



Brake Light System Modifications to Prevent Rear-end Vehicular Crashes: USING BASIC COMPUTER TECHNOLOGY TO STRENGTHEN VISUAL CUES TO THE VEHICLE BEHIND ABOUT THE RATE OF DECELERATION. Presentation # 212249 - by Art Cohen, JD MPH [November 2009]

Rear-End Collision Data

- FACT #1:** There are roughly about 6 million vehicular crashes every year on American roads and streets.
- FACT #2:** Crash database studies ... [have] shown that more than 29 percent of ... (these) crashes ... [are] **rear-end crashes**, a figure that has remained steady during the past decade (National Transportation Safety Board, 2001; NHTSA, 2007).
- FACT #3:** These [rear-end] crashes often result in serious injuries, loss of productive time, and high levels of property damage, particularly vehicle damage. Furthermore, these crashes often cause traffic congestion, resulting in reduced highway throughput. They occasionally result in occupant deaths, but the proportion is substantially less, contributing approximately 5.4 percent of traffic deaths in the United States (NHTSA, 2007).
- FACT #4:** Secondary crashes are often a result of initial rear-end crashes, placing other drivers, emergency and law enforcement personnel, and anyone else near the original crash scene in jeopardy.
- FACT #5:** Because of these figures, NHTSA [has] determined that further research should be undertaken directed at reducing rear-end crashes.

Sources for the above:
 Traffic Safety Facts Crash Stats
 DOT HS 811 172 A Brief Statistical Summary June 2009
 US Department of Transportation - National Highway Traffic Safety Administration (NHTSA)
 DOT HS 811 127 April 2009
 Evaluation of Enhanced Brake Lights Using Surrogate Safety Metrics
 Task 1 Report: Further Characterization and Development of Rear Brake Light Signals.
 Background - Page 1

Now, please take the "Car Drivers' Quiz" to learn your RECS (Rear-End Collision Score)

Look below at the CURRENT APPLICABLE FEDERAL REGULATIONS:

Nat'l Highway Traffic Safety Admin., DOT - Title 49 Code of Federal Regulations [CFR] §571.108

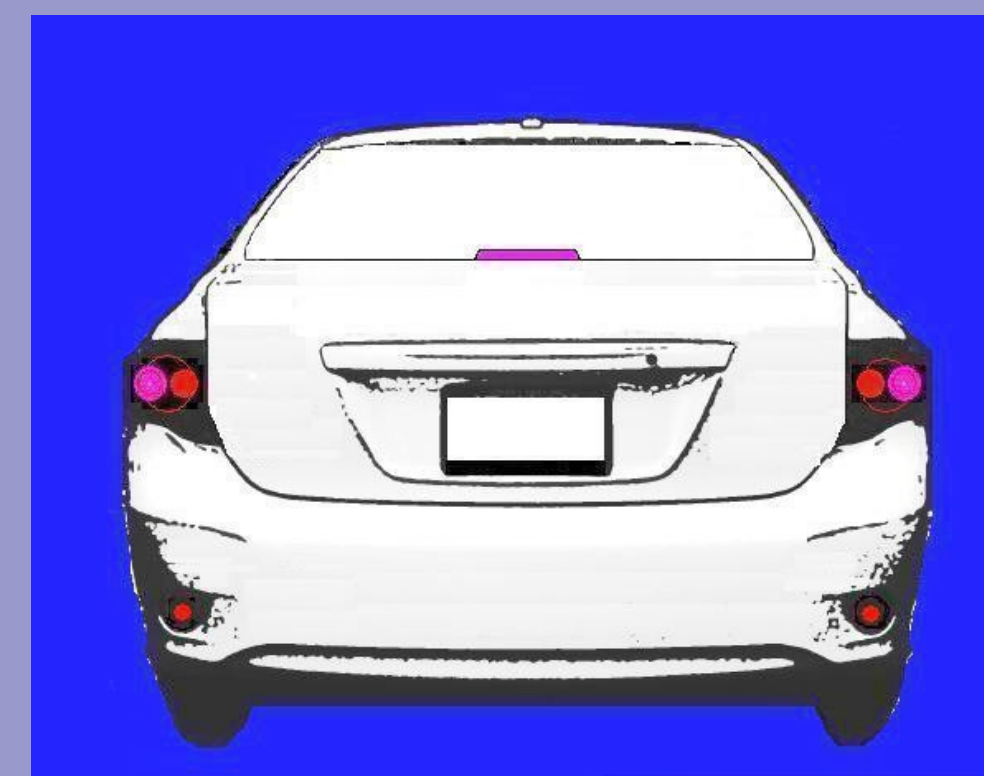
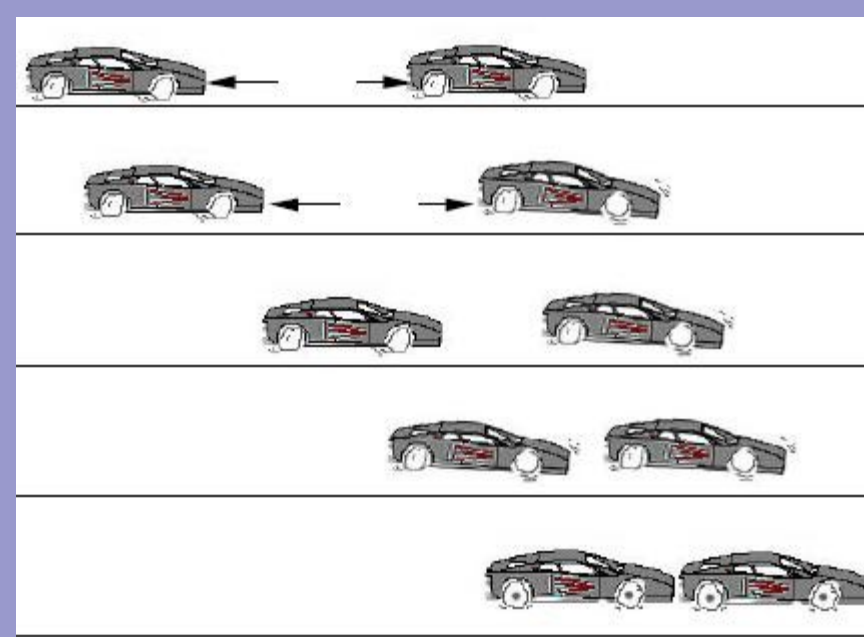
S5.5.4 The stop lamps on each vehicle shall be activated upon application of the service brakes. The high-mounted stop lamp on each vehicle shall be activated only upon application of the service brakes.

S5.5.10 The wiring requirements for lighting equipment in use are:
 (a) Turn signal lamps, hazard warning signal lamps, and school bus warning lamps shall be wired to flash;
 (b) Headlamps and side marker lamps may be wired to flash for signaling purposes;
 (c) A motorcycle headlamp may be wired to allow either its upper beam or its lower beam, but not both, to modulate from a higher intensity to a lower intensity in accordance with section S5.6;
 (d) -----> All other lamps shall be wired to be steady-burning. <-----

CURRENT BRAKE LIGHT

Nighttime - either stopping or already stopped with foot on brake

To avoid this:



What These Current Lights Do Not Tell the Driver Behind

- Whether the brakes are actually working to slow down the car;
- Whether the car is slowing or has stopped;
- The rate at which the car is slowing.

IMPROVED BRAKE LIGHT

Nighttime - beginning braking

Nighttime - continued braking

Nighttime - stopped with foot on brake



What These Improved Lights Can Tell the Driver Behind

- That the brakes are actually working to slow down the car;
- That the car is slowing or has stopped;
- The rate at which the car is slowing.

Examples of Recent Work Completed or Under Development by Others

- US Patent Office: Contains over 100 improvements to the conventional brake light. Check out Patent #3,593,278 for a brake light which uses a variable frequency of flashing to indicate a vehicle's rate of deceleration.
- Web link: "Why Not?" www.whynot.net which contains many suggestions about innovative brake lights [see the subject heading "better brake light" since 2003].
- Rensselaer Polytechnic Institute - Bullough John D., Yan, Hua, and Van Derlofske, John: "Effects of sweeping, color and luminance distribution on response to automotive stop lamps" (2003) in Society of Automotive Engineers Transactions Journal of Passenger Cars - Mechanical Systems, 111(6), 1294-1298.
- University of Toronto - Li, Zhonghai and Milgram, Paul: "An empirical investigation of a dynamic brake light concept for reduction of rear-end collisions through manipulation of optical looming" International Journal of Human-computer Studies, Vol. 66, Issue 3 (March 2008), Pages 158-172.
- Virginia Tech - five studies for the National Highway Traffic Safety Administration (NHTSA) between 2002 and 2009 [DOT # 809425, 809597, 809864, 810846, and 811127] and three NHTSA summaries of these studies in 2009 [DOT HS 811128, 811129, and 811130]
- The Mercedes-Benz automobile company: In 2005, it petitioned NHTSA for an exemption to regulatory Standard No. 108 on vehicle lamps (which required, among other things, brake lights to be steady and not flash) - see S5.510(d) in the lower left-hand corner of this poster. In 2006, Mercedes-Benz was granted that exemption. It had apparently already been using such flashing brake lights on its A-Class cars (which are not available in the USA).

- Interestingly, modified brake lights have been in use recently on some larger motorcycles.
- The Volvo Car Corporation has been pioneering a collision warning system to prevent rear-end collisions using a warning light inside the vehicle and a system for charging the brakes for a stop. Unlike the method proposed by this Poster Session, the Volvo system is not based on modification of the brake lights on the back of each car.

Now let's watch an improved braking light sequence slides on the laptop's computer screen!