| Application No. | Applicant | Regulation(s) affected | Nature of the special permits thereof |
|---|---|---|---|
| 21433–N ......... | Pyrotek Special Effects Lititz .. | 173.306(k) .............................. | To authorize the transportation in commerce of used and partially full 2Q cans of flammable gas (Salamander or G-Flame cans) in accordance with the exception for aerosols in § 107.306(k). (mode 1). |
| 21435–N ......... | Zhejiang Dongcheng Printing Industry Co., Ltd. | 173.304(d) .............................. | To authorize the manufacture, marking, sale and use of a non-DOT specification non-refillable inside container similar to a 2Q specification container. (modes 1, 2, 3, 4). |
| 21437–N ......... | Linde Gas & Equipment Inc ... | 173.181(d)(1), 173.181(d)(1)(ii). | To authorize the transportation in commerce of DOT specification combination packagings that consist of a UN1A1 2 port inner drum, with a capacity other than 10 or 20 liters, inside a UN1A2 drum containing UN 3394, Organometallic Substance, Liquid, Water Reactive, 4.2 (4.3). (modes 1, 2, 3). |
| 21438–N ......... | Samsung SDI America, Inc .... | 172.101(j) ............................... | To authorize the transportation in commerce of lithium ion batteries exceeding 35 kg by cargo-only aircraft. (mode 4). |
| 21441–N ......... | K&M Transportation Services, LLC. | 173.196(b)(2) .......................... | To authorize the transportation in commerce of infectious substances in alternative packaging. (mode 1). |

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**BILLING CODE 4909–60–P**

## DEPARTMENT OF TRANSPORTATION

**[Docket No. DOT–OST–2022–0096]**

## Enhancing the Safety of Vulnerable Road Users at Intersections; Request for Information

**AGENCY:** Department of Transportation (DOT).

**ACTION:** Notice; request for information (RFI).

**SUMMARY:** Improving the safety of pedestrians, bicyclists, and other vulnerable road users (VRUs) is of critical importance to achieving the objectives of DOT's National Roadway Safety Strategy (NRSS), and DOT's vision of zero fatalities and serious injuries across our transportation system. According to data from the National Highway Traffic Safety Administration (NHTSA), in 2020 there were 10,626 traffic fatalities in the United States at roadway intersections, including 1,674 pedestrian and 355 bicyclist fatalities. These fatalities at intersections represent 27% of the total of 38,824 road traffic deaths recorded in 2020. Separately, considerable development efforts have been made into automation technologies over the past two decades, including in the areas of vehicle automation, machine vision, perception and sensing, vehicle-to-everything (V2X) communications, sensor fusion, image and data analysis, artificial intelligence (AI), path planning, and real-time decision-making. DOT is interested in receiving comments on the possibility of adapting existing and emerging automation technologies to accelerate the development of real-time roadway intersection safety and warning systems for both drivers and VRUs in a cost-effective manner that will facilitate deployment at scale.

**DATES:** Written submissions must be received within 30 days of the publication of this RFI. DOT will consider comments received after this time period to the extent practicable.

**ADDRESSES:** Please submit any written comments to Docket Number DOT–OST–2022–0096 electronically through the Federal eRulemaking Portal at *https://www.regulations.gov.* Go to *https://www.regulations.gov* and select ''Department of Transportation (DOT)'' from the agency menu to submit or view public comments. Note that, except as provided below, all submissions received, including any personal information provided, will be posted without change and will be available to the public on *https://www.regulations.gov.* You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477) or at *https://www.transportation.gov/privacy.*

**FOR FURTHER INFORMATION CONTACT:** For further information contact *safeintersections@dot.gov.* You may also contact Mr. Timothy A. Klein, Director, Technology Policy and Outreach, Office of the Assistant Secretary for Research and Technology (202–366–0075) or by email at *timothy.klein@dot.gov.*

**SUPPLEMENTARY INFORMATION:** DOT is committed to the vision of zero fatalities and serious injuries on our Nation's roadways, and improving the safety of vulnerable road users (VRUs) at intersections is an important component of that vision. According to data from NHTSA, in 2020 there were 10,626 traffic fatalities in the United States at intersections, including 1,674 pedestrians and 355 bicyclists. These fatalities at intersections represent 27% of the total of 38,824 road traffic deaths recorded in 2020. Ensuring VRU safety is an urgent issue as it is essential to allowing pedestrians, bicyclists, wheelchair users, and others the safe use of roadways in urban and rural environments in the United States. Reducing crashes at roadway intersections is an important component of making our streets safer for all users.

Considerable development efforts have occurred in automation and vehicle automation technologies over the past two decades, including in the areas of machine vision, perception and sensing, vehicle-to-everything (V2X) communications, sensor fusion, image and data analysis, artificial intelligence (AI), path planning, and real-time decision-making on board vehicles. For the purposes of this RFI, these automation technologies are considered to include but are not limited to advanced driver assistance systems (ADAS), automated driving systems (ADS) and associated vehicle connectivity technologies, as well as other automation technologies that can enhance the safety of VRUs at roadway intersections. DOT is interested in receiving comments on the feasibility of adapting these automation technologies to the application of warning systems that provide real-time safety and warning alerts for both VRUs and drivers at intersections in a cost-effective manner that will facilitate the deployment of these systems at scale. Such safety systems could warn of and mitigate the effects of an impending crash at an intersection for VRUs and vehicles alike.

### A Conceptual VRU and Vehicle Warning System

The on-vehicle automation technologies currently being developed for fully automated vehicle operation—including machine vision, perception, sensor fusion, real-time decision-making, artificial intelligence and V2X—could be used today to enhance safety for all road users. Consider the deployment of these technologies as infrastructure assets at each roadway intersection, pedestrian crossing, and railroad crossing, in order to alert approaching vehicles of the approach or incursion of pedestrians, bicyclists and other VRUs, and vice versa. A conceptual VRU and vehicle warning system will likely be made up of fixed infrastructure assets that use robust sensing and computational technologies to perform optimally across a range of environmental and operational conditions, including non-line-of-sight (NLOS) conditions. The conceptual intersection safety system that is described in this RFI should not be considered as prescriptive, but merely one potential configuration amongst many possible designs.

At busy roadway intersections across any particular time period there will be a large number of vehicle and VRU movements, including vehicles turning, pedestrians crossing the roadway, bicyclists crossing the roadway, etc. For the majority of these movements, including those that involve close interaction between drivers and VRUs, the vehicle-VRU interaction will proceed without incident. A small fraction of those interactions might involve near-misses where a vehicle comes close to colliding with another vehicle or a VRU at a roadway intersection. A much smaller fraction of those interactions results in a collision between vehicles and VRUs, resulting in injury or in a smaller fraction yet, an entirely avoidable pedestrian or VRU fatality. It is the intent of this RFI to investigate the possibility of developing new technologies, or new technology and/or system combinations, to prevent vehicle-VRU crashes while facilitating normal traffic flows and VRU movements.

For the purposes of this RFI, VRUs are defined as pedestrians, bicyclists, and micro-mobility device users, including users of scooters, e-skateboards, wheelchairs, etc. Vehicles are defined as any roadway vehicles including passenger cars, trucks, vans, public transit buses, and commercial vehicles. Equipping each roadway intersection location today with the requisite machine vision hardware, computational capability, networking, communications, and safety alerting and warning technology would likely cost hundreds of thousands of dollars per roadway intersection. While this concept of repurposing mobile (vehicle) automation technologies in the fixed domain is not new, it has not been commercialized or implemented at scale due to the high system costs involved and the complexities of developing a standardized and proven safety solution. There is an imperative to reduce the cost of providing advanced safety systems that can ensure the safety of all road users at roadway intersections, pedestrian crossings, trail-roadway crossings, and railroad crossings. A cost reduction of 10–100x for such a system—down to under $10,000 for the hardware and software ''stack'' per intersection—would significantly accelerate the implementation and deployment of these potentially life-saving road safety technologies. As an example of the potential of cost reduction in an adjacent domain, LiDAR units for automated vehicles (AVs) have seen a 100x reduction in cost while progressing from large roof-mounted electro-mechanical systems to smaller solid-state devices.

An effective roadway intersection safety system (designated here as a ''conceptual VRU and vehicle warning system'') will likely require machine vision, perception or sensing (LiDAR, radar, cameras, acoustics etc. mounted on stationary structures), sensor fusion, computation, communications, and warning systems to be developed, tested and validated, and integrated along with software for vision, sensing, and decision-making (to include AI). The intention of this RFI is to ascertain the state of the art of relevant automation technologies, and the potential for re-purposing existing and emerging technologies for this stationary intersection safety application. The reduction in the cost of these life-saving systems by a factor of 10–100x through the targeted application of automation technologies would allow for the development of a new, standardized VRU warning system that could significantly benefit system end-users, including State, local, Tribal and territorial DOTs and jurisdictions.

## Additional Considerations for a VRU and Vehicle Warning System

The development of an automated VRU and vehicle warning system should incorporate the use of existing standards and protocols to the greatest extent possible. System-to-vehicle and vehicle-to-system communications and networking (V2X), using standard and emerging protocols, will likely be required (note that ''system'' here can include fixed infrastructure elements or communication with portable devices). For instance, smart mobile phone notifications for either VRUs or approaching vehicles using near-field communications (such as Bluetooth) might be a useful additional warning technology, beyond other alerting systems, but the use of smart electronic devices by VRUs should not be a requirement for the efficacy of an intersection safety system. Virtual machine vision systems incorporating ''crowd-sourced'' vehicle-based real-time imaging and information sharing (moving and parked vehicles) could also be of use. Ensuring night-time, low light, and reduced visibility (*e.g.,* fog, rain, snow) operation will be critical for such an intersection safety system. It is anticipated that developers of VRU and vehicle warning systems will benefit from the collection of large amounts of data and imagery from the operation of a real-world roadway intersection to develop vision systems and train machine learning (ML) algorithms. This data could be developed and shared to accelerate the parallel development of effective solutions.

Important considerations for any intersection safety technology include its efficacy of operation while not degrading existing levels of safety or traffic operation; its ability to be implemented and deployed at scale; the system cost; consistent and reliable system operation and performance; operation under all weather, lighting and environmental conditions; reliability and maintenance requirements; personnel and training requirements; ease of deployment; ease of calibration and customization at a specific intersection location; its potential for rapid commercialization and deployment within 3–5 years; upgradeability and modularity, and interoperability and data transfer capability with existing signal operating systems and traffic management systems, while avoiding technological lock-in.

It is not anticipated that a single technical solution or system will be suitable for implementation at all roadway intersections, but it is anticipated that a single solution can be developed that will suit a large proportion of the most crash-prone intersections. These technologies may also serve to enhance the use of Data-Driven Safety Analysis (DDSA) techniques that can inform State, local, Tribal, and territorial DOTs in their decision making, and allow them to target the implementation of infrastructure investments that improve safety and equity. Once deployed in multiple locations, real-time data sharing between adjacent or neighboring intersection safety systems could further improve the safety of local road networks.

**General Considerations for the Development of a VRU and Vehicle Warning System**

First, the addition of a VRU and vehicle warning system should not degrade the baseline performance of any existing intersection. It is acknowledged that a hardware and software-based intersection safety system may have significant additional 'soft' costs beyond the cost of construction (or bill of materials for its constituent components)—permitting, installation, testing, calibration, operation (although operation should be fully automated), training, maintenance, integration with other existing systems, R&D costs, etc. A VRU and vehicle warning system should ideally leverage existing components, systems and technologies to the greatest extent possible (including open, interoperable communications to maximize the accessibility and safety benefits), should meet all applicable Federal and State standards, should be suitable both for new installations and retrofits, and its software should use transparent non-opaque algorithms. Any system installation, use, operation, and maintenance should be expeditious and minimally disruptive to the road users. It is anticipated that determining the performance of any intersection safety system will require extensive testing in both benign and extreme environments, including for electromagnetic compatibility, and will probably require extensive data collection for overall system development, testing, validation and calibration.

**System Components and Hardware and Software Technologies—A Conceptual Design**

A conceptual design for a VRU and vehicle intersection safety system would likely require the following elements and would probably need to account for the associated features or considerations (these potential design elements should not be considered to be prescriptive, but merely representative of the current state of the art):

- *Sensing and perception.* A perception system will likely require machine vision that includes cameras, LiDAR and radar that provide a full field of view under all lighting and weather conditions, and to provide redundancy. The resolution, bandwidth, latency, power consumption, and cost considerations of the vision and perception system will be important.
- *Sensor fusion, image and data analysis.* This will likely require high computational throughput (of the order of gigapixels per second), and should utilize industry-standard computational and networking bus architectures. The real-time image and data analysis should sense the movement of individual VRUs and vehicles, and be capable of inferring intent. Privacy protections should be maintained, and precise timing (derived from global navigation satellite systems [GNSS] or secondary or back-up sources that can be space- or land-based) should be used. It is likely that the sensor fusion, image, and data analysis will require significant levels of AI (and ML) capability and be capable of high gigabit per second data throughputs.
- *Path planning and prediction.* The discrete paths of motion of all vehicles and VRUs in or near the intersection (perhaps as many as twenty or more items of interest) will likely need to be tracked and predicted simultaneously in order to determine potential or impending vehicle-VRU conflicts. This computation, logic and decision-making will likely need to be performed by a high bandwidth, low latency, high speed microprocessor-based system located at the intersection (perhaps in a roadside unit, or RSU). The real-time decision-making process will need to result in an ''alert or no alert/warning or no warning'' output that minimizes false positives and false negatives while ultimately providing safe and actionable warnings to the VRUs and/or approaching vehicles.
- *Data handling and storage.* Large quantities of data (potentially terabytes of data per day per intersection) may be required to be stored and archived, with attention paid to anonymization, privacy, and cybersecurity threats. This will likely include local storage as well as cloud- or edge-based archiving.
- *Communications and networking.* A roadside unit or other form of infrastructure (*i.e.,* Access Point, small-cell set-up, or edge-computer) will likely be required to house the computational hardware as well as providing full connectivity—perhaps to include 5G connectivity, V2X, Wi-Fi or other near-field communications, and GPS or its equivalent (for precision timing). The roadside infrastructure will likely provide secure interconnection to the intersection traffic signals (via a signal cabinet) and to a central traffic management system for that jurisdiction (potentially through a wireless or fiber optic link).
- *Warning system.* A VRU and vehicle warning system will likely require audible alarms, visual alerts, and other more advanced real-time alerts, such as haptic or projected images, for example. It will require real-time interconnection with the intersection's traffic signals, perhaps to adjust signal timing in real-time. The alerting system will need to be capable of alerting VRUs who are visually or hearing impaired, and offer ADA-compliant operation.
- *Other intersection safety system considerations.* A fully automated system is desired that does not degrade the underlying existing safety of an intersection, is upgradeable by virtue of a modular hardware and software design, uses open architectures to the fullest extent possible, including potentially open-source software, utilizes industry-accepted software development practices and is intrinsically cybersecure and maintains data privacy protections.

This RFI is intended to inform DOT on the status of automation technologies and other complementary technologies that can be used to improve or enhance the safety of pedestrians, bicyclists, and other VRUs at or near roadway intersections. DOT seeks information on the state of the art, and emerging trends in, perception, machine vision, sensor fusion, real-time image and data analysis, path planning, decision-making, connectivity, and warning systems that could be implemented in real-time at intersections to improve pedestrian and other VRU safety.

**Specific Questions**

Responses to this RFI are intended to inform DOT on the status of technologies that can be used to improve or enhance the safety of pedestrians, bicyclists, and other VRUs at or near roadway intersections, including the status of the current technical development or deployment of those technologies.

DOT is providing the following questions to prompt feedback and comments. DOT encourages public comment on any or all of these questions, and also seeks any other information commenters believe is relevant.

DOT is requesting information from all interested entities and stakeholders, including innovators and technology developers, researchers and universities, transportation system operators, transportation-focused groups, organizations and associations, and the public.

The questions to which DOT is interested in receiving responses are:

*(A) General Technical Considerations*

1. What is the overall feasibility of developing an effective intersection safety system for vulnerable road users (VRUs) based on existing and emerging mobile (vehicle) automation technologies (including other

complementary technologies) as described in this RFI?

2. What perception, machine vision, and sensor fusion technologies (and other sensing modalities or combinations) are best suited to an effective intersection safety and VRU and vehicle warning system?

3. What real-time image and data analysis techniques are best suited to provide the required machine vision and perception for an effective intersection safety system?

4. What techniques are most effective in providing real-time vehicle and VRU path planning and prediction capabilities at fixed roadway intersections?

5. What new and emerging technologies can enhance machine-based decision making at intersections—including determining potential vehicle-VRU conflicts, incidents, dilemma zones, and encroachment in real-time?

6. What is the potential role of AI and/or ML in perception, image analysis, data analysis and decision-making at intersections, both in real-time and asynchronously? What is the potential for real-time learning and group learning across a number of similarly-equipped intersections?

7. How could such a system work effectively with all types of VRUs (pedestrians, bicyclists, wheel-chair users, users of electric scooters, etc.) and all types of vehicles (cars, trucks, vans, transit buses, commercial vehicles, etc.)?

*(B) System Installation and Deployment*

1. How can the required installation, setup and calibration requirements for a perception and decision-making based intersection safety system be minimized?

2. What pedestrian and VRU alerting and warning methodologies and systems would be most useful, including for example, visual (or projected), audible, haptic, connected, other?

3. What vehicle driver alerting and warning systems would be most useful, to alert drivers in real-time of impending conflicts at intersections?

4. What potential modes of connectivity, such as V2X (V2N, V2P, V2V, V2I . . . ), cellular or Wi-Fi, for connecting vehicles, infrastructure, signals, and VRUs, would be most useful and effective to assure the greatest degree of accessibility for all intersection users?

5. What industry standards, best practices, processes, protocols, and interoperability requirements and capabilities are needed or best suited for the development of an effective intersection safety system?

6. How can interfaces with traffic signal controllers and traffic management systems be best implemented? What data storage and curation of the system performance history (on-board, at the edge or in the cloud) are required?

7. How can issues related to reduced visibility (*e.g.,* night-time, low light, bad weather) be addressed and mitigated during both the development and deployment of an effective intersection safety system?

8. Are there any existing research and development efforts, deployments, or pilot demonstrations underway that aim to provide some or all of the capabilities described in this RFI?

*(C) Human Factors and Performance Measurement*

1. What human behavioral considerations are most important in the implementation of an intersection safety system to ensure maximum VRU and driver compliance with the warnings and alerts provided?

2. What are the most relevant human factors, cognition and human-machine interface (HMI) considerations for both VRUs and drivers to ensure the maximum efficacy of an intersection safety system?

3. What metrics, key performance indicators, and measures of success are important for determining the performance and efficacy of an intersection safety system?

4. How would testing and validation of an intersection safety system best be accomplished before full system deployment at active intersections?

5. How can a testing and validation plan be devised that would balance testing and development safety with the ultimate real-world performance of an intersection safety system?

6. What performance data would be required to validate the testing and efficacy of an intersection safety system, and how could that performance data be generated?

7. What measurement and statistical approaches are applicable to real-time decision-making at intersections? How can decision or warning errors be minimized (*e.g.,* through reducing false positives and/or false negatives)?

*(D) Development Costs and Time to Deployment*

1. What is the potential schedule and cost to develop an effective intersection safety system? What are the potential future hardware and software ''stack'' costs for a system that can be deployed at the scale of (for example) 100,000 commercial installations after 3–5 years of development?

2. What equity considerations factor into the potential testing, implementation, and deployment of an effective intersection safety system?

3. What team composition of development, commercialization and deployment partners would be required to achieve the successful commercialization and deployment of such a system?

4. For what proportion of intersections (signalized and/or unsignalized) would such a system be well-suited? What characteristics or measures are important in determining whether a specific intersection is well-suited for the implementation of an effective intersection safety system? How could such a system be further developed or adapted for use in rural areas?

5. What are the installation, calibration, training, maintenance, and operating considerations for deployment of such a system across its full life-cycle by a range of potential end-users, including State, local, Tribal and territorial DOTs, cities and towns?

*(E) Please Comment on Any Other Issues Relevant to the Development, Commercialization, and Deployment of an Effective Intersection Safety System*

**Confidential Business Information**

Do not submit information whose disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information ''CBI'') to *Regulations.gov*. Comments submitted through *Regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted.

Issued in Washington, DC, on September 13, 2022.

**Robert C. Hampshire,**

*Deputy Assistant Secretary for Research and Technology.*

[FR Doc. 2022–20188 Filed 9–15–22; 8:45 am]

**BILLING CODE 4910–9X–P**

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## DEPARTMENT OF THE TREASURY

### Agency Information Collection Activities; Submission for OMB Review; Comment Request; Multiple Internal Revenue Service (IRS) Information Collection Requests

**AGENCY:** Departmental Offices, Department of the Treasury.

**ACTION:** Notice of information collection, request for comment.