Google™

January 11, 2016

Mr. Paul A. Hemmersbaugh
Chief Counsel
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE
Washington, DC 20590

Re: Self-cancellation of Turn Signals in Self-Driving Vehicles

Dear Mr. Hemmersbaugh:

In our letter to you dated November 12, 2015, Google, Inc. ("Google") requested that the National Highway Traffic Safety Administration (NHTSA) interpret certain Federal Motor Vehicle Safety Standards (FMVSSs) in a manner that we believe is both reasonable and conducive to implementation of self-driving vehicles. One issue we addressed in that letter (at page 14) was self-cancellation of turn signals by "steering wheel rotation" as mentioned in S9.1.1 of FMVSS No. 108, "Lamps, reflective devices, and associated equipment." We noted there that nothing in S9.1.1 nor any other FMVSS requires a vehicle to be equipped with a steering wheel. We maintained there, and continue to maintain, that the self-cancellation effectuated by the self-driving system (SDS) in Google's self-driving vehicle (SDV) makes the SDV compliant with S9.1.1.

This letter provides further information concerning how cancellation of the turn signal will work in Google's SDVs.

In a conventional vehicle, the steering wheel angle corresponds with and is coupled to the angle of the front road wheels by the steering column and steering rack. Turn signals are typically canceled through action of a mechanism in the steering column. That mechanism is activated by the rotation of the steering wheel (linked to the steering rack by the steering column) in the direction opposite to the set turn signal. This, in turn, occurs either by the driver turning the wheel, or if the driver releases the steering wheel, through the self-returning action of the front wheels toward the straight ahead position. The important point is that the steering wheel and steering rack position do not work independently of each other, so cancellation of the signal by steering wheel rotation or by steering rack travel are essentially the same thing.

In the SDV, the steering wheel and steering column are replaced by an actuator which is on the steering rack and which is controlled directly by the SDS. The SDS decision to use the turn signals is based on an analysis of the planned vehicle trajectory and relevant context that is

run multiple times per second. The SDS cancels the turn signals by monitoring the steering rack travel (i.e., the front wheel turning angle), and cancelling the signals when the angle moves in the opposite direction to that of the turn.[1] Thus, our system self-cancels based on the steering rack position, which is what happens in a conventional vehicle by virtue of the link between the steering rack, steering column, and steering wheel.

Accordingly, we continue to believe that, since nothing in the FMVSSs, including S9.1.1., requires a vehicle to have a steering wheel, S9.1.1 can properly be read as requiring self-cancellation of the turn signal as the steering rack returns to normal position. In context, "steering wheel rotation" as used in that standard is simply a readily observable surrogate for steering rack travel. Therefore, because steering rack travel in the SDV will trigger the cancellation function just as the corresponding steering wheel rotation does in a conventional vehicle, we believe the SDV complies with S9.1.1.

We appreciate the consideration you are giving to our request and look forward to receiving your response.

Sincerely,

Chris Urmson
Director, Self-Driving Car Project

Cc: Dr. Mark R. Rosekind, Administrator, National Highway Traffic Safety Administration

[1] In contrast, a conventional cancel mechanism often leaves the turn signals on after gentle maneuvers, such as lane changes, leaving it up to the driver to manually cancel the signal. The SDS helps eliminate this problem.