U.S. Department of Transportation

National Highway Traffic Safety Administration

ODI RESUME

OFFICE OF DEFECTS INVESTIGATION

NHTSA

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Investigation: PE 14-014
Date Opened: 05/20/2014 **Date Closed:** 05/13/2015
Investigator: Jeff Quandt **Reviewer:** Jeff Quandt
Approver: Stephen Ridella
Subject: Excessive Brake Pedal Travel

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Nissan North America, Inc.
Products: 2013-2014 Nissan Sentra, Versa Sedan and Versa Note
Population: 605,963

Problem Description: The brake pedal may gradually sink when applied very slowly or when the vehicle is stopped with light pressure applied to the brake pedal.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	19	275	294
Crashes/Fires:	1	1	2
Injury Incidents:	0	0	0
Fatality Incidents:	0	0	0
Other*:	0	701	701

***Description of Other:** Warranty claims

ACTION / SUMMARY INFORMATION

Action: This Preliminary Evaluation is closed.

Summary:

On May 20, 2014, ODI opened PE14-014 based on eight complaints alleging incidents of excessive brake pedal travel in model year (MY) 2013 through 2014 Nissan Sentra, Versa Sedan and Versa Note passenger cars (Figure 1) and information in Early Warning Reporting field reports indicating issues with master cylinder internal seals. In response to an information request letter sent by ODI, Nissan identified a condition with the master cylinder in early production subject vehicles that could result in a slow internal leak past one of the recuperating seals to the brake reservoir when the brake pedal is depressed very slowly or lightly (Figure 2). The subject vehicles are equipped with fixed seal master cylinders supplied by TRW. To address concerns with water hammer noise with the standard seal design, the master cylinders in the early production subject vehicles used AWH (anti-water hammer) seals. The AWH seals are sensitive to contamination from assembly plant cleanliness issues, which can produce the internal leak condition during slow or light brake applies but perform as designed with normal or emergency brake applications. TRW indicated that the risk of contamination interacting with the subject seals is greatest after the evacuation and pressure fill process used to fill the brake system during the manufacturing process (early life issue). TRW developed a new master cylinder seal design (EVO seal) that addresses the noise concern and eliminates the internal leak concern associated with contamination by providing a secondary seal (Figure 3).

Nissan implemented the new master cylinder design in vehicle production on September 23, 2013. ODI's analysis shows that the master cylinder warranty claim rate is much higher in vehicles produced before the change (Figure 4). Statistical analysis showed that the condition is an early-life problem with relatively low failure rates projected through 100,000 miles and approximately 58 percent of the failures projected to occur by that mileage have already occurred (Table 1). Warranty claims are highest (78% of claims) in vehicles with less than 10,000 miles (Figure 5) and 50 percent of claims involved vehicles with less than 90 days in service (Figure 6).

ODI evaluated 22 crash claims that included allegations of master cylinder failure, sinking brake pedal or pedal to the floor (Table 2). The analysis identified only three crashes in which a brake performance issue related to the

master cylinder was duplicated by post-incident inspection, including one with a different problem than the seal leak issue (a broken plunger). The two crash complaints related to a possible master cylinder concern involved 1 vehicle with the AWH seal and 1 with the EVO seal. Both were minor crashes. The remaining crashes do not appear to be related to any issues with the master cylinder or other brake system fault. In the 4 crashes with Event Data Recorder information available, the data indicated that the brakes were applied too late to avoid the collisions. These include 2 crashes with less than a half second of braking before impact and 2 in which brake applications lasting 1.0 to 2.5 seconds resulted in high decelerations consistent with fully functioning brake systems, but too late to avoid the collision. Overall, the rates of crashes adjusted for vehicle exposure (total vehicle years in service) do not show any correlation to the high warranty rates associated with the AWH seal leak concern (Table 3 & Figure 7).

Given these circumstances, further use of the agency resources in this matter does not appear to be warranted. Accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist. The agency will continue to monitor complaints and other information relating to the alleged defect and take further action in the future if warranted.

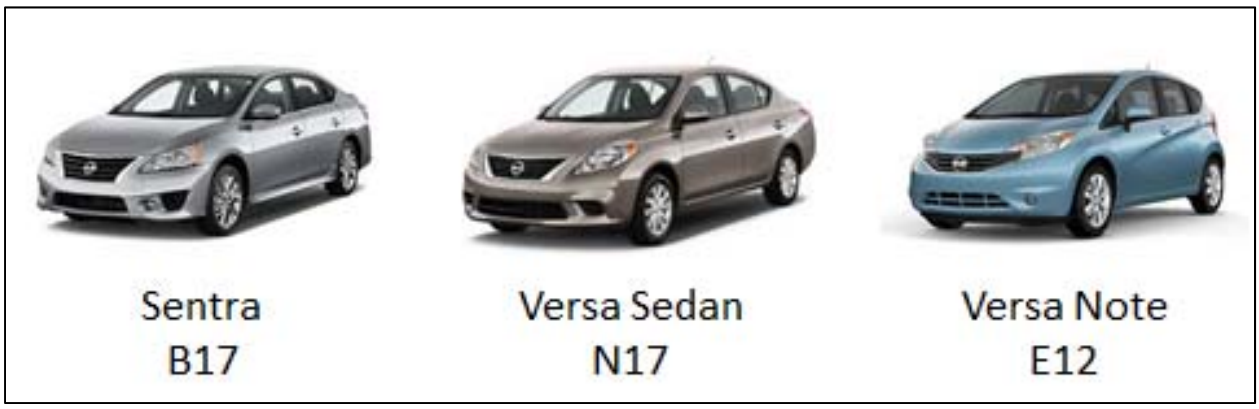

Figure 1. Subject Vehicles.

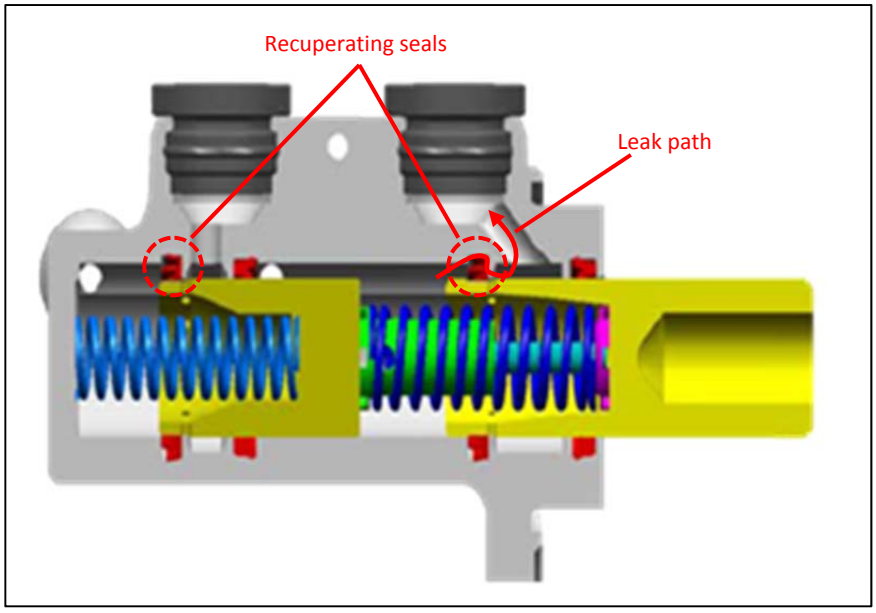

Figure 2. Fixed Seal Master Cylinder, TRW Automotive.

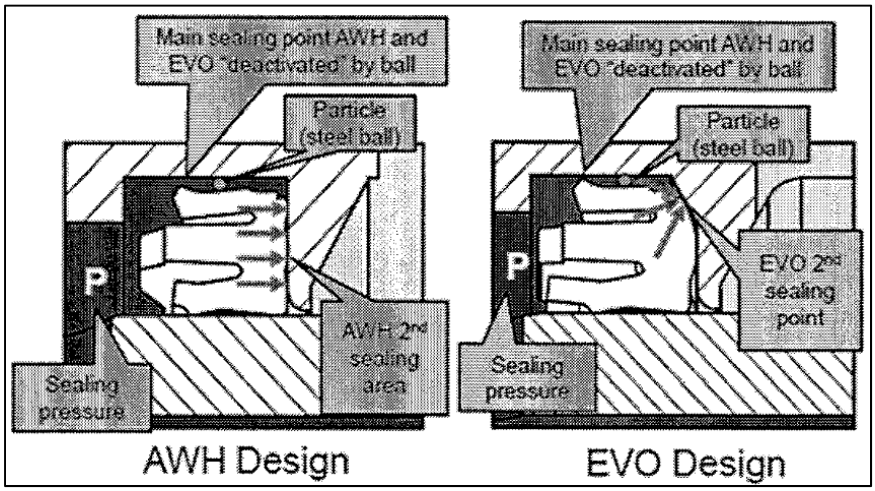

Figure 3. Recuperating Seal Design Change.

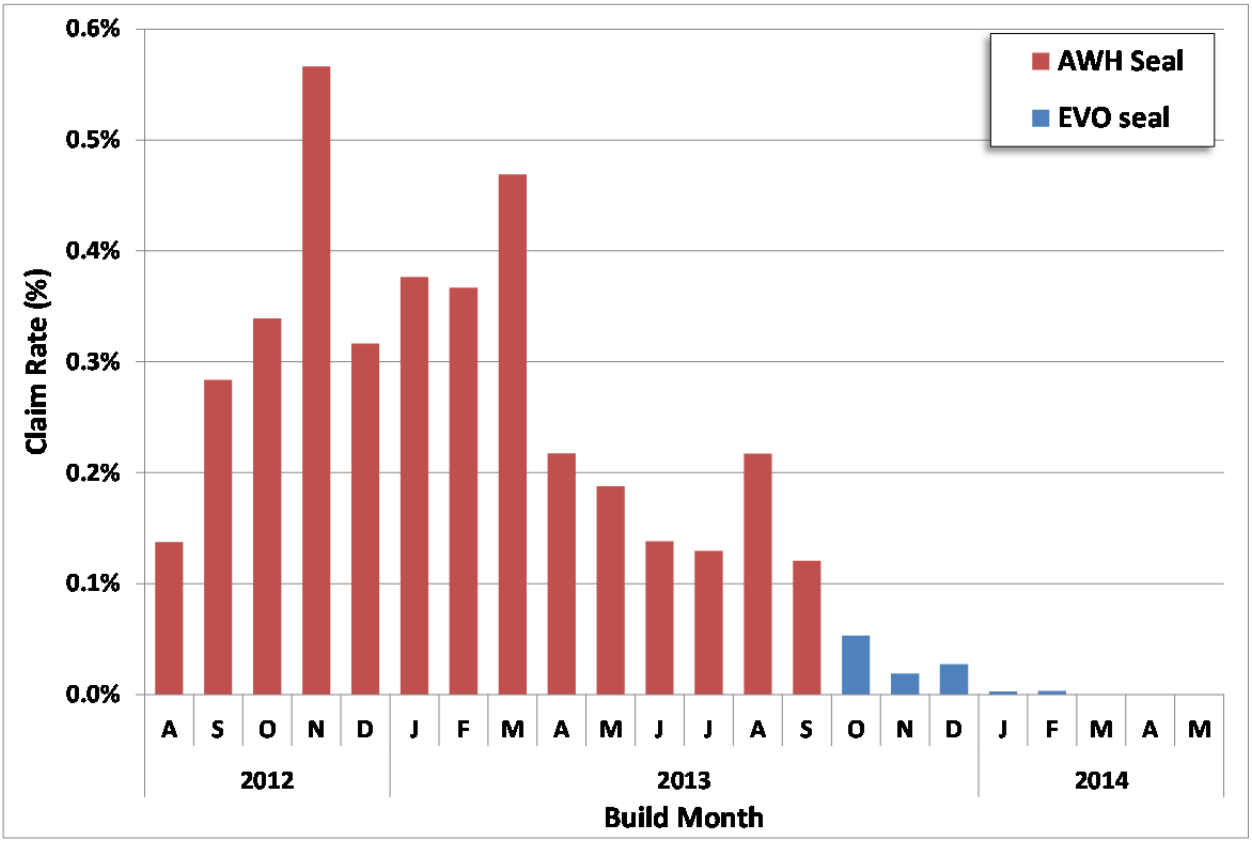

Figure 4. Subject Vehicle Warranty Claim Rates by Vehicle Month of Build (Nissan IR response data, through 23-May-2014).

Master Cylinder	Model	Units	Warranty	Rate	Projected failure rate at 100,000 miles	Projected failures at 100,000 miles	Additonal failures by 100,000 miles	Rate for additional failures by 100,000 miles	% of projected that have already failed
Pre-CM (AWH seal)	Sentra	132,122	833	0.63%	1.21%	1,599	766	0.58%	52%
	Versa Sedan	91,574	285	0.31%	0.38%	348	63	0.07%	82%
	Versa Note	22,296	58	0.26%	0.44%	98	40	0.18%	59%
	Total	245,992	1,176	0.48%	0.83%	2,045	869	0.35%	58%
Post-CM (EVO seal)	Sentra	229,675	117	0.05%	0.18%	413	296	0.13%	28%
	Versa Sedan	84,859	41	0.05%	0.13%	110	69	0.08%	37%
	Versa Note	45,437	20	0.04%	0.07%	32	12	0.03%	63%
	Total	359,971	178	0.05%	0.15%	556	378	0.10%	32%

Table 1. Warranty claim data and projected failure rates by master cylinder design and vehicle model.
Pre-countermeasure (Pre-CM) master cylinders with the AWH seals were used in vehicles produced before September 23, 2013, when the countermeasure master cylinder design with EVO seals (Post-CM) was implemented in vehicle production.

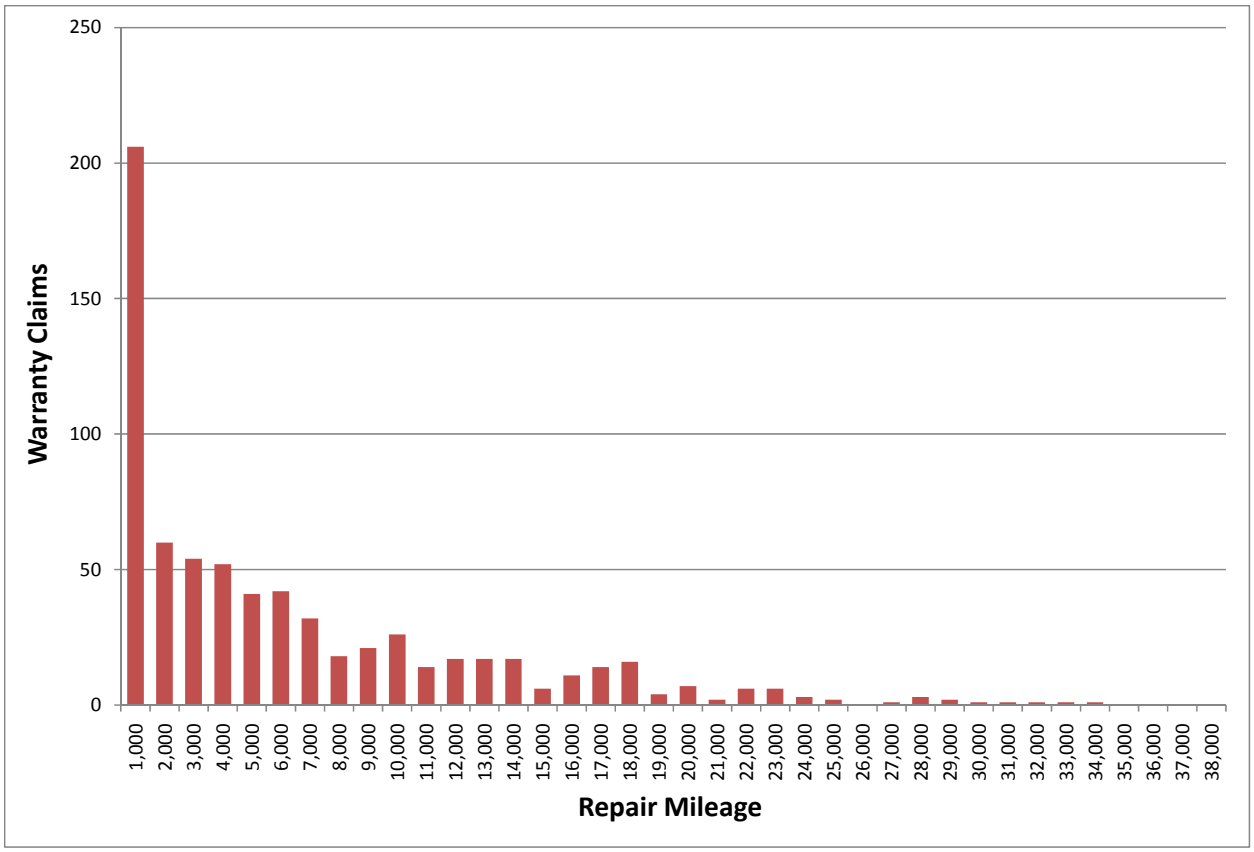

Figure 5. Warranty Claims by Repair Mileage.

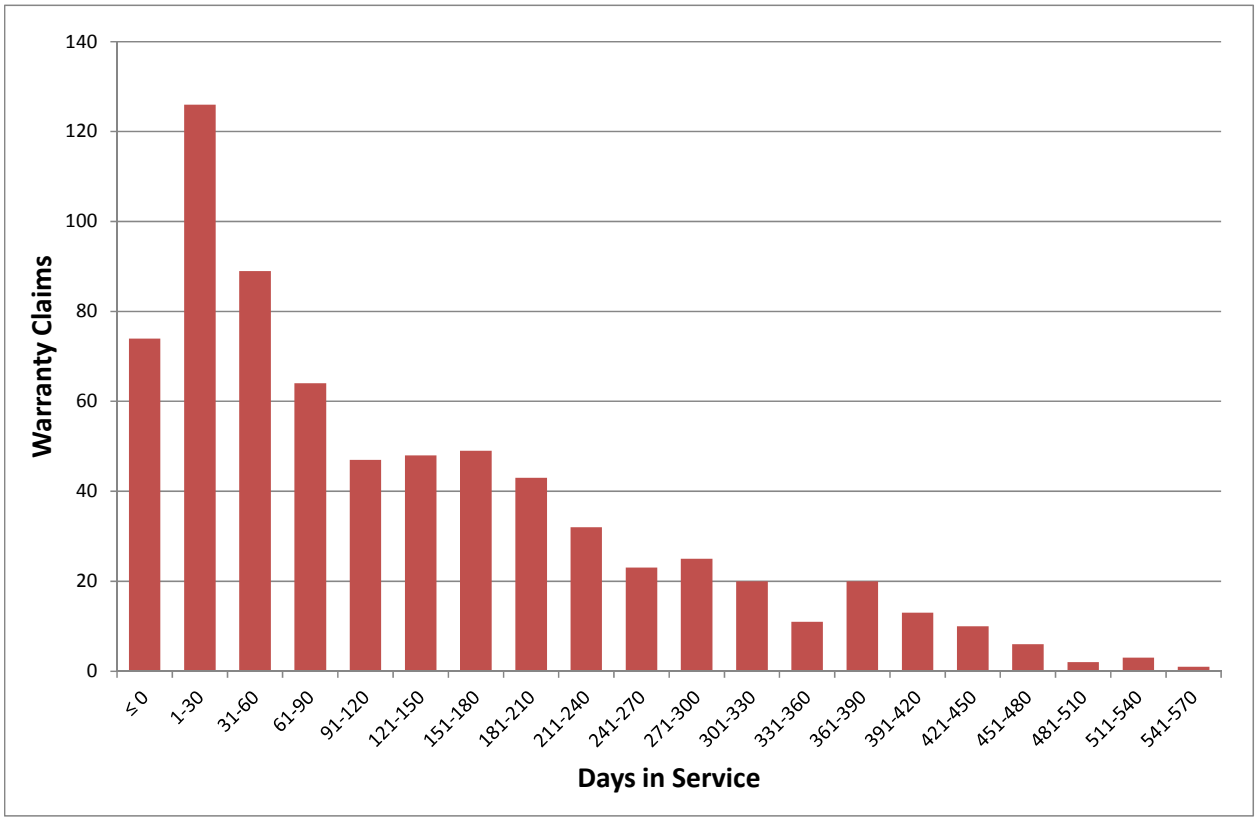

Figure 6. Warranty Claims by Days in Service.

No.	Complaint ID	Vehicle	M/C design	Fail date	Incident miles	Incident days in service	Incident speed	Injuries	NMC post-incident inspection	Condition duplicated	Allegation
1	VOQ 10704166	2014 Versa	Post-CM	Apr-15	25,000	357	25	0			Stop & go traffic on interstate, rear ended vehicle in front, no NMC record
2	VOQ 10701549	2013 Sentra	Pre-CM	Mar-15	10,021	590	4	0			Descending steep driveway, no brakes, collision with unknown object , no NMC record
3	VOQ 10705968	2014 Sentra	Post-CM	Feb-15	12,000	183	38	0			Braked to avoid sudden stop in traffic, hit vehicle in front, cited by police
4	VOQ 10694922	2013 Sentra	Pre-CM	Jan-15	16,953	487	10	0	✓		Stop & go traffic, rear ended vehicle in front, EDR shows no brake at -0.5s before impact
5	VOQ 10654196	2014 Versa Note	Pre-CM	Nov-14	41,000	432	45	0			Approaching stop sign at bottom of hill, alleged loss of brakes and steering
6	NMC 15975793	2014 Sentra	Post-CM	Oct-14	25,020	234	25	0	✓		Driving on secondary road, braked to avoid crossing vehicle, pedal to floor
7	NMC 15946382	2014 Versa Note	Post-CM	Oct-14	426	229	2	0	✓		Moved forward from stop, hit vehicle in front
8	VOQ 10632056	2013 Versa	Pre-CM	Sep-14	39,000	599	65	1			Heard pop on interstate, lost all control, crossed lane and hit rail, vehicle totalled
9	NMC 15713784	2014 Versa	Post-CM	Sep-14	9,265	193	32	0	✓		Braked in parking lot, pedal to floor/accelerated, EDR shows 1.0g late braking
10	VOQ 10638454	2015 Versa	Post-CM	Sep-14	1,000	2	0	0			Rolled forward from stop with brake applied, fender bender
11	NMC 15152436	2013 Versa	Pre-CM	Aug-14	30,689	160	10	1	✓		Stop & go traffic, pedal to floor, hit vehicle in front, EDR shows no brake at -0.5s before impact
12	NMC 15151589	2013 Sentra	Pre-CM	Jul-14	6,195	139	40	1	✓		Braked for stopped vehicle, pedal to floor, EDR shows 1.0g late braking less than 2.5s from impact
13	NMC 14979144	2014 Versa	Post-CM	Jul-14	1,961	134	5	0	✓	✓	Backing in driveway, pedal to the floor, hit parked vehicle
14	NMC 14931417	2014 Sentra	Post-CM	Jul-14	2,574	129	2	0	✓		Rolled forward from stop with brake applied/pumped, hit vehicle in front
15	NMC 14359809	2014 Sentra	Post-CM	May-14	4,394	114	15	0	✓		Braked for stopped vehicle, pedal to floor, hit stopped vehicle, towed
16	VOQ 10606971	2013 Sentra	Post-CM	Jan-14	Unk	43	25	2			Braked for sudden stop in traffic, brakes not responsive, hit vehicle
17	NMC CA4675921	2013 Sentra	Pre-CM	Dec-13	9,295	263	Unk	0			Brake went to floor, hit vehicle in front
18	NMC 12488673	2014 Versa	Pre-CM	Nov-13	6,729	92	5	0	✓	✓	Pulling into driveway, hit basketball hoop support, broken M/C plunger
19	VOQ 10567226	2013 Sentra	Pre-CM	Aug-13	Unk	56	20	2			Braked for sudden stop in traffic at traffic light, hit vehicle in front
20	VOQ 10555316	2013 Sentra	Pre-CM	Aug-13	900	16	25	0			Brakes "seized", hit vehicle in front, major front end damage
21	NMC 11997928	2014 Versa	Pre-CM	Aug-13	905	35	Unk	0	✓	✓	Sinking pedal, fender bender
22	NMC 11416151	2014 Versa	Pre-CM	Jun-13	106	1	5	0	✓		Braked when backing, pedal to floor and hit tree

Table 2. Alleged brake failure crashes analyzed as part of PE14-014.

Master Cylinder	Model	Production Volume	Vehicle Years	Crashes	Crash Rate per 100,000 VehYrs
Pre-CM (AWH seal)	Sentra	132,122	244,463	6	2.5
	Versa Sedan	91,574	178,906	5	2.8
	Versa Note	22,296	32,015	1	3.1
	Total	245,992	455,385	12	2.6
Post-CM (EVO seal)	Sentra	293,528	156,041	5	3.2
	Versa Sedan	123,249	69,533	4	5.8
	Versa Note	112,616	57,744	1	1.7
	Total	529,393	283,318	10	3.5

Table 3. Crash rate analysis by master cylinder and vehicle model (Post-CM include MY 2015 vehicles).

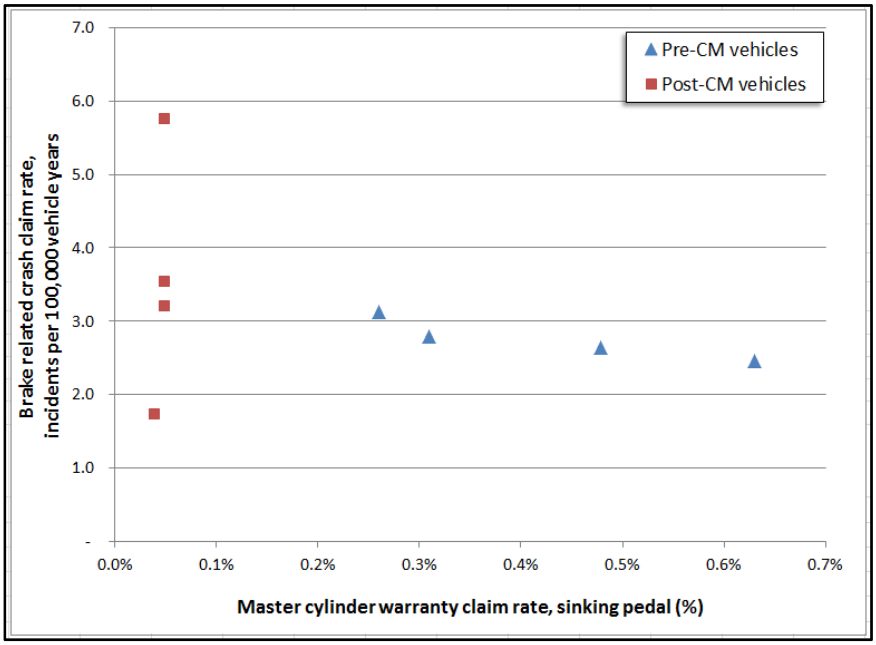

Figure 7. Crash rate vs master cylinder warranty claim rate.

VOQs associated with this closing resume:

10683394, 10682890, 10671945, 10648599, 10640186, 10639444, 10638454, 10630122, 10629686, 10629161, 10620824, 10608459, 10605471, 10598812, 10578529, 10568725, 10533115, 10515614, 10487647