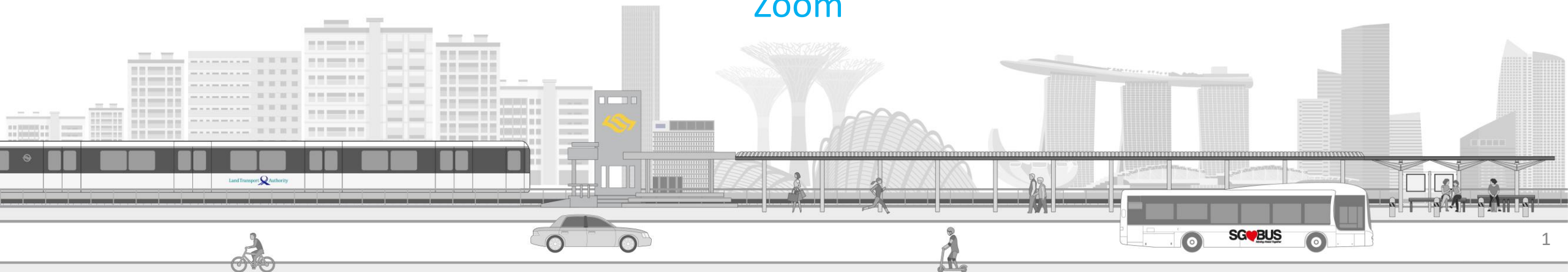


UMGC CALL FOR DESIGNING BUS STOPS, TAXI STANDS AND PICK-UP DROP-OFFS FOR AN AUTONOMOUS VEHICLE FUTURE

GRANT CALL BRIEFING

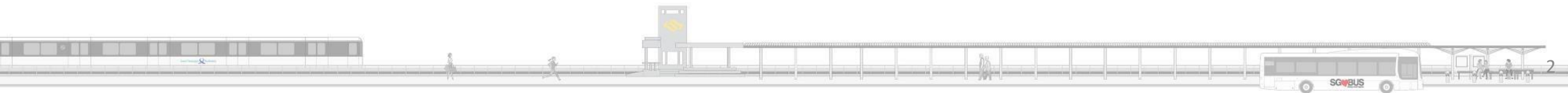
26 October 2020, 5:00 PM

Zoom



Overview of Grant Call

- Grant call has been launched on 19 Oct (Monday) and will close on **16 Nov, 1200 hrs (Monday)**. Projects awarded under this grant call will be co-led by LTA and URA.
- Project duration should be preferably kept within **2 years**.
 - Deliverables are expected to be commensurate with the length and amount of funding
- Grant call is open to research proposals which articulate a comprehensive approach to identify design recommendations and strategies that facilitate AV operation at bus stops, taxi stands and PUDOs, during the transition period.
- Include public bus stops as well as taxi stands and PUDOs at commercial, residential, mixed-use buildings and public transport node developments. To cover three types of AVs – AV buses, AV shuttles and AV sedans (7-seaters and below).



Motivation for Research Project

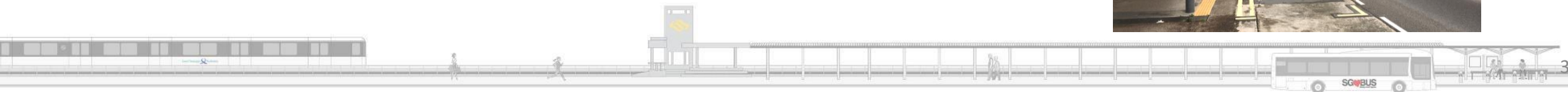
Need to understand the **challenges** that existing bus stop, taxi stand and PUDO designs may pose to AVs.



Study how these facilities can be **designed** and **equipped** to facilitate AV deployment and enhance user experience.



Findings will contribute to the formulation and review of **guidelines** or **standards** for bus stops, taxi stands and PUDOs to ensure the safe operation of AVs with other manned vehicles.



Focus Areas

Objectives

A Analyse demand and throughput of bus stops, taxi stands and PUDOs

To understand the effect of design, development characteristics, and AV-type scenarios on the demand and throughput of bus stops, taxi stands and PUDOs.

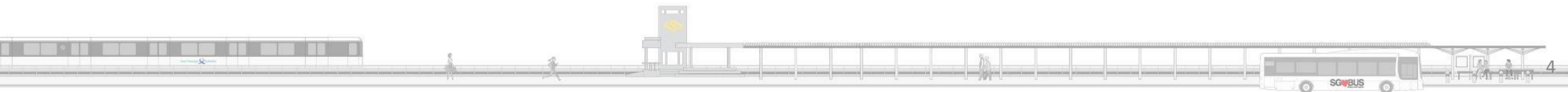
B Propose design suited for AVs

To propose design recommendations for bus stops, taxi stands and PUDOs that allow AVs and manned vehicles to operate safely and efficiently, considering the sensor capabilities of AVs and the range of physical elements found at these facilities.

C Exploring the impact of AVs at bus stops, taxi stands, and PUDOs for commuters

To explore the impact of AVs for different users and enhance the service quality at bus stops, taxi stands, and PUDOs in an AV environment.

*Proposals must respond to all 3 Focus Areas, but there is no prescribed order for their completion.



Focus Area A: Analyse demand and throughput

Current situation: Today, the capacity of bus stops, taxi stands and PUDOs can be constrained by the rising inflow of vehicles due to changing mobility preferences. When AVs are introduced, it is uncertain what impact they will have on the vehicular flows at these facilities.

Scope

Baseline assessment of the existing conditions and challenges of selected bus stops, taxi stands and PUDOs (e.g. traffic and pedestrian peak flows, dwell time, queue length, number of traffic conflicts, etc. at different times of the day).

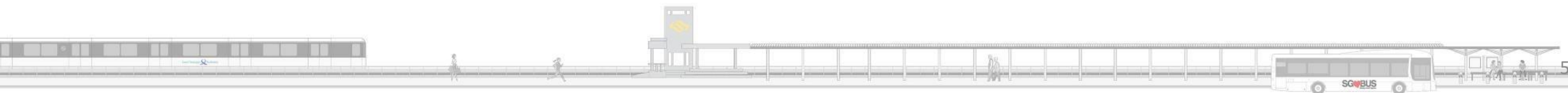
Identify development-level factors and bus stop/taxi stand/PUDO design factors that affect the demand and throughput of bus stops, taxi stands, and PUDOs.

Model future demand and throughput based on the identified factors under different AV-type scenarios.

Possible deliverables

A model (or equivalent) to predict the demand and throughput at bus stops, taxi stands and PUDOs based on development-level factors and design factors, for different AV-type scenarios (e.g. AV buses, AV shuttles, and AV-sedans that include taxis or private hire).

Final product must be compatible with agencies' existing systems and will not require additional license costs.



Focus Area B: Propose design suited for AVs

Current Situation: It is unsure if the way that existing bus stops, taxi stands and PUDOs are designed will be suitable to support AV deployment. Moreover, PUDOs in Singapore are designed differently, posing challenges for AVs to safely navigate them.

Scope

Identify the physical elements at bus stops, taxi stands and PUDOs which would pose challenges to the perception, navigation and localisation of AVs (taking into consideration how AV tech would evolve and mature).

Taking reference from international best practices and the findings of this study, propose design recommendations for bus stops, taxi stands and PUDOs of different development types, examples include

- The layout of the bus stop/taxi stand/PUDO facility
- Setting up of dedicated bays
- Demarcation of bays
- Types of barriers
- Safety features (e.g. BFA ramp, wheelchair waiting area)
- Use of low-cost supporting elements (e.g. reflective strips, additional signages) or supporting sensors (including LIDAR, RADAR and cameras)

Possible deliverables

A set of design recommendations for bus stops, taxi stands and PUDOs at different development types.

A prototype for a new bus stop, taxi stand and PUDO based on the study findings/recommendations and strategies for retrofitting of existing facilities for the transition period.

Validation of the proposed design recommendations through an identified pilot site.



Focus Area C: Exploring the impact of AVs at bus stops, taxi stands, and PUDOs for commuters

Current Situation: Bus stops, taxi stands and PUDOs are busy locations with multiple activities. In the near future, we expect more PUDOs to be co-located with other facilities, increasing the types of human and vehicular interactions.

Scope

Evaluate the impact of AVs on the safe movement of manned vehicles and commuters at bus stops, taxi stands, and PUDOs under different environmental conditions and design specifications.

Identify and analyse the behaviours and needs of different passenger groups (e.g. the elderly, wheelchair users) when using AV-ready bus stops, taxi stands and PUDOs.

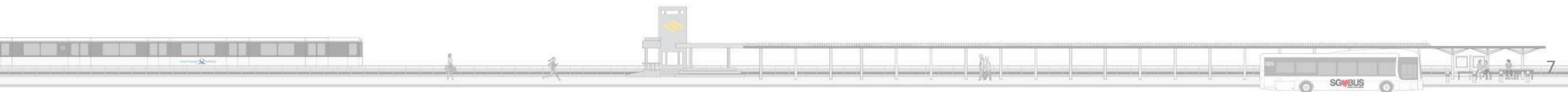
Recommend strategies, that could include the use of V2I technology, to improve the safety and services provided to commuters.

Possible deliverables

A set of recommended strategies to improve the safety and services of bus stops, taxi stands and PUDOs.

Demonstration of how these strategies could be integrated into the overall design of the bus stop, taxi stand and PUDO prototype.

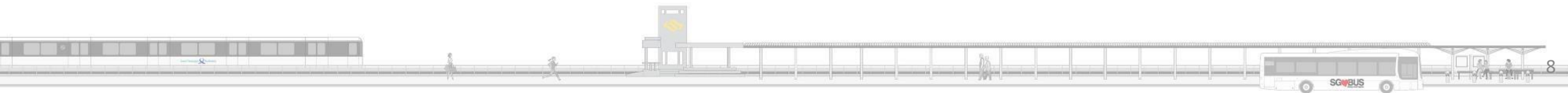
A validation plan for the proposed recommendations.



Networking List

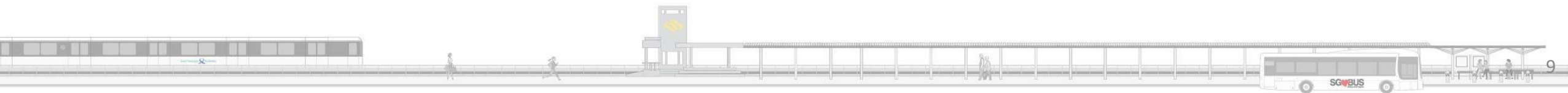
- Various parties have asked us to direct them to potential partners who may be interested to submit a joint proposal. In view of the challenges with networking in the current situation, LTA and URA will put together a networking list to facilitate link-ups.
- Interested parties can fill in your contact details in the form by **26 October, 2359**. Consolidated contact details will be released to those who have filled in the form on the next day.

<https://form.gov.sg/5f8eefc0fa5be00011610d0a>



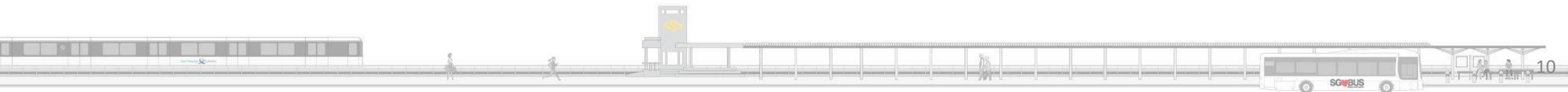
Eligibility Criteria

- The call will be open to all R&D organisations in Singapore including publicly funded **institutes of higher learning (IHLs), not-for-profit research institutions (RIs), public sector agencies, companies and company-affiliated research entities.**
- 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.



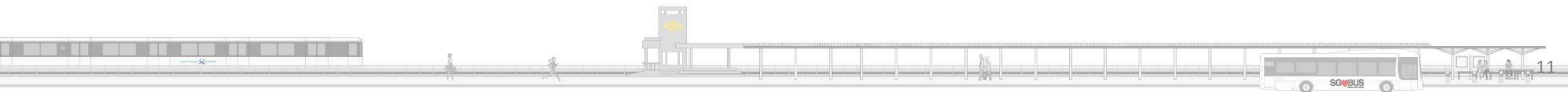
Funding Support

- 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.
- Funding support will be up to 5 years, however project duration should be preferably kept within **2 years.**
- Deliverables are expected to be commensurate with the level of funding requested. Payment for projects will be on a reimbursement basis, upon the achievement of milestones acceptable by LTA.



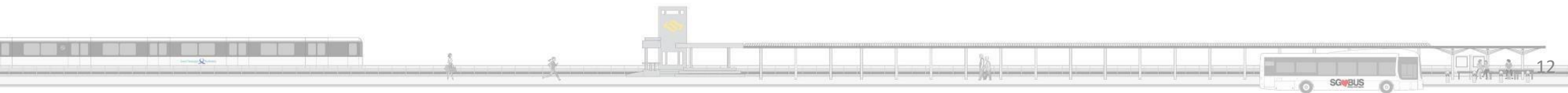
Proposal Guidelines

- Objective: importance of problem to be addressed and how expected outcomes will achieve the desired objectives
- Approach: how the team's proposed approach is better than the current state of the art technology, as well as potential pathways to deployment or commercialization
- Project Execution Plan: team members, budget, timeline, key milestones
 - Indicators (not required to propose targets for all): industry projects, industry R&D funding, industry R&D spending, industry RSE jobs created, technologies deployed



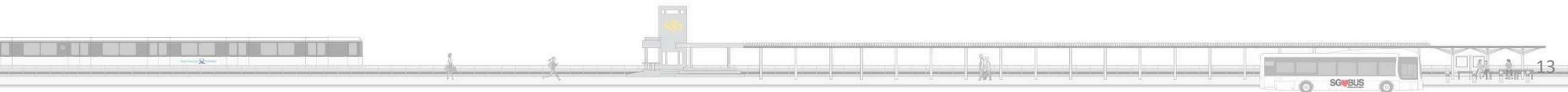
Application Process

- All relevant documents and templates will be available for downloading on the LTA website.
- Proposals are to adhere to the full proposal guidelines under Attachment 1. Interested applicants should submit full proposals (including Offline Application package, Annex C and D) to [LTA Innovate@lta.gov.sg](mailto:LTA_Innovate@lta.gov.sg) by **16 Nov 2020 (Monday), 1200hrs**. Submissions are to indicate the email subject title as “[Submission for UMGC PUDO] Title of Proposal”.
- Only documents in Word, Excel and PDF will be accepted. Please keep the total submission size of your documents to 10 mb.
- For applications from IHLs and A*STAR research institutes, please submit your proposals through your respective research offices. Research offices are to consolidate the proposals and obtain DOR endorsement for submission.



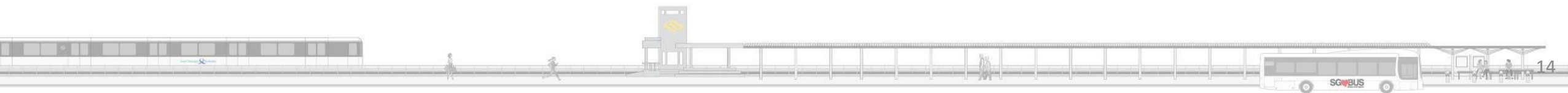
Evaluation Criteria

- Proposals will be selected and evaluated based on **i) potential for impact, ii) strength of project execution, and iii) technical competency of team.**
- Proposals which involve a trial or pilot with clear plans to deploy/ scale-up the solutions developed are highly preferred.
- Proposals that provide cash or in-kind contributions/ committed to co-fund the research costs will be viewed favourably.
- Multi-disciplinary/organisation teams or teams with industry collaborators are encouraged to perform holistic analysis and facilitate downstream commercialisation and deployment of R&D technologies developed.
- Applicants who do not have a working AV for pilots are to work with industry partners who are able to supply them.



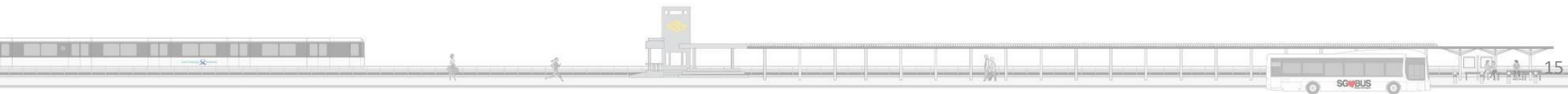
Common Observations by Evaluation Panel and Reviewers

- R&D value of proposals needs to be strengthened
- Relevance of solutions should be further elaborated
- Proposals should include quantitative targets to be achieved
- Clarity on how ideas can be implemented/deployed



Q & A

*Grant Call FAQs and Briefing Q&A will be uploaded onto the website



Thank You!

For further enquiries on this Open Call, please email LTA at LTA_Innovate@lta.gov.sg.

LTA website:

[https://www.lta.gov.sg/content/ltagov/en/industry_innovations/development_funds/research_technology_grant_calls/Designing Bus Stops Taxi Stands and Pick-Up Drop-Offs.html](https://www.lta.gov.sg/content/ltagov/en/industry_innovations/development_funds/research_technology_grant_calls/Designing_Bus_Stops_Taxi_Stands_and_Pick-Up_Drop-Offs.html)

