# Analysis of Vehicle Defective Brakes and Tires David B. Brown University of Alabama Center for Advanced Public Safety (CAPS) February 15, 2020

For more information on this subject from NHTSA and other sources, please see: http://www.safehomealabama.gov/tag/defects-recalls/

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# Introduction

The frequency displays, below in this section, for C222 (CU Contributing Vehicle Defect Frequency) show that the most often crash-contributing defect is brakes, with 41.3% of the vehicledefect crashes. Note that the listing omits those crashes where vehicle defects were not indicated to be contributing to the crash. The next two in frequency both relate to tires, and combined they account for 5338, which is 33.6% of the vehicle defect crashes. These will be considered together because they are not independent. Both Tire Blowout/Separation (3584 crashes) and Improper Tread Depth (1754 crashes) can be caused by tire wear, and thus many of them are the result of not performing timely tire maintenance. Together brakes and tires contributed to 11,914 crashes, which is about 75% of all contributing vehicle defect crashes.

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C222	: CU Contributing	Vehicle De	fect	Frequency	Cum. Frequency	Percentage	Cum. Percent	C222: CU Contri	buting Vehicle De	fect
•	Brakes			657	6576	41.34	41.34			
	E Tire Blowout/Se	eparation		358	4 10160	22.53	63.86			
	E Improper Tread	Depth		175	4 11914	11.03	74.89			
	Steering			119	1 13105	7.49	82.37			
	Wheels			90	5 14011	5.69	88.07			
	Power Train			57	6 14587	3.62	91.69			
	Trailer Hitch/Coup	oling		30	5 14893	1.92	93.61			
	Suspension			18	7 15080	1.18	94.79			
	Fuel System			15	7 15237	0.99	95.78			
	Windows/Windshi	ield		12	9 15366	0.81	96.59			
	E Tail Lights			12	3 15494	0.80	97.39			
	E Headlights			12	1 15615	0.76	98.15			
	E Body/Doors			9	1 15706	0.57	98.72			
	E Wipers			6	3 15769	0.40	99.12			
	Tum Signal			5	7 15826	0.36	99.48			
	E Mirrors			5	2 15878	0.33	99.81			
	E Cruise Control			1	7 15895	0.11	99.91			
	Exhaust			1	4 15909	0.09	100.00			
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					2014-2018 Alabam	a Integrated Crash D	Data			
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#### **C222** CU Contributing Vehicle Defect Frequency

The frequency distribution above indicates that the combined tire and brake defects account for about 75% of all crashes caused by vehicle defects. These are further subdivided by about 41% brake faults and 24% tire faults. Steering, wheels and power train occur rarely compared to these with 7.49%, 5.69%, and 3.62%, respectively. The items being compared are shown graphically in the display below.



#### C222 Contributing Vehicle Defect Limited to Brakes and Tires

#### **C025 Crash Severity**

While considering these defect types as an overview, it is insightful to consider the severity of the crashes caused by each. The IMPACT display given below compares the two defect type by crash severity. From this it can be seen that the negative impact of these two defect types is not totally revealed by their frequencies. Tire defects resulted in 74 fatal crashes over the five years, while defective brakes were involved in only 7 fatal crashes. The under-representation of tire faults in the next two worse severity types indicates a very large over-representation of tire faults in these two categories as well. Compensating for this, the lowest severity types (Possible Injury and Property Damage Only) are over-represented in the brake-defect caused crashes. See a further discussion of severity beginning with C025 in the Recommendations section below.



#### Crash Severity of the Two Defect Types Being Compared

# Recommendations

Recommendations will be presented here as a summary of the findings. They will be referenced by the CARE crash attribute numbers (Cnnn) for ease of reference to the IMPACT displays that will follow. Please read the *Introduction to the IMPACT Displays* section below to better understand the comparisons that are being made in the IMPACT displays.

The following present the recommendations by CARE crash attribute number:

- C001, C002 and C010: Geographical Area. City, County and Rural/Urban displays show clearly that defective brakes are far more prevalent in the urban areas, while tire defects are largely a rural issue. Inspections of trucks and cars should take into consideration where the predominance of the driving will take place for that vehicle and concentrate accordingly.
- C011 and C033: Highway Classifications and Locales. Reinforcing the results given above is the over-representation of brake problems on municipal streets, while tire problems are over-represented on Interstates. Similarly, Locales associated with urban areas reflect brake problems, while Open Country is significantly over-represented in tire defects.
- C028: Mileposted Routes. The high-level conclusion that we can come to in comparing mileposted routes (combined, Interstate, State and Federal) is that the State and Federal routes have far higher a proportion of brake problems as opposed to Interstates, which have the much higher proportion of tire-caused crashes. The increased proportion of tire problems on Interstates might be partially attributed to (1) higher speeds, (2) longer duration trips, and (3) less reliance on brakes for safe operation.
- C003: Year. Over the five-year period of the study, there was an increase of 214 (18.4%) for brakes, and an increase of 103 (10.8%) for tires. This provides some evidence that brake problems are increasing more than tire problems, with the increased traffic volume affecting both.
- C004, C006, C008 and C031: Enforcement Times. While Brake issues are over-represented in November and December, as opposed to tire issues that tend to be clustered in the warmer months of May-July. There is little reason to alter enforcement strategy on this account. The variability over the days of the week seem to be causes more by large differentials in brake defect crashes: Friday, Tuesday and Wednesday being over-represented, while Saturday and Sunday are significantly under-represented in brake-caused crashes (i.e., tire problems are over-represented). Correlated with this is the time of day: rush hours are over-represented with brake problems, whereas late night hours are more often attributed to tire defects. So if selective enforcement could differentiate between these two defect types, the concentration for brakes would be during the week, and especially rush hours, while the concentration for tires would be weekends and late-night.
- C006 and C008: see C004.

- C015: Primary Contributing Circumstance (PCC). As expected, urban types of crashes are related to bad brakes, from Misjudge Stopping Distance down to Various Failed to Yield Right of Way items. DUI and speed-related items are over-represented for tire faults.
- C017 and C023: First Harmful Event and Manner of Crash. Bad brakes clearly cause a major over-representation in Collision with Vehicle in Traffic and Collision with Parked Motor Vehicle. Bad tires tend to cause relatively more collisions with obstacles that are single-vehicle crashes off the roadway. Manner of Crash (C023) produces essentially identical results.
- C022: Type of Roadway Junction Feature. Four-Way Intersections and T-Intersections are significantly over-represented for bad brakes, while bad tires are more associated with junctions related to the Interstates.
- C023: see C017.
- C025, C038, C060 and C224: Crash Severity Factors. The severity results (C025) here are quite surprising and probably unexpected for most people. Notice just in the raw frequency that there are nearly ten times the fatal crashes cause by tires as that caused by defective brakes. (No statistical significance results are shown if any of the items being compared has less than 20 occurrences.) The next two most severe classifications are also quite significant. The least severe injury crashes are under-represented for faulty tires. Let us consider the causes of increased severity:
  - C038: Adjusted EMS Arrival Delay. A major problem with defective tire crashes is their distance from available EMS first responders. Being over-represented in rural crashes, the time it takes them to be reached is significantly higher than most brake-defect crashes, which occur in urban areas.
  - C060: Number of Injuries (including fatalities). All of the injury categories are over-represented in defective tires as opposed to defective brakes. This is consistent with the other severity metrics.
  - C224: Speed at Impact. This display makes it abundantly clear that the speed of impact of tire-defect caused crashes is much, much higher than the typical brake-defect crash. This reflects the proven fact that in Alabama above 40 MPH, an increase in the impact speed of 10 MPH doubles the probability (exponentially) that the crash will result in a fatality. The background coloring shows a very high significance for higher frequency of brake-defect crashes in the 1-35 MPH range. For tire defect caused crashes there is a similar exceedingly high over-representation in the 51-70 MPH range.
- C031: see C004.
- C032: Weather. As usual, weather changes things. The major finding in several previous studies is that wet pavement reduces fatalities by virtue of slowing the traffic speeds. In this case we find brakes being more of a problem in clear weather, and tires being a larger problem in the rain (about twice what is expected when compared to the proportion of brake-defect caused crashes.
- C033: see C011.
- C038: See C025.

- C052: Number of Vehicles. Single vehicle crashes are over-represented in defective tirecaused crashes. Defective brakes are more apt to cause two, three or higher multiple-vehicle crashes.
- C060: see C025.
- C101: Causal Unit (CU) Type. Passenger Cars and Mini-vans have the greatest brake problems, as opposed to SUVs and large trucks, which have a higher proportion of tire problems.
- C107: CU Driver Raw Age. Clearly the younger drivers have much more of a problem with brakes than they do with tires. This is about the only conclusion that can be obtained by studying these two distributions. The reason for this is probably that they are more apt to be involved in shorter trips, and in predominantly urban areas.
- C109: CU Driver Gender. The same thing probably explains the male-female disparity males drive the longer trips; while females are more into urban driving.
- C110: Driver Residence Distance. This is also an expected result since shorter trips are correlated with brake defects, while longer trips are correlated with tire defects.
- C121, C122 and C123: CU Driver Condition and (Officer Opinion of) Sobriety. These attributes confirm what was found in the Primary Contributing Circumstances (C015) and the other alcohol and drug test results. ID/DUI is more correlated with defective tires than with defective brakes. This is probably because ID is correlated with rural driving.
- C125: CU Vehicle Maneuvers. Intuitively, brakes will be involved in maneuvers which require their use. On the other hand, tires can go out at any time, and so those which are most common to driving are thus over-represented.
- C204: Sequence of Events. Defective brakes are close to seven times more likely to result in collision with another vehicle in traffic, close to six times more likely to result in running off the road straight, and over 3 times more likely to result in a collision with a parked motor vehicle. The first of these is by far the most predominant, occurring over 30 times more than the second two.
- C208: Model Year. Brakes are problematic up through the 1998 model year. Neither defect type until model year 2008, and from that point forward, defective tires are over-represented.
- C224: see C025.
- C233: Point of Initial Impact. Head on Center is over-represented for brakes defects by over twice what would be expected, and no other attributes are over-represented. Defective tires, especially blow-outs, will tend to pull the vehicle one way or the other, and this accounts for most of the other point of initial impact over-representations.

# **Introduction to the IMPACT Displays**

In order to get insight into these two vehicle defect types, an IMPACT analysis was performed that compared them against each other. This showed the similarities and differences between the two types of defects. Experimentally, each of them can be viewed as the other's control group. When one of them is over-represented, this could indicate an even larger issue than if the comparison were against no defects at all. To facilitate future reference, the comparisons are generally ordered in the way that they appear in the data. Use the navigation bar of Word or the PDF search to get to specific comparisons. In the results, the "Subset" is the proportion of brake defect caused crashes (represented by the red bars in the charts). The "Other" (blue bars) is not the complement, which is often the case in IMPACT comparisons, but it is the proportion of tire-defect caused crashes.

To summarize, in the displays that follow the *red bars* represent the proportion of the attributes of the 6576 crashes that had Brakes as the Contributing Vehicle Defect. These are compared against comparable attributes of the combined Tire defect types: (1) Tire Blowout/Separation and (2) Improper Tread Depth, which had 3,584 and 1,754 crashes, respectively (5,338 total). These tire defect proportions are given by the *blue bars* in the charts. Several of the displays are "pruned" to remove irrelevant items of low frequency that had very low relative impact on crashes in general.

Please do not confuse the color of the bars with the background colors in the table. In the tables, red background indicates that defective brakes are over-represented by over twice what would be expected from the defective tires proportion; conversely, green background indicates that tires are over-represented by over twice what would be expected from the defective brakes proportion. This will be represented by an Odds Ratio of 0.5 or less.

# **IMPACT** Comparison of Brakes (Red Bars) with Tires (Blue Bars)

<b>6</b> 2	2014-2018 Alabama Integrated	Crash Data		~ V	eh Defects Bra	kes		~ 💡 🔞 1	/ 1/2014 ~ 12/3
Order:	Max Gain 🗸 De	scending	- 🗸 Su	ppress Zero-V	alued Rows	Signif	icance: Over l	Representation V Three	shold: 2.0 韋
C001:	County	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County	
<u>۲</u>	Mobile	836	17.30	350	10.17	1.702*	344.759		
	Jefferson	1416	29.31	789	22.92	1.279*	308.603		
	Madison	530	10.97	200	5.81	1.888*	249.291		
	Shelby	214	4.43	108	3.14	1.412*	62.417		
	Marshall	168	3.48	82	2.38	1.460*	52.909		
	Dallas	61	1.26	22	0.64	1.976*	30.122		
	Calhoun	186	3.85	114	3.31	1.162	25.996		
	Coffee	56	1.16	23	0.67	1.735	23.718		
	Colbert	89	1.84	48	1.39	1.321	21.630		
	Russell	102	2.11	58	1.69	1.253	20.594		
	Covington	41	0.85	18	0.52	1.623	15.736		
	Franklin	33	0.68	19	0.55	1.237	6.333		
	Dale	32	0.66	38	1.10	0.600	-21.335		
	Cherokee	26	0.54	34	0.99	0.545*	-21.721		
	Lawrence	20	0.41	30	0.87	0.475*	-22.106		
	Autauga	26	0.54	38	1.10	0.487*	-27.335		
	Blount	30	0.62	43	1.25	0.497*	-30.352		
	Chambers	48	0.99	60	1.74	0.570*	-36.213		
	Jackson	42	0.87	58	1.69	0.516*	-39.406		
	Limestone	72	1.49	91	2.64	0.564*	-55.723		
	Conecuh	21	0.43	59	1.71	0.254*	-61.809		
	Chilton	28	0.58	72	2.09	0.277*	-73.055		
	Escambia	36	0.75	84	2.44	0.305*	-81.898		
	Walker	65	1.35	107	3.11	0.433*	-85.179		
	Lee	135	2.79	158	4.59	0.609*	-86.760		
	Cullman	110	2.28	159	4.62	0.493*	-113.164		
	Baldwin	227	4.70	249	7.23	0.650*	-122.483		
	Talladega	81	1.68	147	4.27	0.393*	-125.321		
	St Clair	100	2.07	184	5.35	0.387*	-158.252	Sort by Sum of Max Gain	
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			:	2014-2018 Alal	bama Integrated	d Crash Data			
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#### **C001** County (Counties that had significant differences before pruning)

Counties that had less than 20 defective brakes crashes as well as others that did not significant differences in the proportion of brakes compared to tires crashes. Prior to pruning, all of the above showed significant difference in their proportions. The counties that are over-represented in brakes defects are at the top, while those with more tire defects are toward the bottom.



#### C002 City (Cities that had significant differences before pruning)

See C010; clearly brakes are the larger problem in the urban areas.

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¢?	2014-2	2018 Alabama	Integrate	d Crash Data		~ V	eh Defects Brak	kes		~ 9	12 1	/ 1/2014 ·	/ 12/31
Order:	Natu	ral Order	~ A	scending	🗸 🖂 Su	ppress Zero-V	alued Rows	Sign	ificance: Over I	Representation	✓ Thres	hold: 2.	) 🕂
C003:	Year	e		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County C002: City			^
•	2014			1162	17.67	955	17.89	0.988	-14.486	C003: Year			
	2015			1287	19.57	1140	21.36	0.916*	-117.391	C004: Month	opth		
<u> </u>	2016			1410	21.44	1076	20.16	1.064	84.452	C006: Day of th	e Week		
	2017			1341	20.39	1109	20.78	0.982	-25.202	C007: Week of	the Year		~
	2018			1376	20.92	1058	19.82	1.056	72.626	Sort by Sum of	Max Gain		
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				2014-2018	Alabama Integr	ated Crash Dat	ta - Filter = Veh	Defects Brake	es vs. Veh Defec	ts Tires			
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		0		2014	20	15	2016	2	017	2018			
							C003: Year						

#### C003 Year

There is a general trend up that reflects the increase in the number of vehicle-miles traveled. The only significant difference between the two defect types was in 2015, where tire defects had a large increase. Overall, between 2014 and 2018, there was an increase of 214 (18.4%) for brakes and an increase of 103 (10.8%) for tires. The 2016 year was an outlier in most respects, and that has been studied in other analyses, e.g.,:

http://www.safehomealabama.gov/wp-content/uploads/2018/12/AL-Fatality-PPT-Comp-CY2016-w-2014-v08.pdf



Brake issues are over-represented in November and December, while tire issues tend to be clustered in the warmer months of May-July.

#### C006 Day of the Week



Weekends are over-represented in tire issues, while Friday, Tuesday and Wednesday (in that order) are over-represented in brake contributing defects.

Correlated with this is the time of day given next. Rush hours are over-represented with brake problems, whereas late night are most often attributed to tire defects.

# C008 Time of Day

🚦 CA	RE 10.2.0.8 - [IMPACT Result	s - 2014-2018	Alabama Integ	rated Crash D	ata - Veh Defe	cts Brakes vs. \	/eh Defects Tir	es] — 🗆 X
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<b>6</b> 2	2014-2018 Alabama Integrated	Crash Data		~ V	eh Defects Brak	es		✓ ♥ 〒 1/ 1/2014 ∨ 12/31
Order:	Natural Order - As	cending	🖂 🖂 Su	ppress Zero-V	alued Rows	Signif	icance: Over	Representation V Threshold: 2.0
C008:	Time of Day	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County  C002: City
•	12:00 Midnight to 12:59 AM	49	0.75	98	1.84	0.406*	-71.728	C003: Year
	1:00 AM to 1:59 AM	51	0.78	82	1.54	0.505*	-50.018	C004: Month
	2:00 AM to 2:59 AM	43	0.65	53	0.99	0.659	-22.292	C005: Day of the Week
	3:00 AM to 3:59 AM	37	0.56	70	1.31	0.429*	-49.235	C007: Week of the Year
	4:00 AM to 4:59 AM	32	0.49	71	1.33	0.366*	-55.466	C008: Time of Day
	5:00 AM to 5:59 AM	82	1.25	123	2.30	0.541*	-69.526	C009: Data Source
	6:00 AM to 6:59 AM	134	2.04	203	3.80	0.536*	-116.080	C010: Rural or Urban
	7:00 AM to 7:59 AM	436	6.63	269	5.04	1.316*	104.613	C012: Controlled Access
	8:00 AM to 8:59 AM	309	4.70	221	4.14	1.135	36.745	C013: E Highway Side
	9:00 AM to 9:59 AM	259	3.94	228	4.27	0.922	-21.878	C015: Primary Contributing Circumstanc
	10:00 AM to 10:59 AM	316	4.81	258	4.83	0.994	-1.836	C016: Primary Contributing Unit Number
	11:00 AM to 11:59 AM	340	5.17	281	5.26	0.982	-6.170	C017: First Harmful Event
	12:00 Noon to 12:59 PM	466	7.09	314	5.88	1.205*	79.176	C019: E Most Harmful Event
	1:00 PM to 1:59 PM	456	6.93	389	7.29	0.952	-23.218	C020: E Distracted Driving Opinion
	2:00 PM to 2:59 PM	477	7.25	418	7.83	0.926	-37.943	C021: Distance to Fixed Object
	3:00 PM to 3:59 PM	712	10.83	476	8.92	1.214*	125.605	C022: E Type of Roadway Junction/Featu
	4:00 PM to 4:59 PM	604	9.18	410	7.68	1.196*	98.912	C024: School Bus Related
	5:00 PM to 5:59 PM	555	8.44	361	6.76	1.248*	110.276	C025: Crash Severity
	6:00 PM to 6:59 PM	371	5.64	278	5.21	1.083	28.526	C026: Intersection Related
	7:00 PM to 7:59 PM	252	3.83	199	3.73	1.028	6.848	C027: At Intersection
	8:00 PM to 8:59 PM	212	3.22	181	3.39	0.951	-10.978	C028: Mileposted Route
	9:00 PM to 9:59 PM	156	2.37	147	2.75	0.861	-25.093	C029: National Highway System
	10:00 PM to 10:59 PM	136	2.07	123	2.30	0.898	-15.526	C031: Lighting Conditions
	11:00 PM to 11:59 PM	89	1.35	80	1.50	0.903	-9.554	C032: Weather
	Unknown	2	0.03	5	0.09	0.325	-4.160	C033: Locale Y
	) 	1						
								✓ Display
		2014-2018	Alabama Integr	ated Crash Dat	ta - Filter = Veh	Defects Brakes	s vs. Veh Defec	ts Tires
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	0 1	4:00 AM to 4	59 AM 9	00 AM to 9:5	9 AM 2:0	0 PM to 2:59	PM 7:00	PM to 7:59 PM Unknown
					C008: Time	of Dav		

#### C010 Rural or Urban



The county and city results basically reflect the rural-urban over-representations. Clearly urban areas are over-represented in brakes issues, while rural areas have proportionately far more problems with tires.

# **C011 Highway Classification**

🖡 CA	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes vs. Veh Defects Tires] -													
🖡 Ei	le <u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact <u>L</u> oc	ations <u>T</u> ool	ls <u>W</u> indow	<u>H</u> elp					. 8 ×		
<b>6</b> 2	2014-2018 Alabama	Integrated	Crash Data		$\sim$	Veh Defects Bra	akes		~ 9	12 1	/ 1/2014	· v 12/3		
Order	Max Gain	∼ De:	scending	~	uppress Zero-\	Valued Rows	Signi	ficance: Over	Representation	✓ Thres	nold: 2	.0 🜲		
C011:	Highway Classific	ations	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C409: CU Traffi C010: Rural or	c Control Urban		^		
<u>ا ا</u>	Municipal		2990	45.47	797	14.93	3.045*	2008.158	C011: Highway	Classificat				
	State		1206	18.34	770	14.42	1.271*	257.420	C233: CU Point	nt of Initial Impact				
	Private Property		210	3.19	21	0.39	8.117*	184.130	C015: Primary (	Contributin	a Circum	istanc		
	Federal		975	14.83	654	12.25	1.210*	169.323	C050: Has Coo	rdinate				
	County		758	11.53	758	14.20	0.812*	-175.797	C027: At Interse	section	~			
	Interstate		437	6.65	2338	43.80	0.152*	-2443.234	Sort by Sum of	Max Gain				
00	1 🐼 🖉										5	Display		
	2014-2018 Alabama Integrated Crash Data - Filter = Veh Defects Brakes vs. Veh Defects Tires C011: Highway Classifications													
	60 40 등 등 20 0	M	Aunicipal	State	Private P	Property	Federal	County	Interstate					
					C011:	Highway Class	sifications							

🚦 CA	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes AND Not Primary Contributing Circ											
🔋 <u>E</u> i	le <u>D</u> ashboard <u>F</u> ilters <u>A</u> nalysis <u>I</u> n	npact <u>L</u> o	cations	<u>T</u> ools <u>W</u> in	ndow <u>H</u>	elp		_ & ×				
<b>6</b>	2014-2018 Alabama Integrated Crash Data		$\sim$	Veh Defe	ects Brakes			✓ ♥ 1/ 1/2014 ∨ 12/3				
Order	Max Gain V Descending		Suppress Ze	aro-Valued R	ows	Significa	ance: Over	Representation Y Threshold 2.0				
			50pp1055 20			- Ciginici						
COIS	Primary Contributing Circumstance	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds	Max Gain	Cons. Primary Contributing Circumstance				
•	Misjudge Stopping Distance	889	28.38	68	3.78	7.507*	770.576					
	Followed too Close	760	24.26	80	4.45	5.455*	620.678					
	E Ran Traffic Signal	206	6.58	11	0.61	10.753	186.843					
	E Ran Stop Sign	143	4.56	7	0.39	11.730	130.809					
	E Failed to Yield Right-of-Way from Stop Sign	91	2.90	7	0.39	7.465	78.809					
	E Failed to Yield Right-of-Way Making Left	54	1.72	3	0.17	10.336	48.775					
	Unseen Object/Person/Vehicle	89	2.84	25	1.39	2.044*	45.462					
	E Failed to Yield Right-of-Way from Traffic	42	1.34	4	0.22	6.029	35.034					
	Improper Lane Change/Use	56	1.79	17	0.94	1.892	26.394					
	E Other Improper Action	50	1.60	21	1.17	1.367	13.428					
	E Swerved to Avoid Vehicle	97	3.10	58	3.22	0.960	-4.008					
	E Aggressive Operation	67	2.14	75	4.17	0.513*	-63.614					
	DUI	42	1.34	69	3.84	0.350*	-78.165					
	E Ran off Road	147	4.69	157	8.73	0.538*	-126.419					
	E Other - No Improper Driving	82	2.62	141	7.84	0.334*	-163.555					
	Over Speed Limit	69	2.20	157	8.73	0.252*	-204.419					
	E Over Correcting/Over Steering	42	1.34	157	8.73	0.154*	-231.419					
	Driving too Fast for Conditions	207	6.61	741	41.19	0.160*	-1083.469	Sort by Sum of Max Gain				
00	) 🕼 🖉							Display				
			2014-2018	Alabama Int	egrated Cra	sh Data						
			C015: Prin	nary Contrib	uting Circun	nstance						
	60											
	잘 40											
	£ 20											
				-								
	E	E Failed to Yield	l op Sign	EC	ther Improper	Action	EO	ther - No Improper Driving				
	Kight-0	. way non ou		Primary Co	ontributing C	incumetance						
			0013	. Thinking CC	ana ibuunu C	a sumaturiot						

## **C015 Primary Contributing Circumstances**

All attributes with less than 40 cases were removed. DUI and Speed are correlated with faulty tires as opposed to bad brakes.



## C017 First Harmful Event (30 or less removed)

This attribute had the highest total maximum gain.



#### C022 Type of Roadway Junction/Feature

Brakes contribute to more crashes at intersections, while tire defects are more on locations described by Bridge/Overpass/Underpass, Entrance or Exit Ramp, and Off Ramp. This was further confirmed by C026 (not shown), which had an odds ratio for brake-related crashes at intersections to be close to 6 times that of defective tires.

🔋 CA	RE 10.2	2.0.8 - [IMF	PACT Re	sults - 2014-	2018 Alabam	a Integrated	Crash Data	- Veh Defects	s Brakes ANI	) Not E Man	ner of Crash = 14	OR —		×
🔋 Ei	ile <u>D</u>	ashboard	<u>F</u> ilter	s <u>A</u> nalysis	i <u>I</u> mpact	<u>L</u> ocations	Tools	<u>W</u> indow <u>I</u>	<u>H</u> elp				-	₽ ×
<b>6</b>	2014-2	018 Alabam	na Integra	ated Crash Da	ta	$\sim$	Veh [	Defects Brakes	3		~ 5	💡 🌇 1/ 1	1/2014 ~	/ 12/3
Order	Max G	àain	~	Descending	~	Suppres	s Zero-Value	d Rows	Signific	ance: Over	Representation	✓ Threshold	j: 2.0	<b>A</b>
C023:	EMan	ner of Cra	sh		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C023: E Mann	ter of Crash		
•	Rear B	End (front to	rear)		3446	54.56	328	7.09	7.697*	2998.270				
	Side In	mpact (90 d	legrees)		486	7.69	70	1.51	5.086*	390.448				
	Side In	mpact (angl	ed)		335	5.30	158	3.41	1.553*	119.325				
	Angle	(front to side	e) Oppos	ite Direction	132	2.09	43	0.93	2.249*	73.304				
	Causa	l Veh Backi	ing: Rear	rto Side	36	0.57	2	0.04	13.187	33.270				
	Angle	(front to side	e) Same	Direction	105	1.66	61	1.32	1.261	21.733				
	Angle	Oncoming (	(frontal)		89	1.41	50	1.08	1.304	20.748				
	Causa	l Veh Backi	ing: Rear	rto Rear	19	0.30	0	0.00	0.000	19.000				
	Head-	On (front to	front only	y)	113	1.79	83	1.79	0.997	-0.298				
	Sidesv	vipe - Same	Directio	n	236	3.74	177	3.83	0.977	-5.611				
	Sidesv	vipe - Oppo	site Direc	ction	52	0.82	56	1.21	0.680	-24.442				
	Single	Vehicle Cra	ash (all ty	pes)	1267	20.06	3599	77.78	0.258*	-3645.748	Sort by Sum	of Max Gain		
00	1	1												Display
						2014-2	018 Alabama	Integrated Ci	rash Data					
							C023: E Ma	anner of Cras	h					
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		-												
			_											
	<u>S</u>	-												
	edne	50												
	<u>ل</u> ت													
		0												
		0 1		Side Imp (90 degre	act Ar es) O	ngle (front to sid pposite Directio	e) Angl n side) Sa	e (front to me Direction	Causal Veh B Rear to R	acking: ear S	Sideswipe - ame Direction	Single Vehicle Crash (all types)		
							C023	E Manner of	Crash					

# C023 Manner of Crash

This attribute had the fifth highest total Max Gain.

# C025 Crash Severity

🔋 CA	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes vs. Veh Defects Tires] - 🗆 🗙												
E E	ile <u>D</u> ashl	ooard <u>F</u> i	ilters	<u>A</u> nalysis	<u>I</u> mpact <u>L</u> oc	ations <u>T</u> ool	s <u>W</u> indow	<u>H</u> elp				-	₽ ×
<b>6</b>	2014-2018	Alabama Int	egrated	Crash Data		$\sim$	Veh Defects Bra	akes		~ 💡	1/1	/2014 \	/ 12/3
Order	: Natural Ord	ler	~ Asc	ending	<b>⊠</b> s	uppress Zero-\	/alued Rows	Signit	ficance: Over f	Representation ~	Threshold	: 2.0	÷
C025	: Crash Sev	C023: E Manner of C C024: School Bus R	anner of Crash pol Bus Related										
	Fatal Injury			7	0.11	74	1.39	0.077	-84.162	C025: Crash Severit	у		
	Incapacitat	ing Injury		185	2.81	375	7.03	0.400*	-276.971	C026: Intersection F	elated		
	Non-Incap	acitating Inju	JIY	515	7.83	633	11.86	0.660*	-264.807	C028: Mileposted R	oute		
	Possible In	iury		763	11.60	408	7.64	1.518*	260.376	C029: National High	way Syste	em	
	Property D	amage Only		4924	74.88	3772	70.66	1.060*	277.190	C030: Functional Cl	ass		~
	Unknown			182	2.77	76	1.42	1.944*	88.374	Sort by Sum of Max	Gain		
00	) 🐼 🖉												Display
				2014-201	3 Alabama Integ	rated Crash Da C02	ta - Filter = Vel 5: Crash Sever	n Defects Brake ity	es vs. Veh Defe	cts Tires			
	C025: Crash Severity												
		0		Fatal Injury	Incapacitati Injury	ng Non-Inca In	pacitating P ury C025: Crash Se	ossible Injury everity	Property Damage Only	Unknown	-		

# **C028** Mileposted Routes

🖡 CA	RE 10.2.0.8 - [IMPACT Result	ts - 2014-2018	Alabama Integ	rated Crash D	ata - Veh Defeo	ts Brakes ANI	D Not Milepos	ted Route = 257 OR	- 🗆	×
🖳 E	ile <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> ı	mpact <u>L</u> oca	tions <u>T</u> ools	s <u>W</u> indow	<u>H</u> elp			-	8×
<b>*</b>	2014-2018 Alabama Integrated	l Crash Data		~ V	eh Defects Brak	es		~ 💡 😨	1/ 1/2014 $ \smallsetminus $	12/31
Order	: Max Gain 🗸 De	escending	✓ ☑ Su	ppress Zero-V	alued Rows	Signif	icance: Over	Representation V Th	reshold: 2.0	-
C028	Mileposted Route	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C028: Mileposted Rout	e	
•	AL0003	191	8.63	69	2.18	3.951*	142.656			
	AL0001	233	10.52	144	4.56	2.309*	132.109			
	AL0002	131	5.92	61	1.93	3.065*	88.261			
	AL0007	103	4.65	35	1.11	4.200*	78.478			
	AL0053	118	5.33	70	2.22	2.406*	68.956			
	AL0038	107	4.83	57	1.80	2.679*	67.064			
	AL0006	99	4.47	64	2.03	2.208*	54.159			
	AL0042	73	3.30	29	0.92	3.593*	52.682			
	AL0004	61	2.76	22	0.70	3.957*	45.586			
	AL0017	64	2.89	32	1.01	2.855*	41.580			
	AL0016	47	2.12	10	0.32	6.708	39.994			
	AL0059	46	2.08	10	0.32	6.565	38.994			
	AL0075	53	2.39	20	0.63	3.782*	38.987			
	AL0013	76	3.43	58	1.84	1.870*	35.363			
	AL0069	61	2.76	40	1.27	2.177*	32.975			
	AL0005	57	2.57	36	1.14	2.260*	31.777			
	AL0025	54	2.44	35	1.11	2.202*	29.478			
	AL0077	38	1.72	16	0.51	3.390	26.790			
	AL0021	53	2.39	43	1.36	1.759*	22.873			
	AL0012	54	2.44	46	1.46	1.676*	21.771			
	AL0014	34	1.54	20	0.63	2.426*	19.987			
	AL0008	50	2.26	44	1.39	1.622*	19.1/2			
	AL0009	33	1.49	31	0.98	1.519	11.280			
	IN0010	39	1./6	205	6.49	0.272*	-104.630			
	280071	42	1.90	284	8.99	0.211*	-156.980			
	1110020	34	1.54	2/6	8.73	0.1/6"	-159.375			
	INUUSS	107	4.83	529	16.74	0.289	-263.630			
	COUDAIL	001	7.05	019	20.92	0.272	-417.018	Sort by Sum of Max Gai	in	
	s s 2									)isplay I
			:	2014-2018 Ala	bama Integrated	Crash Data				
				C028	: Mileposted Ro	ute				
	40									
	_									
	б а									
	nba. 20									
	0									
		AL0053		AL001/	ALO	)69 ad David-	AL0012	IN0085		
11					CU28: Mileboste	eu Route				

Routes with 30 or less brake-related crashes were removed.

## **C031 Lighting Conditions**

🔋 CA	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes vs. Veh Defects Tires] - 🗆 🗙											
🖡 Ei	ile <u>D</u> ashboard <u>F</u> ilters <u>A</u> nalysis <u>I</u> n	npact <u>L</u> oc	ations <u>1</u>	ools <u>W</u> in	idow <u>H</u> el	р		_ @ X				
<b>6</b>	2014-2018 Alabama Integrated Crash Data		$\sim$	Veh Defe	cts Brakes			✓ ♥ 1/ 1/2014 ∨ 12/3				
Order:	: Max Gain V Descending	✓ Ø Si	uppress Ze	ro-Valued Ro	ows	Significa	ance: Over	Representation V Threshold: 2.0 主				
C031:	Lighting Conditions	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds	Max Gain	C023: E Manner of Crash C024: School Bus Related				
<u> </u>	Daylight	5021	76.35	3870	72.50	1.053*	253.462	C025: Crash Severity				
<u> </u>	E Dark - Continuous Lighting Both Sides of	224	3.41	94	1.76	1.934*	108.199	C027: At Intersection				
<u> </u>	E Dark - Spot Illumination Both Sides of Roa	363	5.52	210	3.93	1.403*	104.296	C028: Mileposted Route				
	E Dark - Spot Illumination One Side of Road	215	3.27	120	2.25	1.454*	67.169	C029: National Highway System				
	Dusk	212	3.22	146	2.74	1.179	32.139	C030: Functional Class				
	E Dark - Continuous Lighting One Side of R	46	0.70	19	0.36	1.965	22.593	C031: Lighting Conditions				
	E Dark - Unknown Roadway Lighting	14	0.21	7	0.13	1.623	5.377	C032: Weather				
	Dark - Roadway Lighted	8	0.12	3	0.06	2.165	4.304	C034: E Police Present at Time of Crast				
	Other	3	0.05	0	0.00	0.000	3.000	C035: Police Notification Delay				
	Not Applicable	4	0.06	3	0.06	1.082	0.304	C036: Police Arrival Delay				
	Unknown	2	0.03	4	0.07	0.406	-2.928	C037: EMS Arrival Delay				
	Dawn	73	1.11	88	1.65	0.673*	-35.409	C038: Adjusted EMS Arrival Delay				
	Dark - Roadway Not Lighted	391	5.95	774	14.50	0.410*	-562.508	Sort by Sum of Max Gain				
0	) 🕸 🖉							🗸 Display				
	2014-2018 /	Alabama Integ	rated Crasł C(	n Data - Filte )31: Lighting	r = Veh Defe Conditions	cts Brakes v	vs. Veh Defeo	xts Tires				
	100											
	50 50											
	E Dark - Continuous Lighting Both Sides of Roadway	E Dark - Spo Illumination One Side of Roadway	ot 1 V	E Dark - Continuous Lighting One Side of Roadway	Dark - F Lig	Roadway hted	Not Applicat	ble Dawn				
/I				C031: Lig	hting Conditi	ons						

These results can be correlated with the urban-rural and other geographic results, but this could be a root cause for those other results.

C032	Weather
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🚦 C/	ARE 10.2.0	0.8 - [IMP/	ACT Resu	lts - 2014-2018	Alabama Integ	rated Crash D	ata - Veh Defe	ects Brakes vs.	Veh Defects Tir	res]	_		ı x
E E	ile <u>D</u> a	shboard	<u>F</u> ilters	<u>A</u> nalysis <u>I</u>	mpact <u>L</u> oca	tions <u>T</u> ools	<u>W</u> indow	<u>H</u> elp					_ 8 ×
6	2014-20	18 Alabama	a Integrate	d Crash Data		~ V	eh Defects Bra	kes		~ 9	12	1/ 1/201	14 ~ 12/31
Order	r: Max Ga	in	~ D	escending	✓ ✓ Si	ippress Zero-V	alued Rows	Signi	ificance: Over	Representation	~ Thre	eshold:	2.0 🛓
C032	: Weathe	ſ		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C029: Nationa C030: Function	I Highway	System	^
•	Clear			4275	65.01	2850	53.39	1.218*	764.022	C031: Lighting	Conditio	ns	
	Cloudy			1269	19.30	1024	19.18	1.006	7.512	C032: Weathe	r		
	Unknow	'n		1	0.02	5	0.09	0.162	-5.160	C033: Locale	Present	at Time (	ofCrash
	Fog			32	0.49	32	0.60	0.812	-7.422	C035: Police N	Votification	n Delay	UI CIASI
	Sleet/H	ail/Freezing	g Rain	3	0.05	9	0.17	0.271	-8.087	C036: Police A	rrival Dela	ау	
	Snow			3	0.05	14	0.26	0.174	-14.247	C037: EMS Arr	ival Delay		
	E Mist			179	2.72	193	3.62	0.753*	-58.761	C038: Adjuste	d EMS Arri	val Dela;	y maga ¥
	Rain			814	12.38	1205	22.57	0.548*	-670.466	Sort by Sum o	f Max Gair		amage
	) 💜 ,	<i>S</i>											🗹 Display
				2014-2018	Alabama Integ	rated Crash Da	ta - Filter = Veł	n Defects Brake	es vs. Veh Defec	cts Tires			
						C	032: Weather						
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		80											
	ac l	60											
	edne	40											
	ů.	20											
		0	and the second s	,	Į	1	1		Į	1 1			
				Clean	clouds	mon	S.	Rain	Snow	E Misi Rain			
					0	ŝ		ail/Fr					
								H/H					
								т. Т					
							C032: Weat	her					

Clear weather leads to significantly more brake-related crashes, while rain is over-represented in tire-defect related crashes.

# C033 Locale

🚦 CA	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes vs. Veh Defects Tires] - 🗆 🗙											
🚦 Ei	ile <u>D</u> ashboard <u>Filters</u>	<u>A</u> nalysis <u>I</u>	mpact <u>L</u> oca	ations <u>T</u> ool	s <u>W</u> indow	<u>H</u> elp				-	∂ ×	
<b>\$</b>	2014-2018 Alabama Integrate	d Crash Data		~ \	/eh Defects Bra	kes		~ 💡	1/ 1	1/2014 ~	/ 12/3	
Order	Max Gain 🗸 D	escending	✓ Ø Si	uppress Zero-V	/alued Rows	Signif	icance: Over	Representation ~	Threshold	j: 2.0	×	
C033		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C201: CU Vehicle M C019: E Most Harm	lost Harm ful Event	ful Even	t 🔺	
<u>۲</u>	Shopping or Business	3195	48.59	713	13.36	3.637*	2316.640	C023: E Manner of	Crash			
	Residential	1693	25.75	700	13.11	1.963*	830.655	C224: CU Estimate	d Speed a	at Impac	t	
	School	105	1.60	24	0.45	3.551*	75.434	C032: Number of W	enicies			
	Manufacturing or Industrial	137	2.08	91	1.70	1.222	24.895	C205: E CU Seque	nce of Eve	ents #2		
	Playground	3	0.05	0	0.00	0.000	3.000	C053: Number of D	rivers Red	corded		
	Other	51	0.78	65	1.22	0.637*	-29.075	C040: Agency ORI			~	
	Open Country	1392	21.17	3745	70.16	0.302*	-3221.548	Sort by Sum of Max	Gain			
0	i 😪 🖉										Display	
		2014-2018	Alabama Integr	ated Crash Da	ta - Filter = Veh C033: Locale	Defects Brake	es vs. Veh Defe	octs Tires				
	Common State	Shopping or Business	Residential	School	Manufacturi or Industrial	g Playgrou	ind Ot	her Open Country				
					C033: Loca	le						

### C038 Adjusted EMS Arrival Delay

🚦 CA	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes AND Not Adjusted EMS Arrival Delay 🛛 🗙										
E E	ile <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> n	npact <u>L</u> oca	ations <u>T</u> ools	s <u>W</u> indow	<u>H</u> elp				_ 8 ×	
<b>6</b> 8	2014-2018 Alabama Integrated	d Crash Data		~ V	/eh Defects Bral	kes		~ 9	1/ 1/20	14 🗸 12/31.	
Order	: Max Gain 🗸 De	escending	✓ Ø St.	uppress Zero-V	alued Rows	Signi	ficance: Over	Representation	✓ Threshold:	2.0	
C038	Adjusted EMS Arrival Delay	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C038: Adjusted	EMS Arrival Dela	ay	
•	0 to 5 minutes	455	27.66	245	13.91	1.988*	226.139				
	6 to 10 minutes	567	34.47	489	27.77	1.241*	110.211				
	11 to 15 minutes	284	17.26	418	23.74	0.727*	-106.466				
	16 to 20 minutes	148	9.00	273	15.50	0.580*	-107.017				
	21 to 30 minutes	121	7.36	218	12.38	0.594*	-82.640				
	31 to 45 minutes	48	2.92	75	4.26	0.685	-22.060				
	46 to 60 minutes	11	0.67	24	1.36	0.491	-11.419				
	61 to 90 minutes	7	0.43	14	0.80	0.535	-6.078				
	91 to 120 minutes	3	0.18	1	0.06	3.212	2.066				
	Over 180 minutes	1	0.06	2	0.11	0.535	-0.868	Sort by Sum of	Max Gain		
	) @ <i>\$</i>							, 		Display I	
				2014 2010 01-	hama letaerata	Crack Data					
				2014-2016 Aldi		Crash Data					
				CU38: Adjt	Isted EMS Arriv	ai Delay					
	40										
	ê –										
	en 20 -										
	<u></u> б										
	0							1			
	v 1	6 to 10 minut	tes 16	to 20 minutes	s 31 to 4	5 minutes	61 to 90 m	inutes Over	180 minutes		
				C038:	Adjusted EMS	Arrival Delay					

This result seems consistent to the facts that tire-defect related crashes (blue bars) are more severe and the also occur more in rural areas. Perhaps the more severe crashes lead to a greater sense of urgency, but this is just speculation. See C224 for speed severity metrics. The more general cross-tabulation below shows the overall relationship between ambulance delay times and severity.

CARE 10.2.1.0	CARE 10.2.1.0 - [Crosstab Results - 2014-2018 Alabama Integrated Crash Data - Filter = Severity EMS Called] — 🗆 🗙										
🚦 <u>F</u> ile <u>D</u> ashb	board <u>F</u> ilters	<u>A</u> nalysis <u>C</u> rossta	b <u>L</u> ocations <u>1</u>	ools <u>W</u> indow	<u>H</u> elp			-	₽ ×		
2014-2018	Alabama Integrated	Crash Data	$\sim$	Severity EMS Called	1	~	9	1/	1/2014		
Suppress Zero Va	lues: Rows and Co	olumns V Select	Cells: 🔳 🗸 🚿	9	Column: Ci	rash Severity ; Row	EMS Arriv	al Delay	<b>@</b>		
	Fatal Injury	Incapacitating Injury	Non- Incapacitating Inju	Possible Injury	Property Damage Only	TOTAL					
0 to 5 minutes	617	5193	11197	14535	13415	44957					
otoominutes	16.27%	18.98%	23.67%	27.15%	31.41%	25.73%					
6 to 10 minutes	1120	7954	14681	17578	13892	55225					
o to to minutes	29.54%	29.06%	31.03%	32.83%	32.52%	31.61%					
11 to 15 minutes	850	5863	8673	8797	7111	31294					
TT to 15 minutes	22.42%	21.42%	18.33%	16.43%	16.65%	17.91%					
16 to 20 minutes	469	3353	5055	4874	3500	17251					
to to 20 minutes	12.37%	12.25%	10.68%	9.10%	8.19%	9.87%					
21 to 30 minutes	442	3187	4669	4440	2880	15618					
2110 30 minutes	11.66%	11.65%	9.87%	8.29%	6.74%	8.94%					
31 to 45 minutes	156	1210	1879	2147	1174	6566					
51 to 45 minutes	4.11%	4.42%	3.97%	4.01%	2.75%	3.76%					
46 to 60 minutes	42	261	577	640	358	1878					
40 10 00 minutes	1.11%	0.95%	1.22%	1.20%	0.84%	1.07%					
61 to 90 minutes	30	203	376	363	228	1200					
or to so minutes	0.79%	0.74%	0.79%	0.68%	0.53%	0.69%					
91 to 120 minutes	13	57	83	66	47	266					
51 to 120 minutes	0.34%	0.21%	0.18%	0.12%	0.11%	0.15%					
121 to 180	12	47	80	60	56	255					
minutes	0.32%	0.17%	0.17%	0.11%	0.13%	0.15%					
Over 180 minutes	41	39	40	38	55	213					
over too minutes	1.08%	0.14%	0.08%	0.07%	0.13%	0.12%					
τοτοι	3792	27367	47310	53538	42716	174723					
TOTAL	2.17%	15.66%	27.08%	30.64%	24.45%	100.00%					

#### Cross-tabulation Severity by Ambulance Arrival Time for <u>All Crashes</u>

This cross-tabulation considers all crashes for which an EMS unit was called. For these crashes, "Property Damage Only" represents the number of crashes in which EMS were called but no one was found to have any injury; so this could be renamed: no injury. Note how the numbers and proportions in this column go down with increases in the arrival times above 10 minutes. The probability of a crash being fatal increases by 50% with an arrival of 6-10 minutes. For arrivals from 11 to 90 minutes, the probability doubles. For 91-180 minutes it goes up by a factor of 3.5; and this factor increases to 14 for arrival times over 180 minutes.

# **C052** Number of Vehicles

🚦 CA	🖡 CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes vs. Veh Defects Tires] - 🛛 🗙												
🚦 Ei	le <u>D</u> ashboard <u>F</u> ilter	s <u>A</u> nalysis <u>I</u>	mpact <u>L</u> oc	ations <u>T</u> ool	s <u>W</u> indow	<u>H</u> elp		-	₽ ×				
¢?	2014-2018 Alabama Integra	ted Crash Data		~ \	/eh Defects Bra	ikes		✓ ♥ 1/ 1/2014	/ 12/3				
Order:	Natural Order 🗸 🗸	Ascending	🗸 🖂 Si	uppress Zero-\	/alued Rows	Signit	ficance: Over f	Representation V Threshold: 2.0	-				
C052:	Number of Vehicles	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C201: CU Vehicle Most Harmful Even C019: E Most Harmful Event	it ^				
•	1 Vehicle	1458	22.17	3832	71.79	0.309*	-3262.725	C023: E Manner of Crash					
	2 Vehicles	4512	68.61	1351	25.31	2.711*	2847.673	C224: CU Estimated Speed at Impac	t				
	3 Vehicles	516	7.85	129	2.42	3.247*	357.082	C032: Number of Venicles					
	4 Vehicles	67	1.02	18	0.34	3.021	44.825	C205: E CU Sequence of Events #2					
	5 Vehicles	17	0.26	3	0.06	4.600	13.304	C053: Number of Drivers Recorded					
	6 Vehicles	3	0.05	4	0.07	0.609	-1.928	C040: Agency ORI					
	7 Vehicles	2	0.03	0	0.00	0.000	2.000	C002 <sup>-</sup> City	~				
	8 Vehicles	1	0.02	0	0.00	0.000	1.000	Sort by Sum of Max Gain					
00	) 😪 🖉								Display				
		2014-2018	Alabama Integr	ated Crash Da C052:	ta - Filter = Veh Number of Veh	) Defects Brake icles	es vs. Veh Defe	cts Tires					
	100												
	100												
	<u>ک</u>												
	B 50												
	Ĕ												
	0												
		IVehicle 2V	ehicles 3 V	ehicles 4	/ehicles 5	Vehicles 6	Vehicles 7	Vehicles 8 Vehicles					
				C	)52: Number of	Vehicles							

This attribute had the 7<sup>th</sup> largest total Max Gain.

### **C060** Number Injured (Includes Fatalities)

🖡 CA	CARE 10.2.1.0 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes vs. Veh Defects Tires] - 🛛 🗙												
🖳 Ei	le <u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	<u>I</u> mpact	<u>L</u> ocations	Tools <u>W</u> ind	ow <u>H</u> elp					-	₽×
<b>6</b>	2014-2018 Alabama	a Integrated C	Crash Data	1	$\sim$	Veh Defects	Brakes		~ 9	1/ 1/2014	4 ~ 12/31/20	)18 🗸	• •
Order	Max Gain	<ul> <li>✓ Desc</li> </ul>	cending	~	Suppress Z	ero-Valued Row	s	Si	ignificance: Over	r Representation	✓ Thresh	iold: 2.0	) 🛊
C060:	Number Injured (	Includes Fat	alities) Free	Subset quency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C057: Numbe C058: Numbe	of Pedestriater of Pedacycl	ans lists	^
•	No Injuries			5080	77.2	5 38	44 72.0	1.073*	344.492	C059: Numbe	er Injured (No	n-Fatal)	
	1 Injury			1090	16.5	3 10	87 20.36	0.814*	-249.099	C060: Numbe	er Injured (Inc	ludes Fat	aliti
	2 Injuries			289	4.3	9 2	68 5.02	. 0.875	-41.155	C061: Numbe	er of Railroad	Trains	
	3 Injuries			79	1.2	ו	67 1.20	0.957	-3.539	C063: Has Ra	ailroad Cross	ing Num	ber
	4 Injuries			26	0.4	)	39 0.73	0.541*	-22.045	C080: CMV In	volved		
	5 Injuries			6	0.0	9	11 0.2	0.443	-7.551	C081: E Has	Truck Bus Su	pplement	t
	6 Injuries			2	0.0	3	9 0.17	0.180	-9.087	C101: Causa C102: CU No	n-Motorist Ind	pe dicator	
	7 Injuries			1	0.0	2	6 0.1	0.135	-6.392	C103: CU Co	mmercial Mo	tor Vehicle	e Inc
	9 Injuries			1	0.0	2	2 0.04	0.406	-1.464	C104: CU Lef	t Scene		
	10 Injuries			1	0.0	2	1 0.02	0.812	-0.232	C105: CU Dri	ver Age Rang	e 1	~
	13 Injuries			1	0.0	2	0 0.00	0.000	1.000	Sort by Sum	of Max Gain		
0	) 💱 🖉									E	Display Filte	er Name	
				2014-20	18 Alabama Inte	grated Crash Da C060: Number	ata - Filter = Veh De Injured (Includes F	fects Brakes vs. Ve atalities)	eh Defects Tires				
	100												
	~												
	50 50 0												
			11	Injury	3 In	juries	5 Injuries	7 Inj	uries	10 Injuries			
						C060: Nu	mber Injured (Inclue	es Fatalities)					

Tire-defect related crashes are over-represented in the one-injury and most of the multiple-injury categories as well. There is little doubt that these crashes are more severe, and one reason is the increased speeds of impact (see C224).

# C101 Causal Unit (CU) Type

🚦 CA	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes AND Not Causal Unit (CU) Type = 21										
₿ E	ile <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> r	mpact <u>L</u> oca	tions <u>T</u> ools	<u>W</u> indow	<u>H</u> elp				_ 8 ×	
<b>6</b>	2014-2018 Alabama Integrated	Crash Data		~ V	eh Defects Brak	(es		~ 9	1/ 1/2	014 ~ 12/31	
Order	: Max Gain V De	scending	✓ 🗸 Su	ppress Zero-V	alued Rows	Signif	icance: Over	Representation	✓ Threshold:	2.0 🛓	
C101	: Causal Unit (CU) Type	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C101: Causal	Unit (CU) Type		
•	Passenger Car	3247	49.75	2330	44.09	1.129*	369.880				
	E Mini-van	165	2.53	87	1.65	1.536*	57.571				
	Pick-Up (Four-Tire Light Tr	1276	19.55	999	18.90	1.034	42.419				
	E Cargo Van (10000 lbs or	54	0.83	29	0.55	1.508	18.190				
	E Single-Unit Truck (2-Axle	102	1.56	76	1.44	1.087	8.154				
	E Other Passenger Vehicle	13	0.20	4	0.08	2.632	8.061				
	E Other Heavy Truck (Can	19	0.29	9	0.17	1.710	7.887				
	Station Wagon	22	0.34	15	0.28	1.188	3.478				
	E Passenger Van	16	0.25	22	0.42	0.589	-11.166				
	E Truck (6 or 7) with Trailer	17	0.26	32	0.61	0.430	-22.514				
	E Single-Unit Truck (3 Axle	70	1.07	79	1.49	0.718	-27.550				
	Motorcycle	57	0.87	69	1.31	0.669	-28.202				
	E Sport Utility Vehicle (SUV)	1251	19.17	1065	20.15	0.951	-64.079				
	E Tractor/Semi-Trailer	217	3.33	463	8.76	0.380*	-354.720	Sort by Sum o	f Max Gain		
	) 🗞 🖉									Display	
			:	2014-2018 Alal	bama Integrated	l Crash Data					
				C101: C	ausal Unit (CU)	) Туре					
	60										
	. 40										
	eu cy										
	nbe										
	L 20										
	0		No. al a Huit To	In the CD And Int	C Time)	E Tauris A	C				
		ES	single-Unit Tr	UCK (2-Axle/	b-Tire) M. Coupol I I-it	E Truck (	6 or 7) with 1	railer			

The unit types at the top (e.g., Passenger Car, Mini-van and Pick-Up) are more inclined to brake problems. Those with Odds Ratios less than 1.000 are over-represented in tire problems (e.g., Tractor/Semi-Trailers and SUVs).

#### C107 CU Driver Raw Age



Collectively, the age group from 16-20 is significantly over-represented in brake faults. We suspect this is because they are driving cars of model year much older than other ages. This is confirmed by the cross-tabulation of two age ranges (16-20 and 21-25) by model year given below. It is obvious that they are driving significantly older vehicles.

2014-2018	Alabama Integrated C	rash Data	$\sim$	Veh Def Age by Model Yr	
Suppress Zero Va	Iues: Rows and Col	umns 🗸 Select	Cells: 🔳 🗸 🛞	Column: CU Driver Age Range 2 ; Row: CU Model Year	
	16 to 20 Years	21 to 25 Years	TOTAL		^
1000	1870	1503	3373	1	
1330	1.64%	1.50%	1.57%		
1997	2797	2009	4806	]	
1337	2.45%	2.00%	2.24%		
1998	3256	2510	5766		
	2.85%	2.50%	2.69%		
1999	4288	3147	7435		
	3.76%	3.13%	3.46%		
2000	5441	4064	9505		
	4.77%	4.04%	4.43%		
2001	5795	4180	9975		
	5.08%	4.16%	4.65%	-	
2002	6698	5029	11727		
	5.8/%	5.00%	5.46%	-	
2003	7488	5602	13090		
	6.56%	5.5/%	6.10%	-	
2004	7922	6095	14017	-	
	6.94%	6.06%	6.53%	-	
2005	8224	6585	14809		
	7.20%	6.55%	6.90%		
2006	8129	/000	15129		
	/.12%	6.96%	7.05%		
2007	8136	/252	15388		
	/.13/6	/.21%	12052	-	
2008	5 00°/	6231	6.02%		
	3.03%	0.20%	0.03%		
2009	3.54%	4040	3.77%		
	4457	4520	0077		
2010	3.90%	4.50%	4 18%		
	4278	4359	8637		
2011	3.75%	4 34%	4 02%		
	4886	5026	9912		
2012	4.28%	5.00%	4.62%		
	4675	5100	9775		
2013	4.09%	5.07%	4.55%		
0011	4021	4540	8561		
2014	3.52%	4.52%	3.99%		
2015	3138	3805	6943		
2015	2.75%	3.79%	3.23%	1	
2016	2113	2668	4781	1	
2010	1.85%	2.65%	2.23%		
2017	1183	1533	2716		
2017	1.04%	1.53%	1.26%		
2018	356	518	874		
2010	0.31%	0.52%	0.41%		
2019	11	34	45		
2010	0.01%	0.03%	0.02%		
ΤΟΤΑΙ	114185	100523	214708		
	53.18%	46.82%	100.00%		~

# Cross-tabulations of driver age (for 16-20 and 21-25) by Model year

#### C109 CU Driver Gender



Females are more prone to brake faults, while Males are over-represented in tire faults.

#### C110 Driver Residence Distance



Shorter trips are correlated with brake defects, while longer trips are correlated with tire defects.

# C121 CU Driver Condition

🚦 C/	CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes AND Not CU Driver Condition = 7 OR 🛛 🗙											
B E	ile <u>D</u> ashboard <u>F</u>	ilters	<u>A</u> nalysis <u>I</u>	mpact <u>L</u> oca	ations <u>T</u> ools	<u>W</u> indow	<u>H</u> elp				-	∂ ×
<b>6</b>	2014-2018 Alabama In	tegrated	Crash Data		~ V	eh Defects Bra	kes		~	7 😨 1/	1/2014 $ \smallsetminus$	12/31
Order	r: Max Gain	~ Des	scending	~	ippress Zero-V	alued Rows	Signi	ficance: Over	Representation	✓ Thresho	ıld: 2.0	÷
C121	: CU Driver Condition		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C121: CU Dri	iver Condition		
•	Apparently Normal		6262	98.17	4927	97.06	1.011*	70.248				
	E Physical Impairment		13	0.20	2	0.04	5.172	10.487				
	E Asleep/Fainted/Fati	igued	19	0.30	12	0.24	1.260	3.920				
	Illness		4	0.06	6	0.12	0.530	-3.540				
	E Emotional (Depresse	ed/A	17	0.27	20	0.39	0.676	-8.134				
	E Under the Influence	of Al	64	1.00	109	2.15	0.467*	-72.980	Sort by Sum	of Max Gain		
	D 😪 🖉											)isplay
					2014-2018 Ala	bama Integrate	d Crash Data					
					C121:	- CU Driver Con	dition					
	> 100											
	<u> </u>											
	Free											
	0—		ŧ	Į			1	28	a a			
			Y Norr	E.		2 Fait	1	Emotio	dilleno.			
			parent	100		Faile		E Angryff	Allot			
			₹	E Pły		186 86		1	E Leg			
								(Dep				
					C12	1: CU Driver C	ondition					

This confirms the findings of C015 and the other alcohol and drug test results given below. ID/DUI is more correlated with defective tires than with defective brakes. This is probably because ID is correlated with rural driving.

### C122 CU Drivers Officer Opinion Alcohol



Further confirming C121 above.

#### 🚦 CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes AND Not CU Driver Officer Opinion D... File Dashboard Filters Analysis Impact Locations Tools Window <u>H</u>elp 2014-2018 Alabama Integrated Crash Data Veh Defects Brakes 1/ 1/2014 ~ 9 12 Order: Max Gain Descending Over Representation $\sim$ $\sim$ Suppress Zero-Valued Rows Significance: Threshold: C123: CU Driver Officer Opinion Drugs Value Frequency Odds Ratio C123: CU Driver Officer Opinion Drugs Subset Other Other Max Percent Percent Frequency Gain No - Driver Was Not Under 6303 99.67 4987 99.18 1.005\* 30.568 Yes - Driver Was Under Inf. 21 0.33 41 0.82 0.407\* -30.568 Sort by Sum of Max Gain 📋 🕼 | 🗞 🖉 2014-2018 Alabama Integrated Crash Data C123: CU Driver Officer Opinion Drugs 100 Frequency 50 0

 $\times$ 

∂ x

12/31

2.0 ÷

Display

## C123 CU Drivers Officer Opinion Drugs

Further confirmation for drugs. Recall that an under-representation in the lower lines indicates an over-representation for tire defects.

No - Driver Was Not Under Influence of Yes - Driver Was Under Influence of Drugs C123: CU Driver Officer Opinion Drugs

## C125 CU Vehicle Maneuvers

🔋 CA	RE 10.2.0.8 - [IMPACT Result	s - 2014-2018	Alabama Integ	rated Crash D	ata - Veh Defe	cts Brakes vs. V	Veh Defects Tir	es] — 🗆 X
🔋 Ei	le <u>D</u> ashboard <mark>Filters</mark>	<u>A</u> nalysis <u>I</u> r	npact <u>L</u> oca	tions <u>T</u> ools	s <u>W</u> indow	<u>H</u> elp		_ & ×
۴	2014-2018 Alabama Integrated	Crash Data		~ V	/eh Defects Brak	(es		✓ ♥ 1/ 1/2014 ∨ 12/31
Order	Max Gain V De	scending	✓ ✓ Su	ppress Zero-V	alued Rows	Signif	icance: Over	Representation V Threshold: 2.0
C129:	CU Vehicle Maneuvers	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C119: E CU Endorsement Violations #2 C120: E CU Driver Employment Status
•	Slowing/Stopping	1376	20.99	109	2.04	10.280*	1242.149	C121: CU Driver Condition
	Turning Left	286	4.36	86	1.61	2.708*	180.393	C122: CU Driver Officer Opinion Alcohol
	Turning Right	231	3.52	77	1.44	2.443*	136.445	C124: CU Driver Alcohol Test Type Given
	Backing	132	2.01	4	0.07	26.873	127.088	C125: E CU Driver Drug Test Type Given
	Other	127	1.94	42	0.79	2.462*	75.425	C126: CU Driver Alcohol Test Results
	E Entering Main Road	77	1.17	23	0.43	2.726*	48.756	C127: E CU Driver Drug Test Results
	E Stopped for Sign/Signal	44	0.67	1	0.02	35.831	42.772	C129: CU Vehicle Maneuvers
	Legally Parked	23	0.35	0	0.00	0.000	23.000	C130: E CU Non-Motorist Maneuvers
	Stopped in Traffic	25	0.38	5	0.09	4.072	18.860	C201: CU Vehicle Most Harmful Event
	Making U-Tum	7	0.11	2	0.04	2.850	4.544	C202: CU Contributing Circumstance
	E Leaving Main Road	35	0.53	25	0.47	1.140	4.300	C203. CO First Harmul Event Eccation
	P Start in Traffic	2	0.03	0	0.00	0.000	2.000	C205: E CU Sequence of Events #2
	E Changing Lanes	86	1.31	71	1.33	0.986	-1.187	C206: E CU Sequence of Events #3
	Unknown	6	0.09	9	0.17	0.543	-5.052	C207: E CU Sequence of Events #4
	Illegally Parked	3	0.05	10	0.19	0.244	-9.280	C208: CU Model Year
	E Overtaking/Passing	19	0.29	42	0.79	0.368	-32.575	C210: CU Body (Passenger Cars Only)
	E Negotiating a Curve	204	3.11	679	12.72	0.245*	-629.804	C211: E CU Owners State 🗸 🗸
	Movement Essentially Strai	3872	59.07	4153	77.80	0.759*	-1227.834	Sort by Sum of Max Gain
00	) @ <i>9</i>							🗌 Display
			1	2014-2018 Alal	bama Integrated	l Crash Data		
				C129: C	U Vehicle Mane	euvers		
	100							
	_							
	-							
	-							
	≩ — <b>_</b>							
	° 50 − 50 − 50 − 50 − 50 − 50 − 50 − 50							
i	E _							
	_							
	0		Other		Making	U-Turn		llegally Parked
			othor	C1	29: CU Vehicle	Maneuvers		angany i uniou
				01	20. CO Venicle	maneuvers		

Several maneuvers at the top correlate with bad brakes. Bad tires show significant over-representation when negotiating a curve, and also Movement Essentially Straight.

## C204 CU Sequence of Events #1

🚦 CA	RE 10.2.0.8 - [IMPACT Result	s - 2014-2018 A	Alabama Integ	rated Crash D	ata - Veh Defe	cts Brakes AN	D Not E CU Se	quence of Events	s #1 — 🗆	×	
🖡 Ei	ile <u>D</u> ashboard <u>F</u> ilters	<u>A</u> nalysis <u>I</u> r	mpact <u>L</u> oca	tions <u>T</u> ools	Window	<u>H</u> elp				- 8 ×	
😵 2014-2018 Alabama Integrated Crash Data 🗸 Veh Defects Brakes 🗸 🌱 🛐 1/ 1/2014 🗸 12/31											
Order	: Max Gain 🗸 De	scending	✓ 🗸 Su	ppress Zero-V	alued Rows	Signit	ficance: Over	Representation	✓ Threshold:	2.0 🜲	
C204:	ECU Sequence of Events #	1 Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C204: E CU 8	Sequence of Events	#1	
•	Collision with Vehicle in Tra	4135	64.09	485	9.44	6.792*	3526.202				
	Ran Off Road Straight	163	2.53	23	0.45	5.646*	134.129				
	Collision with Parked Motor	150	2.32	37	0.72	3.230*	103.556				
	Collision with Vehicle in (or	97	1.50	11	0.21	7.025	83.192				
	Downhill Runaway	44	0.68	0	0.00	0.000	44.000				
	Collision with Other Fixed O	60	0.93	13	0.25	3.677	43.682				
	Collision with Utility Pole	40	0.62	15	0.29	2.124	21.171				
	Fire/Explosion	45	0.70	22	0.43	1.630	17.384				
	Collision with Tree	27	0.42	14	0.27	1.536	9.426				
	Collision with Other Post/P	11	0.17	3	0.06	2.921	7.234				
	Collision with Fence	16	0.25	10	0.19	1.275	3.447				
	Collision with Curb/Island/	58	0.90	46	0.89	1.004	0.258				
	Collision with Sign Post	14	0.22	14	0.27	0.797	-3.574				
	Collision with Mailbox	10	0.15	14	0.27	0.569	-7.574				
	Evasive Action (Swerve/Br	435	6.74	367	7.14	0.944	-25.678				
	Collision with Ditch	25	0.39	41	0.80	0.486*	-26.465				
	Overtum/Rollover	30	0.46	49	0.95	0.488*	-31.507				
	Collision with Guardrail Face	12	0.19	39	0.76	0.245	-36.955				
	Collision with Other Non-Fix	18	0.28	45	0.88	0.319	-38.486				
	Collision with Concrete Barr	22	0.34	106	2.06	0.165*	-111.057				
	Crossed Centerline	70	1.08	183	3.56	0.305*	-159.711				
	Other Non-Collision	23	0.36	172	3.35	0.107*	-192.904				
	Ran Off Road Left	178	2.76	716	13.93	0.198*	-720.761				
	Ran Off Road Right	377	5.84	1003	19.51	0.299*	-882.019				
	Vehicle Defect/Componen	392	6.08	1707	33.21	0.183*	-1750.717	Sort by Sum	of Max Gain	]	
00	1 av 9									Display	
			:	2014-2018 Alat	oama Integrated	d Crash Data					
				C204: E CU	Sequence of E	Events #1					
	80										
	60										
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	°anger 40										
L	20										
	0	Downhill Runav	way (	Collision with Othe	er E	Evasive Action	Col	lision with	Vehicle Defect/Component	ent	
	Post/Pole/Support (Swerve/Brake) Concrete Barrier Failure										
11				C204: E	CU Sequence	of Events #1					

Items with less than 10 occurrences were removed. This attribute had the second highest total Max Gain.

### C208 CU Model Year

🔋 CA	🔋 CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes vs. Veh Defects Tires] - 🗆 🗙												
🖡 Ei	ile <u>D</u> ashboard	<u>F</u> ilters	<u>A</u> nalysis	Impact	ocations <u>T</u> o	ols <u>W</u> indov	v <u>H</u> elp					-	đх
<b>6</b>	😵 2014-2018 Alabama Integrated Crash Data 🗸 Veh Defects Brakes 🗸 🌱 😨 1/ 1/2014 🗸 12/31												
Order	Natural Order	~ As	cending	~	Suppress Zero	-Valued Rows	Si	gnificance: 0	ver Repre	sentation	✓ Thresho	ld: 2.0	
C208:	CU Model Year		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	^ C1	19: E CU E 20: E CU E	Endorsement V Driver Employm	iolations ient Stat	s#2 ∧ us
	1982		10	0.1	5 4	0.07	2.030	5.075	C1	21: CU Dri	ver Condition		
	1983		16	0.2	4 2	0.04	6.497	13.537		22: CU Dri 23: CU Dri	ver Officer Opir	IION AICO	nol
	1984		18	0.2	7 6	0.11	2.436	10.612		24: CU Dri	ver Alcohol Tes	t Type G	iven
	1985		19	0.2	9 4	0.07	3.858	14.075	C1	25: E CU [	Driver Drug Tes	t Type Gi	iven
	1986		28	0.4	3 12	0.22	1.895	13.224	C1	26: CU Dri	ver Alcohol Tes	t Result	s
	1987		23	0.3	5 11	0.21	1.698	9.455		27: E CU [	Driver Drug Tes	t Results	S
	1988		38	0.5	8 20	0.37	1.543	13.373		28. CU Vel 29: CU Vel	hicle Maneuver	s el Direci	uon
	1989		49	0.7	5 29	0.54	1.372	13.291	C1	30: E CU N	Von-Motorist Ma	aneuvers	s
	1990		55	0.8	4 33	0.62	1.354	14.365	C2	01: CU Vel	hicle Most Harr	nful Ever	nt
	1991		67	1.0	2 30	0.56	1.814*	30.059	C2	02: CU Co	ntributing Circu	umstanc	e
	1992		79	1.2	0 36	0.67	1.782*	34.671		03: CU Fin	st Harmful Ever	nt Locati	on
	1993		114	1.7	3 42	0.79	2.204*	62.283		04: E CU 8 05: E CU 8	Sequence of Ev	ents #1	
	1994		154	2.3	4 89	1.67	1.405*	44.409		06: E CU S	Sequence of Ev	ents #3	
	1995		200	3.0	4 98	1.84	1.657*	79.327	C2	07: E CU S	Sequence of Ev	ents #4	
	1996		195	2.9	7 99	1.85	1.600*	73.095	C2	08: CU Mo	del Year		
•	1997		264	4.0	2 153	2.87	1.401*	75.602	C2	09: CU Ma	ke t (Decentration	0	-1.3
	1998		261	3.9	7 183	3.43	1.158	35.661		10: CU B0	dy (Passenger )woore State	Cars Or	nly)
	1999		313	4.7	6 278	5.21	0.914	-29.318		12: CU Lid	ense Tao State	÷	
	2000		364	5.5	4 315	5.90	0.938	-23.878	C2	13: CU Vel	nicle Usage		
	2001		401	6.1	0 331	6.20	0.984	-6.580	C2	14: E CU E	Emergency Stat	us	
	2002		428	6.5	1 304	5.70	1.143	53.667	C2	15: E CU F	Placard Require	ed	
	2003		424	6.4	5 361	6.76	0.954	-20.521		16: E CU F	lacard Status		
	2004		407	6.1	9 355	6.65	0.931	-30,133		Fort by Sum	of Max Gain		*
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					2014-2018 A	labama Integra	ted Crash Dat	а					
					C:	208: CU Model	Year						
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			19	86		1996		2006			2016		
	C208: CU Model Year												

Brakes are problematic up through the 1998 model year. Neither defect type until model year 2008, and from that point forward, defective tires are over-represented.

#### 🚦 CARE 10.2.0.8 - [IMPACT Results - 2014-2018 Alabama Integrated Crash Data - Veh Defects Brakes AND Not CU Estimated Speed at Im... $\times$ <u>File</u> <u>D</u>ashboard đх <u>Filters</u> <u>Analysis</u> <u>Impact</u> <u>Locations</u> Tools <u>W</u>indow <u>H</u>elp 2014-2018 Alabama Integrated Crash Data Veh Defects Brakes 1/2014 $\sim$ 12 Order: Max Gain Descending ÷ ~ Suppress Zero-Valued Rows Significance: Over Representation Threshold: 2.0 C224: CU Estimated Speed at Im C224: CU Estimated S ed at Imnac Subset Odds Ratio Subset Other Other Max Percent Percent Frequency Gain equency 1 to 5 MPH 345 0.59 322.552 9.08 25 15.369\* 6 to 10 MPH 320 8.42 37 0.87 9.632\* 286.777 11 to 15 MPH 383 10.08 46 1.09 9.273\* 341.696 342 16 to 20 MPH 9.00 72 1.70 5.290\* 277.350 21 to 25 MPH 337 8.87 89 2.10 4.217\* 257.085 26 to 30 MPH 380 10.00 133 3.14 3.182\* 260.577 10.47 215 5.08 204.947 31 to 35 MPH 398 2.062\* 36 to 40 MPH 355 9.34 4.73 1.977\* 175.416 200 41 to 45 MPH 386 10.16 379 8.96 1.134 45.688 46 to 50 MPH 142 3.74 256 6.05 0.618\* -87.868 185 4.87 565 13.35 0.365\* -322.325 51 to 55 MPH 56 to 60 MPH 73 1.92 371 8.77 0.219\* -260.129 -526.811 61 to 65 MPH 73 1.92 668 15.78 0.122\* 66 to 70 MPH 55 1.45 978 23.11 0.063\* -823.166 71 to 75 MPH 15 0.39 116 2.74 0.144 -89.159 76 to 80 MPH 5 0.13 57 1.35 0.098 -46.181 81 to 85 MPH 2 0.05 12 0.28 0.186 -8.775 4 86 to 90 MPH 3 0.08 0.09 0.835 -0.592 91 to 95 MPH 1 0.03 0.02 0.102 1 1.114 Sort by Sum of Max Gain 📋 🕼 🚳 🖉 Display 2014-2018 Alabama Integrated Crash Data C224: CU Estimated Speed at Impact 30 20 Frequency 10 0 21 to 25 MPH 46 to 50 MPH 71 to 75 MPH C224: CU Estimated Speed at Impact

### C224 CU Estimated Speed at Impact

This attribute had the 6<sup>th</sup> highest total Max Gain.

C233	CU I	Point	of I	nitial	Impact
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CA	ARE 10.2.0.8 - [IMP/	ACT Res	ults - 201	4-2018 Ala	bama Integr	ated Crash Da	ta - Veh Defe	ts Brakes vs.	Veh Defects 1	[ires] — □ ×			
E E	ile <u>D</u> ashboard	<u>F</u> ilters	<u>A</u> naly	/sis <u>I</u> mp	act <u>L</u> ocat	ions <u>T</u> ools	<u>W</u> indow	<u>H</u> elp		- 8	×		
<b>*</b>	2014-2018 Alabama	a Integrat	ed Crash	Data	\ \	Ve	h Defects Brak	es		✓ ♀ 1/ 1/2014 ∨ 1.	2/3		
Order	- Max Gain		Descendir	20			luad Paura	Signifi	opposi Over	Representation y Thurshold 20			
Order		Ť.	Descendi			press zero-va	lueu nows	Signin	cance. Over				
C233	: CU Point of Initia	l Impact		Subse Frequenc	t Subs V Percer	et Other nt Frequency	Other Percent	Odds Ratio	Max Gain	C409: CU Traffic Control C010: Rural or Urban	^		
•	Area 12 - Head On	Center		490	2 74.5	54 1929	36.14	2.063*	2525.622	C011: Highway Classifications			
	Area 6 - Rear End	Center		21	5 3.2	27 195	i 3.65	0.895	-25.225	C233: CU Point of Initial Impact			
	Area 9 - Broadside	Left		8	2 1.2	25 98	1.84	0.679*	-38.728	C230: CU Areas Damaged #1			
	Area 13 - Top			1	9 0.2	29 54	1.01	0.286	-47.524	C050: Has Coordinate			
	E Area 10			6	4 0.9	93 93	3 1.74	0.559*	-50.569	C027: At Intersection			
	E Area 2			7	2 1.(	)9 102	2 1.91	0.573*	-53.656	C413: E CU Turn Lanes			
	Unknown			3	2 0.4	19 84	1.57	0.309*	-71.481	C021: Distance to Fixed Object			
	E Area 4			5	0 0.7	76 101	1.89	0.402*	-74.424	C018: Location First Harmful Event Rel t			
	Area 3 - Broadside	Right		6	1 0.9	93 128	3 2.40	0.387*	-96.686	C206: E CU Sequence of Events #3			
	E Area 8			5	1 0.7	78 125	5 2.34	0.331*	-102.990	C411: CU Opposing Lane Separation			
	Area 5 - Right Rea	r Angle		5	3 0.8	31 166	3.11	0.259*	-151.499	C036: Police Arrival Delay			
	Area 15 - Attachme	ent		7	4 1.1	13 184	3.45	0.326*	-152.674	C203: CO First Harmful Event Location			
	Area 7 - Left Rear	Angle		5	5 0.8	34 181	3.39	0.247*	-167.978	C055: Number of Motorists Recorded			
	Area 14 - Underca	mage		5	4 0.8	32 211	3.95	0.208*	-205.936	C227: CU Vehicle Towed			
	Not Applicable			10	1 1.5	54 344	6.44	0.238*	-322.781	C129: CU Vehicle Maneuvers			
	Area 1 - Right From	t Angle		36	4 5.5	54 627	7 11.75	0.471*	-408.415	C410: CU Traffic Control Functioning	J		
	Area 11 - Left Fron	t Angle		32	7 4.9	97 716	13.41	0.371*	-555.056	Sort by Sum of Max Gain	Ť		
00	) 🗞 🖉									🗹 Disp	lay		
			201	4-2018 Ala	bama Integra	ted Crash Data	- Filter = Veh	Defects Brake	s vs. Veh Defe	ects Tires	٦		
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	- 1				E Area 10		E	E Area 8		Not Applicable			
	C233 CII Point of Initial Impact												

For more information on this subject from NHTSA and other sources, please see: <u>http://www.safehomealabama.gov/tag/defects-recalls/</u>