Safety-Related Seat Latching Problems in the 1995 Nissan Maxima

May 1995

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Summary

During a 40 mph offset crash test, the driver seat of a 1995 Nissan Maxima, which was occupied by a belted Hybrid III test dummy, moved forward and rotated significantly. The pattern of damage observed on the seat track latching mechanisms after the crash indicated that the inboard latching mechanism either disengaged early in the crash or was not fully engaged prior to the crash. The disengaged latch compromised the Maxima's restraint system performance during the crash, permitting a substantial amount of forward movement of the dummy's lower body. In the Nissan Maxima, the front seat belt buckles are attached to the inboard sides of the seats. It is likely that the disengaged seat latch contributed to the high acceleration forces measured on the dummy's lower legs as well as a gash on its right knee. It may also have contributed to the high head accelerations that occurred despite the presence of an air bag.

Further investigation indicated that the disengaged seat latch in the crash test most likely resulted from full or partial disengagement of the latch prior to the crash. Seats in six new 1995 Maximas were examined at a new car dealership. Researchers found that the teeth of the inboard latches frequently did not engage, or only partially engaged, in their corresponding slots on six of the seven seats with manual adjusters. One of the seats was in the unlatched position when first examined, prior to any movement by the researchers. This lack of proper engagement appears to be due to a slight misalignment between the teeth and slots. Although the seats felt secure, observation under the seats showed they were not fully latched.

Crash Test Results

As part of crashworthiness evaluations of 1995 midsize four-door cars, the Insurance Institute for Highway Safety crash tested a 1995 Nissan Maxima GXE into an offset barrier at 40 mph on March 1, 1995. A Hybrid III 50th percentile male dummy was positioned in the driver's seat according to procedures specified in Federal Motor Vehicle Safety Standard 208; the manual lap/shoulder belt was fastened. The full report of the test and evaluation, *Crashworthiness Evaluation*, *Crash Test Report (CF95012)*, 1995 Nissan Maxima GXE, is available from the Insurance Institute for Highway Safety. During the test, the driver's seat failed to maintain its adjustment in its tracks, resulting in rotation and forward movement of the seat. The right (inboard) side moved forward 21 cm and the left (outboard) side moved forward 8 cm. Because the inboard seat belt anchor is attached to the seat, failure of the seat track latch compromises restraint system effectiveness and increases the risk of injurious contacts with interior components.

Both lower legs of the instrumented dummy in the Nissan Maxima experienced loads exceeding published thresholds for fracture of the ankles and feet as well as the stronger, long bones of the lower leg. In addition, the Nissan Maxima was the only one of the 14 midsize cars tested in which the dummy head accelerations indicated a risk of serious injury. The instrument panel was loaded by both dummy knees, both feet were fully dorsiflected against the joint rotation stop, and the seat was against the backs of both lower legs after the crash. The right knee of the dummy suffered a gash, apparently when it loaded and bent the ignition key.

Postcrash inspection of the seat adjustment/latching mechanisms revealed only minor nicks and paint scrapes on the inboard-side driver's seat track, but there were bent teeth and gouged slots on the outboard side, indicating that the outboard track latch absorbed most of the load of the crash while the inboard side slid along its track. One possible explanation for this pattern of damage is that the inboard side track latching mechanism released during the crash, perhaps as the seat pan deformed. This scenario is possible because the Nissan Maxima seat latching mechanism design is controlled from the outboard (master) side; the inboard (slave) side latching mechanism is activated by a wire that runs laterally under the seat pan from the master side, and deformation of the seat pan could disengage the slave latch by pressing on the wire.

Another possibility is that the outboard, master side of the seat was fully latched before the crash but the inboard, slave side was not. A slight misalignment of the teeth of the slave latch with the slots in its track could result in the inboard side remaining unlatched when the master side is latched. This type of disengagement could go undetected by an occupant if the positive latching on the master side held the seat firmly in place for normal operation. During the crash, the unlatched side would move forward first while the seat is held on the latched side, resulting in the observed rotation of the seat and deformation of the seat pan, followed by failure of the outboard side latch.

The Institute's precrash procedure for determining that seats were correctly positioned involved moving the seats fully forward and then backward to the midpoint of the seat track length. A person then sat in the seat and attempted to rock it to ensure that the latching mechanism was fully engaged. Latching was presumed if the seat could not be moved; there was no precrash, under-seat inspection to assure complete latching.

Investigation of Maximas and Other Nissan Vehicles with Similar Seat Track Latches and Belt Attachments

To investigate the possibility that the inboard side of the Nissan Maxima seat was not fully engaged in the track mechanism before the crash, new Nissan Maximas with mechanically adjustable seats were examined to determine whether no engagement, or only partial engagement, of the inboard (slave) side latching mechanism could be observed.

On May 3, 1995, researchers and a film crew visited a new car dealership, Colonial Auto Center in Charlottesville, Virginia, and inspected the front seat fore/aft manual adjusting mechanisms on five new 1995 Nissan Maxima four-door sedans. The film crew recorded the actions of the researchers adjusting the seats. They also recorded views of the under seat area, using a very small video camera mounted on the end of a flexible rod. A sixth Nissan Maxima was inspected at the same dealership by the researchers on May 19, 1995 (the film crew was not present). Also on May 19, the researchers examined the front seat latches of several other Nissan car models with the same latch design and seat belt buckles attached to the seats. None of these other models exhibited the latching problems observed in the Maxima sedans. (Details of all of the inspected cars are given in the Appendix.)

Only one of the six Maximas examined was equipped with both driver and passenger seats that were manually adjustable. The remainder had driver seats with power adjusters and passenger seats with manual adjusters. The single manually adjustable driver seat did not exhibit the latching problem (except possibly in one attempt when the seat was in its nearly extreme forward position). However, on each of the six cars' passenger seats, the situation in which the teeth of the master (outboard) latch fully engaged in the slots in the track but the teeth of the slave (inboard) latch did not engage, or only partially engaged, in their corresponding slots was observed. This lack of proper engagement appears to be due to slight misalignment between the teeth and slots on the inboard side of the seat compared with those on the outboard side.

On one of the six Maximas, the passenger seat was found to be unlatched on the slave side before the researchers sat in the seat or attempted any seat repositioning. On this car, it was impossible to latch the slave side no matter how hard the researchers pushed or pulled on the seat while seated in it or kneeling beside it outside the car.

For the other five Maximas, the condition occurred when the seats were moved in the fore/aft direction on their tracks by activating the adjustment lever in the normal fashion (for three of these vehicles, the latch was first misaligned without a seated occupant). When the slave latches were out of position (and the levers were left untouched), repeated attempts to engage the latches on the inboard side were almost always unsuccessful regardless of the amount of rearward force applied to the seat by the person sitting in it. Applying forward force to the seat (again while sitting in it without touching the adjustment lever) would sometimes, but not always, cause full engagement, indicating that the teeth were more likely to misalign slightly behind their corresponding slots rather than ahead of them. Usually the only way to engage a latch after it was determined to be unlatched was to activate the adjustment lever and reposition the seat forward or rearward, but even this did not assure full engagement on both sides. There was no way to tell if a seat was fully latched except by looking underneath the seat cushion. The seats felt secure even if the slave sides were not engaged.

A seventh Nissan Maxima four-door sedan, used by the Institute in 5 mph front-into-barrier and rearinto-pole tests, also had the same latching problem on the passenger seat as the cars inspected at the dealership. Because the driver seat had been removed from this vehicle (for comparison with the seat damaged in the offset crash test) prior to the investigation of potential seat latching problems, it could not be examined for the problem of misalignment.

Latch Investigations of Other Nissan Vehicles

While at the dealership on May 19, researchers also investigated the latch mechanisms on four Nissan Pathfinders, a Nissan pickup, and a Nissan Quest (see Appendix). These vehicles have seat track latch mechanisms similar to the Maxima, but the seat belt is not anchored to the seat. No latch problems were observed in the pickup or van, but in all four Pathfinders the slave-side latch sometimes remained disengaged after adjustment of the seat by a researcher. The driver seat in two of the Pathfinders was found with the slave-side latch disengaged before the researchers sat in the seat or attempted any seat repositioning.

Appendix
Nissan Maxima Four-door Sedans Inspected May 3, 1995

Model	VIN	Build Date	Driver/Passenger Seat Adjustment	Seat Latch Problem?	Belt Anchored to Seat?
Maxima GXE*	JN1CA21D2ST647740	2/95	Manual/manual	Yes	Yes
Maxima GXE	JN1CA21D5ST648915	2/95	Power/manual	Yes	Yes
Maxima GXE	JN1CA21D1ST633246	1/95	Power/manual	Yes	Yes
Maxima SE**	JN1CA21D9ST612936	10/94	Power/manual	Yes	Yes
Maxima GLE	JN1CA21D7ST648382	2/95	Power/manual	Yes	Yes

Nissan Models with Similar Seat Latches Inspected May 19, 1995							
Maxima SE	JN1CA21D2ST660326	3/95	Power/manual	Yes	Yes		
Sentra GXE	1N4AB41D1SC750845	4/95	Manual/manual	No	Yes		
Sentra GXE	1N4AB41D6SC736696	3/95	Manual/manual	No	Yes		
200SX SE	1N4AB42D0SC506179	2/95	Manual/manual	No	Yes		
Altima GLE	1N4BU31D4SC152466	10/94	Manual/manual	No	Yes		
Quest XE	4N2DN11WXSD818369	11/94	Manual/manual	No	No		
Pathfinder XE**	JN8HD17YXSW051048	1/95	Manual/manual	Yes	No		
Pathfinder XE**	JN8HD17Y0SW053584	1/95	Manual/manual	Yes	No		
Pathfinder SE	JN8HD17Y0SW056596	2/95	Manual/manual	Yes	No		
Pathfinder XE	JN8HD17Y2SW049407	12/94	Manual/manual	Yes	No		
Pickup XE	1N6HD16Y8SC335483	12/94	Manual/manual	No	No		

Nissan Maxima Tested by IIHS at 5 MPH									
Maxima GXE	JN1CA21D1ST059733	9/94	Manual/manual	Yes	Yes				

^{*} Videotape showing the misalignment problem for this vehicle is available.

^{**}The inboard seat track latch was found in the disengaged position on these vehicles.