March 6, 2020

James Owens
Acting Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Submitted electronically to https://www.regulations.gov and via electronic mail
Docket No. NHTSA-2019-0102

Intel Corporation Response to Request for Comments:
Advanced Driver Assistance Systems Draft Research Test Procedures

Dear Acting Administrator Owens:

Intel Corporation appreciates the opportunity to respond to the U.S. Department of Transportation's (USDOT) National Highway Traffic Safety Administration (NHTSA) Request for Comments on *Advanced Driver Assistance Systems (ADAS) Draft Research Test Procedures*.

We applaud USDOT and NHTSA's continued leadership in advancing the safe testing and deployment of ADAS in motor vehicles and motor vehicle equipment. Intel has strongly supported the Department's efforts to advance ADAS technologies in order to enable increased safety and to save lives. As NHTSA has estimated, traffic crashes in the U.S. claimed 36,560 lives in 2018,[1] and the U.S. social harm (economic and societal impact) of motor vehicle crashes is over $800 billion each year.[2] With 94 percent of serious crashes caused by human error – and the potential for ADAS technologies to mitigate human error in the driving equation – the positive societal impact of ADAS technologies is significant.

[1] *2018 Fatal Motor Vehicle Crashes: Overview*, Report No. DOT HS-812-826 (October 2019), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812826.

[2] *Economic and Societal Impact of Motor Vehicle Crashes*, 2010 (revised), Report No. DOT HS-812-013. Washington, DC: NHTSA (May 2015), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013.

Intel's Mobileye business unit is the leader in ADAS today, powering 70% of models that received a 5-star safety rating from Euro NCAP in 2018-2019. We are pioneers in the use of computer vision technology to save lives on the road. Today that technology is scaling up to become the building blocks for a fully autonomous (Level 5) vehicle (AV). At the same time, the technology we are developing for AVs is proving useful for next-level ADAS that we call "level 2+."[3]

Mobileye is dedicated to leveraging the newest technology, including AI, deep learning and crowdsourcing, to create the hardware and software needed to help our over 25 OEM partners enable ADAS systems and eventually AVs. Over 54 million vehicles worldwide are equipped with Mobileye technology. Mobileye's technology keeps passengers safer on the roads, reduces the risks of traffic accidents, saves lives and has the potential to revolutionize the driving experience by enabling autonomous driving.

Mobileye's software algorithms and EyeQ® chip (now in its 5th generation) perform detailed interpretations of the visual field in order to anticipate possible collisions with other licensed vehicles, pedestrians, animals, debris and other obstacles. Our products are also able to detect roadway markings such as lanes, road boundaries, barriers and similar items, as well as to identify and read traffic signs and traffic lights. What sets the EyeQ family of system-on-chip (SoC) devices apart from the competition is EyeQ's ability to support complex and computationally intense vision processing and still maintain low power consumption even while located on the windshield.

To address the challenge of autonomous driving, Mobileye is also setting the path for harnessing the power of the crowd through its Road Experience Management (REM). REM is an end-to-end crowd sourced mapping and localization engine for enhanced ADAS and full autonomy. REM leverages the proliferation of camera-based ADAS systems to build and maintain in near real-time an accurate HD map of the environment. While other sensors such as radar and LiDAR may provide redundancy for object detection, the camera is the only real-time sensor for driving path geometry and other static scene semantics (such as traffic signs, on-road markings, etc.). Therefore, for path sensing and foresight purposes, only a highly accurate map can serve as the source of redundancy.

Once an AV can sense the scene around it and localize itself on a map, the final piece allowing it to share the road with human drivers is the "driving policy." We have published a transparent, technology-neutral mathematical model for automated driving system (ADS) safety decision making called Responsibility-Sensitive Safety or RSS.[4] RSS formalizes what it means to be a safe driver into technology-neutral and transparent mathematical equations. It provides a detailed,

[3] *Defining the "Plus" in L2+*, https://newsroom.intel.com/articles/defining-plus-l2/#gs.qfiu0x.

[4] *Responsibility-Sensitive Safety (RSS): A mathematical model for autonomous vehicle safety*, https://www.mobileye.com/responsibility-sensitive-safety/.

practicable, and efficient solution for validating an ADS that results in a verifiable safe-by-design automated vehicle. And while RSS was originally designed for ADS, RSS can also be leveraged to ADAS to enhance the safety of human drivers. By using RSS formulas with automated emergency braking, we can help the vehicle to proactively avoid risk *via* a technique we call "Automated Preventative Braking (APB)."[5] Using formulas to determine the moment when the vehicle enters a dangerous situation, APB would help the vehicle return to a safer position by applying small, barely noticeable preventative braking instead of sudden braking to prevent a collision. If APB were installed in every vehicle using an affordable forward-facing camera, we believe this technology can eliminate a substantial proportion of front-to-rear crashes resulting from the inattention of drivers. And if we add surround camera sensing and the map into the equation so that preventative braking can be applied in more situations, we can hope to eliminate nearly all collisions of this nature.[6]

The drive toward an autonomous future is first and foremost about safer roads. It is a future that cannot come soon enough for the over 1 million people that die worldwide in crashes each year.[7] Intel and Mobileye see it as a moral imperative to deliver the technology that will make this future possible. But we don't have to wait for AVs to make our roads safer. ADAS solutions are already reducing the number and severity of crashes. And the more vehicles we can equip with this technology, the more we can bring these benefits forward. For Intel and Mobileye, safety is our North Star. And the safer roads we expect from our autonomous future are arriving with assisted driving today.

Intel and Mobileye appreciate the opportunity to engage with USDOT and NHTSA through this comment process, as we work with partners across the industry to enable and proliferate this life-saving technology. Thank you for your consideration of our feedback and ongoing efforts to ensure American leadership in the safe testing and deployment of this life-saving technology. If you have any questions or require follow-up information, please contact Yoni Epstein, Advanced Development Project Manager at +972-2-5417373 or Yoni.Epstein@Mobileye.com.

Sincerely,
/s/ Nancy Bell

Nancy Bell
Policy Counsel, Automated Driving & IoT
Intel Corporation

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[5] *Vision Zero: Can Roadway Accidents be Eliminated without Compromising Traffic Throughput?*, https://www.mobileye.com/responsibility-sensitive-safety/vision_zero_with_map.pdf.

[6] *Using Autonomous Vehicle Technology to Make Roads Safer Today,* https://newsroom.intel.com/editorials/using-autonomous-vehicle-technology-make-roads-safer-today/#gs.qgtbbj

[7] https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries

APPENDIX A

Feedback on Draft Research Test Procedures Developed by NHTSA to Assess the Performance of Certain Types of Advanced Driver Assistance Systems (ADAS) Available to Consumers

Light Vehicles

1. Intersection Safety Assist (ISA)

We have several comments regarding the proposed ISA scenarios:

- Scenario S1-C will likely not be supported by the majority of current systems on the market due to Field-Of-View limitations. In the coming years, as ADAS products evolve towards 360° sensing, we expect a larger number of models will be able to support collision avoidance in this scenario.

- In the ISA Scenario 3 near-miss scenario (SV turning), the "miss timing" is slightly too short. Minute deviations in execution can cause a collision or yield braking responses.

- The paths of the SV in turning scenarios with fixed radii (S2-A, S3) should be refined to clothoid-paths, which will yield acceptable lateral accelerations. The current radii may also cause systems to change their risk assessment very late, making full avoidance very difficult to achieve, especially at high speeds. The same comment applies to S2B & S2C, where requiring a function to respond properly in these scenarios will yield an oversensitive function with a high risk of false activations due to the difficulty in accurately predicting the acceleration and turning maneuver. Harmonization of test protocols with the maneuvers defined by Euro NCAP in similar scenarios should be considered.

2. Pedestrian Automatic Emergency Braking (PAEB)

- Many OEMs configure their Pedestrian-FCW to thresholds which would result in an alert for the S1f/S1g tests, such a warning should be considered acceptable.

- The paths of the SV in turning scenarios with fixed radii (S2-A, S3) should be refined to clothoid-paths which will yield more acceptable lateral accelerations and can be harmonized with the path-definitions used in similar maneuvers in Euro NCAP protocols.

3. **Traffic Jam Assist (TJA)**

- In the LVDAD scenario, the speeds are not clear. The test overview (5.3.5.2) states the SV is 30mph while in the table (3) there are 2 different speeds (15mph & 25mph). In addition, the headway is not properly defined.

<u>Mapping</u>

As new ADAS products are deployed, some of the advanced features utilize real-time maps, such as REM. These maps provide an accurate 3D model of the world, which in turn enhances the accuracy and availability of various safety features by localizing the host car with cm-level accuracy within the map. Examples of such enhancements are:

- Lane Keep Assist receives consistent and accurate information regarding the lane markers and road edges, and the driving path for each lane. The map also ensures lane-keeping support can be maintained in scenarios that are more complex such as sharp curves, slopes/crests and highway exits, in particular those that are not fully marked.

- Speed Assist & Intelligent Cruise Control benefit from comprehensive near real-time information regarding all speed limit information, including construction areas and dynamic speed limits, while more advanced function can also utilize information about road closures, traffic jams, car accidents, hazards on the road and more.

- Enhanced Relevance for Semantics – understanding exactly which traffic signs and traffic lights are relevant for the host lane or driving path serves to provide an added layer of redundancy to real-time sensing, and enables higher robustness levels required for advanced functionality such as warning or braking on red traffic lights or violation of stop or no entry signs.

We recommend ensuring test protocols are designed such that functions relying on HD maps will be able to utilize their full potential. For example, if closed test courses are to be used then such courses should be open to be mapped by relevant map suppliers. Intel and Mobileye look forward to further engagement with the agency on achieving this goal.