



U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

ODI RESUME

OFFICE OF DEFECTS INVESTIGATION

NHTSA

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Investigation: PE 17-005
Date Opened: 09/18/2017
Investigator: Peter Kivett
Approver: Stephen Ridella
Subject: Seatbelt Retractor Failure

Date Closed: 03/25/2019
Reviewer: Bruce York-B

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Polaris Industries, Inc.
Products: 2015 - 2019 Model Year Polaris Slingshot
Population: 10,658

Problem Description: Seatbelt retractor failed.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	1	0	1
Crashes/Fires:	0	0	0
Injury Incidents:	0	0	0
Fatality Incidents:	1	0	1
Number of Fatalities:	1	0	1

ACTION / SUMMARY INFORMATION

Action: Closing Preliminary Evaluation: Safety Recall 18V-531

Summary:

See attached closing resume summary.

Summary:

On April 30, 2017, the Office of Defects Investigation (ODI) received Vehicle Owner's Questionnaire (VOQ) #10981465 alleging the seatbelt retractor on a 2015 Polaris Slingshot failed during a crash, resulting in fatal injuries to the driver of the vehicle. The subject Slingshot vehicle is a three-wheeled motorcycle that, according to a Livonia, Michigan police report, veered while making a lane change and slid sideways into oncoming traffic where it was struck by a passenger vehicle heading in the opposite direction. The police report indicated that although the driver was wearing his seatbelt, he was partially ejected from the vehicle during the crash.

On September 27, 2017, ODI, Polaris, and legal representatives for the vehicle owner conducted a joint inspection of the motorcycle involved in the fatal crash. The inspection found that the vehicle had seatbelts installed and that the seatbelt retractor sustained considerable damage in the crash. The cover for the retractor spring had been dislodged, the spring was unwound, and the spool was disconnected from the retractor body. There were load marks on the seatbelt webbing and latch plate indicating that the seatbelt retractor had properly locked the occupant in place during the initial impact phase of the crash.

In April 2018, ODI took possession of the subject vehicle and transported it to NHTSA's Vehicle Research and Test Center (VRTC) in Marysville, Ohio for further study and nondestructive testing. A 3D scan of both the crashed vehicle and an exemplar vehicle were conducted. Damage to the motorcycle body included significant intrusion into the side of the motorcycle that displaced the tubular steel frame by an average of 21.2 inches on the passenger side (See Figure 1.). Crash modeling and data collected from the passenger car event data recorder (EDR) involved in the crash estimate a severe change in velocity of the Polaris Slingshot motorcycle from 45mph to 0mph. ODI concluded that the Polaris vehicle's seatbelt retractor worked properly and was locked initially, but due to the severity of the crash, was then compromised as a result of lateral loading of the belt. In addition, the retractor frame was bent, the locking pin pulled from the cam slot and the seat belt released to maximum extension of 16+ inches. In this specific instance, as discussed more fully below, the evidence indicates that the installed seatbelt retractor failed due to the severity of the crash.

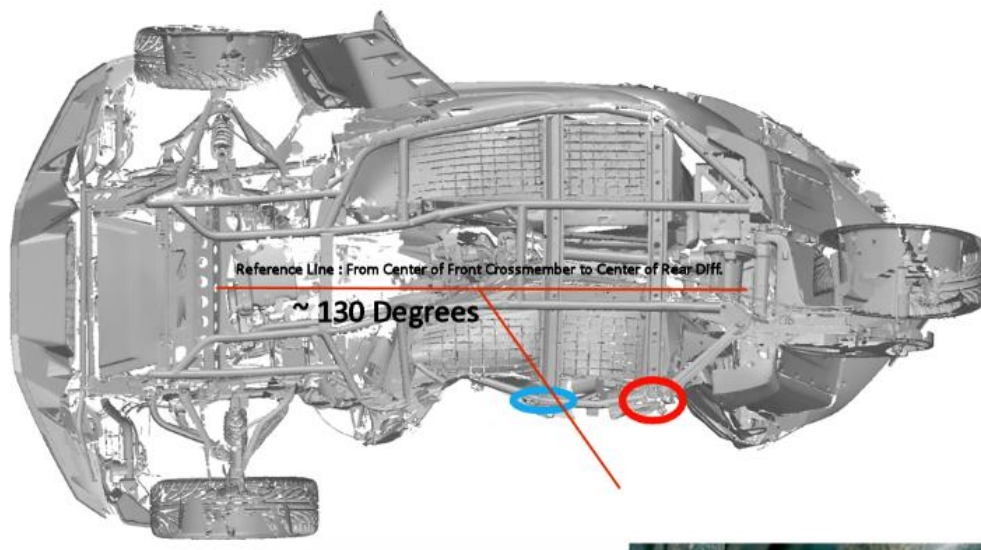


Figure 1. Depicting the angle and level of intrusion into subject vehicle.

Given these facts, ODI wanted to determine if the seatbelts installed on the subject vehicles would withstand the forces generated in a lower severity crash.

Seatbelts are not required by law to be installed on motorcycles. Therefore, to determine if the seatbelts installed on the Polaris motorcycles would withstand the forces of a lower severity crash, ODI first had to determine what test could be conducted that might best represent that scenario. ODI determined that a standard crash test FMVSS 214 (Side impact protection for passenger cars) modified slightly to better test the durability of the driver side seatbelt would represent an industry accepted repeatable test for analyzing the seatbelt forces. FMVSS 214 was modified to have a mechanically drawn sled hitting the subject vehicle on the passenger side in the forward travel position at a 28-degree angle as shown in Figure 2.

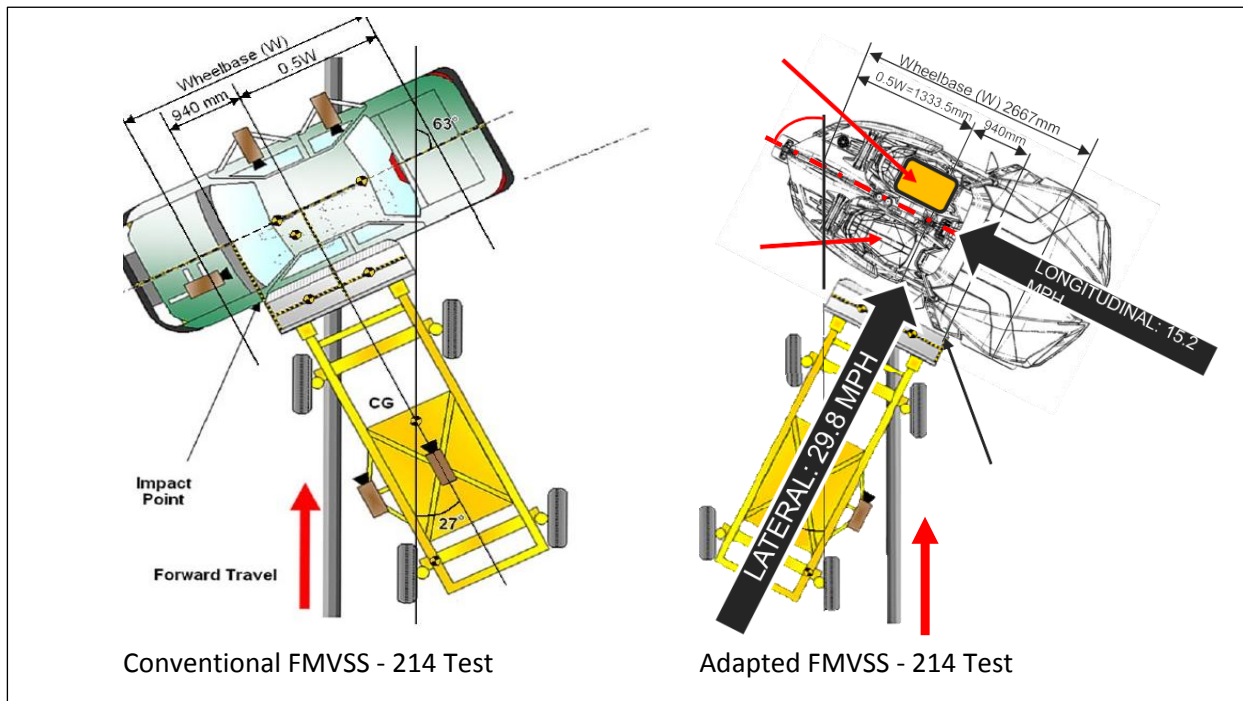


Figure 2.

From April through May 2018, four tests were conducted on 2016 through 2018 model year (MY) Polaris Slingshot motorcycles using this modified FMVSS 214 crash method. The first three tests showed there was a difference in retractor performance on the 2018 MY motorcycles relative to the earlier model years. As a result, Polaris was tasked with determining the cause of the performance variation. Polaris found the 2018 MY motorcycles incorporated a change in frame design that occurred starting in the 2017 MY. The earlier model (2015 – 2016) Slingshots had a cast rear chassis structure that was more robust than the later (2017- 2018) MY vehicles which evolved to a tubular design. During testing, the frame was found to fail on the 2018 MY motorcycles where it did not on the older vehicles. Polaris developed a metal seat belt guide that, in the event of a frame fracture during a side impact on a 2017 or newer MY motorcycle, would keep the seatbelt from creating a lateral load on the seatbelt retractor

body. The fourth test was conducted on a 2018 MY slingshot equipped with the metal seat belt guide. The results of the test showed that seatbelts on the motorcycle equipped with the guide performed similarly to Slingshot motorcycles with the original frame design that was not failing during testing.

Through controlled testing, the seatbelts installed on 2015 and 2016 MY Polaris Slingshot motorcycles have been shown to perform satisfactorily in a crash with energy levels similar to those generated during a standard FMVSS 571.14 test. The addition of seatbelt guides by Polaris on the 2017 MY and new Slingshot motorcycles results in the seatbelts on these newer motorcycles also performing satisfactorily during testing.

ODI is unaware of any other similar seatbelt retractor failures on Polaris Slingshot vehicles.

Polaris is conducting Safety Recall 18V-531 on MY 2017 and 2018 vehicles. An “Energy Management Loop” (EML) shown in Figure 3. will be retrofitted to the recalled population. The EML restricts forces on the seatbelt to the longitudinal direction upon side impacts that result in a rear frame fracture.

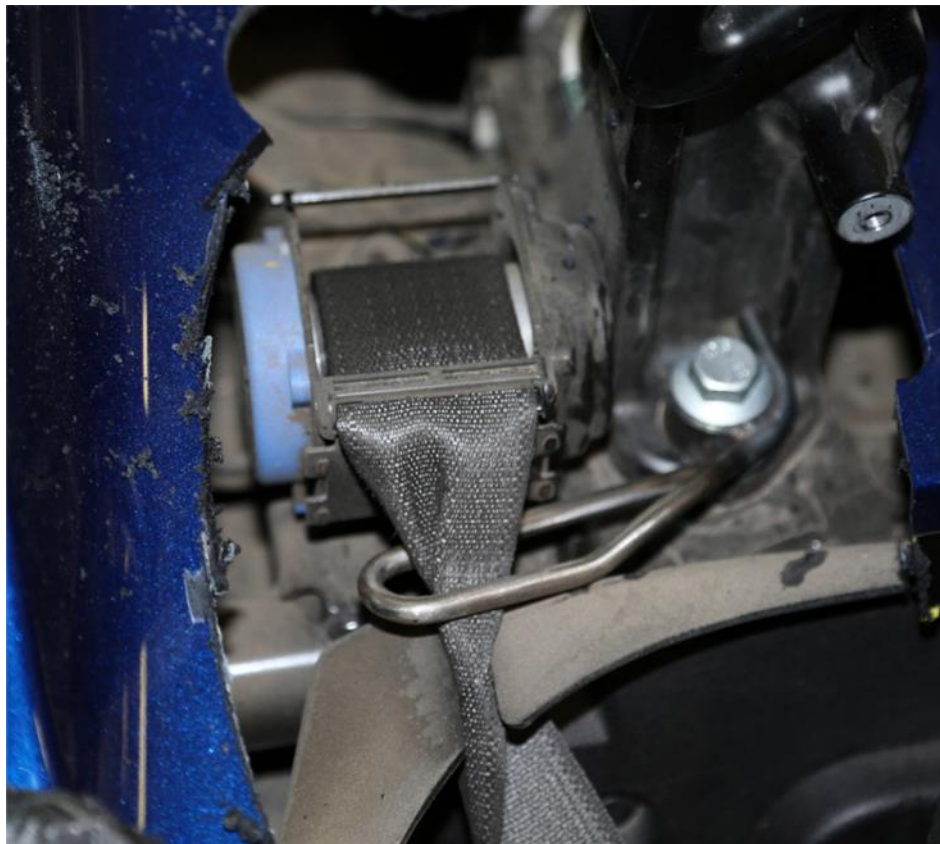


Figure 3.

With recall action 18V-531 taken by Polaris, this investigation is closed.

The ODI report cited above can be reviewed at: <http://www-odi.nhtsa.dot.gov/owners/SearchNHTSAID> using the following complaint identification number: 10981465.