U.S. Department of Transportation

National Highway Traffic Safety Administration

ODI RESUME

OFFICE OF DEFECTS INVESTIGATION

NHTSA

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Investigation: PE 16-015
Date Opened: 12/16/2016 **Date Closed:** 08/11/2020
Investigator: Kareem Habib **Reviewer:** Jeff Quandt
Approver: Stephen Ridella
Subject: Powered vehicle rollaway

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: LAND ROVER, JAGUAR CARS LTD
Products: MY2012-2014 Range Rover Evoque & Jaguar XF
Population: 48,954

Problem Description: Operators allege incidents of unexpected vehicle movement with the engine running after allegedly shifting the transmission to Park and exiting the vehicle.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	6	11	15**
Crashes/Fires:	6	10	14**
Injury Incidents:	3	0	3
Fatality Incidents:	0	0	0

** Total eliminates duplicates received by ODI and manufacturer.

ACTION / SUMMARY INFORMATION

Action: This Preliminary Evaluation has been closed.

Summary:

On December 16, 2016, ODI opened PE16-015 to investigate seven complaints alleging incidents of powered rollaway in model year (MY) 2012 through 2014 Land Rover/Range Rover Evoque and Jaguar XF vehicles. The complaints all alleged that the rollaway incidents occurred after the operators shifted to Park and exited the vehicle with the engine left running. All of the incidents alleged that crashes resulted from the unexpected vehicle movement and three alleged injuries. Two of the complaints counted in the opening resume (ID's 10760326 and 10884136) involved the same vehicle and incident. ODI has not received any new complaints since PE16-015 was opened, resulting in current ODI report totals of 6 incidents, 6 crashes and 3 injuries.

Field data provided by Jaguar Land Rover (JLR) in response to ODI's information request letter for PE16-015 included 10 allegations of powered rollaway incidents in the subject vehicles, including 9 alleging crashes. Updates provided by JLR through October 25, 2019, have identified one additional powered rollaway allegation in the subject vehicles. The new incident included a crash allegation, bringing the JLR field incident totals to 11 incidents and 10 crashes. None of the JLR reports allege injuries. Two of the JLR reports are duplicates of incidents reported to ODI, resulting in a total of 15 incidents, 14 crashes and 3 injury allegations in the subject vehicles.

ODI's analysis of system design and field incident investigative data has not identified any mechanical or electronic faults that have caused subject vehicle transmissions to shift out of Park with no operator input nor has the analysis identified any faults that would result in a failure to execute a valid Park shift selection. JLR's field investigations of powered rollaway incidents have assessed the root cause to be operator error. Based on these assessments and the low rate and declining trend in rollaway incidents, this investigation is closed. The closing of this investigation does not foreclose the Agency from taking further action if warranted or the potential for a future finding that a safety-related defect exists based upon additional information the agency may receive. For more detailed information about field incident analysis for the subject and peer vehicles see the attached report.

The ODI reports (VOQs) cited above can be viewed at NHTSA.gov under the following reference numbers with duplicate records shown in parentheses: 10504853, 10548937, 10565212, 10631673, 10760326 (10884136), 10892346.

1.0 Basis. On December 16, 2016, ODI opened PE16-015 to investigate six complaints alleging incidents of powered rollaway in model year (MY) 2012 through 2014 Land Rover Range Rover Evoque and Jaguar XF vehicles.[1] The complaints alleged experiencing unexpected vehicle movement after the operators shifted to Park and exited the vehicle with the engine left running. All of the incidents alleged that crashes resulted from the unexpected vehicle movement and three alleged injuries.

2.1 Subject vehicles. The subject vehicles are MY 2012 through 2014 Land Rover Range Rover Evoque and Jaguar XF vehicles. Jaguar Land Rover (JLR) sold 48,954 subject vehicles in the United States. The subject vehicles are equipped with electronic ("E-shift") rotary style gear selectors supplied by Kostal Automotive.

2.2 Peer vehicles. The peer vehicles are all other MY 2009 through 2020 Jaguar and Land Rover equipped with E-shift gear selectors that JLR sold in the United States. JLR produced 637,363 peer vehicles through September 2019 for sale in the United States, including 463,623 vehicles with rotary gear selectors and 173,740 vehicles with monostable "stick" gear selectors.

3.0 Alleged defect. Unexpected movement after allegedly shifting to "P" Park and exiting the vehicle with the ignition "on" and the engine running.

4.0 System description. The primary components of JLR's E-shift systems are the Gear Selector Module (GSM) and Transmission Control Module (TCM). The GSM is located in the center console and provides the operator interface for selecting and displaying gear position. Depending on design level, driver gear shift requests are performed with either a polystable rotary gear selector knob (Figure 1) or a monostable gear selector stick (Figure 2). The GSM communicates driver gear shift requests to the TCM via a CAN/Flexray communication bus. The TCM is located at the gearbox and includes the electro-mechanical actuator for executing gear shift requests received from the GSM.

When the driver selects "park," a rotational actuator bracket in the TCM engages the park pawl via an actuator rod. The actuator rod is mechanically biased to engage the park pawl when there is no hydraulic power or a loss of electrical power. Redundant sensors in the actuator bracket verify park pawl engagement. If "P" Park is selected and park pawl engagement is not verified, "P" Park will not be displayed by the GSM or instrument panel (blank display or flashing "N" Neutral), a "Gearbox Fault" message will be displayed on the instrument panel, and a diagnostic trouble code will be recorded.

5.0 Safety Standard. Federal Motor Vehicle Safety Standard (FMVSS) No. 114, Theft protection and rollaway prevention (49 CFR § 571.114), is intended to decrease the likelihood that a vehicle is stolen, or accidentally set in motion. The standard applies to all passenger cars, and to trucks and multipurpose passenger vehicles with a GVWR of 4,536 kilograms (10,000 pounds) or less. Section 5.2 of the standard includes requirements that: 1) the starting system must prevent key[2] removal unless the gear selection control is locked in "P" Park or becomes locked in "P" Park as a direct result of key removal; and 2) that the transmission gear selection control cannot move from the "P" Park position, unless the key is in the starting system.

In addition, Section 5.3 of the standard requires that each motor vehicle manufactured on or after September 1, 2010 with a GVWR of 4,536 kilograms (10,000 pounds) or less with an automatic transmission that includes a "P" Park position shall be equipped with a system that requires the service brake to be depressed before the transmission can be shifted out of "P" Park. This system shall function in any starting system key position in which the transmission can be shifted out of "P" Park.

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[1] The opening resume counts 7 complaints, but 2 of the complaints (ID's 10760326 and 10884136) involved the same vehicle and incident.

[2] FMVSS 114 defines a "key" as "a physical device or an electronic code which, when inserted into the starting system (by physical or electronic means), enables the vehicle operator to activate the engine or motor."

6.0 Automatic vehicle securement strategies. The subject and peer vehicles all have the capability to shift to "P" Park automatically. The conditions for automatic gear selection are determined by JLR design requirements, which consider Human Machine Interface (HMI) factors, such as the potential for shifting errors caused by non-intuitive controls or operator failure to complete control actions due to unrecognized vehicle operating state (e.g., ignition state, gear position, or parking brake state). In addition, vehicles equipped with electronic parking brakes (EPB) may include control logic for automatic EPB application as well.

6.1 Engine shutoff. All JLR E-shift vehicles are designed to shift to "P" Park automatically when the operator switches the vehicle ignition and engine "off" with the selector in "reverse," "drive," or "sport."[3] This function satisfies the requirements of FMVSS No. 114 Section 5.2 related to key removal and provides protection against unpowered rollaway.

6.2 Driver exit. The subject vehicles, peer rotary gear selector vehicles not equipped with JLR's Intelligent Stop/Start (ISS) technology, and peer rotary gear selector vehicles with ISS that is not active will not automatically shift to "P" Park when the door opens, but provide an audible warning and a message in the driver display. Peer vehicles equipped with monostable "stick" gear selectors are designed to automatically shift to "P" Park if the controller receives the following signals (driver exit indicators) when the engine is running: 1) driver's seat belt released (seat belt buckle sensor signal); 2) service brake released (brake switch signal); and 3) driver's door opened (door switch signal). Peer vehicles equipped with ISS will automatically shift to "P" Park when driver exit indicators are detected and ISS is active and the gear selector is in "drive" or "sport."

6.3 Speed threshold. Driver "P" Park gear selections or automatic "P" Park gear selection commands that occur when the vehicle speed is greater than the Park Pawl Engagement speed are not considered valid "P" Park requests and are NOT executed by the transmission control module in the subject and peer vehicles. In these conditions, the transmission selects "N" Neutral and displays are designed to flash the current gear selector position. When vehicle speed is below the Park Pawl Engagement speed, the transmission executes the "P" Park gear selection request (displays blanked while shift is executed and "P" Park displayed when park pawl engagement is confirmed).[4]

7.0 Field data. JLR did not identify any vehicle faults in field inspections of incident vehicles. The company assessed the incidents to have been caused by operators failing to shift to "P" Park before exiting the vehicle. Analysis of field data by platform found disproportionately high experience in subject Range Rover Evoque vehicles, biased toward early-life incidents. JLR's investigation did not identify any design or manufacturing factors to explain the difference in the early-life experience.

Table 1 provides a breakdown of total field incidents of rollaway in the subject vehicles, peer rotary shift vehicles and peer monostable shift vehicles by platform. As noted, the data show disproportionate experience for the subject Ranger Rover Evoque vehicles. The experience is biased to early-life incidents, with 60 percent of the subject vehicle incidents occurring in the first 12 months of service (Figure 3). Subject and peer vehicles all show relatively low field experience over the most recent 36 months (Table 2). ODI has not received any new complaints of the alleged defect in the subject vehicles since PE16-015 was opened. JLR has received just one complaint of the alleged defect in the subject vehicles in the past 54 months.

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[3] The transmission enters the "Hold Neutral" function when the ignition is switched "off" with the vehicle stationary and "N" Neutral gear selected (car wash mode). The function is active until the driver shifts to "P" Park, the vehicle is locked, or the function time limit expires.

[4] All automobile manufacturer E-shift systems that ODI has reviewed include speed thresholds for shifting to "park." The speeds and control strategies for shifts above the threshold speeds vary by manufacturer and transmission.

Tables 3 and 4 show the field data by shifter type and automated control function. The rates are low for each of the categories analyzed when compared with vehicles investigated and recalled in prior investigations of powered rollaway. Prior investigations of powered rollaway have influenced recalls when design factors have been identified that increase the likelihood of driver shifting errors. The rates are comparable to peer populations analyzed as control groups in those investigations.

8.0 Rollaway investigations. Unexpected movement of a vehicle equipped with an automatic transmission can occur if a vehicle is not safely secured by the parking brake and transmission park pawl before the driver exits the vehicle. When investigating unexpected movement in automatic transmission vehicles ODI considers multiple factors, including: 1) transmission and parking brake components that function to secure the vehicle; 2) safety interlocks that function to limit the potential for operator errors (e.g., ignition-park interlock); 3) design factors that may increase the likelihood of operator error in attempted shifts to “park;” and 4) assess system functional safety design strategy in comparison to industry norms, including driver warning strategies.

8.1 Component/system faults. ODI’s review of incidents reported by consumers and field reports submitted by JLR did not identify any events of powered rollaway that were determined to be caused by malfunctions of transmission or parking brake systems or components. This includes faults that could result in a vehicle failing to remain in “park” and faults that could result in a vehicle failing to shift to “park” upon a valid request from the operator or control module. Evidence of mechanical defects causing or contributing to rollaway incidents should be apparent in post-incident inspection.

8.2 Unpowered rollaway. ODI’s analysis identified nine incidents that appeared to involve unpowered rollaway in the subject and peer vehicles. These incidents tend to occur with the operator in the vehicle and may occur if the driver switches the ignition “off” while moving, switches the ignition “off” on a grade without holding the vehicle stationary with the parking brake or service brake, or switches the ignition off while in “neutral” (i.e., Car Wash Mode) and on a grade without holding the vehicle stationary with the parking brake or service brake. As previously noted in Section 6.3, the JLR E-shift vehicles must be below the threshold speed for shifting to “park” to execute the shift request.

8.3 Powered rollaway. Investigations of powered rollaway have influenced recalls when defect conditions were identified that contribute to the increased likelihood of operator errors related to mis-shifts when attempting to select “park.”

Engineering Analysis EA04-025 influenced the recall of approximately 250 thousand diesel powered heavy-duty pick-up trucks to correct a defect in the transmission that may result in the transmission reaching a static gear position between “reverse” and “park” (NHTSA Recall No. 05V-462). In this gear state the park pawl is not engaged to lock the propulsion shaft and the transmission spool valve may be placed in a position resulting in gradual pressurization of the reverse circuit leading to a delayed powered rollaway in reverse. Either condition may result in unexpected vehicle movement after the driver has exited the vehicle. The recall remedy involved programming the vehicle to provide audible and visual warnings to the operator if the driver is exiting the vehicle when the transmission is not in “park.”

Engineering Analysis EA16-002 influenced the recall of approximately 812 thousand vehicles equipped with monostable E-shift gear selectors to correct a defect related to a non-intuitive shifter function that was confusing to drivers, resulting in high rates of shifting errors when attempting to select “park,” as well as gear selection logic that automatically selected “neutral” in certain conditions (NHTSA Recall No. 16V-240). The recall remedy involved reprogramming the gear selector control logic to automatically select “park” under certain conditions.

In EA16-002, ODI reviewed an HMI study performed for the manufacturer to review usability and acceptance of a new polystable E-shift design. The study compared the new design with the monostable E-shift design that was the subject of EA16-002, a rotary E-shift design similar to that used in the JLR

subject and peer rotary vehicles,[5] and a gated mechanical gear shift design. The study found high error rates for the monostable E-shift design in shifts to "park" and focus groups characterized that design as "insecure," "confusing," and "unintuitive." In comparison, the rotary shifter design produced the lowest rate of parking errors and was characterized as "convenient," "easy," and "intuitive."

Figure 4 compares the failure rates for the vehicles recalled in 05V-462 and 16V-240 with the subject vehicles, peer rotary vehicles, and peer monostable vehicles. None of the JLR vehicles analyzed by ODI showed failure trends as high as the vehicles that were the primary focus of EA04-025 and EA16-002. As previously noted, the subject vehicles showed an early-life trend through the first year of service. No design or HMI factor has been identified to explain the difference between the subject and peer rotary vehicles. Similar to other analyses discussed in 7.0 Field Data, the subject and peer vehicles show no evidence of a defect trend over the past three to four years.

8.4 Driver warning strategies. ODI also assessed JLR's driver warning strategy for driver exit when not in "park" in comparison with peer OE's and documented industry practices for similar production ranges. The Society of Automotive Engineers (SAE) published a recommended practice (SAE J2948) for keyless ignition control design in 2011 to establish industry best practices for minimizing certain user instigated errors, including errors related to: 1) exiting the vehicle with the automatic transmission in a non-parking gear; 2) exiting the vehicle while the vehicle propulsion system is enabled; and 3) exiting a vehicle while the vehicle propulsion system is disabled but the accessory or electrical systems are active.[6] Section 4.7.1 of SAE J2948, "Driver Door Open/Closed Alerts,"

> *An audible alert to the driver shall be activated if the driver-side front door is opened while the starting system is in ACCESSORY, ELECTRICAL or RUN MODE. (See also, FMVSS 114, S5.1.3.)*
>
> *An externally audible or visual alert shall be activated when the starting system is in ACCESSORY, ELECTRICAL, or RUN MODE, all doors become closed, and an electronic key code carrying device (e.g., keyfob) is not present in the vehicle.*
>
> *Alerts are not required if the vehicle automatically shifts to Park and enters STOP MODE whenever the electronic key code carrying device exits the vehicle or the driver door becomes open while the starting system is in ACCESSORY or ELECTRICAL MODE*.

In addition, Section 4.7.2 of SAE J2948, "Shift to Park Indication," provides the following recommendation to reduce the risk of the driver exiting the vehicle with the transmission in a non-parking gear state:

> *In order to discourage the driver from leaving a vehicle equipped with an automatic transmission in a gear position other than PARK, the driver should be prompted to shift the vehicle to "PARK" or the vehicle should automatically shift to PARK upon, for example, the actuation of the keyless ignition control, the opening of the driver's door, or the expiration of a timer.*

As recommended by SAE J2948, the subject vehicles are designed to automatically shift to park when the ignition is switched off by the operator and to provide audible alerts and driver prompts when the driver's door is opened while the vehicle starting system is in Run mode and the transmission is in a non-parking gear state. When the system detects an unfastened driver's seatbelt, open driver's door and service brake switch "off," the cluster sounds a 67 dB rapid burst (5 and 1/3 tones per second) type warning chime for three seconds at 630 Hz.

9.0 Reason for closing. No defects were identified in the design or manufacture of the subject vehicles. The rollaway incidents appear to have resulted from operator error. Because no design or

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[5] Kostal rotary shifter used in certain FCA products.
[6] SAE International Surface Vehicle Recommended Practice, "Keyless Ignition Control Design," SAE Standard J2948, Issued Nov. 2011.

manufacturing defect was identified and because of the low rate and declining trend in rollaway incidents, this investigation is closed. The closing of this investigation does not foreclose the Agency from taking further action if warranted or the potential for a future finding that a safety-related defect exists based upon additional information the agency may receive.

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Figure 1. Rotary shifter.

Figure 2. Monostable stick shifter.

Shifter Type, Vehicle Group	Model	Model Years	Vehicles	Incidents	Rate (R/100k)	Vehicle Years	Exp Adj Rate (R/100k Yrs)	Crashes	Injuries	Deaths
Rotary, Subject Vehicles	Range Rover Evoque (L538)	2012-14	30,430	13	42.7	193,992	6.7	12	2	0
	Jaguar XF (X250)	2012-14	18,524	2	10.8	117,876	1.7	2	1	0
Rotary, Subject Vehicles			**48,954**	**15**	**30.6**	**311,868**	**4.8**	**14**	**3**	**0**
Rotary, Peer Vehicles	Discovery Sport (L550)	2015-19	52,139	4	7.7	120,790	3.3	4	1	0
	Range Rover Velar (L560)	2018-20	34,905	1	2.9	33,365	3.0	0	0	0
	Range Rover Evoque (L538)	2015-19	51,086	3	5.9	155,387	1.9	3	0	0
	Jaguar XE (X760)	2017-19	21,187	1	4.7	46,197	2.2	1	0	0
	Range Rover (L405)	2013-20	109,668	5	4.6	331,825	1.5	3	2	1
	LR4 (L319)	2014-16	24,406	3	12.3	96,332	3.1	1	0	0
	Discovery (L462)	2017-20	20,720	0	0.0	24,115	0.0	0	0	0
	Jaguar XK (X150)	2010-15	9,062	0	0.0	67,892	0.0	0	0	0
	Jaguar F-Pace (X761)	2017-20	53,465	0	0.0	89,058	0.0	0	0	0
	Jaguar XJ (X351)	2010-19	36,877	0	0.0	206,090	0.0	0	0	0
	Jaguar XF (X250/X260)	2009-20	50,108	3	6.0	348,484	0.9	1	0	0
Rotary, Peer Vehicles			**463,623**	**20**	**4.3**	**1,519,535**	**1.3**	**13**	**3**	**1**
Monostable Stick, Peer Vehicles	Range Rover Sport (L494)	2014-20	130,368	4	3.1	368,017	1.1	4	1	0
	Jaguar XE (X760)	2020	1,062	0	0.0	16	0.0	0	0	0
	Range Rover Evoque (L551)	2020	8,575	0	0.0	906	0.0	0	0	0
	Jaguar E-Pace (X540)	2018-20	7,094	0	0.0	4,538	0.0	0	0	0
	Jaguar F-Type (X152)	2014-20	22,699	1	4.4	78,355	1.3	0	0	0
Monostable, Peer Vehicles			**173,740**	**5**	**2.9**	**451,832**	**1.1**	**4**	**1**	**0**

Table 1. Incident rates by shifter and platform, total.

Shifter Type, Vehicle Group	Model	Model Years	Vehicles	Incidents	Rate (R/100k)	Vehicle Years	Exp Adj Rate (R/100k Yrs)	Crashes	Injuries	Deaths
Rotary, Subject Vehicles	Range Rover Evoque (L538)	2012-14	30,430	1	3.3	91,080	1.1	1	0	0
	Jaguar XF (X250)	2012-14	18,524	0	0.0	55,194	0.0	0	0	0
Rotary, Subject Vehicles			**48,954**	**1**	**2.0**	**146,274**	**0.7**	**1**	**0**	**0**
Rotary, Peer Vehicles	Discovery Sport (L550)	2015-19	52,139	4	7.7	110,902	3.6	4	1	0
	Range Rover Velar (L560)	2018-20	34,905	1	2.9	33,365	3.0	0	0	0
	Range Rover Evoque (L538)	2015-19	51,086	3	5.9	126,894	2.4	3	0	0
	Jaguar XE (X760)	2017-19	21,187	1	4.7	45,688	2.2	1	0	0
	Range Rover (L405)	2013-20	109,668	4	3.6	238,552	1.7	3	2	1
	LR4 (L319)	2014-16	24,406	1	4.1	72,910	1.4	0	0	0
	Discovery (L462)	2017-20	20,720	0	0.0	24,115	0.0	0	0	0
	Jaguar XK (X150)	2010-15	9,062	0	0.0	27,186	0.0	0	0	0
	Jaguar F-Pace (X761)	2017-20	53,465	0	0.0	88,210	0.0	0	0	0
	Jaguar XJ (X351)	2010-19	36,877	0	0.0	101,348	0.0	0	0	0
	Jaguar XF (X250/X260)	2009-20	50,108	0	0.0	139,954	0.0	0	0	0
Rotary, Peer Vehicles			**463,623**	**14**	**3.0**	**1,009,124**	**1.4**	**11**	**3**	**1**
Monostable Stick, Peer Vehicles	Range Rover Sport (L494)	2014-20	130,368	3	2.3	276,285	1.1	3	1	0
	Jaguar XE (X760)	2020	1,062	0	0.0	16	0.0	0	0	0
	Range Rover Evoque (L551)	2020	8,575	0	0.0	906	0.0	0	0	0
	Jaguar E-Pace (X540)	2018-20	7,094	0	0.0	4,538	0.0	0	0	0
	Jaguar F-Type (X152)	2014-20	22,699	0	0.0	56,398	0.0	0	0	0
Monostable, Peer Vehicles			**173,740**	**3**	**1.7**	**338,143**	**0.9**	**3**	**1**	**0**

Table 2. Incident rates by shifter and platform, last 36 months.

Gear Selector Type	MMY	Driver Exit Auto-Functions			Vehicles Sold	Field Data						
		Auto-Park	ISS Auto-Park	Auto-EPB		Incidents	Rate (R/100k)	Vehicle Years	Exp Adj Rate (R/100k Yrs)	Crashes	Injuries	Deaths
Rotary	2009-12 X250 2010-12 X351 2010-15 X150 2012-13 L538	N	N	N	81,105	16	19.7	666,106	2.4	13	2	0
	2013-20 X250/X260/X351 2013-20 L405 2014-20 L538/L319 2015-20 L550	N	Y	N	431,472	19	4.4	1,165,299	1.6	14	4	1
Monostable Stick	2014-16 L494, X152	Y	Y	N	83,236	5	6.0	361,026	1.4	4	1	0
	2017-20 L494, X152, X540, X590 2020 L550, L551, X760	Y	Y	Y	90,587	0	0.0	90,878	0.0	0	0	0
Total					686,400	40	5.8	2,283,309	1.8	31	7	1

Table 3. Incident rates by shifter and functional group, total.

Gear Selector Type	MMY	Driver Exit Auto-Functions			Vehicles Sold	Field Data						
		Auto-Park	ISS Auto-Park	Auto-EPB		Incidents	Rate (R/100k)	Vehicle Years	Exp Adj Rate (R/100k Yrs)	Crashes	Injuries	Deaths
Rotary	2009-12 X250 2010-12 X351 2010-15 X150 2012-13 L538	N	N	N	81,105	1	1.2	243,315	0.4	1	0	0
	2013-20 X250/X260/X351 2013-20 L405 2014-20 L538/L319 2015-20 L550	N	Y	N	431,472	14	3.2	911,273	1.5	11	3	1
Monostable Stick	2014-16 L494, X152	Y	Y	N	83,236	3	3.6	247,468	1.2	3	1	0
	2017-20 L494, X152, X540, X590 2020 L550, L551, X760	Y	Y	Y	90,587	0	0.0	90,748	0.0	0	0	0
Total					686,400	18	2.6	1,492,804	1.2	15	4	1

Table 4. Incident rates by shifter and functional group, last 36 months.

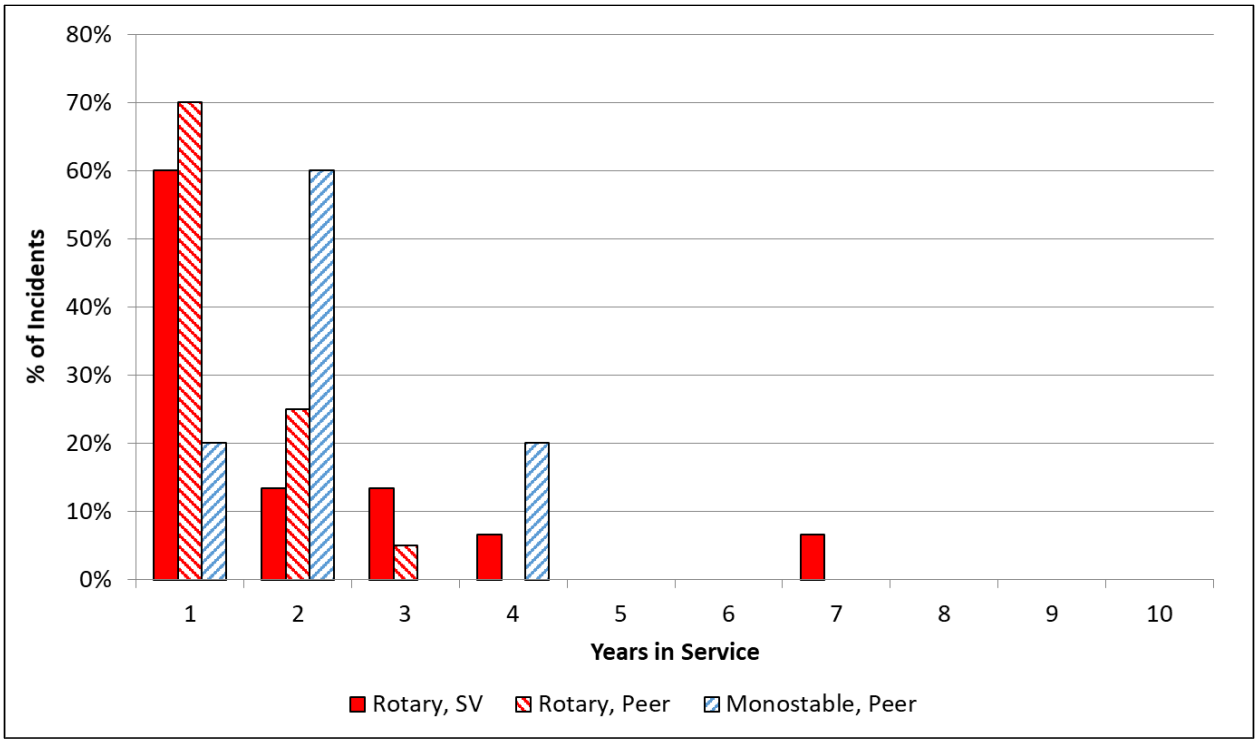

Figure 3. Distribution of incidents by gear selector and vehicle age.

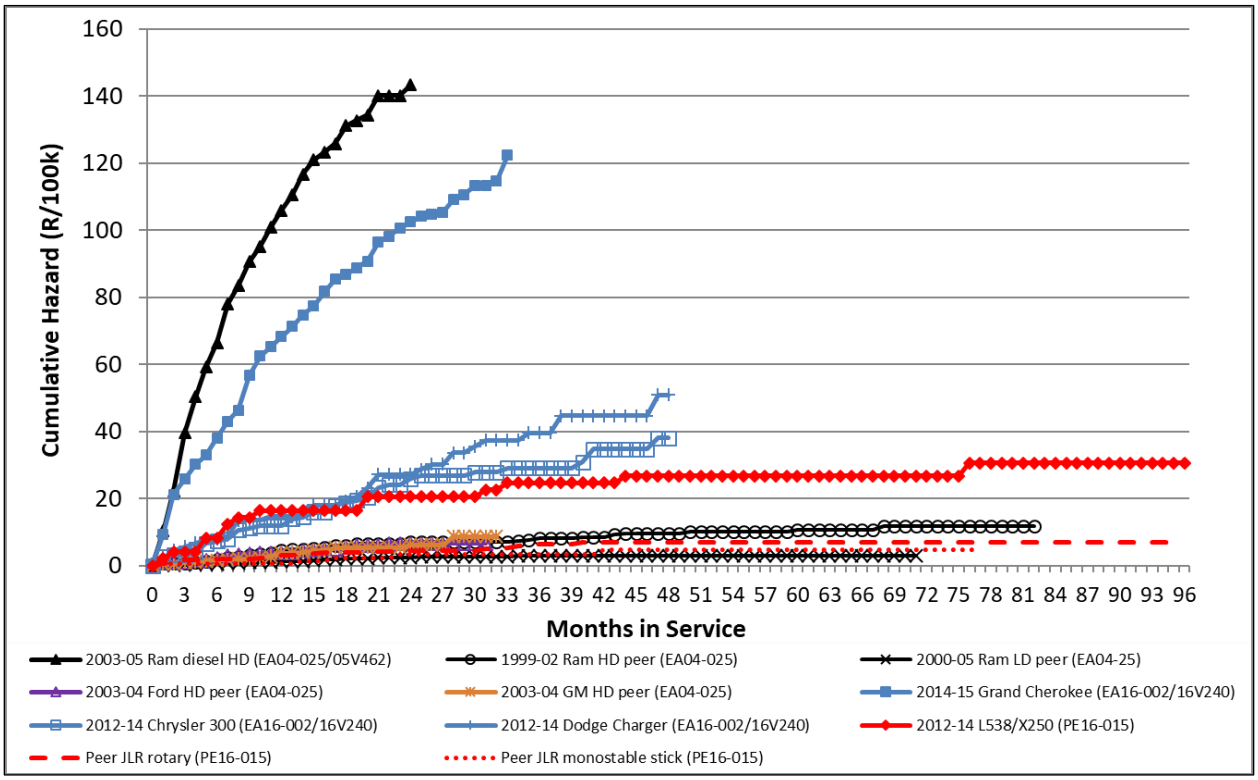

Figure 4. Cumulative hazard analysis in comparison with prior powered rollaway investigations.