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Special Report(Update): Impact of COVID19 Mitigation on Numbers and Costs of California Traffic Crashes

ROAD ECOLOGY CENTER
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Impact of COVID19 Mitigation on California Traffic Crashes

Using observations of reported traffic incidents in our real-time "California Highway Incident Processing System" (CHIPS), the Road Ecology Center found **reduced numbers of crashes, including injury/fatal crashes, on state highways and rural roads that has resulted from Governor Newsom's "shelter in place" order.** We estimate that since the order went into effect, collisions and especially injury and fatality collisions have been reduced by half, from ~1,000 crashes and ~400 injury/fatal crashes per day to 500 and 200 per day, respectively. **These reductions have resulted in a savings to the public of about $40 million/day, or $1 billion** since the order went into effect. Charts showing the change in crashes, including injury/fatal crashes can be seen here: https://roadecology.ucdavis.edu/resources/stayathome-crashes. Simultaneous to the reduction in injury crashes, there were fewer people treated by Sacramento region hospitals and trauma centers for crash-related injuries. We found that **traffic volumes were up to 55% lower on certain highways** after the order compared to a similar period prior to the order, which may account for the reduced number of collisions. We also found that **maximum and average traffic speeds increased slightly on certain highways**, but only by a few mph. When Southern California experienced heavy, record-breaking rains in early April, there was a brief return to "normal" levels of crashes. We highlight collision and injury/fatality hotspots on California highways since the shelter in place order went into effect and for a similar period in 2019. All data were derived from California Highway Patrol incident reports. This report includes **maps of incident hotspots**, and discusses this unexpected benefit of the shelter in place order.

This report and other tools are available on the Road Ecology Center website: https://roadecology.ucdavis.edu.

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Special Report on Impacts of COVID19 Mitigation on California Traffic Crashes

Top 5 Talking Points

1) **The California Highway Patrol collects critical information about traffic accidents, but they need more resources.** Every day, CHP officers patrol thousands of miles of California highways and rural roads and respond to >2,000 incidents per day to protect public safety. At the same time, they sometimes have to rely on out-of-date equipment and are under-staffed relative to the importance of their job. This study and our other research related to traffic incidents was possible due to the care officers take in reporting details of traffic incidents.

2) **Governor Newsom's "Shelter-in-Place" order resulted in a reduction in traffic collisions, injuries/fatalities, and costs.** The daily rate of collisions was reduced by half after the order, compared to the period before the order and to a similar period a year prior (2019). There was a similar reduction, by half, in fatal and injury crashes. The reduction in crashes works out to about 15,000 fewer collisions per month and 6,000 fewer injury/fatal accidents per month directly or indirectly attributable to the shelter-in-place order. These reductions are also equivalent to a savings to the public of ~$40 million/day, or $1 billion since the order went into place.

3) **The reduction in crashes, including injury/fatal crashes reversed during and following heavy rains in Southern California on April 6th and April 9th.** Total and injury/fatal crashes increased during and following heavy rains, primarily in Southern California. Even though traffic volumes did not change during these times, injury/fatal crashes briefly returned to their "normal" levels of 1,000-1,500 crashes per day.

4) **There was a similar ~40% decrease in trauma-injury incidents reported among hospitals in the Sacramento region.** There were fewer people treated in trauma centers and emergency departments in Sacramento region hospitals after the Governors order. This was especially true for pedestrian and cyclists, who experienced an almost 50% reduction in traumatic injuries. There was no similar change seen in 2019 around this time period. These results are consistent with the ~50% reduction in injury crashes seen on highways.

5) **The reductions in traffic accidents is unparalleled and potentially because of a reduction in traffic volumes, with only small changes in speed.** There is no equivalent in our recent transportation history to such large changes in vehicle movement on our state and local roads. The reduction in traffic collisions and injury/fatal accidents in particular, was correlated with a similar % reduction in traffic volumes on a wide range of highways statewide. However, the reduction in traffic was not uniform, with only slight reductions (<30%) on certain interstates. There was also a slight increase in peak (1-3 mph) and average (1-4 mph) speeds, primarily on urban highways. One outstanding question is: Why are so many people still driving on what may be non-essential trips?

Introduction to Study

The COVID19 pandemic has created unprecedented challenges to US and California society and institutions. One of the primary methods to mitigate the impact of the virus is to reduce contact among people. In California, this has been implemented by cities, counties, and the Governor's office through "Shelter-In-Place" orders and related actions (e.g., closure of non-essential businesses). An intended impact of these orders is reduced vehicle traffic among and within cities and towns in order to reduce the rate of spread of the virus (by keeping people at home). A potential unintended impact of reduced traffic is reduced traffic crashes and thus injuries and fatalities for people involved in the incidents.

We examined these potential unintended impacts of the Governor's shelter-in-place order on rates of collisions on California highways and certain major roadways patrolled by the California Highway Patrol. We used real-time data collection and querying tools in our California Highway Incident Processing System (CHIPS), in order to provide a close to real-time assessment of these impacts. We used simple spatial analysis tools to compare distributions of traffic accidents in the several weeks before and after the Governor's order and statistical tests (t-test, 2-tailed) to compare daily rates of collisions before and after the order and with a similar time period from 2019. Like many researchers studying traffic safety in California, we had to rely on methods we invented as the state lacks a uniform traffic incident/injury/fatality tracking system.

Findings

1) Reduction in Number and Costs of Collisions and Injuries/Fatalities

We compared daily rates of collisions on state highways and some major roads during the 22 days after the shelter in place order with collisions in the 22 days immediately prior to the order and to rates a year before (2019, Table 1). We found that the average daily number of collisions was significantly lower in the 22 days after the order (450) than the 22 days prior to the order (1,056 collisions, $p<0.001$) and lower than a similar 22-day period in 2019 (1,128 collisions, $p<0.01$). The reduction in numbers of all collisions, injury, and fatal collision was equivalent to a $40 million/day savings in costs and about $1 billion in savings since the Governor's order went into effect. The cost saving was calculated by using Federal Highway Administration equivalent costs for different types of incidents times the number of each type. Costs include property damage, treatment of injuries, lost time at work, emergency responses, insurance claims, and the equivalent cost of a life.

There was no difference ($p>0.2$) between the number of collisions before the order (1,056 collisions/day) and a similar period in 2019 (1,151 collisions/day). There was a

similar, statistically-significant reduction in daily injury/fatal crashes from the 22-day period prior to the order (496/day) to the 22-day period after the order (237/day, $p<0.01$). The injury/fatal crash rate in 2020 after the order was also significantly lower than the rate in the same period in 2019 ($p<0.05$), whereas there was no difference between rate of injury/fatal crashes in 2020 and 2019 for the dates 22 days prior to the order ($p=0.74$).

Table 1. Change in rates of collisions and injury/fatal accidents before and after the Governor's shelter-in-place order. The before period (2/27-3/19/2020) was compared to the equivalent period in 2019 and after the order (3/21-4/11/2020). A similar "after" period in 2019 was used for comparison.

ACCIDENT TYPE/COST	BEFORE ORDER (2/27-3/19/2019)	BEFORE ORDER (2/27-3/19/2020)	"AFTER" ORDER (3/21-4/11/2019)	AFTER ORDER (3/21-4/11/2020)
COLLISION	1151	1056	1128	450
INJURY/FATALITY	509	496	448	237
% REDUCTION BEFORE/AFTER			n.s	52% (P<0.01)
COST/DAY		$139,352,785		$99,092,702

The reduction in injury/fatal accidents was evenly-distributed throughout the state (Figure 1). There were injury/fatal accidents on most highways in California after the order (Figure 1A) and for a similar period in 2019 (Figure 1B).

A B

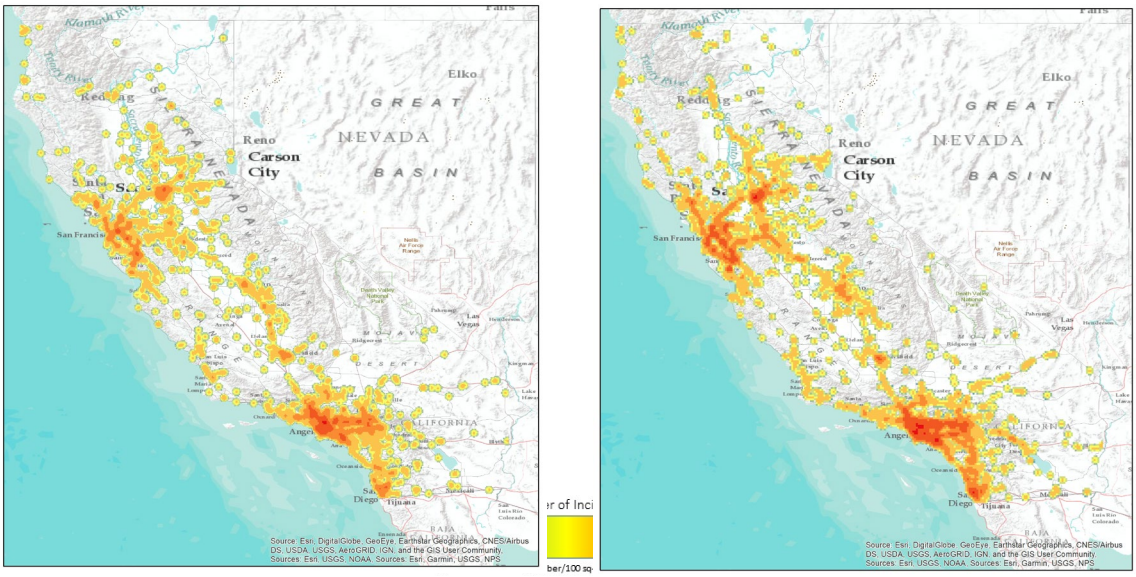

Figure 1. Density of injury/fatal accidents on state highways and certain major roads (A) between 3/21/2020 and 3/30/2020 and (B) between 3/21/2019 and 3/30/2019.

2) Change in Collisions Following Heavy Rains

The reduction in traffic crashes, injuries, and fatalities was temporarily reversed by heavy rains in Southern California. Injury/fatal rates increased from ~200/day to >1,000/day on 4/6/2020 and >600/day on 4/9/2020. These rates immediately decreased to ~200/day following the rain events, suggesting that they were entirely due to rain. There was no similar change in traffic volumes in this period. We suspect that reduced traffic volumes following the stay-at-home has allowed people who decide to travel to maintain higher travel speeds during most of the day, compared to commuter-related congestion prior to the stay-at-home order. These higher speeds likely contributed to an exceptionally high 5-fold change in rate of collisions compared to changes normally expected with rains (2-3 fold). This chart (Figure 2) is available here: https://roadecology.ucdavis.edu/resources/stayathome-crashes.

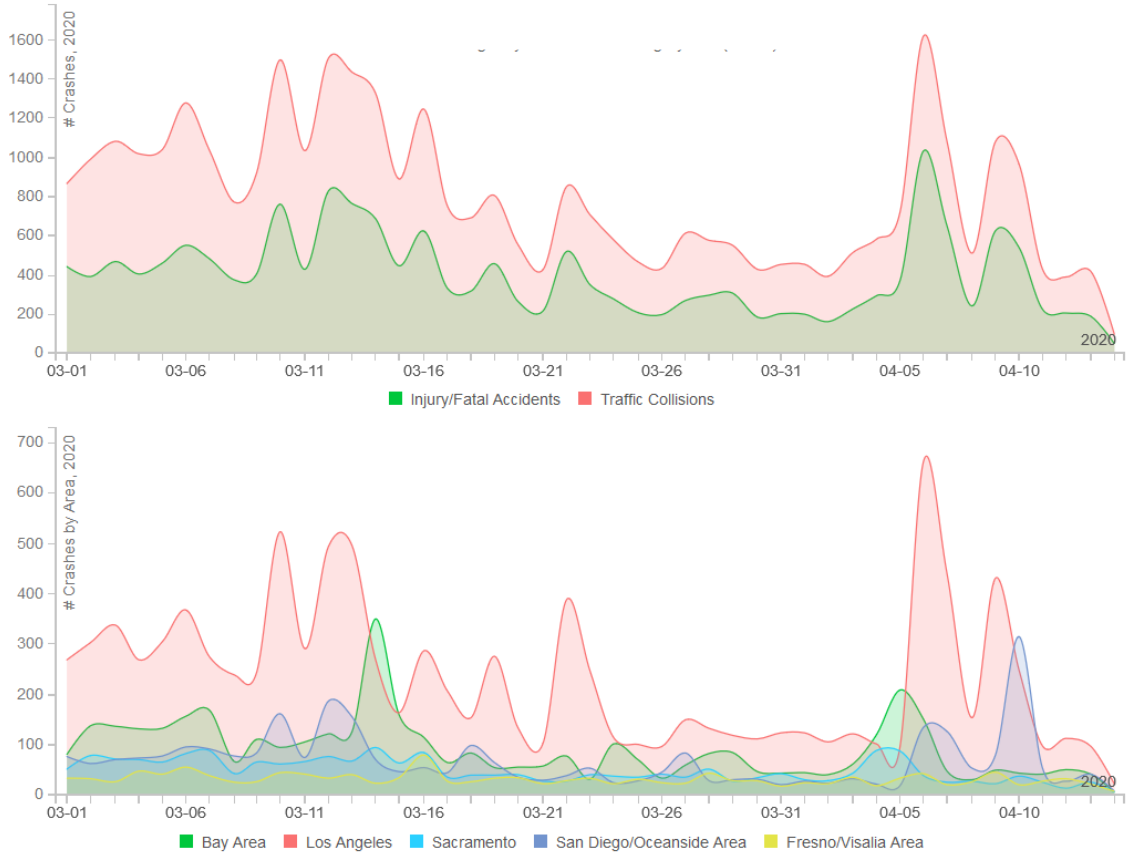

Figure 2. Top graph: Rates of crashes and injury/fatal crashes on state highways and certain major roads between 3/1/2020 and 4/11/2020. Bottom graph: Rates of crashes for different areas of California for 3/1/2020 to 4/11/2020.

3) Confirmation of Reduced Injury Rates at Sacramento Region Hospitals

We received records of treatments of traumatic injuries from traffic crashes from a trauma surgeon at UC Davis Medical Center (Dr/Professor David Shatz). These included records of motorcycle, automobile, bicycle and pedestrian incidents in the Sacramento region reported by 4 regional hospitals. Across these hospitals, there was a 38% reduction in motorcycle/automobile trauma injuries from 3/1-19/2020 to 3/21-4/6/2020 ($p=0.11$) and 46% reduction in bicycle/pedestrian trauma injuries over the same period ($p=0.065$). Although these changes were not statistically-significant, the direction of change (reduction post-order) is consistent with the findings for the CHP-reported injury crashes. For the same period in 2019, there was no difference between pre and post 3/20/2019 rates of treatments of motor-vehicle and pedestrian/bicycle injury victims ($p \geq 0.2$).

4) Change in Traffic Volumes

Caltrans and other entities maintain an array of traffic volume and speed detectors throughout California. Traffic volumes were compared for select highways before and after the shelter-in-place order. There were statistically significant ($p<0.01$) reductions in traffic volumes of 20 to 55% compared to prior to the shelter-in-place order. The changes in traffic can be seen here for select highways, between 3/10 and 4/11/2020: https://roadecology.ucdavis.edu/visualizations/chips/linegraph-trafficvolume/. These reductions are virtually identical to the original report, with twice the number of days post-order. This suggests that the number of cars has reached a minimum plateau and is not further reducing. Traffic volumes for a select set of highways is shown in Table 2 and change in traffic volume over time for I-5 near Oceanside (Figure 3).

Figure 3. Traffic volumes (peak vehicles/hour) for Interstate 5 near Oceanside between March 10 and April 11, 2020.

Table 2. Average traffic volume (peak # vehicles/hour) changes before and after the Governor's shelter-in-place order for select California highways. All changes were statistically significant. There was no difference between traffic volumes in 2019 and 2020 for the 10-day period before the order (3/10 - 3/19).

HIGHWAY	PEAK VOLUME BEFORE ORDER (VEH/HR)	PEAK VOLUME AFTER ORDER (VEH/HR)
I-5 (OCEANSIDE)	3,340	1,896
I-10 (SANTA MONICA)	5,715	3,881
I-10 (INDIO)	3,210	2,043
I-405 (COSTA MESA)	7,681	4,205
SR 91 (ANAHEIM HILLS)	6,943	5,754
I-280 (DALY CITY)	3,798	2,346
I-80 (FAIRFIELD)	5,780	4,089
I-80 (NV BORDER)	1,090	752
SR 101 (N OF SLO)	2,214	1,005
SR 99 (YUBA CITY)	790	521
SR 152 (LOS BANOS)	1,225	731
SR 49 (MARIPOSA)	318	223
SR 88 (IONE)	280	154
SR 46 (EAST OF SLO)	258	154

5) Change in Traffic Speeds

Traffic speeds at the detectors mentioned in (3) were compared for select highways before and after the shelter-in-place order. There were small increases in peak speed (95th and 99th percentile of all speeds) and small, yet statistically-significant increases in average traffic speed of ~1 to 4 mph when compared to prior to the shelter-in-place order. In general, the changes were greater in urban highways than rural highways. The changes shown here are virtually identical to those for the previous report for the first 10 days after the Governor's order. Traffic speeds for a select set of highways are shown in Table 3 and charts showing speed on April 3rd relative to the month prior shown in Figure 2.

Table 3. Average traffic speed changes before and after the Governor's shelter-in-place order for select California highways. Unless indicated with "n.s." non-significant, all changes in average speed were statistically significant. "95th" and "99th" refers to the 95th and 99th percentile values for the range of speed values for the days before and after the order.

HIGHWAY	PEAK SPEED CHANGE 95TH/99TH (MPH)	AVERAGE SPEED CHANGE (MPH)
I-80 (NV BORDER)	+1/0	+3.8
US99 (S OF YUBA CITY)	0/1	+0.2 (n.s.)
I280 (DALY CITY)	+1/2	+1.6
SR46 (E OF SLO)	+1/2	+0.6
SR88 (IONE)	+1.2/3	+1.3
SR49 (MARIPOSA)	+2/1.2	+0.2 (n.s.)
US101 (SLO)	+0.6/1	-1.6
I-405 (COSTA MESA)	+2/2	+3.5
SR91 (ANAHEIM HILLS)	+0/1	-1.2 (n.s.)
I-5 (OCEANSIDE)	+2/2	+0.7 (n.s.)
I-10 (PALM SPRINGS)	+1/1	-0.12 (n.s.)

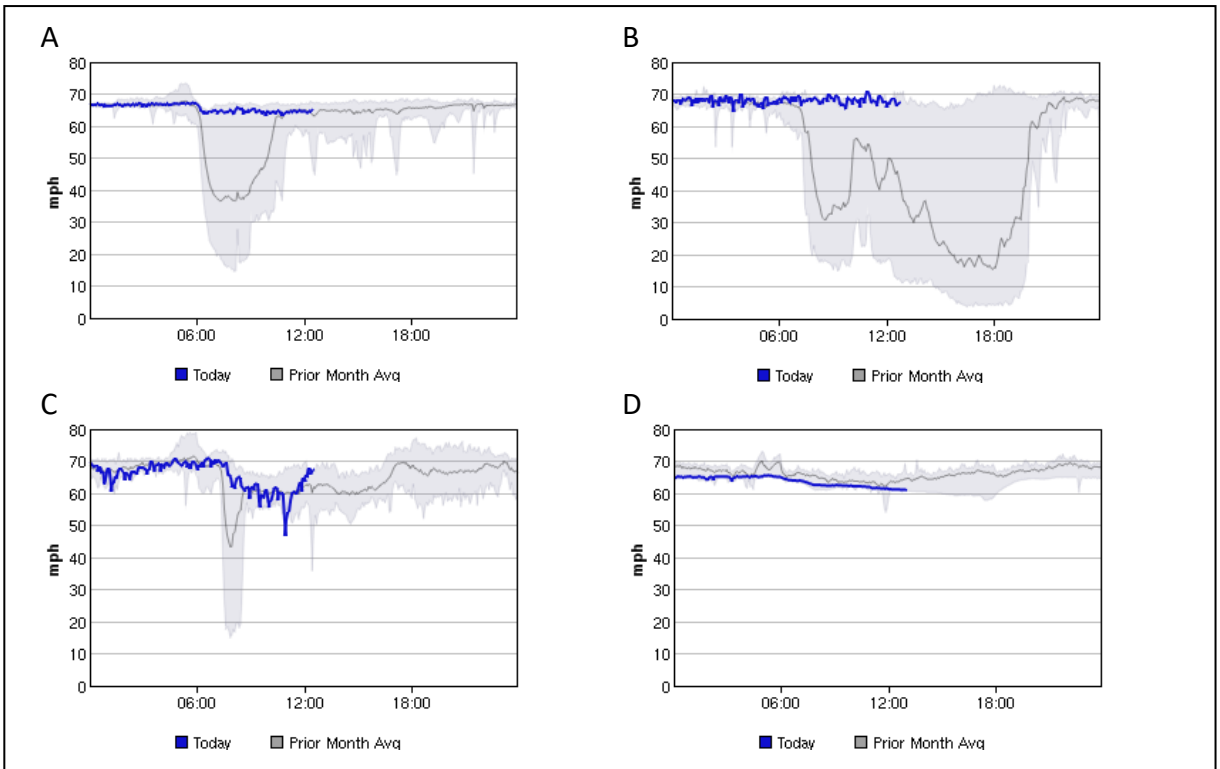

Figure 4. Traffic speed on April 3rd (blue line) on A) I-405, B) I-10, C) SR110, and D) SR101, compared to previous month's range of traffic speeds (grey line and area).

Conclusions

Governor Newsom's shelter-in-place order and similar orders at the jurisdictional scale had a profound effect on daily travel in California, with >20 - 55% reductions in traffic volumes found across select highways. This in turn seems to have resulted in a ~50% reduction in total collisions and injury/fatal accidents reported by CHP and a $40 million/day savings to the California public. This reduction was similar to reductions in Sacramento-region hospital treatment of people involved in injury crashes. Despite the large changes in traffic volumes there were only small changes in peak traffic speeds and average speeds. However, people were able to maintain higher speeds during times that would otherwise be congested, which may have contributed to a spike in collisions/injuries/fatalities during and following heavy rains in Southern California (April 6 and April 9). Our data captured general traffic properties and may not reflect the increased number, or visibility, of speeders that have been reported anecdotally by others, including the CHP. We appreciate the critical attention to detail and complete incident reporting by the CHP and look forward to increased support for their reporting by the state government.

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