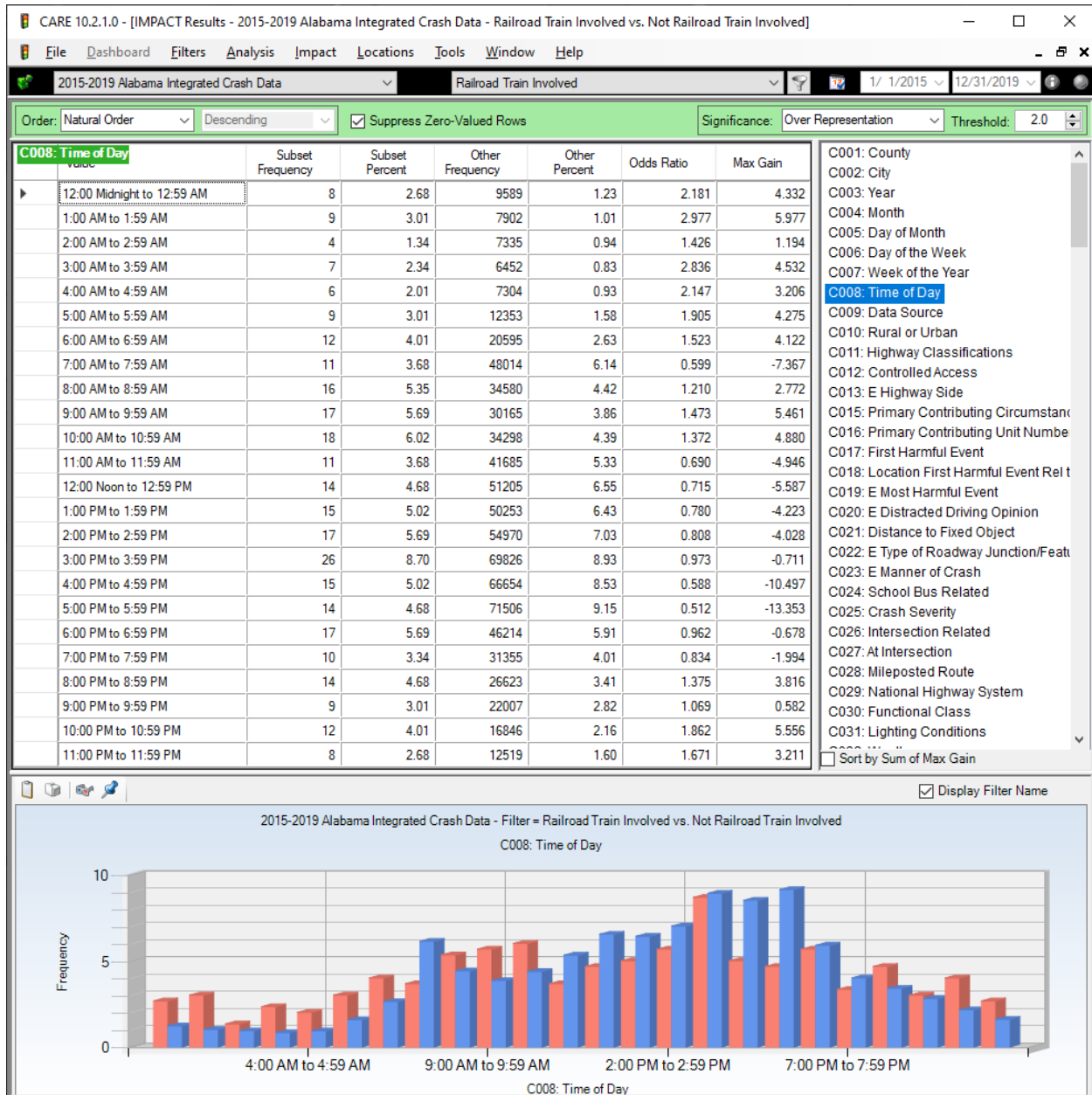
Clearly October and December appear to be significant, but the number of RR-Involved crashes are so low that the standard statistical test cannot show this. We can generally conclude that the month is not critical in determining RR-Involved crashes.

## C006 Day of the Week



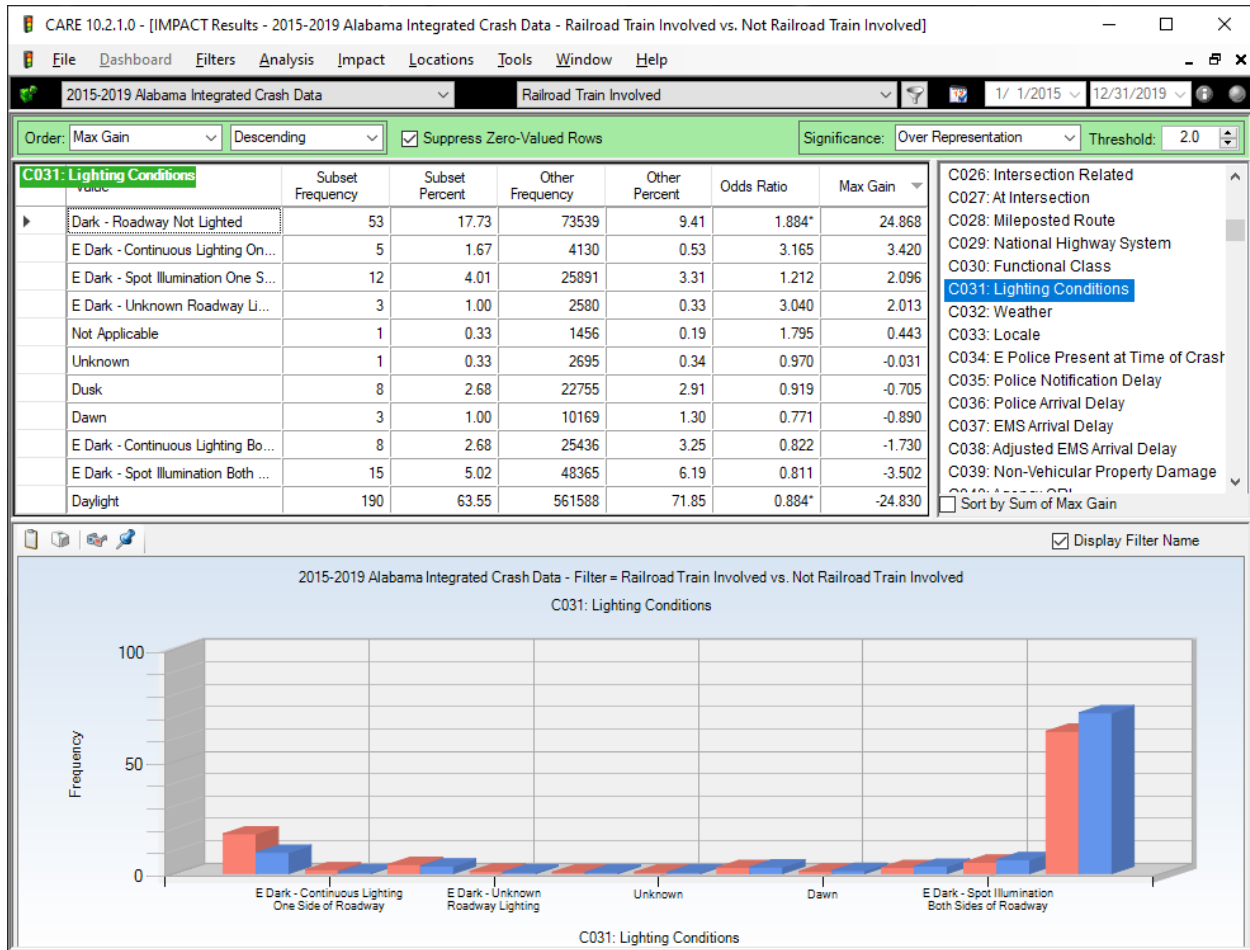
As in the case of Month, the variation in the days of the week are random.

## C008 Time of Day



Over-represented times are significant collectively 8 PM through 9 AM. Trains continue to run at night, the times when other vehicle drivers are the most vulnerable.

## C031 Lighting Conditions



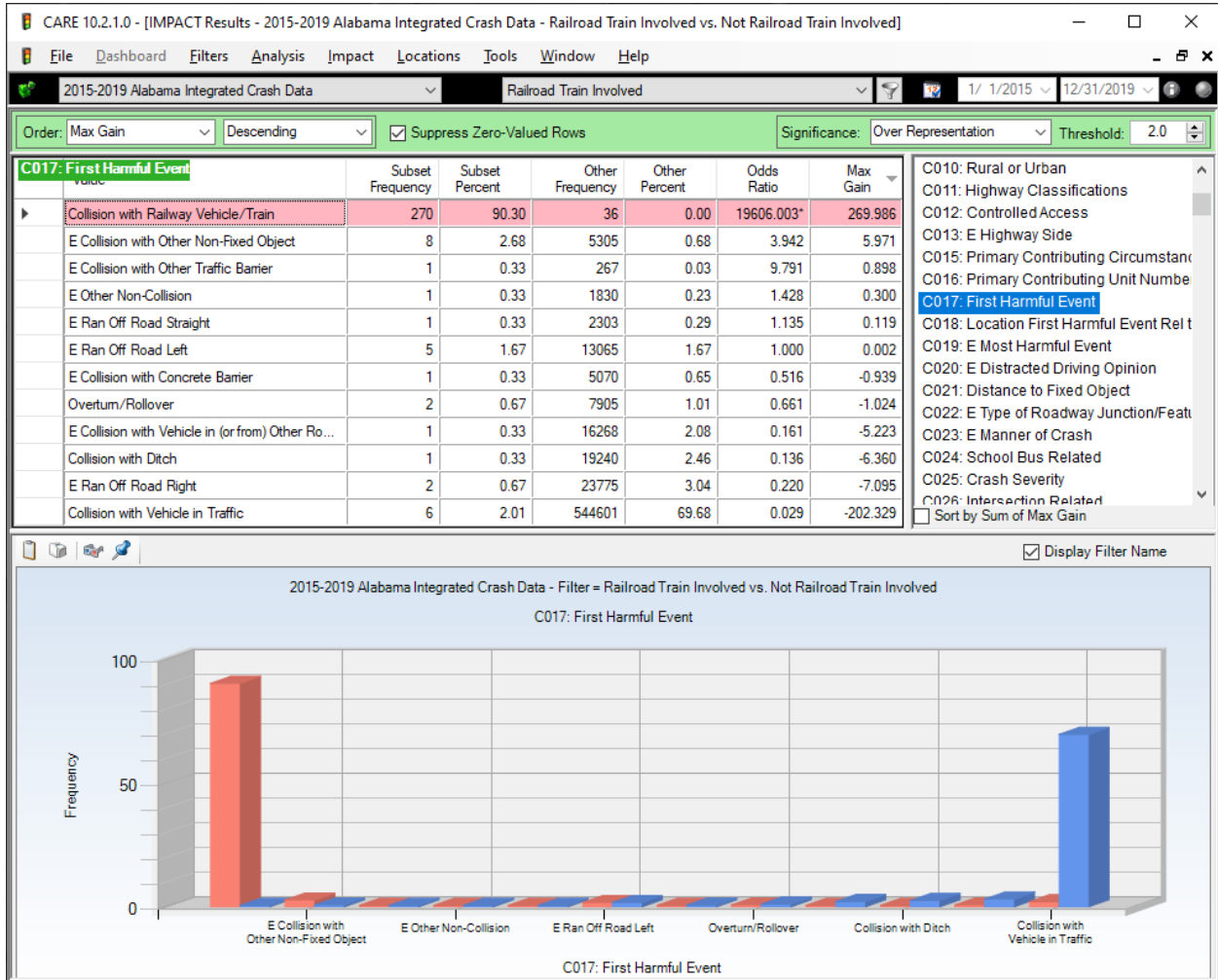
Lighting conditions are consistent with the Time of Day results above.

## C032 Weather

Weather had no apparent effect on RR-Involved crashes.

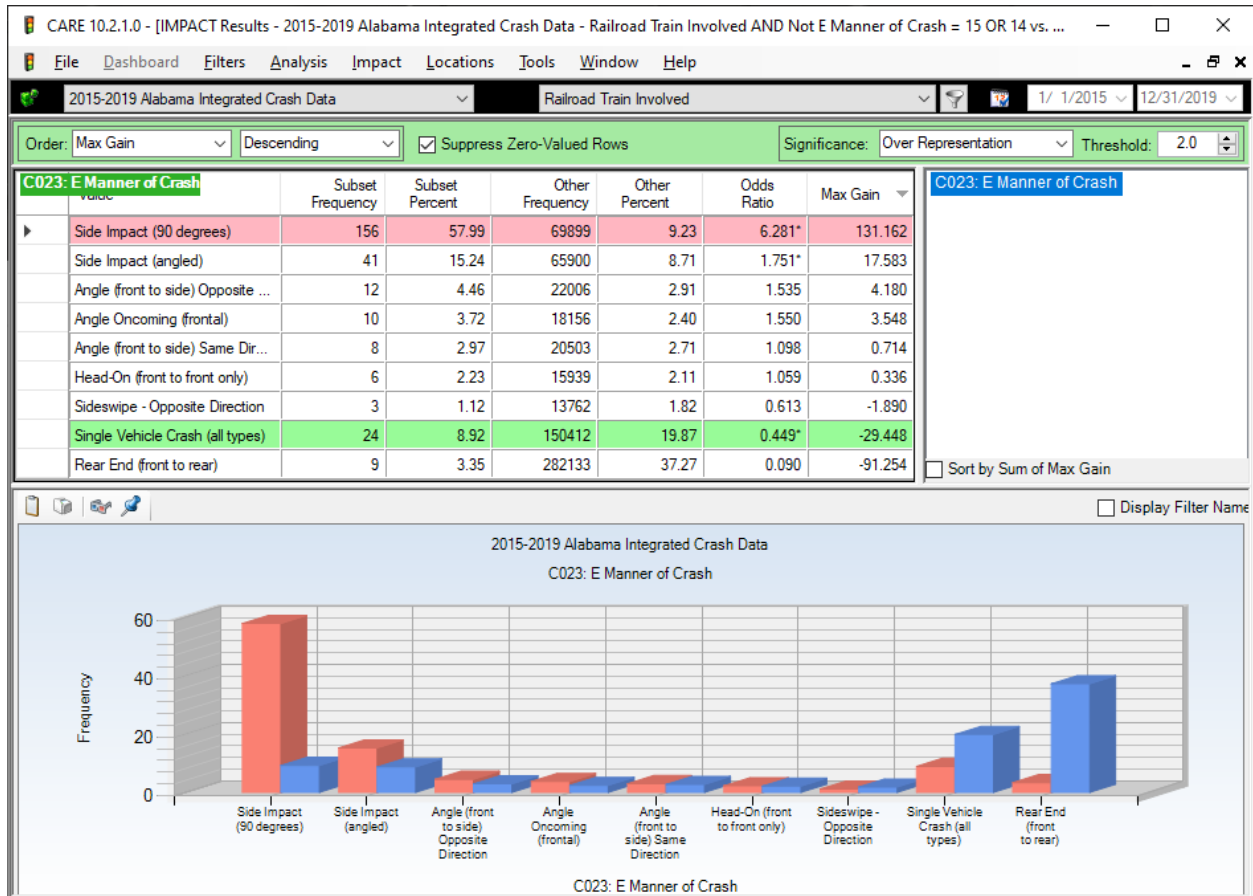
## 5. Driver IMPACT Displays – 17, 23, 52, 80, 107, 109, 115, 122-123, 129

### C017 First Harmful Event



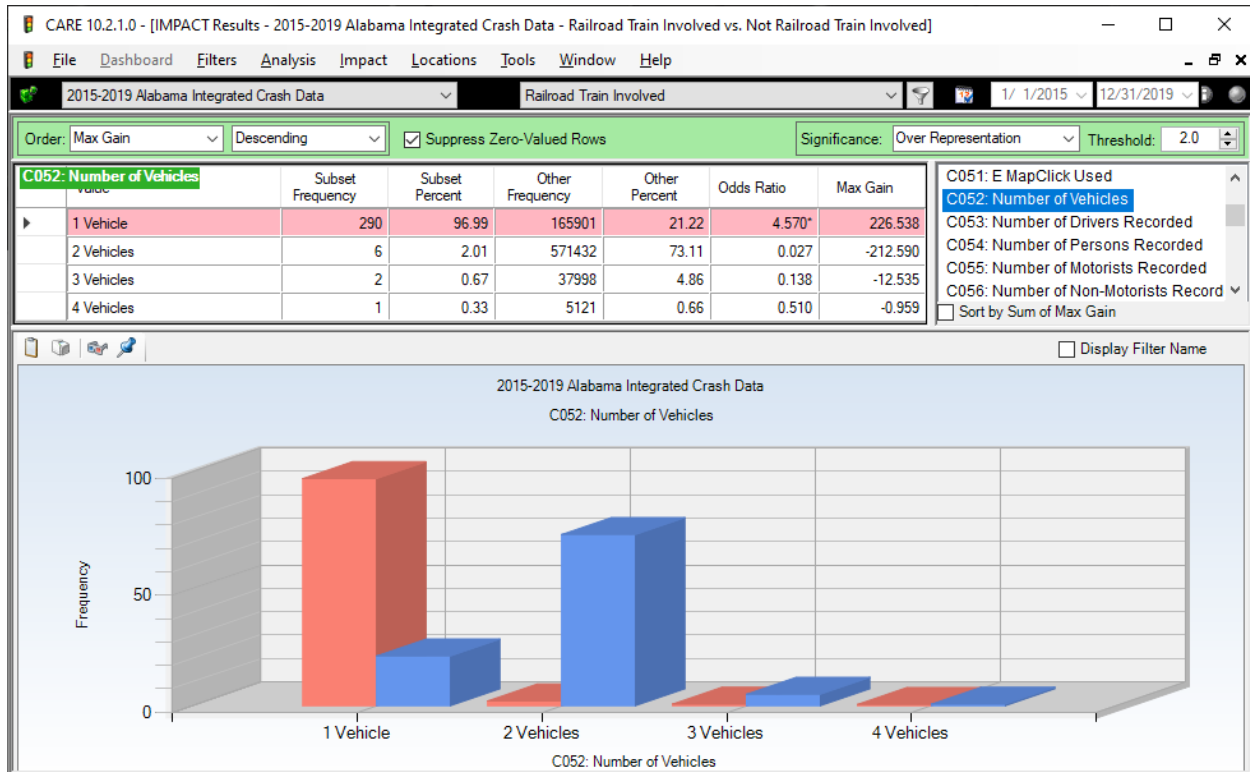
The value of this attribute is in determining those events that did not involve a collision with a train. There were 29 such events.

## C023 E Manner of Crash





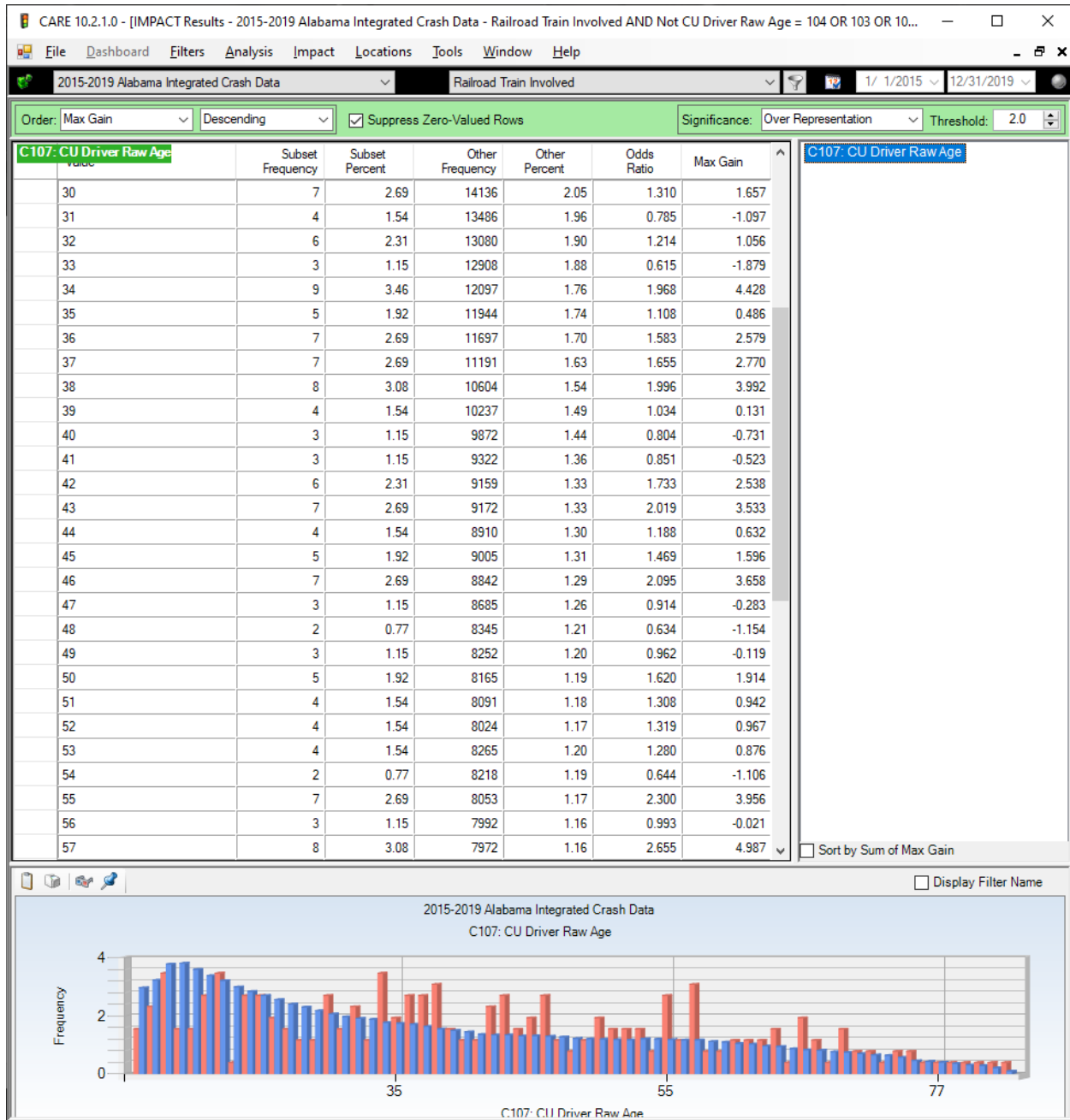
## C052 Number of Vehicles



All of the multi-vehicle crashes except one of the 2-vehicle crashes involved collisions with a RR train. See C017 for the first harmful event of the 28 single vehicle crashes that did not involve a train. The following is C052 (Number of Vehicles) by C017 (First Harmful Event).

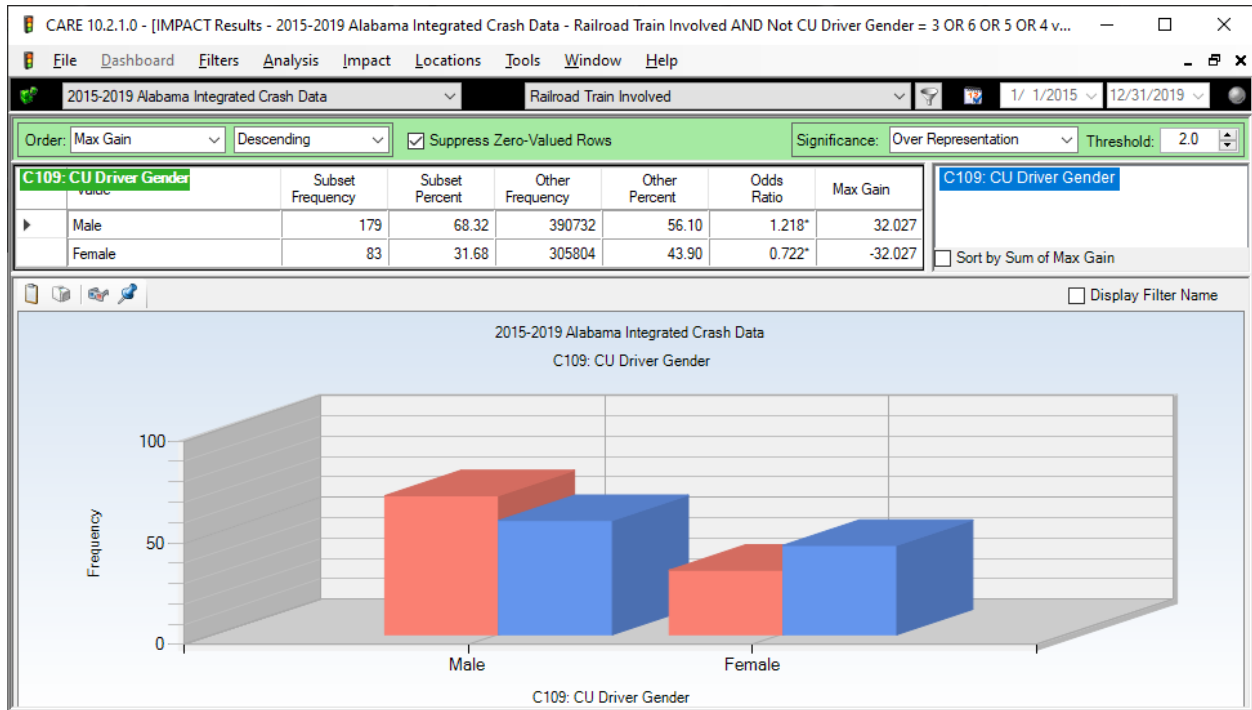
	1 Vehicle	2 Vehicles	3 Vehicles	4 Vehicles	TOTAL
E Ran Off Road Right	2	0	0	0	2
E Ran Off Road Straight	1	0	0	0	1
E Ran Off Road Left	5	0	0	0	5
Overturn/Rollover	2	0	0	0	2
E Other Non-Collision	1	0	0	0	1
Collision with Vehicle in Traffic	5	1	0	0	6
E Collision with Vehicle in (or from	1	0	0	0	1
Collision with Railway Vehicle/T	262	5	2	1	270
E Collision with Other Non-Fixed	8	0	0	0	8
Collision with Ditch	1	0	0	0	1
E Collision with Concrete Barrier	1	0	0	0	1
E Collision with Other Traffic Barri	1	0	0	0	1
<b>TOTAL</b>	<b>290</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>299</b>

## C107 CU Driver Raw Age



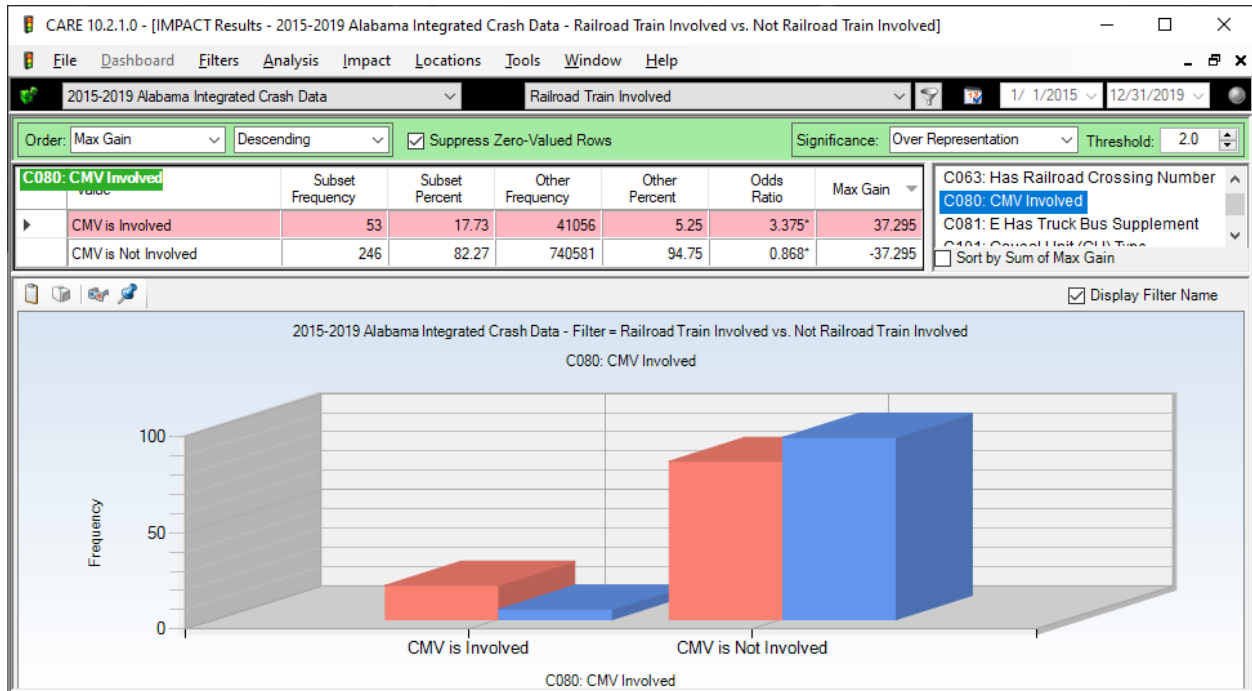
The youngest age group (16) is under-represented by about half of what would be expected from the non-RR-Involved crash proportion. The proportions increase after this and become over-represented in many of the ages in the 30-57 range.

## C109 CU Driver Gender



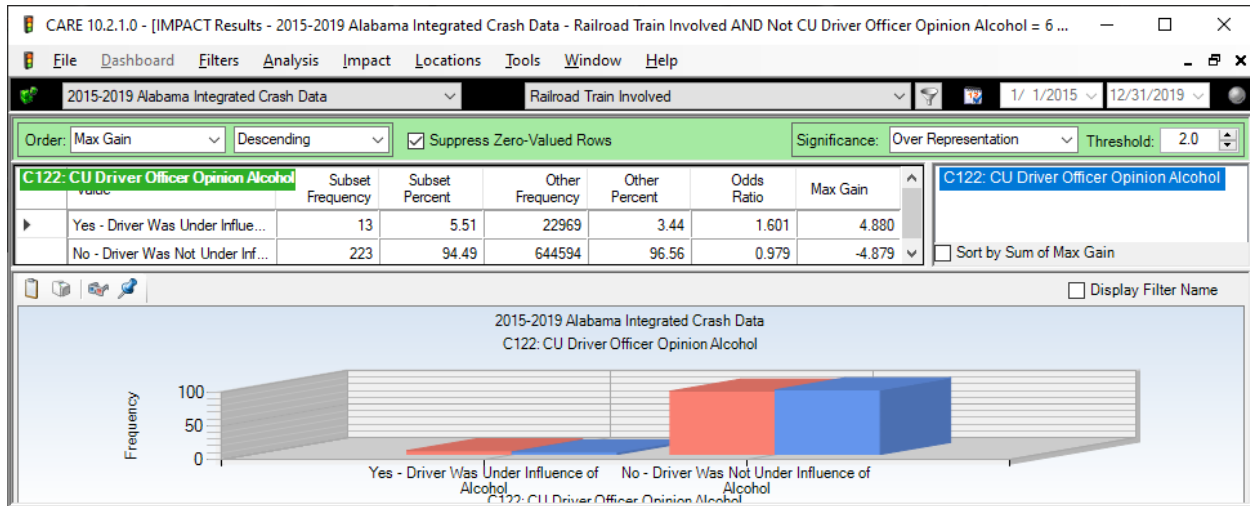
A cross-tabulation of age by gender was performed to determine in what age groups these gender differences show themselves. There is little difference in the 16-20, which would tend to lead us to believe that for the younger drivers, this is a problem with inexperience as opposed to risk-taking. The largest difference of men over women was found to be in the 30-55 age groups.

## C080 CMV Involved

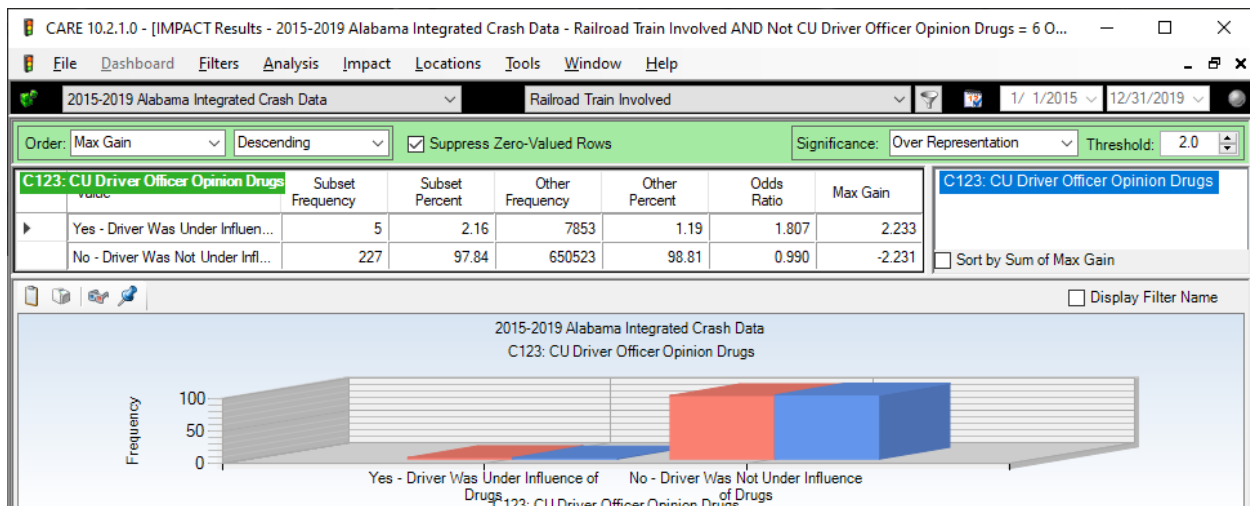


The 53 CMV are in RR-Involved crashes are more than 37 greater than expected. This over-representation is 3.375 times that expected. No doubt, this is an area that should be explored more fully.

## C122 CU Driver Officer Opinion Alcohol

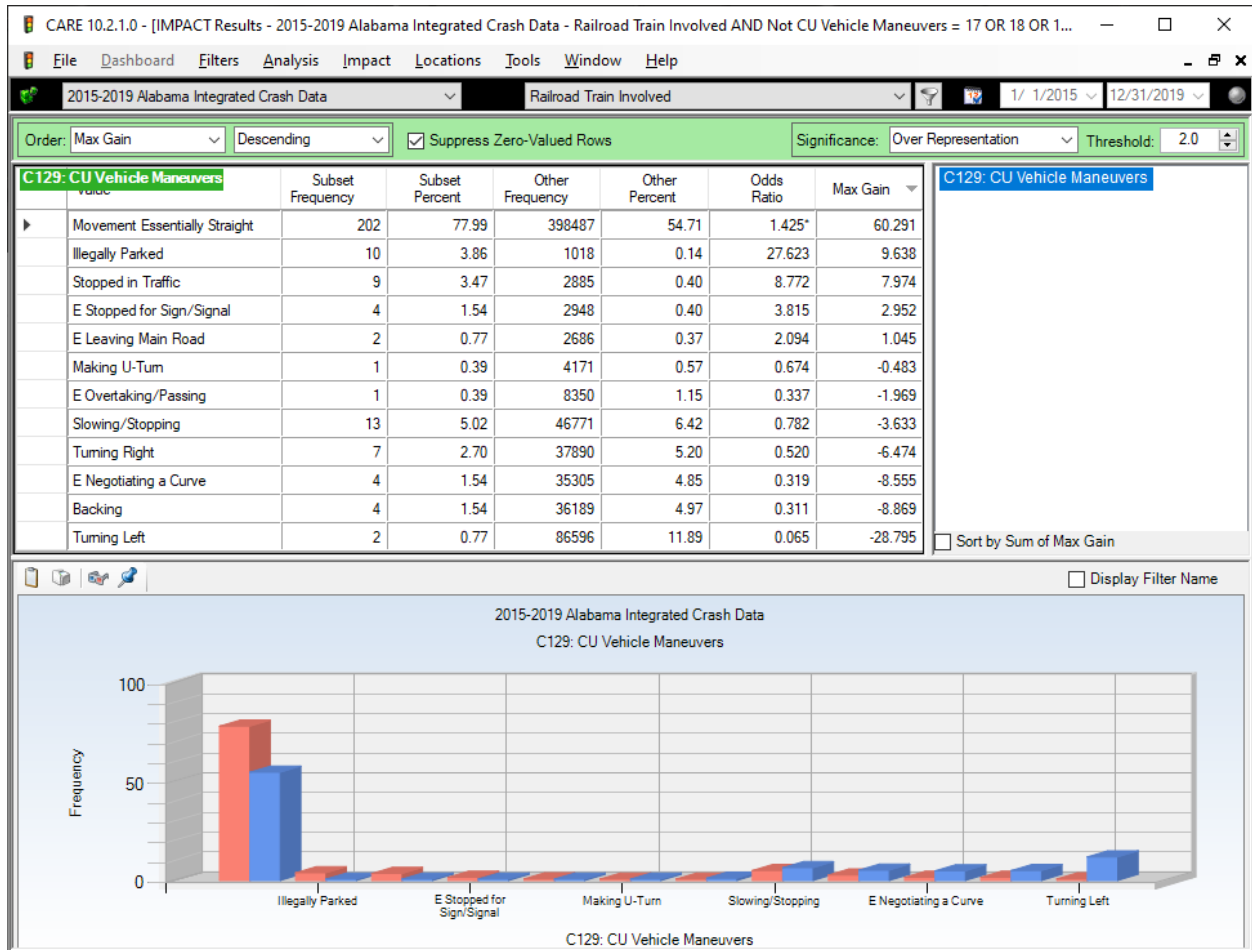


## C123 CU Officer Opinion Drugs



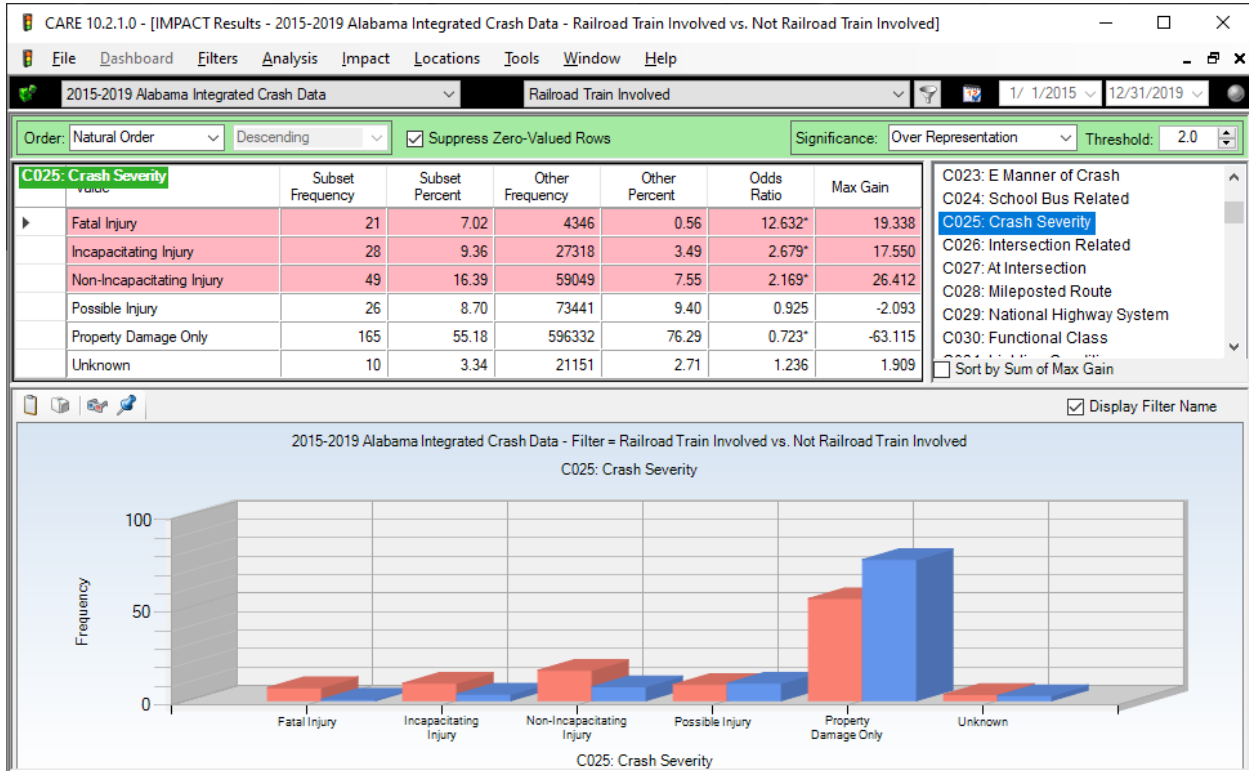
Because of the low sample size, no statistical significance results are given. However, it is clear that both alcohol and drugs had proportions indicating significant over-representations. Alcohol was over 60% higher than the control, while drug use was over 80% higher than expected. This corresponds to the over-represented late-night/early-morning times of day. It is extremely unwise to approach a railroad crossing inebriated.

## C129 CU Vehicle Maneuvers



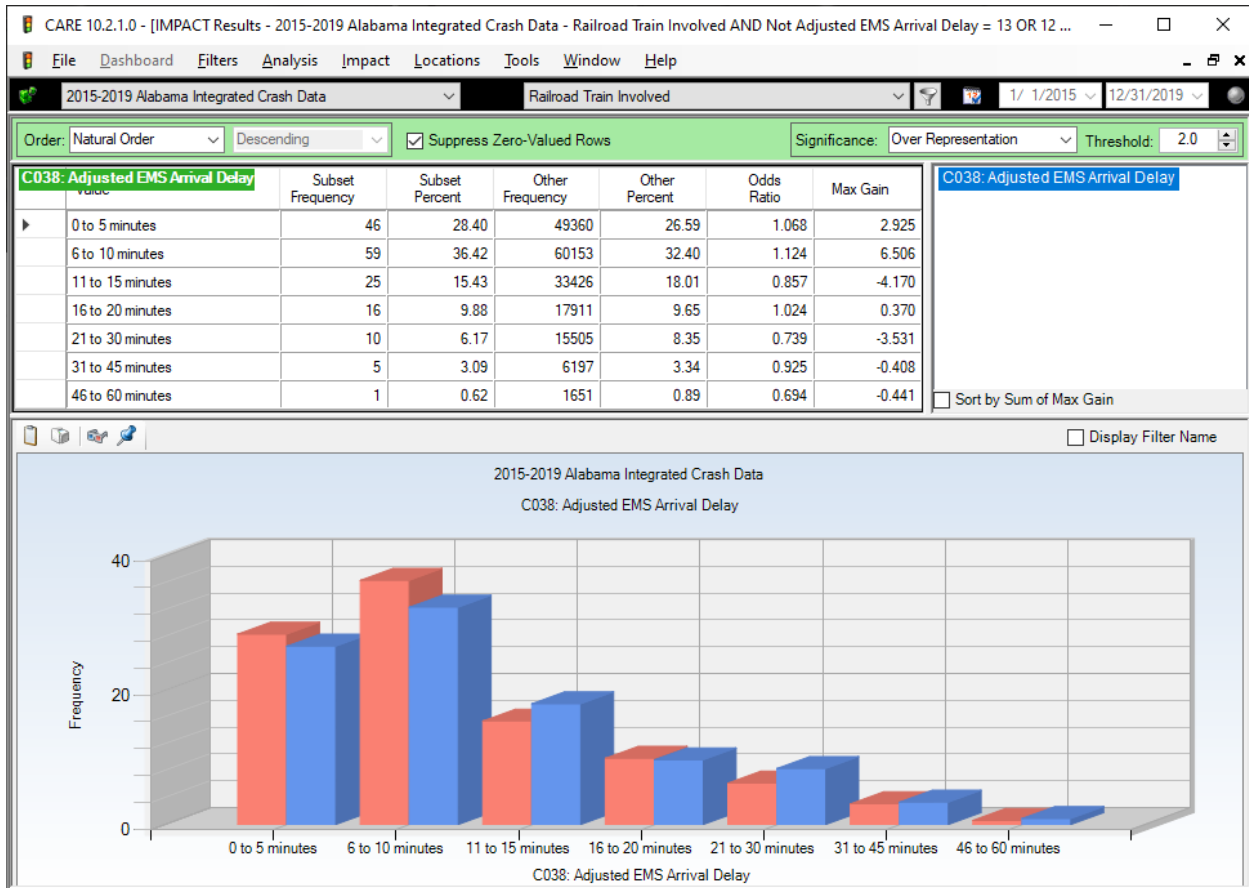
## 6. Severity IMPACT Displays – 25, 38, 60, 224

### C025 Crash Severity



For obvious reasons of physics, the effects of crashes that are RR-Involved are much more severe than other injury crash types. Fatalities are at a proportion that is 12.632 that of crashes in general. The higher injury levels are also well over twice their expected values.

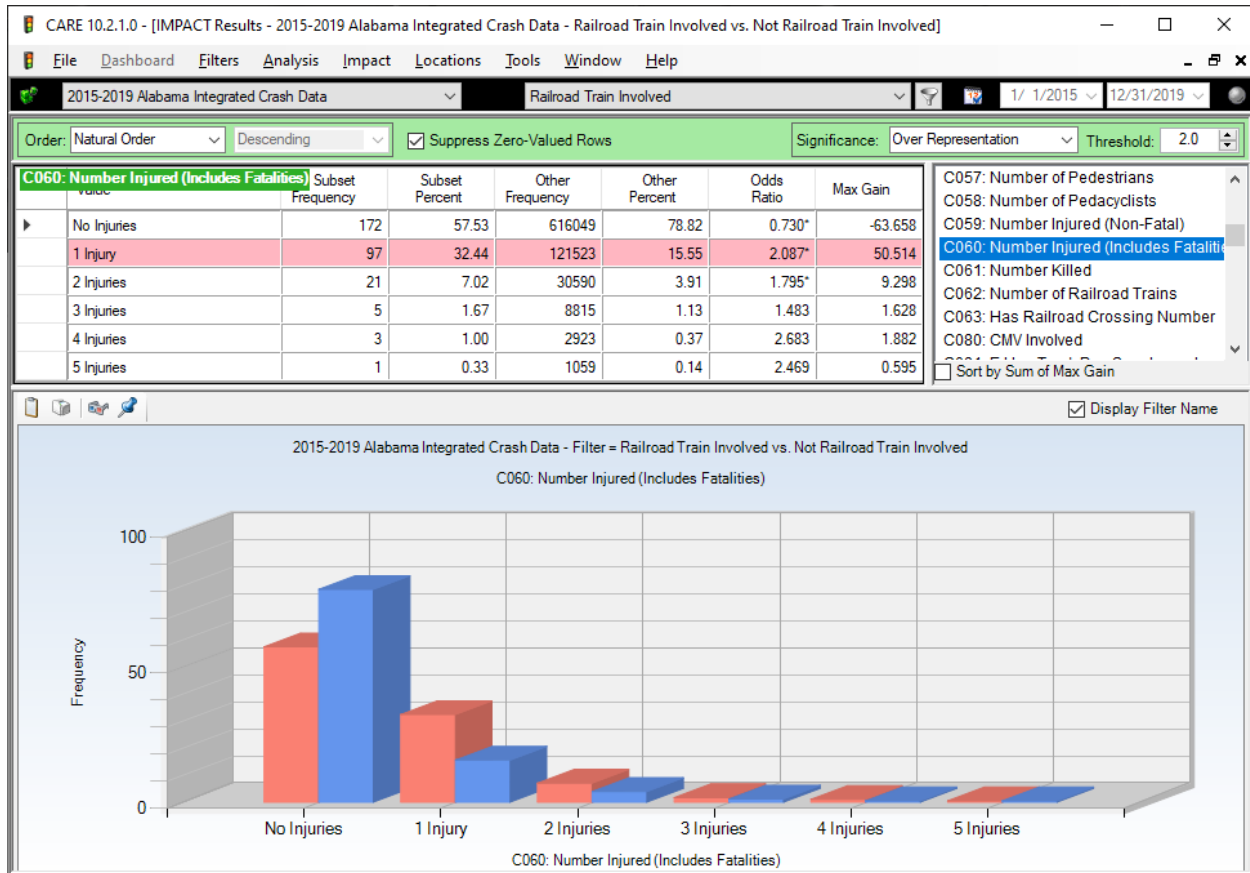
## C038 Adjusted EMS Arrival Delay



The low response time (10 minutes or less) in about 65% of the crashes is probably due to the quick notification by railroad personnel. This combined with the late night time could result in the further ability to respond quickly.

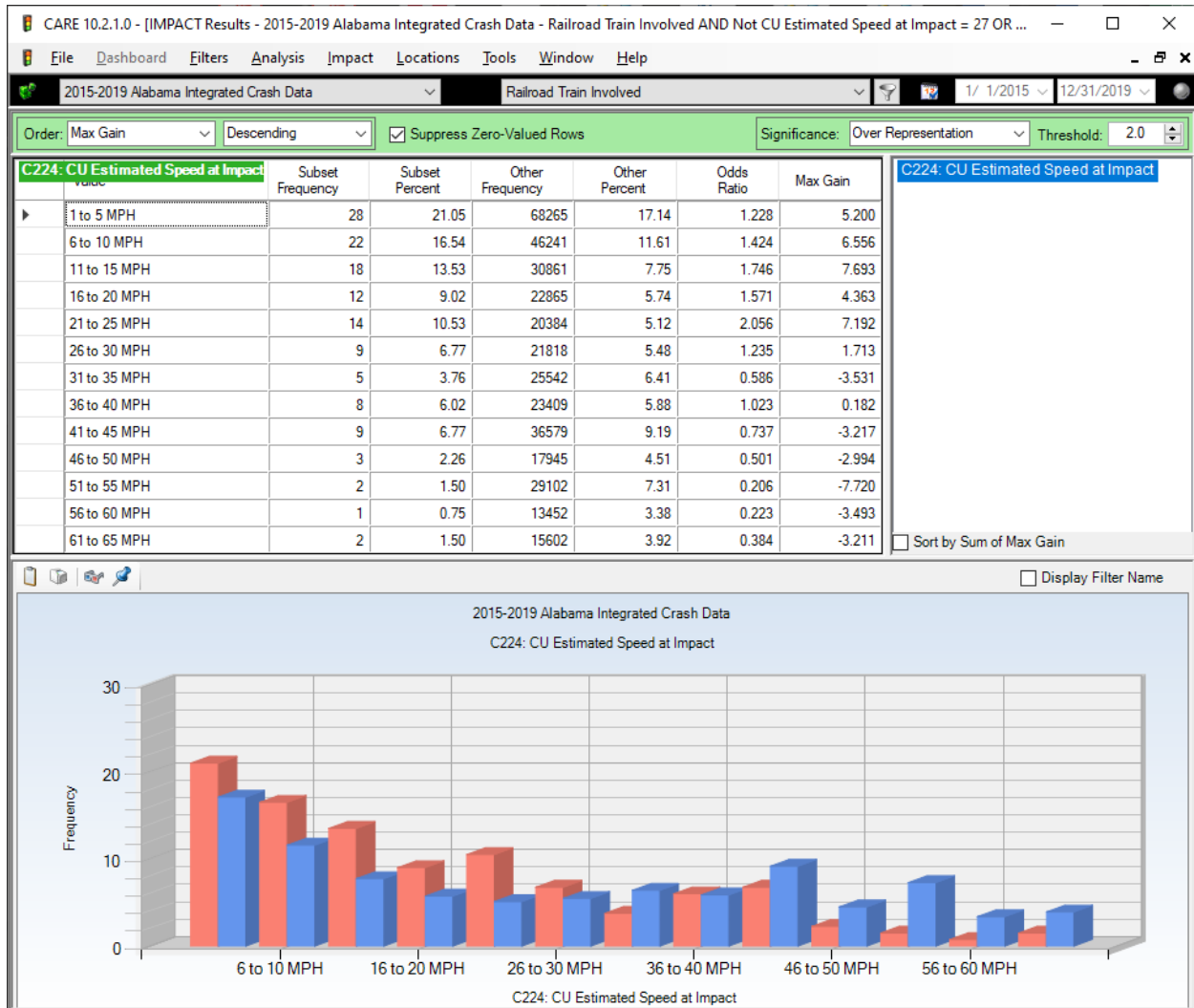


## C060 Number Injured (Including Fatalities)



The increased severity of RR-Involved crashes is also reflected in the number of injuries, all of which are above the average of all non-RR-Involved crashes.

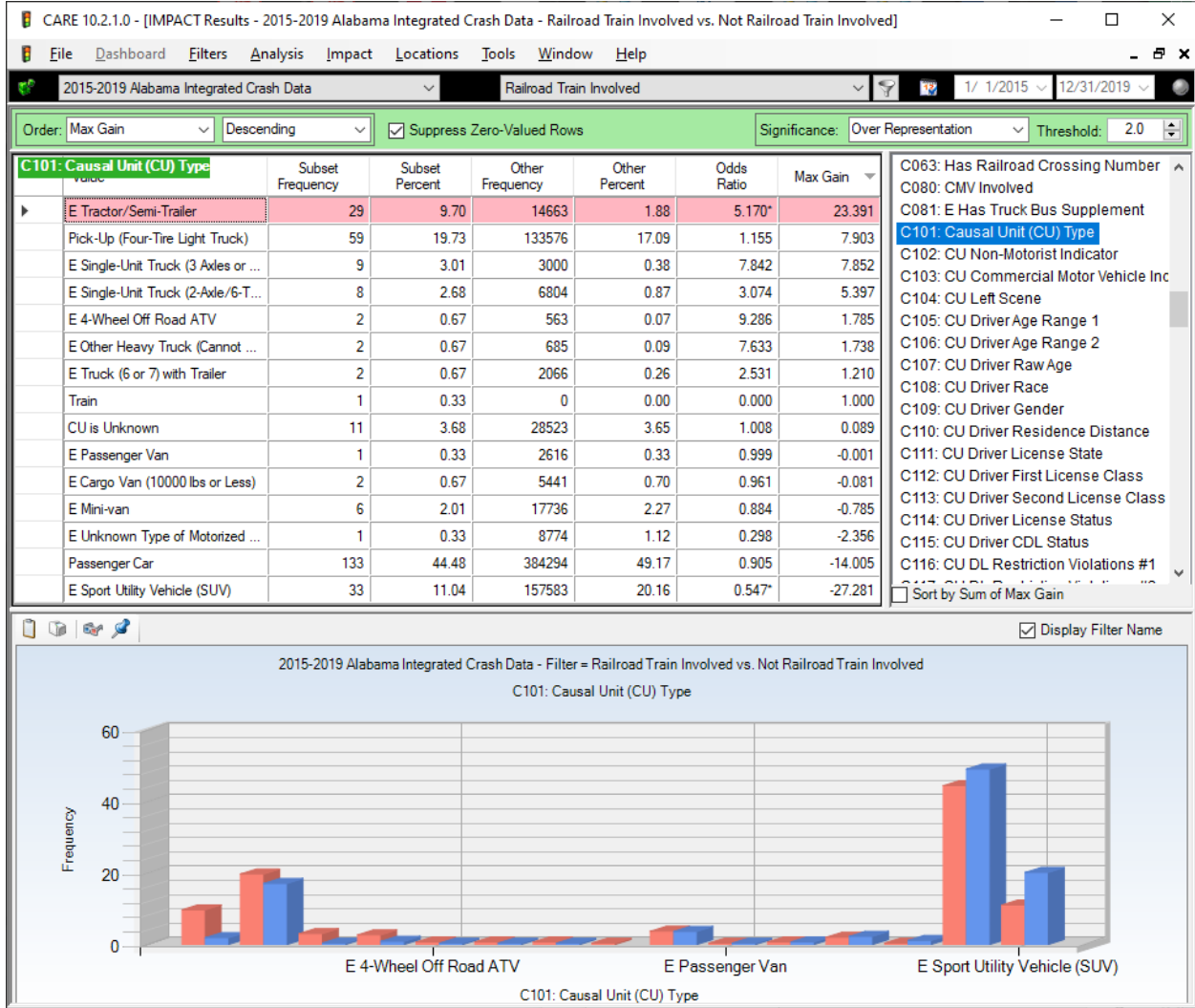
## C224 CU Estimated Speed at Impact



As would be expected, the speeds at impact are relatively low compared to their non-RR-Involved counterparts. This does show that very few drivers “run” the RR intersection. In most cases it would seem that they are creeping across thinking they can make it – perhaps in some cases not looking for or seeing the train at all.

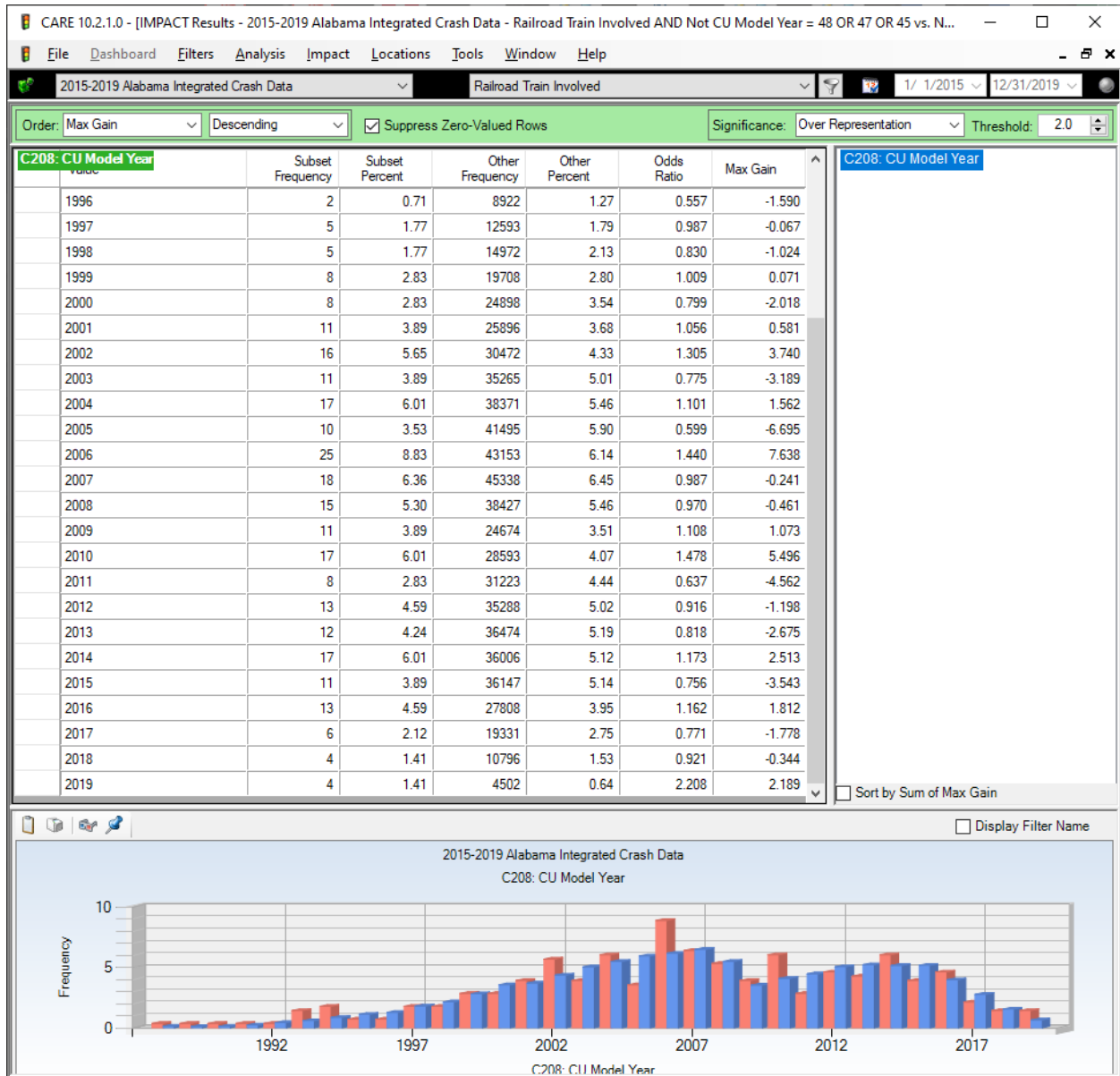
## 7. Vehicle IMPACT Displays – 80, 101, 129, 208

### C101 Causal Unit (CU) Type



It seems the larger the truck the more often they are at fault.

## C208 CU Model Year



There do not seem to be any patterns in this attribute.