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Ms. Sophie Shulman
Acting Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Advanced Notice of Proposed Rulemaking: Advanced Impaired Driving Prevention Technology
Docket No. NHTSA-2022-0079

Dear Acting Administrator Shulman:

The Insurance Institute for Highway Safety (IIHS) welcomes the opportunity to respond to the National Highway Traffic Safety Administration's (NHTSA's) advanced notice of proposed rulemaking (ANPRM) to require advanced impaired driving prevention technology (AIDPT) as directed by Congress under section 24220 of the Infrastructure Investment and Jobs Act (Bipartisan Infrastructure Law [BIL] of 2021). The BIL was signed into law over 2 years ago. Therefore, we are disappointed that this ANPRM does not disclose NHTSA's proposed response to its directive but merely expands upon its previous request for information (85 F.R. 71987–71989, available at https://www.regulations.gov/docket/NHTSA-2020-0102).

IIHS is an independent, nonprofit scientific, and educational organization dedicated to reducing deaths, injuries, and property damage from motor vehicle crashes through research and evaluation and through education of consumers, policymakers, and safety professionals. Our work is wholly supported by United States and Canadian automobile insurers and their associations.

The ANPRM states that NHTSA intends to focus on alcohol impairment. We agree with and encourage this focus. While distracted and drowsy driving also constitute significant risks to users of U.S. roads, alcohol-impaired driving is a particularly large and long-standing problem. In 2021, 13,384 people were killed in crashes involving at least one legally impaired driver (National Center for Statistics and Analysis [NCSA], 2023). These were about 30% of all 2021 road fatalities, a proportion that has remained unchanged for nearly 3 decades. NHTSA's other efforts to curtail impaired driving, as detailed in the ANPRM, are appreciated but do not seem sufficient to make further progress. At the same time, NHTSA's technology scans and its involvement with the Driver Alcohol Detection System for Safety (DADSS) program indicate that several in-vehicle technologies are near ready to detect impaired would-be drivers and prevent them from driving illegally. A regulatory requirement would ensure the necessary additional development effort to bring these technologies to fruition, and NHTSA has acknowledged its authority to require solutions that are not yet "developed, tested, and ready for deployment at the time the standard is promulgated" (NHTSA, 2024, p. 837).

IIHS believes that preventing trips by impaired drivers is preferable to other interventions discussed in the ANPRM. We also recognize that some of the impairment-sensing technologies identified by NHTSA could detect impaired drivers during their trips and also potentially address drowsy and distracted driving. The benefit of preventing trips by impaired drivers is clear (Farmer, 2021), and our updated analysis using data from 2018–2021 shows that 10,158 lives could be saved annually if trips by drivers with a blood alcohol content (BAC) of 0.08 g/dL and higher were prevented (Farmer, 2023; see the Appendix). The benefits of interventions that are possible once a trip has started are less clear. Limiting the speed of a

vehicle (via limp mode) being driven by an impaired driver may have estimable benefits, as doing so would limit the severity of crashes that still occur despite the intervention.
Addressing alcohol-impaired driving likely has a higher degree of public acceptance than attempting to address distracted or drowsy driving. According to the AAA Foundation for Traffic Safety's *2022 Traffic Safety Culture Index*, 94% of people surveyed agreed that driving after drinking is very/extremely dangerous and 7% admitted to doing so in the prior 30 days. While similar proportions of the public found the danger associated with distracted and drowsy driving was similarly high—93% and 96%, respectively—much higher proportions admitted to texting/emailing (27%) or reading (37%) on a handheld device or driving while drowsy (18%). Plus, 65% of respondents in a survey conducted by researchers at Johns Hopkins University agreed or strongly agreed with the statement, “All new cars should have an automatic sensor to prevent the car from being driven by someone who is over the legal alcohol limit” (Ehsani, 2023).

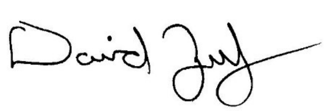
We are concerned that NHTSA considers "the term ‘passive’ to mean that the system functions without direct action from vehicle occupants” (NHTSA, 2024, pp. 831, 838). This interpretation seems to exclude the DADSS touch sensor, especially as NHTSA recognizes that some drivers in cold weather may need to remove gloves to interact with such a sensor. Even if integrated into “something that the driver must touch to operate the vehicle,” the sensing portion of a start button, gear selector, or steering wheel may not be located where some drivers choose to touch these (NHTSA, 2024, p. 844). Thus, drivers would be required to make a direct action to touch the specific sensing part of the vehicle control interface.

Many vehicles can be started remotely with mobile device apps, and some have push-button gear selectors with separate buttons for reverse and forward gears. The ways in which drivers interact with their vehicles is always evolving, and NHTSA should take this into account. NHTSA’s narrow interpretation of the term “passive” may exclude AIDPT interactions that drivers will find acceptable even if it involves new or novel ways to initiate a trip. We encourage NHTSA to reconsider its interpretation of “passive,” noting that section 24220 of the BIL does not define passive in any way. Instead, we suggest that NHTSA consider that “passive” would constitute any action that drivers would consider acceptable as part of their routine for embarking on a trip.

We offer answers to selected questions posed by NHTSA on pages 3 to 10.

The U.S. Congress has directed NHTSA to “issue a final rule … that requires passenger motor vehicles manufactured after the effective date of that standard to be equipped with advanced drunk and impaired driving prevention technology,” and more than 2 years have passed since the BIL was signed (NHTSA, 2024, p. 837). We urge NHTSA not to shirk its assignment. While the technology to passively detect alcohol-impaired drivers and prevent them from driving is not readily available in the marketplace, a regulatory requirement to equip passenger motor vehicles will inspire the additional effort needed to make it a reality.

Sincerely,



David Zuby
Executive Vice President and Chief Research Officer

Responses to select questions posed by NHTSA in Docket No. NHTSA-2022-0079

1.1. NHTSA requests feedback on the two technology scan findings. Are there technologies, or technology capabilities or limitations not captured in these reports? If so, what are they?

IIHS recently became aware of a technology that may be of interest to NHTSA's consideration of an AIDPT rulemaking. CorrActions (https://www.corractions.com) is a technology company that claims its software can discern various cognitive states, including alcohol impairment, through measurements of muscular movement, which possibly could be implemented by monitoring steering wheel inputs. See *Volvo Cars Tech Fund Invests in Driver Monitoring Startup CorrActions* (Lardinios, 2023), for example.

1.4. NHTSA is seeking input on how a test procedure for driver impairment detection systems could be developed and executed in a FMVSS.

NHTSA could develop a modification of SAE Recommended Practice J3214 to test passive breath sensors. An SAE committee is currently developing such a standard for testing systems in consumer vehicles, and DADSS has developed reference gas mixtures simulating human breath that could be used in conjunction with the standard. The same committee is also developing a test for systems based on measurements of capillary BAC through the skin, which could leverage DADSS's effort to develop surrogate skin that can be infused with alcohol (Zaouk et al., 2023).

If the agency chooses to include systems to detect and address distracted and drowsy driving, then it could use testing that follows the European Union examples for type regulation. Driver Drowsiness and Attention Warning (DDAW) systems are defined in Article 6 of Regulation (EU) 2019/2144 and Delegated Regulation (EU) 2021/1341. Advance Driver Distraction Warning (ADDW) systems are defined in Article 6 of Regulation (EU) 2019/2144 and Delegated Regulation (EU) 2023/2590. Automakers should be familiar with both standards and welcome U.S. harmonization with them. The DDAW regulation depends on testing with human subjects, which while more complicated than tests typically used for judging compliance with Federal Motor Vehicle Safety Standards (FMVSSs) should not be an impediment to its use. NHTSA has used this precedent in prescribing guidelines for the *Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices* (NHTSA, 2013).

NHTSA clearly has many options as it contemplates how a requirement for AIDPT could be enforced. We also would like to remind the agency that it has previously stipulated functional requirements without prescribing test procedures to verify them. FMVSS 126 (2007) requires that electronic stability control (ESC) systems mitigate understeer conditions without also defining a relevant test. Instead, the regulation defines necessary attributes of an ESC system (see S4 and S5.1) and also describes the documentation that automakers must make available to NHTSA upon request (see S6). Additionally, NHTSA has created a process for adopting compliance test procedures that did not exist when FMVSS 208 (2000) was promulgated (see S27.1). Thus, it seems that NHTSA's ability to create a standard for AIDPT is not contingent upon its ability to prescribe a compliance test procedure.

1.5. What kind of performance requirement should NHTSA consider to mitigate defeat strategies (*e.g.,* taping over the camera-based DMS or removing/replacing rear-view mirrors that contain driver monitoring equipment)?

NHTSA could mitigate the effect of defeat strategies by stipulating that AIDPT systems monitor their operability and be able to either prevent the vehicle from moving or allow it to operate only in limp-home mode when they detect that they cannot determine a driver's state because a sensor or camera has been blocked, damaged, or disconnected. It would help driver understanding if NHTSA also required that the AIDPT system present an informative error message when it limits vehicle function in response to a malfunction or tampering.

1.11. Under what conditions should a vehicle allow a driver to turn off driver impairment monitoring, if at all? If allowed, should a system be reset to "on" upon the next ignition cycle?

IIHS does not recommend that NHTSA allow driver impairment monitoring systems to be switched on and off by the driver. If the agency decides there are valid reasons to allow this, then these systems should be required to reset before the next trip.

2.2. Although the legal thresholds for DUI/DWI laws focus on BAC/BrAC, BAC/BrAC are typically not used in isolation by law enforcement to determine impairment. BrAC/BAC may provide additional evidence of impairment after an officer has observed driving behavior, the appearance of the driver (*e.g.,* face flushed, speech slurred, odor of alcoholic beverages on breath), the behavior of the driver, and any statements the driver has made about alcohol or drug use. Additionally, an officer may have administered the Standard Field Sobriety Test. Considering this, should regulatory options use BAC/BrAC in isolation to determine whether drivers are above the legal limit? If so, why?

The purpose of AIDPT is to mitigate the consequences (crashes, injuries, and death) of people driving in an impaired state. An FMVSS requiring AIDPT should not prescribe systems designed to help convict drivers of having violated impaired driving laws, which is the role of law enforcement and the basis for the need to gather additional evidence of the offense.

IIHS believes that using the BAC/breath alcohol content (BrAC) legal limit in isolation is an acceptable threshold for determining whether an AIDPT system should prevent a vehicle from moving or otherwise modify its function to reduce the risk of crashes. The legal limit seems a reasonable level to balance acceptability with a meaningful intervention against the alcohol-impaired driving problem.

The 2013–2014 National Roadside Survey of Alcohol and Drug Use by Drivers found that 1.5% of drivers had BACs at or above 0.08% during weekend nights (Berning et al., 2015), although rates at other times may be lower. A study conducted during 2010–2012 in Virginia Beach found 0.4% of drivers not involved in crashes had BACs that high (Compton & Berning, 2015). Thus, it can be expected that a very small percentage of drivers would be denied the full use of their vehicles if the threshold were set at BAC ≥ 0.08%. Nevertheless, preventing trips by drivers at this level of alcohol impairment could prevent more than 10,000 deaths according to an updated version of a 2021 analysis (Farmer, 2023; see the Appendix).

2.3. Are commenters concerned about using the legal limit (.08 g/dL) when there are indications that some individuals exhibit intoxication that would impact driving at lower or higher levels, depending on a number of factors discussed in the introduction? Why or why not? Might drivers with a BAC greater than 0 g/dL but less than .08 g/dL interpret the fact that their vehicle allows them to drive as an indication that it is safe for them to drive after drinking? If so, are there ways to mitigate this possible unintended consequence?

2.4. Given the quantifiable positive impacts on highway safety that Utah has experienced since lowering its BAC thresholds to .05 g/dL, should NHTSA consider setting a threshold lower than .08 g/dL?

While the science of intoxication and its effect on driving could support setting the threshold for an AIDPT intervention lower than the legal limit, IIHS does not believe such systems would be as broadly acceptable to the driving public. A recent survey found that 65% of respondents agreed or strongly agreed with the statement, “All new cars should have an automatic sensor to prevent the car from being driven by someone who is over the legal alcohol limit” (Ehsani, 2023). It seems likely that an intervention at lower levels of intoxication would be less strongly supported. Nevertheless, preventing all drivers with BAC ≥ 0.05 g/dL would save an additional 1,239 lives compared with setting the threshold at 0.08 g/dL.

As stated in our answer to Question 2.2, we believe that setting the threshold at 0.08 g/dL strikes a reasonable balance between the safety need and public acceptance. We suggest that setting a lower threshold either be staged with a later compliance date than specified in section 24220 of the BIL or in a separate rulemaking following the evaluation of the initial rule.

2.6. Would a standard that allows or requires systems that approximate BAC using BrAC (at any concentration) meet the Safety Act’s requirement that standards be objective? Would the technology detect BAC?

The presence of alcohol in the breath of a person who has consumed alcohol is explained by an underlying physiological process. The strong correlation between BrAC and BAC (e.g., Lukas et al, 2019) and its use as evidence in courts indicate that it is an objective indicator of BAC. Other physiologically explainable correlates to BAC with strong relations also would be objective.

2.8. What precision/accuracy should BAC detection technology be required to meet? Should any precision/accuracy requirement be fixed at a final rule stage, or should it become progressively more stringent over time with a phase-in?

It would be prudent for NHTSA to specify minimum levels of precision and accuracy as part of a rule requiring AIDPT in all light vehicles. Ideally, the specification would minimize the chance of misclassifying drivers as being above or below the threshold for intervention. The DADSS program has proposed standard error and standard deviation values at various levels of BAC to achieve this end (Ferguson et al, 2011). However, NHTSA should not allow the unavailability of ideal technology to prevent it from requiring systems that could prevent a significant number of trips by drivers with illegal BAC. As our updated analysis shows (Appendix), 9,243 or 7,020 lives could be saved by preventing trips with drivers whose BACs exceeded 0.1 g/dL or 0.15 g/dL, respectively. We agree that setting looser standards initially with a gradual phase in of a lower threshold and tighter requirements for accuracy and precision could accommodate the additional development time that may be needed to meet them.

2.9. For a BAC based sensor, NHTSA seeks comment on when during a vehicle's start-up sequence an impairment detection measurement should occur. For example, should an initial measurement of BAC/BrAC be required upon vehicle start-up, or before the vehicle is put into drive, and why? What is a reasonable amount of time for that reading to occur?

IIHS suggests that measurement could begin as soon as all vehicle doors are closed, which in the case of a system passively monitoring the driver's breath, may be necessary to isolate it from outside air. A determination should be made before allowing the vehicle to move (e.g., before a shift into Drive mode). This is preferable to upon vehicle start-up, as activating the engine or other power source would help mitigate concerns about drivers being stranded in adverse weather without shelter, warmth, or cooling while they arrange alternate means of transportation. Determining whether to allow the vehicle to move should happen in less time than the average driver needs to close the door, fasten their seat belt, activate the vehicle's main power source, and select Drive or Reverse mode.

2.10. NHTSA recognizes that ongoing detection would be necessary to identify if a driver reaches an impairment threshold only after commencing a trip, particularly if drinking during a drive. NHTSA seeks comment on whether BAC/BrAC measurements should be required on an ongoing basis once driving has commenced, and, if so, with what frequency, and why. Further, would a differentiation of the concentration threshold between initial and ongoing detection be recommended and why?

The decision to include the capability to measure a driver's BAC/BrAC during a trip should be predicated on the coincident capability to effectively and safely intervene to reduce the risk of harm associated with the driver continuing the trip. The only intervention that could be deemed safe without further study is presenting an alert to a driver who is detected to have a BAC above the threshold. Whether such a warning would be effective at encouraging safer behavior is not known.

Interventions involving automated control of the vehicle—slowing, stopping, or steering—are not without risk given the current state of automation available in passenger vehicles. Spicer et al (2021), for example, found that nearly 70,000 crashes that involved a struck disabled vehicle or a pedestrian that had exited their disabled vehicle occurred annually during 2016–2018, resulting in at least 1,300 serious injuries and 505 fatalities. Also, continued monitoring of the driver could be misconstrued as a lack of trust. DADSS is meant to be protective rather than punitive. Therefore, we suggest that the initial implementations of DADSS technology be limited to preventing trips by impaired drivers.

2.11. NHTSA requests comments on operational difficulties in using touch-based sensing (*e.g.,* consumer acceptance in colder climates when gloves may interfere) or in using breath-based sensing (*e.g.,* mouthwash, vaping, alcohol-drenched clothing, or other false positive indicators).

The issue of gloves in the context of a touch-based system raises the question of whether a touch system can be considered "passive" under the definition NHTSA has adopted in the ANPRM. Thus, IIHS recommends that NHTSA adopt a less stringent definition of "passive" and accept that when AIDPT systems initiate BAC measurement, it is done by a means shown to be acceptable to a large majority of drivers.

Breath alcohol immediately following the use of mouthwash with high concentrations of alcohol can be high enough to be detected as above the legal limit. However, these breath alcohol concentrations dissipate quickly, dropping below the legal limit in 15 minutes or less and becoming undetectable after about 20 minutes (Ernstgård et al., 2020).

2.12. What can be done to mitigate physical destruction and misuse? Examples may include having a sober passenger press the touch sensor or breathe toward the breath sensor. If mitigations exist, how might these mitigations impact the effectiveness of alcohol detection systems?

It may be possible to mitigate attempts to "trick" the system by requiring that systems incorporate driver monitoring system (DMS) cameras and algorithms to monitor that button presses, breath samples, etc., are coming from the person in the driver seat. Damaging or disabling the system could be discouraged by requiring that systems in such states prevent the vehicle from operating or adopt limp-home mode.

3.1. In light of the technology development needs to both passively and accurately detect .08 g/dL BAC and passively monitor the performance of a driver of a motor vehicle to accurately identify whether that driver may be impaired, are there interim strategies NHTSA should pursue?

If NHTSA decides not to require systems that passively and accurately detect whether drivers have a BAC ≥ 0.08 and prevent the vehicle from moving when in that state, then it should require systems that detect nonspecific forms of impaired driving by assessing driving inputs, kinematics, and DMS camera images. The regulation could leverage testing procedures from the European regulations identified in our answer to Question 1.4. Such systems could be required to respond to positive detections with milder forms of intervention than preventing or seriously limiting vehicle operation. Such a regulation also should define a phase-in of systems that would detect illegal BAC and prevent or seriously limit vehicle operations.

3.3. NHTSA is considering a phased approach to addressing alcohol impairment. The agency is concerned about false positives. Effectively, this approach could have a first phase that aims to address alcohol-impaired drivers with a BAC of .15 g/dL or higher, where an alcohol sensor could have better accuracy in detecting alcohol-impairment, in combination with a camera-based DMS and/or other vehicle technologies. By improving the BAC detection accuracy, it may gain more consumer acceptance by lowering the false positive rate (*i.e.,* the chance that someone with a BAC below .08 g/dL is incorrectly identified as alcohol-impaired by a vehicle system). This would also target the drivers with the highest levels of impairment. With time and accuracy improvement, a second phase could be pursued to achieve the .08 g/dL BAC accuracy needed to comply with BIL. NHTSA therefore seeks comment on the viability of this regulatory approach. Is a BAC of .15 g/dL the right limit to phase in?

IIHS agrees that if state-of-the-art AIDPT would result in too many interventions for nondrinking drivers, then phasing in the required threshold, accuracy, and precision is a reasonable approach to ensuring progress to address alcohol-impaired driving. As indicated in our response to Question 2.8, 9,243 or 7,020 lives could be saved by preventing trips with drivers whose BACs exceeded 0.1 g/dL or 0.15 g/dL, respectively.

Depending on the prescribed precision, some subthreshold but illegally impaired drivers may also be prevented from driving under this approach. As such, it would be a meaningful step toward eliminating alcohol-impaired driving with a lower risk of inconveniencing nondrinking drivers.

3.4. An option could also be a system with primary and secondary indicators within a driver impairment algorithm. For example, a system could incorporate a zero or low (.02 g/dL) tolerance BAC detection technology to initially sense whether alcohol is present in the vehicle. This would serve to "wake up" a driver impairment algorithm. Since this could be hand sanitizer or alcohol on a person's clothing, a second confirmation of driver impairment from a driver monitoring system would be needed. Driver performance measures, such as eye gaze, lane weaving, etc. would be the primary indicators of impairment and utilize evidence of alcohol as a supplementary indicator for alcohol impairment. Given this approach, would such a system allow a vehicle to better distinguish between alcohol impairment and other forms of impairment that have similar indicators (*i.e.,* the percentage of eyelid closure can be an indicator of both drowsy and drunk driving)? NHTSA notes that it has not identified any passive, production-ready, alcohol-impaired driver detection technology capable of accurate detection at .02 g/dL and seeks comment on the status of such technology.

IIHS is conducting research with the University of Iowa, the results of which may have bearing on NHTSA's question. We will share our results with the agency when the work is complete.

The use of a zero/no tolerance sniffer could be used to allow AIDPT that do not meet NHTSA's narrow definition of "passive." For example, a passive sniffer system that detects the presence of alcohol could issue a prompt directing the driver to place their hand on a touch-based sensor. When no alcohol is detected, the driver would be allowed to initiate vehicle motion without a secondary action.

4.3. NHTSA seeks comment on any adverse consequences of an impaired driver being unable to drive his/her vehicle. For example, this could result in an alcohol-impaired person being stranded late at night for hours and susceptible to being a victim of crime or environmental conditions (*e.g.,* weather). Or an alcohol-impaired camper may need to use his/her vehicle to escape from a rapidly approaching wildfire or environmental conditions (weather). How often would such incidences expect to occur (assuming full fleet implementation)? Are there logical strategies for mitigating the negative effects? What if the vehicle owner wishes to drive their vehicle on private land (*i.e.,* not on public roads)?

NHTSA's Non-Traffic Surveillance system provides some insight on the issues raised in this question. On average from 2008 to 2011, 483 people died in the circumstances captured by this surveillance. The most common non-crash fatality involved people being crushed by a falling vehicle (NCSA, 2020). At most, 38 deaths involved an "alcohol-impaired camper (that) may need to use his/her vehicle to escape from a rapidly approaching wildfire" (NHTSA, 2024, p. 853). (Thirty-three people died in vehicle fires, two of other burns, and three in miscellaneous vehicle incidents (NCSA, 2020). Although, it seems unlikely that any of these involved the circumstances NHTSA hypothesizes.)

Twenty deaths involved hypothermia and two involved drowning, which might relate to NHTSA's concern about being endangered by weather. It is likely that the relatively small number of deaths associated with being stranded in a nonworking vehicle (if that was the case for these deaths) represents the fact that

drivers in these situations have other means of getting where they are going. Indeed, Agero (2024) reports making 12 million roadside assistance dispatches per year, 20% of which involved flat tires (Cooper, 2023). Taxis, ride-hailing services, and ubiquitous mobile phones that could be used to summon a family member or friend provide illegally impaired drivers with alternate means of transportation.
If NHTSA finds that existing means are insufficient to address the concerns raised in this question, then it could require that AIDPT systems also include a means, independent of a connected mobile phone, to summon assistance. Motor vehicles are increasingly being equipped with internet connectivity, so such a requirement would be unlikely to add cost to an AIDPT system.

4.4. Given the previous examples, should there be an override feature for emergencies? Should there be maximum speed of the vehicle be limited during override? How could override feature be preserved for extreme situations and not used routinely when alcohol-impaired?

Ideally, an emergency qualifying for a legitimate override of an AIDPT system would represent a greater expected harm to someone than that associated with the impaired-driving trip needed to avoid that harm. Nevertheless, impaired drivers reacting to emergencies imperil themselves and their passengers as well as other road users.

At the societal level, the frequency of such emergencies in comparison to the toll of impaired driving should be considered with respect to deciding to allow emergency overrides. One possible way to deter abuse of emergency overrides would be to record when and where they occur. Doing so would conceivably facilitate holding cheating drivers accountable for any harm they may cause as a result of driving while impaired.

Limiting the vehicle speed would mitigate the crash risk and consequences associated with allowing systems to be overridden in emergency situations.

4.5. If a system detects alcohol impairment prior to the start of a trip and an interlock is activated, should retest(s) be allowed, at what elapsed time interval(s), and why? NHTSA especially seeks comment on test/data analysis methods for determining an optimal retest interval strategy. Finally, should data be recorded on the vehicle if retesting is permitted?

It would be reasonable to allow or require that AIDPT systems support retesting in cases of an interlock activation, although the number of retests within a specified period ought to be limited. The retest interval should be set to accommodate possible temporary sources of false BAC/BrAC readings, e.g., an immediate prior use of high-alcohol mouthwash. The system should not record BAC except in cases of an override (if allowed). IIHS does not recommend the recording of retests.

6.2. Stopping in the middle of the road could introduce new motor vehicle safety problems, including potential collisions with stopped vehicles and impaired drivers walking in the roadway. What strategies can be used to prevent these risks? How are risks different if the vehicle stops on the shoulder of the road? What preventative measures could be implemented for vehicles approaching the stopped vehicle? What are the risks to occupants involved in those scenarios?

According to Spicer et al (2021), 566 people were killed and 14,371 were injured in crashes that involved disabled vehicles. These risks could be ameliorated by automatic and enhanced hazard lighting and the remote notification of other drivers. Emergency Safety Solutions (2024), for example, is developing both features, and research by the Virginia Tech Transportation Institute has shown that hazard lights blinking with a frequency of 5 Hz enhance drivers' ability to respond to disabled vehicles on the side of the road (Terry et al., 2021; Williams & Gibbons, 2022).

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Appendix: Update of the 2021 IIHS study *Potential Lives Saved by In-Vehicle Alcohol Detection Systems*

The 2021 IIHS study *Potential Lives Saved by In-Vehicle Alcohol Detection Systems* by Charles M. Farmer estimated the

- number of U.S. crash deaths per year attributable to alcohol-impaired driving and the
- number of lives that could be saved per year within 3, 6, and 12 years of a mandate for vehicle-based alcohol detection systems.

These estimates were based on fatal crash data from calendar years 2015–2018. IIHS updated the analyses in this 2021 study using fatal crash data from calendar years 2018–2021.

Annual crash deaths attributable to alcohol-impaired drivers

During the years 2015–2018, there were on average 36,831 roadway crash deaths per year, with 10,666 (29%) involving alcohol-impaired drivers (Table 1, as published in Farmer, 2021).

During the years 2018–2021, there were on average 38,784 roadway crash deaths per year, with 11,502 (30%) involving alcohol-impaired drivers (Table 1 updated, Farmer, 2023).

After a 1.3% decline in 2019, deaths increased 7.3% in 2020 and 10.1% in 2021. After a 4.8% decline in 2019, deaths involving alcohol-impaired drivers increased 14.9% in 2020 and 14.2% in 2021.

Table 1. Deaths in crashes on U.S. roadways, 2015–2018

Year	Deaths	Deaths involving an alcohol-impaired driver*	% involving an alcohol-impaired driver
2015	35,485	10,280	29.0
2016	37,806	10,967	29.0
2017	37,473	10,908	29.1
2018	36,560	10,511	28.8
	147,324	42,666	29.0

* Deaths in crashes involving at least one driver with a BAC of 0.08 g/dL or higher (National Center for Statistics and Analysis, 2019).

Table 1 (updated). Deaths in crashes on U.S. roadways, 2018–2021

Year	Deaths	Deaths involving an alcohol-impaired driver*	% involving an alcohol-impaired driver
2018	36,835	10,710	29.1
2019	36,355	10,196	28.0
2020	39,007	11,718	30.0
2021	42,939	13,384	31.2
	155,136	46,008	29.7

* Deaths in crashes involving at least one driver with a BAC of 0.08 g/dL or higher (National Center for Statistics and Analysis, 2023).

Potential lives saved per year

In the 2021 study, the potential lives saved per year in calendar years 2015–2018 were originally published in Table 4 (p. 10): 1,040 within 3 years of a mandate for vehicle-based alcohol detection systems, 4,596 within 12 years, and 9,409 long-term.

For calendar years 2018–2021, these estimates are updated to 1,071 within 3 years of a mandate, 4,632 within 12 years, and 10,158 long-term (Table 4 updated, Farmer 2023).

Table 4. Potential lives saved per year if drivers were restricted to various BAC levels

Based on years 2015-2018	Potential lives saved if BACs were reduced to		
Driver type	Zero	Below 0.05 g/dL	Below 0.08 g/dL
All drivers	11,930	10,574	9,409
Drivers of vehicles < 12 years old	5,857	5,178	4,596
Drivers of vehicles < 9 years old	3,882	3,426	3,037
Drivers of vehicles < 6 years old	2,612	2,301	2,038
Drivers of vehicles < 3 years old	1,334	1,174	1,040
Drivers with prior alcohol convictions	986	907	837
Fleet drivers	465	399	348

Table 4 (updated). Potential lives saved per year if drivers were restricted to various BAC levels (updated)

Based on years 2018–2021	Potential lives saved if BACs were reduced to				
Driver type	Zero	Below 0.05 g/dL	Below 0.08 g/dL	Below 0.10 g/dL	Below 0.15 g/dL
All drivers	12,822	11,397	10,158	9,243	7,020
Drivers of vehicles < 12 years old	5,850	5,200	4,632	4,216	3,197
Drivers of vehicles < 9 years old	4,459	3,959	3,524	3,206	2,429
Drivers of vehicles < 6 years old	3,016	2,677	2,382	2,169	1,644
Drivers of vehicles < 3 years old	1,372	1,209	1,071	974	741
Drivers with prior alcohol convictions	913	842	774	719	572
Fleet drivers	530	450	392	354	263

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