

Predict Collisions Before They Happen: How Nauto's Predictive Collision Avoidance Can Impact Fleet Safety

Nauto Analysis of System Performance and December 2024
VTTI AI Dash Cam Performance Evaluation

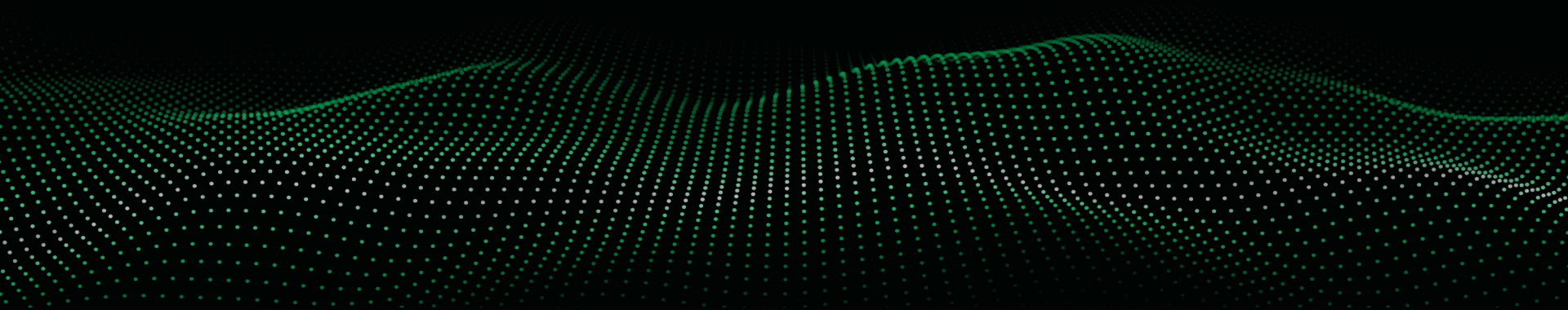


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Risk Is Everywhere

Operating a fleet vehicle – from a company pickup to a delivery van to a Class 8 long-haul truck – places drivers in a constant state of risk detection. Every intersection, on-ramp, or blind curve adds more inputs. Then you have to factor in the most unpredictable element of all: other humans. Keeping watch for vulnerable road users (motorcyclists, bicyclists, and pedestrians) gives drivers too much to process. That's where predictive AI comes in.

Focused on Risk

Because an AI system isn't worried about the route, what's for lunch, or the song on the radio, it gives drivers a second brain that is only thinking about one thing: how to prevent collisions. Nauto Predictive Risk Fusion AI delivers 26.4 trillion computational operations per second that's 30x faster raw processing than the human visual cortex with a sole focus on ensuring safe driving.

Common Risk Factors

Many of the most costly and catastrophic vehicle incidents share risk factors that a predictive AI system can help address.

- **Driver distraction** is involved in 80% of collisions, typically occurring within three seconds before the crash¹
- **Intersections** are higher-risk zones, especially for pedestrians and bicyclists.
- **Speeding** increases the severity of collisions and the chance of a fatality for a pedestrian (85% at 40 mph vs. 5% at 20 mph)²

How does an AI system addressing these risk factors help drivers? The Nauto AI dash cam system **delivered faster alerts** during daytime conditions in two of three tests performed by VTTI when distracted driver behavior was also observed when compared to the system only observing the external scene.

The Need to Reduce Risk Behind the Wheel

1.6M crashes

caused annually by using a phone while driving¹

70%

of collision-related losses caused by inattentive driving²

1. National Safety Council
2. Nauto Internal Data

1. NHTSA, The Impact of Hand-Held And Hands-Free Cell Phone Use on Driving Performance and Safety-Critical Event Risk, April 2013

2. AAA Foundation for Traffic Safety, Impact Speed and a Pedestrian's Risk of Severe Injury or Death

The Evolution of Fleet Safety Systems

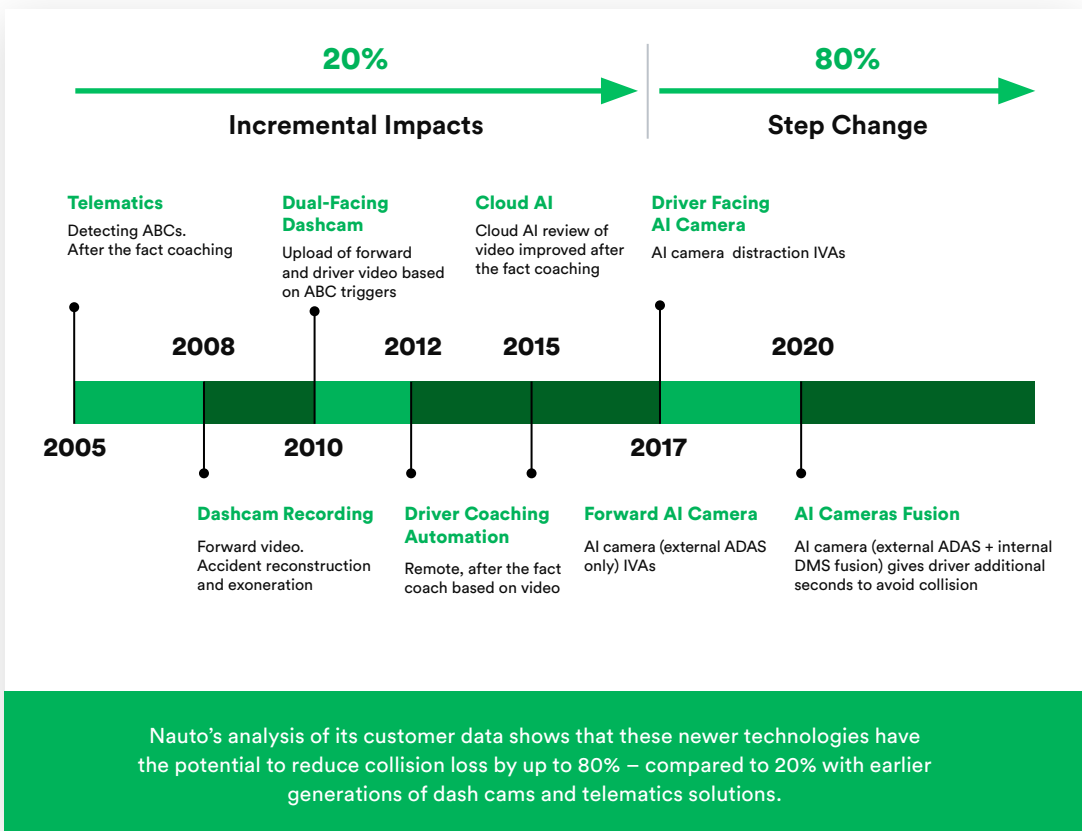
For the last twenty years, fleet operators have been incorporating new technologies into their vehicles to improve driver safety, reduce collision risk, and combat the rising operating costs of their fleet.

Telematics solutions and early dash cams gave fleet operators the ability to marginally address driver performance, but **only after unsafe behavior or even a potentially serious incident had already occurred**. Driver behavior change was dependent on driver coaching which may be ineffective when performed days or weeks after the incident – or not even occur at all.

Forward-facing ADAS (advanced driver-assistance systems) added a focus on external hazards such as forward collision warnings and lane departures, but those only account for ~17% of collision loss vs. 70% for driver behavior-related factors such as distraction, cellphone use, and drowsiness, according to Nauto's analysis of its customers' data.

Then, the next generation of driver-facing AI-powered dash cams added real-time in-vehicle alerts (IVAs), establishing a new paradigm that **gives drivers prompt, in-cab feedback so that they can self-correct risky driving behaviors in real-time**.

Impact on Loss Reduction Potential



The Next Step: Risk Fusion

The ADAS that comes as part of advanced safety packages in vehicles can only consider external risk. With the introduction of Nauto's risk fusion capabilities that combine an external focus similar to ADAS with awareness of risky driver behaviors occurring inside the vehicle, **drivers can more quickly be alerted to possible risks outside of their vehicle**, such as a stopped car or a pedestrian waiting at a crosswalk. If the driver is distracted, they will need more time to react, and the system alerts them accordingly.

Nauto Sees How Risks Interact and Explode

Multiple Risks, One Alert

Distraction, speeding, and other risks don't happen in isolation. Nauto fuses them into a single, meaningful signal.

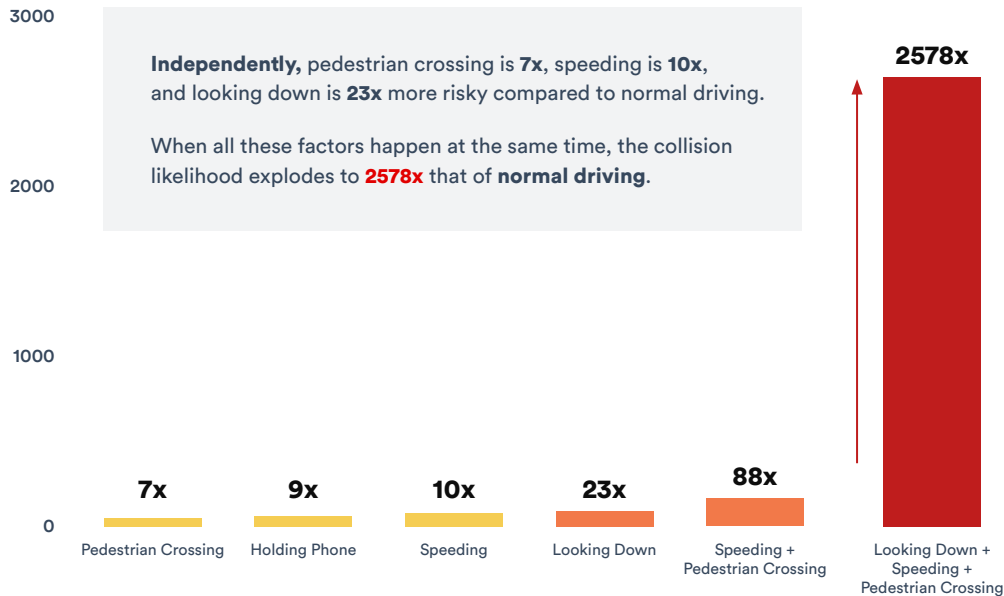
Real-World Risk Is Compounding

Drivers rarely crash because of one factor. Risk builds. Nauto's fusion AI sees how behaviors stack up in real time.

Smarter Intervention, Earlier

Nauto understands how risk develops so drivers get an alerts in those life-changing moments before a collision.

Collision Likelihood When Multiple Risk Factors Are Present (non-exhaustive)



Note: Nauto's risk factor data is based on Nauto's database of 6 billion AI-processed miles.

Real-Time Is Not In Time

Fleet safety dash cam providers deliver a standard set of functionality to their customers. There is the **recording and logging** of single-factor driver behavior (e.g. did they look at their phone?) to enable scoring, coaching, and reporting. **Reactive features** reconstruct an incident after it has already occurred to determine fault and hopefully prevent the next incident. Some systems miss as much as 80% of collisions, depending on their detection threshold.

Most recently and most impactfully, **real-time alerts** have become the norm, alerting drivers in-cab of dangerous behaviors within seconds to try and prevent a collision. For premium AI safety dashcams, all of this functionality has established a baseline in **collision reduction by dollar loss rate of up to 30%.**¹

Predict, Not Just Prevent

Even as AI has become table stakes in dash cam systems, there is yet another level for AI systems to achieve: predictive alerts. Thanks to Nauto's dual cameras and advanced in-device AI processing, drivers are more **rapidly alerted to potential risks outside the vehicle** – especially if they are distracted.

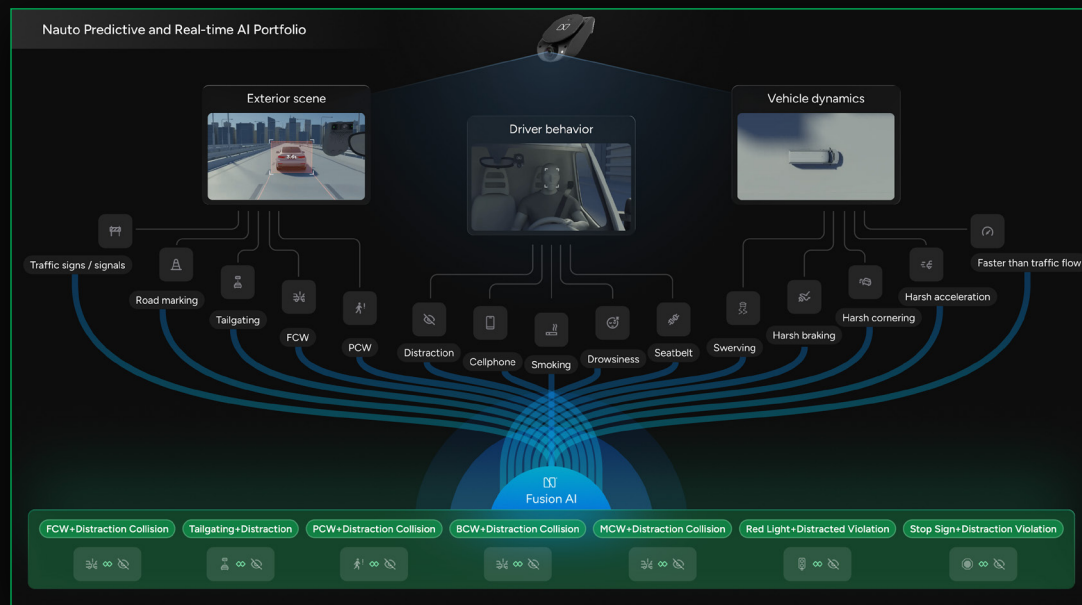
By delivering faster alerts that are more aware and integrative of the situation around and in the vehicle, predictive alerts help drivers avoid more collisions and greatly reduce the severity of incidents.

Nauto's predictive alerts have helped customers achieve **up to 80% collision loss reduction**, and with a typical result of over 50% collision loss reduction.

¹ Up to 30% metric is based on published data from Motive "Maximize ROI through visibility and control, 2023"; Samsara/IDC "The Business Value of Samsara, 2024"; and Verizon Connect "2025 Fleet Technology Trends Report, 2025".

² Nauto collision loss reduction numbers are based on Nauto customer data.

Nauto's Predictive Risk Fusion Capabilities



Speed and Accuracy: The Foundation of Risk Fusion

Nauto's risk fusion approach is built on a foundation of fast and highly accurate AI systems that work together in real-time to see the total picture of risk.

When compared with the results from a 2023 VTTI study of AI dash cams, the results from the [December 2024 study](#) demonstrate Nauto's excellence compared to other available systems in identifying various risky driver behaviors and the speed of sounding in-cab alerts to the driver:

100%

successful in-cab alerts for
distracted driver behavior

3.8s

average time to alert for
tested distraction behavior¹

*Statistics shown are from tests performed using a
Class 8 vehicle in both daytime and nighttime conditions.*

If a dash cam takes 7-16 seconds to detect distraction, how will it be able to alert earlier if the driver is momentarily distracted in a critical collision scenario?

To match what Nauto's Predictive Risk Fusion offers, an AI dash cam would need to accurately detect driver distraction and external risks in the blink of an eye, and fuse both what's going on inside and outside of the vehicle to change the outcome from a collision to a successful AI intervention to avoid a collision.

Because the Nauto system is built to understand the full picture of risk, it can also deliver more intelligent interventions – or no intervention at all – because Nauto AI understands all the risks and only alerts to truly risky situations vs. unimportant distractions that might occur when a driver is on the open road with no external dangers present.

Case Study

One Nauto customer was able to achieve dramatic reductions in collisions and mortality for its delivery fleet.

(\$ Loss vs. prior 3-year average)

Pedestrians -45%

Bicycles -53%

Motorcycles -64%

Fatalities -80%

¹ Nauto calculated overall distraction alert accuracy and time to alert by averaging all published data from the Texting, Phone In Lap and Phone Call tests.

*VTTI does not endorse any products

The Impact of Risk Fusion

1.6M

crashes caused annually by
using a phone while driving¹

The dangers of distracted driving aren't limited to those on the road. Distracted driving poses a very real risk to companies with fleets. Nauto's proprietary data captured from over 4 billion AI-processed driving miles shows that inattentive driving accounts for 70% of collision-related losses as well.

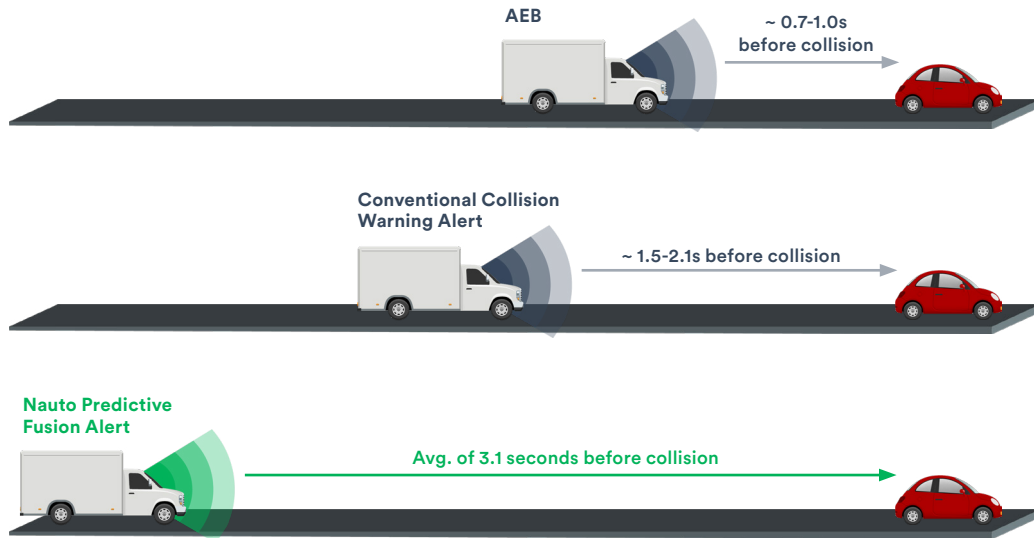
The Importance of Giving Drivers More Time

A forward collision warning from an ADAS system or aftermarket dash cam can help drivers react to an external risk such as a stopped vehicle or a vulnerable road user (VRU) in their path. But if the driver is distracted, the time needed for them to stop short or swerve away can be longer than if they were focused on the road.

Nauto's risk fusion capabilities factor in the driver's current state of attention, so that it can often provide an alert sooner, helping minimize or avoid a collision through additional time that translates into more distance. With extra distance, a vehicle can be slowed to a level where even if the collision is not avoided, it is no longer fatal to a VRU, saving lives and saving fleets from financial damages.

Extra Time and Distance for Drivers to React Can Prevent Collisions

Automatic emergency braking (AEB) is defined as occurring when a forward collision system takes over control of the vehicle braking system to intervene and apply max braking force to attempt to avoid or reduce a collision (> 1.0G).



Note: AEB and conventional collision warning alert times are defined by IIHS test protocols, [Front Crash Prevention: Vehicle-to-Vehicle](#) and [Small Overlap Frontal Crashworthiness Evaluation Crash Test Protocol](#).

The True ROI of Preventing Collisions

Crashes Affect Everyone

According to a report published by the Advocates for Highway & Auto Safety, the **annual economic cost of fatal crashes in the U.S. is estimated to be \$417 billion**¹. This includes \$141B in property damage costs, \$130B in lost productivity, \$108B in other costs, and \$38B in present and future medical costs. While these abstract numbers may not be top of mind for fleet operators who have been tasked with cutting costs, **there are far-reaching impacts to prioritizing savings over safety.**

Rising Insurance Costs

Commercial auto insurance premiums have been rising steadily for the past decade, with no signs of slowing down. According to Risk Strategies, **physical damage coverage increased by 20% to 25%, umbrella liability by 10% to 30%, and auto liability by 10% to 20%**, year over year from 2024 to 2025.¹ Nuclear verdicts, distracted driving incidents, rising vehicle repair costs, and driver shortages are just a few of the factors fueling rate hikes for fleet operators. Many fleets are unable to pay the higher insurance costs, so they are increasing deductibles and limits, only increasing their financial risk.

One of the few levers a fleet has available to combat the cost of insurance is to **provide evidence that its drivers are proven safer**. If they are involved in fewer incidents and better able to be exonerated if they are not at fault, and if they can avoid the most severe incidents involving loss of life, a fleet will be able to better negotiate its premium.

Nuclear Verdicts

Fleet operators have increasingly been on the wrong side of nuclear verdicts (defined as any award to the plaintiff over \$10 million) when there are fatalities or severe injuries resulting from a collision. According to a survey by the American Transportation Research Institute¹, nuclear verdicts are the third most worrisome issue for the industry. With recent verdicts clearing the \$100 million mark, avoiding collisions with pedestrians and other VRUs may not only save a life – they may save a business.

Finding and Retaining Drivers

Fleet operators need to combat perennially high driver turnover – **around 90% for large truckload carriers and 70% for smaller carriers**, according to the American Trucking Associations (ATA). Plus, hiring and training a new driver can cost commercial carriers upwards of \$10,000³, while the average cost of turnover for a skilled driver with over one year of experience for a service fleet may exceed \$20,000. By helping drivers stay safe while respecting their privacy, fleets can better retain their drivers and control their costs.

Is Your Focus on Preventing the Most Costly Collisions?

Backing / Stationary Objects Collisions

55% of all collision incidents
but only

9% of all third party losses

All Other Collisions (Ped Strike, Head-On, Etc)

45% of all collision incidents

91% of all third party losses

Note: Nauto's data is based on Nauto's database of 6 billion AI-processed miles.

1. HDT <https://www.truckinginfo.com/10229818/nuclear-verdicts-insurance-cost-electric-vehicles-rise-in-atr-top-industry-issu>

2. Risk Strategies <https://www.risk-strategies.com/state-of-the-insurance-market-report-2025-outlook-rate-forecast>

3. Commercial Carrier Journal

Performance Evaluation Summary

Study Background

The Virginia Tech Transportation Institute (VTTI), a globally recognized leader in transportation research, conducted a performance test of Nauto's AI-powered safety system in December 2024. Nauto commissioned the evaluation to test its differentiated set of predictive collision alert capabilities that analyze the external scene and the driver's attentiveness simultaneously to better evaluate risk.

The tests performed included approaching a stopped car, approaching a motorcycle target, and approaching a pedestrian target in a light-duty commercial vehicle. The tests were performed with an attentive driver and then with a distracted, texting driver to measure the difference in alert speed when Nauto's proprietary Predictive Risk Fusion capabilities recognized the increased risk from distracted driving.

In this piece, Nauto reviews VTTI's data, analyzes its data from over 6 billion AI-monitored miles, captures industry statistics, and utilizes publicly available information to examine the need for safety systems that go beyond real-time alerts to deliver predictive alerts.

For further results including findings from VTTI's testing of Nauto's technology in a commercial truck, download Nauto's report, **Nauto's AI Safety System Soars in Performance Study**, where Nauto's technology demonstrated **100% detection of cell phone use distracted driving behaviors during testing with a time-to-alert under 5 seconds in both daytime and nighttime conditions.**

Key Results

The testing of the Nauto AI dash cam showed that during daylight conditions, the system alerted drivers to potential forward collisions faster when the test driver was distracted by texting, compared to when the driver was attentive in 2 out of 3 tests. During daytime conditions, **75-100% of the alerts gave the driver sufficient time to swerve and avoid the collision.**

Furthermore, forward collision warning (FCW) and pedestrian collision warning (PCW) alerts for multiple scenarios - stopped vehicle, pedestrian, and motorcycle - sounded with 80-100% accuracy in daytime conditions.

Why It Matters

Nauto's data and customer results, as well as external studies of distracted driving, show that giving drivers more time to react to a potentially dangerous collision helps prevent or reduce the severity of collisions. Predictive collision alerts can provide drivers with even more time to react, which is vital in preventing collisions with pedestrians, cyclists, motorcyclists, and other vulnerable road users (VRU) that are potentially deadly to the victim and highly costly to a fleet owner. Further, in the unfortunate scenario where a collision may still occur, more timely alerts can help reduce the severity of that collision, transforming a fatality into an injury or reducing a severe injury to a minor one.

Nauto's Risk Fusion Results

When the Driver Was Texting, the Nauto System Delivered

10%

Faster Alert Speed for a Collision with a Stopped Car¹ – 8 additional feet to avoid a collision at 25mph

6%

Faster Alert Speed for a Collision with a Pedestrian¹ – 7.5 additional feet to avoid a collision at 25mph

1. Percentage changes are based on daytime FCW time to alert without distraction in the external-only tests vs. with distraction in the risk fusion tests. To see nighttime results, please download the full report.

Why the Transportation Industry Trusts VTTI

The Virginia Tech Transportation Institute (VTTI) is a globally recognized research organization dedicated to advancing transportation safety and innovation. Founded in 1988, VTTI conducts cutting-edge research to improve vehicle systems, infrastructure, and driver behavior, fostering safer and more efficient roadways for all users.

The Leaders in Performance Evaluation

VTTI delivers dependable testing under real-world conditions. This study utilized the Virginia Smart Roads, a state-of-the-art, closed test-bed research facility managed by VTTI in cooperation with the Virginia Department of Transportation (VDOT). The Smart Roads enable evaluations during both daytime and nighttime scenarios with controlled variables, such as weather and driver proficiency, managed by VTTI's expert researchers.

Proven Impact on Safety and Policy

Over the years, VTTI's research has influenced meaningful changes in public policies, both nationally and internationally, to improve the safety of drivers, passengers, and pedestrians. Additionally, VTTI's work continues to advance the design of vehicles and infrastructure, promoting safety and reducing environmental impact.

VTTI leads the National Surface Transportation Safety Center for Excellence and led the U.S. Department of Transportation Safety Through Disruption University Transportation Center from 2016-2023.

VTTI's Research Looks to Reduce the Over **40,000 Fatalities¹** and **\$340 Billion Economic Cost²** of Motor Vehicle Incidents Each Year

1. Insurance Institute for Highway Safety, June 2024
2. NHTSA, January 2023

Performance Evaluation Approach

Objectives

The objective of this study was to assess Nauto technology for alert performance under VTTI's AI-dash cam testing protocol. The study tested Nauto's fleet safety technology's alert performance for five driver maneuvers performed during high-risk driving scenarios in a light-duty vehicle (summarized in this report) as well as six risky driving behaviors as performed in a heavy truck (these results were released in an [earlier report](#)). Each case tested Nauto's predictive collision warnings utilizing its proprietary risk fusion capabilities.

Methods

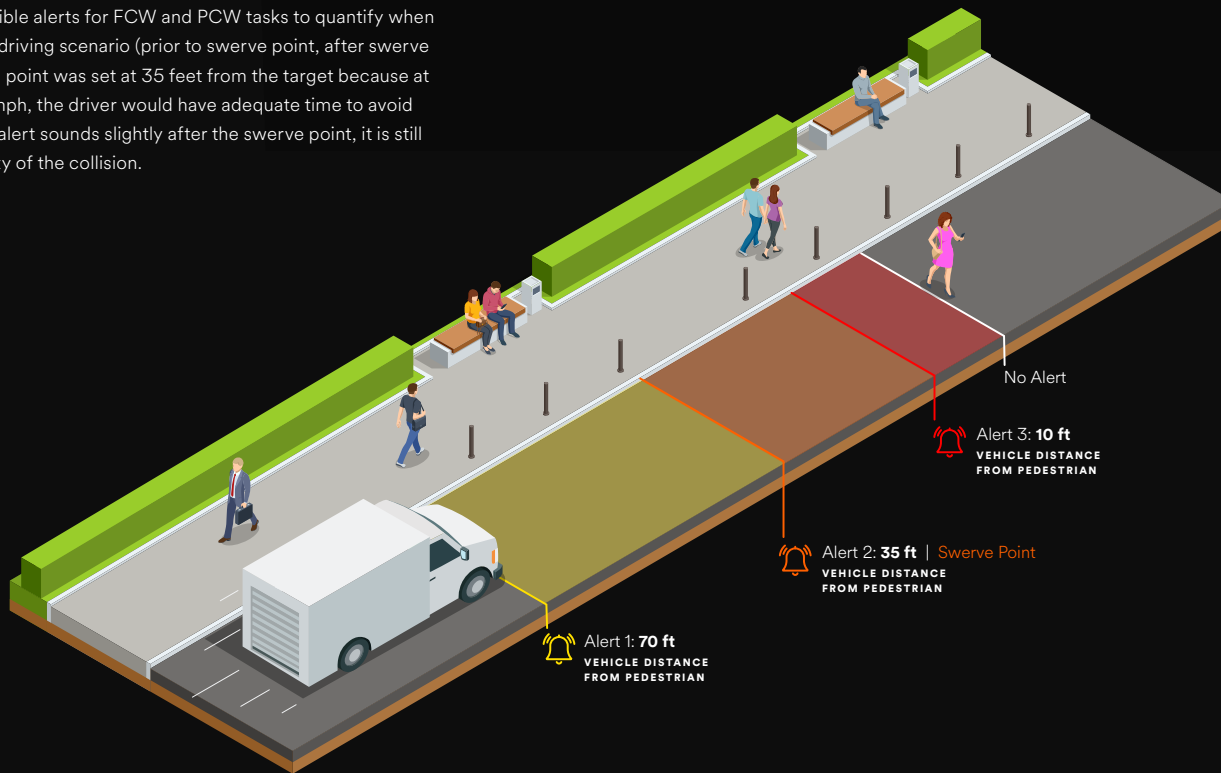
VTTI has a dash cam assessment protocol that it used to evaluate performance by calculating rates of in-cabin audible alerts, rates of alerts recorded on the virtual platform's dashboard, and time to alert (TTA) from the start of the tested driving behavior or from time to collision, depending on the test scenario. This study also references a swerve point measurement (see sidebar) to measure the timeliness of alerts in relation to a target and if they occurred in sufficient time for a driver to avoid striking the target. The study design was developed based on previous research, with a focus on findings from naturalistic driving research involving commercial drivers.

Assumptions

- The system was tested in one placement location, at 2 times of day/lighting (daytime and nighttime) conditions, with 10 replications per time of day (20 tests per task).
- Factors that may affect system performance that were controlled in the current study:
 - Weather: The trials were conducted in generally good weather, on dry roadways
 - Driver: All trials included the same commercial driver (a trained VTTI researcher)
 - System location in the vehicle
 - Vehicle model
- Analysis results may not apply to conditions outside of those tested in the current study.

What Is a Swerve Point?

VTTI separated the rate of audible alerts for FCW and PCW tasks to quantify when alerts began during the tested driving scenario (prior to swerve point, after swerve point, after target). The swerve point was set at 35 feet from the target because at the test vehicle's speed of 25 mph, the driver would have adequate time to avoid the target. In the case that the alert sounds slightly after the swerve point, it is still valuable in reducing the severity of the collision.



Nauto Delivers Predictive Collision Alerts

Nauto Delivers Predictive Collision Alerts in Time to Help Avoid Collisions

Nauto's risk fusion feature aims to improve driver safety by sounding alerts sooner when there is risk of colliding with an object on the road, such as a lead vehicle, pedestrian, or cyclist, and the driver is simultaneously distracted. This faster notification can give drivers increased reaction time to avoid potential collisions or external hazards.

Nauto developed this table to compare the percentage of times the risk scenario was detected and an alert was sounded in daytime conditions – 'successful' in-cab alerts – for each test, the average time to alert in-cab, and the percentage of alerts that occurred prior to the swerve zone for both external scene only scenarios and scenarios where the driver was texting.

For two of the three scenarios, the Nauto system provided faster average alerts when it also detected distracted driving behaviors. In a real-world scenario, this can give drivers extra time and increased distance to either stop short or swerve away from another vehicle or pedestrian, and could make the difference between a serious incident and a near-miss.

For results during both daytime and nighttime conditions, please download the [full study report from VTTI](#).

Comparison of Alert Accuracy and Time-to-Alert Data With and Without Distraction

		Percent Successful Alerts	Average Time to Alert	Percent Alerts Prior to Swerve Zone
External Scene Only	Approaching Stopped Vehicle Target	90%	2.3s	78%
	Approaching Pedestrian VRU Target	80%	2.7s	75%
	Approaching Motorcycle VRU Target	100%	4.2s	100%
Fusion (while texting)	Approaching Stopped Vehicle Target	80%	2.1s	75%
	Approaching Pedestrian VRU Target	90%	2.5s	89%
	Approaching Motorcycle VRU Target	90%	4.6s	100%

Note: All data shown is from daytime tests

For results during both daytime and nighttime conditions, please download the [full study report from VTTI](#).

80-90%

in-cab alerting accuracy when approaching VRU Stand-Ins when driver was distracted¹

88%

in-cab alerts delivered prior to swerve zone to avoid target when driver was distracted¹

Nauto's Approach Is Different: Predictive Risk Fusion

There are other AI dash cams available on the market, but **Nauto was built from the ground up with a unique approach to risk: risk fusion**. It was clear that it was not sufficient to simply see risks as individual events. They need to be fused – and fused in real-time – to create the biggest impact on risk reduction.

This approach has been reinforced by the over 6 billion miles logged in Nauto's database, coupled with advanced data science research. To this day, Nauto's product development efforts are focused on providing **real-time alerts for the most important factors that reduce collision risk and losses**.

The Nauto AI dash cam also delivered high accuracy and speed of alerts in additional testing by VTTI, demonstrating its excellence compared to other available systems in identifying various risky driver behaviors and the speed of sounding in-cab alerts to the driver.

Single Factor vs. Multi Factor

Based on published information, **only Nauto is currently capable of real-time, multi-risk fusion calculations** to provide drivers with advanced detection and alerting to the presence of pedestrians, bicyclists, and motorcyclists in combination with driver behavior detection. This ability to detect and alert based on combined behaviors **exponentially increases safety because it is addressing multi-factor scenarios**, such as using a cellphone while braking or close following another vehicle while drowsy.

Advanced AI Technology

Risk fusion requires calculating risk across simultaneous events in milliseconds. It's difficult, but it's critical. That's why the Nauto AI dash cam is built on **the most powerful hardware available** today, which supports sophisticated, compute-intensive algorithms that are protected by **dozens of patented innovations**. This combination is the foundation for class-leading in-cab alert accuracy and speed.

Integrated Systems

Forward collision warning sensors have become common in new vehicles, but even advanced ADAS options from manufacturers that include FCW (forward collision warnings) do not factor driver behavior into their alerts. Adding Nauto to a vehicle delivers powerful ADAS functionality that is integrated into a holistic risk approach.

The Bottom Line

VTTI's study provides objective system performance data on Nauto's real-time AI safety solution. Nauto believes this data showcases its system's ability to **deliver superior safety and savings**, through 40-80% collision reduction, driver behavior improvements, and large decreases in collision loss, leading to payback in as little as 4.5 months for self-insured fleets.

Getting Started with Nauto

Better fleet and driver safety can't wait, so Nauto has developed end-to-end processes that can lead to implementation in just a few weeks with a higher level of customer service.

With Nauto, implementation covers more than just installation and initial user training. Nauto engages all its resources to ensure deployment is successful, including a dedicated project manager, customer success rep, and a full support team that includes a training manager, safety & risk advisory services, and a customer support team. Nauto maintains a high level of support because our mission is to help ensure customers are successfully reducing collisions and protecting lives, not just installing devices.

Nauto's safety and risk advisory services encompass program design, best practice methodologies, baselining, ROI analysis, and driver education to help ensure customer success. The Nauto team works to estimate the impact Nauto can make for a fleet, including in-depth loss reduction analysis, and demonstrates value to your finance, operations, and driver teams.

Implementation and installation are fast and easy. The devices can be installed in vehicles in as little as 20 minutes, and the system arrives with pre-configured settings tuned to national safety standards.

Using robust APIs, Nauto integrates with numerous existing technologies, including telematics systems (e.g., Geotab), fleet management systems and dispatch, routing, business intelligence, timecard, vehicle maintenance, and claims management tools.

The Nauto solution successfully scales from small fleets with several vehicles to fleets with tens of thousands of vehicles across all industry sectors, use cases, and vehicle types.

Nauto

Makes It Easy to Get Started

Supports Rapid Implementation

Delivers Safety and Savings

Thank You!

Read the full study at:

[VTTI: AI Dash Cam Performance Testing](#)



Disclaimer

This research was funded by Nauto. Although care has been taken to ensure complete and accurate study results, recipients of this document accept the possibility of unintended errors or omissions. The results expressed in this document are based on data collected from September 20, 2024, through December 12, 2024, under specific testing conditions that may not apply to other circumstances. VTTI does not endorse any products included or not included in this study.