

**SAFETY EVALUATION OF  
RIGHT TURN ON RED**

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## **Abstract**

This paper defends the safety record of California's Right Turn on Red law and takes issue with assertions that this policy increases the risk of collisions.

## **SAFETY EVALUATION OF RIGHT TURN ON RED**

Woody Allen once commented that the only good thing about California is that you can make right turns on red. Even though we personally think that there are other good things about California, we do agree that right turn on red (RTOR) is a proven, safe and effective traffic engineering policy.

We recognize, however, that this opinion is not shared by everyone. Pedestrians who experience the annoyance of drivers turning right on red, looking to their left, and ignoring people crossing from their right, raise a legitimate concern as to whether this maneuver is desirable or safe. The issue is also open to debate in the Transportation Engineering profession. An article in the January, 2002 issue of the ITE Journal by Richard Retting, Marsha Nitzburg, Charles Farmer, and Richard Knoblauch asserted that

“RTOR increases the risk of motor-vehicle crashes and injuries, especially in urban areas.”

This paper began as a response to a request from the San Francisco Board of Supervisors that the Department of Parking and Traffic investigate the desirability of prohibiting right turns on red at all intersections in San Francisco. Since this is a question that comes up frequently in discussions with the public, it is important for Traffic Engineers to understand the advantages and disadvantages of prohibiting right turns on red.

### **The California Law**

California’ law permitting right turns on red took effect on January 1, 1939. Section 21453 (b) of the California Vehicle Code (CVC) requires drivers to make the turn “after stopping”; it also requires drivers to “yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to traffic lawfully using the intersection.”

According to the CVC, right turns are permitted, “except when a sign is in place prohibiting a turn . . .” San Francisco currently has signs prohibiting turns on red at about 125 of its 1050 signalized intersections. Right turns on red are often prohibited at intersections with high volumes of pedestrian/vehicle conflicts or where sight distances or intersection geometrics may pose a safety problem for right turns on red. The Department of Parking and Traffic evaluates requests for right turn on red prohibitions on a case by case basis.

The fine for violating Section 21453 (b) was raised by the State Legislature in 1997 to \$271, as part of a measure to increase fines for all red light running.

### **Studies**

Since California was one of the earliest states to permit right turns on red, the University of California evaluated whether the law posed a safety problem. In 1956 James C. Ray studied collisions at 75 intersections in San Francisco, Berkeley and Richmond, California (1). He found that about 0.3% (12/3338) of collisions involved right turn on red movements.

His study found not only a very low incidence of RTOR collisions, but it also found that right turns on red have a lower rate of collisions than right turns on green. He found that of a sample of 110 accidents involving right turning vehicles, 12 involved right turn on red, i.e. 11%. He also found that 18% of the total right turning movements were made on red. He states, “Therefore, the right-turn-on red contributes fewer accidents than the rate at which right-turn-on-red vehicles were exposed to accidents.” His cautious conclusion is that RTOR is “no more hazardous than the right-turn-on-green.”

The City and County of San Francisco has found that these figures have held true over the years. For example, from 1994 to 1996 there were 44 reported collision caused by RTOR out of a total of 9764 intersection collisions—0.3% in 1994, 0.6% in 1995, and

0.5% in 1996. Our average—0.45% was very close to the 1956 figure of 0.3% reported by James C. Ray.

We also found that RTOR accounts for very few reported pedestrian collisions. From 1994 to 1998 there were 41 reported collisions involving pedestrians and RTOR violations out of 5,372 total reported pedestrian collisions. This represents 0.8% of the reported pedestrian collisions.

### **A Critical Look at the Data**

One objection to the above data could be that RTOR is causing collisions, but is not being cited in the police reports as a cause, i.e. violation of pedestrian right-of-way, DUI, or other causes may be listed instead. To examine this, we selected 100 pedestrian collisions at random to study the collision reports more closely. This sample found that 50 of these collisions occurred at mid-block locations, 25 at non-signalized intersections, and 25 at signalized intersections. Of the 25 pedestrian/auto collisions at signalized intersections, none was caused by right turn on red violations, but 12 were caused by failure to yield the right-of-way to pedestrians on green lights. While this is an admittedly small sample, it does indicate that RTOR is not involved in a significant percentage of collisions, consistent with our data above.

Another objection could be that San Francisco only collects data primarily on injury collisions. It could be that RTOR violations lead to hurt feelings and anger more than

broken bones. In fact, sometimes the City and County of San Francisco prohibits RTOR at intersections with high volumes of pedestrians, primarily to keep drivers from infringing on pedestrian right-of-way by creeping into the intersection. We feel this is an appropriate reason to prohibit RTOR, but it is not primarily done for safety reasons. Of course, as noted, we also prohibit RTOR where limited sight distance or unusual roadway geometrics dictate.

While the issue of injury collisions vs. property damage only collisions may have some validity, the James C. Ray 1956 paper did analyze injury collisions as a subset of reported collisions and concluded that about 0.7% of personal injury accidents (4/556) included a RTOR, a figure higher than our present day numbers. This again suggests that RTOR collisions as a percentage of total collisions have not increased since 1956. It may be that the percentage of RTOR collisions has decreased, perhaps due to prohibitions of RTOR where such turns are not appropriate.

### **Other Studies**

Two references were cited in the January, 2002 *ITE Journal* article supporting the claim that RTOR increases the risk of collisions. One is by Paul Zador, Jack Moshman, and Leo Marcus from 1982 (2). The study examines intersection collisions before and after various states changed their laws to permit RTOR. It found that the percentage of collisions involving right turns in these states increased from 8.9% to 10.2% in the years following approval of RTOR, while there was a decrease in right turn collisions in states

that did not change their law in comparable periods. The paper states, “There were 20.7% more crashes involving right turn maneuvers at signalized intersections following the introduction of RTOR than there would have been had RTOR not been introduced.”

Given that well under 1% of San Francisco’s collisions are caused by RTOR, it appears impossible that banning RTOR would reduce collisions by more than 1%, even if none of the new right turns on green resulted in crashes. Therefore, the results of our study and the Zador study appear to be inconsistent. The Zador study did conclude, however, that there was not a significant change in severe/incapacitating crashes. Therefore, non-injury collisions could be a factor. Another factor could be a learning curve for drivers and pedestrians to adjust to the new law. It is also possible that the states that enacted the RTOR law had not had time to prohibit RTOR at key busy intersections, as has been done in California.

Another paper cited in the January, 2002 *ITE Journal* article is by Claude Dussault (3). He also studied before and after data for RTOR, so the same considerations mentioned above apply. Like Zador, et al, he agrees that there is no detectable difference in injury accidents, but he argues that the increase in property damage only accidents is significant. He contends that there was a 44% increase in pedestrian accidents and a 59% increase in bicycle accidents due to RTOR.

This again is inconsistent with our findings. As noted, in San Francisco we found only 0.8% of drivers in pedestrian collisions were cited for violation of RTOR from 1994 -

1996. We also found that 12.3% of intersection collisions (1200/9778) involved right turns. Assuming that the percentage of pedestrian collisions at intersections involving right turns is at least 12% (in our sample of 100 pedestrian collisions cited above, the percentage was 24%--12/50), then abolishing RTOR could not decrease pedestrian collisions by more than  $0.8/12 = 6.7\%$ . Again this assumes that none of the former RTOR movements would result in collisions.

For Dussualt's 44% increase figure to be possible, it would require that less than 2% of all pedestrian collisions involve right turns. This low number of right turning collisions is in fact consistent with Dussualt's study. Dussualt states, “. . .right turn accidents accounted for clearly less than 1% of all accidents. . .” This does not fit San Francisco's experience, however.

### **Recommendations**

If prohibiting right turns on red at all intersections would clearly improve pedestrian safety, we would support such a change. However, we do not believe that this is the case. Prohibiting right turn on red would require drivers to turn on green. This would most likely increase the number of collisions by right turning vehicles. It is also intuitive that accidents involving right turn on green are relatively more severe than right turn on red, as vehicles in the former case are moving nearly at full speed.

To the extent that RTOR collisions do exist, they are a problem. It is important to note that failure to stop is a violation of RTOR, and should be cited as such. Also, failure to yield to pedestrians is a violation of RTOR, and should be cited. With California's strict red light running fines (\$271), we feel that strong enforcement is a viable deterrent to such violations. Overall, we feel that education and enforcement are the best ways to improve driver compliance with the need to stop and yield before turning right-on-red. Design changes such as reducing the curb radius can also help discourage RTOR violations.

As noted, No-Turn-on-Red restrictions are desirable where high volumes of pedestrian and conflicting vehicular traffic exist. We recommend that such restrictions continue to be implemented on a case-by-case basis, as provided under California law.

Although it is of lesser importance than safety, we also feel that traffic flow is improved where right turn on red is permitted. Especially at locations near capacity, the intersection Level of Service is better with right turn on red. Also, for drivers on side streets turning on to major arterials, the delay is reduced if they are permitted to turn right on red. Transit operations also benefit, since buses can more easily pull up to nearside bus stops as right turning vehicles ahead of them dissipate.

## Conclusions

Our conclusion is that the California law and San Francisco's current policy permitting right turns on red is sound. It has a proven record of safety; it provides for posting No-Turn-On-Red where appropriate; it includes stiff penalties for violations; and it reduces unnecessary delay and frustration for motorists and transit riders.

- (1) The Effect of Right-Turn-On-Red on Traffic Performance and Accidents at Signalized Intersections, James C. Ray, Berkeley California, May, 1956.
- (2) Adoption of Right Turn on Red: Effects on Crashes at Signalized Intersections, Paul Zador, Jack Moshman, and Leo Marcus, Accident Prevention and Analysis, Volume 14, Number 3, June 1982
- (3) Safety Effects of Right Turn on Red: A Meta Analysis, Claude Dussault, Proceedings of the Canadian Multidisciplinary Road Safety Conference VIII, June 14-16, 1993, Saskatoon, Saskatchewan

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