

## **GRANT CALL FOR APPLIED RESEARCH PROJECTS TO ENHANCE TRAFFIC MANAGEMENT AND ROAD SAFETY WITH VEHICLE-TO-EVERYTHING (V2X) TECHNOLOGIES**

### **1. OVERVIEW**

- 1.1. The technology proliferation and market availability of V2X technologies, as well as emergence of game-changing communication enablers like 5G, has led to the possibilities of adopting such technologies for a highly networked, smart and efficient land transport system.
- 1.2. As Singapore continues to develop with increasing economic activities and maturing townships, traffic interactions between road users (e.g. public and private buses, cars, taxis, motorcycles and pedestrians) have become more complex in our densely populated environment. Our land transport system has evolved over the years with the adoption of advanced sensor and monitoring systems, such as junction cameras, traffic monitors and the ERP System, in order to cope with the complexity of traffic management and to enhance road safety.
- 1.3. V2X is a communication means of between vehicles and between vehicle and infrastructure, such as the various parts of the traffic system around them. With its increase in adoption and coupled with other technological improvements in communications and artificial intelligence, they present opportunities to further the improvements made to our roads and traffic systems. Advanced applications of V2X technologies can also complement the applications of Autonomous Vehicle (AV) technology for safe and efficient operations, which the government is planning to pilot for public transport services.

### **2. SCOPE**

- 2.1. Adopting an applied research & development approach, selected V2X proposals will ideally be carried out in a living lab environment to testbed innovative mobility solutions and concepts.
- 2.2. The intent of this grant call is to explore new concept of operations for traffic management and road safety in response to advancements in technologies such as 5G, mobile edge computing and C-V2X. The selected proposals

should eventually aspire to translate the research & development outcomes from plausible concepts into realistic, implementable solutions which can be scaled separately, or as complementary enhancements to existing systems. The desired **operational outcomes of the work streams for V2X** are as follows:

- a. Enhance Traffic Management. Today, sensors are deployed to collect data to support land transport operations. Examples of data sources include health and operational status of road infrastructure which could be captured in data and video for maintenance purposes. Leveraging the data collected, data fusion and combined analytics could be performed to piece together a comprehensive, well-informed situational picture to support timely responses on anomalies detected in the operating environment on our roads. This work stream will focus on interactions between various road users to realise enhanced road and traffic operational efficiency through applications that collect, process and integrate information from different parts of the transport system via advanced communication and sensor systems and optimisation algorithms. In doing so, this will enhance situation awareness for better traffic management.
- b. Enhance Road Safety. Enhancing road safety supports one of the key goals of under the Land Transport Master Plan 2040 theme of “Safer Journeys” for a “Vision Zero” environment. This is particularly essential to ensure a safe and conducive commuting environment for our pedestrians and active mobility users who are significant contributors towards our car-lite goals. With the novel use of V2X applications to improve traffic flow guidance and increase road users’ situation awareness, safety can potentially be enhanced at high interaction areas such as crossing zones and shared paths. This work stream will investigate developing V2X as a technology enabler to prioritise safety in our road environment.

2.3. To support the above work streams, Research & Development (R&D) focus areas, delineated along the V2X value chain, have been identified. The scope and outcomes of selected proposals covering one or more of these areas, once completed, would create scientific knowledge and insights in V2X applications. *These focus areas are not hard-fixed but suggested to loosely pigeon-hole the type of proposals which may be received.* The **R&D focus areas** are as follows:

- a. Sensors & Detection. Sensors and detection systems to reliably understand and track traffic-influencing information (including but not limited to Motorists and Pedestrians).

- b. Architecture, Communications & Cybersecurity. Scalable and feasible system architectures and the required communications protocols (e.g. technologies such as 5G or DSRC). It can also consider pertinent issues such as the required information rate and capacity, wireless interferences and cybersecurity to support the Capability.
  - c. Algorithms, Artificial Intelligence & Optimisation. Algorithms, AI and Optimisation tools which can predict, facilitate or automate sense-making, recommendation and response processes to optimise resources.
  - d. Data Management, Fusion & Analytics. Management of large traffic-related datasets and/or the fusion of different data sources to draw insights and relationships through analytics.
  - e. Management, Reporting & Response Systems. Command and Control system setup, management or dashboard tools to exert functionality jurisdiction and monitoring oversight.
- 2.4. The proposer is highly encouraged to partner and collaborate with relevant industry stakeholders to deliver R&D projects that have high potential for industrial practicality and commercial scalability. Proposals with **Technology Readiness Level (TRL) between five (5) to seven (7)** that involve applied research trials in operational environments will be preferred. Appendix 1 shows the definition of the TRLs.

### 3. ELIGIBILITY CRITERIA

- 3.1. This call is open to all R&D organisations in Singapore including publicly funded institutes of higher learning (IHLs), not-for-profit research institutions, public sector agencies, companies and company-affiliated research entities.
- 3.2. The Lead Principal Investigator will be required to have a minimum time commitment of 9 months per year in Singapore. International parties can participate in the project as Collaborators. All work should be done in Singapore, unless expressly approved by LTA.

### 4. APPLICATION PROCESS AND EVALUATION CRITERIA

- 4.1. Proposals will be selected and evaluated based on i) potential for impact and subsequent scalability, ii) strength of project execution, and iii) technical competency of the team.

- 4.2. Submission of proposals for this Open Call commences on 19 October 2020 (Monday), 1200 hrs. Interested applicants should submit proposals to the following email address [LTA\\_Innovate@lta.gov.sg](mailto:LTA_Innovate@lta.gov.sg) by 16 November 2020 (Monday), 1200 hrs. Only documents in **Word**, **Excel** and **PDF** formats should be submitted.
- 4.3. Proposals should cover the objectives, proposed approach and project execution plan. The guidelines for drafting the proposal is in Attachment 1.
- 4.4. LTA will support 100% of the approved qualifying direct costs of a project for IHLs, not-for-profit research institutions and public sector agencies. Companies and company-affiliated research entities will qualify for up to 70% of the approved qualifying direct costs of a project. 20% of indirect costs (costs that are incurred for common or joint objectives and therefore cannot be identified readily and specifically with a particular project) will only be allowed for IHLs and not-for-profit entities. A list of non-fundable direct cost items is in Attachment 3. Applications have to be accompanied with endorsements from your respective Director of Research.
- 4.5. Funding support will be up to five years although proposals with durations of three years or less are preferred. Extensions may be granted, subjected to reasonable justifications. Deliverables are expected to be commensurate with the level of funding requested. Funding support will be based on the achievement of milestones in a payment schedule.
- 4.6. Proposals that provide cash or in-kind contributions will be viewed favourably. Multi-disciplinary/organisation teams or teams with industry collaborators are also encouraged to perform holistic analysis and facilitate downstream commercialisation and deployment of R&D technologies developed. Proposals which involve a trial or pilot and include plans for scale-up are preferred. Where applicable, technology readiness level (TRL) of the proposed technology should be at least TRL 5 (prototype demonstration in a relevant environment) and above at the end of the project. Appendix 1 shows the definitions of the TRLs.
- 4.7. The following may be rejected without review:
- Late or incomplete proposals (including proposals that do not follow the guidelines)
  - Proposals that do not fall within the scope of the grant call
  - Duplicates of proposals submitted to any other funding agencies for simultaneous consideration
  - Ineligibility of the Investigators or R&D organisation

- 4.8. Submission of proposals to LTA shall be construed as consent by the applicants to participate in the evaluation process. Selection of reviewers is at the sole and exclusive discretion of LTA.
- 4.9. LTA may require proposals to be revised or combined as it sees fit to enhance outcomes, facilitate integration of approaches, and optimise funding resources. LTA's funding decision will be final.

## **5. CONTACT INFORMATION**

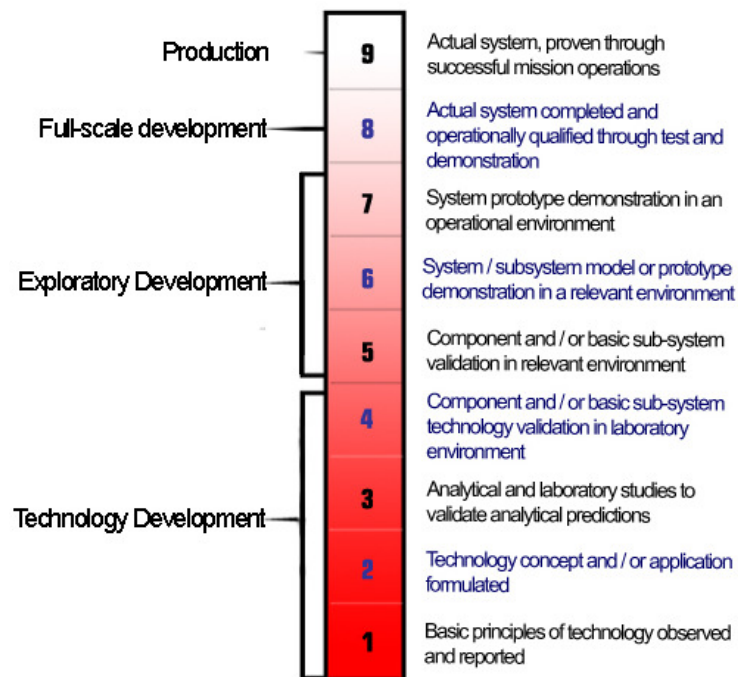
- 5.1. For further enquiries on this Open Call, please email LTA at [LTA Innovate@lta.gov.sg](mailto:LTA_Innovate@lta.gov.sg).

## Appendix 1: Technology Readiness Level Chart

A progressive approach, depending on the Technology Readiness Level (TRL) at the point of decision, is used to evaluate test-bedding of new mobility concepts.

### Technology Readiness Level

#### R&D - Technology Readiness Mapping



#### Prototype demonstration in a relevant environment (for TRL 5 & 6)

A technology of interest has demonstrated potential to meet certain transport objectives. It will then be pursued for further development at the component level and subsequently tested for operational viability within confined test areas that mimic part of an envisaged operational environment.

#### Proof-of-Concept (POC) demonstration in an operational environment (for TRL 7)

If a technology of interest has been proven its potential at the component level, its development will be further pursued. In this case, the test-bedding environment will be escalated into the actual operational environment with actual interaction with other road users and commuters. At this stage, we will focus on evaluating the proposed mobility concept, which deploys the technology of interest, for its envisaged benefits and values in meeting the transport objectives.

#### Full Scale Deployment (FSD) (for TRL 8 & 9)

This level will be considered after a successful Proof-of-Concept (POC) demonstration. However, it may not be a straight-forward process as other considerations like commercial viability, operational sustainability, and other policy considerations (especially when the new mobility concept could be disruptive to existing modes of travel).