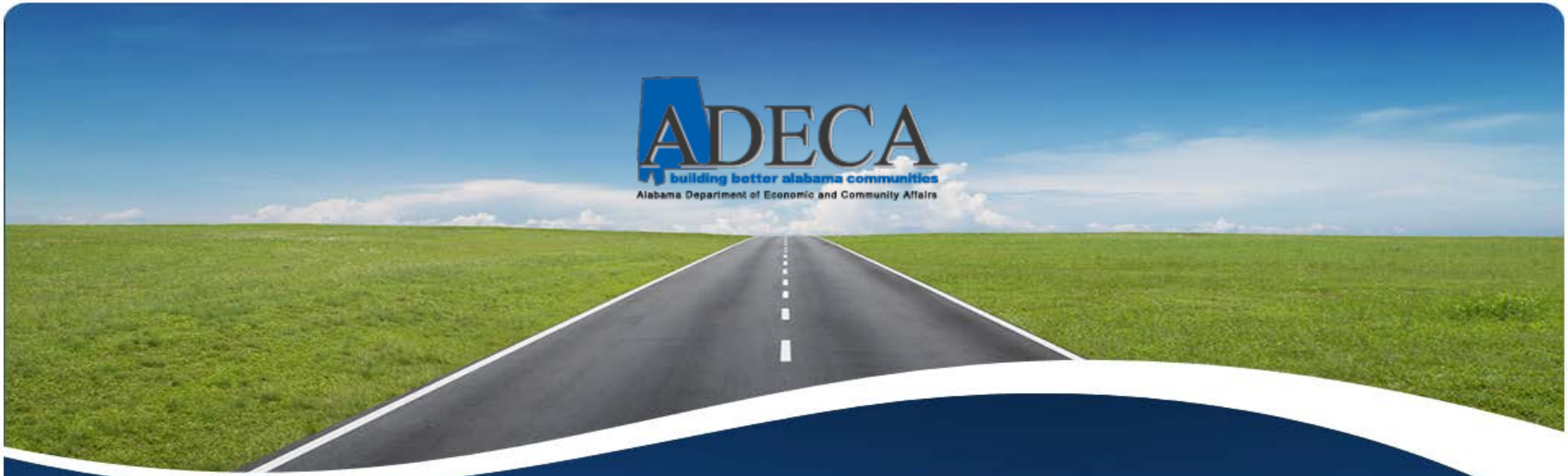

Weather Analyses

Effect of Weather on Crashes

(Alabama 2012 Crash Data)

David B. Brown

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January 10, 2014

Question:
Overall Weather Effects

Multiple Choice

What proportion of crashes in Alabama occur in rainy weather?

a. 10%

b. 20%

c. 30%

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C032: Weather

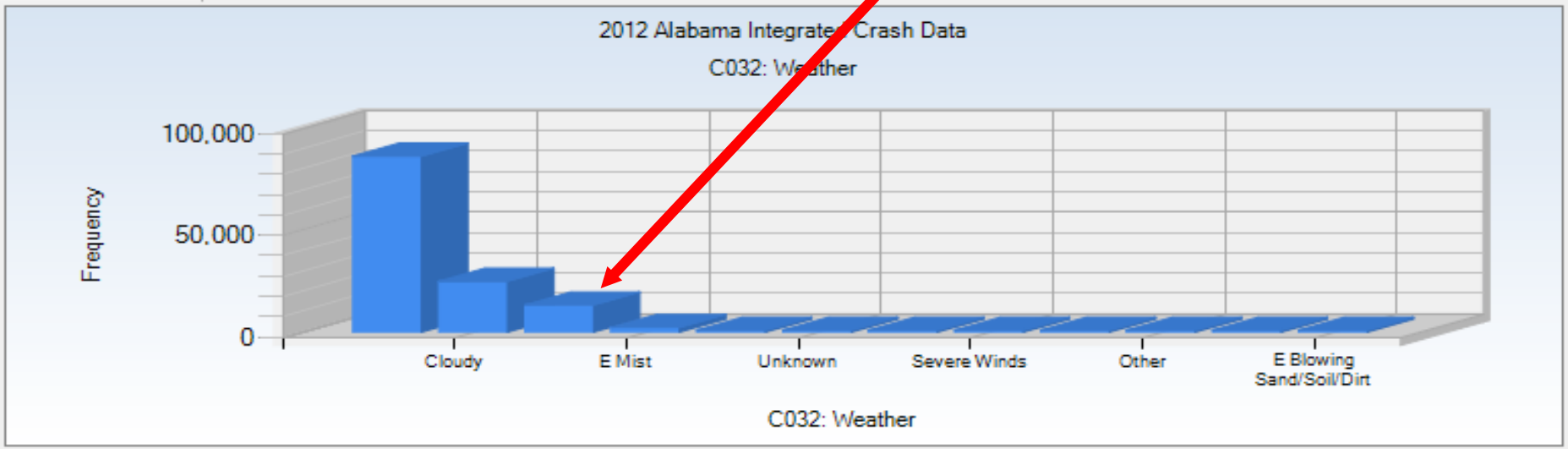
Value	Frequency	Cum. Frequency	Percentage	Cum. Percent
Clear	86480	86480	67.44	67.44
Cloudy	24980	111460	19.48	86.92
Rain	13310	124770	10.38	97.30
E Mist	2247	127017	1.75	99.05
Fog	845	127862	0.66	99.71
Unknown	209	128071	0.16	99.87
Sleet/Hail/Freezing Rain	57	128128	0.04	99.92
Severe Winds	43	128171	0.03	99.95
Snow	34	128205	0.03	99.98
Other	24	128229	0.02	99.99

C032: Weather

C032 = Rain

Display Average

Display Filter Name



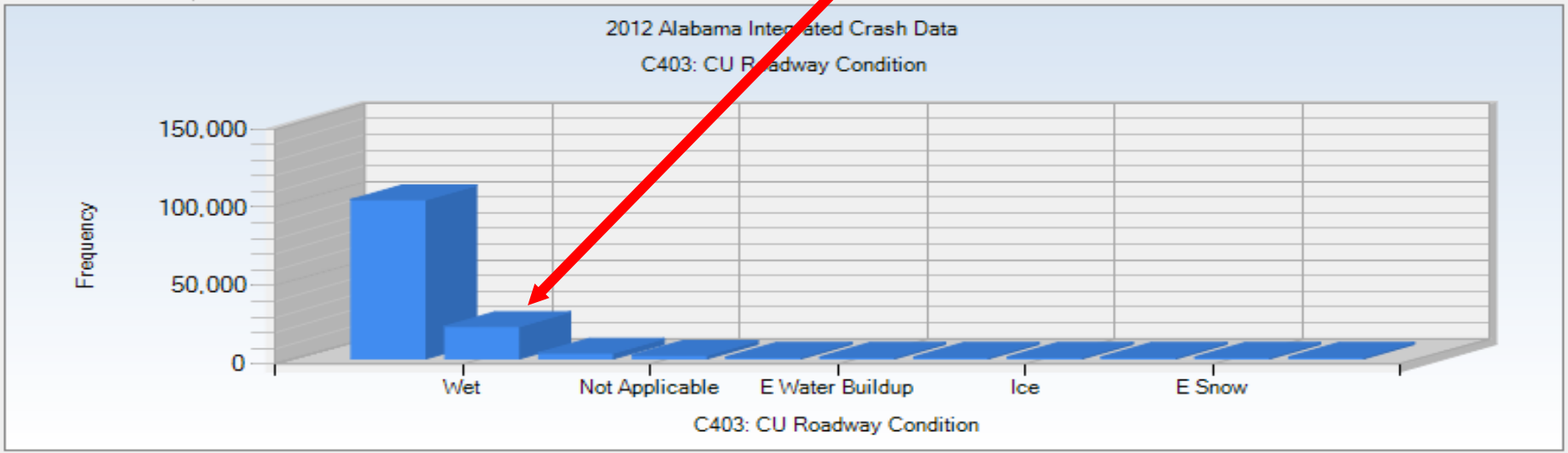
C403: CU Roadway Condition

Value	Frequency	Cum. Frequency	Percentage	Cum. Percent
Dry	101348	101348	79.01	79.01
Wet	20601	121949	16.06	95.07
CU is Unknown	3605	125554	2.81	97.88
Not Applicable	2255	127809	1.76	99.64
Unknown	142	127951	0.11	99.75
E Water Buildup	139	128090	0.11	99.86
Muddy Sand/Dirt/Gravel	80	128170	0.06	99.92
Ice	67	128237	0.05	99.97
Other	26	128263	0.02	99.99
E Snow	8	128271	0.01	100.00
E Slush	3	128274	0.00	100.00

C403: CU Roadway Condition

C403 = Wet Pavement

Display Average Display Filter Name



Question:
Weather Crash Increase Effects

Does knowing that wet weather is involved in 16% of all crashes tell us anything about how much wet weather (including wet pavement) increases crash frequency?

What is the crash frequency increase correlated to wet pavement?

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Definitions for the Comparison

- Wet Pavement (WP) – from C403 and C583
- Wet Day (WD) == 200 or More “WP” Crashes
  - Daily average for all crashes is 352
  - 200/352 = 57% minimum to be a wet day
- Dry Day == Zero WP Crashes Occurred
- Comparison is on a Crash-Per-Day Basis

Question:
Specific Weather Effects

Multiple Choice

What is the crash frequency increase correlated to wet days as defined above?

a. 20%

b. 40%

c. 60%

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Comparison of Wet and Dry Days

(Overall: 352 crashes per day)

- Wet: 13,423 Crashes in 29 Days (463 C/Day)
- Dry: 14,869 Crashes in 46 Days (323 C/Day)
- Increase of 463-323 = 140 Crashes per Day
- Over 40% (43.2%) More Crashes per Day
- Conclusion: Rain is a Major Factor
  - In crash causation
  - What about severity?

Question:
Wet weather Crash Severity?

True of False:

.

The severity of wet crashes is about the same as that for dry weather crashes.

CAPS
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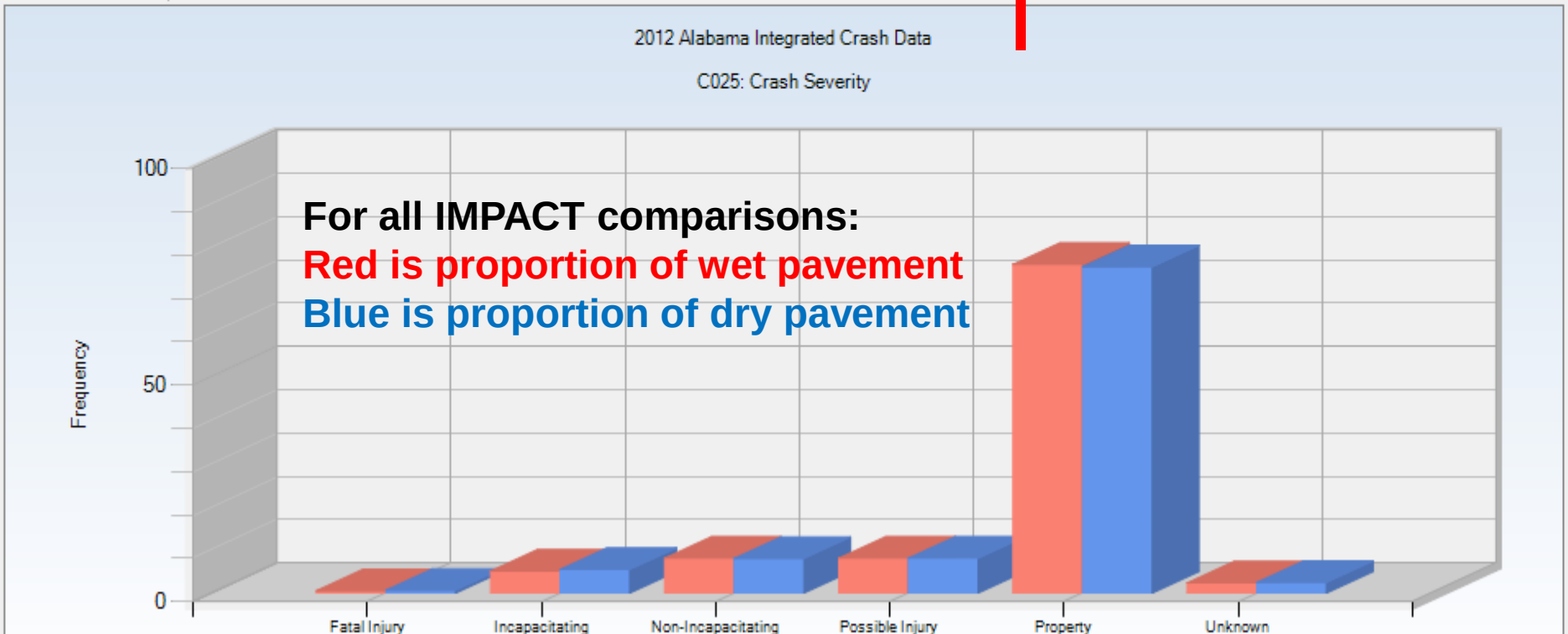
C025: Crash Severity

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Fatal Injury	113	0.55	699	0.65	0.845	-20.683
Incapacitating Injury	1046	5.08	5882	5.46	0.930	-78.929
Non-Incapacitating Injury	1659	8.05	8611	7.99	1.007	12.152
Possible Injury	1660	8.06	8672	8.05	1.001	1.485
Property Damage Only	15642	75.93	81208	75.39	1.007	111.021
Unknown	481	2.33	2646	2.46	0.951	-25.046

C015: Primary Contributing Circumstan
C016: Primary Contributing Unit Numbe
C017: First Harmful Event
C018: Location First Harmful Event Rel
C019: E Most Harmful Event
C020: E Distracted Driving
C021: Distance to Fixed Object
C022: E Type of Roadway Junction/Fea

Sort by Sum of Max Gain

Display Filter Name



For all IMPACT comparisons:
Red is proportion of wet pavement
Blue is proportion of dry pavement

Question:
EMS Response Time

Multiple Choice:

Average response time for wet weather injury EMS crash increases by …

a. Less than a Minute
b. 1-5 Minutes
c. 5-10 Minutes

CAPS
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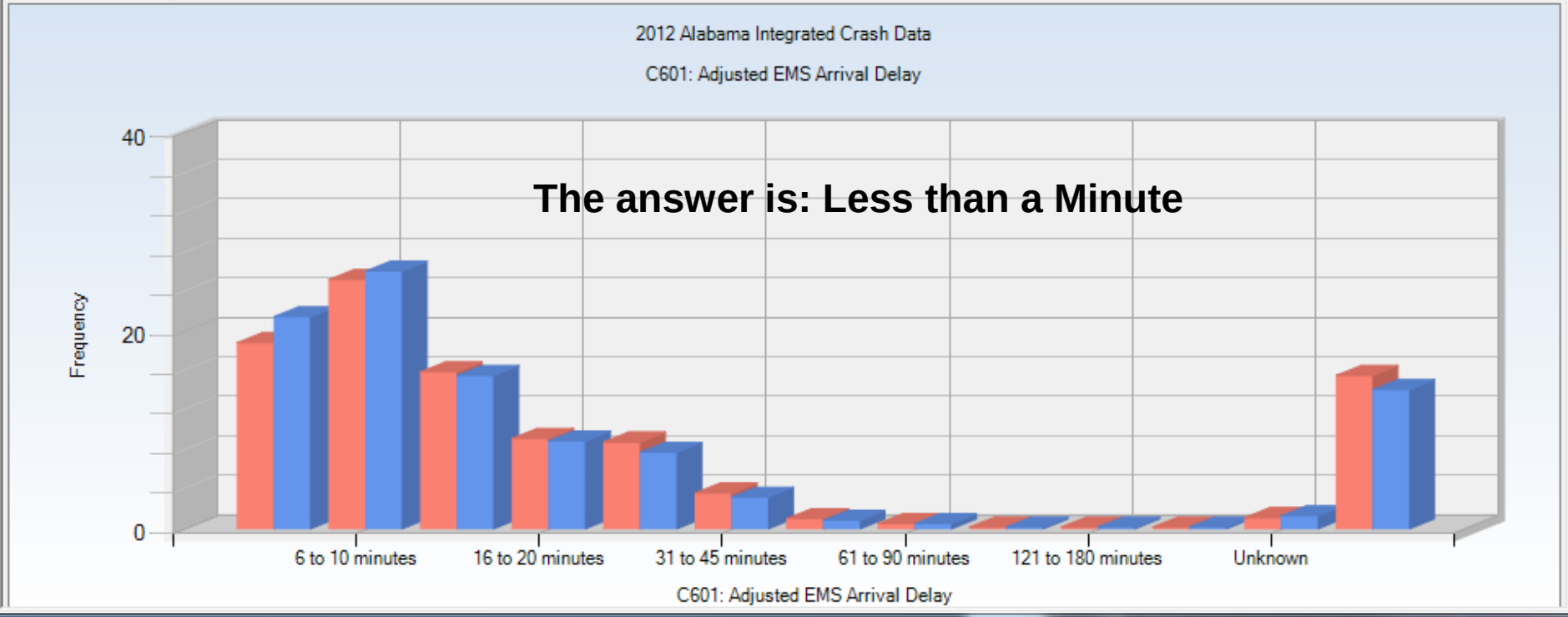
C601: Adjusted EMS Arrival Delay

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
0 to 5 minutes	822	18.84	4777	21.47	0.877*	-114.848
6 to 10 minutes	1101	25.23	5803	26.08	0.967	-37.063
11 to 15 minutes	693	15.88	3451	15.51	1.024	16.203
16 to 20 minutes	399	9.15	1977	8.89	1.029	11.278
21 to 30 minutes	383	8.78	1721	7.74	1.135*	45.484
31 to 45 minutes	158	3.62	713	3.20	1.130	18.169

C601: Adjusted EMS Arrival Delay

Sort by Sum of Max Gain

Display Filter Name



Question:
Wettest Months?

True of False:

.

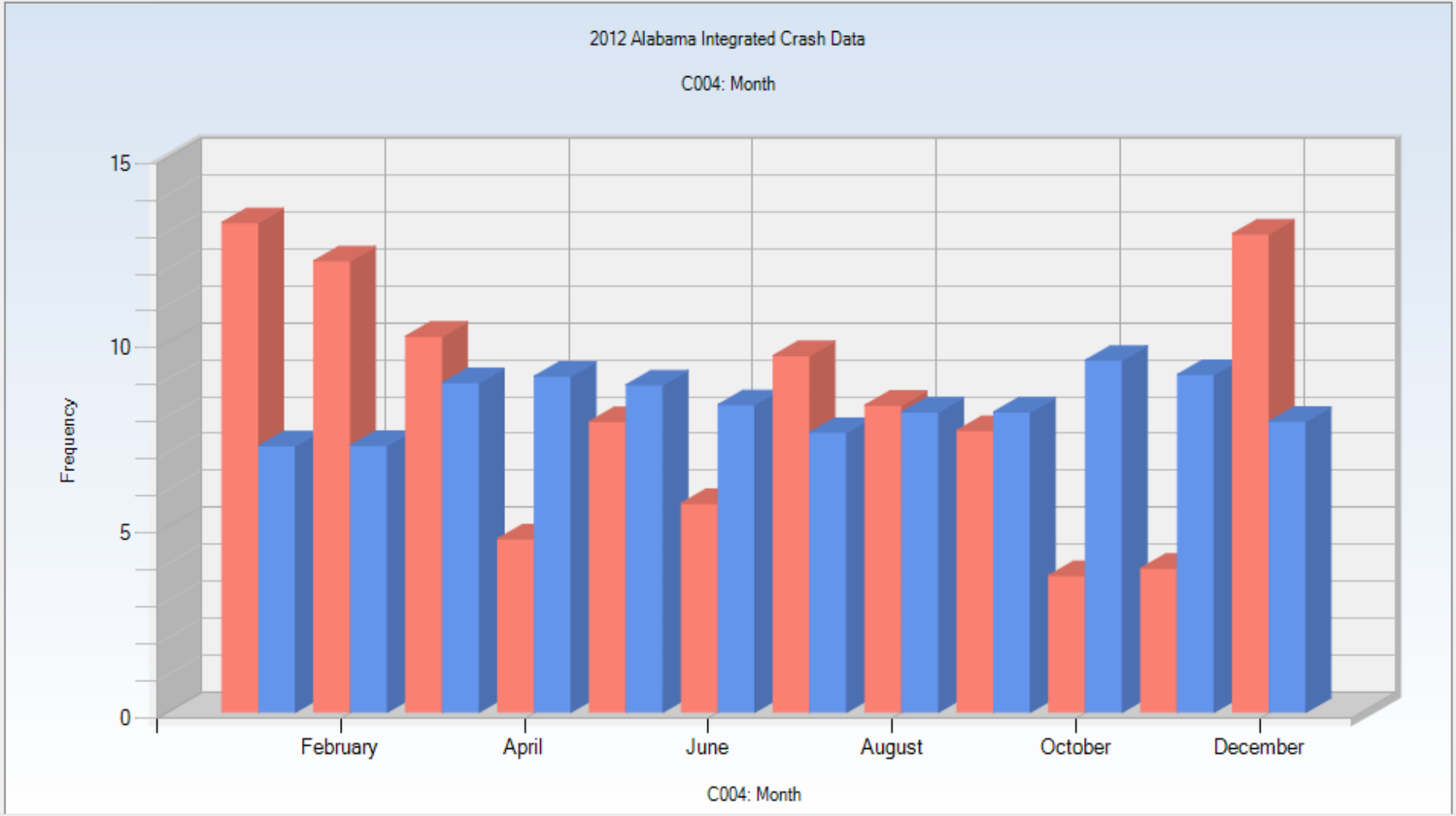
October and November are among some of Alabama's wettest months.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

C004: Month

Sort by Sum of Max Gain

Display Filter Name



Question:
Time of Day

True of False:

.

Wet weather crashes tend to be most over-represented during rush hours as opposed to night-time.

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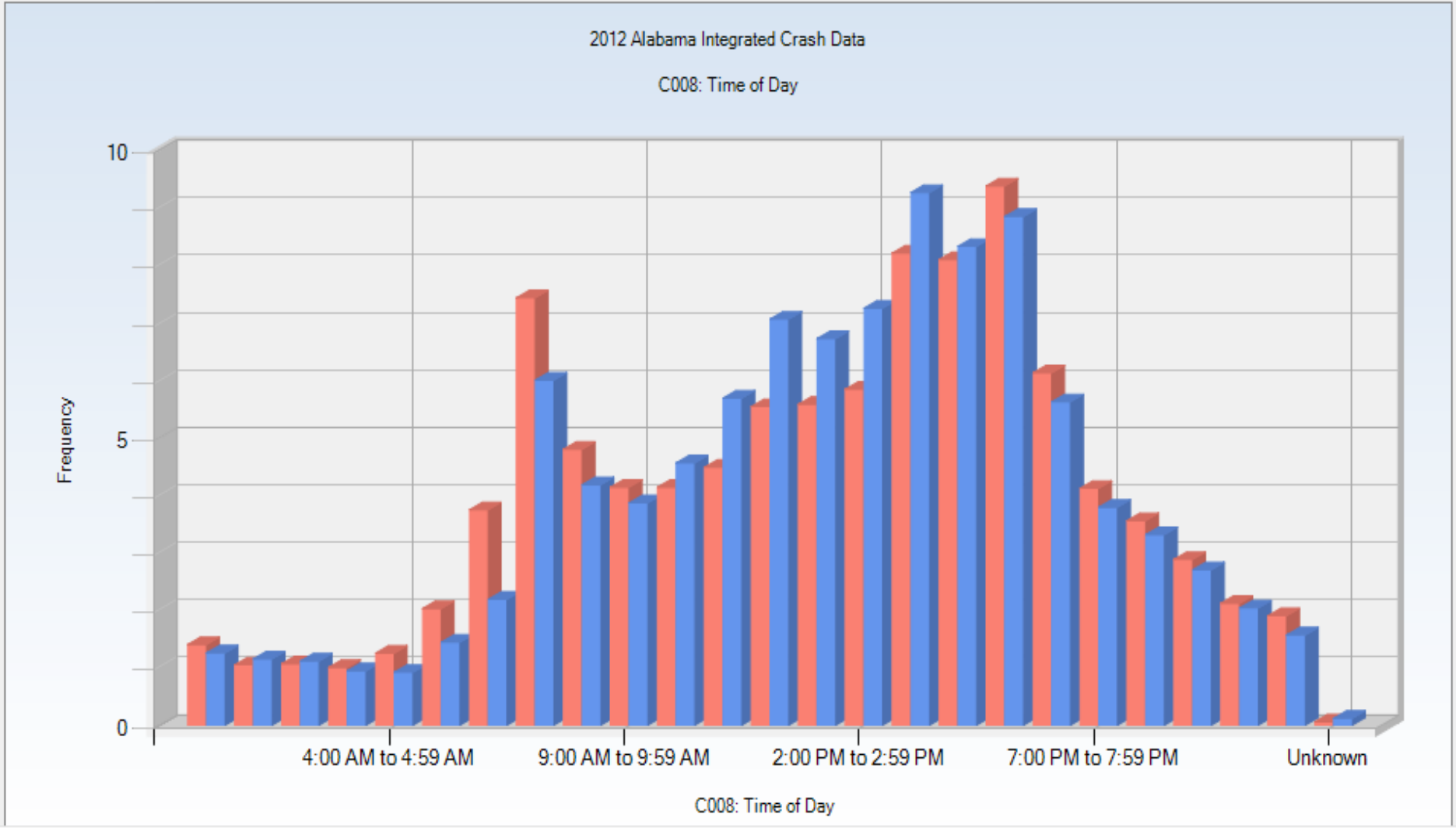
C008: Time of Day

Sort by Sum of Max Gain

Display Filter Name



Question:
Rural or Urban

True of False:

.

Rural crashes seem to be more sensitive to increases caused by wet weather than those in the urban areas.

CAPS
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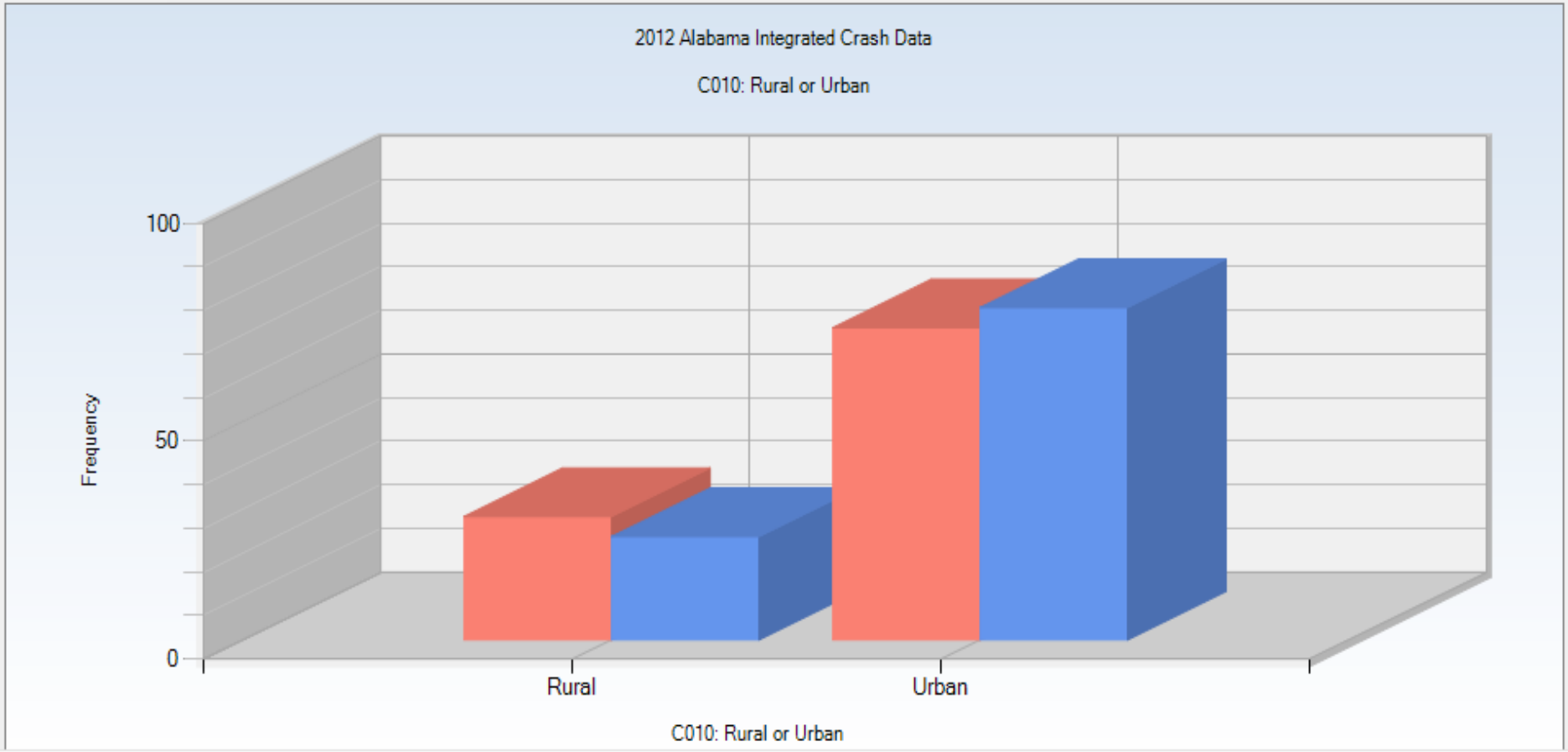
C010: Rural or Urban

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Rural	5838	28.34	25527	23.70	1.196*	955.977
Urban	14763	71.66	82191	76.30	0.939*	-955.977

C001: County
C002: City
C003: Year

Sort by Sum of Max Gain

Display Filter Name



Question:
Highway Classification

True of False:

.

Interstate highways have higher sensitivity to wet weather than state routes.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

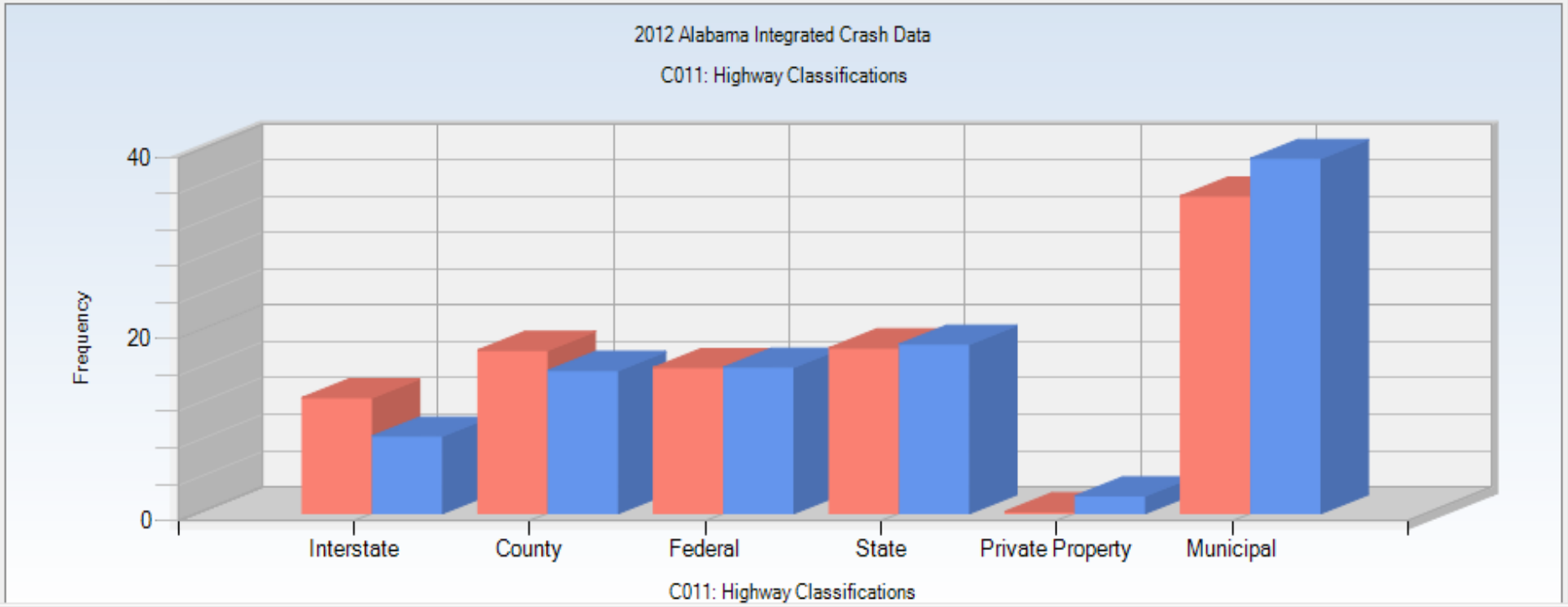
C011: Highway Classifications

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Interstate	2626	12.75	9180	8.52	1.496*	870.331
County	3700	17.96	16954	15.74	1.141*	457.558
Federal	3305	16.04	17330	16.09	0.997	-9.352
State	3754	18.22	20066	18.63	0.978	-83.610
Private Property	21	0.10	2079	1.93	0.053*	-376.607
Municipal	7195	34.93	42094	39.08	0.894*	-855.451

C008: Time of Day
C009: Data Source
C010: Rural or Urban
C011: Highway Classifications
C012: Controlled Access
C013: E Highway Side
C014: Distance from Node 1
C015: Primary Contributing Circumstan

Sort by Sum of Max Gain

Display Filter Name



Question:
Contributing Circumstances

True of False:

.

Following too closely is reported to be more of a problem in causing wet weather crashes than dry weather crashes.

CAPS
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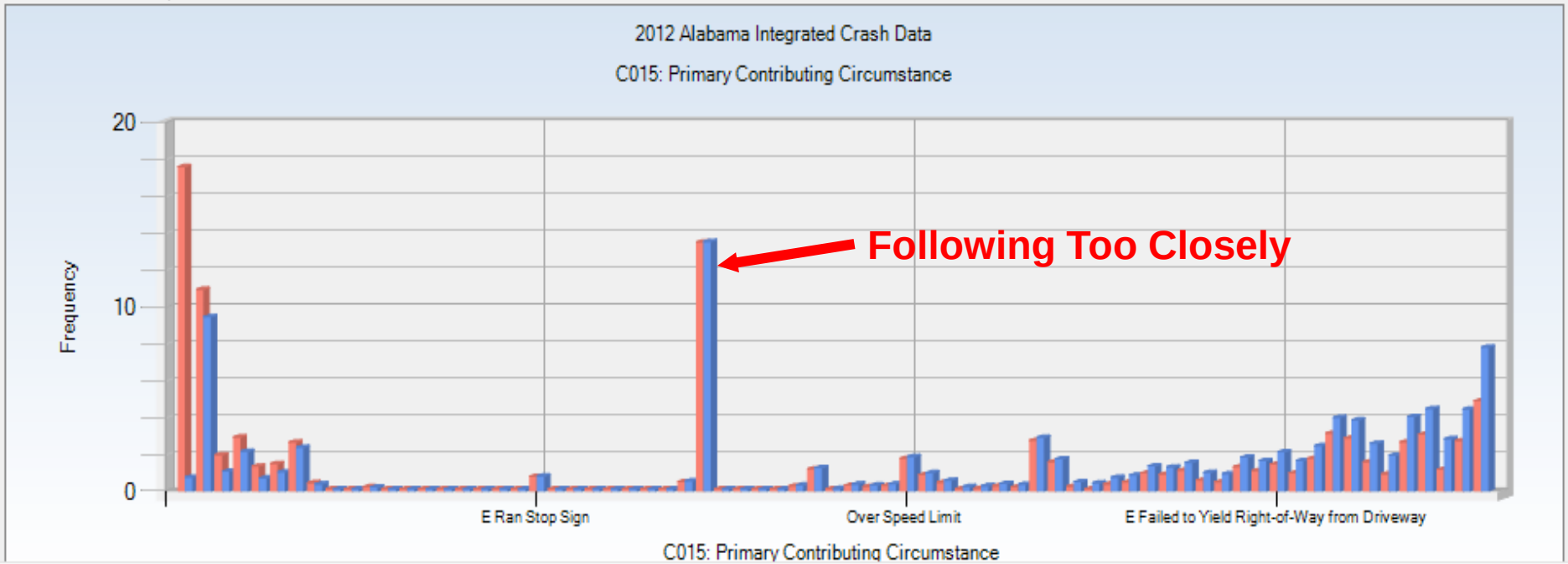
C015: Primary Contributing Circumstance

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Driving too Fast for Conditions	3624	17.59	793	0.74	23.895*	3472.339
Misjudge Stopping Distance	2252	10.93	10164	9.44	1.159*	308.141
P Driver Not in Control	400	1.94	1138	1.06	1.838*	182.358
E Ran off Road	601	2.92	2303	2.14	1.365*	160.553
E Over Correcting/Over Steering	274	1.33	749	0.70	1.913*	130.754
E Other - No Improper Driving	303	1.47	1103	1.02	1.436*	92.052
E Swerved to Avoid Vehicle	543	2.64	2537	2.36	1.119*	57.800

C009: Data Source
C010: Rural or Urban
C011: Highway Classifications
C012: Controlled Access
C013: E Highway Side
C014: Distance from Node 1
C015: Primary Contributing Circumstan
C016: Primary Contributing Unit Numbe
C017: First Harmful Event

Sort by Sum of Max Gain

Display Filter Name



Question:
First Harmful Event

True of False:

.

While "collisions with other vehicles" account for the majority of wet weather harmful events, it is under-represented compared to dry-weather crashes.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

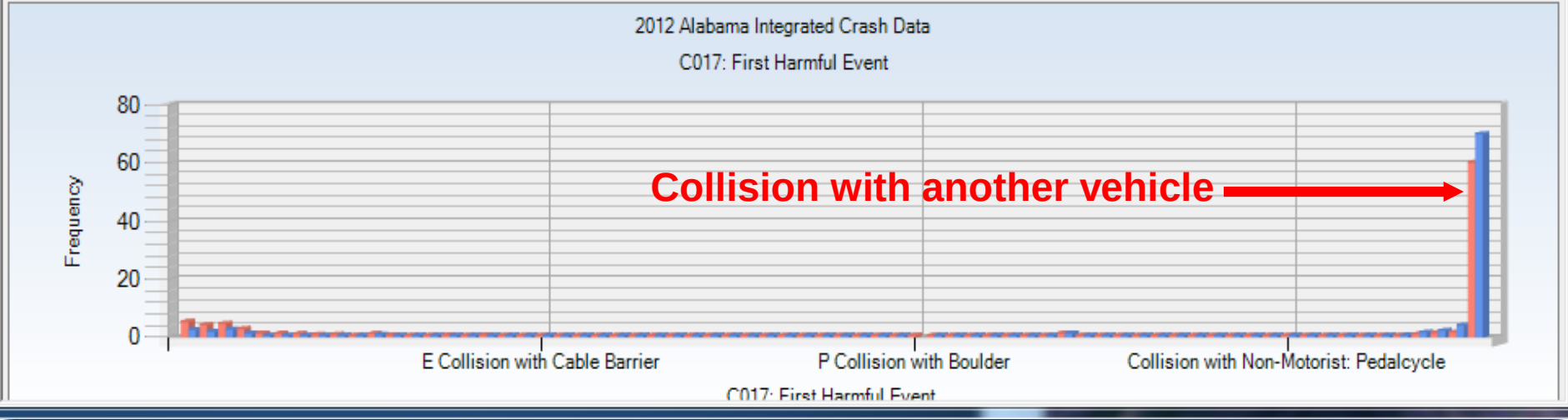
C017: First Harmful Event

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Collision with Ditch	1104	5.36	2838	2.64	2.033*	560.920
Collision with Tree	876	4.25	2125	1.97	2.154*	469.359
E Ran Off Road Right	962	4.67	2890	2.69	1.740*	408.969
E Ran Off Road Left	597	2.90	1480	1.38	2.108*	313.787
E Collision with Concrete Barrier	300	1.46	304	0.28	5.157*	241.826
E Collision with Guardrail Face	271	1.32	519	0.48	2.729*	171.684
E Evasive Action (Swerve/Bra...	239	1.16	690	0.64	1.810*	106.961
E Collision with Embankment	190	0.92	574	0.53	1.730*	80.159
Collision with Sign Post	206	1.00	661	0.61	1.629*	79.511
Collision with Bridge Abutment/...	115	0.56	234	0.22	2.568*	70.222
Collision with Utility Pole	252	1.22	959	0.89	1.373*	68.486

C010: Rural or Urban
C011: Highway Classifications
C012: Controlled Access
C013: E Highway Side
C014: Distance from Node 1
C015: Primary Contributing Circumstan
C016: Primary Contributing Unit Numbe
C017: First Harmful Event
C018: Location First Harmful Event Rel
C019: E Most Harmful Event
C020: E Distracted Driving
C021: Distance to Fixed Object
C022: E Type of Roadway Junction/Fea
C023: E Manner of Crash

Sort by Sum of Max Gain

Display Filter Name



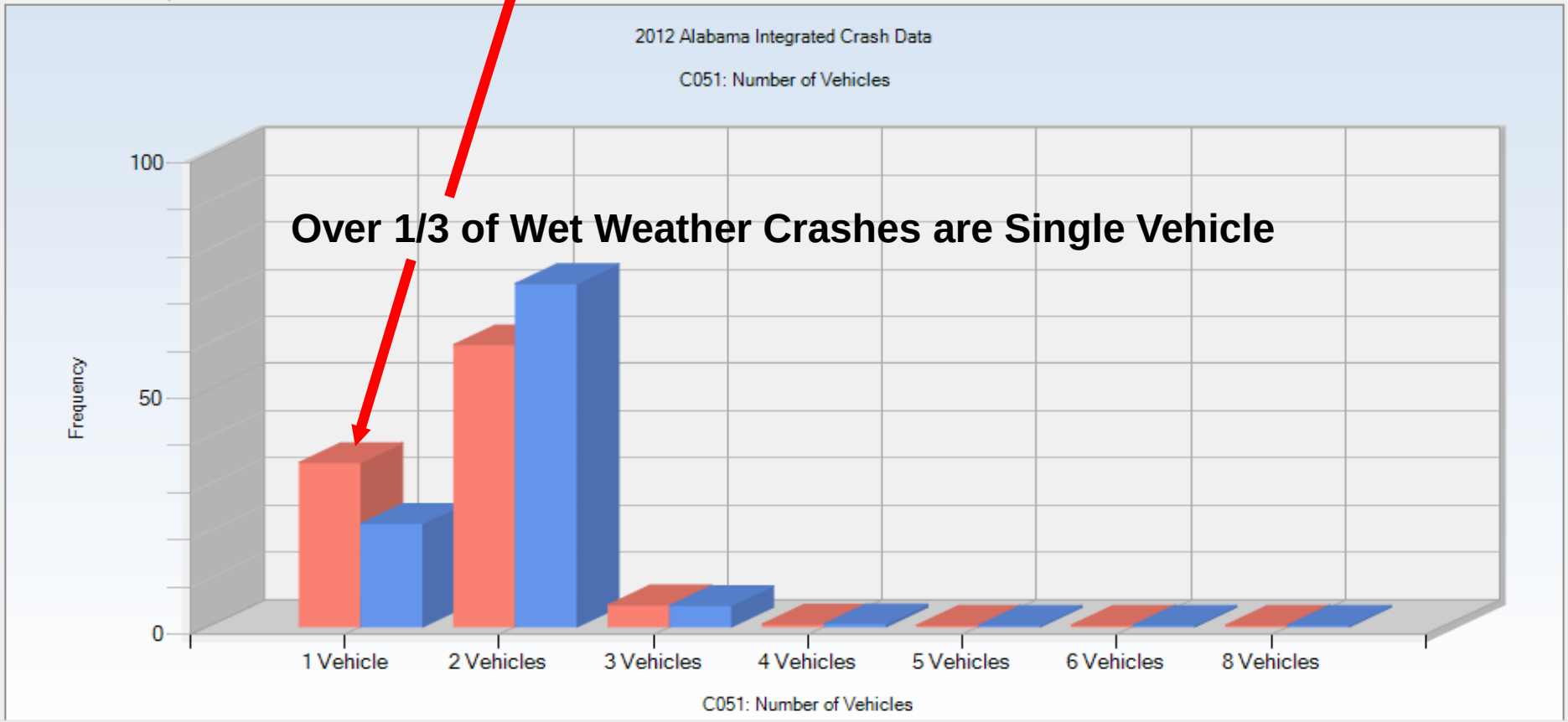
C051: Number of Vehicles

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
1 Vehicle	7180	34.85	23608	21.92	1.590*	2664.985
2 Vehicles	12326	59.83	78450	72.83	0.822*	-2677.513
3 Vehicles	953	4.63	4856	4.51	1.026	24.293
4 Vehicles	119	0.58	680	0.63	0.915	-11.050

C046: HasRTMP
C049: ALDOT Division
C050: ADECA CTSP Region
C051: Number of Vehicles
C052: Number of Drivers Recorded

Sort by Sum of Max Gain

Display Filter Name



Question:
Intersection Involvement

True of False:

.

Relatively fewer wet (than dry) weather crashes occur at intersections.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

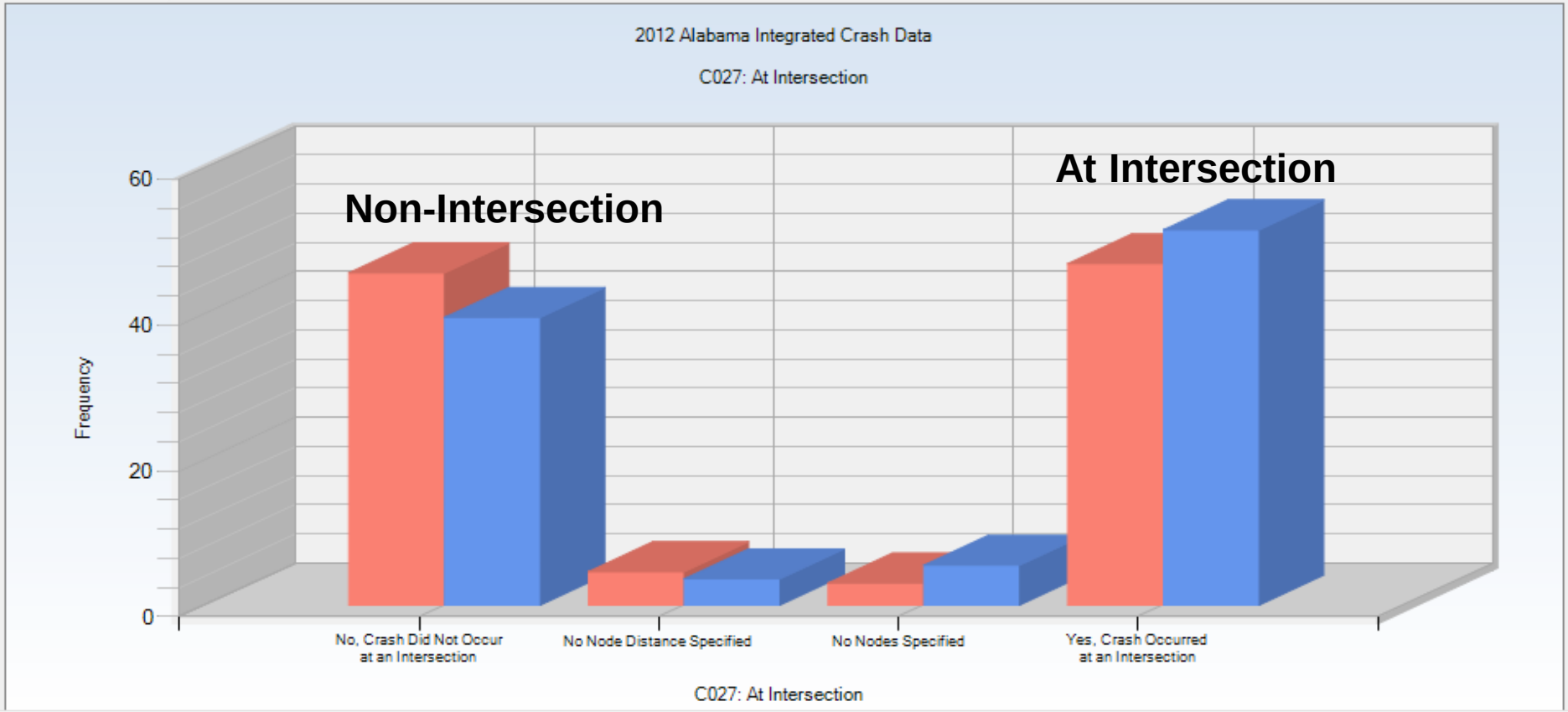
C027: At Intersection

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
No, Crash Did Not Occur at an I...	9389	45.58	42512	39.47	1.155*	1258.607
No Node Distance Specified	943	4.58	3869	3.59	1.274*	203.056
No Nodes Specified	621	3.01	5882	5.46	0.552*	-503.929
Yes, Crash Occurred at an Inter...	9648	46.83	55455	51.48	0.910*	-957.734

C024: School Bus Related
C025: Crash Severity
C026: Intersection Related
C027: At Intersection
C028: Mileposted Route
C031: Lighting Conditions

Sort by Sum of Max Gain

Display Filter Name



Question:
Commercial Motor Vehicles (CMV)

True of False:

.

Commercial Motor Vehicles (CMVs) are involved in about the same proportion of wet weather crashes as private vehicles.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

C450: CU CMV Indicator

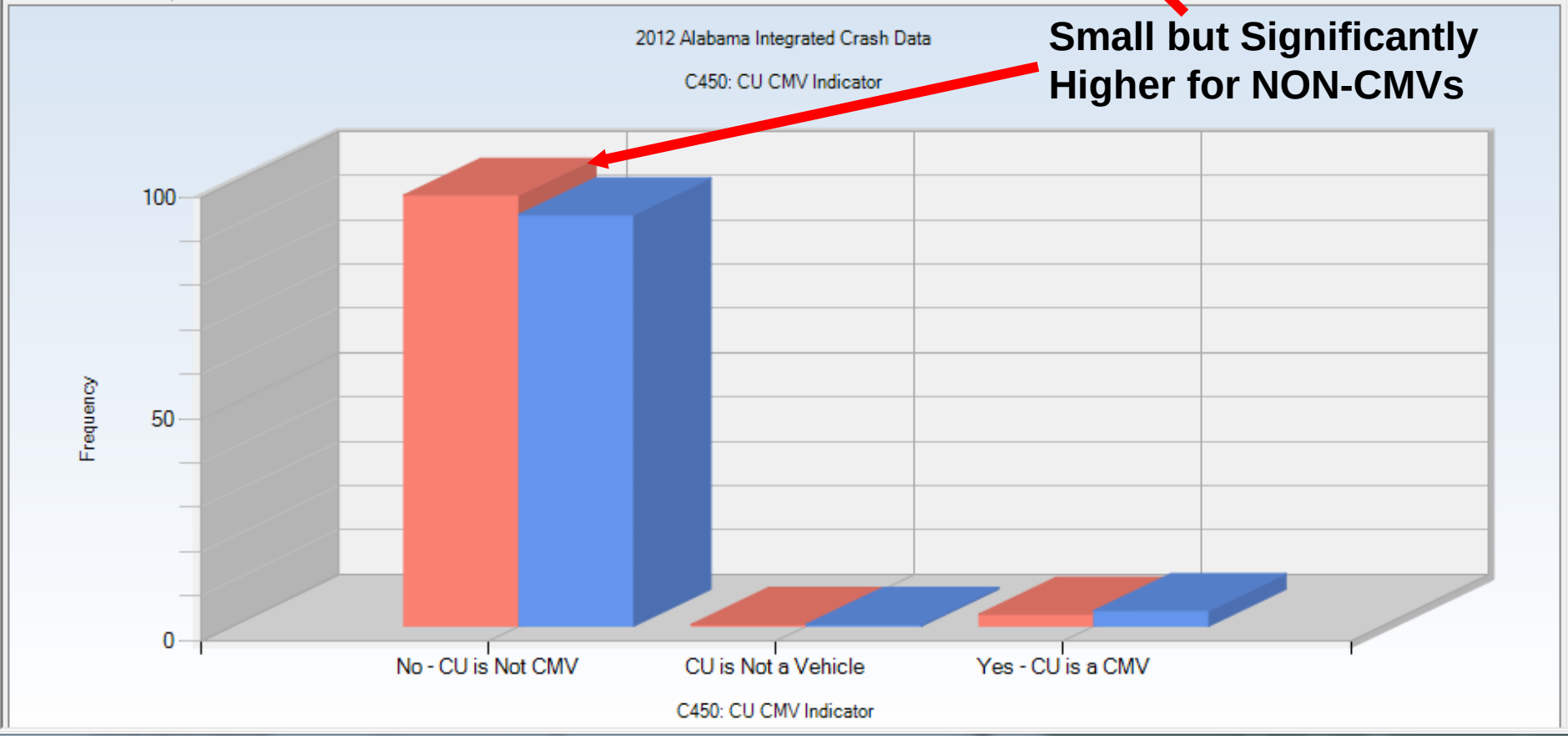
Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
No - CU is Not CMV	20020	97.18	99941	92.79	1.047*	905.282
CU is Not a Vehicle	33	0.16	424	0.39	0.407*	-48.094
Yes - CU is a CMV	548	2.66	3742	3.47	0.766*	-167.695

C450: CU CMV Indicator

Sort by Sum of Max Gain

Display Filter Name

Small but Significantly Higher for NON-CMVs



Question: Motorcycles

True of False:

.

Motorcycles cause more than their share of wet weather crashes.

CAPS
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C101: Causal Unit (CU) Type

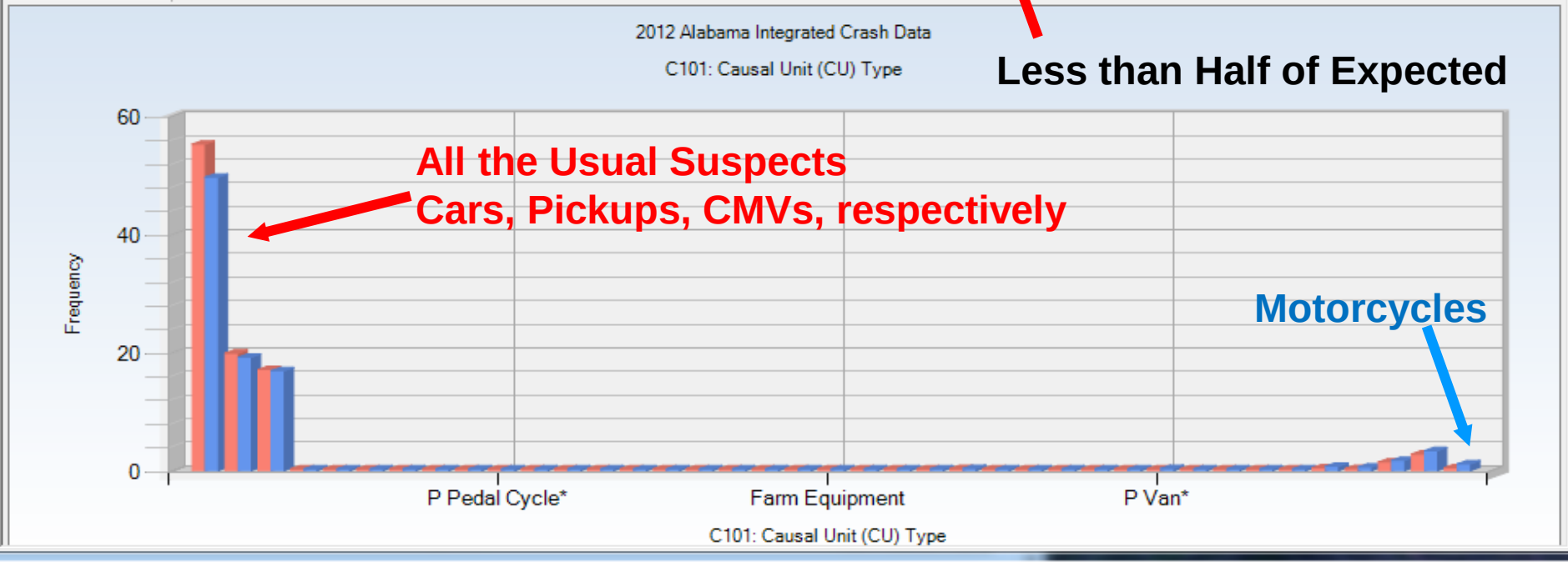
Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
E 4-Wheel Off Road ATV	5	0.02	99	0.09	0.264	-13.934
E Other Heavy Truck (Cannot ...	12	0.06	150	0.14	0.418	-16.688
E Single-Unit Truck (3 Axles or ...	34	0.17	293	0.27	0.607*	-22.037
Pedestrian	20	0.10	275	0.26	0.380*	-32.594
E Single-Unit Truck (2-Axle/6-T...	103	0.50	789	0.73	0.683*	-47.898
E Unknown Type of Motorized ...	68	0.33	677	0.63	0.525*	-61.477
E Tractor/Semi-Trailer	295	1.43	1864	1.73	0.828*	-61.493
E Van or Mini-Van	572	2.78	3625	3.37	0.825*	-121.287
Motorcycle	100	0.49	1207	1.12	0.433*	-130.841

C060: Number Killed
C080: CMV Involved
C101: Causal Unit (CU) Type
C102: CU Non-Motorist Indicator
C103: CU Commercial Motor Vehicle In
C105: CU Left Scene
C106: CU Driver Age
C107: CU Driver Raw Age
C108: CU Driver Race
C109: CU Driver Gender
C110: CU Driver Residence Distance

Sort by Sum of Max Gain

Display Filter Name

Less than Half of Expected



Question:
Causal Driver

True of False:

.

Compared to younger drivers, older drivers have greater problems in wet weather.

CAPS
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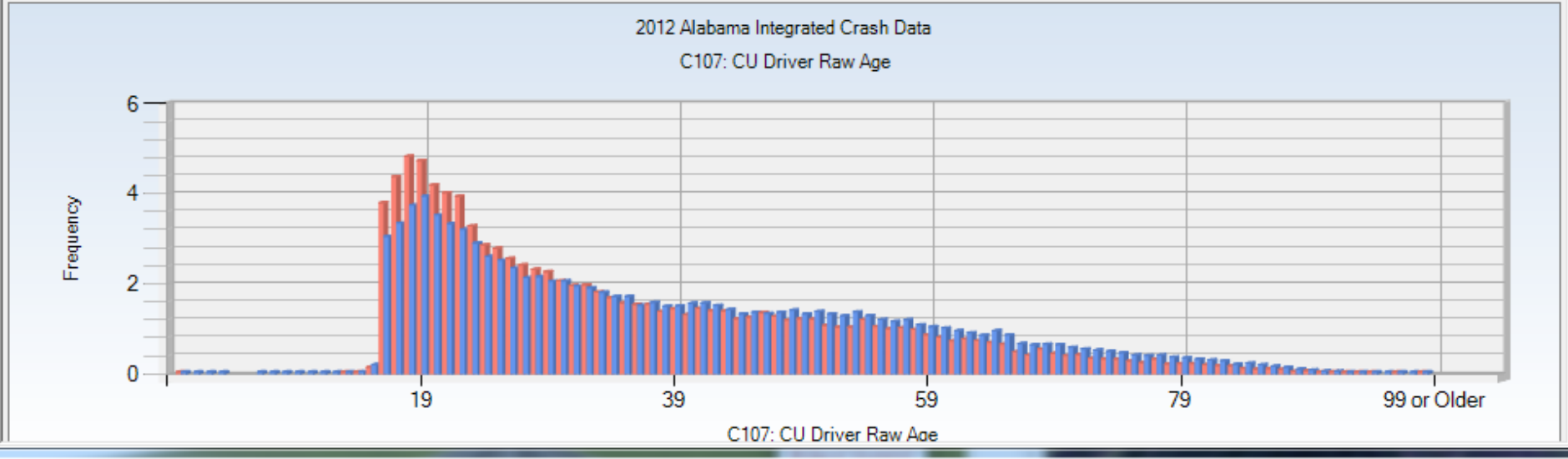
C107: CU Driver Raw Age

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
16	739	3.80	2886	3.05	1.245*	145.304
17	852	4.38	3164	3.35	1.309*	201.115
18	940	4.83	3542	3.75	1.290*	211.354
19	921	4.73	3731	3.94	1.200*	153.474
20	816	4.19	3334	3.53	1.190*	130.143
21	782	4.02	3153	3.33	1.206*	133.378
22	767	3.94	3032	3.21	1.230*	143.269
23	639	3.28	2746	2.90	1.131*	74.104
24	556	2.86	2463	2.60	1.097	49.322
25	542	2.79	2384	2.52	1.105	51.573
26	498	2.56	2222	2.35	1.089	40.899

C107: CU Driver Raw Age

Sort by Sum of Max Gain

Display Filter Name



Question:
Driver Gender

True of False:

.

Men have more of a problem with wet weather than women do.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

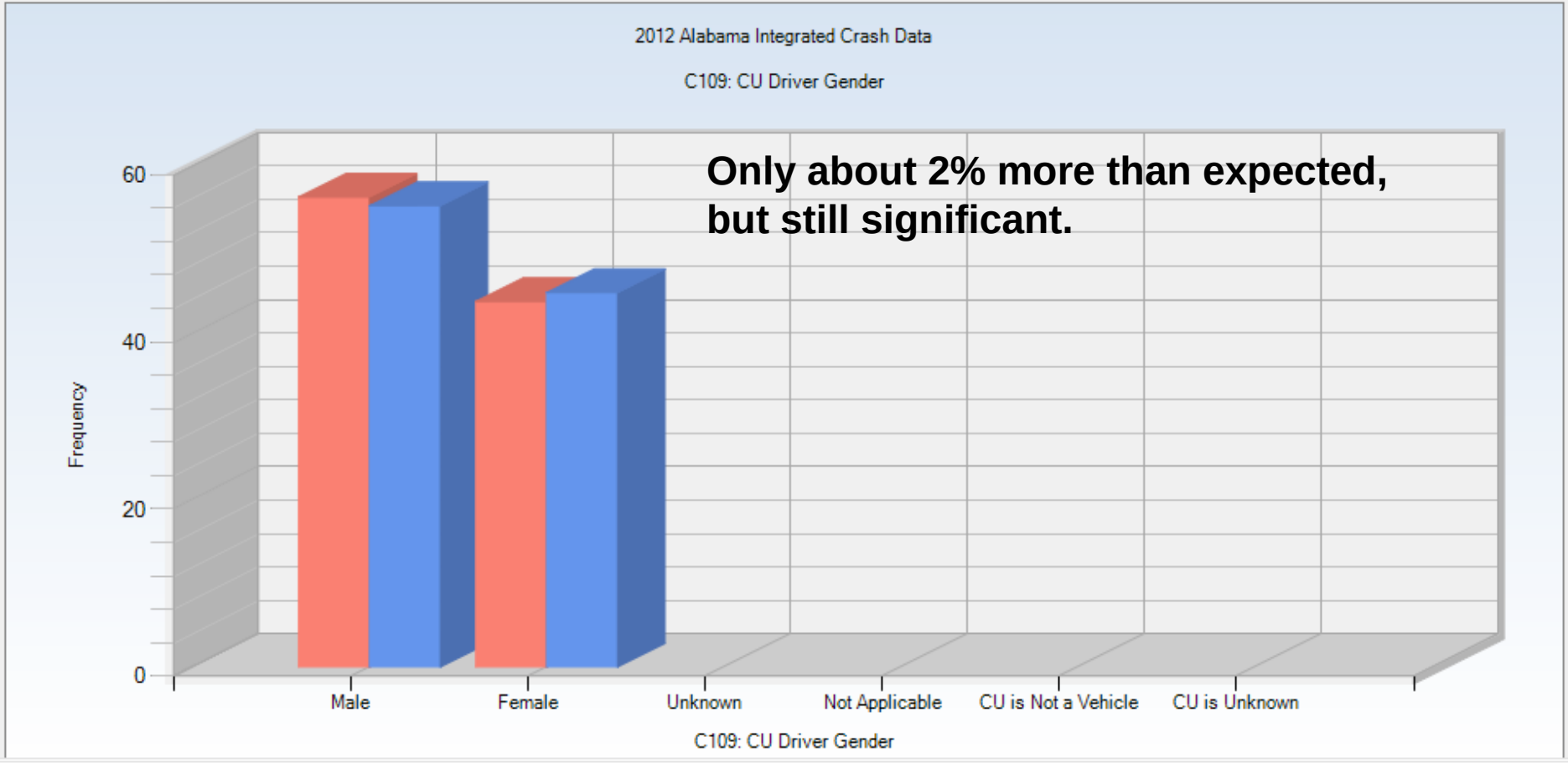
C109: CU Driver Gender

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Male	11039	56.25	52820	55.20	1.019*	206.746
Female	8586	43.75	42875	44.80	0.976*	-206.746

C109: CU Driver Gender

Sort by Sum of Max Gain

Display Filter Name



Question:
Model Year

True of False:

.

Newer vehicles have fewer problems with wet weather.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

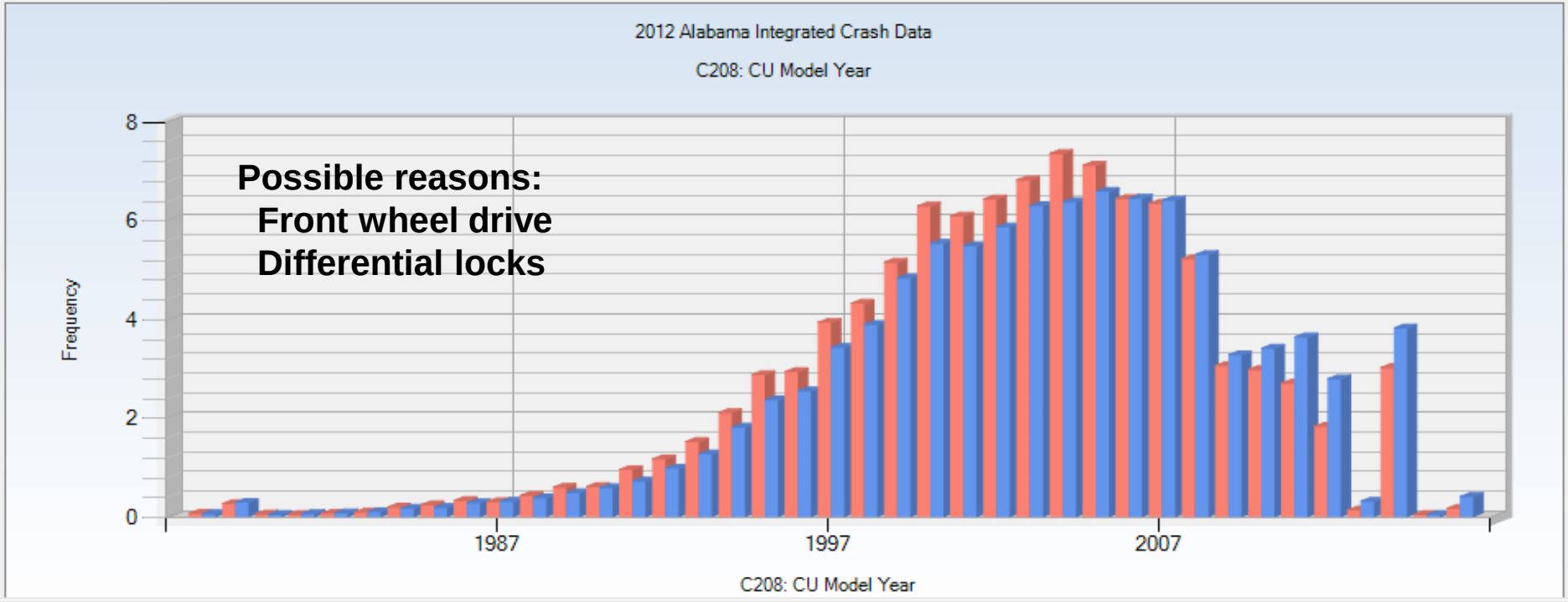
C208: CU Model Year

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
2002	1312	6.42	6236	5.86	1.096*	114.650
2003	1391	6.81	6689	6.29	1.083*	106.671
2004	1501	7.35	6773	6.37	1.154*	200.543
2005	1452	7.11	7000	6.58	1.080*	107.957
2006	1314	6.43	6851	6.44	0.999	-1.434
2007	1294	6.34	6811	6.40	0.989	-13.753
2008	1065	5.22	5639	5.30	0.984	-17.722

C130: E CU Non-Motorist Maneuvers
C201: CU Vehicle Most Harmful Event
C202: CU Contributing Circumstance
C203: CU First Harmful Event Location
C204: E CU Sequence of Events #1
C205: E CU Sequence of Events #2
C206: E CU Sequence of Events #3
C207: E CU Sequence of Events #4
C208: CU Model Year
C209: CU Make

Sort by Sum of Max Gain

Display Filter Name



Possible reasons:
Front wheel drive
Differential locks

Question:
Grade and Curvature

True of False:

.

Grade and curvature do not have much of an impact on wet weather crashes.

CAPS
CENTER FOR ADVANCED PUBLIC SAFETY

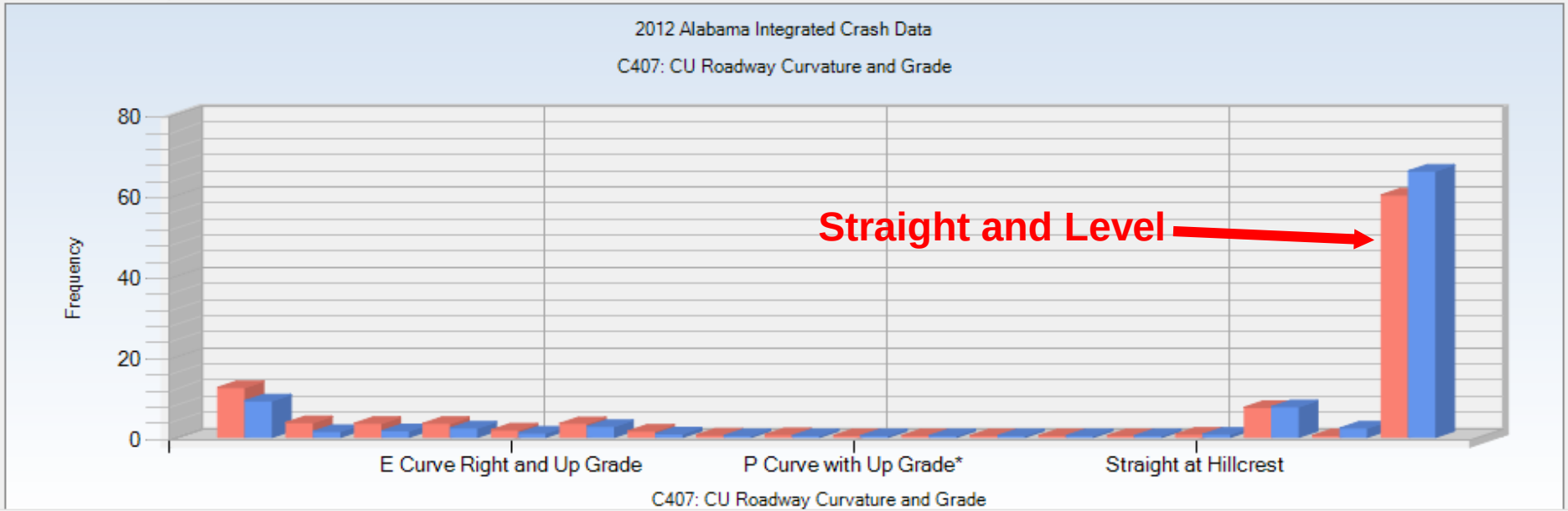
C407: CU Roadway Curvature and Grade

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Straight with Down Grade	2542	12.34	9756	9.07	1.361*	674.096
E Curve Right and Down Grade	749	3.64	1551	1.44	2.522*	452.042
E Curve Left and Down Grade	712	3.46	1697	1.58	2.191*	387.089
E Curve Left and Level	702	3.41	2433	2.26	1.507*	236.173
E Curve Right and Up Grade	370	1.80	1128	1.05	1.713*	154.031
E Curve Right and Level	700	3.40	2871	2.67	1.273*	150.312
E Curve Left and Up Grade	316	1.53	943	0.88	1.750*	135.451
P Curve with Down Grade*	116	0.56	216	0.20	2.805*	74.644
P Curve and Level*	128	0.62	383	0.36	1.746*	54.670
P Curve with Up Grade*	59	0.29	150	0.14	2.054*	30.281

C330: CU Driver/Non-Motorist Transpor
C331: E CU Driver/Non-Motorist Transp
C401: E CU Involved Road/Bridge
C402: E CU Road Surface Type
C403: CU Roadway Condition
C404: E CU Environmental Contributing
C405: CU Contributing Material in Roac
C406: CU Contributing Material Source
C407: CU Roadway Curvature and Grac
C408: CU Vision Obscured By
C409: CU Traffic Control
C410: CU Traffic Control Functioning
C411: CU Opposing Lane Separation

Sort by Sum of Max Gain

Display Filter Name



Question:
Workzone Effects

True of False:

.

Workzone related crashes are reduced when the weather is wet.

CAPS
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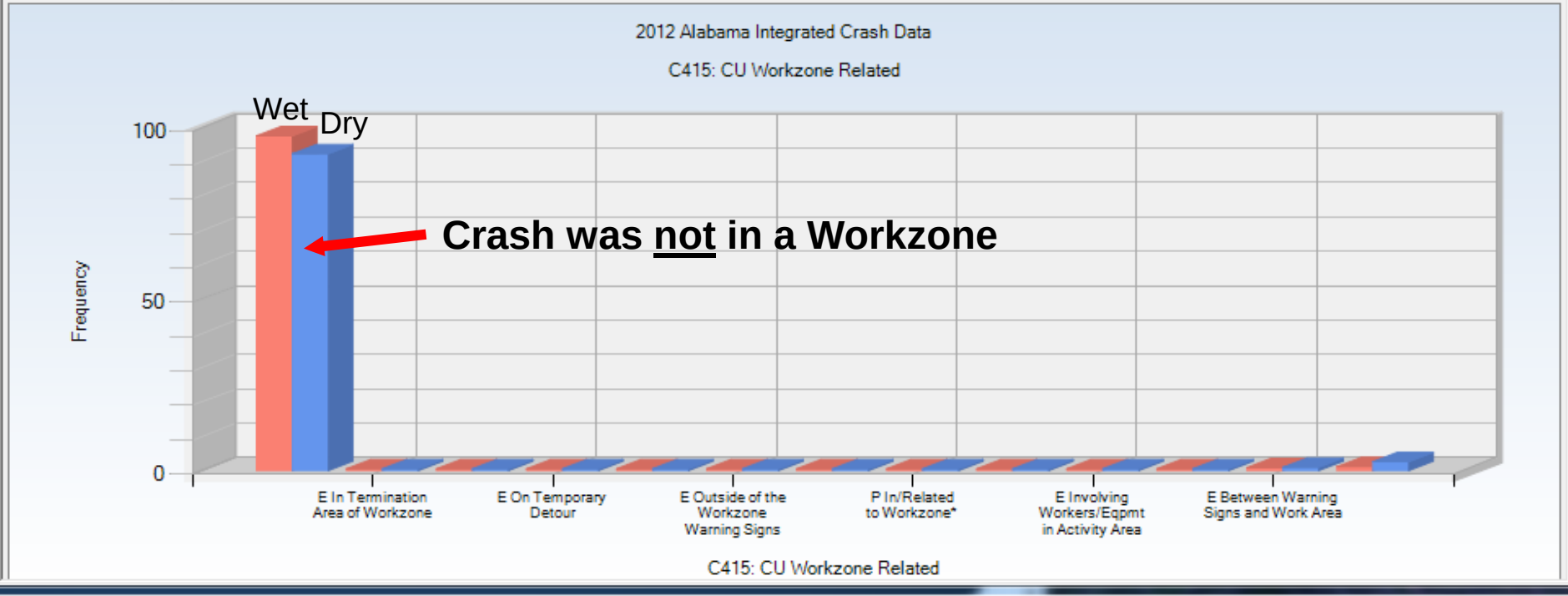
C415: CU Workzone Related

Value	Subset Frequency	Subset Percent	Other Frequency	Other Percent	Odds Ratio	Max Gain
Not In/Related to Workzone	20073	97.44	99316	92.24	1.056*	1070.939
E In Termination Area of Workz...	17	0.08	64	0.06	1.388	4.755
E Involving Roadway Condition...	10	0.05	44	0.04	1.188	1.582
E On Temporary Detour	2	0.01	15	0.01	0.697	-0.870
E Not Involving Workers/Condi...	63	0.31	347	0.32	0.949	-3.391
E Outside of the Workzone Wa...	16	0.08	114	0.11	0.734	-5.812
E Other Workzone Area	2	0.01	45	0.04	0.232	-6.610
P In/Related to Workzone*	6	0.03	75	0.07	0.418	-8.350

C413: E CU Turn Lanes
C414: CU One-Way Street
C415: CU Workzone Related
C416: E CU Workzone Type
C417: E CU Workers Present
C418: E CU Law Enforcement Present
C450: CU CMV Indicator
C451: E CU CMV Weight
C452: CU CMV Hazard Materials Involve
C453: E CU CMV Hazard Materials Rele

Sort by Sum of Max Gain

Display Filter Name



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Alabama Department of Economic and Community Affairs

Roundtable Input and Questions
Thank You!