Google Self-Driving Car Testing Report on Disengagements of Autonomous Mode December 2015

Introduction

In accordance with regulations issued by the the California Department of Motor Vehicles (DMV), Google Auto LLC ("Google") submits this report of disengagements from autonomous mode that have occurred when operating its self-driving cars (SDCs) on public roads in California. In accordance with the DMV rule[1] , this report covers the period from the date of issuance of Google's Manufacturer's Testing Permit (September 24, 2014) through November 30, 2015.

As of the end of November, Google had operated its self-driving cars in autonomous mode for more than 1.3 million miles. Of those miles, 424,331 occurred on public roads in California during the period covered by this report -- with the vast majority on surface streets in the typical suburban city environment of Mountain View, CA and neighboring communities. We're self-driving 30,000-40,000 miles or more per month, which is equal to two to four years of typical US adult driving.

The setting in which our SDCs and our drivers operate most frequently is important. Mastering autonomous driving on city streets -- rather than freeways, interstates or highways -- requires us to navigate complex road environments such as multi-lane intersections or unprotected left-hand turns, a larger variety of road users including cyclists and pedestrians, and more unpredictable behavior from other road users. This differs from the driving undertaken by an average American driver who will spend a larger proportion of their driving miles on less complex roads such as freeways. Not surprisingly, 89 percent of our reportable disengagements have occurred in this complex street environment (see Table 6 below).

Disengagements are a critical part of the testing process that allows our engineers to expand the software's capabilities and identify areas of improvement. Our objective is not to minimize disengagements; rather, it is to gather, while operating safely, as much data as possible to enable us to improve our self-driving system. Therefore, we set disengagement thresholds conservatively, and each is carefully recorded. We have an evaluation process in which we identify disengagements that may signal any safety issues, and we resolve them by refining our software, firmware, or hardware and incorporating those changes across our entire fleet.

As we continue to develop our technology, the rate of safety significant disengagements has fallen even as we drive more autonomous miles on public roads.

Disengagements Covered by This Report

The DMV rule defines disengagements as deactivations of the autonomous mode in two situations: (1) "when a failure of the autonomous technology is detected," or (2) "when the safe operation of the vehicle requires that the autonomous vehicle test driver disengage the autonomous mode and take immediate manual control of the vehicle." In adopting this definition, the DMV noted:

[1] Section 227.46 of Article 3.7 (Autonomous Vehicles) of Title 13, Division 1, Chapter 1, California Code of Regulations

"This clarification is necessary to ensure that manufacturers are not reporting each common or routine disengagement."[2]

As part of testing, our cars switch in and out of autonomous mode many times a day. These disengagements number in the many thousands on an annual basis though the vast majority are considered routine and not related to safety. Safety is our highest priority and Google test drivers are trained to take manual control in a multitude of situations, not only when safe operation "requires" that they do so. Our drivers err on the side of caution and take manual control if they have any doubt about the safety of continuing in autonomous mode (for example, due to the behavior of the SDC or any other vehicle, pedestrian, or cyclist nearby), or in situations where other concerns may warrant manual control, such as improving ride comfort or smoothing traffic flow. Similarly, the SDC's computer hands over control to the driver in many situations that do not involve a "failure of the autonomous technology" and do not require an immediate takeover of control by the driver. We explain more in each relevant section below.

Failure of the Autonomous Technology Detected

In events where the software has detected a technology "failure" -- i.e. an issue with the autonomous technology that may affect the safe operation of the vehicle -- the SDC will immediately hand over control to the driver; we categorize these as "immediate manual control" disengagements. In these cases, the test driver is given a distinct audio and visual signal, indicating that immediate takeover is required.[3]

"Immediate manual control" disengage thresholds are set conservatively. Our objective is not to minimize disengages; rather, it is to gather as much data as possible to enable us to improve our self-driving system. Our self-driving system runs thousands of checks on itself every second. Immediate manual control disengages are triggered primarily when we detect a communication failure between the primary and secondary (back-up) self-driving systems (for example, a broken wire); when we detect anomalies in sensor readings related to our acceleration or position in the world (accelerometers or GPS); or when we detect anomalies in the monitoring of key functions like steering and braking.

During the reporting period, Google's fleet of SDCs experienced 272 such disengagements. Our test drivers are trained and prepared for these events and the average driver response time of all measurable events was 0.84 seconds.

As we continue to develop and refine the self-driving software, we are seeing fewer disengagements of this type despite a growing number of miles driven each month (Table 1). The number of autonomous miles we are driving between immediate manual control disengagements is increasing steadily over time. The rate of this type of disengagement has dropped significantly from 785 miles per disengagement in the fourth quarter of 2014 to 5318 miles per disengagement in the fourth quarter of 2015. Figure 1 illustrates this improvement.

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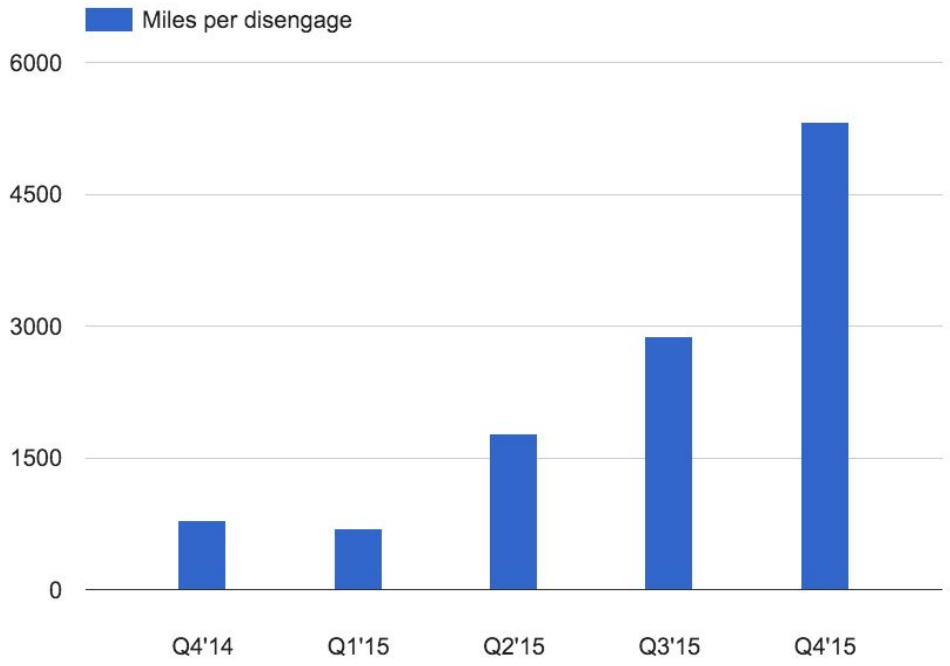
[2] DMV's Final Statement of Reasons at page 2.

[3] During this testing phase of the software, our SDC hands over control to test drivers on many other occasions that are not "failures" of the autonomous technology. As we calibrate our software and hardware, we closely monitor its performance and alert our drivers and engineers to any minor anomalies.

Table 1: Disengagements related to detection of a failure of the autonomous technology

Month	Number Disengages	Autonomous miles on public roads
2014/09	0	4207.2
2014/10	14	23971.1
2014/11	14	15836.6
2014/12	40	9413.1
2015/01	48	18192.1
2015/02	12	18745.1
2015/03	26	22204.2
2015/04	47	31927.3
2015/05	9	38016.8
2015/06	7	42046.6
2015/07	19	34805.1
2015/08	4	38219.8
2015/09	15	36326.6
2015/10	11	47143.5
2015/11	6	43275.9
Total	272	424331

Figure 1: Autonomous miles driven per disengagement related to detection of a failure of the autonomous technology



Disengagements Where Safe Operation of the Vehicle Requires Control by the Driver

Our test drivers play a critical role in refining our technology and ensuring the safe operation of the vehicles while we are in this development phase. They are directed to take control of the vehicle as often as they feel is necessary and for a variety of reasons relating to the comfort of the ride, the safety of the vehicle, or the erratic or unpredictable behavior of other road users.

Each time a test driver takes manual control of the vehicle, our system automatically records the circumstances leading up to the disengagement from autonomous mode and flags them for review by the software team. This information, along with feedback given by the test driver, is used to evaluate the software for any potential safety issues or areas of improvement, such as making our self-driving car drive more smoothly.

To help evaluate the significance of driver disengagements, we employ a powerful simulator program -- developed in-house by our engineers -- that allows the team to “replay” each incident and predict the behavior of the self-driving car (had the driver not taken control of it) as well as the behavior and positions of other road users in the vicinity (such as pedestrians, cyclists, and other vehicles). The simulator can also create thousands of variations on that core event so we can evaluate

what would have happened under slightly different circumstances, such as our vehicle and other road users moving at different times, speeds, and angles.

Through this process we can determine the events that have safety significance and should receive prompt and thorough attention from our engineers in resolving them. In the reporting period, there were 69 events across our fleet in which safe operation of the vehicle required disengagement by the driver.

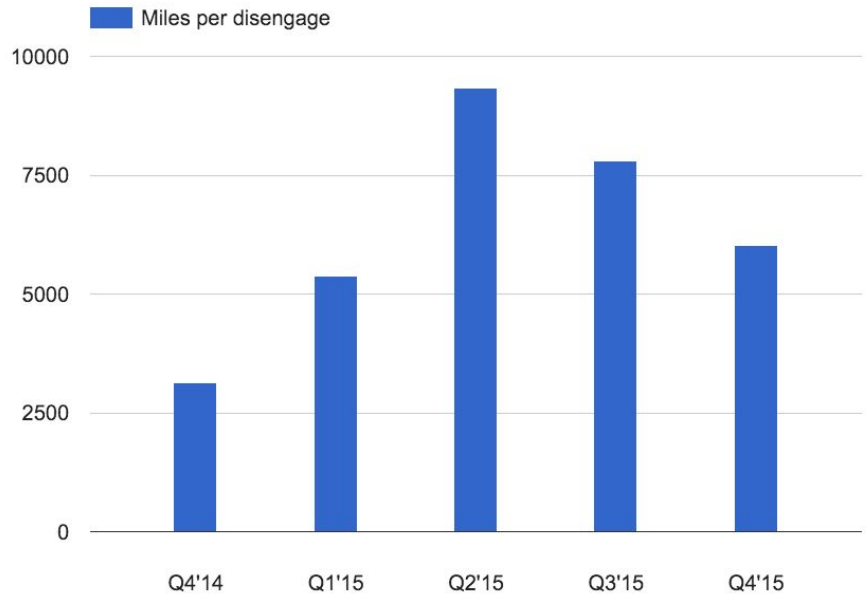
Each of these events is carefully studied to root out the underlying issue or family of issues, and our software is then refined. The revised software is tested extensively, in simulation, on closed courses and on public roads with our test drivers. Even with the vast majority of our autonomous miles being driven in complex city street environments, we only record a few safe operation disengagements each month (Table 2) .

Table 2: Driver-initiated disengagements related to safe operation of the vehicle

Month	Number Disengages	Autonomous miles on public roads
2014/09	2	4207.2
2014/10	5	23971.1
2014/11	7	15836.6
2014/12	3	9413.1
2015/01	5	18192.1
2015/02	2	18745.1
2015/03	4	22204.2
2015/04	4	31927.3
2015/05	4	38016.8
2015/06	4	42046.6
2015/07	10	34805.1
2015/08	3	38219.8
2015/09	1	36326.6
2015/10	5	47143.5
2015/11	10	43275.9
Total	69	424331

Figure 2, below, displays how the number of autonomous miles driven between such disengagements has changed over the calendar quarters covered in the report. The low absolute number of events makes a trend hard to discern because an aberrational month can skew the data.

Figure 2: Autonomous miles driven per driver-initiated disengagement related to safe operation of the vehicle



Of the 69 reportable safe operation events, 13 were "simulated contacts" -- events in which, upon replaying the event in our simulator, we determined that the test driver prevented our vehicle from making contact with another object. The remaining 56 of the 69 events were safety-significant because, under simulation, we identified some aspect of the SDC's behavior that could be a potential cause of contacts in other environments or situations if not addressed. This includes proper perception of traffic lights, yielding properly to pedestrians and cyclists, and violations of traffic laws. To be clear, however, these 56 events during the reporting period would very likely not have resulted in a real-world contact if the test driver had not taken over.

In 10 of the 13 simulated contact events, the SDC's predicted behavior would have, in simulation, caused contact (though 2 of these involved simulated contact with traffic cones). In 3 of the 13 occasions, a driver in another vehicle made a move that would have, in simulation, caused a contact with our car (e.g., in one case the other vehicle was driving the wrong way down the road in the SDC's path); in these cases, we believe a human driver could have taken a reasonable action to avoid the contact but the simulation indicated the SDC would not have taken that action.

These events are rare and our engineers carefully study these simulated contacts and refine the software to ensure the self-driving car performs safely. A software "fix" is tested against many miles of simulated driving, then tested on the road, and, after careful review and validation, rolled out to the entire fleet. The rate of these simulated contact disengagements is declining even as autonomous miles driven increase. Because the simulated contact events are so few in number, they do not lend themselves well to trend analysis, but, we are generally driving more autonomous miles between these events. From April 2015 to November 2015, our cars self-drove more than 230,000 miles without a single such event.

Table 3: Disengagements related to simulated contacts of the autonomous technology

Month	Number Disengages	Autonomous miles on public roads
2014/09	0	4207.2
2014/10	2	23971.1
2014/11	4	15836.6
2014/12	2	9413.1
2015/01	1	18192.1
2015/02	0	18745.1
2015/03	1	22204.2
2015/04	1	31927.3
2015/05	0	38016.8
2015/06	0	42046.6
2015/07	0	34805.1
2015/08	0	38219.8
2015/09	0	36326.6
2015/10	0	47143.5
2015/11	2	43275.9
Total	13	424331

Summary of All Reportable Disengagements

Table 4 summarizes all disengagements required to be reported to the DMV, i.e., both those where a failure of the autonomous technology was detected and those involving drivers taking control when required for safe operation. A brief description of each reportable disengagement is shown in Appendix A.

Table 4: All Reportable Disengagements

Month	Number Disengages	Autonomous miles on public roads
2014/09	2	4207.2
2014/10	19	23971.1
2014/11	21	15836.6
2014/12	43	9413.1
2015/01	53	18192.1
2015/02	14	18745.1
2015/03	30	22204.2
2015/04	51	31927.3
2015/05	13	38016.8
2015/06	11	42046.6
2015/07	29	34805.1
2015/08	7	38219.8
2015/09	16	36326.6
2015/10	16	47143.5
2015/11	16	43275.9
Total	341	424331

Figure 3, below, shows the relationship between all reportable disengagements and the number of autonomous miles driven.

Figure 3: Autonomous miles driven per reportable disengagement

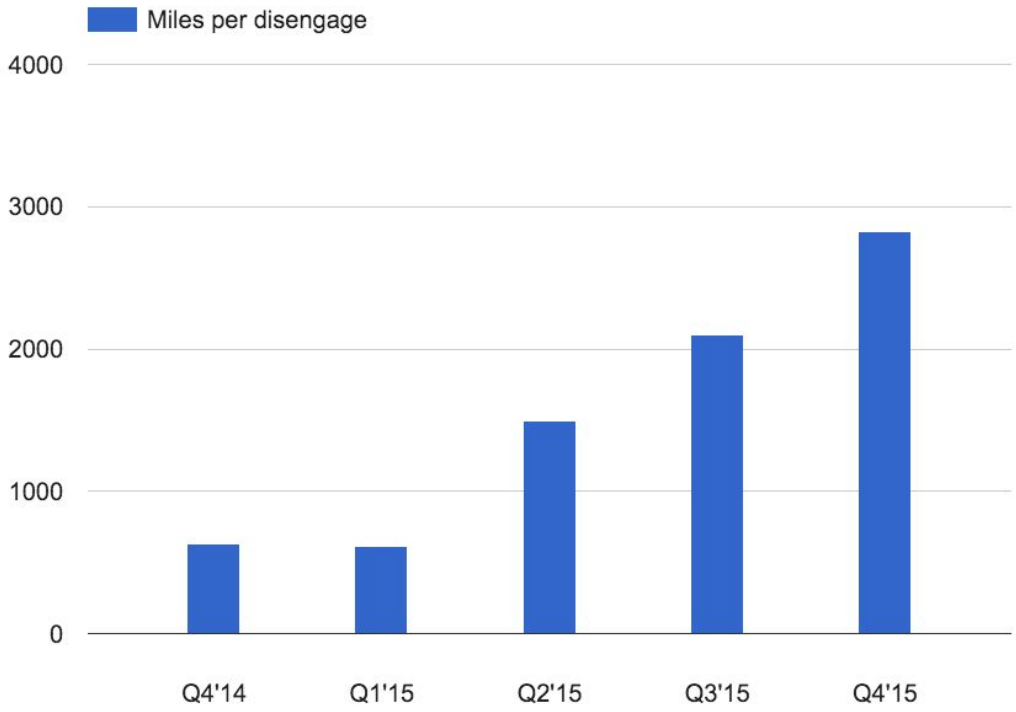


Table 5 below provides the breakdown of disengagements by cause. Note that, while we have used, where applicable, the causes mentioned in the DMV rule (weather conditions, road surface conditions, construction, emergencies, accidents or collisions), those causes were infrequent in our experience. Far more frequent were the additional causes we have labeled as unwanted maneuver, perception discrepancy, software discrepancy, hardware discrepancy, incorrect behavior prediction, or other road users behaving recklessly.[4]

Table 5: Disengagements by Cause

[4] Our cause descriptions reflect the categories of disengagements that our experience has taught us are the most useful for analyzing any underlying issue. "Recklessly behaving road user" indicates that our driver disengaged from autonomous mode to respond to reckless behavior by another driver, cyclist, or pedestrian. "Hardware discrepancy" indicates that a hardware element is not performing as expected. "Unwanted maneuver of the vehicle" involves the SDC moving in a way that is undesirable (e.g., coming uncomfortably close to a parked car). "Perception discrepancy" refers to a situation in which the SDC's sensors are not correctly perceiving an object (e.g., perceiving overhanging branches as an obstacle). "Incorrect behavior prediction of other traffic participants" involves not correctly predicting the behavior of another road user (e.g., incorrectly predicting that pedestrians on the sidewalk will jaywalk). "Software discrepancy" covers situations involving apparent software inadequacies that do not readily fall into other categories (e.g., map or calibration issues).

Cause	Sep 2014	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	May 2015	Jun 2015	Jul 2015	Aug 2015	Sep 2015	Oct 2015	Nov 2015	Total
disengage for weather conditions during testing	0	0	0	0	1	5	0	6	0	0	0	0	0	0	1	**13**
disengage for a recklessly behaving road user	1	0	1	1	1	3	3	7	0	0	0	2	1	0	3	**23**
disengage for hardware discrepancy	0	1	0	0	2	1	0	1	0	5	8	1	8	8	4	**39**
disengage for unwanted maneuver of the vehicle	0	3	6	14	15	1	3	2	1	0	3	2	0	3	2	**55**
disengage for a perception discrepancy	1	2	3	18	19	2	20	30	4	4	8	0	4	3	1	**119**
disengage for incorrect behavior prediction of other traffic participants	0	2	2	0	1	0	2	0	0	0	0	0	0	1	0	**8**
disengage for a software discrepancy	0	11	9	9	14	2	1	5	8	2	9	2	3	1	4	**80**
disengage for construction zone during testing	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	**3**
disengage for emergency vehicle during testing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
Total	**2**	**19**	**21**	**43**	**53**	**14**	**30**	**51**	**13**	**11**	**29**	**7**	**16**	**16**	**16**	**341**

Table 6 provides information on the location of disengagements covered in this report.

Table 6: Disengagements by Location

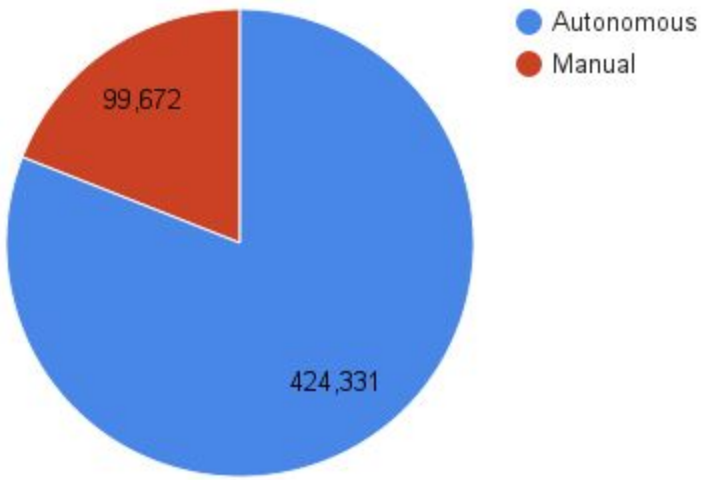
Location	Sep 2014	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	May 2015	Jun 2015	Jul 2015	Aug 2015	Sep 2015	Oct 2015	Nov 2015	Total
Interstate	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**1**
Freeway	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	**4**
Highway	0	1	2	0	1	1	4	2	3	2	2	2	5	4	3	**32**
Street	2	18	19	43	52	13	26	49	9	9	23	5	11	12	13	**304**
Total	**2**	**19**	**21**	**43**	**53**	**14**	**30**	**51**	**13**	**11**	**29**	**7**	**16**	**16**	**16**	**341**

In its listing of possible disengagement causes, the DMV rule asks each manufacturer to state "whether the disengagement was the result of a planned test of the autonomous vehicle." All the disengagements reported here occurred during planned testing of the SDCs. However, if the rule is seeking information on whether the disengagement occurred during planned testing of the disengagement function itself, we do not test that function on public roads. Instead, we test the function in our own facilities during vehicle preparation.

Miles Driven by Autonomous Vehicles

Appendix B shows the total number of miles each autonomous vehicle was tested in autonomous mode on public roads each month. The total miles driven on public roads in California by Google's fleet during the period, broken down by autonomous and manual modes, is shown in Figure 4.

FIgure 4: Miles driven on public roads in California.



Time Elapsed Between Technology Failure and Driver Assumption of Control

The DMV rule requires that our report include in our summary of disengagements the "period of time elapsed from when the autonomous vehicle test driver was alerted of the technology failure and the driver assumed manual control of the vehicle." This requirement is relevant only to the "technology failure" category of disengagements when the vehicle hands over control to the driver for immediate action. Appendix A shows this elapsed time for each disengagement where the data are available. In the vast majority of cases, the driver took control in one second or less after the immediate manual control message was received. The average time of all measurable events was 0.84 seconds.

Appendix A
Summary of Each Reportable Disengagement

Date	Location	Type	Time to manual	Cause
Sep 2014	Street	Safe Operation	-	Disengage for a perception discrepancy
Sep 2014	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Oct 2014	Street	Safe Operation	-	Disengage for a perception discrepancy
Oct 2014	Street	Failure Detection	0.7s	Disengage for hardware discrepancy
Oct 2014	Street	Safe Operation	-	Disengage for incorrect behavior prediction of other traffic participants
Oct 2014	Street	Failure Detection	0.8s	Disengage for unwanted maneuver of the vehicle
Oct 2014	Street	Failure Detection	0.8s	Disengage for unwanted maneuver of the vehicle
Oct 2014	Street	Failure Detection	0.9s	Disengage for a software discrepancy
Oct 2014	Street	Safe Operation	-	Disengage for a perception discrepancy
Oct 2014	Highway	Failure Detection	0.6s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	0.9s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	0.9s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	1.0s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	0.6s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	0.9s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	0.6s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	0.6s	Disengage for a software discrepancy
Oct 2014	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Oct 2014	Street	Safe Operation	-	Disengage for incorrect behavior prediction of other traffic participants
Oct 2014	Street	Failure Detection	0.7s	Disengage for a software discrepancy
Oct 2014	Street	Failure Detection	*	Disengage for a software discrepancy
Nov 2014	Street	Failure Detection	0.5s	Disengage for a software discrepancy
Nov 2014	Highway	Failure Detection	0.8s	Disengage for a software discrepancy
Nov 2014	Street	Failure Detection	0.7s	Disengage for a software discrepancy
Nov 2014	Street	Failure Detection	0.2s	Disengage for a software discrepancy
Nov 2014	Street	Failure Detection	0.7s	Disengage for a software discrepancy

Nov 2014	Street	Safe Operation	-	Disengage for a perception discrepancy
Nov 2014	Street	Failure Detection	0.2s	Disengage for incorrect behavior prediction of other traffic participants
Nov 2014	Street	Failure Detection	0.8s	Disengage for a software discrepancy
Nov 2014	Street	Failure Detection	0.6s	Disengage for a software discrepancy
Nov 2014	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Nov 2014	Street	Failure Detection	*	Disengage for incorrect behavior prediction of other traffic participants
Nov 2014	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Nov 2014	Street	Failure Detection	0.7s	Disengage for unwanted maneuver of the vehicle
Nov 2014	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Nov 2014	Street	Safe Operation	-	Disengage for a perception discrepancy
Nov 2014	Street	Failure Detection	0.2s	Disengage for unwanted maneuver of the vehicle
Nov 2014	Highway	Failure Detection	1.1s	Disengage for a software discrepancy
Nov 2014	Street	Safe Operation	-	Disengage for a perception discrepancy
Nov 2014	Street	Failure Detection	2.2s	Disengage for unwanted maneuver of the vehicle
Nov 2014	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Nov 2014	Street	Failure Detection	2.2s	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	0.2s	Disengage for a software discrepancy
Dec 2014	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	*	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	1.8s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.7s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.8s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	*	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.3s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	1.2s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.8s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.3s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	1.1s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	1.7s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	1.1s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	*	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	*	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	0.3s	Disengage for a software discrepancy

Dec 2014	Street	Failure Detection	0.9s	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	1.0s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	*	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	0.7s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	*	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	1.3s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	0.4s	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	0.2s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	2.0s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	0.8s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.8s	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	1.6s	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	0.8s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	0.3s	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	1.7s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.3s	Disengage for unwanted maneuver of the vehicle
Dec 2014	Street	Failure Detection	0.4s	Disengage for a recklessly behaving agent
Dec 2014	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	1.2s	Disengage for a software discrepancy
Dec 2014	Street	Failure Detection	*	Disengage for a perception discrepancy
Dec 2014	Street	Safe Operation	-	Disengage for construction zone during testing
Dec 2014	Street	Safe Operation	-	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	*	Disengage for a perception discrepancy
Dec 2014	Street	Failure Detection	1.3s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	1.9s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.5s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.3s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.3s	Disengage for a perception discrepancy

Jan 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.8s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.3s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.8s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.5s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.7s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	*	Disengage for adverse road surface conditions such as road holes or bumps
Jan 2015	Street	Failure Detection	0.4s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.3s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.7s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.3s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	1.0s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.4s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	1.4s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	1.9s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.3s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.2s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.2s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	1.0s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	2.0s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.2s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.8s	Disengage for a perception discrepancy
Jan 2015	Highway	Safe Operation	-	Disengage for a recklessly behaving agent
Jan 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Jan 2015	Street	Safe Operation	-	Disengage for incorrect behavior prediction of other traffic participants
Jan 2015	Street	Failure Detection	0.3s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	1.4s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	1.3s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.9s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	*	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.6s	Disengage for a software discrepancy

Jan 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.4s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	1.6s	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.9s	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.4s	Disengage for a perception discrepancy
Jan 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Jan 2015	Street	Failure Detection	0.6s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.6s	Disengage for a software discrepancy
Jan 2015	Street	Safe Operation	-	Disengage for hardware discrepancy
Jan 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jan 2015	Street	Failure Detection	0.9s	Disengage for a software discrepancy
Jan 2015	Street	Failure Detection	0.2s	Disengage for hardware discrepancy
Feb 2015	Street	Failure Detection	0.7s	Disengage for hardware discrepancy
Feb 2015	Street	Failure Detection	1.6s	Disengage for weather conditions during testing
Feb 2015	Highway	Failure Detection	0.4s	Disengage for weather conditions during testing
Feb 2015	Street	Failure Detection	0.7s	Disengage for weather conditions during testing
Feb 2015	Street	Failure Detection	1.2s	Disengage for weather conditions during testing
Feb 2015	Street	Failure Detection	0.9s	Disengage for weather conditions during testing
Feb 2015	Street	Failure Detection	0.3s	Disengage for a recklessly behaving agent
Feb 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Feb 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Feb 2015	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Feb 2015	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Feb 2015	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Feb 2015	Street	Failure Detection	1.0s	Disengage for a perception discrepancy
Feb 2015	Street	Failure Detection	0.4s	Disengage for unwanted maneuver of the vehicle
Mar 2015	Street	Failure Detection	1.0s	Disengage for a software discrepancy
Mar 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.6s	Disengage for a recklessly behaving agent
Mar 2015	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Mar 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Mar 2015	Street	Failure Detection	1.5s	Disengage for a recklessly behaving agent
Mar 2015	Highway	Failure Detection	0.5s	Disengage for a perception discrepancy
Mar 2015	Highway	Failure Detection	*	Disengage for unwanted maneuver of the vehicle

Mar 2015	Street	Failure Detection	2.0s	Disengage for a perception discrepancy
Mar 2015	Street	Safe Operation	-	Disengage for construction zone during testing
Mar 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Mar 2015	Highway	Failure Detection	0.4s	Disengage for a perception discrepancy
Mar 2015	Highway	Safe Operation	-	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.8s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.7s	Disengage for incorrect behavior prediction of other traffic participants
Mar 2015	Street	Failure Detection	1.6s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.4s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.5s	Disengage for unwanted maneuver of the vehicle
Mar 2015	Street	Safe Operation	-	Disengage for incorrect behavior prediction of other traffic participants
Mar 2015	Street	Failure Detection	1.4s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.1s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	0.5s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	1.4s	Disengage for a recklessly behaving agent
Mar 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	1.9s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	1.8s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	1.0s	Disengage for a perception discrepancy
Mar 2015	Street	Failure Detection	1.8s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.2s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	2.1s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Apr 2015	Street	Failure Detection	0.8s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.9s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Apr 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.5s	Disengage for a recklessly behaving agent
Apr 2015	Street	Failure Detection	0.8s	Disengage for a recklessly behaving agent
Apr 2015	Street	Failure Detection	2.2s	Disengage for a perception discrepancy

Apr 2015	Street	Failure Detection	0.3s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.3s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.3s	Disengage for unwanted maneuver of the vehicle
Apr 2015	Street	Failure Detection	1.6s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.9s	Disengage for a recklessly behaving agent
Apr 2015	Street	Failure Detection	1.5s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.5s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.7s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.6s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.7s	Disengage for a perception discrepancy
Apr 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.2s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.9s	Disengage for weather conditions during testing
Apr 2015	Street	Failure Detection	0.6s	Disengage for weather conditions during testing
Apr 2015	Street	Failure Detection	*	Disengage for weather conditions during testing
Apr 2015	Street	Failure Detection	*	Disengage for weather conditions during testing
Apr 2015	Street	Failure Detection	0.4s	Disengage for weather conditions during testing
Apr 2015	Street	Failure Detection	*	Disengage for weather conditions during testing
Apr 2015	Street	Failure Detection	0.9s	Disengage for a recklessly behaving agent
Apr 2015	Street	Failure Detection	1.4s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.1s	Disengage for a recklessly behaving agent
Apr 2015	Street	Failure Detection	*	Disengage for a recklessly behaving agent
Apr 2015	Street	Failure Detection	0.7s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	0.6s	Disengage for a perception discrepancy
Apr 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Apr 2015	Highway	Failure Detection	0.5s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	*	Disengage for a recklessly behaving agent
Apr 2015	Highway	Failure Detection	0.8s	Disengage for a perception discrepancy
Apr 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.0s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	*	Disengage for a software discrepancy

Apr 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Apr 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Apr 2015	Street	Failure Detection	0.5s	Disengage for unwanted maneuver of the vehicle
Apr 2015	Street	Failure Detection	0.7s	Disengage for a perception discrepancy
Apr 2015	Street	Failure Detection	1.5s	Disengage for hardware discrepancy
May 2015	Street	Failure Detection	*	Disengage for a software discrepancy
May 2015	Street	Failure Detection	*	Disengage for a software discrepancy
May 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
May 2015	Street	Failure Detection	*	Disengage for a software discrepancy
May 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
May 2015	Highway	Failure Detection	1.1s	Disengage for a software discrepancy
May 2015	Freeway	Failure Detection	0.8s	Disengage for a software discrepancy
May 2015	Highway	Failure Detection	0.6s	Disengage for a software discrepancy
May 2015	Highway	Failure Detection	*	Disengage for a software discrepancy
May 2015	Street	Failure Detection	*	Disengage for a software discrepancy
May 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
May 2015	Street	Failure Detection	0.4s	Disengage for unwanted maneuver of the vehicle
May 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jun 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jun 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Jun 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jun 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jun 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jun 2015	Street	Failure Detection	0.5s	Disengage for a software discrepancy
Jun 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jun 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jun 2015	Highway	Safe Operation	-	Disengage for a perception discrepancy
Jun 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jun 2015	Highway	Safe Operation	-	Disengage for a perception discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for a perception discrepancy

Jul 2015	Highway	Safe Operation	-	Disengage for construction zone during testing
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Jul 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Jul 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Jul 2015	Street	Failure Detection	1.2s	Disengage for a perception discrepancy
Jul 2015	Street	Failure Detection	0.3s	Disengage for a perception discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Jul 2015	Interstate	Failure Detection	1.8s	Disengage for a software discrepancy
Jul 2015	Freeway	Failure Detection	*	Disengage for a software discrepancy
Jul 2015	Freeway	Failure Detection	*	Disengage for a software discrepancy
Jul 2015	Freeway	Failure Detection	*	Disengage for a software discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Jul 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Jul 2015	Highway	Failure Detection	0.9s	Disengage for a software discrepancy
Jul 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Aug 2015	Street	Failure Detection	*	Disengage for a software discrepancy
Aug 2015	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Aug 2015	Highway	Failure Detection	*	Disengage for a software discrepancy
Aug 2015	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Aug 2015	Highway	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Aug 2015	Street	Failure Detection	*	Disengage for unwanted maneuver of the vehicle
Aug 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Street	Failure Detection	0.2s	Disengage for a perception discrepancy
Sep 2015	Street	Failure Detection	*	Disengage for a perception discrepancy

Sep 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Sep 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Highway	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Highway	Failure Detection	*	Disengage for a software discrepancy
Sep 2015	Street	Failure Detection	*	Disengage for a perception discrepancy
Sep 2015	Highway	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Street	Failure Detection	1.5s	Disengage for a software discrepancy
Sep 2015	Street	Failure Detection	0.8s	Disengage for a perception discrepancy
Sep 2015	Highway	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Sep 2015	Highway	Failure Detection	2.1s	Disengage for a software discrepancy
Oct 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Street	Failure Detection	1.3s	Disengage for unwanted maneuver of the vehicle
Oct 2015	Highway	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Oct 2015	Highway	Failure Detection	*	Disengage for a software discrepancy
Oct 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Oct 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Oct 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Highway	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Street	Failure Detection	0.4s	Disengage for a perception discrepancy
Oct 2015	Street	Safe Operation	-	Disengage for incorrect behavior prediction of other traffic participants
Oct 2015	Highway	Failure Detection	*	Disengage for hardware discrepancy
Oct 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Nov 2015	Highway	Safe Operation	-	Disengage for weather conditions during testing
Nov 2015	Street	Safe Operation	-	Disengage for a software discrepancy
Nov 2015	Street	Safe Operation	-	Disengage for a software discrepancy

Nov 2015	Street	Safe Operation	-	Disengage for a software discrepancy
Nov 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Nov 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Nov 2015	Highway	Safe Operation	-	Disengage for a recklessly behaving agent
Nov 2015	Street	Safe Operation	-	Disengage for a recklessly behaving agent
Nov 2015	Street	Safe Operation	-	Disengage for a perception discrepancy
Nov 2015	Street	Failure Detection	1.8s	Disengage for emergency vehicle during testing
Nov 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Nov 2015	Street	Safe Operation	-	Disengage for unwanted maneuver of the vehicle
Nov 2015	Highway	Failure Detection	*	Disengage for a software discrepancy
Nov 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Nov 2015	Street	Failure Detection	*	Disengage for hardware discrepancy
Nov 2015	Street	Safe Operation	-	Disengage for a recklessly behaving agent

(*) The time is not available for this disengagement event. Our primary self-driving system is responsible for measuring and logging these response times. In 88 of the technology failure disengagements, the nature of the failure prevented collection of this information. The absence of data was caused by interrupted communication between the logging system and the system that provides status information on driver input. However, given the apparent effectiveness of the immediate manual control warning, the average response time, there is no reason to conclude that the driver response times were different even where the data are not available.

Appendix B
Autonomous miles on public roads in California
for each car and month
(shows last four digits of car's VIN)

Vehicle	****4107	****7036	****0779	****5356	****7943	****9069	****7007	****0888	****2177
Sep 2014	0	37.4	783.9	585.5	1.4	0	334.6	675.5	79
Oct 2014	13	1518.4	2477.6	2704.5	229.9	0	1140.9	2593	757.4
Nov 2014	5.9	317.7	1439.3	1558.5	488.7	0	847.5	1100.7	75.6
Dec 2014	0	14	0	0	434.1	18.9	61.4	16	629.8
Jan 2015	0	470.5	706.8	271.5	1492	347.5	15	244	1325
Feb 2015	31.9	792.2	418.3	977.5	881.2	1009.4	876.7	798.8	809.8
Mar 2015	59.8	D.2	1702.8	1527	543.8	1431.8	1739.8	1604.7	1159.5
Apr 2015	484.7	1586.3	1696	25.3	1642.4	2086.3	246.8	1495.3	1993.2
May 2015	1817	1137.8	2165.2	1848.7	1693.4	2052.9	1364.1	1507.9	1578.4
Jun 2015	666.6	2492	2285.9	2256.8	1047.2	1800.4	1506.1	1945.3	1846.8
Jul 2015	1981.3	1286.8	1997.7	861.3	74.3	72.1	850.9	2308.5	184.1
Aug 2015	2663.3	1799.1	2065.5	53.5	511.7	178.9	958	2225.2	441.6
Sep 2015	1348.2	924.2	2011.6	549.1	874.4	1403.5	1024.4	2234.7	2306.4
Oct 2015	2082.3	2602.6	0	1665.7	184.2	1773.7	456.1	2212.8	1659.5
Nov 2015	2229.5	1007.4	1174.3	2248	2842.7	1549	80.9	2251.9	2092.6
Total	**13383.5**	**15991.6**	**20924.9**	**17132.9**	**12941.4**	**13724.4**	**11503.2**	**23214.3**	**16938.7**

Vehicle	****1704	****5457	****3028	****0202	****9817	****5409	****5497	****5048	****5362
Sep 2014	0	105.4	147.4	144.1	0	258.6	2.1	65.3	66.9
Oct 2014	630.1	1723	1172.6	470.2	0	1342.4	358.9	1984.9	1198.6
Nov 2014	478.3	1620.8	1008.6	735.5	316.1	810.2	648	809.1	860.4
Dec 2014	80.5	567.7	265.5	768.7	393.5	454.9	1231.5	582.2	372
Jan 2015	442	589.9	1079.3	1370.4	560.2	922.5	2249.8	703.3	976.6
Feb 2015	214	742.9	165.4	1756.8	566	894.6	2126.2	0	0
Mar 2015	766.4	63.5	63.9	1329.9	1680.9	1619.1	1829	0	16.8
Apr 2015	1809.3	349.2	1148.3	1529.2	1447.8	2100.9	2049	2041.6	1431
May 2015	2088.9	1075.7	2004.2	933.5	1820.3	1483	1049.2	1704.6	972.8
Jun 2015	1324.6	1907.1	2445.4	1663.5	1474.7	2548.9	1769.8	1998.4	1765.5
Jul 2015	2071.9	1388.8	1910.8	1581.4	1753.6	2109.4	608.8	2030.6	1737.2
Aug 2015	1324.3	100.6	1857.7	1453.7	2023.1	1403.2	1097.7	2172.5	2050.9
Sep 2015	728.6	331.8	1985.7	2228.1	2415.4	1745.4	746.6	2102.4	1844.2
Oct 2015	567.7	584.5	824.6	1930.7	2749.9	1144	679.7	2119.5	2553.7
Nov 2015	24.8	1442.2	15.2	1120.2	2541.1	1283.6	34.6	1137.5	394
Total	**12551.4**	**12593.1**	**16094.6**	**19015.9**	**19742.6**	**20120.7**	**16480.9**	**19451.9**	**16240.6**

Vehicle	****5619	****5019	****4001	****6138	****0059	****5510	****5511	****5512	****5513
Sep 2014	184.4	244.5	133.6	222.1	135.5	0	0	0	0
Oct 2014	510.7	839.4	906	825	574.6	0	0	0	0
Nov 2014	574.5	429.8	734.2	568.6	408.6	0	0	0	0
Dec 2014	963.9	350.4	881.2	465.7	861.2	0	0	0	0
Jan 2015	1169.2	540.4	1403.6	347	965.6	0	0	0	0
Feb 2015	1737	552.2	1305.4	963.9	1124.9	0	0	0	0
Mar 2015	465.1	730.1	1114.9	1038.3	1711.9	0	0	0	0
Apr 2015	1816.5	151.6	1749.1	1778.5	1269	0	0	0	0
May 2015	2125.1	2075.3	1840.6	2061.5	1616.7	0	0	0	0
Jun 2015	980	2080	2189.7	1289	2214.5	0	0	0	0
Jul 2015	2230.3	1875.3	1900.2	2120.7	1338.9	0	0	0	0
Aug 2015	2185.6	1849.2	836.7	1294.8	22.4	0	0	0	0
Sep 2015	1573.6	1012.2	25	1128.5	1285.3	0	0	0	0
Oct 2015	1451.3	862	2046.7	1441.1	2774.7	0	0	0	0
Nov 2015	442.7	1822.7	1311.9	1811.7	2383.2	0	0	0	0
Total	**18409.9**	**15415.1**	**18378.8**	**17356.4**	**18687**	**0**	**0**	**0**	**0**

Vehicle	****5514	****5515	****5516	****5517	****5518	****5519	****5520	****5521	****5522
Sep 2014	0	0	0	0	0	0	0	0	0
Oct 2014	0	0	0	0	0	0	0	0	0
Nov 2014	0	0	0	0	0	0	0	0	0
Dec 2014	0	0	0	0	0	0	0	0	0
Jan 2015	0	0	0	0	0	0	0	0	0
Feb 2015	0	0	0	0	0	0	0	0	0
Mar 2015	0	0	0	0	0	0	0	0	0
Apr 2015	0	0	0	0	0	0	0	0	0
May 2015	0	0	0	0	0	0	0	0	0
Jun 2015	0	0	0	0	0	0	0	0	229
Jul 2015	0	0	0	0	0	0	0	0	243.3
Aug 2015	0	0	0	0	0	0	0	0	1446.7
Sep 2015	0	0	0	0	0	0	0	0	259.5
Oct 2015	0	0	0	0	0	0	0	0	160.2
Nov 2015	0	0	0	0	0	0	0	0	293.1
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2631.8**

Vehicle	****5523	****5524	****5525	****5526	****5527	****5528	****5529	****5530	****5531
Sep 2014	0	0	0	0	0	0	0	0	0
Oct 2014	0	0	0	0	0	0	0	0	0
Nov 2014	0	0	0	0	0	0	0	0	0
Dec 2014	0	0	0	0	0	0	0	0	0
Jan 2015	0	0	0	0	0	0	0	0	0
Feb 2015	0	0	0	0	0	0	0	0	0
Mar 2015	0	0	0	0	0	0	0	0	0
Apr 2015	0	0	0	0	0	0	0	0	0
May 2015	0	0	0	0	0	0	0	0	0
Jun 2015	319.4	0	0	0	0	0	0	0	0
Jul 2015	13.3	0	0	57.9	125.3	90.4	0	0	0
Aug 2015	346.8	0	0	1255.9	1145.2	778	78	825.6	842
Sep 2015	405.7	0	0	882.7	627.7	1059.9	142.2	290.5	236.4
Oct 2015	261.4	0	0	1376.7	1207.3	743.8	440	299.7	376.4
Nov 2015	0	0	0	10.8	998.5	460.7	767.4	336.7	340.1
Total	**1346.6**	**0**	**0**	**3584**	**4104**	**3132.8**	**1427.6**	**1752.5**	**1794.9**

Vehicle	****5532	****5533	****5534	****5535	****5536	****5537	****5538	****5539	****5540
Sep 2014	0	0	0	0	0	0	0	0	0
Oct 2014	0	0	0	0	0	0	0	0	0
Nov 2014	0	0	0	0	0	0	0	0	0
Dec 2014	0	0	0	0	0	0	0	0	0
Jan 2015	0	0	0	0	0	0	0	0	0
Feb 2015	0	0	0	0	0	0	0	0	0
Mar 2015	0	0	0	0	0	0	0	0	0
Apr 2015	0	0	0	0	0	0	0	0	0
May 2015	0	0	0	0	0	0	0	0	0
Jun 2015	0	0	0	0	0	0	0	0	0
Jul 2015	0	0	0	0	0	0	0	0	0
Aug 2015	385.1	38.4	508.9	0	0	0	0	0	0
Sep 2015	181.6	274	137.1	0	0	0	0	0	0
Oct 2015	42.7	556	150.6	0	401.7	0	1006.6	0	1880.9
Nov 2015	215.5	1275	24.3	0	798.8	1293.7	8.4	0	600.6
Total	**824.9**	**2143.4**	**820.9**	**0**	**1200.5**	**1293.7**	**1015**	**0**	**2481.5**

Vehicle	****5541	****5542	****5543	****5544	****5545	****5546	****5547	****5548	****5549
Sep 2014	0	0	0	0	0	0	0	0	0
Oct 2014	0	0	0	0	0	0	0	0	0
Nov 2014	0	0	0	0	0	0	0	0	0
Dec 2014	0	0	0	0	0	0	0	0	0
Jan 2015	0	0	0	0	0	0	0	0	0
Feb 2015	0	0	0	0	0	0	0	0	0
Mar 2015	0	0	0	0	0	0	0	0	0
Apr 2015	0	0	0	0	0	0	0	0	0
May 2015	0	0	0	0	0	0	0	0	0
Jun 2015	0	0	0	0	0	0	0	0	0
Jul 2015	0	0	0	0	0	0	0	0	0
Aug 2015	0	0	0	0	0	0	0	0	0
Sep 2015	0	0	0	0	0	0	0	0	0
Oct 2015	1053.5	370.7	570.1	640.5	455.5	0	0	466	219.9
Nov 2015	287.4	319.3	29.8	560.1	487.3	807.2	30.9	875.1	738.8
Total	**1340.9**	**690**	**599.9**	**1200.6**	**942.8**	**807.2**	**30.9**	**1341.1**	**958.7**

Vehicle	****5550	****5551	****5552	****5553	****5554	****5555	****5556	****5557	****5558
Sep 2014	0	0	0	0	0	0	0	0	0
Oct 2014	0	0	0	0	0	0	0	0	0
Nov 2014	0	0	0	0	0	0	0	0	0
Dec 2014	0	0	0	0	0	0	0	0	0
Jan 2015	0	0	0	0	0	0	0	0	0
Feb 2015	0	0	0	0	0	0	0	0	0
Mar 2015	0	0	0	0	0	0	0	0	0
Apr 2015	0	0	0	0	0	0	0	0	0
May 2015	0	0	0	0	0	0	0	0	0
Jun 2015	0	0	0	0	0	0	0	0	0
Jul 2015	0	0	0	0	0	0	0	0	0
Aug 2015	0	0	0	0	0	0	0	0	0
Sep 2015	0	0	0	0	0	0	0	0	0
Oct 2015	0	96.3	0	0	0	0	0	0	0
Nov 2015	444.4	30.3	0	0	0	0	0	0	0
Total	**444.4**	**126.6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Vehicle	****5559
Sep 2014	0
Oct 2014	0
Nov 2014	0
Dec 2014	0
Jan 2015	0
Feb 2015	0
Mar 2015	0
Apr 2015	0
May 2015	0
Jun 2015	0
Jul 2015	0
Aug 2015	0
Sep 2015	0
Oct 2015	0
Nov 2015	0
Total	**0**