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 road-ways 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), Fa-tigued/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 nopassing 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: <u>http://www.safehomeala-bama.gov/wp-content/uploads/2019/10/Youth-Risk-Taking-Analysis-v08.pdf</u> 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 <u>http://www.safehomealabama.gov/wp-content/up-loads/2021/09/15100_Countermeasures10th_080621_v5_tag.pdf</u>. 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.

Filter Logic: Passing Zone 409 OR Improper 15	_		×
Logic Tree Logic Text			
One or more of the following are true (OR) One or more of the following are true (OR) One or more of the following are true (OR) One or more of the following are true (OR) One or more of the following are true (OR) One or more of the following are true (OR) One or more of the following are true (OR) One or more of the following are true (OR) One or more of the following are true (OR)	Passing Zone ⇒is equal to Impro	oper Passi	ing
64559 records selected by this 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

🖡 CA	CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Passing Zone 409 OR Improper 15 vs. Not Pas										
E E	ile <u>D</u> ashboard <u>F</u> ilters <u>A</u>	nalysis <u>I</u> m	npact <u>L</u> o	cations <u>1</u>	ools <u>W</u> in	dow <u>H</u> e	lp	_ & ×			
6 2	2016-2020 Alabama Integrated Cra	ash Data		\sim	Passing Z	one 409 OR	Improper 15	✓ ♥ 1/ 1/2016			
Order: Max Gain V Descending V Suppress Zero-Valued Rows Significance: Maximum Gain V Threshold: 200.0											
C409	CU Traffic Control	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C403: CU Roadway Condition			
	No Passing Zone	59170	91.65	0	0.00	0.000	59170.000	C405: CU Contributing Material in Road			
	E Railroad Pavement Markings	1	0.00	44	0.01	0.247	-3.048	C406: CU Contributing Material Source			
	E Railroad Crossbucks	2	0.00	98	0.01	0.222	-7.017	C407: CU Roadway Curvature and Grad			
	Railroad Signals/Bells	3	0.00	228	0.03	0.143	-17.978	C409: CU Traffic Control			
	Unknown	2	0.00	224	0.03	0.097	-18.610	C410: CU Traffic Control Functioning			
	E Crossing Guard	6	0.01	299	0.04	0.218	-21.511	C411: CU Opposing Lane Separation			
	Railroad Gates	4	0.01	375	0.05	0.116	-30.504	C412: CU Trafficway Lanes			
	E School Zone Sign/Device	5	0.01	480	0.07	0.113	-39.165	C413: E CO run Lanes C414: CU One-Way Street			
	E Warning Sign	1	0.00	450	0.06	0.024	-40.404	C415: CU Workzone Related			
	Flag Person	7	0.01	578	0.08	0.132	-46.182	C416: E CU Workzone Type			
	Other	3	0.00	772	0.11	0.042	-68.032	C417: E CU Workers Present			
	Police Officer	9	0.01	989	0.14	0.099	-81.998	C418: E CU Law Enforcement Present II			
	E Workzone Signs	22	0.03	2273	0.32	0.105*	-187.138	C451: E CU CMV Weight			
	Flashing Traffic Control Signal	18	0.03	3054	0.44	0.064	-262.998	C452: CU CMV Hazard Materials Involve			
	Lane Control Device	175	0.27	12179	1.74	0.156*	-945.587	C453: E CU CMV Hazard Materials Rele			
	Yield Sign	51	0.08	17280	2.46	0.032*	-1538.928	C454: E CU CMV Bus Usage			
	CU is Unknown	125	0.19	28722	4.09	0.047*	-2517.704	C456: E CU CMV Venice Conliguration			
	Not Applicable	117	0.18	29177	4.16	0.044*	-2567.568	C457: E CU CMV Cargo Body Type			
	Stop Sign	215	0.33	66588	9.49	0.035*	-5911.744	C461: E CU CMV Sequence of Events #*			
	Traffic Signals	813	1.26	172792	24.63	0.051*	-15085.5	C462: E CU CMV Sequence of Events #2			
▶	No Controls Present	3810	5.90	364840	52.00	0.113*	-29758.8	Sort by Sum of Max Gain			
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			201	6-2020 Alaba	ma Integrate	d Crash Dat	ta				
				C409: 0	CU Traffic Co	ontrol					
	100										
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	0 PR	ailroad Crossbu	icks	E Crossing Gua	ard	Other		Yield Sign No Controls Present			
	or P	avement Markir	ngs*	-				-			
JI				C4	109: CU Traff	ic 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.

Order	Max Gain 🗸 🗸	Descending	~ 🗹	Suppress	Zero-Val	ued Rows	Signific	ance:	Maxim	um Gain 🗸 Threshold: 200.0 🛓
C015:	Primary Contributing Ci	rcumstance	Subset	Subset	Other quency	Other ^p ercent	Odds Ratio	Max Gain	^	C007: Week of the Year C008: Time of Day
	Improper Passing		6570	10.18	0	0.00	0.000	6570		C010: Rural or Urban
	Over Speed Limit		4610	7.14	6329	0.90	7.916*	4027		C011: Highway Classifications
	Driving too Fast for Condit	ions	5044	7.81	24096	3.43	2.275*	2826		C012: Controlled Access
	DUI		4285	6.64	16292	2.32	2.859*	2785		C015: Primary Contributing Circumstand
	E Swerved to Avoid Anima	al	2678	4.15	5118	0.73	5.687*	2207		C016: Primary Contributing Unit Numbe
	E Fatigued/Asleep		2725	4.22	10285	1.47	2.880*	1778		C017: First Harmful Event
	E Other Distraction Inside	the Vehicle	2449	3.79	14552	2.07	1.829*	1110		C018: Location First Harmful Event Rel t
	E Ran off Road		2302	3.57	14980	2.13	1.670*	923.6		C020: E Distracted Driving Opinion
	Unseen Object/Person/Ve	éhicle	4885	7.57	43295	6.17	1.226*	901.4		C021: Distance to Fixed Object
	E Swerved to Avoid Vehic	de	2364	3.66	16264	2.32	1.580*	867.5		C022: E Type of Roadway Junction/Feat
	E Crossed Centerline		1475	2.28	8479	1.21	1.891*	694.8		C023: E Manner of Crash
	E Over Correcting/Over S	iteering	1130	1.75	6612	0.94	1.857*	521.6		C024: School Bus Related
	Defective Equipment		1403	2.17	10875	1.55	1.402*	402.3		C026: Intersection Related
	E Distracted by Use of Ele	ectronic Communicat	897	1.39	5815	0.83	1.677*	361.9		C027: At Intersection
	Traveling Wrong Way/Wr	rong Side	556	0.86	2741	0.39	2.205*	303.8		C028: Mileposted Route
	E Distracted by Use of Oth	her Electronic Device	402	0.62	2178	0.31	2.006*	201.6		C029: National Highway System
	Vision Obstructed		451	0.70	3264	0.47	1.502*	150.6		C030: Functional Class
	E Other - No Improper Driv	ving	846	1.31	7716	1.10	1.192*	136.0		C032: Weather
	E Distracted by Passenge	r	371	0.57	2632	0.38	1.532*	128.8		C033: Locale
	Cargo Fell or Load Shift		264	0.41	2227	0.32	1.288*	59.094		C034: E Police Present at Time of Crast
	E Aggressive Operation		1135	1.76	11898	1.70	1.037	40.268		C035: Police Notification Delay
	E Distracted by Insect/Re	eptile	64	0.10	378	0.05	1.840*	29.220		C037: EMS Arrival Delay
	E Wrong Side of Road		57	0.09	342	0.05	1.811*	25.533		C038: Adjusted EMS Arrival Delay
	Improper Load/Size		47	0.07	242	0.03	2.111*	24.734	~	Sort by Sum of Max Gain
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Cargo Fell or Load Shitt E Disregarded other Road Markings Other C015: Primary Contributing Circumstance										

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)

¢?	2016-2020 Alabama Integr	ated Crash Dat	а	~	Passi	ng Zone 409	OR Imprope	r 15	✓ ♥ 1/ 1/201	
Order:	Max Gain 🗸 🗸	Descending	~	Suppres	s Zero-Value	ed Rows Sig	nificance:	Maxim	um Gain 🗸 Threshold: 200.0 🐳	
C002:	City	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	^	C001: County	
•	Rural Madison	4161	6.45	5597	0.80	8.079*	3645.953		C003: Year	
	Rural Cullman	2222	3.44	3269	0.47	7.386*	1921.180		C004: Month	
	Rural Tuscaloosa	2381	3.69	6596	0.94	3.923*	1774.022		C005: Day of Month C006: Day of the Week	
	Rural Walker	1824	2.83	1599	0.23	12.396*	1676.857		C007: Week of the Year	
	Rural Lee	1886	2.92	2288	0.33	8.958*	1675.454		C008: Time of Day	
	Rural Lauderdale	1745	2.70	1143	0.16	16.590*	1639.819		C010: Rural or Urban	
	Rural Elmore	1367	2.12	1778	0.25	8.355*	1203.385		C011: Highway Classifications	
	Rural Limestone	1520	2.35	3446	0.49	4.793*	1202.892		C013: E Highway Side	
	Rural Marshall	1328	2.06	1477	0.21	9.771*	1192.083		C015: Primary Contributing Circumstance	
	Rural Mobile	1941	3.01	8148	1.16	2.589*	1191.204		C016: Primary Contributing Unit Numbe	
	Rural Calhoun	1461	2.26	3731	0.53	4.255*	1117.666		C017: First Harmful Event	
	Rural Morgan	1327	2.06	2319	0.33	6.218*	1113.601		C019: E Most Harmful Event	
	Rural Blount	1179	1.83	1429	0.20	8.966*	1047.500		C020: E Distracted Driving Opinion	
	Rural Talladega	1320	2.04	3080	0.44	4.657*	1036.572		C021: Distance to Fixed Object	
	Rural Jackson	1005	1.56	706	0.10	15.469*	940.032		C022: E Type of Roadway Junction/Featu	
	Rural Coffee	914	1.42	775	0.11	12.816*	842.683		C023: E Manner of Crash	
	Rural Autauga	951	1.47	1560	0.22	6.625*	807.446	~	Sort by Sum of Max Gain	
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				2016-2020	Alabama Integ	grated Crash	Data			
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		Indian S	Springs	Ha	aleyville		Graysville		Priceville	
					C	002: Citv				

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 underrepresented, 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.

🚦 CA	RE 10.2.1.3 - [IMPACT Res	ults - 2016-20	20 Alabama	Integrated C	Crash Data - P	assing Zone	409 OR Impre	oper 15 vs. Not Passi — 🗆 🗙
🖡 <u>E</u> i	le <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>W</u>	indow <u>H</u> e	lp	_ & ×
6	2016-2020 Alabama Integrat	ted Crash Data		\sim	Passing	Zone 409 OR	Improper 15	✓ ♥ 〒 1/ 1/2016
Order	Natural Order 🗸 🗸	Descending	~	Suppress	Zero-Valued I	Rows Signifi	cance: Over	Representation V Threshold: 2.0
C008:	Time of Day	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C004: Month
•	12:00 Midnight to 12:59	1357	2.10	8102	1.15	1.820*	611.537	C006: Day of the Week
	1:00 AM to 1:59 AM	1060	1.64	6726	0.96	1.713*	441.143	C007: Week of the Year
	2:00 AM to 2:59 AM	999	1.55	6121	0.87	1.774*	435.808	C008: Time of Day
	3:00 AM to 3:59 AM	1003	1.55	5320	0.76	2.049*	513.508	C010: Rulai of Orban
	4:00 AM to 4:59 AM	1234	1.91	5890	0.84	2.277*	692.063	C012: Controlled Access
	5:00 AM to 5:59 AM	1915	2.97	10535	1.50	1.976*	945.677	C013: E Highway Side
	6:00 AM to 6:59 AM	2587	4.01	17855	2.54	1.575*	944.166	C015: Primary Contributing Circumstance
	7:00 AM to 7:59 AM	4046	6.27	41178	5.87	1.068*	257.223	C016: Primary Contributing Unit Number
	8:00 AM to 8:59 AM	2553	3.95	30575	4.36	0.908*	-260.198	C018: Location First Harmful Event Rel t
	9:00 AM to 9:59 AM	2289	3.55	26980	3.85	0.922*	-193.423	C019: E Most Harmful Event
	10:00 AM to 10:59 AM	2595	4.02	31243	4.45	0.903*	-279.660	C020: E Distracted Driving Opinion
	11:00 AM to 11:59 AM	2932	4.54	38578	5.50	0.826*	-617.552	C021: Distance to Fixed Object
	12:00 Noon to 12:59 PM	3169	4.91	47200	6.73	0.730*	-1173.860	C023: E Manner of Crash
	1:00 PM to 1:59 PM	3433	5.32	46405	6.61	0.804*	-836.712	C024: School Bus Related
	2:00 PM to 2:59 PM	3769	5.84	50456	7.19	0.812*	-873.443	C025: Crash Severity
	3:00 PM to 3:59 PM	5083	7.87	62649	8.93	0.882*	-681.318	C026: Intersection Related
	4:00 PM to 4:59 PM	4745	7.35	60678	8.65	0.850*	-837.967	C027: At Intersection C028: Mileposted Route
	5:00 PM to 5:59 PM	4925	7.63	64871	9.25	0.825*	-1043.764	C029: National Highway System
	6:00 PM to 6:59 PM	3716	5.76	41981	5.98	0.962*	-146.661	C030: Functional Class
	7:00 PM to 7:59 PM	2805	4.34	28439	4.05	1.072*	188.335	C031: Lighting Conditions
	8:00 PM to 8:59 PM	2554	3.96	23540	3.35	1.179*	388.091	C032: Weather
	9:00 PM to 9:59 PM	2325	3.60	19236	2.74	1.314*	555.101	C034: E Police Present at Time of Crash
	10:00 PM to 10:59 PM	1919	2.97	14766	2.10	1.412*	560.384	C035: Police Notification Delay
	11:00 PM to 11:59 PM	1471	2.28	10973	1.56	1.457*	461.377	C036: Police Arrival Delay
	Unknown	75	0.12	1357	0.19	0.601*	-49.857	Sort by Sum of Max Gain
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				2016-2020 ΔΙ	ahama Integra	ted Crash Da	ata	
				C	:008: Time of	Day		
	10					-		
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			<u>ah</u>					Titte.
	0	100 (11)	50 411				50 DM -	
		4:00 AM to 4	:59 AM	9:00 AM to 9	C008: Tin	2:00 PM to 2	:59 PM /:	UU PM to 7:59 PM Unknown

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

🔋 CA	RE 10.2.1.3 - [IMPACT Re	sults - 2016-2	020 Alabam	na Integrated	Crash Data	- Passing Zo	one 409 OR Ir	nprope	r 15 vs. Not Pas	si —		×
🔋 Ei	le <u>D</u> ashboard <u>F</u> ilter	s <u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	Tools	<u>W</u> indow	<u>H</u> elp				-	₽×
6	2016-2020 Alabama Integra	ated Crash Dat	a	~	Passi	ng Zone 409	OR Improper	15		\sim	1/	1/2016
Order:	Max Gain 🗸	Descending	~	Suppres	s Zero-Value	ed Rows Sig	nificance: 0	ver Rep	resentation	✓ Thresh	old: 2.0	
C017:	First Harmful Event	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain		004: Month 005: Day of Mo	onth		^
	Collision with Ditch	7229	11.20	11441	1.63	6.867*	6176.309		006: Day of the	Week		
	Collision with Tree	6305	9.77	9221	1.31	7.431*	5456.572		007: Week of t	ne rear		
	Overtum/Rollover	2860	4.43	4583	0.65	6.782*	2438.316		010: Rural or 0	Jrban		
	E Collision with Animal:	2716	4.21	7812	1.11	3.779*	1997.215	c	011: Highway	Classificati	ons	
	E Collision with Emban	1666	2.58	2297	0.33	7.883*	1454.652		012: Controlle	dAccess		
	Collision with Culvert H	1434	2.22	1587	0.23	9.821*	1287.980		013: E Highwa	ly Side Contribution	Circumo	ton
	Collision with Utility Pole	1535	2.38	4616	0.66	3.614*	1110.280		016: Primary 0	Contributing	Unit Nur	nbe
	Collision with Fence	1183	1.83	2217	0.32	5.799*	979.013		017: First Har	nful Event	, on the second	
	Collision with Mailbox	1196	1.85	2666	0.38	4.876*	950.700		018: Location	First Harm	iul Event F	Relt
	Collision with Sign Post	1236	1.91	3115	0.44	4.312*	949.388		019: E Most H	armful Ever	nt	
	Collision with Other Fix	1060	1.64	4272	0.61	2.697*	666.932		020: E Distrac	ted Driving	Opinion	
	E Collision with Animal:	707	1.10	1000	0.14	7.684*	614.990		021: Distance	to Fixed Ot Roadway)ject lunction/F	eat
	E Collision with Animal:	354	0.55	1188	0.17	3.239*	244.692		023: E Manne	of Crash	ancaonn	Can
	Fire/Explosion	285	0.44	1049	0.15	2.953*	188.481		024: School B	us Related		
	E Collision with Other N	621	0.96	4826	0.69	1.399*	176.958	c	025: Crash Se	verity		
	E Collision with Guardr	277	0.43	1227	0.17	2.454*	164.103		026: Intersecti	on Related		
	Collision with Bridge Ab	295	0.46	1572	0.22	2.040*	150.360		027: At Interse	ction d Route		
	E Collision with Guardr	535	0.83	4202	0.60	1.384*	148.372		029: National	Highway Sv	/stem	
	E Collision with Other P	203	0.31	1026	0.15	2.150*	108.597		030: Functiona	al Class		
	Cargo/Equipment Loss	148	0.23	1353	0.19	1.189	23.510	c	031: Lighting (Conditions		
	Immersion	32	0.05	103	0.01	3.377*	22.523		032: Weather			
	Jackknife	49	0.08	300	0.04	1.775*	21.397		033: Locale	Present at 1	Time of C	ract
	E Collision with Falling/	82	0.13	773	0.11	1.153	10.876		035: Police No	tification D	elav	1451
	E Fell/Jumped from Mo	42	0.07	343	0.05	1.331	10.440	0	036: Police Arr	ival Delay	-	
	E Thrown or Falling Obj	52	0.08	460	0.07	1.229	9.675	~IF	Sort by Sum of	al Delav Max Gain		¥
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				2010 2020	Al-L l-t-		Dete					
				2016-20207	Alabama Inte	grated Crash	Data					
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	80											
2	60											
	40											
<u> </u>	20											
	0 Ulasana						-					
		Cargo/Equ	ipment Loss or	Shift	P Collision with	Gas Line	E Dov	vnhill Run	away	E Collision v in (or from) Ot	vith Vehicle her Roadway	y
					C017: First H	Harmful Even	t					

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.





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

🖡 CA	CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Passing Zone 409 OR Improper 15 vs. Not Passi										
🔋 Ei	ile <u>D</u> ashboard <u>F</u> ilters <u>A</u>	<u>A</u> nalysis <u>I</u> m	npact <u>L</u> oca	tions <u>T</u> ool	s <u>W</u> indow	<u>H</u> elp		_ & ×			
6	2016-2020 Alabama Integrated C	rash Data		~ F	assing Zone 4	109 OR Imprope	er 15	✓ ♥ 1/ 1/2016			
Order	: Max Gain 🗸 Desc	ending	✓ ✓ Su	ppress Zero-V	alued Rows	Significance:	Over Represer	ntation V Threshold: 2.0			
C129:	CU Vehicle Maneuvers	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C120: E CU Driver Employment : C121: CU Driver Condition			
•	E Negotiating a Curve	16847	26.11	18064	2.58	10.112*	15180.878	C122: CU Driver Officer Opinion			
	E Overtaking/Passing	4578	7.09	3823	0.55	12.983*	4225.388	C123: CU Driver Officer Opinion			
	Movement Essentially Straight	33135	51.35	356646	50.98	1.007	239.979	C124: CU Driver Alconol Test Typ			
	Illegally Parked	128	0.20	926	0.13	1.499*	42.591	C125: CU Driver Alcohol Test Re			
	CU is Not a Vehicle	201	0.31	1987	0.28	1.097	17.730	C127: E CU Driver Drug Test Re:			
	P Pass on Left	4	0.01	5	0.00	8.674	3.539	C128: CU Vehicle Initial Travel D			
	P Wrong Side of Road	3	0.00	20	0.00	1.626	1.155	C129: CU Vehicle Maneuvers			
	P Pass on Right	1	0.00	2	0.00	5.421	0.816	C130: E CU Non-Motorist Maneu			
	P Avoid Object in Road	2	0.00	29	0.00	0.748	-0.675	C202: CU Contributing Circumst			
	P Start in Traffic	1	0.00	37	0.01	0.293	-2.413	C203: CU First Harmful Event Lo			
	Legally Parked	17	0.03	527	0.08	0.350	-31.608	C204: E CU Sequence of Events			
	Making U-Tum	320	0.50	3910	0.56	0.887	-40.636	C205: E CU Sequence of Events			
	Stopped in Traffic	148	0.23	2631	0.38	0.610*	-94,669	C206: E CU Sequence of Events			
	E Leaving Main Road	63	0.10	2613	0.37	0.261*	-178.008	C207: E CO Sequence of Events			
	E Stopped for Sign/Signal	19	0.03	2931	0.42	0.070	-251,339	C209: CU Make			
	Other	247	0.38	6707	0.96	0.399*	-371 616	C210: CU Body (Passenger Car:			
	E Entering Main Road	887	1 37	18379	2.63	0.523*	-808 176	C211: E CU Owners State			
	Linknown	19/	0.20	12201	1 90	0.525	-1022.909	C212: CU License Tag State			
	Slowing /Stopping	1602	2.40	/1770	5.97	0.130	2250.460	C213: CO venicle Usage			
	Turning Dialat	1105	1.71	90011	5.37	0.410	2200.400	C215: E CU Placard Required			
	Deskies	1105	1.71	30311	J.20	0.525	-2233.403	C216: E CU Placard Status			
		105	1.24	34064	4.87	0.200	-2340.716	C217: CU Hazardous Cargo			
		125	0.19	28722	4.11	0.04/*	-2524.156	C218: E CU Hazardous Release			
	E Changing Lanes	594	0.92	42969	6.14	0.150*	-3369.219	C219: CU Attachment			
L	Turning Left	3503	5.43	82524	11.80	0.460*	-4108.550	Sort by Sum of Max Gain			
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			2016-2	2020 Alabama	Integrated Cr	ash Data					
				C129: CU Veł	nicle Maneuve	ers					
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	0	Can Stepichte in 1	de Truce I	D Dia unité T			and a second				
	P Go Straight in Left Turn Lane P Bic with Traffic off Road Legally Parked Backing 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

CA	ARE 10.2.1.3 - [IMPACT Resul	ts - 2016-2020	Alabama Inte	grated Crash	Data - Passin	g Zone 409 OF	R Improper 15 v	∕s. Not Passi — □ ×			
E E	ile <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis	mpact <u>L</u> oc	ations <u>T</u> oo	ols <u>W</u> indow	v <u>H</u> elp		_ @ ×			
*	2016-2020 Alabama Integrated	d Crash Data		\sim	Passing Zone	409 OR Improp	er 15	✓ ♥ 1/ 1/2016			
Order	Max Gain 🗸 D	escending	~	uppress Zero-	Valued Rows	Significance:	Over Represer	ntation V Threshold: 2.0			
C032	Weather	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C027: At Intersection C028: Mileposted Route			
	Cloudy	13268	20.55	122372	17.44	1.178*	2008.328	C029: National Highway System			
	Rain	7708	11.94	77690	11.07	1.078*	559.601	C030: Functional Class			
	Fog	749	1.16	3179	0.45	2.561*	456.494	C032: Weather			
	E Mist	1819	2.82	15578	2.22	1.269*	385.640	C033: Locale			
	Severe Winds	69	0.11	259	0.04	2.895*	45.169	C034: E Police Present at Time (
	Snow	108	0.17	789	0.11	1.488*	35.403	C035: Police Notification Delay			
	Sleet/Hail/Freezing Rain	81	0.13	645	0.09	1.365*	21.652	C036: Police Arrival Delay			
	E Blowing Snow	6	0.01	39	0.01	1.672	2.412	C037. EWS Arrival Delay C038: Adjusted EMS Arrival Delay			
	E Blowing Sand/Soil/Dirt	1	0.00	11	0.00	0.988	-0.012	C039: Non-Vehicular Property Da			
	Other	10	0.02	212	0.03	0.513	-9.507	C040: Agency ORI			
	Unknown	64	0.10	2300	0.33	0.302*	-147.627	C042: Highway Patrol Troops			
	Clear	40676	<mark>63.01</mark>	478564	68.21	0.924*	-3357.552	Sort by Sum of Max Gain			
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			2016	-2020 Alabam	a Integrated C	rash Data					
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	1	Rain	E Mist	S	now	E Blowing Sno	w Othe	er Clear			
	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

I	CARE	10.2.1.3 - [IMPA	ACT Resul	lts - 2016-2020) Alabama Inte	grated Crash	Data - Passin	g Zone 409 Of	R Improper 15	vs. Not Passi.	. –		Х
ľ	<u>F</u> ile	<u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact <u>L</u> oo	ations <u>T</u> oo	ls <u>W</u> indow	v <u>H</u> elp				-	8×
¢?	20	16-2020 Alabama	Integrate	d Crash Data		\sim	Passing Zone	409 OR Improp	er 15		~ 9	2/	1/2016
Orc	ler: M	lax Gain	~ D	escending	✓ Ø \$	uppress Zero-	Valued Rows	Significance:	Over Represer	ntation ~	Threshol	d: 2.0	÷
C4	03: CI	U Roadway Cor	ndition	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C330: CU C331: E C	Driver/Non U Driver/No	-Motoris on-Motor	t Tr 🔺
ŀ	W Dr	/et ry		13520 50341	20.94 77.98	116575 526258	16.61 75.00	1.260*	2793.965 1920.140	C401: E C C402: E C	U Involved U Road Su	Road/Br Irface Ty	ridg pe
	lo	e		270	0.42	1800	0.26	1.630*	104.382	C403: CU C404: E C	Roadway (U Environn	Condition nental C	n ont
	E	Snow Slush		28	0.07	308 142	0.04	1.553* 2.143*	15.661 14.935	C405: CU C406: CU	Contributir Contributir	ig Materi Ig Materi	ial i ial S
	Ot	ther		22	0.03	148	0.02	1.616	8.383	C407: CU C408: CU	Roadway (Vision Obs	Curvature scured B	e ar ly
	M	uddy Sand/Dirt/0	Gravel	17	0.08	357	0.09	0.903	-5.598	C409: CU	Traffic Con Traffic Con	trol trol Fun	ctio
	U	nknown		38	0.06	849	0.12	0.486*	-40.116	C411: CU	Opposing I	Lane Se	par
	CI	U is Unknown		102	0.18	25000	4.09	0.043	-2517.704	Sort by S	um of Max C	àain	~
	0	er 🖉								,			C
					2016	-2020 Alabam	a Integrated C	rash Data					
						C403: CU R	oadway Condi	tion					
		100											
	Frequency	50											
		0		Dry	ES	low	I Other	Mu Sand/D	l Jddy irt/Gravel	Not Applicable		-	
	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

🚦 C/	CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Passing Zone 409 OR Improper 15 vs. Not Passi												
E E	ile <u>D</u> ashboard <mark>F</mark> ilters	<u>A</u> nalysis	<u>I</u> mpact <u>L</u> oo	ations <u>T</u> oo	ols <u>W</u> indow	v <u>H</u> elp		_ & ×					
6	2016-2020 Alabama Integrat	ed Crash Data		\sim	Passing Zone	409 OR Improp	er 15	✓ ♥ 1/ 1/2016					
Order	: Natural Order 🗸 🗸	Descending	✓ Ø \$	ouppress Zero-	Valued Rows	Significance:	Over Represe	ntation V Threshold: 2.0					
C025	Crash Severity	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C021: Distance to Fixed Object C022: E Type of Roadway Junctic					
	Fatal Injury	1233	1.91	3184	0.45	4.209*	940.041	C023: E Manner of Crash					
	Suspected Serious Injury	5563	8.62	18837	2.68	3.210*	3829.813	C024: School Bus Related					
	Suspected Minor Injury	8568	13.27	50695	7.23	1.837*	3903.566	C025: Crash Seventy					
	Possible Injury	4647	7.20	66672	9.50	0.758*	-1487.473	C027: At Intersection					
	Property Damage Only	43907	68.01	542400	77.30	0.880*	-5999.081	C028: Mileposted Route 🗸					
	Unknown	641	0.99	19866	2.83	0.351*	-1186.865	Sort by Sum of Max Gain					
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			2016	6-2020 Alabam	a Integrated Ci	rash Data							
				C025: C	rash Severity								
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		Fatal Injury	Suspected Serious Injury	Suspecte Minor Inju	d Possib ry	ole Injury Di	Property amage Only	Unknown					
				C025	5: Crash Sever	ity							

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 Ration) 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

1	🔋 CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Passing Zone 409 OR Improper 15 AND Not Ad – 🛛 🗙													
ľ	<u>F</u> ile	<u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>W</u>	<u>/</u> indow <u>H</u> e	lp			_ & ×		
6 2	20	16-2020 Alabama	Integrate	ed Crash Data	1	~	Passing	Zone 409 OR	Improper 15		~ Y	1/ 1/2016		
Orc	ler: M	lax Gain	~ [)escending	~	Suppress	Zero-Valued	Rows Signifi	cance: Over	Representation	✓ Thresho	ld: 2.0 🚖		
C0:	38: Ac	djusted EMS Arr	ival Dela	y Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C038: Adjust	ted EMS Arrival [Delay		
•	0	to 5 minutes		1822	9.03	46546	28.69	0.315*	-3967.342					
	6	to 10 minutes		4522	22.41	54665	33.70	0.665*	-2277.175					
	11	1 to 15 minutes		4860	24.09	28289	17.44	1.381*	1341.444					
	16	6 to 20 minutes		3493	17.31	14020	8.64	2.003*	1749.207					
	21	1 to 30 minutes		3345	16.58	11753	7.25	2.288*	1883.174					
	31	1 to 45 minutes		1342	6.65	4760	2.93	2.267*	749.956					
	46	6 to 60 minutes		383	1.90	1257	0.77	2.450*	226.656					
	61	1 to 90 minutes		251	1.24	613	0.38	3.292*	174.756					
	91	1 to 120 minutes		58	0.29	122	0.08	3.822*	42.826					
	12	21 to 180 minutes		38	0.19	130	0.08	2.350*	21.831					
	0	ver 180 minutes		63	0.31	67	0.04	7.560*	54.667	Sort by Sum	n of Max Gain			
		Se 🖉										Ε		
						2016-2020 AI	labama Integr	ated Crash Da	ata					
						C038: Ad	ljusted EMS A	Arrival Delay						
		40												
	>													
	nenc	20	-											
	Freq	20												
		0												
		0	(to 10 minute	es 16 to	20 minutes	31 to 45 r	minutes 6	61 to 90 minute	es 121 to 180	minutes			
						C038	3: Adjusted El	MS Arrival Del	ay					

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 or speed and seatbelts on fatal crashes.

CARE 10.2.1.3	- [Crosstab Results	s - 2016-2020 Alabar	ma Integrated Cras	h Data - Filter = Pas	sing Zone 409 OR II	mproper 15]	- 🗆	×
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2016-2020	Alabama Integrated (Crash Data	~	Passing Zone 409 O	R Improper 15	~	Se 😨 1/ 1	1/2010
Suppress Zero Va	lues: None	 ✓ Select 	Cells: 🔳 🔻 %	Sec. Co	lumn: Crash Severity	; Row: CU Estimate	d Speed at Impact	4
	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	

Cross-tabulation Estimated Speed at Impact vs Severity

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.

CARE 10.2.1.3 - [Crosstab Results - 2016-2020 Alabama Integrated Crash Data - Filter = Passing Zone 409 OR Improper 15] - 🗆 🗙													
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2016-2020 /	Alabama Integrated C	irash Data	~	Passing Zone 409 0	R Improper 15	~	See 1/ 1	1/2016					
Suppress Zero Va	lues: Rows and Col	umns 🗸 Select	Cells: 🔳 🛛 🔏	Secol	umn: Crash Severity	; Row: CU Driver/N	on-Motorist Safety Equipment	2					
	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						

Cross-tabulation Estimated Seatbelt Use vs Severity

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.

CARE 10.2.1.3	- [Crosstab Result	s - 2016-2020 Alaba	ma Integrated Crasl	h Data - Filter = Pas	sing Zone 409 OR li	mproper 15]	- 0	×					
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2016-2020 Alabama Integrated Crash Data V Passing Zone 409 OR Improper 15 V 🌱 😨 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	5 Vehicles 0		7	5	20	1	35						
6 Vehicles	6 Vehicles 0 0		0	2	2	0	4						
TOTAL	1233	5563	8568	4647	43907	641	64559						

Cross-tabulation of Severity by Number of Vehicles

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

🚦 CA	RE 10.2.1.3 - [IMPACT Results - 2016-2	020 Alabama lı	ntegrated	Crash Dat	a - Passin	g Zone 40	9 OR Impr	oper 15 AND Not Ca — 🛛 🗙
🔋 Ei	le <u>D</u> ashboard <u>F</u> ilters <u>A</u> nalysis	<u>I</u> mpact <u>I</u>	ocations	<u>T</u> ools	<u>W</u> indov	v <u>H</u> elp		_ <i>a</i> ×
6	2016-2020 Alabama Integrated Crash Date	3	\sim	Pas	sing Zone	409 OR Im	proper 15	✓ ♥ 1/ 1/2010
Order:	Max Gain V Descending	~ 2] Suppress	Zero-Valu	ued Rows	Significar	nce: Over	Representation V Threshold: 2.0
C101:	Causal Unit (CU) Type	Subset equency	Subset Percent	Other equency	Other Percent	Odds Ratio	Max Gain	C101: Causal Unit (CU) Type
•	Pick-Up (Four-Tire Light Truck)	14886	23.19	116253	17.56	1.321*	3614.7	
	Motorcycle	1381	2.15	4061	0.61	3.507*	987.267	
	E Single-Unit Truck (2-Axle/6-Tire)	707	1.10	6420	0.97	1.136*	84.551	
	E 4-Wheel Off Road ATV	112	0.17	469	0.07	2.463*	66.528	
	E Single-Unit Truck (3 Axles or Less)	318	0.50	2720	0.41	1.206*	54.283	
	E Tractor/Semi-Trailer	1340	2.09	13474	2.04	1.026	33.632	
	Pedestrian	157	0.24	1400	0.21	1.157	21.263	
	E Low Speed Vehicle	29	0.05	108	0.02	2.770*	18.529	
	E Truck (6 or 7) with Trailer	195	0.30	1902	0.29	1.057	10.592	
	E Other Motorized Cycle/Low Speed Veh	icle 21	0.03	142	0.02	1.525	7.232	
	E Truck Tractor Only (Bobtail)	41	0.06	350	0.05	1.208	7.066	
	E Other Heavy Truck (Cannot Classify)	64	0.10	625	0.09	1.056	3.403	
	E Bicyclist	36	0.06	522	0.08	0.711	-14.610	
	Station Wagon	152	0.24	1748	0.26	0.897	-17.477	
	E Other Bus (Seats More than 15)	77	0.12	1083	0.16	0.733*	-28.002	
	E Other Passenger Vehicle	59	0.09	928	0.14	0.656*	-30.974	
	E Passenger Van	148	0.23	2313	0.35	0.660*	-76.256	
	E Cargo Van (10000 lbs or Less)	383	0.60	5198	0.79	0.760*	-120.971	
	E Mini-van	1328	2.07	15262	2.31	0.897*	-151.723	
	E Sport Utility Vehicle (SUV)	12816	19.97	144189	21.78	0.917*	-1163	
	Passenger Car	29938	46.64	342681	51.76	0.901*	-3286	Sort by Sum of Max Gain
00) 🕼 🖉							[
		2()16-2020 A	labama Int	tegrated C	rash Data		
		2.	C101:	Causal U	nit (CU) T	ype		
	60							
	<u> </u>							
	and							
8	Ë 20 1							
	E Sing	le-Unit Truck	04	E Other Mot	orized ed Vehicle		E Other Bus ((Seats E Sport Utility Vehicle (SUV)
	(0,0		(C101: Cau	sal Unit (C	U) Type	and a share	/

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

🚦 CA	CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Passing Zone 409 OR Improper 15 AND Not C 🛛 🗙												
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6	2016-2020 Alabama I	ntegrate	d Crash Dat	a	~	Passi	ng Zone 40	9 OR Improper	r 15		~ 💡	12 1	/ 1/2016
Order	: Max Gain	~ D	escending	~	Suppres	s Zero-Value	ed Rows S	ignificance:	Over F	Representation	✓ Thresh	iold: 2	.0 🚖 0.
C107	CU Driver Raw Age	F	Subset requency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	^	C107: CU Driv	er Raw Age		
•	15		122	0.20	1155	0.19	1.079	8.939					
	16		2336	3.91	17180	2.81	1.389	654.285	5				
	17		2530	4.23	18694	3.06	1.383	700.082	2				
	18		2600	4.35	22096	3.62	1.202	437.068	3				
	19		2460	4.12	22727	3.72	1.106	235.300					
	20		2124	3.55	21596	3.54	1.005	5 10.012	2				
	21		1995	3.34	20328	3.33	1.003	3 5.133	3				
	22		1754	2.93	19498	3.19	0.919	-154.620					
	23		1650	2.76	18000	2.95	0.936	-111.983	8				
	24		1608	2.69	16949	2.78	0.969	-51.103	8				
	25		1567	2.62	16257	2.66	0.98	5 -24.365	5				
	26		1535	2.57	15590	2.55	1.000	8.927	7				
<u> </u>	27		1465	2.45	14807	2.43	1.01	15.573	3				
	28		1370	2.29	14217	2.33	0.984	-21.673	3				
	29		1386	2.32	13425	2.20	1.05	5 71.854	<u> </u>				
	30		1257	2.10	12788	2.09	1.004	5.209					
	31		1247	2.09	12026	1.97	1.059	69.799					
	32		1169	1.96	11614	1.90	1.028	32.129	2 ~	Sort by Sum o	of Max Gain		
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					2016-2020	Alabama Inte	grated Cras	h Data					
					C10	07: CU Drive	r Raw Age						
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						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-represend 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 M	odel	year
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🖡 CA	RE 10.2.1.3 - [IMPA	CT Re	sults - 2016-2	020 Alabar	na Integrated	l Crash Dat	a - Passing Z	Zone 409 Ol	R Improper 15 AND — 🗆 🗙
🔋 Ei	le <u>D</u>ashboard	<u>F</u> ilter	s <u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	; <u>T</u> ools	<u>W</u> indow	<u>H</u> elp	_ @ ×
*	2016-2020 Alabama	Integra	ated Crash Dat	a	~	Pas	sing Zone 40	9 OR Improp	er 15 🗸 🌱 😨 1/
Order	Max Gain	~	Descending	~	Suppres	ss Zero-Valu	ied Significa	nce: Over	Representation V Threshold: 2.0
C208:	CU Model Year		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C208: CU Model Year
•	2000		2314	4.37	18974	3.39	1.291*	521.165	
	2001		2411	4.56	20127	3.59	1.268*	509.219	
	2002		2860	5.41	23749	4.24	1.274*	615.979	
	2003		3217	6.08	28094	5.02	1.212*	562.424	
	2004		3416	6.46	31492	5.62	1.148*	440.350	
	2005		3793	7.17	34300	6.13	1.170*	552.025	
	2006		3826	7.23	36071	6.44	1.123*	417.685	
	2007		3791	7.16	38915	6.95	1.031	113.958	
	2008		3170	5.99	33526	5.99	1.001	2.160	
	2009		1982	3.75	21688	3.87	0.967	-67.279	
	2010		2114	4.00	25684	4.59	0.871*	-312.857	
	2011		2428	4.59	28258	5.05	0.909*	-242.072	
	2012		2473	4.67	32291	5.77	0.811*	-578.146	
	2013		2746	5.19	33990	6.07	0.855*	-465.683	
	2014		2751	5.20	33636	6.01	0.866*	-427.234	
	2015		2894	5.47	36081	6.44	0.849*	-515.260	
	2016		2478	4.68	31830	5.68	0.824*	-529.587	
	2017		1954	3.69	23823	4.25	0.868*	-297.013	
	2018		1176	2.22	15084	2.69	0.825*	-249.273	
	2019		795	1.50	9019	1.61	0.933	-57.197	
	2020		309	0.58	3170	0.57	1.032	9.470	
	2021		12	0.02	157	0.03	0.809	-2.835	Sort by Sum of Max Gain
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				2	2016-2020 Ala	bama Integr	ated Crash D	ata	
					C20	8: CU Mode	Year		
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			200	4	2	2009 C208: CILM	odel Year	2014	2019

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

B	🔋 CARE 10.2.1.3 - [IMPACT Results - 2016-2020 Alabama Integrated Crash Data - Passing Zone 409 OR Improper 15 AND													
B	<u>F</u> ile <u>D</u> a	ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocatior	ns <u>T</u> ools	<u>W</u> indow	<u>H</u> elp				-	8×
¢?	2016-20	20 Alabam	a Integrate	d Crash Data	3	~	Pa	ssing Zone 4	409 OR Impr	oper 15		~ *	9	1/
Ore	Order: Max Gain V Descending V Suppress Zero-Valued Significance: Over Representation V Threshold: 2.0													
C1	21: CU Dr	iver Condit	ion		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds	Max Gain	C121: CU	Driver Co	ndition	
►	E Unde	er the Influe	nce of Alco	ohol/Drugs	4595	7.93	19124	3.21	2.469*	2733.619				
	E Aslee	ep/Fainted/	Fatigued		2381	4.11	9551	1.60	2.561*	1451.380				
	Illness				468	0.81	2474	0.42	1.944*	227.200				
	E Emot	ional (Depr	essed/Ang	ry/Distur	241	0.42	2109	0.35	1.174*	35.726				
	E Phys	ical Impairm	ient		157	0.27	1780	0.30	0.906	-16.251				
	Apparently Normal 50091 86.46 560156 94.11 0.919* -4430.214 Sort by Sum of Max Gain													
					20)16-2020 AI	abama Integ	rated Crash	Data					
						C121	CU Driver	Condition						
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						С	121: CU Dri	ver Conditio	n					

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.