Analysis of the Most Critical Factors in Young (16-20 Year Old) Driver-Caused Vehicle Crashes

Updated using CY2017-2021 Data

David Brown
brown@cs.ua.edu

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1.0 Introduction

For general NHTSA and other information on young drivers, please see:
http://www.safehomealabama.gov/tag/young-drivers/

1.1 The IMPACT Studies in General (CY 2017-2021)

The goal of this problem identification is to assure that the young driver program considered by the state throughout FY 2022-23 is completely evidence-based, the evidence being derived from data obtained from crash records. This study was initially conducted based on data from calendar years 2011-2015, and it was first updated for any changes that were observed in CY 2016 data. This most recent update used CY 2016-2021 data.

CARE IMPACT displays are used to present this information, and the corresponding findings are explained with each display. The comparisons made were between those crashes in which the causal drivers were in the age group of 16-20 years (generally represented by the red bars in the charts) and those drivers aged 21 and older (generally represented by the blue bars in the charts). By comparing these two age groups, problems that are unique to 16-20-year-old drivers can be identified.

Terminology: to make the narrative flow easier, in the context of this document, the term ***young drivers*** will be applied to drivers of age 16-20 years. The term ***older drivers*** will refer to those 21 year of age and older.

Please observe the following aspects of the IMPACT outputs:

- Values prefixed by an E are strictly from the eCrash system; while those prefixed by a P are from the paper-forms-based system of crash reporting. Value descriptors that have no prefix indicate that the descriptor is common to both the E and P systems. Most of variable unique to the paper reports have evolved out since the conversion to eCrash was initiated in mid-2009. However, a few jurisdictions continued to submit on the paper forms requiring this designation.
- The two "Subset" columns (Frequency and Percent) for this analysis were created by a filter that only allowed 16-20 aged driver (young driver) caused crashes. An alternative would be to look at all crashes that involved young drivers, but much better results are obtained by considering only those young drivers that caused the crash, since the inclusion of (non-causal) victim drivers in this age group would tend to dilute the results. Countermeasures to be considered are those that apply directly to young driver caused crashes.

- The "Other" columns provide a control to which the "Subset" columns are compared. In this case the "Other" columns represent the subset formed from all crashes that were not caused by *young drivers* (i.e., caused by *older drivers* according to the definitions above).
- For example, we compared Primary Contributing Circumstances (PCC) of crashes caused by young drivers to the PCC of crashes that were not caused by young drivers. The rationale for this comparison is that it highlights where young drivers are doing things differently from their older driver counterparts, and this would indicate where countermeasures are to be applied that specifically address the younger drivers.
- The Odds Ratio column indicates the extent of the difference found. It is just the "Subset Percentage" divided by the "Other Percentage." As an example, an Odds Ratio of 2.00 in the "Over the Speed Limit" row would indicate that younger drivers were two times more likely to be reported to be "Over the Speed Limit" by reporting officers than those attributed to older drivers.
- The asterisk (*) on some of the Odds Ratios is an indication that the proportion of the particular characteristics had a statistically significant difference found between the young drivers and the older drivers. This indicates that young drives are behaving in a statistically significant different way when it comes to these crash attributes, i.e., the differences observed are not just due to chance. No statistical tests are performed if either of the column numbers being compared is less than 20.
- Max Gain. This column indicates the number of crashes that would be saved over the five years of the study if young drivers had the same percentage of crashes with the corresponding attribute value as the older drivers. The ordering of the output is generally based on this column, with the exception of those attributes that are more understandable if they are presented in a natural ordering (e.g., time of day, month, number of injuries, etc.)

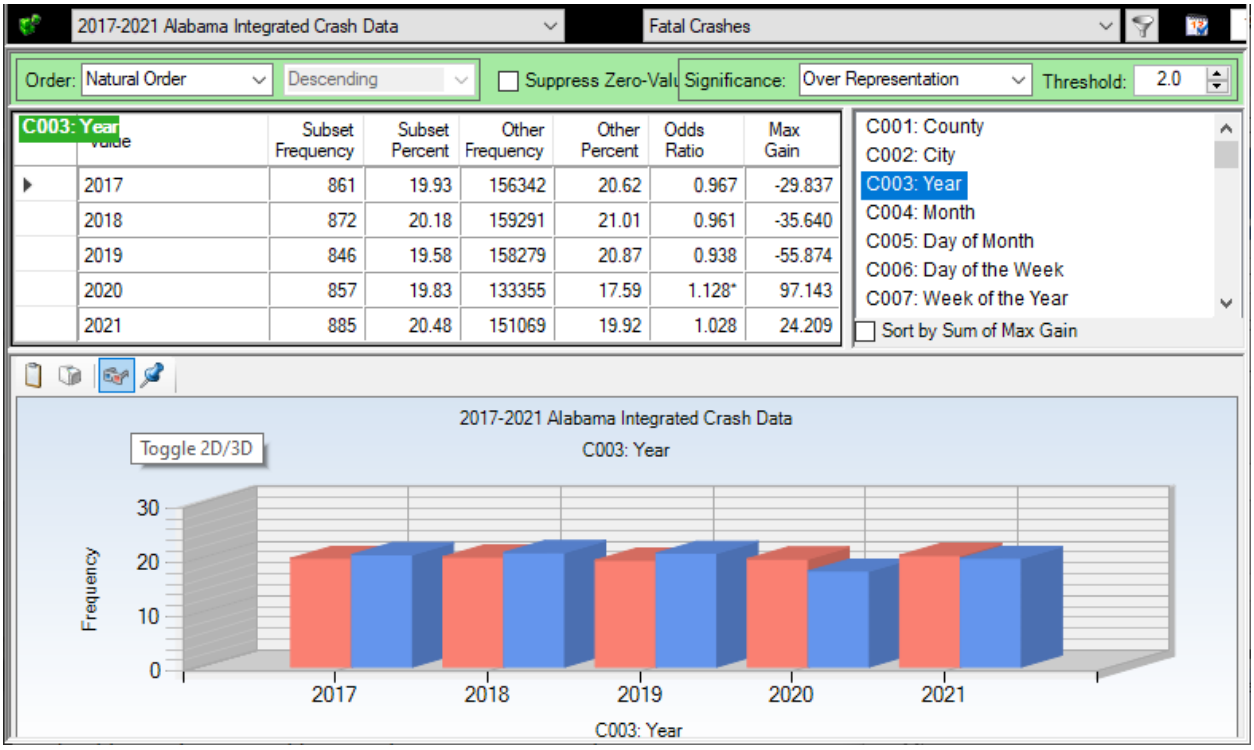
The findings of the problem identification will be presented in the following numbered order:

1. Introduction – this section (including Section 1.2 below).
2. Crash Causal Factors – listed first in that it was considered to be the most important in developing countermeasures for young driver caused crashes.
3. Severity Factors – given that a crash has occurred, its consequences can only be mitigated by a reduction in injury severity; and these factors are considered as equally important as the causation factors in reducing fatalities.
4. Driver Demographics – for purposes of evidence-based enforcement, the driver demographics, time factors and geographical factors are essential to determine the who, what, when, where, how and why of young driver crashes.
5. Time Factors – year, month, day of the week and time of day.
6. Geographical Factors – cities and counties as well as other geographical characteristics found to be over-represented.
7. Roadway and Vehicle Factors – there are less of a cause than driver characteristics, but may be useful especially in determining roadway and vehicle attributes that give young drivers their greatest problems.
8. Summary and Conclusions – ordered according to the list above.

1.2 The CY 2017-2021 Update to the 2011-2015 Study

The primary reason for conducting an update using the more recent CY 2017-2021 data is to determine if there were any significant changes in CY 2017-2021 that should alter the original findings. It might be noted that IMPACT study results, especially those over multiple years, are fairly stable. By this we mean that they do not tend to change from year to year. For example, the over-representation of young drivers in speed-related crashes is not expected to change in a relative short time. When changes are discovered, they will be emphasized.

That said, we must add that 2020 was not a "usual" year because of the restrictions imposed for the COVID pandemic. The major difference was in the number of crashes that were recorded. Unfortunately, the number of fatal crashes did not go down by the same proportion. An IMPACT comparison of fatal vs non-fatal crashes showed fatal crashes in 2020 to have a statistically significant Odds Ratio of 1.128, as shown in the following IMPACT analysis.

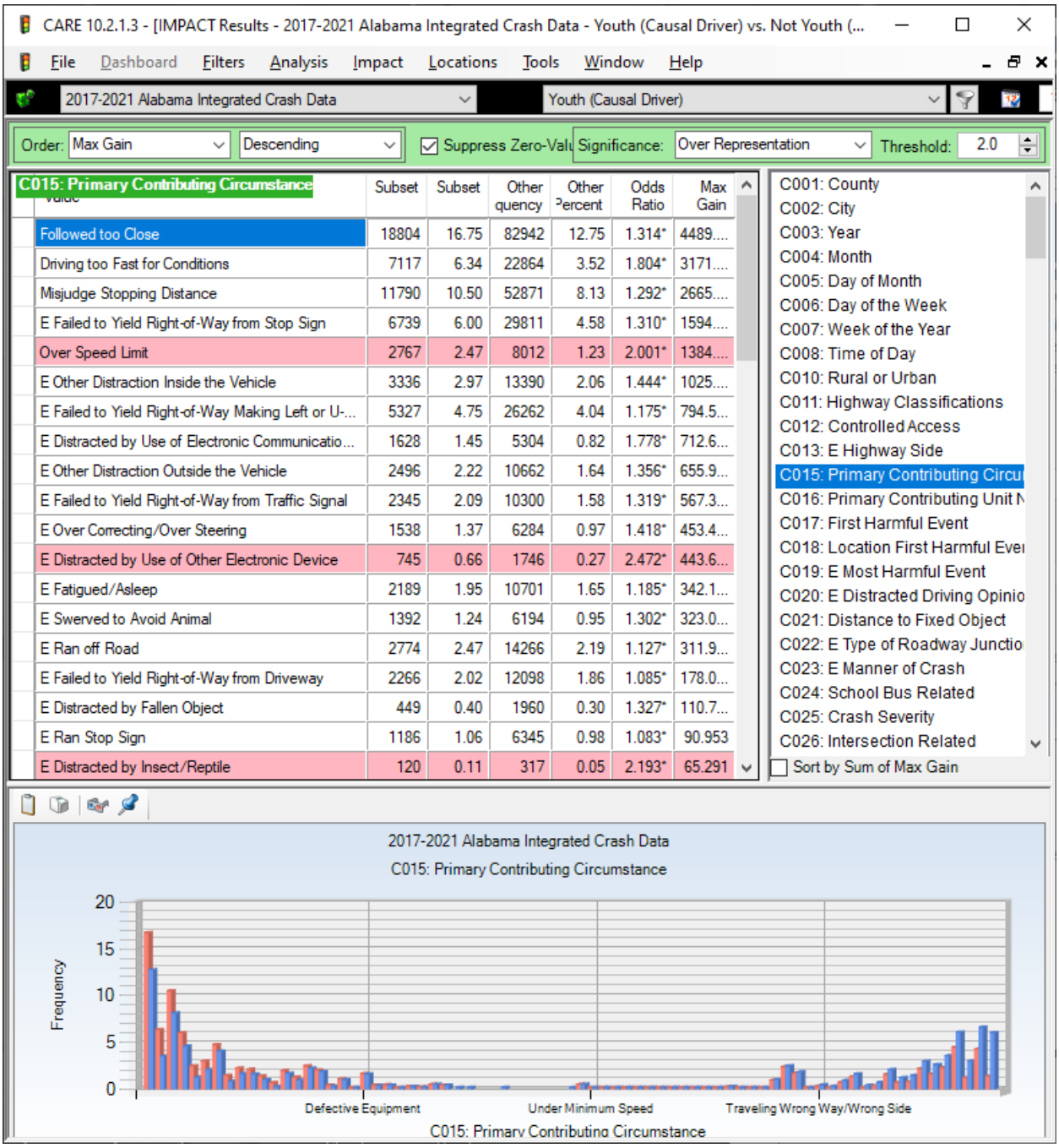


The 2020 fatal crash proportion (19.83%) was about the same as that for other years. However, the total number of crashes decreased to only 17.59% of the total for all five years. It is obvious that something different was occurring on the roadways in 2020 than in previous years, and this seemed to carry into 2021, but to a smaller degree.

2.0 Crash Causal Factors for Younger Drivers

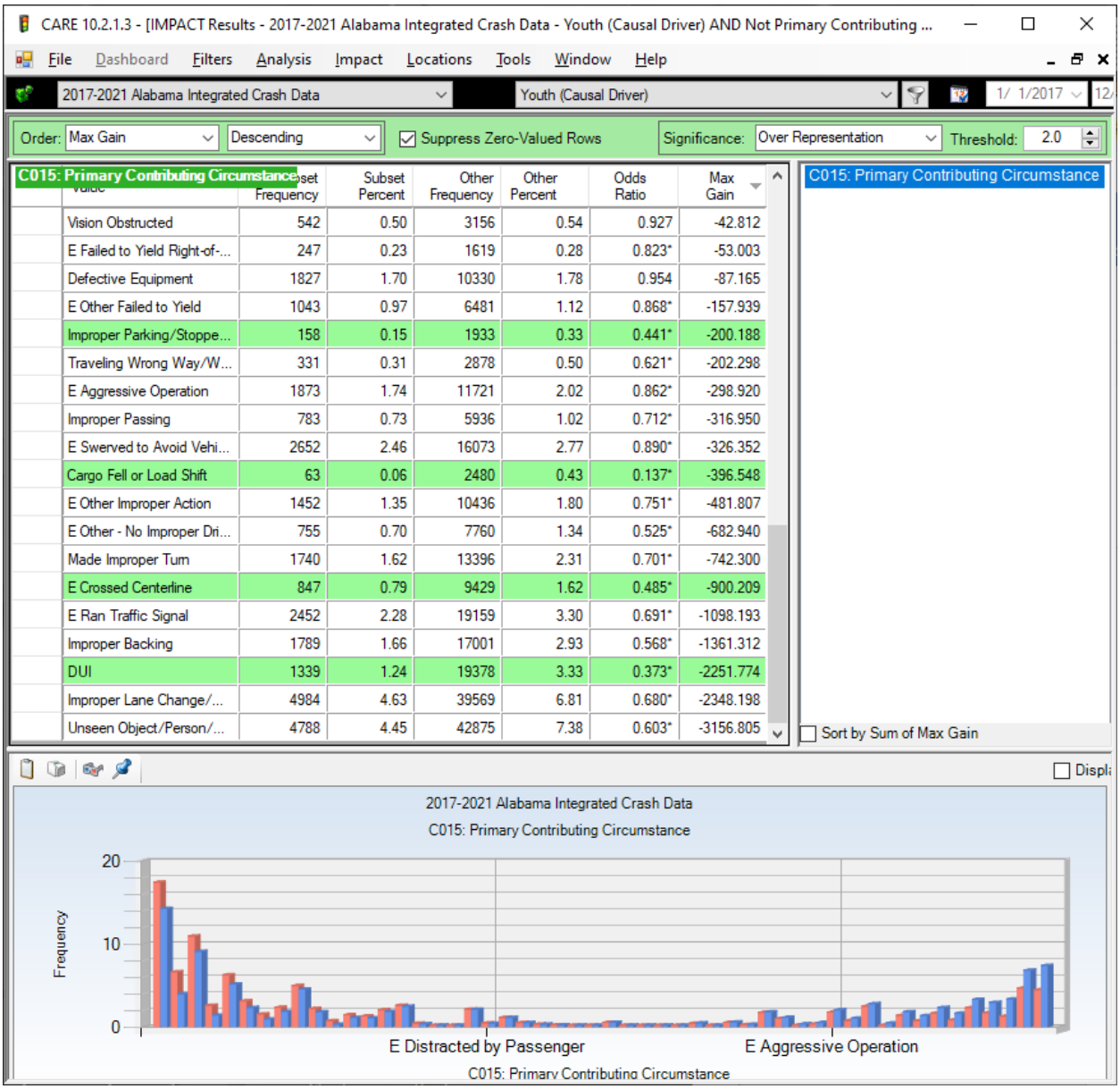
This part of the analysis was to determine those factors that are the most likely contributors to crashes caused by young drivers.

2.1a Primary Contributing Circumstance – Items of Significantly Over-Representation



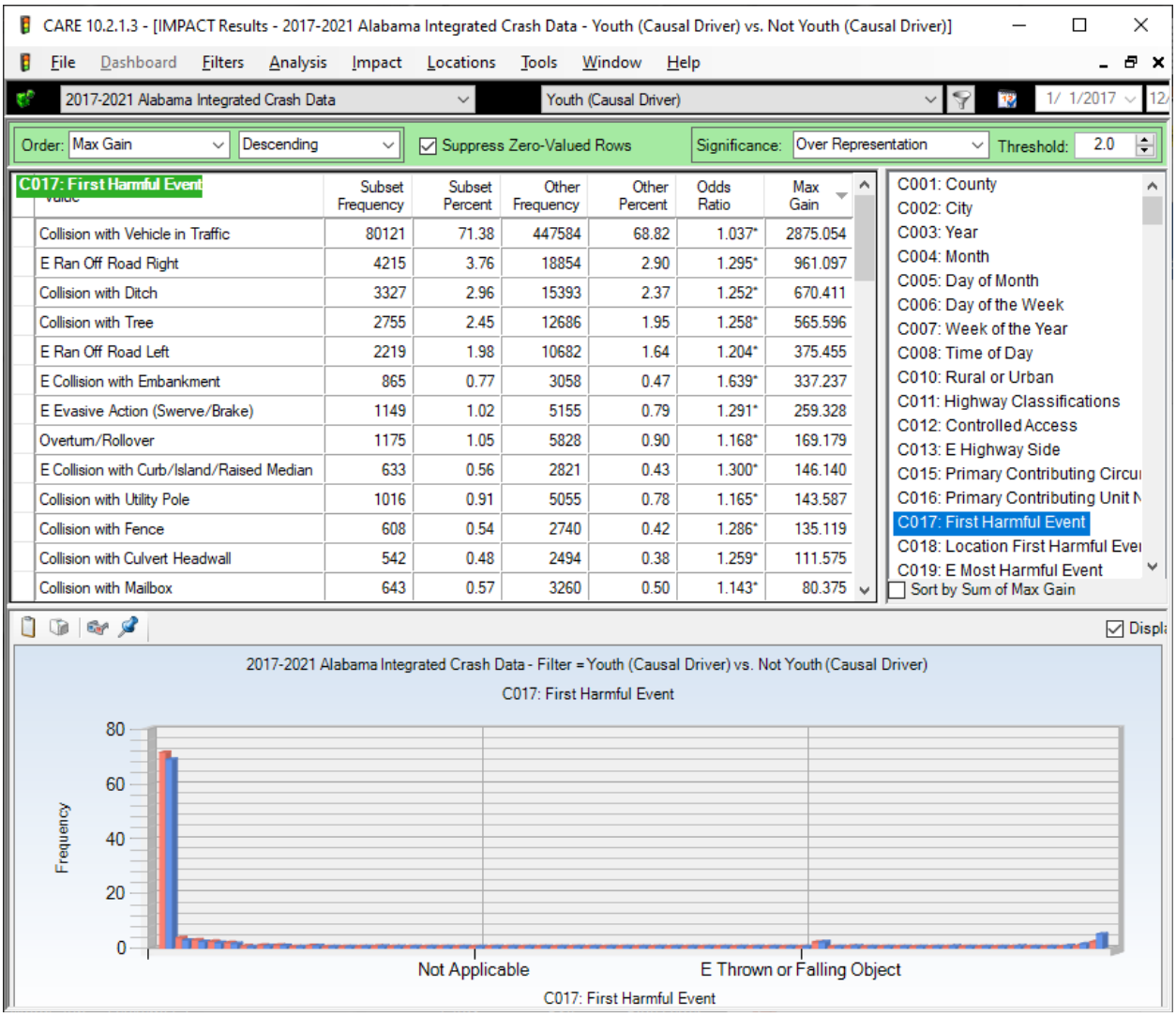
Over-represented items are largely risk-taking behaviors that are highly associated with younger drivers. In order of maximum potential expected gain (Max Gain), these include: Following too Close, Driving too Fast for Conditions, Misjudge Stopping Distance, Failure to Yield the Right of Way, and Over the Speed Limit.

2.1b Primary Contributing Circumstance – Items of Significant Under-Representation



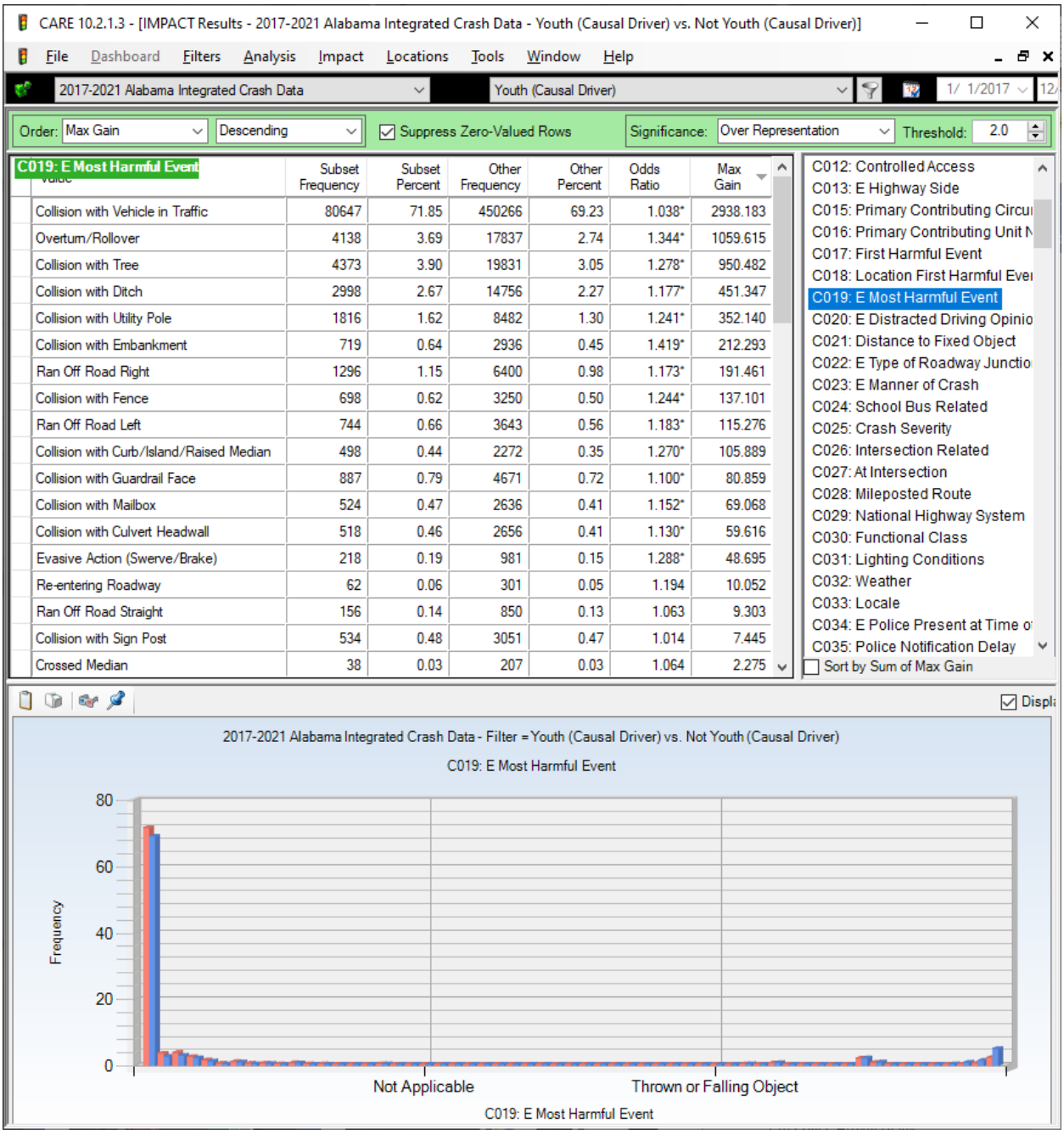
In developing an optimal set of countermeasures, it is equally important to know where resources are not needed. Those at the bottom of the table above have the greatest under-representations. While some have high frequencies, reducing them much further may not be very practical. Young drivers are notably under-represented in their DUI, thanks to the 21-year-old legal drinking age law. There are other under-represented items that might be attributed to their recent training and passing the drivers' test, and in some cases the effects of the Graduated Drivers Licensing (GDL) acts. In many cases, these under-represented items indicate those countermeasures that have been successful or younger drivers.

2.2 First Harmful Event – Significant Over-Representations



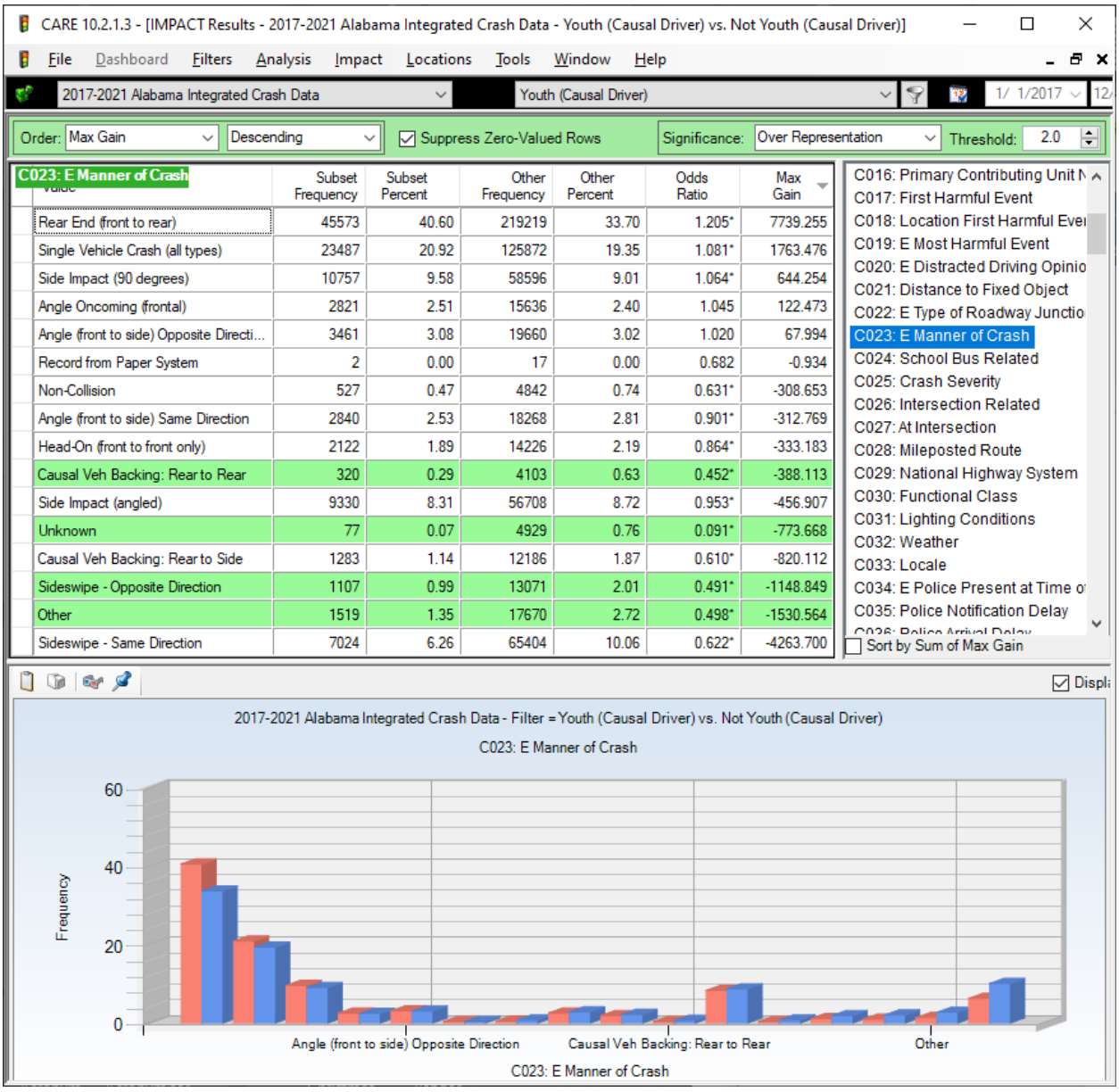
It is impossible to separate these first harmful events from speeding and other risk-taking behaviors. A major change was found in Collision with Vehicle in Traffic, which was under-represented in the CY2011-2015 data. It is now over-represented indicating that young people are now having more problems with other vehicles as opposed to single vehicle crashes. All other items were about as expected.

2.3 Most Harmful Event – Items with Significant Over-Representations



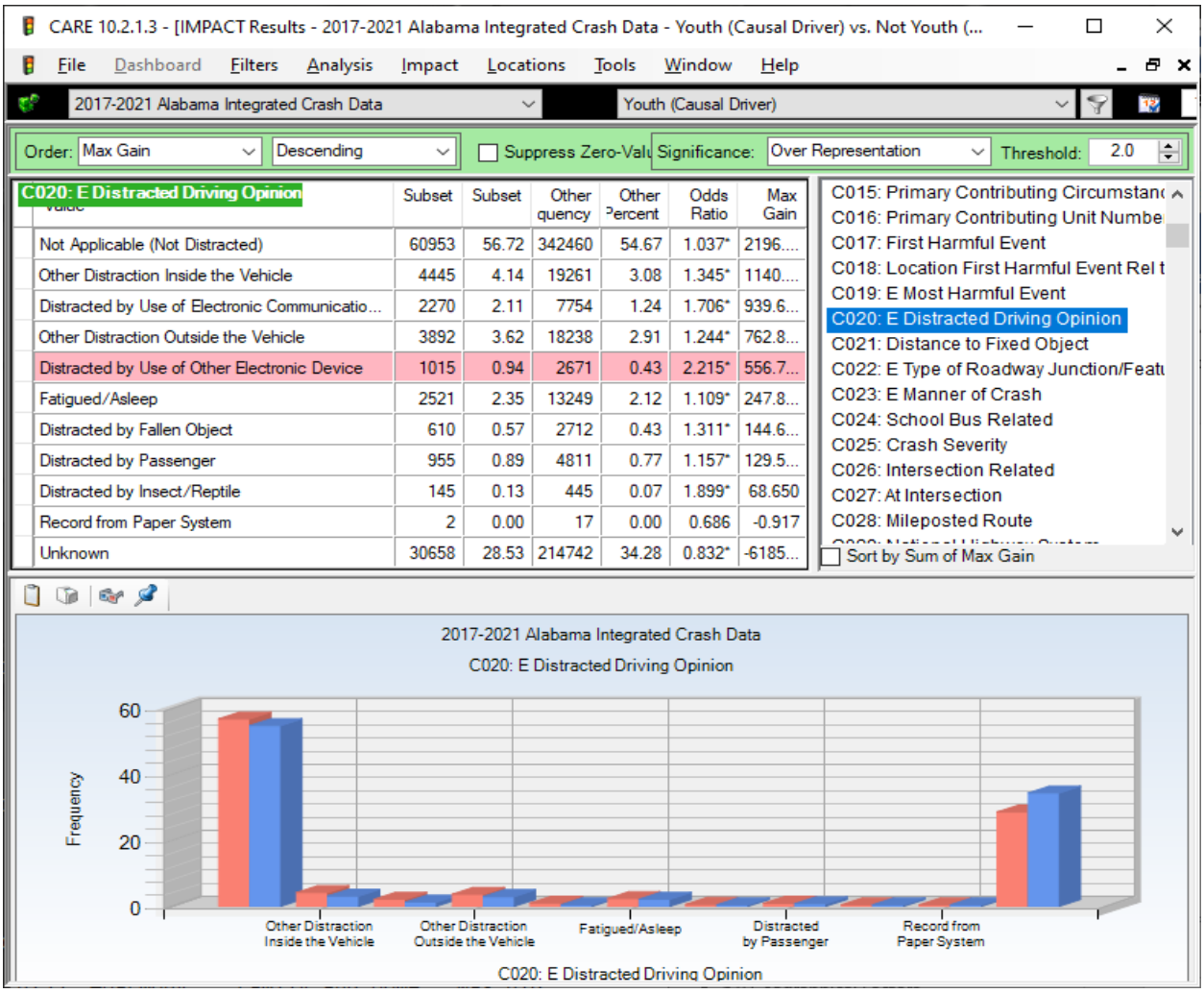
The Most Harmful Event attribute indicates more what caused harm as opposed to what caused the crash. Over 88% of young drivers' crashes involve two or more vehicles. This is only a few percentage points above the older drivers, but the difference is significant. See Section 3.4 for the numbers of vehicles comparison.

2.4 Manner of Crash



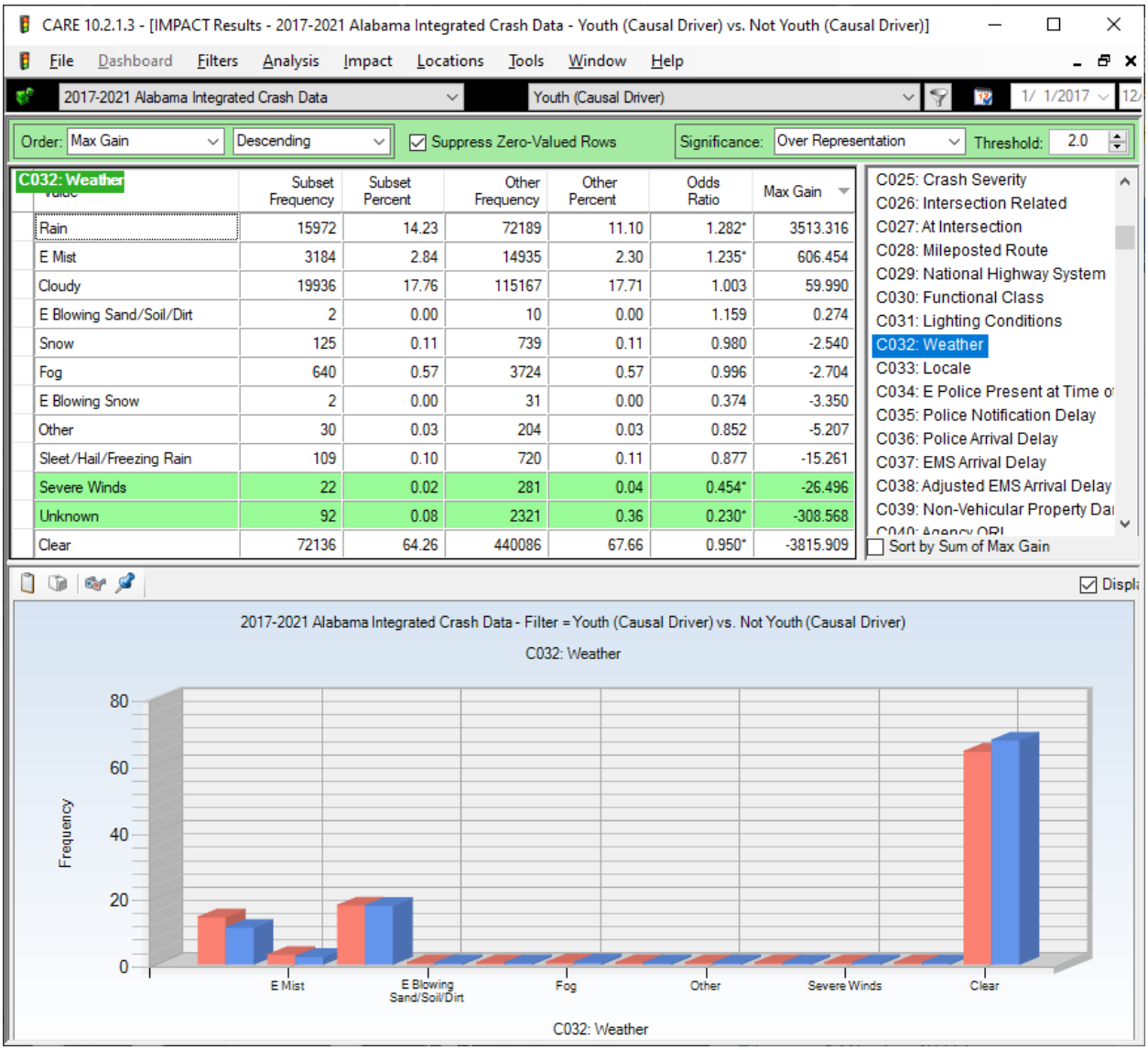
Additional clues regarding the causes of the crash can be seen from the Manner of Crash. Rear End crashes reflect poor estimation of stopping distance (inexperience). The over-representation of single vehicle crashes shows an excess of unforced errors and risk-taking. These two, along with Side Impact (90 degrees) are the only three categories that are significantly over-represented.

2.5 Distracted Driving – Officer's Opinion



Distracted driving under-reporting. It is clear to all traffic safety professionals that the reported incidence of distracted driving is far less than that occurring in reality on the roadway. For example, if a conservative estimate of 20% of drivers at any time are involved with an electronic device, then we would expect the percentage of crashes to be affected would be 20%. In reality, most observers perceive from their informal observations that this proportion to be well above 30%. It is a valid assumption, however, that officers would not report this attribute for young drivers any differently than they would for older drivers. This means that while the absolute numbers given are almost certain to be lower than reality, they do form a representative random sample of all distracted driving occurring for both the younger and the older causal drivers. That being the case, the comparison of the two subsets is valid and valuable in determining the affinity of distractions to the younger drivers. The only under-represented category is "Unknown." Other Distractions Inside the Vehicle have the highest Max Gain; these should not be assumed to be other passengers, since there is another category for that, which is also over-represented, showing the value of the GDL in restricting the number of passengers.

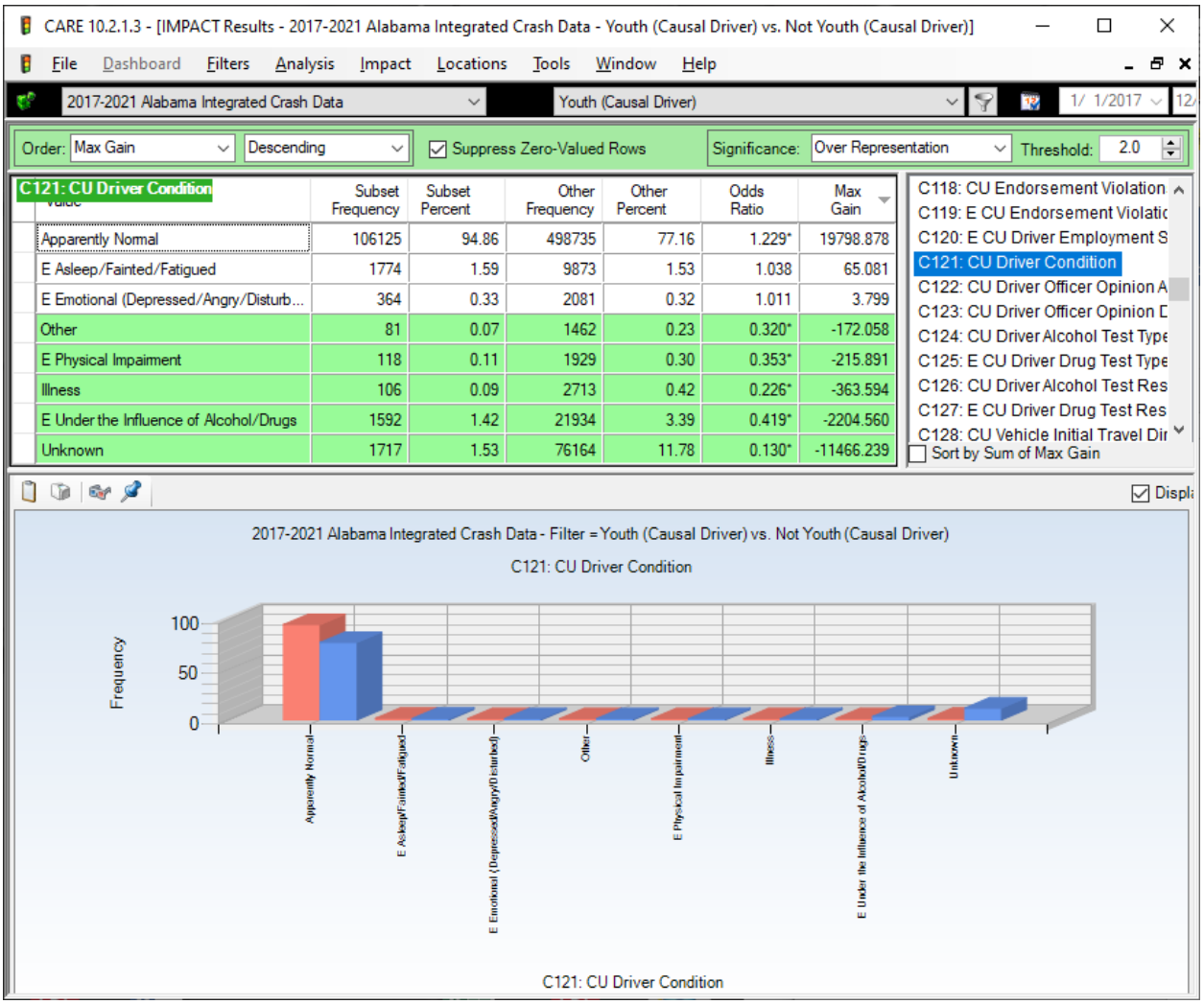
2.6 Weather



We are including weather as a major causal factor mainly because our analysis of the 2015 general increase in all crashes was largely attributed to the increase in rainfall days in 2015. Studies in Alabama have shown that the effect of rain on visibility and surface condition can increase the frequency of crashes by as much as 40%. See:
http://www.safehomealabama.gov/wp-content/uploads/2019/05/Weather-Combine-Binder1.pdf

The display above shows that rain is a particular issue for young drivers, their having 28.2% more than their expected number of crashes in the rain. This is definitely a subject that needs to be given more attention in training and testing. The combination of inexperience (they may not have had a serious scary skid at this point), coupled with their inclinations to take risks, is a bad combination in the rain.

2.7 CU Driver Condition

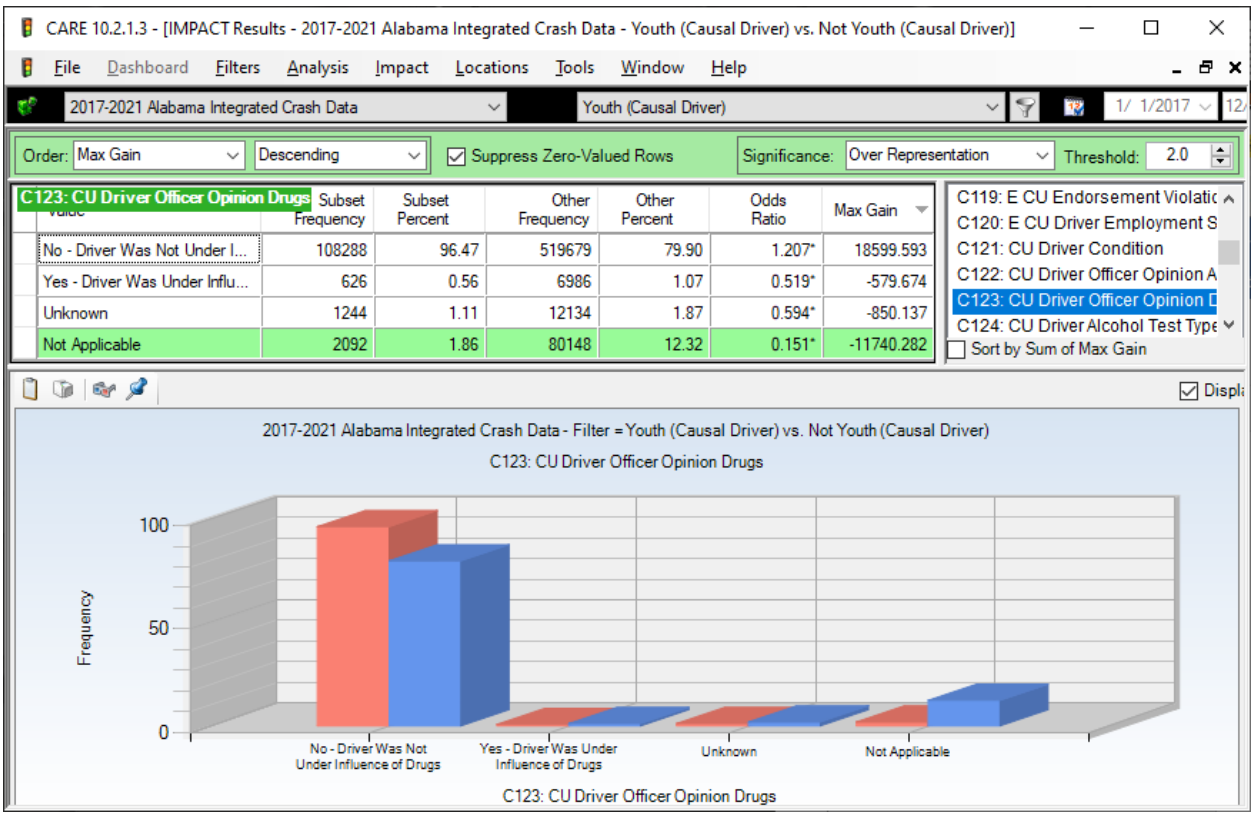


This and the next attribute show a very positive characteristic of younger drivers – the fact that they have not yet gotten into drinking/drugs and driving. We say "not yet" because this problem does build with each year of age, and it becomes over-represented at age 21 and stays that way well into the 30s. We attribute this to the age 21 drinking law, and any suggestion that this age should be lowered (as was made a few years ago by some university presidents) is absurd on the surface and should be opposed by all serious traffic safety advocates.

The massive use of marijuana that is sweeping those states that have legalized its use. See "Marijuana's Effect on Your Driving" here:

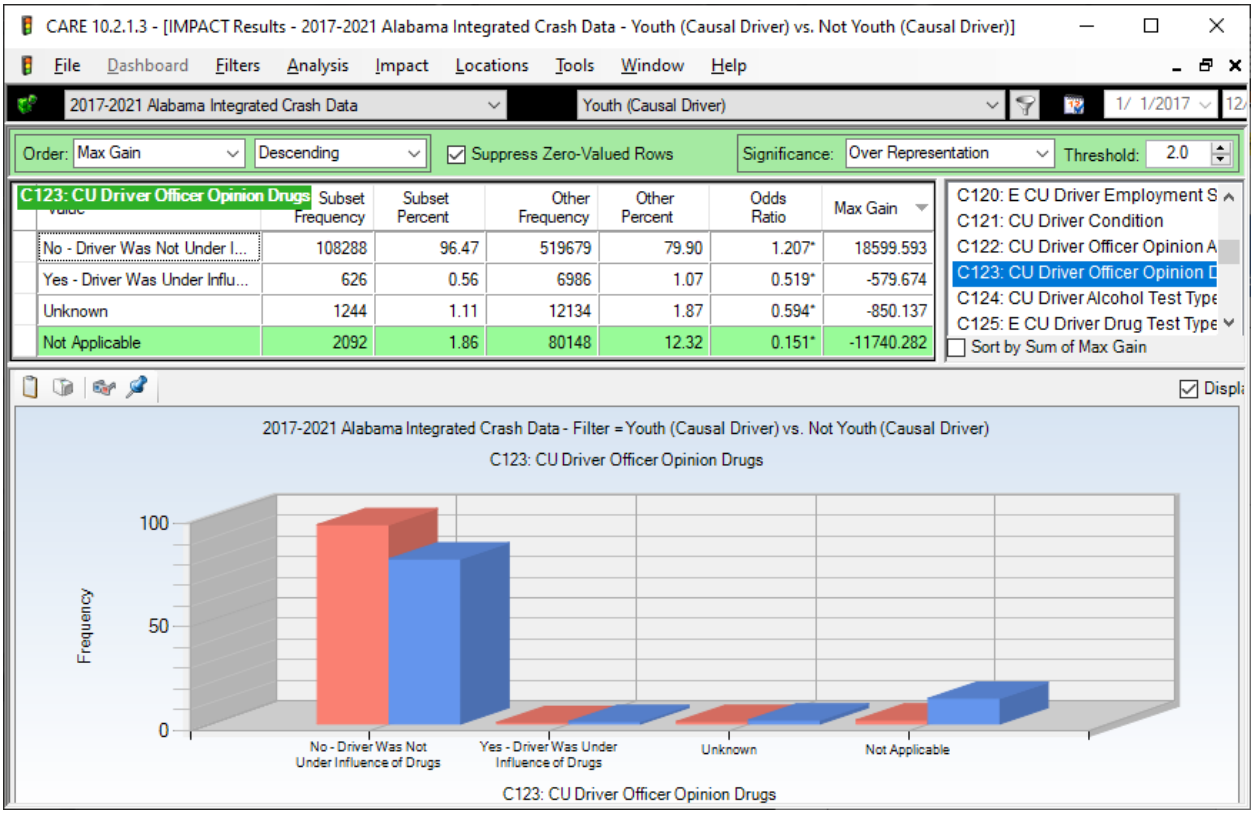
https://www.nhtsa.gov/drug-impaired-driving/understanding-how-marijuana-affects-driving

2.8 CU Driver Officer Opinion Alcohol



Young drivers are generally doing quite well in avoiding the problems of alcohol and other drugs. However, the fact that a significant number of young-driver crashes have involved alcohol (2,065) and other drugs (626) is an indication that the PI&E directed at young drivers should continue and be extended.

2.9 CU Driver Officer Opinion Drugs

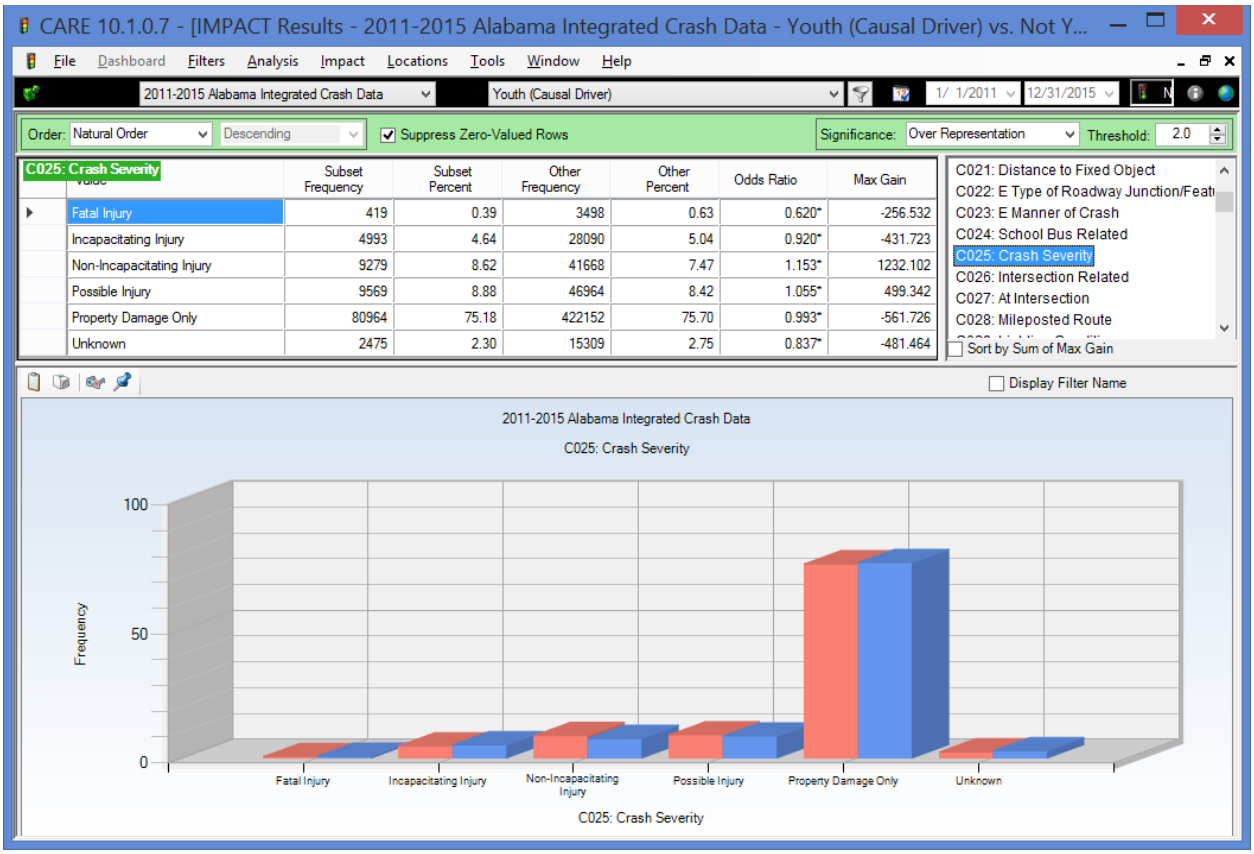


See discussion above for alcohol and non-alcohol drugs.

3.0 Severity Factors

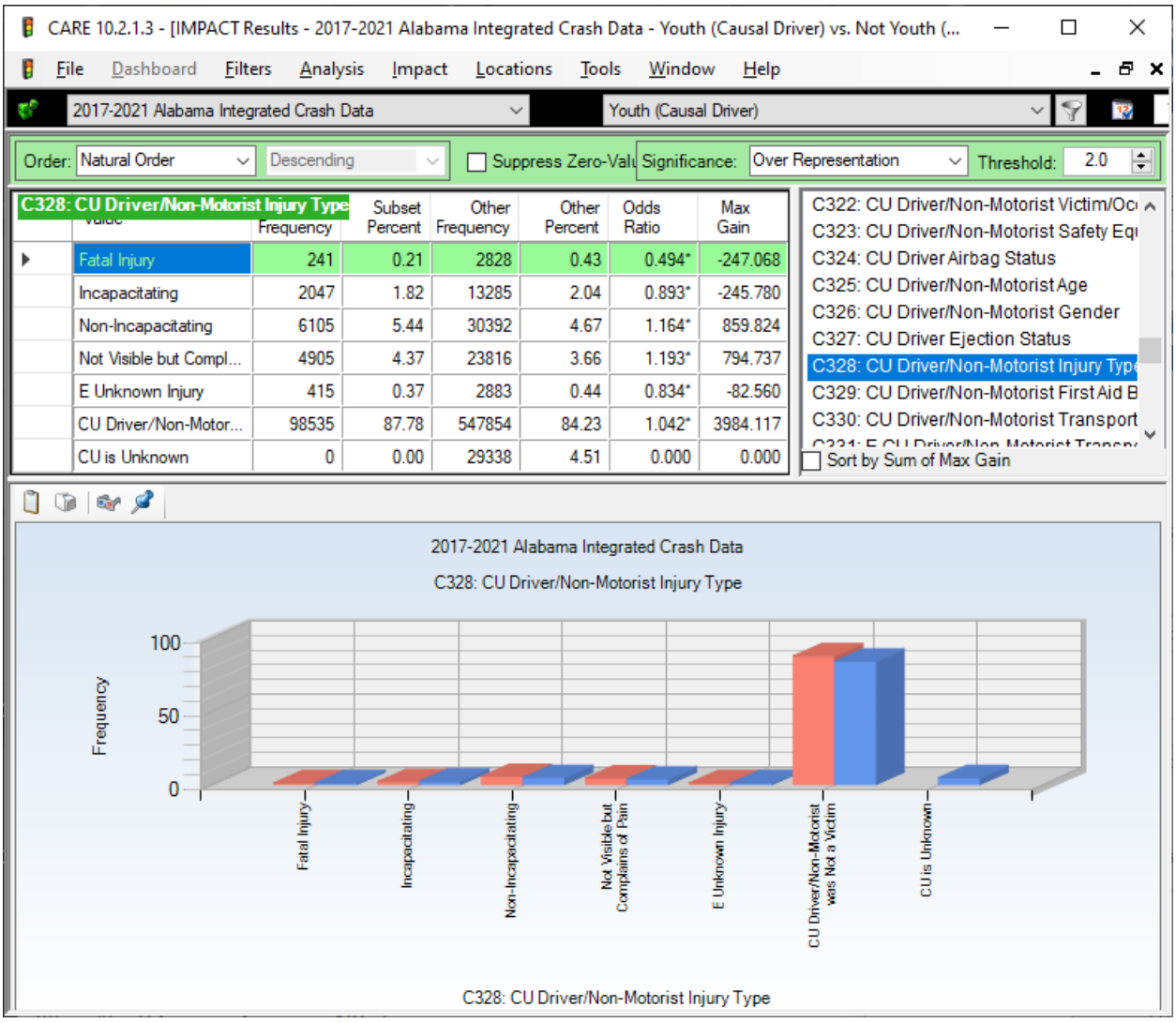
Severity factors were analyzed in several different categories to determine to what extent crashes caused by younger drivers produce severities different from older driver caused crashes.

3.1 Crash Severity



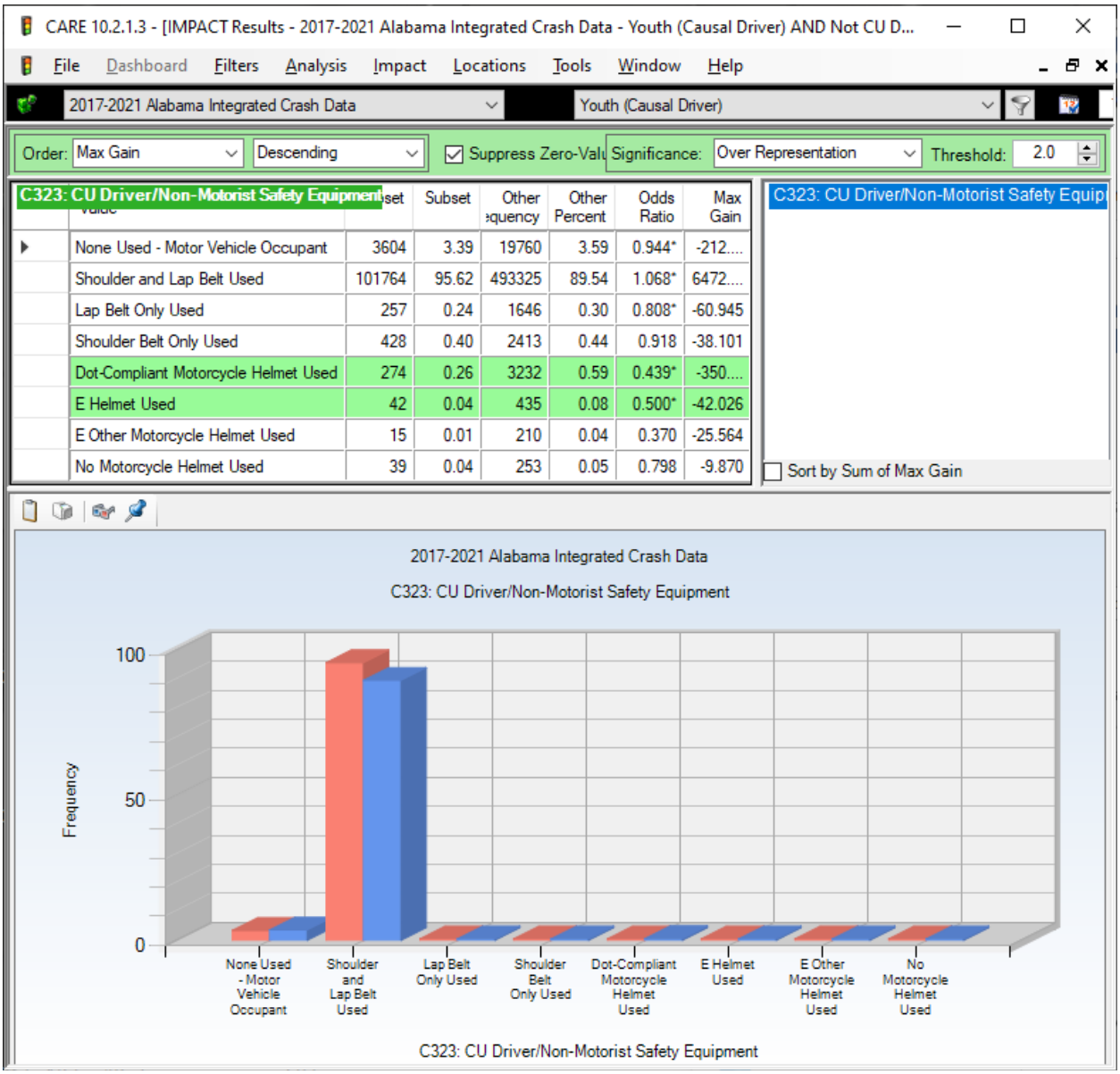
This attribute is the severity of the worse injured person in the crash, not just the causal driver. It is clear that fatal and incapacitating injury are significantly under-represented. The over-representation that balances these out are the two lessor injury categories. The younger drivers and their typically younger passengers have a far greater survival rate than older persons under the identical circumstances.

3.2 CU Driver Injury Type



The favorable youth severity results for all crash occupants is greatly multiplied for the causal drivers, in that we know that all causal drivers in the subset are of ages 16-20 inclusive. Thus, for example, the under-representation (Odds Ratio) improves from 0.620 for all persons in the crash to 0.494 when just referring to causal drivers. Interesting here in comparing these two displays, since there were 419 fatal crashes in general, and 241 of them were the causal drivers, this leaves 177 crashes in which persons were killed other than the aged 16-20 causal driver.

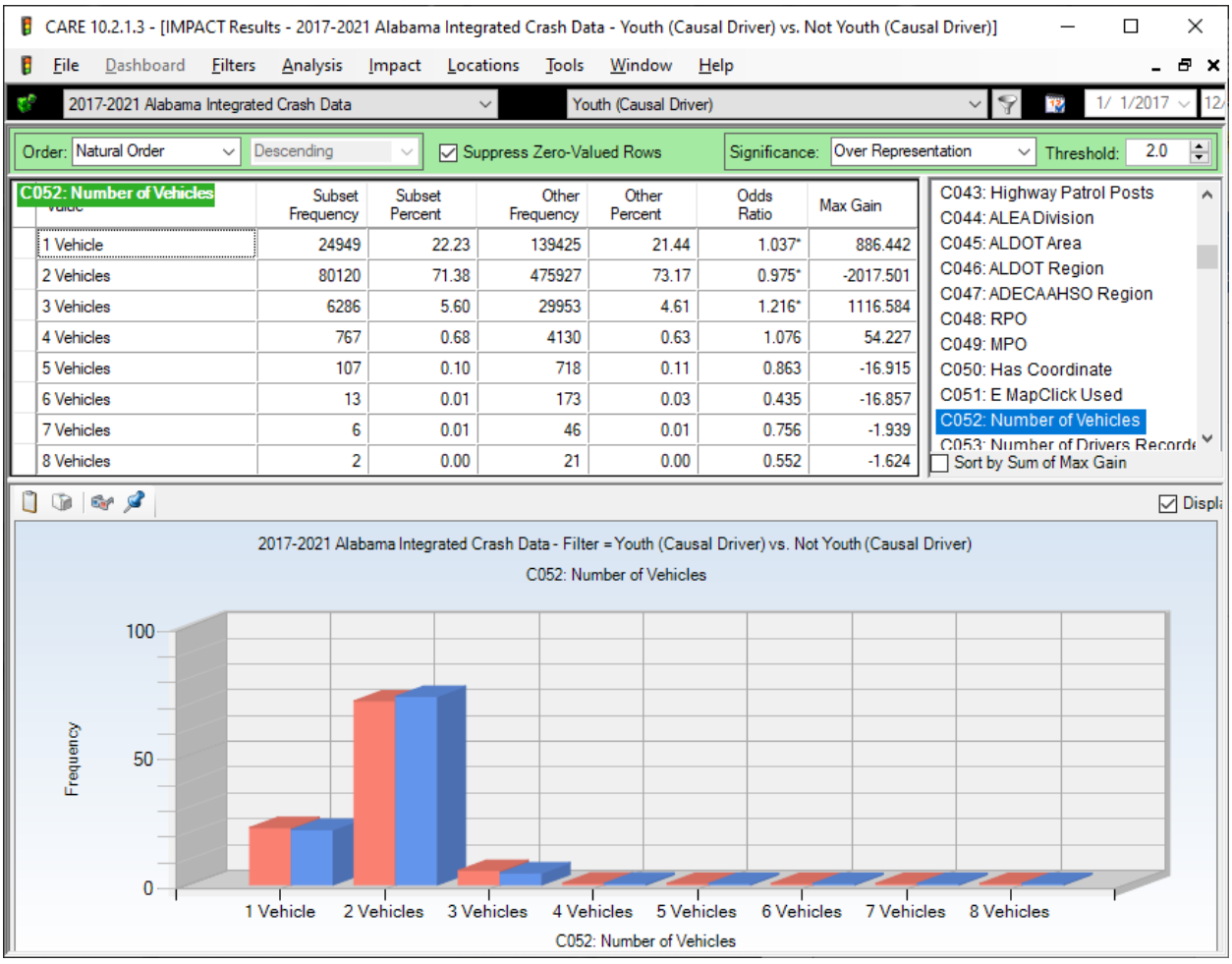
3.3 CU Driver Safety Equipment (Seatbelt Use)



C323: CU Driver/Non-Motorist Safety Equipment	Subset	Subset	Other Frequency	Other Percent	Odds Ratio	Max Gain
None Used - Motor Vehicle Occupant	3604	3.39	19760	3.59	0.944*	-212....
Shoulder and Lap Belt Used	101764	95.62	493325	89.54	1.068*	6472....
Lap Belt Only Used	257	0.24	1646	0.30	0.808*	-60.945
Shoulder Belt Only Used	428	0.40	2413	0.44	0.918	-38.101
Dot-Compliant Motorcycle Helmet Used	274	0.26	3232	0.59	0.439*	-350....
E Helmet Used	42	0.04	435	0.08	0.500*	-42.026
E Other Motorcycle Helmet Used	15	0.01	210	0.04	0.370	-25.564
No Motorcycle Helmet Used	39	0.04	253	0.05	0.798	-9.870

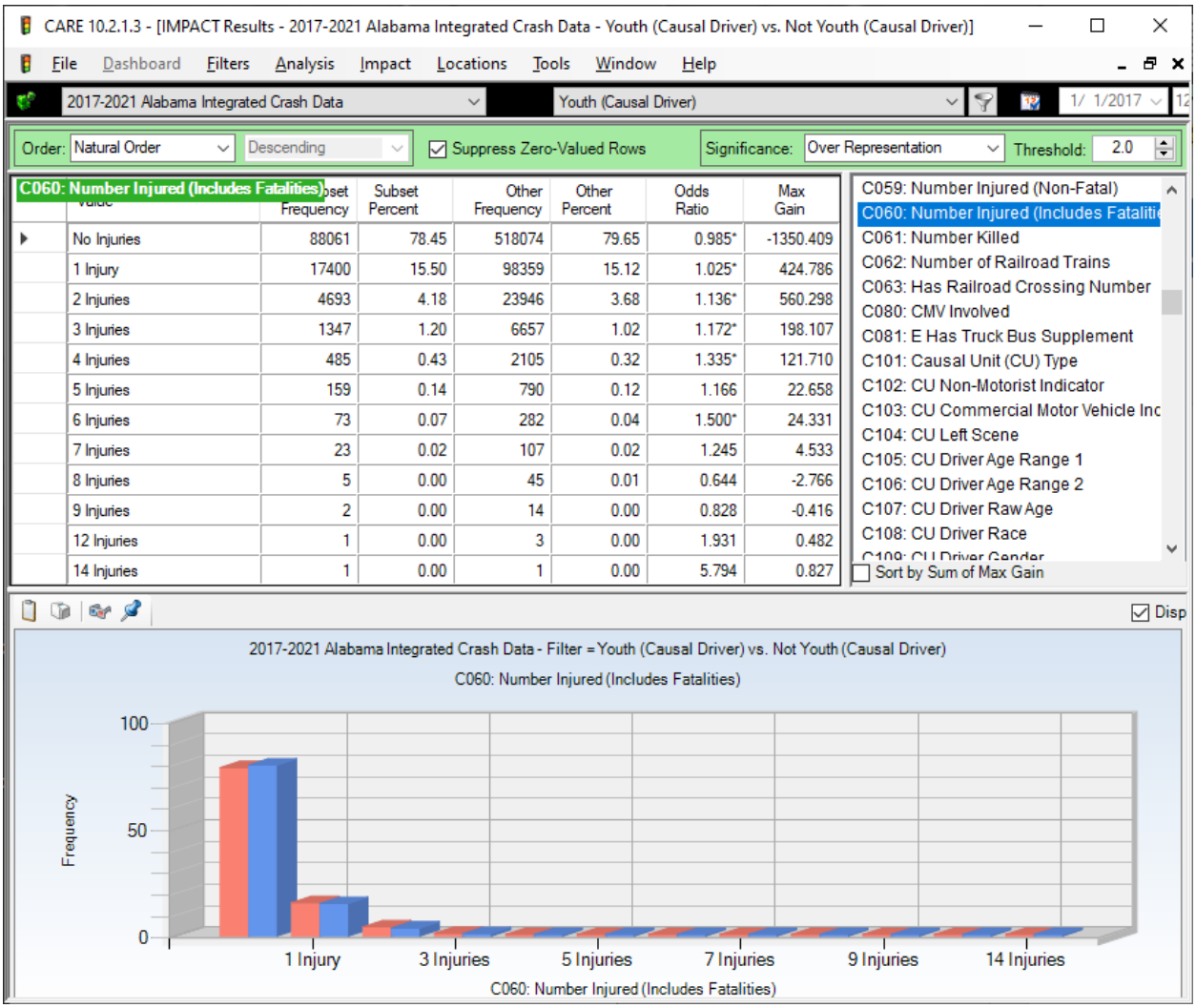
Younger drivers seem to be doing a relatively good job in buckling up, as they are significantly over-represented in the "Shoulder and Lap Belt Used" category. This probably reflects their general training throughout their school years, both in the schools and the families.

3.4 Number of Vehicles



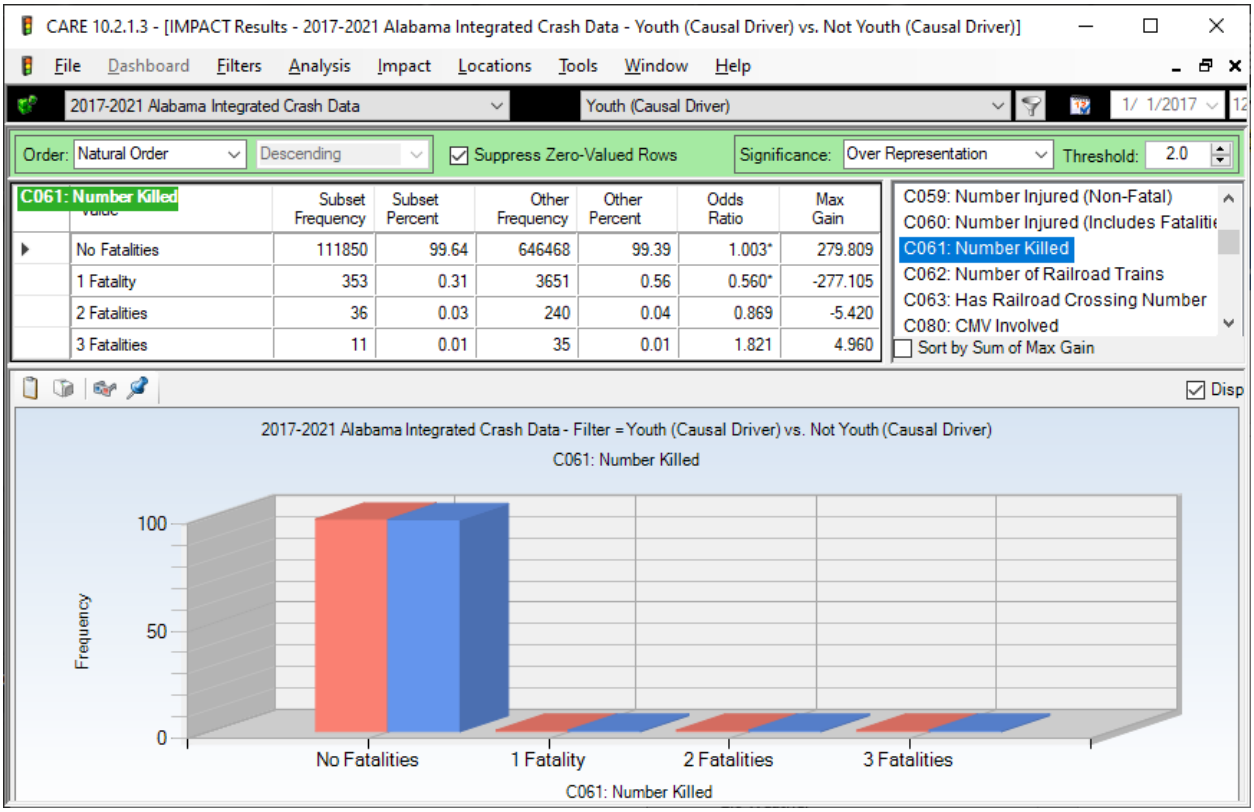
Generally young drivers have about more than their share of single-vehicle crashes. In this case the over-representation was measured at 3.7% greater than the older control group. This amounted to about 886 crashes over the five-year period.

3.5 Number Injured (Includes Fatalities)



This display shows that crashes with no injuries are significantly under-represented for younger drivers. The 1-7 injury classifications are all over-represented, which is alarming. Taking all of the information in Section 3 above collectively, we can say that while any give crash may not be fatal, there are more people injured in the younger-driver caused crashes than that for older drivers.

3.6 Number Killed



As indicated above, the number of fatalities caused by younger drivers is fewer than expected (in comparison with older drivers), and so the No Fatalities category is significantly over-represented, even though the Odds Ratio (1.003) is amall. Correspondingly, the one and two fatality categories are under-represented, although this is not significant for the two fatality category.

The three-fatality category is over-represented (no significance is calculated when there are less than 20 crashes in either subset). News reports have shown that some young drivers have caused some horrific crashes causing death not only to their own passengers but to those in other vehicles. While these crashes get high coverage, fortunately, they are relatively few in number. But that is of no solace to the families who have lost loved ones, including the families of the causal drivers. In all but a few exceptional cases the most severe of these crashes involve a very high level of risk acceptance, and in some cases the intent to increase risk, usually by high speeds. Countermeasures to prevent these types of incidents have clearly not been as successful as traffic safety professionals would like, and research must continue in this area. It should be recognized that warning young drivers against specific risky behaviors is not an effective countermeasure if, in fact, it is their inclination to take risks. The warnings might have just the opposite effects.

3.7 Speed at Impact

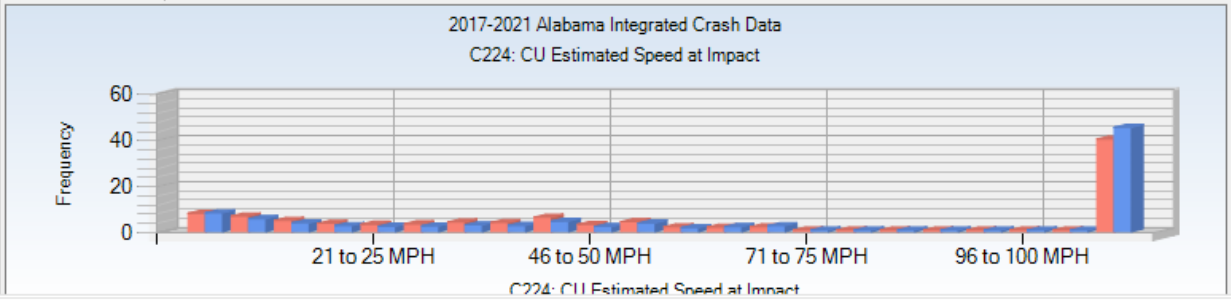
2017-2021 Alabama Integrated Crash Data | Youth (Causal Driver)

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

C224: CU Estimated Speed at Impact	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
1 to 5 MPH	8668	8.01	51159	8.19	0.977	-203.280
6 to 10 MPH	7384	6.82	35536	5.69	1.198*	1221.842
11 to 15 MPH	5335	4.93	23931	3.83	1.286*	1185.220
16 to 20 MPH	3965	3.66	16888	2.71	1.354*	1036.519
21 to 25 MPH	3499	3.23	14935	2.39	1.351*	909.181
26 to 30 MPH	3711	3.43	15571	2.49	1.374*	1010.894
31 to 35 MPH	4543	4.20	18417	2.95	1.423*	1349.381
36 to 40 MPH	4337	4.01	17190	2.75	1.455*	1356.150
41 to 45 MPH	6821	6.30	28583	4.58	1.376*	1864.535
46 to 50 MPH	3424	3.16	13996	2.24	1.411*	997.009
51 to 55 MPH	4676	4.32	23573	3.78	1.144*	588.299
56 to 60 MPH	2303	2.13	11195	1.79	1.186*	361.719
61 to 65 MPH	2174	2.01	13827	2.21	0.907*	-223.685
66 to 70 MPH	2340	2.16	16362	2.62	0.825*	-497.270
71 to 75 MPH	653	0.60	3717	0.60	1.013	8.450
76 to 80 MPH	443	0.41	2302	0.37	1.110	43.819
81 to 85 MPH	130	0.12	743	0.12	1.009	1.159
86 to 90 MPH	108	0.10	550	0.09	1.132	12.627
91 to 95 MPH	21	0.02	124	0.02	0.977	-0.502
96 to 100 MPH	61	0.06	332	0.05	1.060	3.429
Over 100 MPH	36	0.03	203	0.03	1.023	0.799
Unknown	43628	40.30	283721	45.45	0.887*	-5570.9...

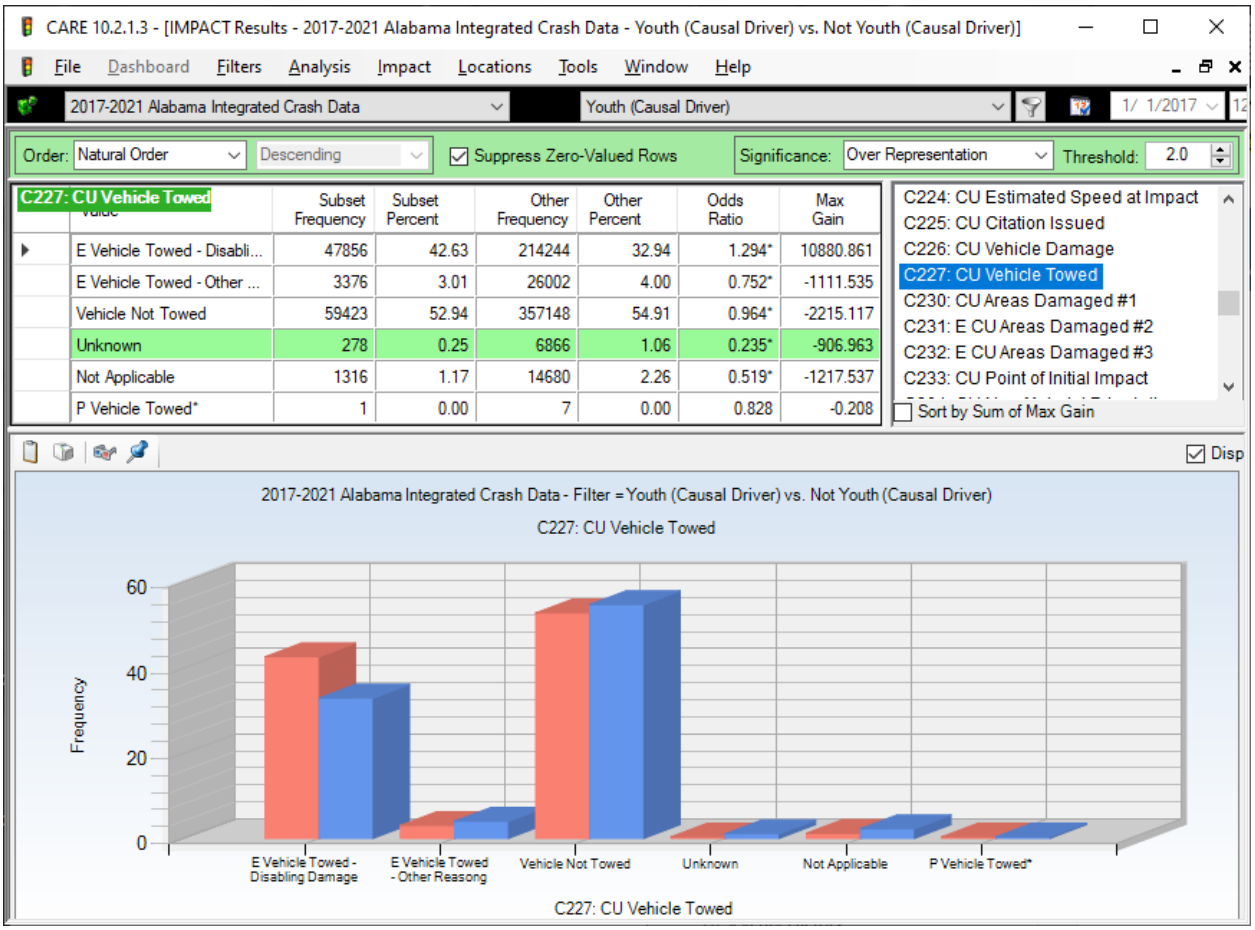
C224: CU Estimated Speed at Impact

Sort by Sum of Max Gain



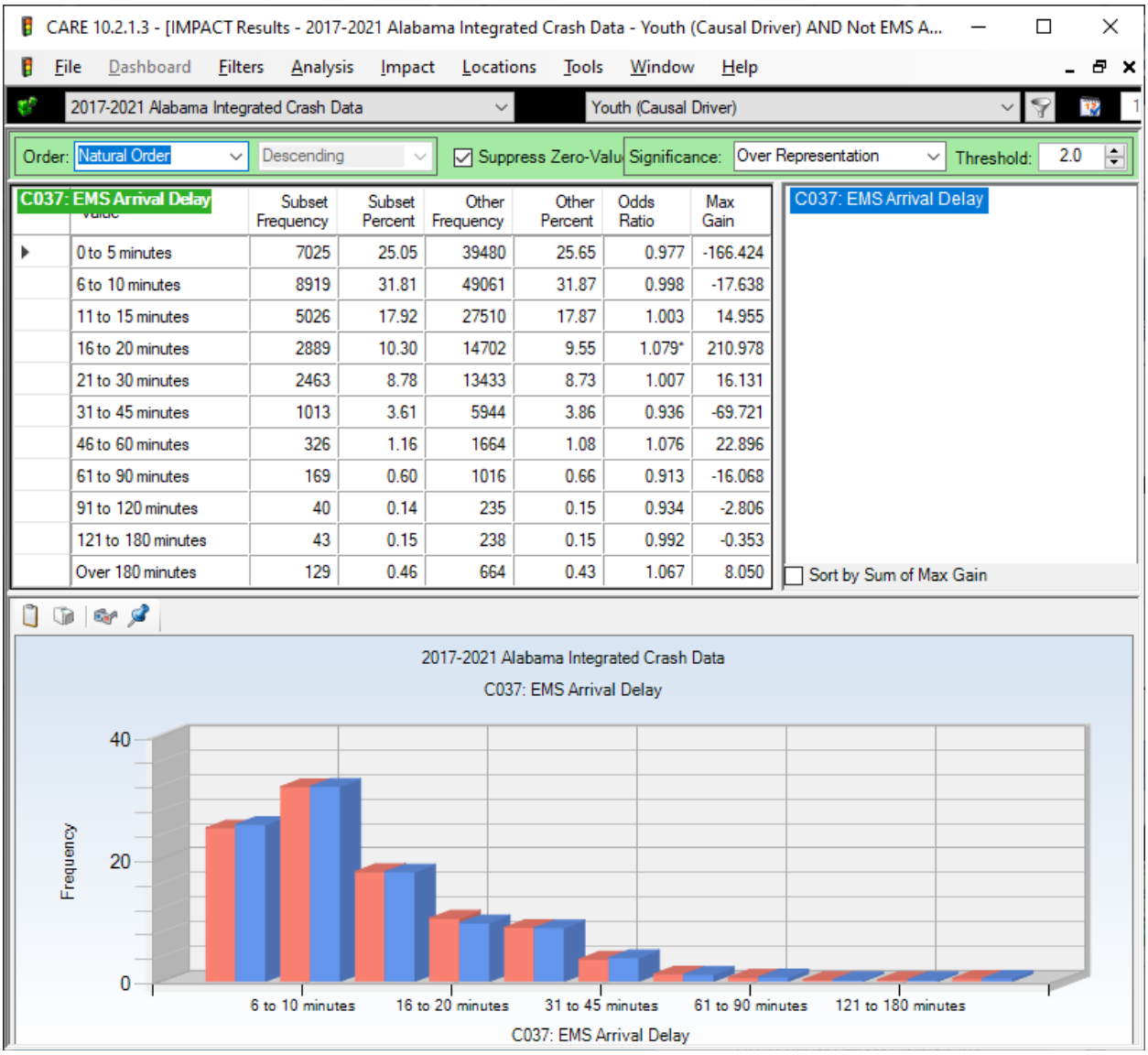
The evidence of increased crash severity is reinforced by the large frequencies at the over-the-speed-limit speeds. While some of these are not determined to be statistically significant, each one of these cases is significant from a practical point of view in that the chances for severe injury and death is dramatically increase. It has been found that above 45 MPH, every ten miles per hour of impact speed effectively doubles the probability of the crash being a fatality. So, the chances that crashes above 80 MPH will cause death is extremely high, making each one of these crashes quite significant from a life-saving point of view.

3.8 CU Vehicle Towed



This is another indicator that young-driver caused crashes are more severe than those caused by older drivers. This is an objective indicator that is not affected by the fact that younger occupants are more durable (less apt to be killed). Their proportion of Towed – Disabling Damage was 42.63% as compared to 32.94% for the older drivers.

3.9 Adjusted EMS Arrival Delay



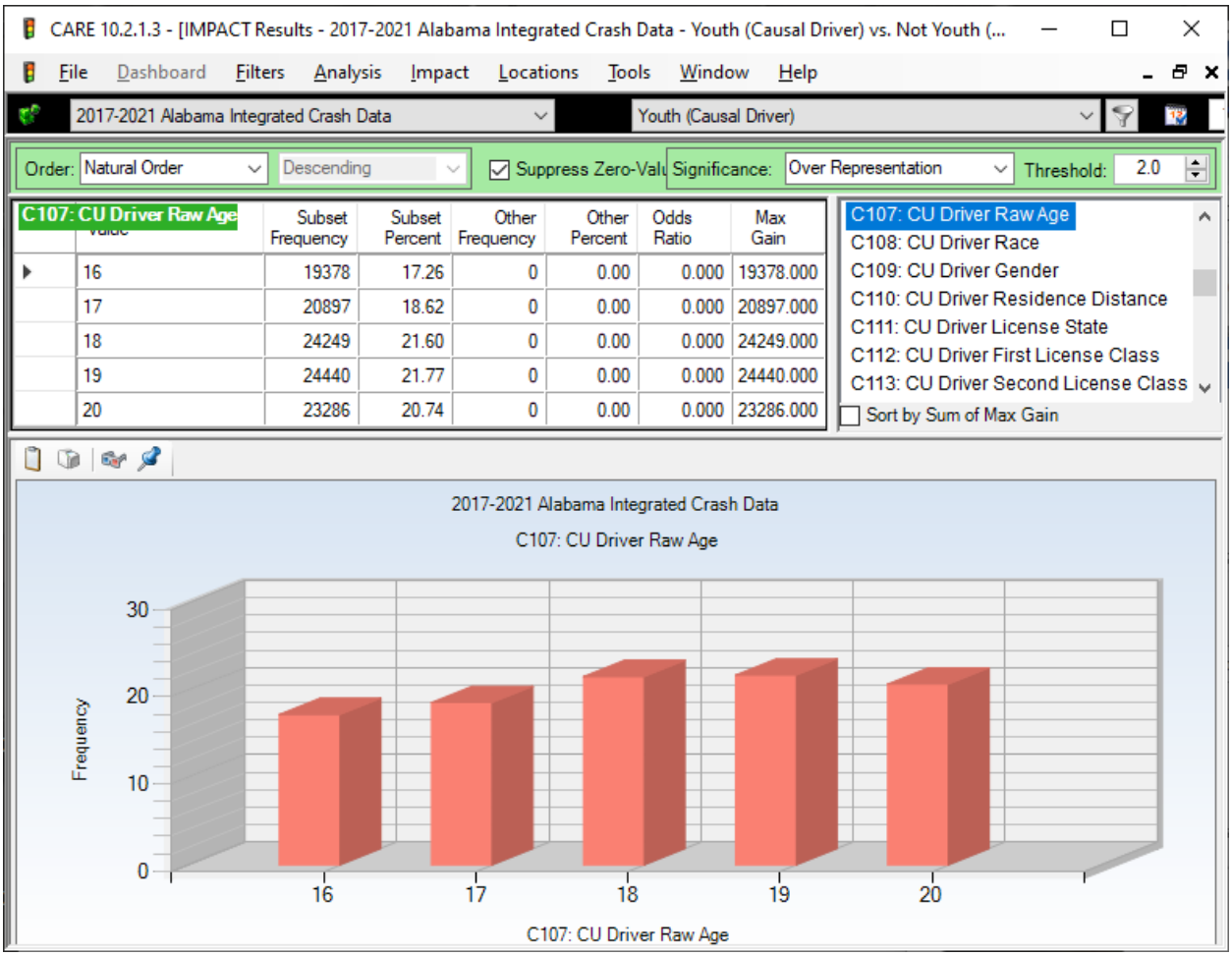
C037: EMS Arrival Delay	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
0 to 5 minutes	7025	25.05	39480	25.65	0.977	-166.424
6 to 10 minutes	8919	31.81	49061	31.87	0.998	-17.638
11 to 15 minutes	5026	17.92	27510	17.87	1.003	14.955
16 to 20 minutes	2889	10.30	14702	9.55	1.079*	210.978
21 to 30 minutes	2463	8.78	13433	8.73	1.007	16.131
31 to 45 minutes	1013	3.61	5944	3.86	0.936	-69.721
46 to 60 minutes	326	1.16	1664	1.08	1.076	22.896
61 to 90 minutes	169	0.60	1016	0.66	0.913	-16.068
91 to 120 minutes	40	0.14	235	0.15	0.934	-2.806
121 to 180 minutes	43	0.15	238	0.15	0.992	-0.353
Over 180 minutes	129	0.46	664	0.43	1.067	8.050

EMS arrival is an indicator of the extent to which the severity of a crash can be mitigated. EMS personnel effectiveness is almost completely determined by how quickly they can get to the scene of the crash. The effect is exponential and after a certain amount of time elapses, there is very little that can be done in life-threatening situations. The delay time for the younger drivers was essentially the same as for older drivers, with only one delay time (16-20 minutes) having a significantly higher proportion.

4.0 Driver Demographics

A knowledge of driver demographics provides information that helps to target many counter-measures.

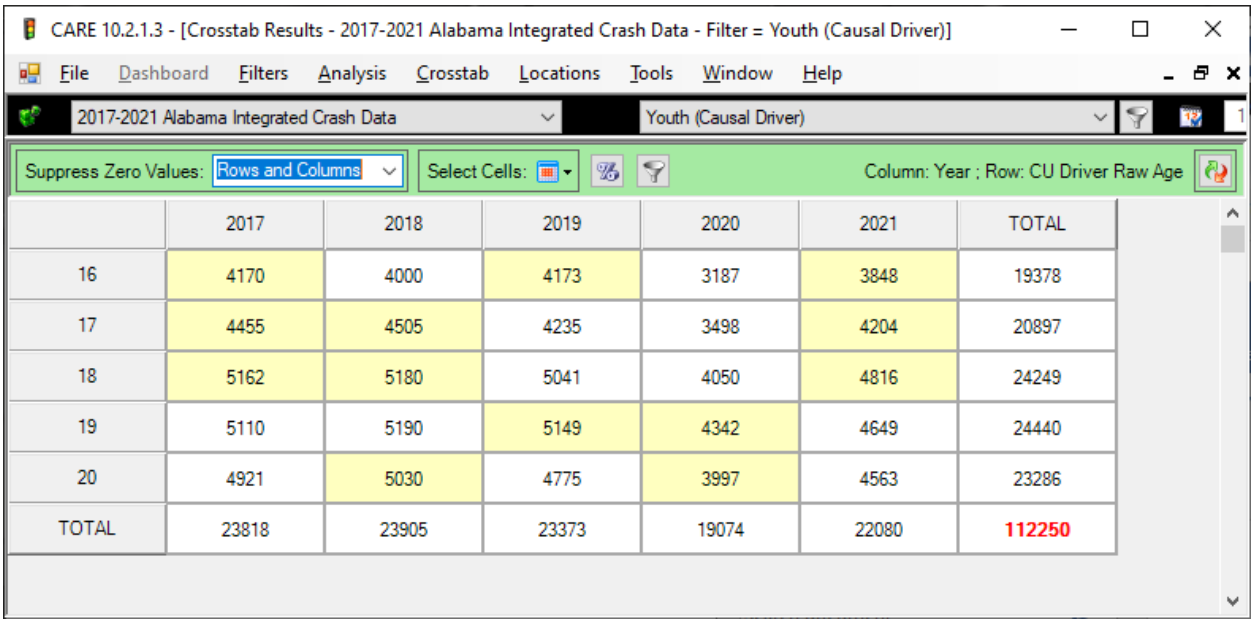
4.1 Causal Unit Driver Age



The ages of the victim drivers are not given because they are not the causal drivers when those in the 16-20 age group are causal.

The number of crashes at the different ages within the 16-20 driver age range would be expected to grow as the number of drivers grows. This is generally the case with an average 25.1% per age year up to and including age18. At that point there is a 3.97% drop in the comparative total percentage. Assuming that there is no drop in the number of younger licensed drivers at age 20, we would attribute this to an improvement in their experience level and perhaps an improvement in their aversion to taking risks.

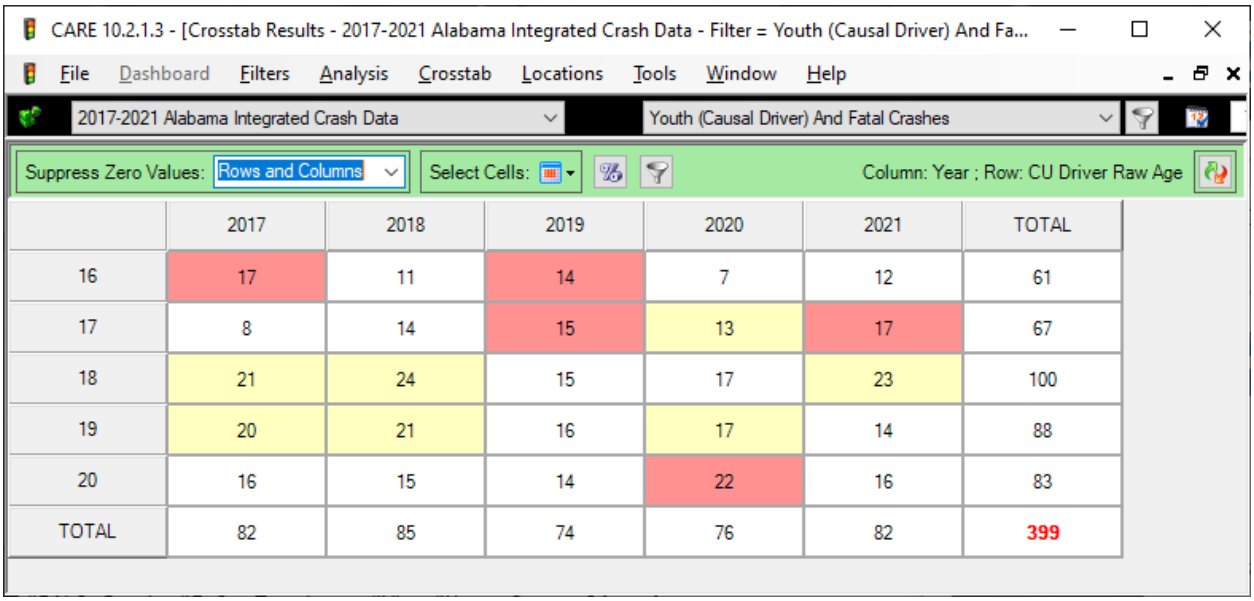
Cross-Tabulation of Age by Year, 2017-2021, All Crashes



	2017	2018	2019	2020	2021	TOTAL
16	4170	4000	4173	3187	3848	19378
17	4455	4505	4235	3498	4204	20897
18	5162	5180	5041	4050	4816	24249
19	5110	5190	5149	4342	4649	24440
20	4921	5030	4775	3997	4563	23286
TOTAL	23818	23905	23373	19074	22080	112250

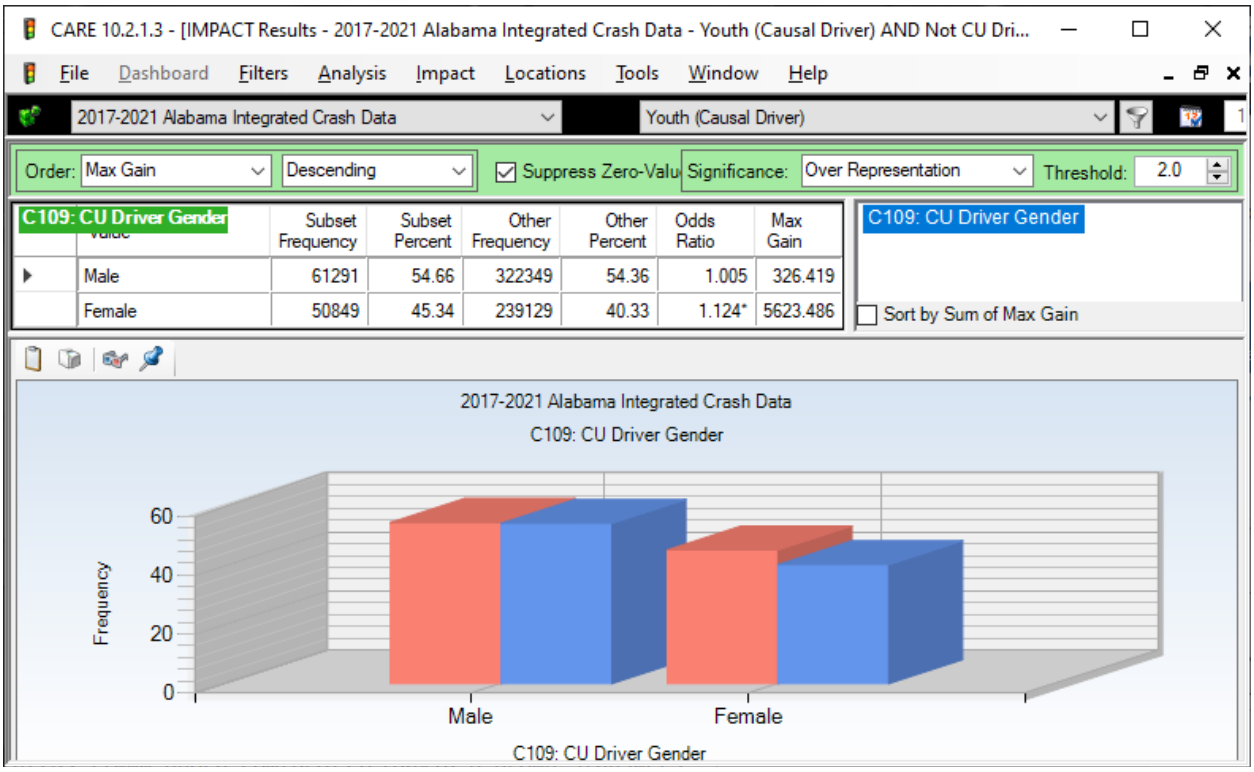
The table above shows annual consistency in young driver crashes until 2020 when the effects of the COVID pandemic took effect. The picture for young drivers causing fatal crashes is about the same, but with a drop in both 2019 and 2020. However, the identical total number (82) of fatal crashes for 2017 and 2021 demonstrates consistency over the years. See the table for fatal crashes below. Other time factors, see Section 5.0.

Cross-Tabulation of Age by Year, 2017-2021, Fatal Crashes



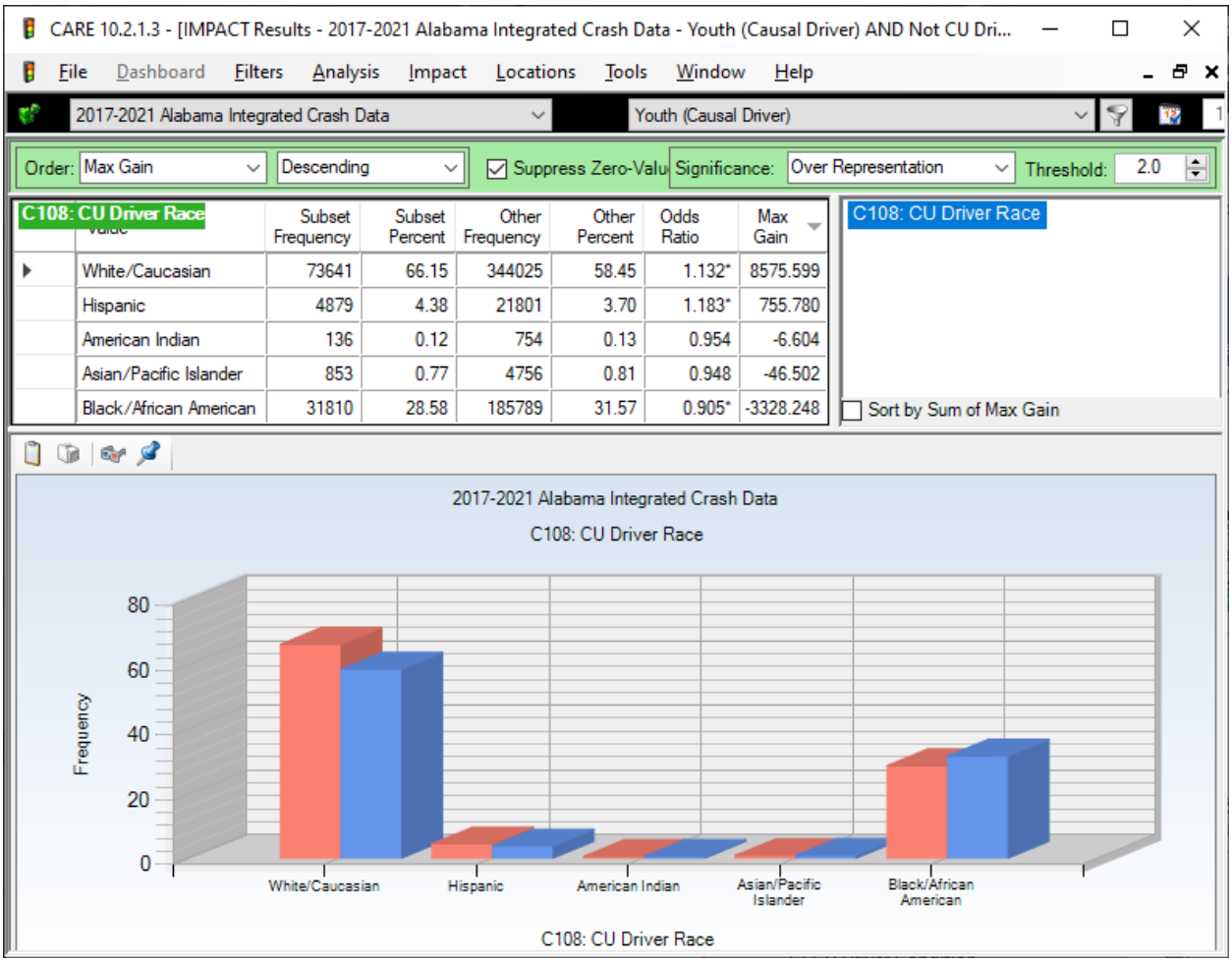
	2017	2018	2019	2020	2021	TOTAL
16	17	11	14	7	12	61
17	8	14	15	13	17	67
18	21	24	15	17	23	100
19	20	21	16	17	14	88
20	16	15	14	22	16	83
TOTAL	82	85	74	76	82	399

4.2 Driver Gender



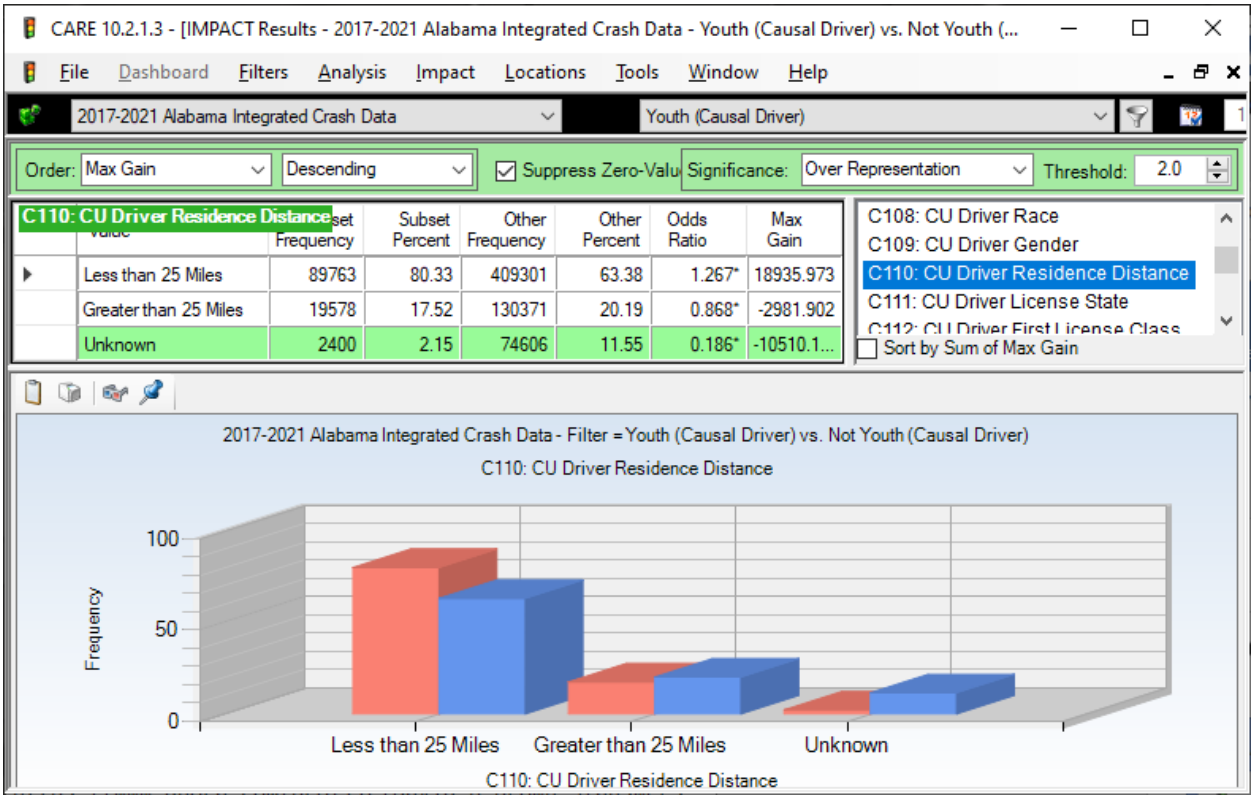
Males account for about 54.66% of crashes which involved young drivers, which is not significantly different from the 54.36% of their crashes at the older ages. This reflects the numbers that have drivers' licenses plus the amount of driving that they do. Overall, this does not lead to any major conclusions without the mileage data. Generally, males have had a much higher over-representation in crashes where risk-taking is involved, e.g., those involving speeding. Females have 45.34% of the youth caused crashes as opposed to only 40.33% of those caused by older drivers. This is a significant difference, and it is one of the very few places where females are significantly over-represented. We expect that many males have driving experience prior to the age of 16, in a variety of vehicles.

4.3 Causal Unit Driver Race



With 66.15% of the crashes, White/Caucasians were over-represented in the young driver crashes over all other racial categories except Hispanic. Hispanic drivers were under-represented in the previous (2011-2015) study, but are now over-represented. However, their crash frequency is less than 7% (6.62%) of that of White/Caucasians.

4.4 CU Driver Residence Distance



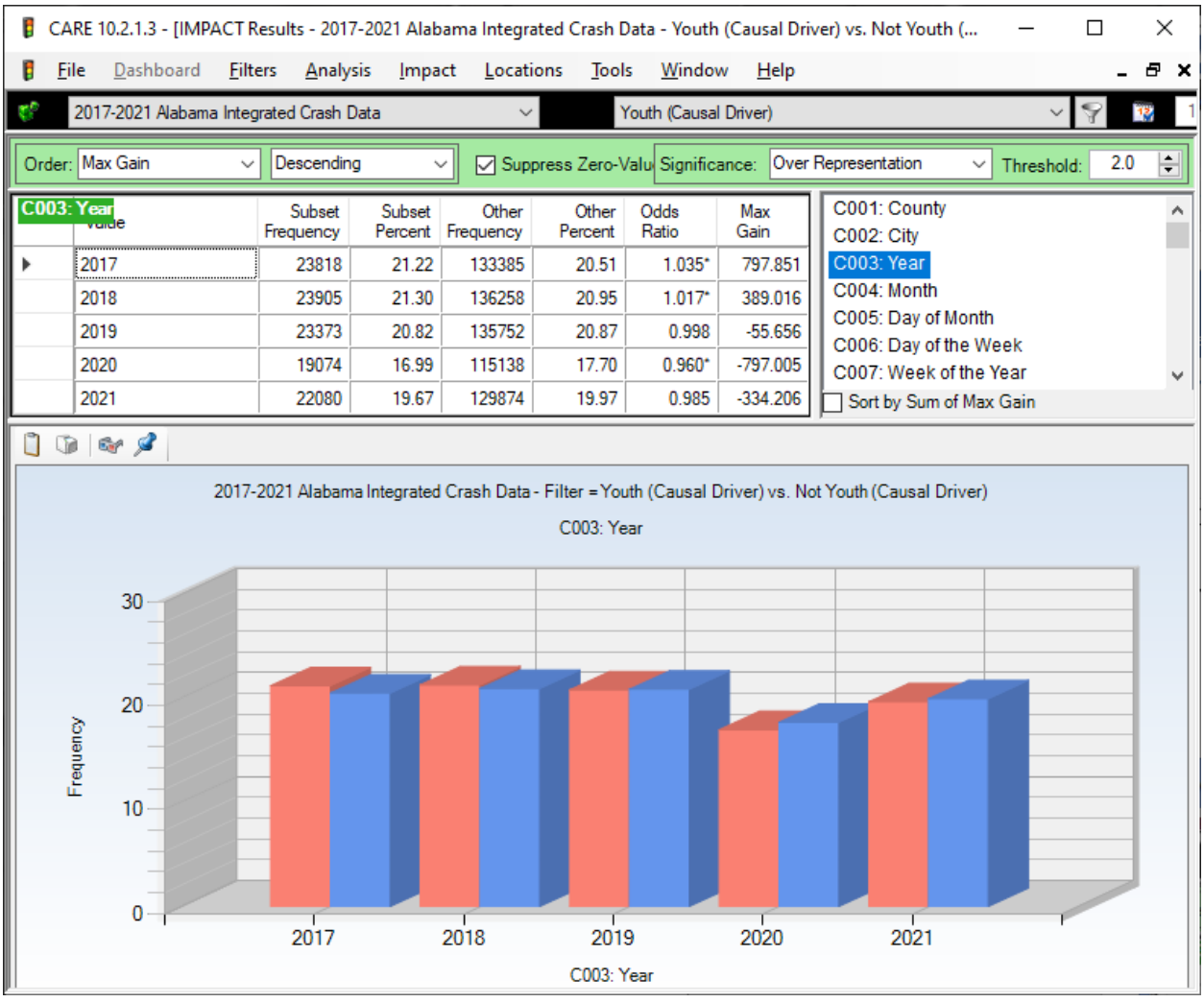
It is expected that younger drivers would be driving closer to home on average, compared to the older drivers.

5.0 Time Factors

Time factors were analyzed in several different categories to determine overrepresentation for Year, Month, Day of the Week and Time of Day. Analysis of these time factors allows for the determination of times (particular days of week, times of day, etc.) in which more crashes occur for younger drivers, and thus, those times in which enforcement would be more fruitful. This is part of the state's evidence-based enforcement efforts.

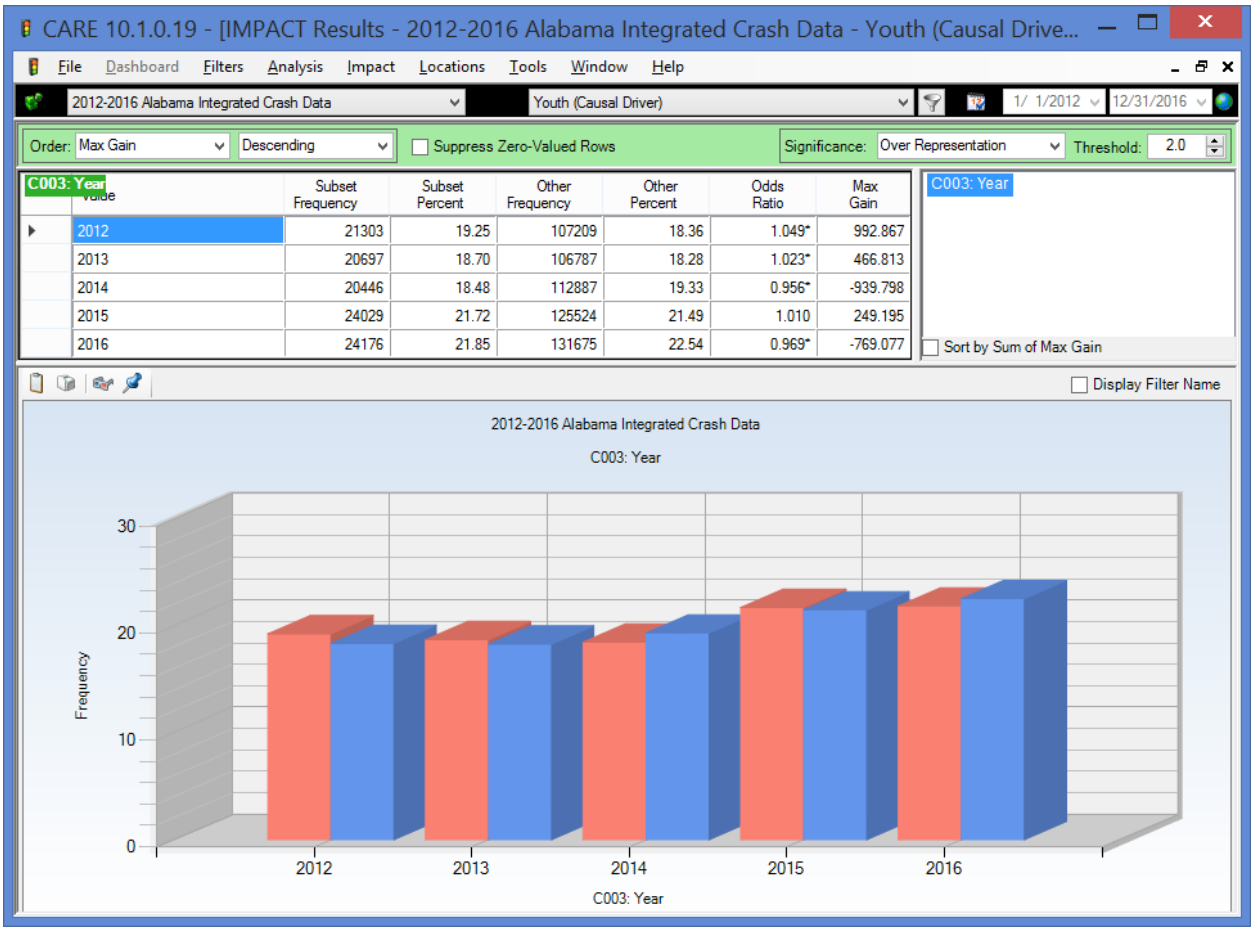
5.1 Year

Comparison of Young Drivers (red) with Older Drivers (blue) by Year (2017-2021)



Younger drivers had a proportion that was significantly higher than the older drivers for 2017 and 2018, and they were very close in their proportion for 2019. The effects of the COVID pandemic are clear in 2020 and 2021. See the next page for historical trends starting in 2012.

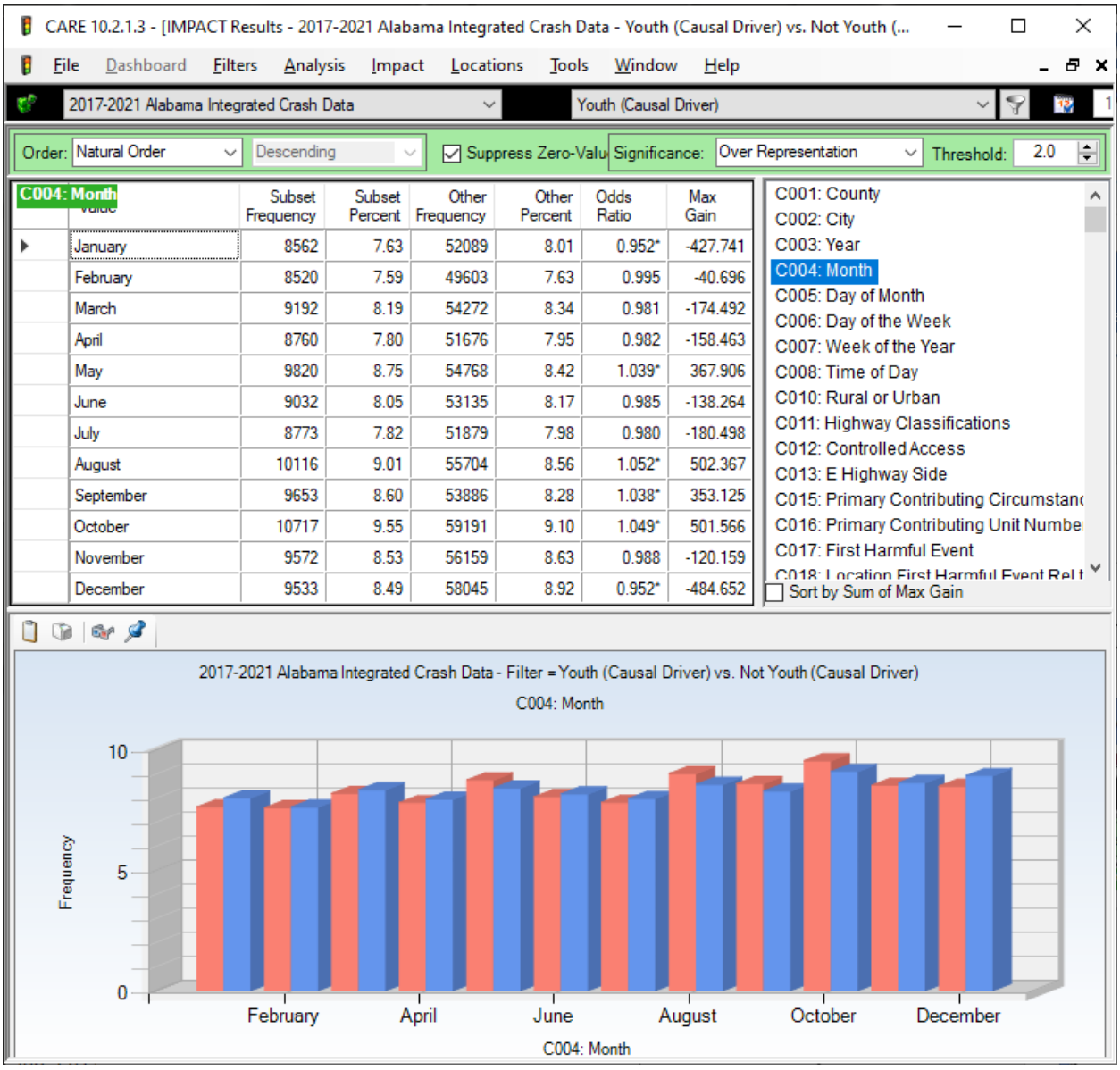
Comparison of Young Drivers (red) with Older Drivers (blue) by Year (2012-2016)



First note that crashes in general have been increasing on an average of 4.60% per year, with a drop in 2013, and a surge in 2015. Young driver crashes have not tracked this trend in that they have not increased as much as the older drivers, their increase from 2012 to 2016 being 13.5% (2.7% per year).

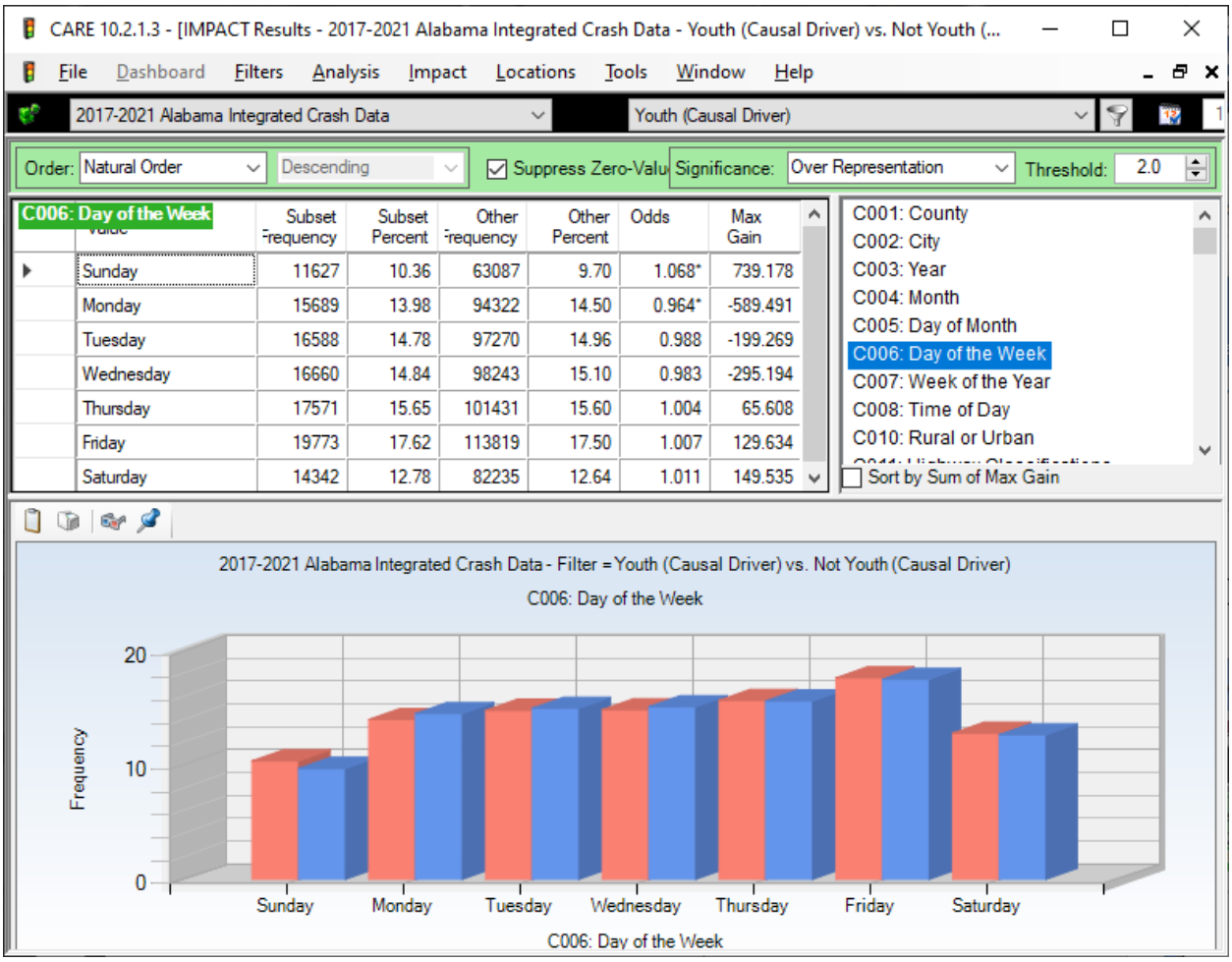
This shows a leveling off of young drivers' crashes in 2016, although it increased slightly. It did not increase in the percentage that the older drivers increased, and for that reason it became significantly under-represented in 2016.

5.2 Month



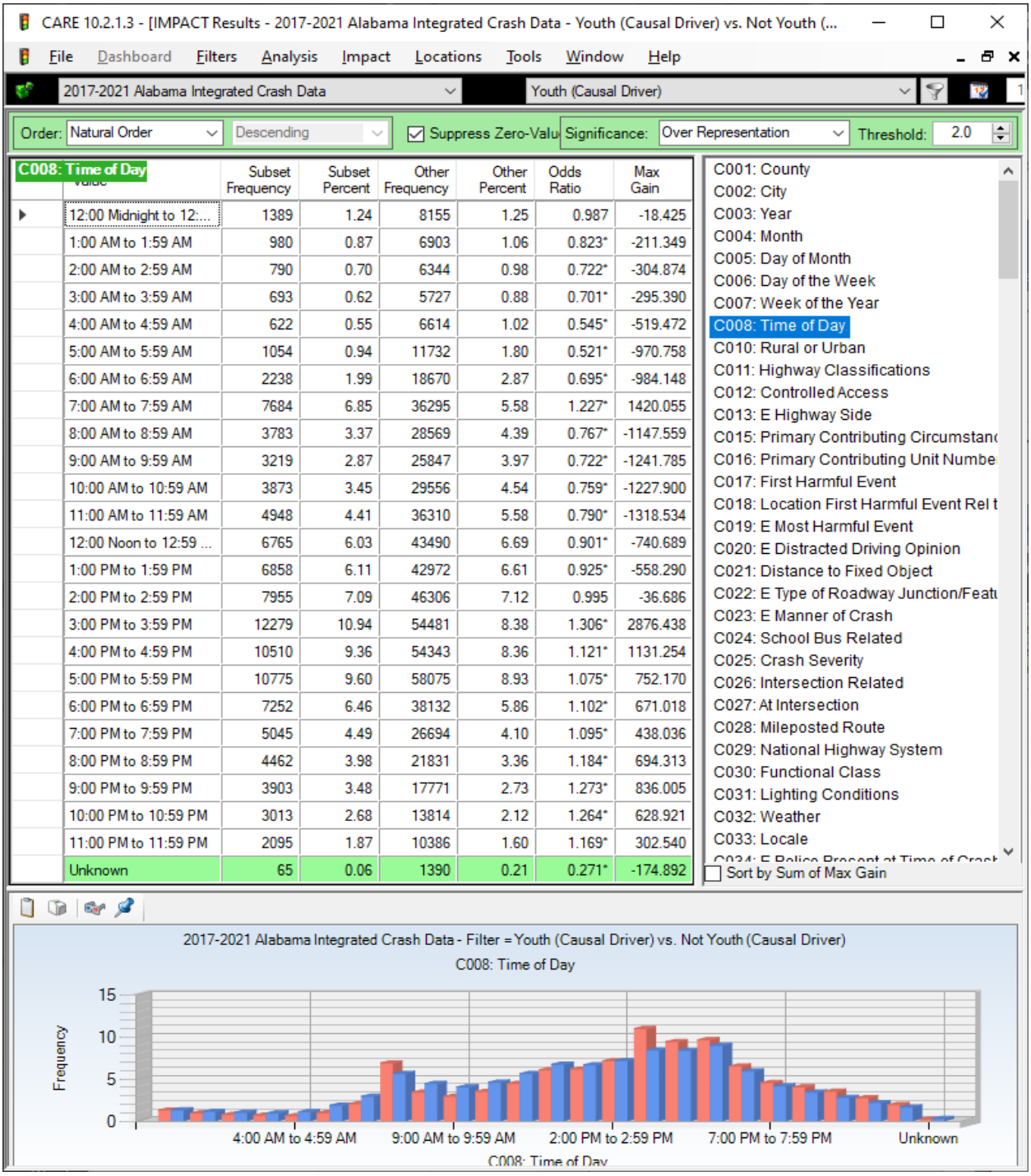
Patterns of over-representation appear to be in the months of May and August-October, which are the months that increased school activities becomes greatest.

5.3 Day of the Week



The Fridays and the weekends are over-represented for crashes involving young drivers, as would be expected. Over-representation needs to be coupled with the raw frequency to get the whole picture. For example, while Sunday is significantly over-represented, it only had 11,627 young driver crashes, which is considerably lower than the weekdays. Similarly, Saturday, while higher is still below the average over the week. Contrasted with this is Friday, which has both the highest number and a significant over-representation. Increased afternoon traffic on Fridays, and the various "Friday-night" events push these numbers up.

5.4 Time of Day



It is quite clear from this chart just when it is that the younger drivers are putting in their highest mileages. Before and after school pop up significantly greater than the normal rush hours, and the significant over-representations continue through the midnight hour. The most over-represented hours are from 3 PM through to 11:59 PM.

5.5 Time of Day by Day of the Week

CARE 10.2.1.3 - [Crosstab Results - 2017-2021 Alabama Integrated Crash Data - Filter = Youth (Causal Driver)]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2017-2021 Alabama Integrated Crash Data | Youth (Causal Driver) | 1/ 1/2017 | 12/31/2021

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	406	138	117	132	121	144	331	1389
1:00 AM to 1:59 AM	281	79	89	90	89	97	255	980
2:00 AM to 2:59 AM	229	67	81	58	62	87	206	790
3:00 AM to 3:59 AM	196	60	50	61	68	74	184	693
4:00 AM to 4:59 AM	145	60	65	75	74	74	129	622
5:00 AM to 5:59 AM	151	137	137	158	145	172	154	1054
6:00 AM to 6:59 AM	167	328	377	405	392	364	205	2238
7:00 AM to 7:59 AM	172	1261	1504	1603	1533	1330	281	7684
8:00 AM to 8:59 AM	212	630	675	657	715	590	304	3783
9:00 AM to 9:59 AM	311	460	508	503	572	441	424	3219
10:00 AM to 10:59 AM	454	524	537	498	585	619	656	3873
11:00 AM to 11:59 AM	537	689	724	699	677	821	801	4948
12:00 Noon to 12:59 PM	825	901	962	957	978	1132	1010	6765
1:00 PM to 1:59 PM	829	999	859	953	976	1198	1044	6858
2:00 PM to 2:59 PM	918	1101	1166	1153	1117	1438	1062	7955
3:00 PM to 3:59 PM	857	1916	1983	1921	2069	2512	1021	12279
4:00 PM to 4:59 PM	918	1587	1677	1591	1727	2011	999	10510
5:00 PM to 5:59 PM	874	**1621**	1796	1798	1944	1823	919	10775
6:00 PM to 6:59 PM	802	951	1064	1046	1154	1327	908	7252
7:00 PM to 7:59 PM	664	636	683	690	751	833	788	5045
8:00 PM to 8:59 PM	601	558	533	622	635	750	763	4462
9:00 PM to 9:59 PM	494	441	482	501	540	733	712	3903
10:00 PM to 10:59 PM	360	319	302	308	395	669	660	3013
11:00 PM to 11:59 PM	215	219	206	173	240	526	516	2095
Unknown	9	7	11	8	12	8	10	65
TOTAL	11627	15689	16588	16660	17571	19773	14342	112250

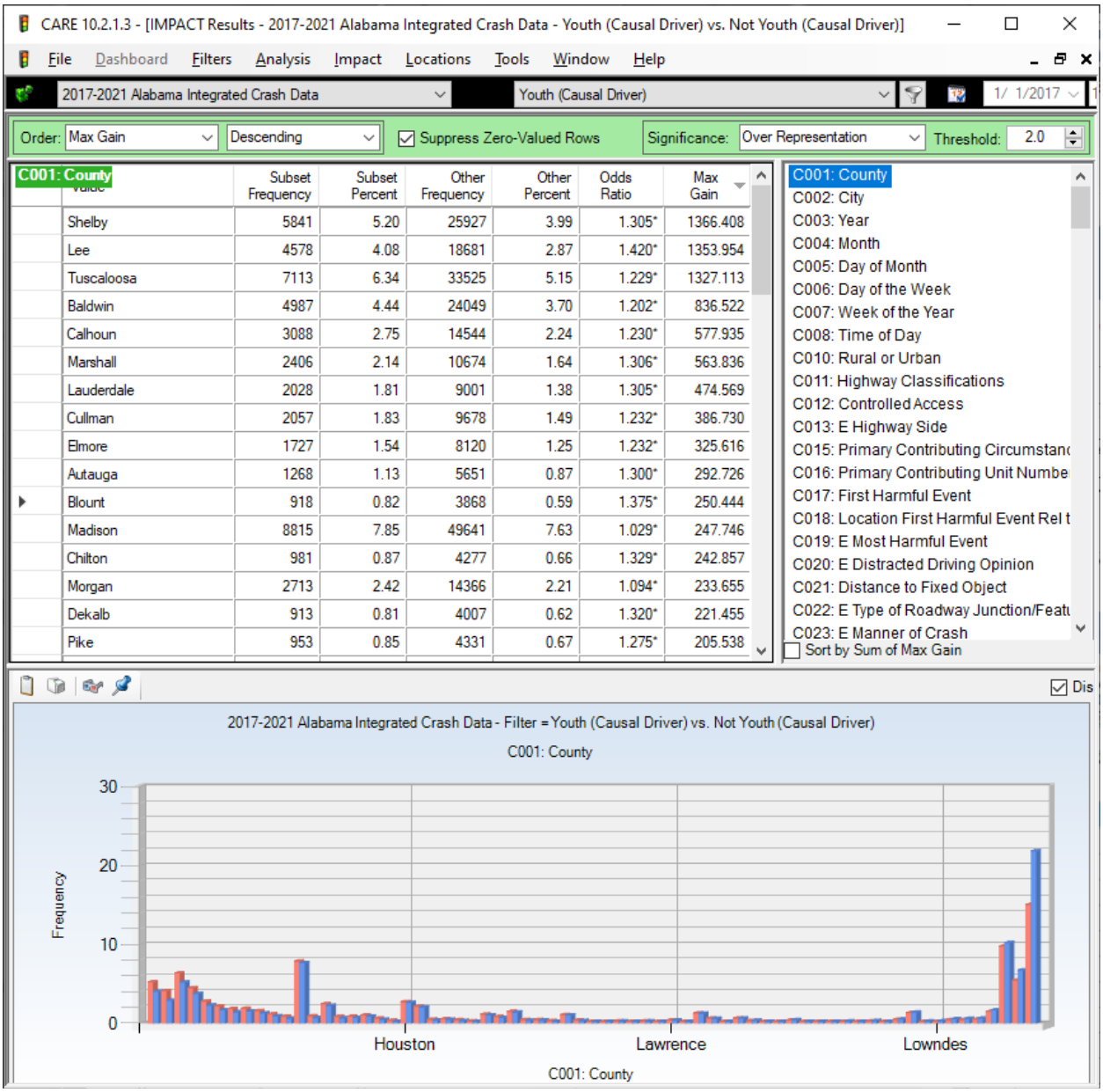
The time of day by day of the week for young drivers is quite enlightening and shows just when these over-representations occur. Note the red starting somewhat on Friday night, going into Saturday morning, and then Saturday night going into Sunday morning. While the red makes these look like the worst times, the coloring is based on percentages across the days, and the fact that these times are over-represented on weekends is largely because there are so few crashes at these times on week days. So it is very important to check the numbers. For example, while the

Saturday and Sunday mornings are over-represented, the number of crashes in these hours only range from about 150 to a little over 400. Contrasted with this is the 7 AM weekday hours that average over 1,500 crashes. Even the 8 AM and 9 AM hours on weekdays average above 500, many of them are not red because those overall hours have a very high percentage of the crashes. Even worse, consider the 5PM weekday hours, which average close to 1,700 crashes each. So use both the colors and the numbers in getting a feel for the best times for enforcement or other countermeasures.

6.0 Geographical Factors

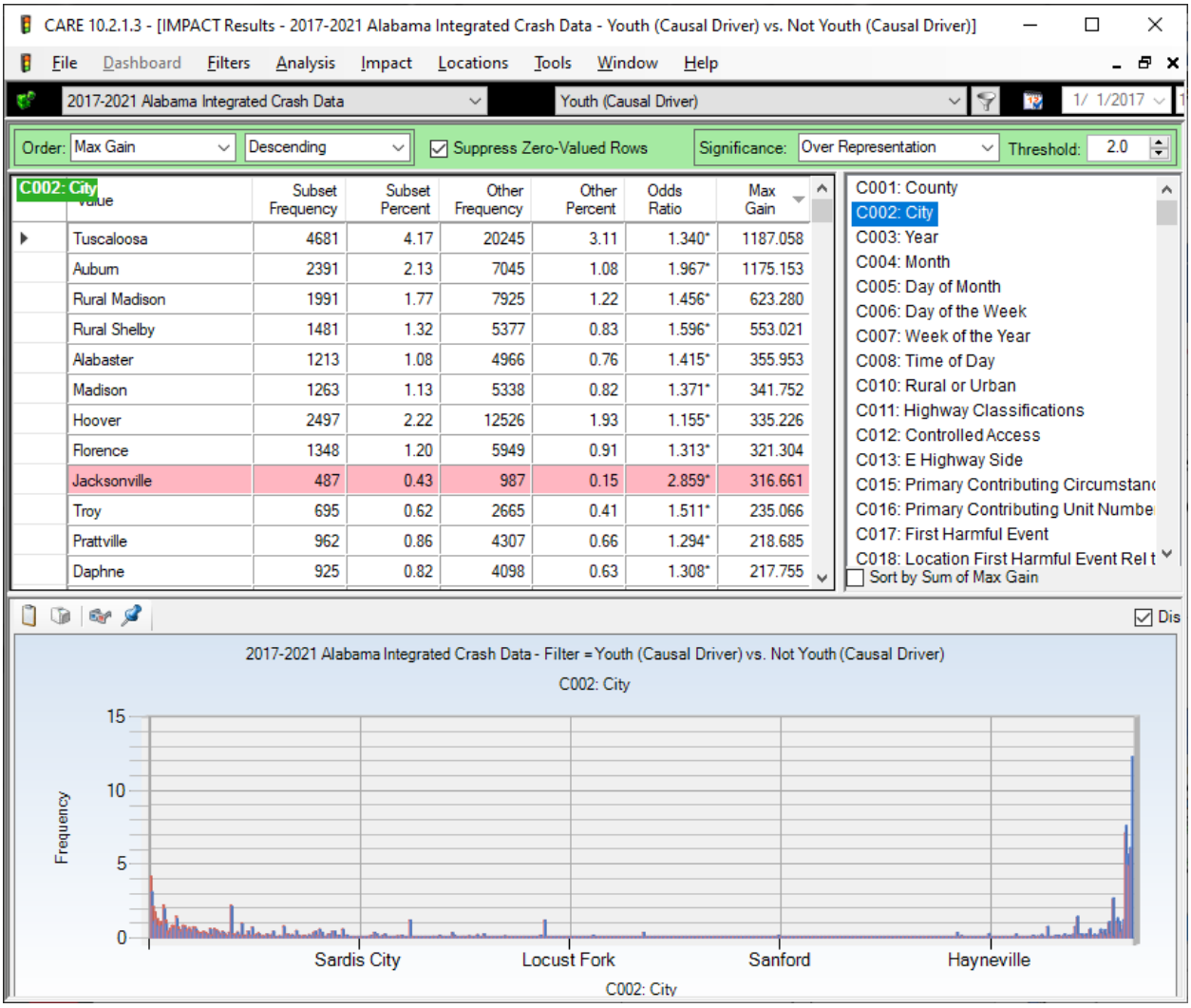
Geographical factors were analyzed in order to determine which areas of the state are overrepresented for crashes involving young drivers. In order to determine these problem areas, geographical factors were analyzed in the following categories: county, city, rural versus urban, highway classification and locale.

6.1 County



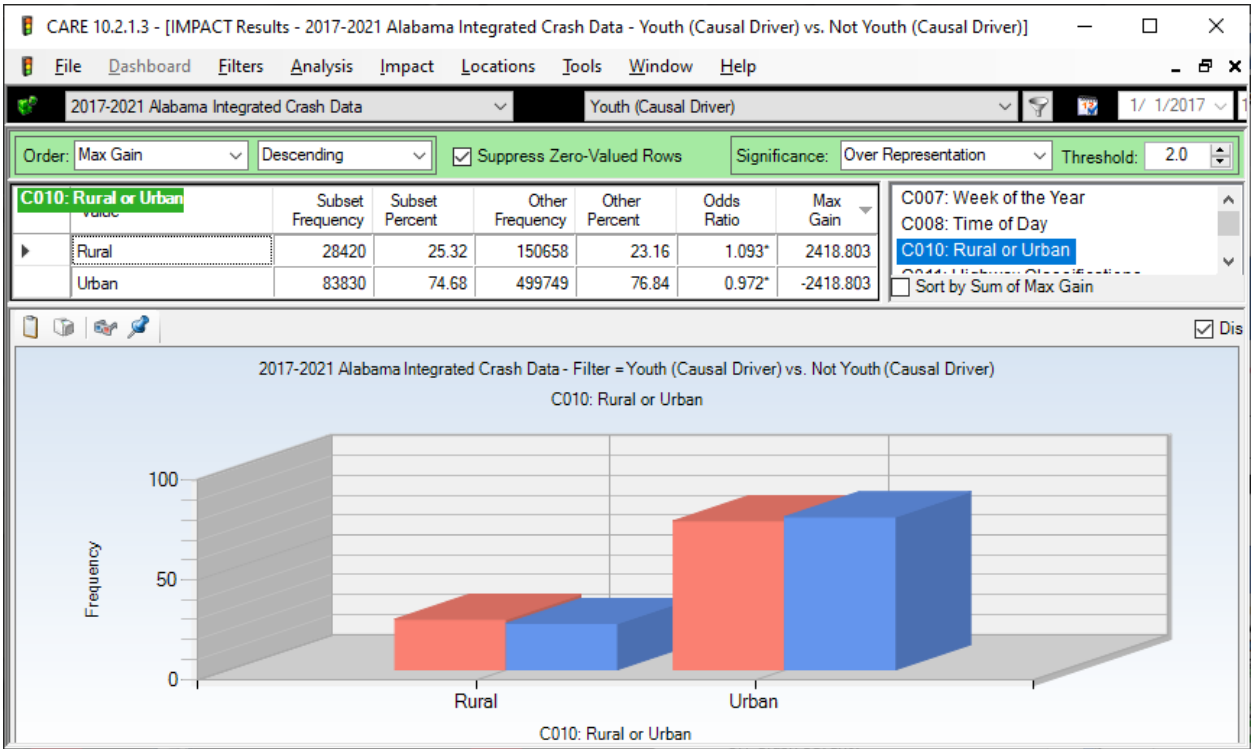
The counties with the greatest overrepresentation factors for young-driver caused crashes include first Shelby followed by the two "college towns" Tuscaloosa and Lee, followed by Baldwin, Calhoun. Marshal, Lauderdale and Cullman. There is nothing inherently unsafe about these geographical areas – the number of crashes is an excellent proxy for the number of young-driver miles driven in these counties. The display above is for all counties with a Max Gain of 200 or more. This 200 represents the number of crashes that would be saved in that county if the proportion of young-driver crashes was the same as that of older drivers. Similarly for the City display below.

6.2 City

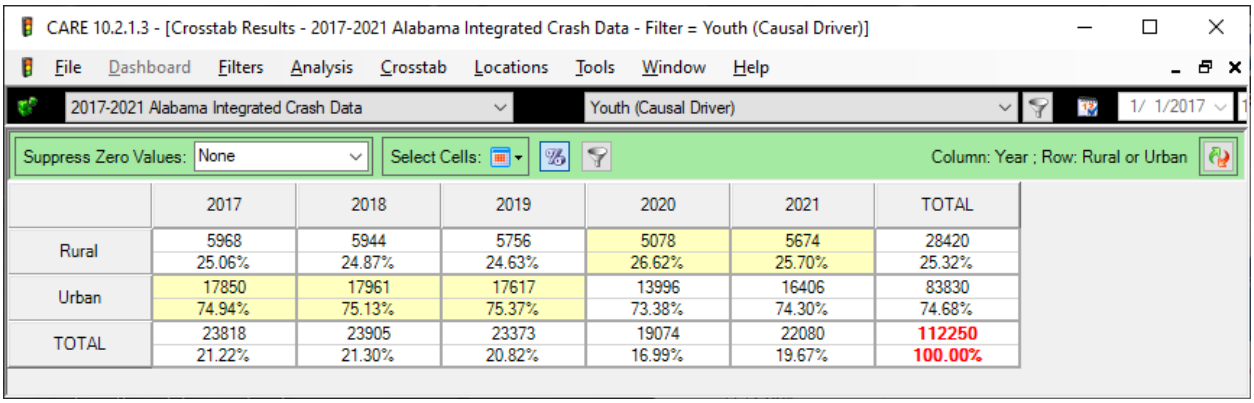


Over-represented cities also reflect the amount of driving that is being done by young drivers within these various cities and rural areas (which are considered to be virtual cities for comparative purposes). Jacksonville is the only city in this group that had an Odds Ratio greater than 2.0. This seems to be more from the low proportion of the crashes in the older aged population than deficiencies on the part of young drivers.

6.3 Rural/Urban



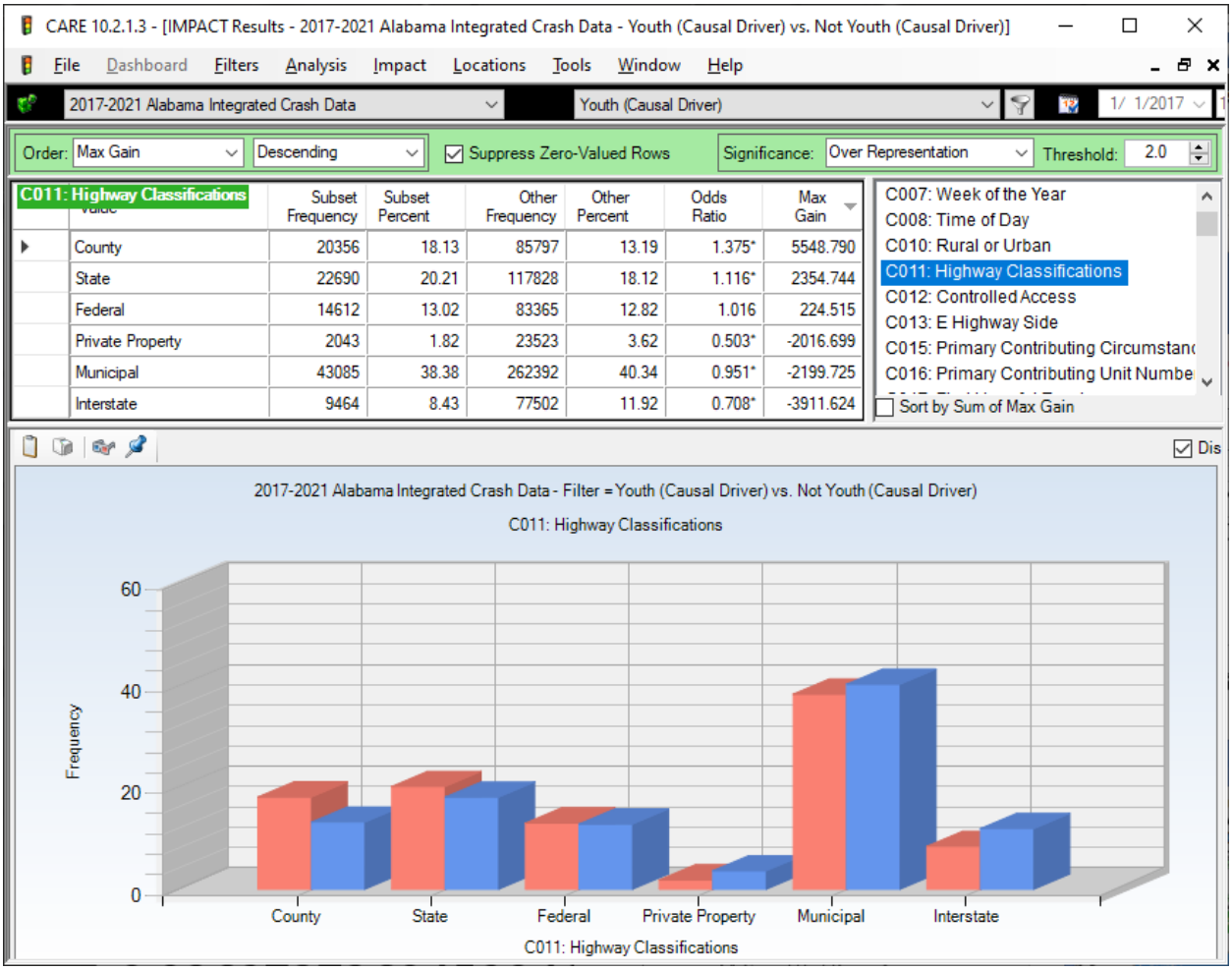
There has been a recent trend away from rural area driving and a corresponding increase in crashes in the urban areas. The following cross-tabulation that is restricted to ONLY young drivers indicates that the above is the result of years 2011 through 2013 as opposed to the two most recent years.



	2017	2018	2019	2020	2021	TOTAL
Rural	5968 25.06%	5944 24.87%	5756 24.63%	5078 26.62%	5674 25.70%	28420 25.32%
Urban	17850 74.94%	17961 75.13%	17617 75.37%	13996 73.38%	16406 74.30%	83830 74.68%
TOTAL	23818 21.22%	23905 21.30%	23373 20.82%	19074 16.99%	22080 19.67%	112250 100.00%

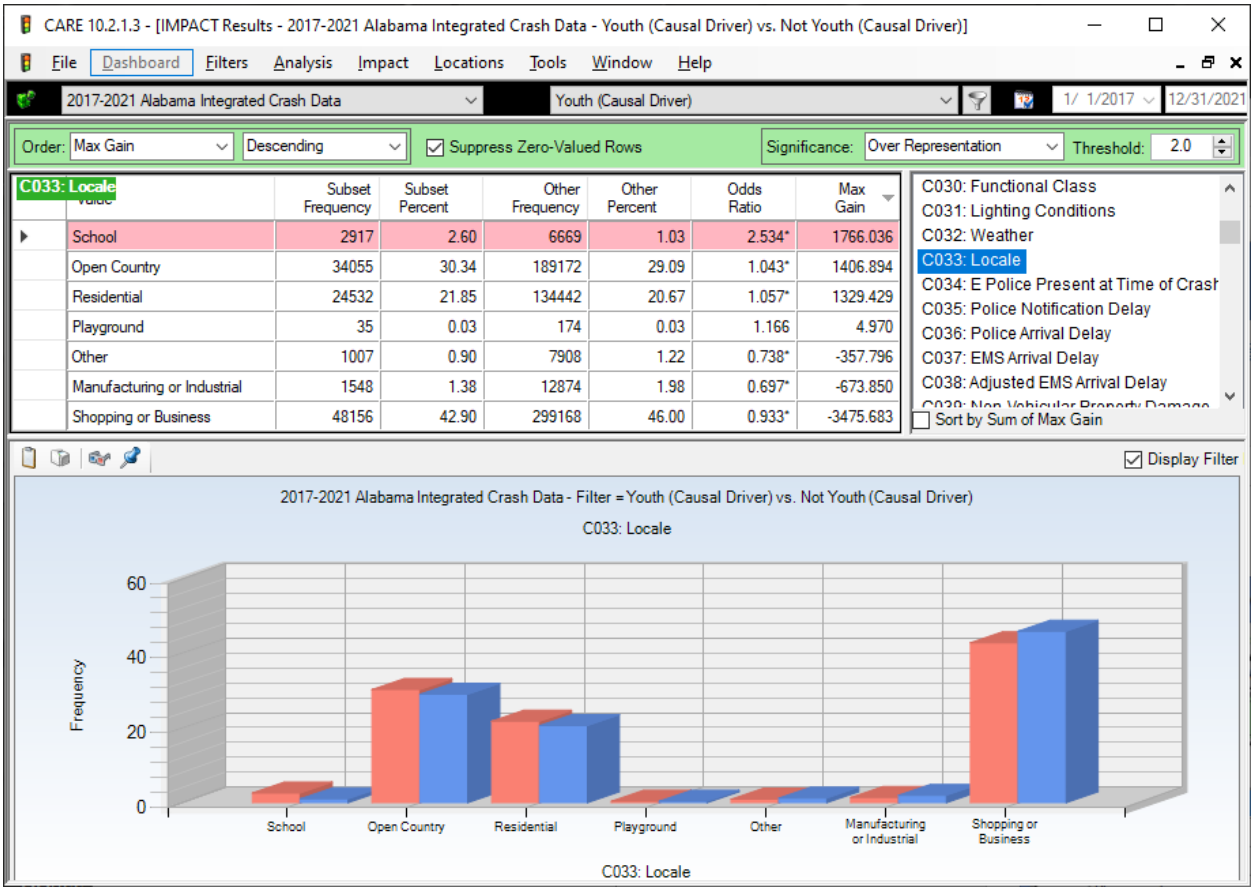
It is clear that in years 2017 and 2019, the young drivers have participated in this shift to the urban areas, which is particularly emphasized by the 17,850 urban crashes in 2017. The pandemic in 2020 and 2021 not only reduced their driving, but shifted it to a higher proportion in the rural areas.

6.4 Highway Classification



Crashes caused by young drivers are greatly over-represented on county highways, with nearly 1.4 times (1.375) the expected number of crashes. State routes were also significantly over-represented. Interstates were under-represented indicating the tendency of younger drivers to drive locally. It is interesting that Municipal roads were significantly under-represented. More analysis needs to be performed if this rural/urban breakdown is seen to be a major factor in countermeasure development. This should focus on the two most recent years, since the urban/rural trends might be masked by the earlier years.

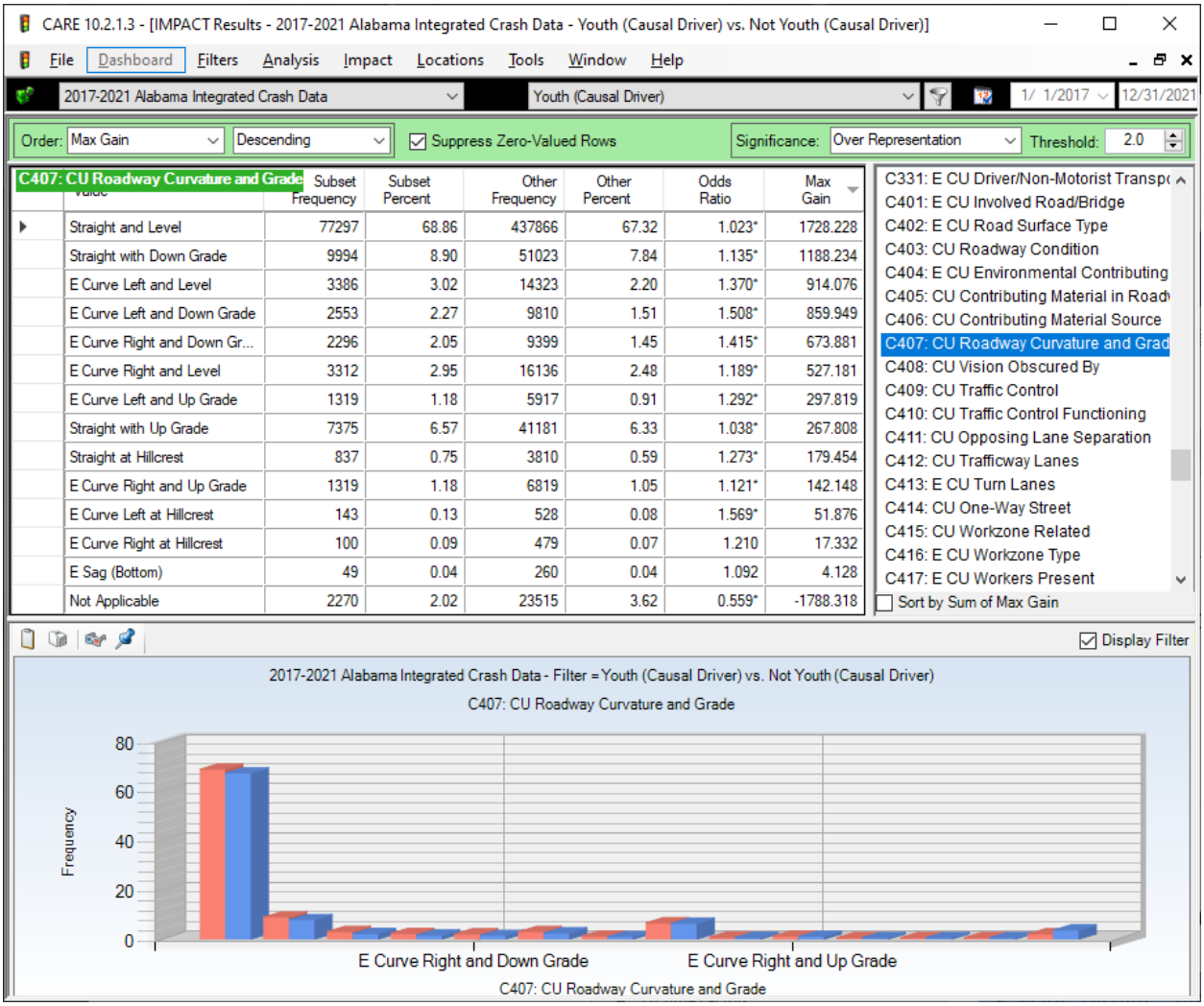
6.5 Locale



Crashes caused by younger drivers are overrepresented in School, Open Country and Residential areas.

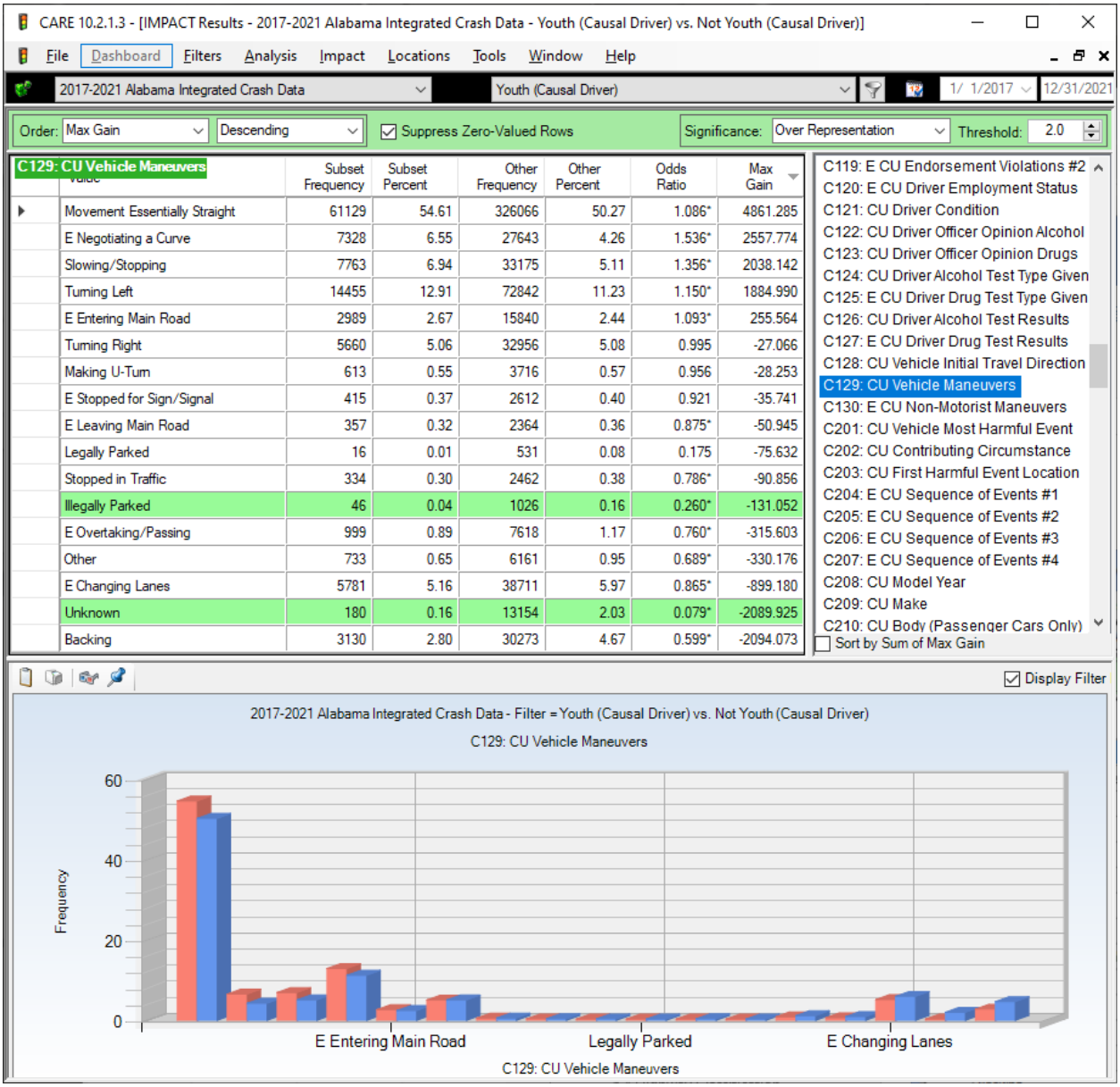
7.0 Roadway and Vehicle Factors

7.1 CU Roadway Curvature and Grade



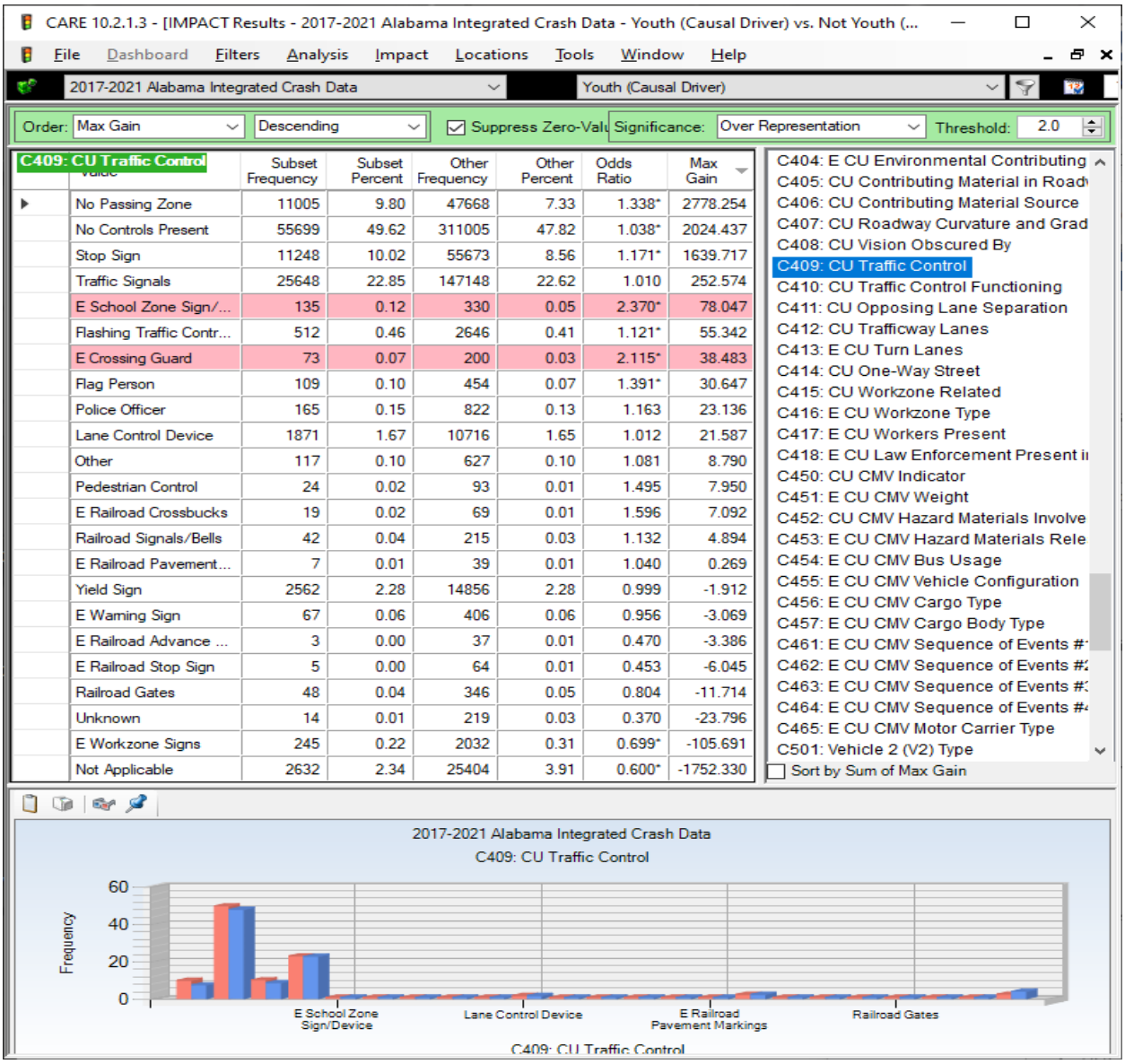
Several of the Down Grades are particularly problematic for young drivers who have not yet experienced the fact that braking might take twice as long on a down slope, something that usually takes a few near-miss incidents to make a lasting impression on the brain. They may not even realize that they are on a down grade. Note that three out of the top five Max Gain categories include down grades. This could be particularly problematic on wet pavement, which was found to be over-represented by 28.2% for the younger drivers.

7.2 CU Vehicle Maneuvers



Vehicle maneuvers give an indication as to how the driver responded to the roadway conditions given in the previous section. Negotiating a Curve and Slowing/Stopping both reflect on the findings given above. Movement Essentially Straight is a large over-represented category that shows that inexperienced drivers really do not need a roadway condition to have a problem; but in fairness the differential between the young and older drivers is really not that large (4.34%) – this is just a large category, which tends to move it up on the Max Gain ordered list scale.

7.3 Traffic Control



The No Passing Zone, and No Controls Present would both indicate typical rural area conditions, while most of those further down on the list are more related to urban areas. Young drivers' under-representations in Workzones, and at Yield Signs and Traffic Signals are all positive indicators of their attention. School zone sign over-representation is expected for school-aged drivers.

7.4 Vehicle Age – Model Year

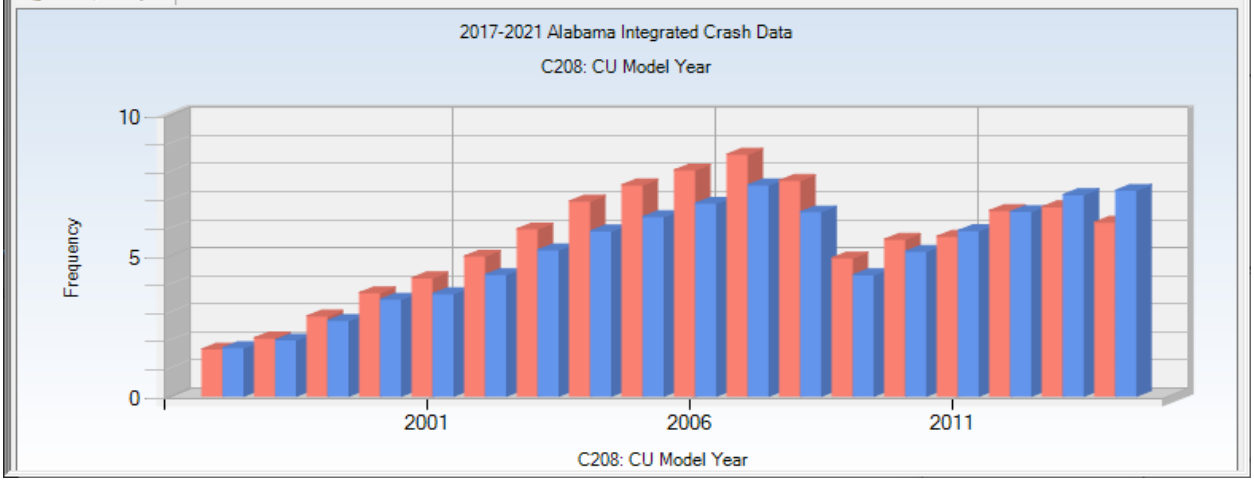
2017-2021 Alabama Integrated Crash Data | Youth (Causal Driver)

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

C208: CU Model Year	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
1997	1489	1.68	7465	1.72	0.974	-40.498
1998	1843	2.07	8680	2.00	1.036	64.562
1999	2533	2.85	11689	2.70	1.058*	138.050
2000	3272	3.68	14954	3.45	1.068*	208.087
2001	3740	4.21	15826	3.65	1.153*	497.424
2002	4428	4.99	18765	4.33	1.152*	583.254
2003	5288	5.95	22582	5.21	1.143*	661.192
2004	6169	6.95	25502	5.88	1.181*	943.916
2005	6685	7.53	27704	6.39	1.178*	1008.750
2006	7153	8.05	29778	6.87	1.172*	1051.809
2007	7653	8.62	32607	7.52	1.146*	972.178
2008	6824	7.68	28458	6.56	1.170*	993.263
2009	4372	4.92	18733	4.32	1.139*	533.811
2010	4963	5.59	22343	5.15	1.084*	385.161
2011	5055	5.69	25552	5.89	0.966*	-180.329
2012	5871	6.61	28491	6.57	1.006	33.502
2013	5987	6.74	31109	7.18	0.939*	-386.898
2014	5500	6.19	31781	7.33	0.845*	-1011.5...

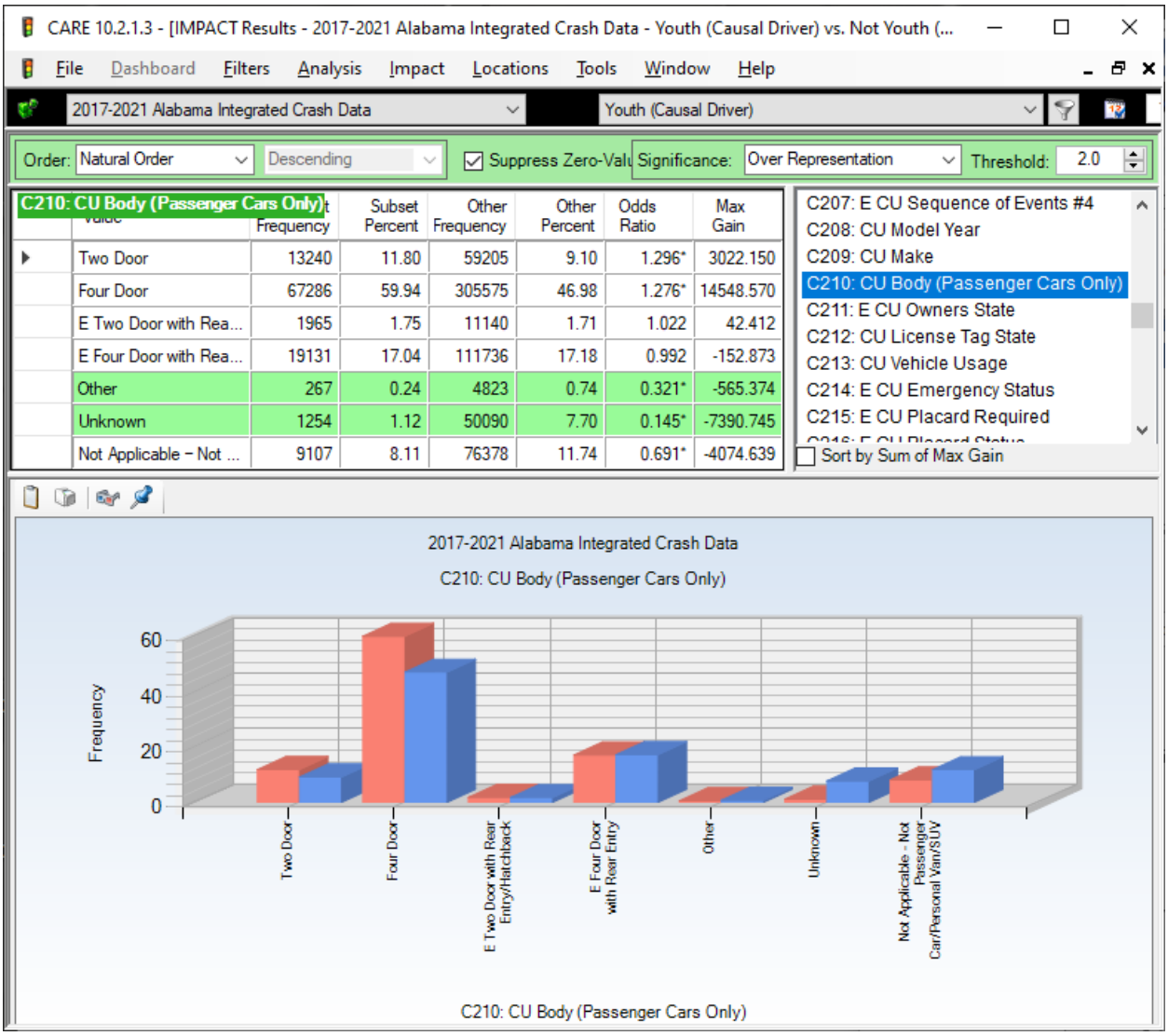
C208: CU Model Year

Sort by Sum of Max Gain



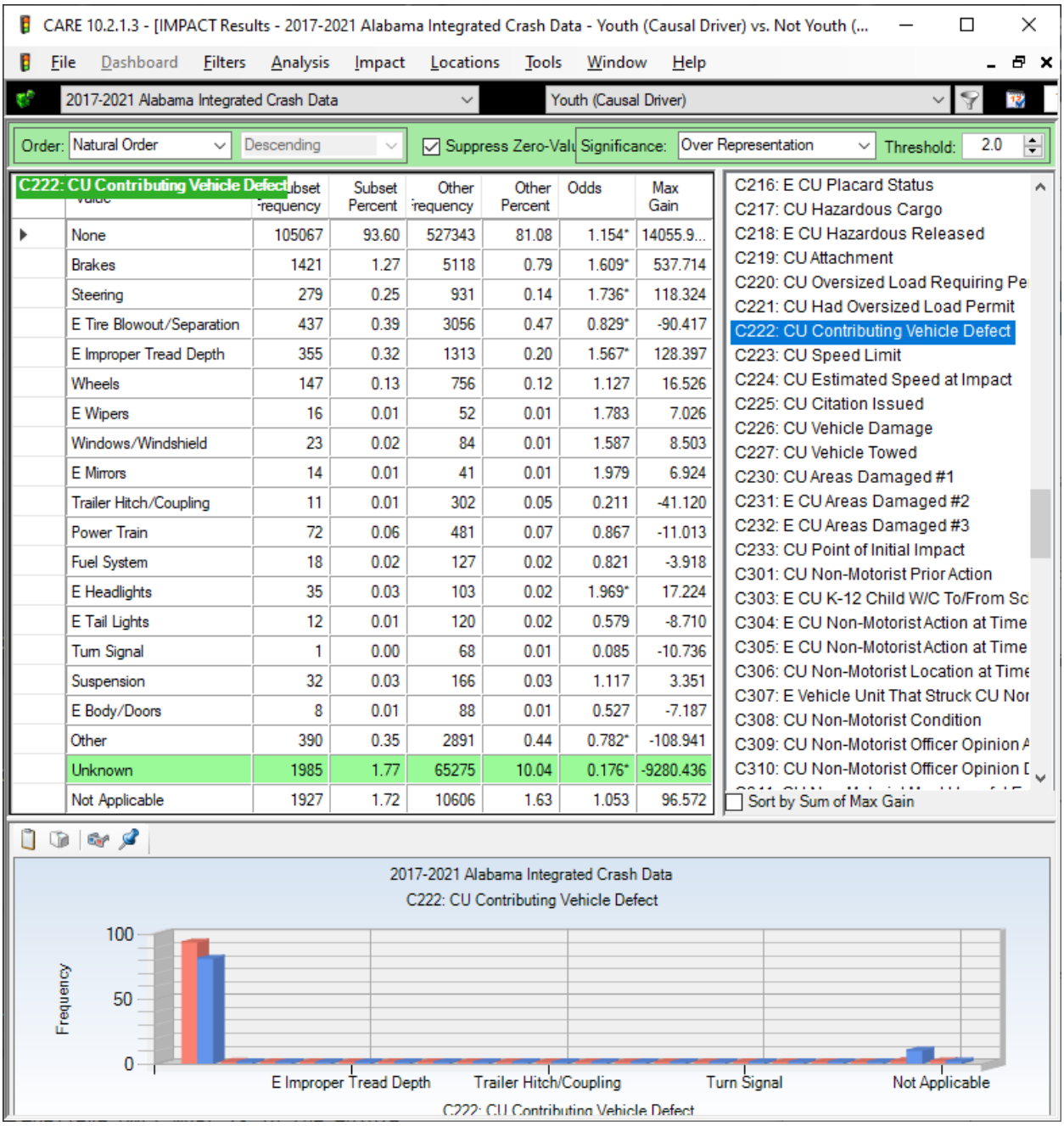
Crashes caused by young drivers are significantly overrepresented in vehicles with model years 1997-2010, all of which are shown in the table above. The seatbelt and air bags in these older vehicles may be in disrepair, and these vehicles may be harder to handle. All of this should be taken into consideration in driver training and PI&E programs directed at younger drivers. See below for vehicle defects, which also would be related to older model vehicles.

7.5 CU Vehicle Body Type



This shows the type of vehicle young drivers are operating in general, although this attribute is for young causal drivers only. The comparison with CY 2011-2015 data indicated that the proportion of four door vehicles involved in young driver crashes increased in CY 2017-2021 to 58.92% from 53.65%, which is statistically significant. The trend toward larger cars and SUVs is a logical product of the improvement in the economy, so it will be reversed in the current and near future.

7.6 CU Contributing Vehicle Defects



Young drivers in general do not have proportionally more vehicle defect issues – they are over-represented in the None category, which is good. However, this percentage is down from the CY 2011-2015 data from 97.36% to 93.73%. For older drivers this percentage also decreased from 93.39% to 81.39% reflecting the relative ages of the vehicles being driven. This enables us to see what issues they have when problems do arise. Brakes, Improper Tread Depth and Steering are the greatest issues for both age groups.

8.0 Summary and Conclusions

The following summarizes the findings of the analysis:

- **Crash Causal Factors**
  - Over-represented items are largely risk-taking behaviors that are highly associated younger drivers: Driving too Fast for Conditions, Following too Close, Over the Speed Limit, Misjudge Stopping Distance, and Failure to Yield that Right of Way.
  - Young drivers are notably under-represented in their DUI and many other forms of improper driving.
  - Nearly 80% (about 77.8%) of young drivers' crashes involve two or more vehicles. However, their over-represented single vehicle crashes shows an excess of unforced errors and risk-taking.
  - Electronic devices have the highest causal rank among distracted driving types that are defined. Not as well defined are "Other Distractions Inside the Vehicle," exceed these in number. While this may point to passengers, the Distracted by Passenger category was also significantly over-represented. Since distractions are involved in about 20% of young driver crashes, this would seem to be quite useful for countermeasure development.
  - Rain was a particular issue for young drivers, their having over 28% (Odds Ratio 1.282) more than their expected number of crashes in the rain (in comparison with older drivers).
- **Severity Factors**
  - Fatal and incapacitating injury are significantly under-represented in young driver caused crashes, reflecting the fact that typically younger drivers (and their passengers) have a far greater survival rate than older drivers under the identical circumstances.
  - Younger drivers seem to be doing a relatively good job in buckling up, as they are significantly over-represented (Odds Ratio 1.068) in this category.
  - Crashes with no injuries are significantly under-represented for younger drivers (Odds Ratio 0.993).
  - Although significant, the single injury crashes are only slightly more than what would be expected (Odds Ratio 1.025).
  - The 2-6 injury classifications are all over-represented for the younger causal drivers.
  - Taking all of the information in Section 3 collectively, we can say that while any given crash may not have as high a severity, there are more people involved in injury crashes in the younger-driver caused crashes.
  - Crashes with impact speeds above 75 were generally over-represented for young driver caused crashes.
  - Necessity for young-driver caused crashes to be towed because of vehicle disability is over-represented by 29.4%, indicating that these crashes are more severe in the physics involved than those caused by older drivers.
  - Younger driver caused crashes requiring EMS had an under-representation in the shortest two categories, while many of those above 11-20 minutes are over-represented.

- **Driver Demographics**
  - Causal unit driver ages showed a rise from 16-19 and then a slight (1.03%) drop-off for 20 year olds.
  - Males account for about 54.66% of crashes which involved young drivers, which was about as expected (54.36% for older drivers). Females were over-represented with an Odds Ratio of 1.124 (5,623 more crashes than expected over the five-year period).
  - Caucasians were over-represented in the young driver crashes (Odds Ratio 1.132) over the other racial categories. While only about 7% of the Caucasian frequency count, Hispanics had a larger Odds Ratio (1.183), indicating that their Hispanic control group had a relatively lower relative proportion of crashes than the Caucasians.
  - A proportion of about 26.7% more of the younger drivers (than older drivers) are having their crashes within 25 miles of home.
- **Time Factors**
  - Year. Younger drivers had a proportion that was significantly higher than the older drivers for 2017 and 2018, and they were very close in their proportion for 2019. The effects of the COVID pandemic are clear in 2020 and 2021, when their numbers dropped to slightly lower percentages that comparable older drivers.
  - Month. Patterns of over-representation appear to be in the months of May and August-October.
  - Day of the Week. Fridays and the weekends are over-represented for crashes caused by young drivers, demonstrating when they are on the road.
  - Time of Day. Before and after school are significantly greater than the normal rush hours, and the significant afternoon over-representations continue through the midnight hour. The most over-represented hours are from 3 PM through 11:59 PM.
  - Time of Day by Day of the Week. Friday night, early Saturday morning, Saturday night, and early Sunday morning were all over-represented hours. However, far more crashes occur before and after school hours (see the totals column). After school crash frequencies are much greater than those before school.
- **Geographical Factors**
  - Both county and city crash frequencies are excellent proxies for the locations where most young drivers are operating their vehicles, so little causality other than that should be assigned. However, this does give an excellent time and place for selective enforcement and other time-dependent countermeasures.
  - There has been a recent trend away from rural area driving and a corresponding increase in crashes in the urban areas, which now have about 75% (74.68%) of the young-driver crashes.
  - Young drivers on county highways had 1.375 times the expected number of crashes for older drivers. State routes were also over-represented (significant Odds Ratio 1.116). Interstates were under-represented indicating the tendency of younger drivers to drive locally.
  - Crashes caused by younger drivers are overrepresented in School, Residential and Open Country areas.

- **Roadway and Vehicle Factors**
    - Curve and Down Grades are particularly problematic for young drivers who have not yet experienced the fact that braking might take twice as long on a down slope.
    - Three out of the top five Max Gain categories for roadway curvature/grade included down grades.
    - Over-represented vehicle maneuvers included Negotiating a Curve, Slowing/Stopping, Turning Left, and Entering Main Road.
    - Over-represented Traffic Controls for young driver caused crashes included No Passing Category, No Controls Present, and Stop Signs. All other Max Gains are less than 100; these three are all over 1000.
    - Crashes caused by young drivers are greatly overrepresented in vehicles with model years 1997-2010. Newer models are generally under-represented.
    - Brakes, Improper Tread Depth and Steering are the greatest vehicle defect issues for younger drivers.

9.0 Most Relevant Conclusions and Recommendations

The following are considered to be the most important findings of this study from the point of view of countermeasure development:

- **Crash Causal Factors**
    - Over-represented items that are largely risk-taking behaviors are highly associated younger drivers: Driving too Fast for Conditions, Following too Close, Over the Speed Limit, Misjudge Stopping Distance, and Failure to Yield that Right of Way. These should be given emphasis in driver training and PI&E.
    - In all but a few exceptional cases the most severe crashes involve a very high level of risk acceptance, and in some cases the intentional increase of risk, usually by high speeds. Countermeasures to prevent these types of incidents have clearly not been as successful as traffic safety professionals would like, and research must continue in this area. It should be recognized that warning young drivers against specific risky behaviors is not an effective countermeasure for those who want to increase their risks. *These warnings might have just the opposite effects.*
    - A review of efforts to reduce young drivers' risk taking is in the following:

      http://www.safehomealabama.gov/wp-content/uploads/2019/10/Youth-Risk-Taking-Analysis-v08.pdf

    - Nearly 80% of young drivers' crashes involve two or more vehicles. However, their over-representation in single vehicle crashes show an excess of unforced errors and risk-taking.
    - Electronic devices have the highest causal rank among distracted driving types, of those items that are specifically defined. They were related to 1,497 additional crashes above what would be expected if their proportion of these crashes was the same as older drivers. Special emphasis should be given to avoiding these distractions on the part of younger drivers.

- Rain was a particular issue for young drivers, their having 28.2% more than their expected number of crashes in the rain (in comparison with older drivers). Young drivers need to be given exercises in coming to a stop on wet pavement, especially on downslopes.

- **Severity Factors**
  - Several of the crashes with impact speeds over 70 MPH were over-represented for young driver caused crashes. Male younger drivers are especially prone to taking such risks.
  - Necessity for young-driver caused crashes to be towed is over-represented by 29.4%, indicating that these crashes are more severe in the physics involved than those caused by older drivers.
- **Time Factors**
  - Year. Younger drivers had a proportion that was significantly higher than the older drivers for 2017 and 2018, and they were very close in their proportion for 2019. The effects of the COVID pandemic are clear in 2020 and 2021, when their numbers dropped to slightly lower percentages that comparable older drivers.
  - Day of the Week. Fridays and the weekends are over-represented for crashes caused by young drivers.
  - Time of Day. Before and after school are significantly greater than the normal rush hours, and the significant afternoon over-representations continue through the midnight hour. The most over-represented hours are from 3 PM through to 11:59 PM.
  - Time of Day by Day of the Week. Friday night, early Saturday morning, and Saturday night, early Sunday morning were over-represented hours. However, far more crashes occur before and after school hours. These hours should provide guidance for the most effective selective enforcement times, along with the County and Cities that are over-represented to provide guidance in the locations. Selective enforcement needs to focus on those times when young-driver crashes are at their highest.
- **Roadway and Vehicle Factors**
  - Curve and Down Grades are particularly problematic for young drivers who have not yet experienced the fact that braking might take twice as long on a down slope. There is no substitute here for hands and feet on an operating vehicle.
  - Over-represented vehicle maneuvers included Negotiating a Curve, Slowing/Stopping, Turning Left, and Entering Main Road.
  - Young drivers on county highways had nearly 1.4 times (Odds Ration 1.375) the expected number of crashes. State routes were also over-represented. Interstates were under-represented indicating the tendency of younger drivers to drive locally. Some selective enforcement targeting younger male drivers is warranted on County roads.

For more general NHTSA and other information on young drivers, please see:
http://www.safehomealabama.gov/tag/young-drivers/