

IMPACT Study of Passing Related (PR) Crashes In the 2016-2020 Time Frame

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Introduction

This study is an analysis of crashes involving vehicles involved in passing. The time frame chosen was the most recent five years (2016-2020) to get the most current representative data available on these types of crashes. The IMPACT displays of this report will compare: (1) Crashes either in No Passing Zones (C409) or Improper Passing (C015) involved crashes compared against (2) all other crashes. The goal of these comparisons is to isolate those causes and characteristics that are different for Passing Related (PR) crashes. To do this a filter was developed to be used to create a subset that had one or both of the following characteristics:

- The crash occurred in a No Passing Zone as given by C409; or
- The crash was indicated as Improper Passing Primary Contributing Circumstance (C015).

This filter is further explained in the Formal Filter Definition for PR Crashes section below.

Findings and Recommendations Related to PR Crashes

The findings of this study surface the who, what, where, when, how and driver/vehicle demographics of PR crashes. The findings will be given first in this section followed by a second section that will present the recommendations for reducing these types of crashes. The PR considered for the 2016-2020 time period resulted in 1,233 Fatal crashes and 5,563 Suspected Serious Injury Crashes, or a total of 6,796 crashes in the two highest severity classifications. The major goal of this study was to reduce these fatal and severe crashes. However, it was felt that more depth could be obtained by considering all PR crashes during this time period. By using IMPACT to compare these crashes to all non-PR crashes, the goal was to surface what makes the PR crashes different, and thereby reduce their frequency by addressing these differences.

This section is a type of executive summary. A brief statement of findings for the various categories of crashes will be given first. To see the details for these findings, see the IMPACT displays and interpretations in the Characteristics of Speed Caused Fatal and Severe Injury (PR) section. Recommendations are given in the final subsection, and they are in the same categories after the findings.

Brief Statement of Findings by Category for PR Crashes

- **Geographical Characteristics** – Generally PR crashes occur close to five (4.682) times their expected proportion in the Rural as opposed to Urban areas. County roads had over five (5.1333) times their expected proportion, and state roads had 1.706 times the expected from non-PR crashes. All of the other highway classifications were highly significant in their under-representations. The rural parts of most Counties showed very significant over-representation, and Intersections were under-represented with less than half (0.417) of their expected proportion.
- **Time Considerations** – The variations per year were found only in 2019 and 2020, where these two years essentially cancelled each other out; thus, no annual trends are of significance. Time of day (night-time) and day of the week (weekends) give strong evidence of being correlated with Impaired Driving (DUI) caused crashes. This was verified in the Alcohol and Other Drugs discussion below.
- **Driver Behavior** – the First Harmful Event provides a prioritized list of roadside features that should be addressed, not just for PR crashes, but for crashes in general. Ditches and Trees lead the list with over twice the frequencies as all of the following over-represented items. Most all roads have ditches, most of which cannot be eliminated. Trees can be removed but the number of them requires prioritization. The indication from Vehicle Maneuvers is that drivers are not anticipating and slowing down for curves, since Negotiating a Curve had an Odds Ratio of 10.112. This is expected since most no-passing zones are on curves. Also as expected, Overtaking/Passing also had close to 13 (12.983) times its expected proportion.

- Roadway Characteristics/Conditions – Weather and roadway conditions are not in the control of the driver, but their reactions to adverse conditions are. Passing zones may be more difficult to see in wet weather. Cloudy and Rain both had significantly higher proportions than non-PR crashes. Wet pavement was significantly over-represented by 1.256, over 25% higher than expected from the non-PR subset. Weather is given to have about the same significant over-representations. However, Animal in Roadway has a proportion that is 7.494 times its expected value. Rural areas have a greater number of deer, which probably accounts for over 90% of these crashes. About half of these PR crashes involved collisions with deer, but attempts to avoid deer (without striking the deer) explains this difference.
- Severity, and Conditions Affecting Severity – the PR crashes considered for the 2016-2020 time period resulted in 1,233 Fatal crashes and 5,563 Suspected Serious Injury Crashes. Both of these were highly significantly over-represented by Odds Ratios of 4,209 and 3.210, respectively, indicating that PR crashes have a much higher severity than non-PR crashes.
- Severity is increased by EMS delay, and for the PR crashes all of Odds Ratios increased with the delay times, with all those above 15 minutes being highly significant. This was a consequence of most of the PR crashes being both rural and the nighttime over-representations.
- The failure to wear seatbelts appears to be as much of a reason for a crash to be of much higher severity, and the expected None Used for the non-PR subset was 2.42 (about 97.5% compliance with seatbelt laws), while the PR None Used percent was 9.21%. The percent using both Shoulder and Lap Belt was about the same for PR and non-PR subsets. Cross-tabulations of “Severity by Estimated Speed at Impact” and “Restraint Use” further confirm these relationships with “Crash Severity.” These cross-tabulations are given following the IMPACT displays.
- Crash Type – PR crashes are dramatically over-represented in Single Vehicle crashes, with an Odds Ratio of 2.913. It is important to recognize that two vehicles may have been involved prior to the crash, but only one of them was recorded to have crashed. Pedestrian and CMV crashes are about as expected; i.e., their proportions are not significantly different from the non-PR crashes.
- Driver and Vehicle Demographics – The major over-represented PR causal vehicle was the Motorcycle, with 3.507 times the expected proportion. The other two dramatically over-represented vehicles are low speed vehicles that probably should not be on the roadways in any event. Most of these crashes probably occur as faster-moving vehicles catch up with them and attempt to pass to avoid a collision. The proportion of Pedestrian crashes is not significantly different from the non-PR crashes. The Youngest drivers (16-19) are all significantly over-represented in PR crashes. Above these ages, there is no clear patterns of over-representation. The “unemployment rate” in the PR subset is over 23.61%, and it is shown to be over-represented by an Odds Ratio of over two (2.046). As for the Causal Unit Contributing Circumstances, Improper Passing was used in C015 to create the filter for CR, so its relative information is of no consequence. Below that we can see the driver errors that led to the crashes. Those over-represented by more than a

factor of 2 are given in the following list (along with their Odds Ratios): Over Speed Limit (7.319), Ran off Road (3.330), Driving too Fast for Conditions (2.010), Swerved to Avoid Animal (5.054), Over Correcting/Over Steering (2.964), DUI (1.974), Fatigued/Asleep (2.376), Crossed Centerline (2.539), and Traveling Wrong Way/Wrong Side (2.466). Finally, the CU Model Years indicate that PR causal vehicles were significantly over-represented in the early model year (2000 through 2007). *Note that this display is a comparison of Model years independent of the year in which the crash occurred.*

- Effects of Alcohol and Other Drugs – We saw above with time of day and day of the week that there was a strong indication of Impaired Driving taking place in the PR subset. The Driver Condition attribute shows the proportion of “Under the Influence” to be 3.21 times the proportion of its non-PR counterpart. The specific Officer Opinion are quite comparable, with alcohol having 2.417 times, and (other) drugs being 2.309 times their expected proportions, both are highly significant and prove that DUI plays a very large part in PR crashes.

Recommendations to Reduce PR Crashes Based on Findings

- Geographical Recommendations – Center hotspot analysis procedures on high volume rural roadways where PR crashes show over-representations; use the PR filter to identify these hotspots.
- Time Recommendations – Modify the times of selective enforcement to the over-represented times (weekends during the nighttime hours), recognizing that deterrence might be more effective if law enforcement presence is displayed in the earlier nighttime hours. PI&E: warn all drivers of the increased late-night danger of difficulty in recognizing no-passing zones, increased DUI crashes, and inform them of the use of selective enforcement at these times.
- Driver Behavior Recommendations – To the extent feasible, establish programs for clear roadside (especially large trees) using the hotspot results with concentrations on county roads. Also, if possible, make ditches more crash friendly by eliminating steep side-slopes. Perform evaluations to determine the effectiveness of PI&E programs aimed at speed reduction before curves, caution when overtaking and passing in the rural areas, and the proper interpretation of passing zone roadway stripes.
- Roadway Condition Recommendations – Create a PI&E program to inform drivers of all inclement weather hazards emphasizing that passing zones are more difficult to see in inclement weather and at night. Determine passing zone hotspots for crashes in rainy conditions and water buildups.
- Severity, and Conditions Affecting Severity Recommendations – Repeated from findings above: “Perhaps more than any other, this [restraint] attribute shows why PR crashes have so many fatalities. The rate of no restraints used is 9.21%, which is almost four (3.802) times that of the non-PR subset. Even with the recommended safety equipment used, motorcycle PR crashes are extremely severe.” It is highly problematic that high-risk individuals involve themselves in unsafe speeds and dangerous passing at the same

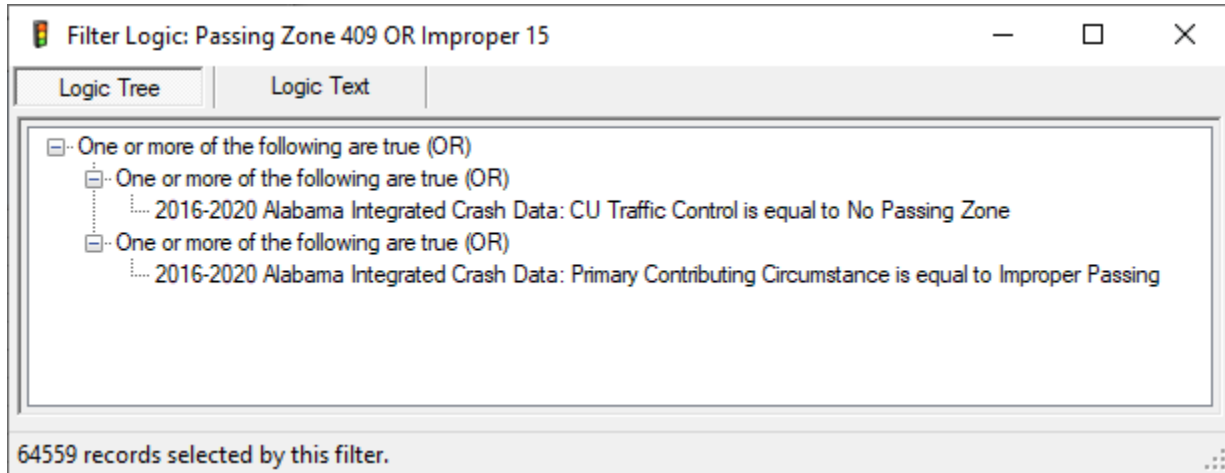
time they refuse to use restraints. Since this is no new problem, it is clear that new measures need to be developed to identify these individuals and apply some newly developed countermeasures. One possibility is the emphasis on the mandatory use of seatbelts to those who are in alcohol/drug programs.

- Crash Type Recommendations – PR crashes are dramatically over-represented in Single Vehicle crashes, with an Odds Ratio of 2.913. It is important to realize that a single-vehicle crash does not necessarily imply that the vehicles that crashed were not either passing or being passed prior to the crash, i.e., multiple vehicles were involved even though they did not get on the crash report form.
- Driver and Vehicle Demographics Recommendations – Motorcycle manufactures and club representatives need to be involved in developing effective countermeasures for motorcyclists in general, with special emphasis on the dangers of passing. The only age group that can be targeted for PR crashes is the 16-19 (inclusive) age group. At this age many do not have the ability to fully recognize risk. See: <http://www.safehomealabama.gov/wp-content/uploads/2019/10/Youth-Risk-Taking-Analysis-v08.pdf> for potential countermeasures to reduce risk-taking of younger drivers. A study should be conducted to determine if there is a way to target unemployed drivers for PI&E information, perhaps distribution of information along with their unemployment checks.
- Effects of Alcohol and Other Drugs Recommendations – the large variety of efforts that are currently being made to reduce DUI should be expanded since considerable study has gone into them, and their successes are well documented. Nevertheless, the over-representations in both drugs and alcohol argue for more emphasis. For a review of these countermeasures see Section one of http://www.safehomealabama.gov/wp-content/uploads/2021/09/15100_Countermeasures10th_080621_v5_tag.pdf . This document also recommends other countermeasures for the items given above.

Passing-Related (PR) Crashes

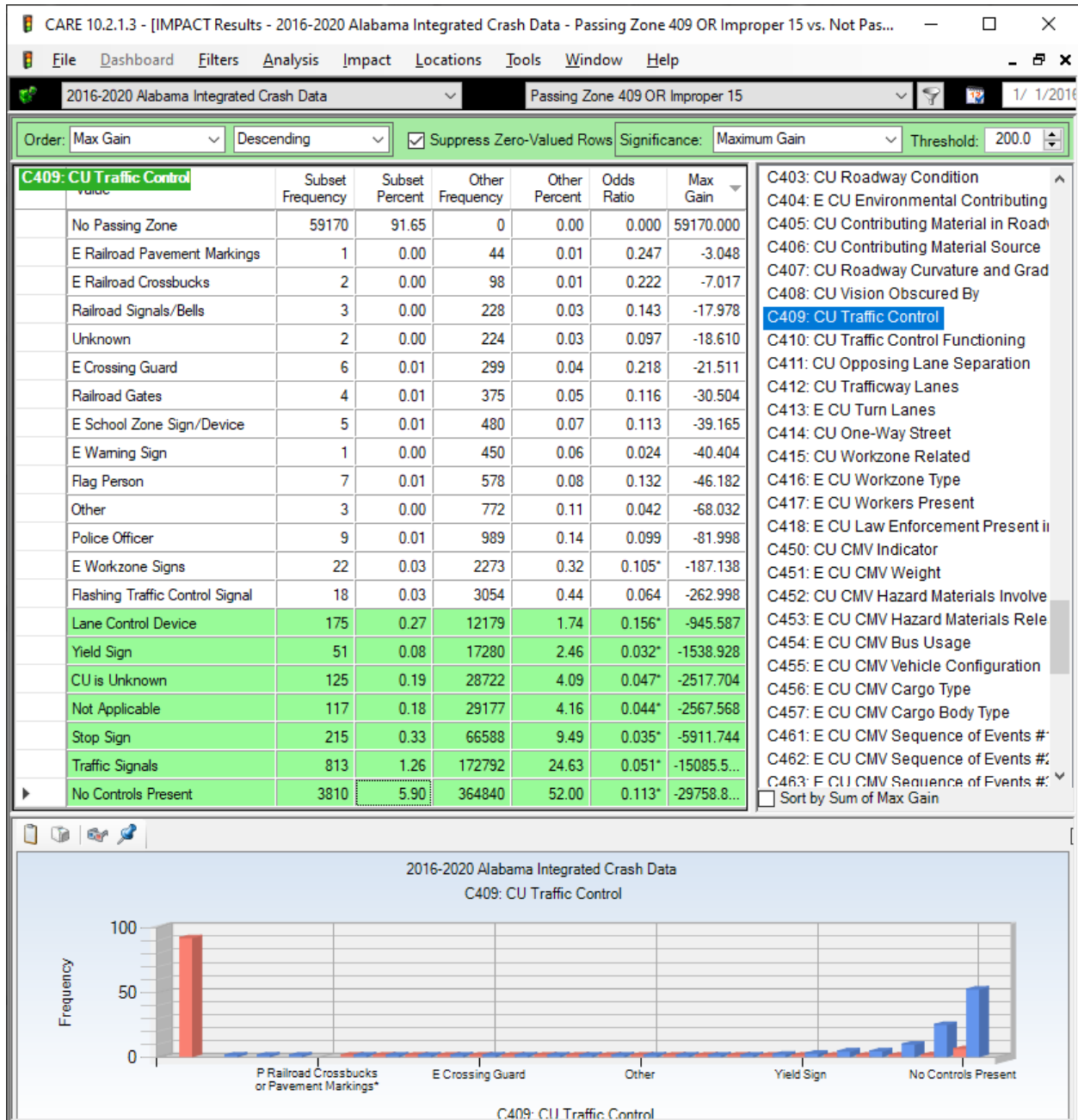
Formal Filter Definition for PR Crashes

The IMPACT displays given in this section were set up to demonstrate effect of the filter being applied, which was initially described above. The following is the CARE logic for the filter.



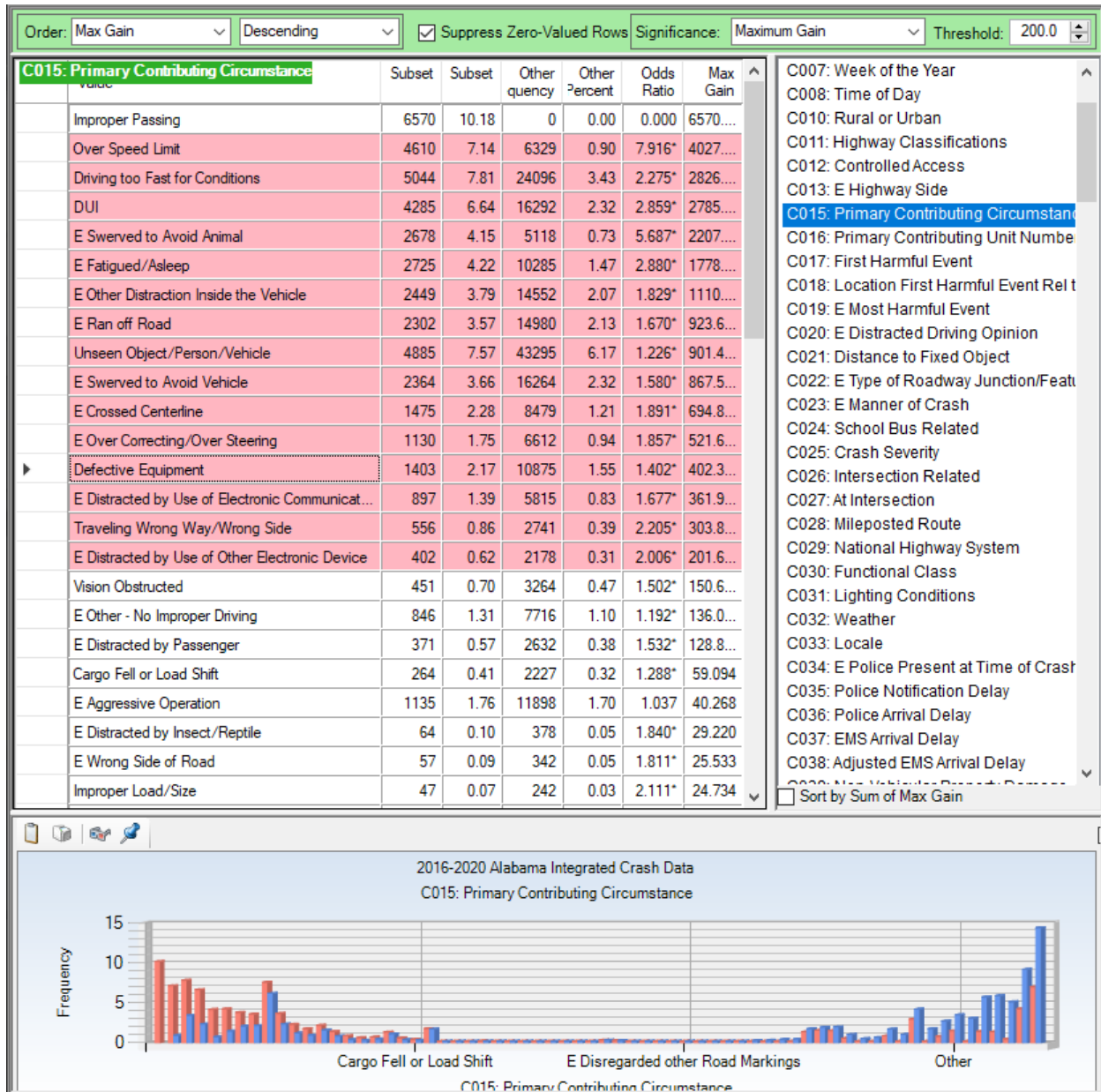
The three IMPACT displays that follow were restricted to this PR filter for the “Subset” columns. The “Other” two columns to which these items are being compared are all crashes not in the “Subset,” which will be referenced as nonPR.

C409 CU Traffic Control



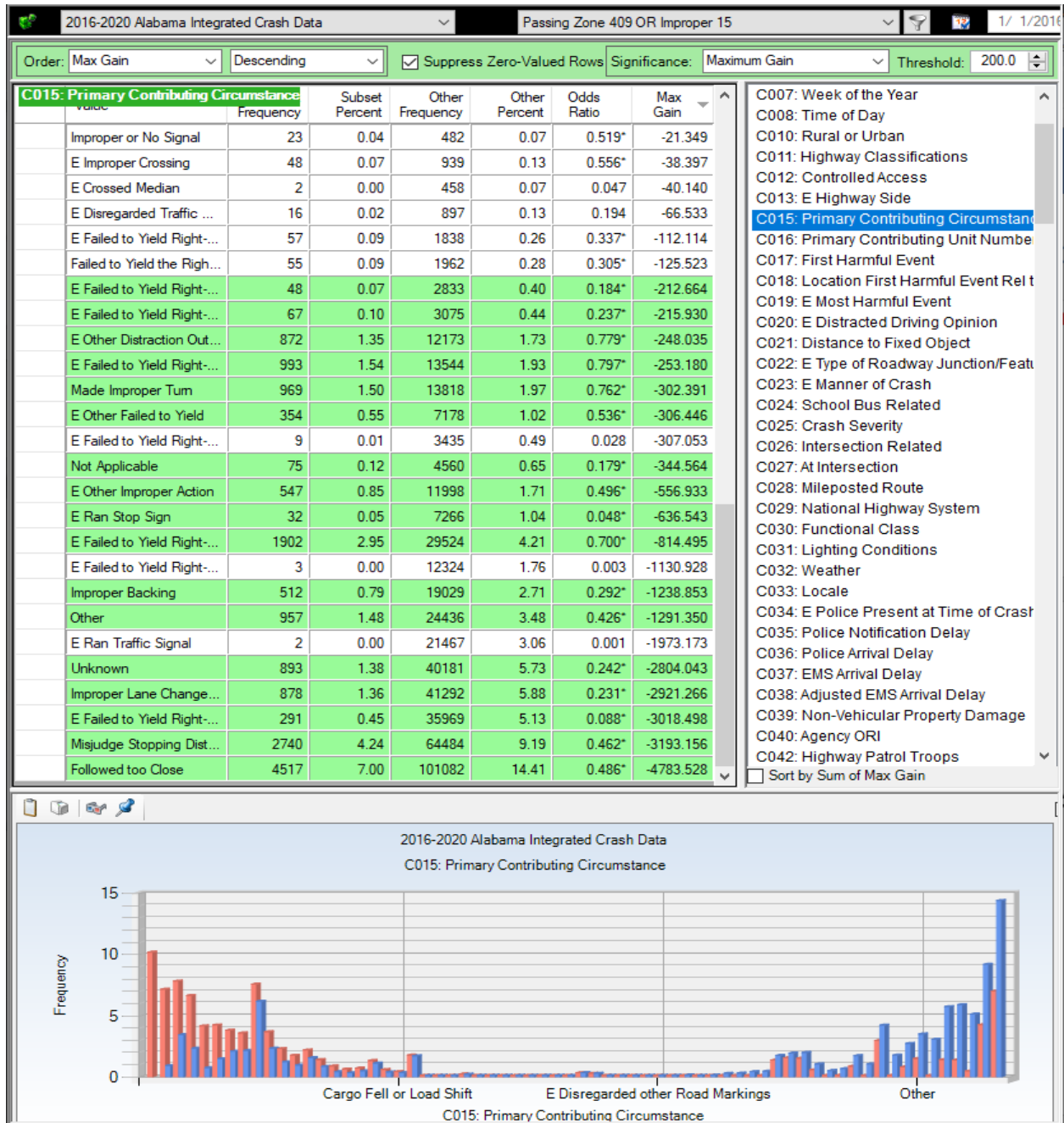
A total of 59,170 crashes were in No Passing Zones. Why are there other items in this display? These all come from the Primary Contributing Circumstance (C015): "Improper Passing," which is shown in the next display. That would be passing outside of no-passing zones, which could include crashes in the process of legal passing.

C015a Primary Contributing Circumstances (with significant positive Max Gains)



Improper Passing was one of the conditions creating the filter. Other than these crashes, this display tells what driver violations were in effect when the causal vehicle was in the No Passing Zone. All of the 6,570 Improper Passing PCC crashes in the very top item were created by the filter. All other items in this display had significantly higher proportions than the non-PR subset, showing a high correlation of these items to the PR subset.

C015b Primary Contributing Circumstances (with significant negative Max Gains)

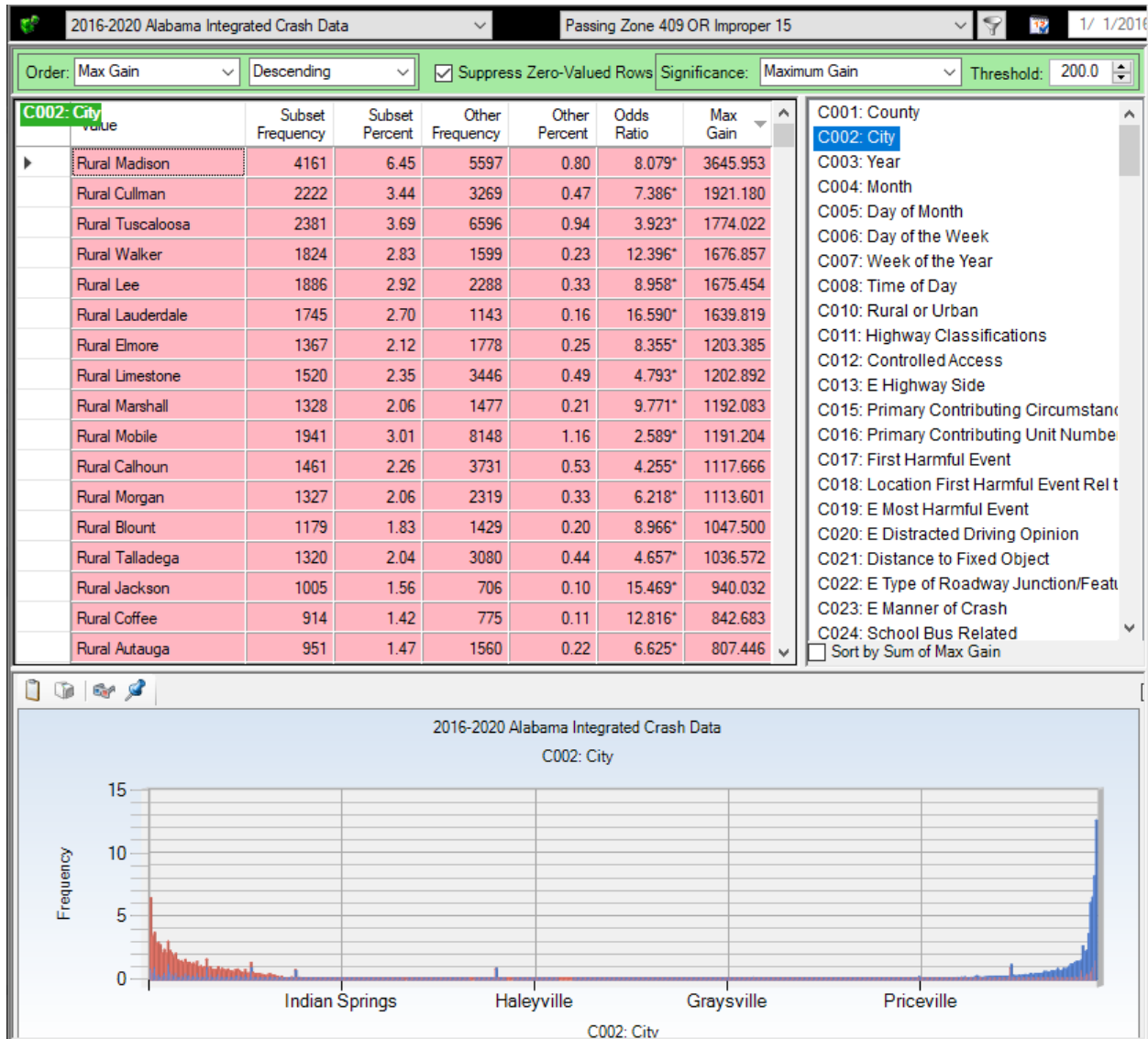


Negative Max gains indicate that the PR subset had a lower than expected proportion in these PCC items, and thus much less correlation with them. The next section gives the IMPACTs used for the findings and recommendations presented above.

Characteristics of PR Crashes

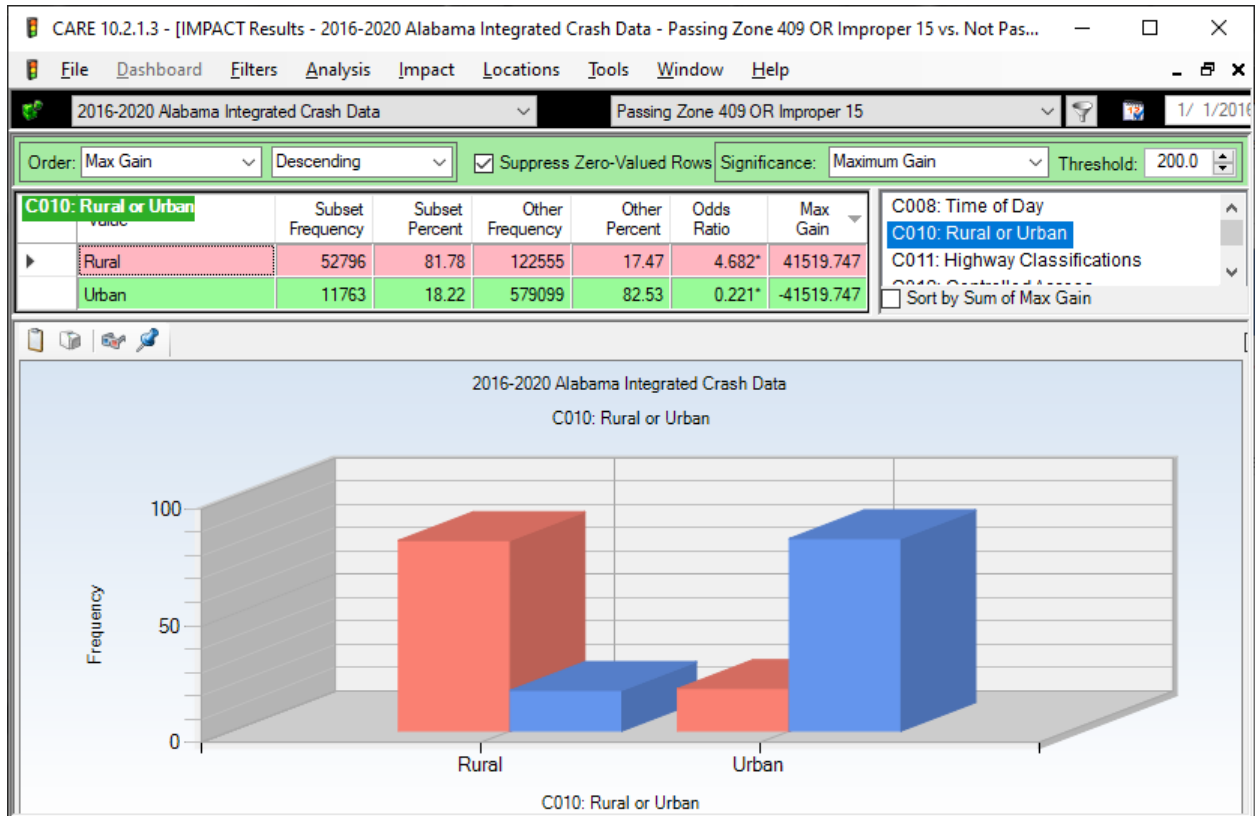
Geographical Characteristics

C002 City (top over-represented cities)



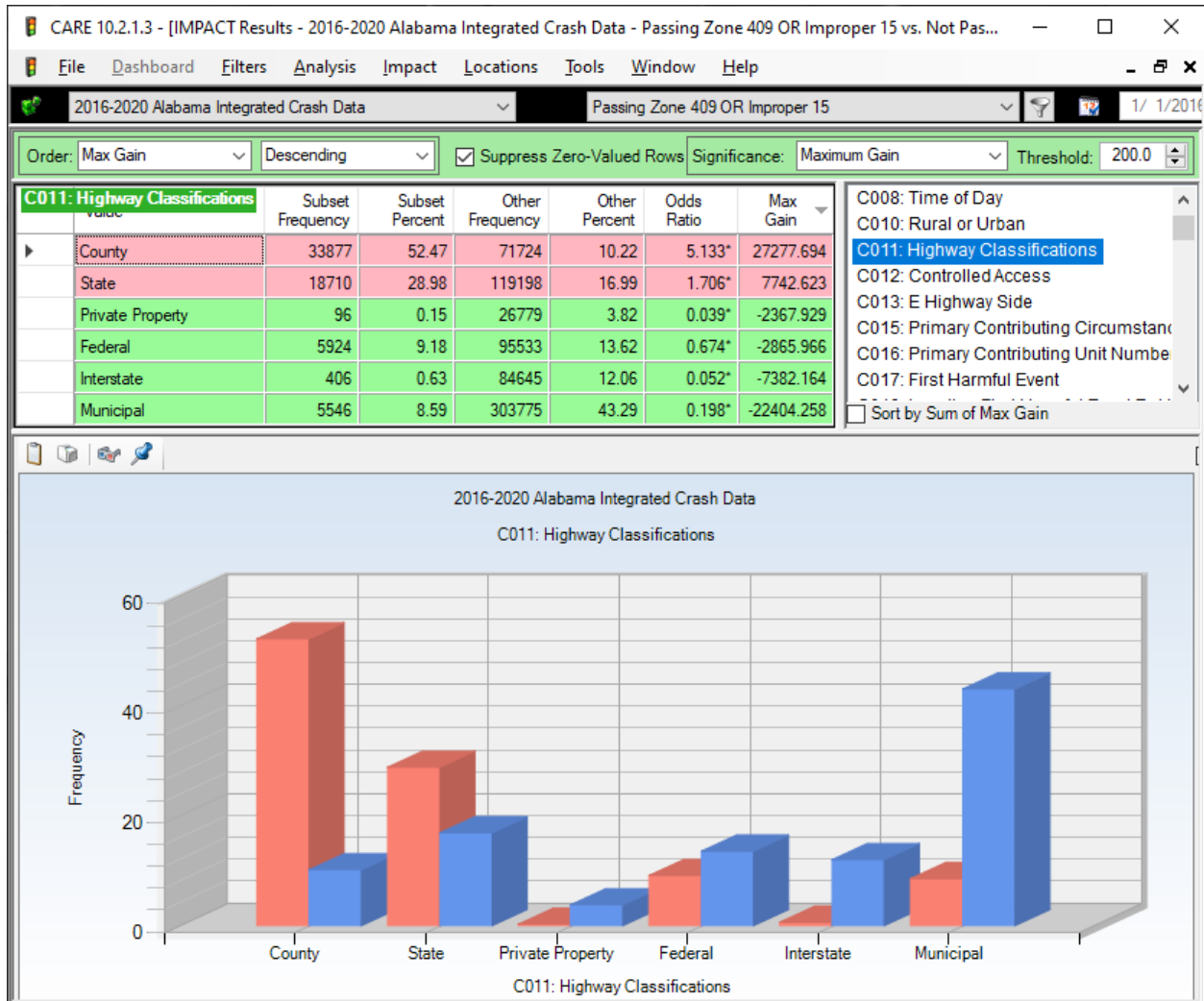
Virtually all of the high MaxGain areas fell into the Rural areas of the counties. Urban areas were significantly under-represented in the following order: Birmingham, Mobile, Montgomery, Huntsville and Tuscaloosa.

C010 Rural or Urban



Rural highways are most apt to have PR crashes due to the increased speed that can be attained on these roadways. The over-representation is 4.682 times that expected as given by the Odds Ratio.

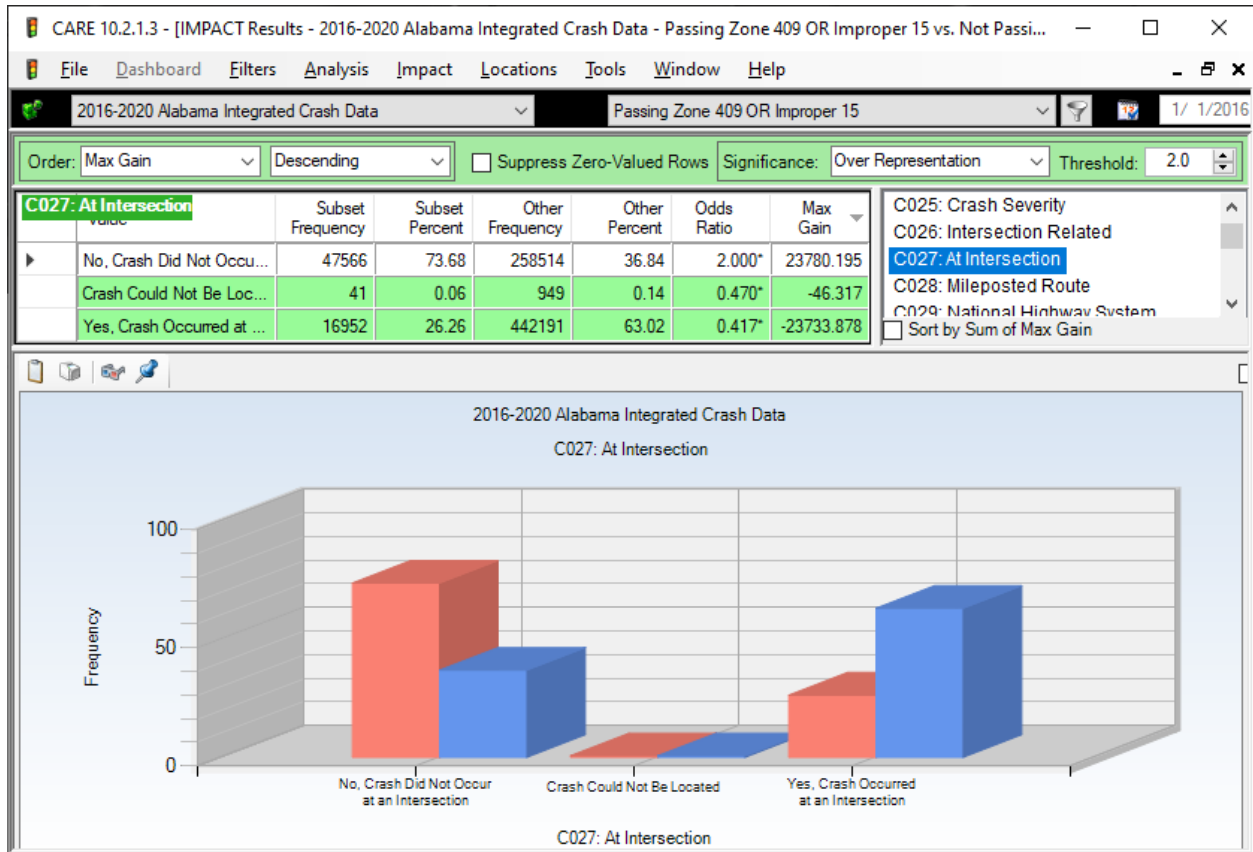
C011 Highway Classification



County roads are the clear losers here with over five times their expected proportion. Speed is feasible on most county roads, but the roadway configurations and roadsides are not designed for any type of crash, much less those involving high speed. Passing on these two-lane roads is particularly hazardous and even where legal there is usually a sight-distance problem. The speed limit maximum on virtually all county roads is 45 MPH for a reason.

State routes come in next with an over-representation of close to two. No Passing Zones are clearly marked with painted lines, but they are not easy to read for any distance at night. All the other road classifications are under-represented.

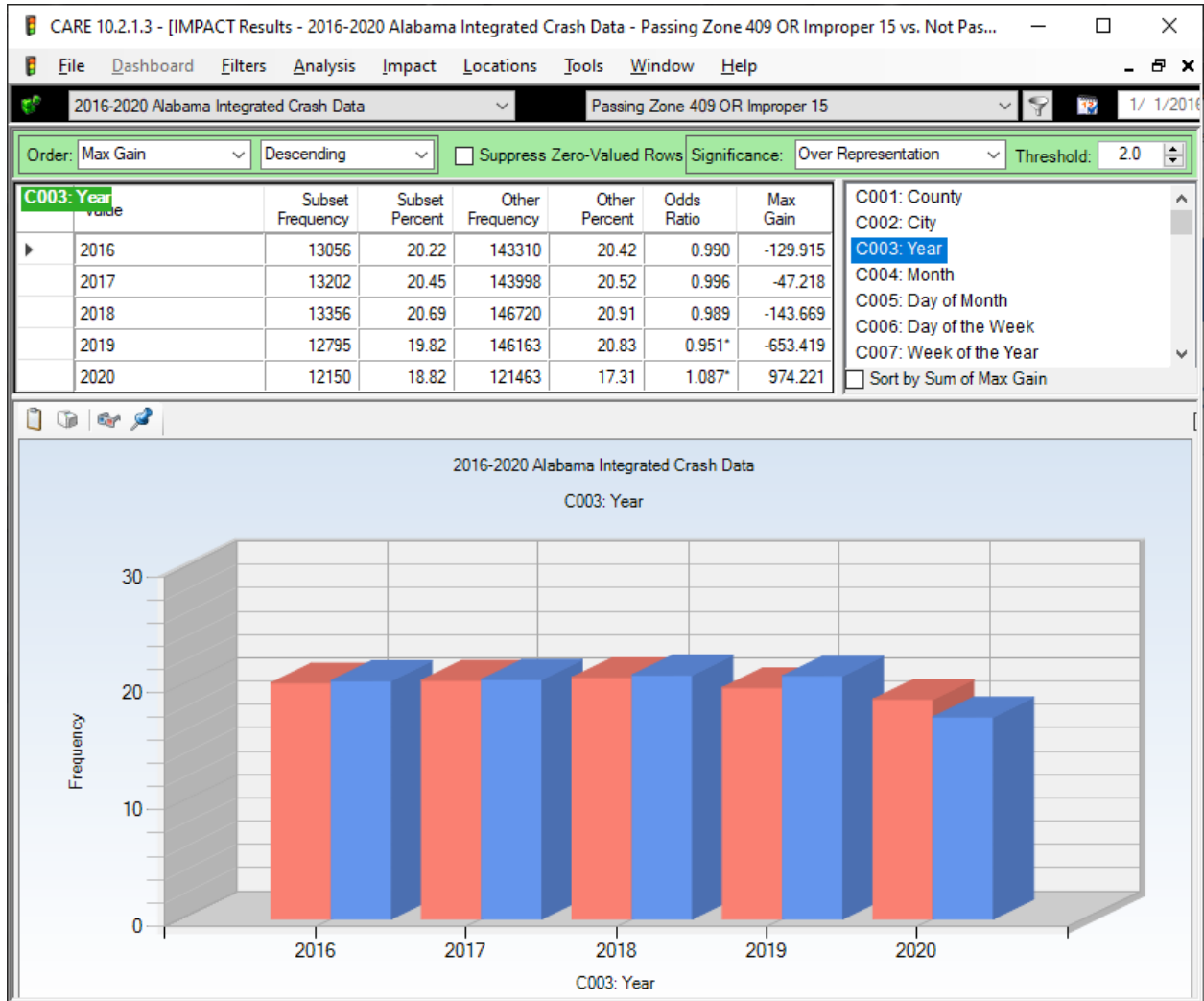
C027 At Intersection



As expected in primarily rural crashes, intersections are under-represented. Close to three quarters of the crashes were not at intersections.

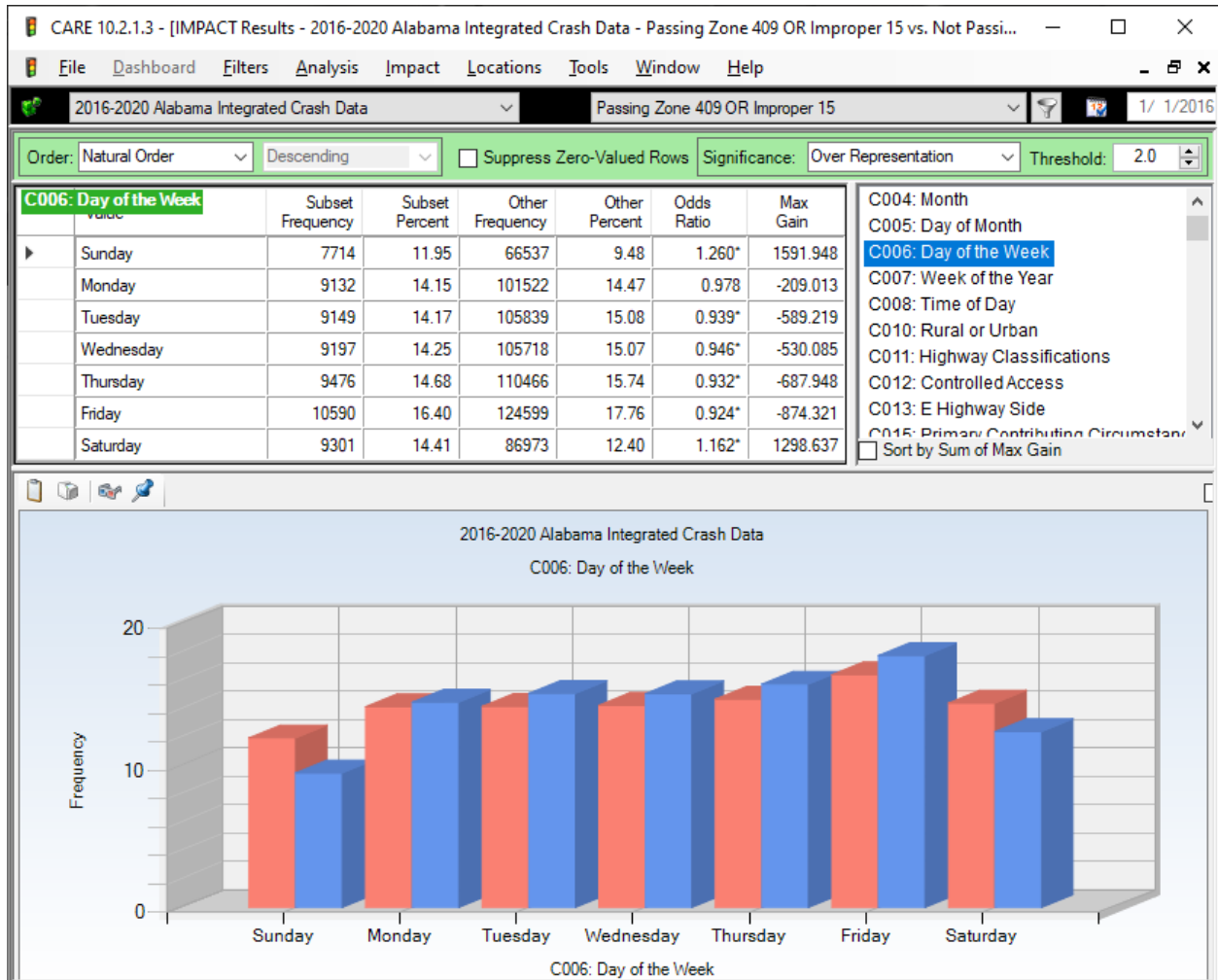
Time Considerations

C003 Year



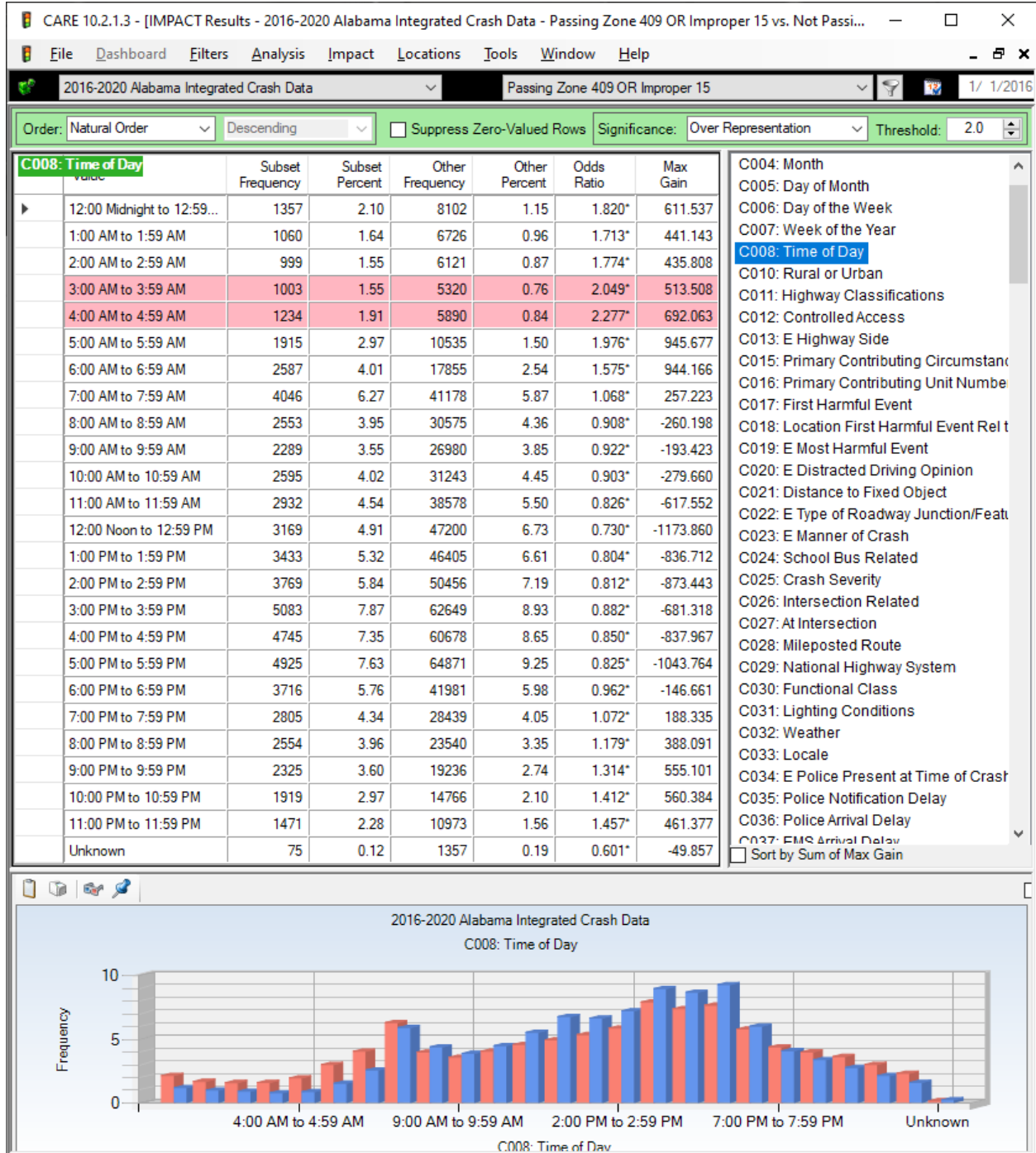
Years 2016-2018 show no significant differences between the proportion of PR crashes and non-PR crashes. 2019 was under-represented in PR crashes and 2020 was over-represented by about the same amount, both being significant. 2020 is generally lower because of the COVID-19 restrictions.

C006 Day of the Week



PR Crashes are significantly over-represented on weekends, which may be indicative of DUI (Drugs and Alcohol) – see C121, C122 and C123 below. All other days of the week are under-represented, and the only one that is not statistically significant is Monday. Friday is higher than any of the others, but its proportion is not greater than non-PR crashes.

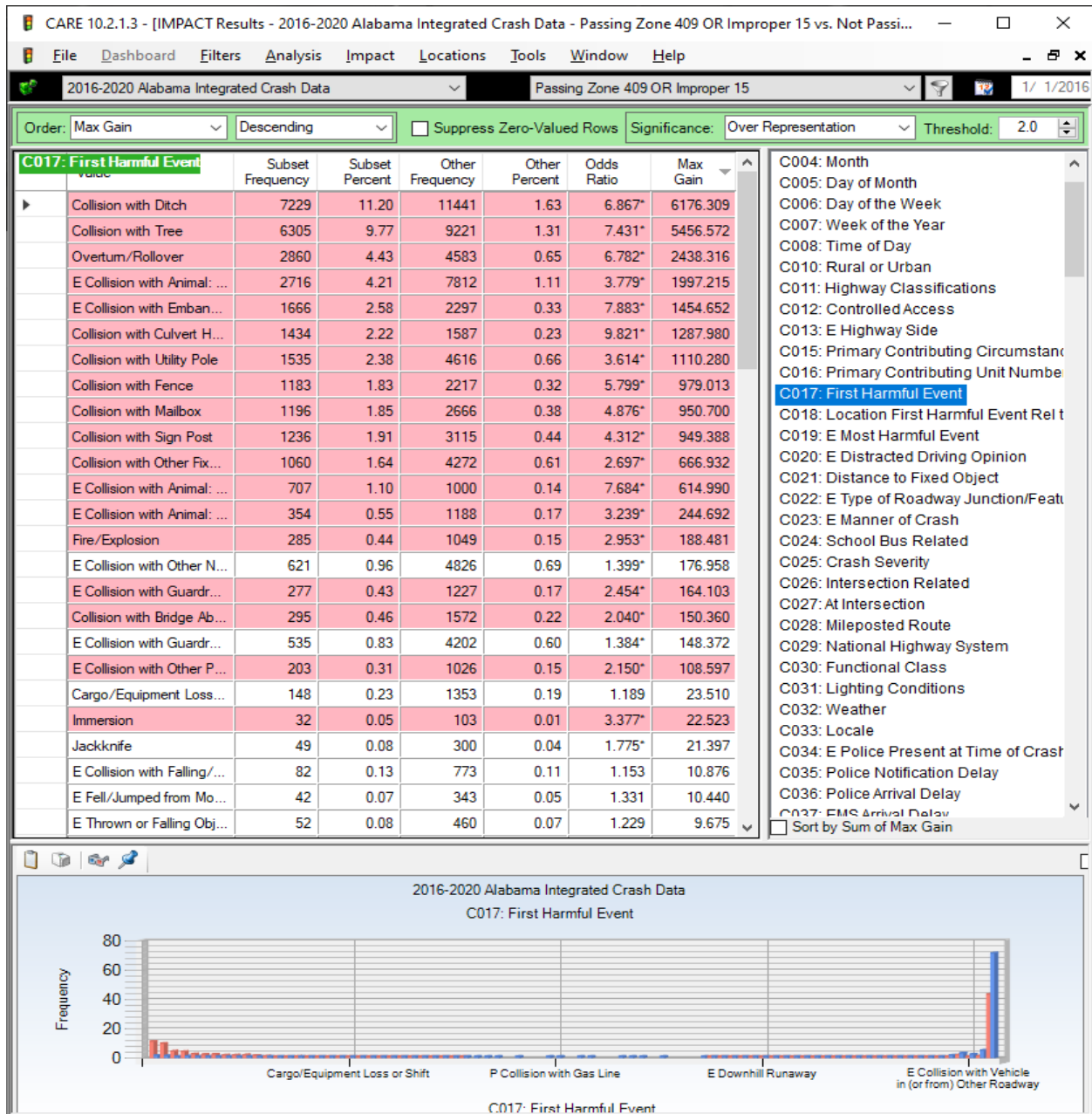
C008 Time of Day



Very clearly, PR crashes are highly over-represented in the nighttime (dark) hours. Unusual is the very high over-representation in the later early morning hours. This indicates potential issues other than DUI.

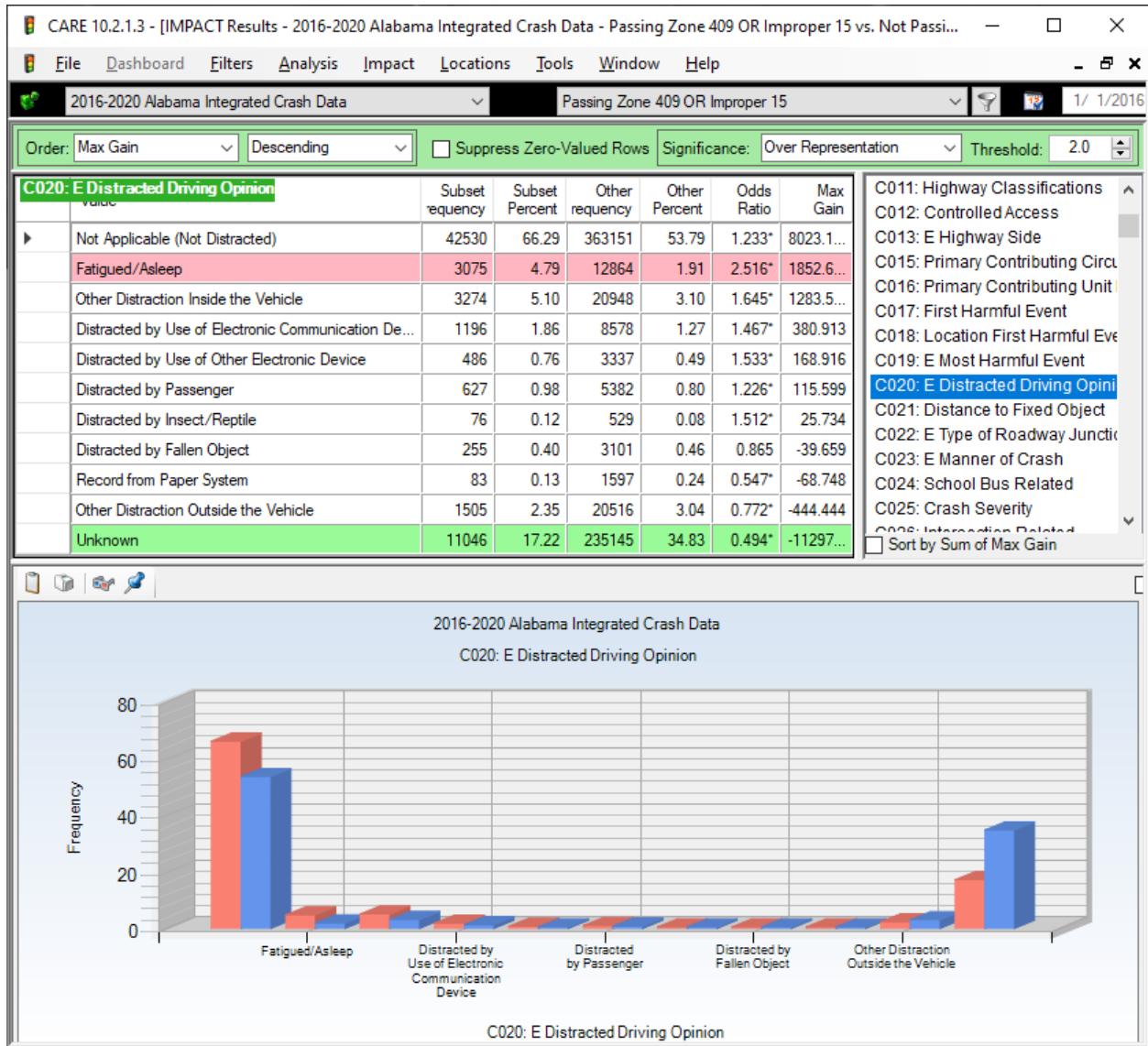
Driver Behavior

C017 First Harmful Event



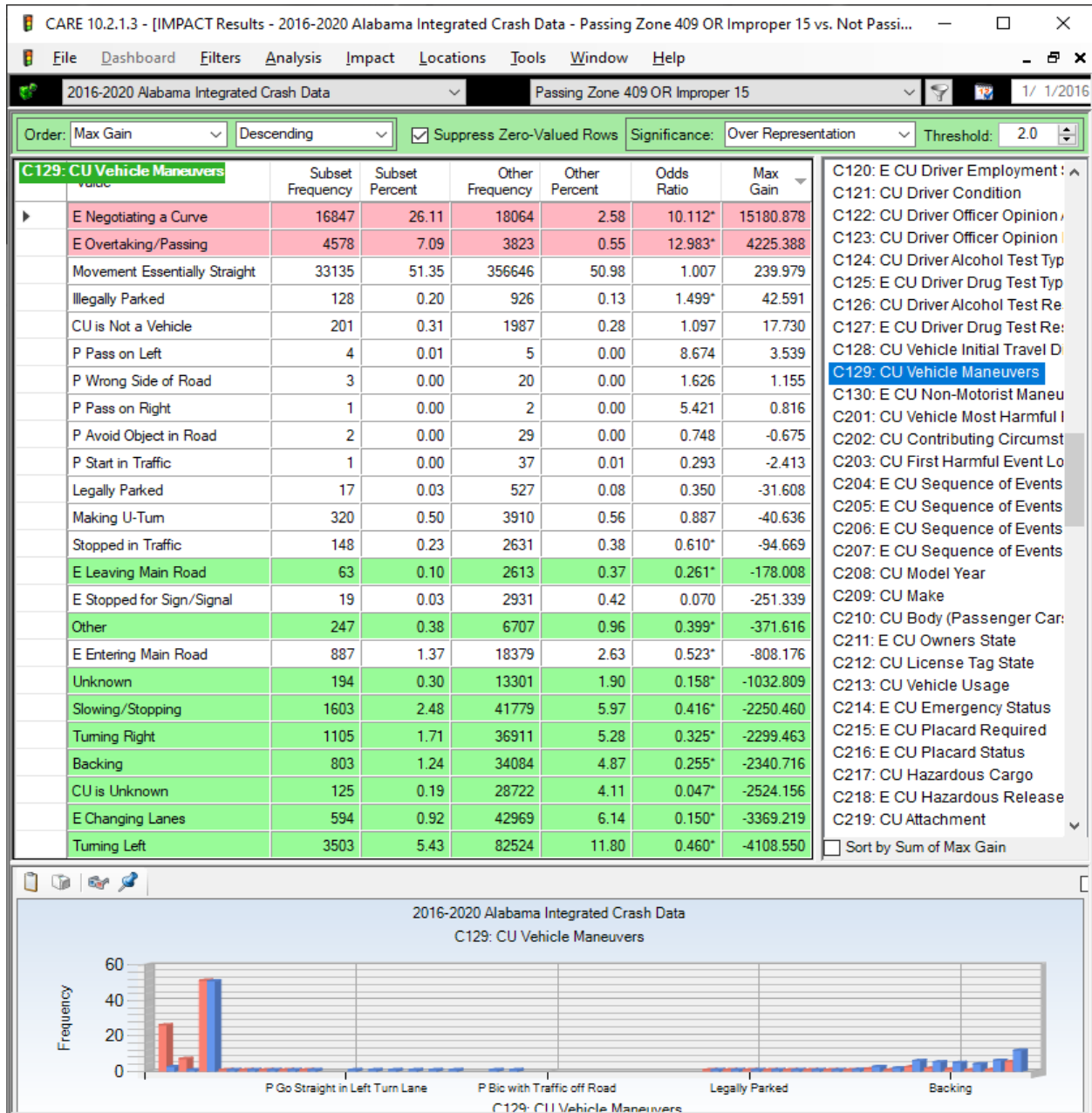
These results answer the question: What was hit first? All items with a Max Gain in excess of 8 crashes are given. The high blue bar at right is Vehicle in Traffic, which is dramatically under-represented despite it having the highest frequency of both PR and non-PR crashes.

C020 Distracted Driving [officer's] Opinion



Fatigued/Asleep is considered to be a distraction within the eCrash reporting system. In this case it shows a very significant over-representation of 2.516 time the expected (the proportion for non-PR crashes). Given the over-represented later early morning times of these crashes, this is an expected result. Most of the other distractions are also significantly over-represented. Obviously, drowsiness and distractions in general are significant causes of PR crashes.

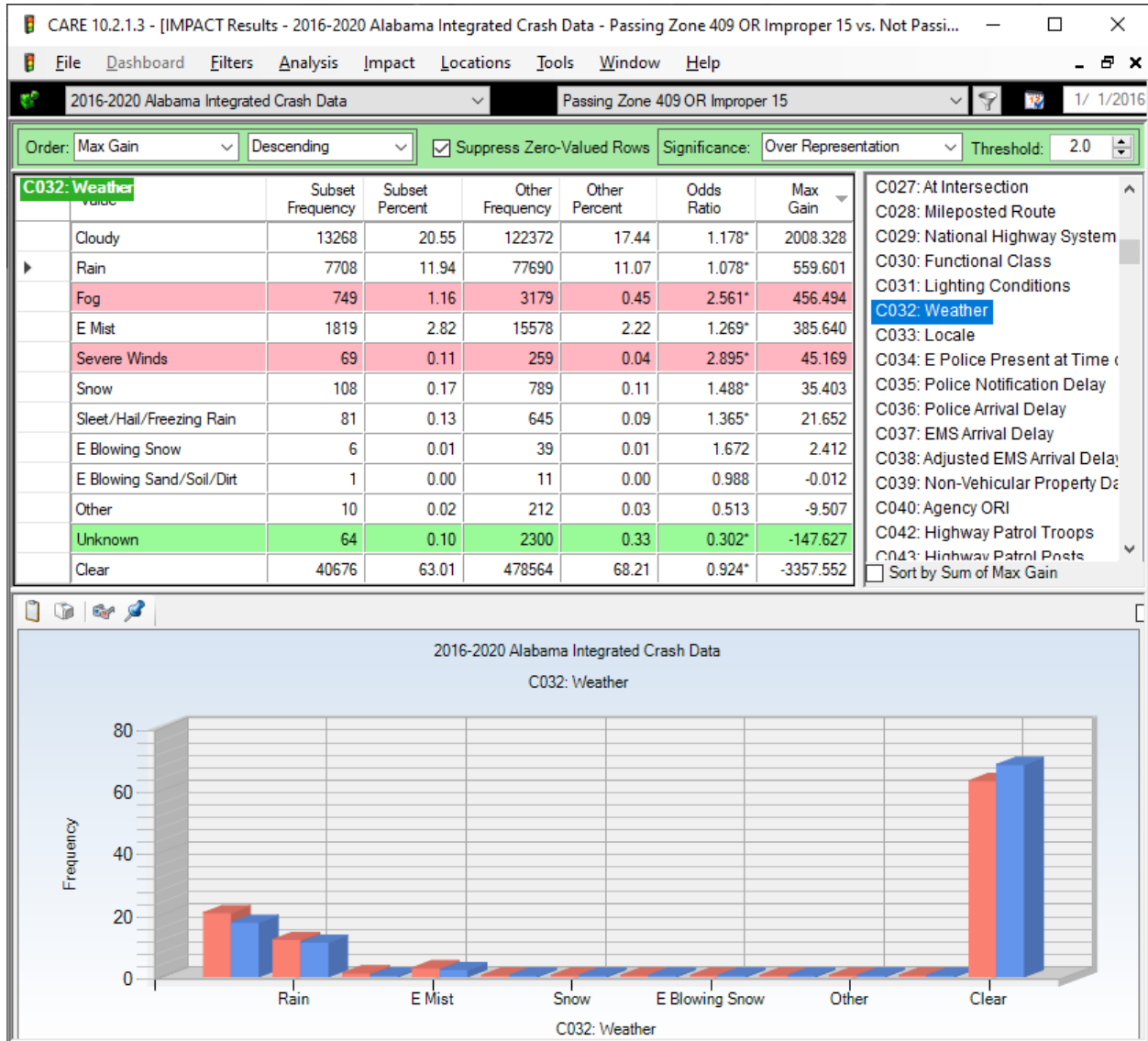
C129 CU Vehicle Maneuvers



Both Negotiating a Curve and Overtaking to Pass are extremely significantly over-represented, with Odds Ratios of 10.112 and 12.983, respectively. Usually those with an Odds Ratio greater than 2 are considered to be highly statistically significant and are indicated as such with a red background. In this case the Overtaking/Passing item could be explained by the filter. However, it seems clear that the No Passing Zones in question are largely due to curves.

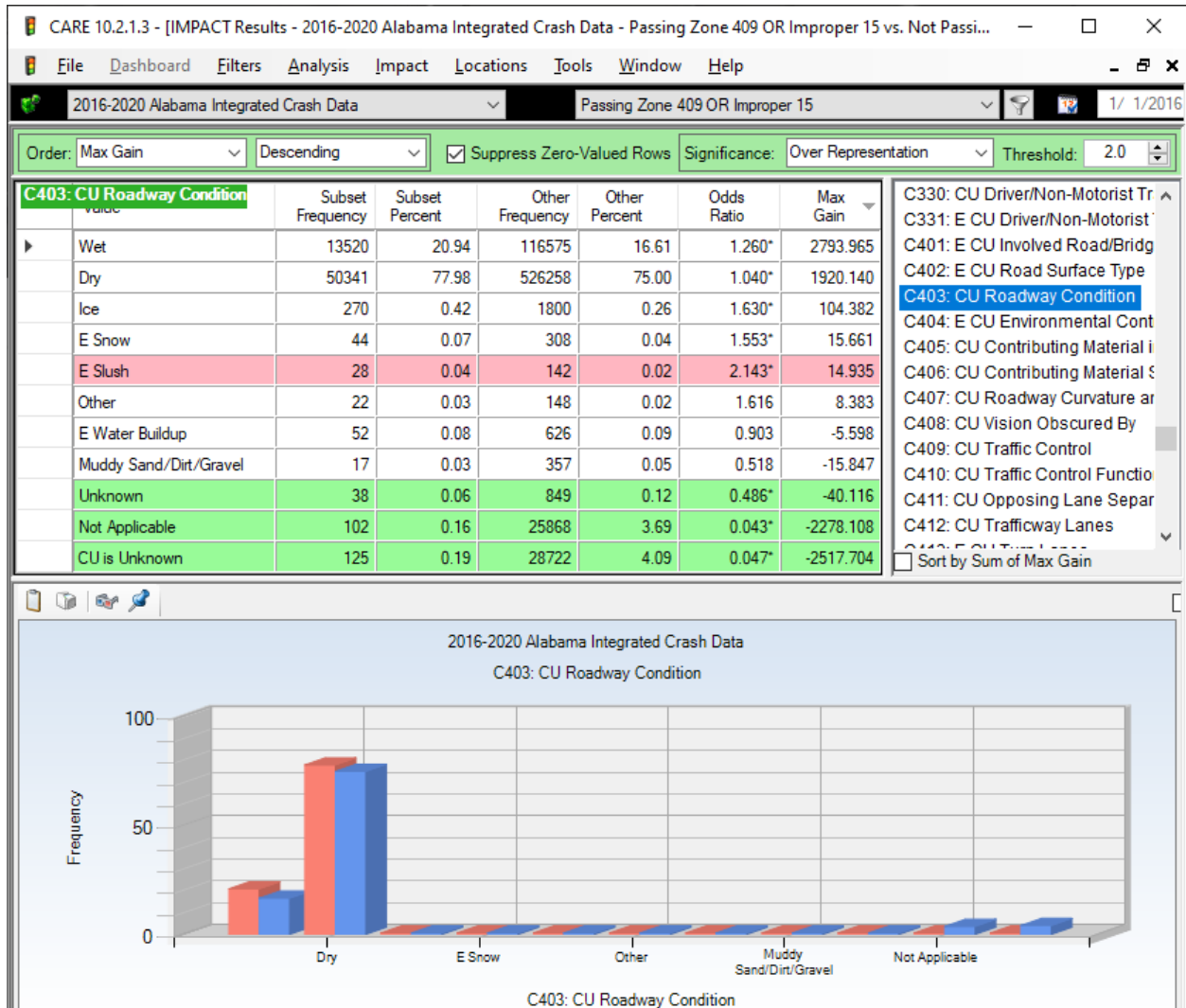
Roadway Characteristics and Attributes

C032 Weather



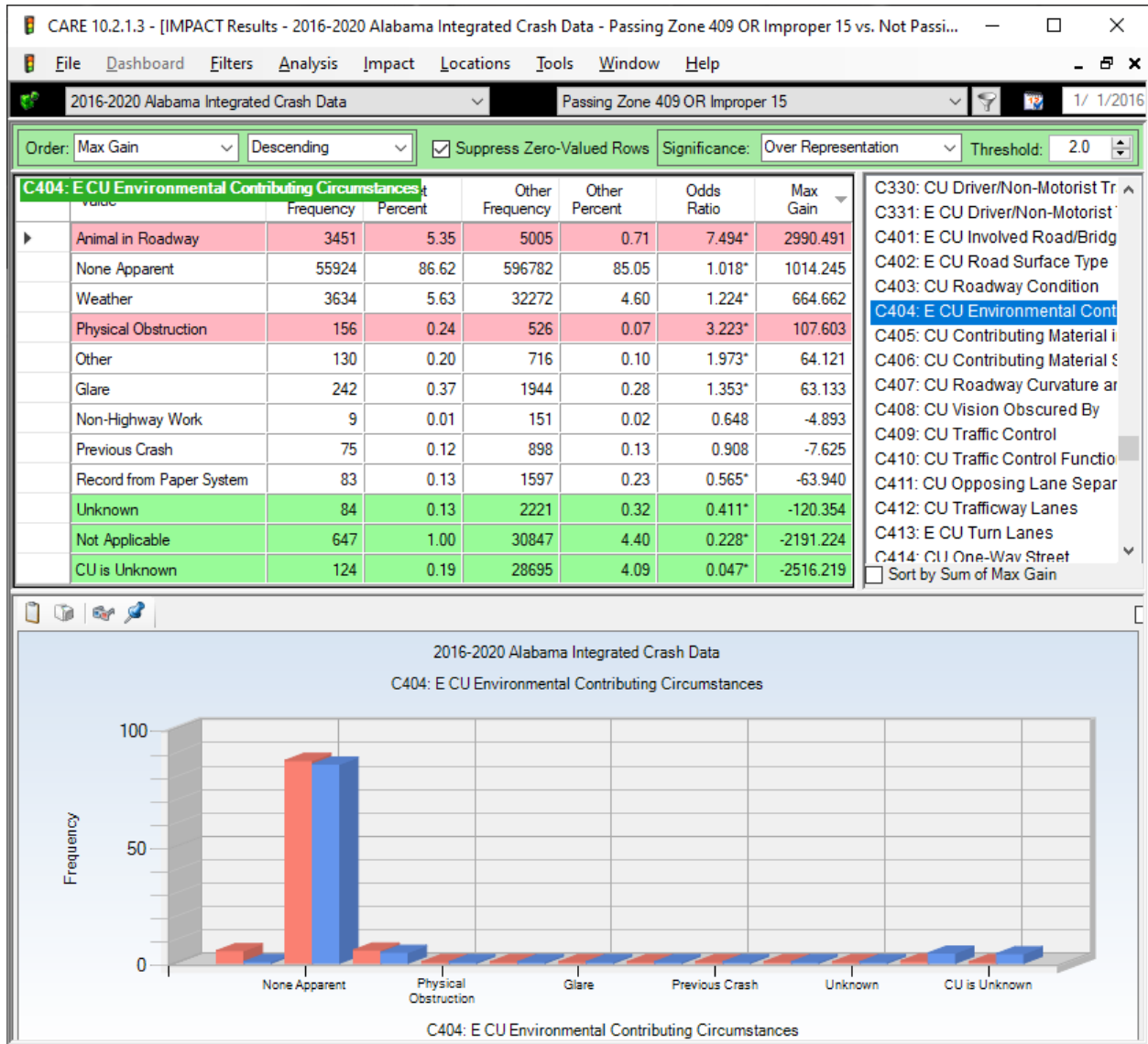
Clearly visibility in identifying when driving in a No Passing Zone is critical to avoiding collisions. While limited visibility in the rain is obviously a problem, the presence of cloudy weather itself is probably not as much of a problem as the indication that it had been raining (see C403 immediately below for wet pavement). Another possibility is the curtailing of the natural lighting. Since there is little artificial lighting in the rural areas, this could be due to the blocking of moonlight at night or the sun during the day. Clear weather is significantly under-represented.

C403 CU Roadway Condition



It is interesting that the frequency of the Wet road conditions is very close to the Cloudy given in C032 immediately above. Problems obviously occur when it is difficult, or impossible to see the no-passing markings on the roadway. Note especially Snow and Slush, which cover these markings completely.

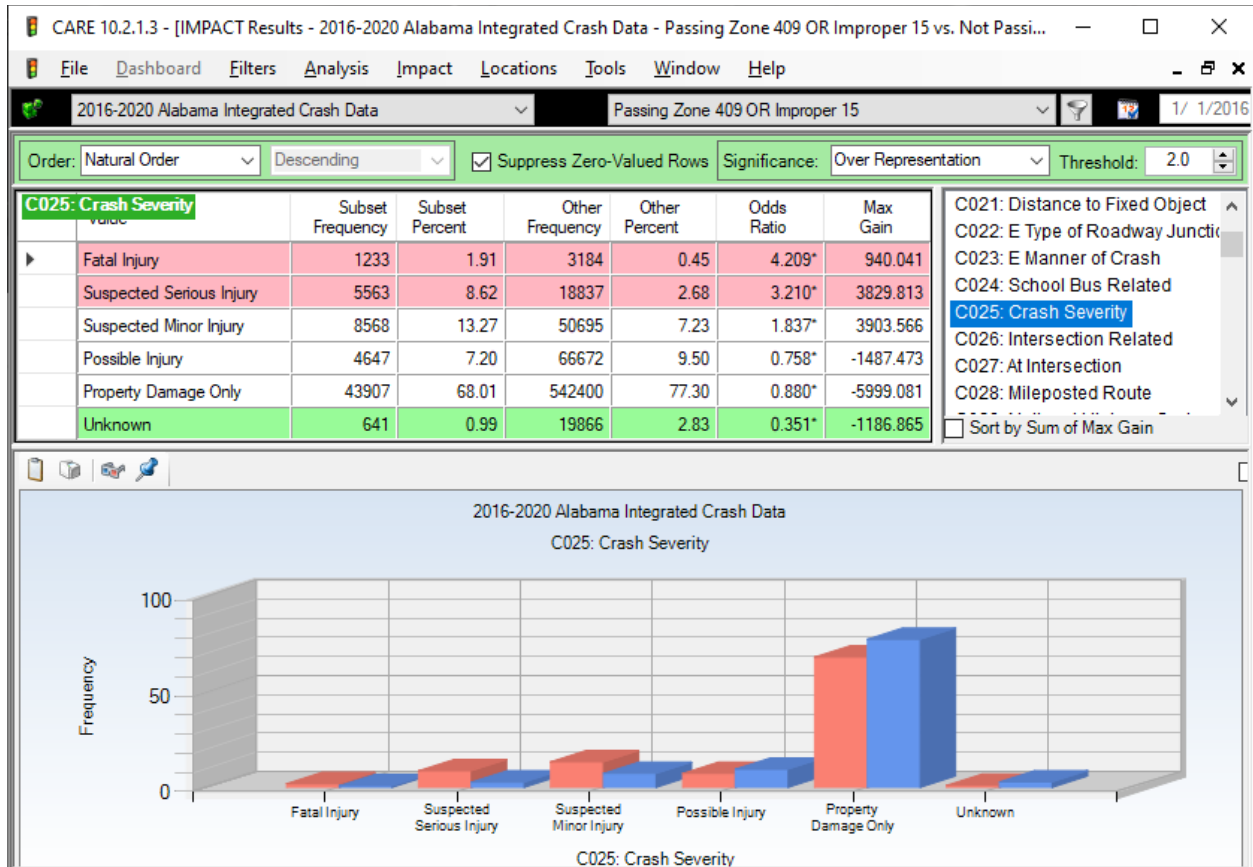
C404 CU Environmental Contributing Factors



This attribute is interesting because weather is not cited as much as would be expected from some of the other weather-related items. Animal in roadway (most likely deer) is 7.494 times the proportion of non-PR crashes. This corresponds to the night-time over-representations for PR crashes. In these cases, the crash might not be related to passing; however, if an animal is encountered in the process of passing, the results could be disastrous, even if the animal is not struck.

Severity and Conditions Affecting Severity

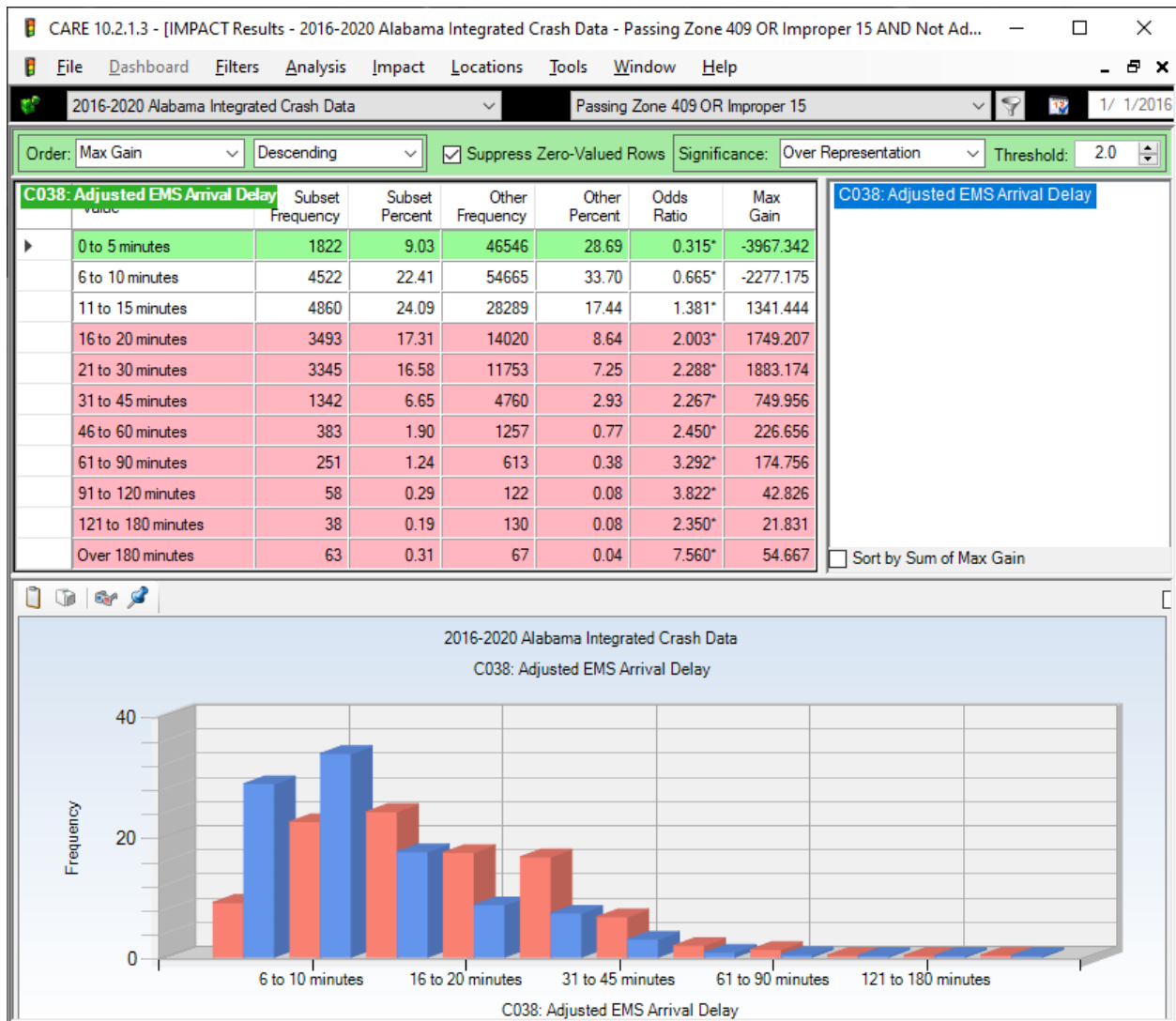
C025 Crash Severity of the PR Crashes



The crashes that we are considering to be PR result in 1,233 fatal crashes over the five-year period (about 248 per year). This means that almost one in every four (3.582) fatal crashes can be attributed to PR.

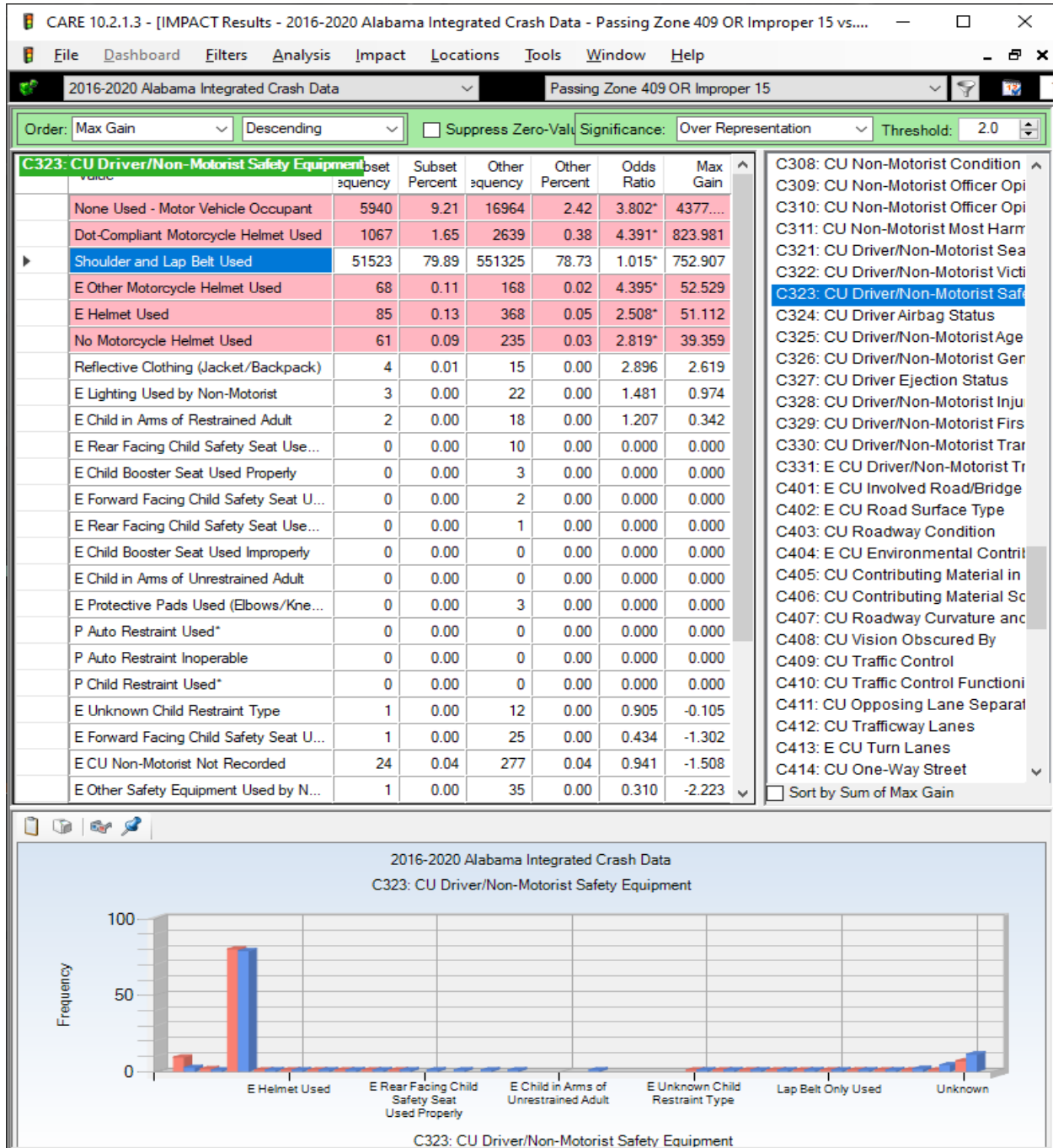
PR crashes are extremely severe, with over-representations in the Fatal Injury (4.209 Odds Ratio) and the Suspected Serious Injury (3.210 Odds Ratio), the two most severe injury levels. Suspected Minor Injury is also significantly over-represented.

C038 Adjusted EMS Arrival Delay



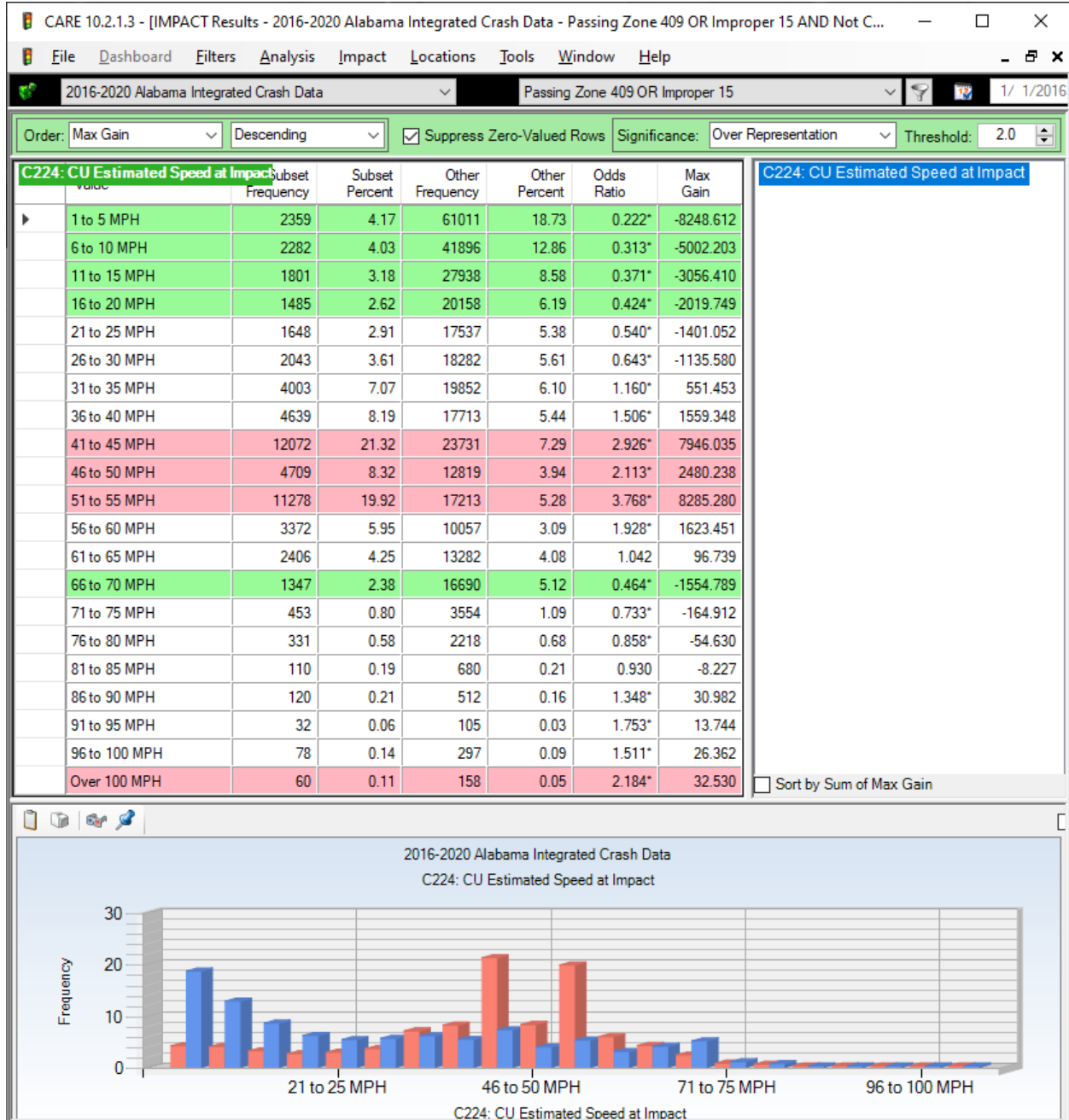
All ambulance delay times above 16 minutes are highly significantly over-represented. No doubt, the higher than normal EMS arrival delays accounts for the greater proportion of the crashes being fatal. The cause of this is mainly the distance to the crashes in rural areas. It is also increased by the time of day, and in some cases the inability to see a crashed single vehicle at night. It is important to realize that all crashes in No-Passing zones do not involve passing.

C323 CU Driver Safety Equipment



Perhaps more than any other, this attribute shows why PR crashes have so many fatalities. The rate of no restraints used is 9.21%, which is almost four (3.802) times that of the non-PR subset. Even with the recommended safety equipment used, motorcycle PR crashes are extremely severe. The common issue is that of risk-taking.

C224 CU Estimated Speed at Impact



Another major factor increasing the fatality rate of PR crashes is their impact speed. For 2-vehicle crashes, generally one of the vehicles would be passing the other at a higher speed, and the speed at impact would reflect this. Impact speeds are highly over-represented in the three 41-55 MPH ranges. This drops off somewhat until we get to the extremely high speeds above 86 MPH. See the two cross-tabulations below for the effects of speed and seatbelts on fatal crashes.

Cross-tabulation Estimated Speed at Impact vs Severity

CARE 10.2.1.3 - [Crosstab Results - 2016-2020 Alabama Integrated Crash Data - Filter = Passing Zone 409 OR Improper 15]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2016-2020 Alabama Integrated Crash Data Passing Zone 409 OR Improper 15 1/ 1/2016

Suppress Zero Values: None Select Cells: Column: Crash Severity ; Row: CU Estimated Speed at Impact

	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL
41 to 45 MPH	84	970	1735	875	8355	53	12072
46 to 50 MPH	59	417	758	413	3044	18	4709
51 to 55 MPH	234	1270	1988	924	6804	58	11278
56 to 60 MPH	119	550	665	254	1756	28	3372
61 to 65 MPH	130	462	493	169	1113	39	2406
66 to 70 MPH	104	314	286	101	517	25	1347
71 to 75 MPH	55	117	81	32	162	6	453
76 to 80 MPH	67	88	59	22	92	3	331
81 to 85 MPH	26	30	19	7	27	1	110
86 to 90 MPH	25	40	22	8	23	2	120
91 to 95 MPH	8	10	6	2	6	0	32
96 to 100 MPH	29	15	14	4	15	1	78
Over 100 MPH	19	13	7	7	13	1	60
E Stationary	5	25	36	27	319	2	414
Unknown	126	194	455	426	5455	306	6962
Not Applicable	2	3	10	15	184	10	224
CU is Not a Vehicle	47	75	51	10	16	2	201
CU is Unknown	0	0	3	4	113	5	125
TOTAL	1233	5563	8568	4647	43906	641	64558

The following indicates the probability of the PR crash being fatal for the impact speeds:

36 to 40 MPH: 1 in 166 fatal;
 51 to 55 MPH: 1 in 48 fatal;
 66 to 70 MPH: 1 in 13 fatal;
 96 to 100 MPH or above: 1 in 3 fatal.

Cross-tabulation Estimated Seatbelt Use vs Severity

CARE 10.2.1.3 - [Crosstab Results - 2016-2020 Alabama Integrated Crash Data - Filter = Passing Zone 409 OR Improper 15]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

2016-2020 Alabama Integrated Crash Data Passing Zone 409 OR Improper 15 1/ 1/2016

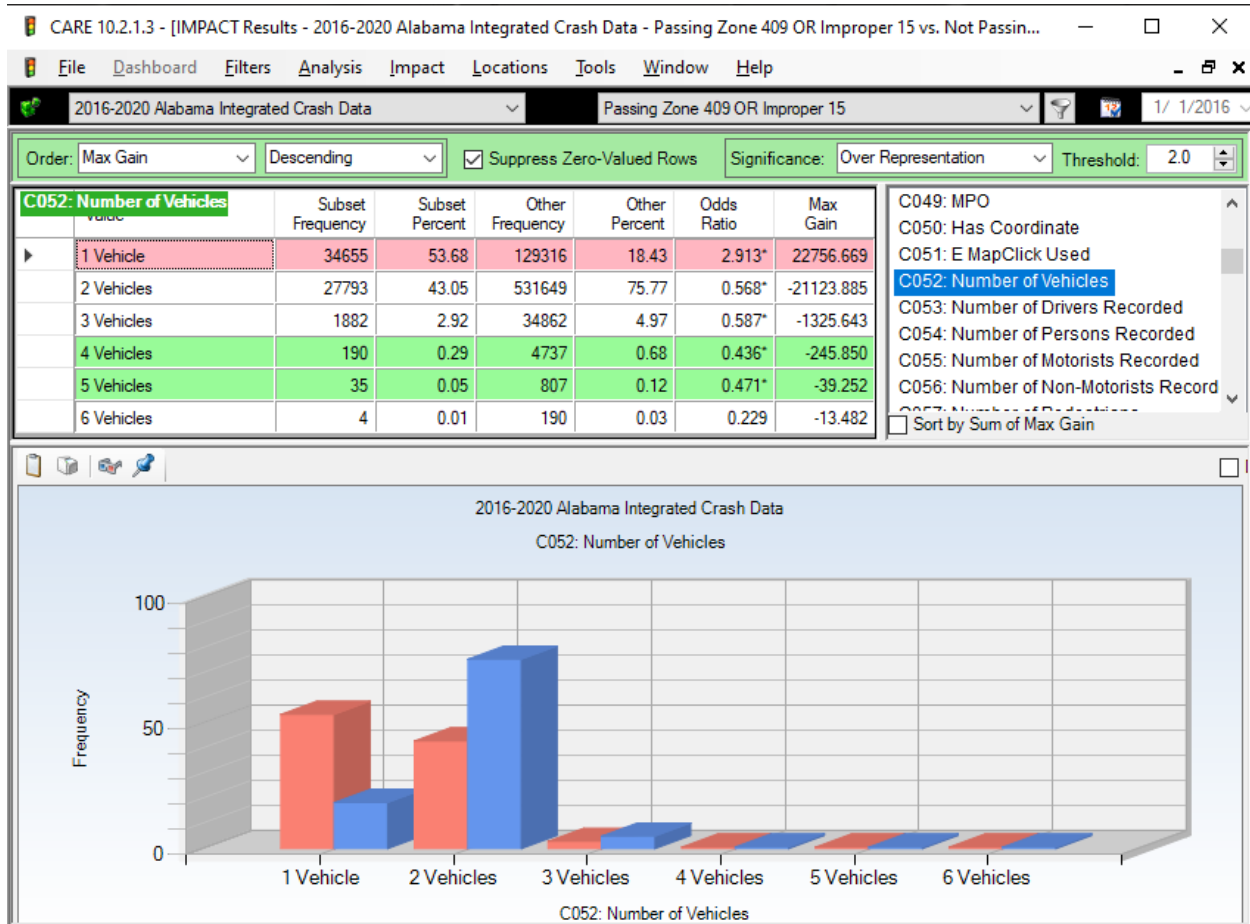
Suppress Zero Values: Rows and Columns Select Cells: Column: Crash Severity ; Row: CU Driver/Non-Motorist Safety Equipment

	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL
None Used - Motor Vehicle Oc	585	1502	1455	464	1882	52	5940
Shoulder and Lap Belt Used	428	3284	6344	3885	37311	271	51523
Lap Belt Only Used	5	14	13	6	111	1	150
Shoulder Belt Only Used	3	6	9	6	71	1	96
E Forward Facing Child Safety Seat	0	0	0	0	1	0	1
E Unknown Child Restraint Type	0	0	0	0	1	0	1
E Child in Arms of Restrained Adult	0	0	1	0	1	0	2
Dot-Compliant Motorcycle Helme	80	395	322	72	194	4	1067
E Helmet Used	3	29	28	7	17	1	85
Reflective Clothing (Jacket/B	0	2	1	0	0	1	4
E Lighting Used by Non-Motorist	1	1	0	1	0	0	3
E Other Safety Equipment Used	0	1	0	0	0	0	1
E Other Motorcycle Helme	10	32	15	2	9	0	68
No Motorcycle Helmet Used	10	27	15	2	7	0	61
Other	1	4	2	5	15	0	27
Unknown	52	134	235	137	3551	258	4367
Not Applicable	46	103	88	32	122	4	395
CU is Unknown	0	0	3	4	113	5	125
E CU Driver Not Recorded	6	9	30	20	441	43	549
E CU Non-Motorist Not Reco	3	6	7	1	7	0	24
TOTAL	1233	5549	8568	4644	43854	641	64489

The numbers are clear: even at the high speeds generally involved with passing, seatbelts save lives. The probability of a PR crash being fatal is one in 10 without proper restraints. With them it is reduced to one in 120.

Crash Type

C052 Number of Vehicles



Single vehicle crashes of the PR type are almost three (2.913) times those of non-PR crashes. This does not necessarily imply that the vehicles that crashed were not either passing or being passed prior to the crash. It means that in this case only one of them was involved in the crash.

Cross-tabulation of Severity by Number of Vehicles

CARE 10.2.1.3 - [Crosstab Results - 2016-2020 Alabama Integrated Crash Data - Filter = Passing Zone 409 OR Improper 15]

File Dashboard Filters Analysis Crosstab Locations Tools Window Help

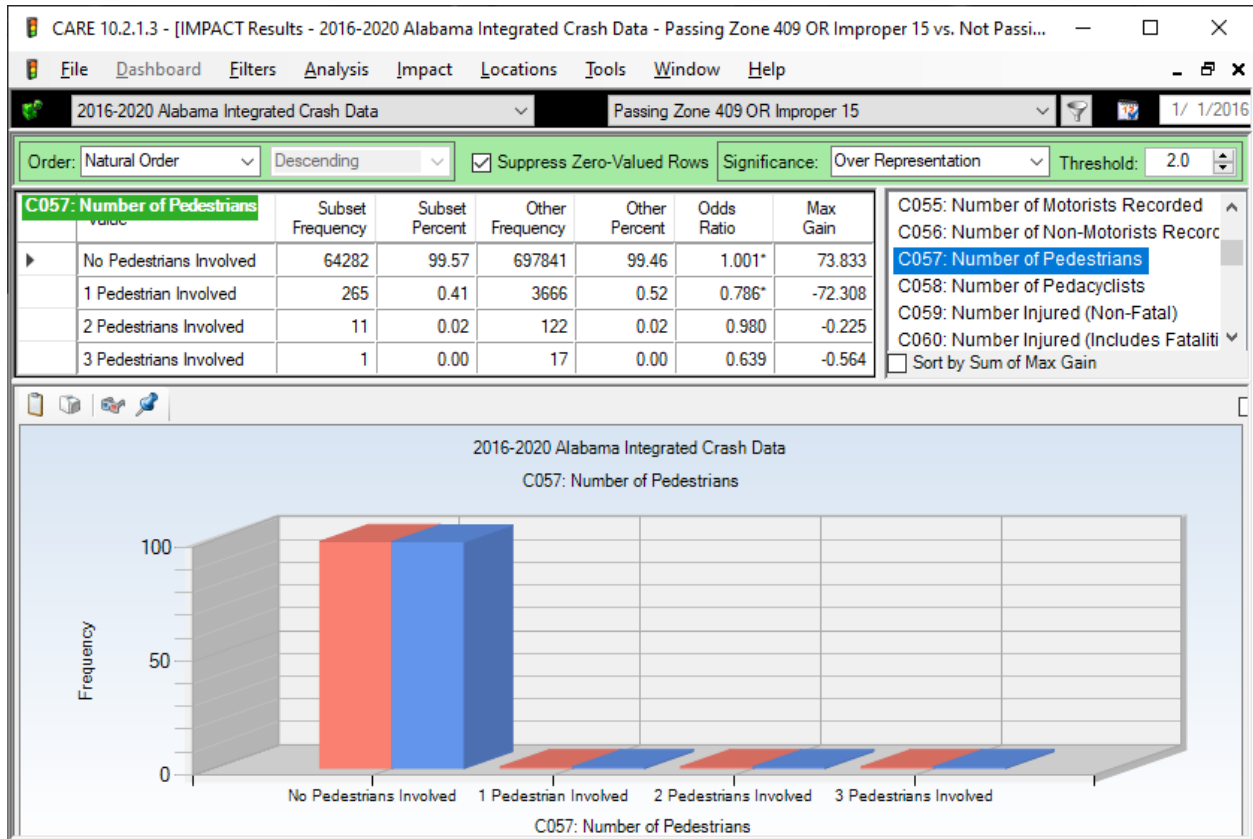
2016-2020 Alabama Integrated Crash Data Passing Zone 409 OR Improper 15 1/ 1/2016

Suppress Zero Values: Rows and Columns Select Cells: Column: Crash Severity ; Row: Number of Vehicles

	Fatal Injury	Suspected Serious Injury	Suspected Minor Injury	Possible Injury	Property Damage Only	Unknown	TOTAL
1 Vehicle	805	3918	5500	2429	21612	391	34655
2 Vehicles	374	1430	2703	1925	21127	234	27793
3 Vehicles	49	193	315	261	1050	14	1882
4 Vehicles	5	20	43	25	96	1	190
5 Vehicles	0	2	7	5	20	1	35
6 Vehicles	0	0	0	2	2	0	4
TOTAL	1233	5563	8568	4647	43907	641	64559

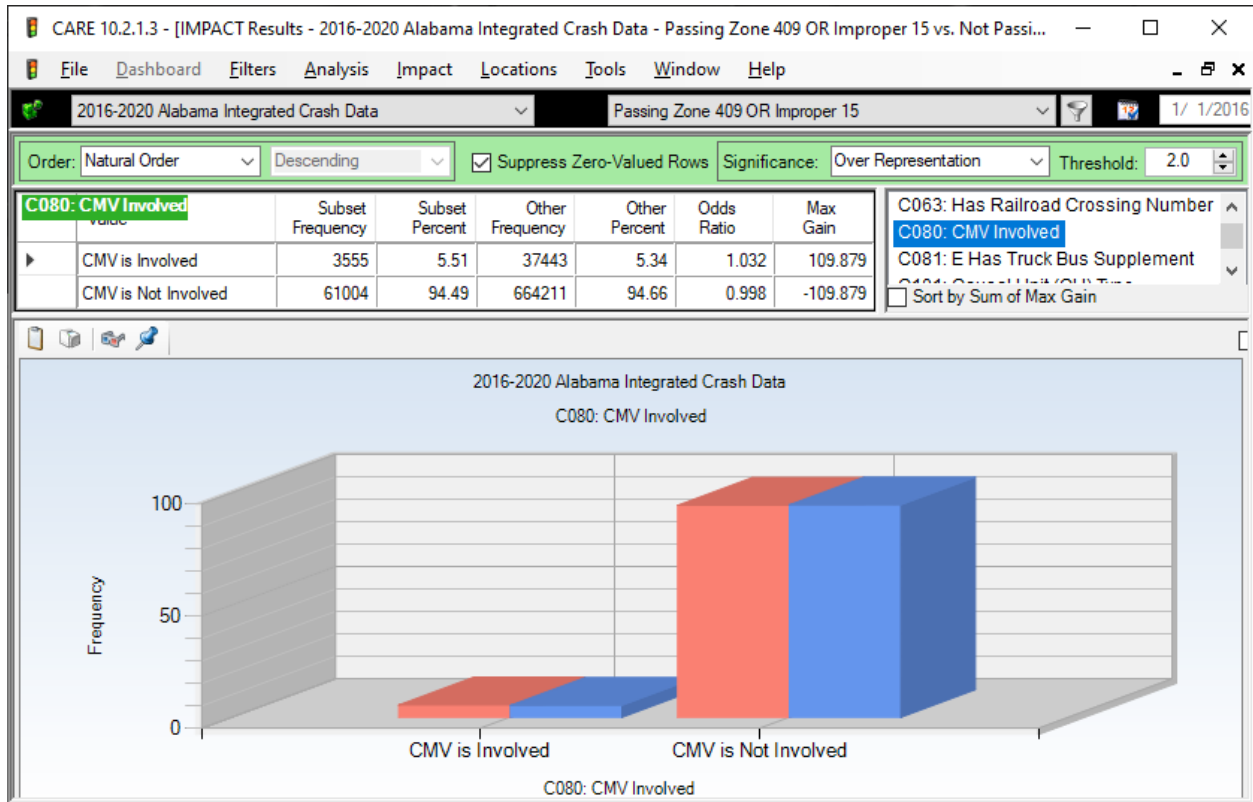
Severity is much higher for single-vehicle PR crashes than when two-vehicles are involved. The fact that only one vehicle is involved in the crash does not necessarily imply that passing was not involved. Either the vehicle passing or the vehicle being passed could have been involved in the crash. Or, alternatively, the crash could have occurred in a no-passing zone when passing was not involved.

C067 Number of Pedestrians



There were 290 pedestrian crashes in the PR subset, and their proportions were generally less than the proportion in the non-PR subset. Thus, we conclude that there is not causal effect of PR and pedestrian crashes.

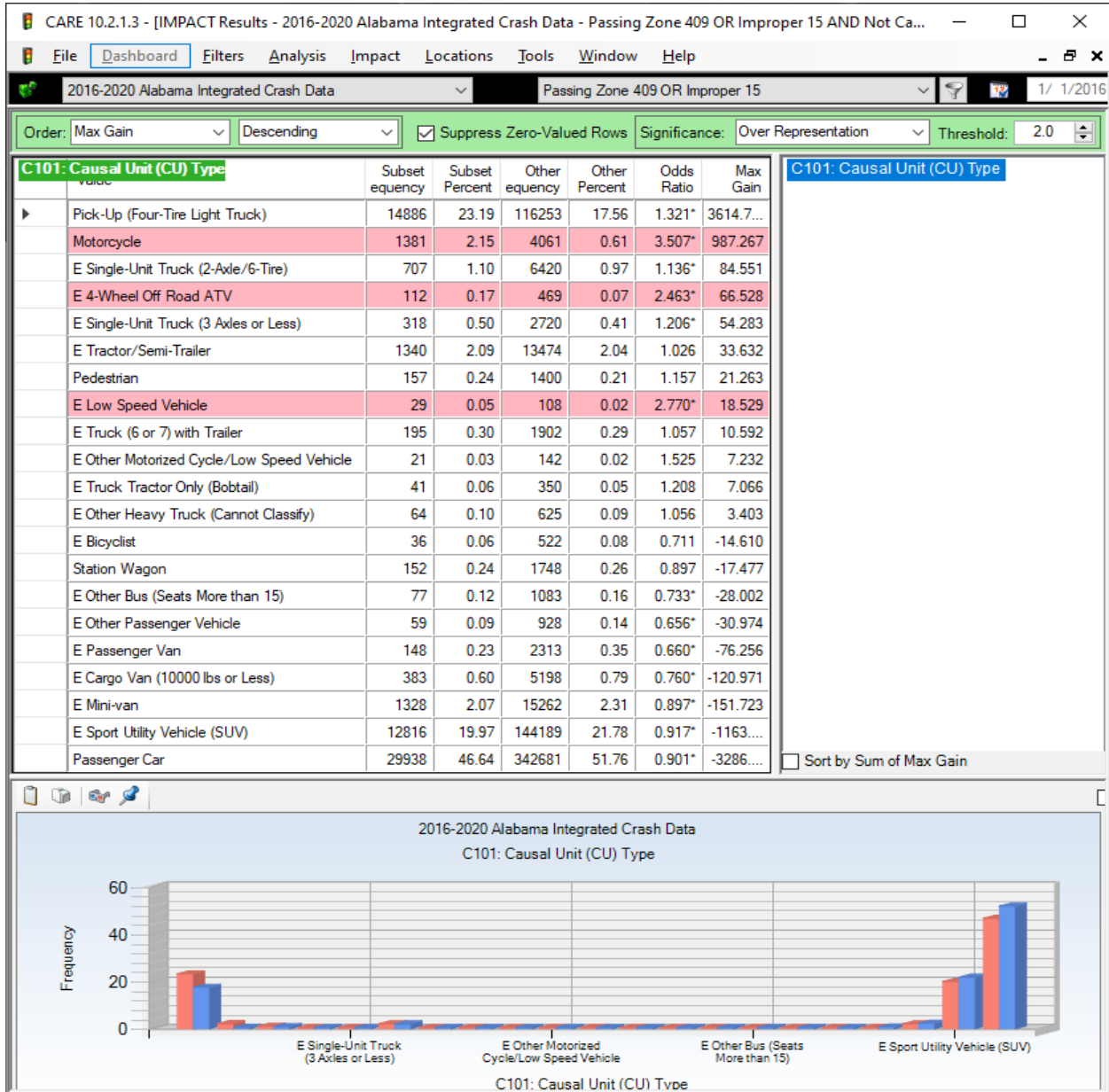
C080 CMV Involvement



CMV = Commercial Motor Vehicles = primarily large trucks. Large truck crashes generally create considerable publicity, and no doubt, with the disparity of the vehicle weights, a larger proportion are more deadly than with collisions between cars. However, the Odds Ratios close to one indicate there is nothing abnormal for them in the PR subset.

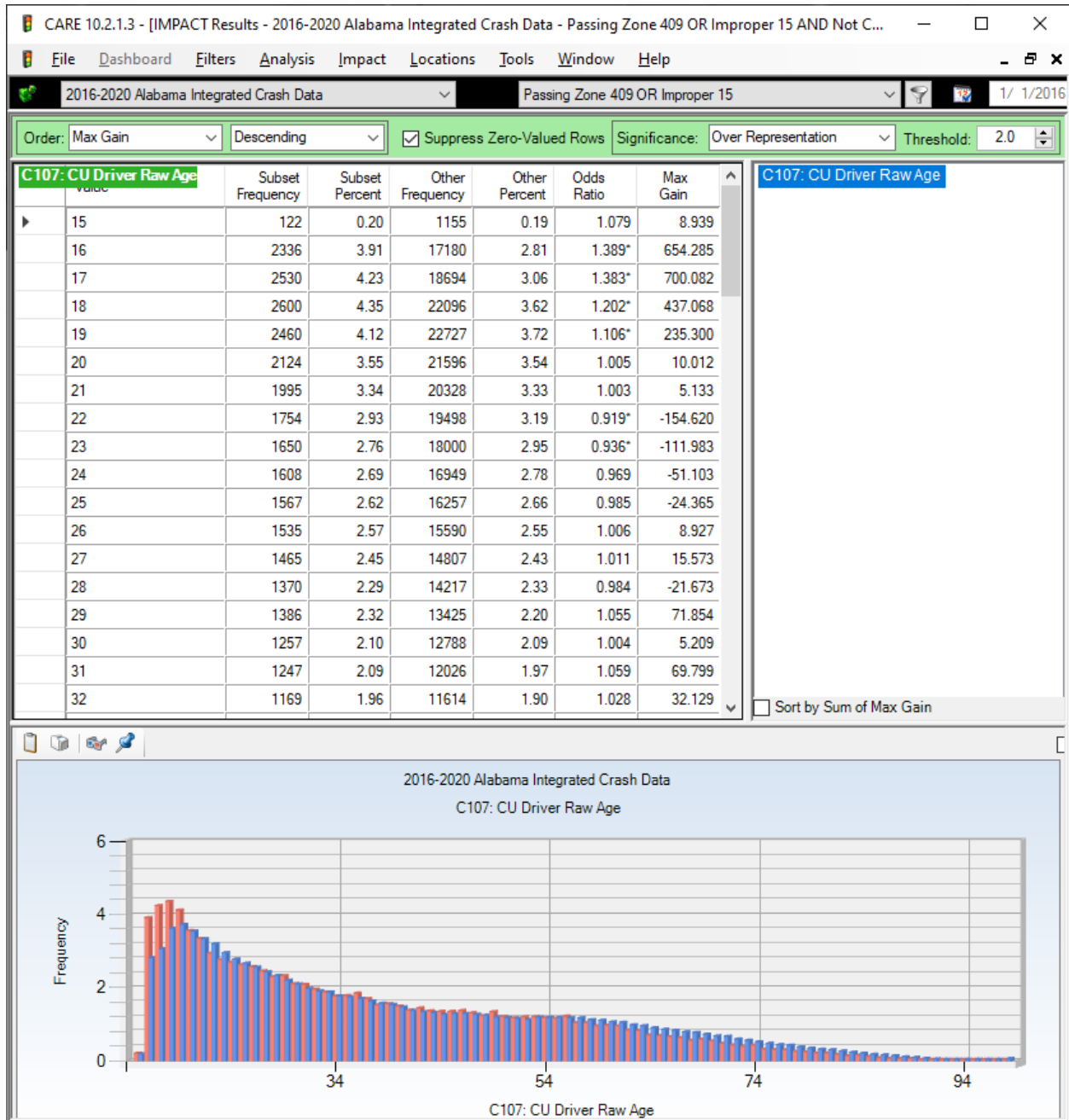
Driver and Vehicle Demographics

C101 Causal Unit Type



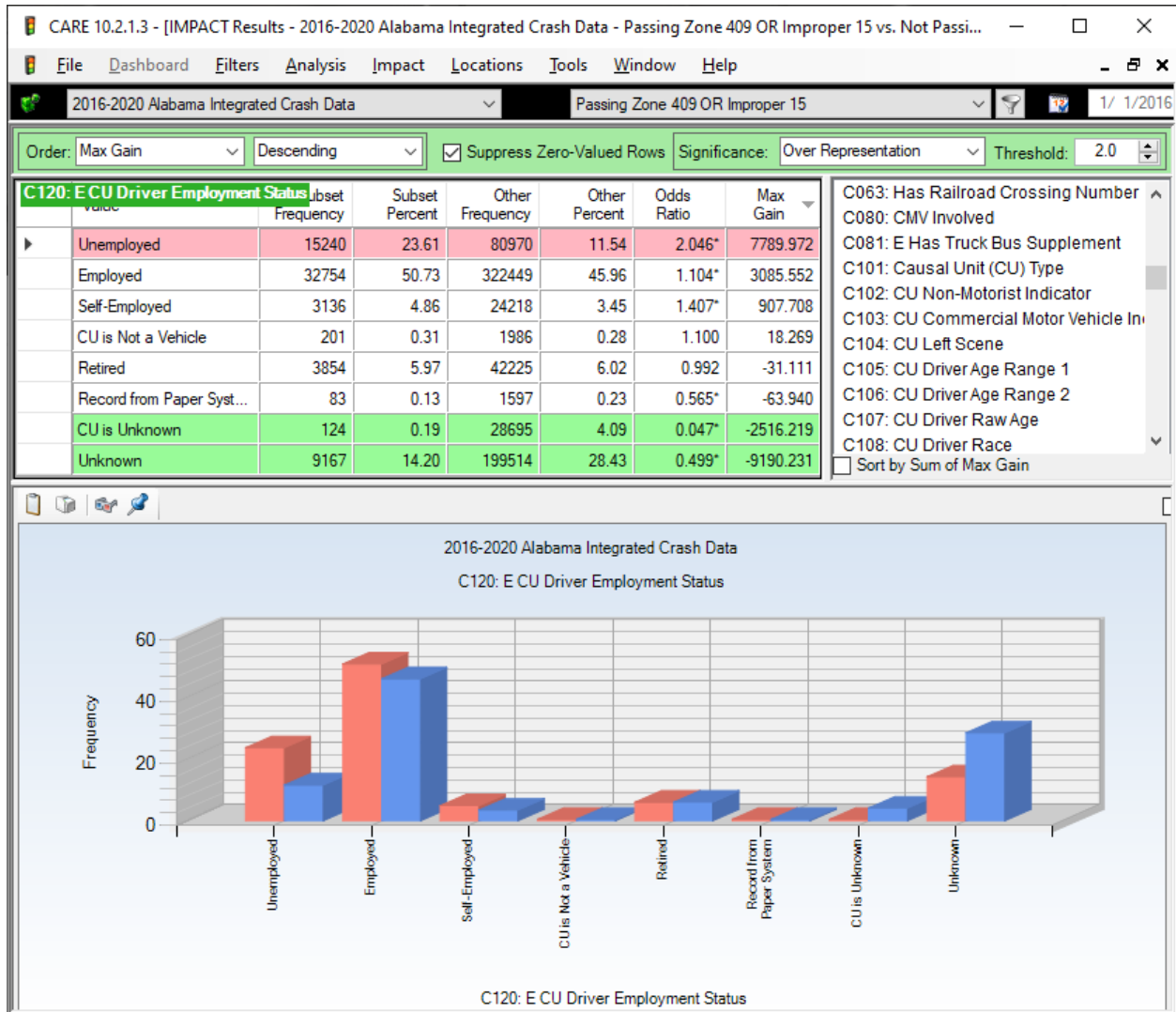
The above indicates the types of vehicles that are causing the PR crashes. The following were over-represented by over twice their nonPR crashes: Motorcycles, 4-Wheel Off Road ATVs and Low Speed Vehicles. Pickups are at the top of the list because of their large number. However, Passenger Cars have a higher frequency (the highest) but are at the bottom of the list because of their prevalence in nonPR crashes. Items with less than 20 crashes were excluded from the list.

C107 CU Driver Raw Age



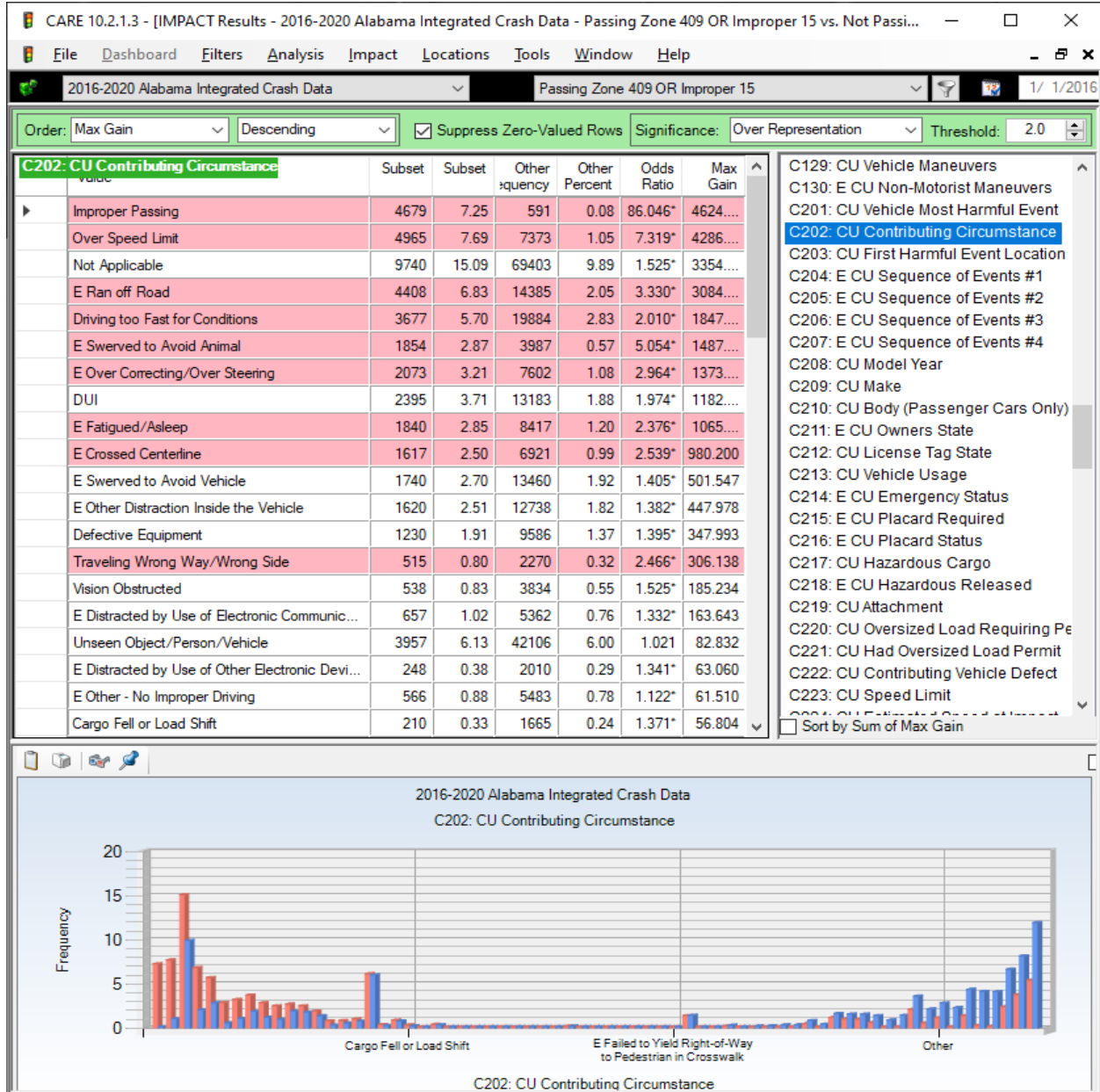
The Youngest drivers (16-19) are significantly over-represented. After that there is no clear pattern except the *under*-represented of drivers 57 and above.

C120 CU Driver Employment Status



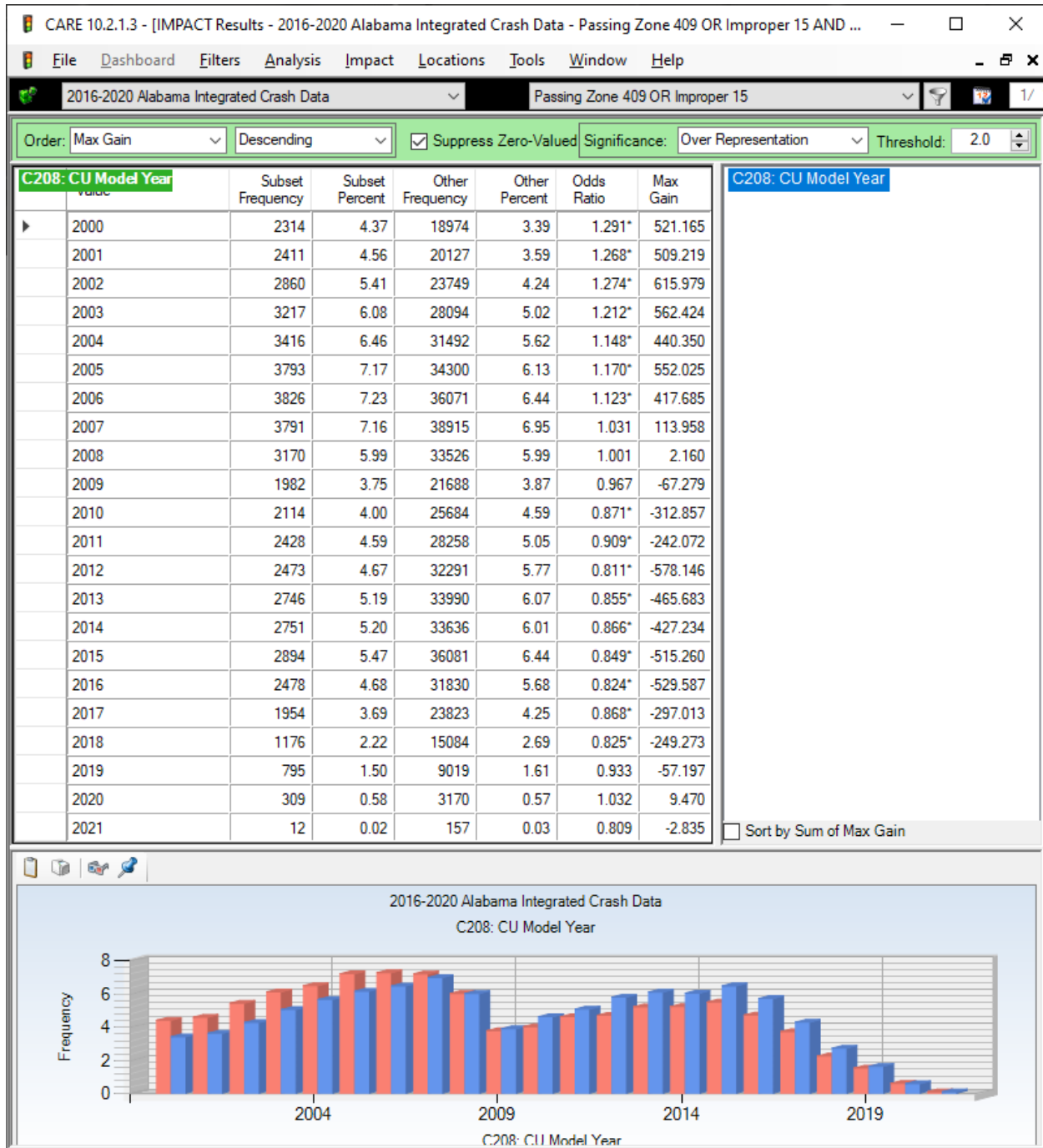
The “unemployment rate” in the PR subset is over 23.61%, and it is shown to be over-represented by an Odds Ratio of over two (2.046). There is no reasonable explanation as to why they would have a greater PR crash rate, so we would look to other issues that could cause both the crashes and the unemployment, e.g., DUI; see C121-123.

C202 CU (Causal Unit) Contributing Circumstances (Max Gain > 20)



Improper Passing was used in C015 to create the filter for CR, so its relative information is of no consequence. Below that we can see the driver errors that led to the crashes. Those over-represented by more than a factor of 2 are given in the following list (along with their Odds Ratios): Over Speed Limit (7.319), Ran off Road (3.330), Driving too Fast for Conditions (2.010), Swerved to Avoid Animal (5.054), Over Correcting/Over Steering (2.964), DUI (1.974), Fatigued/Asleep (2.376), Crossed Centerline (2.539), and Traveling Wrong Way/Wrong Side (2.466).

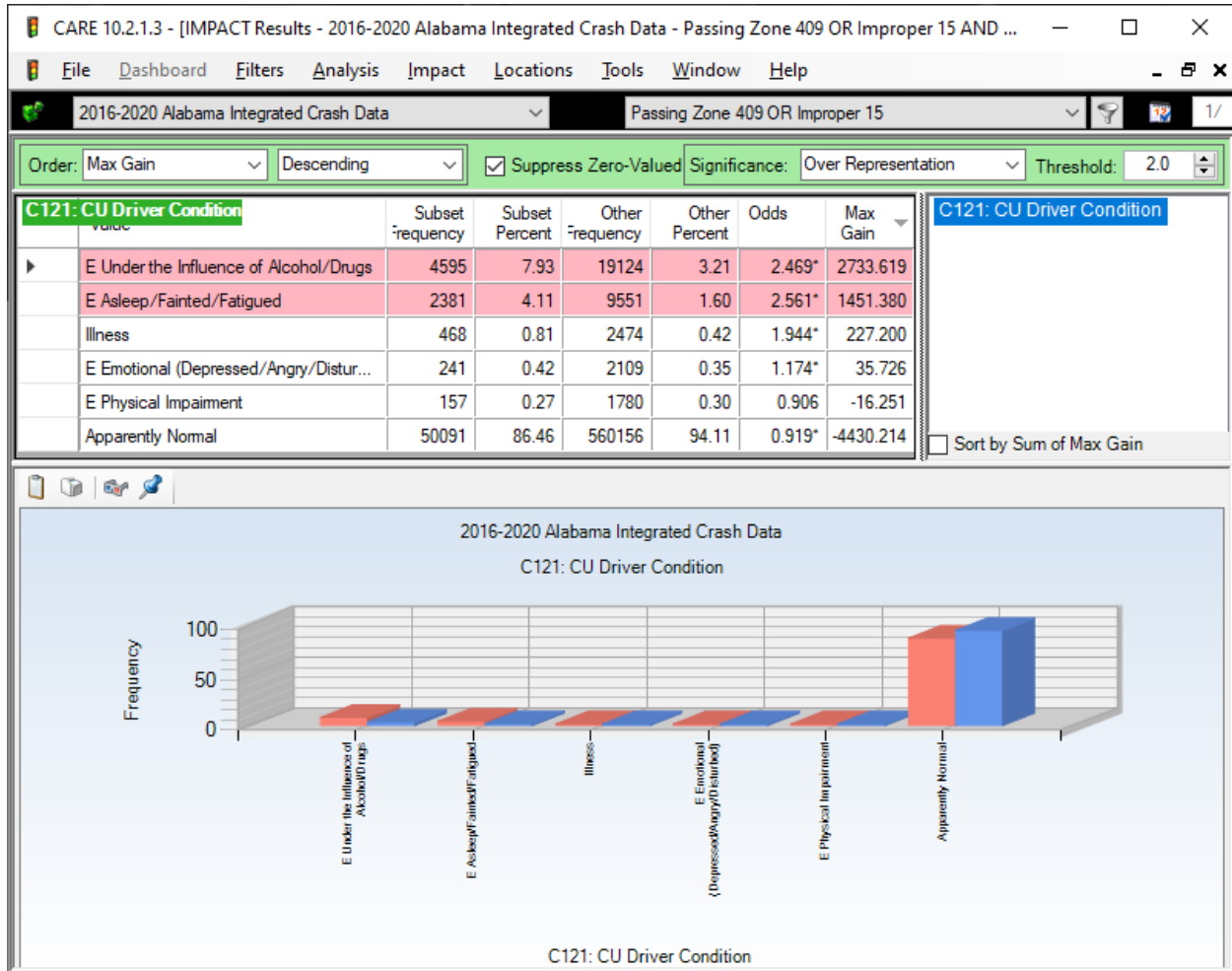
C208 CU Model year



This is a very interesting distribution showing that the major problems occur in model year vehicles 2007 and older.

Effects of Alcohol and Other Drugs

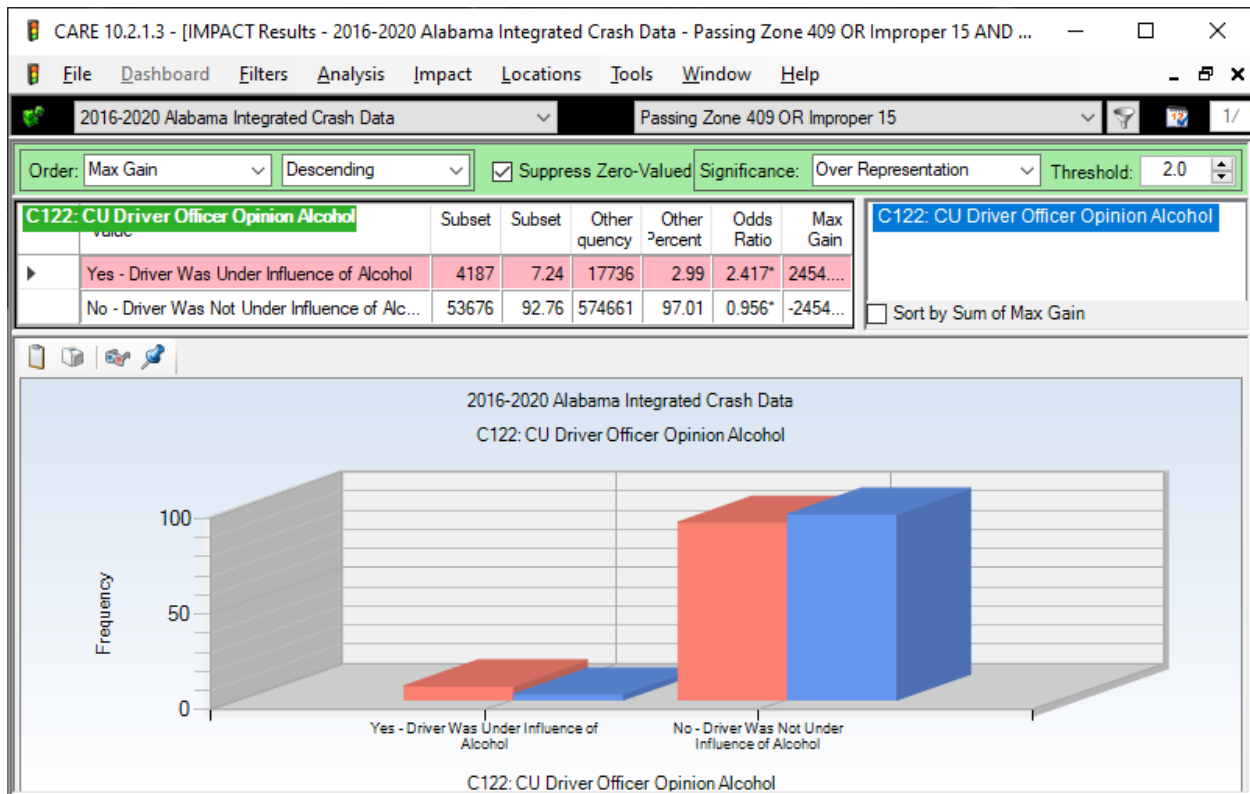
C121 CU Driver Condition



This provides considerable insight into what might be “wrong” with drivers who cause PR crashes. It is quite understandable why those who are inebriated would have increased crash frequency. However, why would they be speeding coupled with what they must know to be a limited reaction capability? This combined with the reluctance to buckle up creates deadly situations.

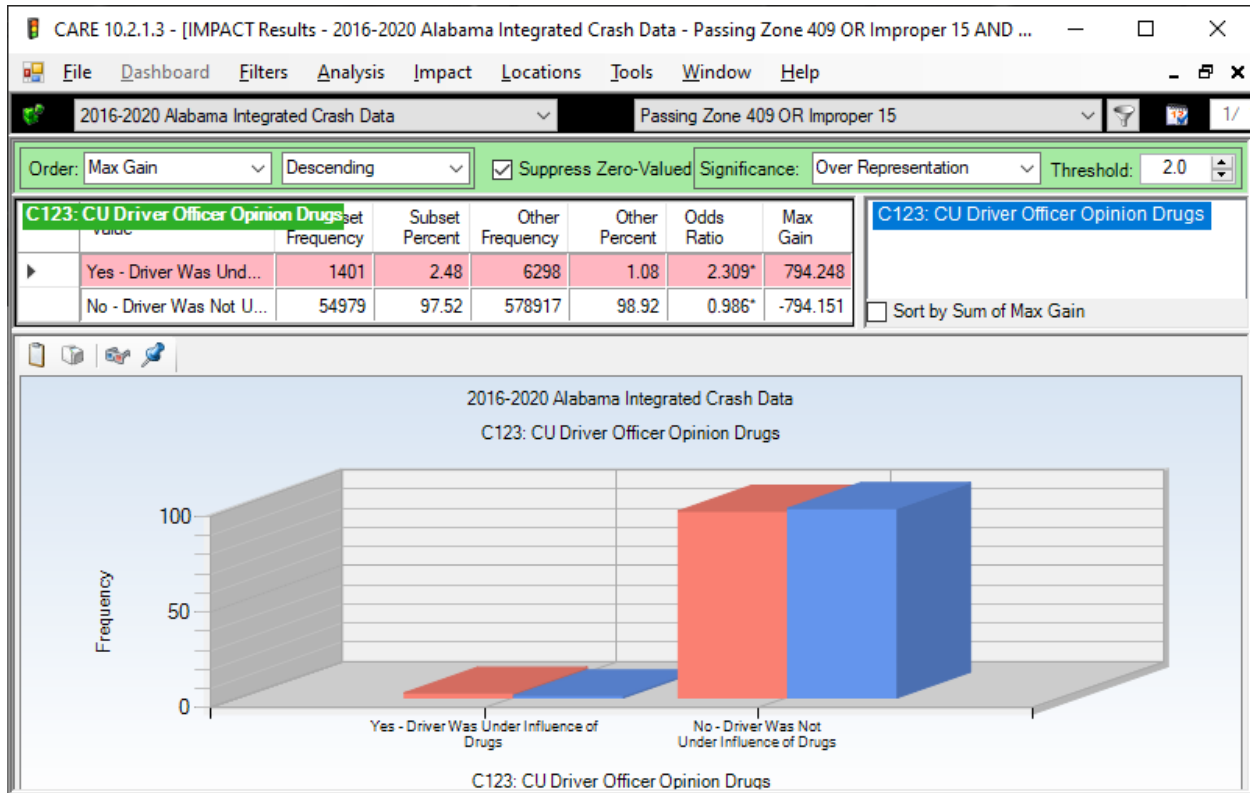
The following two variables will examine DUI more closely.

C122 CU Officer Opinion Alcohol



The proportion of drivers who are impaired by alcohol in PR crashes is well over twice (2.417) the non-PR subset. This can clearly be seen as a causal factor in PR type crashes.

C123 CU Officer Opinion Drugs



The proportion of drivers who are impaired by non-alcohol drugs is 2.309 times that of the control group, which is close to the comparable metric for alcohol (2.417). We recognize that alcohol IS A DRUG, but we are using the common accommodative language in making this distinction. Both alcohol and other drugs are comparable in their effect in causing PR crashes, although alcohol had almost exactly three times the frequency as did drugs. Recognize that the BAC test for alcohol makes it much easier to identify than the identification of the dozens of common drugs that are in use, including some that are prescription drugs.