



U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

ODI RESUME

Investigation: EA 17-001
Prompted by: EWR Field Reports
Date Opened: 04/03/2017
Investigator: Peter Kivett
Approver: Stephen Ridella
Subject: Windshield Wiper Motor Failure

Date Closed: 04/08/2020
Reviewer: Bruce York-B

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Daimler Trucks North America LLC
Products: 2015-2016 Freightliner Cascadia Trucks
Population: 193,862

Problem Description: The windshield wiper motor intermittently ceases to operate causing a loss of vision while driving in rain or snow.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	1	4	4**
Crashes/Fires:	0	1	1
Injury Incidents:	0	0	0
Fatality Incidents:	0	0	0
Other*:	0	2,625	2,625

*Description of Other: Manufacturer Warranty Claims and Field Reports

** Total eliminates duplicates received by ODI and manufacturer.

ACTION / SUMMARY INFORMATION

Action: This Engineering Analysis is closed.

Summary:

On April 3, 2017, the Office of Defects investigation (ODI) opened Engineering Analysis (EA17-001) as an upgrade to a Preliminary Analysis (PE16-005). The investigation focused on alleged windshield wiper failures on 2015-2016 MY Freightliner Cascadia trucks. ODI received Early Warning Reporting (EWR) field reports from the manufacturer describing wipers that intermittently failed to operate, causing a loss of visibility for the driver while driving in rain or snow. Several of the reports alleged multiple vehicles experiencing the failure, while multiple failures also happened on the same vehicle. Many of the field reports indicated the windshield wiper problem was resolved once the wiper motor was replaced.

Following a detailed analysis of data collected by ODI it was determined that a low failure rate for a complete loss of wiper function existed on the subject vehicles. Given this low failure rate and the Technical Service Bulletins (TSBs) to address this issue released by DTNA, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that no safety-related defect exists. The agency reserves the right to take further action if warranted by the circumstances.

For a detailed summary of the investigation see attached closing resume document.

The ODI reports cited above can be reviewed at:
<http://www-odi.nhtsa.dot.gov/owners/SearchNHTSAID>
using the following complaint identification number: 11141519

ENGINEERING ANALYSIS CLOSING SUMMARY**SUBJECT VEHICLES: 2015-2016 Freightliner Cascadia Trucks****EA No.: 17-001****Date Opened: 03-Apr-17****Date Closed: xx-Mar-20**

BASIS: On April 3, 2017, the Office of Defects investigation (ODI) opened Engineering Analysis (EA17-001) as an upgrade to a Preliminary Analysis (PE16-005). The investigation focused on alleged windshield wiper failures on 2015-2016 MY Freightliner Cascadia trucks. ODI received Early Warning Reporting (EWR) field reports from the manufacturer describing wipers that intermittently failed to operate, causing a loss of visibility for the driver while driving in rain or snow. Several of the reports alleged multiple vehicles experiencing the failure, while multiple failures also happened on the same vehicle. Many of the field reports indicated the windshield wiper problem was resolved once the wiper motor was replaced.

THE ALLEGED DEFECT: The wiper motor intermittently ceases to operate causing a loss of visibility while driving and increasing the risk of a crash.

INVESTIGATION CLOSING SUMMARY: On April 3, 2017, the Office of Defects Investigation (ODI) upgraded a Preliminary Evaluation (PE16-005) to this Engineering Analysis (EA17-001) to investigate loss of windshield wiper function on Daimler Trucks North America LLC's (DTNA) model year (MY) 2015-2016 Freightliner Cascadia vehicles.

During the PE phase of the investigation, ODI received warranty, field report, and consumer complaint data from the DTNA. Analysis showed the subject vehicles experienced two separate windshield wiper failure modes. In the first failure mode, the windshield wipers did not return to the correct parked position after the windshield wipers were turned off. However, ODI does not consider this failure mode to be a safety related defect because the windshield wipers functioned normally when the windshield wipers were turned back on. In the second failure mode, the windshield wipers completely ceased to function. While ODI had difficulty determining which failure mode vehicle operators complained about, ODI interviewed many of the drivers of the subject vehicles and concluded it was likely that at least some of the vehicles experienced a total loss of windshield wiper function.

Additionally, during the PE phase of ODI's investigation, DTNA collected and analyzed windshield wiper motors from vehicles that allegedly experienced windshield wiper failure and bench tested those motors. In each case, DTNA concluded that the motor operated normally. DTNA informed ODI that it had not been able to duplicate the windshield wipers completely failing to function, as alleged in reports. DTNA concluded that windshield wipers failing to return to the correct parked position was caused by deterioration of the windshield wiper park brush that rides against the brush plate, which may result in a diminished windshield wiper park signal. Consequently, DTNA implemented two design changes that affected the wiper park signal and improved windshield wiper function in the subject vehicles (assembly part number: TRI F91498 495): (1) a modification to the specification for the grease used in the windshield wiper motors; and (2) a modification to the brush plate assembly. DTNA implemented the two design changes in new DTNA vehicles on August 22, 2016. Additionally, DTNA made the design changes available as a service part on February 2, 2017.

After ODI upgraded its PE investigation to this EA in April 2017, ODI analyzed updated failure data on the subject vehicles. Additionally, ODI analyzed windshield wiper failure data on a group of peer vehicles also produced by DTNA. ODI's data analysis examined warranty data, telematics reports, customer complaints, field reports, and how that information related to the design, use, diagnosis, servicing, and perceived performance of the windshield wiper function. ODI concluded that the overall windshield wiper complaint rate dropped significantly after DTNA implemented the above-discussed grease and brush plate assembly changes in the windshield wiper motor.

ODI also conducted a thorough review of warranty claims submitted prior to DTNA's two design changes. ODI discovered that the "failed" term, which ODI originally thought suggested the windshield wipers had stopped working, actually described windshield wipers that had failed to return to the correct parked position. ODI concluded that the elevated warranty claim rate for "failed" windshield wiper motors was inadvertently caused by the verbiage used in DTNA's warranty claim system. For example, the descriptions used by DTNA's dealers when repairing windshield wiper systems that had improperly parked often included the word "failed." This coding issue by DTNA's dealers greatly influenced ODI's original failure analysis during the PE phase of the investigation. This initial analysis caused ODI to believe that a defect in performance may exist with the windshield wiper motor.

Additionally, during the EA, ODI and DTNA performed an in-depth evaluation of the windshield wiper system and user interface. ODI worked with DTNA to instrument subject vehicles for testing. These test vehicles included both DTNA and customer fleet vehicles. ODI also worked with the Virginia State Police to interview drivers of the subject vehicles as they passed through a Virginia State Highway Weight Station. This field interviewing process helped corroborate previous test findings.

ODI learned that the windshield wiper system employs a single commutator and a slip-ring brush plate assembly to monitor the windshield wiper's arm position each time the arm cycles past the windshield wiper's correct parked position. This windshield wiper parked signal is an input to the vehicle's body control system that determines the proper activation/deactivation conditions for the windshield wiper motor to ensure correlation with the commands from the windshield wiper stalk switch. However, the dielectric grease in the windshield wiper motor can produce a wiper parked signal error. ODI learned that windshield wipers with this error condition can cycle for a duration of up to five seconds after a driver attempts to stop the windshield wipers. This error condition may also result in windshield wipers stopping in random locations (i.e., not in the correct parked position) or erroneously sweeping across a windshield.

As described in some complaints, testing also confirmed that in very rare events, when a request for windshield wiper activation is made, the windshield wipers completely failed to function. It was discovered that these rare events can occur if the windshield wiper system experiences a brief over-current condition, followed within 100 milliseconds by a second brief over-current condition resulting in the system behaving as though a single large overcurrent condition had occurred. In this faulty over-current situation, the system stops the windshield wipers from functioning and sets a fault code. However, by design, drivers can return the windshield wipers to a fully functional state by indexing the stalk switch without having to cycle the ignition switch or pull the vehicle off the road. Any additional wiper request by the vehicle operator will result in the wipers operating normally.

ODI concluded that the failure mode involving windshield wipers completely ceasing to function occurred rarely and that the vast majority of warranty claims and subsequent windshield wiper motor replacements were associated with windshield wipers parking in the incorrect location. ODI reached this conclusion after jointly reviewing with DTNA a significant, random sample of warranty data for a sub-population of 2015 MY subject vehicles. ODI found that this sub-population of vehicles had the highest windshield wiper warranty claim rate of the entire population of the subject vehicles. ODI analyzed descriptions of the problem submitted by claimants, repairing technicians' comments, and the component used to remedy claims. ODI determined that 76% of the warranty claims it reviewed were related to windshield wipers parking incorrectly, 4% were related to the windshield wipers ceasing to function, and the remaining 20% were related to other failures or were undetermined. ODI used these rates from the sample population to estimate a worst-case overall warranty rate for each failure mode across the entire population of subject vehicles, which was a 0.07% failure rate for windshield wipers completely failing to function and a 1.33% failure rate for windshield wipers parking in an incorrect location. Finally, ODI compared the warranty rates of windshield wipers failing to function between DTNA's peer vehicles and DTNA's subject vehicles. ODI learned that the loss of function failure rate on peer vehicles was more than five times higher than the failure rate on the subject vehicles. At the end of this EA investigation, ODI determined that the alleged failure of windshield wipers in DTNA's subject vehicles does warrant further action at this time due to a failure rate for loss of windshield wiper function (0.07%) after four to five years of exposure and the fact that incorrectly parked windshield wipers can be reset by turning the switch off and then on again.

Towards the end of this investigation, DTNA released two Technical Service Bulletins (TSB) related to the subject vehicles' windshield wiper system that remedy the two windshield wiper failure modes. One of the TSBs addressed the windshield wipers not parking properly and the other addressed the windshield wipers failing to function. DTNA released the first TSB, number 10164406 (DTNA #82-018), on August 15, 2019. That TSB provides maintenance personnel with instructions on how to diagnose and repair a subject vehicle that is demonstrating the windshield wiper park failure mode. If a subject vehicle was manufactured before the grease and brush plate assembly changes were implemented in production, maintenance personnel are instructed to replace the windshield wiper motor with the newer design unit. If the windshield wiper motor has the updated design, the technician is instructed to inspect and repair the park signal wire between the motor and SAM Cab module. The second TSB, number 10164416 (DTNA #82-019), which DTNA also released on August 15, 2019, provides maintenance personnel with instructions on how to diagnose and repair a subject vehicle that has experienced the windshield wipers completely failing to function and has displayed a specific fault code. In those cases, technicians are instructed to update the SAM Cab software. The updated software incorporates an additional evaluation loop to assess the validity of the over-current event without requiring the operator to index the windshield wiper stalk switch. This eliminates the possibility of the windshield wipers failing to function.

Given the low failure rate for wipers ceasing to function and the TSB released by DTNA, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that no safety-related defect exists. The agency reserves the right to take further action if warranted by the circumstances.