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April 1, 2020

The Honorable Elaine L. Chao  
Secretary of Transportation  
United States Department of Transportation  
1200 New Jersey Ave., S.E.  
Washington, DC 20590

The Honorable Michael Kratsios  
United States Chief Technology Officer  
Office of Science and Technology Policy  
1650 Pennsylvania Ave., N.W.  
Washington, DC 20504

**Re: Office of the Secretary (OST) U.S. Department of Transportation (DOT) Notice of Request for Comments: *Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0 (AV 4.0)*, Docket No. DOT-OST-2019-0179, 85 Fed. Reg. 7011 (February 6, 2020)**

Dear Secretary Chao and Mr. Kratsios:

Intel Corporation (Intel) appreciates this opportunity to provide input to the US Department of Transportation's ("DOT" or "Department") and the White House Office of Science and Technology Policy (OSTP) request for public comment on *Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0 (AV 4.0)*.

We applaud your continued leadership in advancing the safe testing and deployment of automation technologies across the U.S. surface transportation system and commend the Department's recognition of the increasingly critical role that technology companies like Intel are playing in the development, testing and deployment of automated vehicles. AV 4.0 continues the Administration's efforts to vastly increase safety on our nation's roads and highways, enhance mobility for our elderly and disabled communities, improve transportation efficiency, and prioritize U.S. competitiveness in the highly competitive global automated vehicle marketplace through a resource that unifies AV-related initiatives across the Federal government and identifies important opportunities for public-private collaboration

Intel has strongly supported the Department's efforts to advance automated vehicle technologies in order to enable increased safety and ensure that the U.S. remains a technology leader in automated vehicle innovation and investment.

And, Intel wholly concurs with USDOT's automation principles. This includes prioritizing safety first and foremost; adopting technology neutral policies that promote competition and innovation; supporting development of industry-driven and performance-oriented voluntary technical standards; and encouraging a consistent regulatory and operational environment to enable scale of automated vehicles. The principles outlined in AV 4.0 are helpful to public and private entities alike as they work towards the common goal of advancing roadway safety.

As a global leader in vehicle safety technologies and the development of automated driving systems (ADS), Intel's comments will focus on AV 4.0's highest guiding principle, namely prioritizing the physical safety of vehicle operators, occupants, and vulnerable road users including pedestrians, bicyclists, and motorcyclists.

From driver assist solutions through fully automated vehicle technologies, our mission is road safety. And, we believe that now more than ever, a unified and collaborative approach is critical to enable the successful testing and deployment of AV technologies. In 2018 alone, 36,560 people died in the 2 million traffic crashes on our nation's roadways.<sup>1</sup> Given that 94 percent of car crashes are attributable to human behavior or error, AVs can decrease the likelihood of these crashes by supplementing or even replacing the human driver.

We have been an industry leader in collaboratively defining a universally acceptable set of safety assurance principles for ADS. Specifically, we believe it is important for industry to collaborate on a technology neutral, transparent, performance-based model and test procedure for ADS safety decision making, in partnership with DOT and/or global standards bodies. This will enable a common definition of what it means for an automated vehicle to drive safely, as well as a common metric to measure and assess the safety of an automated vehicle.

Consistent with this belief, we have published a transparent, technology-neutral mathematical model for ADS safety decision making called Responsibility-Sensitive Safety or RSS.<sup>2</sup> RSS formalizes what it means to be a safe driver into technology-neutral and transparent mathematical equations. It provides a detailed, practicable, and efficient solution for validating an ADS that results in a verifiable safe-by-design automated vehicle. As a parameterized model, RSS also enables flexibility in setting the balance between the safety and usefulness of automated vehicles operating in the real world.<sup>3</sup> This collaborative model is being supported by a number of industry-wide stakeholders and initiatives –

- A 2018 RAND report highlighted RSS as a “leading” measure (reflecting performance, activity, prevention) of a safe-by-design automated vehicle.<sup>4</sup> RSS may be used as a

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

<sup>2</sup> Responsibility-Sensitive Safety (RSS): A mathematical model for autonomous vehicle safety, <https://www.mobileye.com/responsibility-sensitive-safety/>.

<sup>3</sup> Driving safely is often cultural and RSS, as a parametrized model, enables customization to ensure automated vehicles are “driving safely” as defined by each country (e.g., U.S.) or region (e.g., EU) where vehicle is operating.

<sup>4</sup> Measuring Automated Vehicle Safety, Forging a Framework, RAND Corporation (2018), at 29-32, [https://www.rand.org/content/dam/rand/pubs/research\\_reports/RR2600/RR2662/RAND\\_RR2662.pdf](https://www.rand.org/content/dam/rand/pubs/research_reports/RR2600/RR2662/RAND_RR2662.pdf).

“lagging” measure (observations of safety outcomes or harm) to collect statistical evidence of frequency of dangerous situations and crashes.

- Intel recently joined ten other automated driving and mobility industry leaders<sup>5</sup> to publish the Safety First for Automated Driving framework,<sup>6</sup> a first-of-its-kind framework for safe automated passenger vehicles, which defines a safe-by-design approach to automated driving. RSS is featured in this framework as an element for a safe-by-design automated vehicle. This effort is now the basis of an ISO Detailed Technical Report (ISO / TC 22 / DTR 4804).
- The Institute of Electrical and Electronics Engineers (IEEE) has approved a proposal to develop a standard for safety considerations in automated vehicle (AV) decision-making, naming Intel to lead the workgroup.<sup>7</sup> Participation in the workgroup includes broad industry representation. Intel has contributed RSS to the workgroup, which importantly seeks to align the industry on what it means for an automated vehicle to drive safety.

Proving the safety of automated vehicles is essential to establish consumer trust, in order to realize the multifold benefits these vehicles will deliver. We must invest in the research of transparent, technology-neutral safety assurance solutions, appropriate public policies, and common industry safety standards. Public-private consortiums, broad-based coalitions, and global standards bodies like IEEE, SAE, and ISO play a critical role in these efforts and building the trust necessary to test and deploy automated vehicles at scale across the U.S.

We would also like take this opportunity to applaud AV 4.0's recognition of the advancements in the safe testing and deployment of ADAS in motor vehicles and motor vehicle equipment. As noted in AV 4.0, “[t]oday's Advanced Driver Assistance Systems (ADAS) that help vehicles avoid collisions form the building blocks for tomorrow's Automated Driving Systems (ADS). Advances in these technologies can reduce roadway crashes, fatalities, and injuries and assist the USDOT in managing safety risks along the path to the full commercial integration of AV technology.”

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, the U.S. social harm (economic and societal impact) of motor vehicle crashes is over \$800 billion each year.<sup>8</sup> With the potential for ADAS technologies to mitigate human error in the driving equation – the positive societal impact of ADAS technologies is significant.

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<sup>5</sup> Aptiv, Audi, Baidu, BMW, Continental, Daimler, FCA, HERE, Infineon, Intel, Volkswagen.

<sup>6</sup> Intel and Auto Industry Leaders Publish New Automated Driving Safety Framework (July 2, 2019), at 55-56, <https://newsroom.intel.com/news/intel-auto-industry-leaders-publish-new-automated-driving-safetyframework/#gs.q95rv4>.

<sup>7</sup> <https://newsroom.intel.com/news/ieee-to-define-a-formal-model-for-safe-automated-vehicle-decision-making/#gs.w4e678>

<sup>8</sup> *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. At the same time, the technology we are developing for AVs is proving useful for next-level ADAS, categorized as level 2+ (L2+), that Mobileye introduced in 2017 to apply the life-saving potential of AV technology to today's vehicles,<sup>9</sup> automakers recognize this exciting opportunity to enhance safety, making roads safer in the near term while bridging the gap to higher levels of autonomy, and eight out of 11 L2+ systems in production as of Q4 2019 are based on Mobileye technology.

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 is also using RSS formulas with automated emergency braking which can help the vehicle to proactively avoid risk *via* a technique we call "Automated Preventative Braking (APB)."<sup>10</sup> Using RSS 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 without relying on sudden emergency braking maneuvers. And if we add surround camera sensing and the mapping into the equation so that preventative braking can be applied in more situations, we can hope to eliminate nearly all collisions of this nature.<sup>11</sup>

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.<sup>12</sup> 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. 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.

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<sup>9</sup> *Defining the "Plus" in L2+*, <https://newsroom.intel.com/articles/defining-plus-l2/#gs.qfiu0x>.

<sup>10</sup> *Vision Zero: Can Roadway Accidents be Eliminated without Compromising Traffic Throughput?*, [https://www.mobileye.com/responsibility-sensitive-safety/vision\\_zero\\_with\\_map.pdf](https://www.mobileye.com/responsibility-sensitive-safety/vision_zero_with_map.pdf).

<sup>11</sup> *Using Autonomous Vehicle Technology to Make Roads Safer Today*, <https://newsroom.intel.com/editorials/using-autonomous-vehicle-technology-make-roads-safer-today/#gs.ggtbbj>

<sup>12</sup> <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>

Intel appreciates the opportunity to engage with DOT and OSTP through this comment process and we are excited to be enabling life-saving vehicle safety technologies with our partners across the marketplace. Thank you for your ongoing efforts to ensure American leadership in the safe testing and deployment of these transformative AV and ADAS technologies.

Sincerely,

/s/ Nancy Bell

Nancy Bell

Policy Counsel, Automated Driving & IoT

Intel Corporation