# Special Study of
# Response of Various Crash Types to COVID Quarantine

**Weeks Ending March 3 through June 30, 2020 Data (17 Weeks)**
**The first 17 Weeks of the government quarantine recommendations**

**David B. Brown, PhD, P.E.**
brown@cs.ua.edu
**July 3, 2020**

**Table of Contents**

# 1 Introduction

The purpose of this report is to present the results of several analyses that have been performed during and subsequent to the COVID quarantine actions. The base week (Week 1 on all charts) was originally the crash results from the week of March 4-10, 2020. This week was used in the original studies, since this was the last week in which the traffic volume and vehicle mix were considered to be "normal."

It was determined by a review of the findings for Week 15 that some of the estimates for Week 1 were outliers in the sense that they were either significantly higher or significantly lower than the average over the first 10 weeks of 2020. It was determined that the average over the ten weeks itself would be a much better "Week 1" comparison. For this reason, the original Week 1 (represented by a value of 1 in the charts) has been adjusted to be the average over the first 10 weeks of 2020, i.e., the weeks before the COVID advisories were issued. We feel that the results given in this report are an improvement over those prior to Week 15, and we will continue to attempt to improve the information presented in any way that comes to our attention.

All cases where the "Week 1" base has been changed are given in Table 1 below. Although several of these now are not close approximations to the original Week 1 values, we will still for consistency call them "Week 1." So think of the Week 1 crash number as *the closest number that we could derive that approximates the crash levels of the various crash types in 2020 prior to the COVID quarantine actions.* The questions to be answered relate to how the various types of crashes were reduced (or increased) with the decline in traffic after Week 1. This is given in each of the charts by Weeks 2, 3, … 17, the last of which is the week of June 24-30, 2020.

There are many things being written at this time regarding traffic ramifications of the COVID-19 virus. If this report contradicts any of those reported findings, this should not infer that either this or other sources are incorrect. They are most likely based on different data sources, which could vary considerably from state to state. The data source for the results in this report are Alabama crashes as reported by eCrash, and thus the results obtained have their most direct application within the state of Alabama. See credit at end of this section.

How can metrics of extremely different values (e.g., all crashes and bicycle crashes) be compared on the same chart? The answer is that the *number of crashes* for each are not being compared. What is being compared are the *proportions* by which the metric increased or decreased in the weeks following the initiation of COVID quarantine guidance. These proportions (e.g., 0.9, 0.8, 1.2, etc.) are given on the Y axis. Week 1 is the name we are giving to the baseline average chosen to gauge relative increases and decreases in the various types of crashes. "Week 1" represents crash frequency (of various types) under normal (pre-COVID) conditions.

All of the crash charts contain two lines representing *fatal* and *all crashes* in order to provide a common frame of reference for comparing how the various crash types changed. In addition to

all crashes and fatal crashes, which are in all of the charts, the following crash types were also compared (each independently, two lines per chart);

- Speeding Crashes and ID/DUI Crashes
- Pedestrian Crashes and Bicycle Crashes
- Motorcycle Crashes and Large Truck Crashes
- Aggressive Driving and Interstate Travel
- Young Driver Crashes and Federal/State Travel
- Rural Crashes and Urban Crashes.

The crash frequencies for the above for the original and updated Week 1 are given in Table 1.

**Table 1. Original and Updated "Week 1" Crash Frequencies**

| Crash Type | Original Week 1 | Updated Week 1 |
|---|---|---|
| All Crashes | 3,445 | 2,794 |
| Fatal Crashes | 22 | 14 |
| Speeding Involved Crashes | 141 | 207 |
| Impaired Driving (ID/DUI) Crashes | 99 | 97 |
| Pedestrian Involved | 19 | 15 |
| Bicycle Crashes | 4 | 3 |
| Motorcycle Crashes | 22 | 14 |
| Large Truck Caused Crashes | 132 | 104 |
| Aggressive Driving Crashes | 53 | 44 |
| Crashes on Interstate Highways | 435 | 321 |
| Misjudged Stopping Distance | 315 | 257 |
| Young Driver (16-20) Caused Crashes | 522 | 404 |
| Rural Crashes | 790 | 665 |
| Urban Crashes | 2,655 | 2,129 |

The Y axis measures how much the particular crash type either increased (greater than1) or decreased (less than one) from Week 1. Multiply by 100 to turn these proportions into percentage increases or decreases. Comments are given beneath each of the charts.

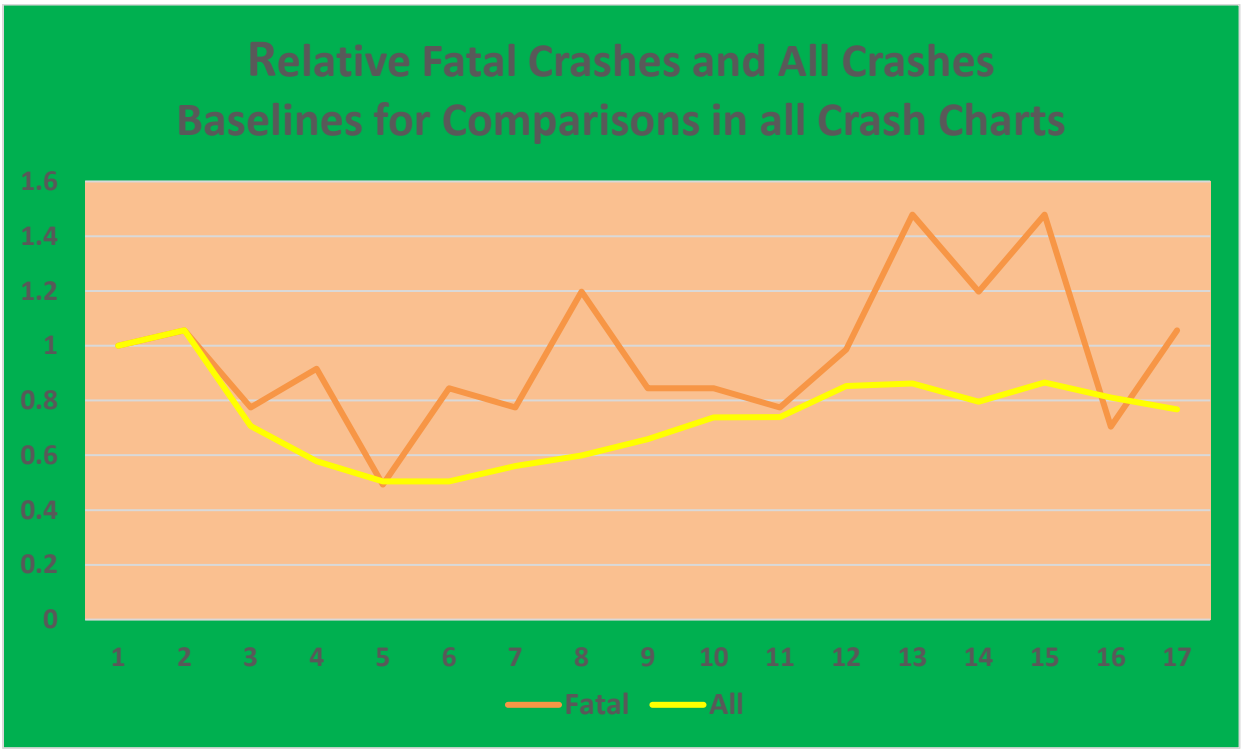
Five additional sections appear after the standardized charts:

- Section 3. CARE IMPACT comparisons for several of the crash types plotted;
- Section 4. Weekly new COVID cases plotted with weekly total crashes;
- Section 5. Daily comparison of fatalities in 2020 vs. 2019 starting April 1, 2020.
- Section 6. Daily comparisons, as in Section 5, but for the first months of the years; and
- Section 7. Correlation analysis showing how total crashes predict AADT.

The chart in Section 7 demonstrates the very high correlation between traffic volume and crash frequency. Crash frequency is an excellent proxy measure for traffic volume, and thus the charts can be used to gauge the degree to which the drivers of the various vehicle types conformed to the COVID quarantine, assuming that they had that flexibility.

To begin, please consider the *All crashes* (yellow) and the *fatal crashes* (orange) lines first, illustrated in the display below. Lighter colors were chosen for these two lines so they would blend into the background to prevent major distraction from the other two lines. Consistent with what has been observed in most states, all crashes came down to about 50% of their pre-COVID levels. However, after Week 5, fatal crashes not only did not remain at these lower levels, but recently have been well above their pre-COVID levels. See Section 5 for more details.

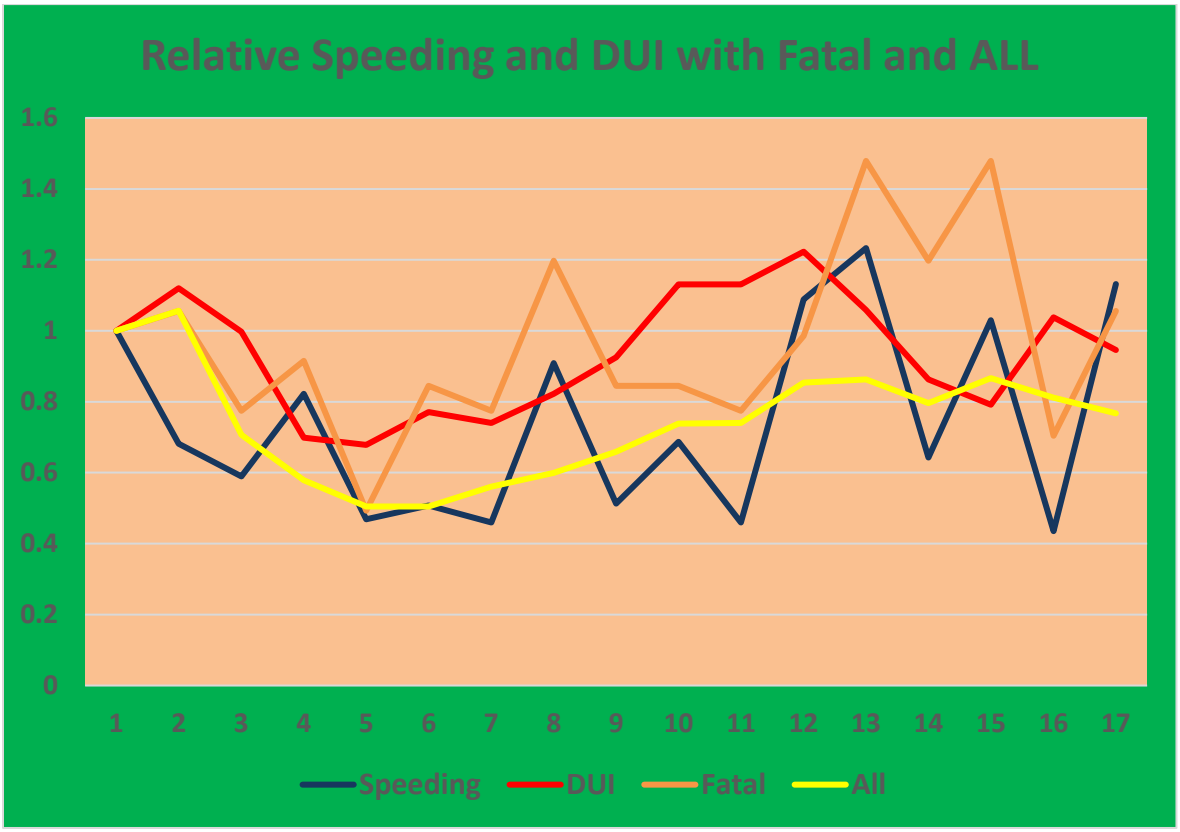
In Weeks 10-12 both curves are close to 80% of the pre-COVID levels. "All crashes" have now leveled out to about 80%. Fatal crashes rose in Weeks 13 and 15 to over 40% higher than the pre-COVID level. See Sections 5 and 6 below for how the fatalities in 2020 compare by day to those of 2019.




*We appreciate the efforts of the Alabama Law Enforcement Agency (ALEA) and local law enforcement agencies in collecting these data, and ALEA's role in maintaining the crash records. We also appreciate the daily annual (2020 vs 2019) comparison of fatalities maintained by CAPS. Also, we are updating the new Sate COVID case numbers from Bing:*
https://www.bing.com/search?q=number+covid+fatalities+in+United+states&FORM=BAWPGLM&u=&redir=2&frb=1

# 2 First 17 Weeks Response Temporal Displays

## 2.1 Speeding Crashes and Impaired Driving Crashes (ID/DUI)

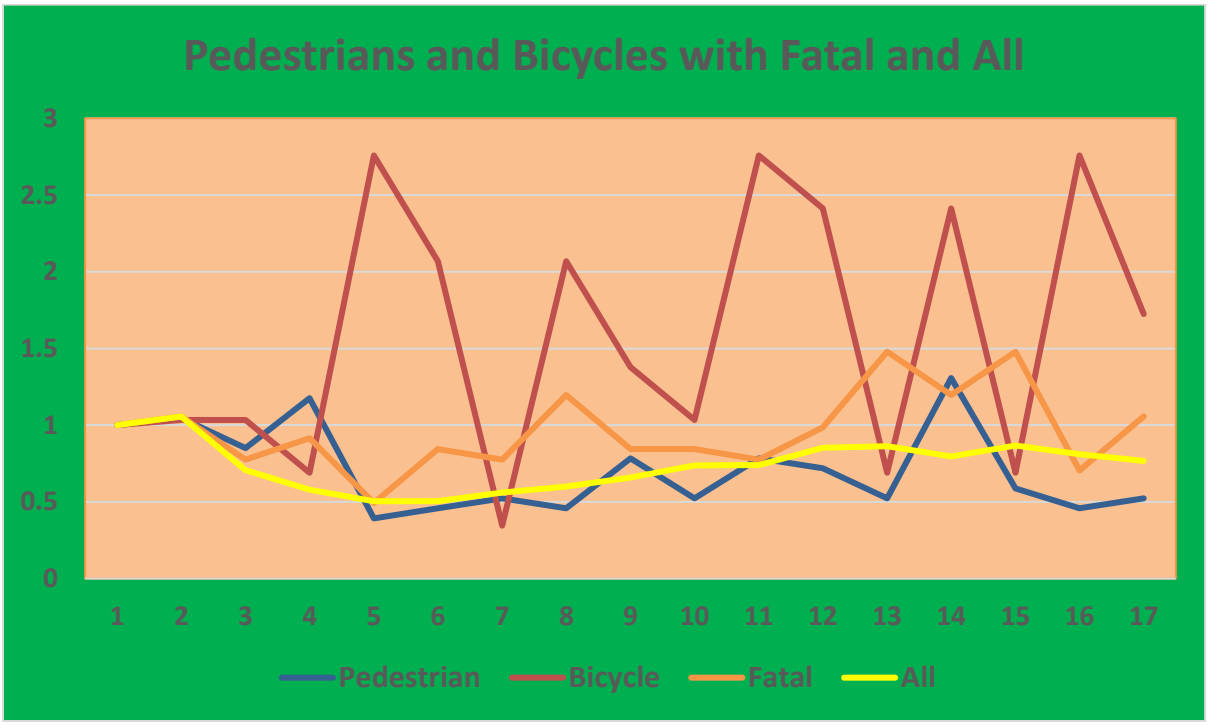



It is interesting to see the close correlation between the Speeding and Fatal crash lines. Very few fatal crashes do not involve some degree of excessive speed. ID/DUI crashes increased in the first week, and while it decreased for a few weeks after that, it was higher than its pre-COVID proportion from Weeks 10 through 13 before recently decreasing. For more details on Speeding and ID/DUI crashes, please see Section 3.1.

According to Alabama crash reports, traffic deaths as of June 27, 2020 were 6.9% lower than this day in 2019. However, the fatality rate per mile increased significantly, as it has in all states according to the National Safety Council. The total crash frequency through the end of May 2020 was 51,243, as compared to 65,898 for the end of May in 2019. This is a 22.2% reduction in total crashes, which provide an excellent proxy for traffic volume (see Section 6 of this report). However, the fatality reduction through the end of May 2020 was only 8.4%, well under half of what it should have been.

The following quote shows that this general result has been observed nationally: *"The risk [of death per crash] on our roads has actually increased," according to the NSC's manager of statistics Ken Kolosh. He stated that although an 8 percent decrease in deaths from one March to the next March is great news, that decrease would have been greater if the risk had stayed the same. We should have seen closer to an 18 percent decrease in deaths."*

## 2.2 Pedestrians and Bicycles

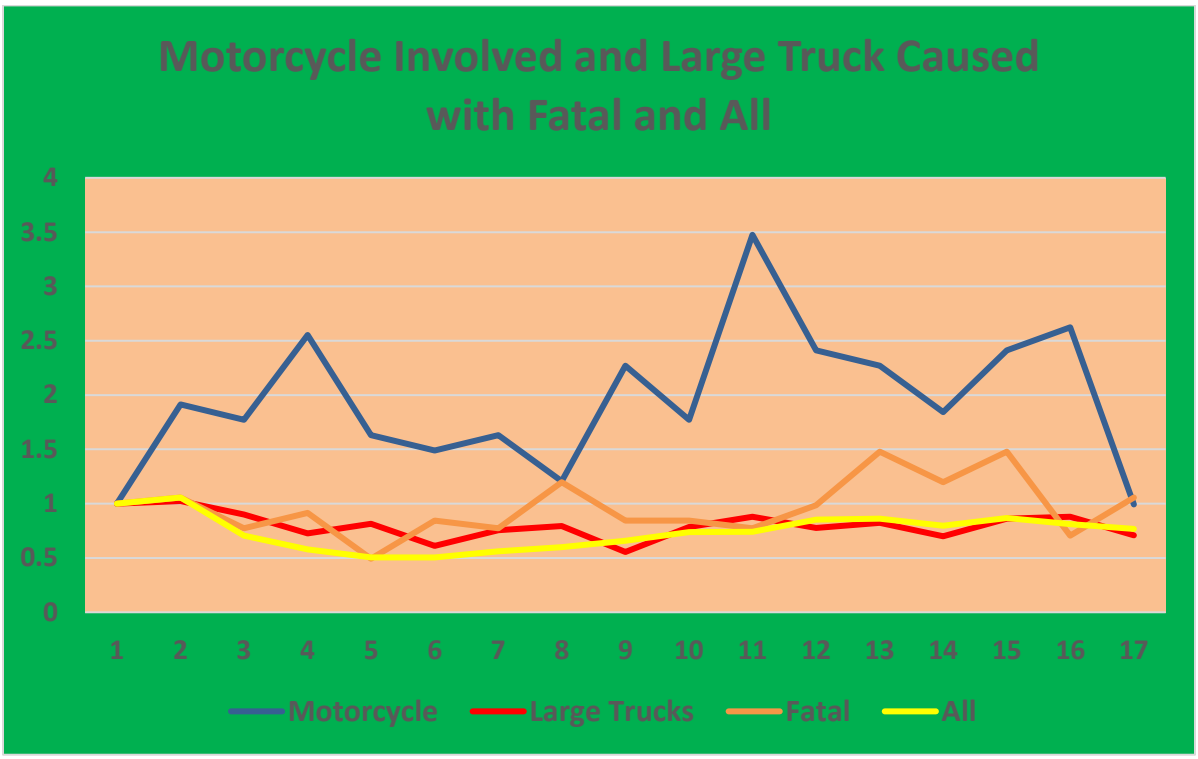



Pedestrian collisions (blue) had a slight rise in the 4th week but then came down to the very near the All Crash levels. This seems to be generally confirmed by the most recent weeks, with just one brief exception in Week 14.

Bicycles on the other hand had a dramatic increase in crashes relative to the other crash proportions, which might indicate that a large number of new bicyclists are engaging in this activity without the normal crash avoidance habits of more experienced bicyclists. While this came down in Weeks 7, 13 and 15 it was above its pre-COVID level in the other weeks. The relatively small numbers per week account for the jagged line.

For more details on Pedestrian and Bicycle crashes, please see Section 3.2.

## 2.3 Motorcycles Involved Crashes and Large Truck Caused



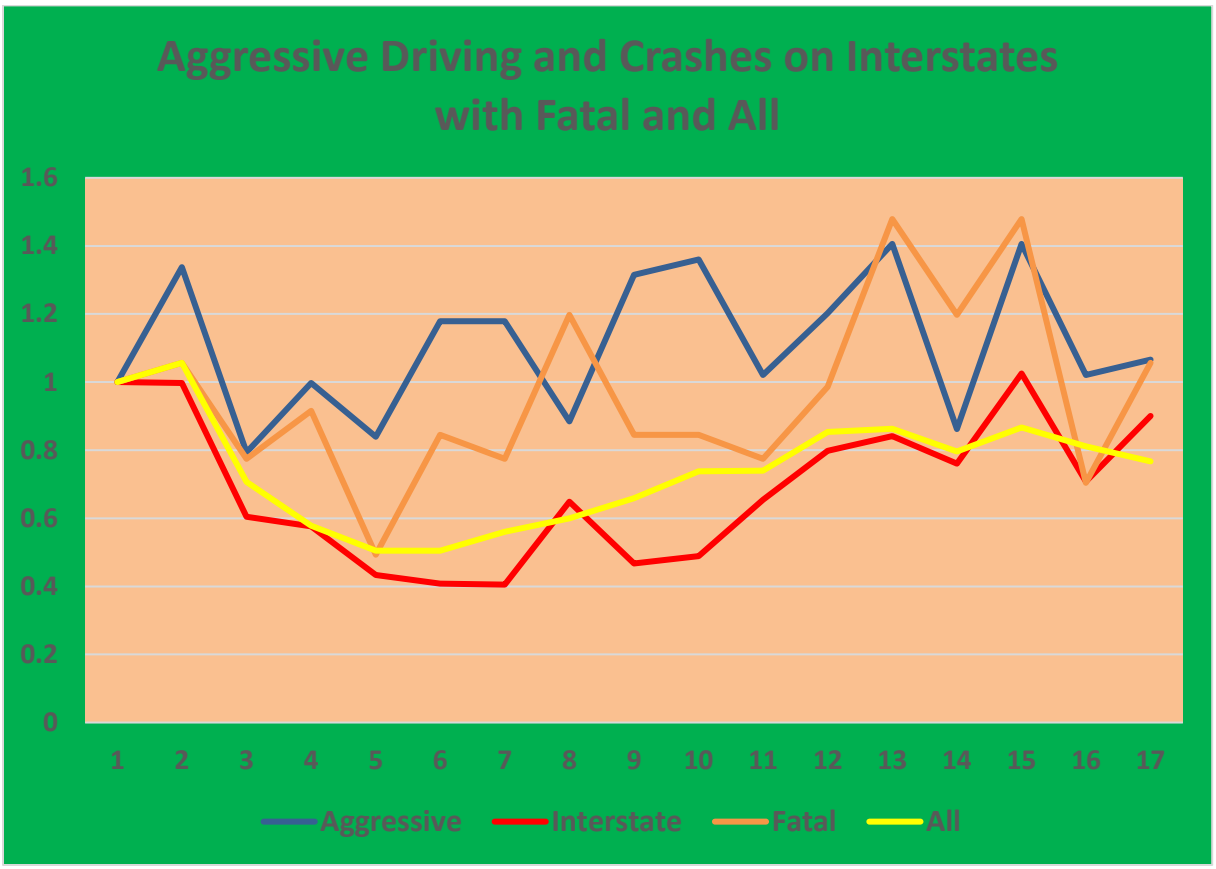

It was speculated that since the number of trucks on the road had not decreased nearly as much as passenger vehicles, that truck crashes might have relatively higher comparative proportion. This has not been the case, as can be seen. It could be noted that a significant proportion of two-vehicle truck crashes have historically been caused by passenger cars (especially at the higher severity levels), so fewer cars on the road what help to reduce truck crashes as well. For a study of causative vehicle types in disparate two-vehicle crashes for a large variety of vehicle types and all severity classifications, please see:

http://www.safehomealabama.gov/wp-content/uploads/2018/12/At-Fault-Analyses-Discussion-v04.pdf

Clearly motorcycles (blue) have a much different pattern, and we suspect that the cause would be much the same as that discussed for bicycles above. The proportion of motorcycle crashes are well above their pre-COVID levels, and this has contributed to a relatively higher fatal crash rate. As of June 23, 2020, there were 9 fatal crashes caused by motorcycles during the COVID period.

For more information on causal unit types, please see Section 3.3.

## 2.4 Aggressive Driving Crashes and Interstate Crashes

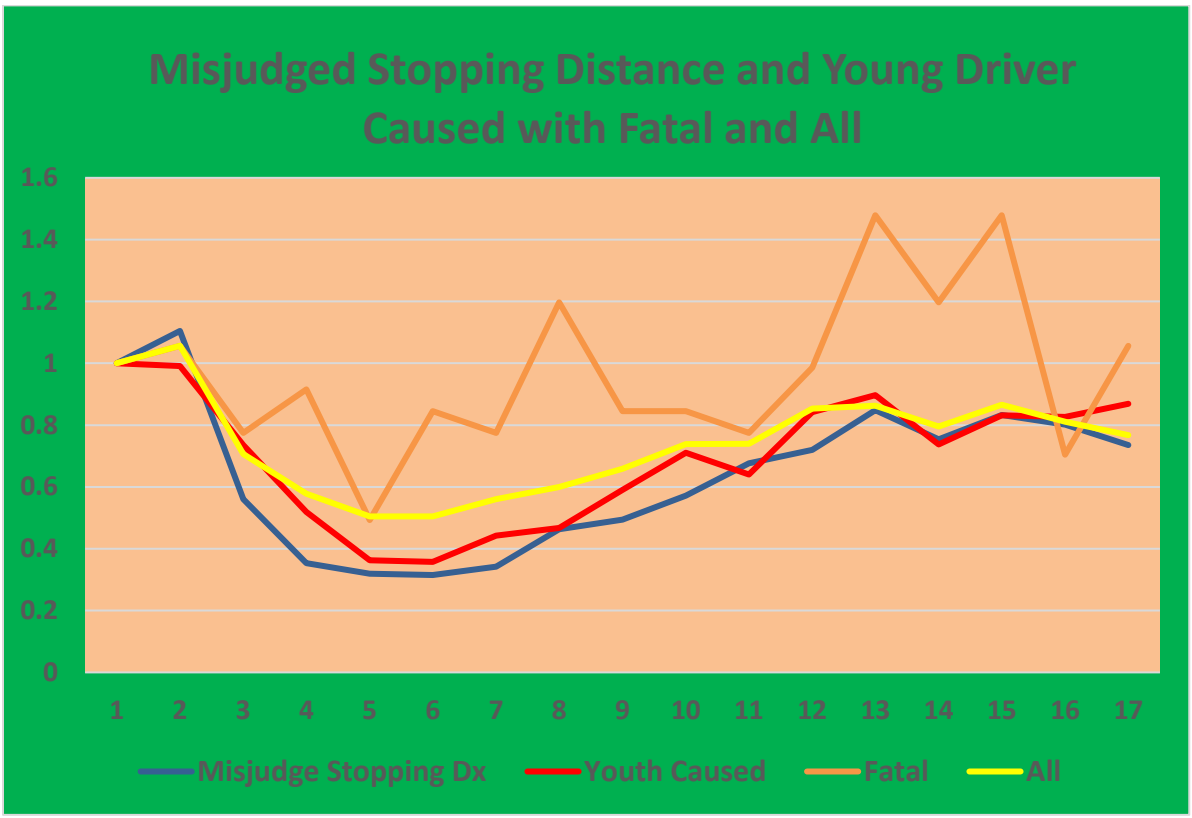



With very few exceptions, Interstate travel crashes dropped off more than either fatal crashes or total crashes, which probably indicates that fewer longer trips are being taken in the COVID period.

On the other hand, aggressive driving rose in Week 2, and then fell for about three weeks, but clearly not as much as crashes in general, and Interstate crashes in particular. The aggressive driving line is choppy because of the relatively few crashes that typically fall into this category. There were fewer in weeks 8, 11, 14 and 16, but generally this crash type has stayed well above the Week 1 level.

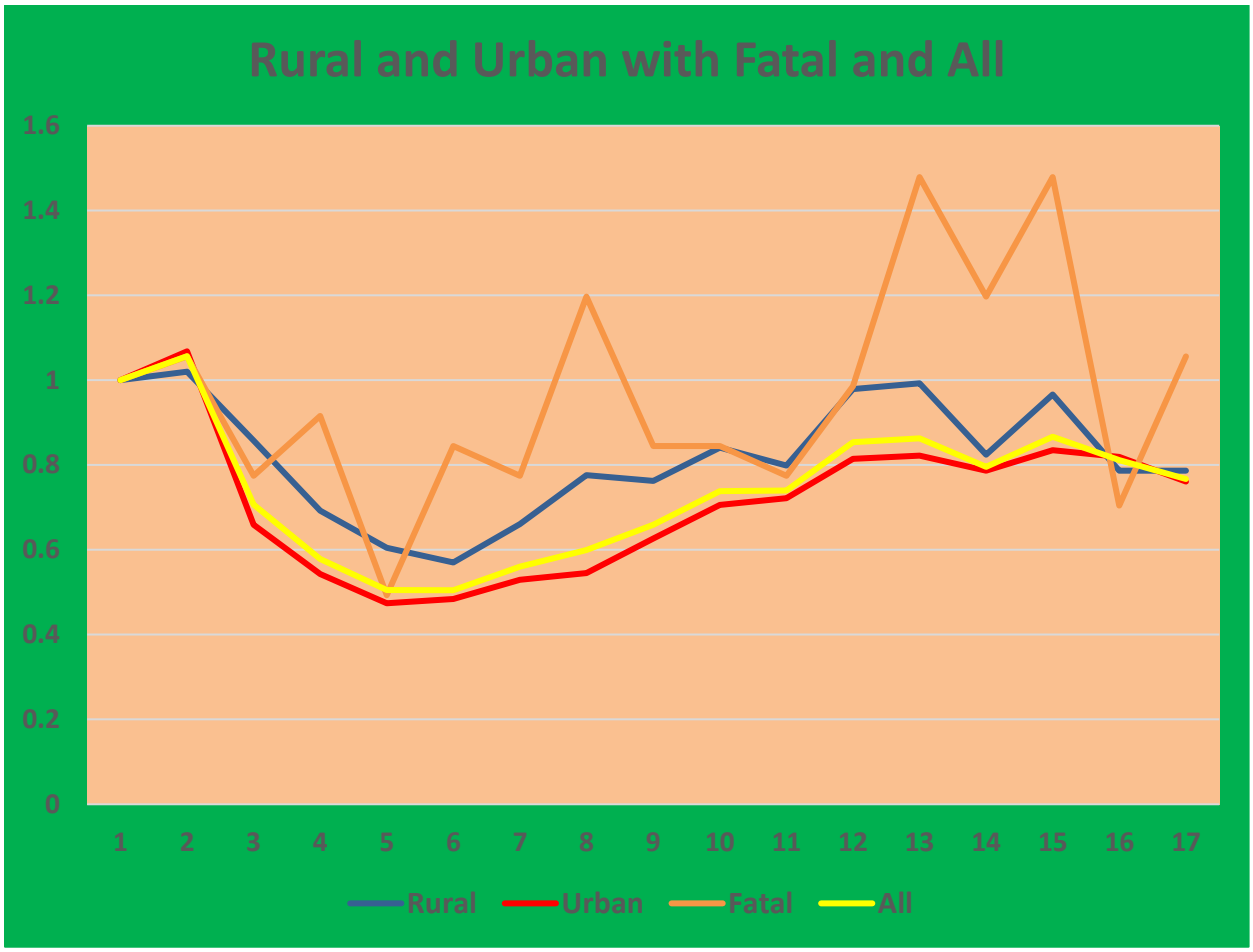
This is a time of considerable frustration on the roadways for many people. We appeal to everyone to be patient and have consideration for other drivers on the road. Driving aggressively is not going to get you there any quicker, and it might not get you there at all.

## 2.5 Misjudge Stopping Distance and Young (16-20) Driver Caused Crashes




Misjudging stopping distance and youth driver (aged 16-20) caused crashes both followed the general All Crash trend in their reductions, as far as the shapes of the curves are concerned. Both of these generally had a greater proportionate reduction than the overall crashes. It is good to see that younger drivers are not causing more than their expected number of crashes in these critical times.

## 2.6 Rural and Urban




Since the total of Urban and Rural crashes equals All-Crashes, it is expected that one of these will be above, and the other below, the yellow (All Crash) line. Since Week 1, the Rural crashes have been above this line, and the Urban crashes have been below it. This indicates that rural driving did not fall off as much as city driving, a fact that could be out of the need for rural dwellers in securing the necessities of life.

# 3 CARE IMPACT Comparisons Relative to the Temporal Graphs

Unless otherwise stated, the IMPACT displays in this section are comparisons of identical crash attributes for the COVID time frame in 2020 (March 11-June 15, 2020) against all crashes in 2018, 2019 and 2020 up to the COVID time frame (before March 11, 2020). The last four days of the COVID time frame (June 13-16, 2020) had only partial reporting in the crash database. Total crashes per day in these four days were about 47.3% of the average crash counts for the first 12 days of June. This has no practical effect on the IMPACT comparisons.

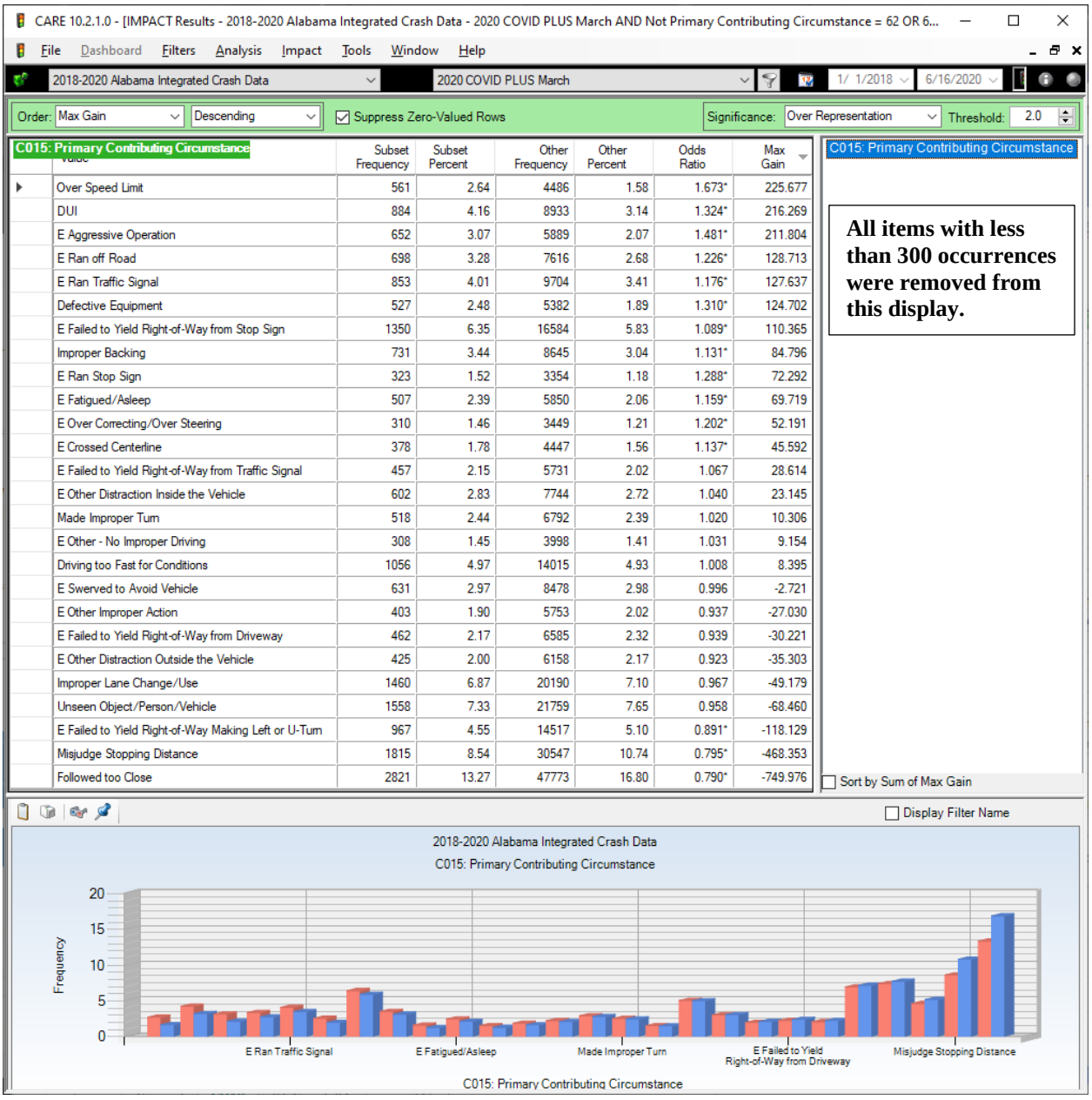
The Non-COVID time period is also referenced as "Normal" in some of the comments below.

For instructions on the reading and use of IMPACT, please click here:

https://www.technolytix.net/uploads/2/2/7/6/22761914/description_of_care_impact_output.pdf

Please get back with us if you have any questions or see any way we can help.

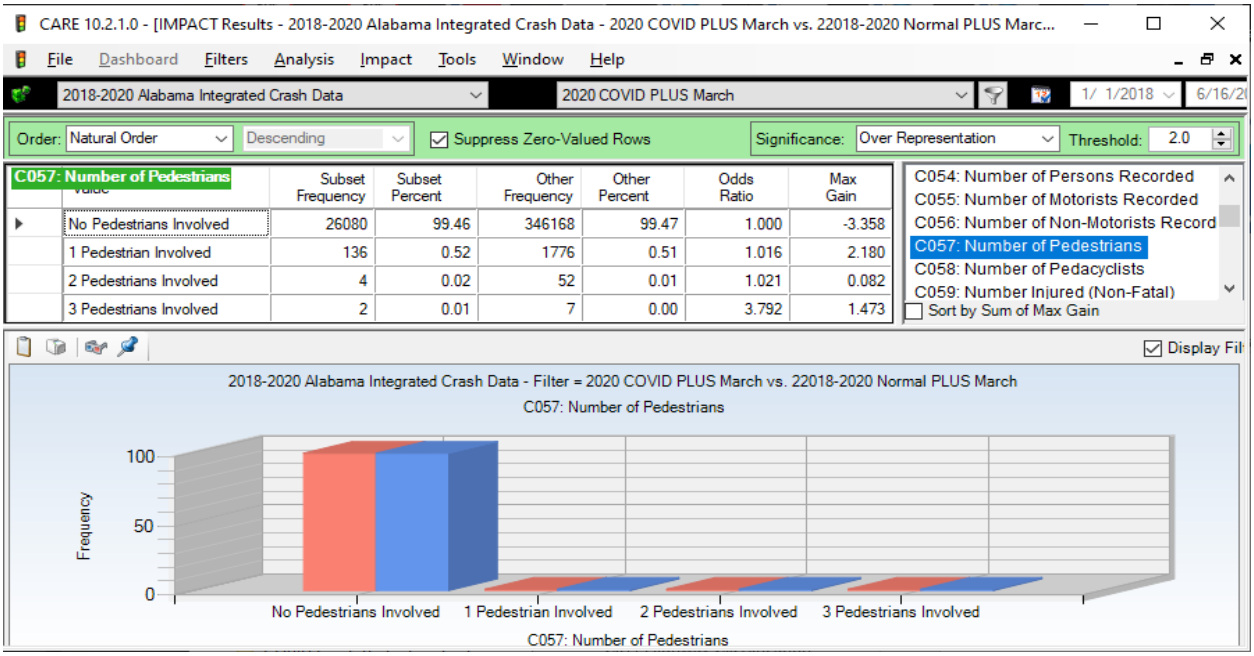
## 3.1 C015 Primary Contributing Circumstances (PCC) – Comp 2.1 and 2.4



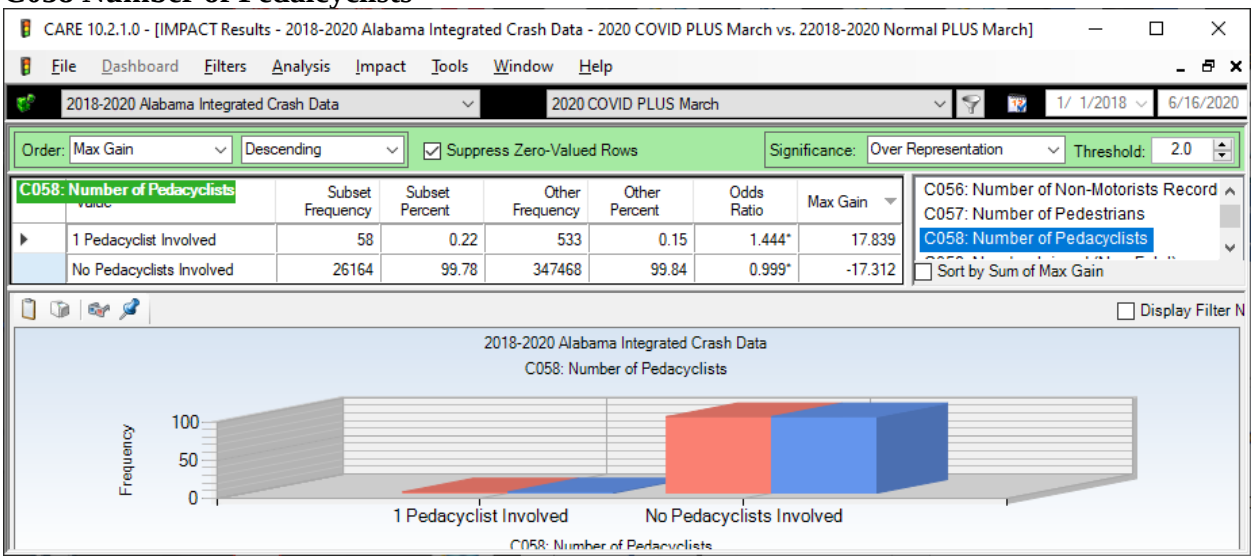

The most significant over-representations are seen in Speed, DUI and Aggressive Operation, which is consistent with the graphs in Sections 2.1 and 2.4. An asterisk (*) on the Odds Ratio value indicates that there is a significant difference in this item between the COVID and the Normal periods. There were 11 that showed significant over-representations, the top three were Speed, DUI and Aggressive Operation.

## 3.2 C057 and 58 Pedestrians and Bicycles Involved – Comp 2.2

### C057 Number of Pedestrians

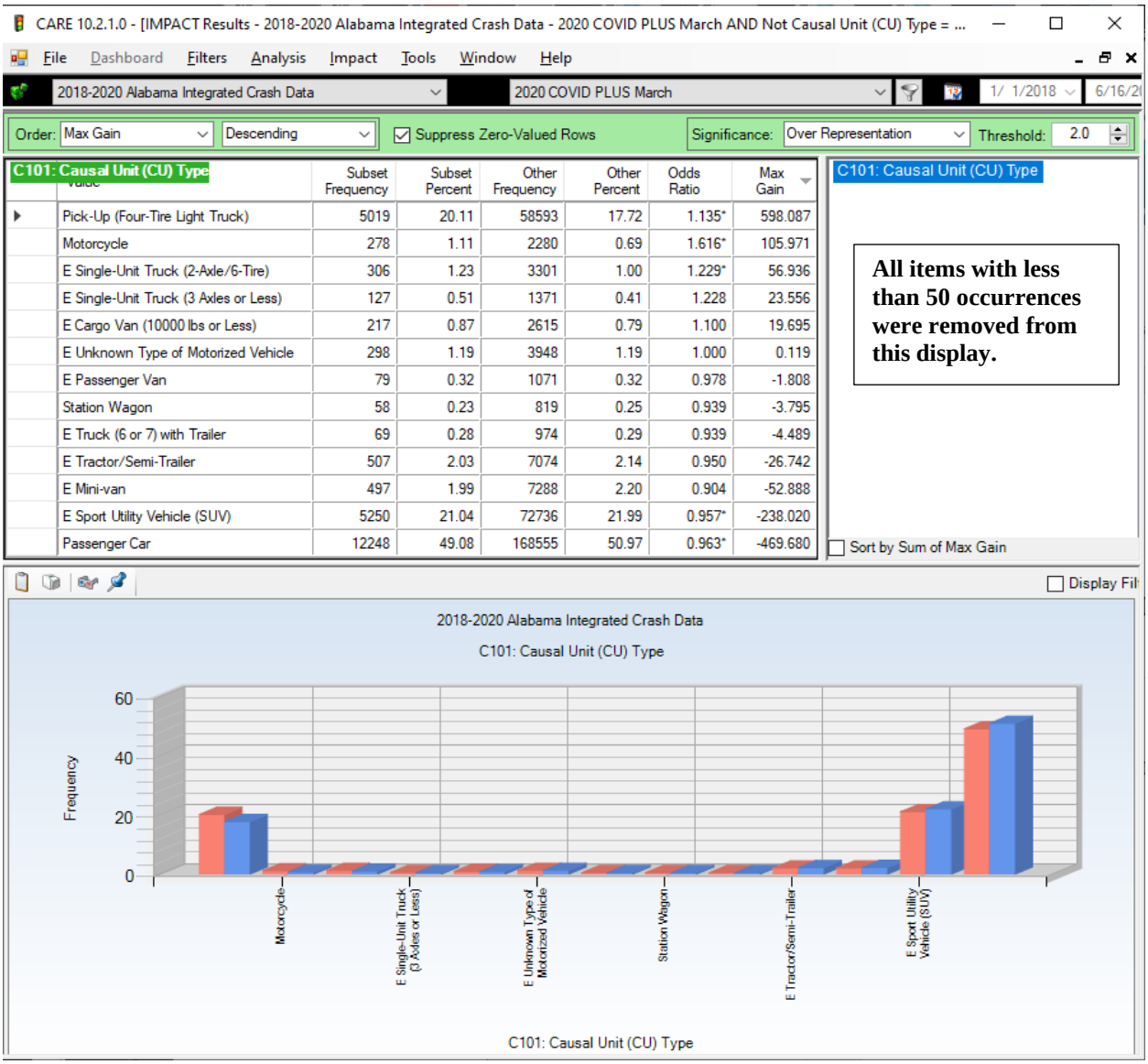



### C058 Number of Pedalcyclists



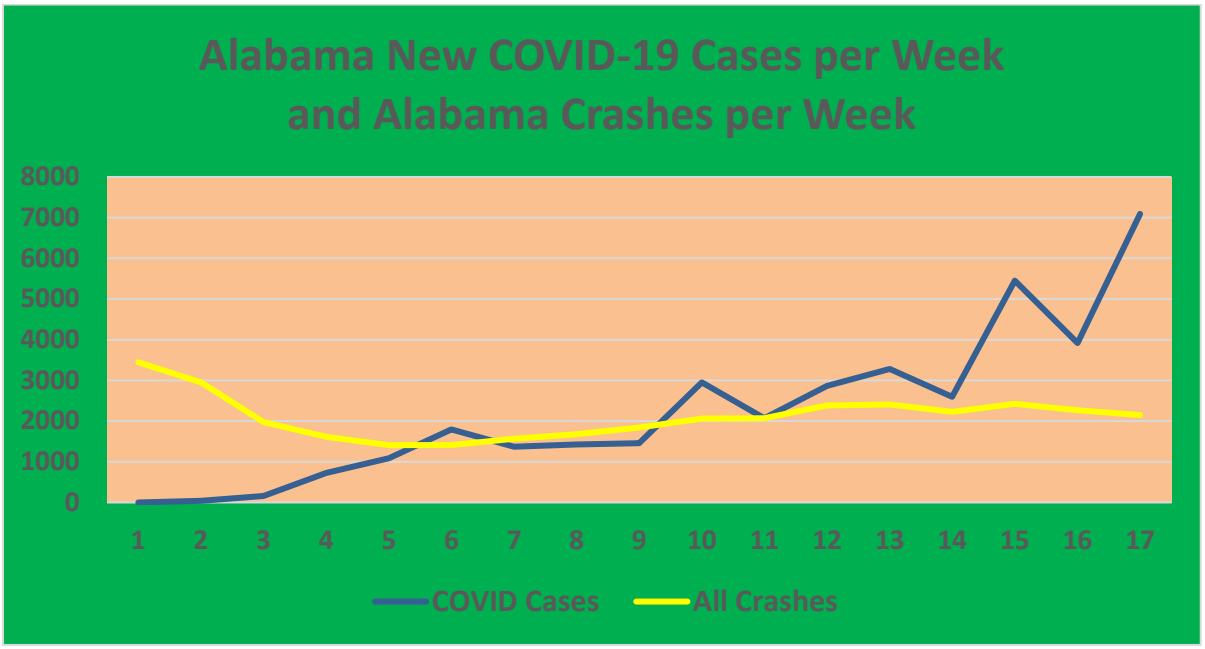

Bicycles had a much greater proportionate increase than did pedestrians as is shown in Section 2.2. Pedestrian count changes were not above what could be expected from random variation. On the other than, the bicycle proportion increased by a factor that was 44.4% higher for the COVID period than for the Normal period.

## 3.3 C101 Causal Unit (CU) Type – Comp 2.3




There was a significant increase in pick-ups and motorcycles; a reduction in SUVs and passenger cars. The increase in the proportion of motorcycles was 61.6% compared to the normal time period (see Section 2.3), which was over 4 times the increase seen in pick-ups. The larger trucks did not appear to have significant increases, as shown in Section 2.3.

## 4 COVID Case and Crash Change Comparison over the 17 Weeks

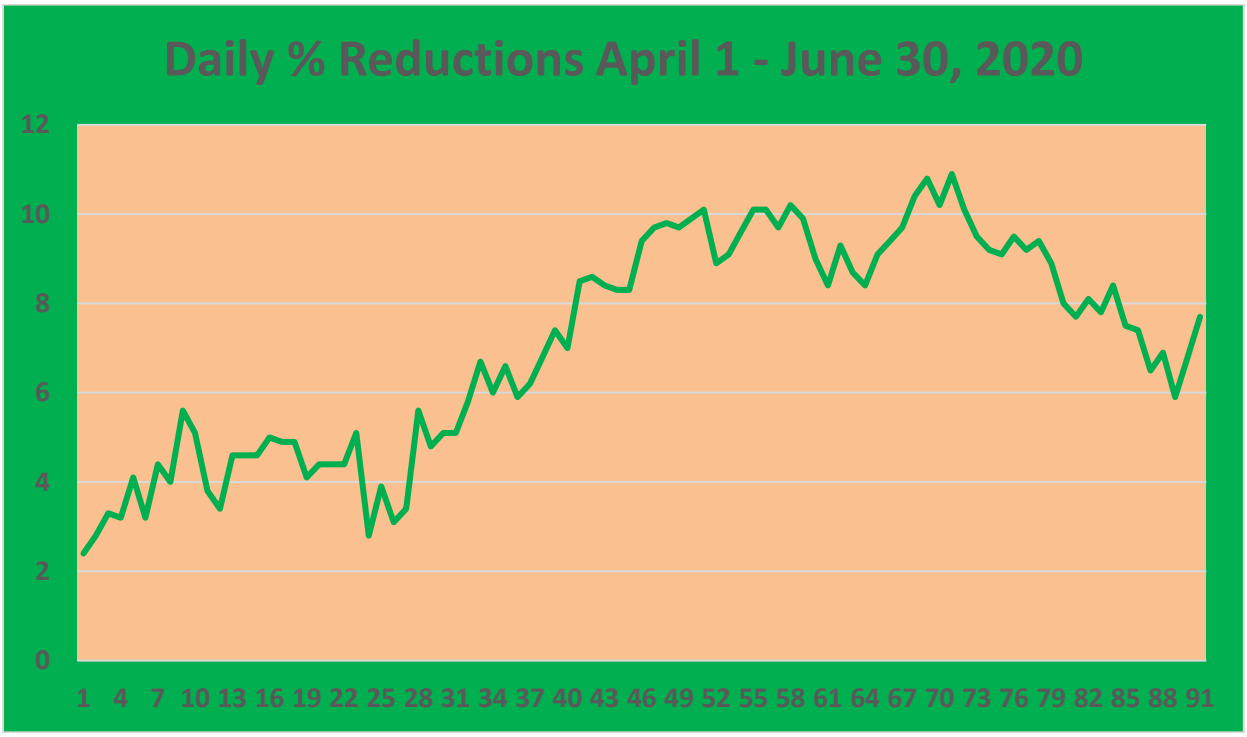



The chart shows the actual numbers of <u>new</u> COVID cases per week (blue line) and the numbers of crashes in the same weeks (yellow line). The number of crashes per week started out with its Week 1 level and dropped to less than half of that, which then bottomed out in Weeks 5 and 6. It has now gone back up to over 2000 per week and we expect it to stabilize at this level for a few more weeks. The general up trend in the number of new COVID cases per week (dark blue line) seemed to have been broken in Week 11, but then it resumed its upward trend. The most recent (Weeks 15 and 16) dramatic increase, *to 5,453 and 3920 cases*, seems to have little correlation with roadway traffic volume, but some effects might be seen moving forward with it. Consider this quote from AL.com obtained June 18, 2020:

"It's a real increase in cases that we're finding," said Dr. Jeanne Marrazzo, director of infectious diseases at the University of Alabama at Birmingham, during a public update on Monday afternoon. "People ask about a second wave, and I've been saying we never stopped having a first wave." AL.com reference:
https://www.al.com/news/2020/06/birmingham-sees-new-high-in-coronavirus-hospitalizations-at-uab.html

To get an idea of what lies ahead, the daily totals for June 24th, 25th and 26th (the first three days of Week 17) are 1,180; 1,129; and 964, respectively. Based upon these we are not anticipating a significant reduction in COVID cases for the week ending June 30, 2020. At this point we have no way of telling what proportion of new COVID cases are due to additional testing. This should level out over the next few months and the testing becomes more consistent.

## 5 Reduction in % Fatalities 2020 vs. 2019 after April 1, 2020




The chart above gives the percent fatality Reduction in 2020 Compared to the identical days in 2019 from April 1 through June 23 of both years. These are *daily readings* as opposed to the charts in Section 2, which are weekly changes in the various types of crashes. This chart, as well as the one on the following page, are also reporting *actual fatalities* as opposed to *fatal crashes*, which are reported in the previous charts in Section 2.

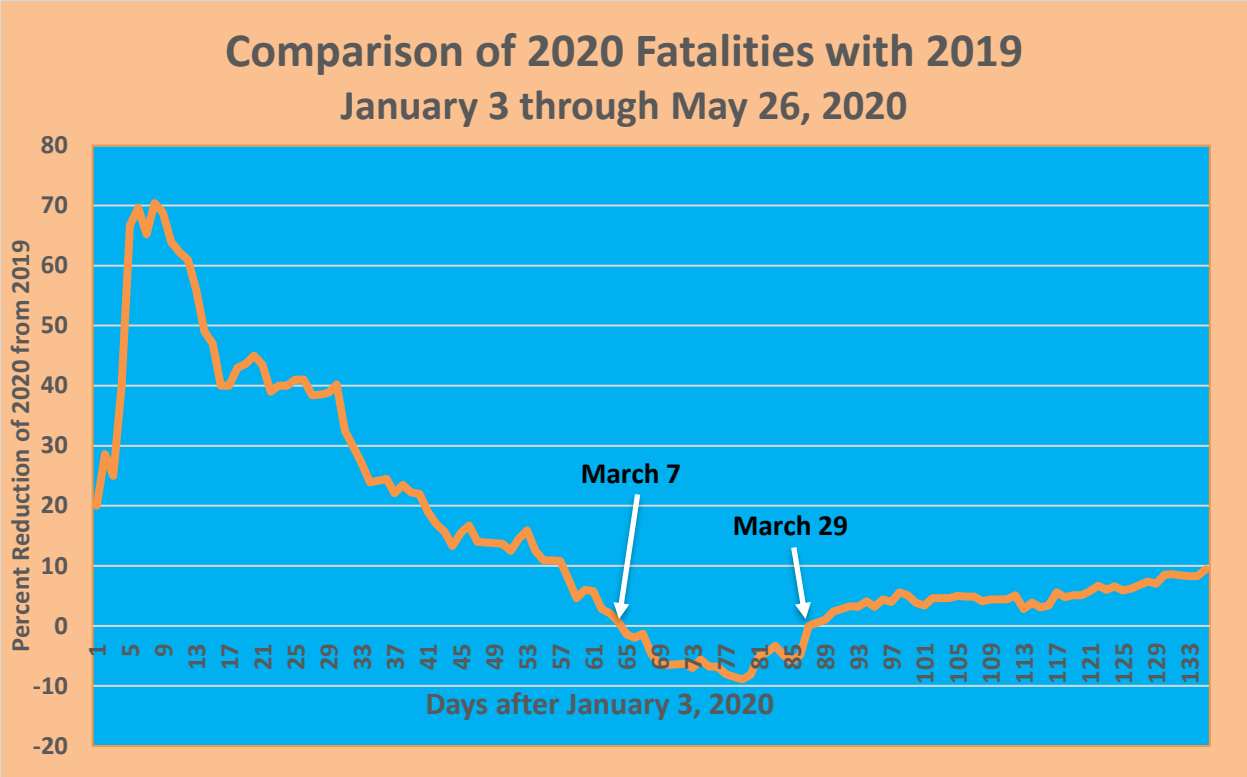
Rather than starting on January 3, 2020 (as is true of the graph in the next section, this graph starts in April 1, 2020. The numbers on the X-axis here are the number of days after April 1, 2020.

This chart includes updates up to June 30, 2020, which is the last day reported (Day 91). The exact readings for June 30 were: 452 fatalities in 2019; 417 fatalities in 2020; a reduction of 7.7% as of that date. Unfortunately, the general trend of this metric is down from over 10% in June 11, 2020. We are quite hopeful that this trend is reversed soon.

See the next section for a review of the same metric. but from the beginning of the year until May 26, 2020.

## 6 Percent Reduction in 2020 Traffic Fatalities vs. 2019

The following is for the first four months of the two years.

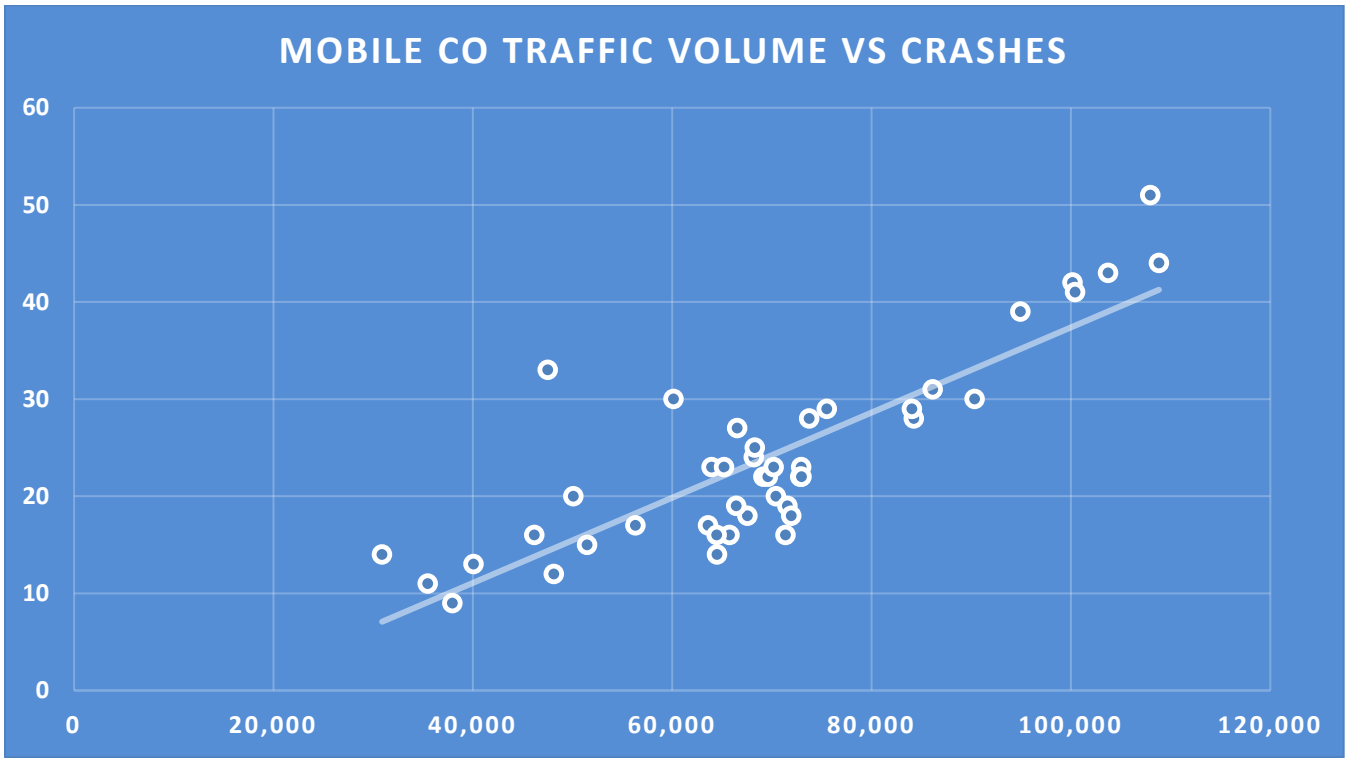



The current reduction in 2020 from 2019, as of June 13, 2020, is 9.2% fewer in 2020 than 2019.

Alabama started off year 2020 with major reductions in fatalities compared to 2019. At one point it had a 70% reduction, but this was early in the year before there were enough daily numbers to do any reasonable statistical comparison. From this high, it slid down in almost a straight line until March 7, when it reached the zero break-even point (same in both years). At that point in time the 2020 fatalities numbered exactly what they did in 2019 – no percent reduction.

March 7 is within our "Week 1" (March 3-9, 2020) for the charts in Section 2. Recall that Week 1 was the last week before the COVID quarantines took effect, but the number of crashes for the comparisons have been updated to be the average of the first ten weeks in 2020.. It is strictly coincidental that this was the week in which the fatality counts for 2019 and 2020 became identical. As can be seen from the chart, the 2020 increase in fatalities continued past March 7, and it was not zero again until March 29, well after the first quarantines had taken effect. This chart extends until May 16, 2020, and it will not be updated.

## 7 Correlation Analysis: Relationship between ADT and Crash Frequency




The regression above, with a correlation coefficient = 0.8430, indicates a nearly perfect relationship between Crashes and Average Daily Traffic (ADT). This analysis, which considered the identical roadway and a similar traffic mix, was performed where the differences in traffic volumes were due solely to the quarantine caused by COVID. Volume and crashes were compared over 43 days from 3/9/2020 to 4/23/2020, and the correlation coefficient of the resulting least-squares regression line was 0.8430, which indicates an extremely high correlation. The sample of traffic volume was obtained from I-10, Milepost 3.

The conclusion that can be drawn from this is that the major portion (virtually all) of the variations experienced after Week 1 (March 3-9) were due to the reduction in traffic volume. The only other cause of it could have been that the drivers remaining on the road (after the COVID quarantine went into effect) were of superior skill and experience. While we believe this is true, and that it had some effect, its effect would be relatively small compared to the reduction in traffic volume.