CARE IMPACT Study of
Traffic Crashes Involving Aggressive Driving
2013-2017 Data

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Table of Contents

Table of Contents 0

Introduction and Summary of Findings 2
- Definition of Aggressive Driving 3
- Definition of Aggressive Operation 6
- Comparison of Findings AD vs AO 7
- Summary of Findings 8

Crash Characteristics 15
- C015 Primary Contributing Circumstance – Ordered by Frequency 15
- C015 Primary Contributing Circumstance – Most Correlated 16
- C129 CU Vehicle Maneuvers 17
- C023 Manner of Crash 18
- C017 First Harmful Event – All Items with 300 or More Occurrences 19
- C203 CU First Harmful Location 20
- C051 Number of Vehicles 21
- C056 Number of Pedestrians 22

Time Characteristics 23
- C003 Year 23
- C004 Month 24
- C008 Time of Day 25
- C029 Lighting Conditions 26
- C006 Day of the Week 27
- Day of the Week by Time of Day 28

Driver Characteristics (Demographics and Behavior) 30
- C020 E Distracted Driving Opinion 30
- C107 CU Driver Raw Age Frequency Distribution 31
- C121 CU Driver Condition 32

C122 CU Driver Officer Opinion Alcohol 33
C123 CU Driver Officer Opinion Drugs 34
C213 CU Vehicle Usage....35
C104 CU Left the Scene 36
C109 CU Driver Gender 37
Driver Gender by Severity....38
Male vs Female Characteristics 39

Severity Characteristics 41
C025 Crash Severity 41
C224 CU Estimated Speed at Impact....42
C227 CU Vehicle Towed....43
C060 Number Killed....44
C058 Number Injured (Non-Fatal) 45
C036 Adjusted EMS Arrival Delay 46

Geographical Characteristics 47
C010 Rural or Urban....47
C031 Locale 48
C011 Highway Classifications....49
C110 CU Driver Residence Distance 50
C001 County – Over-Represented....51
Tuscaloosa, Montgomery, Madison, Mobile, Cullman, Lauderdale and Morgan Counties 52

Vehicle Characteristics 54
C101 Causal Unit (CU) Type 54
C208 CU Model Year 55

Roadway Environment and Pavement Characteristics 56
C412 CU Traffic Lanes....56
C408 CU Vision Obscured By....57
C030 Weather 58
C403 CU Roadway Condition 59
C022 E Type of Roadway Junction Feature 60
C027 At Intersection....61
C407 CU Roadway Curvature and Grade....62
C409 CU Traffic Control....63
C415 CU Workzone Related 64

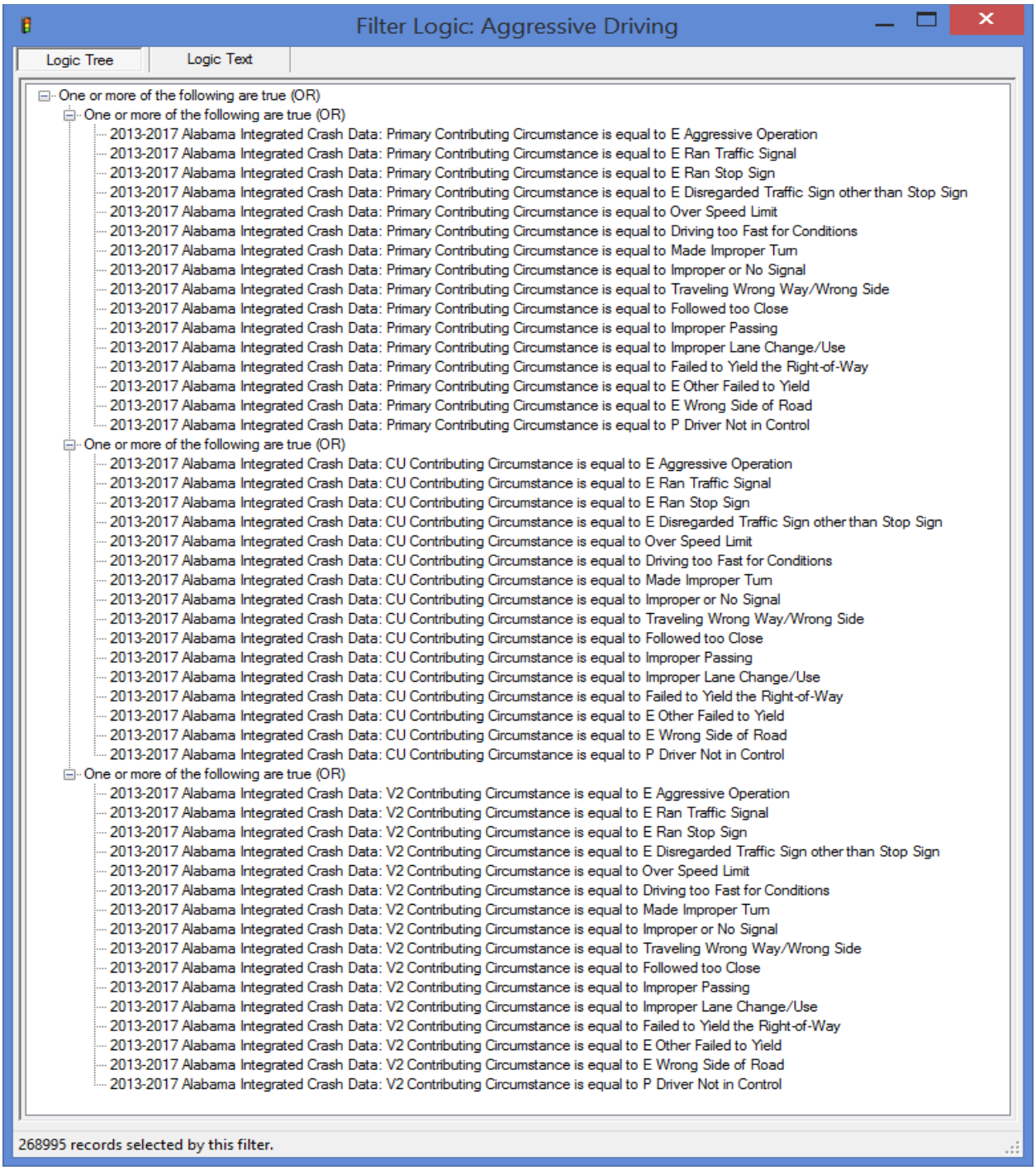
Introduction and Summary of Findings

This introductory section consists of the following parts:

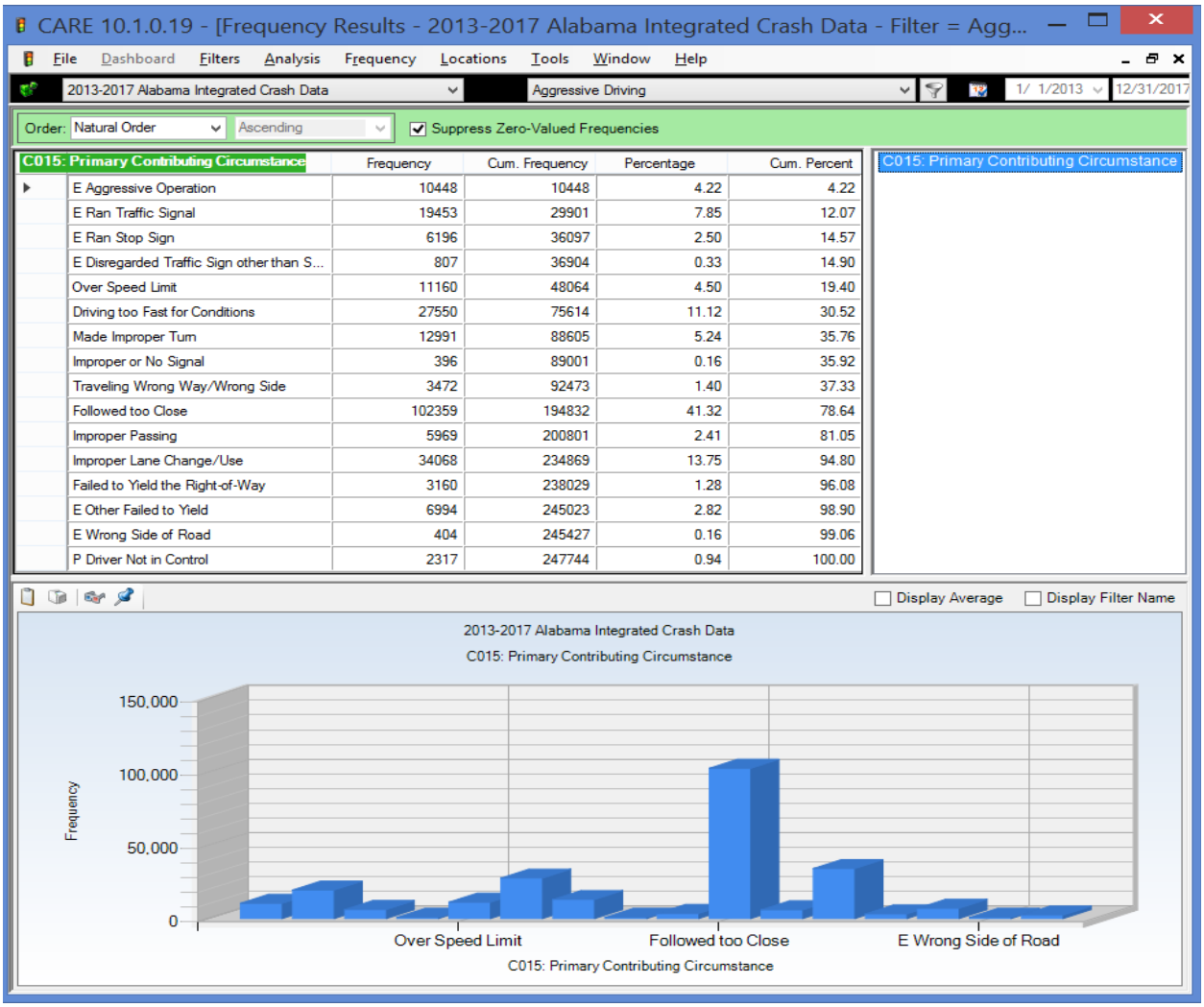
- A definition of the broad categorization of Aggressive Driving (AD), which was the primary focus of this study.
- A definition of the much narrower Aggressive Operation (AO), which meets the FMCSA specification for what is technically called aggressive operation. It is important that the distinction between these two classifications is understood.
- Discussion of findings comparing AD with AO.
- A summary of findings section, which essentially serves as an executive summary for the findings of this study.

Definition of Aggressive Driving

Filter Used for Aggressive Driving Analyses

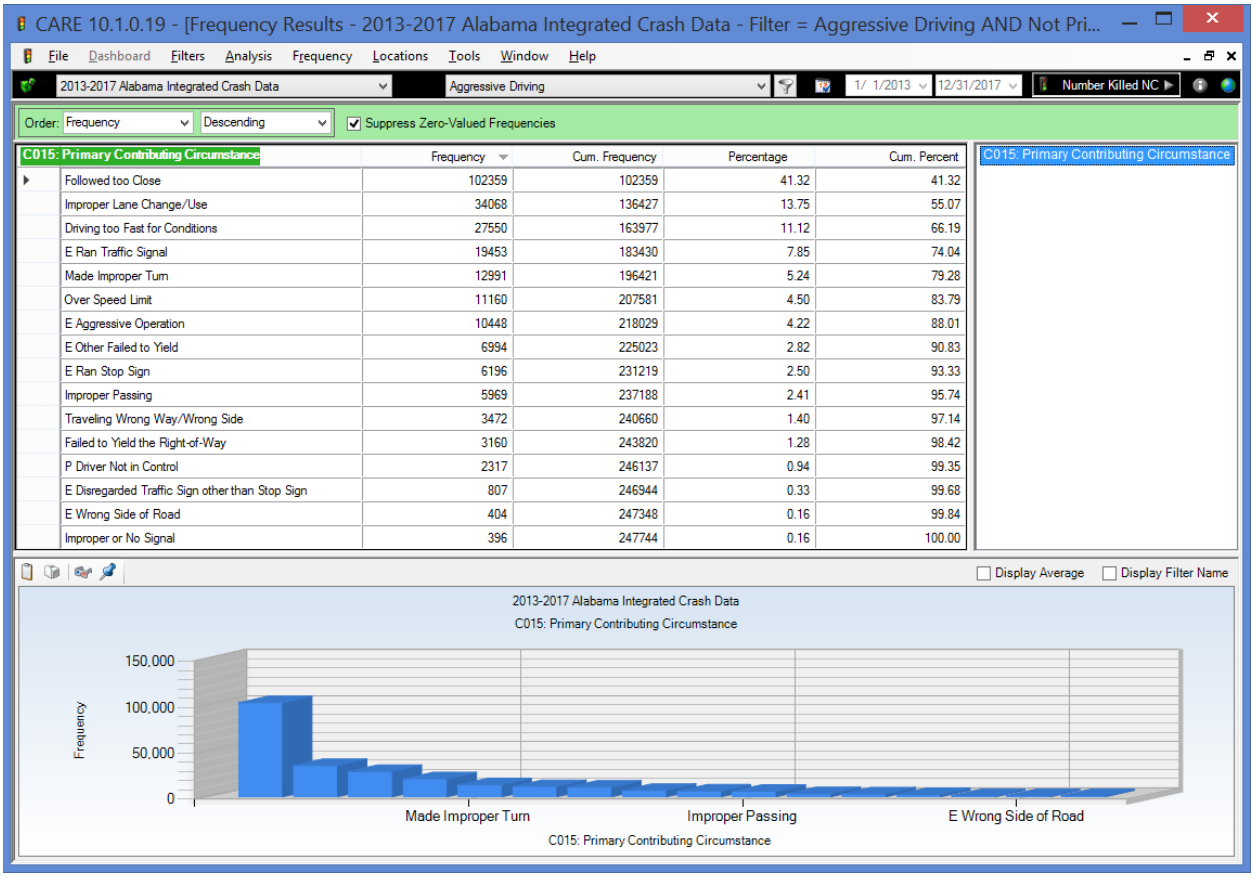


The basis for the filter given above was proposed in the SHSP meetings of 2017. It was felt that each of these items would indicate Aggressive Driving (AD) if it showed up in any of the three contributing circumstance attributes (Primary, Contributing Unit, or Second Vehicle). There are 16 values listed within each of the attributes, one of which is Aggressive Operation (AO). Since any of these values could, by themselves, indicate driver aggressive behavior, for purposes of this analysis it was felt that the broadest possible definition should be used.



The subject came up that quite often a driver may transition into an aggessive attitude without even knowing it. We saw this as an additional reason to make the definition as broad as possible, since this factor should be considered in the development of countermeasures for AD. In considering the results, all of these factors should be borne in mind. The display above shows the Primary Contributing Circumstances (C015) for the 3-attribute filter above. This does not

count all cases since its values only accout for one of the three variables. Since this attribute (C015) would also include many values outside of the filter that occur in the other two attributes, these were pruned from the display. The purpose of this is to show the overall distribution of the various values as opposed to providing the numbers for each one of them. We will see in some of the summaries below that the total number of AD crashes over the five years of the data in the study (CY2013-2017) was 268,995 crashes. To further enable th relationship among the values, the display below places these same results in order from greatest to smallest frequency.



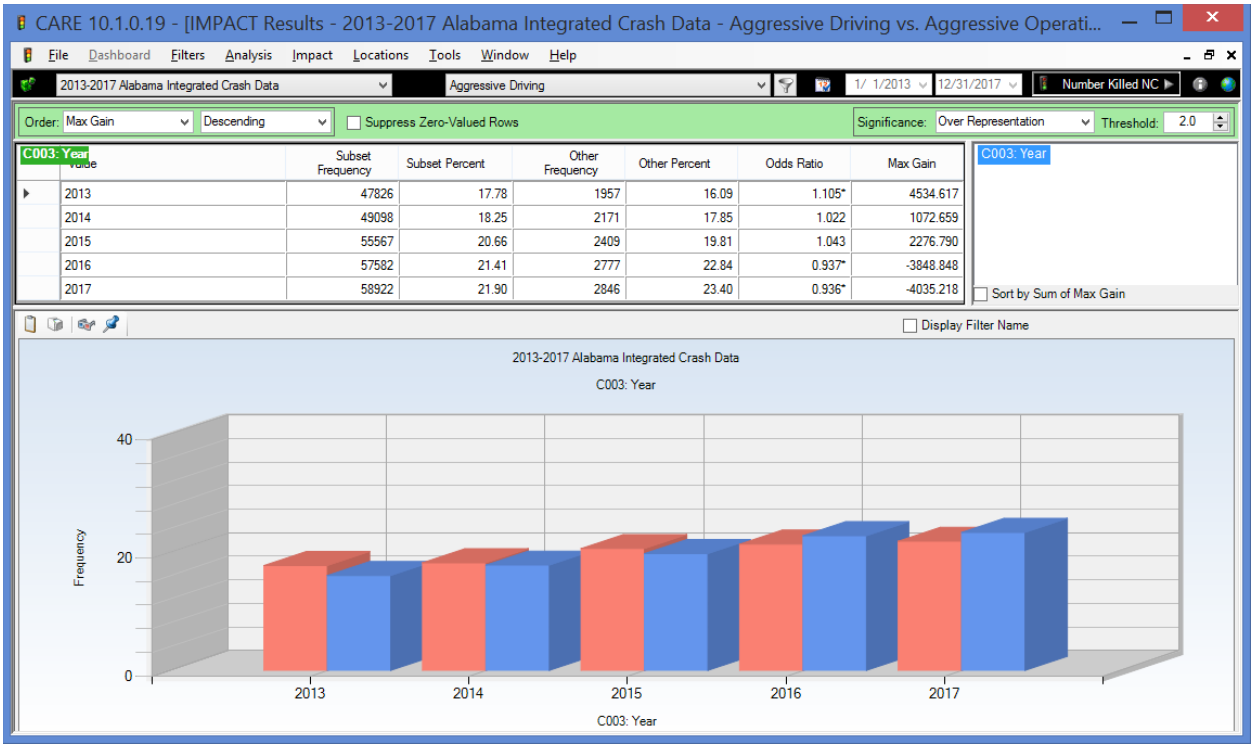
To summarize, the reason for using this very broad definition for this study is to assure that we get all of the cases in the target subset. The fact that some of these were not the result of aggressive driving will dilute the findings because the contrast between AD and non-AD will be smaller than its true difference. This will make the findings "conservative" in putting a higher burden of proof on the AD subset. That is, some being counted as AD will not arise from an aggressive driver. But, when significant differences are found, we can be sure that the statistical significance is valid, and that the odds ratio and the percent differences are at least the size that is being reported, and perhaps much greater.

Definition of Aggressive Operation

The distinction between Aggressive Driving (AD) and Aggressive Operation (AO) is quite important in that these two subsets of the crash data are very much different. Note, for example, that AO is a value for the three contributing circumstance attributes, and thus, AO is a subset of AD. AO is not determined by filtering of other variables (e.g., contributing circumstances) as was true with AD. It is determined as an opinion of the reporting officer, and the criteria for the officer specifying AO as the contributing circumstance is as follows:

> *In all cases for which there are multiple contributing circumstances (i.e., no one value can be entered to adequately describe what contributed to the crash), reporting officers are to select the Aggressive Operation (AO) code.*

The rationale for this is that typically contributing circumstance indicate faults on the part of the causal driver. The decision-makers felt that if more than one contributing circumstance, then there would be a good chance that the driver was not just making a mistake, but was intentionally acting to break the rules. This would certainly correlate very highly with aggressive driving.



The IMPACT display above by year compares the AD with the AO results per year, where the proportions are indicated in the chart, and the actual values are indicated in the table. The total for the AD subset is 268,995 crashes, and the AO subset is 12,160 crashes. This is a very large difference, the AO crashes being only about 4.5% of the AD crashes, and only about 1.7% of all crashes. While the AO *might* give us close to zero false positives, it should also be clear that this is grossly under-reported estimate of the number of crashes caused by or involving aggression. Other issues with AO will be discussed in the next section, where the rationale for using AD as opposed to AO will be further justified.

The display above over the five years for the data is also beneficial for seeing the growth in AD as compared to AO reporting. The AD is represented by the red bars, while the AO bars are in blue. This indicates a potentially positive trend in more complete and accurate AO reporting as time has gone by and officers have gotten used to using the AO code.

For more comparisons over the five year period, see C003 below.

Comparison of Findings AD vs AO

While the comparison between AD and non-AD crashes formed the primary basis for this study, a second comparison of AO vs. non-AO was performed and the results were compared. In the summaries given in the net section, the AD comparison will be presented first, and then any major differences that were found in the AO part of the study will be presented and discussed.

Very few similarities were found in comparing AD with AO results. The reason for this has to do with how these two crash causes are defined. AD is defined from contributing circumstances and is almost independent of the reporting officer's opinion. AO, on the other hand, depends almost entirely on the reporting officer determining that more than one contributing circumstance was in effect, and therefore instead of indicating any of them, AO is selected.

The primary problem in this arises primarily in Impaired Driving (ID) caused crashes, either DUI Alcohol or DUI Drugs (or both). In a very large number of ID cases there will be more than one contributing circumstance, and thus the reporting officer will select AO. However, the cause of the problem is clearly not anything to do with aggression. In fact, the impaired driver might be the least aggressive on the road, not really knowing of caring about things one way or the other. We recognize that this is not always that case and there are exceptions in which ID drivers are quite aggressive. However, generally they are two different causes and for them to be correlated in such a strong way indicates that the AO attribute definition is not effective in surfacing aggression. There are many times that multiple contributing circumstance occur when aggression is not present, and ID served to highlight this flaw. This provided additional support for the focus of this study being upon AD as opposed to AO.

Summary of Findings

The comparisons in this document are between those crashes that were indicated by the filter defined above to be AD involved crashes against those that were not found to be such. Once this was accomplished, a second comparison of AO vs. non-AO crashes was performed to determine if major differences existed for each of the attributes.

The results of these analyses enable the characteristics for AD and AO crashes to surface so that traffic safety professionals can determine their magnitude and optimize aggressive driving safety programs so that emphasis is placed on the most important factors.

The following summary is a list of conclusions that were obtained from the major focus that was on the broadly defined Aggressive Driving (AD). These analyses were repeated for Aggressive Operation (AO), as defined above, but discussions were restricted to only where major contradictions between the two analyses were found.

- Crash Characteristics
    - C015-Primary Contributing Circumstance. Following Too Close is by far the greatest primary contributing factor in the AD involved subset of crashes, followed by Improper Lane Change/Use, Driving too fast for Conditions, and Ran Traffic Signal. When Over Speed Limit is combined with Driving Too Fast for Conditions, these combined speed related items become second place.
    - C129-CU Vehicle Maneuvers. The largest max gains are in Changing Lanes (odds ratio > 4), Overtaking/Passing (odds ration almost 9), and Negotiating a Curve.
    - C023-Manner of Crash. Manner of crash reflects the Following Too Close over-representation discussed above, and it is by far the highest frequency with about 46% of the AD crashes. Sideswipe-Same Direction has over twice the expected proportion.
    - C017-First Harmful Event. Collisions with vehicle in traffic (multi-vehicle crashes) are by far the greatest First Harmful Event, accounting for over 80% of the AD crashes, but only about 67% of the non-AD.
    - C203-CU First Harmful Event Location. Reflecting the large number of "vehicle in traffic" the vast majority of crashes occur on the roadway as opposed to running off the road. AO crashes were quite different with the largest number and over-representation being single-vehicle crashes, and rear-end crashes being the most under-represented. (Note: as you go through the various difference, observe how ID skews the AO findings. This will be discussed in detail when we get to the ID attributes, but will not be repeated over and over here.)
    - C051-Number of Vehicles. Single vehicle crashes are under-represented with an odds ratio of about 63%. Multiple vehicle crashes above two vehicles are generally all over-represented. AO crashes showed single vehicles to be over-represented and two-vehicle crashes to be under-represented.

- C056-Number of Pedestrians. AD crashes are under-represented in pedestrian involvement. AO crashes were over-represented for all numbers of pedestrians involved.

- Time Characteristics
  - C003-Year. Year is of interest because it shows that AD crashes are increasing at very close to their non-AD counterparts. This is expected since the AD filter covers a large proportion of crashes in general. AD has a fairly stable proportion compared to total crashes, which indicates that any changes are due to changes in overall crashes in general. AO, on the other hand, shows a consistent, although small growth rate, which may indicate that reporting officers are getting more used to employing this code.
  - C004-Month. Patterns of over-representation were found in the wet months of February, March and April, as well as the hot months of June, July and August, indicating that weather could be a factor. See C030 for weather. AO crashes were significantly over-represented in May, June and July.
  - C008-Time of Day. The clear pattern is for AD crashes to be over-represented in the afternoon building up to the afternoon rush hours. This is quite reasonable, including some over-representation in the morning rush hours as well. The indication of cause is the traffic density. AO crashes were quite different, showing over-representations in most of the night-time hours (7 PM until 5 AM).
  - C029-Lighting Conditions. The results here are consistent and tend to reinforce those for C008 immediately above. AO had all of the darkness categories over-represented.
  - C006-Day of the Week. As would be suspected from the over-representations in the rush hours, weekdays tend to be over-represented (3 out of 5 significant), with Friday being the worst. The weekend days are expectedly under-represented in AD crashes. AO crashes were over-represented on Saturday and Sunday, and higher but slightly under-represented on Friday.
  - Day of the Week by Time of Day. No hasty conclusions should be drawn from the color coding of this cross-tabulation. Please see the discussion of this result after the cross-tabulation. AO crashes showed the classic over-representations on weekends that is found for alcohol and drugs.

- Driver Characteristics (Demographics and Behavior)
  - C020. Distracted Driving Officer's Opinion. Distracted driving is involved in only about 10.4% of aggressive driving crashes, as compared to 27.7% of all non-aggressive crashes. This is probably because the reporting officers in aggressive driving crashes consider other things of greater importance. Other distractions outside of the vehicle seem to be of greatest concern, and perhaps related to the presence of aggression.

- C107-CU Driver Raw Age Frequency Distribution. Significant over-representations in ages 16-28; over-representations continue until age 34, although not significant. This is above this age group's normally high frequency when compared to all other ages.
- C121. CU Driver Condition. The "Emotional (Depressed/Angry/Disturbed)" value is significantly over-represented with about 50% higher proportion than what would be expected. However, it is less than half of a percent of the total crashes in the AD subset. It is out-numbered by Asleep/Fainted/Fatigued and Under the Influence of Alcohol/Drugs, even though these two values are very significantly under-represented. Contrasted with this, the over-representation of Emotional category was close to 15 times that expected for AO, yet with less than 4% of the total AO crashes.
- C122-CU Driver Officer's Opinion Alcohol. While the number of cases is fairly high (5498), the involvement of alcohol is significantly under-represented (48.5% of expected). Thus, it can be concluded that alcohol is not a major causative factor in AD involved crashes. Contrasted with this, AO cases had close to four times their expected number of positives for alcohol, which tends to explain most of the other differences. In other words, officers would tend to see multiple violations in the case of impaired driving and would then select the Aggressive Operation indicator, with possibly little or no actual evidence of the driver being aggressive.
- C123-CU Driver Officer's Opinion Drugs. Although the number of positives here is well under half of that of alcohol, the remaining information from this attribute is quite comparable to that for alcohol. For AO, drugs were indicated over 6 times what would be expected for non-AO. The reasons here are quite the same as given for alcohol in the previous item.
- C213. CU Vehicle Usage. Overwhelmingly personal, with the over-represented times indicating that the major personal usage is in commuting.
- C104-CU Left the Scene. An over-representation might be expected of AD drivers. While such was found, it was a very small (although significant) relative difference from the non-AD drivers. Thus, leaving the scene is not concluded to be a major factor with AD. It was with AO, where there was about 4 times the expected proportion of left-the-scene crashes.
- C109-CU Driver Gender. While males are significantly over-represented in their proportion of aggressive driving crashes, we would suspect most traffic safety professionals will be surprise at how very small the difference is between their AD vs. their non-AD proportions. For example, the over-representation in the proportion of AD to non-AD for males is less than 1% (0.7%, or 1.007 times that of non-AD). However, this picture changes dramatically when we just look at fatal crashes – see the cross-tabulation discussed after this variable. AO crashes follow the ID pattern of the proportion of males being over-represented by over 30%.

- Driver Gender by Severity. Consistently with AO, this indicated a dramatic over-representation of male aggressive driving fatal crashes, which indicates that female aggressive driving is quite different from male aggressive driving. This is considered in more detail in the next item.
- Male vs. Female Characteristics (AD comparisons only). The following were the key items of difference between male driver AD crashes and the AD crashes where females were driving:
  - AD male drivers were dramatically over-represented driving pick-ups by an odds ratio of 4.5 times what would be expected. There seems to be a strong correlation between males driving pick-ups and AD.
  - In cars, males get more aggressive in two-door models (odds ratio 2.0) than their female counterparts.
  - Males tend to be driving older vehicles than female AD drivers.
  - Male AD drivers are over-represented in Speed & Driving Too Fast for Conditions, DUI, and Improper Passing. Speed at impact is dramatically higher.
  - Locale is over-represented in open country and rural areas; about 25-30% higher than female.
  - The male driver AD crash has a First Harmful Event over twice as likely to be a rollover than that of female AD drivers.
  - Most all of the differences listed above are heavily related to increased speed at impact.
  - Failure to use seatbelts for men is about twice that of women, which further explains the relatively higher number of fatal crashes.

- Severity Characteristics
  - C025-Crash Severity. There can be no doubt that both AD and AO crashes result in relatively more deaths and incapacitating injuries than do non-AD crashes. The fatality probability is 32.8% higher for AD crashes than for non-AD, resulting in an increase of 453 fatal crashes over the five year period. See the next item for speed at impact.
  - C224. Estimated Speed at Impact. This result confirms the speculation that impact speeds for AD (and AO) crashes are significantly higher, on average, than their non-AD (non-AO) counterparts. Especially high over-representations occur at most speeds above 71 MPH.
  - C227-CU Vehicle Towed. With the results given above, it would be expected that the proportion towed would be much higher. A quick cross-tabulation determined that the large number not towed were coming from the 102,359 following too close (rear end) crashes, of which 74% were not towed. For AO the over-representation because of disabled vehicle was about 40% higher, and it was close to three times being towed for other reasons (e.g., driver inebriated).
  - C060-Number Killed. Single fatality crashes were significantly under-represented, while all multiple fatality crashes were over-represented. This is highly correlated to the increased speed proportion. For AO, all of the fatal categories

were over-represented, with one and two fatalities being about 5 and 7 times their expectations, respectively,

- C058-Number Injured (Non-Fatal). Multiple injuries followed the same pattern as multiple fatalities; all but none of the multiple injury cases were significantly over-represented. AO were quite different with both single and multiple injury cases being significantly over-represented.
- C036-Adjusted EMS Arrival Delay. All times over 15 minutes are over-represented and of the six values, only two of them are not significant in their over-representations. This is probably due to the geographical distribution, which will be considered next.

- Geographical Characteristics
  - C010-Rural or Urban. AD crashes are significantly over-represented on rural roads, which probably explains the ambulance delay time findings. It also explains some of the higher speed conclusions.
  - C031-Locale. Shopping or Business is the overwhelming local in which AD crashes occur, followed by Open Country and Manufacturing or Industrial. All of the rest are under-represented. AO were over-represented in Residential and Open Country as opposed to Shopping or Business, which was under-represented.
  - C011-Highway Classification. AD crashes are over-represented on Interstate and Federal roads, but not on any of the others. While all of the differences are significant, the largest differences are in the Interstates, with about 38% higher proportion than expected, and Municipal with about 8% lower proportion than expected in comparison with the non-AD crashes. AO had their greatest over-representation on country roads, with municipal and Interstate roadways significantly over-represented as well.
  - C110-Driver Residence Distance. It appears that drivers have more of a tendency toward AD when they are further away from home. The opposite is true with AO, which was significantly over-represented in Less than 25 Miles.
  - C001-County Over-Represented. It seems clear that there are certain counties that are over-represented in AD crashes. Further analyses was required to determine the common characteristics that would contribute to this tendency. The results of that analysis is given in the next item.
  - Seven Highest Max-Gain Counties (AD comparisons only). This special IMPACT runs were performed to begin to answer the question "What is it about these seven counties that distinguish them from the others?" The following is a summary of those differences:
    - AD crashes were highly over-represented on the municipal roadways in these counties.
    - Urban areas were over-represented as well as "less than 25 miles from home" in these counties.
    - Intersections and collisions with vehicles in traffic and other characteristics that correlate with urban driving, including shorter EMS arrival times.

        - Typical urban primary contributing circumstances were found: following too close, improper lane changes, running traffic signals, and failure to yield.
        - Age seemed to be the largest disparity in AD driver demographics. Ages 16-23 were significantly over-represented in the bad counties, reflecting the overall comparison given for C107. All other ages were either under-represented of not significantly over-represented.
        - Females were over-represented in the bad county AD crashes by a very small but significant 1% (odds ratio: 1.022).
        - More driving close to home was being done for the AD crashes in the bad counties (71.6%) as opposed to the comparison (67.1%) probably reflecting the gender differences.
        - Unemployment of involved drivers was higher in the bad AD counties; it was 15.1% in the bad counties and 11.2% for the others, a significant difference.
        - Alcohol impairment was significantly higher in the bad AD counties, at a proportion about 32% higher than in the comparison counties. It was effectively the same in the proportion comparison for drug impairment, although, as usual the numbers for drug impairments were considerably smaller. In the AD bad counties, AD drivers had about 5,512 cases of Alcohol impairment, while the number impaired by drugs was just 1928.
        - Most of the other attributes that were over-represented in this comparison were also those over-represented in the AD vs. non-AD comparison.

- Vehicle Characteristics
    - C101. CU Vehicle Type. The most over-represented AD vehicles tend to be passenger cars and motorcycles. The most under-represented are pick-ups, SUVs, trucks and mini-vans.
    - C208-CU Model Year. The later model years are relatively under-represented in AD crashes.

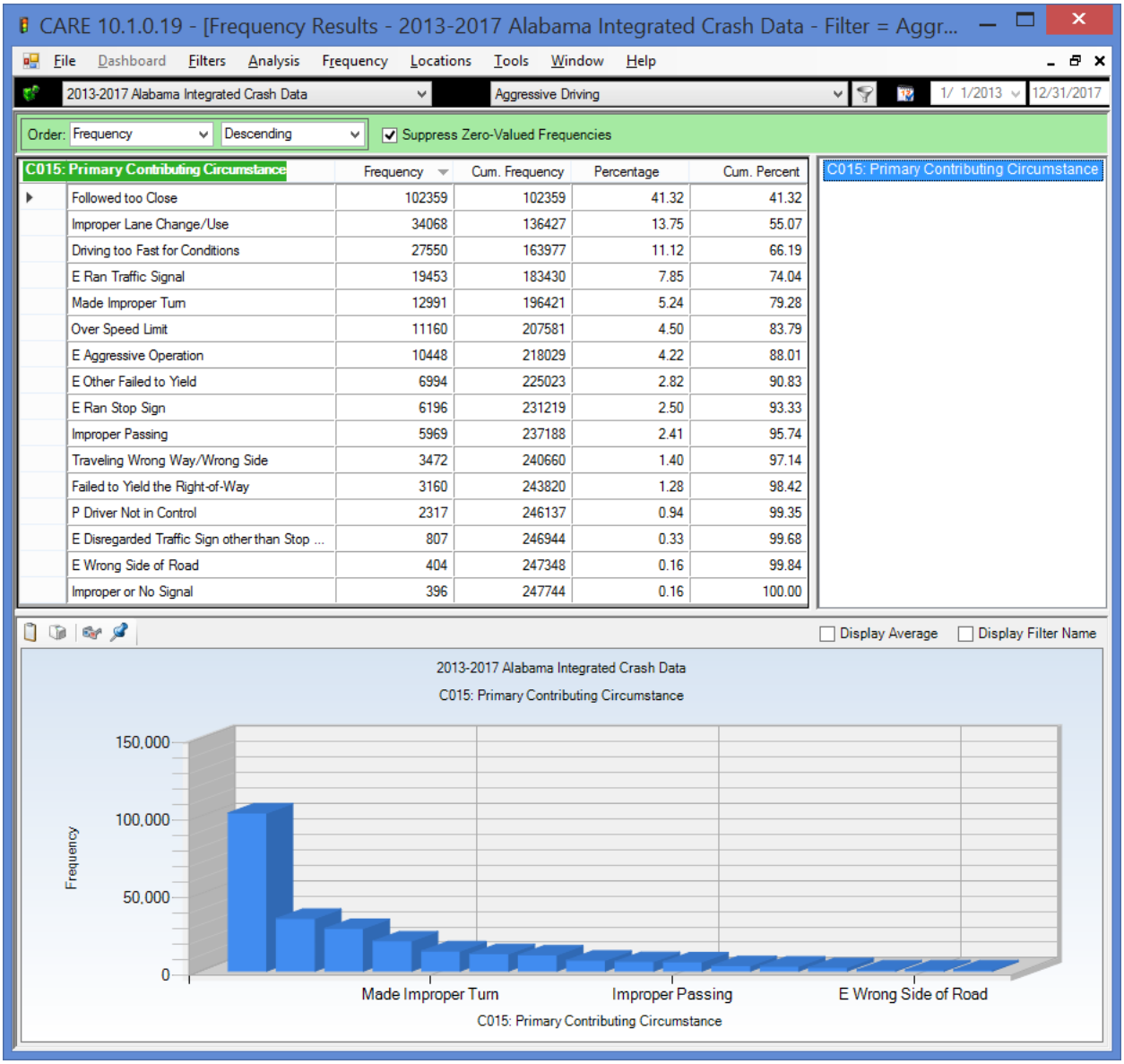
- Roadway Environment/Pavement Characteristics
    - C412-Traffic Lanes. Generally, greater the number of lanes, the greater the relative inclination toward AD, while AO crashes were highly concentrated on two-lane roadways.
    - C408-CU Vision Obscured by. Vision obscurities that arise to the highest criticality seem to be items that might catch the AD driver by surprise, especially weather and the sun. See the next item for weather considerations.
    - C030-Weather. AD crashes are over-represented by almost 60% greater proportion than expected when in rain. The question remains as to whether the rain causes the aggressive driving or whether those who are driving aggressively fail to slow down for the rain. For AO, clear weather was over-represented and rain was significantly under-represented.

- C403-CU Roadway Condition. There is almost a 40% higher proportion than expected of wet-pavement crashes, which confirms the rain finding above for AD.
- C022-Type of Roadway Junction. Four-Way Intersection had the highest max gain, being over three times the second tier, which included Bridge Overpass/Underpass, and Entrance or Exit Ramp. Four-Way Intersections were significantly under-represented for AO.
- C027-At Intersection. While a significant over-representation was found at intersections, it was quite small. Intersections were under-represented for AO.
- C407-CU Roadway Curvature and Grade. Crashes on downgrades are expected when AD drivers are distracted by aggressiveness and do not realize that the braking distance may have increased by a factor of 2 or 3 compared to level roadway. Similarly, all of the curve categories were over-represented.
- C409-CU Traffic Control. Traffic Signals, Yield Signs and Lane Control Device were all significantly over-represented, with Traffic Signals having an order of magnitude greater max gain.
- C415-Workzone Related. AD crashes are under-represented in workzones, their having 92.5% of their crashes there as opposed to 93.0% for non-AD crashes. Large construction projects are clearly the greatest problem in both the absolute and the relative sense.

The following sections present the IMPACT displays from which the above summary conclusions were drawn. Traffic safety professionals who are involved with aggressive driving and/or aggressive operation countermeasures are urged to consider each of the IMPACT outputs carefully, and if there are any questions, please contact Dr. David Brown at brown@cs.ua.edu.

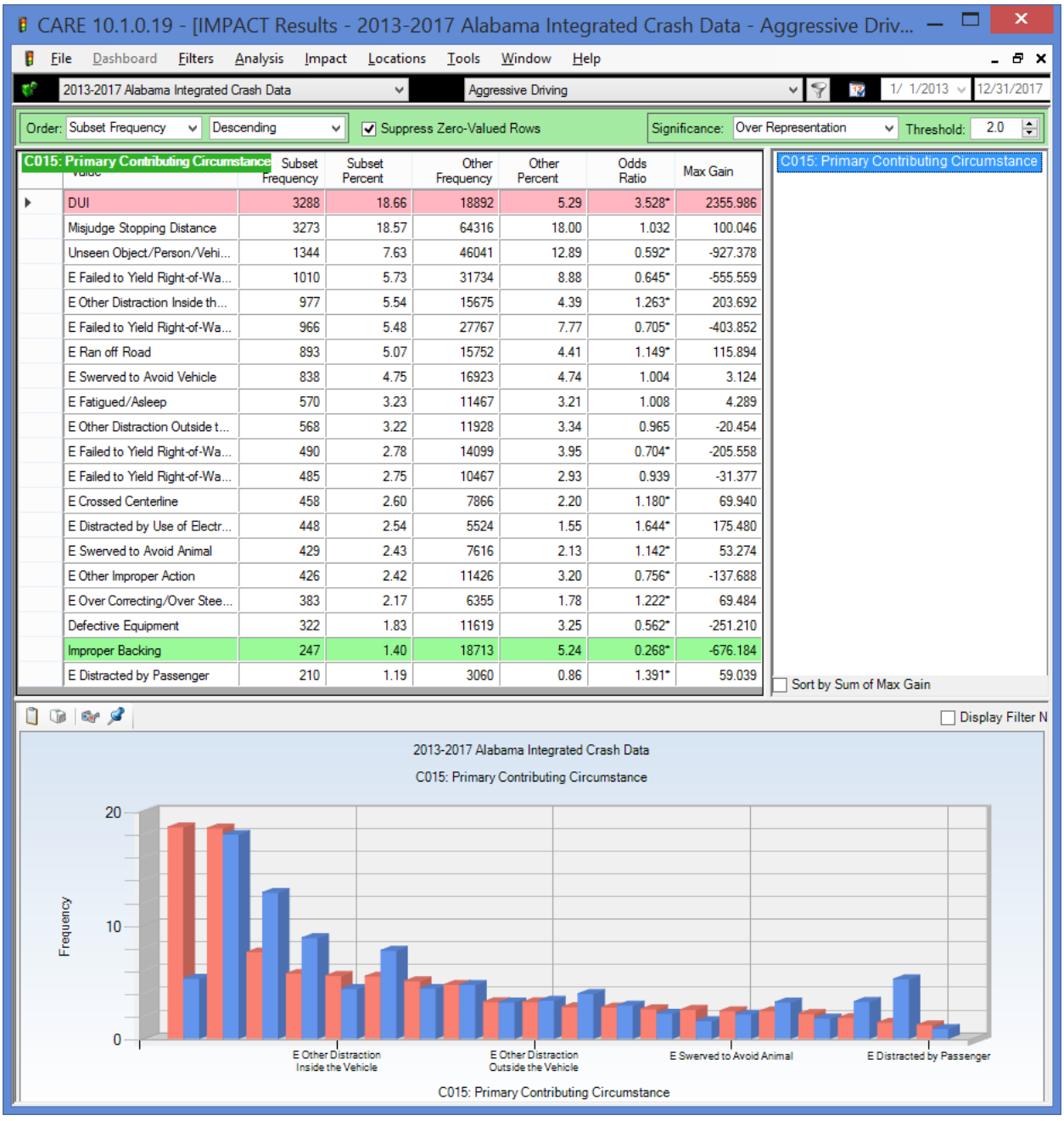
Crash Characteristics

C015 Primary Contributing Circumstance – Ordered by Frequency



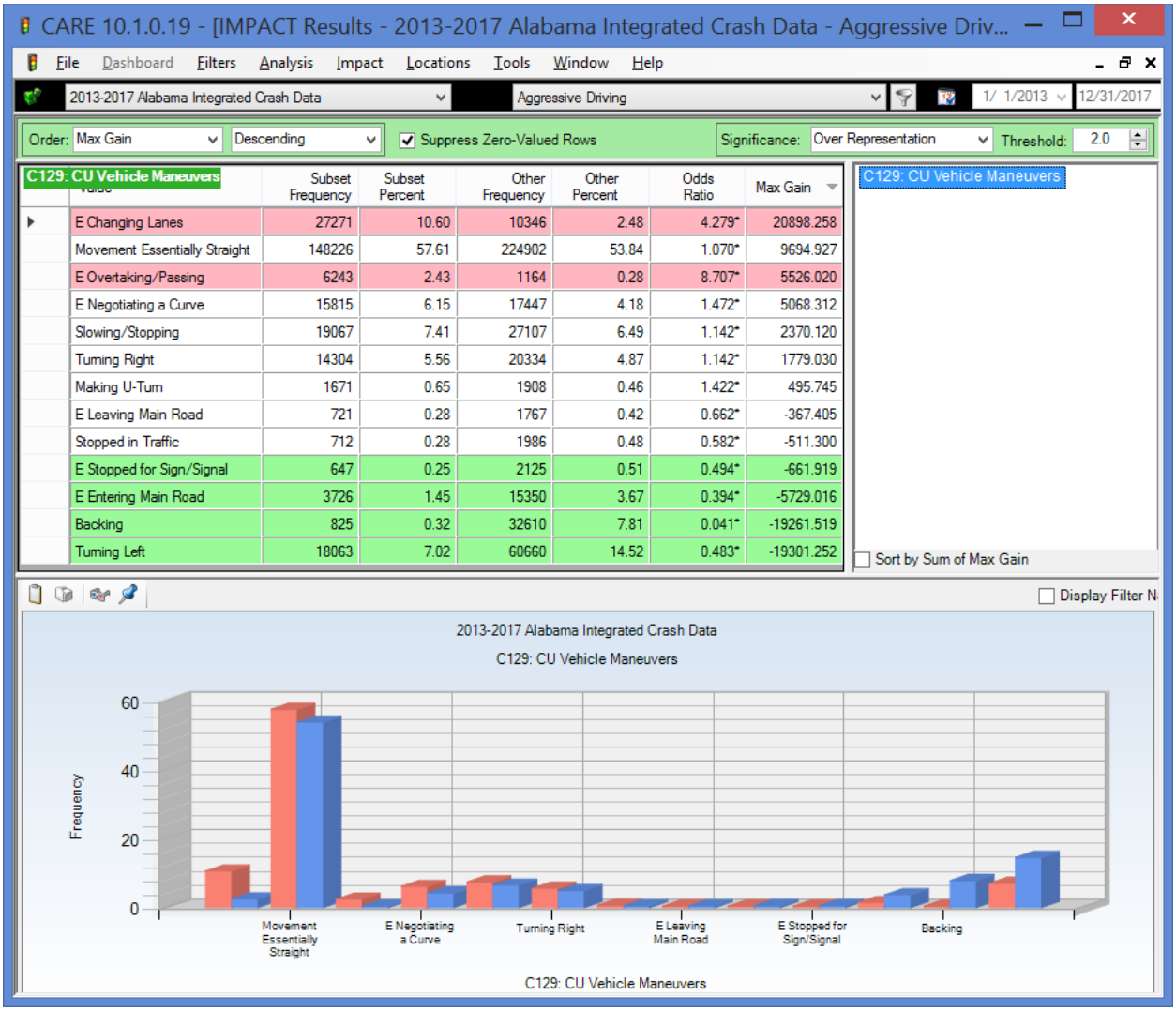
C015 Primary Contributing Circumstance – Most Correlated

The following are the PCCs that were not indicated as AD items for C015, but that came out anyway in C015 because AD was indicated in either C202 or C542. In other words, these would be C015 PCCs that are correlated with AD indicated by the other CC variables. In the display below they are being compared with the same values for non-AD.

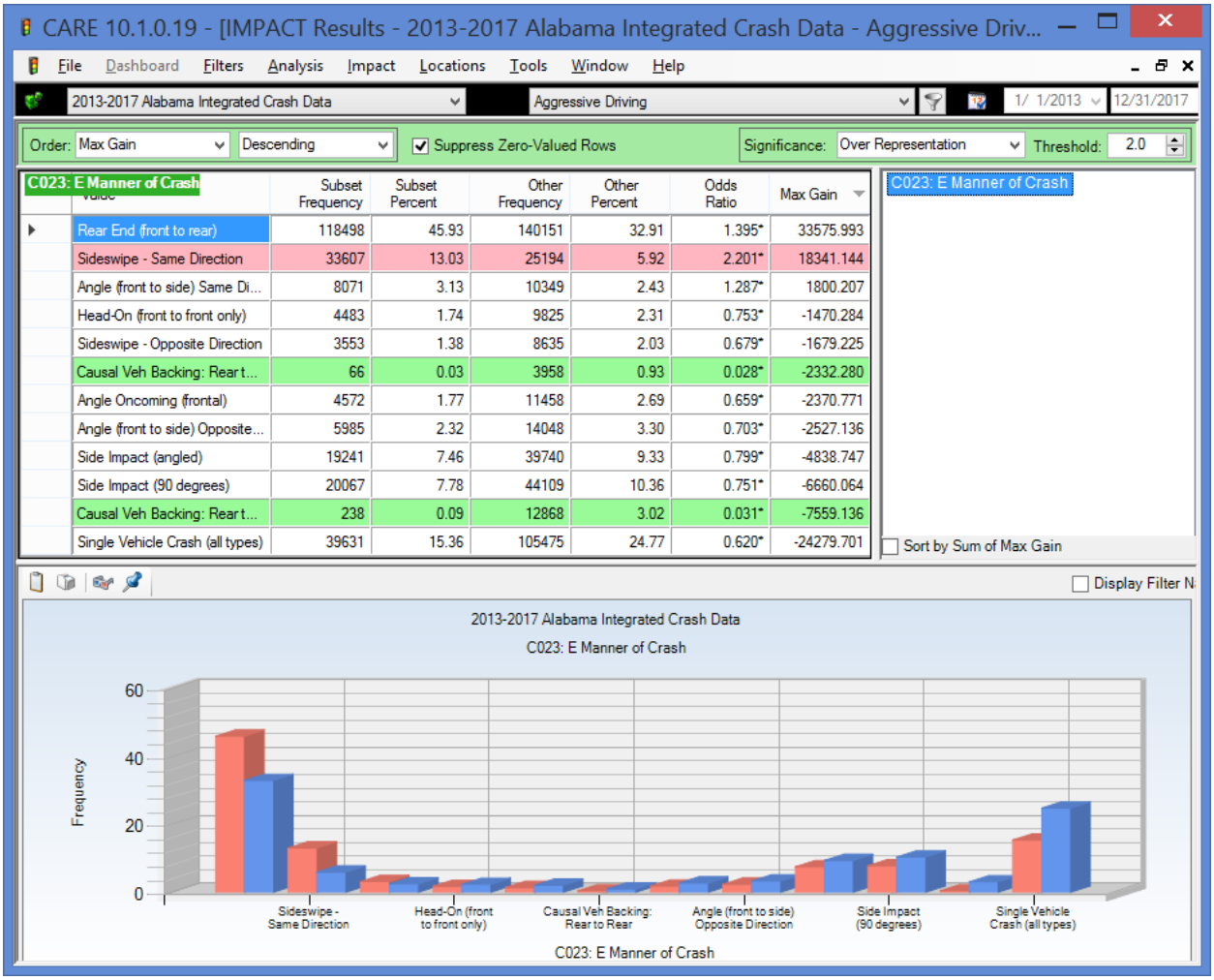


Items with less than 200 occurrences have been pruned out of the output above. The resulting items give an indication of what other circumstances are commonly associated with AD in C015 when an AD value is chosen in one of the other contributing circumstance attributes (C202 or C542).

C129 CU Vehicle Maneuvers

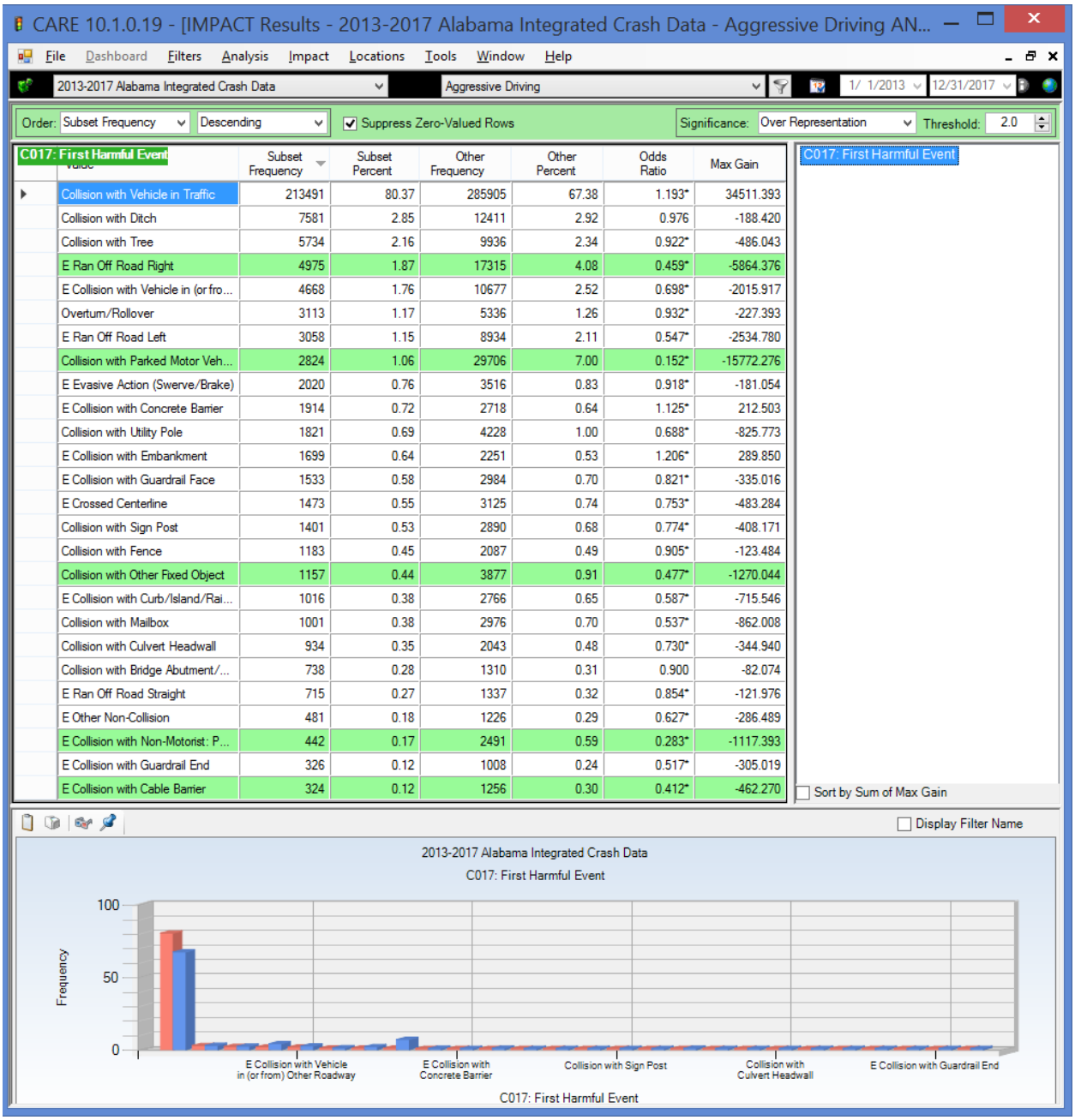


C023 Manner of Crash



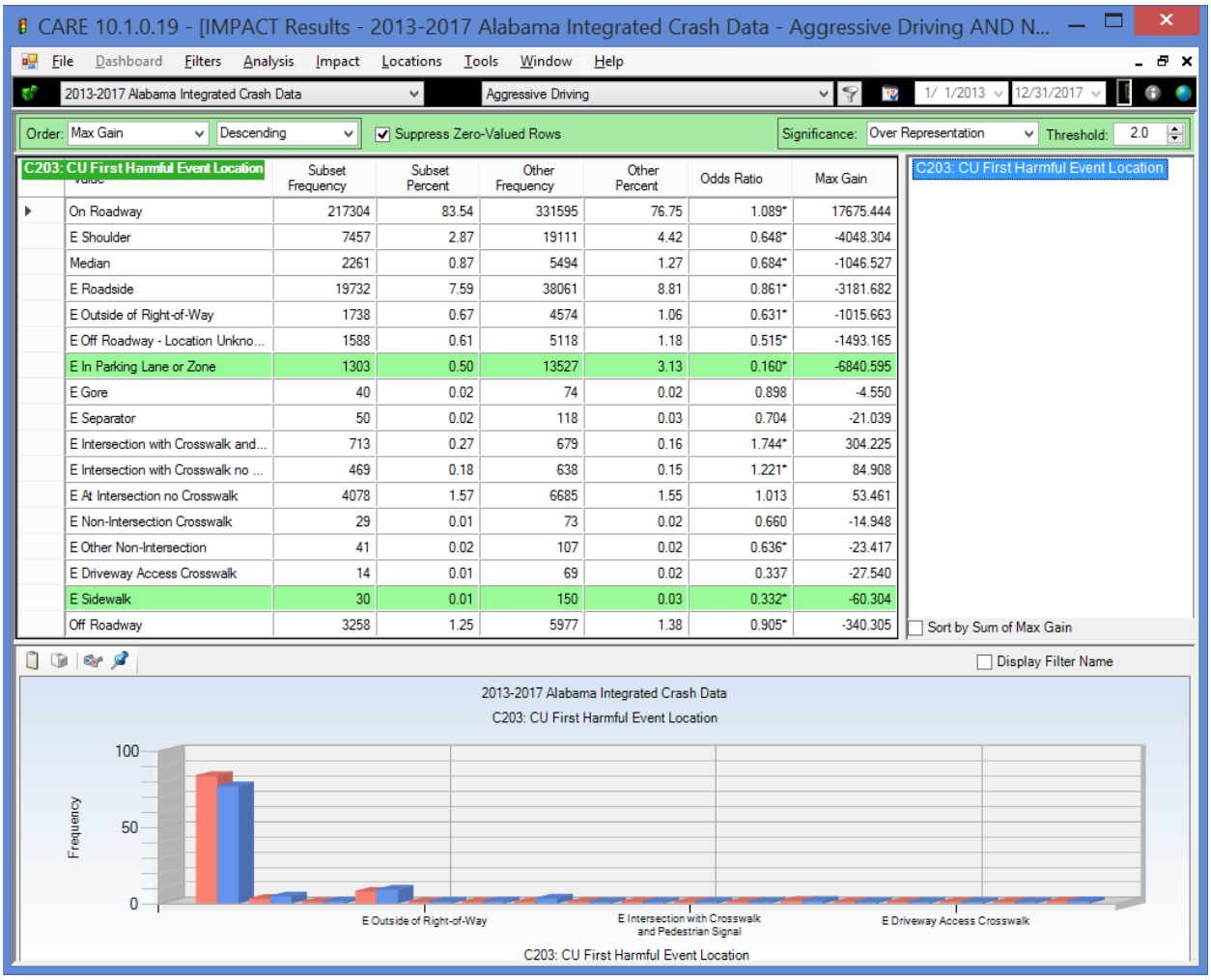
AD crashes are over-represented in Rear End (1.395 times expected), Sideswipe – Same Direction (2.201), and Angle (front to side) Same Direction (1.201).

C017 First Harmful Event – All Items with 300 or More Occurrences



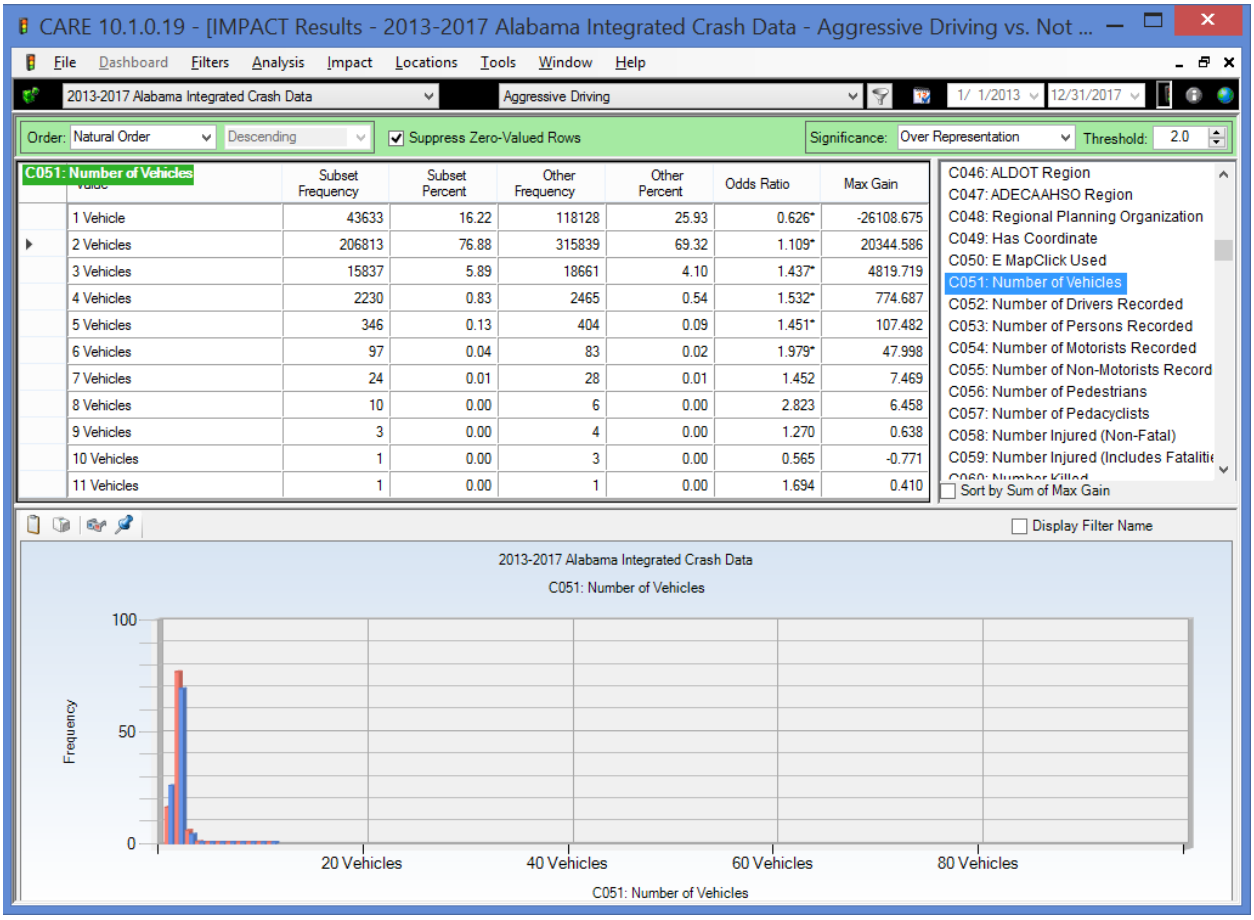
Ordered by AD frequency, notice that only three items are over-represented. The top one is Collision with Vehicle in Traffic, which would be most 2-vehicle crashes. The only single vehicle crashes that are over-represented are: Collision with a Concrete Barrier (e.g., a NJ lane divider) and Collision with Embankment. See C051 next.

C203 CU First Harmful Location



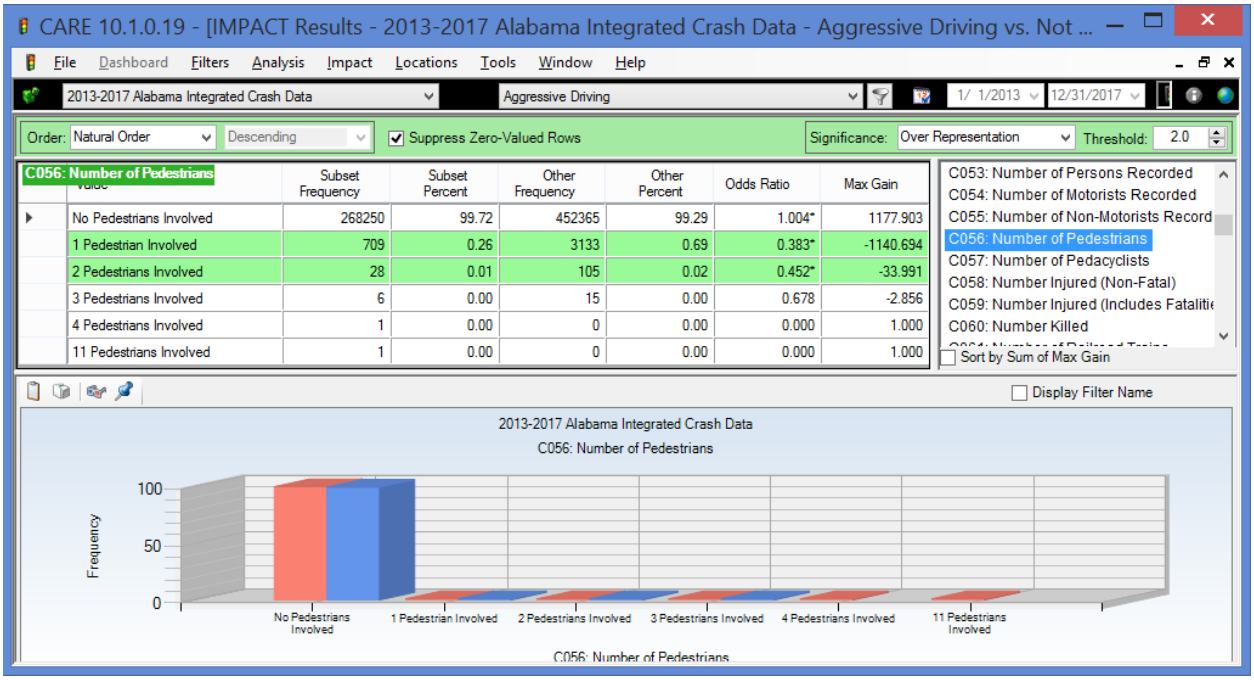
These results support the findings of the two attributes given above. Of new concern might be the potential problem with pedestrian not at crosswalks. However, see the next attribute.

C051 Number of Vehicles



This attribute explains many of the other attributes. It demonstrates that AD is dramatically under-represented in single-vehicle crashes (only 62.6% of the proportion expected. Multiple vehicle crashes are for the most part all over-represented. This indicates that aggressive drivers tend to have a negative impact on other drivers as opposed to just themselves. As a rough comparison, ID/DUI crashes tend to be highly over-represented in single vehicle crashes.

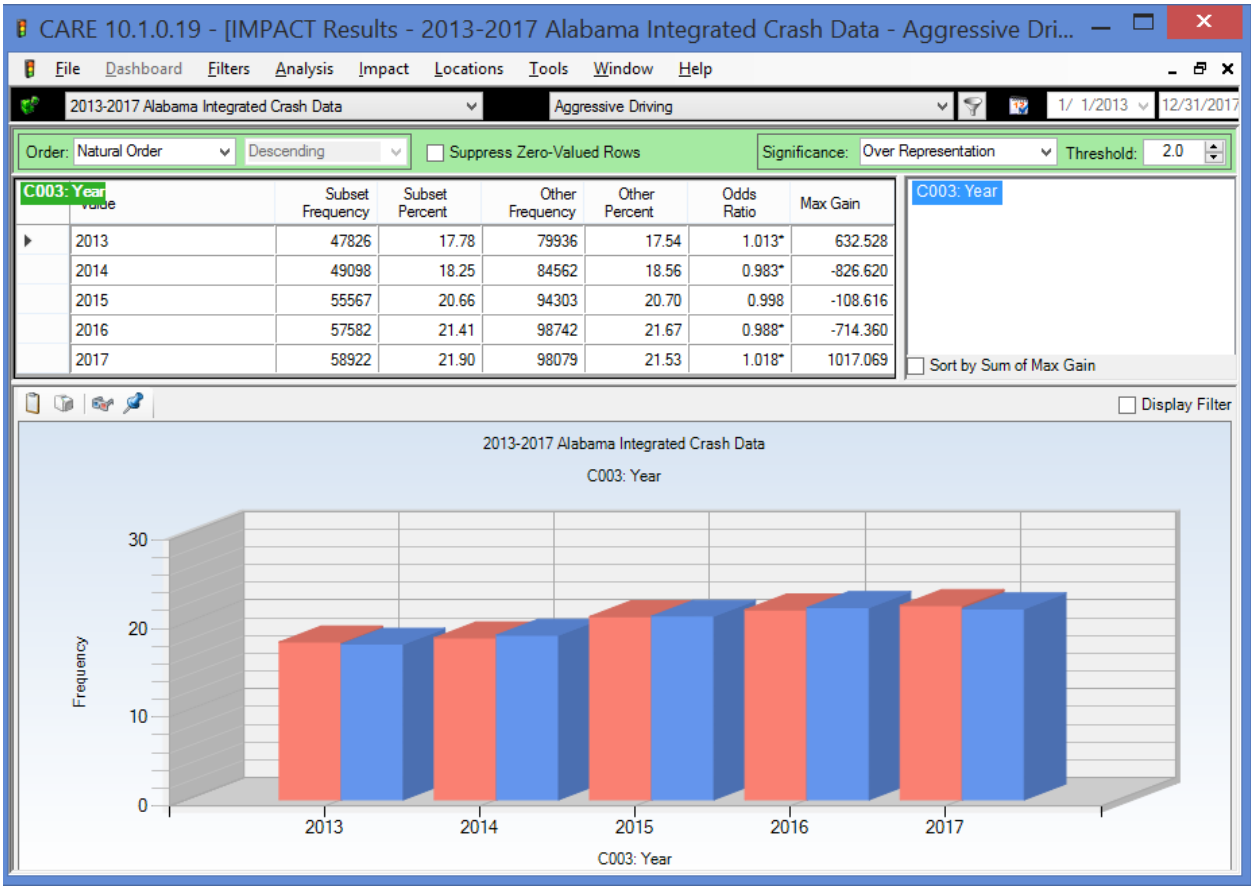
C056 Number of Pedestrians



AD crashes are under-represented in pedestrian involvement.

Time Characteristics

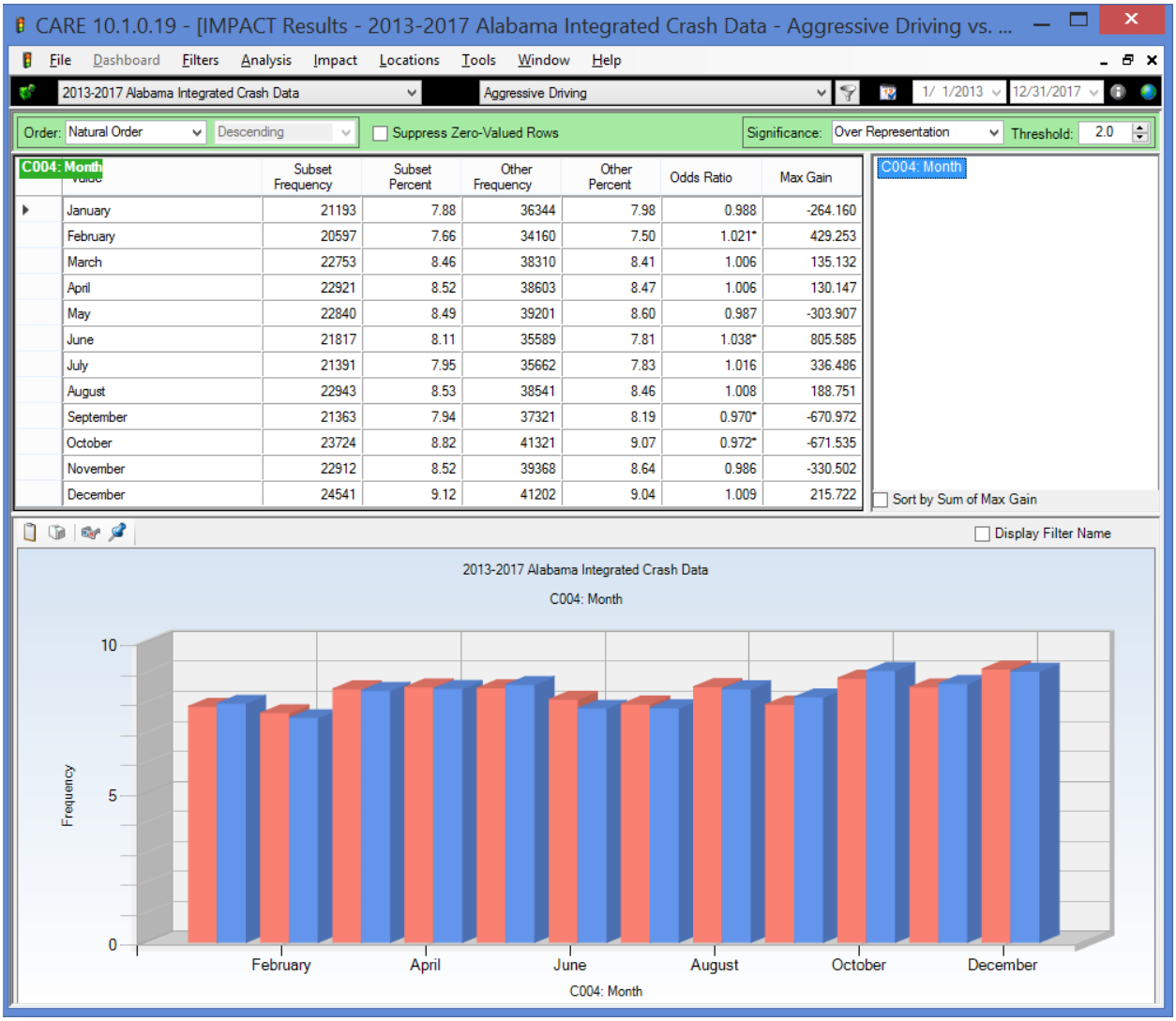
C003 Year



The growth of AD crashes over 5 years is a very significant 23.20%. However, this must be compared to the growth in nonAD crashes over 5 years, which was 22.70%. The following table gives the proportion of crashes that were AD and AO to total crashes, and this shows very little change from year to year, and thus we conclude that the grown in both AD and AO crashes is related to increased driving in general.

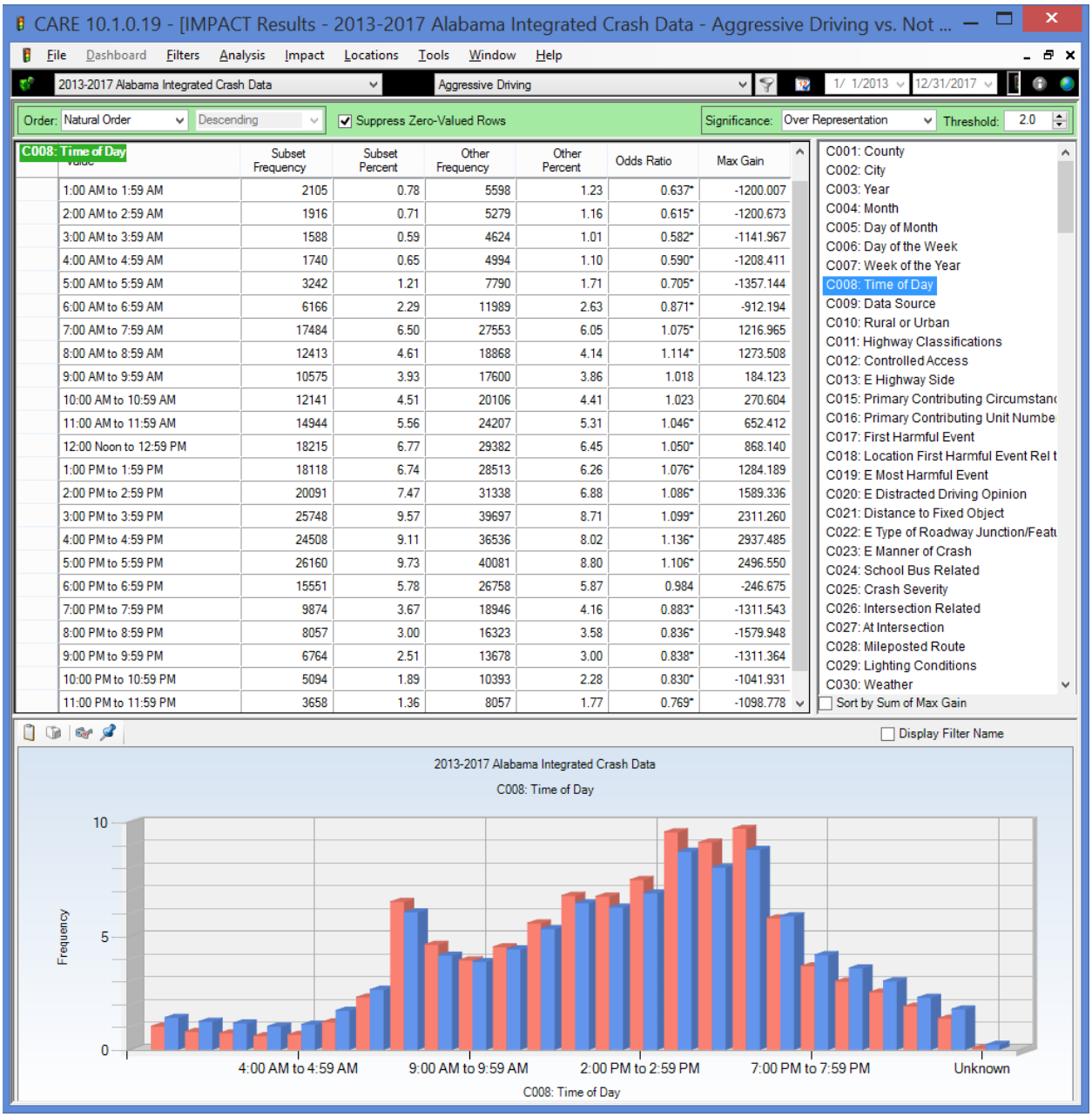
Year	% AD	%AO
2013	37.43%	1.53%
2014	36.73%	1.62%
2015	37.08%	1.61%
2016	36.84%	1.78%
2017	37.53%	1.81%
Average	**37.12%**	**1.67%**

C004 Month



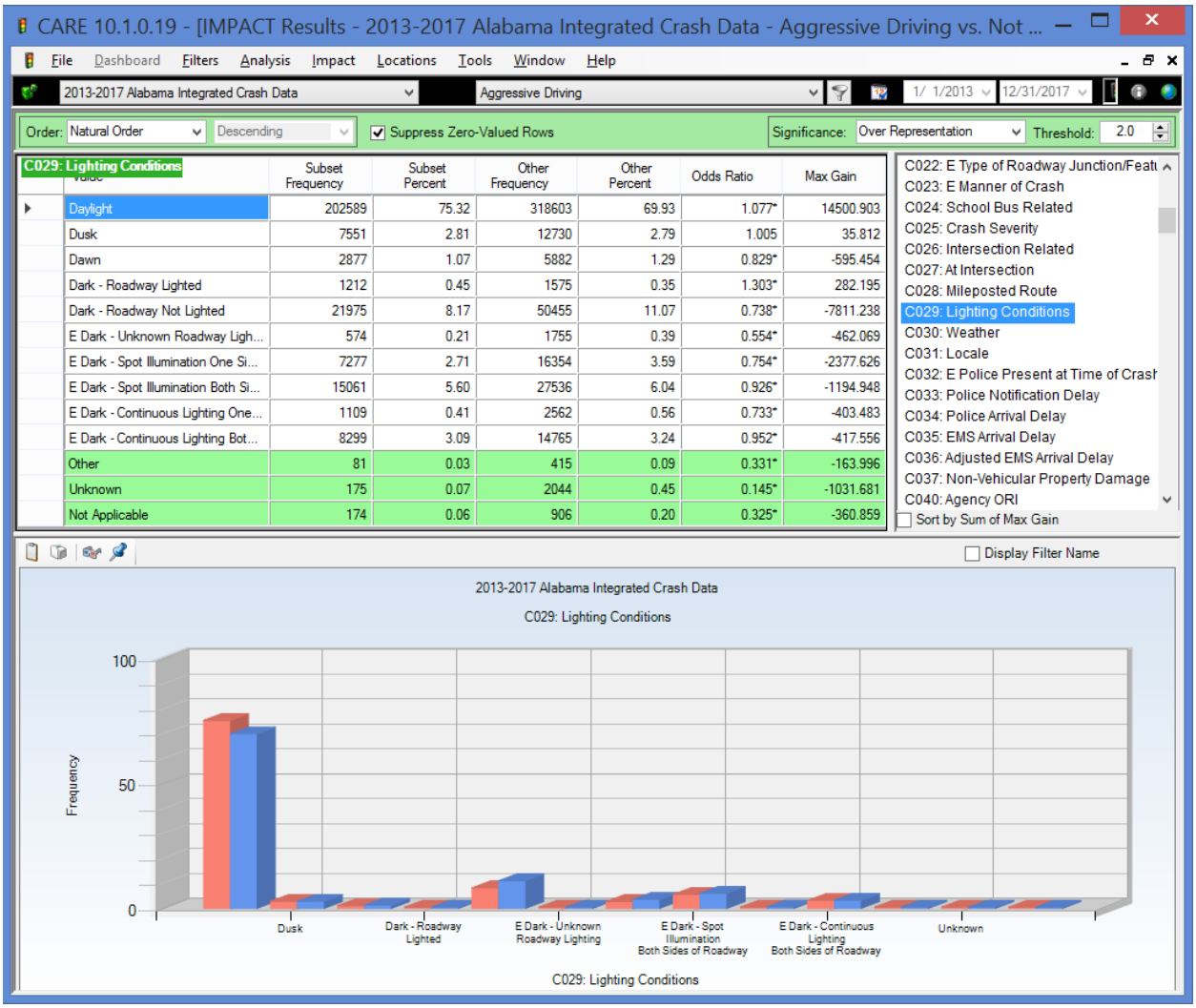
The above shows the possibility of weather affecting aggressive attitudes. The three summer months of June, July and August are all over-represented, which could point to heat as the source. February, March and April are over-represented, which could point to the presence of rain as a cause. See C030 below for direct effects of weather.

C008 Time of Day



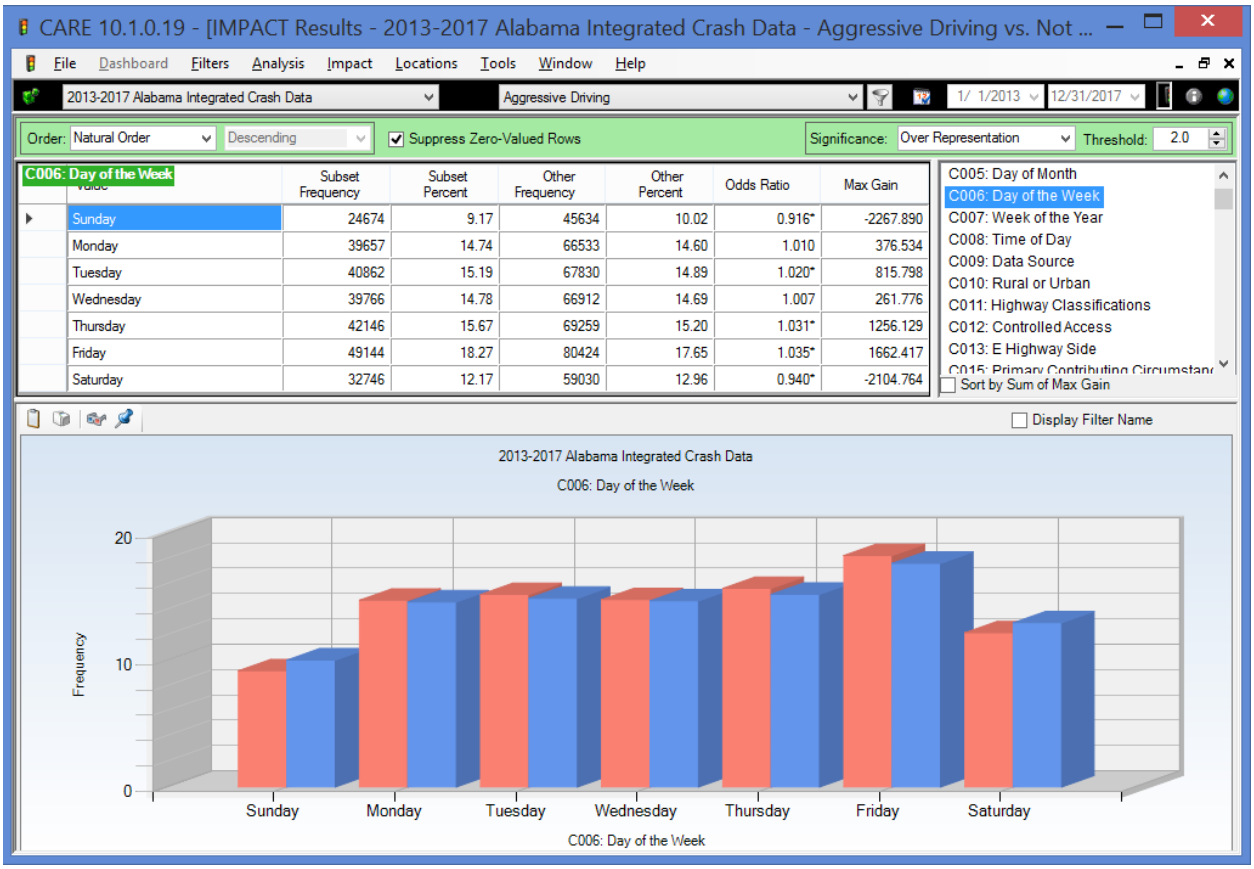
The clear pattern is for AD crashes to be over-represented in the afternoon building up to the afternoon rush hours. This is quite reasonable, including some over-representation in the morning rush hours as well.

C029 Lighting Conditions



Reinforcing the conclusions above, the daylight times are over-represented.

C006 Day of the Week



As would be suspected from the over-representations in the rush hours, weekdays tend to be over-represented (3 out of 5 significant), with Friday being the worst. The weekend days are expectedly under-represented in AD crashes.

Day of the Week by Time of Day

CARE 10.1.0.19 - [Crosstab Results - 2013-2017 Alabama Integrated Crash Data - Filter = Aggressive ...

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2013-2017 Alabama Integrated Crash Data | Aggressive Driving | 1/ 1/2013 | 12/31/2017

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	714	258	226	253	265	316	695	2727
1:00 AM to 1:59 AM	575	182	151	179	202	271	545	2105
2:00 AM to 2:59 AM	550	153	137	142	162	250	522	1916
3:00 AM to 3:59 AM	442	138	126	145	125	184	428	1588
4:00 AM to 4:59 AM	337	198	204	202	203	231	365	1740
5:00 AM to 5:59 AM	329	518	500	471	491	529	404	3242
6:00 AM to 6:59 AM	357	1034	1113	1048	1029	1062	523	6166
7:00 AM to 7:59 AM	458	3213	3448	3451	3267	2876	771	17484
8:00 AM to 8:59 AM	536	2192	2311	2291	2099	2027	957	12413
9:00 AM to 9:59 AM	816	1651	1739	1658	1693	1651	1367	10575
10:00 AM to 10:59 AM	1127	1726	1855	1727	1834	2050	1822	12141
11:00 AM to 11:59 AM	1337	2252	2162	2164	2285	2646	2098	14944
12:00 Noon to 12:59 PM	1727	2642	2723	2625	2731	3377	2390	18215
1:00 PM to 1:59 PM	2026	2569	2585	2463	2691	3335	2449	18118
2:00 PM to 2:59 PM	2088	3058	2869	2746	2955	3779	2596	20091
3:00 PM to 3:59 PM	1935	4090	3972	3853	4226	5371	2301	25748
4:00 PM to 4:59 PM	1836	3673	3908	3700	4147	5018	2226	24508
5:00 PM to 5:59 PM	1844	4187	4491	4337	4585	4574	2142	26160
6:00 PM to 6:59 PM	1575	2049	2351	2258	2422	2968	1928	15551
7:00 PM to 7:59 PM	1219	1242	1206	1270	1463	1898	1576	9874
8:00 PM to 8:59 PM	1022	982	1032	1088	1139	1404	1390	8057
9:00 PM to 9:59 PM	817	800	802	802	937	1363	1243	6764
10:00 PM to 10:59 PM	595	490	587	536	731	1070	1085	5094
11:00 PM to 11:59 PM	392	347	347	341	453	878	900	3658
Unknown	20	13	17	16	11	16	23	116
TOTAL	24674	39657	40862	39766	42146	49144	32746	268995

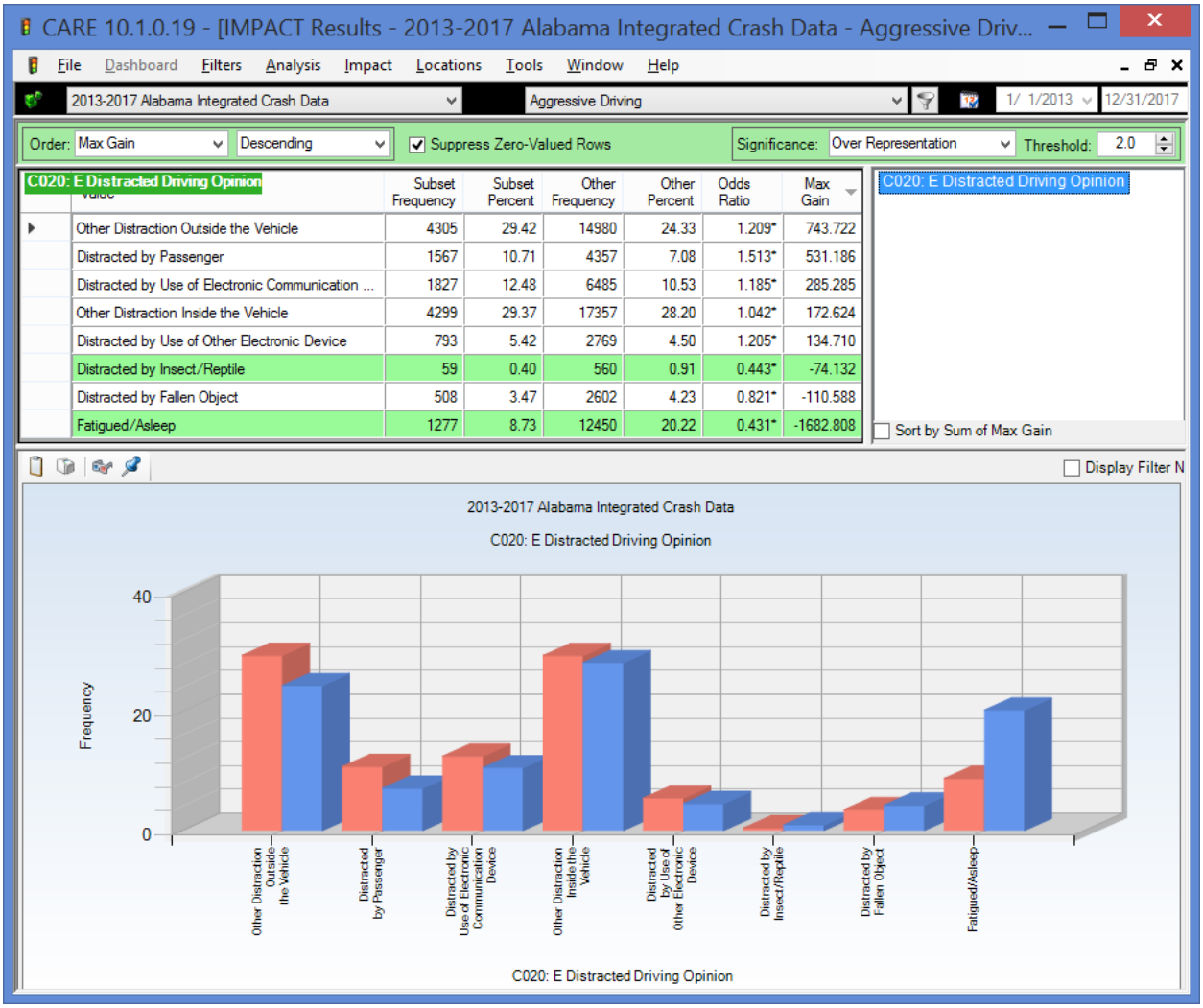
The largest hourly numbers are during the weekdays rush hours. They are generally not shown in red since no one of them is significantly higher than. Interesting symmetry not observed in any other such cross-tab. The 7 PM to 5 AM continuum on Saturday night going into Sunday

morning is significantly over-represented. There is a temptation to say that the same thing occurs Sunday night going into Monday, but Monday morning is not over-represented. The symmetrical over-representation in the upper right corner is Saturday morning, not Monday. What the colors do not reveal (and may even conceal) is the very high numbers on Friday night. The reason that these high numbers are not shown in red background is that the other numbers on Friday are so high, and thus, their percentages are low compared to Saturday and Sunday. We have to realize that Sunday night is red for the same reason – note that the numbers on Sunday night are relatively low in general, but the proportions for that day are well above the overall proportions for those hours. Summary: in interpreting this cross-tab, be sure to look at the actual numbers and recognize that the color background is relative, i.e., it is set by comparing the proportion for that time slot for that day against the overall proportion for that time slot for all days.

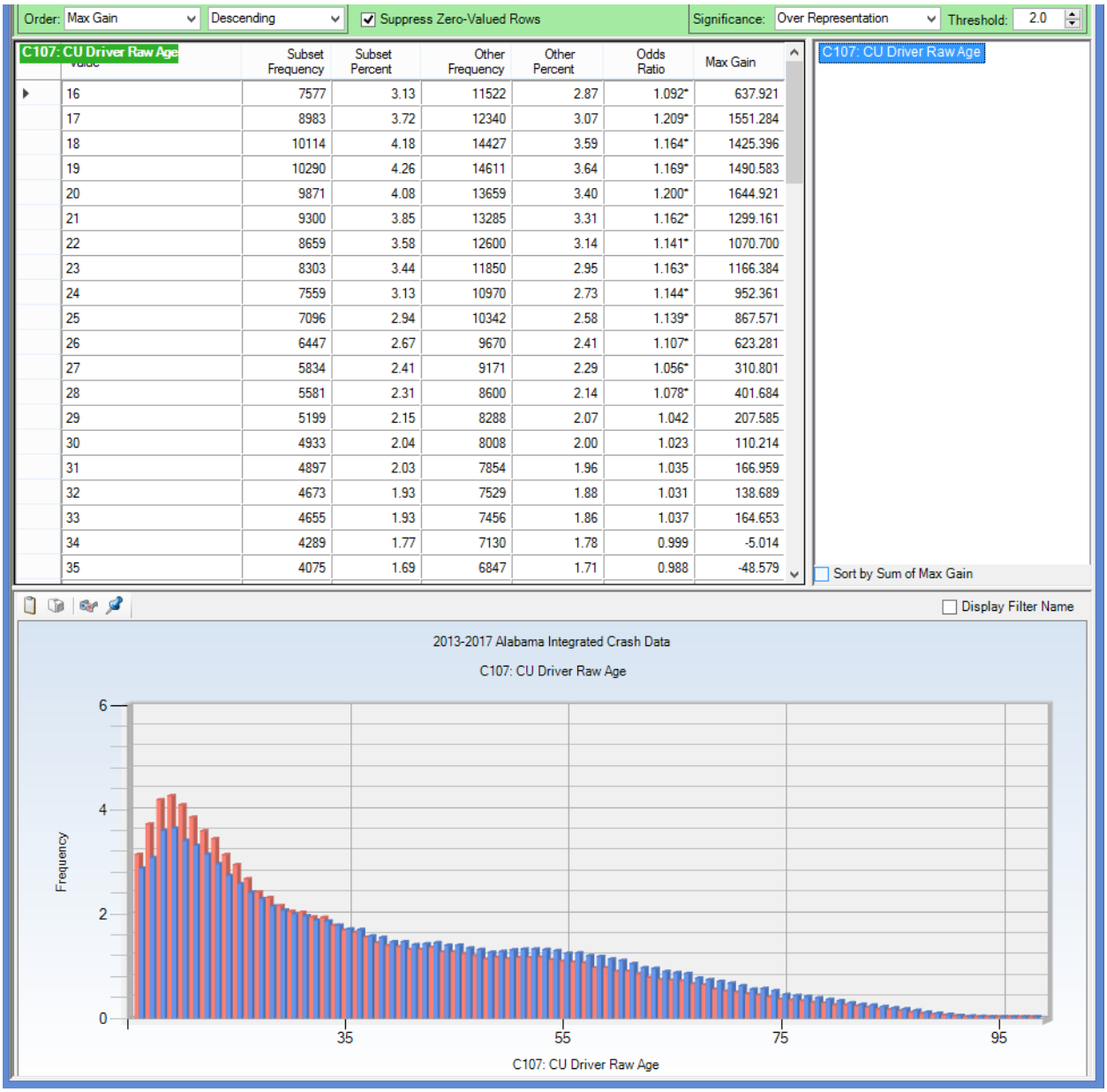
Driver Characteristics (Demographics and Behavior)

C020 E Distracted Driving Opinion

Distracted driving accounts for only about 10.4% of aggressive driving crashes, as compared to 27.7% of all non-aggressive crashes. This is probably because the reporting officers in aggressive driving crashes consider other things of greater importance. However, the possibility that aggressive drivers tend to be distracted by things other than their aggression should not be marginalized. The IMPACT below was run suppressing the cases where distracted driving was not a factor in both the aggressive and non-aggressive situations. Thus the comparisons are in the proportions where there was a report of distracted driving. Other distractions outside of the vehicle seem to be of greatest concern, and perhaps related to the presence of aggression.

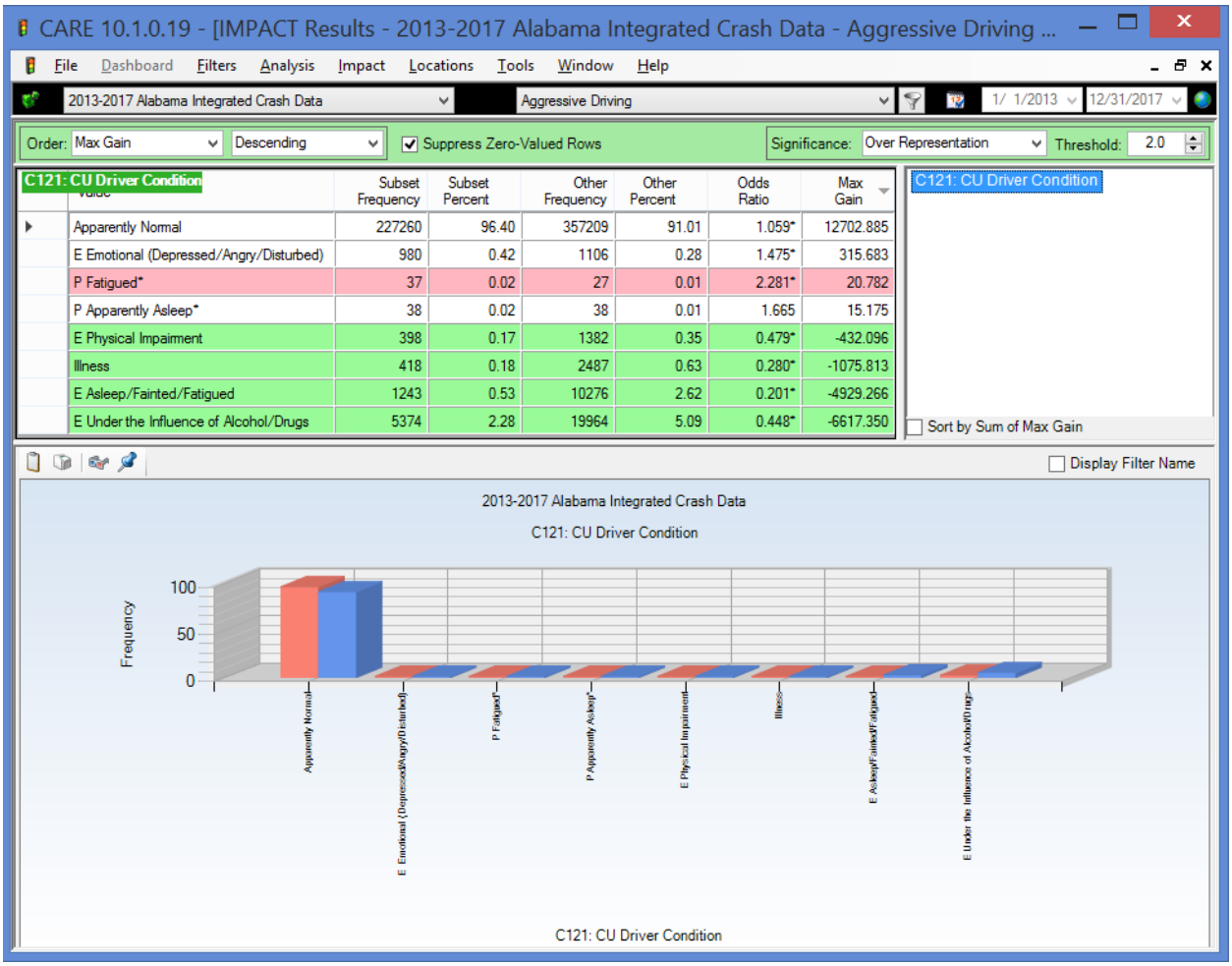


C107 CU Driver Raw Age Frequency Distribution



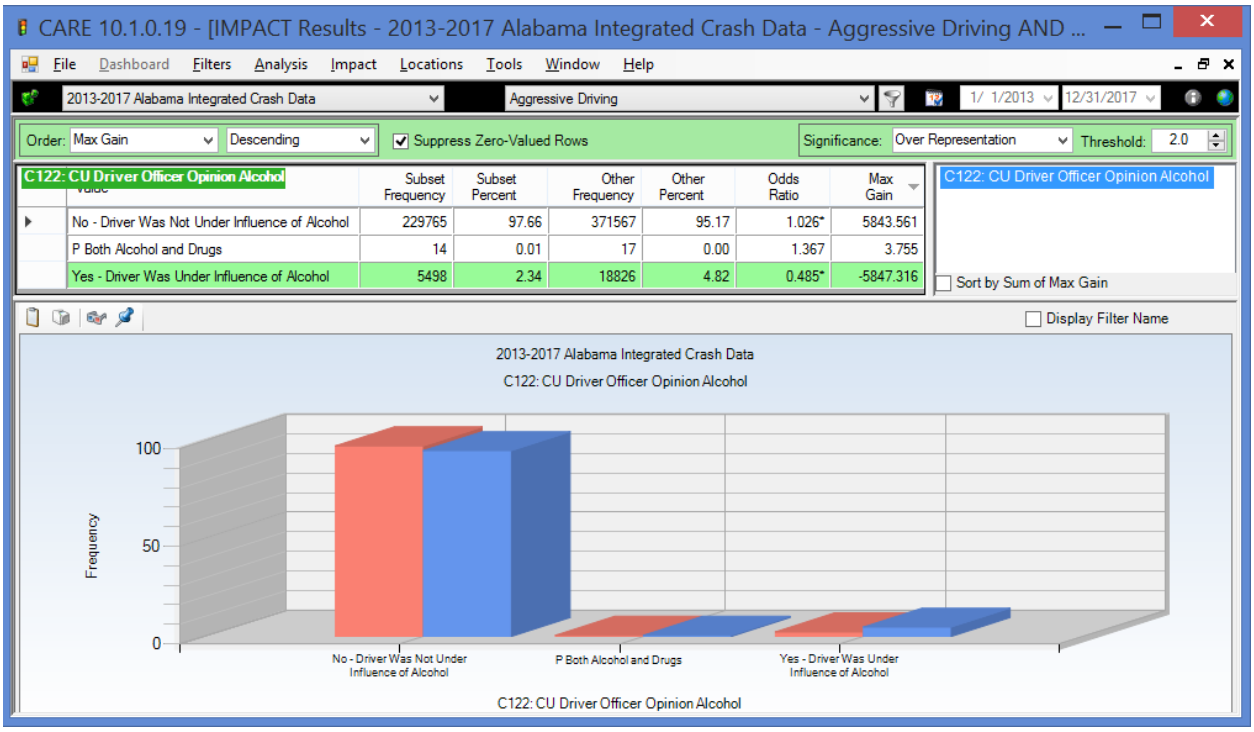
Significant over-representations in ages 16-28; over-representations continue until age 34.

C121 CU Driver Condition



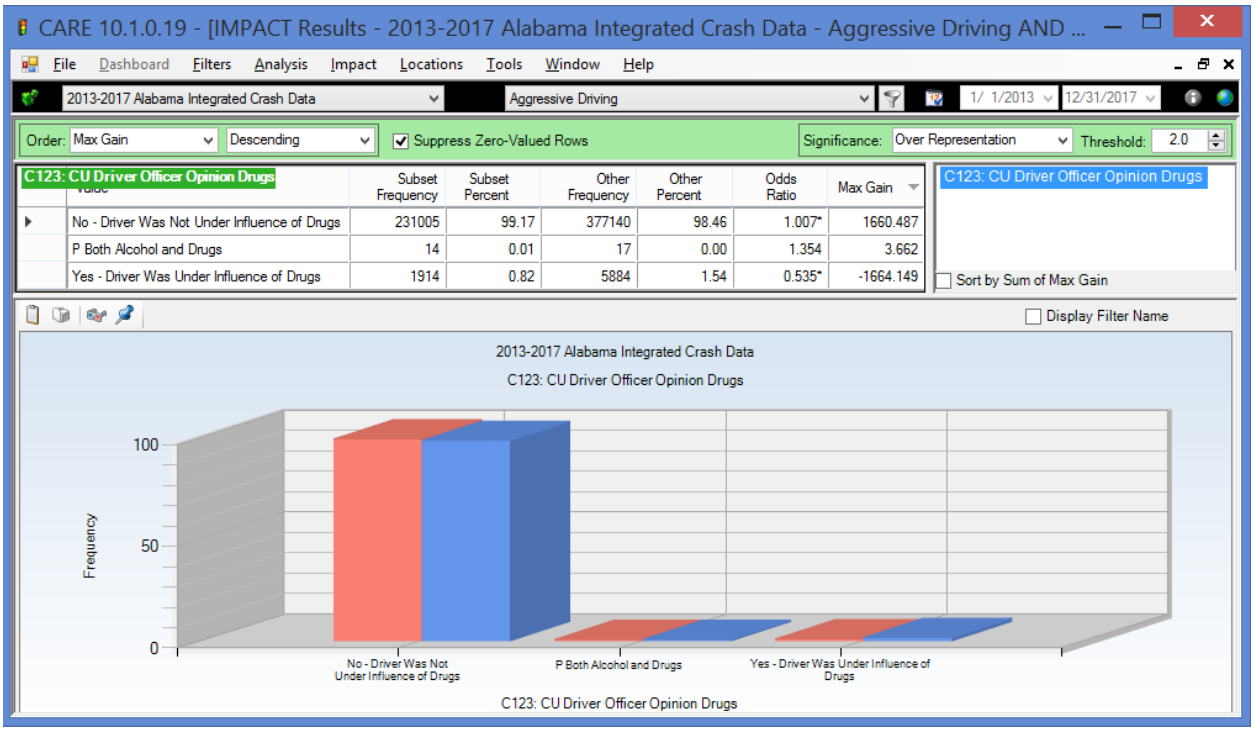
The “Emotional (Depressed/Angry/Disturbed)” value is significantly over-represented with about 50% higher proportion than what would be expected. However, it is less than half of a percent of the total crashes in the AD subset. It is out-numbered Asleep/Fainted/Fatigued and Under the Influence of Alcohol/Drugs, even though these two values are very significantly under-represented. It appears that alcohol/drugs could play a major part in AD – they will be considered next.

C122 CU Driver Officer Opinion Alcohol



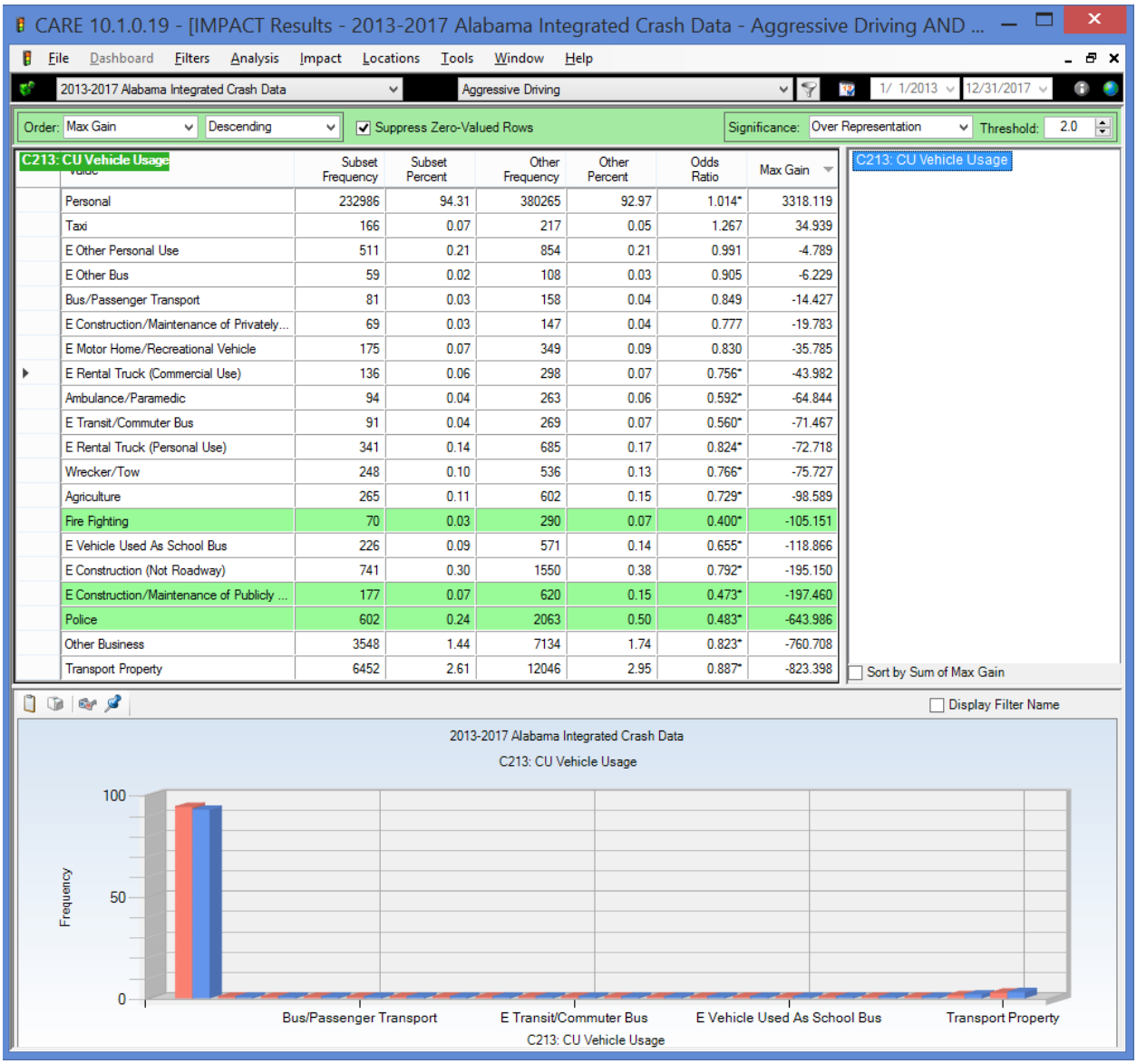
While the number of cases is fairly high (5498), the involvement of alcohol is significantly under-represented (48.5% of expected). Thus, it can be concluded that alcohol is not a major causative factor in AD involved crashes.

C123 CU Driver Officer Opinion Drugs



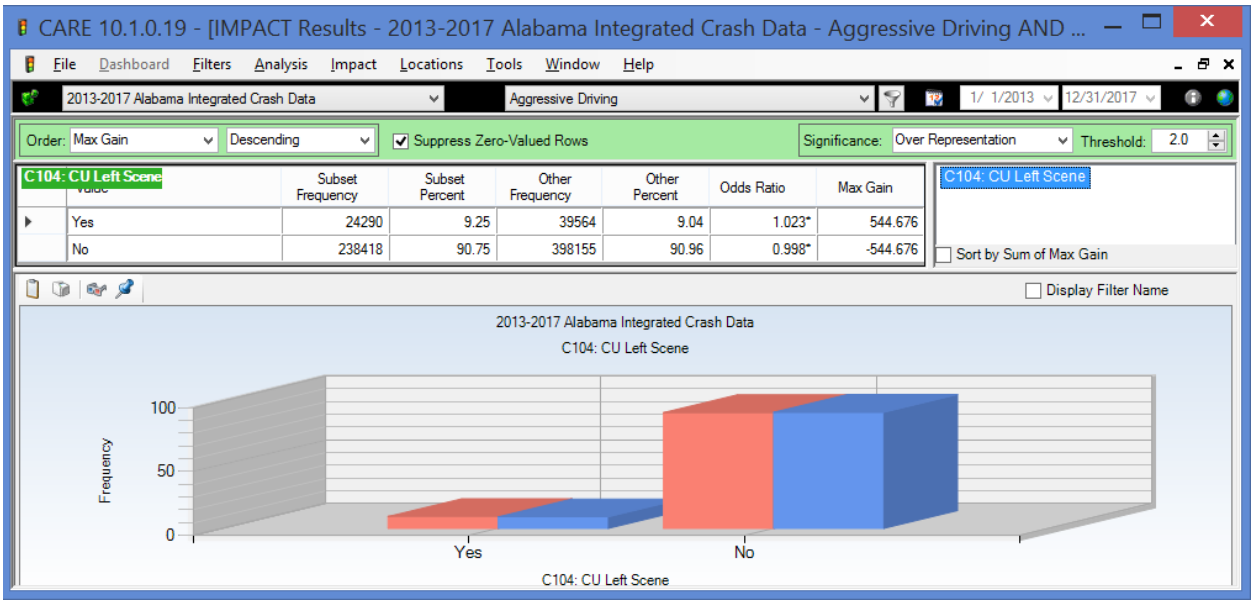
Although the number of positives here is well under half of that of alcohol, given this understanding, the remaining information from this attribute is quite comparable to that for alcohol.

C213 CU Vehicle Usage



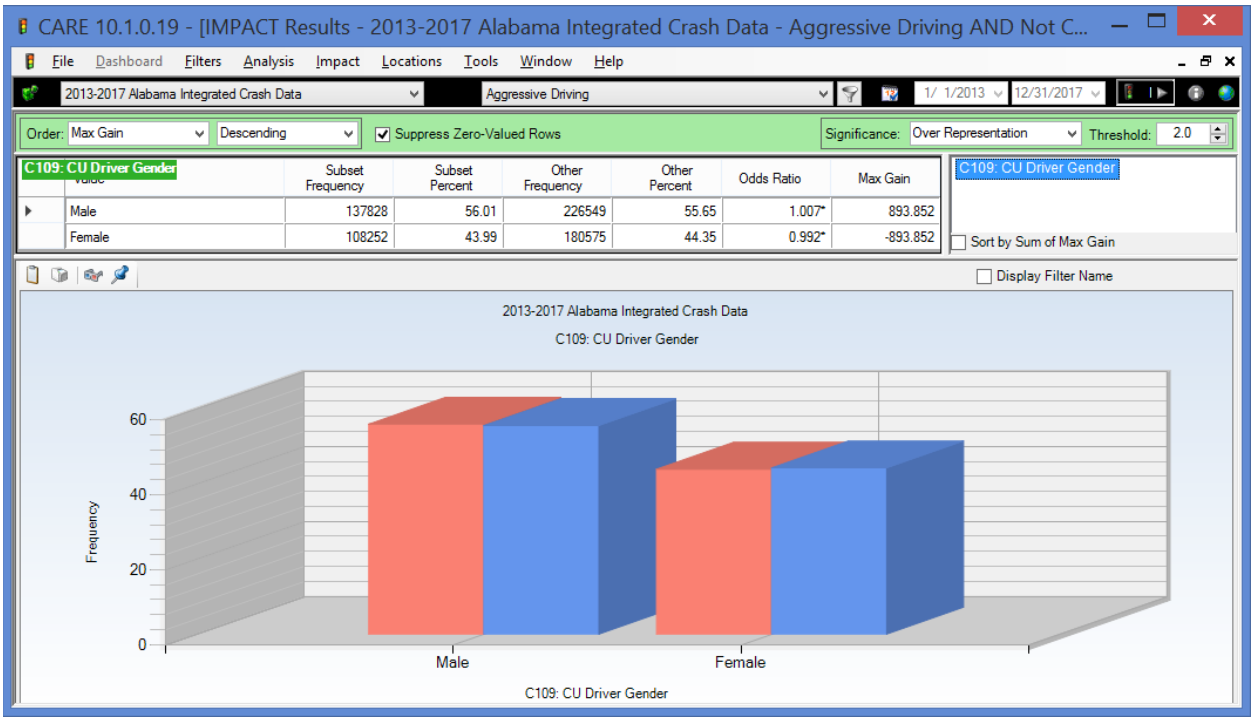
Overwhelmingly personal, with the over-represented times indicating that the major personal usage is in commuting.

C104 CU Left the Scene



The over-representation might be expected of AD drivers; its very small (although significant) relative difference with non-AD drivers is probably less than expected. Thus, leaving the scene is not seen to be a major factor with AD.

C109 CU Driver Gender



While males are significantly over-represented in their proportion of aggressive driving crashes, we would suspect most traffic safety professionals will be surprise at how very small the difference is between their AD vs. their non-AD proportions. For example, the over-representation in the proportion of AD to non-AD for males is less than 1% (0.7%, or 1.007 times that of non-AD). However, this picture changes dramatically when we just look at fatal crashes – see the cross-tabulation discussed on the next page.

Driver Gender by Severity

CARE 10.1.0.19 - [Crosstab Results - 2013-2017 Alabama Integrated Crash Data - Filter = ...

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2013-2017 Alabama Integrated Crash Data | Aggressive Driving | 1/ 1/2013 | 12/

Suppress Zero Values: None | Select Cells: | Column: Crash Severity ; Row: CU Driver Gender

	Fatal Injury	Incapacitating Injury	Non-Incapacitating Inju	Possible Injury	Property Damage Only	Unknown	TOTAL
Male	1326 72.38%	7087 59.65%	10572 55.50%	12823 49.53%	103107 50.53%	2913 46.39%	137828 51.24%
Female	410 22.38%	4276 35.99%	7402 38.86%	11366 43.90%	82507 40.43%	2291 36.49%	108252 40.24%
Unknown	9 0.49%	166 1.40%	435 2.28%	758 2.93%	13499 6.62%	830 13.22%	15697 5.84%
Not Applicable	0 0.00%	4 0.03%	8 0.04%	12 0.05%	164 0.08%	27 0.43%	215 0.08%
CU is Not a Vehicle	78 4.26%	189 1.59%	237 1.24%	97 0.37%	99 0.05%	19 0.30%	719 0.27%
CU is Unknown	9 0.49%	159 1.34%	393 2.06%	834 3.22%	4690 2.30%	199 3.17%	6284 2.34%
TOTAL	1832 0.68%	11881 4.42%	19047 7.08%	25890 9.62%	204066 75.86%	6279 2.33%	268995 100.00%

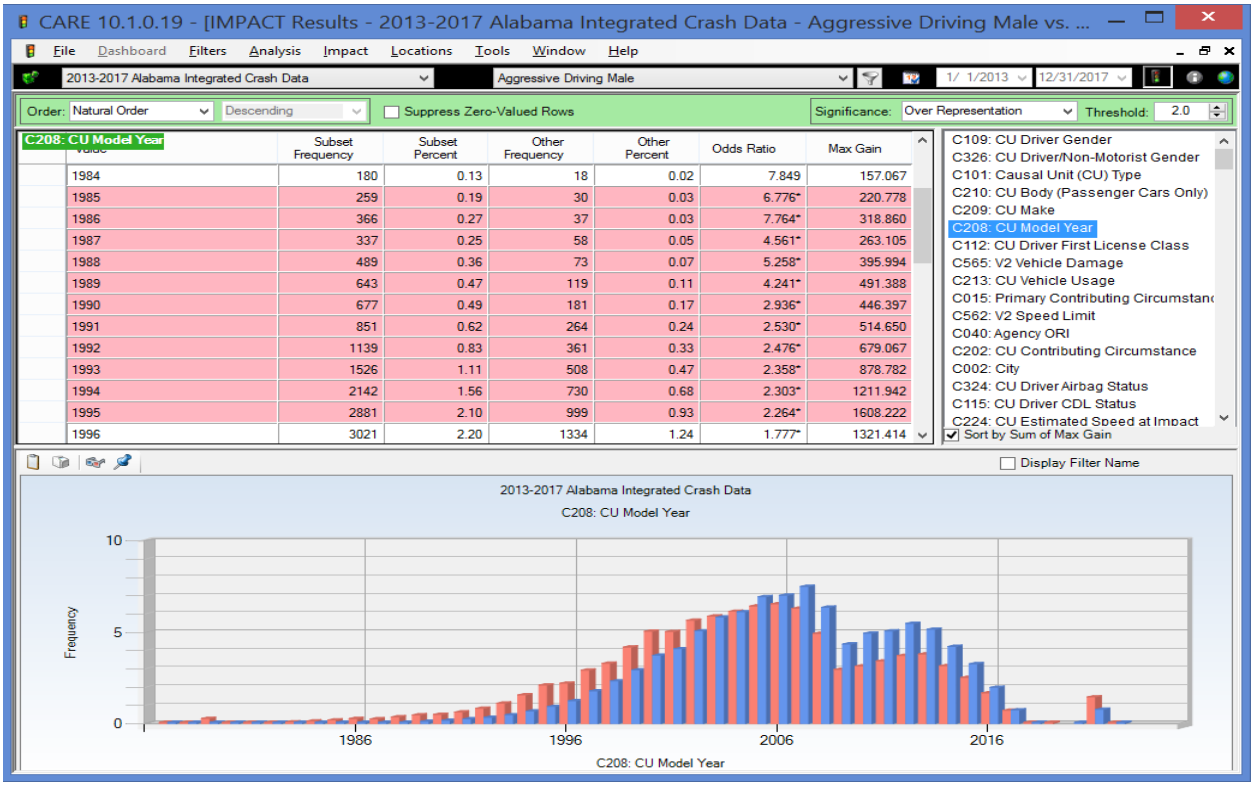
This indicates a dramatic over-representation of male aggressive driving fatal crashes, which indicates that female aggressive driving is quite different from male aggressive driving. This will be considered in more detail in a separate section below.

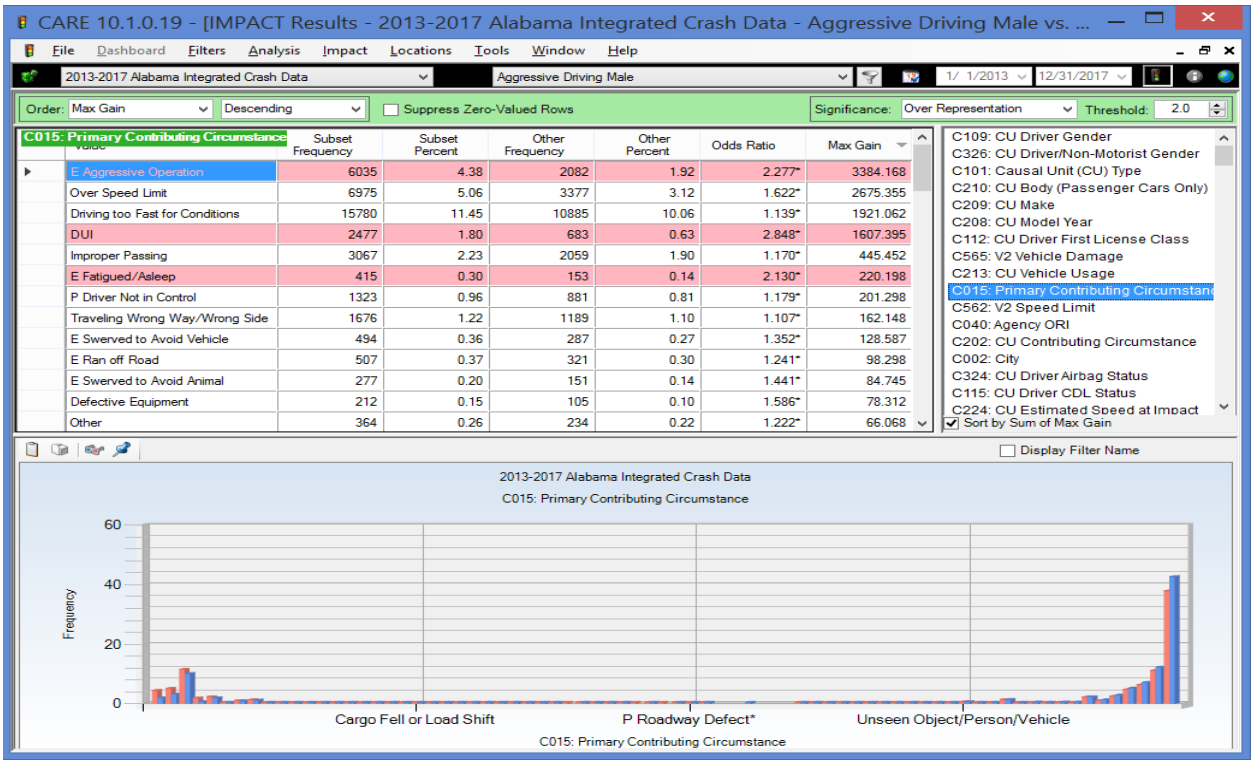
Male vs Female Characteristics

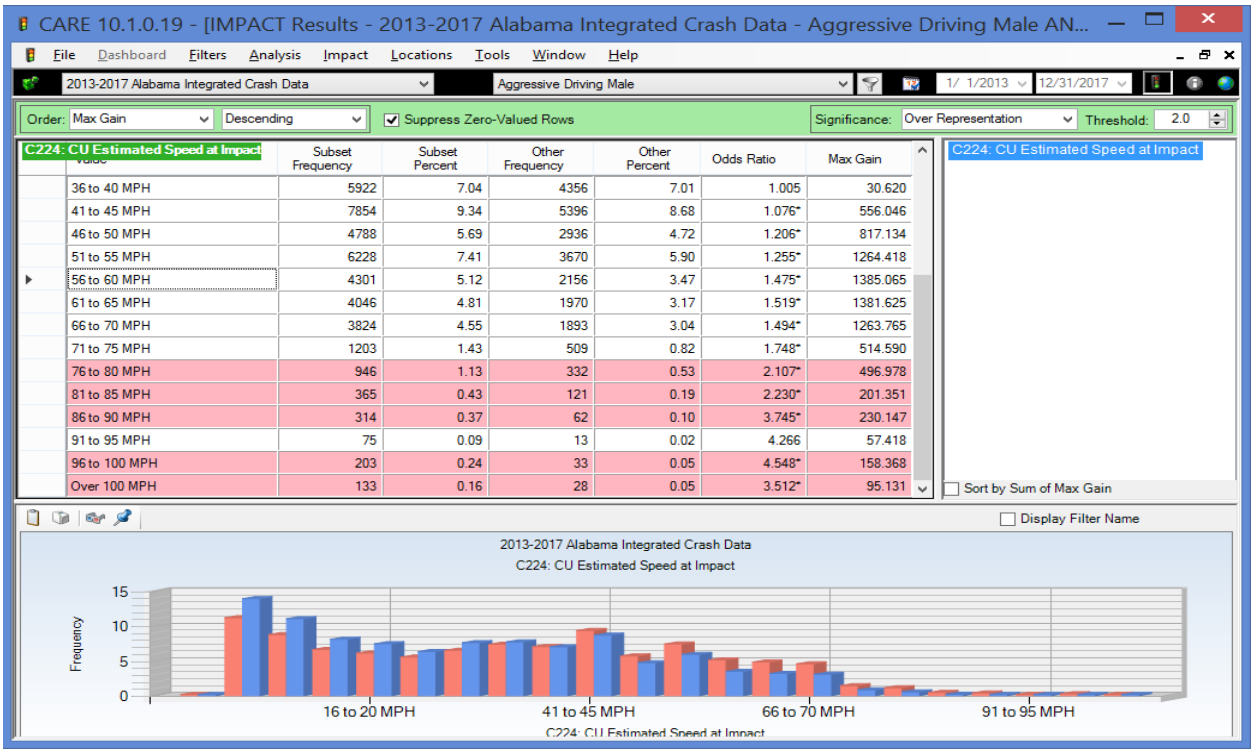
Because there were such dramatic differences in the frequencies and proportions of male and female AD drivers, it was felt that additional study along these lines was warranted.

Notable over-representations found:

- AD male drivers were dramatically over-represented driving pick-ups by an odds ratio of 4.5 times what would be expected. Seems that there is a strong correlation between driving a pick-up and aggressive driving.
- In cars, males get more aggressive in two-door models (odds ratio 2.0).
- Males tend to be driving older vehicles. See display below.
- Male AD drivers are over-represented in Speed & Driving Too Fast for Conditions, DUI and Improper Passing. Speed at impact is dramatically higher. See display below.
- Locale is over-represented in open country and rural areas; about 25-30% higher than female.
- The male driver AD crash has a First Harmful Event over twice as likely to be a rollover.
- Most all of the differences listed above are heavily related up to speed increased speed at impact. See display below.
- Failure to use seatbelts is about twice that of women, which further explains the relatively higher number of fatal crashes.

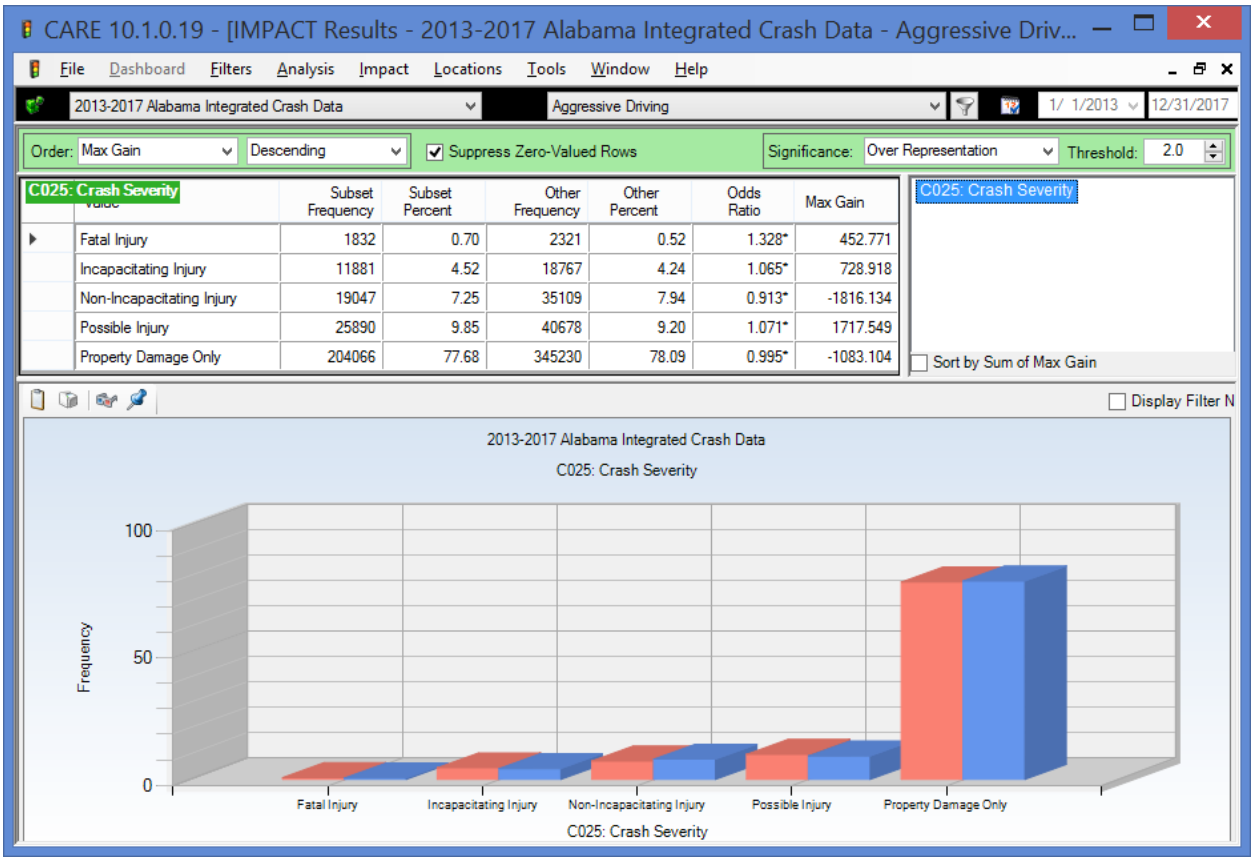



CARE 10.1.0.19 - [IMPACT Results - 2013-2017 Alabama Integrated Crash Data - Aggressive Driving Male vs. ...
File Dashboard Filters Analysis Impact Locations Tools Window Help
2013-2017 Alabama Integrated Crash Data
Aggressive Driving Male
1/ 1/2013
12/31/2017
Order: Max Gain
Descending
Suppress Zero-Valued Rows
Significance: Over Representation
Threshold: 2.0
C015: Primary Contributing Circumstance
Subset Frequency
Subset Percent
Other Frequency
Other Percent
Odds Ratio
Max Gain
E Aggressive Operation 6035 4.38 2082 1.92 2.277* 3384.168
Over Speed Limit 6975 5.06 3377 3.12 1.622* 2675.355
Driving too Fast for Conditions 15780 11.45 10885 10.06 1.139* 1921.062
DUI 2477 1.80 683 0.63 2.848* 1607.395
Improper Passing 3067 2.23 2059 1.90 1.170* 445.452
E Fatigued/Asleep 415 0.30 153 0.14 2.130* 220.198
P Driver Not in Control 1323 0.96 881 0.81 1.179* 201.298
Traveling Wrong Way/Wrong Side 1676 1.22 1189 1.10 1.107* 162.148
E Swerved to Avoid Vehicle 494 0.36 287 0.27 1.352* 128.587
E Ran off Road 507 0.37 321 0.30 1.241* 98.298
E Swerved to Avoid Animal 277 0.20 151 0.14 1.441* 84.745
Defective Equipment 212 0.15 105 0.10 1.586* 78.312
Other 364 0.26 234 0.22 1.222* 66.068
C109: CU Driver Gender
C326: CU Driver/Non-Motorist Gender
C101: Causal Unit (CU) Type
C210: CU Body (Passenger Cars Only)
C209: CU Make
C208: CU Model Year
C112: CU Driver First License Class
C565: V2 Vehicle Damage
C213: CU Vehicle Usage
C015: Primary Contributing Circumstanc
C562: V2 Speed Limit
C040: Agency ORI
C202: CU Contributing Circumstance
C002: City
C324: CU Driver Airbag Status
C115: CU Driver CDL Status
C224: CU Estimated Speed at Impact
Sort by Sum of Max Gain
Display Filter Name
2013-2017 Alabama Integrated Crash Data
C015: Primary Contributing Circumstance
Frequency
60
40
20
0
Cargo Fell or Load Shift
P Roadway Defect*
Unseen Object/Person/Vehicle
C015: Primary Contributing Circumstance


CARE 10.1.0.19 - [IMPACT Results - 2013-2017 Alabama Integrated Crash Data - Aggressive Driving Male AN...
File Dashboard Filters Analysis Impact Locations Tools Window Help
2013-2017 Alabama Integrated Crash Data
Aggressive Driving Male
1/ 1/2013
12/31/2017
Order: Max Gain
Descending
Suppress Zero-Valued Rows
Significance: Over Representation
Threshold: 2.0
C224: CU Estimated Speed at Impact
Subset Frequency
Subset Percent
Other Frequency
Other Percent
Odds Ratio
Max Gain
36 to 40 MPH 5922 7.04 4356 7.01 1.005 30.620
41 to 45 MPH 7854 9.34 5396 8.68 1.076* 556.046
46 to 50 MPH 4788 5.69 2936 4.72 1.206* 817.134
51 to 55 MPH 6228 7.41 3670 5.90 1.255* 1264.418
56 to 60 MPH 4301 5.12 2156 3.47 1.475* 1385.065
61 to 65 MPH 4046 4.81 1970 3.17 1.519* 1381.625
66 to 70 MPH 3824 4.55 1893 3.04 1.494* 1263.765
71 to 75 MPH 1203 1.43 509 0.82 1.748* 514.590
76 to 80 MPH 946 1.13 332 0.53 2.107* 496.978
81 to 85 MPH 365 0.43 121 0.19 2.230* 201.351
86 to 90 MPH 314 0.37 62 0.10 3.745* 230.147
91 to 95 MPH 75 0.09 13 0.02 4.266 57.418
96 to 100 MPH 203 0.24 33 0.05 4.548* 158.368
Over 100 MPH 133 0.16 28 0.05 3.512* 95.131
C224: CU Estimated Speed at Impact
Sort by Sum of Max Gain
Display Filter Name
2013-2017 Alabama Integrated Crash Data
C224: CU Estimated Speed at Impact
Frequency
15
10
5
0
16 to 20 MPH
41 to 45 MPH
66 to 70 MPH
91 to 95 MPH
C224: CU Estimated Speed at Impact

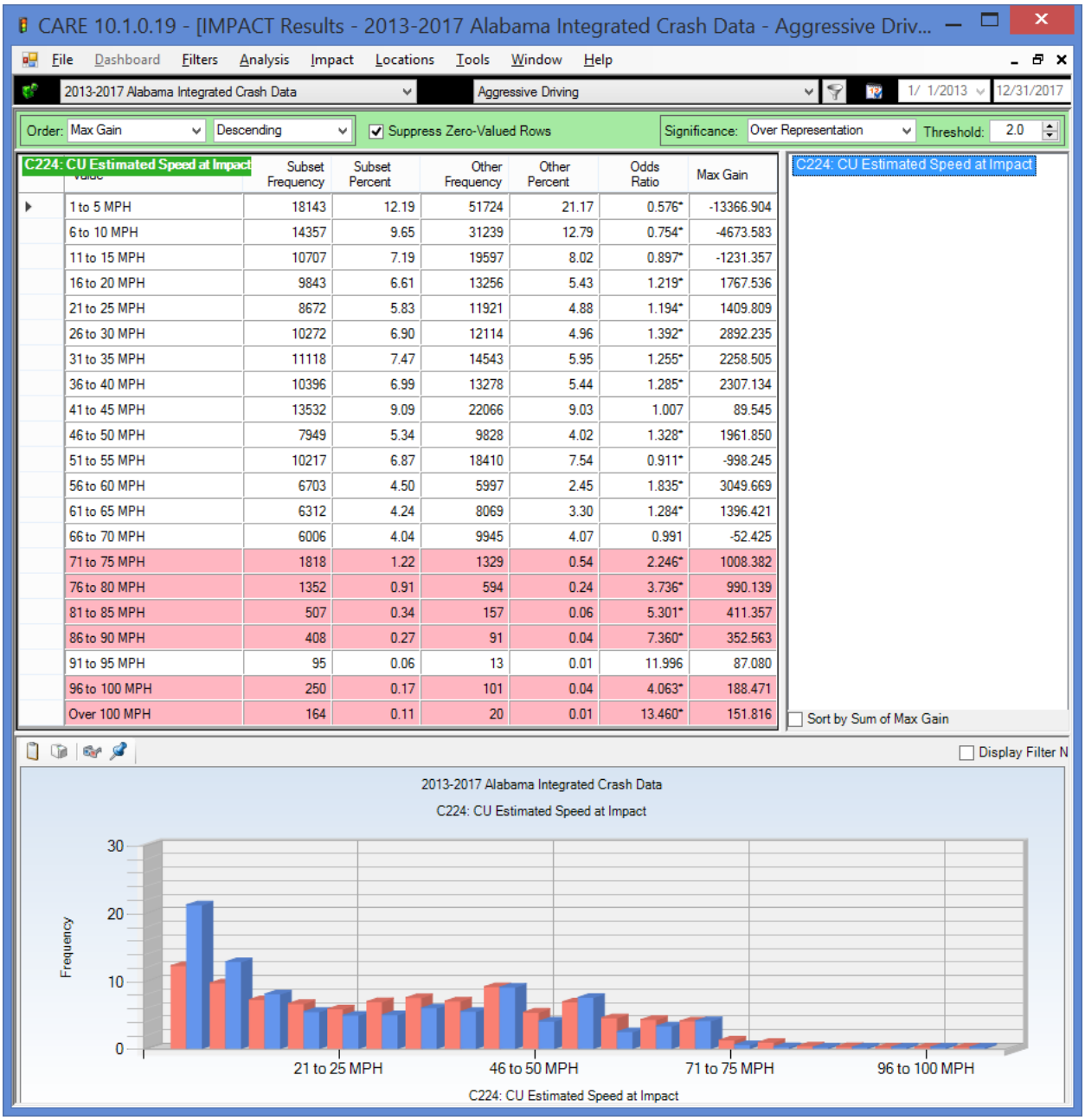
Severity Characteristics

C025 Crash Severity



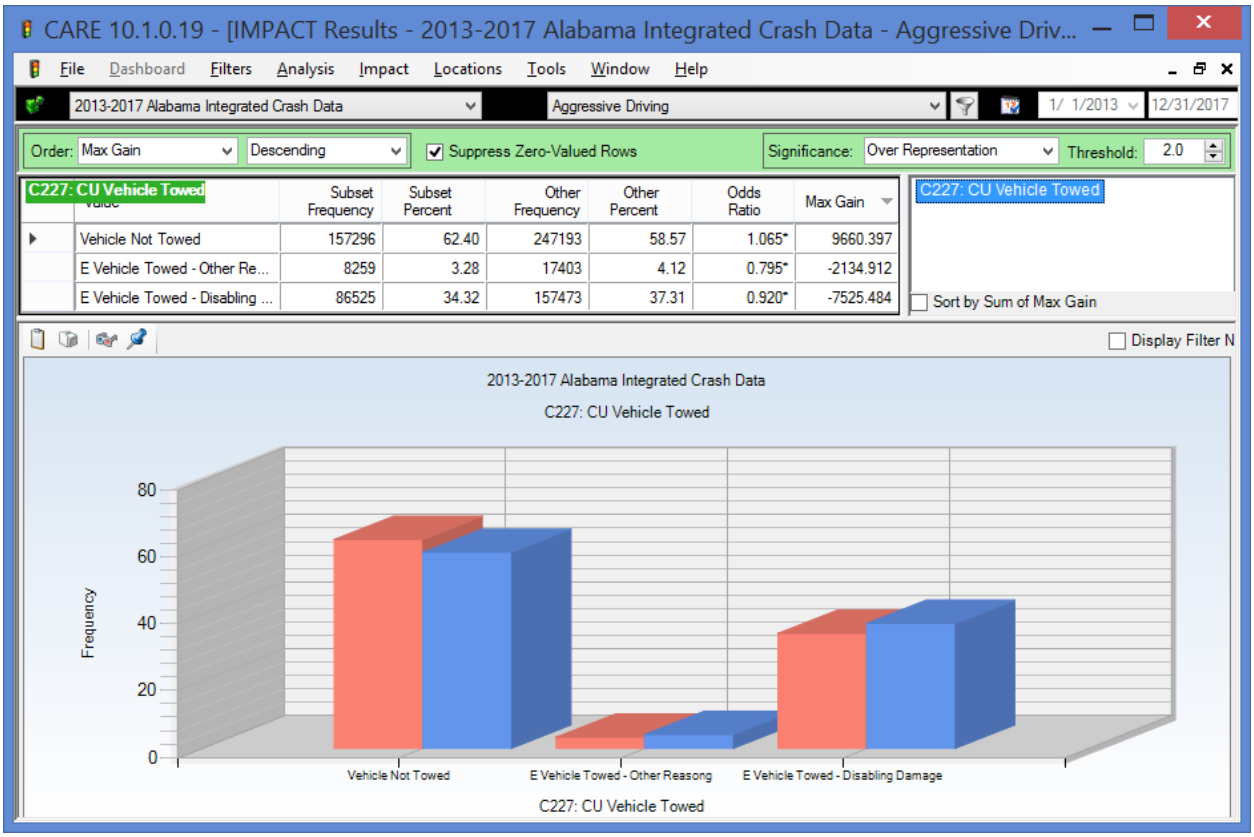
There can be no doubt that AD crashes result in relatively more deaths and incapacitating injuries than do non-AD crashes. The fatality probability is 32.8% higher for AD crashes than for non-AD, resulting in an increase of 453 fatal crashes over the five year period.

C224 CU Estimated Speed at Impact



This result confirms the speculation that impact speeds for AD crashes are significantly higher, on average, than their non-AD counterparts. Especially high over-representations occur at most speeds above 71 MPH.

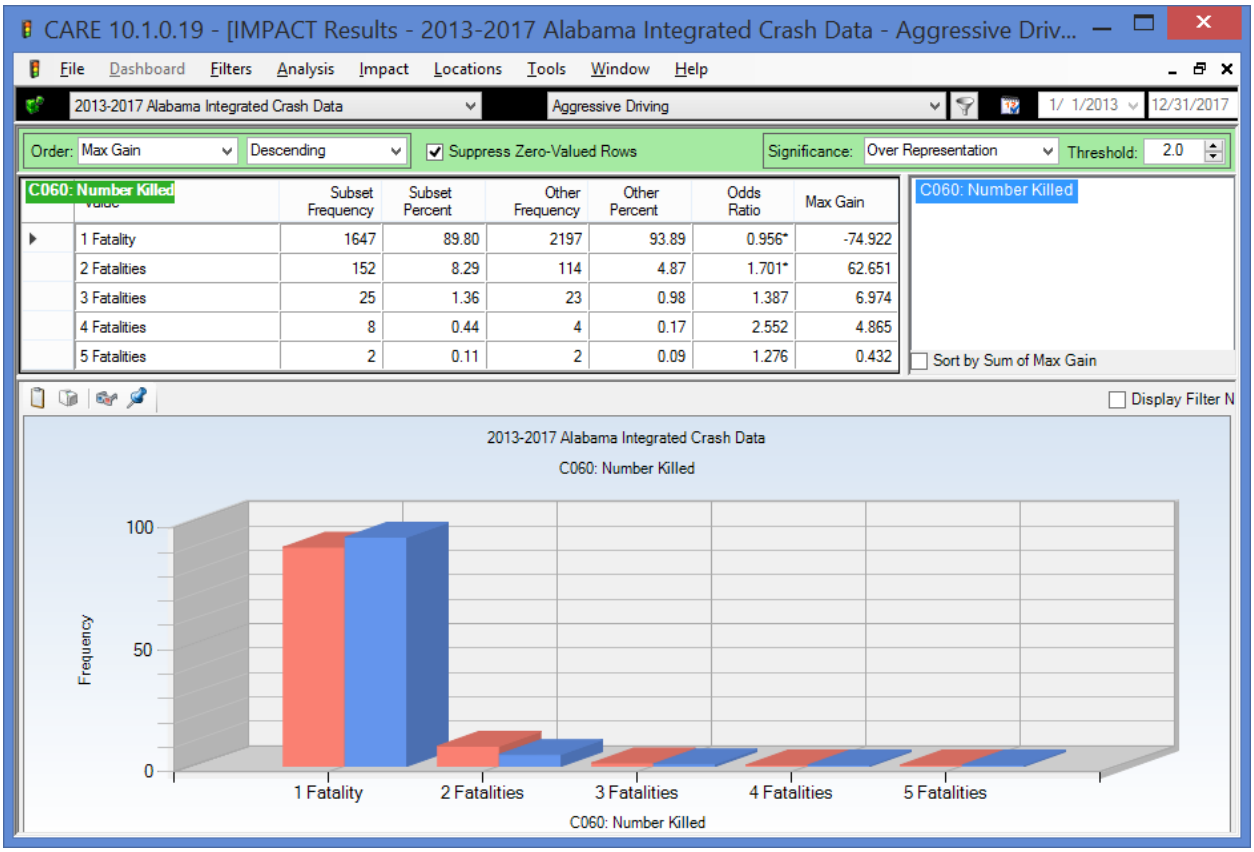
C227 CU Vehicle Towed



Given the attributes before this one, which indicated higher speeds and greater injury per crash, this result would seem to be contradictory. We present it for this reason.

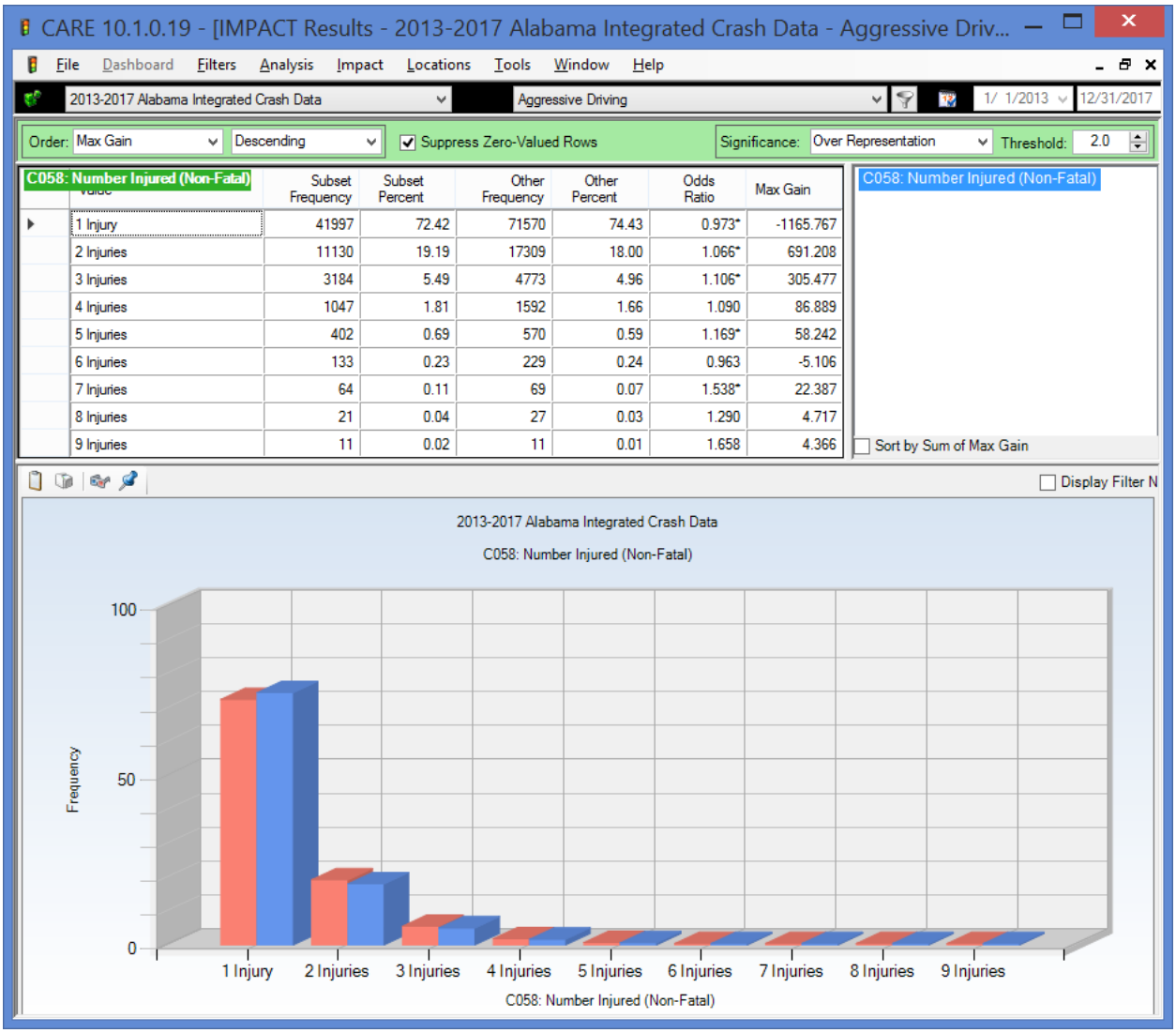
C060 Number Killed

The following is a comparison for those crashes that resulted in at least one fatality. This makes it clear that the AD is over-represented in multiple fatality crashes. We would suspect that both the increased fatal crashes and the increase in multiple fatalities must be caused by speed. See the next attribute.

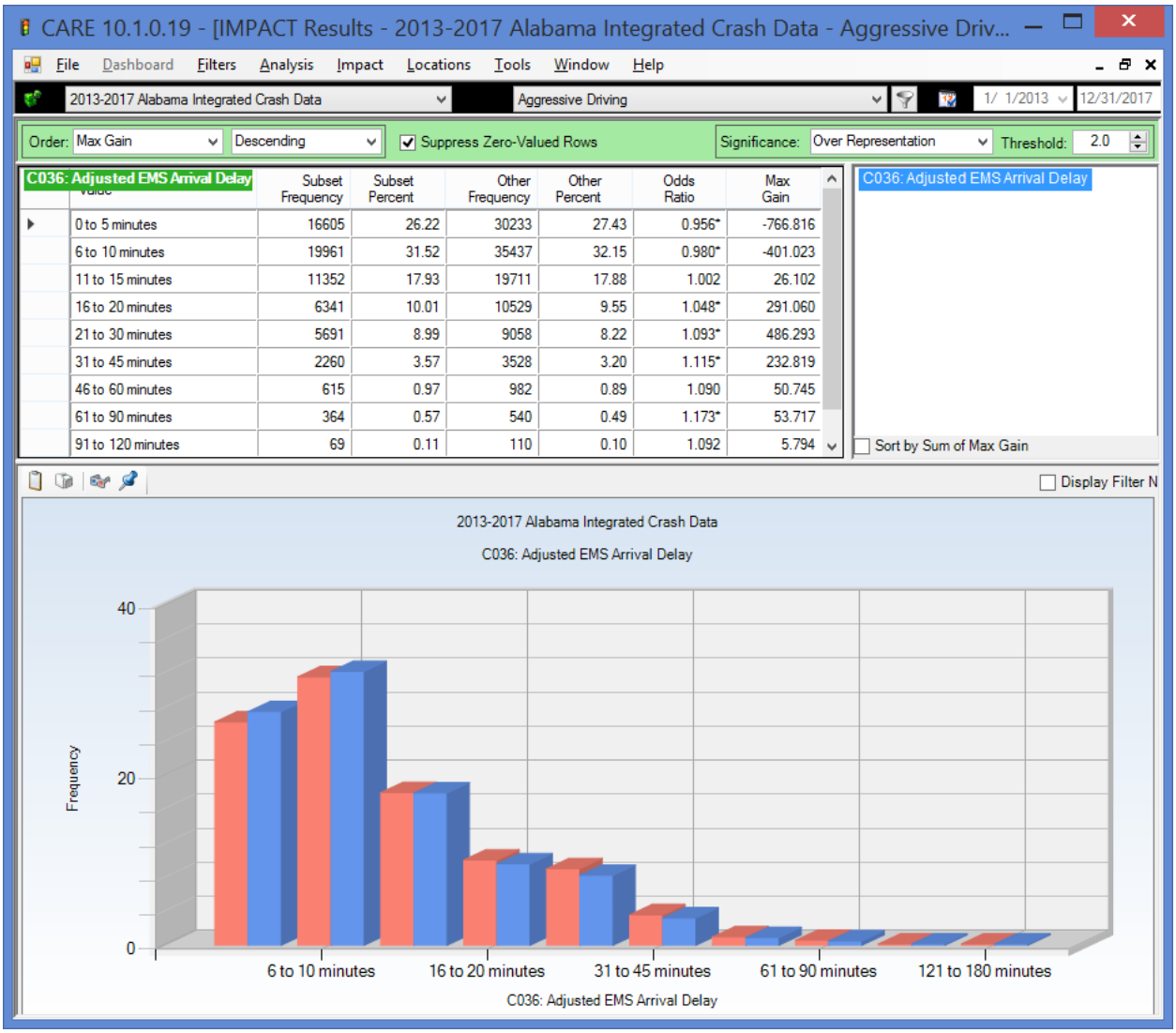


C058 Number Injured (Non-Fatal)

The following has pruned the non-injury case as well as those values that had less than ten instances. It shows that multiple injuries follow the same basic pattern as multiple fatalities.



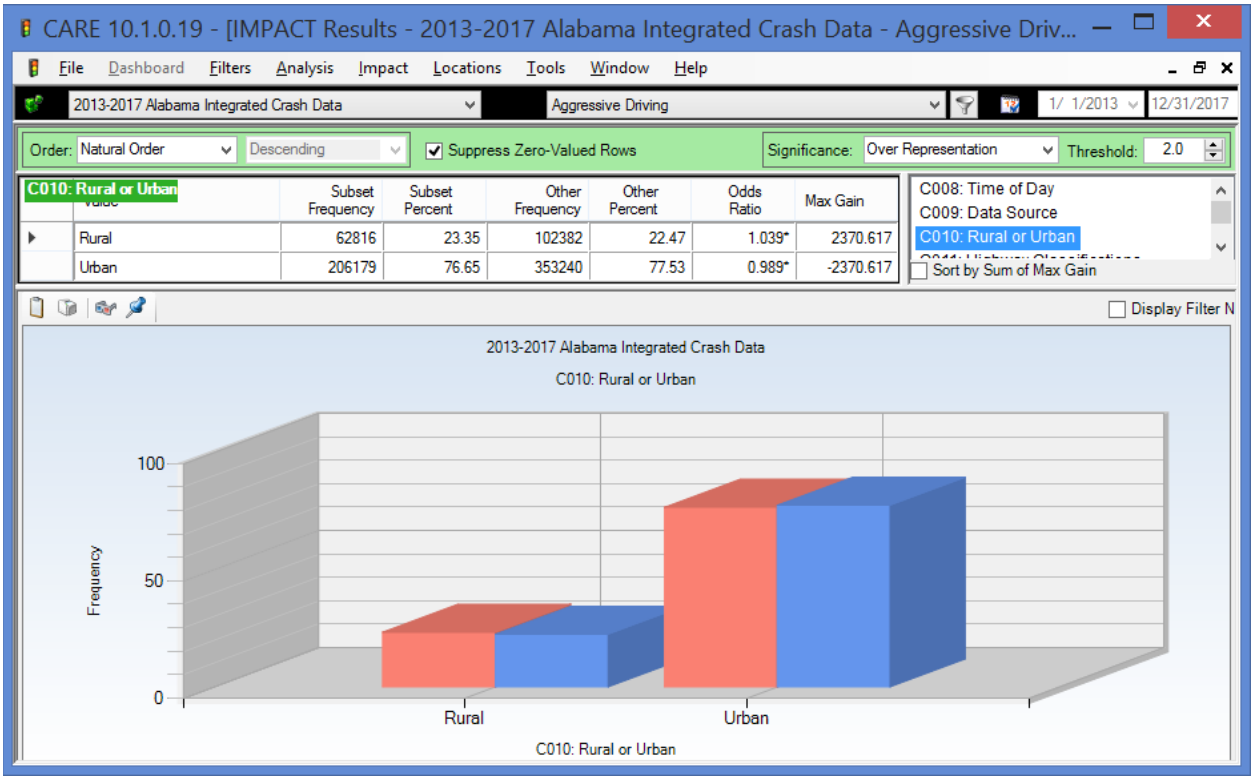
C036 Adjusted EMS Arrival Delay



All times over 15 minutes are over-represented and of the six values, only two of them are not significant in their over-representations. This is probably due to the geographical distribution, which will be considered next.

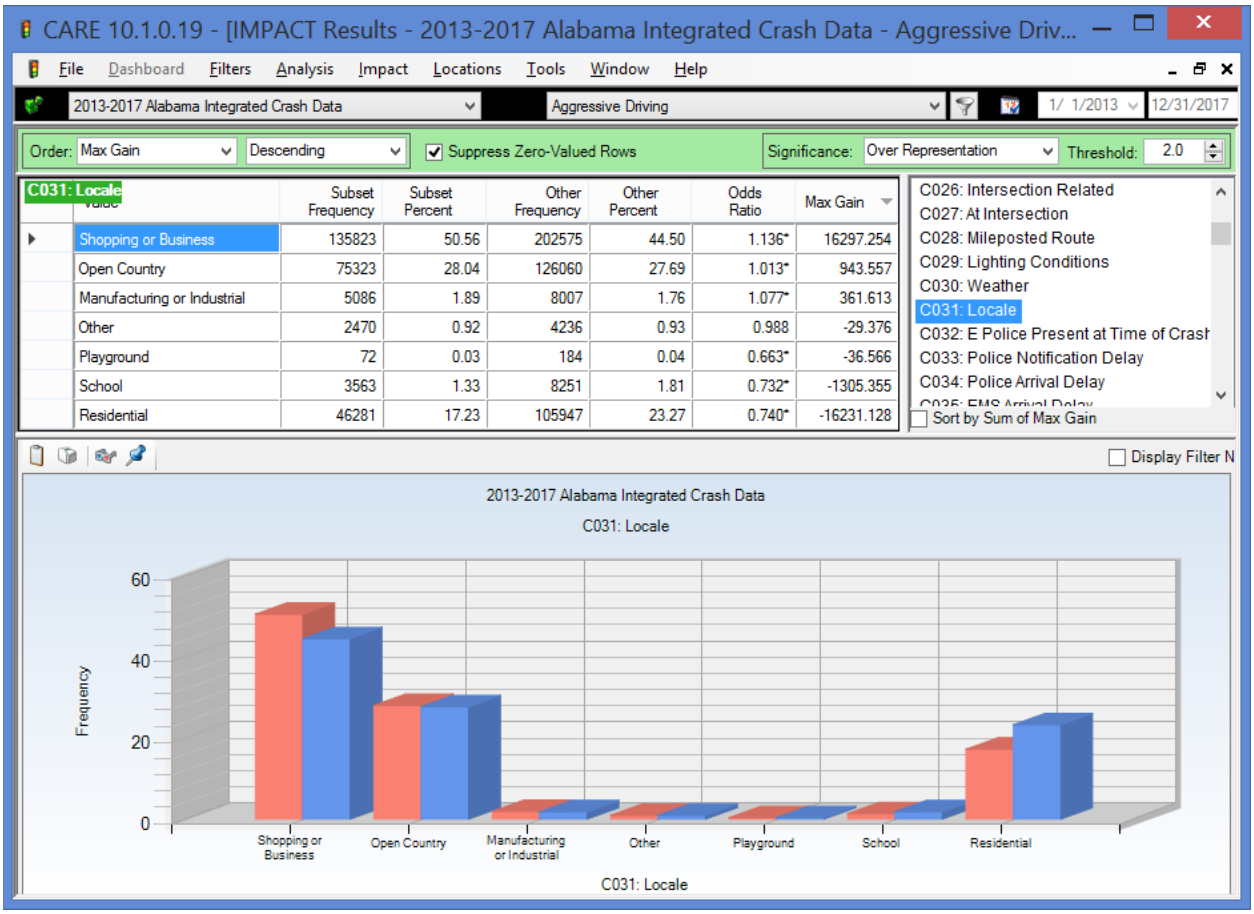
Geographical Characteristics

C010 Rural or Urban



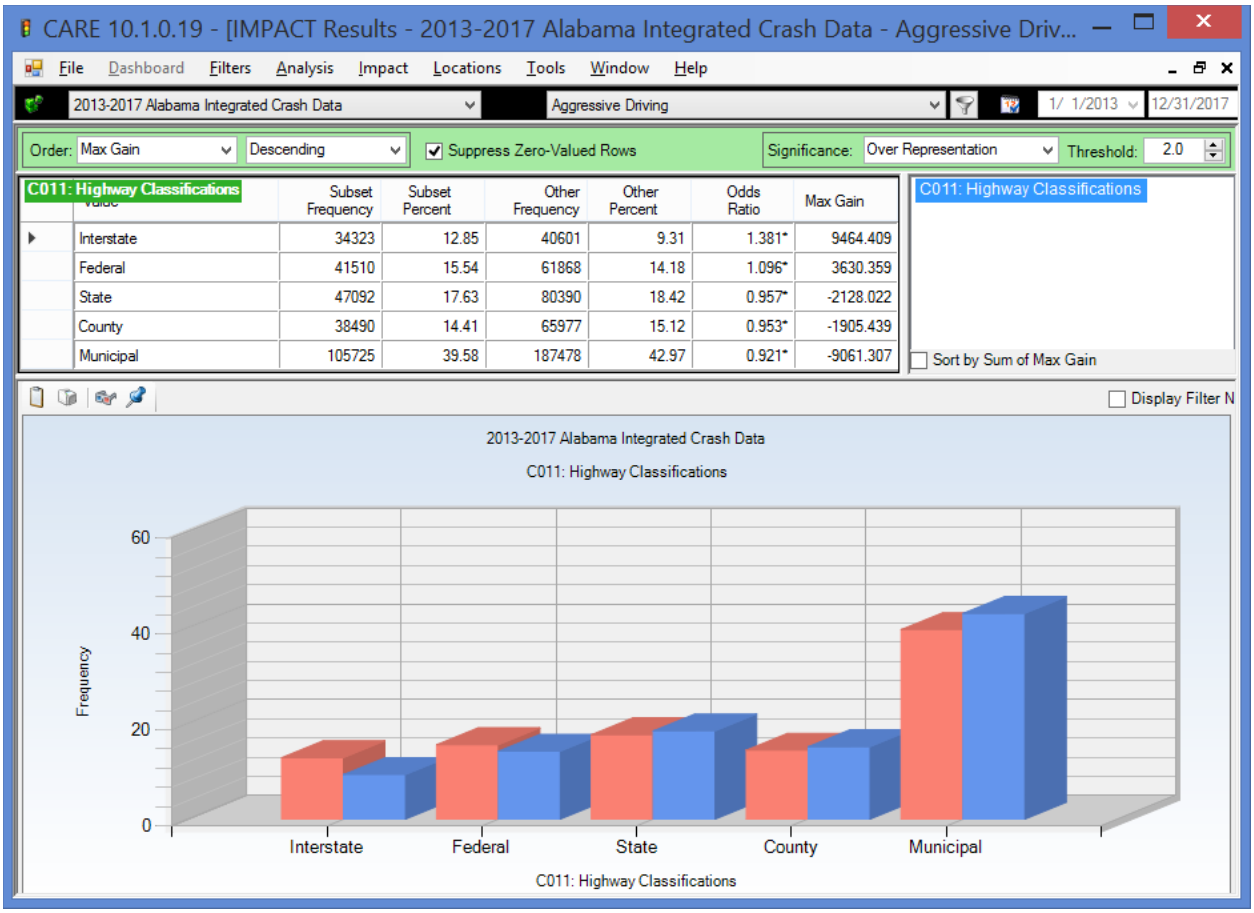
AD crashes are significantly over-represented on rural roads, which probably explains the ambulance delay time findings.

C031 Locale



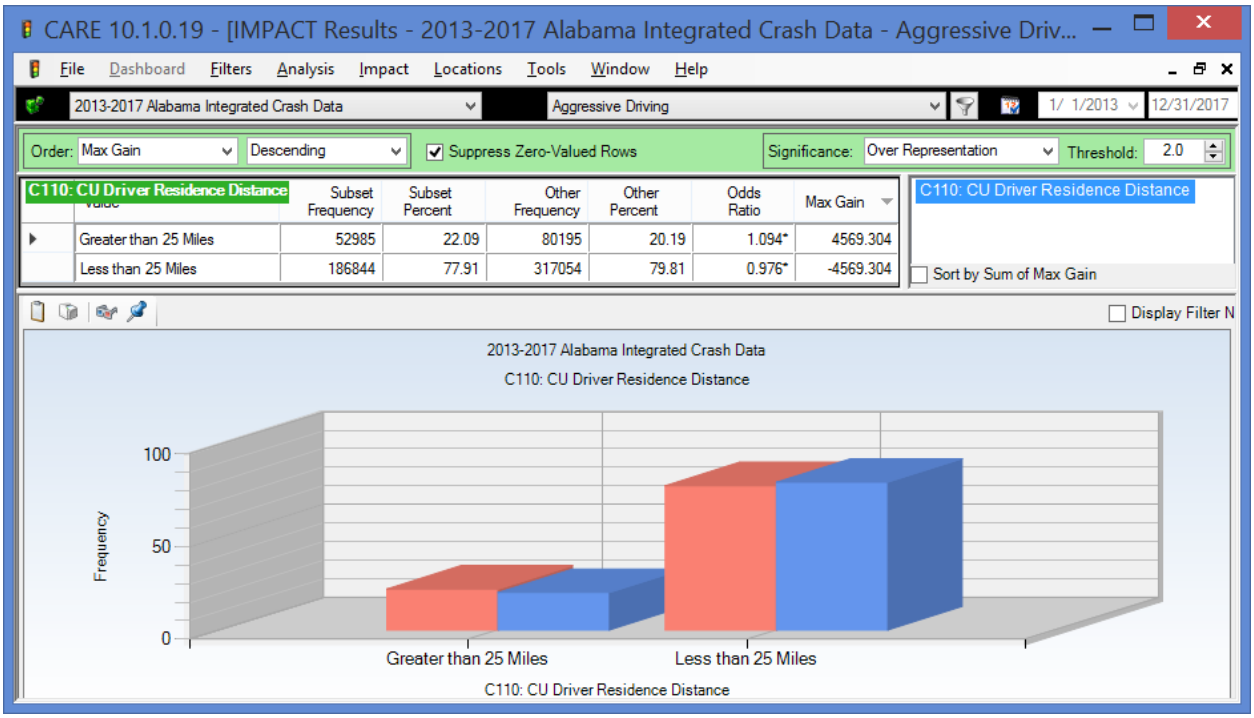
Shopping or Business is the overwhelming local in which AD crashes occur, followed by Open Country and Manufacturing or Industrial. All of the rest are under-represented.

C011 Highway Classifications



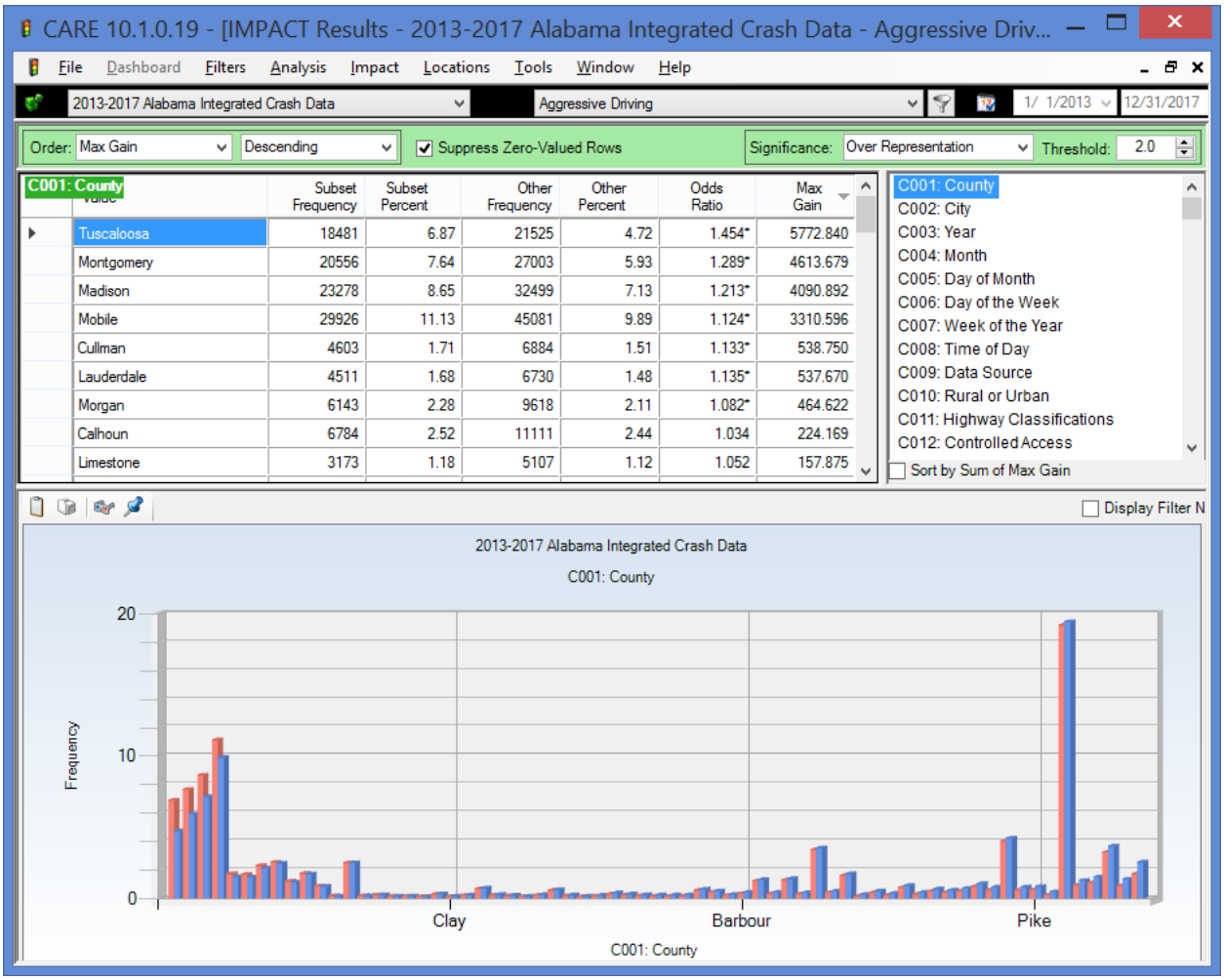
AD crashes are over-represented on Interstate and Federal roads, but not on any of the others. While all of the differences are significant, the largest differences are in the Interstates, with about 38% higher proportion than expected, and Municipal with about 8% lower proportion than expected in comparison with the non-AD crashes.

C110 CU Driver Residence Distance



It appears that drivers have more of a tendency toward AD when they are further away from home.

C001 County – Over-Represented



It seems clear that there are certain counties that are over-represented in AD crashes. Further analyses was required to determine the common characteristics that would contribute to this tendency. This is done in a separate section below.

Tuscaloosa, Montgomery, Madison, Mobile, Cullman, Lauderdale and Morgan Counties

These seven counties were significantly over-represented (see the C001, County attribute above). The goal here was to attempt to determine why this might be the case. The following differences were found between these counties and the rest of the state, strictly for AD crashes:

- AD crashes were highly over-represented on the municipal roadways in these counties.
- Urban areas were over-represented as well as "less than 25 miles from home" in these counties.
- Intersections and collisions with vehicles in traffic and other characteristics that correlate with urban driving, including shorter EMS arrival times.
- Typical urban primary contributing circumstances were found: following too close, improper lane changes, running traffic signals, and failure to yield.

So while in general, rural areas are over-represented, they tend to have a greater over-representation in moderately urbanized counties. Urbanized counties that are under-represented include Etowah, Baldwin, Jefferson, and Shelby (referenced below as the good counties).

To buffer out the urban/rural effect, a comparison was made between the 7 over-represented (bad) counties and these four under-represented (good) counties, both subsets urbanized. The major over-represented contributing circumstance in the bad countries. Although not as pronounced, the other over-represented contributing circumstances included Improper Lane Change, Speed (over speed limit and too fast for conditions), and failure to yield (several categories). Why these values would be different in the difference county subsets is unclear, but it is not due to the good counties being rural; in fact, the bad counties were over-represented in urban crashes having 84.3% as opposed to 81.3%, a difference that is not large enough to account for the disparity in the AD crashes. However, AD crashes in the bad counties on municipal roads were over-represented by a proportion 44% higher than expected, and all other roadway classifications were under-0represented.

Looking at driver demographics between these two county AD subsets:

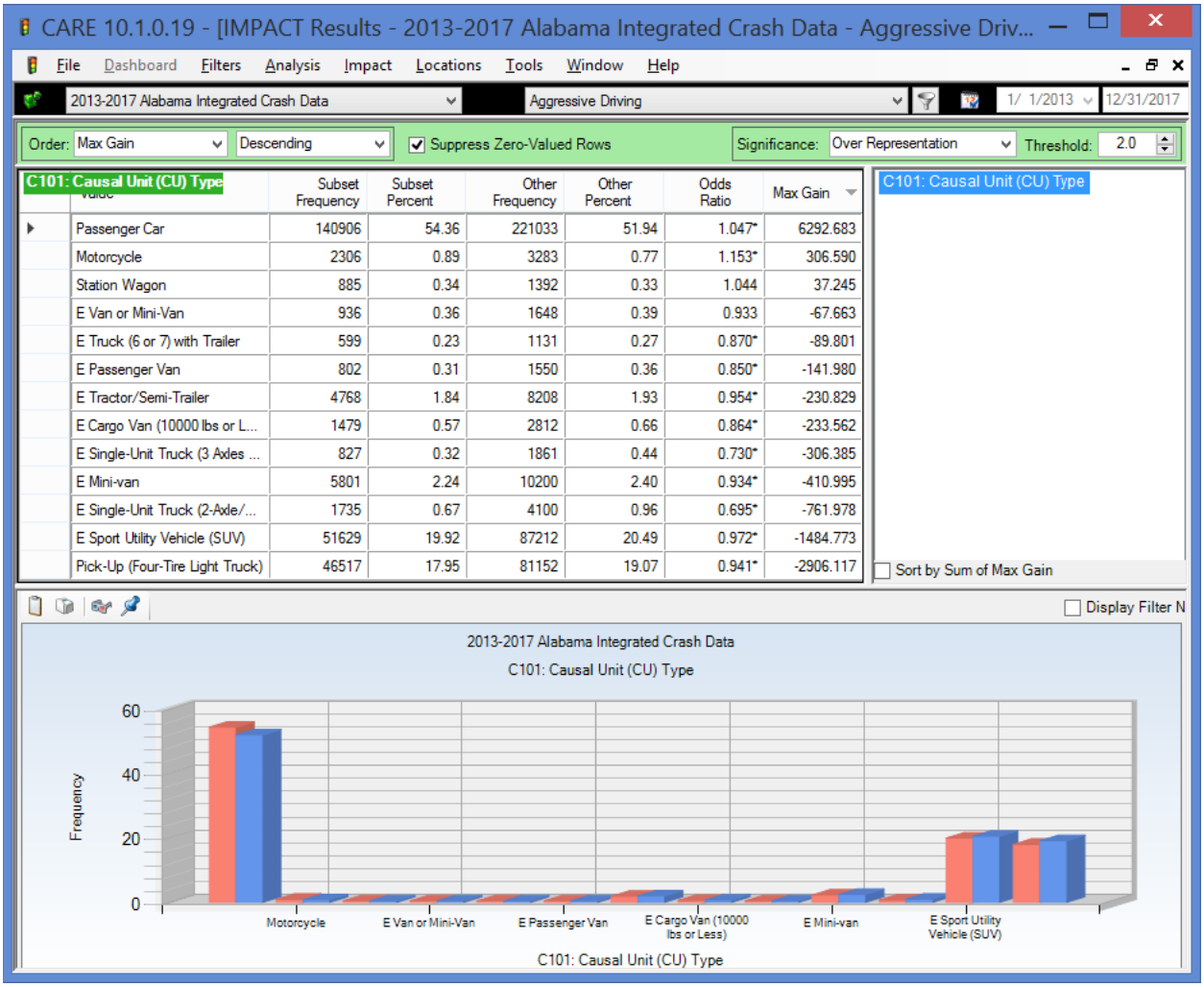
- Age seemed to be the largest disparity in AD driver demographics. Ages 16-23 were significantly over-represented in the bad counties, reflecting the overall comparison given for C107. All other ages were either under-represented of not significantly over-represented.
- Females were over-represented in the bad county AD crashes by a very small but significant 1% (odds ratio: 1.022).
- More driving close to home was being done for the AD crashes in the bad counties (71.6%) as opposed to the comparison (67.1%) probably reflecting the gender differences.
- Unemployment of involved drivers was higher in the bad AD counties; it was 15.1% in the bad counties and 11.2% for the others, a significant difference.

- Alcohol impairment was significantly higher in the bad AD counties, at a proportion about 32% higher than in the comparison counties. It was effectively the same in the proportion comparison for drug impairment, although, as usual the numbers for drugs were considerably smaller. In the AD bad counties, AD drivers had about 5,512 cases of Alcohol impairment, while the number impaired by drugs was just 1928.
- Most of the other attributes that were over-represented in this comparison were also those over-represented in the AD vs. non-AD comparison.

Vehicle Characteristics

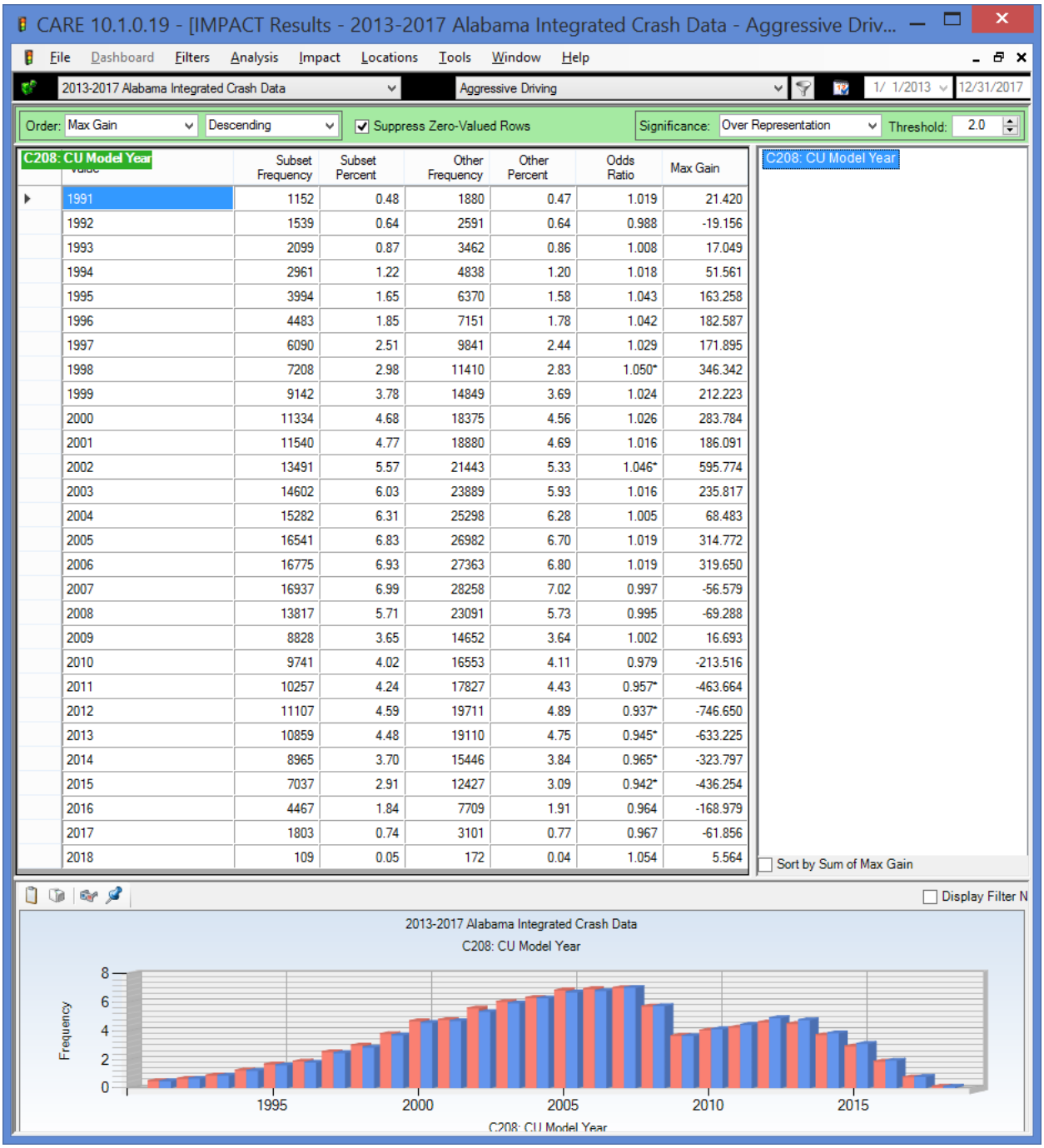
C101 Causal Unit (CU) Type

The following were for causal units that had 400 or more crashes.



Much can be learned from the above just by considering the extremes. The most over-represented AD vehicles tend to be passenger cars and motorcycles. The most under-represented are pick-ups, SUVs, trucks and mini-vans.

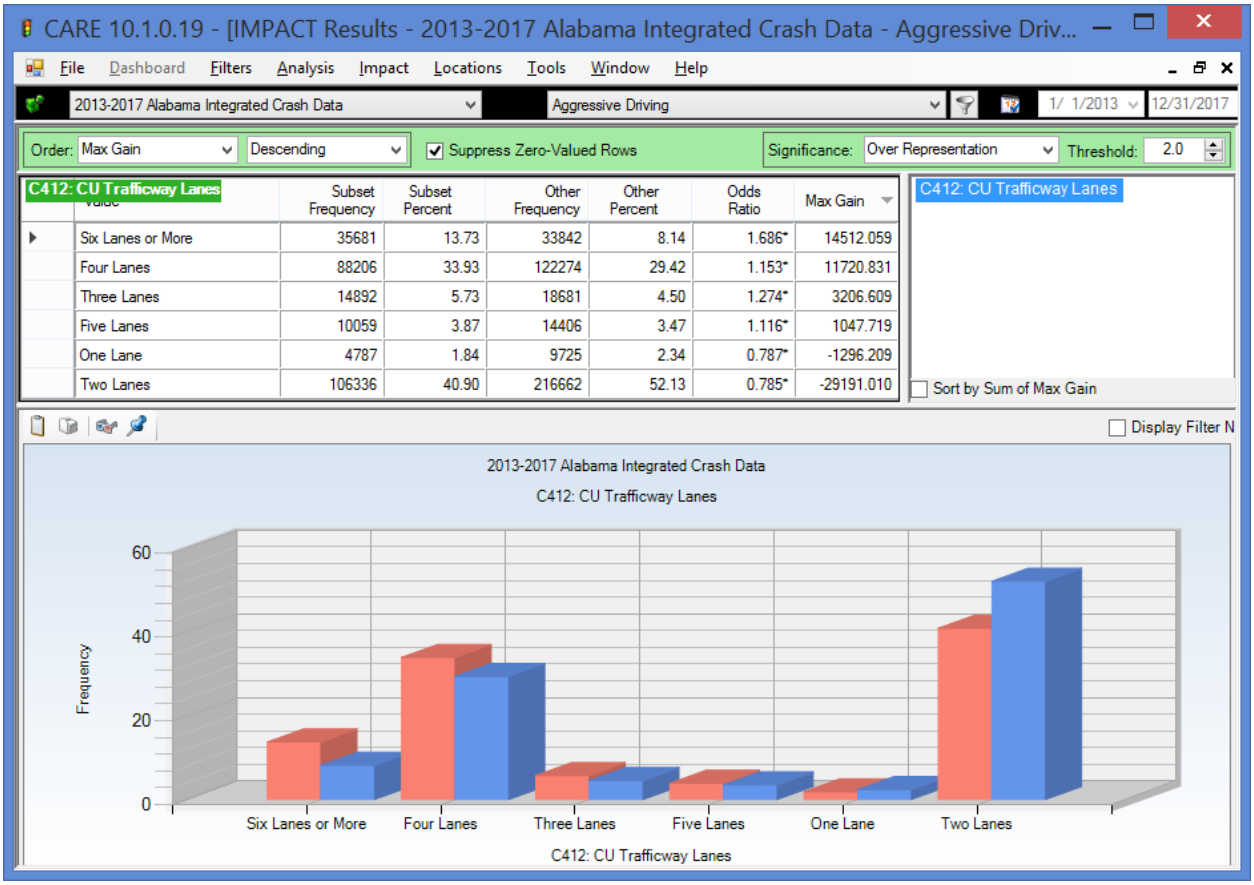
C208 CU Model Year



The later model years are relatively under-represented in AD crashes.

Roadway Environment and Pavement Characteristics

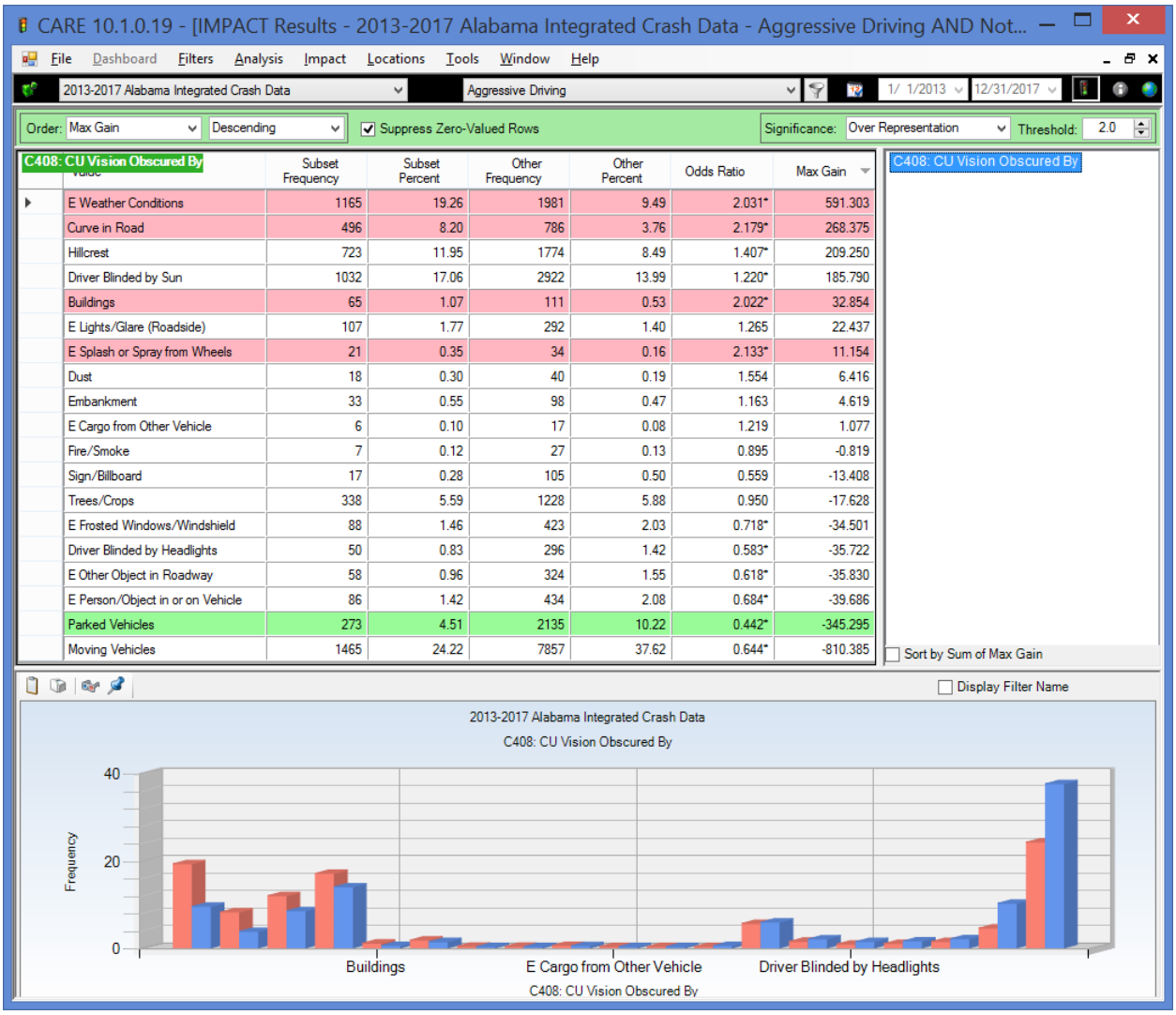
C412 CU Traffic Lanes



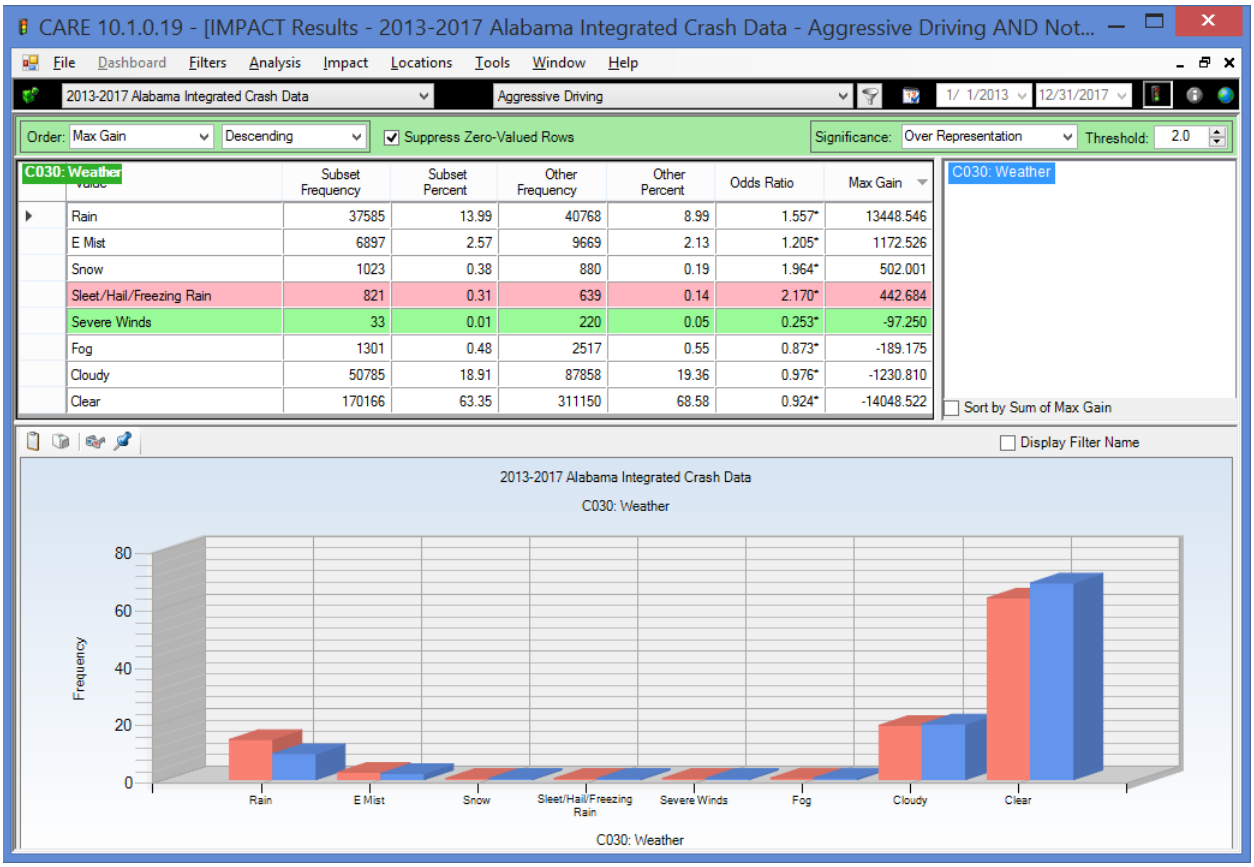
Generally, greater the number of lanes, the greater the relative inclination toward AD.

C408 CU Vision Obscured By

Vision obscurity seems not to be a major problem in AD crashes, with 93.7% falling into the Not Obscured category, as opposed to 85.8% for the non-AD crashes. However, there are some significant differences that occur that might shed some light on AD. In the following the not-obscured value was suppressed, meaning that the comparison is between situations where vision was obscured are being compared between AD and non-AD crashes. Things that arise to the highest criticality seem to be items that might catch the AD driver by surprise, especially weather and the sun. See the next item for weather considerations.

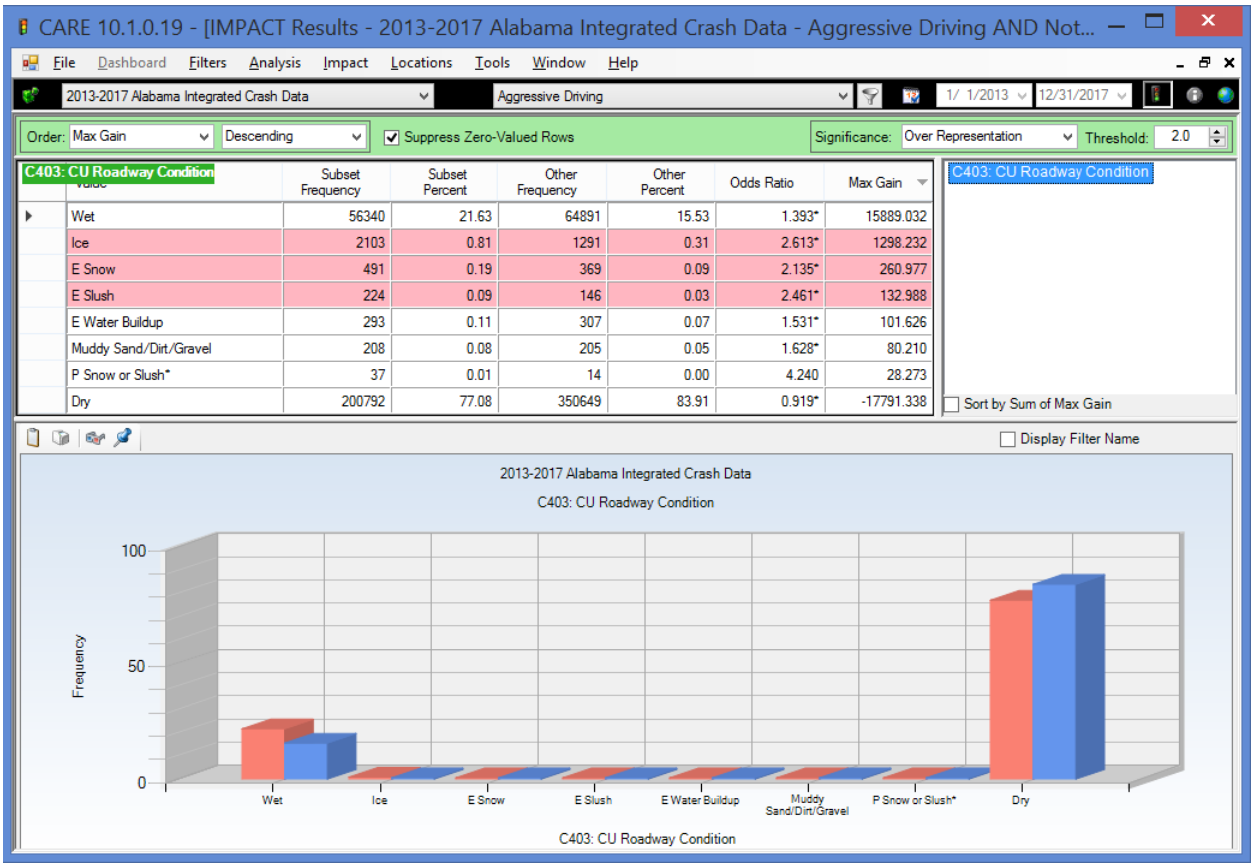


C030 Weather



AD drivers do not seem to be deterred by bad weather, at least not nearly as much as non-AD drivers. The question remains as to whether the rain causes the aggressive driving or whether those who are driving aggressively fail to slow down in the rain.

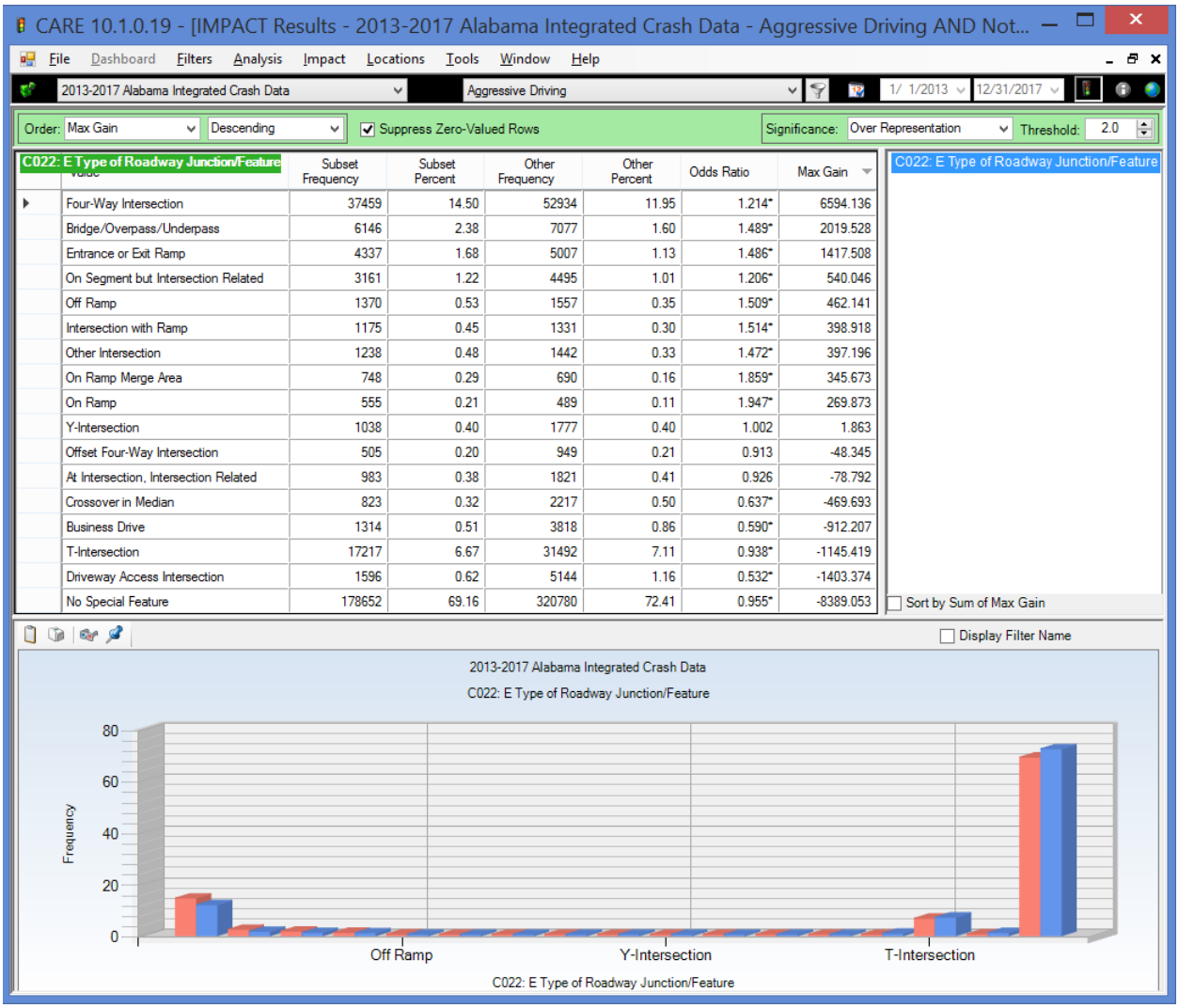
C403 CU Roadway Condition



This further confirms the weather findings above. There seems to be a dramatic disregard for extreme slippery conditions, which may be characteristic of the emotional response to aggression and its related abandonment of logical thinking.

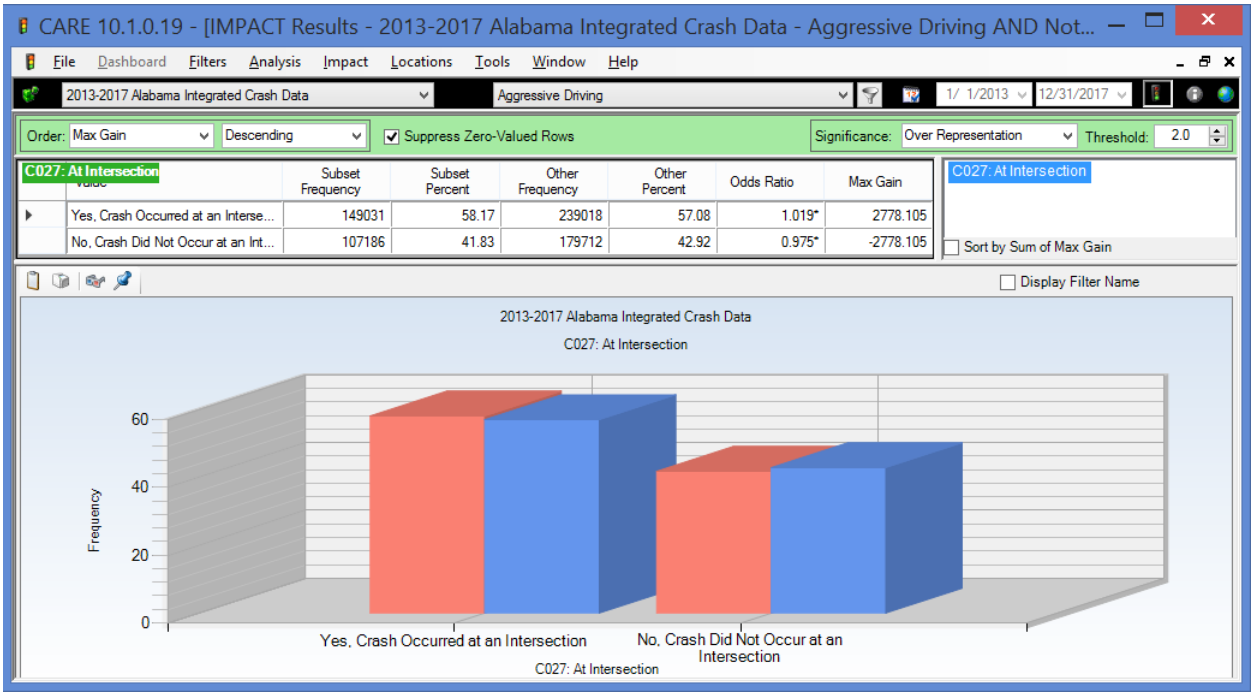
C022 E Type of Roadway Junction Feature

The following suppressed all items with less than 500 AD crashes. Four-way Intersections and the others at the top of the list give the AD drivers particular problems.



Four-Way Intersection had the highest max gain, being over three times the sec-ond tier, which included Bridge Overpass/Underpass, and Entrance or Exit Ramp.

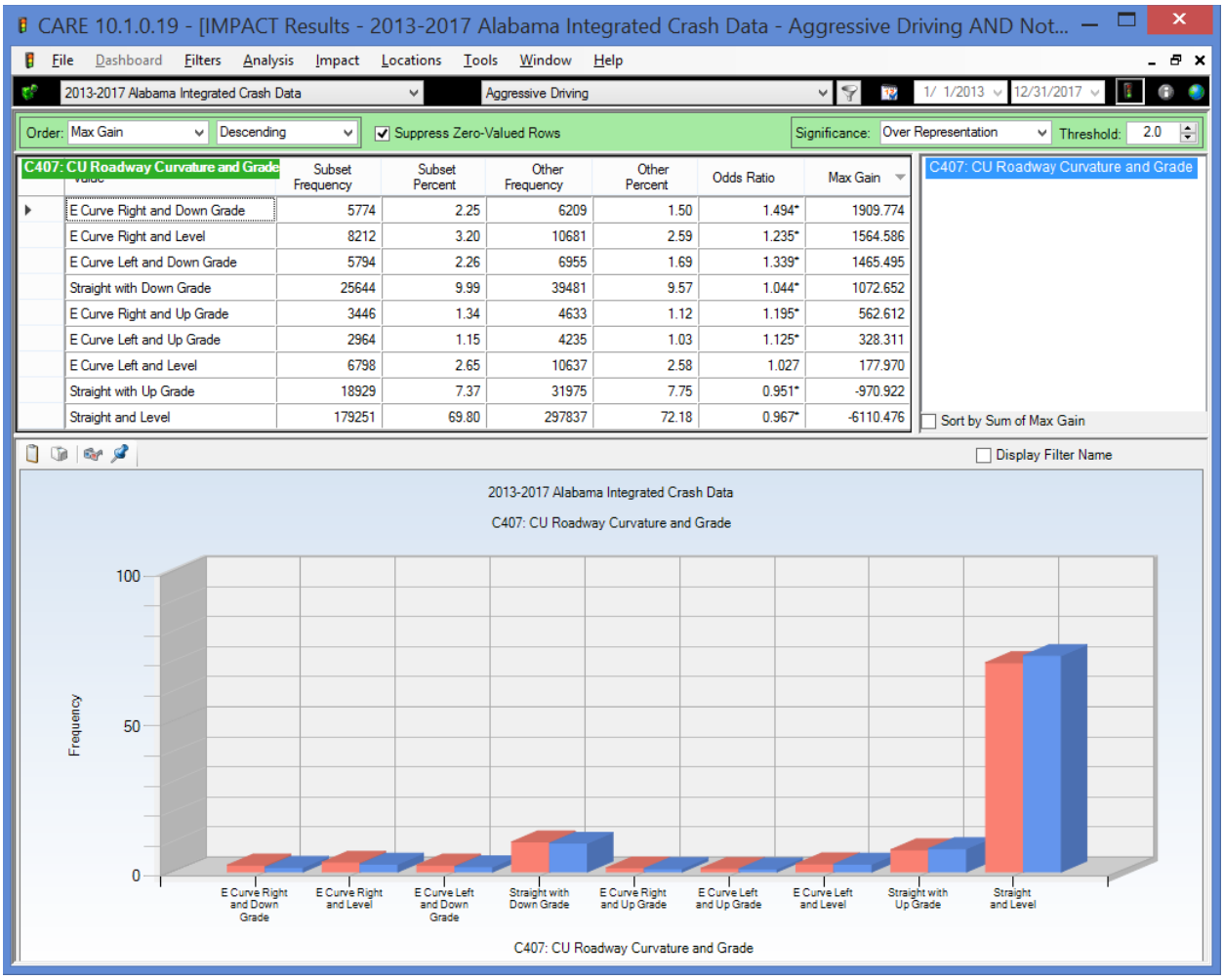
C027 At Intersection



The over-representation at intersections for AD crashes is significant, but it is not a large over-representation.

C407 CU Roadway Curvature and Grade

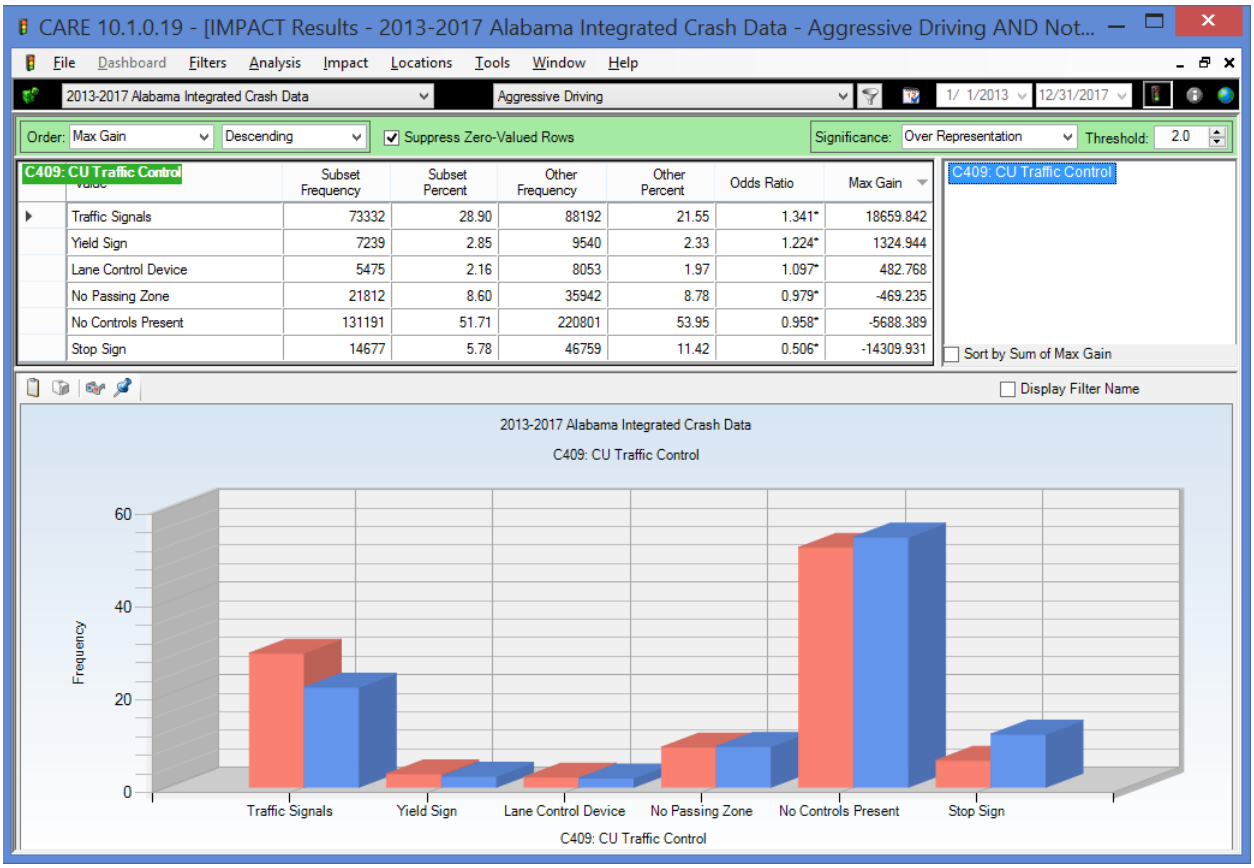
All items that had less than 1% of the total AD crashes were suppressed.



Crashes on downgrades are expected when AD drivers are distracted by other things and do not realize that the braking distance may have increased by a factor of 2 or 3 compared to level roadway. Similarly, all of the curve categories were over-represented.

C409 CU Traffic Control

All items that had less than 1% of the total of the AD crashes were suppressed. The larges and most significant over-representations involve traffic signals and yield signs.



C415 CU Workzone Related

AD crashes are under-represented in workzones, their having 92.5% of their crashes there as opposed to 93.0% for non-AD crashes. The comparison below is for those crashes that do occur in workzones. Large construction projects are clearly the greatest problem in both the absolute and the relative sense. Lane closures fall a distant second and are not significant. Interestingly, lane shifts are even fewer, but they do show a significantly higher proportion than the non-AD crashes.