# **CARE IMPACT Study of Railroad Involved Crashes**

2015-2019 Data

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## 1. Introduction

To review the full impact of RR-Involved crashes over the five calendar years (2015-2019) of this study, there were 21 Fatal Injury crashes; 28 Incapacitating Injury crashes; 49 Non-Incapacitating Injury crashes; 26 Possible Injury crashes; 165 Property Damage Only crashes, and 10 of unknown severity, for a total of 299 crashes over the five-year period. This averages to about 60 RR-Involved crashes in Alabama per year. Additional information on crash severity is given in Section 6 below.

The table below indicates the number of crashes and fatal crashes in each year of the study. This is further discussed in conjunction with attribute C003 (Crashes per Year) within Section 4, and C025 (Crash Severity).

#### Frequency of RR Train Involved Crashes by Year

Year	<b>Fatal Crashes</b>	All Crashes	% of Total
2015	4	67	22.4%
2016	5	64	21.4%
2017	4	49	16.4%
2018	4	56	18.7%
2019	4	<u>63</u>	<u>21.1%</u>
Total	21	299	100.00%

These differences in annual results are not beyond those that can be expected from random variation. The following table illustrates the item within the C062, Number of Railroad Trains, that was used to create the filter for this study.

#### Frequency Distribution C061 Used to Create Railroad Involved Crashes

C C	ARE 10.2.1.0 - [Frequency	Results - 2015-	2019 Alabama Integrate	d Crash Data	a - Filter = Ra	ilroad Train Involved	]		_		×
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<b>6</b> 2	2015-2019 Alabama Integr	rated Crash Data	~	Railroa	d Train Involve	ed	~ 9	1/ 1/2015 🗸	/ 12/31/20	)19 🗸 (	9 0
Orde	r: Natural Order 🗸 🗸	Ascending	Suppress	Zero-Valued	Frequencies						
C062	2: Number of Railroad Tra	ins	Frequency	Cum	. Frequency	Percentage	Cum. Percent	C062: Number of	Railroad Ti	rains	
•	No Trains Involved			0	0	0.00	0.00				
	1 Train Involved		29	9	299	100.00	100.00				
	2 or More Trains Involved	1		0	299	0.00	100.00				
	) @r 🖉							Display Average	🗌 Displa	ay Filter	Name
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				C062	Number of Ra	ailroad Trains					
	Frequency	400 200									
	Ĕ	0 -,	No Trains Invol		rain Involve ber of Railroa	Involve					

# 2. Major Findings and Recommendations

The details for the summaries in this section are given in the several sections that follow, referenced by general classification and crash attribute numbers (Cnnn). The acronym we will use for railroad train involved crashes will be *RR-Involved*.

#### **Geographical Findings (Section 3)**

- C010 Rural or Urban. No significant differences were found compared to non-RR-Involved. The general breakdown is 22.45 rural to 77.55 urban. For RR-Involved it is 26.09 and 73.91. The conclusion is that the proportion of rural and urban crash frequency at railroad crossing is what would be expected for all crashes in rural and urban areas.
- C011 Highway Classification. Close to 50% of the RR-Involved crashes were at Municipal road locations reflecting the traffic density there. However, the more significant finding is that of County roads, which had 2.486 times the expected proportion of crashes. Further analysis indicated that these were generally of higher severity than the municipal crashes, with ten of the fatal crashes and 13 incapacitating injury crashes occurring on county roads.
- C027 At Intersection. The vast majority of RR-Involved crashes will be at or near intersections – this result shows 59.74. Those that are not at intersections would generally be quite close to the crossing, which most officers marked as intersections. Several attributes below will provide more detail.
- C033 Locale. Manufacturing or Industrial have an extremely high Odds Ratio (8.389) primarily because very few crashes in general (less that 2%) occur in these locales. The other locales reflect the densities of the locations where RR crossing exist.
- C110 Driver Residence Distance. There were no significant differences found, indicating that the location of RR-Involved crashes are in the typical driving areas and distances.

#### **Time and Weather Findings (Section 4)**

- C003 Year. While the differences between years can only be viewed as random variations, it is notable that there seems to be a trend toward reduction, with the average of the last four years (58) being a little over 13% reduction from the 2015 count of 67. We would hope that this favorable trend will continue.
- C004 Month. There is no indication that one time of year will produce more RR-Involved crashes that others.
- C006 Day of the Week. Sunday, with 38 RR-Involved crashes, comes closest to be statistically significant (1.317 Odds Ratio). However, it is one of the three lowest days of the week, the other two being Saturday and Tuesday. No general patterns can be inferred.
- C008 Time of Day. Over-represented times are significant collectively throughout the night 8 PM through 9 AM. Trains continue to run at night, the times when other vehicle drivers are most vulnerable. An interesting under-representation occurs around the rush hours. Increased traffic density could contribute to better perception of RR trains.

- C031 Lighting Conditions. This generally is consistent with the time-of-day findings. The dark times are all over-represented, and Dark-Roadway Not Lighted is significant.
- C032 Weather. Weather has no apparent effect on the RR-Involved crashes in this fiveyear time frame.

#### **Driver Related Findings (Section 5)**

- C017 First Harmful Event. The value of this attribute is primarily in recognizing some of the events that did not involve a collision with a train. There were 29 such events recorded. The three highest were (1) Collision with Other Non-Fixed Object-8; (2) Collision with Vehicle in Traffic-6; and (3) Ran Off the Road Left-5. Some of these were probably in the process of avoiding a train that was not initially recognized to be a danger.
- C023 Manner of Crash. The results here are as expected, with the side-impact cases being 73% of those reported.
- C052 Number of Vehicles. It seems clear that most reporting officers do not indicate the RR train to be a highway vehicle. While it appears that there are some exceptions, this finding helps us to interpret several of the other attributes. A crosstab that follows the IMPACT display shows that all of the nine multi-vehicle crashes except one (a 2-vehicle crash) involved collisions with a RR train. See C017 in Section 5 for the first harmful events of the 28 single vehicle crashes that did not involve a train.
- C107 CU Driver Raw Age. The youngest age group (16) is under-represented by about half of what would be expected from the non-RR-Involved crash proportion. The proportions increase after this and become over-represented in many of the ages in the 30-57 range.
- C109 CU Driver Gender. Males are significantly over-represented. A cross-tabulation of age by gender was performed to determine in what age groups these gender differences show themselves. There is little difference in the16-20, which would tend to lead us to believe that this is a problem is not just attributable to risk-taking. The largest difference of men over women was found to be in the 30-55 age groups, which is where these age groups tend to be over-represented. The exact reason for middle-aged males to be more susceptible to RR-Involved crashes, is difficult to determine since there are only about 32 cases that can be studied. However, countermeasures for these crashes would seem to be much more appropriate if they are targeted toward middle-aged men. The fact that these ages and genders are also over-represented in CMV crashes might also be an indicator see the next attribute.
- C080 CMV Involved. The proportion of CMVs in RR-Involved crashes is well over three times that of non-RR-Involved crashes. The increase is from about 1 in 20 to almost one in five. No doubt CMVs should be a major concern in RR-Involved countermeasure development.
- C122 CU Officer Opinion Alcohol and C123 CU Officer Opinion Drugs. Because of the very low sample size (13 positives for alcohol, 5 for drugs), no statistical significance results are given. However, it is clear that both alcohol and drugs had proportions indicating a pattern of over-representations. Alcohol was over 60% higher than the control,

while drug use was over 80% higher than expected. This corresponds to the over-represented late-night/early-morning times of day. It is extremely unwise to approach a railroad crossing inebriated, and especially at night. However, generally those who drive in this condition cannot avoid RR crossings.

• C129 Vehicle Maneuvers. This result is fairly obvious with respect to vehicles getting hit going through RR intersections. The items other than "Movement Essentially Straight" are useful clues in determining what is happening with those crashes where a RR train was not one of the vehicles in the crash.

#### **Severity Findings (Section 6)**

- C025 Crash Severity. The fact that so many RR-Involved crashes are so severe is probably the reason that they are given strong attention. Fatal injury crashes occur at 12.632 times the proportion of non-RR-Involved crashes. Next to Fatal Injury Crashes, the two highest severity crashes (Incapacitating Injury and Non-Incapacitating Injury) are all both more than twice their expectations.
- C038 Adjusted EMS Arrival Delay. The low response time (10 minutes or less) in about 65% of the crashes is probably due to the quick notification by railroad personnel. This combined with the absence of traffic late at night time could contribute to quick response.
- C060 There are over-representations seen in all of the injury categories, showing that generally RR-Involved crashes involve injury more than traffic crashes in general. RR-Involved crashes have a highly significant over-representation in the single-injury category. Two things account for the large proportion of injury crashes. First, there is a vast disparity in the relative weights between the two vehicles involved. A second factor in many cases may be the high probability that the driver of the passenger vehicle did not see the train until it was too late to take any effective defensive actions.
- C224 CU Estimated Speed at Impact. The speeds are relatively low for the severity because they do not take into consideration the speed of the trains. We can observe from this result that a significant proportion of the crashes are not the result of a failure to see the train (and "run" the crossing), but the inclination to go through the crossing at a lower speed, not perceiving the true hazard.

#### Vehicle Related Findings (Section 7)

- C101 Causal Unit (CU) Type. The CMV findings in C080 are reflected here in the causal vehicle types. All of the heavy trucks are over-represented by an Odds Ratio of at least 2, and Tractor/Semi Trailer is at the top of the list with an over-representation of 5.170 (over five times the expected when compared with non-RR-Involved crashes. Pick-Ups (Four Tire Light Trucks) have the second largest Max Gain and they are third in the list when it comes to crash frequency. The top frequency vehicle is Passenger Car, but their high frequency in crashes in general moved them toward the bottom of the list, since they are under-represented.
- C208 CU Model Year. There are no recognized patterns in this attribute. Vehicles of various model years seem to be have RR-Involved crashes in their proportion to their numbers in the traffic population.

# 3. Geographical/Roadway IMPACTs - 10, 11, 27, 33

#### C010 Rural or Urban

No significant differences were found from normal driving. The general breakdown is 22.45 rural to 77.55 urban. For RR-Involved it is 26.09 and 73.91.

#### CARE 10.2.1.0 - [IMPACT Results - 2015-2019 Alabama Integrated Crash Data - Railroad Train Involved vs. Not Railroad Train Involved] \_ X Eile Dashboard Filters Analysis Impact Locations Tools Window Help đΧ 2015-2019 Alabama Integrated Crash Data ٣0 Railroad Train Involved 12 1/ 1/2015 2/31/2019 ß Order: Max Gain Descending Suppress Zero-Valued Rows Significance: Over Representation 2.0 + $\sim$ $\sim$ Threshold: C011: Highway Classification C007: Week of the Year Subset Subset Other Other Percent ٨ Odds Ratio Max Gain Frequency Percent Frequency C008: Time of Day C009: Data Source 102 34.11 107274 13.72 2.486\* 60.964 County C010: Rural or Urban Municipal 145 48.49 317895 40.67 1.192\* 23.395 011: Highway Classi Private Property 18 6.02 26999 3.45 1.743 7.672 C012: Controlled Access State 26 8.70 138393 17.71 0.491\* -26.940 C013: E Highway Side Interstate 2 0.67 85798 10.98 0.061 -30.820 C015: Primary Contributing Circumstanc Federal 0.149 -34.272 6 2.01 105278 13.47 Sort by Sum of Max Gain 📋 🕼 🚳 🖉 Display Filter Name 2015-2019 Alabama Integrated Crash Data C011: Highway Classifications 60 40 Frequ 20 0 Private Property Interstate County Municipal State Federal C011: Highway Classifications

### C011 Highway Classification

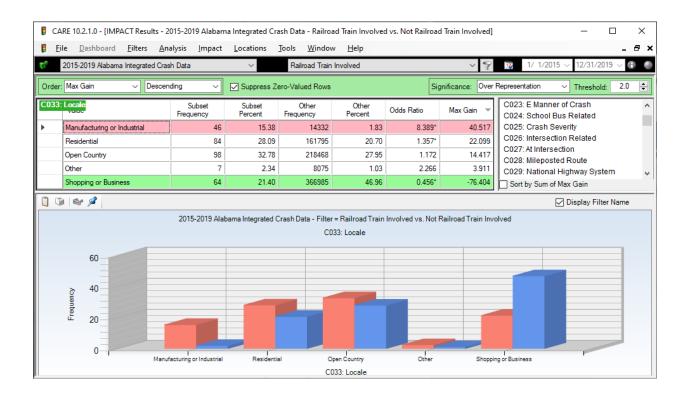
There is a very highly statistically significant difference in the County road locations, with the RR-Involved being well over twice (2.486 times) the proportions of non-RR-Involved County road crashes. Municipal roads are also over-represented, but by not nearly as much.

#### **C027 At Intersection**

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2015-2019 Alabama Integrated Crash Data	✓ Railn	oad Train Involved	~ 9	™ 1/ 1/2015 ∨ 12/31/2019 ∨ f	
Order: Max Gain V Descending	Suppress Zero-Valu	ed Rows	Significance: Over	Representation ~ Threshold: 2.0	-
C027: At Intersection	Subset Subset Frequency Percent	Other Other Frequency Percent	Odds Max Ratio Gain	C026: Intersection Related C027: At Intersection	^
<ul> <li>Yes, Crash Occurred at an Intersection</li> </ul>	245 81.94	466980 59.74	1.372* 66.366	C028: Mileposted Route	~
No, Crash Did Not Occur at an Intersection	54 18.06	312550 39.99	0.452* -65.560	Sort by Sum of Max Gain	
📋 🕼 🞯 🔎				Display Filter Name	
100 Computer	Crash Occurred at an Inte		ed vs. Not Railroad I rain Inv		

This attribute is of interest because the "No …" category gives the number of crashes that occurred near or related to RR Intersections but not right at the crossing. See also C017 First Harmful Event under Driver attributes.

#### C033 Locale



# 4. Time, Weather and Lighting IMPACT Displays – 3-4, 6, 8, 31-32

# C003 Year

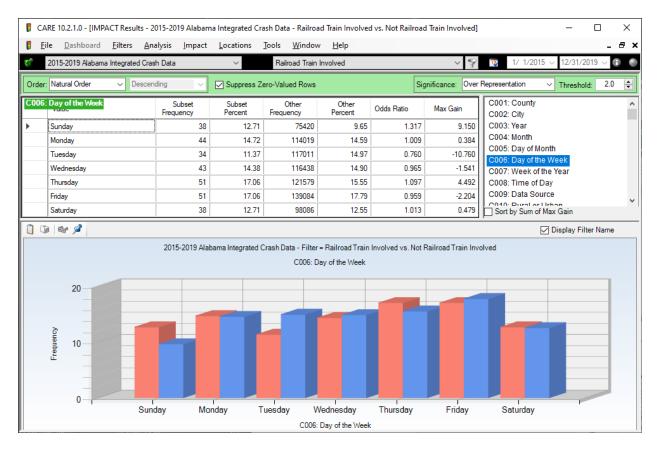
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Order	r: Natura	l Order	✓ Desc	ending 🗸	Suppres	s Zero-Valued R	lows	Sig	nificance: Over	Representation	✓ Thresho	ld: 2.0	
C003	: Year voide			Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County C002: City			^
•	2015			67	22.41	149817	19.17	1.169	9.690	C003: Year			
	2016			64	21.40	156301	20.00	1.070	4.210	C004: Month C005: Day of I	lonth		
	2017			49	16.39	157143	20.10	0.815	-11.112	C005: Day of t			
	2018			56	18.73	159968	20.47	0.915	-5.193	C007: Week o			~
	2019			63	21.07	158408	20.27	1.040	2.404	Sort by Sum	of Max Gain		
	0	<i>s</i>									🗌 Di	splay Filt	ter Name
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							C003: Year						

#### C004 Month

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<u> </u>	2015-2019 Alabama Integrated	Crash Data	~	Railroad Train I	nvolved		~ A	1/ 1/2015 ∨ 12/31/2019 ∨ ① ②
Order:	Natural Order V Des	cending 🗸 🗸	Suppress Ze	ero-Valued Rows		Sig	gnificance: Over	Representation V Threshold: 2.0 🛬
C004:	Month	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County A C002: City
•	January	18	6.02	60749	7.77	0.775	-5.238	C003: Year
	February	28	9.36	59038	7.55	1.240	5.416	C004: Month C005: Day of Month
	March	20	6.69	66457	8.50	0.787	-5.422	C006: Day of the Week
	April	27	9.03	66531	8.51	1.061	1.550	C007: Week of the Year
	May	21	7.02	66904	8.56	0.821	-4.593	C008: Time of Day
	June	23	7.69	61933	7.92	0.971	-0.691	C009: Data Source
	July	24	8.03	61035	7.81	1.028	0.652	C010: Rural or Urban
	August	23	7.69	67747	8.67	0.888	-2.915	C011: Highway Classifications C012: Controlled Access
	September	20	6.69	64150	8.21	0.815	-4.539	C013: E Highway Side
	October	36	12.04	70241	8.99	1.340	9.131	C015: Primary Contributing Circumstanc
	November	23	7.69	66702	8.53	0.901	-2.516	C016: Primary Contributing Unit Number
	December	36	12.04	70150	8.97	1.342	9.165	Sort by Sum of Max Gain
0	à 🐟 🖉							🖂 Display Filter Name
		2015-2019 Ala	bama Integrated C	Crash Data - Filter C0	= Railroad Train 04: Month	Involved vs. Not F	Railroad Train Invo	olved
	15							
	Leafuence 5	ĥ	ſ					
	- I	February	April		r Ine C004: Month	August	Octo	ber December

Clearly October and December appear to be significant, but the number of RR-Involved crashes are so low that the standard statistical test cannot show this. We can generally conclude that the month is not critical in determining RR-Involved crashes.

#### C006 Day of the Week



As in the case of Month, the variation in the days of the week are random.

#### C008 Time of Day

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_	2015-2019 Alabama Integrate			<u>_</u>							
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Order:	Natural Order 🗸 🛛	escending)	$\sim$	Suppress Ze	ero-Valued Rows	\$	Significance: Over Representation V Threshold: 2.0				
C008:	Time of Day	Fre	Subset equency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C001: County A C002: City		
۱.	12:00 Midnight to 12:59 AM		8	2.68	9589	1.23	2.181	4.332	C003: Year		
	1:00 AM to 1:59 AM		9	3.01	7902	1.01	2.977	5.977	C004: Month		
	2:00 AM to 2:59 AM		4	1.34	7335	0.94	1.426	1.194	C005: Day of Month C006: Day of the Week		
	3:00 AM to 3:59 AM		7	2.34	6452	0.83	2.836	4.532	C007: Week of the Year		
	4:00 AM to 4:59 AM		6	2.01	7304	0.93	2.147	3.206	C008: Time of Day		
	5:00 AM to 5:59 AM		9	3.01	12353	1.58	1.905	4.275	C009: Data Source		
	6:00 AM to 6:59 AM		12	4.01	20595	2.63	1.523	4.122	C010: Rural or Urban		
	7:00 AM to 7:59 AM		11	3.68	48014		0.599	-7.367	C011: Highway Classifications		
	8:00 AM to 8:59 AM		16	5.35	34580		1.210	2.772	C012: Controlled Access C013: E Highway Side		
	9:00 AM to 9:59 AM		10	5.69	30165		1.473	5.461	C013: E Highway Side C015: Primary Contributing Circumstanc		
	10:00 AM to 10:59 AM		17	6.02	34298	4.39	1.473	4.880	C016: Primary Contributing Unit Numbe		
	11:00 AM to 11:59 AM		10	3.68	41685	5.33	0.690	-4.946	C017: First Harmful Event		
									C018: Location First Harmful Event Rel t		
	12:00 Noon to 12:59 PM		14	4.68	51205		0.715	-5.587	C019: E Most Harmful Event		
<u> </u>	1:00 PM to 1:59 PM		15	5.02	50253	6.43	0.780	-4.223	C020: E Distracted Driving Opinion		
	2:00 PM to 2:59 PM		17	5.69	54970		0.808	-4.028	C021: Distance to Fixed Object C022: E Type of Roadway Junction/Featu		
	3:00 PM to 3:59 PM		26	8.70	69826	8.93	0.973	-0.711	C023: E Manner of Crash		
	4:00 PM to 4:59 PM		15	5.02	66654	8.53	0.588	-10.497	C024: School Bus Related		
	5:00 PM to 5:59 PM		14	4.68	71506	9.15	0.512	-13.353	C025: Crash Severity		
	6:00 PM to 6:59 PM		17	5.69	46214	5.91	0.962	-0.678	C026: Intersection Related		
	7:00 PM to 7:59 PM		10	3.34	31355	4.01	0.834	-1.994	C027: At Intersection		
	8:00 PM to 8:59 PM		14	4.68	26623	3.41	1.375	3.816	C028: Mileposted Route C029: National Highway System		
	9:00 PM to 9:59 PM		9	3.01	22007	2.82	1.069	0.582	C030: Functional Class		
	10:00 PM to 10:59 PM		12	4.01	16846	2.16	1.862	5.556	C031: Lighting Conditions		
	11:00 PM to 11:59 PM		8	2.68	12519	1.60	1.671	3.211	Sort by Sum of Max Gain		
	) 😪 🖉								Display Filter Name		
		20	)15-2019 Alab	ama Integrated C	rash Data - Filte	er = Railroad Train	Involved vs. Not F	Railroad Train Invo	blved		
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	Comen 5										
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	0	4.00									
		4:00	) AM to 4:59	AM 9:	00 AM to 9:59		00 PM to 2:59 P	'M 7:00	PM to 7:59 PM		
						C008: Time of Da	Ŷ				

Over-represented times are significant collectively 8 PM through 9 AM. Trains continue to run at night, the times when other vehicle drivers are the most vulnerable.

#### **C031 Lighting Conditions**

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¢?	2015-2019 Alabama Integrated Crast	h Data	~	Railroad Train I	nvolved		~ 9	™ 1/ 1/2015 ∨ 12/31/2019 ∨ 1
Orde	er: Max Gain 🗸 Descend	ding ~	Suppress Ze	ro-Valued Rows		Sig	nificance: Over	Representation V Threshold: 2.0 🖨
C03	1: Lighting Conditions	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 📼	C026: Intersection Related C027: At Intersection
•	Dark - Roadway Not Lighted	53	17.73	73539	9.41	1.884*	24.868	C028: Mileposted Route
	E Dark - Continuous Lighting On	5	1.67	4130	0.53	3.165	3.420	C029: National Highway System
	E Dark - Spot Illumination One S	12	4.01	25891	3.31	1.212	2.096	C030: Functional Class C031: Lighting Conditions
	E Dark - Unknown Roadway Li	3	1.00	2580	0.33	3.040	2.013	C032: Weather
	Not Applicable	1	0.33	1456	0.19	1.795	0.443	C033: Locale
	Unknown	1	0.33	2695	0.34	0.970	-0.031	C034: E Police Present at Time of Crash
	Dusk	8	2.68	22755	2.91	0.919	-0.705	C035: Police Notification Delay
	Dawn	3	1.00	10169	1.30	0.771	-0.890	C036: Police Arrival Delay C037: EMS Arrival Delay
	E Dark - Continuous Lighting Bo	8	2.68	25436	3.25	0.822	-1.730	C038: Adjusted EMS Arrival Delay
	E Dark - Spot Illumination Both	15	5.02	48365	6.19	0.811	-3.502	C039: Non-Vehicular Property Damage
	Daylight	190	63.55	561588	71.85	0.884*	-24.830	Sort by Sum of Max Gain
	D & #							🗹 Display Filter Name
		2015-2019 Alat	oama Integrated Ci		Railroad Train		Railroad Train Invo	olved
	100							
	Sumon Solution							
	0 EDar	rk - Continuous Lightin ne Side of Roadway	ng E Dark - Ur Roadway L		Unknown	Da	wn E	Dark - Spot Illumination Both Sides of Roadway
				C031:	Lighting Condit	tions		

Lighting conditions are consistent with the Time of Day results above.

#### C032 Weather

Weather had no apparent effect on RR-Involved crashes.

# 5. Driver IMPACT Displays - 17, 23, 52, 80, 107, 109, 115, 122-123, 129

#### **C017 First Harmful Event**

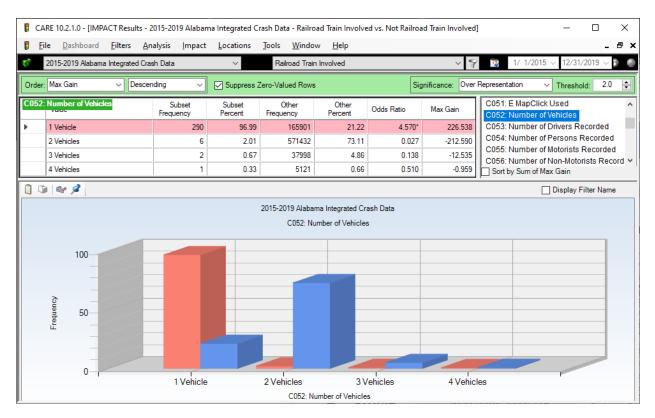
<u>F</u> ile	E 10.2.1.0 - [IMPACT Results - 2015-2019 A Dashboard <u>F</u> ilters <u>A</u> nalysis <u>I</u> m	-			lelp		anninoneaj	- 8
20	015-2019 Alabama Integrated Crash Data	~	Railn	oad Train Involv	ed		~ 9	32 1/ 1/2015 ∨ 12/31/2019 ∨ 1
der:	Max Gain V Descending	🗸 🗹 Supp	ress Zero-Valu	ed Rows		Signifi	cance: Over	Representation V Threshold: 2.0
)17: F	irst Harmful Event	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 👻	C010: Rural or Urban C011: Highway Classifications
C	Collision with Railway Vehicle/Train	270	90.30	36	0.00	19606.003*	269.986	C012: Controlled Access
E	Collision with Other Non-Fixed Object	8	2.68	5305	0.68	3.942	5.971	C013: E Highway Side
E	Collision with Other Traffic Barrier	1	0.33	267	0.03	9.791	0.898	C015: Primary Contributing Circumstan C016: Primary Contributing Unit Numbe
E	Other Non-Collision	1	0.33	1830	0.23	1.428	0.300	C017: First Harmful Event
E	E Ran Off Road Straight	1	0.33	2303	0.29	1.135	0.119	C018: Location First Harmful Event Rel
E	Ran Off Road Left	5	1.67	13065	1.67	1.000	0.002	C019: E Most Harmful Event
E	E Collision with Concrete Barrier	1	0.33	5070	0.65	0.516	-0.939	C020: E Distracted Driving Opinion C021: Distance to Fixed Object
C	Overtum/Rollover	2	0.67	7905	1.01	0.661	-1.024	C022: E Type of Roadway Junction/Feat
E	Collision with Vehicle in (or from) Other Ro	1	0.33	16268	2.08	0.161	-5.223	C023: E Manner of Crash
C	Collision with Ditch	1	0.33	19240	2.46	0.136	-6.360	C024: School Bus Related
E	E Ran Off Road Right	2	0.67	23775	3.04	0.220	-7.095	C025: Crash Severity C026: Intersection Related
C	Collision with Vehicle in Traffic	6	2.01	544601	69.68	0.029	-202.329	Sort by Sum of Max Gain
۲	a 🖉							🗹 Display Filter Name
	2015-201	9 Alabama Integ				ved vs. Not Rail	road Train Invo	olved
				C017: First Har	mful Event			
	100							
,								
Frequency	50							
Lean								
	0 E Collision with							
		E Other	Non-Collision	E Ran Off Roa	diaft Ov	erturn/Rollover	Collision w	vith Ditch Collision with

The value of this attribute is in determining those events that did not involve a collision with a train. There were 29 such events.

#### C023 E Manner of Crash

8	CARE 10	.2.1.0 - [IMPACT	Results - 2	015-2019 Alaba	ama Integrated	Crash Data - R	ailroad Train Inv	volved AND No	t E Manner of C	rash = 15 Ol	R 14 vs	- 0	×
Ø	<u>F</u> ile	<u>D</u> ashboard <u>F</u> il	lters <u>A</u> n	alysis <u>I</u> mpao	t <u>L</u> ocations	<u>T</u> ools <u>W</u> i	ndow <u>H</u> elp						- 8 ×
<b>6</b>	2015-	2019 Alabama Inte	egrated Cras	sh Data	~	Railroad	Train Involved			~ 💡	2 1/ 1/20	)15 < 12/31	/2019 🗸
Ord	er: Max	Gain 💉	~ Descen	nding ~	Suppres	s Zero-Valued F	lows	Sig	nificance: Over	Representatio	n v	hreshold:	2.0 🜲
<b>C02</b>	3: E Ma	nner of Crash		Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 🔻	C023: E I	Manner of Ci	rash	
	Side	Impact (90 degree	es)	156	57.99	69899	9.23	6.281*	131.162				
	Side	Impact (angled)		41	15.24	65900	8.71	1.751*	17.583				
	Angle	e (front to side) Op	posite	12	4.46	22006	2.91	1.535	4.180				
	Angle	e Oncoming (fronta	al)	10	3.72	18156	2.40	1.550	3.548				
	Angle	e (front to side) Sar	me Dir	8	2.97	20503	2.71	1.098	0.714				
	Head	d-On (front to front	only)	6	2.23	15939	2.11	1.059	0.336				
<u> </u>	Sides	swipe - Opposite D	irection	3	1.12	13762	1.82	0.613	-1.890				
	Singl	e Vehicle Crash (a	ll types)	24	8.92	150412	19.87	0.449*	-29.448				
	Rear	End (front to rear)		9	3.35	282133	37.27	0.090	-91.254	Sort by	Sum of Max G	iain	
	🗊   🗞	r 🖉										Display F	Filter Name
					:	2015-2019 Alaba	ima Integrated C	rash Data					
						C023: E	Manner of Cras	h					
		60											
		10											
	el C	40											
	Frequency	00											
	ш	20											
		0											
		0-1	Side Impa (90 degree		t Angle (front to side) Opposite Direction	Angle Oncoming (frontal)	Angle (front to side) Same Direction	Head-On (front to front only)	Sideswipe - Si Opposite Direction	l ingle Vehicle Crash (all types)	Rear End (front to rear)		
						C02	3: E Manner of (	Crash					

#### **C052** Number of Vehicles



All of the multi-vehicle crashes except one of the 2-vehicle crashes involved collisions with a RR train. See C017 for the first harmful event of the 28 single vehicle crashes that did not involve a train. The following is C052 (Number of Vehicles) by C017 (First Harmful Event).

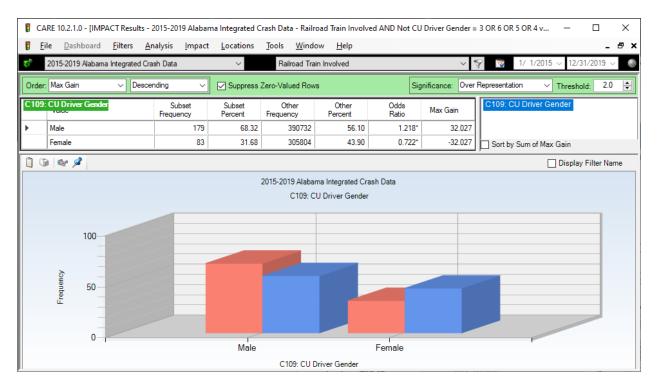
2015-2019	Alabama Integrated C	rash Data	$\sim$	Railroad Train Involv	ed	✓ ♀ 1/ 1/2015 ∨ 12/31/2019 ∨
Suppress Zero Va	lues: Rows and Colu	umns 🗸 Select	Cells: 🔳 🕶 %	9		Column: Number of Vehicles ; Row: First Harmful Event 🔃
	1 Vehicle	2 Vehicles	3 Vehicles	4 Vehicles	TOTAL	
E Ran Off Road Right	2	0	0	0	2	
E Ran Off Road Straight	1	0	0	0	1	
E Ran Off Road Left	5	0	0	0	5	
Overturn/Rollover	2	0	0	0	2	
E Other Non- Collision	1	0	0	0	1	
Collision with Vehicle in Traffic	5	1	0	0	6	
E Collision with Vehicle in (or from	1	0	0	0	1	
Collision with Railway Vehicle/T	262	5	2	1	270	
E Collision with Other Non-Fixed	8	0	0	0	8	
Collision with Ditch	1	0	0	0	1	
E Collision with Concrete Barrier	1	0	0	0	1	
E Collision with Other Traffic Barri	1	0	0	0	1	
TOTAL	290	6	2	1	299	

#### C107 CU Driver Raw Age

CA	RE 10.2.1.0 - [IMP/	ACT Result	ts - 2015-2019 Ala	bama Integrated	Crash Data - Ra	ilroad Train Invo	lved AND Not	CU Driver Raw Age	= 104 OR 103 OF	R 10 – 🗆 🗙
🖳 Ei	i <b>le <u>D</u>ashboard</b>	<u>F</u> ilters	<u>A</u> nalysis <u>I</u> mp	act <u>L</u> ocations	<u>T</u> ools <u>W</u> in	ndow <u>H</u> elp				_ 8
¢?	2015-2019 Alabama	Integrated	l Crash Data	~	Railroad 1	Frain Involved		~ *	💡 🦉 1/ 1	1/2015 $\scriptstyle{\vee}$ 12/31/2019 $\scriptstyle{\vee}$
Order	Max Gain	∼ De	escending	Suppres	s Zero-Valued Ro	ows		Significance: Over	Representation	✓ Threshold: 2.0 ♣
C107:	CU Driver Raw A	ge	Subset Frequency		Other Frequency	Other Percent	Odds Ratio	Max Gain	C107: CU Dr	iver Raw Age
	30		7	7 2.69	14136	2.05	1.310	1.657		
	31		4	1.54	13486	1.96	0.785	-1.097		
	32			_	13080	1.90	1.214	1.056		
	33				12908	1.88	0.615	-1.879		
	34		9	_	12097	1.76	1.968	4.428		
	35		5		11944	1.74	1.108	0.486		
	36		7	_	11697	1.70	1.583	2.579		
	37		3	_	11191 10604	1.63 1.54	1.655	2.770		
	38		4		10604	1.54	1.034	0.131		
	40			_	9872	1.45	0.804	-0.731		
	41			_	9322	1.36	0.851	-0.523		
	42				9159	1.33	1.733	2.538		
	43		7	7 2.69	9172	1.33	2.019	3.533		
	44			1.54	8910	1.30	1.188	0.632		
	45		5	5 1.92	9005	1.31	1.469	1.596		
	46		7	7 2.69	8842	1.29	2.095	3.658		
	47		:	3 1.15	8685	1.26	0.914	-0.283		
	48		2	2 0.77	8345	1.21	0.634	-1.154		
	49			3 1.15	8252	1.20	0.962	-0.119		
	50			5 1.92	8165	1.19	1.620	1.914		
	51		4	1.54	8091	1.18	1.308	0.942		
	52		4		8024	1.17	1.319	0.967		
	53		4	_	8265	1.20	1.280	0.876		
	54				8218	1.19	0.644	-1.106		
	55				8053	1.17	2.300	3.956		
	56		3	_	7992	1.16	0.993	-0.021	L	
n n	57			3 3.08	7972	1.16	2.655	4.987 🗸	Sort by Sum	
9	) 🗞 🖉									Display Filter Name
						bama Integrated ( CU Driver Raw A				
	A Sureal A			uh	hu	lahui	lun l	hout	lu lu	Magness.
	0-1			35	(	C107: CU Driver F	55 Raw Age			77

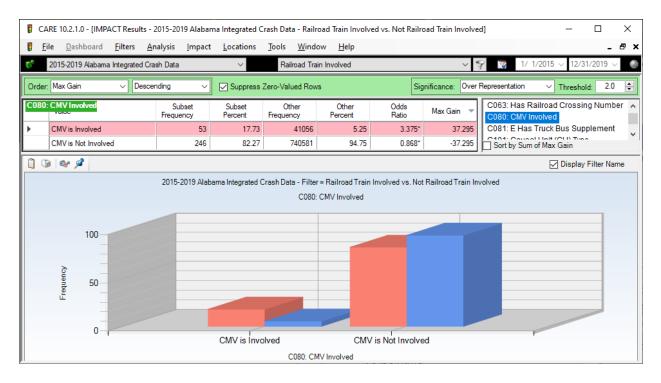
The youngest age group (16) is under-represented by about half of what would be expected from the non-RR-Involved crash proportion. The proportions increase after this and become over-represented in many of the ages in the 30-57 range.

#### C109 CU Driver Gender



A cross-tabulation of age by gender was performed to determine in what age groups these gender differences show themselves. There is little difference in the16-20, which would tend to lead us to believe that for the younger drivers, this is a problem with inexperience as opposed to risk-tak-ing. The largest difference of men over women was found to be in the 30-55 age groups.

#### C080 CMV Involved



The 53 CMV are in RR-Involved crashes are more than 37 greater than expected. This over-representation is 3.375 times that expected. No doubt, this is an area that should be explored more fully.

#### C122 CU Driver Officer Opinion Alcohol

C/	ARE 10.2.1.0 - [IMPACT Results -	2015-2019 Alabar	ma Integrated	Crash Data - Ra	ilroad Train Invo	lved AND Not	CU Driver Officer O	pinion Alcohol = 6 —	
E E	ile <u>D</u> ashboard <u>F</u> ilters <u>A</u> r	nalysis <u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>W</u> in	ndow <u>H</u> elp				_ 8 ×
¢°	2015-2019 Alabama Integrated Cra	sh Data	~	Railroad 1	Frain Involved		~		/2019 🗸 🔘
Order	r: Max Gain 🗸 Desce	nding ~	Suppress	Zero-Valued R	ows	[	Significance: Over	Representation V Threshold	d: 2.0 🜲
C122	CU Driver Officer Opinion Alco	hol Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C122: CU Driver Officer Opini	ion Alcohol
•	Yes - Driver Was Under Influe	13	5.51	22969	3.44	1.601	4.880		
	No - Driver Was Not Under Inf	223	94.49	644594	96.56	0.979	-4.879 🗸	Sort by Sum of Max Gain	
1	) 🛯 🖉							Display	Filter Name
					bama Integrated ( ver Officer Opinio				
	۲00 المعرفة 50 المعرفة 100 المعرفة								
		Yes	s - Driver Was ( Alco	Under Influence ( hol C122: CIL Driver	of No - Driver	Was Not Under Alcohol	Influence of	•	

#### C123 CU Officer Opinion Drugs

1	CARE 10.2.1.0 - [IMPACT Results - 20	015-2019 Alaban	na Integrated C	rash Data - Railr	oad Train Involve	ed AND Not CU	Driver Officer O	pinion Drugs = 6	0 – 🗆	×
B	<u>File D</u> ashboard <u>Filters Ana</u>	alysis <u>I</u> mpact	<u>L</u> ocations	<u>T</u> ools <u>W</u> ind	ow <u>H</u> elp				-	. 🕫 🗙
<del>ور</del>	2015-2019 Alabama Integrated Crast	h Data	$\sim$	Railroad Tra	in Involved		~ <	💡 🏆 1/ 1.	/2015 \(\to \) 12/31/2019	~ 0
Ord	der: Max Gain V Descend	ding ~	Suppress	Zero-Valued Row	'S	Sig	nificance: Over	Representation	✓ Threshold: 2.	0 🜲
C12	23: CU Driver Officer Opinion Drugs	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C123: CU Driv	ver Officer Opinion Dru	ugs
	Yes - Driver Was Under Influen	5	2.16	7853	1.19	1.807	2.233			
	No - Driver Was Not Under Infl	227	97.84	650523	98.81	0.990	-2.231	Sort by Sum o	of Max Gain	
	🔞 🚳 🖉								Display Filter N	ame
					ma Integrated Cra er Officer Opinion					
	50 IOO									
	0	Yes		nder Influence of <sup>8</sup> 123: CII Driver (	No - Driver W	as Not Under In of Drugs	fluence			

Because of the low sample size, no statistical significance results are given. However, it is clear that both alcohol and drugs had proportions indicating significant over-representations. Alcohol was over 60% higher than the control, while drug use was over 80% higher than expected. This corresponds to the over-represented late-night/early-morning times of day. It is extremely unwise to approach a railroad crossing inebriated.

#### C129 CU Vehicle Maneuvers

-	ARE 10.2.1.0 - [IMPACT Results - ile <u>D</u> ashboard <u>F</u> ilters <u>A</u>		-	rash Data - Railr <u>T</u> ools <u>W</u> indo		ed AND Not CU	Vehicle Maneuve	ers = 17 OR 18 C		×
¢?	2015-2019 Alabama Integrated Cra	ash Data	~	Railroad Tra	in Involved		~ \$	2 📆 1/1	/2015 > 12/31/2019 >	0
Order	: Max Gain 🗸 Desce	ending ~	Suppress	Zero-Valued Row	s	Sig	nificance: Over F	Representation	✓ Threshold: 2.0	÷
C129	CU Vehicle Maneuvers	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain 🔻	C129: CU Vel	nicle Maneuvers	
•	Movement Essentially Straight	202	77.99	398487	54.71	1.425*	60.291			
	Illegally Parked	10	3.86	1018	0.14	27.623	9.638			
	Stopped in Traffic	9	3.47	2885	0.40	8.772	7.974			
	E Stopped for Sign/Signal	4	1.54	2948	0.40	3.815	2.952			
	E Leaving Main Road	2	0.77	2686	0.37	2.094	1.045			
	Making U-Tum	1	0.39	4171	0.57	0.674	-0.483			
	E Overtaking/Passing	1	0.39	8350	1.15	0.337	-1.969			
	Slowing/Stopping	13	5.02	46771	6.42	0.782	-3.633			
	Tuming Right	7	2.70	37890	5.20	0.520	-6.474			
	E Negotiating a Curve	4	1.54	35305	4.85	0.319	-8.555			
	Backing	4	1.54	36189	4.97	0.311	-8.869			
	Turning Left	2	0.77	86596	11.89	0.065	-28.795	Sort by Sum	of Max Gain	
1	) 🛯 🖉								Display Filter Name	;
				2015-2019 Alaba	ma Integrated Cra	sh Data				
				C129: CU	Vehicle Maneuver	s				
	100									
	100									
	2	_								
	Solution 50									
	Ĕ									
	0									
		Illegally Parked	E Stopped f Sign/Signa	ior Mak I	ing U-Turn	Slowing/Stopping	E Negotiatir	g a Curve	Turning Left	
				C129:	CU Vehicle Mane	euvers				

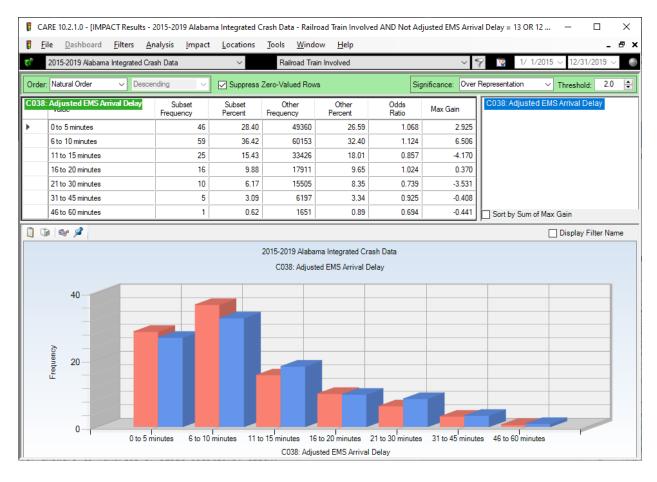
# 6. Severity IMPACT Displays - 25, 38, 60, 224

#### **C025 Crash Severity**

CA	RE 10.2.1.0 - [IMF	ACT Resul	ts - 2015-201	19 Alabar	na Integrated C	rash Data - Rai	road Train Involv	ed vs. Not Railr	oad Train Involve	d]	-		×
🔋 <u>E</u> il	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> ind	low <u>H</u> elp					-	₽×
<b>6</b>	2015-2019 Alabam	a Integrated	l Crash Data		$\sim$	Railroad Tr	ain Involved		~ *	💡 🦉 1/ 1	/2015 > 12/3	31/2019	~
Order:	Natural Order	∼ De	escending	~	Suppress	Zero-Valued Ro	ws	Sig	gnificance: Over	Representation	✓ Thresh	old: 2.0	÷
C025:	Crash Severity		Sub Freque	oset ncy	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C023: E Manr C024: School			^
►	Fatal Injury			21	7.02	4346	0.56	12.632*	19.338	C025: Crash			
	2015-2019 Alabama Integra Natural Order	ıry		28	3.36 2/318 3.49 2.6/9 1/.330				C026: Interse C027: At Inters				
	Non-Incapacitatin		49	16.39	59049	7.55	2.169*	26.412	C027: At Inters				
	Possible Injury			26	8.70	73441	9.40	0.925	-2.093	C029: Nation		stem	
	Property Damage Only 16			165	55.18	596332	76.29	0.723*	-63.115	C030: Functional Class			~
	Unknown			10	3.34	21151	2.71	1.236	1.909	Sort by Sum	of Max Gain		
	) 🗇 🖉										🗹 Display	y Filter Na	me
			2015-2	2019 Alab	ama Integrated (		er = Railroad Train : Crash Severity	Involved vs. No	t Railroad Train In	volved			
	100												
	Xouenber												
			Fatal Injury	4	I Incapacitating Injury	Non-Incapac	tating Possib	l le Injury	Property Damage Only	I Unknown	-		
							25: Crash Severity						

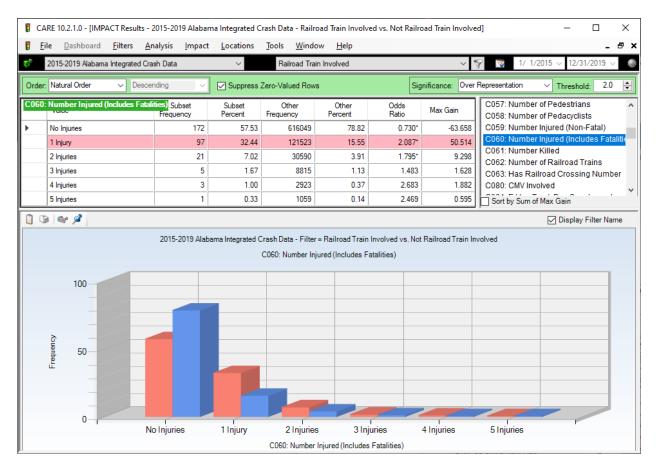
For obvious reasons of physics, the effects of crashes that are RR-Involved are much more severe than other crash types. Fatalities are at a proportion that is 12.632 that of crashes in general. The higher injury levels are also well over twice their expected values.

#### C038 Adjusted EMS Arrival Delay



The low response time (10 minutes or less) in about 65% of the crashes is probably due to the quick notification by railroad personnel. This combined with the late night time could result in the further ability to respond quickly.

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



The increased severity of RR-Involved crashes is also reflected in the number of injuries, all of which are above the average of all non-RR-Involved crashes.

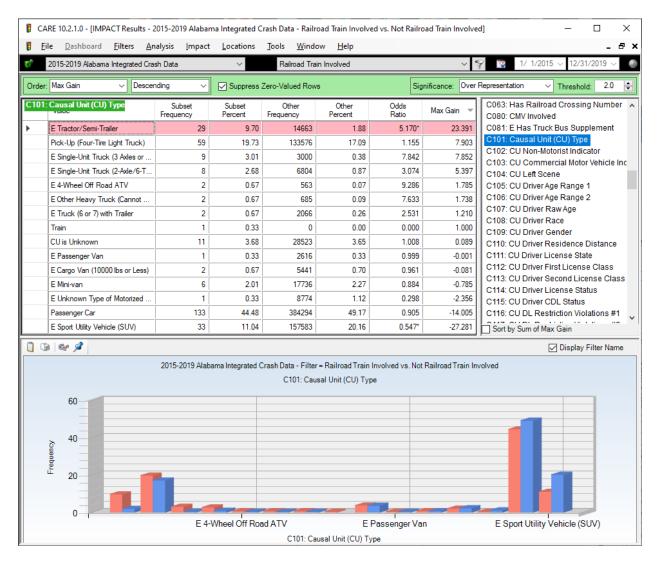
CAI				-	rash Data - Railr <u>T</u> ools <u>W</u> indo		d AND Not CU	Estimated Speed	l at Impact = 27 OR − □	×
<b>1</b>	2015-2019 Alabama Int	egrated Cras	sh Data	$\sim$	Railroad Tra	in Involved		~ §	7 1/ 1/2015 ~ 12/31/201	9 ~
Order:	Max Gain	~ Descer	ding ~	Suppress	Zero-Valued Row	'S	Sig	nificance: Over F	Representation V Threshold:	2.0 🛟
C224:	CU Estimated Spee	d at Impact	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C224: CU Estimated Speed at In	pact
•	1 to 5 MPH		28	21.05	68265	17.14	1.228	5.200		
	6 to 10 MPH		22	16.54	46241	11.61	1.424	6.556		
	11 to 15 MPH		18	13.53	30861	7.75	1.746	7.693		
	16 to 20 MPH		12	9.02	22865	5.74	1.571	4.363		
	21 to 25 MPH		14	10.53	20384	5.12	2.056	7.192		
	26 to 30 MPH		9	6.77	21818	5.48	1.235	1.713		
	31 to 35 MPH		5	3.76	25542	6.41	0.586	-3.531		
	36 to 40 MPH		8	6.02	23409	5.88	1.023	0.182		
	41 to 45 MPH		9	6.77	36579	9.19	0.737	-3.217		
	46 to 50 MPH		3	2.26	17945	4.51	0.501	-2.994		
	51 to 55 MPH		2	1.50	29102	7.31	0.206	-7.720		
	56 to 60 MPH 61 to 65 MPH		1	0.75	13452 15602	3.38	0.223	-3.493		
~			2	1.00	10602	3.92	0.364	-3.211	Sort by Sum of Max Gain	
	😪 🔎								Display Filter	Name
						ma Integrated Cras mated Speed at Im				
	30 20 Kotenbart 10	h	h	ß	h			1.		
	0	6 to	10 MPH 1	16 to 20 MPH	26 to 30 M	IPH 36 to 4 Estimated Speed a		46 to 50 MPH	56 to 60 MPH	

#### C224 CU Estimated Speed at Impact

As would be expected, the speeds at impact are relatively low compared to their non-RR-Involved counterparts. This does show that very few drivers "run" the RR intersection. In most cases it would seem that they are creeping across thinking they can make it – perhaps in some cases not looking for or seeing the train at all.

# 7. Vehicle IMPACT Displays - 80, 101, 129, 208

#### C101 Causal Unit (CU) Type



It seems the larger the truck the more often they are at fault.

<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> in	dow <u>H</u> elp					- e
20	)15-2019 Alabama	Integrated	Crash Data		~	Railroad T	rain Involved		~ *	9 1/ 1	/2015 ~ 12/31/	/2019 🗸
	1ax Gain	-	cending						Circuit and Duran	Deemeentation		2.0
	U Model Year	Des	_	~		Zero-Valued Ro		L		Representation	✓ Threshold	: 2.0
U8: C	U Model Tear			ubset uency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain	C208: CU Moo	Jei teal	
1	996			2	0.71	8922	1.27	0.557	-1.590			
1	997			5	1.77	12593	1.79	0.987	-0.067			
1	998			5	1.77	14972	2.13	0.830	-1.024			
1	999			8	2.83	19708	2.80	1.009	0.071			
2	000			8	2.83	24898	3.54	0.799	-2.018			
2	001			11	3.89	25896	3.68	1.056	0.581			
2	002			16	5.65	30472	4.33	1.305	3.740			
2	003			11	3.89	35265	5.01	0.775	-3.189			
2	004			17	6.01	38371	5.46	1.101	1.562			
2	005			10	3.53	41495	5.90	0.599	-6.695			
2	006			25	8.83	43153	6.14	1.440	7.638			
2	007			18	6.36	45338	6.45	0.987	-0.241			
2	800			15	5.30	38427	5.46	0.970	-0.461			
2	009			11	3.89	24674	3.51	1.108	1.073			
2	010			17	6.01	28593	4.07	1.478	5.496			
2	011			8	2.83	31223	4.44	0.637	-4.562			
2	012			13	4.59	35288	5.02	0.916	-1.198			
2	013			12	4.24	36474	5.19	0.818	-2.675			
2	014			17	6.01	36006	5.12	1.173	2.513			
2	015			11	3.89	36147	5.14	0.756	-3.543			
2	016			13	4.59	27808	3.95	1.162	1.812			
2	017			6	2.12	19331	2.75	0.771	-1.778			
2	018			4	1.41	10796	1.53	0.921	-0.344			
2	019			4	1.41	4502	0.64	2.208	2.189 🗸	Sort by Sum o	of Max Gain	
	er 🖉									,	Display F	ilter Name
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There do not seem to be any patterns in this attribute.