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Testing Rear-Door-Logic Based Unattended Child Reminder Systems

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16. Abstract From 1998 to 2023 there were 971 reported deaths in the United States due to pediatric vehicular heatstroke (PVH), an average of 37 PVH deaths per year. Unattended child reminder systems (UCRS), also known as child presence detection (CPD) systems, use direct sensing methods to detect or indirect sensing methods to infer the presence of a child inside a vehicle. If a child is detected or inferred, the UCRS provides an alert and may also include interventions that could reduce the risk to a child who has been left unattended knowingly or unknowingly. The most common types of UCRS in production in 2023 are indirect sensing systems that identify a rear door opening to infer the potential presence of a child. This study analyzes 12 vehicles that use rear-door-logic based systems to alert drivers to children forgotten in the rear seats at the end of journeys through comparisons with UCRS alert recommendations.			
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Executive Summary

To further understanding on the issue of a child dying of heat stroke after being left behind or gaining access to a vehicle, the National Highway Traffic Safety Administration has conducted research and supported various public awareness campaigns. In 2020 NHTSA researchers Prasad and Wetli (2022) investigated the use of original equipment manufacturer (OEM) and after-market systems that attempt to address this issue. To continue this research an evaluation of current systems was needed. The most common OEM systems in the U.S. market currently are rear-door-logic based systems. Therefore, these systems became the focus of this research study with the objective of understanding how an OEM system alerts a driver to a forgotten child in a rear seat.

Researchers selected for testing 12 vehicles with rear-door-logic based systems and available in summer 2023. NHTSA developed a generalized test drive procedure for research purposes that could be applied to indirect sensing or direct sensing systems to analyze two common scenarios where children are unattended in vehicles: left behind and gained access to the vehicle. These 12 vehicles were taken through each test drive procedure, and researchers documented when a driver received an alert and the characteristics of those alerts. The timing of the recorded alerts was then compared to the test procedure and description of the system in the owner's manual to compare alert timings. The selected vehicles that were listed in the Alliance for Automotive Innovation's (Auto Innovators) 2022 and 2023 heatstroke reports were compared to the voluntary commitment document (Alliance of Automobile Manufacturers, Inc., & Association of Global Automakers, Inc., 2019, the forerunner agencies that became Auto Innovators in 2020) to determine if the systems aligned with the statements made in the commitment. Finally, each of the selected vehicles' alert characteristics were compared to criteria formulated by NHTSA researchers.

This study showed there is no widespread commonality between the 12 vehicle systems regarding when alerts are received, if the auditory alert is distinct from other auditory alerts, the language used in the visual alerts, and if the vehicle sends an alert after a mid-journey stop. No vehicle could alert to a child who gained access to the unlocked vehicle. Looking at all the test drives performed for all scenarios, 6 of 78 tests did not perform as described in the owner's manual. In 24 out of 74 tests, the vehicle did not alert to an unattended child in the vehicle. However, the owner's manual did not state that an alert would happen in those scenarios.

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Introduction

Unattended child reminder systems (UCRS), also known as child presence detection (CPD) systems, use detect through direct sensing methods or infer through indirect sensing methods the presence of a child inside vehicles. If a child is detected or inferred, the UCRS provides an alert and may also include interventions that could reduce risk to an unattended child left knowingly or unknowingly. The most common types of UCRS in production in 2023 are indirect sensing systems that identify a rear door opening and closing to infer the potential presence of a child.

Background

Pediatric vehicular heatstroke (PVH), also known as hyperthermia, occurs when a child is unattended in a hot vehicle until the child has a heatstroke. A heatstroke can occur when body temperature exceeds 40°C or 104°F (Morris & Patel, 2023), overwhelming the person's thermoregulatory mechanism. As the core temperature increases, there is a higher risk of cellular damage, leading to organ failure and possible death. A child's thermoregulatory system is less efficient than an adult's, causing body temperature to warm at a rate potentially three to five times faster (Tsuzuki-Hayakawa et al, 1995). This inefficient temperature regulation puts children at higher risk for heatstroke if left unattended in a vehicle.

From 1998 to 2023 there were 971 reported deaths, an average of 37 deaths per year, due to PVH in the United States as reported by Noheatstoke.org (Null, 2023).¹ The lowest year for PVH deaths was 2015 at 25 deaths, while the highest recorded deaths occurred in 2018 and 2019 at 53 deaths each, as shown in Figures 1 and 2. Of those reported deaths, 52.2 percent were categorized as the child being forgotten by the caregiver in an unattended vehicle (referred to in this report as "left behind"). When looking at all cases from 1998 to 2022, there were 47 percent that involved a child being forgotten when the caregivers or guardians mistakenly believed they had dropped the children off at childcare or preschool. The two other major situations resulting in PVH fatalities included the child gaining vehicle access without caregiver knowledge (referred to in this report as "gained access") (24.5 percent) and the caregiver knowingly leaving the child in the back seat (20.7 percent). The Noheatstroke organization's data is regarded by many safety organizations as a comprehensive catalogue of hyperthermia incidents that have occurred since 1998.

¹ [Editor's note: Since 2018, NHTSA's Special Crash Investigations unit has been investigating and reporting on child hyperthermia cases in vehicles. See, for example, Wiacek et al., 2022, *NHTSA Special Crash Investigations: Comprehensive Study of 2019 U.S. Pediatric Vehicular Hyperthermia Fatalities*, Report No. DOT HS 813 360, at <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813360>]

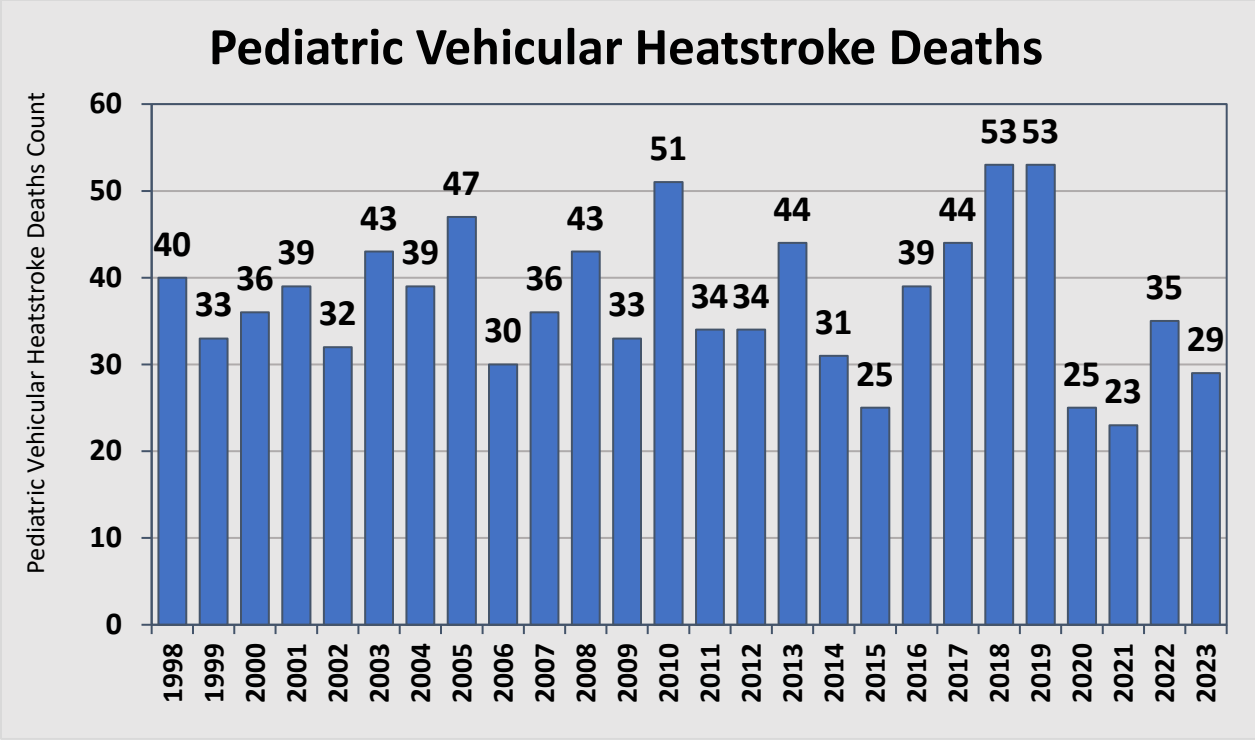


Figure 1. Pediatric Vehicular Heatstroke Fatalities (1998-2023) from Null, 2023

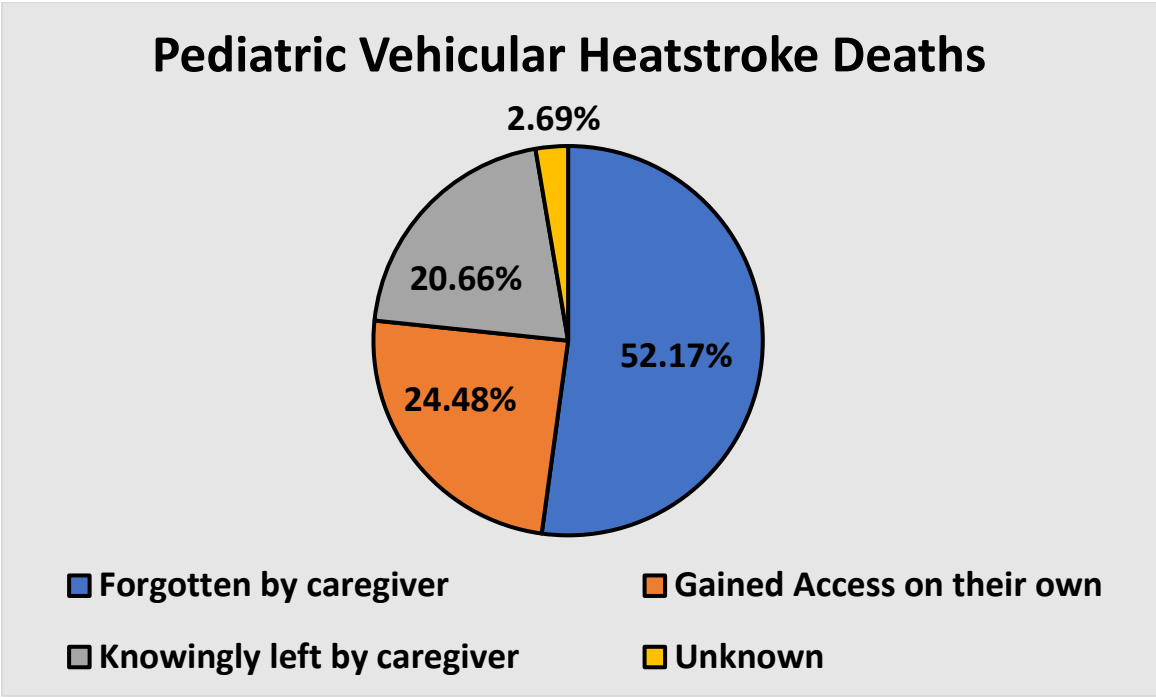


Figure 2. Pediatric Vehicular Heatstroke Fatalities (1998-2023) by category, from Null, 2023

Members of the Auto Innovators group voluntarily committed to incorporate rear seat occupant alerts as standard equipment in their passenger-car fleets by model year 2025 (AAM & AGA, 2019). The commitment states that the alert shall include a distinct combination of auditory alert

and visual alert and activate after the vehicle engine or motor is deactivated by the driver. As part of the commitment, members provide regular updates on their progress. Auto Innovators publishes an annual list that includes the make, model, and model year (MY) of all selected vehicles from each manufacturer that currently have UCRS as standard equipment (Auto Innovators, 2022, 2023).

Euro NCAP released a detailed protocol in November 2022, *Test and Assessment Protocol – Child Presence Detection*, on how it will evaluate and reward UCRSs. The protocol includes alert and warning requirements, and test procedures for UCRSs that use direct or indirect sensing. A section of this protocol meets the voluntary agreement created by Auto Innovators as discussed previously.

Objective

The objective of this study was to understand how each of the OEM systems alert a driver to a possible child in the rear seat. To do this, NHTSA developed test procedures and alert criteria like those used by Euro NCAP, and then analyzed 12 vehicles that use rear-door-logic based systems to determine if they match the alert timings described in the vehicle owner’s manuals, and the alert criteria. NHTSA developed these test drive procedures and alert criteria to enable comparison between existing systems for research purposes, and not to evaluate whether systems are effective at addressing PVH.

Vehicle Selection

The 12 vehicles selected for testing were the 2022 Hyundai Tucson, 2022 Cadillac XT4, 2022 Toyota Camry, 2022 Chevrolet Equinox, 2022 Honda Civic, 2022 Nissan Rogue, 2022 Honda Odyssey, 2020 Subaru Forester, 2023 Ford Maverick, 2017 Chevrolet Bolt, 2023 Honda HR-V, and 2023 Cadillac CT5. They were selected based on availability of rear-door-logic based systems to researchers in summer 2023 across a variety of vehicle types and manufacturers.

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Owner's Manual Information

The owner's manual of each vehicle has detailed information about UCRS operation such as when the alert could be expected and how to enable or disable the system. This information is summarized in the sections immediately below for the selected vehicles. Additional details are in Appendix A (Owner's Manual Information). The location of the alerts within the vehicle on the instrument panel and/or audio/information screen can be seen in Figures E-8, E-9, and E-10 of Appendix E (Alert Descriptions).

2022 Hyundai Tucson

The Hyundai Tucson owner's manual said a visual alert stating, "Check rear seats" and an illustration of rear seats would be received on the instrument panel (referred to as the cluster in the owner's manual) after the engine was turned off and the driver door had been opened if the system is armed by opening and closing a rear door or the lift gate. No time limit was specified for activation of the reminder system after rear doors were opened and closed. The manual also states this vehicle is equipped with a motion detection system that was activated after the first alert is received, the driver door is closed, and the vehicle is locked. If movement is detected by this system, then the horn would sound for approximately 25 seconds and would repeat up to 8 times if movement is continually detected. The manual states that the system will detect movement for up to 8 hours after the doors are locked and can be disabled if the vehicle is unlocked. This research did not review this detection system as the focus of this study was rear-door-logic based systems. This owner's manual did not state if the reminder system would be disarmed for the remainder of the trip if the vehicle was turned off.

2022 Cadillac XT4 Crossover

The Cadillac XT4 owner's manual said that a visual alert stating, "Rear Seat Reminder Look in Rear Seat" would be received on the instrument panel when the vehicle was turned off if the reminder system was armed by a second-row door being opened and closed while the vehicle was turned on or up to 10 minutes before the vehicle was turned on. This owner's manual stated the reminder system was armed only once each time then would be deactivated when the vehicle was turned on and off and must be rearmed by opening and closing a second-row door. This vehicle's manual stated that an alert would still be received at the end of the journey even if a child had exited the vehicle before the end of the trip through a rear door if the vehicle was still running.

2022 Toyota Camry

The Toyota Camry owner's manual said that a visual alert stating, "Attention: Check Rear Seat" would be received on the instrument panel (referred to as the multi-information display in the owner's manual) for approximately 6 seconds when the vehicle was turned off if the reminder system was armed. The system is armed by a rear door opening and closing in the 10 minutes before the engine is started or any time after the engine is started. However, it also states that the system may not be activated if a rear door is opened and closed within 2 seconds. This owner's manual did not state if the reminder system would be disarmed for the remainder of the trip if the vehicle was turned off.

2022 Chevrolet Equinox AWD

The Chevrolet Equinox owner's manual said that a visual alert stating, "Rear Seat Reminder Look in Rear Seat" would be received on the instrument panel when the vehicle was turned off if the reminder system was armed. The reminder system is activated when a second-row door is opened and closed while the vehicle is on or up to 10 minutes before the vehicle is turned on. This owner's manual stated the reminder system is armed only once each time the vehicle is turned on and off and must be rearmed by opening and closing a second-row door. This owner's manual stated that an alert will still be received at the end of the journey even if a child has exited the vehicle before the end of the trip through a rear door if the vehicle is still running.

2022 Honda Civic EX

The Honda Civic owner's manual said that a visual alert stating, "Check rear seats" with an illustration of a vehicle would be received on the instrument panel (referred to as the driver information interface in the owner's manual) when the vehicle was turned off if the reminder system was armed. The reminder system is activated if a rear door was opened and closed shortly before the vehicle being turned on, up to 10 minutes, or after the vehicle is turned on. This owner's manual stated the reminder system would alert once when the vehicle was turned off and then the system would be disarmed, thus requiring the system to be rearmed before it would alert again.

2022 Nissan Rogue

The Nissan Rogue featured two versions of its reminder system, alert only or alert and horn, which were tested separately. In the test drive summaries below, these are referred to as "Nissan Rogue ("alert only" mode)" and "Nissan Rogue ("alert and horn" mode)" to differentiate which test mode is being discussed.

For both alert modes the owner's manual said a visual alert stating "Rear Door Alert is Activated" would appear on the instrument panel (referred to as the vehicle information display in the owner's manual) when the vehicle was started, and the system had been armed by opening and closing a rear door up to 10 minutes before the vehicle was started. The driver would then receive a "notification message" when it was shifted into Park if the reminder system was activated, and the vehicle had been driven. This message would be received with two options, one to temporarily disable the alert for that stop and an option to dismiss the message but leave the alert enabled. Once the vehicle was turned off and the driver exited the vehicle an alert stating "Check Rear Seats for All Articles" will appear on the vehicle information display. If the alert and horn mode was active, an audible alert from the horn would occur a short time after the final visual alert unless the system was deactivated by opening and closing a rear door. Also in this mode, if the doors were locked before the alert was deactivated the horn would sound, and if the liftgate was open the horn would be delayed until the liftgate was closed. This owner's manual did not state if the reminder system would be disarmed for the remainder of the trip if the vehicle is turned off.

2022 Honda Odyssey Touring

The Honda Odyssey owner's manual said that a visual alert stating, "Check Rear Seats" with an illustration of a vehicle would be received on the instrument panel (referred to as the driver information interface in the owner's manual) when the vehicle was turned off if the reminder system was armed. The system is armed by the rear doors being opened or closed within 10

minutes of turning on the vehicle. The owner's manual also indicates that for models with "CabinWatch", a reminder will appear on the audio/information screen with a live video of the second and third row 1 second after the first alert appears on the instrument panel. This video would be presented next to the same visual alert and vehicle illustration from the instrument panel. This owner's manual stated the reminder system would be disarmed when the vehicle was turned off, indicating that it would need to be rearmed by operating the rear doors to alert.

2020 Subaru Forester

The Subaru Forester owner's manual said that a visual alert stating, "Reminder, Look in Rear Seat" would be provided on the instrument panel (referred to as the combination meter in the owner's manual) when the vehicle was turned off and the driver door has been opened if the system had been armed by opening and closing a rear door. No time limit was specified for activation of the reminder system after rear doors were opened and closed. This owner's manual did not state if the reminder system would be disarmed for the remainder of the trip if the vehicle was turned off.

2023 Ford Maverick AWD

The Ford Maverick owner's manual said that a visual alert stating, "Check rear seats for occupants." along with an illustration of a vehicle with a child restraint in a rear seat would be received on the audio/information screen (referred to as the information and entertainment display screen in the owner's manual) when the vehicle was turned off if the reminder system was armed. The system is armed by opening and closing a rear door within 15 minutes of the vehicle being turned on, within 15 minutes of an auditory or visual alert being displayed or sounded, or at any point while the vehicle was running. The owner's manual did not state if the reminder system would be disarmed for the remainder of the trip if the vehicle was turned off.

2017 Chevrolet Bolt EV

The Chevrolet Bolt owner's manual said that a visual alert stating, "Rear Seat Reminder Look in Rear Seat" would be received on the instrument panel when the vehicle was turned off if the reminder system was armed. The reminder system is armed if a rear door has been opened and closed within 10 minutes of the vehicle being turned on or at any point while the vehicle is running. This owner's manual stated the reminder system was armed only once each time the vehicle was turned on and off and must be rearmed by opening and closing a second-row door. This manual stated that an alert would still be received at the end of the journey even if a child had exited the vehicle before the end of the trip through a rear door if the vehicle was still running.

2023 Honda HR-V

The Honda HR-V owner's manual said that a visual alert stating, "Check rear seats" with an illustration of a vehicle would be received on the instrument panel (referred to as the driver information interface in the owner's manual) when the vehicle was turned off if the reminder system was armed. The reminder system is armed if a rear door has been opened and closed within 10 minutes of the vehicle being turned on or at any point while the vehicle is running. This owner's manual stated the reminder system would be disarmed when the vehicle was turned off and would need to be rearmed to alert.

2022 Cadillac CT5

The Cadillac CT5 owner’s manual said that a visual alert stating, “Rear Seat Reminder Look in Rear Seat” would be received on the instrument panel when the vehicle was turned off if the reminder system was armed. The reminder system is armed if a rear door has been opened and closed within 10 minutes of the vehicle being turned on or at any point while the vehicle is running. This owner’s manual stated the reminder system was armed only once each time the vehicle was turned on and off and must be rearmed by opening and closing a second-row door. This manual stated that an alert would still be received at the end of the journey even if a child had exited the vehicle before the end of the trip through a rear door if the vehicle was still running.

Owner’s Manuals Summary

The information detailed in the owner’s manual information sections above and in Appendix A (Owner’s Manual Information) is summarized below in Table 1. This includes information on how the reminder system is armed, the amount of time before and after the vehicle is turned on that the system can be armed, and any actions that will disarm the system during use of each of the selected vehicles.

Table 1. Owner’s manual information summary table

	Arming the System	Arming Timing	Disarming the System
2022 Hyundai Tucson	Opening and closing a rear door or lift gate	No information in the owner’s manual	No information in the owner’s manual
2022 Cadillac XT4	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on or while engine is running	Only armed once each time the vehicle is turned on and off
2022 Toyota Camry	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on or while engine is running	No information in the owner’s manual
2022 Chevrolet Equinox	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on or while engine is running	Only armed once each time the vehicle is turned on and off
2022 Honda Civic	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on	When the vehicle is turned off
2022 Nissan Rogue	A rear door being opened and closed, and the vehicle is driven	Up to 10 minutes before the vehicle is turned on	When a rear door is opened and closed again
2022 Honda Odyssey	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on	When the vehicle is turned off
2020 Subaru Forester	A rear door being opened and closed	No information in the owner’s manual	No information in the owner’s manual

	Arming the System	Arming Timing	Disarming the System
2023 Ford Maverick	A rear door being opened and closed	Within 15 minutes of when the vehicle is turned on or an alert being received, or while engine is running	When a rear door is opened and closed again
2017 Chevrolet Bolt	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on or while engine is running	Only armed once each time the vehicle is turned on and off
2023 Honda HR-V	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on or while engine is running	When the vehicle is turned off
2022 Cadillac CT5	A rear door being opened and closed	Up to 10 minutes before the vehicle is turned on or while engine is running	Only armed once each time the vehicle is turned on and off

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Test Procedures and Testing Results

NHTSA designed 7 test drive procedures to assess the behavior of the selected vehicle's UCRS for research purposes. The step-by-step procedure for each test drive can be found in Appendix B (Test Drive Procedures).² These were intended to mirror the test drive requirements in the Euro NCAP Child Presence Detection Test and Assessment Protocol, including the ability to meet the voluntary commitment made by Auto Innovators mentioned previously. The Euro NCAP (2022) protocols for Alert and Warnings awards points for alerts outside (but not inside) the vehicle when the vehicle is turned off. These protocols were not followed exactly but used as a guideline with some modifications. One of these modifications included recording the appearance of in-vehicle alerts and alerts when the vehicle was turned off.

The various test drives are meant to encompass a variety of situations that could occur in everyday use of a vehicle such as stops for fuel or to pick up or drop off a child. The procedures are not exclusive to a specific method of determining or inferring that a rear occupant may be in the vehicle, such as indirect sensing or direct sensing systems, when subjected to common scenarios encountered in transporting children.

Test Drive Summaries and Results

During the seven vehicle test drives, researchers documented when an alert was provided to the driver. These recorded alerts were compared to the step of each test drive procedure during which the alert was received to determine at what moments during a test drive or trip the alert activated. The steps at which the alerts were received were compared to the statements made in the vehicles' owner's manuals. Additionally, the received alerts were reviewed to determine whether an alert was provided during the final steps of the test procedure,³ which would correspond to the end of the trip if a child were to be left unattended in the vehicle. The data matrix containing when these alerts were received and when they were described to occur in the owner's manual can be found in Appendix C (Test Drive Results).

Test Drive 1

This drive simulates starting with a locked vehicle that is turned off, the driver forgets to remove the child at the end of the trip and does not lock the doors initially, but rather locks the doors 30 seconds after door closure. To test this scenario the vehicle begins turned off and locked. The test driver then unlocks the vehicle, opens a rear door, and places a child presence detection (CPD) dummy into a rear seat, enters the vehicle, and drives the vehicle. At the end of the trip the test driver parks the vehicle, exits the vehicle, leaves the CPD dummy in the vehicle, and waits 30 seconds before locking the vehicle.

Results: The Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, Ford Maverick,

² Although the test drive procedures used in this report specify the use of a CPD dummy, the procedures are designed for use with both indirect sensing and direct sensing systems, and the choice of dummy (or use of no dummy) has no impact on results when testing vehicles equipped only with indirect sensing systems. A Hybrid-III crash test dummy was used for the testing described in this report. This had no impact on the results because all vehicles tested were equipped with indirect sensing systems.

³ The final steps of the test procedure include placing the vehicle in Park, turning off the vehicle, opening the driver door, exiting, and walking away from the vehicle.

Cadillac CT5, and Nissan Rogue (“alert and horn” mode) performed as described in their owner’s manuals.

The Nissan Rogue (“alert only” mode) did not perform as described in the owner’s manual. The owner’s manual states this vehicle would alert when the driver first turns on the vehicle, when shifted to Park, and when the driver has exited the vehicle and closed the driver door. However, in the “alert only” mode, the vehicle displayed the reminder when the vehicle was turned on and shifted to Park, but not when the driver exited the vehicle.

All vehicles alerted during the final few steps of the test procedure.

Test Drive 2

This drive simulates starting with an unlocked vehicle that is turned off, the driver forgets to remove the child at the end of the trip and does not lock the doors initially, but rather locks the doors 30 seconds after door closure. To test this scenario the vehicle begins turned off and unlocked. The test driver then opens a rear door, and places a CPD dummy into a rear seat, enters the vehicle, and drives the vehicle. At the end of the trip the test driver parks the vehicle, exits the vehicle, leaves the CPD dummy in the vehicle, and waits 30 seconds before locking the vehicle.

Results: The Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, Ford Maverick, Cadillac CT5, and Nissan Rogue (“alert and horn” mode) performed as described in their owner’s manuals.

The Nissan Rogue (“alert only” mode) performed the same as it did in Test Drive 1, which is not as described in the owner’s manual.

All vehicles alerted during the final few steps of the test procedure.

Test Drive 3

This drive simulates a trip, starting with a locked vehicle that is turned off, where a child is in the rear seat of the vehicle and the driver stops in the middle of the trip for less than 10 minutes, such as for refueling, and the driver does not reopen a rear door during the stop. During the mid-trip stop, the UCRS alert is dismissed by the driver. The driver then continues the trip (within 10 mins) and then forgets to remove the child at the end of the trip. To test this scenario the vehicle begins turned off and locked. The test driver then unlocks the vehicle, opens a rear door, and places a CPD dummy into a rear seat, enters the vehicle, and drives the vehicle. Mid-trip the test driver parks the vehicle and turns the motor/engine off to simulate a fuel stop. During this stop the driver door is opened and closed, but no rear doors are opened. The stop lasts no more than 10 minutes before the test driver re-enters and continues the trip. At the end of the trip the test driver parks the vehicle, exits the vehicle, but does not remove the CPD dummy before locking the vehicle.

Results: The Honda Odyssey, Nissan Rogue (“alert and horn” mode), Honda Civic, Cadillac XT4, Chevrolet Equinox, Ford Maverick, Honda HR-V, Chevrolet Bolt, Subaru Forester, and Cadillac CT5 performed as described in their owner’s manuals. The Nissan Rogue (“alert only” mode) did not perform as described in their owner’s manuals. The Toyota Camry and the Hyundai Tucson owner’s manuals did not state that the reminder

system would be deactivated when the vehicle was turned off. However, when performing this test drive the system was deactivated at the mid-trip stop when the vehicle was turned off. This caused these vehicles to not alert at the end of the trip.

The Nissan Rogue (“alert only” mode) owner’s manual states this vehicle would alert when the driver first turns on the vehicle, when shifted to Park, and when the driver had exited the vehicle and closed the driver door. In the “alert only” mode, the vehicle displayed the alert when turned on at the beginning of the trip and when shifted to Park, but not when the vehicle was turned on the second time or when the driver exited the vehicle and shut the door. This owner’s manual did not state that the system would be disarmed if the vehicle was turned off and in testing it was not disarmed in both modes as at least one of the alerts described in the owner’s manual was received after the vehicle was turned off.

Although they performed as described in their owner’s manuals, the Honda Odyssey, Honda Civic, Cadillac XT4, Chevrolet Equinox, Honda HR-V, Chevrolet Bolt, and Cadillac XT5 did not alert to the CPD device that had been left in the vehicle at the end of the trip, which simulated a child being left in a vehicle, due to the vehicle being off at the mid-trip stop. All other vehicles alerted during the final few steps of the test procedure.

Test Drive 4

This drive simulates a trip, starting with a locked vehicle with no rear doors that is turned off, where the driver forgets to remove a child at the end of the trip and locks the vehicle.

To test this scenario the vehicle begins turned off and locked. The test driver then unlocks the vehicle and places a CPD dummy into a rear seat by moving a front row seat, enters the vehicle, and drives the vehicle. At the end of the trip the test driver parks the vehicle, exits the vehicle, but does not remove the CPD dummy before locking the vehicle. The driver does so by not repeating the actions needed to access the rear seat and CPD dummy (e.g., move driver’s or passenger’s seat) at the end of the trip.

Results: Drive 4 was not tested because two-door vehicles with indirect sensing were not identified.

Test Drive 5

This drive simulates a trip, starting with a locked vehicle that was turned off, where two children are in the rear seat at the beginning of the trip. One child exits the vehicle mid-trip while the vehicle remains on, and the trip continues. At the end of the trip the driver exits the vehicle and forgets the one remaining child before locking the vehicle.

To test this scenario the vehicle begins turned off and locked. The test driver then unlocks the vehicle, opens a rear door, and places two CPD dummies into the rear seats, enters the vehicle, and drives the vehicle. Mid-trip the test driver stops and removes one CPD dummy from the vehicle by exiting through the driver door and opening and closing a rear door. During this stop the vehicle is left running and sits idle until one CPD dummy has been removed and the test driver has re-entered the vehicle to resume the trip. At the end of the trip the test driver parks the vehicle, exits the vehicle, and does not remove the second CPD dummy before locking the vehicle.

Results: The Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, Ford Maverick, and Cadillac CT5 performed as described in their owner’s manuals.

The Nissan Rogue (“alert only” mode and “alert and horn” mode) did not perform as described in the owner’s manual. The owner’s manual states this vehicle would alert when the driver first turns on the vehicle, when shifted to Park, and when the driver had exited the vehicle and closed the driver door. However, in both modes the vehicle only alerted when the vehicle was turned on and when it was shifted to Park but not when the driver exited the vehicle and closed the door.

The Nissan Rogue in both modes also did not alert at the end of the trip to the CPD device that had been left in the vehicle at the end of the trip, which simulated a child being left in a vehicle, as expected by researchers. However, such an alert was not described in the owner’s manual as the vehicle had previously alerted to the presence of a child in the rear seat during the mid-trip stop. All other vehicles alerted during the final few steps of the test procedure.

Test Drive 6

This drive simulates a trip, starting with a locked vehicle that is turned off, where there is no child in the vehicle at the start of the trip. A child then enters the vehicle mid-trip while the vehicle remains running, and the trip continues. At the end of the trip the driver exits and forgets the child before locking the vehicle. To test this scenario the vehicle begins turned off and locked. The test driver then unlocks the vehicle, enters the vehicle, and drives the vehicle. Mid-trip the test driver stops, exits the vehicle, opens a rear door, and installs a CPD dummy into a rear seat. During this stop the motor/engine is left on and sits idle until the CPD dummy has been installed and the test driver has reentered the vehicle to resume the trip. At the end of the trip the test driver parks the vehicle, exits the vehicle, and does not remove the CPD dummy at the end of the trip before locking the vehicle.

Results: The Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Nissan Rogue (“alert and horn” mode), Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, Ford Maverick, and Cadillac CT5 performed as described in their owner’s manuals.

The Nissan Rogue (“alert only” mode) did not perform as described in its manual. The owner’s manual states this vehicle would alert when the driver first turns on the vehicle, when shifted to Park, and when they have exited the vehicle and closed the driver door. However, in the “alert only” mode, the vehicle only alerted when the vehicle was turned on and when it was shifted to Park but not when the driver exited the vehicle and closed the door.

All vehicles alerted during the final few steps of the test procedure.

Test Drive 7

This drive simulates a child gaining unmonitored access to a vehicle. To test this scenario the vehicle begins turned off and unlocked for at least 30 minutes. Any door on the vehicle is then opened, a CPD dummy is installed into the vehicle, and the door is closed.

Results: The Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Nissan Rogue (“alert only” mode and “alert and horn” mode), Toyota Camry, Honda HR-V, Cadillac XT4, Chevrolet Bolt, Ford Maverick, and Cadillac CT5 performed as described in their owner’s manuals.

The Subaru Forester’s owner’s manual did not mention that this vehicle needed to be turned on for the reminder system to be armed. However, during testing the vehicle did need to be turned on for the system to be armed.

None of the vehicles selected provided an alert during the final few steps of the test procedure.

Test Drive Results Summary

Throughout the test drives, several vehicles did not perform the alert in the manner described in the owner’s manual. More information about the owner’s manuals can be found in Appendix C (Test Drive Results). Vehicles that did not meet alert expectations throughout the various drives follow.

- Drive One – Nissan Rogue (“alert only” mode)
- Drive Two – Nissan Rogue (“alert only” mode)
- Drive Three – Nissan Rogue (“alert only” mode)
- Drive Four – Drive was not performed.
- Drive Five – Nissan Rogue (“alert only” mode and “horn and alert” mode)
- Drive Six – Nissan Rogue (“alert only” mode)
- Drive Seven – All vehicles performed as described in their owner’s manual.

Throughout the test drives several vehicles did not alert during the final few test procedure steps when the owner’s manual did not describe an alert would occur, these vehicles follow. More information can be found in Appendix C (Test Drive Results).

- Drive One – All vehicles alerted during the final few steps of the test procedure.
- Drive Two – All vehicles alerted during the final few steps of the test procedure.
- Drive Three – Honda Odyssey, Honda Civic, Toyota Camry, Cadillac XT4, Hyundai Tucson, Chevrolet Equinox, Honda HR-V, Chevrolet Bolt, and Cadillac CT5
- Drive Four – Drive was not performed.
- Drive Five – Nissan Rogue (“alert only” mode and “horn and alert” mode)
- Drive Six – All vehicles tested alerted to the CPD dummy left in the vehicle.
- Drive Seven – No vehicles alerted during the final few steps of the test procedure.

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Arming Timing

Along with performing these test drives, researchers attempted to replicate other aspects of the system performance described in the owner's manuals. One such aspect was the amount of time after a vehicle was started that the system could be armed. Many of the owner's manuals stated that they could be armed at any point while the vehicle was running.

To test this feature, the vehicles were started and left to idle for a chosen amount of time (30 or 60 minutes). Once this time had been reached, a rear door was opened and closed, and the vehicle was taken through the test drive 1 procedure. If the vehicle provided an alert consistent with the alert seen previously during testing, researchers determined that the vehicle could be armed after that waiting period between turning on the vehicle and operating the rear doors.

Researchers found that the reminder system was armed when a rear door was opened after 30 minutes after the vehicle is turned on in the Honda Civic, Honda Odyssey, Toyota Camry, Cadillac XT4, Nissan Rogue, Subaru Forester, Chevrolet Bolt, Honda HR-V, and after 60 minutes in the Honda Civic, Honda Odyssey, Toyota Camry, Nissan Rogue.

Auto Innovators Commitment

Not all vehicles selected for this study were listed in the 2022 and 2023 Auto Innovators heatstroke reports that detailed vehicles equipped with UCRS (Auto Innovators, 2022, 2023); and of the vehicles listed in the reports, not all conformed with the specifications in the Auto Innovators commitment agreement (AAM & AGA, 2019).

The commitment document states that systems in vehicles that appear in the 2022 and 2023 heatstroke reports⁴ shall "activate after the vehicle engine or motor is deactivated by the operator." However, in one vehicle, listed below, the alert was activated at a time other than engine or motor deactivation.

Nissan Rogue – Activates after the vehicle is placed in Park.

The commitment also states that vehicles that appear on the 2022 and 2023 heatstroke reports⁵ shall feature a distinct combination of auditory alert and visual alert. All vehicles had a distinct visual and auditory alert combination; however, the auditory alerts alone were not distinct⁶ in the following vehicles.

Honda Civic – Alert sounds like auditory alerts at start-up for "maintenance due."

Honda Odyssey, Nissan Rogue, Toyota Camry, Honda HR-V – Alert sounds like the seatbelt auditory alert.

Cadillac XT4, Cadillac CT5 – Alert sounds like auditory alert when vehicle is placed in Park.

⁴ All vehicles selected appeared in the 2022 and 2023 heatstroke reports except the Subaru Forester and the Chevrolet Bolt.

⁵ *ibid.*

⁶ For the purpose of this research report, NHTSA understands a "distinct" auditory alert to be an alert that is discriminable from other auditory signals used by that vehicle.

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Alert Characteristics Considerations

For the purposes of this research study, NHTSA researchers formulated a list of criteria to compare the alert characteristics present in the selected vehicles. These criteria were developed in part from previous NHTSA human factors research activities and best practices, including *Human Factors Design Guidance for Driver-Vehicle Interfaces* (Campbell et al., 2016) as well as existing criteria for indirect sensing CPD systems, including the Euro NCAP (2022) *Test and Assessment Protocol – Child Presence Detection*. Without such criteria, it would be difficult to compare alerts between vehicles. NHTSA developed these alert criteria to enable comparison between existing systems for research purposes, and not to evaluate whether systems are effective at addressing PVH.

Alert Criteria Summaries and Results

The alert criteria were developed and sorted into three sections: (1) unattended child reminder system alerts, (2) temporary deactivation (no UCRS alerts for the current trip), and (3) long-term deactivation (no UCRS alerts for current and future trips). For purposes of the present characterization effort, the UCRS alerts section below describes criteria for delivering alerts to an occupant in the driver’s seat. This includes the visual and auditory components of the message presented to a driver, as well as the timing and duration of messages. The temporary deactivation and long-term deactivation sections describe the process for temporary and long-term deactivation of UCRS alerts, the way these options are presented to a driver, and the ways in which the deactivation status of is shown to the driver.

Each of the selected vehicles was taken through the 7 test drives described in the previous section. During these drives, the auditory and visual alerts of each vehicle were documented including the language of the visual alert message, length of time the visual alert is displayed, the length of time the auditory alert is heard, the tone of the auditory alert, and options presented to the driver. The documented alert characteristics were then compared to the criteria developed by NHTSA. The entire alert criteria data matrix can be found in Appendix D (Alert Criteria Data Matrix). An additional description of the wording of the alerts, arming and alert timing, and the options for temporary deactivation presented to the driver seen in the selected vehicles can be found in Appendix E (Alert Descriptions).

UCRS Alerts

Criterion 1: The auditory and visual alerts initiate concurrently at a time no earlier than engine/motor off and no later than driver door unlatching/opening.

Results: In the Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, Ford Maverick, and Cadillac CT5, auditory and visual alerts initiated concurrently at a time no earlier than engine/motor off, therefore meeting criterion one.

The Nissan Rogue (“alert only” mode and “alert and horn” mode) did not meet this criterion because the alerts received by the driver when the vehicle is turned on, parked, and at driver exit are not in the window of engine/motor off and driver door unlatching/opening.

Criterion 2: The auditory alert is clearly perceptible and distinct from other auditory alerts used in the vehicle.

Results: Only the Hyundai Tucson, Chevrolet Equinox, and Ford Maverick had auditory alerts that were clearly perceptible and distinct from other auditory alerts used in the vehicle.

The Honda Civic did not meet this criterion because the unattended child reminder alerts were the same tone as the “maintenance due” tone. The Honda Odyssey, Nissan Rogue (“alert only” mode and “alert and horn” mode), Toyota Camry, Honda HR-V, and Subaru Forester did not meet this criterion because the unattended child reminder alerts were the same tone as the seatbelt reminder tone. The Cadillac XT4, Chevrolet Bolt, and Cadillac CT5 did not meet this criterion because the unattended child reminder alerts were the same tone as the tone when the vehicle is shifted into Park.

Criterion 3: The visual alert is to be located so that, when activated, they are visible to an occupant in the driver’s seat.

Results: In all the vehicles tested the visual alert of the UCRS was located on the instrument panel and/or on the audio/information screen where it was visible to an occupant seated in the driver’s seat.

Criterion 4: The visual alert provides an unambiguous message to check rear seating positions.⁷

Results: The Ford Maverik, Nissan Rogue (“alert only” mode and “alert and horn” mode), Cadillac XT4, Chevrolet Equinox, Subaru Forester, Chevrolet Bolt, and Cadillac CT5 provided specific information in the reminder message.

The Hyundai Tucson, Toyota Camry, Honda Civic, and Honda HR-V stated, “check rear seat(s)”⁸. Some included a graphic of rear seats highlighted. The Honda Odyssey had the same “Check Rear Seats” message, however it also provided a live video of the third row.

The language of the reminder message in each of the selected vehicles can be found in Appendix E (Alert Descriptions).

Criterion 5: The visual alert persists indefinitely until the driver door is opened, and then for a minimum of 30 additional seconds after the driver door has been opened. However, the visual alert may be cancelled at any point in this sequence if a rear door is opened.

Results: The Nissan Rogue (“horn and alert” mode) had a visual alert that lasted indefinitely before the driver door was opened, then lasted 70 seconds after. Therefore, this vehicle meets criterion 5.

The Honda Odyssey Touring, Nissan Rogue (“alert only” mode), Honda Civic, Cadillac XT4, Chevrolet Equinox, Ford Maverick, Honda HR-V, Chevrolet Bolt, Subaru Forester, Cadillac CT5, Toyota Camry, and Hyundai Tucson do not have a visual alert that persists indefinitely until a driver door was opened, and then for a minimum of 30 seconds afterwards. Thus, these vehicles do not meet criterion 5. The length the visual alerts are

⁷ For the purposes of this report, NHTSA did not determine if vehicles met or did not meet this criterion but provided the language of the alerts for informational purposes.

⁸ The message “check rear seat(s)” could convey a mechanical issue with the rear seats that needs to be checked instead of following the intent of being a reminder message.

displayed for can be found within Appendix D (Alert Criteria Data Matrix) and Appendix E (Alert Descriptions).

The time the reminder message displayed for each vehicle can be found in Appendix D (Alert Criteria Data Matrix).⁹

Temporary Deactivation

Criteria 6 to 8 are adapted from Euro NCAP's (2022) *Test and Assessment Protocol – Child Presence Detection*, section 3.3.6.1.

Criterion 6: Temporary deactivation¹⁰ for the remainder of the trip is more complicated than a short push of a button to avoid deactivating the reminder system inadvertently.

Results: Only two vehicles contained temporary deactivation options for the reminder system, the Nissan Rogue and Hyundai Tucson. In the Nissan Rogue (“alert only” mode and “alert and horn” mode) temporary deactivation was more complicated (moving a cursor using a scroll-wheel and pushing a button) than a short push of a button, therefore meeting criterion 6.

The Hyundai Tucson did not meet this criterion because disabling the second alert is the only option presented when the first message appears and is done with one push of a button.



Figure 3. Nissan Rogue dismissal and temporary deactivation of the alert system

⁹ Researchers did not test if vehicles would end the visual alert before the specified time limit if a rear door had been opened, as the focus of this study was a child occupant forgotten in a vehicle or unmonitored access to a vehicle where a rear door would not be opened.

¹⁰ For the purposes of this study, temporary deactivation was defined to be the option to disable a secondary reminder alert when presented with an earlier reminder alert.

Criterion 7: Temporary deactivation is a different process than that required for delay and cancellation of an alert.

Results: Only two vehicles contained temporary deactivation options for the reminder system, the Nissan Rogue (“alert only” mode and “alert and horn” mode) and Hyundai Tucson. The Hyundai Tucson did not have a process to delay a reminder alert and therefore was not evaluated for this criterion. The Nissan Rogue (both modes) featured a different process to delay and cancel the alert and therefore met this criterion.

Criterion 8: If a reminder system has been temporarily deactivated, the inactive status of the reminder system must be indicated by a dedicated telltale that is compliant with 49 CFR § 571.101 – Standard No. 101; Controls and displays.

Results: Only two vehicles contained temporary deactivation options for the reminder system, the Nissan Rogue (“alert only” mode and “alert and horn” mode) and Hyundai Tucson. Neither vehicle with this option met criterion 8 because neither vehicle had a dedicated telltale for temporary deactivation of the UCRS.

Long-Term Deactivation

Criteria 9 to 12 are adapted from Euro NCAP’s (2022) *Test and Assessment Protocol – Child Presence Detection*, section 3.3.6.2.

Criterion 9: Long-term deactivation is more complicated than a short push of a button to avoid deactivating the reminder system inadvertently.

Results: In all vehicles tested, long-term deactivation of the reminder system was more complicated than a short push of a button to avoid deactivating the system inadvertently, therefore meeting criterion 9.

Criterion 10: Long-term deactivation is a different process than that required for delay and cancellation of an alert.

Results: In all vehicles tested, long-term deactivation of the reminder system was a different process than that required for delay and cancellation of an alert, therefore meeting criterion 10.

Criterion 11: An option to reactivate the reminder system by the driver is offered.

Results: All vehicles tested had the option available to the user to re-enable the alerts. However, only the Ford Maverick displayed a message every 6 months reminding users the system was disabled and offering them the option to reactivate the UCRS.

Criterion 12: If a reminder system has been deactivated, the inactive status of the reminder system is indicated by a dedicated telltale that is compliant with 49 CFR § 571.101.

Results: All vehicles tested did not meet criterion 12 because they do not have a dedicated telltale for long-term deactivation of the reminder system.

Alert Criteria Results Summary

Throughout the study several vehicles did not meet the alert considerations in the set criteria. More information about criterion testing can be found below and in Appendix D (Alert Criteria Data Matrix). Vehicles that did not meet alert considerations throughout testing:

- Criterion 1 - Nissan Rogue (“alert only” mode and “alert and horn” mode)
- Criterion 2 - Honda Civic, Honda Odyssey, Nissan Rogue (both modes), Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, and Cadillac CT5
- Criterion 3 - All vehicles tested met this criterion.
- Criterion 4 - NHTSA did not determine if vehicles met or did not meet this criterion.
- Criterion 5 - Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Nissan Rogue (“alert only” mode), Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, Ford Maverick, and Cadillac CT5
- Criterion 6 - Hyundai Tucson¹¹
- Criterion 7 - All vehicles tested met this criterion.¹²
- Criterion 8 - Nissan Rogue (both modes) and Hyundai Tucson¹³
- Criterion 9 - All vehicles tested met this criterion.
- Criterion 10 - All vehicles tested met this criterion.
- Criterion 11 - Honda Civic, Hyundai Tucson, Chevrolet Equinox, Honda Odyssey, Nissan Rogue (both modes), Toyota Camry, Honda HR-V, Subaru Forester, Cadillac XT4, Chevrolet Bolt, and Cadillac CT5
- Criterion 12 - No vehicles tested met this criterion.

¹¹ Only the Nissan Rogue and Hyundai Tucson were evaluated for this criterion.

¹² Only the Nissan Rogue was evaluated for this criterion.

¹³ Only the Nissan Rogue and Hyundai Tucson were evaluated for this criterion.

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Conclusions

The most common OEM system seen on the U.S. market in summer 2023 are rear-door-logic based systems; therefore, these systems were the focus of this study. To assess these reminder systems capabilities at alerting to the detected or inferred presence of a child, test procedures that represent some common situations that may lead to children left unattended in the vehicle were developed. The procedures, found in Appendix B (Test Drive Procedures), can be applied to UCRS that use direct sensing or indirect sensing.

The 12 vehicles in this study were selected based on the availability of rear-door-logic based systems in summer 2023 and were evaluated using the test drive procedures. A variety of alerts were observed in the vehicles tested, as summarized in Appendix E (Alert Descriptions). Some vehicles displayed the visual alert when the vehicle transmission was put in Park, or when the driver door was opened instead of engine deactivation. However, 10 of the 13 vehicles only alerted the first time the vehicle was turned off after the system had been armed. The occurrence of alerts during the test drives are listed in Appendix C (Test Drive Results). These occurrences were inconsistent with the owner's manuals in 6 of the 78 tests performed, as noted in the test drive results.

There were also scenarios that tested the UCRS outside of the capabilities described in the owner's manual, but still left a child unattended in the vehicle at the end of a trip. In 24 out of 74 tests, the vehicle did not alert to an unattended child in the vehicle at the end of a trip in situations where the owner's manual did not state that an alert would happen. Two of these scenarios occurred when one child exited mid-trip (drive 5), 9 occurred during the test drive that simulated a vehicle being turned off at a fuel stop (drive 3), and 13 occurred in the gained access scenario (drive 7).

Outside of these test drive procedures, a set of alert criteria were developed to compare the characteristics of the alerts received throughout testing. These criteria covered three main sections, UCRS alerts, temporary deactivation, and long-term deactivation. The alert criteria and whether each of these vehicles' alerts met them can be found in Appendix D (Alert Criteria Data Matrix). Most of the vehicles met at least 3 of the 5 criteria under the UCRS alerts. However, 9 vehicles did not have auditory alerts that were distinct from other alerts in that vehicle. In these vehicles the auditory alerts were the same as the alert for other reminders such as maintenance or the seatbelt, while others were like everyday functions such as the sound heard when the vehicle was shifted to Park. For the temporary deactivation section, only 3 vehicles could be evaluated as many did not have this feature. All vehicles did not have a dedicated telltale stating the status of the temporary deactivation feature. In the long-term deactivation section, all vehicles met at least 2 criteria. All vehicles except the Ford Maverick did not offer a reminder message to reactivate the system. No vehicles had a dedicated telltale stating the status of the long-term deactivation feature.

Overall, this study showed there was no commonality between when an alert was received, if the auditory tone associated with the alert was distinct from other auditory tones, the language of the visual alerts, and if the vehicle was equipped to alert after a mid-journey stop. However, one commonality among the vehicles was the inability to alert to a child who gained access to an unmonitored vehicle.

This report focuses exclusively on rear-door-logic based approaches, while NHTSA continues to identify and test vehicles equipped with direct sensing systems as they are introduced to the market.

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¹⁴ On January 8, 2020, the Alliance of Automobile Manufacturers, Inc., & Association of Global Automakers, Inc., announced they were merging to become the Alliance for Automotive Innovation.

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Appendix A. Owner's Manual Information

Hyundai Tucson

Rear Occupant Alert (ROA) (if equipped)

Rear Occupant Alert is provided to prevent a driver from leaving a vehicle with a rear passenger left in the vehicle.

System setting

To use Rear Occupant Alert, it must be enabled from the Settings menu in the infotainment system screen. Select:

- Setup → Vehicle Settings → Convenience → Rear Occupant Alert

For more details, refer to the separately supplied Infotainment manual with your vehicle.

System operation

- **First alert**
When you turn off the engine and open the driver's door after opening and closing the rear door or liftgate, the 'Check rear seats' warning message appears on the cluster.
- **Second alert**
After the first alert, the second alert operates when any movement is detected in the vehicle after the driver's door is closed and all the doors are locked. The horn will sound for approximately 25 seconds. If the system continues to detect a movement, the alert operates up to 8 times.
Unlock the doors with the smart key to stop the alert.
- The system detects movement in the vehicle for 8 hours after the door is locked.
- The second alert is activated only after the prior activation of the first alert.

System precautions

- Make sure that all the windows are closed. If the window is open, the alert may operate by the sensor detecting an unintended movement (for example, wind or bugs).



If you do not want to use Rear Occupant Alert, press the OK button on the steering wheel when the first alert is displayed on the cluster. Doing so will deactivate the second alert one time.

- An alert can occur if there is an impact on the roof.
- If boxes or objects are stacked in the vehicle, the system may not detect the boxes or objects. Or, the alert may operate if the boxes or objects fall off.
- The sensor may not operate normally if the sensor is blocked with foreign substances.
- The alert may operate if movement in the driver or passenger seat is detected.
- The alert may operate with the doors locked due to car wash or surrounding vibration or noise.
- If the vehicle is started remotely (if equipped with Remote Start), inside movement detection will stop.
- When the scheduled ventilation function is in operation, inside movement detection will stop.

Figure A-1. Hyundai Tucson owner's manual

WARNING

Even if your vehicle is equipped with Rear Occupant Alert, always make sure to check the rear seat before you leave the vehicle.

Rear Occupant Alert may not operate when:

- Movement does not continue for a certain period of time or the movement is small.
- The rear passenger is covered with an object such as a blanket.
- Always be cautious of the passenger's safety as the detection function and second alert may not operate depending on the surrounding environment and certain conditions.

Figure A-2. Hyundai Tucson owner's manual

Cadillac XT4

Rear Seat Reminder

If equipped, the message REAR SEAT REMINDER LOOK IN REAR SEAT displays under certain conditions indicating there may be an item or passenger in the rear seat. Check before exiting the vehicle.

This feature will activate when a second row door is opened while the vehicle is on or up to 10 minutes before the vehicle is turned on. There will be an alert when the vehicle is turned off. The alert does not directly detect objects in the rear seat; instead, under certain conditions, it detects when a rear door is opened and closed, indicating that there may be something in the rear seat.

The feature is active only once each time the vehicle is turned on and off, and will require reactivation by opening and closing the second row doors. There may be an alert even when there is nothing in the rear seat; for example, if a child entered the vehicle through the rear door and left the vehicle without the vehicle being shut off.

The feature can be turned on or off.

Figure A-3. Cadillac XT4 owner's manual

Toyota Camry

■ Rear seat reminder function

In order to remind you not to forget luggage, etc. in the rear seat, when the engine switch is turned off after any of the following conditions are met, a buzzer will sound and a message will be displayed on the multi-information display for approximately 6 seconds.

- The engine is started within 10 minutes after opening and closing a rear door.
- A rear door has been opened and closed after the engine was started.

However, if a rear door is opened and then closed within approximately 2 seconds, the rear seat reminder function may not operate.

The rear seat reminder function determines that luggage, etc. has been placed in a rear seat based on opening and closing of a rear door. Therefore, depending on the situation, the rear seat reminder function may not operate and you may still forget luggage, etc. in the rear seat, or it may operate unnecessarily.

Figure A-4. Toyota Camry owner's manual

Chevrolet Equinox

Rear Seat Reminder

If equipped, the message REAR SEAT REMINDER LOOK IN REAR SEAT displays under certain conditions indicating there may be an item or passenger in the rear seat. Check before exiting the vehicle.

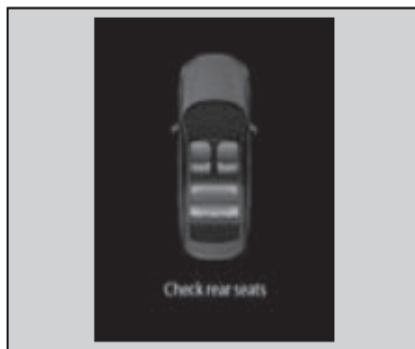
This feature will activate when a second row door is opened while the vehicle is on or up to 10 minutes before the vehicle is turned on. There will be an alert when the vehicle is turned off. The alert does not directly detect objects in the rear seat; instead, under certain conditions, it detects when a rear door is opened and closed, indicating that there may be something in the rear seat.

The feature is active only once each time the vehicle is turned on and off, and will require reactivation by opening and closing the second row doors. There may be an alert even when there is nothing in the rear seat; for example, if a child entered the vehicle through the rear door and left the vehicle without the vehicle being shut off.

Figure A-5. Chevrolet Equinox owner's manual

Honda Civic

This feature alerts you to the possible presence of passengers or items in the rear seats before you exit the vehicle. It activates when the power mode is set to VEHICLE OFF if the rear doors were opened shortly before or after the power mode was set to ON.



A reminder appears on the driver information interface and an alert will sound when the power mode is set to VEHICLE OFF.

Figure A-6. Honda Civic owner's manual

When the power mode is set to VEHICLE OFF, the reminder comes on briefly, then the function is deactivated.

The reminder will not work if the power mode has not been set to ON within 10 minutes of operating the rear doors.

The system does not detect passengers in the rear seats. Instead, it can detect when a rear door is opened and closed, indicating that there may be something in the rear seats.

Figure A-7. Honda Civic owner's manual

Nissan Rogue

The Rear Door Alert system functions under certain conditions to indicate there may be an object or passenger in the rear seat(s). Check the seat(s) before exiting the vehicle.

The Rear Door Alert system is initially disabled. The driver can enable the system using the vehicle information display. (See "Vehicle Settings" (P.2-28).)


When the system is enabled:

- The system is activated when a rear door is opened and closed. When the vehicle is started and the system is activated, a visual message appears in the vehicle information display. (See "31. Rear Door Alert is activated indicator" (P.2-38).)
- If a rear door is opened and closed but the vehicle is not driven, the system will not be activated. A rear door must be opened and closed and the car driven for the system to activate.
- The time interval to activate the system between when the rear door is opened and closed and the vehicle is started is about 10 minutes. A longer interval does not indicate a malfunction.

When the Rear Door Alert system is activated:

- When the driver puts the vehicle in the P (Park) position, a notification message appears in the vehicle information display with the options to "Dismiss Message" or "Disable Alert" if desired.
 - Select "Disable Alert" to temporarily disable for that stop.
 - No selection or "Dismiss Message" will keep the alert enabled for that stop.
- If the alert is enabled when a driver exits the vehicle, a message will appear in the vehicle information display that states "Check Rear Seat for All Articles."
 - If "Horn & Alert" setting is selected:
 - An audible horn sound will occur after a short time unless a rear door is opened and closed within a short time to deactivate the alert.
 - If the doors are locked before the alert is deactivated by opening a rear door, the horn will sound.
 - If the liftgate is opened before a rear door is opened, the horn will be delayed until after the liftgate is closed.

Figure A-8. Nissan Rogue owner's manual

 **WARNING**

- If the driver selects "Disable Alert", no audible alert will be provided regardless of rear door open/close status.
- There may be times when there is an object or passenger in the rear seat(s) but the audible alert does not sound. For example, this may occur if rear seat passengers enter or exit the vehicle during a trip.
- The system does not directly detect objects or passengers in the rear seat(s). Instead, it can detect when a rear door is opened and closed, indicating that there may be something in the rear seat(s).

NOTE:
There may be times when the horn sounds but there are no objects or passengers in the rear seat(s).

NOTE:
If "Alert Only" setting is selected, the message alert will still be shown in the vehicle information display but the horn will not sound.


Figure A-9. Hyundai Tucson owner's manual

31. Rear Door Alert is activated indicator

When the system is enabled, this message appears when the Rear Door Alert system is active and can remind the driver to check the rear seat.

- Using the steering switch, the driver can select "Dismiss Message" to clear the display for a period of time.
- Using the steering switch, the driver can select "Disable Alert" to disable the horn alert for the remainder of the current trip.

For additional information, see "Rear Door Alert" (P.2-68).

 **WARNING**

Selecting "Dismiss Message" during a stop within a trip temporarily dismisses the message for that stop without turning the system off.

Figure A-10. Nissan Rogue owner's manual

Alerts can be provided for other stops during the trip. Selecting "Disable Alert" turns off the Rear Door Alert system for the remainder of a trip and no audible alert will be provided.

NOTE:

This system is disabled until the driver enables it using the settings menu. See "Vehicle Settings" (P.2-28).

32. Check Rear Seat For all articles indicator

When the system is enabled, this message appears when the vehicle comes to a complete stop, the shift position is placed from the D (Drive) to P (Park), and the driver exits the vehicle. This message alerts the driver, after a period of time, to check for items in the rear seat after the audible alert has been provided.

NOTE:

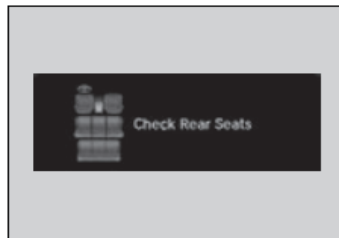
This system is disabled until the driver enables it using the settings menu. See "Vehicle Settings" (P.2-28).

Figure A-11. Nissan Rogue owner's manual

Honda Odyssey

Rear Seat Reminder

This feature alerts you to the possible presence of passengers or items in the second row or third row seats before you exit the vehicle. It activates when the vehicle is set to VEHICLE OFF if the rear doors were opened shortly before or after the vehicle was set to ON.



A reminder appears on the driver information interface and an alert will sound when the power mode is set to VEHICLE OFF.



A reminder appears on the audio/information screen when the power mode is set to VEHICLE OFF. To dismiss the notification, select **Dismiss**.

Figure A-12. Honda Odyssey owner's manual

▶ Rear Seat Reminder

When the power mode is set to VEHICLE OFF, the reminder comes on briefly, then the function is deactivated.

The reminder will not work if the power mode has not been set to ON within 10 minutes of operating the rear doors.

The system does not detect passengers in the rear seat(s). Instead, it can detect when a rear door is opened and closed, indicating that there may be something in the rear seat(s).

Figure A-13. Honda Odyssey owner's manual

Subaru Forester

This function prompts the driver to confirm the presence of passengers and cargo in the rear.

This function will be activated when the rear doors are opened and closed.

It alerts the driver by warning messages on the display and beeps when the ignition switch is in the OFF position.



NOTE

- This function does not directly detect passengers and cargo in the rear seat.
- This function detects the opening and closing of the rear doors. In this situation, there is the possibility that the following phenomenon may occur.
 - It may alert the driver even if there are no passengers or cargo in the rear seat.
 - It may not alert the driver even if there are passengers and cargo in the rear seat.
- This function can be turned ON/OFF using the meter customizing function. Refer to "Function settings and adjustments on the combination meter display (color LCD)" ⇨ P26.
- The ON/OFF setting will not be changed even if the ignition switch is turned to the OFF position.
- The ON/OFF setting will be returned to the default setting if the battery is removed.

Figure A-14. Subaru Forester owner's manual

Ford Maverick

The system monitors when rear doors have been opened and closed to indicate the potential presence of an occupant in the rear seat.

A message displays in the information and entertainment display screen and an audible warning sounds when you switch the ignition off after any of the following conditions have been met:

- A rear door is opened or closed while the ignition is on.
- You switch the ignition on within 15 minutes of a rear door opening and closing.
- You switch the ignition on within 15 minutes of the alert having displayed or sounded.

The system does not function if any door is removed.

The system does not detect the presence of objects or passengers in the rear seat. It monitors when rear doors are opened and closed.

Note: It is possible to receive an alert when there is no rear seat occupant, but alert conditions are met.

Note: It is possible to receive no alert when there is an occupant in the rear seat, if alert conditions are not met. For example, if a rear seat occupant does not enter the vehicle through a rear door.

Note: The audible warning does not sound when the front door is opened before you switch the ignition off.

The rear occupant alert system monitors vehicle conditions and notifies you to check for rear seat occupants when you switch the ignition off.

When you switch the system off, a message appears every six months as a reminder that the system is off. You can switch the system back on or leave it off.

REAR OCCUPANT ALERT SYSTEM AUDIBLE WARNINGS

Sounds when you switch your vehicle off after the alert conditions are met.

The warning sounds for a short period of time.

Figure A-15. Ford Maverick owner's manual

REAR OCCUPANT ALERT SYSTEM INDICATORS



Message
Check rear seats for occupants.

Displays when you switch your vehicle off after the alert conditions are met.

The message displays for a short period of time. Press **Close** to acknowledge and remove the message.

Note: Depending on your SYNC version, the graphic may look different from what you see here.

Figure A-16. Ford Maverick owner's manual

Chevrolet Bolt

Rear Seat Reminder

If equipped, the message REAR SEAT REMINDER LOOK IN REAR SEAT displays under certain conditions indicating there may be an item or passenger in the rear seat. Check before exiting the vehicle.

This feature will activate when a second row door is opened while the vehicle is on or up to 10 minutes before the vehicle is turned on, including if the vehicle was started remotely. There will be an alert when the vehicle is turned off. The alert does not directly detect objects in the rear seat; instead, under certain conditions, it detects when a rear door is opened and closed, indicating that there may be something in the rear seat.

The feature is active only once each time the vehicle is turned on and off, and will require reactivation by opening and closing the second row doors. There may be an alert even when there is nothing in the rear seat; for example, if a child entered the vehicle through the rear door and left the vehicle without the vehicle being shut off.

Figure A-17. Chevrolet Bolt owner's manual

Honda HR-V

This feature alerts you to the possible presence of passengers or items in the rear seats before you exit the vehicle. It activates when the power mode is set to VEHICLE OFF if the rear doors were opened shortly before or after the power mode was set to ON.



A reminder appears on the driver information interface and an alert will sound when the power mode is set to VEHICLE OFF.

Figure A-18. Honda HR-V owner's manual

When the power mode is set to VEHICLE OFF, the reminder comes on briefly, then the function is deactivated.

The reminder will not work if the power mode has not been set to ON within 10 minutes of operating the rear doors.

The system does not detect passengers in the rear seats. Instead, it can detect when a rear door is opened and closed, indicating that there may be something in the rear seats.

Figure A-19. Honda HR-V owner's manual

Cadillac CT5

Rear Seat Reminder

If equipped, the message REAR SEAT REMINDER LOOK IN REAR SEAT displays under certain conditions indicating there may be an item or passenger in the rear seat. Check before exiting the vehicle.

This feature will activate when a second row door is opened while the vehicle is on or up to 10 minutes before the vehicle is turned on. There will be an alert when the vehicle is turned off. The alert does not directly detect objects in the rear seat; instead, under certain conditions, it detects when a rear door is opened and closed, indicating that there may be something in the rear seat.

The feature is active only once each time the vehicle is turned on and off, and will require reactivation by opening and closing the second row doors. There may be an alert even when there is nothing in the rear seat; for example, if a child entered the vehicle through the rear door and left the vehicle without the vehicle being shut off.

Figure A-20. Cadillac CT5 owner's manual

Appendix B. Test Drive Procedures

Test Drive 1

This drive simulates starting with a locked vehicle that is turned off, the driver forgets to remove the child at the end of the trip and does not lock the doors initially, but rather locks the doors 30 seconds after door closure.

1. Verify reminder system is installed and active per manufactures instructions in owner's manual
2. Does system work with smart phone application?
 - Yes
 - Confirm system is communicating with phone app. The app should be running with the screen turned off.
 - No

3. Vehicle should be locked and parked in an open space with at least 100ft clearance from any building or other vehicles.

Note surroundings (other vehicles, open fields, gravel, blacktop, etc.):

4. Unlock the car
5. Open any rear door to install CRS in any rear seat and put child dummy in CRS.
6. Close the rear door.
7. Within 2 minutes, open and enter through the driver door
8. Close the driver door
9. Turn the vehicle on, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received
10. Proceed with driving the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.
 11. Stop the vehicle, place the vehicle in Park, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

12. Turn off the vehicle, wait 30 seconds

- Alert was received
- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

13. Open the driver door, wait 30 seconds

- Alert was received
- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

14. Exit the vehicle and close the driver door and leave the doors unlocked, wait 30 seconds

- Alert was received
- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

15. Lock all doors, walk at least 20 ft away from vehicle, wait 15 minutes

- Alert was received
- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

Alert was not received

Note any other observations – (environment, alert delay, etc.):

Test Drive 2

This drive simulates starting with an unlocked vehicle that is turned off, the driver forgets to remove the child at the end of the trip and does not lock the doors initially, but rather locks the doors 30 seconds after door closure.

1. Verify reminder system is installed and active per manufactures instructions in owner's manual
2. Does system work with smart phone application?
 - Yes
 - Confirm system is communicating with phone app. The app should be running with the screen turned off.
 - No

3. Vehicle should be unlocked and parked in an open space with at least 100ft clearance from any building or other vehicles.

Note surroundings (other vehicles, open fields, gravel, blacktop, etc.):

4. Open any rear door to install CRS in any rear seat and put child dummy in CRS.
5. Close the rear door.
6. Within 2 minutes, open and enter through the driver door
7. Close the driver door
8. Turn the vehicle on, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received
9. Proceed with driving the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.
 10. Stop the vehicle, place the vehicle in Park.
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

11. Turn off the vehicle, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

12. Open the driver door, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

13. Exit the vehicle and close the driver door and leave the doors unlocked, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

14. Lock all doors, walk at least 20 ft away from vehicle, wait 15 minutes

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

Alert was not received

Note any other observations – (environment, alert delay, etc.):

Test Drive 3

This drive simulates a trip, starting with a locked vehicle that is turned off, where a child is in the rear seat of the vehicle and the driver stops in the middle of the trip for less than 10 minutes, such as for refueling, and the driver does not reopen a rear door during the stop. During the mid-trip stop, the UCRS alert is dismissed by the driver. The driver then continues the trip (within 10 mins) and then forgets to remove the child at the end of the trip.

1. Verify reminder system is installed and active per manufactures instructions in owner's manual
2. Does system work with smart phone application?
 - Yes
 - Confirm system is communicating with phone app. The app should be running with the screen turned off.
 - No

3. Vehicle should be locked and parked in an open space with at least 100ft clearance from any building or other vehicles.

Note surroundings (other vehicles, open fields, gravel, blacktop, etc.):

4. Unlock the car
5. Open any rear door to install CRS in any rear seat and put child dummy in CRS.
6. Close rear door.
7. Within 2 minutes, open and enter the driver door
8. Close the driver door
9. Turn the vehicle on, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received
10. Proceed with driving the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.

11. Stop the vehicle, place the vehicle in Park, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

12. Turn off the vehicle, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

13. Open the driver door, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

14. Exit the vehicle and close the driver door and leave the doors unlocked, wait 10 minutes

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

15. After Waiting 10 minutes (Replicate fueling stop)

16. Open and enter the driver door

17. Close the driver door

18. Turn the vehicle on, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

19. Proceed with driving the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.

20. Stop the vehicle, place the vehicle in Park, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

21. Turn off vehicle, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

22. Open the driver door, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

Alert was not received

23. Exit the vehicle and close the driver door and leave the doors unlocked, wait 30 seconds

Alert was received

- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
- Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
- Audible Alert from Phone
- Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

Alert was not received

24. Lock all doors, walk at least 20 ft away from vehicle, wait 15 minutes

Alert was received

- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
- Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
- Audible Alert from Phone
- Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

Alert was not received

Note any other observations – (environment, alert delay, etc.):

Test Drive 4

This drive simulates a trip, starting with a locked vehicle with no rear doors that is turned off, where the driver forgets to remove a child at the end of the trip and locks the vehicle.

1. Verify reminder system is installed and active per manufactures instructions in owner's manual
2. Does system work with smart phone application?
 - Yes
 - Confirm system is communicating with phone app. The app should be running with the screen turned off.
 - No
3. Vehicle should be locked and parked in an open space with at least 100ft clearance from any building or other vehicles.

Note surroundings (other vehicles, open fields, gravel, blacktop, etc.):

4. Unlock the vehicle
5. Open any door, moving the front row seat to access the rear seat, install CRS in any rear seat and put the child dummy in.
6. Close the door.
7. Within 2 minutes, open and enter through the driver door
8. Close the driver door
9. Turn the vehicle on, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received
10. Proceed with drive the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.
 11. Stop the vehicle, place the vehicle in Park, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

12. Turn off the vehicle, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

13. Open the driver door, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

14. Exit the vehicle and close the driver door and leave the doors unlocked, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

15. Lock all doors, walk at least 20 ft away from vehicle, wait 15 minutes

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

Note any other observations – (environment, alert delay, etc.):

Test Drive 5

This drive simulates a trip, starting with a locked vehicle that is turned off, where two children are in the rear seat at the beginning of the trip. One child exits the vehicle mid-trip while the vehicle remains on, and the trip continues. At the end of the trip the driver exits the vehicle and forgets the one remaining child before locking the vehicle.

1. Verify reminder system is installed and active per manufactures instructions in owner's manual
2. Does system work with smart phone application?
 - Yes
 - Confirm system is communicating with phone app. The app should be running with the screen turned off.
 - No
3. Vehicle should be locked and parked in an open space with at least 100ft clearance from any building or other vehicles.

Note surroundings (other vehicles, open fields, gravel, blacktop, etc.):

4. Unlock the vehicle
5. Open any rear door to install two CRS in any two rear seats and put two child dummies in
6. Close the rear door
7. Within 2 minutes, open and enter through the driver door
8. Close the driver door
9. Turn the vehicle on, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received
10. Proceed with driving the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.
 11. Stop vehicle, place vehicle in Park, leave the vehicle on (running), wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

12. Open the driver door, wait 30 seconds

- Alert was received

- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
- Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
- Audible Alert from Phone
- Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

13. Exit the vehicle and open any door adjacent to where a child dummy was placed. Remove one child dummy from the vehicle and close the rear door.

14. Reenter the vehicle through the driver door, shut the driver door and proceed to drive the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.

15. Stop the vehicle, place the vehicle in Park, wait 30 seconds

- Alert was received

- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
- Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
- Audible Alert from Phone
- Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

16. Turn off the vehicle, wait 30 seconds

- Alert was received

- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
- Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
- Audible Alert from Phone
- Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

17. Open the driver door, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

18. Exit the vehicle and close the driver door and leave the doors unlocked, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

19. Lock all doors, walk at least 20 ft away from vehicle, wait 15 minutes

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

Note any other observations – (environment, alert delay, etc.):

Test Drive 6

This drive simulates a trip, starting with a locked vehicle that is turned off, where there is no child in the vehicle at the start of the trip. A child then enters the vehicle mid-trip while the vehicle remains on, and the trip continues. At the end of the trip the driver exits and forgets the child before locking the vehicle.

1. Verify reminder system is installed and active per manufactures instructions in owner's manual
2. Does system work with smart phone application?
 - Yes
 - Confirm system is communicating with phone app. The app should be running with the screen turned off.
 - No
3. Vehicle should be locked and parked in an open space with at least 100ft clearance from any building or other vehicles.

Note surroundings (other vehicles, open fields, gravel, blacktop, etc.):

4. Unlock the vehicle
5. Within 2 minutes, open and enter the driver door
6. Close the driver door
7. Turn the vehicle on, wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received
8. Proceed with driving the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes.
 9. Stop vehicle, place vehicle in Park, leave the vehicle on (running), wait 30 seconds
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

10. Open the driver's door

11. Open any rear door to install CRS in any rear seat and put child dummy in CRS.

12. Close rear door

13. Reenter through the driver's door

14. Close the driver's door, wait 30 seconds

- Alert was received
- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

15. Proceed with driving the vehicle at a speed exceeding 10 mph for a minimum of 5 minutes

- Alert was received
- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

16. Stop the vehicle, place the vehicle in Park, wait 30 seconds

- Alert was received
- Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

17. Turn off the vehicle, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

18. Open the driver door, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

19. Exit the vehicle and close the driver door and leave the doors unlocked, wait 30 seconds

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

20. Lock all doors, walk at least 20 ft away, wait 15 minutes

- Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

Note any other observations – (environment, alert delay, etc.):

--

Test Drive 7

This drive simulates a child gaining unmonitored access to a vehicle.

1. Verify reminder system is installed and active per manufactures instructions in owner's manual
2. Does system work with smart phone application?
 - Yes
 - Confirm system is communicating with phone app. The app should be running with the screen turned off.
 - No

3. Vehicle should be parked in an open space with at least 100ft clearance from any building or other vehicles.

Note surroundings (other vehicles, open fields, gravel, blacktop, etc.):

4. Vehicle is completely off and unlocked for 30 minutes
5. Open any rear door to install CRS in any rear seat and put child dummy in CRS.
6. Close door, wait 15 minutes
 - Alert was received
 - Audible System Hardware Alert (Sound, Horn, speakers, etc.) from Vehicle
 - Visual System Hardware Alert (Lights, Dash, Vehicle, etc.) from Vehicle
 - Audible Alert from Phone
 - Visual Alert from Phone

Additional Details of Alerts: (Duration, Location, Volume, etc.):

- Alert was not received

Note any other observations – (environment, alert delay, etc.):

Appendix C. Test Drive Results

Test Drive 1: This drive simulates starting with a locked vehicle that is turned off, the driver forgets to remove the child at the end of the trip and does not lock the doors initially, but rather locks the doors 30 seconds after door closure.

	Step 2	Step 9	Step 11	Step 12	Step 13	Step 14	Step 15
2022 Honda Odyssey Touring	NO	NO	NO	YES	NO	NO	NO
2022 Nissan Rogue (“Alert only” mode)	NO	YES	YES	NO	NO	NO	NO
2022 Nissan Rogue (“Horn and Alert” mode)	NO	YES	YES	NO	NO	YES	NO
2022 Honda Civic EX	NO	NO	NO	YES	NO	NO	NO
2022 Toyota Camry	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac XT4 Crossover	NO	NO	NO	YES	NO	NO	NO
2022 Hyundai Tucson 4DR SUV	NO	NO	NO	NO	YES	NO	NO
2022 Chevrolet Equinox AWD	NO	NO	NO	YES	NO	NO	NO
2023 Ford Maverick AWD	NO	NO	NO	YES	NO	NO	NO
2023 Honda HR-V	NO	NO	NO	YES	NO	NO	NO
2017 Chevrolet Bolt EV	NO	NO	NO	YES	NO	NO	NO
2020 Subaru Forester	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac CT5	NO	NO	NO	YES	NO	NO	NO

YES	Alert described within the owner’s manual at this section of a trip and received
NO	Alert described within the owner’s manual at this section of a trip and not received
NO	Alert not described within the owner’s manual at this section of a trip but expected due to forgotten child and not received

Relevant Procedure Steps:
Step 2: Does system work with smart phone application?
Step 9: Turn the vehicle on, wait 30 seconds
Step 11: Stop the vehicle, place the vehicle in Park, wait 30 seconds
Step 12: Turn off the vehicle, wait 30 seconds
Step 13: Open the driver door, wait 30 seconds
Step 14: Exit the vehicle and close the driver door and leave the door unlocked, wait 30 seconds
Step 15: Lock all doors, walk at least 20 ft away from the vehicle, wait 15 minutes

Test Drive 2: This drive simulates starting with an unlocked vehicle that is turned off, the driver forgets to remove the child at the end of the trip and does not lock the doors initially, but rather locks the doors 30 seconds after door closure.

	Step 2	Step 8	Step 10	Step 11	Step 12	Step 13	Step 14
2022 Honda Odyssey Touring	NO	NO	NO	YES	NO	NO	NO
2022 Nissan Rogue (“Alert only” mode)	NO	YES	YES	NO	NO	NO	NO
2022 Nissan Rogue (“Horn and Alert” mode)	NO	YES	YES	NO	NO	YES	NO
2022 Honda Civic EX	NO	NO	NO	YES	NO	NO	NO
2022 Toyota Camry	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac XT4 Crossover	NO	NO	NO	YES	NO	NO	NO
2022 Hyundai Tucson 4DR SUV	NO	NO	NO	NO	YES	NO	NO
2022 Chevrolet Equinox AWD	NO	NO	NO	YES	NO	NO	NO
2023 Ford Maverick AWD	NO	NO	NO	YES	NO	NO	NO
2023 Honda HR-V	NO	NO	NO	YES	NO	NO	NO
2017 Chevrolet Bolt EV	NO	NO	NO	YES	NO	NO	NO
2020 Subaru Forester	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac CT5	NO	NO	NO	YES	NO	NO	NO

YES	Alert described within the owner’s manual at this section of a trip and received
NO	Alert described within the owner’s manual at this section of a trip and not received
NO	Alert not described within the owner’s manual at this section of a trip but expected due to forgotten child and not received

Relevant Procedure Steps:
Step 2: Does system work with smart phone application?
Step 8: Turn the vehicle on, wait 30 seconds
Step 10: Stop the vehicle, place the vehicle in Park, wait 30 seconds
Step 11: Turn off the vehicle, wait 30 seconds
Step 12: Open the driver door, wait 30 seconds
Step 13: Exit the vehicle and close the driver door and leave the door unlocked, wait 30 seconds
Step 14: Lock all doors, walk at least 20 ft away from the vehicle, wait 15 minutes

Test Drive 3: This drive simulates a trip, starting with a locked vehicle that is turned off, where a child is in the rear seat of the vehicle and the driver stops in the middle of the trip for less than 10 minutes, such as for refueling and the driver does not reopen a rear door during the stop. During the mid-trip stop, the UCRS alert is dismissed by the driver. The driver then continues the trip (within 10 mins) and then forgets to remove the child at the end of the trip.

	Step 2	Step 9	Step 11	Step 12	Step 13	Step 14	Step 18	Step 20	Step 21	Step 22	Step 23	Step 24
2022 Honda Odyssey Touring	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
2022 Nissan Rogue (“Alert only” mode)	NO	YES	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO
2022 Nissan Rogue (“Horn and Alert” mode)	NO	YES	YES	NO	NO	YES	YES	YES	NO	NO	YES	NO
2022 Honda Civic EX	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
2022 Toyota Camry	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
2022 Cadillac XT4 Crossover	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
2022 Hyundai Tucson 4DR SUV	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
2022 Chevrolet Equinox AWD	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
2023 Ford Maverick AWD	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO
2023 Honda HR-V	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
2017 Chevrolet Bolt EV	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
2020 Subaru Forester	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac CT5	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO

YES	Alert described within the owner’s manual at this section of a trip and received
NO	Alert described within the owner’s manual at this section of a trip and not received
NO	Alert not described within the owner’s manual at this section of a trip but expected due to forgotten child and not received

Relevant Procedure Steps:

Step 2: Does system work with smart phone application?

Step 9: Turn the vehicle on, wait 30 seconds

Step 11: Stop the vehicle, place the vehicle in Park, wait 30 seconds

Step 12: Turn off the vehicle, wait 30 seconds

Step 13: Open the driver door, wait 30 seconds

Step 14: Exit the vehicle and close the driver door and leave the door unlocked, wait 10 minutes

Step 18: Turn the vehicle on, wait 30 seconds

Step 20: Stop the vehicle, place the vehicle in Park, wait 30 seconds

Step 21: Turn off the vehicle, wait 30 seconds

Step 22: Open the driver door, wait 30 seconds

Step 23: Exit the vehicle and close the driver door and leave the vehicles unlocked, wait 30 seconds

Step 24: Lock all doors, walk at least 20 ft away from the vehicle, wait 15 minutes

Test Drive 4: This drive simulates a trip, starting with a locked vehicle with no rear doors that is turned off, where the driver forgets to remove a child at the end of the trip and locks the vehicle.

Test drive 4 was not tested as no two door vehicles with indirect sensing were identified.

Test Drive 5: This drive simulates a trip, starting with a locked vehicle that is turned off, where two children are in the rear seat at the beginning of the trip. One child exits the vehicle mid-trip while the vehicle remains on, and the trip continues. At the end of the trip the driver exits the vehicle and forgets the one remaining child before locking the vehicle.

	Step 2	Step 9	Step 11	Step 12	Step 13	Step 15	Step 16	Step 17	Step 18	Step 19
2022 Honda Odyssey Touring	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Nissan Rogue (“Alert only” mode)	NO	YES	YES	NO	NO	NO*	NO	NO	NO*	NO
2022 Nissan Rogue (“Horn and Alert” mode)	NO	YES	YES	NO	NO	NO*	NO	NO	NO*	NO
2022 Honda Civic EX	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Toyota Camry	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac XT4 Crossover	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Hyundai Tucson 4DR SUV	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
2022 Chevrolet Equinox AWD	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2023 Ford Maverick AWD	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2023 Honda HR-V	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2017 Chevrolet Bolt EV	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2020 Subaru Forester	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac CT5	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO

YES	Alert described within the owner’s manual at this section of a trip and received
NO	Alert described within the owner’s manual at this section of a trip and not received
NO	Alert not described within the owner’s manual at this section of a trip but expected due to forgotten child and not received

Relevant Procedure Steps:

- Step 2:** Does system work with smart phone application?
- Step 9:** Turn the vehicle on, wait 30 seconds
- Step 11:** Stop the vehicle, place the vehicle in Park, leave the vehicle on (running), wait 30 seconds
- Step 12:** Open the driver door, wait 30 seconds
- Step 13:** Exit the vehicle and open any door adjacent to where a child dummy was placed. Remove one child dummy from the vehicle. Close the rear door.
- Step 15:** Stop the vehicle, place the vehicle in Park, wait 30 seconds
- Step 16:** Turn off the vehicle, wait 30 seconds
- Step 17:** Open the driver door, wait 30 seconds
- Step 18:** Exit the vehicle and close the driver door and leave the door unlocked, wait 30 seconds
- Step 19:** Lock all doors, walk at least 20 ft away from the vehicle, wait 15 minutes

*An alert was expected at these steps due to the presence of a child forgotten in the vehicle, however it was not expected per the owner's manual as the vehicle had previously alerted to the presence of a child occupant in the rear seat and the rear door had been opened/closed during the mid-trip stop.

An alert was not expected in the other vehicles at these steps as the other vehicles alerted according to their own owner's manuals at the end of the trip when the child occupant was forgotten.

Test Drive 6: This drive simulates a trip, starting with a locked vehicle that is turned off, where there is no child in the vehicle at the start of the trip. A child then enters the vehicle mid-trip while the vehicle remains on, and the trip continues. At the end of the trip the driver exits and forgets the child before locking the vehicle.

	Step 2	Step 7	Step 9	Step 14	Step 15	Step 16	Step 17	Step 18	Step 19	Step 20
2022 Honda Odyssey Touring	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Nissan Rogue (“Alert only” mode)	NO	NO	NO	YES	NO	YES	NO	NO	NO	NO
2022 Nissan Rogue (“Horn and Alert” mode)	NO	NO	NO	YES	NO	YES	NO	NO	YES	NO
2022 Honda Civic EX	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Toyota Camry	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac XT4 Crossover	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Hyundai Tucson 4DR SUV	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
2022 Chevrolet Equinox AWD	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2023 Ford Maverick AWD	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2023 Honda HR-V	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2017 Chevrolet Bolt EV	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2020 Subaru Forester	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO
2022 Cadillac CT5	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO

YES	Alert described within the owner’s manual at this section of a trip and received
NO	Alert described within the owner’s manual at this section of a trip and not received
NO	Alert not described within the owner’s manual at this section of a trip but expected due to forgotten child and not received

Relevant Procedure Steps:

Step 2: Does system work with smart phone application?

Step 7: Turn the vehicle on, wait 30 seconds

Step 9: Stop the vehicle, place the vehicle in Park, leave the vehicle on (running), wait 30 seconds

Step 14: Close the driver door

Step 15: Proceed with driving the vehicle at a speed exceeding 10 mph for at least 5 minutes

Step 16: Stop the vehicle, place the vehicle in Park, wait 30 seconds

Step 17: Turn off the vehicle, wait 30 seconds

Step 18: Open the driver door, wait 30 seconds

Step 19: Exit the vehicle and close the driver door and leave the door unlocked, wait 30 seconds

Step 20: Lock all doors, walk at least 20 ft away from the vehicle, wait 15 minutes

Test Drive 7: This drive simulates a child gaining unmonitored access to a vehicle.

	Step 2	Step 6
2022 Honda Odyssey Touring	NO	NO
2022 Nissan Rogue (“Alert only” mode)	NO	NO
2022 Nissan Rogue (“Horn and Alert” mode)	NO	NO
2022 Honda Civic EX	NO	NO
2022 Toyota Camry	NO	NO
2022 Cadillac XT4 Crossover	NO	NO
2022 Hyundai Tucson 4DR SUV	NO	NO
2022 Chevrolet Equinox AWD	NO	NO
2023 Ford Maverick AWD	NO	NO
2023 Honda HR-V	NO	NO
2017 Chevrolet Bolt EV	NO	NO
2020 Subaru Forester	NO	NO*
2022 Cadillac CT5	NO	NO

YES	Alert described within the owner’s manual at this section of a trip and received
NO	Alert described within the owner’s manual at this section of a trip and not received
NO	Alert not described within the owner’s manual at this section of a trip but expected due to forgotten child and not received

Relevant Procedure Steps:
Step 2: Does system work with smart phone application?
Step 6: Close door, wait 15 minutes

*The Subaru Forester did not have any information in the owner’s manual stating the vehicle would need to be turned on for the system to be armed. In testing, it was found that the vehicle needed to be turned on for the system to be armed.

Appendix D. Alert Criteria Data Matrix

Alert Criteria Considerations												
Criterion:	UCRS Alerts					Temporary Deactivation			Long-Term Deactivation			
	1	2	3	4	5	6	7	8	9	10	11	12
2022 Honda Odyssey Touring	YES	NO	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO
2022 Nissan Rogue (“Alert only” mode)	NO	NO	YES	-	until driver door is opened **	YES** *	YES* **	NO	YES	YES	NO	NO
2022 Nissan Rogue (“Horn and Alert” mode)	NO	NO	YES	-	Until driver door is opened* and 70 seconds afterwards	YES** *	YES* **	NO	YES	YES	NO	NO
2022 Honda Civic EX	YES	NO	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO
2022 Toyota Camry	YES	NO	YES	-	6 seconds* unless driver door is opened	N/A	N/A	N/A	YES	YES	NO	NO
2022 Cadillac XT4 Crossover	YES	NO	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO
2022 Hyundai Tucson 4DR SUV	YES	YES	YES	-	5 seconds after driver door opened	NO **	N/A	NO	YES	YES	NO	NO
2022 Chevrolet Equinox AWD	YES	YES	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO
2023 Ford Maverick AWD	YES	YES	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	YES	NO
2023 Honda HR-V	YES	NO	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO
2017 Chevrolet Bolt EV	YES	NO	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO
2020 Subaru Forester	YES	NO	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO
2022 Cadillac CT5	YES	NO	YES	-	10 seconds*	N/A	N/A	N/A	YES	YES	NO	NO

YES	Meets Criterion
N/A	Not applicable to this vehicle
NO	Did not meet criterion
-	Criterion was not evaluated

UCRS System Alerts

Criterion 1: The auditory and visual alerts initiate concurrently at a time no earlier than engine/motor off and no later than driver door unlatching/opening.

- * Begins when the vehicle is turned off
- ** Rogue alert tested for up to 4 minutes
- *** The options presented to drivers are to dismiss an alert that has already appeared, or to disable a secondary alert for that trip when presented with the first alert. Results are based on the idea that temporary deactivation in these vehicles is the option to disable a secondary reminder alert when presented when the first alert.

Criterion 2: The auditory alert is clearly perceptible and distinct from other auditory alerts used in the vehicle.

Criterion 3: The visual alert is to be located so that, when activated, they are visible to an occupant in the driver's seat.

Criterion 4: The visual alert provides an unambiguous message to check rear seating positions.¹⁵

Criterion 5: The visual alert persists indefinitely until the driver door is opened, and then for a minimum of 30 additional seconds after the driver door has been opened. However, the visual alert may be cancelled at any point in this sequence if a rear door is opened.

Temporary Deactivation

Criterion 6: Temporary deactivation is more complicated than a short push of a button to avoid deactivating the reminder system inadvertently.

Criterion 7: Temporary deactivation is a different process than that required for delay and cancellation of an alert.

Criterion 8: If a reminder system has been temporarily deactivated, the inactive status of the reminder system must be indicated by a dedicated tell-tale that is clearly visible to the driver.

Long-Term Deactivation

Criterion 9: Long-term deactivation is more complicated than a short push of a button to avoid deactivating the reminder system inadvertently.

Criterion 10: Long-term deactivation is a different process than that required for delay and cancellation of an alert.

Criterion 11: An option to reactivate the reminder system by the driver is offered.

¹⁵ For the purposes of this report, NHTSA did not determine if vehicles met or did not meet this criterion but provided the language of the alerts for informational purposes.

Criterion 12: If a reminder system has been deactivated, the inactive status of the reminder system is indicated by a dedicated tell-tale that is clearly visible to the driver.

Appendix E. Alert Descriptions

- **2022 Hyundai Tucson**

- Upon the driver’s door opening after the vehicle was turned off, there was 1 chime which was different from other tones/alerts with a visual alert that stated, “Check rear seats” and an illustration of rear seats that appeared on the instrument panel. This was presented with the option to “disable” the alert which deactivates a second alert related to the detection system, however his feature was not tested in this study. This visual alert lasted for 5 seconds.



Figure E-1. 2022 Hyundai Tucson visual reminder alert on the instrument panel

- **2022 Cadillac XT4**

- When the vehicle was turned off there were 5 chimes, which were different than the seatbelt reminder alert but same as tone for putting vehicle in Park and lasted a total of 2 seconds. These chimes accompanied a visual alert that stated “Rear Seat Reminder Look in Rear Seat” that appeared on the instrument panel. The visual alert lasted 10 seconds regardless of whether the driver’s door was opened by the driver.

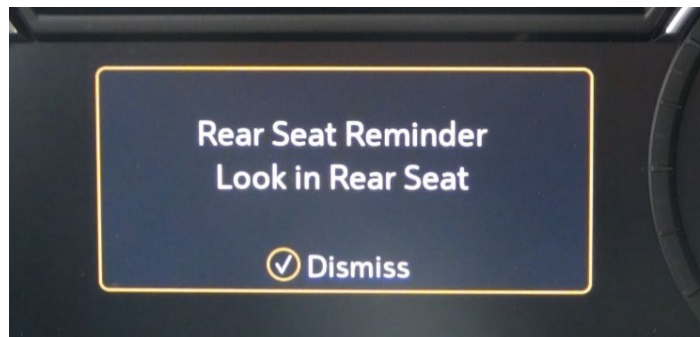


Figure E-2. 2022 Cadillac XT4 visual reminder alert on the instrument panel

- **2022 Toyota Camry**

- When the vehicle was turned off there was 1 chime, which was the same tone as the seatbelt reminder alert and was accompanied by a visual alert that stated “Attention: Check Rear Seat” that appeared on the instrument panel. The visual alert lasted 6 seconds or until the driver’s door was opened, whichever occurred first.



Figure E-3. 2022 Toyota Camry visual reminder alert on the instrument panel

- **2022 Chevrolet Equinox**

- When the vehicle was turned off there were 5 chimes, which were different from other tones/alerts, and lasted a total of 2 seconds that was accompanied by a visual alert that stated “Rear Seat Reminder Look in Rear Seat” that appeared on the instrument panel. The visual alert lasted 10 seconds regardless of whether the driver’s door was opened by the driver.



Figure E-4. 2022 Chevrolet Equinox AWD visual reminder alert on the instrument panel

- **2022 Honda Civic**

- When the vehicle was turned off there was 1 chime, which was different from other tones/alerts and was accompanied by a visual alert that stated “Check rear seats” that appeared on the instrument panel with an illustration of a vehicle with the rear seats highlighted. The visual alert lasted 10 seconds regardless of whether the driver’s door was opened by the driver.

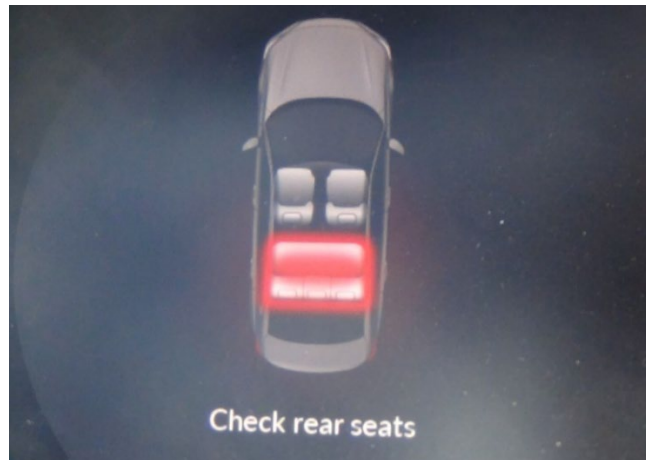


Figure E-5. 2022 Honda Civic visual reminder alert on the instrument panel

- **2022 Nissan Rogue**

- **“Alert Only” Mode**

At the beginning of the trip a visual alert that stated “Rear Door Alert is Activated” appeared on the instrument panel if the system was activated by opening and closing a rear door. Along with this alert, two choices were presented to the driver: “Dismiss Message” (alert remains active) or “Disable Alert” (alert was deactivated for that trip).



Figure E-6. 2022 Nissan Rogue alert activation visual alert on the instrument panel

At the end of the trip, an alert was displayed when the vehicle was placed in Park. There was 1 chime, which was the same tone as seatbelt reminder alert, and accompanied the visual alert that stated “Check Rear Seat for all Articles” on the vehicle information display. Along with this alert, the option to: “Dismiss

Message” was presented to the driver. The visual alert was displayed until the driver door was opened (tested up to 4 minutes).



Figure E-7. 2022 Nissan Rogue visual reminder alert on the instrument panel

- **“Alert and Horn” Mode**

At the beginning of the trip a visual alert that stated “Rear Door is Alert is Activated” appeared on the instrument panel if the system was activated by opening and closing a rear door. Along with this alert, two choices were presented to the driver: “Dismiss Message” (alert remains active) or “Disable Alert” (alert was deactivated for that trip).

At the end of the trip, a visual alert was displayed when the vehicle was placed in Park. There was 1 chime, which was the same tone as seatbelt reminder alert, and accompanied the visual alert that stated “Check Rear Seat for all Articles” on the instrument panel. Along with this alert, two choices were presented to the driver: “Dismiss Message” (alert remains active) or “Disable Alert” (alert was deactivated for that trip). The visual alert was displayed until the driver door was opened (tested up to 4 minutes).

A second visual alert that stated “Check Rear Seat for all Articles” appeared after the driver's door was opened and closed when the vehicle has been turned off. This visual alert remained on the instrument panel for 1 minute and 10 seconds before it disappeared. Eight seconds after the door was closed the horn honked 6 times over a total of 2 seconds. If the doors were locked within the 8 second delay the horn alert was activated. The alerts were cancelled if the rear door was opened within 8 seconds of exiting and closing the driver door. This vehicle’s reminder system remained armed until a rear door was opened and closed again, even after key-off.

- **2022 Honda Odyssey**

- When the vehicle was turned off there was 1 chime, which was the same tone as the seatbelt reminder alert. This chime was accompanied by a visual alert that stated “Check Rear Seats” that appeared on the instrument with an illustration of a vehicle with the rear seats highlighted. 1 second after the first alert appeared, a live video of the 3rd row seating was displayed on the audio/information screen along with the same visual alert and vehicle illustration that was presented on the driver information interface. Both visual alerts lasted 10 seconds regardless of whether the driver’s door was opened by the driver.



Figure E-8. Honda Odyssey dashboard (top) and close-ups of visual alerts on the instrument panel (bottom left) and audio/information screen (bottom right)

Note: The alerts shown in Figures E-8 are not present in the image of the dashboard of the vehicle as this image was added to show where these alerts are located within the vehicle and was not taken during a test drive.

- **2020 Subaru Forester**

- When the vehicle was turned off there were 2 chimes, which were the same tone as the seatbelt reminder alert, lasting a total of 2 seconds. These chimes were accompanied by a visual alert that states “Reminder, Look in Rear Seat” that appeared on the instrument panel. The visual alert lasted 10 seconds regardless of whether the driver’s door was opened by the driver. This vehicle’s reminder system remained armed until a rear door was opened and closed again, even after key-off.



Figure E-9. 2020 Subaru Forester visual reminder alert on the instrument panel

- **2023 Ford Maverick**

- When the vehicle was turned off there were 6 sets of 2 chimes, which were different from other tones/alerts. These chimes were accompanied by a visual alert that stated, “Check rear seats for occupants.” along with an illustration of a vehicle with a child restraint in a rear seat that appeared on the audio/information screen. Both visual and audible alerts occurred concurrently for a total of 10 seconds. This vehicle’s reminder system remained armed until a rear door was opened and closed again, even after key-off.

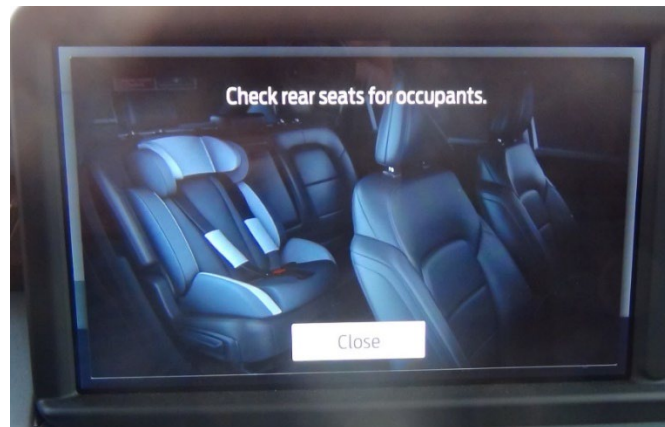


Figure E-10. Ford Maverick visual reminder alert on the audio/information screen

- **2017 Chevrolet Bolt**

- When the vehicle was turned off there were 5 chimes, which were different than the seatbelt reminder alert but were the same as the tone for putting vehicle in Park and lasted a total of 2 seconds. These chimes were accompanied by a visual alert that stated “Rear Seat Reminder Look in Rear Seat” that appeared on the instrument panel. Along with this visual alert the option to “Dismiss” the alert was presented to the driver. The visual alert lasted 10 seconds regardless of whether the driver’s door was opened by the driver.



Figure E-11. 2017 Chevrolet Bolt visual reminder alert on the instrument panel

- **2023 Honda HR-V**

- When the vehicle was turned off there was 1 chime, which was the same tone as the seatbelt reminder alert. This chime was accompanied by a visual alert that stated “Check rear seats” that appeared on the instrument panel with an illustration of a vehicle with the rear seats highlighted. The visual alert lasted 10 seconds regardless of whether the driver’s door was opened by the driver.

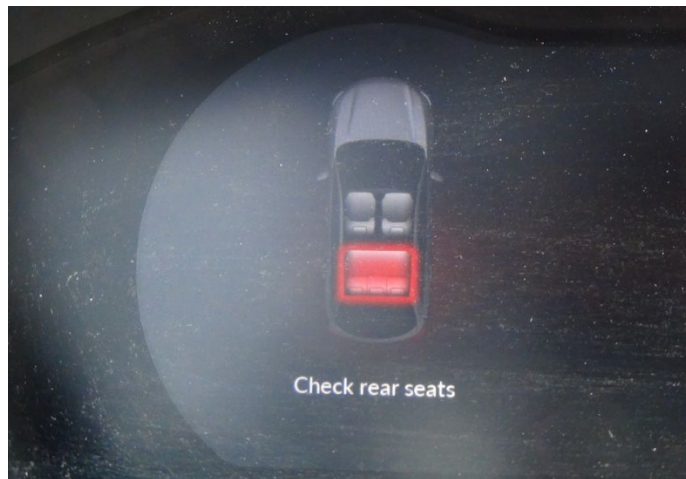


Figure E-12. 2023 Honda HR-V visual reminder alert on the instrument panel

- **2022 Cadillac CT5**

- When the vehicle was turned off there were 2 chimes, which were different than the seatbelt reminder alert but was the same as the tone for putting vehicle in Park and lasted a total of 2 seconds. These chimes were accompanied by a visual alert that stated “Rear Seat Reminder Look in Rear Seat” that appeared on the instrument panel along with an option for the driver to “Dismiss” the alert. The visual alert lasted 10 seconds regardless of whether the driver’s door was opened by the driver.



Figure E-13. 2022 Cadillac CT5 visual reminder alert on the instrument panel

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