TREASURE ISLAND
MOBILITY MANAGEMENT AGENCY

1455 Market Street, 22ND Floor, San Francisco, CA 94103 415-522-4800 info@timma.org www.timma.org

Request for Proposals

for Autonomous Shuttle Services for Treasure Island Autonomous Shuttle Pilot Project

Date Issued	Proposals Due	Expected Duration	Budget	DBE Goal	Contact
May 23, 2022	June 22, 2022 at 2:00 p.m. (electronically)	2 ½ years (30 months)	$825,000	3%	Ron Leong Management Analyst 415.522.4800 ronald.leong@sfcta.org

SECTION I – NOTICE

Notice is hereby given that the Treasure Island Mobility Management Agency (TIMMA) is requesting proposals from qualified respondents (proposers) to provide autonomous shuttle services for the Treasure Island Autonomous Shuttle Pilot Project (Project).

Pre-proposal Conference. Although attendance at the pre-proposal conference is not mandatory, proposers and sub-consultants are encouraged to attend a pre-proposal conference to be held via Zoom. See the schedule in Section II for the conference date and time. Attendees are requested to confirm attendance by completing the online registration form at Zoom Registration by 5:00 p.m. the day before the conference.

Questions. Inquiries regarding the RFP and all notifications of an intent to request clarification of the RFP, must be directed to:

Ron Leong
San Francisco County Transportation Authority
c/o Treasure Island Mobility Management Agency
Email: info@timma.org or ronald.leong@sfcta.org

Questions may be submitted in writing by the stated deadline in Section II by e-mail; please include "RFP 21/22-01 – Autonomous Shuttle Services" in the subject line. TIMMA's responses will be posted to www.sfcta.org/contracting by the date indicated in the schedule, and any addenda to the RFP will also be made available on that webpage prior to the proposal due date. Please see Section II for all important dates and deadlines.

SECTION II – SELECTION PROCESS SCHEDULE

Date	Phase/Item Due
May 23, 2022	Release of RFP
May 31 at 5:00 p.m.	Pre-proposal conference attendees requested to submit registration: Zoom Registration

June 1 at 4:00 p.m.	Pre-proposal conference held via Zoom
June 2 at 5:00 p.m.	Proposers to submit written questions to TIMMA
June 8*	TIMMA issues written responses to questions
June 22, 2:00 p.m.	Responses to RFP and sealed/separate cost proposals due electronically. Late submissions will not be accepted.
June 28*	Invitation(s) to interview issued to short list of proposers* (if necessary)
Week of July 5*	Interviews* (scheduled if necessary)
July TBD*	Recommendation to TIMMA Committee for award
July TBD*	TIMMA Board awards contract

* *Subject to change*

SECTION III – BACKGROUND

Approved in 2011, the redevelopment of Treasure Island is expected to add 8,000 new housing units and other transformative new land uses and open space on the Island over the next 15-20 years. The Treasure Island Transportation Management Act of 2008 (AB 981) authorized the creation or designation of a Treasure Island-specific transportation management agency to support this growing neighborhood. On April 1, 2014, the San Francisco Board of Supervisors adopted a resolution designating the San Francisco County Transportation Authority (Transportation Authority) as the Treasure Island Mobility Management Agency (TIMMA) to implement elements of the Treasure Island Transportation Implementation Plan (TITIP) in support of the Treasure Island (TI)/Yerba Buena Island (YBI) Development Project. The TITIP calls for, and TIMMA will be responsible for, implementing the Treasure Island Mobility Management Program: a comprehensive and integrated program to manage travel demand on Treasure Island as the development project occurs, including an integrated congestion pricing program with vehicle tolling, parking pricing, a free on-island shuttle, and transit pass components. Assembly Bill 141 (Ammiano), signed in 2014, established TIMMA as a separate entity, providing a separation of authorities between TIMMA and the Transportation Authority's other functions. TIMMA is also responsible for implementing shuttle services for Treasure Island and Yerba Buena Island (collectively referred to as "the Islands"). The shuttle services will only operate on the Islands and will not travel onto the Bay Bridge nor to San Francisco and Oakland. The eleven members of the Transportation Authority Board serve as the Board of Commissioners for TIMMA, and Transportation Authority staff also serve as the staff of TIMMA.

The Transportation Authority has budgeted $825,000 for this contract, inclusive of $25,000 budgeted for optional Task 9A. Please note this is a ceiling and not a target.

Project Background and Purpose

In late 2016, the Transportation Authority, acting on behalf of TIMMA, joined the San Francisco Municipal Transportation Agency's (SFMTA) application for federal Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) funding with the Federal Highway Administration (FHWA). The ATCMTD program's goals are to fund Phase 1 Treasure Island AV Shuttle Pilot demonstrations of advanced transportation technologies aimed at addressing mobility and environmental challenges such as congestion reduction and traffic safety through partnerships with the federal government and private sector.

TIMMA has also received an Innovative Deployments to Enhance Arterials Shared Automated Vehicles (IDEA SAV) from the Metropolitan Transportation Commission to fund SAV technology pilot/deployment projects (Phase 2 Treasure Island AV Shuttle Pilot) for people living in Equity Priority Communities, people with disabilities and people in Disadvantaged Communities. The Treasure Island Development Authority (TIDA) is a funding partner of the program. TIDA is a non-profit, public benefit agency dedicated to the economic development of Treasure Island. TIDA oversees and coordinates development work on TI/YBI and will provide physical infrastructure (curbside improvements along route, storage and charging facilities).

Goals of the pilot include measuring: multi-modal road user experiences and perceptions of AV Shuttle operations; ability of AV shuttle services to be accessible to all travelers; the cost and performance (safety, reliability, etc) of AV shuttle services to meet TIMMA's shuttle service requirements and transportation needs of residents and visitors; exploring whether AVS service can improve first- last-mile connections; providing opportunities to demonstrate AV technology, and institutional; and other requirements to deploy and manage AV shuttle services.

The total estimated budget for the Autonomous Vehicle Pilot Shuttle services is $825,000. The Project is intended to extend (9-month) and incorporate lessons learned from the ACTMTD-funded Phase 1 of the demonstration on-island service. The Project will enable TIMMA to learn about the AV technology including its capabilities and limitations, to understand public attitudes towards Autonomous Shuttles, to identify operational requirements and potential benefits and drawbacks of autonomous transportation services; and to share lessons learned. The Project service should be fulfilled by a multi-passenger, shared-use vehicle with autonomous capabilities. The shuttle will traverse public roads within the area of the demonstration project and will be subject to all applicable local, state, and federal regulations. TIMMA has received an informal opinion from the California Public Utilities Commission that the proposed pilot appears to the CPUC Code 226, which creates an exemption from the requirement to possess a certificate of public convenience a necessity.

SECTION IV – SCOPE OF SERVICES

TIMMA seeks an Autonomous Shuttle provider that will develop, deploy, and provide information to evaluate an Autonomous Shuttle pilot service on Treasure Island. TIMMA intends to test a turn-key Autonomous Shuttle service for members of the public that operates on public roadways at a

frequency deemed necessary to address "first and last mile" connections to transit and on-island trips. Human operators (referred to as Autonomous Shuttle test operators or test operators throughout this document) are expected on board each vehicle during operations to monitor the vehicle, take control of the operation of the vehicle should the need arise, gather user's experience via survey tools, and log or gather relevant data. The proposed transportation technology involves vehicles that are Level 4 automated, as defined in SAE J3016 "Levels of Driving Automation" (https://www.sae.org/news/2019/01/sae-updates-j3016-automated-driving-graphic), Americans with Disability Act (ADA) accessible, and preferably electric, serving the public on short trips around the island and to transit hubs. Operations of the fleet are expected to use fixed-route service with a predetermined route and signed stops for passengers to board and alight.

TIMMA will ensure there is secure vehicle storage, available charging, and marked and accessible stop locations. The Autonomous Shuttle provider shall furnish all services and labor necessary to plan, implement, test, operate and maintain, and complete the services described herein. The Autonomous Shuttle provider shall also furnish all materials, equipment, supplies, and incidentals necessary to perform the services (other than those designated in writing to be furnished by TIMMA), and check and/or test the materials, equipment, supplies, and incidentals as necessary in carrying out this work. The Autonomous Shuttle provider shall comply with all applicable federal and state laws, rules, and regulations. TIMMA has obtained an informal opinion from the California Public Utilities Commission for Code 226 that the AV Shuttle Pilot Project meets the criteria for an exemption from the requirement to possess a certificate of public convenience and necessity. TIMMA has also received clarification on CA DMV Article 3.7, Section 227.26 to ensure that the AV Shuttle Pilot Project can operate on the proposed route.

The Autonomous Shuttle provider shall perform pilot testing and pilot operations in accordance with Occupational Safety and Health Administration regulations and accepted safety practices. Pilot testing and operations shall comply with relevant California Department of Motor Vehicles (DMV) and California Public Utilities Commission (CPUC) permit requirements and vehicles must comply with Federal Motor Vehicle Safety Standards (FMVSS) and consider best practices and policies as outlined by Federal Highway Administration, U.S. Department of Transportation, and National Highway Traffic Safety Administration (NHTSA).

Project Goals:

Safety

For this project, the safety goal is to understand the public safety implications of an Autonomous Shuttle while maintaining the safety of shuttle passengers or other road users. Public safety implications may include, but are not limited to, shuttle rider and road user perceptions of safety when riding the shuttle and sharing the road with the shuttle, and actual shuttle operation performance.

Mobility and Operations

The TITIP describes transportation needs for a shuttle service that is needed for Treasure Island. The mobility goal is to demonstrate the ability to provide a reliable limited circulator service carrying members of the public in mixed traffic, as well as specific research tests (without members of the public) on other TI/YBI roadways/conditions (e.g. time of day, roadway geometries, weather conditions). Transportation needs for passenger service include allowing for safe, easy, and reliable circulation for those who choose not to or are unable to walk or bike, connecting to transit stops (bus or ferry), and traveling throughout the Islands. The project aims to understand Autonomous Shuttle reliability, vehicle functionality, operation and maintenance requirements, costs, and project management in a real-world environment.

Research/Share Lessons Learned

This goal seeks to document research findings on whether the Autonomous Shuttle pilot service is safe, secure, reliable, and cost-efficient. For this project, the research plan is to obtain insights from the public and data from the autonomous vehicle (AV) technology and service itself. Data on the vehicle operations, ridership, interactions with road users, and safety is intended to be collected throughout the project period and shared with project stakeholders throughout the course of the project and at completion.

Autonomous Shuttle Provider Responsibilities

The Autonomous Shuttle provider shall be responsible for:

1. Procurement
    a. Execute procurement documents
    b. Obtain and maintain liability insurance, at its own cost and expense, during the term of the contract. The minimum level and types of coverage are included in the terms and conditions of this RFP and are set forth in the Operating Agreement attached as Exhibit G
2. Planning
    a. Address and resolve any problems and project issues that may arise during the project
    b. Review and clarify tasks, submittals, data needs, sequence of events and meetings that are essential to complete all work by the established deadline
    c. Schedule and conduct regular meetings with TIMMA's project team to review the project and relevant information
    d. Attend relevant stakeholder meetings as directed by the TIMMA Project Manager
    e. Designate a liaison between the AV provider and TIMMA's communications team
    f. Develop Work Plan
    g. Develop Safety Management Plan
    h. Develop a Data Management, Sharing, and Cybersecurity Plan
    i. Develop Test Plan
    j. Develop Operations and Maintenance Plan (includes Standard Operating Procedure)
    k. Develop Training Plan
    l. Develop Evaluation and Reporting Plan

i. Develop a plan to capture rider sentiment, concerns, and/or questions

3. Infrastructure Development
    a. Support TIMMA in identifying and coordinating the infrastructure needs for the project
4. Design
    a. Design and procure Autonomous Shuttle vehicles
5. Regulatory Approvals
    a. Acquire regulatory approvals, including FMVSS Exemption, NHTSA Waiver, NHTSA Route Approval, California DMV Approval, and CPUC Approval
6. Deployment
    a. Provide the Autonomous Shuttle vehicle and all associated equipment and equipment maintenance, less the storage, and charging infrastructure provided by TIMMA.
    b. Map vehicle route and potential construction-related detours
    c. Perform customer service activities, including providing logs of contact information (phone, email, website, etc.) for questions and complaints. Promptly (within 24-48 hours) respond to issues and complaints in English, Spanish, Chinese, or Filipino
7. Testing
    a. Conduct vehicle testing according to (TIMMA approved) Test and Safety Plan
8. Training
    a. Conduct required training (according to TIMMA approved plan) for all the staff and public agency personnel (law enforcement, first responders) who may interact with the Autonomous Shuttle
9. Pilot Operations and Maintenance
    a. Perform operations during defined operational period providing all necessary staffing needs, including Autonomous Shuttle test operator
    b. Perform maintenance as identified (and approved by TIMMA) in the Operations and Maintenance Plan
10. Pilot Evaluation & Reporting
    a. Conduct project evaluation (according to TIMMA approved plan) including data collection and analysis
11. Communication and Outreach
    a. Provide feedback for communication and outreach
    b. Support TIMMA in community outreach prior to pilot launch, during pilot, and after pilot concludes
    c. Support and participate in an agreed upon community partnerships effort
    d. Broadly respond to and address project inquiries from TIMMA

TIMMA and Project Management Team Responsibilities

1. Attend project related meetings
2. Schedule and/or conduct stakeholder engagement meetings (SFMTA, TIDA, general public, etc.)
3. Make decisions or provide input to support resolving issues
4. Review and approve all budget, schedule, and design aspects
5. Review and approve all external communications
6. Review and approve provider required submittals

7. Provide relevant documentation needed to complete the project tasks
8. Administer oversight of and authorize testing and operations
9. Public and stakeholder outreach and communications
10. Provide secure vehicle storage and charging
11. Ensure all stops are signed and accessible

The responsibilities matrix shown in Table 1 identifies four (4) types of roles for TIMMA, provider, and other project stakeholders as follows:

- **Responsible (R):** person who performs an activity or does the work and person who is ultimately responsible for the outcome of the activity.
- **Accountable (A):** person who has Yes/No/Veto.
- **Consulted (C):** person that needs to provide feedback and contribute to the activity.
- **Informed (I):** person that needs to know of the decision or action.

Table 1: TIMMA AV Shuttles Pilot Procurement Roles and Responsibilities by Organization

AV Pilot Roles and Responsibilities	TIMMA	SFMTA	FHWA	TIDA	Provider
Procurement					
Request for Information	R/A	C	I	C	I
Request for Proposal	R/A	C	I	C	I
TIMMA Board Approval	R/A	C	I	C	I
Contract Execution	R/A	C	I	I	A
Planning					
Work Plan	C/A	I	I	C	R
Safety Management Plan	C/A	C	I	C	R
Data Management, Sharing and Cybersecurity Plan	C/A	C	I	I	R
Test Plan	C/A	C	I	C	R
Operation &Maintenance Plan (including standard operating procedures)	C/A	C	I	C	R
Training Plan	C/A	C	I	C	R
Evaluation and Reporting Plan	C/A	C	I	C	R
Infrastructure Deployment	C/A	C	I	R/A	C
Design					
Design/Vehicle Manufacturing	C	C	I	I	R
Regulatory Approvals					
FMVSS Exemption	I	C	I	C	R

NHTSA Waiver	I	I	I	I	R
NHTSA Route Approval	I	C	I	I	R
DMV Approval	I	C	I	I	R
CPUC Approval	I	C	I	I	R
Deployment					
Vehicle Delivery	C	I	I	C	R
Route Mapping	C	C	I	C	R
Testing					
Factory Acceptance Testing	C/A	I	I		R
Preliminary Acceptance Testing	A	C	I	C	R
Final Acceptance Testing	A	C	I	C	R
Training	C/A	C	I		R
Pilot Operations and Maintenance	C/A	I	I	I	R
Pilot Evaluation	A	C	I	C	R
Communication and Outreach	R/A	C	I	C	C
Community Partnerships	R/A	C	I	C	R

Note: This table is subject to change. The provider will allow TIMMA ten (10) working days for review and comment on each submittal identified in Project Tasks section. The provider will then have five (5) working days to resubmit the submittal.

Estimated Project Milestone Schedule

Phase 1	
Planning	Completion
Data management, Sharing, Cybersecurity Plan; Test Plan; O&M Plan; Training Plan; Reporting Plan	Fall 2022
Infrastructure Deployment	
Route preparation	Summer 2022
Design	
Design and vehicle manufacturing	Fall 2022
Regulatory Approvals	
FMVSS Exemptions; NHTSA Waiver and Route Approval; DMV Approval; CPUC Approval	Winter 2022
Deployment	
Vehicle Delivery; Route Mapping	Winter 2022
Testing	

Factory Acceptance; Preliminary Acceptance; Final Acceptance	Winter 2022
Training	Winter 2022
Pilot Operations and Maintenance	Winter / Spring 2023
Data Collection and Reporting	Winter / Spring 2023
Pilot Evaluation	Summer 2023
Communication and Outreach	Ongoing
Phase 2	
Continuation of Service	Spring / Fall 2023
Evaluation	Winter 2023
Final Report	Winter 2023/2024

Note: Dates shown on this table are subject to change.

Project Tasks

Task 1 Planning and Project Management

A dedicated project manager from the provider, identified in the proposal will be the single point of contact for the project and available to TIMMA, TIDA, and SFMTA for coordination and lessons learned.

Provider will develop project deliverables, including work plan, safety management plan, implementation plan, data management, data sharing, cyber security plan, test plan, operations & maintenance (O&M) plan, training plan and reporting plan. TIMMA, SFMTA, and TIDA and their representatives (Project Team) will provide guidance and input on the planning activities, attend meetings, and review the deliverables. TIMMA will provide final approval of deliverables.

1.1 Project meetings

Kickoff Meeting: Prepare and conduct a project kick-off meeting at the test site with TIMMA and other project stakeholders, including SFMTA and TIDA.

Discuss/refine the following elements during the project kick-off meeting:

- The elements of the project work plan including risk management plan
- Pilot requirements
- Strategy for pilot demonstration
- Roles and responsibilities
- Meeting schedule and participation

Following the kick-off meeting, conduct a site visit and summarize the outcome of the kick-off meeting for approval by TIMMA.

Project Update Meetings: Conduct monthly project meetings and during pilot operations biweekly meetings with the project team to provide updates on the progress of the work. Track action items and provide meeting summaries after each meeting.

Pre-On-Site Testing First Responder Meeting: Provider shall conduct a meeting with emergency and law enforcement first responders and provide relevant training on how to interact with the shuttle once in operation.

Pre-Field Testing Meeting: The provider shall conduct a Pre-Field Testing meeting with TIMMA to ensure all requirements for on-road deployment (without passengers) have been met. The meeting will take place at the test site and will include a tour of the complete testing site and operations. At this Pre-Field meeting, TIMMA will provide the notice-to-proceed for the field testing (without passengers).

Pre-Pilot Meeting: Conduct a Pre-Pilot meeting with the project team to provide an overview of the field testing results. The meeting will take place at the test site and will include a tour of the complete demonstration site to ensure that the site and the shuttle(s) are ready for pilot operations. At this Pre-Pilot meeting, TIMMA will provide the notice-to-proceed for the commencement operations with passengers. If there are any deficiencies found, the provider has 10 days to provide proof of cure upon adequately addressing all deficiencies.

Note: Requirements for in-person meetings at TIDA offices will be based on the public health orders in place at the time, and will be conveyed to the team well ahead of any meeting.

1.2 Work Plan

Within ten (10) working days of Notice to Proceed and before the kick-off meeting, the provider will submit a detailed schedule and schedule of values. Fifteen working days prior to the kick-off meeting, the provider will submit a detailed Work Plan for TIMMA to review and comment. The Work Plan should include:

- All project tasks and activities including any of TIMMA's responsibilities.
- Identify the necessary pre-planning activities, required materials (beyond shuttles), with lead time and training activities.
- List of expected procedures to be developed.
- All project submittals with due dates, TIMMA review times, and risks that may impact schedule
- Quality plan for the project detailing quality control and quality assurance activities

1.3 Safety Management Plan

Based on the risks identified by the provider when performing a site and existing conditions assessment, as well as prior experience with the vehicles, the provider will develop a Safety Management Plan. The plan shall include safety considerations such as the ability for passengers to safely board/alight, especially those passengers with disabilities, passenger to passenger and

passenger to test operator interactions, managing human traffic control officers and other roadway changes due to construction, interaction with other road users, COVID mitigation, COVID protocol for the Autonomous Shuttle test operators and vehicles, any potential interactions with emergency response and law enforcement officials, and cybersecurity related to vehicle control and/or operations, specifying how specific incidents will be handled. The Safety Management Plan shall detail the operational test period (within which the Autonomous Shuttle will be operated without passengers ensuring the vehicle can safely navigate Treasure Island's road environment) and clearly identify how the vehicle operations will be deemed safe prior to allowing the public on the vehicle. This plan should contain a risk register, with an assessment for each risk of its likelihood and severity and a corresponding mitigation strategy for each risk.

1.4 Data Management, Sharing and Cybersecurity Plan

Develop a Data Management, Sharing, and Cybersecurity Plan to document the project data being collected, managed, and shared. At a minimum, this plan or its supporting documentation shall cover data management, data security, cybersecurity, and data privacy for the data generated by and collected in relation to the Automated Shuttle demonstration. This plan will be updated as needed during the demonstration. The original plan and each update shall be reviewed and commented on by the project team. All data collected during the Pilot Program shall be shared with TIMMA in accordance with the Data Management, Sharing, and Cybersecurity Plan. All data shared with TIMMA will be considered project data. TIMMA shall own all project data and there shall be no restrictions on TIMMA's right to share such data as TIMMA deems appropriate.

Data Management

This plan will identify the procedures and interfaces the provider will use to meet the Data Reporting Requirements listed in 1.8 Reporting Plan. Major data categories include real-time service data, trip and travel data, operations data, and event data. Real-time service data should be shared with TIMMA via a Web API. Trip and travel data, operations data, and event data should be delivered at the transmission frequency shown in the Table 2 in 1.8 Reporting Plan. Tabular data should be submitted in CSV format. Geospatial data should be submitted in Shapefile format. Other data should be submitted in an appropriate format that can be opened and read with standard software. Additional information regarding size and scale of expected data transmission should be included in the plan.

Data Security

The Data Security Plan will identify the means of control (administrative, logical, technical and physical) for data collected for this project and the specific security controls being used. Security controls discussed in the plan are expected to include encryption, physical control, access control, identification and authorization management, testing, secure software development lifecycle, security operations, data loss prevention, patching, antivirus, and malware checking, remote

software upgrades and installation, employee training, security operations event review and incident response plan, including how the project team will be notified of any incident.

Data Privacy

The provider will develop a Data Privacy Plan, Data Privacy Agreement, and participate in a Privacy Impact Assessment. The Data Privacy Plan will lay out the privacy controls that will be in place to protect the data collected for this project. Categories of information that should be included are data minimization, personally identifiable information (collection, use, sharing, access, and correction), data retention, transparency (notices are to be given to riders that data and recordings are collected including any cameras used), de-identification protocols method used before transmitting data for this project and any assessment of re-identification risk or de-identification validation.

Applicable privacy, security and record retention laws that are in effect and that go into effect during this project will need to be included in the plan and any updated plans. Consideration should be given to: San Francisco's Privacy First Policy (San Francisco Charter SEC. 16.130), The California Consumer Privacy Act of 2018, public records laws including the California Public Records Act, Government Code Section 6250, San Francisco Sunshine Ordinance and San Francisco Administrative Code Section 67.1 and other relevant privacy protection laws that come into effect during this project. These laws should be listed as references in the plan and, where applicable, a table should state how they relate to the project.

The Data Privacy Agreement will bind parties with access to PII to data privacy policies developed in the Data Privacy Plan.

Finally, the provider will be required to participate in a Privacy Impact Assessment (PIA) designed to help the team to better understand how Personal Identifiable Information (PII) will be collected, used, stored and shared. At a minimum, the PIA will include data flow analysis for potential PII, identification of personnel who handles PII with relevant protocols, and a final report. Exhibit A includes a sample PIA questionnaire for further reference. Should the provider bring on any subconsultants with PII inclusive data collection, use or sharing duties, the subconsultants shall be required to participate in a Privacy Impact Assessment.

Cybersecurity

The provider must provide and implement a cybersecurity plan consistent with national best practices provided by National Institute of Standards and Technology and Automotive and Information Sharing and Analysis Center. This may be part of the Data Management and Sharing Plan, or it can be a separate document. The cybersecurity plan should also include provisions for vehicle control and operations. The provider shall be solely responsible for maintaining cybersecurity insurance.

1.5 Test Plan

The provider will develop a test plan for the shuttle testing including Factory Acceptance Testing at the provider's facility, and a preliminary and final acceptance testing conducted on public roads after the delivery of the vehicles. As part of the testing plan, identify the scope, objectives, approach, methodology, assumptions, risks, contingency plan, schedule, testing environment, and a testing checklist. It is anticipated that there will be testing on private facilities or other controlled environments and on public roadways (without passengers). Testing scenarios shall be developed with input from TIMMA. For each scenario, the test plan should indicate the method/technique that will be used to test the scenario, the evaluation criteria, and standards for passing or failing the test. The test should provide traceability to a specific System Requirement (SyRS) so that TIMMA may verify that all SyRS have been met. See Project SyRS in Exhibit B. Additionally, the vendor should document important technical requirements in addition to those specified in the SyRS, as necessary and appropriate. The test plan will also provide criteria for suspending and resuming testing, and a description of the staff and resources that are necessary to complete the tests, especially as some tests may involve local stakeholders outside of the provider. Note that current California State regulations require on-road testing without passengers in an environment that is similar to the environment for passenger service testing for 30 days prior to CPUC approval to carry passengers. Testing will include a weather proofing test to prove the vehicle will not leak in the event of heavy rains. The test plan should include preliminary hazard assessment and operational hazard assessment addressing safety and risk mitigation. Sample use cases for testing are identified in the Concept of Operations (Exhibit C).

Project Team will review the draft test plan and may consult, additional subject matter experts TIMMA deems necessary, and in relation to other key plans. The provider shall incorporate any changes requested from TIMMA and submit the final testing plan for TIMMA's approval. The provider will conduct testing only after TIMMA's approval. TIMMA, SFMTA and TIDA representatives will be notified at least 10 days in advance of scheduling a test and offered the opportunity to witness the testing. TIMMA is responsible for final acceptance of each test.

1.6 Operations and Maintenance (O&M) Plan

The provider will develop an O&M plan for the shuttle service. At a minimum, the O&M plan should answer all the questions of who, what, where and when regarding operations and maintenance of the shuttle service. It should identify training, operations, safety, monitoring, maintenance and security procedures and processes as well as handling of exceptions, emergencies, and recovery in a variety of scenarios. The O&M plan will likely leverage, summarize, and consolidate several other submittals from the provider including the training plan and safety management plan and clearly distinguish the roles and responsibilities of TIMMA and the provider and their expected level of effort and cost. The O&M Plan shall include routine and emergency maintenance strategies, as well as a cleaning schedule and strategies for keeping the interior clean (refer to Exhibit D). The O&M Plan shall include check lists for the activities each maintenance and operations staff must perform, including how operations staff will interact with

passengers or other members of the public. Finally, since the shuttle service is intended to be a limited demonstration, the O&M Plan should describe the end service process for discontinuing service including, but not limited to, how service equipment will be repurposed, retired, disposed of, or otherwise handled. The provider shall submit an initial O&M Plan for review by TIMMA or their representatives. The provider shall incorporate any changes from TIMMA and submit the final O&M Plan for TIMMA approval.

1.7 Training Plan

The provider will submit a Training Plan in compliance with the Application Requirements for Autonomous Vehicle Tester Program – Testing with a Driver[1] and per the project schedule. In coordination with TIMMA, TIDA, SFMTA, and other project stakeholders, the provider shall discuss with and train local first responders and law enforcement on how to safely interact with the vehicle in case of emergency and have this information readily available to first responders in the vehicle. The shuttle provider should develop and execute training materials, such as a Local Law Enforcement Interaction Plan as required by the CA DMV for driverless testing, in coordination with and to be reviewed by local law enforcement and first responders. Safety must be an integral part of all instruction.

The plan shall include:

- Target groups training will be developed for test operators law enforcement, emergency responders, etc.
- Specific trainee performance objectives, by group.
- Draft lesson plans by group.
- Specific topics to be covered including subsystem groupings for mechanics and electronic technician training.
- Probable training aids and materials.
- Training schedule.
- Training facilities required.

1.8 Reporting and Evaluation Plan

The provider will develop a Reporting Plan that adheres to the Project Evaluation Framework included as Appendix A of the ConOps (Exhibit C). The reporting plan shall include the project goals, objectives, and the performance measures for each objective included in the evaluation framework. For each performance measure the provider shall include detailed data collection and calculation methodology, data sources, draft surveys tools where applicable, frequency of data collection, sample reporting templates and file formats (when transmitted digitally). TIMMA does not intend to collect personally identifiable information (PII). However, if PII must be collected for

[1] https://www.dmv.ca.gov/portal/vehicle-industry-services/autonomous-vehicles/testing-autonomous-vehicles-with-a-driver/#avt

user surveys or other travel experience needs, provider will need to have Institutional Review Board review the protocol and survey instrument. Provider shall detail how this data will be secured and protected as part of the data privacy plan.

The Reporting and Evaluation Plan should identify datasets for periods when the vehicle is open to passengers and periods for downtime (e.g. due to mechanical or staffing issues), which staff will use to conduct analysis, and summary reports. The datasets should include real-time service data, trip and travel data, operations data, and event data, and any other relevant data categories. Safety incidents (collisions, near misses, sudden acceleration/deceleration) should be reported to TIMMA Project Manager immediately, while trip and travel data, operations data, event data, and other performance measures can be reported on a weekly or monthly basis. The provider shall provide templates for safety incident and operational reporting as part of the Reporting Plan.

Table 2 identifies minimum expectations for data items and reporting frequencies to be collected and submitted to TIMMA.

Table 2: Data to be Shared with TIMMA by Type and Frequency

Data	Frequency of Transmission
Vehicle route and schedule as per General Transit Feed Specifications	Before launch and when changes or updates occur
Wheelchair ramp deployments	Weekly
Wheelchair securements	Weekly
Real-time vehicle location information	Real-time or near real-time
Information in the event of a safety incident including, but limited to Automatic Dependent Surveillance (ADS) sensor information, camera footage, Event Data Recorded data and logs and other telemetry data	As requested and/or immediately in the event of a safety incident
Trip updates and service alerts	Real-time or near real-time
Navigation variances	Daily
Ridership (stop-level boardings and alightings)	Daily
Probe data	Weekly
Actual stop arrival and departure times	Daily
Mechanical data (vehicle condition)	Daily
Vehicles miles traveled	Daily

Disengagements (either by operator or system)	Weekly
Near misses, collisions, and sudden acceleration/deceleration	As soon as possible following each occurrence
Vehicle hours traveled	Daily
Any other logged events (hard stops, evasive maneuvers, unruly passenger behavior, etc.)	Weekly
Number of route-trips served	Daily
Conditions driven in (weather, congestion, pedestrian and cyclist's volumes etc.)	Weekly
Duration of each trip	Daily
Incident reports (Incidents include any collisions, and passenger behavior or other situations when an external entity is called upon for assistance)	Within 48 hours following an incident
Battery usage (such that it can be associated with weather, temperature, vehicle load, etc.)	Weekly
Signal Phasing and Timing, Map Data Messages, and Basic Safety Messages	Monthly
Average vehicle speeds	Weekly
Other data required for pilot evaluation	As needed

Deliverables:

- *Project meeting attendance and/or facilitation, meeting materials, and meeting notes*
- *Work Plan*
- *Safety Management Plan*
- *Data Management*
- *Data Sharing, and Cybersecurity Plan*
- *Test Plan*
- *Operations and Maintenance Plan*
- *Training Plan*
- *Reporting and Evaluation Plan*

Task 2 Vehicle Design

The provider will design and manufacture all Autonomous Shuttles in compliance of all laws and regulations and per vehicle requirements listed in Exhibit B and ADA requirements as identified in Exhibit D. Please include a description of the proposed vehicle design to include items listed below; attach relevant diagrams, product safety data sheets, system architecture diagrams, more detailed information on the operating design domain of the vehicle, etc:

1. Type of propulsion
2. Number of vehicles to be provided
3. Capacity of each vehicle, including the number of seats, riders and operators, wheelchair, stroller, and or bicycle space, luggage/baggage space, etc. per vehicle
4. Vehicle make, model
5. Security features such as internal and external cameras (number and type) and recording capability
6. Model year
7. Availability to wrap or brand the vehicle
8. Passenger counting technology, if available
9. Description of how the service will be readily usable and accessible to people with disabilities
10. Description of the vehicle and how vehicle equipment complies with 49 CFR Part 38 of the Code of Federal Regulations (Americans with Disabilities Act (ADA) Accessibility Specifications for Transportation Vehicles)?
11. If the proposed vehicle(s) are new, used, or modified
12. Detailed description of how vehicle(s) complies with Part 38. of the ADA? Include a discussion of the following sections, as applicable:
    - § 38.23 Mobility aid accessibility
    - § 38.25 Doors, steps and thresholds
    - § 38.27 Priority seating signs
    - § 38.29 Interior circulation, handrails and stanchions
    - § 38.31 Lighting.
    - § 38.35 Public information system
    - § 38.37 Stop request.
    - § 38.39 Destination and route signs
13. Explanation of if the vehicle needs to deviate from the specifications in Exhibit D.
14. Brief description of the vehicle's ability to operate the following operating functions in automated mode:
    a. Performing a low-speed merge, pulling over to the side of the road, and moving out of the travel lane and stopping in order to service stop locations
    b. Following a car when approaching intersections and in stop and go traffic conditions by maintaining a safe distance behind the vehicle in front of them and determining when to proceed based on that vehicle's behavior
    c. Navigating signalized and unsignalized intersections and performing left and right turns
    d. Entering and emerging from a stop-controlled traffic circle
    e. Crossing intersections with traffic speed limits up to 25 mph
    f. Changing lanes (both left and right lane change)
    g. Making appropriate right-of-way decisions when merging from a shuttle stop, at intersections, and when interacting with vulnerable road users
    h. Detecting and responding to encroaching oncoming vehicles
    i. Detecting stopped vehicles in their path and passing if necessary and safe

j. Detecting and responding to static and moving obstacles in their path, including construction equipment
k. Detecting and responding appropriately to emergency vehicles
l. Detecting and responding appropriately to law enforcement
m. Detecting and responding to vulnerable road users, such as pedestrians, cyclists, and scooters, in or approaching the vehicle's projected travel path, including at intersections and crosswalks
n. Providing a safe distance from vehicles, pedestrians, bicyclists, and scooters on the side of the road or sharing the lane
o. Responding safely and appropriately given the traffic situation when there is uncertainty regarding a maneuver. Description of how quickly the vehicle can hand over control to the safety operator as to not impact traffic conditions. Detecting and responding to detours and other temporary changes in traffic patterns, such as people (including construction workers and police officers) directing traffic in unplanned or planned events. An acceptable response includes informing the human operator of the need to take manual control.
p. Operating in normal (not deemed a weather emergency) rain, and fog, conditions
q. Ability for test operator to communicate safety information to pedestrians or other motorists (e.g. horn) and the passengers
r. Emergency braking for obstacles in the road

15. Ability and description of how the human operator shall take manual control if deemed necessary
16. Ability and description of how the vehicle will achieve a minimal risk condition if the human operator cannot take control and how the vehicle will decide where to stop.

Deliverables:

- *Vehicle(s) compliant with all laws and regulations per vehicle requirements listed in Exhibit B and ADA requirements as identified in Exhibit D*

Task 3 Regulatory Approval

The provider is responsible for all federal, state, and local regulatory approval, including FMVSS Exemption, NHTSA Waiver and Route Approval, and the appropriate CA DMV and CPUC permits. Include experience with federal and state permit processes, a timeline for all steps to obtain relevant approvals, exemptions, and permits and potential risks to the schedule. The provider should provide the project team with the opportunity to review any exemption applications that would be required for a complete understanding of safety standards that would be requested for exemption.

Deliverable:

- *Receipt of all federal, state, and local regulatory approval, including any relevant exemption applications*

Task 4 Testing

Provider will perform the 30-day test period, Factory Acceptance Test, and any other required testing (such as tabletop exercise with first responders, preliminary acceptance testing, and full operational testing) as outlined in the Test Plan (Task 1.5) to verify the vehicles are built and will operate in accordance with design specifications, as detailed in the testing plan approved by TIMMA. For each test type conducted, the provider shall record the results and maintain the sensor data for all on- and off-field testing and, upon testing completion, as they may be asked to provide supporting data logs and sensor recordings to TIMMA. TIMMA and SFMTA shall have the option to witness all tests and ride the shuttle prior to delivery for quality assurance purposes. Ten working days' notice to TIMMA PM is required prior to each test being conducted. The provider shall provide a summary of the results of each test type outlined in the test plan, including the capabilities demonstrated, the conditions under which they occurred, and any corrective action necessary for any failed or deferred test cases. The provider shall provide the test summary to TIMMA within ten days of the test being executed. TIMMA, with support from the provider, will determine if additional/repeat tests are required upon reviewing the draft test results and make this determination within ten days of the submittal of the test report; additional testing will be done at provider's expense.

Delivery of the autonomous pilot vehicles at the test site shall be coordinated with TIDA and TIMMA. Prior to delivery, the provider shall prepare certification of their shuttle(s) consistent with applicable federal requirements and standards or have acquired exemption, policies and regulations for such motor vehicle and the Highly Automated Vehicle (HAV) system consistent with California State regulation and guided by US DOT's Policy Guidance, and relevant SAE and Institute of Electrical and Electronics Engineer best practices. The provider will notify TIMMA 15 days before scheduled on-site delivery, TIMMA will witness vehicle delivery. The delivered vehicles shall be inspected by TIMMA or their representatives and accepted by TIMMA for quality assurance purposes. **All vehicles must be NHTSA compliant or have required exemption; TIMMA will not perform acceptance testing or pay for any expenses related to vehicle procurement.**

Once the pre-field-testing meeting detailed in Task 1.1 has been performed, the Provider shall conduct any required testing on public roads without passengers as detailed in the Testing Plan approved by TIMMA. The Provider shall record the sensor data from this testing and share this data as well as a summary of the results of the on-site testing with the Project Team for examination prior to obtaining TIMMA's approval to provide passenger service.

Deliverables:

- *Vehicle delivery and testing*
- *All relevant testing data*
- *Testing summary report*

Task 5 Deployment

Following the successful completion of the on-site testing and the notice-to-proceed provided by TIMMA at the pre-pilot meeting (see Task 1.1), the provider shall start the pilot. The shuttle will run in autonomous mode on the pre-determined route. An Autonomous Shuttle test operator shall be present within the shuttle at all times throughout the pilot period. The vehicle concierge, which could be the safety driver or another designated person on board, will assist the passengers and receive feedback from the users. The provider shall be responsible for the entire operations and maintenance of the shuttle as described in Task 7. A Draft Concept of Operations, which identifies the project stakeholders, their roles and responsibilities, and operational scenarios has been developed for the project. The Concept of Operations is provided in Exhibit C.

Deliverable

- *Vehicle deployment for the length of the pilot period*

Task 6 Training

Conduct Autonomous Shuttle test operator training as identified in the Training Plan approved by TIMMA. Provider is responsible for recruiting and training the Autonomous Shuttle test operators and any other needed positions to complete the project; hiring of local (Treasure Island residents) and/or partnering with local businesses is highly encouraged; please discuss opportunities to support local hiring. Provide information on what position(s) or partners will be available for local hire; include a plan to promote position, timeline for hiring, and compensation. TIMMA will oversee the training activities of the provider and ensure compliance with the training plan.

Provider is encouraged to incorporate local residents of Treasure Island into their workforce. The organization One Treasure Island operates a worker training and job placement program for residents of Treasure Island. All workers available through One Treasure Island meet universal standards of job readiness. Please contact Alex Francois, One Treasure Island Employment Program Manager, at (415) 986-4810 or afrancois@onetreasureisland.org to learn about the availability of locally available residents through One Treasure Island to supplement your workforce. In addition, provider is encouraged to work with labor groups to develop labor harmony provisions.

Deliverable:

- *Recruitment and hiring of operators and relevant positions for a successful project, with a preference for island residents*
- *Shuttle Operator training*

Task 7 Pilot Operations and Maintenance

The provider shall be responsible for the operations and maintenance of the shuttle as detailed in the Operations and Maintenance Plan approved by TIMMA and as outlined in the operating agreement provided in Exhibit G; this includes compliance with all necessary Federal Operating

Requirements. Service will operate on fixed route. Pre-scheduled trips and advance reservation services are not required. The provider is responsible for day-to-day pilot operations and maintenance and the safe storage of the AV shuttles. The provider will provide monthly Operational Reports for TIMMA's review that include route analysis, operational plan, topology, weather, and temperature and other relevant operational elements.

Service Information

1. Vehicle Type
   The vehicle type for the pilot must be ADA accessible and low-emission.

2. Vehicle Route
   Preliminary potential routes have been developed as part of the planning phase of the TIMMA Autonomous Shuttle project (see Exhibit E) and were determined using the original routes proposed in the TITIP, with modifications due to the phased construction of the project and other restrictions. Provider shall work with TIMMA to incorporate public outreach findings, cost constraints, and route feasibility to define a recommended or preferred route to maximize user experience. The route options should account for Muni transit service, parked cars along the route, vegetation maintenance near the road, turning radii when the shuttle is turning, and horizontal and vertical curves. Final pilot route will be coordinated with the Project Team, project stakeholders, and approved by TIMMA. The vehicle route may also be adjusted during the 9-month pilot period to reflect community and passenger feedback collected during the pilot.

3. Quantity and Spacing of Stops
   In coordination with TIMMA, TIDA, SFMTA, and the provider, stops locations will be identified. The provider shall also support TIMMA in identifying critical infrastructure improvement required for the safe operation of the AV shuttle prior to commencing the pilot study and during the pilot period.

   The shuttle stops will be located along a one-to-two-mile loop that connects passengers between the Administration Building on the south side of Treasure Island, the commercial areas on the east side of the island, and the residential area on the north side of the island. The exact route and stop locations will be determined through outreach and coordination with the selected provider; it is anticipated that the route will have up to five stops.

4. Span and Frequency of Service
   Provider will operate shuttle services during select hours between 7:00 AM to 8:00 PM on weekdays and 7:00 AM to 5:00 PM on weekends with at no more than 30-minute headways. A longer headway or shorter route may be considered to minimize the number of shuttles and the overall pilot costs. The exact operating hours will be determined through outreach and coordination with the selected provider.

5. Traveler Demand and Capacity
   Provider shall state maximum traveler capacity given proposed vehicle, span, and frequency of service under current COVID safety guidelines and under non-COVID conditions.

6. Accessibility for People with Disability
   The AV pilot vehicle must comply with the accessibility requirements in 49 CFR Part 38 of the Code of Federal Regulations (ADA). Refer to the questions in Task 2. An example of specific vehicle requirements is included in Exhibit B and Exhibit D. Explain if the vehicle deviates from the specifications in the Exhibits and please detail how the proposed shuttle service will comply with ADA requirements, specifically noting any limitations of the vehicle or any instances where you are not providing accessible service and will instead provide an equivalent service alternative.

7. Traveler Information and Communication
   Provider shall lay out traveler information within the shuttles, on websites, and any mobile application. Onboard the shuttles, provide signage and displays that includes safety related information telling the passenger to hold on, how to sit safely, and notice on board surveillance, as applicable. Optionally, include the route progress and stop locations for traveler situational awareness. In addition to visual signage, provide an audible message with safety information, either by recording or announced by on-board staff. All communication on board and at stops should comply with ADA and Title VI requirements. The Autonomous Shuttle test operator must be able to communicate safety information to pedestrians or other motorists (e.g. horn) and the passengers. Contact information (phone, email, website, etc.) must be provided for questions or complaints from travelers and other members of the public. All communications with the public (including signage, flyers, website or application text and responses to inquires) must be approved by TIMMA. Questions or complaints must be addressed within 24-48 hours and relayed to TIMMA staff on a weekly or monthly basis.

8. Operational Modes
   The Autonomous Shuttles will be operating on a fixed-route service. The speed limit on all roads along the route is 25 MPH. Please be aware that speed limits may be lower due to construction on both Treasure Island and Yerba Buena Island.

9. Supervision
   There will be at least one Autonomous Shuttle test operator onboard the vehicle during the pilot. The onboard staff will have concierge and safety driver roles, although both staff roles could potentially be fulfilled by one person or, alternatively, the concierge could be filled through a local hire program.

   The concierge will be responsible for greeting the passengers, assisting the passengers as needed, providing traveler information, and documenting data and notes. The concierge

will be trained on safety procedures, how to interact with riders, and how to secure people that use mobility devices.

The test operator with safety driver responsibilities will be responsible for taking control of the shuttle in case of a disengagement and ensuring that the shuttle is operating properly. The test operators will be trained on how to safely operate the shuttle, how to identify incorrect operations and how to communicate with the remote operator.

The system operator will have an operations center located in the area or remotely where they can oversee the fleet of shuttles. A remote operator will be located at this center who can be contacted by the Autonomous Shuttle test operator if there are any issues.

10. Storage and Charging
    The shuttles will be stored and charged in an on-island facility located on Avenue M at 13th Street, with secured access and shelter. The planned location for vehicle storage and charging is shown in Exhibit E, below. Charging stations that are SAE J1772 compliant are available and will be free of charge. There will not be other charging stations at stops or along the shuttle's route.

11. Maintenance and Cleaning of Vehicles
    All maintenance will be performed by the shuttle provider. If a shuttle requires maintenance, the shuttle will be taken out of service until the required maintenance is performed.

    Daily, at the beginning or the end of service, the shuttles will be wiped down by the concierge or maintenance staff. In addition, the shuttle cleaning schedule will at a minimum mimic the same cleaning schedule and other standard operating procedures that the Muni buses follow at the time of the pilot. Cleaning procedures are rapidly changing due to the COVID-19 pandemic; refer to Cal/OSHA for COVID and general procedures (https://www.dir.ca.gov/dosh/coronavirus/) and the US DOT and CDC requirements for masking and other protocols on transit (https://www.cdc.gov/quarantine/pdf/Mask-Order-CDC_GMTF_01-29-21-p.pdf)

    TIDA does not allow oil and hazmat substances. If used, they must be securely stored with appropriate double containment; and if discarded, must be discarded in accordance with hazmat laws and regs and IN NO CASE shall any such materials be discharged to the island's wastewater or separate stormwater systems (this includes batteries).

12. Physical Upgrades and Signage
    Traffic signals, pavement markings, and signing within the route segments will be provided in their existing condition. TIMMA is evaluating potential infrastructure improvements before project demonstration and the provider shall work closely with TIMMA on identifying essential improvements for the pilot operations.

13. Right-of-Way
    No property acquisition is anticipated for operation of the shuttle service.

14. Ongoing Software Upgrades and Cybersecurity
    Ongoing software updates shall be provided at no additional cost through the duration of the project. Updates may be handled via over-the-air updates (4G), through Wi-Fi, or manually by concierge or maintenance staff while the shuttle is parked for charging. WiFi reliability on Treasure Island will be available but is not guaranteed.

    Cybersecurity will be the responsibility of the shuttle provider per the approved cybersecurity plan part of the data management and sharing plan.

Deliverable:

- *Ongoing vehicle operations and maintenance for pilot period in accordance with all vehicle standards, operating plans, etc.*

Task 8 Pilot Evaluation

TIMMA will evaluate the performance measures, as outlined in Attachment C – Concept of Operations, on a monthly basis to determine the success of the pilot, with the exception of the safety incidents which will be reviewed each day.

The provider shall track, collect, and submit data as detailed in the Reporting Plan approved by TIMMA.

Deliverable:

- *Monthly reports and data, as determined in the Reporting Plan*

Task 9 Communication and Outreach

TIMMA is responsible for all public communication, marketing, and outreach, with support in attendance or co-facilitation from the provider as needed. Provider should not speak to the media or other outside organizations without TIMMA's prior approval.

Task 9A [Optional]

TIMMA is interested in advancing community partnerships through the pilot and has identified four potential partnerships: local businesses, local workforce (training, hiring), youth and professional education, and technology industry knowledge transfer. Examples may include promotion of on-island businesses, career development and educational programs for student STEM programs, the on-island federal job corps, and training opportunities for transit operators/trainees, relevant operating unions and trades, or identifying collaboration

opportunities for local hire initiatives through the program. TIMMA is interested in additional partnership opportunities and ideas based on provider experiences and knowledge of the industry and Treasure Island and San Francisco community.

This task has a maximum potential budget of $25,000 to be determined based on an agreed upon partnerships strategy, developed as part of this task.

Deliverables:

- *Attendance at all planned community outreach events, select vehicle information and materials as needed; at least 4 meetings are expected*
- *Support in identifying and implementing local economic development, job, and/or educational opportunities through implementation*

SECTION V – RFP RESPONSE REQUIREMENTS: CONTENT AND FORMAT

All proposals should be clear, concise, and provide sufficient information to minimize questions and assumptions. Proposals should be limited to **15 pages** (no smaller than 12-point font shall be used and all page sizes greater than the letter size of 8.5" x 11" will be counted as two pages), excluding cover letter, table of contents, the cost proposal, and the following items, which should be included as attachments: résumés, Disadvantaged Business Enterprise (DBE), certifications, and required exhibits. TIMMA accepts no financial responsibility for any costs incurred in the preparation of proposals. Upon receipt by TIMMA, all accepted proposals submitted in response to this RFP will become the property of TIMMA and shall be subject to disclosure in accordance with the California Public Records Act as discussed in Section IX below.

Time and Place for Submission of Proposals. By the proposal submission deadline, the following must be transmitted:

- **Proposal** (written proposal, without cost proposal): one (1) electronic copy (PDF) including all information herein requested. Please clearly specify in the subject line of the e-mail transmittal: "Response to RFP 21/22-01 for Autonomous Shuttle Services".

- **Cost proposal** (in a separate electronic file): one electronic copy (XLS/XLSX format) including all information herein requested. Please name the file: "Cost Proposal for RFP 21/22-01", and submit along with the proposal.

The proposals must be transmitted electronically to TIMMA at the following address: info@timma.org.

All responses must be in writing and identified as to content and be received by TIMMA by the due date. Proposals received later than the above date and time will be rejected.

Cover Letter. Proposers must submit a letter of introduction for the proposal. The letter must be signed by a person authorized by your firm to obligate your firm to perform the commitments

contained in the proposal. Submission of the letter will constitute a representation that your firm is willing and able to perform the commitments contained in the proposal. The cover letter must also include the following content in the format as shown:

1. Project Manager (The individual in charge of the scope of services, and who will be TIMMA's contact throughout the contract duration) Name: Title: Address: City, State, ZIP: Phone Number: Email:
2. Selection Process Lead (The individual to whom correspondence and other contacts should be directed during the consultant selection process) Name: Title: Address: City, State, ZIP: Phone Number: Email:
3. Negotiating Officer (The individual who will negotiate with TIMMA and who can contractually bind the proposer's firm) Name: Title: Address: City, State, ZIP: Phone Number: Email:
4. Company Headquarter Office Address: City, State, ZIP: Phone Number:
5. List proposed co-venture arrangements or sub-consultants, if any: 1. Company: DBE status: Percentage of involvement: Name: Title: Address:

City, State, ZIP: Phone Number: Email: 2. …
6. ☒ This letter is signed by an officer that is authorized to bind the proposer contractually.
7. ☒ This proposal is firm for a 120-day period from the proposal submission deadline.

Content. Proposals must contain the following five sections:

1. **Proposer Information and Understanding of Project Objectives.** In this section, the proposer must provide a discussion demonstrating an understanding of the services to be provided, the challenges for each task, and their significance to TIMMA.

2. **Technical and Management Approach.** In this section, the proposer must describe its approach to the delivery of the services included in Section IV. This section must (1) reflect the proposer's knowledge of, and ability to demonstrate, a sound approach to the requested services, (2) include a discussion on recommended changes/enhancements, project challenges, and potential impacts to cost, scope, and schedule based on lessons learned, including any recommendations the consultant proposes to lower and/or control costs given the proposed scope of the project and (3) demonstrate the proposer's knowledge of deployment and permitting requirements in California and their potential impacts to the delivery of the services of this RFP on the project schedule and (4) include a discussion of opportunities for local hire, supporting local businesses, community development, and labor harmony through partnerships.

   Proposer must provide the names and positions of all staff for the proposed team. An organization chart should be included that clearly establishes principal team member firms and sub-consultants, if any. Proposer must also identify any specialty sub-consultants that would not necessarily be part of the core team but would be available on an as-needed basis for specialty support. The proposal should also designate the Project Manager in charge of the scope of services and TIMMA's contact throughout the contract duration. In addition, the proposal should briefly address how the efforts of each of the team members will be coordinated. Proposers should provide a staffing plan with level of effort (e.g., person hours per staff) by task. Do not include budget or rate information in the written proposal; this information should be included in the cost proposal. If the work is to be shared among firms and offices at different locations, indicate where each office is located and what work is to be performed in each office.

   Proposals must discuss workload for all key team members, indicating their expected availability, the percentage of their time that will be devoted to TIMMA's contract and any

other assurances as to their ability to provide the requested services in a responsive and timely manner. The description of the management approach should address proposed response time standard and how the management and team structure will help to meet those standards.

3. **Capabilities and Experience.** Proposers must state the qualifications and experience of the proposed team, emphasizing the specific qualifications and experience acquired while providing services similar to those being sought by TIMMA, particularly for the Project Manager and other key project staff members assigned to the Project. Except under certain circumstances beyond the proposer's control, TIMMA will not accept substitutions of key members of the team put forth as part of the winning proposal.

   This section must include the following information:

   - Names of Project Manager and team members;
   - Résumés of all technical personnel to be assigned to work within the scope of services as outlined in Section IV (provide as attachments; résumés will not count toward the page limit);
   - Statement of proposer's background and experience related to activities and services being sought through this RFP;
   - Brief description of similar projects for which the proposer has provided services during the past five (5) years, including the following information:
     - Client, including reference contact information
     - Project description and location
     - Description of services
     - Total value of services provided
     - Actual budget performance vs. projected
     - Actual schedule performance vs. projected
     - Key personnel involved
     - Sub-consultants employed

4. **Assurances and Miscellaneous Items.** In this section, proposals must provide the following information:

   a. Proposers must complete and include the exhibits listed below within the submittal. These exhibits do not count toward the page limit; please provide as attachments to proposal. Exhibit samples are attached to this RFP.

Exhibit	Prime Consultant	Subconsultant(s)
Exhibit F – Federal Compliance Questionnaire	X	X

Exhibit I – Debarment and Suspension Certification	X	X
Exhibit J – Terminated Contracts	X	X
Exhibit K – Workforce Data Spreadsheets	X	X
Exhibit L – Certification Regarding Lobbying	X	X
Exhibit M – Guidance for Bidders Completing the Good Faith Effort Submittal	N/A	N/A
Exhibit 10-I – Notice to Proposers DBE Information	N/A	N/A
Exhibit 10-O1 – Local Agency Consultant Proposal DBE Commitment	X	N/A
Exhibit 10-O2 – Local Agency Consultant Contract DBE Information	X	N/A
Exhibit 15-H – DBE Information – Good Faith Efforts (if DBE goal is not met)	X	N/A

b. Proposers must provide the names, telephone numbers, and e-mail addresses of at least three references, in addition to staff of TIMMA, if any. The references should cover work performed by the Project Manager and other key project staff members, should be for work recently performed and similar in nature to the services sought in this RFP. The references must include a brief description of the projects involved, and the roles of the respective team members in successfully completing the project.

c. Proposers must specify any potential or perceived conflicts of interest which would disqualify its firm from doing business with TIMMA or the Transportation Authority. If proposers are unaware of existing or foreseeable conflicts of interest, a simple statement will suffice. However, proposers should provide a brief description of each apparent, existing, or foreseeable conflict of interest, if any. In addition, list all relevant assignments completed for the City and County of San Francisco within the last five (5) years, and any involvement with TIMMA-funded projects, to enable TIMMA to identify any possible conflicts of interest.

d. Proposers must list any political contributions of money, in-kind services, or loans made to any current member of TIMMA Board of Commissioners within the last three (3) years by management positions of the proposed consultant or sub-consultant. If proposers are unaware of any political contributions, a simple statement will suffice. However, if proposers are aware of any political contribution, proposals should include details, such as to whom, what type of contribution, the date and the amount.

e. Proposers must clearly designate financial submittals or other materials in its submittal, if any, which it in good faith believes to be a trade secret or confidential proprietary information protected from disclosure. See Section IX below, for further details on public disclosure of responses and other materials.

5. **Cost.** The cost proposal will not count toward the page limit and must be submitted as a separate electronic file. This contract will be structured as a lump sum contract, with progress payments made upon the completion of the milestones defined below. A sample cost proposal is provided on Exhibit G.

Required Milestones

- Milestone #1: Contract Initiation
- Milestone #2: Permitting and Plans
    - Completion of Task 1.2 through 1.8
    - Completion of Task 3
- Milestone #3: Vehicle Acceptance and Testing
    - Initiating Task 2 during test period to ensure compliance in later phases of work
    - Completion of Task 4
    - Completion of Task 6
- Milestone #4: Pilot Service for Months 1-3
    - Month 1-3 of Task 5
    - Month 1-3 of Task 7
    - Month 1-3 of Task 9
- Milestone #5: Pilot Service for Months 4-6
    - Month 4-6 of Task 5
    - Month 4-6 of Task 7
    - Month 4-6 of Task 9
- Milestone #7: Pilot Service for Months 7-9
    - Month 7-9 of Task 5
    - Month 7-9 of Task 7
    - Month 7-9 of Task 9
- Milestone #8: Evaluation/Completion
    - Completion of Task 8

Optional Milestone

- Milestone #9: Community Partnerships

SECTION VI – EVALUATION CRITERIA AND METHOD OF AWARD

The proposals will be evaluated by a selection committee appointed by the Executive Director and scored (maximum of 100 points) using the following criteria:

1. **Proposer Information and Understanding of Project Objectives. (15 points)**

    a. Responsiveness to all items requested in the RFP, such as completeness of submission, adherence to required page limits, overall organization and clarity of proposal; and

    b. Understanding of the services to be provided, particularly in relation to TIMMA, and challenges for each task.

2. **Technical and Management Approach. (50 points)**

    a. Effectiveness of the proposed work plan, program and method of execution;

    b. Technical solutions to meet the scope of services; insight and understanding of special issues, problems and constraints, approach towards mitigating and resolving them;

    c. Effectiveness of the team's organizational structure in executing and managing the tasks;

    d. Management approach in providing technically sound and cost-effective services; and

    e. Ability to provide timely, qualified and adequate staffing and services to support project demands.

3. **Capabilities and Experience. (35 points)**

    a. Capability of project team, specific relevant experience, qualifications and expertise of each firm and subconsultant firm, especially the proposed key personnel; and

    b. Client references as to past project performance.

Evaluation Process. The selection committee retains the right to independently verify and evaluate relevant experience and client references, including any sources not mentioned in the proposal.

Submittals receiving an initial score of less than 70 points will not be considered further in the selection process. Proposers that have received a score of 70 points or higher may, at TIMMA's sole discretion, be invited to an interview with the selection committee. TIMMA reserves the right to not conduct oral interviews and determine the winning proposer based solely on the written proposal. If oral interviews are held, individuals who are identified as key personnel in the proposal are required to be in attendance at the interview. Based on the results of the interview,

the selection committee may adjust initial scores on the evaluation criteria identified above to arrive at the final evaluation score. The proposer with the highest final evaluation score shall be designated as the top proposer. Proposers who do not arrive for a scheduled interview, if one is held, will no longer be considered further in the selection process.

Once the top proposer has been identified and the proposer's cost and pricing data has been reviewed, TIMMA staff will start contract negotiations with that proposer. If contract negotiations are not successful, the second-ranked proposer may be asked to negotiate with TIMMA. Each proposer's cost and pricing data will remain sealed/unopened until negotiations begin with that particular proposer. The goal of such negotiations will be to agree on a final contract that delivers the services and work described in this RFP at a fair and reasonable cost to TIMMA. The award, if any, will be made to the proposer whose submittal is most responsive to the RFP and deemed most advantageous to TIMMA.

TIMMA reserves the right to:

1. Modify and/or suspend any and all aspects of this procurement;
2. Issue subsequent RFPs;
3. Alter the Selection Process Schedule;
4. Remedy technical errors in the RFP process;
5. Investigate the qualifications of all firms under consideration;
6. Confirm any part of the information furnished by a Proposer;
7. Obtain further information from any firm or person responding to this procurement;
8. Obtain additional evidence of managerial, financial, or other capabilities;
9. Approve or disapprove the use of particular subcontractors;
10. Negotiate with any, all, or none of the Proposers;
11. Accept other than the lowest-priced Proposal;
12. Cancel or withdraw this RFP at any time without prior notice and TIMMA makes no representations that any contract will awarded to any Proposer responding to this RFP;
13. Waive any informality or irregularity as to form or content of this procurement or any response thereto;
14. Be the sole judge of the merits of the proposals received; and
15. Accept or reject any or all proposals, or any item or part thereof.

TIMMA is not responsible for any costs incurred in preparation and submission of proposals or in any proposer's anticipation of a contract.

SECTION VII – DBE FOR U.S. DEPARTMENT OF TRANSPORTATION ASSISTED CONTRACTS

Terms. The terms used in this Policy have the meanings as defined in U.S. Department of Transportation (DOT) Code of Federal Regulations Title 49 Section 26 (49 CFR § 26).

DBE Objective/Policy Statement. As TIMMA may receive federal financial assistance to fund a portion of this procurement from the United States Department of Transportation through the California Department of Transportation (Caltrans) acting on behalf of the Federal Highway Administration (FHWA), the Metropolitan Transportation Commission (MTC), or the Federal Transit Administration, this procurement is subject to Caltrans regulations in accordance with Code of Federal Regulations Title 49 Section 26 (49 CFR 26).

DBEs and other small businesses are strongly encouraged to participate in the performance of contracts financed in whole or in part with federal funds. The consultant should ensure that DBEs and other small businesses have the opportunity to participate in the performance of the work that is the subject of this solicitation and should take all necessary and reasonable steps for this assurance. The proposer shall not discriminate on the basis of race, color, creed, religion, national origin, ancestry, age, height, weight, sex, sexual orientation, gender identity, domestic partner status, marital status, or disability or AIDS/HIV status in the award and performance of subcontracts. Proposers are encouraged to use services offered by financial institutions owned and controlled by DBEs.

Nondiscrimination. TIMMA will never exclude any person from participation in, deny any person the benefit of, or otherwise discriminate against anyone in connection with the award and performance of any contract covered by 49 CFR 26 on the basis of race, color, sex, or national origin. TIMMA will not, directly or through contractual or other arrangements, use criteria or methods of administration that have the effect of defeating or substantially impairing the accomplishment of the objectives of the Caltrans DBE Program Plan with respect to individuals of a particular race, color, sex, or national origin.

Contract Goal. For this contract, TIMMA has established a DBE goal of **3%**. Firms are requested to provide all applicable certificates or proof of certification along with their submission, which will not count against the page limit. Proposers must document adequate good faith efforts to involve DBEs by completing and submitting the attached Exhibit 10-O1, *Consultant Proposal DBE Commitment*, and Exhibit 10-O2, *Consultant Contract DBE Information*. Proposers must submit Exhibit 15-H, *DBE Information – Good Faith Efforts*, if the DBE goal is not achieved. It is recommended that proposers prepare Exhibit 15-H irrespective of meeting the DBE goal.

DBE Regulations. Bidders shall be fully informed with respect to the requirements of the DBE regulations. The DBE regulations in their entirety are incorporated herein by reference. A DBE must be a small business firm defined pursuant to 13 CFR 121 and be certified through the California Unified Certification Program by the proposal due date. A certified DBE may participate as a prime consultant, sub-consultant, joint venture partner with a prime or sub-consultant, provider of materials or supplies, or as a trucking company. For more information, please refer to Exhibit 10-I, *Notice to Proposers DBE Information*, and Exhibit K, *Guidance for Bidders Completing the Good Faith Effort Submittal*.

SECTION VIII – PROCUREMENT PROTEST AND APPEAL POLICIES AND PROCEDURES

TIMMA has established protest procedures, which apply to all procurements of supplies, equipment, and services.

A bidder or proposer that has timely submitted a bid or proposal in response to a procurement of TIMMA may file a protest asserting that TIMMA has failed to follow applicable policies or procedures relative to seeking, evaluating, and/or awarding a contract or has failed to comply with relevant specifications or procedures contained in the bid documents or request for proposals. In order to file a protest, the protester must be an actual bidder or proposer whose direct economic interests would be affected by the award of a procurement contract or by the failure to award a procurement contract.

Such protests must be filed within the earlier of five (5) business days after (i) notice, actual or constructive, of TIMMA's finding that the bidder or proposer's bid or proposal is not being considered further or (ii) an award of the contract by TIMMA to another bidder or proposer.

All protests must be received by the due date specified above. Protests or notice of protests made orally (e.g., by telephone) will not be considered. Protests must be delivered to TIMMA via in-person delivery or registered mail to:

Deputy Director for Finance and Administration
Treasure Island Mobility Management Agency
1455 Market Street, Floor 22
San Francisco, California 94103
Re: Bid Protest to Request for Proposal #21/22-01

A protest shall be deemed filed when TIMMA actually receives the protest by mail or personal delivery. Failure to file a timely protest shall constitute a waiver of the right to file a protest under these procedures. Within five (5) business days of receipt of an untimely protest, TIMMA shall notify the individual or entity that the protest was untimely and is being rejected. Such notice shall constitute the final decision of TIMMA relative to the untimely protest.

All protests filed must be filed by an actual bidder or proposer responding to the procurement and must be in writing and include the following information:

1. Name of individual or entity filing protest;
2. Business address and telephone number of individual or entity;
3. Name and title of contact person;
4. Description of specific procurement and the action or decision being protested;
5. A clear and concise statement of the protest, including identification of:

a) procedures or specifications contained in bid documents or request for proposals which were allegedly not complied with, or

b) specific instance(s) of Transportation Authority failure to follow its policy and procedures;

6. Detailed factual support for the protest, including relevant documents or correspondence;

7. Desired resolution of the protest; and

8. Dated signature of individual, or authorized representative of entity, filing the protest.

The Executive Director shall review and consider all stated concerns and issues alleged to be in non-compliance and issue a decision within five (5) business days of receipt of the protest. If the decision of the Executive Director is not satisfactory to the protesting party, the protesting party may appeal that decision to the TIMMA Board. The appeal must be filed within five (5) business days of the date of the decision. The appeal must clearly state the basis for disputing the decision of the Executive Director.

The appeal shall be referred to the TIMMA Board, which shall consider whether to accept the appeal and hold a hearing on the matter. If a majority of the TIMMA Board does not wish to accept the appeal, the decision of the Executive Director shall be final.

If a majority of the TIMMA Board agrees to accept the appeal and hold a hearing on the matter, the protesting party shall be notified of the hearing date and time, which shall be scheduled at the earliest convenience of the TIMMA Board. At the hearing, the protesting party shall be allowed fifteen (15) minutes to present its case. TIMMA staff shall then be allowed fifteen (15) minutes to present TIMMA's case. The TIMMA Board may extend these time periods at its discretion.

The TIMMA Board shall review and act upon the appeal at its next regularly scheduled meeting unless it determines that additional time to consider the appeal is required. The TIMMA Board shall issue written notification to the protester of its decision which shall constitute the final decision of TIMMA.

SECTION IX – NOTE REGARDING PUBLIC DISCLOSURE OF RESPONSES AND OTHER MATERIALS

Under the California Public Records Act (PRA; Government Code sections 6250 *et seq*.), records, information and materials submitted to TIMMA, not otherwise exempt, are subject to public disclosure. Immediately after the contract has been awarded, the materials submitted by all proposers will be open to inspection. Each party submitting a response to the RFP should clearly designate financial submittals or other materials, if any, which it in good faith believes to be corporate proprietary information, including trade secrets, protected from disclosure; if no materials are designated, the submitted proposal in its entirety may be subject to the PRA. To the

extent permitted by law, TIMMA will attempt to maintain the confidentiality of such information by providing the proposer with notice that it has received a request. If the proposer desires that such materials not be disclosed, it may, at its own expense, take appropriate legal action to prevent such disclosure. However, such confidentiality cannot be assured, and TIMMA will not be liable for the public disclosure of any material submitted to it. Proposer agrees to defend and hold harmless TIMMA from any suit, judgment, or liability stemming from any withholding or release of information submitted by the proposer to TIMMA.

SECTION X – GRANT REQUIREMENTS

Under the Advanced Transportation and Congestion Management Technologies Deployment Program (ATCMTD) established by the Federal Highway Administration, grants funded by ATCMTD require vendors to comply with the Americans with Disabilities Act (ADA) compliance, Drug-Free Workplace ACT (DFWA) compliance, Equal Employment Opportunity (EEO), and Maintenance policy compliance. Proposers must submit a completed Federal Compliance Questionnaire, Appendix F, by the proposal due date and time. Instructions for completing the Federal Compliance Questionnaire are included in Appendix F. Prior to contract award, the selected proposer is required to demonstrate compliance with the requirements below.

A. **ADA.** Titles II and III of the ADA of 1990 provide that no entity shall discriminate against an individual with a disability in connection with the provision of transportation services. The law sets forth specific requirements for vehicle and facility accessibility and the provision of service, including complementary paratransit service.

Information required to meet ADA compliance:

- ADA complaint procedures, if written;
- ADA complaint form;
- ADA complaint record retention procedures, if written;
- Sample driver handbooks;
- Sample driver operating and training manuals;
- Sample vehicle specifications/information on annunciators;
- Sample internal service provision monitoring materials, such as surveys, checklists, interview forms, etc.;
- ADA reasonable modification policy, if written;
- Procedures for removing vehicles from service and for not placing vehicles into service for pre-trip inspection issues, including (vehicles with inoperative lifts, faulty annunciator, etc.);

- Copies of contracts or other agreements, or terms of other relationships (including, but not limited to, awards, subawards, or cooperative agreements) with private entities to operate fixed-route or demand-response service, including microtransit and commuter bus;
- Copies of vehicle procurements and bid specifications;
- Riders' guides, including paratransit guides. (Often information for general compliance issues such as service animal accommodation or wheelchairs are only found in paratransit information; however, as these issues are not specific to paratransit, they should be identified here.)

B. **DFWA.** Recipients are required to maintain a drug free workplace for all award-related employees; report any convictions occurring in the workplace timely; and have an ongoing drug free awareness program.

Information required to meet DFWA compliance:

- Written drug free workplace policy;
- Examples of drug free awareness notification such as brochures, posters, information on bulletin boards, employee assistance programs;
- Number of employees with a drug statute conviction during the review period.

C. **EEO.** The recipient must ensure that no person in the United States shall on the grounds of race, color, religion, national origin, sex, age, or disability be excluded from participating in, or denied the benefits of, or be subject to discrimination in employment under any project, program, or activity receiving Federal financial assistance under the Federal transit laws.

Information required to meet EEO requirements:

- Number of recipient employees working in the federally-funded program;
- Most recent EEO program;
- Sample documents used for internal dissemination of EEO program;
- Organizational chart identifying EEO officer;
- Designated employee and EEO officer job descriptions;
- Standard performance evaluation for managers/supervisors;
- "Employment Practices Chart" (or alternate documentation containing the same information). See FTA Circular 4704.1A Attachment 4 for the listed information;
- Number of persons hired in areas of underutilization;

- EEO complaint logs;
- List of subrecipients and/or contractors that meet the threshold to develop an EEO program.

D. **MAINTENANCE.** Recipients must keep federally funded vehicles, equipment, and facilities in good operating condition. Recipients must keep ADA accessibility features on all vehicles, equipment, and facilities in good operating order.

Information required to meet maintenance requirements:

- Written vehicle (including vessels) and equipment maintenance plans;
- Written facility maintenance plan.

E. **PREVAILING WAGE.** To the extent applicable, the local prevailing wage requirements, applicable State general prevailing wage rates determined by the Director of Industrial Relations, and the applicable federal prevailing wage rates as determined by the United States Secretary of Labor, if higher, will be made a part of the Agreement.

F. **BUY AMERICA.** This project is subject to the "Buy America" provisions of the Surface Transportation Assistance Act of 1982 as amended by the Intermodal Surface Transportation Efficiency Act of 1991. Proposers must complete and include with their proposal the appropriate certification relating to compliance with the Buy America requirements. A proposer that submits an incomplete or incorrect Buy America certificate may have their proposal deemed non-responsive in the sole discretion of TIMMA. Proposers are advised to review the specific Buy America requirements contained in the Operating Agreement and under 49 CFR (Code of Federal Regulations) Part 661. Buy America requirements apply to each acquisition of iron, steel, or manufactured goods. Thus, unless an acquisition qualifies for a waiver as discussed in 49 CFR Part 661.7, federal funds may not be used to finance the acquisition of iron, steel, or manufactured goods not in compliance with Buy America requirements.

APPENDICES AND EXHIBITS

The following documents are attached:

- Exhibit A - Sample Privacy Impact Assessment Questionnaire
- Exhibit B - Autonomous Shuttle System Requirements (SySR)
- Exhibit C - Autonomous Shuttle Concept of Operations
- Exhibit D - Relevant SFMTA Transit Fleet ADA Requirements
- Exhibit E - Project Area and Potential Routes
- Exhibit F – Federal Compliance Questionnaire

- Exhibit G – Operating Agreement
- Exhibit H – Sample Cost Proposal
- Exhibit I - Debarment and Suspension Certification
- Exhibit J– Terminated Contracts
- Exhibit K – Workforce Data Spreadsheets
- Exhibit L – Certification Regarding Lobbying
- Exhibit M – Guidance for Bidders Completing the Good Faith Effort Submittal
- Exhibit 10-I – Notice to Proposers DBE Information
- Exhibit 10-O1 – Consultant Proposal DBE Commitment
- Exhibit 10-O2 – Consultant Contract DBE Information
- Exhibit 15-H – DBE Information – Good Faith Efforts

EXHIBIT A – Sample Privacy Impact Assessment Questionnaire

Section 1.0: Characterization of Information	Response
1.1 What information is collected, used, disseminated, or maintained in the system?	
1.2 What are the sources of the information in the system?	
1.3 Why is the information being collected, used, disseminated, or maintained? Is there a specific legal mandate or business purpose that requires the use of this information?	
1.4 How is the information collected?	
1.5 What specific legal authorities, arrangements, and/or agreements defined the collection of information?	
1.6 Conclusion: Given the amount and type of data collected, discuss the privacy risks identified and how they were mitigated.	
Section 2.0: Uses of the Information	
2.1 Describe all the uses of information.	
2.2 How will the information be checked for accuracy and/or validity?	
2.3 What types of tools are used to analyze data and what type of data may be produced?	
2.4 If the system uses commercial or publicly-available data, please explain why and how it is used.	
2.5 Conclusion: Describe any types of controls that may be in place to ensure that information is handled in accordance with the described uses in 2.1.	
Section 3.0: Retention	
3.1 What information will be retained?	
3.2 How long will information need to be retained?	
3.3 Is the information deleted in a secure manner?	
3.4 Conclusion: Please discuss the privacy risks associated with the length of time data is retained and how those risks are mitigated.	
Section 4.0: Internal Sharing and Disclosure	
4.1 With which demonstration entities is the information shared, what information is shared, and for what purpose?	
4.2 How is the information transmitted or disclosed?	
4.3 Conclusion: Considering the extent of internal information sharing, discuss the privacy risks associated with the sharing and how they were mitigated.	
Section 5.0: External Sharing and Disclosure	

5.1	With which external organization(s) is the information shared, what information is shared, and for what purpose?	
5.2	Is the sharing of personally identifiable information outside the demonstration compatible with the original collection? If so, is it addressed in a data-sharing agreement? If so, please describe. If not, please describe under what legal mechanism the program or system is allowed to share the personally identifiable information outside of the demonstration.	
5.3	How is the information shared outside the agency and what security measures safeguard its transmission?	
5.4	How does the agency verify that an external organization has adequate security controls in place to safeguard information?	
5.5	Conclusion: Given the external sharing, explain the privacy risks identified and describe how they were mitigated.	
Section 6.0: Notice		
6.1	Was notice provided to the individual prior to collection of information?	
6.2	Do individuals have the opportunity and/or right to decline to provide information?	
6.3	Do individuals have the right to consent to particular uses of the information? If so, how does the individual exercise the right?	
6.4	Conclusion: Describe how notice is provided to individuals, and how the privacy risks associated with individuals being unaware of the collection are mitigated.	
Section 7.0: Access, Redress, and Correction		
7.1	What are the procedures that allow individuals to gain access to their information?	
7.2	What are the procedures for correcting inaccurate or erroneous information?	
7.3	How are individuals notified of the procedures for correcting their information?	
7.4	If no formal redress is provided, what alternatives are available to the individual?	
7.5	Conclusion: Please discuss the privacy risks associated with the redress available to individuals and how those risks are mitigated.	
Section 8.0: Security Implementation		
8.1	What procedures are in place to determine which users may access the system and are they documented?	
8.2	Will contractors have access to the system?	
8.3	Describe what privacy training is provided to users either generally or specifically relevant to the program or system?	

8.4	What auditing measures and technical safeguards are in place to prevent misuse of data?	
8.5	Does the project employ technologies which may raise privacy concerns? If so, please discuss their implementation.	
8.6	Conclusion: Given the sensitivity and scope of the information collected, as well as any information sharing conducted on the system, what privacy risks were identified and how do the security controls mitigate them?	

Exhibit @
Autonomous Shuttle Qwqrc k Pcosgpc k c l rq (SySR)

SYSTEM REQUIREMENTS

March 2021

PREPARED FOR

San Francisco County Transportation Authority
1455 Market Street
San Francisco, CA 94103

PREPARED BY

HNTB Corporation
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Oakland, CA 94607

Table of Contents

List of Tables

List of Acronyms and Abbreviations

ADA .....Americans with Disabilities Act
ADS .....Automated Driving Systems
AVS ..... Autonomous Vehicle Shuttle
CA MUTCD.....California Manual on Uniform Traffic Control Devices
Caltrans .....California Department of Transportation
ConOps.....Concept of Operations
DSRC.....Dedicated Short-Range Communications
FHWA ..... Federal Highway Administration
FMLM ..... First-Mile/Last-Mile
FMVSS ..... Federal Motor Vehicle Safety Standards
FR.....Functional Requirements
GTFS .....General Transit Feed Specifications
NF .....Non-Functional Requirements
NHTSA ..... National Highway Traffic Safety Authority
OR..... Operational Requirements
PR .....Performance Requirements
TIDA..... Treasure Island Development Authority
TIMMA .....Treasure Island Mobility Management Agency
TITIP.....Treasure Island Transportation Implementation Plan
TI/YBI.....Treasure Island and Yerba Buena Island
USDOT ..... United States Department of Transportation
USG..... United States Government

1 Introduction

This Systems Requirements document is intended to provide the requirements that drive the specifications, design, development, implementation, integration and testing of the Treasure Island Mobility Management Agency (TIMMA) Autonomous Vehicle Shuttle (AVS) Pilot Project. The System Requirements document is a “black box” description of what the facility must do, but not how it will do it.

1.1 Document Purpose

This System Requirements document serves as the second in a series of engineering documents intended to describe the TIMMA AVS Pilot Project, building upon the Concept of Operations (ConOps) document. The System Requirements document describes a set of requirements that, when realized, will satisfy the expressed needs of the facility. This document includes the identification, organization, and presentation of the requirements for the TIMMA AVS Pilot Project, which is made up of various components and features. These requirements are derived from the user needs, constraints, and interfaces that the facility is expected to implement. This System Requirements document addresses conditions for incorporating operational concepts, design constraints, and design configuration requirements as well as the necessary characteristics and quality of individual requirements and the set of all requirements.

This document contains the following chapters:

1. **Chapter 1. Introduction** provides an overview of the key project elements that guide the development of this System Requirements document, including an overview of the project, the stakeholders, requirements development process, and referenced materials.

2. **Chapter 2. System Description** focuses on describing and extending the TIMMA AVS Pilot Project system concepts established in the ConOps, including system capabilities, conditions, constraints, and decomposing the system into its functional groups for establishing requirements.

3. **Chapter 3. System Requirements** contains the requirements for each functional group that make up the system.

4. **Chapter 4. Engineering Principles** provides a description of engineering principles applied to the system and requirements definition process.

1.2 Reference Documents

The following documents form a part of this document to the extent specified herein. In the event of a conflict between the documents referenced herein and the contents of this document, this document shall be considered the superseding requirement.

1.3 Government Documents

- 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design
- California Manual on Uniform Traffic Control Devices 2014 Rev 5
- Systems Engineering Guide for Intelligent Transportation Systems, Version 3.0, USDOT

1.4 Nongovernment Documents

Nongovernment documents may include:

- Treasure Island Community Development, LLC – Treasure Island Transportation Implementation Plan (TITIP)
- Concept of Operations for TIMMA AVS Pilot Project

2 System Description

2.1 System Definition

The proposed system includes an AVS, supporting AVS management system, charging/maintenance facility, and their interfaces among each other and with the passengers and road users. Refer to project ConOps for the detailed description of the proposed system.

This document proposes functional and non-functional requirements for the system to be developed and tested. These requirements are generated solely for the system created within this project and are not intended to be prescriptive for AVS developed outside the project.

2.2 User Characteristics

This section defines the stakeholders, users, and their roles and responsibilities for the TIMMA AV Shuttle Pilot Project. Stakeholders refers to an individual or organization affected by the activities, inputs and outputs of the system being developed. They may have a direct or indirect interest in the system and their level of participation may vary. This includes public agencies, private organizations or the traveling public (end users) with a vested interest or "stake" in one or more aspects of the TIMMA AV Shuttle Pilot Project as identified in **Table 1: TIMMA AV Shuttle Pilot Stakeholders** and Users. Users are classified based on their perception of the system and the needs identified. Note that some key personnel may serve in multiple roles based on the user needs and functions.

Table 1: TIMMA AV Shuttle Pilot Stakeholders and Users

Target Stakeholders	**Users**			
	AVS Passengers	**AVS Management System**	**Operations Staff**	**Emergency Vehicle / Operator**
TI/YBI Residents	X			
TI/YBI Visitors	X			
AVS Vendor and Operator		X	X	
Law Enforcement				X
Emergency Medical Services				X
Fire and Rescue				X
Towing Agencies				X

Source: SFCTA

2.2.1 AVS Passengers

AVS Passengers are any riders who use the AVS and are not AVS operations staff. AVS Passengers may be TI/YBI residents, visitors, employees. AVS Passengers may also be users who transferred from another mode of transportation (i.e. pedestrians, bicyclists, shuttle passengers, etc.).

2.2.2 AVS Management System Administrators

AVS Management System users are those who oversee the operations of the shuttle. The AVS Management System users are remote users who may work in the maintenance facility or offsite in a remote operations center.

2.2.3 Operations Staff

AVS Operations Staff users are those who operate the shuttle (i.e. the on-board Operator). These users are located on the AVS but are not considered an AVS Passenger.

2.2.4 Emergency Vehicle / Operator

Emergency Vehicle / Operator users are any users who belong to an emergency response team. These users could be law enforcement, emergency medical services, fire and rescue, and towing agencies. The users may need to access the AVS in the event of an emergency but would not be considered AVS Passengers or Operations Staff.

2.3 Policies and Constraints

The system constraints limit the activities that can be performed during the pilot. The system is constrained by the available budget, the changing environment on TI/YBI, the controlled land use of TI/YBI, and the changing technology landscape.

The available budget limits the duration of the pilot. The pilot is anticipated to last three months. Due to the high fixed cost of deploying the pilot, the variable cost of extending the pilot duration is relatively low to the three-month duration cost.

The changing environment on TI/YBI will affect how well the AVS must perform in work zones. The AVS must be able to perform well in environments that are continuously changing, with both changing lane configurations and surrounding benchmarks like buildings and trees. The AVS or on-board Operator will need to respond to temporary signage and traffic control officers accordingly. In addition, the AVSs will be traveling on roads with mixed-traffic, and even in cases where the roads are closed for testing, they will need to be able to detect and respond to traditional regulatory signs.

SFMTA must be consulted on proposed AVS routes and shuttle stops on Treasure Island.

The controlled land use on TI/YBI will constrain the location of charging and maintenance facilities. While vendors may be free to pick their own facility location on other projects, Treasure Island Development Authority (TIDA) will provide the vendor with facility options.

Automated vehicle technologies are an emerging field and the technology is still under development. There are various plans, guidance, policies, and procedures that have been adopted, published, or currently within rulemaking that govern the use of autonomous vehicles in the state of California and the United States. These include:

- Federal Automated Vehicles Policy, published by the United States Department of Transportation (USDOT) and the National Highway Traffic Safety Administration (NHTSA), provides guidance for developing an approach to automated vehicle performance specifications, the roles delegated to states, and current and proposed regulatory tools to maintain safety in this new transportation environment while not restricting technological innovation.
    - Automated Driving Systems: A Vision for Safety 2.0 (ADS 2.0), published by NHTSA, provides USDOT's cornerstone voluntary guidance document for ADS.
    - Preparing for the Future of Transportation (AV 3.0) builds upon ADS 2.0 and expands the scope to provide USDOT framework and multimodal approach to the safe integration of AVs into the Nation's broader surface transportation system.
    - Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0 (AV 4.0) builds upon AV 3.0 and expands the scope to 38 relevant US Government (USG) components that have direct or tangential equities in the safe development and integration of AV technologies. AV 4.0 seeks to ensure a consistent USG approach to AV technologies, and to detail the authorities, research, and investments being made across the USG so that the US can continue to lead AV technologies' research, development, and integration.
    - Automated Vehicles Comprehensive Plan, developed by USDOT, builds upon the principles stated in AV 4.0, advancing the Department's work to prioritize safety while preparing for the future of transportation.
- Federal Motor Vehicle Safety Standards (FMVSS), also developed by NHTSA, regulate features required for motor vehicles operated on public roads, in categories such as crash avoidance, crashworthiness, and post-crash survivability. Some AVS must receive FMVSS exemptions to operate on public roads.
- The State of California has passed legislation that allows autonomous vehicles that comply with FMVSS to operate on public roadways if a CA DMV permit is issued.
- The California Public Utilities Commission has authorized two pilot programs to test the private prearranged transportation of passengers and has also issued regulations for

the Phase I deployment of AV passenger services. The AVS vendor will need the appropriate California Public Utilities Commission permit prior to providing passenger service. .

The AVS vendor must comply with FMVSS or seek a federal exemption. The vendor must also obtain the appropriate testing permits from the state for testing on public roads and for providing passenger service. These existing regulations and any potential changes or opportunities for exemptions will continue to be monitored by the vendor during the pilot.

3 Requirements

This section of the document lists the identified requirements for TIMMA AVS Pilot Project. The requirements are organized first by requirement type, then by system and services.

The requirements tables in this section include a column for the requirement identifier, user need ID, functional group, description, priority, and verification method:

- The first columns, Requirements Identify, includes a requirement identifier to provide traceability through other documents.
- The second column, User Needs, identifies traceability to user needs, use cases, and/or policies and constraints. The Requirements that doesn't address the identified User Needs directly but addresses the use cases, policies, and constraints, are labeled Not Application (NA).
- The third column, Functional Group, provides the functional group. This is intended to organize the requirements in a manner that allows similar requirements to be grouped together. The following functional groups are considered:
    - Vehicle Control Automation
    - Vehicle System Executive
    - Vehicle System Monitoring and Diagnostics
    - AVS Electric Charging Assist
    - Vehicle Emergency Notification
    - Vehicle Intersection Warning
    - Vehicle Location Determination
    - Vehicle Map Management
    - Vehicle Situation Data Monitoring
    - AVS Roadside Information Reception
    - Fixed-Route Operations
    - Center Vehicle Tracking
    - AVS Schedule Management
    - Center Passenger Counting
    - AVS Passenger Counting
    - Center Security
    - AVS Security
    - Center Information Services
    - AVS On-Board Information Services
    - Center Multi-modal Coordination
    - AVS On-Board Trip Monitoring
    - Garage Maintenance
    - AVS On-Board Maintenance
    - AVS Pedestrian Safety
    - AVS Boarding/Alighting
    - AVS V2V Safety
    - AVS On-Board Fare Management
    - AVS Center Fare Management
    - AVS Performance Improvement
    - AVS Operations
    - Operations
    - Vehicle
    - Transportation
    - Storage
    - Data

- The fourth column, Description, provides the requirement description, which is intended to be well-formed as specified by the *Systems Engineering Guide for Intelligent Transportation Systems*[1]: necessary, clear, complete, correct, feasible, and verifiable.
- The fifth column, Priority, identifies the requirements priorities. The essential priorities are anticipated to be implemented for the pilot. The Desirable priority identifies those requirements which are desirable for future deployments. However, if the vendor can meet the desirable priorities, the vendor may choose to implement and test as part of the pilot project.
- The last column, Verification Method, provides the verification method – the four fundamental verification methods considered include: inspection, demonstration, test, and analysis. Definitions of these methods are provided in Methods of Verification in Chapter 4. Engineering Principles.

Table 2: List of Requirement Types describes the classifications of the requirements in this document.

Table 2: List of Requirement Types

Type	Description
Functional (FN)	The Functional requirements specify actionable and qualitative behaviors (e.g. functions, tasks) of the core system of interest, which in the case of TIMMA AVS Pilot Project.
Operational Requirements (OR)	The Operational requirements are capabilities that are desired to address mission area deficiencies, evolving applications or threats, emerging technologies, or system cost improvements.
Performance (PR)	The Performance requirements specify quantifiable characteristics that define the extent, or how well, and under what conditions, a function or task is to be performed (e.g. rates, velocities).
Non-Functional (NF)	The Non-Functional requirements define the characteristics of the overall operation of the system, including the following: • **Physical (PY)** – specifies the construction, durability, adaptability, and environmental characteristics of the system • **Availability and Recovery (AR)** – define the times of day, days of year, and overall percentage the system can be used and when it will not be available for use as well as recovery point and time objectives. • **Maintainability (MT)** – specify the level of effort required to locate and correct an error during operation.

[1] https://www.fhwa.dot.gov/cadiv/segb/files/segbversion3.pdf

	• **Storage and Transport (ST)** – specify the physical location and environment for the system, including designated storage facility, installation site, repair facility, requirements for transporting equipment, etc.
Data Requirements	The Data Requirements specify the data that are anticipated to be collected as part of the pilot.
ADA Requirements	The ADA Requirements specific the requirements that needs to be satisfied as part of the vendor's compliance with ADA Act of 1990.

Source: SFCTA

3.1 System Requirements

This section itemizes the requirements associated with each of the system's capabilities. A "function" is defined as a group of related requirements. TIMMA AVS Pilot Project's system requirements correspond to the project's various components.

3.1.1 Functional Requirements

This section provides the high-level requirements for the system of interest (i.e. what the system will do). The requirements in **Table 3: Functional Requirements** are organized by the functional groups and are related to the user needs documented in the project ConOps.

Table 3: Functional Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VOC-001-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall monitor the area behind and in front of the AVS to determine the proximity of other objects to the AVS.	Essential	Demonstration
AVS-FN-VOC-002-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall monitor the area to the sides of the AVS to determine the proximity of other objects to the AVS to determine if a control adjustment is needed.	Essential	Demonstration
AVS-FN-VOC-003-v01	AVS-UN016-v01	Vehicle Control Automation	The AVS shall detect, understand and comply with regulatory signs.	Essential	Demonstration
AVS-FN-VOC-004-v01	AVS-UN016-v01	Vehicle Control Automation	The AVS shall understand and comply with speed laws.	Essential	Demonstration
AVS-FN-VOC-005-v01	AVS-UN016-v01	Vehicle Control Automation	The AVS shall detect and understand pavement markings, and be able to operate on streets without clear lane markings.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VOC-006-v01	AVS-UN016-v01	Vehicle Control Automation	The AVS shall detect and understand the directions providing by human traffic control officers, either through the driving system, safety driver, or remote operator, or any combination of these.	Essential	Demonstration
AVS-FN-VOC-007-v01	AVS-UN016-v01 AVS-UN045-v01	Vehicle Control Automation	The AVS shall detect, understand, and comply with traffic signals.	Essential	Demonstration
AVS-FN-VOC-008-v01	AVS-UN02-v01	Vehicle Control Automation	The AVS shall arbitrate between detector concurrent regulatory signs, pavement markings, traffic signs, and object detections.	Essential	Demonstration
AVS-FN-VOC-009-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall provide its location with lane-level accuracy to on-board control automation applications.	Essential	Demonstration
AVS-FN-VOC-010-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall determine the status of host vehicle systems including AVS speed, heading, yaw, wheelspin, ABS, traction control, and wiper status. (host vehicle refers to the originator of a vehicular transmission of information).	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VOC-011-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall determine a potentially hazardous road condition.	Essential	Demonstration
AVS-FN-VOC-012-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall calculate AVS paths to determine if an impending collision is detected.	Essential	
AVS-FN-VOC-013-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall evaluate the likelihood of a collision between two vehicles or a AVS and a stationary object, based on the proximity of other objects to the AVS, roadway characteristics, and the current speed and direction of the AVS.	Essential	Demonstration
AVS-FN-VOC-014-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall provide position control adjustments.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VOC-015-v01	AVS-UN017-v01 AVS-UN018-v01 AVS-UN022-v01 AVS-UN037-v01	Vehicle Control Automation	The AVS shall provide an interface through which an Operator can initiate, monitor, and terminate automatic control of the AVS.	Essential	Demonstration
AVS-FN-VOC-016-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall be capable of performing control actions based upon warnings received regarding pedestrians, cyclists, and other non-motorized and motorized users that are sharing the roadway with the AVS.	Essential	Demonstration
AVS-FN-VOC-017-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS should be capable of performing control actions based upon information received from the infrastructure regarding the status of the intersection the AVS is approaching.	Desirable	Demonstration
AVS-FN-VOC-018-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall automatically perform pre-crash actions, including seatbelt tightening, brake assist, airbag pre-arming, bumper raising/extension.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VOC-019-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall take speed control actions (e.g., throttle, brakes).	Essential	Demonstration
AVS-FN-VOC-020-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall take steering control actions.	Essential	Demonstration
AVS-FN-VOC-021-v01	AVS-UN015-v01 AVS-UN019-v01	Vehicle Control Automation	The AVS shall present AVS control information to the Operator in audible or visual forms without impairing the Operator's ability to control the AVS in a safe manner.	Essential	Demonstration
AVS-FN-VOC-022-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall analyze its own applications' performance and enter fail-safe mode (a mode such that the application cannot provide information or perform actions that affect its host) when critical components fail.	Essential	Demonstration
AVS-FN-VOC-023-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall notify the Operator when onboard components or safety applications are offline.	Essential	Demonstration
AVS-FN-VOC-024-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall collect and monitor data concerning the safety of the AVS - including, steering, braking, acceleration, emissions, fuel economy, engine performance, etc.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VOC-025-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall determine the status of the AVS in terms of its continued ability to operate in a safe manner.	Essential	Demonstration
AVS-FN-VOC-026-v01	AVS-UN020-v01	Vehicle Control Automation	The AVS shall provide warnings to the Operator of potential dangers based on sensor input and analysis concerning the safety of the AVS.	Essential	Demonstration
AVS-FN-VOC-027-v01	AVS-UN023-v01	Vehicle Control Automation	The AVS shall be able to determine when it is uncertain regarding which action to take.	Essential	Demonstration
AVS-FN-VOC-028-v01	AVS-UN023-v01	Vehicle Control Automation	The AVS shall decrease speed and pull over in a legal stopping location, if safe, when it determines uncertainty regarding which action to take.	Essential	Demonstration
AVS-FN-VSE-001-v01	AVS-UN013-v01	Vehicle System Executive	The AVS shall manage the overall device software configuration and operation and support configuration management, computer resource management, and govern software installation and upgrade.	Essential	Demonstration
AVS-FN-VSE-002-v01	AVS-UN013-v01	Vehicle System Executive	The AVS shall allow a service center to remotely install or upgrade software in the AVS. Security of this data exchange shall be addressed in the vendor's Security/Data Management Plan.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VSE-003-v01	AVS-UN013-v01	Vehicle System Executive	The AVS shall provide the capability for an Operator to update the configuration of software or hardware in the AVS.	Essential	Demonstration
AVS-FN-VSM-001-v01	AVS-UN020-v01 AVS-UN032-v01	Vehicle System Monitoring and Diagnostics	The AVS shall be able to monitor on-board sensors to determine the operating conditions of on-board systems critical to safe and efficient operation of the AVS.	Essential	Demonstration
AVS-FN-VSM-002-v01	AVS-UN020-v01	Vehicle System Monitoring and Diagnostics	The AVS shall be capable of performing diagnostic tests using on-board data to identify problems in AVS system operation and to determine possible causes of the problems.	Essential	Demonstration
AVS-FN-VSM-003-v01	AVS-UN020-v01	Vehicle System Monitoring and Diagnostics	The AVS shall be capable of providing diagnostic information regarding on-board systems to the Operator.	Essential	Demonstration
AVS-FN-VSM-004-v01	AVS-UN032-v01	Vehicle System Monitoring and Diagnostics	The AVS Management System shall monitor the status of AVSs.		
AVS-FN-ECA-001-v01	AVS-UN033-v01	AVS Electric Charging Assist	The AVS shall be able to provide the operational status of the electrical system, the charging capacity and charging rate for the AVS, and % charge complete to an electric charging station.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-ECA-002-v01	AVS-UN031-v01	AVS Electric Charging Assist	The AVS shall maintain power throughout the operational period.	Essential	Demonstration
AVS-FN-VEM-001-v01	AVS-UN034-v01	Vehicle Emergency Notification	The AVS shall provide the capability for an Operator to report an emergency and summon assistance.	Essential	
AVS-FN-VEM-002-v01	AVS-UN004-v01	Vehicle Emergency Notification	The AVS shall provide the capability to accept input from an Operator, passengers or emergency responders via a panic button or some other functionally similar form of input device provided as part of the in-vehicle equipment.	Essential	Demonstration
AVS-FN-VEM-003-v01	AVS-UN034-v01	Vehicle Emergency Notification	The AVS shall acknowledge the Operator's request for emergency assistance.	Essential	Demonstration
AVS-FN-VEM-004-v01	AVS-UN034-v01	Vehicle Emergency Notification	The AVS shall collect AVS operational state and all sensor information from the host vehicle.	Essential	Demonstration
AVS-FN-VEM-005-v01	AVS-UN034-v01	Vehicle Emergency Notification	The AVS shall determine if the host vehicle has been involved in a collision.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VEM-006-v01	AVS-UN034-v01	Vehicle Emergency Notification	The AVS should forward a request for assistance to AVS Management System containing the AVS's current location, its identity and basic vehicle data relevant to its current condition, as well as any other data, such as AVS orientation, etc., that may be developed in-vehicle by other systems.	Desirable	Demonstration
AVS-FN-VIW-001-v01	AVS-UN015-v01 AVS-UN019-v01 AVS-UN019-v01	Vehicle Intersection Warning	The AVS shall provide AVS path information to identify if AVS is performing an unpermitted movement at an intersection such as a stop sign violation.	Essential	Demonstration
AVS-FN-VIW-002-v01	AVS-UN045-v01	Vehicle Intersection Warning	The AVS should be able to receive intersection signal timing information from roadside infrastructure for the AVS to determine if it will safely cross the intersection given its current location and speed.	Desirable	Demonstration
AVS-FN-VIW - 003-v01	AVS-UN045-v01	Vehicle Intersection Warning	The AVS should be able to receive warning from the infrastructure if an intersection violation appears to be imminent.	Desirable	Demonstration
AVS-FN-VLD-001-v01	AVS-UN015-v01	Vehicle Location Determination	The AVS shall provide the AVS's current location to other in-vehicle functions.	Essential	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VLD-002-v01	AVS-UN015-v01	Vehicle Location Determination	The AVS shall calculate the location from one or more data sources including positioning systems such as GPS, sensors that track AVS movement, and maps used to determine the likely AVS route.	Essential	Analyze
AVS-FN-VLD-003-v01	AVS-UN015-v01	Vehicle Location Determination	The AVS should obtain position correction data from the Connected Vehicle Roadside Equipment.	Desirable	Analyze
AVS-FN-VLD-004-v01	AVS-UN015-v01	Vehicle Location Determination	The AVS shall apply position correction data to its base positional data.	Essential	Analyze
AVS-FN-VMP-001-v01	AVS-UN027-v01	Vehicle Map Management	The AVS shall make basemap, roadway geometry, intersection geometry and parking facility geometry information available to other onboard vehicle applications.	Essential	Analyze
AVS-FN-VMP-002-v01	AVS-UN027-v01	Vehicle Map Management	The AVS should provide its location to AVS Management System.	Desirable	Analyze
AVS-FN-VMP-003-v01	AVS-UN027-v01	Vehicle Map Management	The AVS should obtain basemap updates from AVS Management System.	Desirable	Analyze
AVS-FN-VMP-004-v01	AVS-UN027-v01	Vehicle Map Management	The AVS should obtain roadway geometry information from AVS Management System.	Desirable	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-VMP-005-v01	AVS-UN027-v01	Vehicle Map Management	The AVS should obtain intersection geometry information from AVS Management System.	Desirable	Demonstration
AVS-FN-SDM-001-v01	AVS-UN030-v01	Vehicle Situation Data Monitoring	The AVS shall receive data collection parameters from AVS Management System.	Essential	Demonstration
AVS-FN-SDM-002-v01	AVS-UN030-v01	Vehicle Situation Data Monitoring	The AVS shall provide traffic-related data including snapshots of measured speed and heading and events including starts and stops, speed changes, and other vehicle control.	Essential	Demonstration
AVS-FN-SDM-003-v01	AVS-UN030-v01	Vehicle Situation Data Monitoring	The AVS shall provide data to AVS Management System in accordance with data collection parameters provided.	Essential	Demonstration
AVS-FN-SMA-001-v01	AVS-UN030-v01	Vehicle Speed Management Assist	The AVS shall travel at speed appropriate for the real-time road conditions (shall not exceed posted speed at any time).	Essential	Demonstration
AVS-FN-RIR-001-v01	AVS-UN016-v01	AVS Roadside Information Reception	The AVS shall present to the Operator a visual display of static sign information or dynamic roadway conditions information.	Essential	Demonstration
AVS-FN-FRO-001-v01	AVS-UN027-v01	Fixed-Route Operations	The AVS Management System shall provide the interface to the system Operator to control the generation of new routes and schedules.	Desirable	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-FRO-002-v01	AVS-UN027-v01	Fixed-Route Operations	The AVS Management System shall dispatch fixed route AVS.	Essential	Demonstration
AVS-FN-FRO-003-v01	AVS-UN038-v01	Fixed-Route Operations	The AVS Management System shall consult with SFMTA on the generation of routes and schedules.	Essential	Demonstration
AVS-FN-FRO-004-v01	AVS-UN027-v01 AVS-UN046-v01	Fixed-Route Operations	The AVS Management System shall receive information from SFCTA concerning work zones, roadway conditions, weather conditions, incidents, asset restrictions, work plans, etc. for use in scheduling.	Essential	Demonstration
AVS-FN-FRO-005-v01	AVS-UN051-v01	Fixed-Route Operations	The AVS Management System shall disseminate up-to-date schedules and route information to SFMTA.	Essential	Demonstration
AVS-FN-FRO-006-v01	AVS-UN009-v01	Fixed-Route Operations	The AVS Management System should provide an interface to the archive data repository to enable the SFCTA to retrieve historical operating data for use in planning AVS routes and schedules.	Desirable	Demonstration
AVS-FN-FRO-007-v01	AVS-UN029-v01	Fixed-Route Operations	The AVS Management System shall monitor AVS schedule adherence to manage AVS operations.	Essential	Demonstration
AVS-FN-CVT-001-v01	AVS-UN029-v01	Center Vehicle Tracking	The AVS Management System shall monitor the locations of all AVS within its network.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-CVT-002-v01	AVS-UN029-v01	Center Vehicle Tracking	The AVS Management System shall determine adherence of AVSs to their assigned schedule.	Essential	Demonstration
AVS-FN-ASM-001-v01	AVS-UN029-v01	AVS Schedule Management	The AVS shall receive a vehicle assignment including shuttle route information, and shuttle service instructions for the Operator.	Essential	Demonstration
AVS-FN-ASM-002-v01	AVS-UN029-v01	AVS Schedule Management	The AVS shall determine the deviation from the predetermined schedule.	Essential	Demonstration
AVS-FN-ASM-003-v01	AVS-UN029-v01	AVS Schedule Management	The AVS shall calculate the estimated times of arrival (ETA) at shuttle stops.	Essential	Demonstration
AVS-FN-ASM-004-v01	AVS-UN043-v01	AVS Schedule Management	The AVS should determine scenarios to correct the schedule deviation.	Desirable	Demonstration
AVS-FN-ASM-005-v01	AVS-UN043-v01	AVS Schedule Management	The AVS should provide the schedule deviations and instructions for schedule corrections to the AVS Operator.	Desirable	Demonstration
AVS-FN-ASM-006-v01	AVS-UN029-v01	AVS Schedule Management	The AVS should send the schedule deviation and estimated arrival time information to the AVS Management System.	Desirable	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-ASM-007-v01	AVS-UN028-v01	AVS Schedule Management	The AVS shall notify the AVS Management System of AVS location and operational status as the AVS exits and returns to the Maintenance/storage facility to support future AVS assignments.	Essential	Demonstration
AVS-FN-APC-001-v01	AVS-UN009-v01	AVS Passenger Counting	The AVS shall count passengers boarding and alighting.	Essential	Demonstration
AVS-FN-APC-002-v01	AVS-UN009-v01	AVS Passenger Counting	The passenger counts shall be related to location to support association of passenger counts with routes, route segments, or shuttle stops.	Essential	Demonstration
AVS-FN-APC-003-v01	AVS-UN009-v01	AVS Passenger Counting	The passenger counts shall be timestamped so that ridership can be measured by time of day and day of week.	Essential	Demonstration
AVS-FN-APC-004-v01	AVS-UN009-v01	AVS Passenger Counting	The AVS shall send the collected passenger count information to the AVS Management System.	Essential	Demonstration
AVS-FN-CPC-001-v01	AVS-UN009-v01	Center Passenger Counting	The AVS Management System shall collect passenger count information from each AVS.	Essential	Demonstration
AVS-FN-CPC-002-v01	AVS-UN009-v01	Center Passenger Counting	The AVS Management System shall calculate shuttle ridership data by route, route segment, shuttle stop, time of day, and day of week based on the collected passenger count information.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-CPC-003-v01	AVS-UN009-v01	Center Passenger Counting	The AVS Management System shall provide compiled ridership data available to the SFCTA.	Essential	Demonstration
AVS-FN-CSE-001-v01	AVS-UN014-v01	Center Security	The AVS Management System shall monitor AVS operational data to determine if the AVS is off-route and assess whether a security incident is occurring.	Essential	Demonstration
AVS-FN-CSE-002-v01	AVS-UN014-v01	Center Security	The AVS Management System shall receive reports of emergencies on-board AVSs entered directly by the AVS Operator or from a traveler through interfaces such as panic buttons or alarm switches.	Essential	Demonstration
AVS-FN-CSE-003-v01	AVS-UN014-v01	Center Security	The AVS Management System authenticate AVS Operators.	Essential	Demonstration
AVS-FN-CSE-004-v01	AVS-UN014-v01	Center Security	The AVS Management System shall provide shuttle incident information along with other service data to emergency centers.	Essential	Demonstration
AVS-FN-CSE-005-v01	AVS-UN014-v01	Center Security	The AVS Management System shall receive information pertaining to a wide-area alert such as weather alerts, disaster situations, or child abductions.	Essential	Demonstration
AVS-FN-CSE-006-v01	AVS-UN034-v01	Center Security	The AVS Management System shall send wide-area alert information to travelers (on-board AVS).	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-CSE-007-v01	AVS-UN034-v01	Center Security	The AVS Management System shall notify the response to cybersecurity incidents involving the shuttle including notifying Emergency Management, SFCTA and SFMTA.	Essential	Demonstration
AVS-FN-CSE-007-v01	AVS-UN034-v01	Center Security	The AVS Management System should be able to remotely disable (or reset the disabling of) a AVS in service.	Desirable	Demonstration
AVS-FN-ASE-001-v01	AVS-UN014-v01	AVS Security	The AVS shall perform video and audio surveillance inside of AVSs and output raw video or audio data for local monitoring (for processing or direct output to the AVS Operator). Surveillance must comply with the City's Privacy First and Surveillance policies.	Essential	Demonstration
AVS-FN-ASE-002-v01	AVS-UN014-v01	AVS Security	The AVS shall perform video and audio surveillance inside of AVSs and output raw video or audio data for remote monitoring.	Essential	Demonstration
AVS-FN-ASE-003-v01	AVS-UN014-v01	AVS Security	The AVS shall perform video and audio surveillance inside of AVSs and output raw video or audio data for local storage (e.g., in an event recorder).	Essential	Demonstration
AVS-FN-ASE-004-v01	AVS-UN014-v01	AVS Security	The AVS shall monitor and output surveillance and sensor equipment status and fault indications.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-ASE-005-v01	AVS-UN014-v01	AVS Security	The AVS shall receive acknowledgments of the emergency request from the AVS Management System and output this acknowledgment to the AVS Operator or to the travelers.	Essential	Demonstration
AVS-FN-ASE-006-v01	AVS-UN014-v01	AVS Security	The AVS shall be capable of receiving an emergency message for broadcast to the travelers or to the AVS Operator.	Essential	Demonstration
AVS-FN-ASE-007-v01	AVS-UN037-v01	AVS Security	The AVS shall be capable of being disabled or enabled based on commands from the authentic inputs from the AVS Operator.	Essential	Demonstration
AVS-FN-ASE-008-v01	AVS-UN003-v01	AVS Security	The AVS shall perform authentication of the AVS Operator.	Essential	Demonstration
AVS-FN-CIS-001-v01	AVS-UN003-v01	Center Information Services	The AVS Management System shall exchange shuttle schedules, real-time arrival information, and general shuttle service information with SFMTA to support transit traveler information systems.	Essential	Demonstration
AVS-FN-CIS-002-v01	AVS-UN003-v01	Center Information Services	The SFCTA shall provide AVS advisory data, including alerts and advisories pertaining to major emergencies, or man-made disasters.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-AIS-001-v01	AVS-UN003-v01	AVS On-Board Information Services	The AVS should enable traffic and travel advisory information to be requested and output to the traveler. Such information may include shuttle routes, status, schedules, real-time schedule adherence.	Desirable	Demonstration
AVS-FN-AIS-002-v01	AVS-UN003-v01	AVS On-Board Information Services	The AVS shall broadcast advisories about the imminent arrival of the AVS at the next stop via an on-board automated annunciation system.	Essential	Demonstration
AVS-FN-AIS-003-v01	AVS-UN003-v01 AVS-UN006-v01	AVS On-Board Information Services	The AVS shall support input and output forms that are suitable for travelers with physical disabilities.	Essential	Demonstration
AVS-FN-AIS-004-v01	AVS-UN003-v01	AVS On-Board Information Services	The AVS shall gather advisory data, including alerts and advisories pertaining to major emergencies, or man-made disasters.	Essential	Demonstration
AVS-FN-AIS-005-v01	AVS-UN003-v01	AVS On-Board Information Services	The AVS shall tailor the output of the request traveler information based on the current location of the AVS.	Essential	Demonstration
AVS-FN-CMM-001-v01	AVS-UN044-v01	Center Multi-modal Coordination	The AVS Management System should coordinate with other transportation providers on schedules and services.	Desirable	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-CMM-002-v01	AVS-UN044-v01	Center Multi-modal Coordination	The AVS Management System should share transfer cluster and transfer point information with other transit centers. A transfer cluster is a collection of stop points, stations, or terminals where transfers can be made conveniently.	Desirable	Demonstration
AVS-FN-ATM-001-v01	AVS-UN001-v01 AVS-UN002-v01 AVS-UN007-v01 AVS-UN008-v01	AVS On-Board Trip Monitoring	The AVS shall support the computation of the location of a AVS using on-board sensors to augment the location determination function. This may include proximity to the shuttle stops or other known reference points as well as recording trip length.	Essential	Demonstration
AVS-FN-ATM-002-v01	AVS-UN038-v01	AVS On-Board Trip Monitoring	The AVS shall record shuttle trip monitoring data including vehicle mileage and electric charge.	Essential	Demonstration
AVS-FN-ATM-003-v01	AVS-UN038-v01	AVS On-Board Trip Monitoring	The AVS shall record shuttle trip monitoring data including operational status information such as doors open/closed, running times, etc.	Essential	Demonstration
AVS-FN-ATM-004-v01	AVS-UN030-v01	AVS On-Board Trip Monitoring	The AVS shall send the AVS trip monitoring data to AVS Management System-based trip monitoring functions.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-ATM-005-v01	AVS-UN001-v01 AVS-UN002-v01	AVS On-Board Trip Monitoring	The AVS shall stop at all designated shuttle stops.	Essential	Demonstration
AVS-FN-ATM-006-v01	AVS-UN007-v01 AVS-UN008-v01	AVS On-Board Trip Monitoring	The AVS should receive (and act upon) requests from travelers to stop at designated shuttle stop.	Desirable	Demonstration
AVS-FN-CGM-001-v01	AVS-UN038-v01	Garage Maintenance	The Maintenance/Storage Facility shall collect operational and maintenance data from AVS.	Desirable	Demonstration
AVS-FN-CGM-002-v01	AVS-UN013-v01	Garage Maintenance	The Maintenance/Storage Facility shall monitor the condition of a AVS to analyze brake, drive train, sensors, battery charge, steering, tire, processor, communications equipment, and AVS mileage to identify mileage based maintenance, out-of-specification or imminent failure conditions.	Essential	Demonstration
AVS-FN-CGM-003-v01	AVS-UN013-v01	Garage Maintenance	The Maintenance/Storage Facility shall generate AVS maintenance schedules that identify the maintenance or repair to be performed and when the work is to be done.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-CGM-004-v01	AVS-UN013-v01	Garage Maintenance	The Maintenance/Storage Facility shall verify that the AVS maintenance activities were performed correctly, using the AVS's status, the maintenance personnel's work assignment, and the AVS maintenance schedules.	Essential	Demonstration
AVS-FN-CGM-005-v01	AVS-UN013-v01	Garage Maintenance	The Maintenance/Storage Facility shall generate a time-stamped maintenance log of all maintenance activities performed on an AVS.	Essential	Demonstration
AVS-FN-CGM-006-v01	AVS-UN013-v01	Garage Maintenance	The Maintenance/Storage Facility shall provide AVS operations personnel with the capability to update AVS maintenance information and receive reports on all AVS operations data.	Essential	Demonstration
AVS-FN-OBM-001-v01	AVS-UN038-v01	AVS On-Board Maintenance	The AVS shall collect and process AVS mileage data from the sensors on-board.	Essential	Demonstration
AVS-FN-OBM-002-v01	AVS-UN038-v01	AVS On-Board Maintenance	The Maintenance/Storage Facility shall collect and process the AVS's operating conditions such as engine temperature, brake wear, internal lighting, environmental controls, etc.	Essential	Demonstration
AVS-FN-APS-001-v01	AVS-UN015-v01	AVS Pedestrian Safety	The AVS shall determine if pedestrians are near an AVS.	Essential	Demonstration
AVS-FN-APS-002-v01	AVS-UN015-v01	AVS Pedestrian Safety	The AVS shall determine if pedestrians are at risk of crash due to proximity of AVS.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-APS-003-v01	AVS-UN015-v01	AVS Pedestrian Safety	The AVS shall take appropriate actions to prevent collision.	Essential	Demonstration
AVS-FN-APS-004-v01	AVS-UN011-v01	AVS Pedestrian Safety	The AVS shall make itself visible with lights.	Essential	Demonstration
AVS-FN-APS-005-v01	AVS-UN011-v01	AVS Pedestrian Safety	The AVS shall emit an alert sound to warn pedestrians of the shuttle's presence.		Demonstration
AVS-FN-ABA-001-v01	AVS-UN039-v01 AVS-UN040-v01	AVS Boarding/Alighting	The AVS should determine when its position is near a shuttle station/stop.	Desirable	Demonstration
AVS-FN-ABA-002-v01	AVS-UN039-v01 AVS-UN040-v01	AVS Boarding/Alighting	The AVS should determine whether pedestrians are at AVS stops.	Desirable	Demonstration
AVS-FN-ABA-003-v01	AVS-UN039-v01 AVS-UN040-v01	AVS Boarding/Alighting	The AVS should stop at the designated shuttle stop (if pedestrians are present).	Desirable	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-FN-AVS-001-v01	AVS-UN001-v01 AVS-UN002-v01	AVS V2V Safety	The AVS shall provide to other vehicles an audio and/or visual indication of its intent to leave a designated shuttle stop.	Essential	Demonstration
AVS-FN-AVS-002-v01	AVS-UN001-v01 AVS-UN002-v01	AVS V2V Safety	The AVS shall take appropriate action if a collision threat exists as it prepares to leave a stop or station.	Essential	Demonstration
AVS-FN-AVS-003-v01	AVS-UN001-v01 AVS-UN002-v01	AVS V2V Safety	The AVS shall be able to identify if another vehicle is pulling in front of it to make a right turn using its sensors that can detect the location of other vehicles.	Essential	Demonstration
AVS-FN-AFM-001-v01	AVS-UN041-v01	AVS On-Board Fare Management	The AVS should support payment for shuttle fares.	Desirable	Demonstration
AVS-FN-CFM-001-v01	AVS-UN041-v01	AVS Center Fare Management	The AVS Management System should support the payment of shuttle fare transactions.	Desirable	Demonstration
AVS-FN-AFM-001-v01	AVS-UN043-v01	AVS Performance Improvement	The AVS Management System should optimize route operations and minimize passenger travel time by limiting dwell times and maintaining consistent headways on its route.	Desirable	Demonstration

3.1.2 Operational Requirements

Table 4. Operational Requirements below identifies the AVS operational requirements for the project.

Table 4. Operational Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-OPS-001-v01	AVS-UN012-v01 AVS-UN042-v01	Operations	The Operator shall be responsible for keeping the AVS charged/fueled for the duration of the daily service period.	Essential	Demonstration
AVS-OP-OPS-002-v01	AVS-UN012-v01	Operations	The charging/fueling shall be able to be performed manually.	Essential	Demonstration
AVS-OP-OPS-003-v01	AVS-UN042-v01	Operations	The AVS should be able to automatically connect to a charging/fueling source independently of human assistance from the operations staff.	Desirable	Demonstration
AVS-OP-OPS-004-v01	AVS-UN005-v01	Operations	The Operator shall always remain within the AVS while in operation and shall be responsible for greeting and assisting guests.	Essential	Inspection
AVS-OP-OPS-005-v01	AVS-UN035-v01	Operations	The Operator within the AVS always shall be responsible for taking control of the AVS, if necessary. (Greeting role and the taking control roles may be played by the same person.)	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-OPS-006-v01	AVS-UN005-v01	Operations	Operator shall have received training from the Vendor to: • Assisting and interacting with passengers, including providing mobility assistance during passenger boarding and alighting, as necessary, and how to properly secure people who use mobility devices • Provide accurate basic information about the AVS, and the purpose of the route • Receive and record passenger feedback • Operate a ramp, door, and/or charging station, if not automated • Road test an AVS • Have a working knowledge of AVS equipment • Perform clean-up, including bodily fluid • Intervene in AVS operations, if necessary • Collect data necessary to evaluate the pilot • Comply with all the training requirements set forth by the DMV and CPUC for both safety drivers and remote operators.	Essential	Verification
AVS-OP-OPS-007-v01	AVS-UN005-v01	Operations	Operators shall be employees, contractors, or agents of the Vendor.	Essential	Inspection

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-OPS-008-v01	AVS-UN005-v01	Operations	Operators shall obtain and maintain: • Defensive driving certification • First Aid training • A valid driver's license that is recognized by the State of California • No more than two traffic violations or preventable accidents in the last three years • All necessary permits to operate an autonomous vehicle in the state of California.	Essential	Inspection
AVS-OP-OPS-009-v01	NA	Operations	The Vendor shall be responsible for developing Standard Operating Procedures for the AVSs and Operations staff.	Essential	Inspection
AVS-OP-OPS-010-v01	AVS-UN031-v01	Operations	The Operator shall ensure the AVSs are sufficiently charged or taken out of service early under abnormal conditions after servicing all passengers who are already on board.	Essential	Demonstration
AVS-OP-OPS-011-v01	AVS-UN046-v01	Operations	The Vendor shall monitor local weather patterns.	Essential	Demonstration
AVS-OP-OPS-012-v01	AVS-UN024-v01	Operations	The Vendor shall define and document the operational design domain (ODD) of the AVS. This includes identifying how the AVS will respond when operating outside of it's ODD, or when the ODD changes during daily operations (e.g.: weather-related impacts). The Vendor shall also identify when and how SFCTA will be notified when a vehicle leaves it's ODD.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-OPS-013-v01	AVS-UN046-v01	Operations	The Vendor shall collaboratively work with SFCTA to define an upcoming inclement weather event threshold that would risk placing the shuttle in service when outside its ODD (such as ponding water on the roadway, visibility, or other physical limitations) at which it would suspend or limit operations or shift to manual mode.	Essential	Demonstration
AVS-OP-OPS-014-v01	AVS-UN046-v01	Operations	The Vendor shall notify SFCTA in the event this inclement weather threshold is met.	Essential	Demonstration
AVS-OP-OPS-015-v01	AVS-UN046-v01	Operations	The Vendor shall suspend or limit operations or shift to manual mode when the inclement weather threshold is met.	Essential	Demonstration
AVS-OP-OPS-016-v01	AVS-UN046-v01	Operations	The AVS Management System should be able to monitor local weather patterns and be aware of an approaching severe weather event or other conditions that may impact AVS operations.	Desirable	Demonstration
AVS-OP-OPS-017-v01	AVS-UN046-v01	Operations	The Vendor shall immediately notify SFCTA of any crashes involving any road user or incidents related to passengers.	Essential	Inspection
AVS-OP-OPS-018-v01	AVS-UN046-v01	Operations	The Vendor shall have an incident response plan in the event of an incident.	Essential	Inspection
AVS-OP-VEH-001-v01	NA	Vehicle	The Operator shall ensure sufficient tire pressure and enough tread to safety operate AVS.	Essential	Inspection

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-VEH-002-v01	AVS-UN001-v01 AVS-UN002-v01	Vehicle	The AVS shall stop and open doors at designated locations to allow passengers to board and alight.	Essential	Demonstration
AVS-OP-VEH-003-v01	AVS-UN001-v01 AVS-UN002-v01	Vehicle	The AVS doors shall have a safety sensitive edge and/or mechanism to open if an object is stuck in the doorway.	Essential	Demonstration
AVS-OP-VEH-004-v01	NA	Vehicle	The AVS shall not park in a spot blocking access to a fire hydrant or crosswalk or any other prohibited location.	Essential	Demonstration
AVS-OP-VEH-005-v01	AVS-UN005-v01	Vehicle	The AVS shall stop and open doors if they have detected that there is an issue on board, through sensors, passenger input, and/or secure override.	Essential	Demonstration
AVS-OP-VEH-006-v01	AVS-UN005-v01	Vehicle	The AVS shall also have multiple secure means of egress, in the event the primary exit is blocked and/or power failure occurs.	Essential	Inspection
AVS-OP-VEH-007-v01	AVS-UN039-v01 AVS-UN040-v01	Vehicle	The AVS should allow passengers to board and alight on-demand at designated stops without stopping at each stop.	Desireable	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-VEH-008-v01	AVS-UN041-v01	Vehicle	The AVS may have the ability to collect fares. Fares will not be collected as part of the pilot but could be demonstrated for use in other scenarios where AVSs may be deployed.	Desirable	Demonstration
AVS-OP-VEH-009-v01	AVS-UN003-v01	Vehicle	The AVS shall be capable of providing directional (i.e., eastbound to Avenue B & 9th Street) information in audible and visual form to passengers on both the inside and the outside of the AVS.	Essential	Demonstration
AVS-OP-VEH-010-v01	NA	Vehicle	The AVS shall be able to operate on the public roads as defined above in mixed traffic (integrated with other vehicles, trucks, bicyclists, pedestrians, etc.) without Operator intervention, except in cases of failure or degraded conditions and maintenance conditions. (Refer to ConOps for definition of these conditions.)	Essential	Demonstration
AVS-OP-VEH-011-v01	AVS-UN024-v01	Vehicle	The Vendor shall identify the ability of AVS to operate the following operating functions in automated mode:	Essential	Demonstration
AVS-OP-VEH-011.1-v01	AVS-UN024-v01	Vehicle	Following the specified route.	Essential	Demonstration
AVS-OP-VEH-011.2-v01	AVS-UN024-v01	Vehicle	Pulling over to the side of the road.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-VEH-011.3-v01	AVS-UN024-v01	Vehicle	Moving out of the travel lane and stopping to service stop locations.	Essential	Demonstration
AVS-OP-VEH-011.4-v01	AVS-UN024-v01	Vehicle	Performing car following when approaching intersections.	Essential	Demonstration
AVS-OP-VEH-011.5-v01	AVS-UN024-v01	Vehicle	Performing car following in stop and go traffic conditions by maintaining a safe distance behind the vehicle in front of them and determining when to proceed based on that vehicle's behavior.	Essential	Demonstration
AVS-OP-VEH-011.6-v01	AVS-UN024-v01	Vehicle	Navigating unsignalized intersections.	Essential	Demonstration
AVS-OP-VEH-011.7-v01	AVS-UN024-v01	Vehicle	Performing left and right turns.	Essential	Demonstration
AVS-OP-VEH-011.8-v01	AVS-UN024-v01	Vehicle	Entering and emerging from a stop-controlled traffic circle.	Essential	Demonstration
AVS-OP-VEH-011.9-v01	AVS-UN024-v01	Vehicle	Crossing intersections with traffic speed limits up to 35 mph. (	Essential	Demonstration
AVS-OP-VEH-011.10-v01	AVS-UN024-v01	Vehicle	Changing lanes (both left and right lane change).	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-VEH-011.11-v01	AVS-UN024-v01	Vehicle	Making right-of-way decisions when merging from a shuttle stop.	Essential	Demonstration
AVS-OP-VEH-011.12-v01	AVS-UN024-v01	Vehicle	Making right-of-way decisions at intersections.	Essential	Demonstration
AVS-OP-VEH-011.13-v01	AVS-UN024-v01	Vehicle	Making right-of-way decisions when interacting with vulnerable road users.	Essential	Demonstration
AVS-OP-VEH-011.14-v01	AVS-UN024-v01	Vehicle	Detecting and responding to encroaching oncoming vehicles.	Essential	Demonstration
AVS-OP-VEH-011.15-v01	AVS-UN024-v01	Vehicle	Detecting stopped vehicles in their path.	Essential	Demonstration
AVS-OP-VEH-011.16-v01	AVS-UN024-v01	Vehicle	Passing stopped vehicles when necessary and safe.	Essential	Demonstration
AVS-OP-VEH-011.17-v01	AVS-UN024-v01	Vehicle	Detecting and responding to static obstacles in their path.	Essential	Demonstration
AVS-OP-VEH-011.18-v01	AVS-UN024-v01	Vehicle	Detecting and responding to moving obstacles in their path (include construction equipment).	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-VEH-011.19-v01	AVS-UN024-v01	Vehicle	Detecting emergency vehicles, and when their sirens are on, and yielding appropriately or following directions of emergency officials.	Essential	Demonstration
AVS-OP-VEH-011.20-v01	AVS-UN024-v01	Vehicle	Detecting that they are being asked by law enforcement to move a specific way, and responding accordingly.	Essential	Demonstration
AVS-OP-VEH-011.21-v01	AVS-UN024-v01	Vehicle	Detecting and responding to vulnerable road users, such as pedestrians, cyclists, and scooters, in the vehicle's projected travel path, including at intersections and crosswalks.	Essential	Demonstration
AVS-OP-VEH-011.23-v01	AVS-UN024-v01	Vehicle	Providing a safe distance from vehicles, pedestrians, bicyclists, and scooters on the side of the road.	Essential	Demonstration
AVS-OP-VEH-011.24-v01	AVS-UN024-v01	Vehicle	Decreasing speed when there is uncertainty regarding which action to take.	Essential	Demonstration
AVS-OP-VEH-011.25-v01	AVS-UN024-v01	Vehicle	Detecting and responding to detours and other temporary changes in traffic patterns, such as people (including construction workers and police officers) directing traffic in unplanned or planned events. (An acceptable response includes informing the human Operator of the need to take manual control.)	Essential	Demonstration
AVS-OP-VEH-011.26-v01	AVS-UN024-v01	Vehicle	Operating in normal rain, fog, and light snow conditions not deemed a weather emergency.	Essential	Demonstration

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-OP-VEH-011.27-v01	AVS-UN024-v01	Vehicle	Operating in the roadway of the project area (With steep slopes and other conditions).	Essential	Demonstration
AVS-OP-VEH-011.28-v01	AVS-UN024-v01	Vehicle	Performing a low-speed merge.	Essential	Demonstration

Source: SFCTA

3.1.3 Performance Requirements

Table 5: Performance Requirements below identifies the AVS performance requirements for the project.

Table 5: Performance Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-PR-OPS-001-v01	NA	Operations	The Vendor shall provide service as detailed in the scope of work and agreed to with SFCTA.	Essential	Inspection
AVS-PR-OPS-002-v01	NA	Operations	Ridership shall be monitored by time-of-day and day-of-week, and operating hours may be adjusted to better accommodate demand, considering AVS capabilities.	Essential	

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-PR-OPS-003-v01	NA	Operations	The Vendor shall meet a minimum headway of as detailed in the scope of work and agreed to with SFCTA. As with operating hours, desired minimum headway may be modified during certain time periods depending on ridership but shall remain within the capabilities of the Vendor's originally proposed AVS fleet size. Stop departure times shall be scheduled to complement nearby Muni services.	Essential	Inspection

Source: SFCTA

3.1.4 Non-Functional Requirements

The non-functional requirements (NF) for the core system of interest specifies the characteristics of the overall operation of the system such as physical, availability, reliability, maintainability and storage and transport.

3.1.4.1 Physical Requirements

Table 6: Physical Requirements below identifies the AVS physical requirements for the project.

Table 6: Physical Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-PY-VEH-001-v01	NA	Vehicle	Each AVS shall have a minimum capacity of at least 4 passengers excluding the Operator.	Essential	Inspection
AVS-PY-VEH-002-v01	NA	Vehicle	While the AVS should have a minimum capacity of 4 passengers (excluding the Operator), higher (10+ person) capacity AVSs are preferred.	Desirable	Inspection
AVS-PY-VEH-003-v01	NA	Vehicle	The AVS shall also have space for passengers to store foldable wheelchairs and mobility devices, small amounts of luggage, such as grocery bags and strollers.	Essential	Inspection
AVS-PY-VEH-004-v01	NA	Vehicle	The Vendor shall agree to allow the AVSs to be wrapped or otherwise branded consistent with the intent of the deployment. Branding may include the Vendor's logo if desired alongside other graphics and sponsor brands. The Vendor shall provide limitations on placement of branding, to not occlude vital system functions, as part of its proposal. The final design will be coordinated with SFCTA.	Essential	Inspection

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-PY-VEH-005-v01	AVS-UN048-v01	Vehicle	The AVS should be all-electric or hybrid (electric with another fuel type).	Desirable	Inspection
AVS-PY-VEH-006-v01	NA	Vehicle	Each AVS shall have seatbelts for all seated passengers.	Essential	Inspection
AVS-PY-VEH-007-v01	NA	Vehicle	The AVS shall have non-slip covers for seats.	Essential	Inspection
AVS-PY-VEH-008-v01	NA	Vehicle	The AVS shall have handrails on the interior.	Essential	Inspection
AVS-PY-VEH-009-v01	AVS-UN049-v01	Vehicle	The AVS should have bike racks.	Desirable	Inspection
AVS-PY-VEH-010-v01	AVS-UN050-v01	Vehicle	The AVS should have free Wi-Fi (for passenger access).	Desirable	Inspection
AVS-PY-VEH-011-v01	NA	Vehicle	The AVS shall be model/manufacturer year 2020 or newer.	Essential	Inspection
AVS-PY-VEH-012-v01	NA	Vehicle	The AVS shall be free of any major dents, scratches, or other damage that may prevent the AVS from operating correctly or be cosmetically unappealing.	Essential	Inspection

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-PY-VEH-013-v01	NA	Vehicle	The Vendor shall include responses for the AVS's status to the USDOT National Highway Traffic Safety Administration (NHTSA) 12-point safety assessment, as well as whether the AVS has completed the assessment, whether the assessment has been submitted to NHTSA and, if not, whether there are any plans to do so.	Essential	Inspection
AVS-PY-VEH-014-v01	NA	Vehicle	The AVS shall comply with all applicable FMVSS or have approval to operate under an exemption to the FMVSS. If not compliant, describe how the items not in compliance are directly related to the full automation capability with no driver.	Essential	Test
AVS-PY-VEH-015-v01	AVS-UN025-v01	Vehicle	The AVS shall have climate control capabilities (heat and air conditioning).	Essential	Test
AVS-PY-VEH-016-v01	AVS-UN006-v01	Vehicle	The AVS shall be accessible to those with disabilities. (Onboard Operators will be on board each AVS during operations, and they may aid passengers beyond what the	Essential	Test

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
			AVS is independently capable of (such as securing a wheelchair or providing audible alerts).		
AVS-PY-VEH-017-v01	AVS-UN019-v01	Vehicle	The AVS shall be equipped with brake lights.	Essential	Test

Source: SFCTA

3.1.4.2 Availability and Reliability Requirements

Table 7: Availability and Reliability Requirements below identifies the AVS and AVS Management System availability and reliability requirements for the project.

Table 7: Availability and Reliability Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-AR-AOP-001-v01	NA	AVS Operations	The AVS shall be available for operations during the identified operational period for at least 98% of the pilot duration. (for example, if the total pilot is 90 days with 8 hours of operational period, the then the AVS shall be available for 98% x 90 x 8 = 705.6 hours).	Essential	Inspection

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-AR-AOP-002-v01	AVS-UN047-v01	AVS Operations	The AVS should be available for 24/7 operations for at least 98% of the pilot duration.	Desirable	Inspection
AVS-AR-CMS-001-v01	AVS-UN013-v01	AVS Management System	The AVS Management system shall be available for operations during the AVS operational period for at least 99.999% of the time.	Essential	Inspection
AVS-AR-AOP-001-v01	AVS-UN013-v01	AVS On-Time Performance	The AVS shall arrive at a stop within 5 mins of arrival schedule.	Essential	Inspection
AVS-AR-AOP-002-v01	AVS-UN013-v01	AVS On-Time Performance	The AVS shall not depart from the stop more than 5 mins after scheduled departure time.	Essential	Inspection

Source: SFCTA

3.1.4.3 Maintainability Requirements

Table 8: Maintainability Requirements below identifies the AVS and AVS Management System maintainability requirements for the project.

Table 8: Maintainability Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-MR-AOP-001-v01	NA	AVS Operations	The AVS shall not be taken out of service for planned maintenance during operational period. (Planned maintenance shall be scheduled only during non- operational period).	Essential	Inspection
AVS-MR-AOP-002-v01	NA	AVS Operations	The AVS shall maintain electric charge for operations during the entire operational period (charging shall be done during off operational hours. Additional AVS may be used to provide service if AVS can't maintain charge through the operational period).	Essential	Inspection
AVS-MR-AOP-003-v01	NA	AVS Operations	The mean time to repair shall be less than 3 days for failure of any AVS component. (Vendor shall maintain the operational service by providing an alternate AVS during the repair period.)	Essential	Inspection
AVS-MR-AOP-004-v01	NA	AVS Operations	The vendor shall identify time and frequency of preventative maintenance as part of the Operations and Maintenance Plan.	Essential	Inspection

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-MR-AOP-005-v01	NA	AVS Operations	The vendor shall make available appropriately trained maintenance personnel (for performing charging, planned, and unplanned maintenance) as needed during the pilot duration.	Essential	Inspection

Source: SFCTA

3.1.4.4 Storage and Transport Requirements

Table 9: Storage and Transport Requirements below identifies the AVS storage and transport requirements for the project.

Table 9: Storage and Transport Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-ST-TPT-001-v01	AVS-UN026-v01	Transportation	The AVS shall have the ability to be towed or pushed by a support vehicle.	Essential	Inspection
AVS-ST-STG-001-v01	NA	Storage	The AVS shall be stored in a secured location during non-operational period.	Essential	Inspection

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-ST-STG-002-v01	NA	Storage	The Vendor shall maintain a maintenance and storage facility within the project area.	Essential	Inspection
AVS-ST-CHG-001-v01	NA	Charging	The Vendor shall install (or use an existing) charge station.	Essential	Inspection

Source: SFCTA

3.1.5 Data Requirements

Table 10: Data Requirements below identifies the data requirements for the project.

Table 10: Data Requirements

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-DT-DAT-001-v01	AVS-UN030-v01	Data	The Vendor shall agree to collect and store all raw data, including video, audio and sensor data. Video and audio shall be stored separately. Data should be made available to the SFMTA and SFCTA in the form and format requested (identified in these sub-requirements).. (Optionally, data	Essential	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
			that would be useful to potential passengers (such as real-time vehicle location information) will be shared via the APIs from the AVS Management System.)		
AVS-DT-DAT-001.1-v01	AVS-UN038-v01	Data	• Vehicle route and schedule in General Transit Feed Specification (GTFS) in real-time or near real-time.	Essential	Analyze
AVS-DT-DAT-001.2-v01	AVS-UN038-v01	Data	• Real-time vehicle location information in real-time or near real-time.	Essential	Analyze
AVS-DT-DAT-001.3-v01	AVS-UN038-v01	Data	• Trip updates and service alerts in real-time or near real-time.	Essential	Analyze
AVS-DT-DAT-001.4-v01	AVS-UN009-v01	Data	• Ridership (stop-level boardings and alightings), including time of rider boarding and alighting (daily).	Essential	Analyze
AVS-DT-DAT-001.5-v01	AVS-UN038-v01	Data	• Actual stop arrival and departure times (daily).	Essential	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-DT-DAT-001.6-v01	AVS-UN038-v01	Data	• Vehicles miles traveled (daily).	Essential	Analyze
AVS-DT-DAT-001.7-v01	AVS-UN038-v01	Data	• Vehicle hours traveled (hours the vehicle is in service) (daily).	Essential	Analyze
AVS-DT-DAT-001.8-v01	AVS-UN038-v01	Data	• Number of route-trips served (daily).	Essential	Analyze
AVS-DT-DAT-001.9-v01	AVS-UN038-v01	Data	• Duration of each trip (daily).	Essential	Analyze
AVS-DT-DAT-001.10-v01	AVS-UN038-v01		• Grams of CO2 per passenger mile (if applicable) (weekly).	Essential	Analyze
AVS-DT-DAT-001.11-v01	AVS-UN038-v01	Data	• Battery capacity/usage (such that it can be associated with weather, temperature, vehicle load, etc.) (weekly).	Essential	Analyze
AVS-DT-DAT-001.12-v01	AVS-UN038-v01	Data	• Average vehicle speeds along each segment of the route (weekly).	Essential	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-DT-DAT-001.13-v01	AVS-UN038-v01	Data	• Count and duration of wheelchair ramp or lift deployments (weekly).	Essential	Analyze
AVS-DT-DAT-001.14-v01	AVS-UN038-v01	Data	• Sensor and other telemetry data (weekly).	Essential	Analyze
AVS-DT-DAT-001.15-v01	AVS-UN038-v01	Data	• Navigation variances (weekly).	Essential	Analyze
AVS-DT-DAT-001.16-v01	AVS-UN038-v01	Data	• Mechanical data (vehicle condition) (weekly).	Essential	Analyze
AVS-DT-DAT-001.17-v01	AVS-UN038-v01	Data	• Disengagements by the operator or the system with the disengagement timestamps, locations, and causes (weekly).	Essential	Analyze
AVS-DT-DAT-001.18-v01	AVS-UN038-v01	Data	• Any other safety incidents events (hard stops, near misses, evasive maneuvers, unruly passenger behavior, etc.) (weekly).	Essential	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-DT-DAT-001.19-v01	AVS-UN038-v01	Data	• Percent of time during operating hours the system is shut down (cause)(weekly).	Essential	Analyze
AVS-DT-DAT-001.20-v01	AVS-UN038-v01	Data	• Number of security breach attempts, immediate reporting (weekly aggregate).	Essential	Analyze
AVS-DT-DAT-001.21-v01	AVS-UN038-v01	Data	• Number of successful security breaches, immediate reporting (weekly aggregate).	Essential	Analyze
AVS-DT-DAT-001.22-v01	AVS-UN038-v01	Data	• Conditions driven in (weather, congestion, etc.) (weekly).	Essential	Analyze
AVS-DT-DAT-001.123-v01	AVS-UN038-v01	Data	• Incident reports (including any collisions or crimes) within 24 hours or sooner, following an incident. All data (video, audio, sensors, etc.) 5 minutes before and after each incident should be included.	Essential	Analyze
AVS-DT-DAT-001.24-v01	AVS-UN038-v01	Data	• Passenger Behavior reports (including any situations when an external entity is called upon for assistance and is not deemed an imminent	Essential	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
			passenger safety concern) within one week following an incident. All data (video, audio, sensors, etc.) 5 minutes before and after each incident should be included.		
AVS-DT-DAT-001.25-v01	AVS-UN038-v01	Data	• User and non-user surveys (before and after the pilot).	Essential	Analyze
AVS-DT-DAT-001.26-v01	AVS-UN038-v01	Data	• Number of times people with disabilities were able to hail, board, secure themselves, or alight with and without concierge assistance (weekly), and number of times people with disabilities were not able to hail, board, secure themselves, or alight with and without concierge assistance (weekly).	Essential	Analyze
AVS-CO-DAT-001.27-v01	AVS-UN038-v01	Data	• Number of bicycles on board the AVS (weekly) and number of bicycles that were not able to board AVs due to space constraints.	Essential	Analyze

ReqID	User Need ID	Functional Group	Description	Priority	Verification Method
AVS-CO-DAT-001.28-v01	AVS-UN038-v01	Data	• Annualized operating expense per service mile (end of pilot).	Essential	Analyze
AVS-CO-DAT-001.29-v01	AVS-UN038-v01	Data	• If a Connected Vehicle On-Board Unit is used, a record of operational data exchanged (includes SPaT and MAP messages the vehicle receives, BSM it sends, etc.) (weekly).	Desirable	Analyze

3.1.6 ADA Compliance

The Vendor shall identify its ability to comply with all applicable requirements of the Americans with Disabilities Act of 1990 (ADA), 42 U.S.C. 12101 et seq. and 49 U.S.C. 322; Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. 794; Section 16 of the Federal Transit Act, as amended, 49 U.S.C. app. 1612; and the following regulations and any amendments thereto:

- USDOT regulations, "Transportation Services for Individuals with Disabilities (ADA)," 49 CFR. Part 37;
- USDOT regulations, "Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance," 49 CFR. Part 27;
- US. DOT regulations, "Americans With Disabilities (ADA) Accessibility Specifications for Transportation Vehicles," 49 CFR. Part 38;
- Department of Justice (DOJ) regulations, "Nondiscrimination on the Basis of Disability in State and Local Government Services," 28 CFR. Part 35;
- DOJ regulations, "Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities," 28 CFR. Part 36;
- General Services Administration regulations, "Construction and Alteration of Public Buildings," "Accommodations for the Physically Handicapped," 41 CFR. Part 101-19;
- Equal Employment Opportunity Commission (EEOC) "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR. Part 1630;
- Federal Communications Commission regulations, "Telecommunications Relay Services and Related Customer Premises Equipment for the Hearing and Speech Disabled," 47 CFR. Part 64, Subpart F; and FTA regulations, "Transportation for Elderly and Handicapped Persons," 49 CFR Part 609.

4 Engineering Principles

This section describes engineering principles that guide composition of the TIMMA Autonomous Vehicle Shuttle Pilot Project.

4.1 Methods of Verification

The software and hardware components that make up the TIMMA Autonomous Vehicle Shuttle Pilot Project will be individually verified, then integrated to produce top-level assemblies and microservices. These assemblies will also be individually verified before being integrated with others to produce larger, evolving assemblies until the complete system has been integrated and verified.

The requirements also maintain a verification method, which details the plan for verifying the requirement based on its stated definition. One of the verification methods listed in **Table 11: Methods of Verification** is assigned for each requirement. Using the requirements defined in the previous section,

Table 11: Methods of Verification

Type	Description
Inspection	Verification through a visual, auditory, olfactory, or tactile comparison
Demonstration	Verification that exercises the system software or hardware as it is designed to be used, without external influence, to verify the results are specified by the requirement
Test	Verification using controlled and predefined inputs and other external elements (e.g. data, triggers, etc.) that influence or induce the system to produce the output specified by the requirement
Analyze	Verification through indirect and logical conclusion using mathematical analysis, models, calculations, testing equipment and derived outputs based on validated data sets

Source: SFCTA

CONCEPT OF OPERATIONS

TIMMA Autonomous Vehicle Shuttle Pilot Project

FINAL CONCEPT OF OPERATIONS

May 2020

PREPARED FOR

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San Francisco County Transportation Authority

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Acronyms and Abbreviations

APC ..... Automated Passenger Counter

AV ..... Autonomous Vehicle

AVS ..... Autonomous Vehicle Shuttle

ConOps ..... Concept of Operations

FMLM ..... First-Mile/Last-Mile

SFCTA ..... San Francisco County Transportation Authority

SFMTA ..... San Francisco Municipal Transportation Agency

TICD ..... Treasure Island Community Development

TIDA ..... Treasure Island Development Authority

TIMMA ..... Treasure Island Mobility Management Agency

TITIP ..... Treasure Island Transportation Implementation Plan

TI/YBI ..... Treasure Island and Yerba Buena Island

1 Scope

General

This Concept of Operations (ConOps) serves as the first in a series of engineering documents intended to describe the development of the Treasure Island Mobility Management Agency (TIMMA) Autonomous Vehicle Shuttle (AVS) Pilot Project.

1.1 Document Overview

The purpose of the ConOps is to clearly convey a high-level view of the required AVS system from the viewpoint of each stakeholder. This document frames the overall system and establishes the technical course for the Project by serving as a bridge between early project motivations and the eventual technical requirements. By design, the ConOps is technology independent, focusing on the overall functionality of the proposed AVS system.

1.2

The ConOps also serves to communicate user needs for, and expectations of, the proposed system. The document provides stakeholders the opportunity to offer input regarding proposed system functionality and is intended to help form a consensus among stakeholders to create a single vision for the system moving forward.

The intent of the pilot project is to procure and test an AV service, not to develop original technology or equipment. The ConOps is intended to provide a quick reference for project stakeholders to ensure a consistent understanding of project needs, process framework, and other system attributes and to inform procurement documents. It is also intended to be specific in establishing the operational expectations yet allow flexibility in the actual deployment scenario since it is anticipated that construction and maintenance of traffic conditions on Treasure Island and Yerba Buena Island (TI/YBI) during the pilot phase may require dynamic path rerouting.

The document contains the following sections:

- Section 1 provides a document overview.
- Section 2 identifies all documents referenced.
- Section 3 describes the current and supporting systems and the challenge(s) to be addressed.
- Section 4 describes the features that motivate the project's development.
- Section 5 describes the proposed system at a high-level, indicating the operational features that are to be provided, without specifying design details.
- Section 6 describes the Use Cases and Operational Scenarios, which illustrate how the project will operate from various perspectives.
- Section 7 describes the impacts the project will have on multiple stakeholders including system users, owners and operators.
- Section 8 provides an analysis of the impacts presented in Section 7.

System Overview

The TIMMA AV Shuttle Pilot Project aims to evaluate the potential of autonomous vehicle (AV) technology to improve first-mile/last-mile (FMLM) and intra-island mobility on TI/YBI, as described in the Treasure Island Transportation Implementation Plan (TITIP). The TITIP prioritizes pedestrian and bicycle mobility, enhanced by shared mobility services in order to minimize the need for travel in a personal vehicle. To design the streets in a way that prioritizes pedestrian and bicycle mobility, in the final future condition of the island, the intra-island bus service will be replaced with shuttles on the island, with high-capacity bus and ferry service at a central Transit Hub.

The shuttle system envisioned by the TITIP is a shared shuttle operated by a human driver. An AVS system could better fulfill the mobility needs on TI/YBI. AVSs have the potential to reduce operating costs and attract residents and visitors to the islands and the city. Most AVS currently on the market are electric, with no tailpipe emissions, which supports the TITIP's sustainability goal of an environmentally-sensitive means of transportation. The pilot project will allow the TIMMA and its stakeholders to understand the potential of AV technology for use as an intra-island mobility solution on TI/YBI as well as provide lessons learned for future AVS deployments throughout the city, region, and nation.

2 Referenced Documents

Table 1 contains documents and literature used to gather input for this document.

Table 1: References

Title	Publication Date
California Department of Motor Vehicles - Autonomous Vehicle Deployment (Public Use) Program[1]	2018
California Department of Motor Vehicles - Testing of Autonomous Vehicles with a Driver[2]	2018
California Public Utilities Commission - Autonomous Vehicle Passenger Service Pilot Program[3]	2018
San Francisco County Transportation Authority (SFCTA) Emerging Mobility Evaluation Report	2018
San Francisco Municipal Transportation Agency (SFMTA) - Muni Bus Map	2019
SFMTA, City and County of San Francisco - Advanced Transportation and Congestion Management Technologies Deployment Initiative Grant Application	2016
Treasure Island Development Authority - Treasure Island Transportation Implementation Plan	2011

Source: SFCTA

[1] https://www.dmv.ca.gov/portal/dmv/detail/vehindustry/ol/deployment
[2] https://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/testing
[3] https://www.cpuc.ca.gov/avcpilotinfo/

3 Current System

General

The purpose of this section is to provide context on the situation that has motivated the development of an AVS system on TI/YBI, including the current and planned network infrastructure, its users, and supporting policies and constraints. Sub-sections provide an overview of the goals and scope of the project, review supporting policies and procedures, define current modes of operation, and provide an overview of the users impacted by the current system. Collectively, this section serves to provide a better understanding of the current transportation system.

In the context of this project, the current system refers to the system into which the pilot will be deployed. The island is currently under construction, so the current system is subject to change based on the progress of the Treasure Island development and other projects that may impact the AVS pilot.

Background, Objectives and Scope

The Treasure Island development is a phased redevelopment project currently under design and construction on TI/YBI. As part of the project, an extensive transportation network has been planned to accommodate the 25,000 new residents on Treasure Island. The residents will generate tens of thousands of trips a day. Due to space constraints, private automobiles will be discouraged on TI/YBI with congestion management strategies, like congestion pricing. The transportation network on TI/YBI will heavily rely on transit services.

As described in the TITIP, once the Treasure Island development is complete in approximately 15-20 years, the island will have multiple bus lines, ferries, a new roadway network, and pedestrian/bicycle facilities. There will be a transit hub located in the southwest area of Treasure Island that integrates all modes of transportation to allow users to transfer among modes of transportation.

Infrastructure and building construction on the island are not expected to be complete until at least 2035 and is implemented in several phases. On-going construction will be taking place on the islands during the testing of the AVS pilot. Therefore, the AVS will be operating on a combination of newly constructed roadways, existing roadways, and roadways that are under construction. Streets may be completed before surrounding amenities, which may still be under construction.

During the pilot, the northeast side of TI will continue to operate as a commercial area, the northwest side will continue to operate as a residential area. The southern end of TI will be closed for construction, with the exception of the Treasure Island Administration Building. The only land use on YBI will be the US Naval Training Station on the east side of the island.

The TIMMA AV Shuttle Pilot Project is anticipated to operate for three months. The goal is to determine whether an AVS or a traditional shuttle serves the mobility goals of the islands better, and what can provide a reliable and positive user experience. During this time, performance will be measured, and lessons learned regarding the efficiencies and limitations of AVS compared to traditional shuttle service will be documented. These outcomes will help to

determine whether to consider future AVS deployments on Treasure Island. Confounding factors will be identified in the evaluation plan to ensure that the results are independent of other variables (e.g. changes in land use).

Description of the Current System

The existing transportation services on TI/YBI consist of a roadway network and bus service as discussed below.

3.3 Roadway Network

The roadway network on TI/YBI primary consists of two-lane, two-way roads with stop-controlled intersections. Most existing roads on Treasure Island have sidewalks, while existing roads on Yerba Buena do not contain pedestrian facilities.

3.3.1

The roadway network on Treasure Island is flat, with grades between 0% and 2%. Yerba Buena contains grades exceeding 12% at some locations. The inter-connecting roadway between the two islands, known as the Causeway, and portions of Macalla Road on YBI, have grades exceeding 17%.

To access the islands, there are ramps to and from YBI connected to I-80, the San Francisco-Oakland Bay Bridge, which passes through YBI in a tunnel.

Prior to and during the AVS pilot, the roadway network on the east side of Treasure Island will be under construction and several roads will be closed. The ramps from I-80 to Macalla Road on YBI will be closed, along with the roads under I-80. The preliminary AVS routes take the road network at the time of the pilot into consideration.

3.3.2

Bus Service

As of December 2019, the existing transit service to TI/YBI is a San Francisco Municipal Railway (Muni) bus line (25 Treasure Island) is a 24-hour daily bus service. It is scheduled to run every 10 to 20 minutes daily with the exception of late night "Owl" service that is scheduled for 30-minute frequency. The primary purpose of the bus service is to get users (residents, workers and visitors) on and off the islands. The service route provides connection between the island and the Salesforce Transit Center located in the East Cut neighborhood in the eastern side of downtown San Francisco. There are 19 existing bus stops on the island. A map of the existing Muni bus service serving TI/YBI, as well as the planned bus service during the time of the pilot, can be found in **Appendix B**. During the construction on the island, the 25 Treasure Island line will be rerouted, and stops will be moved to accommodate the road closures.

The 25 Treasure Island Muni bus serves customers 24 hours a day, seven days a week. The frequency of service is scheduled for 10 to 20 minutes until the late night "Owl" service begins between 12 am midnight to 6am when frequency is scheduled for 30 minutes (as of May 2020). Due to traffic congestion on the San Francisco-Oakland Bay Bridge, the 25 Treasure Island line often experiences reliability issues such as delays and slow travel times.

Existing bus stop infrastructure includes bus shelters at 74% of the stops on Treasure Island. Other stops are marked with a bus zone box in the street or with Muni stop bar and pole

markings. An assessment of the existing bus stop infrastructure is planned with the goal of improving amenities and accessibility of these stops wherever possible during the pilot.

Modes of Operation for the Current System

The following modes of operation establish the operational condition of the current system. The modes, as identified in **Table 2**, are defined as:

Table 2: Definition of System Modes of Operation

Mode	Definition
Mode 1: Normal Operating Conditions	Normal operating condition, the system is operating as designed.
Mode 2: Failure / Degraded Conditions	Situations that require the temporary shutdown or delay of the system.
Mode 3: Maintenance Conditions	The condition of the system where repair is done for an unscheduled breakdown of equipment functionality or scheduled preventative maintenance.

Source: SFCTA

The failure mode can occur when an incident such as a traffic collision or a severe weather event occurs. This could lead to a temporary closure of the roads until they are safe to re-open to traffic, or more commonly delays in Muni service while a bridge incident is cleared. There are two ramps from the San Francisco – Oakland Bay Bridge to the islands so when there is an incident, Muni is often re-routed to the Oakland turnaround and uses the YBI ramp to access TI.

The maintenance mode can occur when the transit vehicles need routine or emergency maintenance.

Users and Other Involved Personnel

TI/YBI contains a variety of stakeholders, whose diverse needs must be considered during the development of AVS project goals and objectives. Currently, there is no AVS service on TI/YBI or within Muni's service area, so there are no current users of an AVS system. Bus riders living on or commuting to TI/YBI are likely to use a service like the proposed AVS and are considered current circulator users. The transportation system on TI/YBI is utilized by several types of users, all of whom may eventually use the AVS.

Support Environment

The support environment includes the systems, personnel, and processes that make up the existing transportation system. SFMTA is currently responsible for all the systems, personnel, and the processes associated with the existing transportation system.

4 Justification for and Nature of Changes

General

This section explains the justification for the development of an AVS service to address TI/YBI mobility challenges. This section begins with a summary of motivations for a new or modified system, before describing and prioritizing the desired changes, including those changes that were identified but not included in this project due to the nature of the pilot. Proposed changes are shaped by the user needs identified throughout the section.

Operational Policies and Constraints

The TITIP set forth principles and polices that will be carried through the entire Treasure Island redevelopment project. The principles and policies have remained the same and will continue to lay the groundwork for the Treasure Island redevelopment project.

The TITIP describes initiatives that incentivize transit and shuttle use and disincentivize personal vehicle use. These initiatives include congestion management pricing, parking management, ramp metering, transit vouchers, and more. The initiatives also include a free, alternative-fuel, on-island shuttle. This pilot evaluates whether autonomous shuttle technology is viable and desirable to fulfill the planned shuttle service.

Principles

The TITIP defines the redevelopment's future transportation principles as:

- Transportation infrastructure on TI/YBI will be designed around opportunities to safely and comfortably walk and bike as primary modes;
- Transit services to and from TI/YBI will operate throughout the day, evening, and weekends at high levels of service consistent with meeting demand and providing high-quality alternatives to the private automobile;
- Automobile use will be discouraged via parking policies, congestion pricing, and other policies such as ramp metering;
- The plan will be financially viable; and
- Transportation services and pricing will be managed over time to meet the real-time needs of residents, workers, and visitors to TI/YBI.

These principles are intended to guide the overall mobility of the island once the full redevelopment is complete. The principles have informed the development of the pilot but are not directly applicable to this short duration deployment at an early phase of redevelopment.

Policies

The TITIP defines the redevelopment's transportation policies as:

- Prioritize walking
- Maximize the usefulness of bicycling
- Maximize effectiveness and convenience of transit and ridesharing
- Use transportation demand management

- Promote transit
- Improve Bay Bridge ramps

Integration with Sustainability Goals

In addition to the transportation principles and policies, sustainability is a key priority. The Islands' design with the central Transit Hub and shops and dense, transit-oriented land use promotes the use of biking and walking, thereby reducing the number of automobile trips.

4.2.3 Project Goals

The goals for the project represent the desired result that the project team expects to achieve from the project. The goals are meant to be broad and guide the direction of the project, while the objectives define the specific, measurable targets by which the project team will measure success. Refer to **Appendix A** for the goals and objectives framework.

4.3

Safety

For this project, the safety goal is to understand the public safety implications of an AVS without risking safety of the public. Public safety implications may include public perception of safety when riding the shuttle, how often the AVSs disengage, and how often collisions occur. AVSs will be operated without passengers during the operational test period to ensure there are no crashes before passengers are allowed on. It is anticipated that the AVS will be deployed safely during the pilot and is perceived as a safe solution by AVS passengers and road users.

4.3.1

4.3.2 Mobility

In the TITIP, the future transportation needs describe a shuttle service that is needed for the island. The mobility goal is to understand if AV Shuttle technology can meet TIMMA's intra-island transportation service needs at TI/YBI, including allowing for easy circulation for those who choose not to or are unable to walk or bike, connect to transit stops (bus or ferry), serve a majority of land-uses (i.e. can travel throughout the islands), and accommodate bicycles. If the mobility goal is met, then an AVS could serve as a viable alternative to the non-AV shuttles described in the TITIP and become a long-term FMLM solution on TI/YBI.

4.3.2

Operations

The project team aims to understand TIMMA's organizational capabilities and infrastructure needs to operate an AVS. By having a better understanding of the organization and infrastructure needs of an AVS deployment, SFCTA and partner agencies may better recognize other opportunities to deploy AVS in the San Francisco Bay area to solve FMLM challenges.

4.3.3

4.3.4 Share Lessons Learned

This goal seeks to explore whether the AVS pilot service is secure, reliable, cost-efficient enough for a full-scale AVS deployment on TI/YBI in lieu of a driven shuttle service, as envisioned in the TITIP, including the need for free service that operates 24 hours a day.

4.3.4

The final goal of the project is to gather insights from the public during the pilot and share lessons learned with community and key stakeholder (SFCTA, SFMTA, and TIDA). The lessons

learned from this pilot will help other community members who may be interested in deploying AVSs. The lessons learned may be posted on SFCTA's website to facilitate community access.

Project Objectives

The AVS intends to address eight (8) primary objectives as it relates to this deployment. These are captured in **Table 3**. The objectives will be measured to evaluate the success of the pilot. The hypotheses are statements that can be tested to determine the outcome of the objective.

Table 3: Performance Measure Framework

	Objectives	Hypothesis
1A	Protect the safety of passengers & road users in TI/YBI during pilot operations	AV shuttle technology is safely deployed on TI/YBI during the pilot
1B	Explore whether AV shuttle technology can safely navigate the driving challenges of TI/YBI.	The pilot provides data to inform long term decisions about safe AV Shuttle deployments.
		An AV Shuttle is perceived by passengers and road users as a safe long-term solution for TI.
2A	Explore whether AV shuttle service can be accessible to everyone	AV shuttles are capable of serving individuals with disabilities, including people using wheelchairs, without human assistance.
		AV shuttles are not a barrier to disadvantaged or vulnerable users[4].
		AV shuttles can carry bicycles and personal transportation devices, strollers & luggage or operator has a roadmap to provide accommodations under full deployment.
2B	Explore the AV shuttles' ability to meet the intra-island needs of users in TI/YBI	AV shuttle service can meet TI/YBI user needs.
3A	Explore whether AV shuttle technology can meet TIMMA's TI/YB shuttle operation needs	AV shuttle operations are secure from cyber-attacks.
		AV shuttle operations can provide accurate, reliable and timely data.
		AV shuttle operation costs are equal or less than other similar public services.
3B	Explore whether AV shuttle technology can meet TIMMA's TI/YB shuttle service needs and constraints	AV shuttles can meet TIMMA's shuttle service requirements.
		AV shuttles can provide reliable (without disruptions) service.
		AV shuttle operator will meet or have a roadmap to meet CA public fleet emission goals (all electric by 2040).

[4] Disadvantaged or vulnerable users includes users who are vision impaired, mobility impaired, or otherwise disabled or socio-economically disadvantaged.

	Objectives	Hypothesis
4A	Provide opportunity to demonstrate AV technology to key stakeholders and community groups through pilot.	The AV pilot is a learning opportunity for key stakeholders and community groups.
4B	Upon pilot completion, pilot results are shared with stakeholders	AV pilot outcomes are collected and shared with stakeholders.

Source: SFCTA

Essential Features

4.5 This section identifies the User Needs of the AVS project. Many needs were identified based on the established project goals and objectives (see Appendix A), discussion with SFCTA, SFMTA, Treasure Island Development Authority (TIDA), and guidance on behavioral competencies for highly autonomous vehicles from the Federal Automated Vehicles Policy. Additional needs were added in consideration of this being a public service, both from the passenger perspective and as additional desired capabilities of the AVS shuttle. User needs were also derived from existing Treasure Island development goals, project meetings, and existing documents.

Table 4: User Needs

Identification	Title	Description	Rationale
AVS Passenger Needs			
AVS-UN001-v01	Boarding AVS	An AVS passenger needs the AVS to stop and open its door at designated locations to board the AVS.	To start a passenger trip.
AVS-UN002-v01	Alighting AVS	An AVS passenger needs the AVS to stop and open its door at designated locations to alight the AVS. The vehicle must be able to stop and open doors for a passenger emergency.	To end a passenger trip.
AVS-UN003-v01	Traveler Information	An AVS passenger needs information on the AVS's route, status, schedule, and next stop to make travel decisions. Information must be conveyed both visually and audibly.	To allow passengers to plan for start and end of a trip and effectively use the shuttle service.

Identification	Title	Description	Rationale
AVS-UN004-v01	Passenger Safety Alert	An AVS passenger needs to be able to alert the Vendor's AVS Management System[5] when there is an issue on board the AVS. Also provide first aid kit/fire extinguisher within the AVS.	To be able to respond in the event of an emergency, criminal activity, or other safety concerns.
AVS-UN005-v01	Concierge	An AVS passenger needs to be able to be greeted and given instructions, if necessary, when boarding or alighting the AVS.	To improve safety and customer service of the AVS system. Note that the safety driver and concierge may be the same person.
AVS-UN006-v01	ADA Accessibility	An AVS passenger that uses a mobility device needs to be provided with a method to safely board, alight and secure their device.	To ensure the safety of passengers with disabilities using the AVS.
AVS Needs			
AVS-UN007-v01	Stop for Passenger Boarding	The AVS needs to know where to stop to pick up passengers.	To start a passenger trip and provide a shuttle service. For this project, the shuttle will stop at every designated shuttle stop. Optionally, there may be an app that will allow for skipping stops.
AVS-UN008-v01	Stop for Passenger Alighting	The AVS needs to know where to stop to drop off passengers.	To finish a passenger trip and provide a shuttle service. For this project, the shuttle will stop at every designated shuttle stop. Optionally, there may be an app that will allow for skipping stops.

[5] Throughout this document AVS Management System refers to the vendor's back-office management system overseeing the shuttle operation.

Identification	Title	Description	Rationale
AVS-UN009-v01	Ridership data	The AVS needs to collect ridership data.	To understand AVS utilization, passenger counts may be collected by an Automated Passenger Counter (APC) or a concierge.
AVS-UN010-v01	ADA Accessibility	The AVS needs to know when to deploy a ramp or activate other equipment to allow for riders with disabilities to use the AVS	To facilitate people who are boarding and alighting without concierge support.
AVS-UN011-v01	Quiet Car Alert	The AVS needs to emit an alert sound to warn pedestrians. The AVS needs to make itself visible with lights.	To alert pedestrians, bicyclists, and other road users of an on-coming AVS.
AVS-UN012-v01	Manual Fueling	The AVS needs to be able to be manually connected to a charging source if electric or fueled if another fuel source is used.	To recharge the battery or refuel the vehicle.
AVS-UN013-v01	Transportation Management System	The AVS needs to have an on-board transportation management system.	To collect data on the AVS location, to support Traveler Information and comfort, to meet AVS passenger user needs, and to provide data to support performance measures
AVS-UN014-v01	Security Camera	The AVS needs to have an on-board and outside video camera installed and video transmitted to the AVS Management System.	To monitor the inside and outside of the vehicle for security purposes.
AVS-UN015-v01	Law Following – Open Traffic Environment	The AVS needs to be able to detect other street users, objects and vehicles on the public roadway, classify those objectives correctly, predict their path, accurately plan a traffic maneuver and execute such maneuver.	To safely navigate the roadway, interact with other road users in mixed traffic, and not cause, directly or indirectly, traffic collisions.

Identification	Title	Description	Rationale
AVS-UN016-v01	Law Following – Regulatory	The AVS needs to have knowledge of and the ability to follow local, state, and federal driving laws, including the ability to detect and understand regulatory signs, speed laws, pavement markings, and traffic signals.	To operate in compliance with traffic laws.
AVS-UN017-v01	Law Following – Temporary Traffic Control	The AVS needs to be able to detect and respond to detours, humans directing traffic, and other temporary changes in traffic patterns.	To operate in compliance with traffic laws, even when conditions have deviated from the everyday. Safety driver may need to assume control during the pilot.
AVS-UN018-v01	Route Deviation	The AVS needs to be able to deviate from its specified route when necessary and safe.	To safely operate in case a detour is required from the route specified by the AVS Management System or safety driver.
AVS-UN019-v01	Crash Avoidance	The AVS needs to be able to detect an imminent collision and respond to avoid the collision or minimize the impact, in a manner that does not put passengers at risk of injury. The AVS must include an event data recorder that has the capacity to retain data according to the standards in 49 CFR 563, as well as additional data consistent with 2020 SAE standards for AV data loggers.	For crash avoidance and impact minimization in the event of control loss, an imminent collision, or road departure situations.
AVS-UN020-v01	Fall Back	The AVS needs to be able to safely operate when it's faced with abnormal conditions, such as with a malfunctioning detector, in an unfamiliar environment, or after an incident has occurred.	To inform the AVS Management System, minimize risks, stop at a safe location, and remove itself out of service if needed.

Identification	Title	Description	Rationale
AVS-UN021-v01	Detection Arbitration	The AVS needs to be able to arbitrate between detected concurrent regulatory signs, pavement markings, traffic signals, human traffic control gestures, and object detections.	To determine the safest and most legal course of action, when confronted with multiple inputs.
AVS-UN022-v01	Disengagement Mechanism	The AVS must be able to disengage from autonomous mode.	To allow the safety driver to take manual control
AVS-UN023-v01	Uncertainty in Course of Action	The AVS needs to be able to decrease speed and pull over in a legal stopping location, if safe, when there is uncertainty regarding which action to take.	To minimize the likelihood of a potential incident or the impact of an incident.
AVS-UN024-v01	Operational Design Domain	The AVS needs to verify its Operational Design Domain and restrict operations if operated outside its Operational Design Domain.	To prevent the AVS from operations outside its intended domain.
AVS-UN025-v01	Climate Control	The AVS needs to support climate control within the vehicle.	To increase comfort of the AVS occupants.
AVS-UN026-v01	Tow or Road Clearance	The AVS needs to be able to safely be towed in the event the vehicle is immobilized and needs to be cleared from the roadway.	To ensure the safety of those towing the vehicle and reduce the risk of damaging the AVS.
AVS Management System Needs			
AVS-UN027-v01	Route Definition	The AVS Management System needs to be able to program the operating routes into the AVS.	To tell the AVS where to travel during normal operations.

Identification	Title	Description	Rationale
AVS-UN028-v01	End of Service Period	The AVS Management System needs to end service by terminating at its pre-determined storage spot at the end of the service period.	This allows the AVS to return to the storage area for charging and planned maintenance without inconveniencing the passengers. This will improve customer satisfaction but is not essential to service provision. The AVS may stop in a pre-determined location and be driven to the storage spot by the safety driver. This includes maintaining an emergency fuel reserve to return to the charging/fueling facility
AVS-UN029-v01	Managed AVS Operations	The AVS Management System needs to manage operations, ensuring the AVSs are running on schedule and minimizing conflict with existing Muni service.	To provide a reliable service to passengers and to ensure proper operations of the AVS.
AVS-UN030-v01	Data Transfer	The AVS needs to be able to transfer safety operations and trip data to the AVS Management System and any other designated databases for City analysis.	To analyze the successful performance of the AVS on multiple dimensions. While the data transfer to the AVS Management System is required, transfer to designated databases for City analysis is a desired feature.
AVS-UN031-v01	AVS Charge	The AVS Management System needs to be able to maintain power throughout the operational period to ensure consistent operations on its routes.	To continuously provide service during hours of operation.

Identification	Title	Description	Rationale
AVS-UN032-v01	AVS Operation Monitoring	The AVS Management System needs to be able to monitor the status of the AVSs.	To determine when a degraded or failure condition has occurred.
AVS-UN033-v01	Managed AVS Charging	The AVS Management System needs information on the AVS's battery level, ensuring the AVSs are sufficiently charged.	To mitigate the risk of an unexpected loss of power.
AVS-UN034-v01	Incident Response	The AVS Management System needs to communicate to the AVS Management System and have contingency plans to respond if an incident does occur.	To communicate incidents immediately and plan an appropriate response to incidents and minimize additional risks afterward.
Operations Staff Needs			
AVS-UN035-v01	Manual AVS Operation	Operations staff need to be properly trained on how the AVS technology works, emergency response protocols and how to manually control the AVS if deemed necessary.	To assist the AVS conditions it is unable to negotiate, to minimize risk, and to comply with AV regulations. Note that the safety driver and concierge may be the same person.
AVS-UN036-v01	Assistance for People with Disabilities	Operations staff need to be able to properly secure people who use mobility devices and assist with boarding and alighting.	To ensure the safety of passengers that use mobility devises.
AVS-UN037-v01	AVS Override / Shut Off	Operations staff, when near the AVS, need to be able to safely stop and turn off the AVS.	So that the operations staff can override any other controls the AVS is receiving, which may be faulty or malicious, and bring the AVS to a safe stop before determining the next course of action.

Identification	Title	Description	Rationale
AVS-UN038-v01	Manual Data Collection	Operations staff need to be able to properly collect information on passenger information and operations data.	To be able to calculate performance metrics for data that can't be collected without human assistance, including, but not limited to, number, location, and cause of AV system disengagements; user and non-user surveys; number of times people with disabilities were able to hail, board, secure themselves, or alight without requiring concierge assistance and with assistance; and number of bicycles on board the AVS.

Source: SFCTA

4.6 Desirable Features

The following user needs have been considered but are not deemed as requirements during the pilot. The features are considered desirable and may be considered during the evaluation of vendors.

Table 5: Optional User Needs

Identification	Title	Description	Reason for not Including
AVS Needs (Desired Capabilities)			
AVS-UN039-v01	Stop for Passenger Boarding (On-Demand)	The AVS needs to know where to stop to pick up passengers.	AVS will have a fixed route. On-demand location may not be ADA compliant. However, services may be provided on-demand (at any time based on user request) within the fixed route.
AVS-UN040-v01	On-Demand Stop for Passenger Alighting (On-Demand)	The AVS needs to know where to stop to drop off passengers.	AVS will have a fixed route. On-demand location may not be ADA compliant.

Identification	Title	Description	Reason for not Including
AVS-UN041-v01	Fare Collection	The AVS needs to have the ability to collect fares on board with a system compatible with a Common Payment System and Multi-modal Trip Planning App.	AVS will be free to ride during the pilot.
AVS-UN042-v01	Automatic Charging	The AVS needs to be able to connect to a charging source independently of human assistance from the operations staff.	Alternatively, AVS will have operations staff who can manually charge the AVS.
AVS-UN043-v01	Minimize Travel Time	The AVS Management System needs to optimize route operations and minimize passenger travel time by limiting dwell times and maintaining consistent travel on its route.	Alternatively, dwell times and operating speed will remain constant or modified as needed by the on-board concierge and as road conditions allow.
AVS-UN044-v01	Minimize Transfer Time	The AVS Management System needs to minimize passenger waiting time at shuttle stops shared with fixed route transit by timing AVS arrivals with Muni schedule at terminal and major hubs.	It is not essential to the pilot to time the AVS to the Muni schedule.
AVS-UN045-v01	Coordinate with Signals (DSRC) - TSPS	The AVS needs to have an Onboard Unit using Dedicated Short-Range Communications (DSRC) to interface with the Roadside Units using DSRC at the intersections within the operating area.	Signals will not be installed prior to pilot.

Identification	Title	Description	Reason for not Including
AVS-UN046-v01	Environmental Condition Monitoring	The AVS Management System needs to be able to monitor local weather patterns and be aware of an approaching severe weather event or other conditions that may impact AVS operations.	Alternatively, AVS will have a concierge on board who can determine if the AVS needs to suspend operations.
AVS-UN047-v01	24/7 Operations	The AVS will operate around the clock provided service.	Based on existing Muni operations and TI/YBI growth during the pilot period, it is anticipated that ridership will be too low during pilot period to justify cost of 24/7 operations.
AVS-UN048-v01	Hybrid Vehicle	The AVS will be able to operate all-electric or as a hybrid with other fuel type.	All-electric or hybrid vehicles are preferred for the project, but the project is open to other options to not limit vendors.
AVS-UN049-v01	Bike Racks	The AVS will have bike racks	Bicycles, as well as other devices like wheelchairs, walkers, and strollers, can be brought onto the AVS.
AVS-UN050-v01	Free Wi-Fi	The passengers will have Wi-Fi connectivity within the shuttle	Not in line with project goals and objectives.
AVS-UN051-v01	Multi Modal Trip Planning App	Passengers can receive the real-time AVS location and plan a trip based on the AVS location.	It is optional for the pilot. Also, the AVSs are not integrated into other modes of transportation during the pilot.

403 *Source: SFCTA*

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5 Concepts for the Proposed System

5.1 General

This section provides more detail on the concepts of the AVS system and how it supports the goals of SFCTA. The following sub-sections cover background, operational policies and constraints, a description of the proposed system, modes of operation, stakeholder roles and responsibilities, users, other involved personnel, the support environment, and security and privacy concerns.

5.2 Background, Objectives and Scope

The goal for this AVS project, in line with program-level goals established in the TITIP, is to determine whether AVS shuttle service is an effective and financially viable high-capacity transportation solution for TI compared to traditional shuttle service, and that is affordable to operate, promotes walking and biking and may one day encourage car-light living, meaning residents choose to rely less on personal automobiles and opting for alternative transportation modes like walking, biking, riding transit or carpooling.

These goals and objectives are supported by the following metrics:

Objective 1A: Protect the safety of passengers & road users in TI/YBI during pilot operations:

- Number of collisions and incidents (including injuries)
- Rate of incidents/collisions per mile of operation

Objective 1B: Explore whether AV shuttle technology can safely navigate the driving challenges of TI/YBI:

- Number, location and cause of AV system disengagements (including operating system malfunction or shut down due to an unknown operating parameter or safety driver assuming control of the vehicle) and other potential safety incident (including number, location and context of situations when the shuttle encountered safety events and didn't disengage)
- Perceived personal safety and overall system safety when riding or encountering shuttle

Objective 2A: Explore whether AV shuttle service can be accessible to everyone:

- Number of times people with disabilities (by category of disability) were able to hail, board, secure themselves or alight without requiring concierge assistance. Number of times concierge assistance was required to hail, board, secure or alight (to derive a rate of success). User perceptions of all trip elements (including hailing or reservation system) from persons with disabilities through user survey.
- Vulnerable or disadvantage user perceptions, measured through before and after user survey.
- Number of bicycles on board the AV shuttles. Number of times bicyclists could not board due to capacity. User survey of ease of use for bicycles, personal transportation devices, strollers & luggage.

Objective 2B: Explore AV Shuttle's ability to meet the intra-island needs of users in TI/YBI:

- AV Shuttle service use and perceptions as measured through user and non-user survey

Objective 3A: Explore whether AV shuttle technology can meet TIMMA's TI/YBI shuttle operation needs:

- Percentage of time during operating hours the system is shut down due to operating system security breaches. Number of security breach attempts & number of successful breaches.
- Data is received accurately, per standards and on time.

Annualized operating expense per service mile. **Objective 3B: Explore whether AV shuttle technology can meet TIMMA's TI/YBI shuttle service needs and constraints:**

- Adherence to operating and performance requirements that are accurate with timely reporting of data (operating hours, ridership, disengagements, safety, emissions)
- Actual hours in service as compared to anticipated scheduled hours of service. Dwell times by stop and route durations histograms. If on-demand, percentage of requests fulfilled, response time histogram. Percent of time during operating hours, the system is out of service and cause of service disruption.
- Number of electric, hybrid or alternative fuel vehicles in pilot. Grams CO2 per passenger mile (if not Zero Emission Vehicle) consistent with California Air Resources Board regulations. Year operator would be able to meet CA public fleet emissions goals.

Objective 4A: Provide opportunity to demonstrate AV technology to key stakeholders and community groups through pilot:

- Number of total people participating in a demonstration to key stakeholders and community members

Objective 4B: Upon pilot completion, pilot results are shared with stakeholders:

- Key participant end of pilot survey

5.3 Operational Policies and Constraints

Vehicles in the pre-deployment system are all human operated, and a significant change to the proposed system is the addition of autonomy. There are various policies and procedures that have been adopted, published, or currently within rulemaking that govern the use of autonomous vehicles in the state of California and the United States. These include:

- Federal Automated Vehicles Policy, published by the USDOT and the National Highway Traffic Safety Administration (NHTSA) in September 2016, provides guidance for developing an approach to automated vehicle performance specifications, the roles delegated to states, and current and proposed regulatory tools to maintain safety in this new transportation environment while not restricting technological innovation.
- Federal Motor Vehicle Safety Standards (FMVSS), also developed by NHTSA, regulate features required for vehicles operated on public roads, in categories such as crash

avoidance, crashworthiness, and post-crash survivability. Exemptions are required for vehicles without human controls.

- The State of California has passed legislation that allows autonomous vehicles that comply with FMVSS to be operated on public roadways if a permit is issued for the vehicle by the California DMV.
- The State Public Utilities Commission has authorized two pilot programs for the private prearranged transportation of passengers in test AVs. The AV vendor will need California Public Utilities Commission approval for the deployment.

Automated vehicle technologies are an emerging field and the technology is still under development. The AVS vendor must comply with FMVSS or seek a federal exemption. The vendor must also obtain the appropriate testing permits from the state for testing on public roads and for providing passenger service. These existing regulations and any potential changes or opportunities for exemptions will continue to be monitored by the vendor during the pilot.

The AVSs will be traveling on roads with mixed-traffic, and even in cases where the roads are closed for testing, they will need to be able to detect and respond to traditional regulatory signs. In addition, the streets along the route may be under construction during portions of the pilot. The vehicle or on-board operator will need to respond to temporary signage and flagmen accordingly.

The AVS will likely operate on the same streets and may use the same stops as the Muni 25 Treasure Island. Muni Transit Planning must be consulted on proposed AV bus route alignments on Treasure Island and shared use of bus stops.

5.4 Description of the Proposed System

To see how AVSs could be a potential long-term FMLM solution on TI/YBI, the pilot will deploy AVSs on TI/YBI before the Treasure Island development construction is finished. These AVSs will be deployed in a live mixed-used traffic environment, interacting with other vehicles, bicyclists, pedestrians, and other forms of transportation, and operating in an environment that includes unsignalized intersections. This approach intends to bring a safe, efficient, accessible, environmentally friendly, and easily expandable transportation solution to the region by deploying a fleet of multi-passenger AVSs. The AVSs will serve a route that is designed to meet the transportation needs of the area.

At a high level, this project could be described as a transportation solution that uses an AVS. The strategy to approach this project could therefore be separated into two parts: the transportation component and the automated driving system component. The components also have policy aspects – policies that govern how transit should be introduced and how it should serve all users, and policies that govern the rules for deploying autonomous vehicles in mixed traffic on public roads. These components also have subcomponents, which are described in the following subsections.

Interfaces

5.4.1 Interfaces

5.4.1.1 Passenger Interfaces

A major need of the AVS passengers is to be able to board and alight the AVS, in fact, a viable service will not be possible if this need is not met. The simplest way to accomplish this will be to program the AVSs to stop at every pre-programmed stop along their route. If this procedure is pursued, an interface to passengers will not be necessary. An on-board interface could also provide information on local attractions, weather, and other information or advertisements, if possible, to enhance passenger experience.

AVS passengers would also benefit from information on the AVS's route and current location. This will be provided from the AVSs directly, via static maps, on-board information, and potentially electronic signs at stops that are accessible to all passengers. AVS passengers will also be able to communicate directly with operations staff, as they will be stationed as a concierge on the AVSs.

5.4.1.2 Charging/Maintenance Interfaces

The AVS will also need to interface with the charging, storage, and maintenance facility. If the shuttle is capable of automated charging, the shuttle will activate the facility in order to enter and exit at the beginning and end of the service period. If the shuttle has manual charging, the concierge will store the vehicle and plug it in to charge.

5.4.1.3 Operations Interfaces

The AVSs will send the AVS Management System information on their current operating status. The AVS Management System will be able to override the AVS and bring it to a stop, as will operations staff, but they will only be able to drive the AVS if they are physically present in the vehicle.

If the vendor's AVS Management System and SFMTA have the ability, SFMTA and the AVS Management System may communicate current vehicle location information, which will facilitate transfers, but this is not an essential capability.

If the vendor has the ability to send operations and trip data to other designated databases for City analysis, the vendor will send information from the AVS Management System to the databases for archiving and analysis.

5.4.1.4 Road User Interfaces

The AVS will need to interact with road users in order to operate. Other vehicles, bicycles, pedestrians, scooters, construction equipment, and other users will be detected via outboard sensors on the AVS. Road users will visually and audibly detect the vehicle approaching. The vehicle will meet the minimum required USDOT noise requirement to make the vehicle detectable to visually impaired road users.

5.4.2 Vehicles

The AVSs will not be designed or built by TIMMA but procured from an external vendor and leased for use on the islands during this pilot. If purchased, USDOT requires vehicles comply with Buy America requirements, which is difficult to achieve by vendors that meet federal and California regulatory requirements. However, it is likely that any vehicle will require some

customization for this project. Current AVS have maximum speeds of around 25 mph and provisions for some ADA accessibility for other projects around the country. ADA provisions for the vehicle include those that fall under Title 49 Part 38 Subpart B[6].

The proposed AVSs will incorporate the latest AV technologies available. They must also be able to be fully recharged during the amount of time they are out of operation. Assuming the AVSs operate for 13 hours a day, which may change depending on the final route alignment and schedule, they must also be able to be fully recharged in fewer than 11 hours.

The number of AVSs required for the project will be vendor-specific and determined as part of the proposal. Vendors will be required to meet a headway and hours of service. Each vendor will propose a number of AVSs based on their AVS speed capabilities and battery capacity. It's anticipated that approximately four shuttles will be required to operate the service.

Each AVS is expected to include in-vehicle and outside cameras to be used in cases of emergency or security situations. If possible, footage will be transmitted centrally, and at a minimum it will be uploaded nightly and available for the project team to review when the AVS returns to the charging and maintenance facility. Occupancy will be limited to the maximum weight capacity of the AVS and on-board sensors will be used to detect weight. All AVSs will also be outfitted with seat belts, an emergency button or call box, internal visual and audible indicators. The AVSs will be equipped with robust vehicle health and status monitoring capabilities, a sophisticated obstacle bypass algorithm, and for worst-case scenarios, will have the ability to be operated by a trained human operator. In order to operate in mixed traffic, the AVSs will need to be road legal and compliant with the crashworthiness and other standards set by the FMVSS and appropriate State permits.

The AVSs are expected to be able to operate in minor inclement weather (e.g. light right or high visibility fog), but major adverse weather conditions will require the operator to suspend service. Major weather conditions that could affect service include thunderstorms, earthquakes, and heavy fog.

5.4.3 Route Development Methodology and Proposed Routes

Operationally, the intent is to deploy AVSs on TI/YBI. These AVSs will be deployed to serve two types of trips: transfer trips from the Transit Hub to area destinations and circulator trips within TI/YBI area, with usage independent of how the passenger traveled to TI/YBI.

The plans outlined in the TITIP (as shown in **Appendix C**) include three fixed routes, with the routes being combined into one route at night, and the routes being extended to remote areas on weekends. These routes were designed to serve the retail, commercial, and residential areas and to create a connection to the Transit Hub. Only Phase 1 of the development will be completed by the time that the AVS pilot begins and roads for the next phase will be closed or under construction.

The preliminary routes for the pilot have been developed and can be found in **Appendix D**. It is expected that the AVS service will operate from 7:00 AM to 8:00 PM for weekdays and 7:00

[6] https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&rgn=div5&view=text&node=49:1.0.1.1.28&idno=49#sp49.1.38.b

AM to 5:00 PM on weekends. The routes will be finalized after the procured vendor has tested the vehicle on the route.

Throughout the pilot, roads may periodically be under construction and require rerouting of the shuttle or response to temporary traffic control.

Accessibility

The vehicles must be accessible to those with disabilities. Onboard operators will be on board each vehicle during the pilot, and they may provide assistance to passengers beyond what the vehicle is independently capable of (such as securing a wheelchair or providing audible alerts).

5.4.4 Accessibility requirements and desirable accessibility feature, including onboard staff training, will be incorporated into the vendor selection process. The vendor will be required to identify its ability to comply with all applicable requirements of the Americans with Disabilities Act of 1990 (ADA), 42 U.S.C. 12101 et seq. and 49 U.S.C. 322; Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. 794; Section 16 of the Federal Transit Act, as amended, 49 U.S.C. app. 1612; and the following regulations and any amendments thereto:

- USDOT regulations, "Transportation Services for Individuals with Disabilities (ADA)," 49 CFR. Part 37;
- USDOT regulations, "Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance," 49 CFR. Part 27;
- US. DOT regulations, "Americans With Disabilities (ADA) Accessibility Specifications for Transportation Vehicles," 49 CFR. Part 38;
- Department of Justice (DOJ) regulations, "Nondiscrimination on the Basis of Disability in State and Local Government Services," 28 CFR. Part 35;
- DOJ regulations, "Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities," 28 CFR. Part 36;
- General Services Administration regulations, "Construction and Alteration of Public Buildings," "Accommodations for the Physically Handicapped," 41 CFR. Part 101-19;
- Equal Employment Opportunity Commission (EEOC) "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR. Part 1630;
- Federal Communications Commission regulations, "Telecommunications Relay Services and Related Customer Premises Equipment for the Hearing and Speech Disabled," 47 CFR. Part 64, Subpart F; and

5.4.5

- FTA regulations, "Transportation for Elderly and Handicapped Persons"

Infrastructure Upgrades

Infrastructure upgrades including installation of electric charge stations (for electric vehicles) and establishing a storage maintenance facility may be required to operate the AVSs on TI/YBI existing and future roadways. In addition, although small improvements may be needed to operate the AVSs, roadway construction, ADA ramp updates and shuttle stop infrastructure will not be a part of the TIMMA AV Shuttle Pilot Project. Infrastructure upgrade installation, if necessary, will most likely be the responsibility of TIDA (with inputs from the vendor).

Upgrades may also include bus stop infrastructure. This could be as simple as a temporary sign or as complex as a covered stop, particularly for shared stops with SFMTA. The shuttle stop signage may convey the stop location name, approximate stop times, and headway.

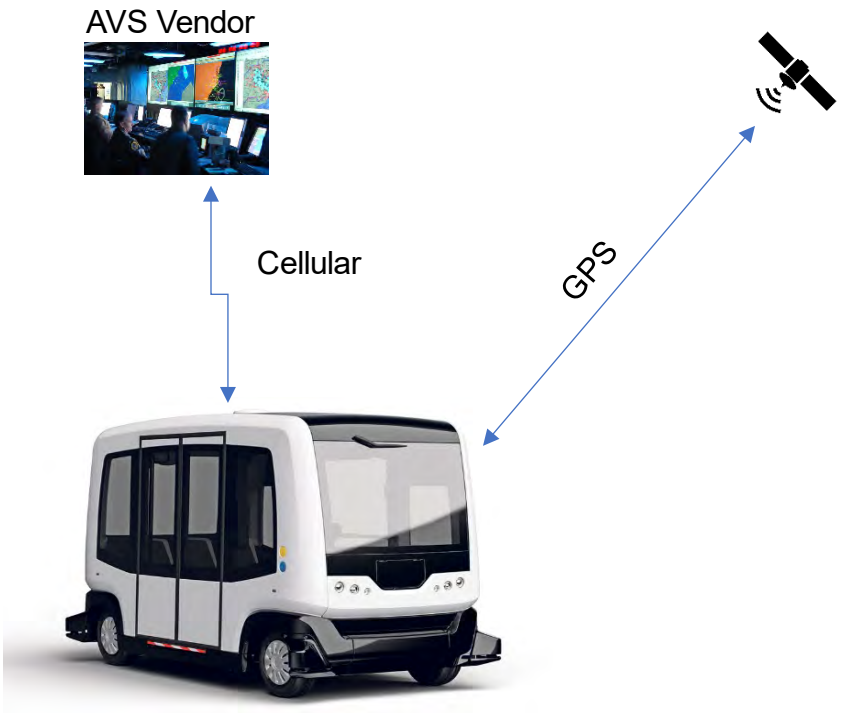
Maintaining the upgrades during the pilot will also be critical for sustained operational performance.

Communications

5.4.6 The AVS is expected to use 4G Long Term Evolution (LTE) and backhaul communications to facilitate the transfer of data associated with the system. 4G LTE is a wide-area wireless technology commonly used by transit agencies to provide communications between the transit management center and the AVS. 4G LTE communications are expected to be utilized for communications between the AVSs and the AVS Management System to support management of the service and any real-time information distribution. AVS status information, roadway conditions, and weather conditions will be transmitted via 4G LTE between the AVS and the AVS Management System. It is not anticipated that there will be communications between the AVS Management System and the communication centers of any other agencies. In the event of an emergency onboard the shuttle, the AVS Management System or onboard staff will contact the San Francisco Police Department to send first responders to the scene.

Satellite communications will be used for the transmission of time and location data from Global Navigation Satellite System (GNSS) satellites to the AVS. A high-level diagram of the communications is depicted in **Figure 1**.

Communications between other objects and users in the system will be physical in nature – this includes operations staff taking control of the AVS (when necessary), communications between operations staff and AVS passengers (on-board the AVS or at an AVS stop), route information on the AVS (static and audio), boarding and alighting the AVS, and the ability of the AVS to detect physical objects on the road and on the roadside.



Source: SFCTA

Figure 1: Proposed AVS System

5.4.7 Facilities

Based on the Route 25 Treasure Island line service map during the pilot and the preliminary shuttle routes, the AVSs will share stops with SFMTA buses. Any stops that will be served by the AVSs will need appropriate signage and need to be ADA accessible. SFMTA and TIDA will evaluate for ADA compliance and complete the associated work prior to the pilot.

A building for the purpose of maintenance, storage, and charging facility for the AVSs may be necessary. Electric utility service will be required for the charging stations.

The AVS Management System will be responsible for remote monitoring of the service and other administrative tasks. The AVS Management System will require an operations center for AVS service oversight. The maintenance, storage, and charging facility may also need to house the AVS Management System physical operations center. Alternatively, the operations center may be in a remote location maintained by the vendor. The staff in the operations center will be responsible for monitoring the status of the operations, managing the service, and communicating with concierge and passengers in the event of an incident. The back-office monitoring service will also serve to collect and forward all applicable data associated with operation of the AVS fleet.

Preliminary locations for the maintenance, storage, and charging facility may be the basement of One Avenue of the Palms or a temporary facility may be built in an empty parking lot on TI/YBI. Coordination with the vendor will be needed to select a location for the facility. The building or space will be made available by TIDA.

5.4.8 Customer Service & Incident Management

During operating service, incidents that are of potential concern often require a vehicle operator to radio for assistance. In an autonomous environment, vehicle operations could begin by hosting a concierge (operations staff) on each of the AVSs. For this pilot, the concierge and safety driver may be the same person. That person would play the role of the safety driver while the vehicle is in motion and the concierge while the vehicle is stopped. The focus of the dual role is safety, and protocols will be established so that safe operations are the priority.

5.4.9 Physical Security

The AVSs are expected to have an on-board mechanism such as a safety alert button that will allow passengers to communicate with the AVS Management System and operations staff if they believe their conditions are unsafe. This could include criminal activity and passenger medical emergencies, as well as AVS malfunctions. On-board operations staff or a concierge will be on board to fill this role and will need to be aware of any concerns, be cognizant of users' perspectives, and respond appropriately.

AVSs and their on-board devices and external detection equipment will need to be physically protected to reduce the chance of theft or unauthorized access to these devices. The proposed maintenance, storage, and charging facility by the vendors will fulfill this purpose during non-service hours. The AVSs will have on-board and external video cameras, as well as an on-board concierge, to ensure that the vehicle remains secure.

5.4.10 System / Data Security

The AVSs will not be able to be operated remotely due to the risks involved, including network security risks. Passengers will also not be able to steer the AVS while on board. If an on-board steering wheel and brakes are installed, it will be accompanied by trained operations staff.

The system will use LTE for monitoring the AVSs and receiving and providing real-time transit information. The system will adhere to security standards for LTE communications, including 3GPP TS 33.401 V14.2.0 (2017-03) – 3GPP System Architecture Evolution (SAE); Security architecture[7]. The system will also have to handle potential GPS spoofing, which will be supported by the redundant systems for vehicle routing and location detection.

5.5 Modes of Operation

The modes of operation, as introduced in Section 3.4, specifically for the new AVS system are as follows:

[7] https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=2296

Table 6: AVS System Modes of Operation

Mode	Definition
Mode 1: Normal Operating Conditions	Normal operating conditions. All AVSs in the fleet are operating on their routes as designed. The AVSs detect and respond to objects and other road users while they travel between stops. At the stops, the vehicle allows passengers to board and alight and offer visual and audible cues to passengers. The AVSs have the charge available to complete their operations. When scheduled charging does occur, an AVS returns to the storage area or to a charging station and safely obtains the needed charge. When daily operations are completed, all AVSs return to the storage area after allowing all on-board passengers to alight at their desired stop. If severe weather or another event occurs and the AVSs are safely taken out of operation before any incidents can occur, while the shuttle service is no longer operational, the AVSs are considered to be operating as intended.
Mode 2: Failure/ Degraded Conditions	Everyday operations have been degraded from the normal operational state. Degraded conditions include traffic causing the shuttle service to be behind schedule, high demand causing the AVS to be at or above capacity, or an AVS running out of charge unexpectedly and needing to return to a charging station immediately. It also includes a system component, such as the automatic charging capability, not working as designed and the system needing to revert into a lower state, in this case manual fueling. The degraded mode also includes passenger safety issues that have caused a passenger alert to be called to the AVS Management System, or the AVS Management System otherwise being alerted that the AVS needs additional monitoring or for operations staff to assist. Severe weather conditions that impact the safety of the vehicles are also included if the AVS is not removed at the point conditions reach an unsafe state outside the scope of the AVS's safe operating conditions. A failure condition occurs if the AVS is not able to make it to a charging station before losing charge, if the AVS has an interaction with a public safety official who believes it is operating in an unsafe manner, if there is an AVS malfunction that could cause additional issues, or if a collision involving the AVS or another incident has occurred. In these cases, operations staff will need to be involved for the AVS to return to a degraded or operational state. In the event of a collision or other incident involving the AVS, operations will be suspended until a cause and mitigation can be established. In the event that AVS operations are suspended, backup non-AV shuttle transportation will be provided by the AVS vendor.
Mode 3: Maintenance Conditions	The AVSs will be regularly checked for any issues. If an issue is detected during routine maintenance, a preventative measure must be scheduled. If an emergency breakdown occurs, the AVS will be taken out of service and repaired by the appropriately trained entity. If operations are ongoing and a spare AVS is available, the AVS undergoing maintenance will become the spare vehicle and service will continue as regularly scheduled.

Source: SFCTA

Users and Other Involved Personnel

Users for the new AVS system are presented in **Table 7**.

Table 7: Users and Applicable Groups

Users	Applicable Groups	Role
AVS Passengers	TI/YBI Residents, Employees, and Visitors	Service user
AVS Management System	Transportation Operations and Management Entity	Manage service operations and data
Operations Staff	Staff hired by the AVS Management System to perform tasks for the AVS that require human assistance, including concierge and safety driver roles. This also includes maintenance staff for maintaining and charging the vehicles.	Assist passengers and operate AVS

Source: SFCTA

Other involved personnel, who are not direct users of the AVSs but will interact with the AVS system include:

Table 8: Other Involved Personnel

Users	Applicable Groups	Role
Bicyclist	Other TI/YBI Residents, Employees, and Visitors	Interact with AVS
Pedestrian	Other TI/YBI Residents, Employees, and Visitors	Interact with AVS
Emergency Vehicle / Emergency Vehicle Operator	Police (San Francisco Police Department), Ambulance, Fire (San Francisco Fire Department)	Respond to incidents
SFMTA	Sustainable Streets, Accessible Services, Transit, System Safety, Information Technology	Operate Muni service
SFCTA	Planning, Capital Projects, Finance and Administration	Project management, funding, and planning
TIDA	Development, Construction and ongoing operations (events, etc.)	Manage development, construction, and ongoing island operations
TICD	Development, Construction	Manage development and construction

Source: SFCTA

Support Environment

The project will be supported by several local and federal agencies. These agencies will support various roles during pilot development and delivery. **Table 9** shows the roles of these agencies.

Table 9: Support Environment

Pilot Development/Delivery	Lead Agency	Support Agency
Conceptual Design	TIMMA (Approver)	TIDA/SFMTA
Concept of Operations	TIMMA	SFMTA/TIDA/FHWA(Approver)
Route Planning	TIDA	TIMMA/SFMTA
Requirements	TIMMA	SFMTA/TIDA
RFP Development	TIMMA	SFMTA/TIDA
Procurement	TIMMA	SFMTA/TIDA
Supply AVS (including all required systems)	Shuttle Vendor	
Testing	Shuttle Vendor	TIMMA/TIDA
AVS Operations	Shuttle Vendor	TIMMA/TIDA
AVS Maintenance	Shuttle Vendor	TIMMA/TIDA
AVS Operations Staff	Shuttle Vendor	
AVS Processes and Procedures	Shuttle Vendor	TIMMA, SFMTA, TIDA

Source: SFCTA

All the operational and support environment including equipment, facilities, computer hardware, software, personnel, operational procedures, maintenance, and disposal will be shuttle vendor's responsibility.

6 Operational Scenarios

This section presents scenarios that capture how the system serves the needs of users and protects all road users when the system is operating under various modes of operation. Each scenario lists objectives, users, flow of events, post-conditions, related policies and business rules, user needs traceability, and a summary of inputs and outputs. The preconditions describe the state of the environment at the onset of the scenario, and the events describe the various events that occur, and actions taken by users and the system. Various scenarios for each use case describe various modes of operations that are expected: normal operating conditions and degraded and/or failure conditions as necessary.

The operational scenarios are intended to depict generally expected scenarios that the AVS may encounter. The scenarios are not intended to be a comprehensive or complete list of possible scenarios.

Six use cases are described in this document:

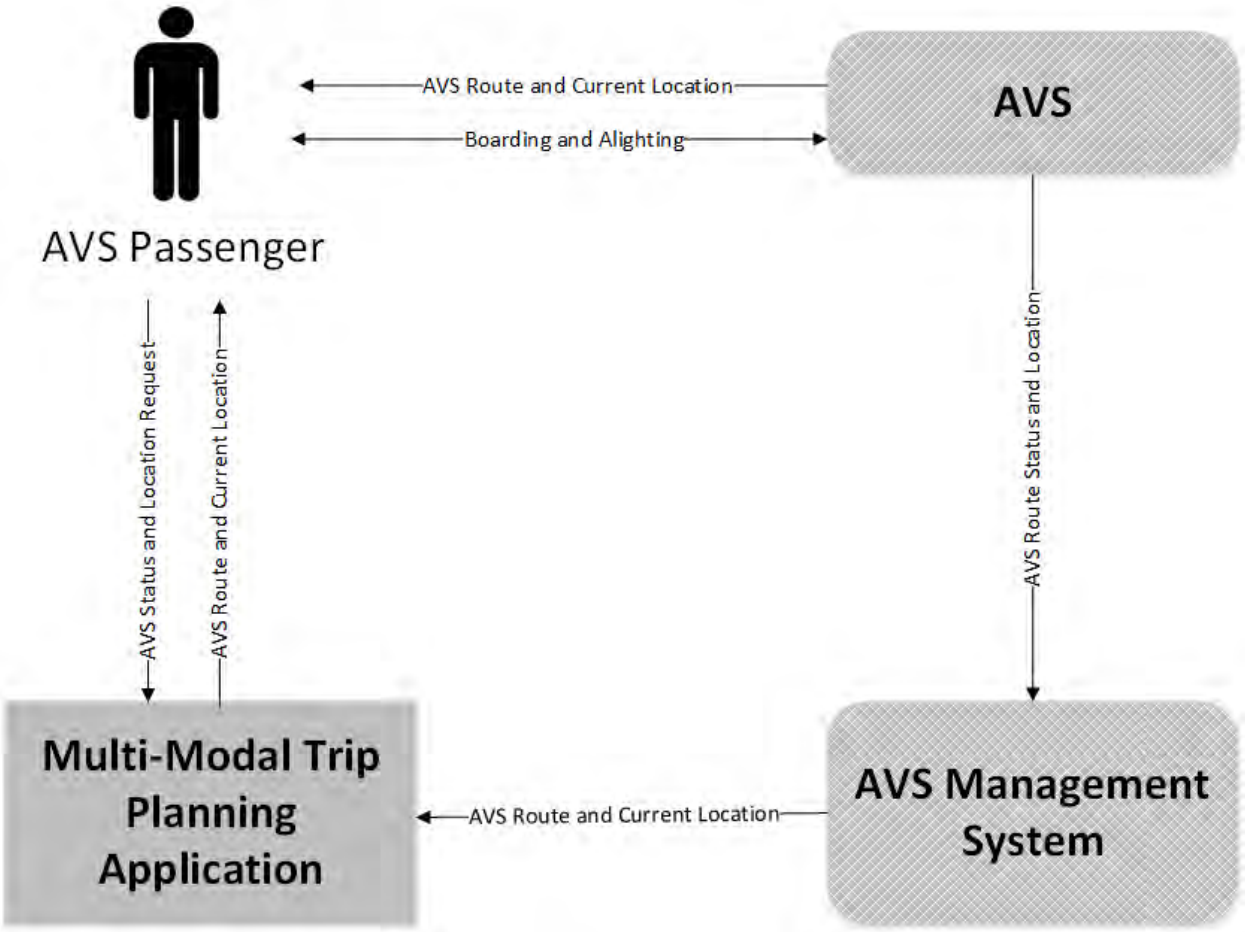
- Use Case 1: Taking an AVS Trip
- Use Case 2: Battery Energy Management and Recharging
- Use Case 3: Mixed Traffic Operations
- Use Case 4: Roadway Object Detection and Reaction
- Use Case 5: Crash Detection and Mitigation
- Use Case 6: AVS Operations Management

Note: During the pilot, the vehicle concierge or safety driver (human operator) will take the role of the Operations Staff and certain functions of the AVS Management System.

Some user needs are universal in nature and are not included in the scenarios for simplicity. Specifically, AVS-UN024-v01 (Operational Design Domain) is not included because the AVS needs to constantly monitor its environment to ensure it is operating in its intended operational design domain. As part of the RFP, the vendor will need to ensure that the operational design domain of their AVSs are compatible with the environment in which they will be operating on TI, including terrain, lighting, weather, and other operational design domain features. AVS-UN030-v01 (Data Transfer) in not included because the AVS and AVS Management System need to transfer data to enable most service functionality.

6.1 Use Case 1: Taking an AVS Trip

This section describes the scenario where a user takes an AVS trip.



(Multi-Modal Trip Planning Application is optional)

Source: SFCTA

Figure 2: Use Case 1: Taking an AVS Trip Diagram

Table 10: Use Case 1 Scenario 1: Normal Operating Conditions – Passenger Pick Up and Drop Off

Use Case	Taking an AVS Trip
Scenario ID & Title	*UC1-S1: Normal Operating Conditions – Passenger Pick Up and Drop Off*
Scenario Objective	• Provision of shuttle service using AVS to an AVS passenger
Operational Event(s)	• The AVS stops at an AVS shuttle stop (either by stopping at every stop or optionally on-demand), allows an AVS passenger to board the AVS, and proceeds along its route • The AVS passenger communicates to the AVS (possibly by push button) that he or she would like to alight at the next stop (optional) • The AVS stops at the next stop and the AVS passenger alights

Use Case	Taking an AVS Trip			
Actor(s)	Actor	Role		
	AVS Passenger	Board and alight AVS at the proper AVS shuttle stops		
	AVS	Stop to pick up passengers, stop to drop off passengers, wait for passengers to complete boarding and alighting before resuming along route, safely interact with traffic stream while pulling into and out of AVS shuttle stops		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS Passenger	1	Waiting at AVS Shuttle Stop 1	Possibly after having accessed AVS Trip Planning information, including route and schedule, via static roadside schedules or optionally real-time data on a mobile device or computer.
	AVS	2	Approaches AVS Shuttle Stop 1 and pulls into the stop area	On a bay or shoulder to the right of travel lanes. The AVS will stop at each stop for fixed-route operations or optionally be summoned for on-demand operations.
	AVS	3	Opens door	To allow AVS passenger to board and other passengers to alight
	AVS Passenger	4	Boards AVS	In case the passenger has a bicycle (or other equipment (wheelchair, walker, stroller, etc.), he or she loads into the AVS prior to boarding.
	AVS	4a	Counts boarding passengers	Counts passenger boarding the AVS using an APC or recorded by concierge.
	AVS	5	Closes door	After detecting that no additional passengers are still boarding or alighting or after a predetermined

Use Case	Taking an AVS Trip			
				interval with a sensor override
	AVS	6	Merges back into traffic stream	After detecting that it is safe to do so
	AVS	7	Continues along route	Stopping at every stop along the route (unless an optional boarding request system is added). This is also where other operational scenarios take place. AVS makes sound and emits lights to let others know of its presence. AVS also has a controlled climate within the vehicle.
	AVS	8	Makes an internal audio and visual display announcement to passengers that the AVS is approaching the next AVS shuttle stop	
	AVS	9	Approaches the next AVS shuttle stop and pulls into stop area (if there was another vehicle, AVS will wait for its turn at the curb).	
	AVS	10	Opens door	To allow AVS passenger to exit, and perhaps to allow other passengers to board
	AVS Passenger	11	Alights AVS	In case the passenger has a bicycle or other equipment (wheelchair, walker, stroller, etc.), he or she unloads into the AVS after alighting.
	AVS	11a	Counts alighting passengers	Counts passenger alighting the AVS using APC or recorded by concierge.
	AVS	12	Closes door	

Use Case	Taking an AVS Trip			
	AVS	13	Merges back into traffic stream	After detecting that it is safe to do so
	AVS	14	Continues along route	
Post-conditions	AVS passengers are transported from origin to destination AVS shuttle stop			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN001-v01 – Boarding AVS AVS-UN002-v01 – Alighting AVS AVS-UN003-v01 – Traveler Information AVS-UN005-v01 – Concierge AVS-UN007-v01 – Stop for Passenger Boarding AVS-UN008-v01 – Stop for Passenger Alighting AVS-UN009-v01 – Ridership Data AVS-UN011-v01 – Quiet Car Alert AVS-UN013-v01 – Transportation Management System AVS-UN015-v01 – Law Following – Open Traffic Environment AVS-UN025-v01 – Climate Control AVS-UN038-v01 – Manual Data Collection			
Inputs Summary	System Initialization Input: AVS route set at time of configuration and advertised to potential passengers Human Inputs: Boarding and alighting requests (optional)			
Output Summary	AVS Data: Passenger counts, including number of bicycles, strollers, wheelchairs, and other equipment and number of users who couldn't board due to capacity; miles driven; dwell time at each stop Survey Data: Perceived personal safety and overall system safety when riding or encountering shuttle (to be collected by operations staff) Operations Data: Annualized operating expenses (to be collected by vendor and SFCTA)			

770 *Source: SFCTA*

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772 **Table 11: Use Case 1 Scenario 2: Normal Operating Conditions – Problem on Board**

Use Case	Taking an AVS Trip
Scenario ID & Title	*UC1-S2: Normal Operating Conditions – Problem on Board*
Scenario Objective	• Provide an opportunity for AVS passengers to alert the AVS Management System if there is a problem on board the AVS *Note: This situation is applicable for a future scenario when there is no vehicle concierge on board. When the vehicle concierge is onboard, he/she will play the role of AVS Management System/Operations Staff.*

Use Case	Taking an AVS Trip			
Operational Event(s)	• While taking an AVS trip, an AVS passenger senses a problem on board • The AVS passenger presses the safety alert button • The AVS Management System is alerted and informs operations staff, who communicate with the AVS passenger, and decide how to intervene			
Actor(s)	Actor	Role		
	AVS Passenger	Alert AVS Management System of problem onboard		
	AVS Management System	Receive alert and relay to operations staff		
	Operations Staff	Respond to AVS passenger, determine the extent of the problem, and respond appropriately		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS Passenger	1	Takes an AVS trip	Currently on board the AVS
	AVS Passenger	2	Senses there is a problem on board	For example, crime or health issue for another passenger
	AVS Passenger	3	Presses Passenger Alert Button	Installed onboard the AVSs
	AVS Management System	4	Sees Passenger Alert Button was pressed, alerts operations staff	
	AVS	4a	The vehicle determines a safe and legal location to come to an immediate safe stop.	
	Operations Staff	5	Contacts AVS passenger	Perhaps through speakers on board AVS. Alternatively, AVS operator staff in the vehicle can assist the passenger.
	Operations Staff	6	Reviews current and recent footage from security camera, if connectivity allows	To further assess the situation, video from the camera will be stored. Footage review could also take place after Step 8.
	Operations Staff	7a	Realizes AVS passenger pressed button with a valid concern	
	Operations Staff	8a	Responds appropriately by contacting the relevant authorities or stepping in manually	

Use Case	Taking an AVS Trip			
	Operations Staff	7b	Realizes AVS passenger pressed button by mistake or with an invalid concern (such as uneasiness with a safe function of the AVS)	
	Operations Staff	8b	Reassures passenger but does not step in or contact authorities	
Post-conditions	• Operations staff can step in and resolve the situation the AVS passenger is sensing on board the AVS			
Policies and Business Rules	SFCTA Video Retention Policy. While AVS is in operation, Management staff to be on-call and operations staff on the island.			
User Needs Traceability	AVS-UN004-v01 – Passenger Safety Alert AVS-UN005-v01 – Concierge AVS-UN014-v01 – Security Camera AVS-UN022-v01 – Disengagement Mechanism			
Inputs Summary	System Initialization Input: Program Passenger Alert Button to contact the AVS Management System when pressed Human Inputs: Communication between AVS passenger and operations staff			
Output Summary	AVS Data: Record that operations staff may have had to intervene (Disengagement data with timestamp, location, and cause); scheduled hours of operation; actual hours of operation			

773 *Source: SFCTA*

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Table 12: Use Case 1 Scenario 3: Normal Operating Conditions – ADA Accessibility

Use Case	Taking an AVS Trip			
Scenario ID & Title	*UC1-S3: Normal Operating Conditions – ADA Accessibility*			
Scenario Objective	• Allow an AVS passenger in a wheelchair or with limited mobility to communicate to the AVS that it should provide assistance so he or she can board and alight more easily			
Operational Event(s)	• The AVS stops at an AVS shuttle stop, and a boarding AVS passenger requests ADA assistance. The AVS provides assistance and the AVS passenger boards. • The AVS continues its route • The AVS passenger communicates to the AVS that he or she would like to alight at the next stop and requests ADA assistance. The AVS stops at the next stop, provides assistance, and the AVS passenger alights.			
Actor(s)	Actor	Role		
	AVS Passenger	Board and alight the AVS		
	AVS	Allow passengers with limited mobility to board and alight the AVS		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Arrives at stop and opens door	
	AVS Passenger	2	Communicates to AVS that it should provide ADA assistance	Likely with a button near the door of the AVS or with a verbal command
	AVS	3	Provides assistance	Perhaps by lowering a ramp or "kneeling", if required, and providing audible guidance.
	AVS Passenger	4	Boards AVS	The passenger or concierge secures the wheelchair as applicable and verifies that the passenger is secure.
	AVS	5	Resets AVS	For example, by retracting ramp
	AVS	6	Closes door	
	AVS	7	Merges back into traffic stream	After detecting that it is safe to do so
	AVS Passenger	8	Indicates when AVS is approaching stop he/she would like to get off at, and requests ADA assistance	
	AVS	9	Arrives at stop, opens door, and provides ADA assistance	

Use Case	Taking an AVS Trip			
	AVS Passenger	10	Alights AVS	
Post-conditions	• AVS passenger could board and alight the AVS and has been transported to their intended destination			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN006-v01 – ADA Accessibility AVS-UN010-v01 – ADA Accessibility AVS-UN036-v01 – Assistance for People with Disabilities			
Inputs Summary	System Initialization Input: ADA assistance request capability will need to be set up for boarding and alighting passengers Human Inputs: None (may be needed during the pilot depending on pilot capabilities)			
Output Summary	AVS Data: Passenger counts, including how many passengers requested ADA assistance and how many disabled passengers could board and be secured without assistance			

776 *Source: SFCTA*

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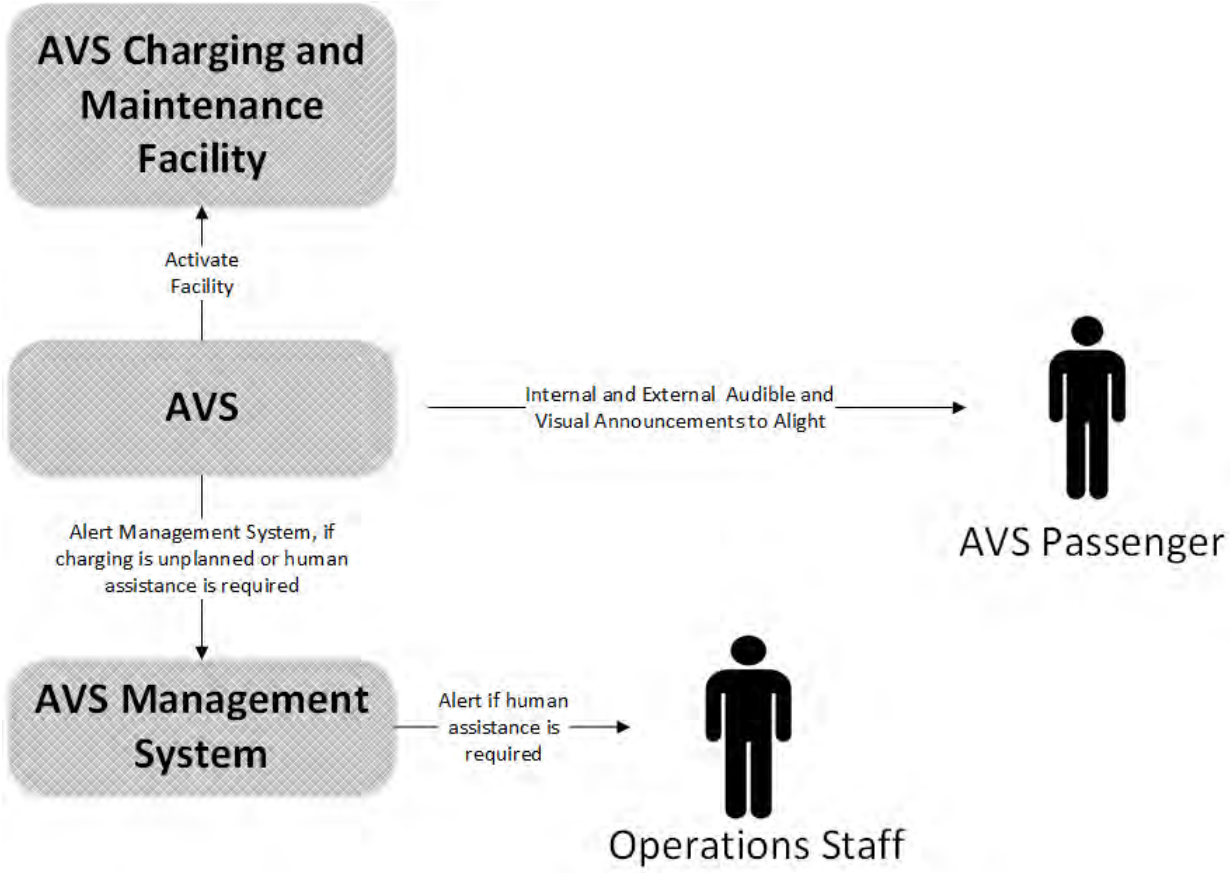
6.2 Use Case 2: Battery Energy Management and Recharging

This section describes scenarios concerning AVS charging and battery management.



Source: SFCTA

Figure 3: Use Case 2: Battery Energy Management and Recharging Diagram

784 **Table 13: Use Case 2 Scenario 1: Normal Operating Conditions – Manual/Automated End of**
785 **Route Recharging**

Use Case	Battery Energy Management and Recharging			
Scenario ID & Title	*UC2-S1: Normal Operating Conditions – Manual/Automated End of Route Recharging*			
Scenario Objective	• Automatically recharge the AVS battery at the end of a route (nearest storage area or charging station) at the end of service *Note: This Use Case assumes that the vehicle will be battery-powered and will require periodic recharging*			
Operational Event(s)	• The AVS arrives at the stop in its route closest to the charging facility and determines if scheduled charging will be required the next time it reaches this stop • The AVS completes a full loop of its route with an alert (through audio and updates on screen monitor) to AVS passengers that it will be taken out of service for charging at that stop • The AVS arrives at that stop and determines if all passengers have exited the AVS • The AVS travels to the storage area for recharging			
Actor(s)	Actor	Role		
	AVS	Navigate to charging area when necessary		
	AVS Passenger 1, AVS Passenger 2	Exit the AVS at or before the end of AVS service		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches AVS Shuttle Stop 1, the stop of the AVS route closest to the charging facility	May also be the final stop of the route
	AVS	2	Determines that the AVS is approaching the end of its service period and that the next service loop will be its last for the day	
	AVS	3	Changes external electronic sign to indicate that the AVS will return to the charging station at the beginning of the loop, and produces an internal audible announcement at every stop that the vehicle will only travel as far as AVS Shuttle Stop 1	
	AVS	4	Continues along route	
	AVS	5	Arrives at AVS Shuttle Stop 1	
	AVS	6	Makes an external audio announcement to waiting passengers not to board the AVS	

Use Case	Battery Energy Management and Recharging			
	AVS	7	Opens door to allow passengers to alight	
	AVS Passenger 1	8	Alights the AVS	
	AVS Passenger 2	9	Boards the AVS	
	AVS	10	Uses internal sensors to detect if there are no AVS passengers remaining	Detects that AVS passenger 2 is still on the AVS
	AVS	11	Waits with door open, and makes an internal and external audio announcement to passengers that all passengers must exit the AVS	
	AVS Passenger 2	12	Alights the AVS	Could board next AVS
	AVS	13	Returns to charging facility	May also be maintenance facility and storage space
	AVS	14	Navigates to the manual/automatic charging point	
	AVS	15a	Remains connected to manual/automatic charger until beginning of the next service period	
	AVS	15b	Remains connected to manual/automatic charger until it has enough energy to complete the remainder of service period	
	AVS	16	Leaves the charging facility and travels to AVS Shuttle Stop 1	Normal service resumes
Post-conditions	• AVS has enough energy to complete its next loop, minimizing service disruptions			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN012-v01 – Manual Fueling AVS-UN028-v01 – End of Service Period AVS-UN031-v01 – AVS Charge AVS-UN033-v01 – Managed AVS Charging			
Inputs Summary	System Initialization Input: reserve energy required to allow AVS to start and complete a new route Human Input: None			
Output Summary	AVS Data: record of charging time; scheduled hours of operation			

Source: SFCTA

Table 14: Use Case 2 Scenario 2: Degraded Conditions –Automated End of Route Recharging

Use Case	Battery Energy Management and Recharging			
Scenario ID & Title	*UC2-S2: Degraded Conditions – Automated End of Route Recharging*			
Scenario Objective	• Automatically recharge the AVS battery at the end of a route (nearest storage area or charging station) when current battery level will not allow AVS to complete the next route *Note: This Use Case assumes that the vehicle will be battery-powered and will require periodic recharging*			
Operational Event(s)	• The AVS arrives at the stop in its route closest to the charging facility and determines if charging will be required the next time it reaches this stop • The AVS completes a full loop of its route with an alert (through audio and updates on screen monitor) to AVS passengers that it will be taken out of service for charging at that stop • The AVS arrives at that stop and determines if all passengers have exited the AVS • The AVS travels to the storage area for recharging			
Actor(s)	Actor	Role		
	AVS 1, AVS 2	Navigate to charging area when necessary, even if unscheduled		
	AVS Passenger 1, AVS Passenger 2	Exit the AVS at or before the end of AVS service		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS 1	1	Approaches AVS Shuttle Stop 1, the stop of the AVS route closest to the charging facility	May also be the final stop of the route
	AVS 1	2	Determines that the AVS does not have enough of a charge to complete another loop after the loop it is about to begin	Charge must also include reserve
	AVS 1	3	Changes external electronic sign to indicate that the AVS will return to the charging station at the beginning of the loop, and produces an internal audible announcement at every stop that the vehicle will only travel as far as AVS Shuttle Stop 1	
	AVS 1	4	Continues along route	
	AVS 1	5	Arrives at AVS Shuttle Stop 1	
	AVS 1	6	Makes an external audio announcement to waiting passengers not to board the AVS	

Use Case	Battery Energy Management and Recharging			
	AVS 1	7	Opens door to allow passengers to alight	
	AVS Passenger 1	8	Alights the AVS	
	AVS Passenger 2	9	Boards the AVS	
	AVS 1	10	Uses internal sensors to detect if there are no AVS passengers remaining	Detects that AVS Passenger 2 is still on the AVS
	AVS 1	11	Waits with door open, and makes an internal and external audio announcement to passengers that all passengers must exit the AVS	
	AVS Passenger 2	12	Alights the AVS	Could board next AVS
	AVS 1	13	Returns to charging facility	May also be maintenance facility and storage space
	AVS 1	14	Navigates to the automatic charging point	
	AVS 1	15	Remains connected to automatic charger until beginning of the next service period	
	AVS 2	15a	Leaves the charging facility and travels to AVS Shuttle Stop 1	Normal service resumes
Post-conditions	• AVS has enough energy to complete its next loop, minimizing service disruptions			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN012-v01 – Manual Fueling AVS-UN028-v01 – End of Service Period AVS-UN031-v01 – AVS Charge AVS-UN033-v01 – Managed AVS Charging			
Inputs Summary	System Initialization Input: reserve energy required to allow AVS to start and complete a new route Human Input: None			
Output Summary	Message from AVS to AVS Management System if unplanned charging event will occur AVS Data: record of unplanned charging events, calculation of vehicle efficiency to help prevent future unplanned charging events; scheduled hours of operation; actual hours of operation			

788 *Source: SFCTA*

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790 **Table 15: Use Case 2 Scenario 3: Degraded Conditions – Manual End of Route Recharging**

Use Case	Battery Energy Management and Recharging			
Scenario ID & Title	*UC2-S3: Degraded Conditions – Manual End of Route Recharging*			
Scenario Objective	• Manually recharge the AVS battery when automatic charging capability is not possible *Note: This Use Case assumes that the AVS will be battery-powered and will require periodic recharging*			
Operational Event(s)	• Malfunctioning automatic charger • This scenario replaces Steps 15-16 in the fully operational scenario for this use case			
Actor(s)	Actor	Role		
	AVS	Successfully connect to a charger, even if it requires human assistance		
	AVS Management System	Manage the charging of the AVSs		
	Operations Staff	Assist with manual fueling of the AVSs		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Detects that automatic charger is not active (or the feature is unavailable)	
	AVS	2	Notifies the AVS Management System that automatic charging is not working	
	AVS Management System	3	Assigns operations staff to manually attend to the AVS	
	Operations Staff	4	Manually plugs in the AVS	
	AVS	5a	Detects that battery charge is sufficient to continue operations	
	AVS	5b	Detects that the battery is fully charged	
	AVS	6	Notifies the AVS Management System to unplug the AVS	So that it can continue service
	AVS Management System	7	Assigns operations staff to manually attend to the AVS	

Use Case	Battery Energy Management and Recharging			
	Operations Staff	8	Manually unplugs the AVS	
	AVS	9	Detects that it is no longer plugged in	
	AVS	10	Leaves the charging facility and travels to the first stop along the route	Normal service resumes
Post-conditions	• AVS has enough energy to complete its next route, minimizing service disruptions			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN012-v01 – Manual Fueling AVS-UN031-v01 – AVS Charge AVS-UN033-v01 – Managed AVS Charging			
Inputs Summary	*Same as Inputs for Normal Operating Conditions scenario*			
Output Summary	Message from AVS to AVS Management System for manual charging assistance AVS Data: record of automatic charger downtime; scheduled hours of operation; actual hours of operation			

791 *Source: SFCTA*

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793 **Table 16: Use Case 2 Scenario 4: Degraded Conditions – Inadequate Battery Energy During**
794 **Service**

Use Case	Battery Energy Management and Recharging	
Scenario ID & Title	*UC2-S4: Degraded Conditions – Inadequate Battery Energy During Service*	
Scenario Objective	• Demonstrate ability of AVS to navigate to a safe location to await operations staff assistance when in the middle of a route and current battery level will not allow AVS to complete route *Note: This Use Case assumes that the AVS will be battery-powered and will require periodic recharging. This scenario is also applicable for any other maintenance issues.*	
Operational Event(s)	• AVS does not have enough charge to complete its route and must navigate to a safe location and await assistance	
Actor(s)	Actor	Role
	AVS Passenger	Not get stranded on an AVS that is not able to complete route due to a drained battery, especially in an unsafe area, such as the roadway
	AVS	Navigate to safe area when necessary

Use Case	Battery Energy Management and Recharging			
	AVS Management System	Assign operations staff to provide response to AVS when necessary		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Is in the middle of the AVS route	
	AVS	2	Detects that it will not be able to complete its current loop with the current energy level	
	AVS	3	Notifies the AVS Management System that the AVS will not be able to reach the end of this route loop	Alternatively, operations staff could make this determination
	AVS	4	Makes an internal audio announcement to passengers that all passengers must exit the AVS at the next stop due to a maintenance issue	
	AVS	5	Arrives at the next AVS shuttle stop	
	AVS	6	Opens door to allow passengers to alight	
	AVS Passenger	7	Alight the AVS	May wait for next AVS or walk to destination
	AVS	8	Uses internal sensors to detect if there are no AVS passengers remaining	No passengers remain
	AVS	9	Closes door	If possible, so that no other passengers can board
	AVS	10a	Remains at this AVS shuttle stop	If this AVS shuttle stop is not in a lane of travel
	AVS	10b	Moves from the AVS shuttle stop to the next-available roadway shoulder	If this AVS shuttle stop is in a lane of travel, and shoulder is available. Operations staff could alternatively do this.

Use Case	Battery Energy Management and Recharging			
	AVS	10c	Moves from the AVS shuttle stop into the next parking lot to park	If this AVS shuttle stop is in a lane of travel, and no shoulder is available, or a parking lot is closer. Operations staff could alternatively do this.
	AVS Management System	11	Assigns operations staff to provide a response to the AVS	
Post-conditions	• AVS passenger is safely able to exit the AVS and informed of options to complete trip • The AVS Management System is notified of the low/empty battery or other maintenance issues and provides an appropriate response to get the AVS fit for normal operating mode			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment AVS-UN033-v01 – Managed AVS Charging			
Inputs Summary	*Same as Inputs for Normal Operating Conditions scenario*			
Output Summary	Message from AVS to AVS Management System of the stop location of the disabled AVS AVS Data: record of unplanned charging incident; scheduled hours of operation; actual hours of operation			

795 *Source: SFCTA*

796

797 **Table 17: Use Case 2 Scenario 5: Failure Conditions – Loss of Battery Energy During Service**

Use Case	Battery Energy Management and Recharging
Scenario ID & Title	*UC2-S5: Failure Conditions – Loss of Battery Energy During Service*
Scenario Objective	• Coming to a safe stop in an unsafe environment due to a complete loss of power *Note: This Use Case assumes that the AVS will be battery-powered and will require periodic recharging. This scenario is also applicable for any other maintenance issues.*

Use Case	Battery Energy Management and Recharging			
Operational Event(s)	• AVS needs to come to a safe stop due to loss of battery charge while en-route or any other maintenance issues.			
Actor(s)	Actor	Role		
	AVS Passenger	Not get stranded on an AVS that is not able to complete route due to a drained battery, especially in an unsafe area, such as the roadway		
	AVS	Navigate to charging area when necessary		
	AVS Management System	Manage the energy of batteries on all AVSs		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Is in the middle of the AVS route	
	AVS	2	Loses primary power	
	AVS	3	Comes to an immediate stop, ideally by pulling over to the side of the road	Switches to secondary backup power
	AVS	4	Notifies the AVS Management System that the AVS will not be able to reach the end of this route loop	Using secondary backup power
	AVS	5	Makes an internal audio announcement to passengers that all passengers must exit the AVS due to a maintenance issue	Using secondary backup power
	AVS	6a	Opens door to allow passengers to alight	Using secondary backup power
	AVS Passenger	6b	Force door open	If no secondary backup power remains
	AVS Passenger	7	Alight the AVS	May wait for next AVS or walk to destination
	AVS Management System	8	Provides a response to the AVS	
Post-conditions	• AVS passenger must safely exit the AVS • The AVS stops in a location where it impedes traffic flow and may cause a hazard for other road users • The AVS Management System is notified of the loss of battery power and provides an appropriate response to get the AVS recharged and back to a normal operating mode. • San Francisco Police Department is notified by AVS Management System. Law enforcement officials may need to be involved to direct other traffic around disabled AVS.			

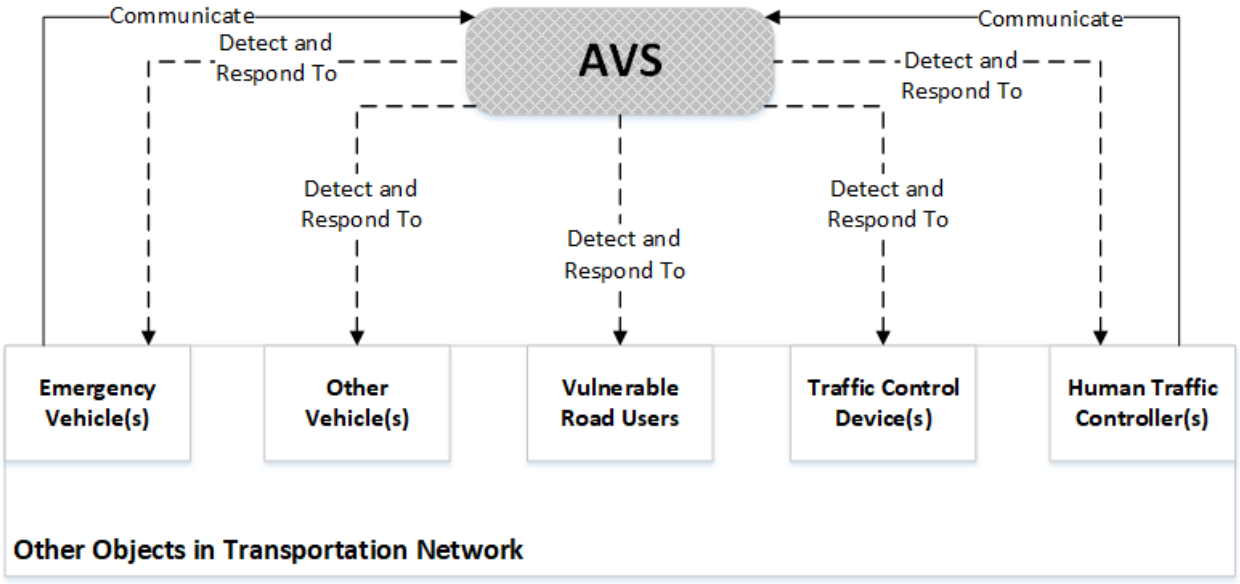
Use Case	Battery Energy Management and Recharging
Policies and Business Rules	*None*
User Needs Traceability	AVS-UN033-v01 – Managed AVS Charging
Inputs Summary	*Same as Inputs for Normal Operating Conditions scenario*
Output Summary	Message from AVS to AVS Management System of the location of the disabled AVS AVS Data: record of unplanned incident on the roadway; scheduled hours of operation; actual hours of operation

798 *Source: SFCTA*

799

Use Case 3: Mixed Traffic Operations

This section describes scenarios where an AVS operates safely in mixed traffic, obeying all applicable laws and regulations.



Source: SFCTA

Figure 4: Use Case 3: Mixed Traffic Operations Diagram

Table 18: Use Case 3 Scenario 1: Normal Operating Conditions – Intersection Navigation

Use Case	Mixed Traffic Operations			
Scenario ID & Title	*UC3-S1: Normal Operating Conditions – Intersection Navigation*			
Scenario Objective	• Demonstrate ability of the AVS to detect intersection type, traffic conditions, all roadway users, assess right-of-way, and complete a movement through an intersection along the direction of the route			
Operational Event(s)	• AVS approaches an intersection and navigates through safely			
Actor(s)	Actor	Role		
	AVS	Safely navigate an intersection		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches intersection	
	AVS	2a	Detects that the AVS is on an uncontrolled approach	
	AVS	3a	Detects whether other intersection approaches are uncontrolled or	

Use Case	Mixed Traffic Operations			
			stop-controlled, detects if there are any other road users at the intersection, and makes appropriate right-of-way decisions	
	AVS	4a	Safely proceeds through the intersection and continues its route	
	AVS	2b	Detects that the AVS is on a stop-controlled approach	
	AVS	3b	Detects whether other intersection approaches are uncontrolled or stop-controlled, detects if there are any other road users at the intersection, and makes appropriate right-of-way decisions	
	AVS	4b	Safely proceeds through the intersection and continues its route	
Post-conditions	• The AVS proceeds safely through the intersection and continues its route			
Policies and Business Rules	California Vehicle Code			
User Needs Traceability	AVS-UN015-v01 – Law-Following – Open Traffic Environment AVS-UN016-v01 – Law Following – Regulatory			
Inputs Summary	System Initialization Input: Right-of-way rules and hierarchy to be programmed into AVS in compliance with US laws, regulations, and normal travel behavior Human Input: None			
Output Summary	AVS Data: Record of decisions made, record of accurate object classification and path prediction			

Source: SFCTA

Table 19: Use Case 3 Scenario 2: Degraded Conditions – Intersection Navigation – Malfunctioning Sensor

Use Case	Mixed Traffic Operations
Scenario ID & Title	*UC3-S2: Degraded Conditions – Intersection Navigation – Malfunctioning Sensor*
Scenario Objective	• Demonstrate fall back condition should the AVS have a malfunctioning sensor diminishing its ability to detect objects

Operational Event(s)	• AVS approaches an intersection with a malfunctioning sensor			
Actor(s)	Actor	Role		
	AVS	Safely navigate an intersection		
	Other Vehicle	Safely navigate an intersection		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches intersection	
	AVS	2	Detects that its sensor is malfunctioning.	
	AVS	3	Comes to a safe stop at next legal and safe location. (AVS may use the secondary sensor to navigate to the safe stop)	
	AVS	4	Alerts AVS Management System and passengers to potential issue and wait for further instructions	
	AVS	5	Prior to coming to safe stop, if it senses potential crash, reacts appropriately to avoid or minimize human injuries	
Post-conditions	• The AVS Management System is notified of the issue and holds the AVS at a stop until the sensor can be fixed			
Policies and Business Rules	California Vehicle Code Division 11 Chapter 2 – Traffic Signs, Signals, and Markings			
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment AVS-UN019-v01 – Crash Avoidance			
Inputs Summary	System Initialization Input: Right-of-way rules and response algorithm to be programmed into AVS in compliance with US laws, regulations, and normal travel behavior Human Input: None			
Output Summary	AVS Data: Record of decisions made, record of reason for malfunction, record of stop location and decision process for location choice			

Source: SFCTA

Table 20: Use Case 3 Scenario 3: Normal Operating Conditions – Regulatory and Warning Signs and Pavement Markings

Use Case	Mixed Traffic Operations
Scenario ID & Title	*UC3-S3: Normal Operating Conditions – Regulatory and Warning Signs and Pavement Markings*
Scenario Objective	• Demonstrate ability of the AVS to detect and properly interpret traffic control devices specified in the MUTCD

Use Case	Mixed Traffic Operations			
Operational Event(s)	• The AVS detects and correctly responds to roadway signage, including regulatory and warning signs, pavement markings, and temporary traffic control devices			
Actor(s)	Actor	Role		
	AVS	Detect signs, pavement markings, and temporary traffic control devices, adjust driving behavior accordingly		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1a	Detects a regulatory sign	
	AVS	2a	Comprehends sign information	
	AVS	3a	Uses information to understand what it must or should do (or not do) under a given set of circumstances	
	AVS	1b	Detects a warning sign	
	AVS	2b	Comprehends sign information	
	AVS	3b	Uses information to understand conditions that might call for a reduction of speed or an action in the interest of safety and efficient traffic operations	
	AVS	1c	Detects a pavement marking	
	AVS	2c	Comprehends pavement marking information	
	AVS	3c	Uses information to understand pavement and curb boundaries, boundary types, regulation, guidance, and warnings	
	AVS	1d	Detects a temporary traffic control device	
	AVS	2d	Comprehends temporary traffic control device information	
	AVS	3d	Uses information to understand what it must or should do (or not do) under a given set of circumstances	
Post-conditions	• The AVS continues its route in a lawful manner			
Policies and Business Rules	https://mutcd.fhwa.dot.gov/kno_2009r1r2.htm *MUTCD Part 2 – Signs* – https://mutcd.fhwa.dot.gov/htm/2009r1r2/part2/part2_toc.htm *MUTCD Part 3 – Markings* – https://mutcd.fhwa.dot.gov/htm/2009r1r2/part3/part3_toc.htm *MUTCD Part 6 – Temporary Traffic Control* – https://mutcd.fhwa.dot.gov/htm/2009r1r2/part6/part6_toc.htm			

Use Case	Mixed Traffic Operations
User Needs Traceability	AVS-UN016-v01 – Law Following – Regulatory AVS-UN017-v01 – Law Following – Temporary Traffic Control
Inputs Summary	System Initialization Input: Local rules, regulations, and standard signage must be programmed into the AVS at time of configuration Human Input: None
Output Summary	AVS Data: Record of objects detected and appropriately classified, record of decisions made and record of instances when the vehicle did not comply with traffic regulations.

816 *Source: SFCTA*

817

818 **Table 21: Use Case 3 Scenario 4: Degraded Conditions – Uncertainty in Course of Action**

Use Case	Mixed Traffic Operations			
Scenario ID & Title	*UC3-S6: Degraded Conditions – Uncertainty in Course of Action*			
Scenario Objective	• Demonstrate ability of the AVS to exercise caution when there is uncertainty in the detection or interpretation of a traffic control device			
Operational Event(s)	• The AVS encounters a situation it does not understand and alerts the AVS Management System to determine whether the situation is unusual and something the AVS has not been programmed to understand or whether there is a maintenance issue with the AVS. The AVS Management System and operations staff can then work to fix the AVS or program in additional scenarios to avoid the same situation in the future.			
Actor(s)	Actor	Role		
	AVS	Safely navigate roadways and understand when it is not fully able to operate normally, alert AVS Management System and move to fall back state in the event of abnormal conditions		
	AVS Management System	Respond to messages from AVS and understand issues AVS is having, and assign operations staff to fix any problems (or suspend service until problems can be fixed)		
	Operations Staff	Provide repairs or solve other problems		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Detects traffic control device	Such as a human controlling traffic or a regulatory sign
	AVS	2	Is not certain of its interpretation of this traffic control device	
	AVS	3	Decreases speed	To properly interpret traffic control device

Use Case	Mixed Traffic Operations			
	AVS	4	Notifies AVS Management System that it has encountered an issue	
	AVS	5a	Resumes certain interpretation of traffic control devices	
	AVS	6a	Continues along route at nominal speed	
	AVS	5b	Continues to not be certain of its interpretation of traffic control devices	
	AVS	6b	Comes to a complete stop and notifies passengers of the issue	
	AVS Management System	7b	Dispatches operations staff to repair sensors and/or manually navigate around the object	
	AVS	8b	Attempts to navigate to an off-street location to wait for operations staff	If navigation allows
	Operations Staff	9b	Repairs sensors	Could include external maintenance entity, or operations staff who manually operates AVS if repair effort is unsuccessful or will require additional resources
	AVS	10b	Continues along route	
Post-conditions	• AVS safely avoided an incident by returning to its fall back condition until issues could be resolved. Issues are now resolved and the AVS can return to normal operations.			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment AVS-UN020-v01 – Fall Back AVS-UN023-v01 – Uncertainty in Course of Action			
Inputs Summary	System Initialization Input: Fall back response must be programmed into AVS at time of configuration Human Input: Operations staff must intervene and work to determine the			

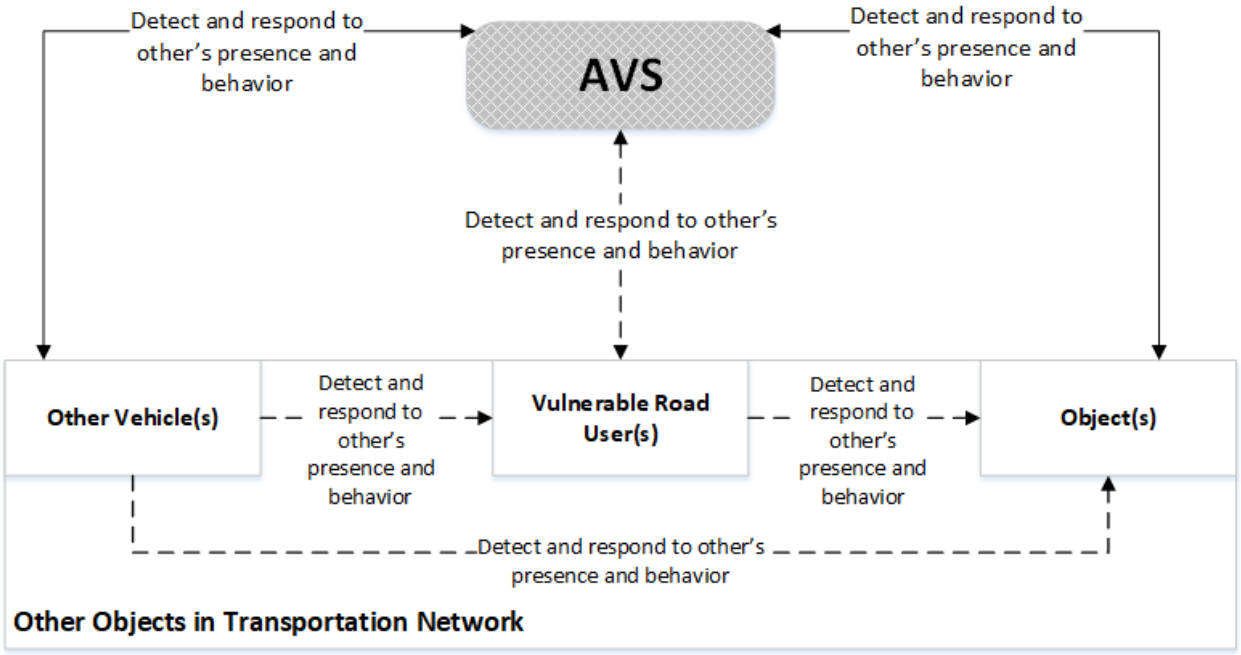
Use Case	Mixed Traffic Operations
	cause of the error to resolve and allow the AVS to return to autonomous operations
Output Summary	AVS Data: Record of incident and AVS's response

Source: SFCTA

Use Case 4: Roadway Object Detection and Reaction

This section describes a scenario where the AVS detects other objects on the roadway.

6.4



Source: SFCTA

Figure 5: Use Case 4: Roadway Object Detection and Reaction Diagram

Table 22: Use Case 4 Scenario 1: Normal Operating Conditions – Vehicle Following

Use Case	Roadway Object Detection and Reaction			
Scenario ID & Title	*UC4-S1: Normal Operating Conditions - Vehicle Following*			
Scenario Objective	• Demonstrate the ability of an AVS to safely operate in mixed traffic			
Operational Event(s)	• The AVS approaches another vehicle from behind, and must adjust its speed to remain at a safe following distance • Another driver changes lanes in front of the AVS, resulting in an unsafe following distance. The AVS must slightly slow down and speed back up to maintain a safe following distance.			
Actor(s)	Actor	Role		
	AVS	Follow vehicles at a minimum following distance, based on the speed of the leading vehicle and the AVS		
	Other Vehicle 1	Safely navigate roadway network		
	Other Vehicle 2	Safely navigate roadway network		
	Actor	Step	Key Action	Comments

Use Case	Roadway Object Detection and Reaction			
Key Actions and Flow of Events	AVS	1	Approaches Other Vehicle 1 from behind	AVS is traveling faster than Other Vehicle 1, but still below the speed limit
	AVS	2	Detects Other Vehicle 1 and the speed of Other Vehicle 1	
	AVS	3	Decreases speed to match the speed of Other Vehicle 1	In a manner, such that the AVS matches Other Vehicle 1's speed once it reaches the following distance corresponding to Other Vehicle 1's speed
	Other Vehicle 2	4	Changes lanes into the space between the AVS and Other Vehicle 1	Resulting in the AVS following distance to be too close.
	AVS	5	Slightly decreases speed	To increase following distance
	AVS	6	Changes speed to match Other Vehicle 2	Once it reaches a following distance corresponding to Other Vehicle 2's speed
	Other Vehicle 2	7	Increases/decreases speed	
	AVS	8	Continues to match the speed of Other Vehicle 2 at the specified following distance	
Post-conditions	• AVS, Other Vehicle 1, and Other Vehicle 2 all continue down the roadway at a safe following distance apart			
Policies and Business Rules	California Vehicle Code Division 11 Chapter 3 Article 2 – Additional Driving Rules			
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment			
Inputs Summary	System Initialization Input: AVS needs to be programed with the safe following distances for each operating speed Human Input: None			
Output Summary	AVS Data: Record of following distances kept, video footage, and decisions made			

Source: SFCTA

Table 23: Use Case 4 Scenario 2: Normal Operating Conditions – Bicycle Following and Passing

Use Case	Roadway Object Detection and Reaction			
Scenario ID & Title	*UC4-S2: Normal Operating Conditions – Bicycle/Pedestrian Following and Passing*			
Scenario Objective	• Demonstrate the ability of an AVS to safely follow a bicyclist/pedestrian and pass the bicyclist/pedestrian if conditions allow			
Operational Event(s)	• The AVS approaches a bicyclist/pedestrian from behind, and must adjust its speed to remain at a safe following distance • The AVS determines if it is safe to pass the bicyclist/pedestrian, and passes if able			
Actor(s)	Actor	Role		
	AVS	Detect bicyclist in roadway, follow bicyclist at safe following distance, pass bicyclist if it is safe to do so		
	Bicyclist	Safely navigate roadway network		
	Other Vehicle	Safely navigate roadway network		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches bicyclist from behind	AVS is traveling faster than bicyclist
	AVS	2	Detects bicyclist and the speed of bicyclist	
	AVS	3	Decreases speed to match the speed of bicyclist	In a manner, such that the AVS matches bicyclist's speed once it reaches the following distance corresponding to bicyclist's speed
	AVS	4	Determines that bicyclist can be legally passed, but only by encroaching into an oncoming lane of traffic	Assuming a two-lane bi-directional road
	AVS	5	Detects that it can safely and lawfully pass the bicyclist without affecting traffic on the other side of the roadway	
	AVS	6	Passes the bicyclist using the approaching lane of traffic	Must pass the bicyclist at safe passing distance (minimum legal passing distance is 3 feet)
	AVS	7	Continues along route	
Post-conditions	• The AVS, traveling at a faster speed than the bicyclist, is now ahead of the bicyclist on the roadway and has passed without any issues			

Use Case	Roadway Object Detection and Reaction
Policies and Business Rules	California Vehicle Code Division 11 Chapter 3 Article 3 – Overtaking and Passing
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment
Inputs Summary	System Initialization Input: AVS must be able to identify a bicyclist and know the safe passing distance Human Input: None
Output Summary	AVS Data: Record of decisions made, record of accurate detection classification, path prediction of bicyclist, and video record of bicyclist actions and placement in roadway.

Source: SFCTA

Table 24: Use Case 4 Scenario 3: Normal Operating Conditions – Pedestrian Detection and Reaction

Use Case	Roadway Object Detection and Reaction			
Scenario ID & Title	*UC4-S3: Normal Operating Conditions – Pedestrian Detection and Reaction*			
Scenario Objective	• Demonstrate the ability of an AVS to detect and stop for a pedestrian crossing the street			
Operational Event(s)	• The AVS approaches a location where a pedestrian is crossing the street, and stops to allow the pedestrian to safely cross			
Actor(s)	Actor	Role		
	AVS	Detect pedestrian waiting to cross the street, detect pedestrian crossing the street, stop for pedestrian to cross		
	Pedestrian	Safely navigate crosswalk		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches a crosswalk	Or another street crossing area that is not marked, including unmarked crosswalks
	Pedestrian	2a	Waits at edge of road to cross at crosswalk	
	AVS	3a	Detects waiting pedestrian	
	Pedestrian	2b	Steps into crosswalk	
	AVS	3b	Detects pedestrian in crosswalk	

Use Case	Roadway Object Detection and Reaction			
	AVS	4	Comes to a stop at the crosswalk	At yield line or at a location that leaves sufficient space between AVS and crosswalk
	Pedestrian	5	Completes traversing the crosswalk	
	AVS	6	Resumes driving along its route	
Post-conditions	• Pedestrian has safely crossed the street and AVS can continue its route			
Policies and Business Rules	California Vehicle Code Division 11 Chapter 5			
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment			
Inputs Summary	System Initialization Input: Location of crosswalks along route to be programmed into AVS (thought it can also identify them by pavement markings) Human Input: None			
Output Summary	AVS Data: Record of decisions made, record of accurate detection classification, path prediction of pedestrian, and video record of pedestrian's actions and placement in crosswalk			

835 *Source: SFCTA*

836

837 **Table 25: Use Case 4 Scenario 4: Normal Operating Conditions – Object Detection**

Use Case	Roadway Object Detection and Reaction			
Scenario ID & Title	*UC4-S4: Normal Operating Conditions – Object Detection*			
Scenario Objective	• Demonstrate the ability of an AVS to detect an object in the roadway and pass or drive over the object if conditions allow			
Operational Event(s)	• The AVS approaches an object, determines whether it can be driven over or needs to be passed, and proceeds when safe			
Actor(s)	Actor	Role		
	AVS	Detect object in the roadway, safely go around the object		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches an object in its path	
	AVS	2	Detects the object	
	AVS	3a	Determines that the object can be driven over	Could be a leaf, plastic bag blown by the wind, etc.
	AVS	4a	Drives over the object	
	AVS	5a	Continues along route	
	AVS	3b	Determines that object cannot be driven over, but it can be passed without leaving the AVS's current lane of travel	Could be a stopped vehicle or construction equipment partially on the curb, or a small object such as a cone or animal
	AVS	4b	Maneuvers within its lane of travel around the object	
	AVS	5b	Continues along route	
	AVS	3c	Determines that the object cannot be driven over, and that it can be passed but only by encroaching into another lane of traffic	Could be a stopped vehicle, construction equipment, large animal, or a cone or flashing arrow signifying the lane is closed
	AVS	4c	Detects that it can safely and legally pass the object without affecting traffic in the other lane	

Use Case	Roadway Object Detection and Reaction			
	AVS	5c	Passes the object using the other lane of traffic	
	AVS	6c	Continues along route	
Post-conditions	• AVS has passed the object safely			
Policies and Business Rules	California Vehicle Code Division 11 Chapter 3 Article 3 – Overtaking and Passing			
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment			
Inputs Summary	System Initialization Input: Program how to identify objects and whether they need to be passed and whether they can be driven over, as well as the laws on passing and how to determine it is safe Human Input: None			
Output Summary	AVS Data: Record of decisions made, record of accurate detection, classification and object path, record of whether AVS decision was out of compliance with the law			

Source: SFCTA

840 **Table 26: Use Case 4 Scenario 5: Degraded Conditions – Object Detection – Uncertainty in**
841 **Course of Action**

Use Case	Roadway Object Detection and Reaction			
Scenario ID & Title	*UC4-S5: Degraded Conditions – Object Detection – Uncertainty in Course of Action*			
Scenario Objective	• Manually navigate the AVS around an object when the AVS is not able to automatically navigate around the object			
Operational Event(s)	• The AVS approaches an object that it is not able to pass without encroaching into another lane of travel and is not able to determine how to safely pass the object • Operations staff are dispatched to the site to navigate the AVS around the object and allow the AVS to continue service			
Actor(s)	Actor	Role		
	AVS	Detect and properly respond to an object in the roadway		
	AVS Management System	Dispatch operations staff when necessary		
	Operations Staff	Manual operation of AVS		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches an object in its path	
	AVS	2	Detects the object	
	AVS	3a	Is not able to determine how to pass the object	Could be due to weather or obstructed view of surrounding conditions
	AVS	3b	Is not able to determine when it is safe to legally pass the object. Comes to a safe stop.	
	AVS	4	Notifies AVS Management System and passengers that it has encountered an issue	
	AVS Management System	5	Sends out operations staff to manually navigate around the object	Alternatively, AVS operations staff on the shuttle will take control of the vehicle or remove debris from the roadway.
	Operations Staff	6a	Removes obstacle from AVS path	
	Operations Staff	6b	Navigates vehicle around object	
	AVS	7	Continues along route	

Use Case	Roadway Object Detection and Reaction
Post-conditions	• AVS passes the object, though with some delay
Policies and Business Rules	*None*
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment AVS-UN020-v01 – Fall Back AVS-UN022-v01 – Disengagement Mechanism AVS-UN032-v01 – AVS Operation Monitoring AVS-UN035-v01 – Manual AVS Operation
Inputs Summary	System Initialization Input: How to identify when it is not able to decide and must alert the AVS Management System Human Input: Must come to the field
Output Summary	AVS Data: Record of decisions made, and times operations staff must step in to assist (Disengagement data with timestamp, location, and cause)

Source: SFCTA

Table 27: Use Case 4 Scenario 6: Failure Conditions – Object Misdetection

Use Case	Roadway Object Detection and Reaction			
Scenario ID & Title	*UC4-S6: Failure Conditions – Object Misdetection*			
Scenario Objective	• Demonstrate consequence of not detecting objects in the roadway environment, and to report an incident once it occurs			
Operational Event(s)	• The AVS drives into an object that it does not detect			
Actor(s)	Actor	Role		
	AVS	Detect and properly respond to an object in the roadway		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches an object in its path	Could be a vehicle or an object
	AVS	2	Does not detect the object	
	AVS	3	Strikes the object	
	General	4	See UC5-S1 steps 3b-7b	
Post-conditions	• AVS has crashed into an object and must alert the AVS Management System to form a plan on how to proceed • AVS will be removed from service until it can be determined what caused the failure to detect the object and the correction is made			
Policies and Business Rules	*None*			

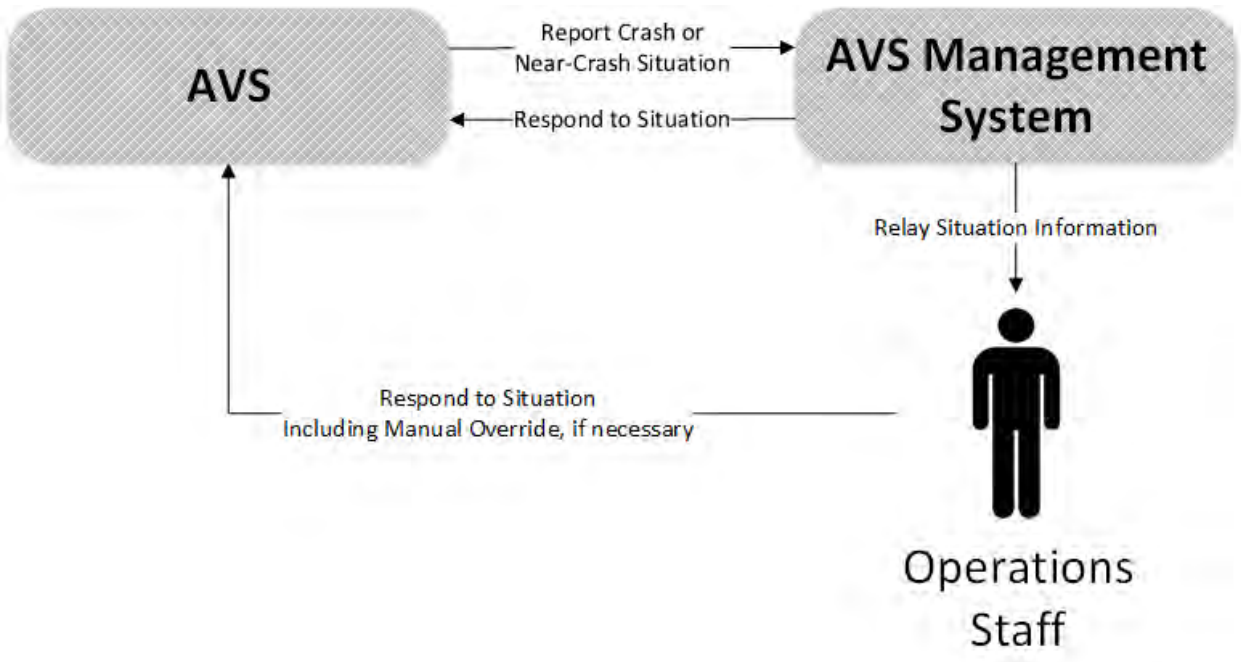
User Needs Traceability	AVS-UN015-v01 – Law Following – Open Traffic Environment AVS-UN020-v01 – Fall Back AVS-UN026-v01 – Tow or Road Clearance AVS-UN034-v01 – Incident Response
Inputs Summary	System Initialization Input: Same as Normal Operating Scenario, but in this case the input was not sufficient Human Input: Operations staff will be alerted and will assist the AVS in recovering from the incident
Output Summary	AVS Data: record of incident including video and all sensor data from the event data recorder; scheduled hours of operation; actual hours of operation

845 *Source: SFCTA*

846

6.5 Use Case 5: Crash Detection and Mitigation

This section describes scenarios where the AVS must detect it has been or is about to be involved in a crash and respond accordingly. In all scenarios, the expected outcome is that the AVS will react in a manner to avoid or minimize injury to humans.



Source: SFCTA

Figure 6: Use Case 5: Crash Detection and Mitigation Diagram

Table 28: Use Case 5 Scenario 1: Normal Operating Conditions – Avoiding an Incident

Use Case	Crash Detection and Mitigation	
Scenario ID & Title	*UC5-S1: Normal Operating Conditions – Avoiding an Incident*	
Scenario Objective	• Demonstrate ability of the AVS to detect an imminent crash situation, and to take the best action to avoid a crash or minimize the potential crash impact, if necessary • Provide a response to a crash situation	
Operational Event(s)	• AVS detects an imminent crash situation and responds to avoid the crash or mitigate its impact. The AVS then alerts the AVS Management System who initiates any additional response protocol.	
Actor(s)	Actor	Role
	AVS	Detect an imminent crash situation and take the best action to avoid a crash if necessary, report crashes to AVS Management System

Use Case	Crash Detection and Mitigation			
	AVS Passenger	Exit the AVS and get examined for injuries if a crash occurs		
	Safety Driver	Notifies public safety officials, responds to scene, and restores service if a crash occurs		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1a	Detects that it has lost control on the roadway	
	AVS	1b	Detects that its path and the path of another vehicle will result in a side impact crash	
	AVS	1c	Detects that its path and the path of another vehicle will result in a head-on crash	
	AVS	1d	Detects that its path and the path of another vehicle will result in a rear-end crash	
	AVS	1e	Detects that its path will result in a road departure	
	AVS	1f	Detects that its path and the path of another object (pedestrian/bicycle/animal/object) will result in a crash	
	AVS	2	Immediately decreases speed and/or stops. Swerving may also be necessary to avoid obstacles in some circumstances.	To avoid or minimize the impact of a potential crash
	AVS	3a	Avoids the crash situation	
	AVS	4a	Reports the near-incident situation	
	AVS	5a	Continues its route	
	Safety Driver	6a	Assesses what led to the near-crash situation	AVS may be out of service during investigation
	AVS	3b	Is involved in a crash	
	AVS	4b	Immediately comes to a stop	
	AVS	5b	Notifies AVS Management System that a crash has occurred	
	Safety Driver	6b	Notifies 911 call center who will then dispatch first responders, tow truck, and other pertinent personnel to the crash scene	

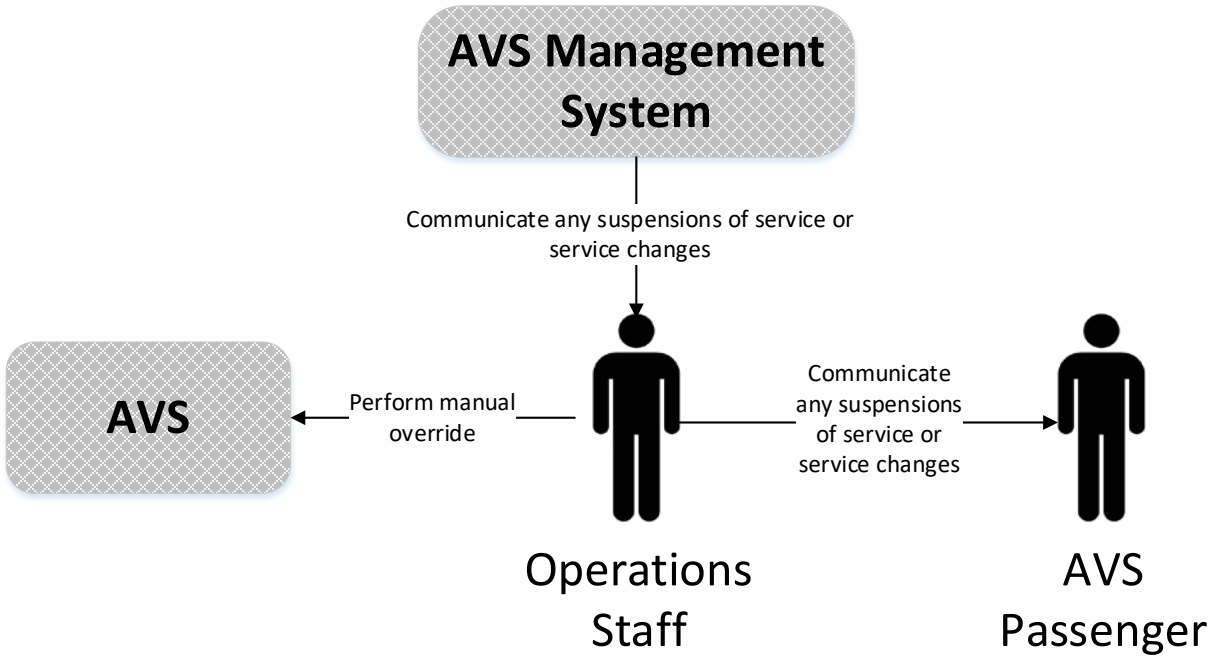
Use Case	Crash Detection and Mitigation			
	AVS Passenger	7b	Exits the AVS and gets examined for injuries by first responders	
	Concierge	8b	Makes plans to restore service	AVS may be out of service during crash investigation and repairs
Post-conditions	• AVS is taken out of service, either because it is physically disabled and needs to be repaired or to update its software to avoid other crashes and near-misses in the future			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN019-v01 – Crash Avoidance AVS-UN020-v01 – Fall Back AVS-UN026-v01 – Tow or Road Clearance AVS-UN034-v01 – Incident Response			
Inputs Summary	System Initialization Input: Fall back and other response protocol to be programmed into AVS Human Input: Incident response protocol may require human input by operations staff to initiate			
Output Summary	AVS Data: Record of crashes and near-misses to be recorded including video and sensor data from the event data recorder; scheduled hours of operation; actual hours of operation			

857 *Source: SFCTA*

858

6.6 Use Case 6: AVS Operations Management

This section describes scenarios that involve AVS operations management.



Source: SFCTA

Figure 7: Use Case 6: AVS Operations Management Diagram

Table 29: Use Case 6 Scenario 1: Normal Operating Conditions – Preemptive Response to Adverse Weather

Use Case	AVS Operations Management	
Scenario ID & Title	*UC6-S1: Normal Operating Conditions – Preemptive Response to Adverse Weather*	
Scenario Objective	• Demonstrate the ability of the system manager to suspend AVS operations when weather that may affect operations is expected to occur (Note: AVS service will be suspended whenever Muni is suspended.)	
Operational Event(s)	• The AVS Management System suspends AVS operations • AVSs pull off the route to a safe location before impending weather arrives	
Actor(s)	Actor	Role
	AVS	Operate in an environment where it can operate as intended
	AVS Passenger	Not get stranded on an AVS that is not able navigate in adverse weather conditions

Use Case	AVS Operations Management			
	AVS Management System	Suspend operations when weather conditions approach that may impact the AVS's ability to navigate the roadway network, manually navigate AVS when necessary		
	Safety Driver	May take manual control of a vehicle if its sensors are disabled due to weather		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS Management System	1	Becomes aware of impending weather conditions	That are expected to impact the ability of the AVS to properly detect traffic control devices
	AVS Management System	2	Sends messages to operational AVSs and operations staff to suspend operations	
	AVS	3a	Completes route	If there is enough time to complete route and adverse weather conditions are expected to last more than a certain amount of time
	AVS Passenger	4a	Exits AVS at stop on route	See UC2-S1
	AVS	5a	Returns to Garage	See UC2-S1
	General	6a	Adverse weather conditions commence	
	AVS Management System	7a	Sends messages to AVSs to resume operations once it is safe to resume operations	
	AVSs	8a	Resumes operations	
	AVS	3b	Pulls off to a safe location off the roadway (e.g., a stop) and notifies passengers of adverse weather conditions	If there is not enough time to complete route or adverse weather conditions are expected to last less than a certain amount of time
	AVS Passenger	4b	May remain in the AVS or may exit the AVS	

Use Case	AVS Operations Management			
	General	5b	Adverse weather conditions commence	
	Safety Driver	6b	May take manual control of vehicle to complete route	If adverse weather conditions last longer than expected
	General	7b	Adverse weather conditions end	
	AVS Management System	8b	Sends messages to AVSs to resume operations	
	AVSs	19b	Resumes operations	
Post-conditions	• AVS resumes operations after suspending service during adverse weather			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN029-v01 – Managed AVS Operations AVS-UN032-v01 – AVS Operation Monitoring AVS-UN035-v01 – Manual AVS Operation			
Inputs Summary	System Initialization Input: None Human Input: Monitor weather conditions and alert AVS to suspend operations if necessary			
Output Summary	AVS Data: Record of time spent with suspended service and reason(s) recorded; scheduled hours of operation; actual hours of operation			

Source: SFCTA

Table 30: Use Case 6 Scenario 2: Normal Operating Conditions – AVS Route Modification

Use Case	AVS Operations Management	
Scenario ID & Title	*UC6-S2: Normal Operating Conditions – AVS Route Modification*	
Scenario Objective	• Demonstrate the ability of the system manager to modify AVS routes when planned conditions along the current AVS route that will not allow the AVS to operate as intended are expected to occur	
Operational Event(s)	• The AVS Management System modifies the AVS route • The AVS begins operation along the new route	
Actor(s)	Actor	Role
	AVS	Travel on roadways that the AVS is capable of navigating

Use Case	AVS Operations Management			
	AVS Management System	Send new route information to AVSs		
	Concierge	Make travelers aware of any service changes		
	Safety Driver	Specify the route on which the AVS should travel, manually drives the AVS when it is not able to do so on its own		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Approaches a road closure along its route	Road closure is unplanned
	AVS	2	Is not able to determine how to pass around the road closure	
	AVS	3	Notifies AVS Management System that it does not know how to proceed	
	Safety Driver	4	Becomes aware of a road closure or road condition	That will not allow the AVS to effectively run its current route
	Safety Driver	5	Manually navigates vehicle	Through a detour to get around unplanned closure
	AVS	6	Continues along route	
	AVS Management System	7	Develops a new route that navigates around the closure or condition	
	AVS Management System	8	Sends new routes to AVSs	
	AVS Management System	9	Updates roadside and online shuttle route information	Detour notices at AVS stops
	AVS	10	Begins traversing new route	When specified by AVS Management System
Post-conditions	• AVS can continue its route, and may know to travel on a new route the next time it reaches this location			
Policies and Business Rules	*None*			
User Needs Traceability	AVS-UN017-v01 – Law Following – Temporary Traffic Control AVS-UN018-v01 – Route Deviation AVS-UN022-v01 – Disengagement Mechanism AVS-UN027-v01 – Route Definition AVS-UN029-v01 – Managed AVS Operations			

Use Case	AVS Operations Management
Inputs Summary	System Initialization Input: Program road closures or conditions so this type of scenario is minimized, program new route Human Input: Manual navigation
Output Summary	AVS Data: Record of decisions made, and record of times manual intervention is required (Disengagement data with timestamp, location, and cause)

871 *Source: SFCTA*

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873 **Table 31: Use Case 6 Scenario 3: Failure Conditions – Manual or System Override**

Use Case	AVS Operations Management			
Scenario ID & Title	*UC6-S3: Failure Conditions – Manual or System Override*			
Scenario Objective	Demonstrate the ability of the system manager to override an AVS's internal system and bring the AVS to a safe stop			
Operational Event(s)	• The AVS begins acting in an erratic or unexpected way • The AVS Management System senses this and overrides the system to bring the AVS to a stop. Alternatively, it notifies operations staff to override the system to bring it to a stop.			
Actor(s)	Actor	Role		
	AVS	Travel safely on roadways		
	Safety Driver	Stop the AVS from behaving unsafely		
Key Actions and Flow of Events	Actor	Step	Key Action	Comments
	AVS	1	Traverses its regular route	
	AVS	2	Begins behaving in an unsafe manner	Perhaps it has been hacked, has a malfunctioning sensor, or has lost connectivity
	Safety Driver	3	Sees the AVS is behaving in an unsafe manner	
	Safety Driver	4	Decides the safest course of action is to stop the AVS immediately	
	Safety Driver	5	Overrides the AVS, bringing it to a stop	
	AVS	6	Comes to a complete stop, opens door, and notifies passengers to alight	So, passengers can alight
Post-conditions	AVS has come to a complete stop, AVS passengers can safely alight, and the reason for the issue can be analyzed			

Use Case	AVS Operations Management
Policies and Business Rules	*None*
User Needs Traceability	AVS-UN022-v01 – Disengagement Mechanism AVS-UN037-v01 – AVS Override / Shut Off
Inputs Summary	System Initialization Input: None Human Input: Manual navigation
Output Summary	AVS Data: Record that manual intervention of a full system override was required (Disengagement data with timestamp, location, and cause); scheduled hours of operation; actual hours of operation

Source: SFCTA

User Needs to Scenarios Summary

Table 32 provides the traceability between the user needs and the scenarios presented previously in this section.

Table 32: User Needs to Scenarios Summary

User Need Identification	User Need Title	Applicable Scenarios
AVS-UN001-v01	Boarding AVS	UC1-S1
AVS-UN002-v01	Alighting AVS	UC1-S1
AVS-UN003-v01	Traveler Information	UC1-S1
AVS-UN004-v01	Passenger Safety Alert	UC1-S2
AVS-UN005-v01	Concierge	UC1-S1 UC2-S2 UC2-S3 UC6-S2
AVS-UN006-v01	ADA Accessibility	UC1-S3
AVS-UN007-v01	Stop for Passenger Boarding	UC1-S1
AVS-UN008-v01	Stop for Passenger Alighting	UC1-S1
AVS-UN009-v01	Ridership Data	UC1-S1
AVS-UN010-v01	ADA Accessibility	UC1-S3
AVS-UN011-v01	Quiet Car Alert	UC1-S1
AVS-UN012-v01	Manual Fueling	UC2-S1 UC2-S2 UC2-S3
AVS-UN013-v01	Transportation Management System	UC1-S1
AVS-UN014-v01	Security Camera	UC1-S2
AVS-UN015-v01	Law Following – Open Traffic Environment	UC1-S1 UC2-S4 UC3-S1 UC3-S2 UC3-S4 UC4-S1 UC4-S2 UC4-S3 UC4-S4 UC4-S5 UC4-S6
AVS-UN016-v01	Law Following – Regulatory	UC3-S1 UC3-S3
AVS-UN017-v01	Law Following – Temporary Traffic Control	UC3-S3 UC6-S2
AVS-UN018-v01	Route Deviation	UC6-S2
AVS-UN019-v01	Crash Avoidance	UC3-S2 UC5-S1
AVS-UN020-v01	Fall Back	UC3-S4 UC4-S5 UC4-S6

User Need Identification	User Need Title	Applicable Scenarios
		UC5-S1
AVS-UN021-v01	Detection Arbitration	N/A
AVS-UN022-v01	Disengagement Mechanism	UC1-S2 UC4-S5 UC6-S2
		UC6-S3
AVS-UN023-v01	Uncertainty in Course of Action	UC3-S4
AVS-UN024-v01	Operational Design Domain	All scenarios
AVS-UN025-v01	Climate Control	UC1-S1
AVS-UN026-v01	Tow or Road Clearance	UC4-S6 UC5-S1
AVS-UN027-v01	Route Definition	UC6-S2
AVS-UN028-v01	End of Service Period	UC2-S1 UC2-S2
AVS-UN029-v01	Managed AVS Operations	UC6-S1 UC6-S2
AVS-UN030-v01	Data Transfer	All scenarios
AVS-UN031-v01	AVS Charge	UC2-S1 UC2-S2 UC2-S3
AVS-UN032-v01	AVS Operation Monitoring	UC4-S5 UC6-S1
AVS-UN033-v01	Managed AVS Charging	UC2-S1 UC2-S2 UC2-S3
		UC2-S4 UC2-S5
AVS-UN034-v01	Incident Response	UC4-S6 UC5-S1
AVS-UN035-v01	Manual AVS Operation	UC4-S5 UC6-S1
AVS-UN036-v01	Assistance for People with Disabilities	UC1-S3
AVS-UN037-v01	AVS Override / Shut Off	UC6-S3
AVS-UN038-v01	Manual Data Collection	UC1-S1

879 *Source: SFCTA*

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7 Summary of Impacts

General

This section provides a summary of the operational and organizational impacts of the proposed system on stakeholders and other supporting entities. This includes a section on temporary impacts that are expected to occur while the new system is being developed, installed, and tested.

Operational Impacts

The AVS system will be a small fleet of AVSs on public roads in mixed traffic. The following are potential operational impacts:

1. Increased travel time on the Corridor: Overall traffic operations on the roads served may be impacted. This could lead to an increase in travel time due to the presence of these slow moving AVSs on the roadway, particularly on YBI where other vehicles travel faster. The hesitance of other drivers to interact with autonomous vehicles may also increase travel time.
2. Reduced Congestion: If ridership on the AVSs increases, there could be a decrease in local congestion. This would be due to TI/YBI visitors choosing to just "park once" and not move their personal vehicles within the area, as well as due to potential higher transit usage.
3. Increased use of multimodal options: With the cars left at parking lots, users will avail of other multi-modal options including walking, biking, transit, ferry, car share program or others.
4. Shift in Boarding/Alighting: Boarding and alighting behavior on SFMTA bus routes servicing TI/YBI may be shifted in response to the location of transfer points to the AVS system and whether they provide a closer service to final destinations servicing TI/YBI. In a long-term deployment, SFMTA may reroute the Route 25 Treasure Island line if the AVS is successful at providing intra-island service on the island.

Organizational Impacts

The implementation of AVS service on the islands is expected to result in minor organization impacts for the stakeholder agencies (SFCTA, SFMTA, TIDA) that may have to take on additional responsibilities associated with the AVS system as identified in the Stakeholder's Roles and Responsibilities section.

The AVS Management System/vendor will be responsible for operations and maintenance of the system. This will include ensuring the AVSs are operating as planned, safely and on schedule. To do this the AVS Management System will need to facilitate a system for monitoring the AVSs, including staffing a back office in the TI/YBI area and deploying operations staff as a "concierge" for passenger questions and on-board monitoring. Maintenance will be done by the vendor with experience maintaining AVSs, such as the vehicle manufacturer, minimizing organizational impacts to existing agencies.

In the long term, this free service could increase shuttle and transit demand to the TI/YBI area, potentially guiding the planning of whether Muni and other transit service routes may need to provide greater capacity through increased frequency or larger capacity shuttle/bus.

7.4 Impacts During Pilot

Regulatory approval at the state, and federal level will be required. This is important to consider because of the amount of time it could take to complete.

The AVSs will be procured from an external vendor. Federal funds are being used for this project, so purchasing the vehicle would be subject to federal procurement regulations such as Buy America. Leasing the vehicles through a subcontractor agreement may not be subject to the same requirements.

The route will be mapped virtually by the vendor. Depending on the final route, no major infrastructure investments by local governments or agencies are anticipated to be necessary, other than potential additional signage, ADA, and storage and maintenance facility upgrades.

On-site testing and route mapping will need to occur before the pilot begins passenger operations. This will need to be done on closed roads first, before testing on TI/YBI roads and could be done at night or during off-peak times. Additionally, the AVSs will be tested on the roads without passengers before allowing passenger service. Introducing AVs into mixed traffic operations will be challenging, both for human drivers and for the autonomous vehicles, as both will have to deal with the unfamiliar behavior of the other entity. If any potential concerns arise during preliminary testing and operations that inform the actual capabilities of the AVSs, the route alignments and other service characteristics may be modified.

8 Analysis of the Proposed System

General

This section provides a summary and analysis of the benefits, limitations, advantages, and disadvantages of the proposed system, as well as any alternatives and tradeoffs considered.

8.1 Potential Benefits

The AVS system will potentially enhance many functionalities of the transportation network and provide additional capabilities, for example the addition of:

8.2

- Service that reduces the distance from transit to area destinations (FMLM)
- Autonomous vehicle technology to shuttle service
- Electric vehicle operations to shuttle service

By providing a safe, clean, reliable FMLM transportation option to TI/YBI, all residents and visitors will have a variety of mobility options, reducing demand for personal vehicles. The zero emissions or reduced emissions AVS combined with the reduced demand for personal vehicles will reduce greenhouse gas emissions for TI/YBI residents and visitors.

In addition, the lessons learned from this project will potentially enable more AVSs to be successfully deployed. The potential safety, mobility and environmental benefits realized from additional deployments will improve FMLM connections in more areas, further reducing the demand for personal vehicles.

8.3 Risks and Limitations

Autonomous vehicles are an emerging technology solution that has not yet been fully tested under all conditions. Many test projects have been implemented in cities around the world, but there have been limited operations in mixed traffic, especially a high-pedestrian environment like TI/YBI. There could be real safety risks associated with vehicles that are not FMVSS compliant and will be operating on public roads with other road users that will be constantly changing due to construction. Because of these safety risks, TIMMA will ensure proper
8.4 insurance policies are in place and the shuttle vendor is operating the AVS as proposed to manage this risk.

Future Deployment Features

Some features that are desirable or not applicable to the pilot may be more desirable for a long-term deployment in the future. In the context of this project, the future is defined as being after the next phases of the Treasure Island development are completed and residents are living on the island. Features that will be more desirable in the full deployment include on-demand boarding/alighting and coordinating with signals. Current desirable features that will be essential in the full deployment will be 24/7 operations and hybrid/electric vehicles.

Appendix A: Goals, Objectives and Evaluation Framework

AV Shuttle Pilot
Goals, Objectives and Evaluation Framework

TIMMA AV Pilot Goals		TIMMA AV Pilot Objectives	Hypothesis	AV Pilot Performance Metric(s)	Performance Metric Justification	Performance Metric Data Source	Scenario Traceability
Safety	**1. Without risking safety of the public, understand the public safety implications of an AV Shuttle.**	1A. Protect the safety of passengers & road users in TI/YBI during pilot operations	AV shuttle technology is safely deployed on TI/YBI during pilot operations.	1A1. Number of collisions and incidents (including injuries).	Documenting all safety incidents occurring during the pilot	Shuttle Operator Collision Report (to include video, time, date, location, collision with what, injuries, which parts of the vehicle were impacted by the collision, damage)	UC4-S6; UC5-S1
				1A2. Rate of incidents/collisions per mile of operation.	A rate normalizes the data and puts the number of incidents and collisions into context. This data can be compared to or aggregated with other projects or pilots and help determine a future service benchmark.	Shuttle Operator Collision Report (to include video, time, date, location, collision with what, injuries, which parts of the vehicle were impacted by the collision, damage)	UC4-S6; UC5-S1
		1B. Explore whether AV shuttle technology can safely address the driving challenges of TI/YB.	The pilot provides data to inform long term decisions about safe AV Shuttle deployments.	1B1. Number, location and cause of AV system disengagements (including operating system malfunction or shut down due to an unknown operating parameter) and other potential safety incidents (including number, location and context of situations when the shuttle encountered safety events and didn't disengage).	Identifying the number of disengagements will identify if the service can potentially operate without a concierge in the future. Knowing the location of disengagements can identify operating restrictions or causes of interference so modifications can be made for improved performance. Gathering data of instances when the AV shuttle can safely maneuver risky situations will help provide a broader picture of AV technology capabilities.	Shuttle Operator	UC1-S2; UC3-S2; UC3-S3; UC3-S4; UC4-S5; UC4-S6; UC5-S1; UC6-S1; UC6-S2; UC6-S3
			An AV Shuttle is perceived by passengers and road users as a safe long term solution for TI	1B2. Perceived personal safety and overall system safety when riding or encountering shuttle	Perceived safety of the system may be different than actual operational safety metrics. Initial perceived safety metrics (both personal and of system overall) and perceived safety metrics from re-occurring users will be important to understand any stakeholder opinion trends.	Shuttle Operator (User Survey)	UC1-S1
Mobility	**2. Understand if AV Shuttle technology can meet TIMAA's intra-island transportation service needs at TI/YBI.**	2A. Explore whether AV shuttle service can be accessible to everyone	AV shuttles can carry bicycles and personal transportation devices, strollers & luggage or operator has a roadmap to provide accommodations under full deployment.	2A1. Number of bicycles on board the AV shuttles. Number of times bicyclists could not board due to capacity. User survey of ease of use for bicycles, personal transportation devices, strollers & luggage.	Having shuttles that are capable of easily, safely and securely boarding, alighting, and storing bicycles, personal transportation devices, strollers & luggage during the transit trip provides for an integrated multi-modal transportation system.	Shuttle Operator, including user survey	UC1-S1; UC1-S3
			AV shuttles are capable of serving individuals with disabilities without human assistance	2A2. Number of times people with disabilities (by category of disability) were able to hail, board, secure themselves or alight without requiring concierge assistance. Number of times concierge assistance was required to hail, board, secure or alight (to derive a rate of success). User perceptions of all trip elements (including hailing or reservation system) from persons with disabilities through user survey.	This measure will help determine if the service can operate without a concierge. User survey provides context of challenges users with disabilities face when using AV system	Shuttle Operator	UC1-S1
			AV shuttles are not a barrier to disadvantaged or vulnerable users.	2A3. Vulnerable or disadvantage user perceptions, measured through before and after user survey.	This performance measure can identify if there are any significant differences in perception that might become barriers for disadvantaged or vulnerable users.	Shuttle Operator (User Survey to include gender identification, race, income demographics, vehicle ownership. Focus group of island residents)	UC1-S1
		2B. Explore the AV Shuttle's ability to meet the intra-island needs of users in TI/YB	AV shuttle service can meet TI/YB user needs	2B1. AV Shuttle service use and perceptions as measured through user survey	Measure user's perception, such as how often do they use the shuttle and for what purposes, how does this service fit in their overall trip, how would the trip be made if the shuttle was not available, how did they hear about the service. Review SFMTA stationless permit program user survey as a starting point.	Shuttle Operator (User Survey)	UC1-S1
Operations	**3. Understand TIMMA's organizational capabilities and infrastructure needs to operate an AV shuttle.**	3A. Explore whether AV shuttle technology can meet TIMMA's TI/YB shuttle operation needs	AV shuttle operations are secure from cyber attacks.	3A1. Percent of time during operating hours the system is shut down due to operating system security breaches. Number of security breach attempts & number of successful breaches.	The AV operating system should avoid service disruption due to security breaches in order to meet performance goals and provide safe operations. Measures the vulnerability of the AV system to cyberattacks	Shuttle Operator	Not applicable to scenarios
			AV shuttle operations can provide accurate, reliable and timely data	3A2. Data is received accurately, per standards and on time.	This metric evaluates whether the data standard and reporting requirements are met	Shuttle Operator	Not applicable to scenarios
			AV shuttle operation costs are equal or less to other similar public services	3A3. Annualized operating expense per service mile	Annualizing the operating expense over the three month pilot project will help determine if the costs per revenue mile are comparable to other existing transit services in the San Francisco bay area in order to understand how the service may complement existing transit services.	Shuttle Operator	
		3B. Explore whether AV shuttle technology can meet TIMMA's TI/YB shuttle service needs and constraints	AV shuttles can meet TIMMA's shuttle service requirements	3B1. Adherence to operating and performance requirements that are accurate with timely reporting of data (operating hours, ridership, disengagements, safety, emissions)	AV shuttle performance should meet contracted service operations and reporting goals so that any service or operation adjustments can be made in a timely manner.	HNTB	Not applicable to scenarios
			AV shuttles can provide reliable (without disruptions) service	3B2. Actual hours in service as compared to anticipated scheduled hours of service. Dwell times by stop and route durations histograms. If on-demand, % of requests fulfilled, response time histogram. Percent of time during operating hours the system is out of service and cause of service disruption.	Metrics are intended to measure system consistency and reliability for users. AV shuttle operations should be reliable. Understanding service disruptions and causes for service disruption will help determine if the technology is reliable for TIMMA operations.	Shuttle Operator/HNTB (Histogram should include statistical information of data including average, mean and standard deviation)	UC1-S1; UC1-S2; UC2-S1; UC2-S2; UC2-S3; UC2-S4; UC2-S5; UC4-S6; UC5-S1; UC6-S1; UC6-S3
			AV shuttle operator will meet or have a roadmap to meet CA public fleet emission goals (all electric by 2040)	3B3. Number of electric, hybrid or alternative fuel vehicles in pilot. Grams CO2 per passenger mile (if not ZEV) consistent with CARB regulations. Year operator would be able to meet CA public fleet emissions goals.	Measures how many electric or alternative fuel vehicles can be placed in operation during pilot, and the year in which 100% electric vehicles can be expected to be commercially available.	Shuttle Operator	Not applicable to scenarios
Share lessons learned	**4. Gather insights from the public during pilot and share lessons learned with community and key stakeholders.**	4A. Provide opportunity to demonstrate AV technology to key stakeholders and community groups through pilot.	The AV pilot is a learning opportunity for key stakeholders and community groups	4A1. Number of total people participating in a demonstration to key stakeholders and community members	The AV pilot at Treasure Island will be an opportunity to observe and learn about AV Shuttle technology and operations.	Shuttle Operator	Not applicable to scenarios
		4B. Upon pilot completion, pilot results are shared with stakeholders	AV Pilot outcomes are collected and shared with stakeholders.	4B1. Key participant end of pilot survey	Stakeholder input on the knowledge gained from the pilot project will help inform future potential project opportunities.	HNTB (Stakeholder Survey)	Not applicable to scenarios

Appendix B: Muni Treasure Island Service Map

SFMTA

25 TREASURE ISLAND

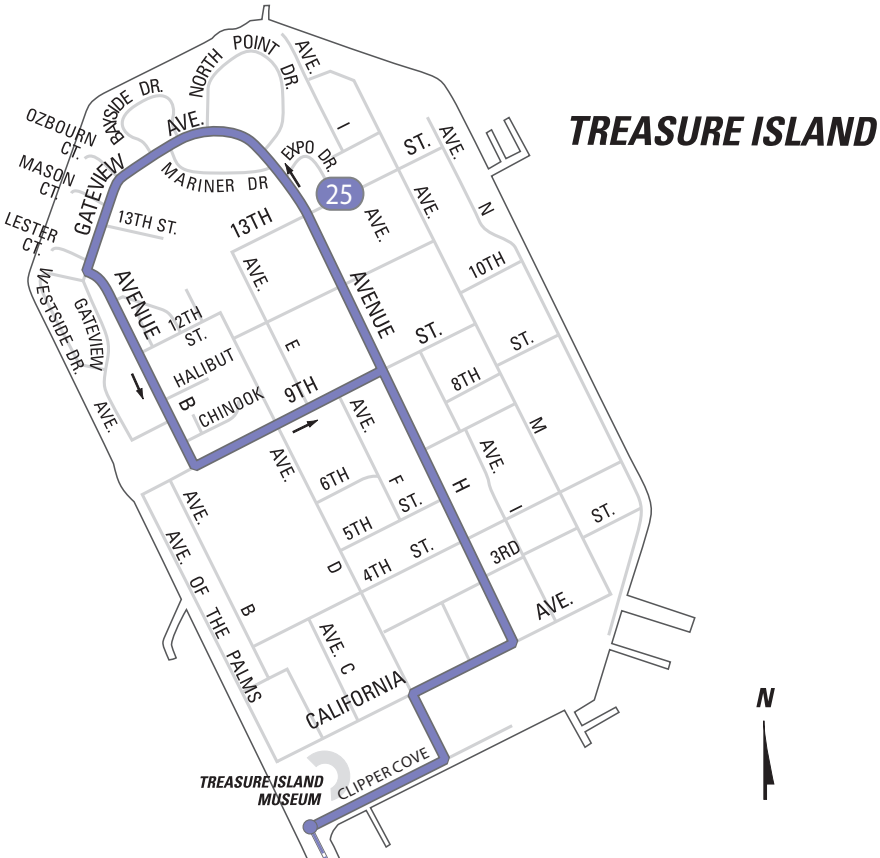
effective 9/14/2019

MAP NOT TO SCALE

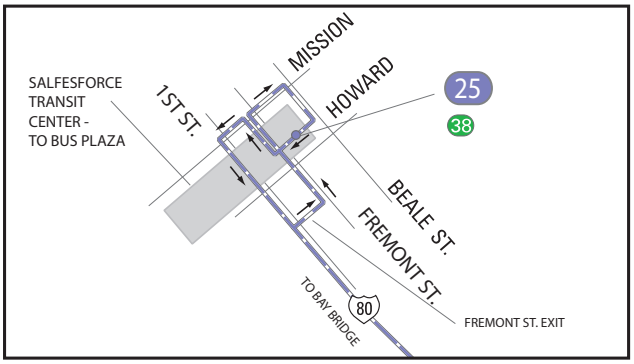
25 Terminal
Local service
Express service/stop
Connecting Muni service
Express service
Station

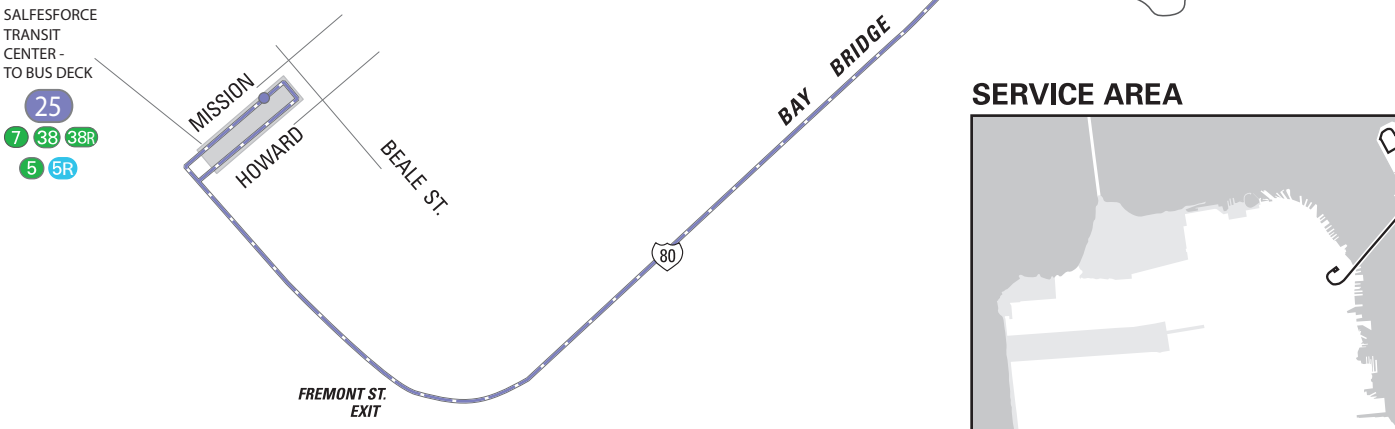
DAYTIME SERVICE TO BUS DECK,
OWL SERVICE TO BUS PLAZA

NORTH



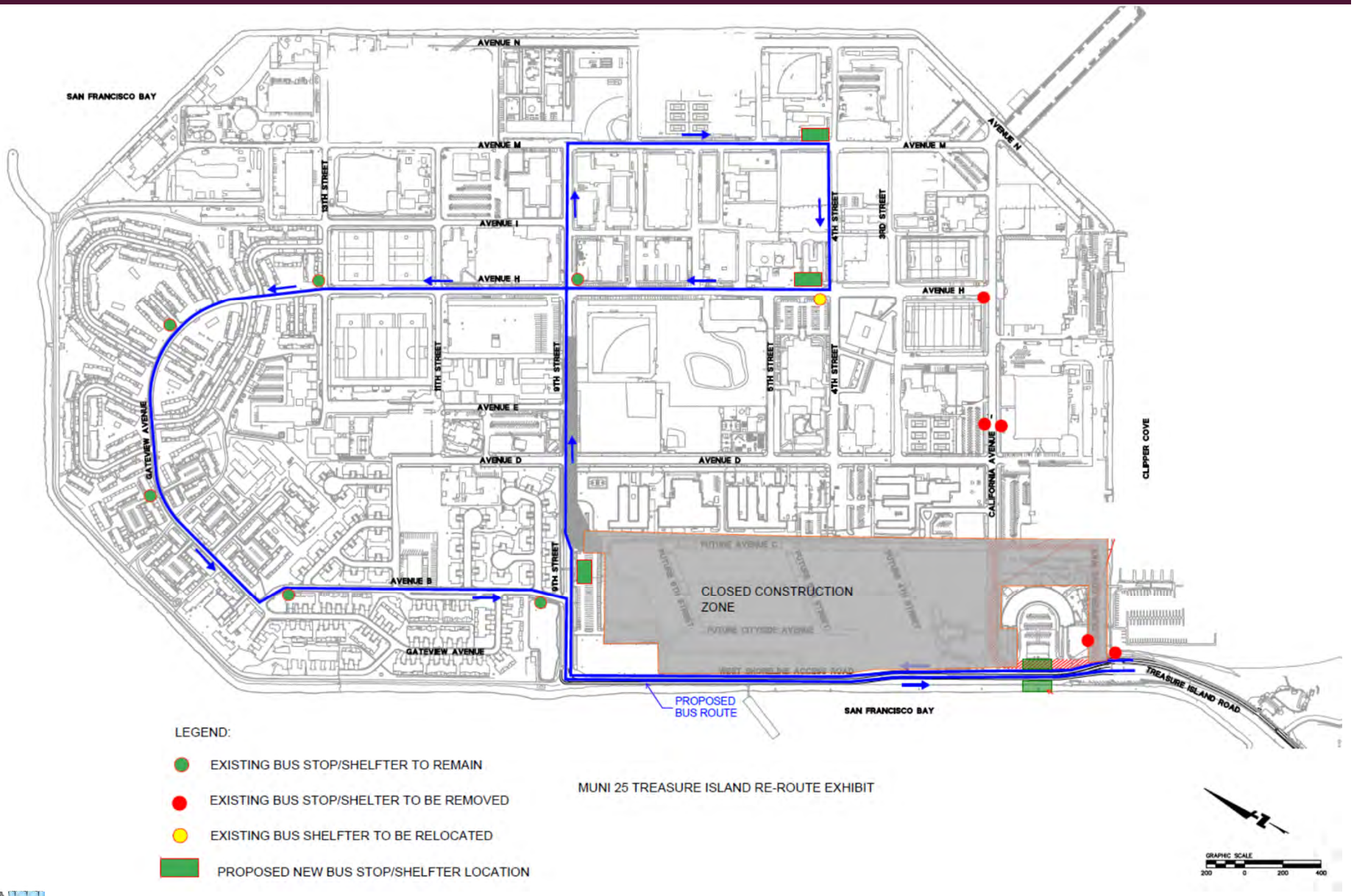
OWL SERVICE - TO BUS PLAZA





SERVICE AREA

TREASURE ISLAND MUNI 25 RE-ROUTE



Appendix C: TITIP Figures

TICD
Treasure Island Community Development, LLC

TREASURE ISLAND TRANSPORTATION IMPLEMENTATION PLAN

Figure 5.1
PROPOSED TRANSIT SERVICE

*Now the Salesforce Transit Center

TICD
Treasure Island Community Development, LLC

TREASURE ISLAND TRANSPORTATION IMPLEMENTATION PLAN

Figure 5.2

PROPOSED BUS AND SHUTTLE ROUTES - TREASURE ISLAND

Appendix D: Route Planning Memorandum

TIMMA AV ROUTE PLANNING MEMORANDUM

TIMMA AV Shuttle

DRAFT MEMORANDUM

March 2020

PREPARED FOR

Treasure Island Mobility Management Agency
1455 Market Street
Floor 22
San Francisco, CA 94103

PREPARED BY

HNTB Corporation
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HNTB

Treasure Island AV Shuttle Pilot
Potential Routes

Introduction

The Treasure Island Mobility Management Agency (TIMMA) is charged with implementing an integrated multi-modal plan, including intra-island shuttles, in phases that align with the development efforts of Treasure Island Community Development, LLC (TICD) and the oversight of the Treasure Island Development Authority (TIDA). Automated vehicle (AV) shuttles will be piloted on the island as part of a holistic solution to deliver safe and sustainable mobility options with equitable access for the entire Island community.

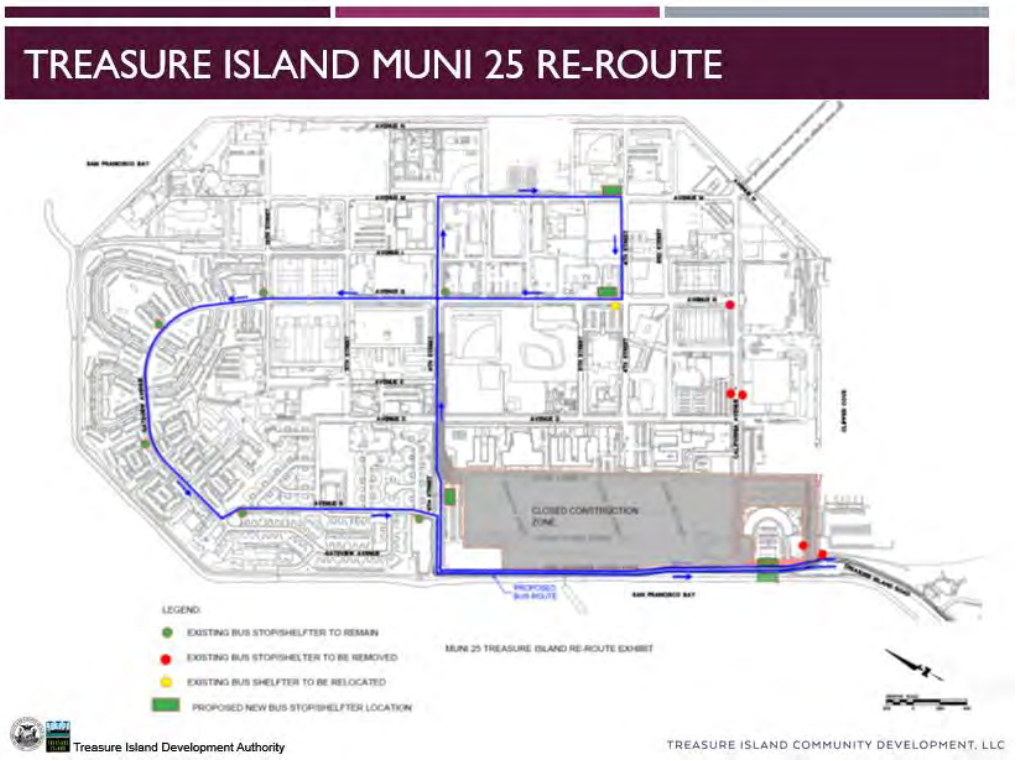
Purpose

The purpose of this route planning memorandum is to identify the considered routes for the shuttle pilot and the locations for the potential storage and maintenance facility. While routes are identified in the Treasure Island Transportation Implementation Plan (TITIP), the routes in the TITIP only apply to the final conditions. This document presents routes that are viable within the phase of construction during the time of pilot. These route options will be discussed with the potential AV shuttle vendor(s) during the procurement process to identify their preferred route for the shuttle services based on their vehicle capabilities.

Methodology

To develop the routes, a meeting was conducted with SFCTA, SFMTA, TIDA, and HNTB. The project team reviewed the construction phasing, the updated San Francisco Municipal Railway (Muni) bus route, and existing landmarks to come up with options for the shuttle service that serve the needs of the island. During this meeting the following elements were noted:

- Due to construction closures (including Clipper Cove Way), Muni Route 25 will be rerouted as shown in the following image.



Both the north and south ends of Avenue M will be closed during the shuttle pilot period (spring & summer of 2021), with access open only to businesses on the center area of the road.
At least one entrance to the admin building will remain open throughout the entire construction period

- Admin Building parking lot circulation is counterclockwise
- In Yerba Buena Island:
  - In June 2021, South Gate will still be under construction with bicycle ramp access only on the weekends
  - The only destination on YBI will be the coast guard (not a lot of demand)
  - AV shuttles may need to service YBI only during specific hours (about an hour per day)
  - Consider YBI route as an on-demand route or a test route (with no passengers)
- It is currently assumed that the AV shuttle pilot can share stops with Muni Route 25 (SFMTA to confirm).

Route Options

Three route options were developed. In addition, potential locations for storage and maintenance facilities were identified. The following section describes each of the options, along with the advantages and disadvantages.

Route 1 – Treasure Island Only

Figure 1 shows the AV shuttles' route along with the major landmarks within the island, potential bus stops, and the direction of the shuttle for Treasure Island only route 1 option. Route 1 starts at the Admin Building and makes a counterclockwise loop around the admin building parking lot. The shuttle then heads north on Avenue of the Palms and makes a right on 9th Street. The shuttle then heads east and makes a left onto Avenue H. The shuttle continues straight along Avenue H and Gateway Avenue then makes a left onto Avenue B. The shuttle continues south on Avenue B then makes a right onto 9th Street. The shuttle continues on Avenue of the Palms until it reaches the Admin Building and starts the route over. The AV shuttles' bus stops will be shared with Route 25 bus stops.

The advantage of Route 1 is that the route is shorter, so fewer shuttles may be needed to maintain a headway than Route 2. The disadvantage of Route 1 is that it includes a left turn which could impact performance and may require infrastructure adjustments to improve sight distance.

Route 2 – Treasure Island Only

Figure 2 shows the AV shuttles' route along with the major landmarks within the island, potential bus stops, and the direction of the shuttle for Treasure Island only route 2 option. Route 2 starts at the Admin Building and makes a counterclockwise loop around the admin building parking lot. The shuttle then heads north on Avenue of the Palms and makes a right on 9th Street. The shuttle then heads east and makes a right onto Avenue M. The shuttle makes a right on 4th Street and another right onto Avenue H. The shuttle continues straight along Avenue H and Gateway Avenue then makes a left onto Avenue B. The shuttle continues south on Avenue B then makes a right onto 9th Street. The shuttle continues on Avenue of the Palms until it reaches the Admin Building and starts the route over. The AV shuttles' bus stops will be shared with Route 25 bus stops.

The advantages of Route 2 are that left turn at Avenue H and 9th Street is eliminated, which should improve shuttle performance, and the route covers more destinations minimizing the walking distance. The disadvantage is that the route is longer, which may increase the number of required shuttles to maintain the same headway as Option 1.

Route 3 – Treasure Island and Yerba Bueno Island

Figure 3 shows the AV shuttles' route along with the major landmarks within the island, potential bus stops, and the direction of the shuttle for both Treasure Island and Yerba Buena Island route 3 option. Route 3 starts with either Route

1 or Route 2. Once the shuttle reaches the Admin Building at the end of the route, instead of stopping at the Admin Building, the shuttle continues on to Yerba Buena Island (YBI). The shuttle makes a left on Macalla Road and continues to the end of the road. At the end of the road, the shuttle makes a hairpin turn down North Gate Road and continues along North Gate. The shuttle makes a left on Army Road and then a U-turn at the end near the Pier. The shuttle then makes a right on North Gate Road, then another right onto Macalla Road. At the end of the Macalla Road, the shuttle makes a right on Treasure Island Road and turns back into the Admin Building parking lot to start the route over. YBI will have four stops as shown in Figure 3.

The advantage of Route 3 is that is provides shuttle coverage to YBI and tests the impact of steep grades on the shuttle performance. The disadvantage is that there won't be many visitors, residents, or workers on that side of the island, so the route will be mostly unused. The route would require more shuttles which would increase the cost of the project. In addition, this route requires coordination with US Coast Guard, as this is the only access route to their facilities in YBI.

Potential Storage and Maintenance Facilities

Four (4) options were proposed for storage and maintenance facility locations as shown in Figure 4. . The options were:

- ***Admin Building***
  The basement of the Admin Building provides locked storage space, but shuttles may not be able to navigate under the building by themselves, which would require assistance from the onboard concierge. The storage area would likely need an electric service and equipment upgrade. Additional information about utility service in this area is needed.

- ***Existing shuttle parking near Mersea***
  The existing shuttle parking near Mersea provides a space near existing electric vehicle chargers but would require fencing in the middle of the parking lot and would be prone to vandalism. New electric lines would need to be run for the shuttle chargers. This lot serves the main tourist destination in the island and is frequently in use, any operations would need to occur during off hours (during the weekdays and earlier in the day).

- ***Back of Mersea parking lot near existing fence area***
  The area in the back of the Mersea parking lot is located near an existing fenced in area. This area would be easy to fence in without looking out of place but would still be easy to vandalize the vehicles because it's outside. New electric line would need to be run for the shuttle chargers.

- ***Building 260***

  Building 260 may have space to store the shuttles and has better security than the parking lot. The storage area would likely need to have the electric upgrade. Additional information about utility services and available space in this building is needed.

Treasure Island AV Shuttle Pilot
Potential Routes

Figure 1: Route Option 1 with Bus Stops – Treasure Island Only

Figure 2: Route Option 2 with Bus Stops – Treasure Island Only

Figure 3: Route Option 3 with Bus Stops – Treasure Island Only and Yerba Buena Island

Figure 4: Potential Storage and Maintenance Facility Locations

EXHIBIT D- Relevant Public Transit Fleet ADA Requirements

The Autonomous Shuttles shall be compliant with the Americans with Disability Act (ADA) requirements. Public transit fleet specifications include the following related requirements:

1.0 Steps & Stepwells

1.1 Steps

Interior step risers shall be no more than 10-3/4 inches.

1.2 Step Treads

Step treads shall be of uniform depth, which shall be no less than 11 inches. All step treads shall be covered with the same nonskid floor covering material and shall remain effective in all weather conditions. The edge of the vestibule floor shall conform to ADA requirements and shall have a maximum of 5/16 inch overhang at the step riser. The edge of the vestibule floor tread shall have a bright, contrasting yellow band no less than two (2) inches wide on the full width of the opening. The color shall be permanently blended into the floor covering material.

1.3 Floor Covering (OPTIONAL)

Floor covering shall be nonskid for transit application with ASTM D2047 ≥ 6 and PTV ≥ 36, material that remains effective in all weather conditions and complies with all ADA requirements. The floor covering, as well as transition of flooring material to the center aisle and to the stepwell area, shall be smooth and present no tripping hazards.

2.0 Door Dimensions

Door openings shall be no less than 75 inches high. One of the doors shall be able to accommodate a 32-inch wheelchair ramp as a minimum, unless a lift-platform provided.

3.0 Wheelchair Loading

A loading system (lift or ramp) shall accommodate passengers on wheelchairs or using crutches, canes, walkers or persons with difficulty using steps ingress and egress from or to the street level or curb quickly to safely, to comfortably enter the vehicle. The wheelchair loading shall have a latch mechanism to prevent it from drifting from its stowed position when it is not in use.

3.1 Wheelchair Accommodation

Each wheelchair accommodation shall provide parking space and a secure tie down for one passenger in a wheelchair. No portion of the wheelchair or its occupant shall protrude into the

normal aisle when parked in the designated wheelchair parking space. Provider shall submit wheelchair accommodation options, wheelchair maneuverability and seating configuration layout for TIMMA review and approval.

3.2 Maneuvering room

Maneuvering room inside the Coach shall accommodate easy travel for a passenger in a wheelchair from the loading device through the Coach to the designated parking area and back out.

3.3 Wheelchair Securing Devices

A wheelchair-securing device three-point securement or approved equal, shall be provided at each wheelchair position. A bumper shall be provided at each wheelchair location. The wheelchair securing devices configuration and installation shall be approved by TIMMA.

3.4 Seat Belts

Three-point securement system shall be provided in the wheelchair parking area. Seatbelts shall be easily accessible for wheelchair users.

4.0 PASSENGER SEATS

The seats shall be contoured to increase passenger comfort, knee room and shuttle capacity. A combination of transverse and longitudinal seating is preferred that maximizes the seating while also allowing room for standees. Priority Seating stencils shall be provided and a seating layout reviewed and approved by TIMMA.

5.0 PASSENGER EXIT SIGNAL

A passenger chime and stop requested signal activated by pull cable or equivalent shall be provided. At least one stop request sign shall be located at a position visible to the operator.

The sign shall remain illuminated until the passenger doors are opened, at which point the chime and illumination systems shall reset. Whenever the sign is illuminated, the chime signal shall be muted, and it shall not disable the "STOP" pushbutton for a wheelchair passenger to request to disembark.

5.1 Mobility Aid Passenger Exit Signal

The mobility aid exit signal shall consist of a push button, chime, (a different chime to differentiate between regular STOP request and mobility aid STOP request), and interior amber LED sign message. The "Stop" push button shall be mounted in an approved position to allow easy access.

When this system is activated, a light on the dashboard shall be illuminated to alert the Autonomous Shuttle test operator that a mobility aid passenger wishes to disembark. This shall also illuminate the "STOP REQUESTED" sign.

6.0 PASSENGER ASSISTS

Passenger assists in the form of full-grip vertical and horizontal handholds shall be provided for the safety of standees and for shuttle ingress and egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and 5th-percentile female standees. For the grab handles and stanchions nearby the wheelchair loading area shall be powder coated in yellow.

7.0 DESTINATION SIGNS

Provider shall include on each shuttle an automatic electronic sign system. All locations and mounting of equipment shall be approved by TIMMA. Message memory shall be changeable and easily downloaded. All sign programming tools shall be supplied by the provider. The displays shall be visible both day and night.

8.0 VOICE ANNOUNCEMENT SYSTEM

The shuttle shall have as a minimum a manual operator announcement system to allow simultaneous internal and external announcements.

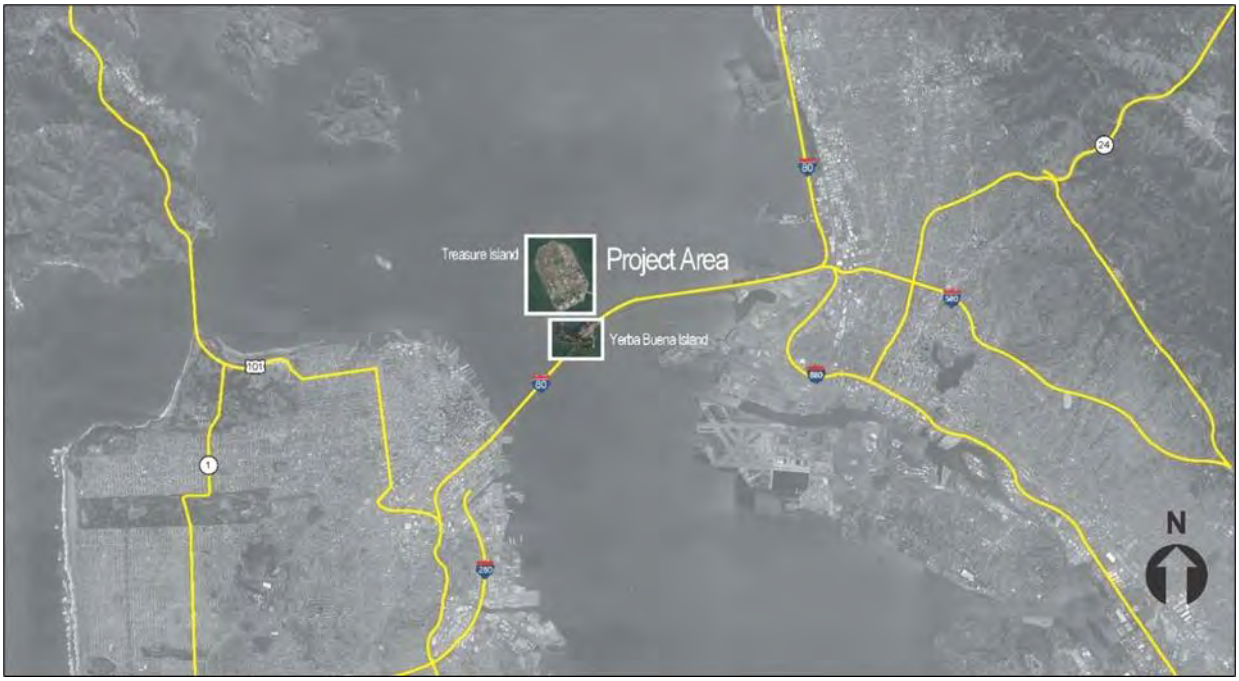
9.0 PROPULSION SYSTEM

An electrically propelled shuttle is preferred over a diesel or gasoline propulsion. Charging will be accommodated as described in Project Task 7 under Service Information. There will be no in-route charging.

EXHIBIT E – Project Area and Potential Routes

GEOGRAPHICAL LIMITATIONS

The Islands are located in San Francisco Bay between San Francisco and Oakland. Yerba Buena Island is a natural island that connects the eastern and western spans of the Bay Bridge via the Yerba Buena Tunnel that runs through the center of the island. Treasure Island is an artificial island to the northwest of Yerba Buena Island that is connected by roadway to Yerba Buena Island. Treasure Island is a flat island, but Yerba Buena Island has steep slopes with grades as much as 20% and limited sight distance.



PROPOSED AUTONOMOUS SHUTTLE ROUTE (FIXED/ON-DEMAND)

A preliminary route has been developed as part of the planning phase of the TIMMA Autonomous Shuttle project. The route was determined using the original routes proposed in the TITIP with modifications due to the phased construction of the Project and other restrictions. Additional considerations when planning the route included parked cars next to the route, vegetation maintenance near the roadways, turning radii when the shuttle is turning, and horizontal and vertical curves. The Project envisions the pilot route to include all, or a portion, of the preliminary route and stops.

Shuttle stops will be located along the route alignment and will be determined through outreach during the start of the project. It is anticipated that the final route will have up to five stops. The headway, route length, number of shuttle stops, and the average speed of the Autonomous Shuttles determine the number of shuttles needed for the Project. Since the purpose of the Project is to evaluate the technology, a longer headway or shorter route may be considered to minimize the number of shuttles and the pilot costs or even extend the Project duration.

Pavement markings and signing within the route segments will be provided in their existing condition. TIMMA is evaluating potential infrastructure improvements before Project deployment.

EXHIBIT F – Federal Compliance Questionnaire

INSTRUCTIONS FOR COMPLETING THE FEDERAL COMPLIANCE QUESTIONAIRE

Name of Applicant Firm: _____

Date Submitted: _____

Preparer's Name: _____

1. The Questionnaire should be completed by a person in the firm who is knowledgeable of and duly authorized to attest to the past and present operations of the firm and its policies.

2. All questions must be answered completely and any "No" or "Not Applicable (N/A)" answers must be fully explained.

3. TIMMA reserves the right to ask for additional documentation if it is reasonably required to make a determination of integrity and responsibility relevant to the goods or services the Applicant Firm will provide to the TIMMA if awarded a contract.

SECTION 1: AMERICANS WITH DISABILITY ACT (ADA) Titles II and III of the Americans with Disabilities Act of 1990 provide that no entity shall discriminate against an individual with a disability in connection with the provision of transportation service. The law sets forth specific requirements for vehicle and facility accessibility and the provision of service, including complementary paratransit service.		**YES**	**NO**	**N/A**
1.	Does the Proposer track, resolve, and respond to ADA-related complaints?			
2.	Are vehicles used in contracted fixed-route service, including microtransit and commuter bus service, accessible?			
3.	Are facilities for providing public transportation readily accessible to and usable by individuals with disabilities?			
4.	Does the Proposer follow provision of service requirements?			
5.	Does the Proposer accommodate individuals who rely on accessible equipment when that equipment is inoperative?			
6.	Is general route-deviation service open to the general public?			
7.	Does the Proposer monitor service provided under contract or other arrangement or relationship, or service provided by another public entity on the Proposer's behalf for compliance with the U.S. Department of Transportation (US DOT) ADA regulations?			

8.	Does the Proposer monitor service provided by subrecipients for compliance with the US DOT ADA regulations?			
SECTION 2: DRUG-FREE WORKPLACE ACT (DFWA) The selected proposer is required to maintain a drug free workplace for all award-related employees; report any convictions occurring in the workplace timely; and have an ongoing drug free awareness program.		**YES**	**NO**	**N/A**
9.	Does the Proposer have a written policy as prescribed in the Drug Free Workplace Act that is distributed to all award-related employees?			
10.	Does the Proposer have an on-going drug free awareness program?			
11.	Did the Proposer report to any federal agency all criminal convictions of award-related employees drug statute violation that occurred in the workplace?			
SECTION 3: EQUAL EMPLOYMENT OPPORTUNITY The selected proposer must ensure that no person in the United States shall on the grounds of race, color, religion, national origin, sex, age, or disability be excluded from participating in, or denied the benefits of, or be subject to discrimination in employment under any project, program, or activity receiving Federal financial assistance under the Federal transit laws.		**YES**	**NO**	**N/A**
12.	Has the Proposer developed the appropriate EEO program?			
13.	Does the Proposer's abbreviated EEO program contain the required elements?			
14.	Does the Proposer ensure proper personnel assignments are made to ensure EEO program implementation?			
15.	Does the Proposer ensure the required elements of its EEO program are properly implemented?			
16.	Does the Proposer provide oversight of subrecipients and/or contractors who meet the EEO program threshold?			
SECTION 4: LOBBYING The selected proposer and subcontractors are prohibited from using appropriated Federal funds to lobby for Federal funds. If the selected proposer and subcontractors uses local funds to lobby for transit purposes, the selected proposer and subcontractors must file the OMB Standard Form LLL with the FHWA.		**YES**	**NO**	**N/A**
17.	Did the Proposer and any subcontractors use only non-federal funds for any lobbying activities and did each file the required disclosure form?			
SECTION 5: MAINTENANCE The selected proposer must keep federally funded vehicles, equipment, and facilities in good operating condition. The selected proposer must keep ADA		**YES**	**NO**	**N/A**

accessibility features on all vehicles, equipment, and facilities in good operating order.				
18.	Does the Proposer have a written maintenance plan(s) for federally funded assets (including vehicles/vessels, facilities, and equipment)?			
19.	Is the Proposer following its program for preventive maintenance inspections for federally funded assets?			
20.	Does the Proposer's vehicle maintenance program address maintenance procedures for wheelchair lifts and other accessibility features?			
21.	Does the Proposer have a system for tracking warranty issues and does the Proposer actively pursue warranty claims?			
22.	Do Proposers have an effective mechanism for monitoring subcontractors' and lessees' maintenance activities?			

TREASURE ISLAND
MOBILITY MANAGEMENT AGENCY

1455 Market Street, 22ND Floor, San Francisco, CA 94103 415-522-4800 info@timma.org www.timma.org

OPERATING AGREEMENT BETWEEN THE TREASURE ISLAND MOBILITY MANAGEMENT AGENCY AND _____ FOR AUTONOMOUS SHUTTLE SERVICES FOR THE TREASURE ISLAND AUTONOMOUS SHUTTLE PILOT PROJECT CONTRACT NO. XX/XX-XX

THIS AGREEMENT is effective as of this _____ day of _____, 2022 ("Effective Date") by and between the TREASURE ISLAND MOBILITY MANAGEMENT AGENCY ("TIMMA") and _____, ("CONTRACTOR"), collectively referred to herein as the "Parties".

RECITALS

A. **WHEREAS**, on April 1, 2014, the San Francisco Board of Supervisors adopted a resolution designating the San Francisco County Transportation Authority ("Transportation Authority") as the Treasure Island Mobility Management Agency to implement elements of the Treasure Island Transportation Implementation Plan ("TITIP") in support of the Treasure Island (TI)/Yerba Buena Island (YBI) Development Project; and

B. **WHEREAS**, the TITIP calls for, and TIMMA will be responsible for, implementing the Treasure Island Mobility Management Program: a comprehensive and integrated program to manage travel demand on Treasure Island as the development project occurs, including a free on-island shuttle; and

C. **WHEREAS**, in late 2016, Transportation Authority, acting on behalf of TIMMA, joined the San Francisco Municipal Transportation Agency's ("SFMTA") application for federal Advanced Transportation and Congestion Management Technologies Deployment ("ATCMTD") funding from the U.S. Department of Transportation ("DOT"), through the Federal Highway Administration ("FHWA"); and

D. **WHEREAS,** the SFMTA and the Transportation Authority, acting on behalf of TIMMA, was awarded $10,990,760 in ATCMTD funds; and

E. **WHEREAS**, the Metropolitan Transportation Commission ("MTC) awarded the Transportation Authority, acting on behalf of TIMMA, $828,000; and

F. **WHEREAS,** the ATCMTD and MTC awards are set forth in the Transportation Authority budget as TIMMA-dedicated funds; and

G. **WHEREAS**, on [DATE], 2022, TIMMA issued a Request for Proposals seeking an Autonomous Shuttle provider to provide Autonomous Shuttle services for the Treasure Island Autonomous Shuttle Pilot Project (the "Pilot Project"); and

H. **WHEREAS**, the selected provider is to develop, deploy, and provide information to evaluate an Autonomous Shuttle pilot service on Treasure Island; and

I. **WHEREAS**, the Pilot Project is intended to provide free, temporary 9-month on-island service;

J. **WHEREAS,** on [DATE], the TIMMA Board approved Resolution [XX-XX], awarding a two and a half-year operating agreement to CONTRACTOR in an amount not to exceed $825,000, to provide Autonomous Shuttle services for the Pilot Project, and authorizing the Executive Director to negotiate agreement payment terms and non-material agreement terms and conditions; and

NOW THEREFORE, the Parties hereto do mutually agree as follows:

Section 1. CONTRACT DOCUMENTS. The complete agreement between the parties shall consist of the following component parts:

1. This Agreement;
2. Exhibit A – Request for Proposal 21/22-01 ("RFP"), including all exhibits, forms, and addenda;
3. Exhibit B – Contractor's Proposal dated [DATE], including any subsequent responsive documents associated therewith;
4. Exhibit C – Priced Statement of Work and Milestones Chart;
5. Exhibit D – Federal Requirements
6. Exhibit E – Certificates of Insurance

This Agreement and the other exhibits mentioned above in this Section, which are incorporated by reference, constitute the complete Agreement between the Parties and are collectively referred to as the "Contract Documents." In the event of any conflict between any of the provisions of the Contract Documents, (including exhibits), the Contract Documents shall control in the following order: (1) this Agreement; (2) the RFP, including all addenda, exhibits, and attachments; (3) the Contractor's Proposal; (4) the Priced Statement of Work and Milestones Chart; (5) Federal Requirements; and (6) Certificates of Insurance.

Section 2. SCOPE OF SERVICES AND TECHNICAL SPECIFICATIONS

CONTRACTOR shall furnish TIMMA with all of the services and materials, and perform any and all other work as specified herein and in full accordance with the "Scope of Services" as provided in the RFP, attached hereto as Exhibit A. The Scope of Services includes developing, deploying, operating, and collecting and providing information to evaluate an Autonomous Shuttle pilot service on Treasure Island. The Pilot Project is comprised of nine tasks, which are fully described in the RFP (Exhibit A) and in the Contractor's Proposal (Exhibit B). All tasks shall be undertaken in compliance with the Priced Statement of Work and Milestones Chart (Exhibit C) and in accordance with the Contract Documents.

CONTRACTOR shall complete the Scope of Services in a competent and professional manner in accordance with the highest industry standards. CONTRACTOR is responsible for the accuracy, quality, and completeness of all of the services and materials, and the performance of any and all of work as specified herein and the Scope of Services. TIMMA's review and approval of any work product, materials, and/or services shall not constitute a waiver of any claim for defects or negligent performance related to the work product, materials, and/or services. Further, TIMMA's review and

approval of any work product, materials, and/or services shall under no circumstances transfer any liability related to the work product, materials, and/or services to TIMMA.

Section 3. TERM

The term of this Agreement shall commence on the Effective Date and will terminate nine months from the Effective Date on _____, 2023 unless earlier terminated Pursuant to Section 9 below or otherwise extended pursuant to Section 4 below.

Section 4. CONTRACT PRICE

The contract amount for the Pilot Project shall not exceed Eight Hundred Twenty-Five Thousand Dollars ($825,000.00) for all services, equipment, materials, supplies, labor, warranties, and other costs.

Section 5. INVOICING; PAYMENT; AND FEES

Transportation Authority, as the grant recipient and acting on behalf of TIMMA, will make all payments to Contractor pursuant to this Agreement. Payment for all work shall be made in accordance with terms and procedures outlined in the Priced Statement of Work and Milestones Chart attached as Exhibit C.

No charges shall be incurred under this Agreement nor shall any payments become due to CONTRACTOR until reports, services, or both, required under this Agreement are received from CONTRACTOR and approved by the Executive Director or his or her designee as being in accordance with this Agreement. Transportation Authority may withhold payment to CONTRACTOR in any instance in which CONTRACTOR has failed or refused to satisfy any material obligation provided for under this Agreement.

Invoices furnished by CONTRACTOR under this Agreement must be in a form acceptable to the Executive Director. All amounts paid by Transportation Authority to Contractor shall be subject to audit by Transportation Authority. A sample of the required invoice format appears in Exhibit G, “Sample Invoice,” attached hereto and incorporated by reference as though fully set forth herein.

Payment shall be made by Transportation Authority to Contractor at the address specified in the section entitled “Notices to the Parties.” In no event shall Transportation Authority or TIMMA be liable for interest or late charges for any late payments.

Section 6. GRANT-FUNDED CONTRACTS

1. Responsibility. CONTRACTOR will be responsible for assuring that CONTRACTOR, its employees and subcontractors, meet all grant requirements placed on federal fund and/or MTC fund recipients. CONTRACTOR, its employees and subcontractors, shall comply with all federal requirements set forth in Exhibit D.

2. Disallowance. If CONTRACTOR requests or receives payment from Transportation Authority for work done or services provided under this Agreement, reimbursement for which is later disallowed by the United States Government and/or MTC, CONTRACTOR shall promptly refund the disallowed amount to Transportation Authority upon Transportation Authority’s request. At its option, Transportation Authority may offset the amount disallowed

from any payment due or to become due to CONTRACTOR under this Agreement or any other Agreement between CONTRACTOR and TIMMA.

Section 7. PERMITS TO OPERATE

To the extent applicable, CONTRACTOR shall, at CONTRACTOR's expense, obtain all necessary federal, state, and local permits, licenses, and regulatory approvals necessary to perform and complete the work under this Agreement, including obtaining all applicable Federal Motor Vehicle Safety Standard ("FMVSS") Exemptions, National Highway Traffic Safety Administration ("NHTSA") Waivers and Route Approvals, and the appropriate California Department of Motor Vehicles ("DMV") and California Public Utilities Commission ("CPUC") permits.

Section 8. SUBCONTRACTORS

CONTRACTOR may subcontract portions of the work and services provided for under this Agreement only upon prior written approval of TIMMA. CONTRACTOR is responsible for its subcontractors throughout the course of the work required to be performed under this Agreement. All subcontracts must incorporate the terms of this Agreement, unless inapplicable. Neither Party shall, on the basis of this Agreement, contract on behalf of, or in the name of, the other Party. Any agreement made in violation of this provision shall be null and void.

Section 9. KEY PERSONNEL

CONTRACTOR shall provide only competent personnel under the supervision of, and in the employment of, CONTRACTOR (or CONTRACTOR's authorized subcontractors) to perform the work under this Agreement. CONTRACTOR shall comply with TIMMA's reasonable requests regarding assignment and/or removal of personnel, but all personnel, including those assigned at TIMMA's request, must be supervised by CONTRACTOR. CONTRACTOR shall commit adequate resources to allow timely completion within the project schedule specified in this Agreement. CONTRACTOR agrees that all personnel identified as key personnel ("Key Personnel" or "Key Person") in the Contractor's Proposal shall be committed and assigned to provide services under this Agreement.

Substitutions of Key Personnel will not be approved except for extenuating circumstances (e.g., illness or departure from the firm). If it is necessary to substitute a Key Person, CONTRACTOR shall propose a replacement in writing to TIMMA for approval. CONTRACTOR shall replace any Key Person departing his or her assigned role under this Agreement with an individual of comparable experience on a non-temporary basis within 30 calendar days of the departure of the Key Person. Failure to replace a Key Person shall be cause for the Transportation Authority to suspend invoice payments. Furthermore, CONTRACTOR shall not be relieved of its obligation for full performance of the Scope of Services as a result of any unfilled position. CONTRACTOR shall be held fully responsible for any inefficiencies, schedule delays or cost overruns resulting in whole or in part from any Key Person departing from his/her assigned role under the Agreement before the end of the term of the Agreement. CONTRACTOR shall bear any additional costs incurred in substituting personnel. Such costs include relocation expenses, expenses related to recruiting and hiring, training and learning on the job. CONTRACTOR acknowledges that the contractor selection and the contractor's fees were based, in part, on CONTRACTOR's proposed Key Personnel for this Agreement.

Section 10. DISPUTE RESOLUTION

The Parties will attempt in good faith to resolve any dispute or controversy arising out of or relating to the performance of services under this Agreement. If the Parties are unable to resolve the dispute, then, CONTRACTOR may submit to the Contract Administrator a written request for administrative review and documentation of the CONTRACTOR's claim(s). Upon such request, the Contract Administrator shall promptly issue an administrative decision in writing, stating the reasons for the determination and any action taken and informing the CONTRACTOR of its right to judicial review. If agreed by both Parties in writing, disputes may be resolved by a mutually agreed-upon alternative dispute resolution process. If the Parties do not mutually agree to an alternative dispute resolution process or such efforts do not resolve the dispute, then either Party may pursue any remedy available under California law. The status of any dispute or controversy notwithstanding, CONTRACTOR shall proceed diligently with the performance of its obligations under this Agreement in accordance with the Agreement and the written directions of TIMMA.

Section 11. TERMINATION

1. Termination for Convenience. TIMMA, by written notice, may terminate this Agreement, in whole or in part, in TIMMA's sole discretion, at any time during the term hereof, for convenience and without cause. If this Agreement is terminated, TIMMA shall be liable only for payment of milestones outlined in the payment provisions of this Agreement that have been satisfactorily completed before the effective date of termination.

2. Termination for Default [Breach or Cause]. If CONTRACTOR does not complete the Tasks in accordance with the Priced Statement of Work and Milestones Chart in Exhibit C, or, if CONTRACTOR fails to perform the services in the manner provided for in this Agreement or the Contract Documents, or if CONTRACTOR fails to comply with any other provisions of this Agreement or the Contract Documents, TIMMA may terminate this Agreement for default. Termination shall be effective upon the serving of a written notice of termination on CONTRACTOR setting forth the manner in which CONTRACTOR is in default. CONTRACTOR will only be paid the Contract Price for supplies delivered and accepted, or services performed in accordance with the manner of performance set forth in the Agreement and the Contract Documents.

    (a) **Excuse**. If it is later determined by TIMMA that CONTRACTOR had an excusable reason for not performing, such as a strike, fire, or flood, events which are not the fault of or are beyond the control of the CONTRACTOR, TIMMA, after setting up a new delivery of performance schedule, may allow CONTRACTOR to continue work, or treat the termination as a termination for convenience.

    (b) **Cure**. TIMMA in its sole discretion may, in the case of a termination for breach or default, allow CONTRACTOR seven (7) days in which to cure the defect. In such case, the notice of termination will state the necessary steps CONTRACTOR must take in order to cure, the time period in which cure is permitted, and any other appropriate conditions.

    (c) **Failure to Remedy**. If CONTRACTOR fails to remedy to TIMMA's satisfaction the breach or default of any of the terms, covenants, or conditions of this Agreement within seven (7) days after receipt by CONTRACTOR of written notice from TIMMA setting forth the nature of said breach or default and the steps necessary to cure such breach or default, then TIMMA shall have the right to terminate the Agreement without any

further obligation to CONTRACTOR. Any such termination for default shall not in any way operate to preclude TIMMA from also pursuing all available remedies at law or under this Agreement against CONTRACTOR and its sureties for said breach or default.

(d) **No Waiver**. In the event that TIMMA elects to waive its remedies for any breach by CONTRACTOR of any covenant, term or condition of this Agreement or the Contract Documents, such waiver by TIMMA shall not limit TIMMA's remedies for any succeeding breach of that or of any other term, covenant, or condition of this Agreement.

(e) **Damages.** If TIMMA terminates the Agreement for cause pursuant to this Section, TIMMA may take over the Work and prosecute the same to completion by TIMMA or otherwise, and the CONTRACTOR shall be liable to TIMMA for reasonable costs incurred by TIMMA in making necessary arrangements for completion of the Work by others. TIMMA shall have the right to set off any such amounts it incurs in order to complete the Work or otherwise related to CONTRACTOR's termination against any payments owed to CONTRACTOR for that portion of the Work which has been completed and accepted by TIMMA.

(f) **All Available Remedies**. TIMMA reserves the right to pursue all available legal, administrative, contractual, and/or equitable remedies in the event of CONTRACTOR's breach of this Agreement or violation of any term of this Agreement.

Section 12. MAINTENANCE AND SERVICE HOURS

1. Service and Maintenance Hours Requirements. CONTRACTOR shall provide the number of service hours provided for and required in Appendix A ("Service Hours"). For purposes of this Agreement, Service Hours means the number of hours per day that CONTRACTOR is required to provide Autonomous Shuttle services to passengers for the Pilot Project. The hours required by CONTRACTOR to complete scheduled and as-needed maintenance and repair of vehicles and equipment shall be in addition to the number of required Service Hours and shall take place outside of regularly scheduled Service Hours to the extent feasible.

2. Liquidated Damages for Service Outages. In the event that CONTRACTOR provides less than ninety-five percent (95%) of the regularly scheduled Service Hours in any thirty (30) day period of the Pilot Project ("Service Outages"), then TIMMA will sustain financial and other damages. Based on the foregoing, in the event of Service Outages, CONTRACTOR shall pay TIMMA as liquidated damages the amount of $5,000 for each 30-day period of the Pilot Project where such Service Outages have occurred. The parties acknowledge that this amount represents TIMMA's reasonable estimate of damages from Service Outages and does not constitute a penalty. TIMMA's right to collect liquidated damages provided for this Section AA are cumulative and not exclusive and are in addition to any and all other rights and remedies provided by law or other sections of this Agreement, including TIMMA's right to collect damages associated with TIMMA's termination of this Agreement for cause due to CONTRACTOR's material breach of this Agreement. At its option, TIMMA may deduct any liquidated damages owed by CONTRACTOR from amounts otherwise payable to the CONTRACTOR or may bill the CONTRACTOR as a separate item.

Section 13. LIABILITY OF THE PARTIES

1. Liability of TIMMA. TIMMA's payment obligations under this Agreement shall be limited to the payment of the compensation provided for in Section 5, "Invoicing; Payment; and Fees," of this Agreement. Notwithstanding any other provision of this Agreement, in no event shall TIMMA, Transportation Authority, SFMTA, or the City and County of San Francisco ("CCSF" or "City") be liable, regardless of whether any claim is based on contract or tort, for any special, consequential, indirect or incidental damages, including, but not limited to, lost profits, arising out of or in connection with this agreement or the services performed in connection with this agreement.

2. Liability for Use of Equipment. TIMMA, Transportation Authority, SFMTA, and CCSF shall not be liable for any damage to persons or property as a result of the use, misuse or failure of any equipment used by CONTRACTOR, or any of its subcontractors, or by any of their employees, even though such equipment is furnished, rented or loaned by TIMMA, Transportation Authority, SFMTA, or CCSF.

3. Liability for Use of Vehicle Storage Location. TIMMA, Transportation Authority, SFMTA, MTC, and CCSF shall not be liable for any damage to persons or property as a result of CONTRACTOR's use or misuse of the on-island vehicle storage location provided by TIMMA, any condition of the vehicle storage location, including any dangerous condition at such facility, or any theft or vandalism perpetrated by third-parties at or near such facility. CONTRACTOR's use of the on-island vehicle storage location for storage and charging of its vehicles is entirely at its own risk and by electing to store and charge its vehicle in the storage location, CONTRACTOR shall waive any and all claims for liability against TIMMA, Transportation Authority, SFMTA, MTC, and CCSF arising out of such storage and/or charging. Furthermore, CONTRACTOR shall indemnify TIMMA, Transportation Authority, SFMTA, MTC, and CCSF for any liability arising out of use of TIMMA's facilities for storage and charging of vehicles in accordance with CONTRACTOR's obligations provided in Section 20 below.

4. Liability for Incidental and Consequential Damages. CONTRACTOR shall be responsible for incidental and consequential damages resulting in whole or in part from CONTRACTOR's acts or omissions.

Section 14. INSURANCE

Prior to commencing operations, CONTRACTOR, at its own cost and expense, unless otherwise specified below, shall procure the types and amounts of insurance listed below against claims for injuries to persons or damages to property that may arise from or in connection with the operations authorized hereunder by the CONTRACTOR and its agents, representatives, employees, and subcontractors. Consistent with the following provisions, CONTRACTOR shall provide Certificates of Insurance, attached hereto and incorporated herein as Exhibit E, indicating that CONTRACTOR has obtained or currently maintains insurance that meets the requirements of this section and under forms of insurance satisfactory, in all respects, to TIMMA. CONTRACTOR shall maintain the insurance policies required by this section throughout the term of this Agreement. CONTRACTOR shall not allow any subcontractor to commence work on any subcontract associated with the operations authorized by this Agreement until CONTRACTOR has obtained all insurance required herein for the subcontractor(s).

1. *Policy Limits*

a. Workers' Compensation, in statutory amounts, with Employers' liability limits not less than $1,000,000.00 each accident;

b. Commercial General Liability Insurance with limits not less than $5,000,000.00 each occurrence, and $10,000,000.00 general aggregate for Bodily Injury and Property Damage, including Contractual Liability, Personal Injury, and Products and Completed Operations.

c. Commercial Automobile Liability Insurance with limits not less than $5,000,000.00 each occurrence, "Combined Single Limit" for Bodily Injury and Property Damage, including Owned, Non-Owned, and Hired auto coverage, as applicable.

d. Professional Liability Insurance with limits not less than $2,000,000.00 per claim. Sub-contractors providing professional services under this Agreement shall be added to CONTRACTOR's policy as an additional insured, or shall provide evidence of their own professional liability insurance which is acceptable to TIMMA's Executive Director.

e. Technology Errors and Omissions and Cyber Liability coverage, with limits of $1,000,000.00 each occurrence and each loss, and $2,000,000.00 general aggregate. The policy shall at a minimum cover:

    i. Professional misconduct or lack of the requisite skill required for the performance of services defined in the contract;

    ii. Liability arising from theft, dissemination, and/or use of confidential information, including but not limited to, bank and credit card account information or personal information as defined in California Code of Civil Procedure 1798.140(o)(1) such as name, address, social security numbers, protected health information or other personally identifying information, stored or transmitted in electronic form;

    iii. Network security liability arising from the unauthorized access to, use of, or tampering with computers or computer systems, including hacker attacks; and

    iv. Liability arising from the introduction of any form of malicious software including computer viruses into, or otherwise causing damage to TIMMA's or third party's computer, computer system, network, or similar computer related property and the data, software, and programs thereon.

f. Umbrella coverage in excess of the underlying liability policies in an amount not less than $10,000,000.00 per occurrence.

2. *Policy Requirements*

a. Acceptability of Insurers. All insurance coverage required by this section must be provided by an insurance company authorized to do business in the State of California. All insurance required by this section is to be placed with insurers with a Best's rating of no less than A:VIII or higher.

b. Verification of Coverage. Prior to beginning the work provided for under this Agreement and prior to any disbursement of funds pursuant to this Agreement, CONTRACTOR shall furnish TIMMA with complete copies of all policies delivered to CONTRACTOR by the insurer, including complete copies of all endorsements attached to those policies. All copies of policies and certified endorsements shall show the signature of a person authorized by that insurer to bind coverage on its behalf. If TIMMA does not receive the required insurance documents prior to CONTRACTOR beginning work under this Agreement, this shall not waive CONTRACTOR's obligation to provide them. TIMMA reserves the right to require complete copies of all required insurance policies at any time.

c. Additional Insured; Primary Insurance; Endorsements.

   i. TIMMA, Transportation Authority, MTC, SFMTA and CCSF, and their respective officers, employees, agents, and volunteers shall be covered as additional insureds with respect to each of the following: liability arising out of activities performed by or on behalf of CONTRACTOR, including the insured's general supervision of CONTRACTOR; products and completed operations of CONTRACTOR, as applicable; premises owned, occupied, or used by CONTRACTOR; and automobiles owned, leased, or used by the CONTRACTOR in the course of operating pursuant to this Agreement. The coverage shall contain no special limitations on the scope of protection afforded to TIMMA or its officers, employees, agents, or volunteers.

   ii. A certified endorsement must be attached to all policies stating that coverage is primary insurance with respect to TIMMA, Transportation Authority, MTC, SFMTA, and CCSF and their respective officers, officials, employees, and volunteers, and that no insurance or self-insurance maintained by TIMMA, Transportation Authority, MTC, SFMTA, and CCSF shall be called upon to contribute to a loss under the coverage.

d. Notice of Reduction in or Cancellation of Coverage. A certified endorsement shall be attached to all insurance obtained pursuant to this Agreement stating that coverage shall not be suspended, voided, canceled, reduced in coverage or in limits, or otherwise materially changed, except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to TIMMA. In the event that any coverage required by this section is reduced, limited, cancelled, or materially affected in any other manner, CONTRACTOR shall provide written notice to TIMMA at CONTRACTOR's earliest possible opportunity and in no case later than ten (10) working days after CONTRACTOR is notified of the change in coverage.

   Any failure of CONTRACTOR to comply with reporting provisions of the policies shall not affect coverage provided to TIMMA and its officers, employees, agents, and volunteers.

e. Claims-made Limitation. Should any of the required insurance be provided under a claims-made form, the following provisions shall apply:

   i. CONTRACTOR must maintain such insurance coverage continuously throughout the term of this Agreement and such insurance must be

maintained and evidence of such insurance must be provided for at least five (5) years after completion of the Agreement or the work.

ii. The retroactive date of the policy must be shown and must be before the date of the Agreement.

iii. If coverage is canceled or not renewed and it is not replaced with another claims-made policy form with a retroactive date that precedes the date of this Agreement, CONTRACTOR shall purchase extended period coverage for a minimum of five (5) years after completion of the Agreement or the work. TIMMA shall have the right to exercise, at CONTRACTOR's sole cost and expense, any extended reporting provisions of the policy, if CONTRACTOR cancels or does not renew the coverage.

iv. A copy of the claim reporting requirements must be submitted to TIMMA for review prior to the commencement of any work under this Agreement.

f. Deductibles and Self-Insured Retentions. CONTRACTOR shall disclose to and obtain the approval of TIMMA for any self-insured retentions and deductibles of all insurance policies required by this Agreement before beginning any of the services or work called for by any term of this Agreement. Further, if the CONTRACTOR's insurance policy includes a self-insured retention that must be paid by a named insured as a precondition of the insurer's liability, or which has the effect of providing that payments of the self-insured retention by others, including additional insureds or insurers do not serve to satisfy the self-insured retention, such provisions must be modified by special endorsement so as to not apply to the additional insured coverage required by this Agreement so as to not prevent any of the parties to this Agreement or any of the additional insureds from satisfying or paying the self-insured retention required to be paid as a precondition to the insurer's liability. Additionally, the certificates of insurance must note whether the policy does or does not include any self-insured retention and also must disclose the deductible.

During the period covered by this Agreement, only upon the prior express written authorization of TIMMA, CONTRACTOR may increase such deductibles or self-insured retentions with respect to TIMMA, its officers, employees, agents, and volunteers. TIMMA may condition approval of an increase in deductible or self-insured retention levels with a requirement that CONTRACTOR procure a bond, guaranteeing payment of losses and related investigations, claim administration, and defense expenses that is satisfactory in all respects to each of them.

g. Subcontractors. Company shall include all subcontractors as insureds under its policies or shall furnish separate certificates and certified endorsements for each subcontractor. All coverages for subcontractors shall be subject to all of the requirements stated herein.

h. Wasting Policy. No insurance policy required by this section shall include a "wasting" policy limit.

i. Waiver of Subrogation. CONTRACTOR hereby grants to TIMMA, Transportation Authority, MTC, SFMTA, and CCSF a waiver of any right to subrogation which any insurer of said CONTRACTOR may acquire against TIMMA by virtue of the payment

of any loss under such insurance. CONTRACTOR agrees to obtain any endorsement that may be necessary to affect this waiver of subrogation, but this provision applies regardless of whether or not TIMMA has received a waiver of subrogation endorsement from the insurer.

j. Variation. TIMMA, Transportation Authority, MTC, SFMTA, and CCSF may approve a variation in the foregoing insurance requirements, upon a determination that the coverage, scope, limits, and forms of such insurance are either not commercially available, or that the TIMMA, Transportation Authority, MTC, SFMTA, and CCSF's interests are otherwise fully protected.

Section 15. INDEPENDENT CONTRACTOR

For the purposes of this Section 14 "CONTRACTOR" shall be deemed to include not only CONTRACTOR, but also any agent, contractor, or employee of CONTRACTOR or its Subcontractors. At all times during the term of this Agreement, CONTRACTOR shall be an independent contractor and shall not be an employee of TIMMA, Transportation Authority, MTC, CCSF, nor SFMTA. TIMMA shall have the right to control CONTRACTOR only insofar as the results of CONTRACTOR's services rendered pursuant to this Agreement; however, otherwise TIMMA shall not have the right to control the means by which CONTRACTOR accomplishes services rendered pursuant to this Agreement. Notwithstanding any other City, state, or federal policy, rule, regulation, law, or ordinance to the contrary, CONTRACTOR and any of its employees, agents, and subcontractors providing services under this Agreement shall not qualify for or become entitled to, and hereby agree to waive any and all claims to, any compensation, benefit, or any incident of employment by TIMMA, Transportation Authority, MTC, CCSF, or SFMTA, including but not limited to eligibility to enroll in the California Public Employees Retirement System (PERS) as an employee of TIMMA, Transportation Authority, MTC, CCSF or SFMTA, and entitlement to any contribution to be paid by TIMMA, Transportation Authority, MTC, CCSF, nor SFMTA for employer contributions and/or employee contributions for PERS benefits.

Section 16. DATA PRIVACY

All data collected by CONTRACTOR shall be collected and stored in accordance with all applicable federal, state, and local laws, including San Francisco's Privacy First Policy (San Francisco Charter SEC. 16.130), the California Consumer Privacy Act of 2018 and the California Privacy Rights Act of 2020 (California Civil Code Section 1798.100 et seq.), and with all applicable federal, state, and local laws and other relevant privacy protection laws that come into effect during the term of this Agreement.

Section 17. DATA SHARING

As referenced in the RFP (Exhibit A), all data collected during the Pilot Program shall be shared with TIMMA in accordance with the Data Management, Sharing, and Cybersecurity Plan developed by CONTRACTOR and approved by TIMMA. All data shared with TIMMA will be considered project data. TIMMA shall own all project data and there shall be no restrictions on TIMMA's right to share such data as TIMMA deems appropriate.

Section 18. RIGHTS IN WORK PRODUCTS

1. Ownership of Work. Notwithstanding any other provision of this Agreement, any interest of CONTRACTOR or its subcontractors, in the work performed or work products created

pursuant to the Scope of Services, including any data, drawings, plans, specifications, blueprints, studies, reports, memoranda, computation sheets, computer files and media or other documents prepared by CONTRACTOR or its subcontractors, shall become the property of and will be transmitted to TIMMA. However, unless expressly prohibited elsewhere in this Agreement, CONTRACTOR may retain and use copies for reference and as documentation of its experience and capabilities.

2. Works for Hire. If, in connection with services performed under this Agreement, CONTRACTOR or its subcontractors creates work products including, without limitation, artwork, copy, posters, billboards, photographs, videotapes, audiotapes, systems designs, software, reports, diagrams, surveys, blueprints, source codes, or any other original works of authorship, whether in digital or any other format, such works of authorship shall be works for hire as defined under Title 17 of the United States Code, and all copyrights in such works shall be the property of TIMMA. If any work products created by CONTRACTOR or its subcontractor(s) under this Agreement are ever determined not to be works for hire under U.S. law, CONTRACTOR hereby assigns all CONTRACTOR's copyrights to such work products to TIMMA, agrees to provide any material and execute any documents necessary to effectuate such assignment, and agrees to include a clause in every subcontract imposing the same duties upon subcontractor(s). With TIMMA's prior written approval, CONTRACTOR and its subcontractor(s) may retain and use copies of such works for reference and as documentation of their respective experience and capabilities.

Section 19. TRADEMARKS AND SERVICE MARKS

1. License. For the term of this Agreement, TIMMA grants CONTRACTOR a license to use TIMMA's name and logo ("TIMMA Property") on CONTRACTOR's website in connection with CONTRACTOR's operation of the Pilot Project.

2. Limitations of License. CONTRACTOR shall not use the TIMMA Property in conjunction with any other licensed name, character, symbol, design, likeness or literary or artistic material, unless any such use is expressly permitted in writing by TIMMA. CONTRACTOR shall not alter TIMMA Property, as used on CONTRACTOR's website, in any way, including size, proportion, colors, or elements, without approval from TIMMA.

3. Promotions or Advertising. CONTRACTOR shall obtain TIMMA's approval for any text used in conjunction with this license on CONTRACTOR's website or in any promotional or advertising media produced by CONTRACTOR. TIMMA shall provide text, as requested by CONTRACTOR, and shall update the text regarding TIMMA's services and functions when required.

Section 20. CONFLICTS OF INTEREST

CONTRACTOR shall not employ any TIMMA official in the work performed pursuant to this Agreement. No officer or employee of TIMMA shall have any financial interest in this Agreement that would violate California Government Code Sections 1090, et seq.

CONTRACTOR hereby warrants that none of its officers, employees, agents, or volunteers is now, or has been in the previous twelve (12) months, an employee, agent, appointee, or official of TIMMA. If any of CONTRACTOR's officers, employees, agents, or volunteers was an employee, agent, appointee, or official of TIMMA in the previous twelve (12) months, CONTRACTOR warrants that they did not participate in any manner in the forming of this Agreement. CONTRACTOR

understands that, if this Agreement is made in violation of Government Code §1090, et seq., the entire Agreement is void and CONTRACTOR will not be entitled to any compensation for services performed pursuant to this Agreement, including reimbursement of expenses, and CONTRACTOR will be required to reimburse TIMMA for any sums paid to CONTRACTOR.

Section 21. COVID-19

CONTRACTOR agrees to comply with all applicable federal, state, and local COVID-19 protocols, including the Treasure Island Development Authority ("TIDA") Safety Protocol for COVID, the TIDA Worksite Visitor Policy, the SFMTA COVID-19 Car Cleaner Instructions for Cleaning and Disinfecting Surfaces in Vehicles, Cal/OSHA COVID and general procedures (https://www.dir.ca.gov/dosh/coronavirus/) and the US DOT and CDC requirements for masking on transit (https://www.cdc.gov/quarantine/pdf/Mask-Order-CDC_GMTF_01-29-21-p.pdf) as may be updated or changed from time to time.

Section 22. INDEMNIFICATION

1. Indemnification; General. CONTRACTOR shall indemnify and save harmless TIMMA, Transportation Authority, SFMTA, MTC, and CCSF and their respective officers, agents and employees from, and, if requested, shall defend them, with counsel selected by TIMMA, against any and all loss, damage, injury, liability, suits, causes of action, and claims thereof for injury to or death of a person (including employees of CONTRACTOR) or loss of or damage to property, or any violation of any federal, state, or municipal law or ordinance, resulting directly or indirectly from CONTRACTOR's performance of this Agreement, including, but not limited to, the use of CONTRACTOR's facilities or equipment or equipment or facilities provided by TIMMA or others. CONTRACTOR's indemnification obligations pursuant to this Section shall apply regardless of the negligence of (and regardless of whether liability without fault is imposed or sought to be imposed on) TIMMA, Transportation Authority, MTC, SFMTA, and/or CCSF, except (i) to the extent that such indemnity is void or otherwise unenforceable under applicable law in effect on or validly retroactive to the date of this Agreement, and (ii) except where such loss, damage, injury, liability or claim is the result of the active negligence or willful misconduct of TIMMA, Transportation Authority, MTC, SFMTA, and/or CCSF and is not contributed to by any act of, or by any omission to perform some duty imposed by law or agreement on CONTRACTOR, its subcontractors or either's agent or employee. The foregoing indemnity shall include, without limitation, reasonable fees of attorneys, consultants and experts and related costs and TIMMA, Transportation Authority, MTC, SFMTA, and/or CCSF's costs of investigating any claims against TIMMA.

2. Duty to Defend. In addition to CONTRACTOR's obligation to indemnify TIMMA, Transportation Authority, MTC, SFMTA, and CCSF, CONTRACTOR specifically acknowledges and agrees that it has an immediate and independent obligation to defend TIMMA, Transportation Authority, MTC, SFMTA,, and CCSF from any claim which actually or potentially falls within this indemnification provision, even if the allegations are or may be groundless, false or fraudulent, which obligation arises at the time such claim is tendered to CONTRACTOR by TIMMA, Transportation Authority, SFMTA, MTC, and/or CCSF and continues at all times thereafter.

3. Intellectual Property Claims. CONTRACTOR shall indemnify and hold TIMMA, Transportation Authority, SFMTA, MTC, and CCSF and their respective officers, agents and employees harmless from all loss and liability, including attorneys' fees, court costs and all other litigation expenses for any infringement of the patent rights, copyright, trade secret or

any other proprietary right or trademark, and all other intellectual property claims of any person or persons in consequence of the use by TIMMA, Transportation Authority, SFMTA, MTC, and CCSF, or any of their respective officers, agents, and employees of work or services to be supplied in the performance of this Agreement.

4. Insurance Not in Place of Indemnity. Acceptance by TIMMA of insurance certificates and endorsements required under this Agreement does not relieve CONTRACTOR from liability under this indemnification and hold harmless clause. This indemnification and hold harmless clause shall apply to any damages or claims for damages whether or not such insurance policies shall have been determined to apply. By execution of this Agreement, CONTRACTOR acknowledges and agrees to the provisions of this Section and that it is a material element of consideration.

Section 23. ASSIGNMENT

TIMMA and CONTRACTOR recognize and agree that this Agreement contemplates personal performance by CONTRACTOR and is based upon a determination of CONTRACTOR's unique personal competence, experience, and specialized personal knowledge. Moreover, a substantial inducement to TIMMA for entering into this Agreement was and is the professional reputation and competence of CONTRACTOR. CONTRACTOR may not assign this Agreement or any interest therein without the prior written approval of TIMMA. CONTRACTOR shall not subcontract any portion of the performance contemplated and provided for herein, other than to the subcontractors noted in Contractor's Proposal, without prior written approval of TIMMA. The provisions of this agreement shall inure to the benefit of and shall apply to and bind the successors and assigns of the parties.

Section 24. PUBLIC RECORDS

CONTRACTOR acknowledges that this Agreement and all records related to its formation, CONTRACTOR's performance of services, and City's payment are subject to the California Public Records Act, (California Government Code Section 6250 et seq.), and the San Francisco Sunshine Ordinance, (San Francisco Administrative Code Chapter 67). Such records are subject to public inspection and copying unless exempt from disclosure under federal, state or local law.

CONTRACTOR shall clearly designate all financial records, submittals or other materials, if any, which it in good faith believes to be corporate proprietary information, including trade secrets, protected from disclosure ("Proprietary Records"); if no records are designated, the Proprietary Records in their entirety may be subject to disclosure under the California Public Records Act and/or the San Francisco Sunshine Ordinance. TIMMA shall not be liable or in any way responsible for the disclosure of any such information.

Although the California Public Records Act recognizes that certain confidential and/or trade secret information may be protected from disclosure, TIMMA may not be in a position to establish that the records submitted by CONTRACTOR qualify for exemption pursuant to applicable law. If TIMMA receives a request for information that CONTRACTOR has designated as Proprietary Information, TIMMA will promptly notify CONTRACTOR of the request. If TIMMA denies the request and the requester takes legal action seeking release of the Proprietary Information, CONTRACTOR agrees to defend the action with counsel acceptable to TIMMA and to otherwise indemnify, defend and hold harmless TIMMA, its agents and employees, from any suit, judgment, liability, and award of attorneys' fees awarded stemming from any withholding or release of information submitted by

CONTRACTOR to TIMMA. This obligation to indemnify and defend survives the termination of this Agreement.

Section 25. GENERAL PROVISIONS

1. Severability. If any provision contained in this Agreement, or any exhibits incorporated as a part hereof, is or becomes invalid, illegal, or unenforceable in whole or in part, such invalidity, illegality, or unenforceability shall not affect the enforceability of the remaining provisions and portions, and the invalid, illegal, or unenforceable provision shall be deemed modified so as to have the most similar result that is valid and enforceable under applicable law.

2. Modifications. The provisions of this Agreement may be modified at any time by agreement of the parties hereto, provided such modification is in writing and signed by all parties to this Agreement. Any agreement made after the date of this Agreement and related to the subject matter contained herein shall be ineffective to modify this Agreement in any respect unless in writing and signed by both Parties.

3. No Agency. No agency, partnership, joint venture, employee-employer, or franchiser-franchisee relationship is intended or created by this Agreement.

4. Governing Law. This Agreement shall be governed by, construed and enforced in accordance with the laws of the State of California, without regard to or application of California's conflict of law principles. Any action to enforce or interpret any provision of this Agreement shall be venued in the court of competent jurisdiction in the City and County of San Francisco.

5. Attorneys' Fees. If a Party to this Agreement brings any action, including arbitration or an action for declaratory relief, to enforce or interpret the provisions of this Agreement, the prevailing Party shall be entitled to reasonable attorneys' fees in addition to any other relief to which that Party may be entitled. The court may set such fees in the same action or in a separate action brought for that purpose.

6. No Waiver. The failure or delay of either party to exercise any right, power or privilege under this Agreement will not operate as a waiver thereof.

7. Mutual Drafting; Interpretation. The Parties mutually represent and warrant that they have each had the opportunity to be represented by counsel of their choice in negotiating this Agreement, and therefore this Agreement shall be deemed to have been negotiated and prepared at the joint request, direction and construction of the Parties, at arm's length, with the advice and participation of counsel, and shall be interpreted in accordance with its terms without favor to either Party, and no presumption or burden of proof shall arise favoring or disfavoring either Party by virtue of the authorship of any of the provisions of this Agreement. Headings are provided in this Agreement for the convenience of the Parties only and shall not be used to interpret the provisions of this Agreement.

8. Entire Agreement. This Agreement comprises the entire agreement between the Parties and supersedes any and all other agreements, either oral or in writing, between the parties hereto with respect to the subject matter hereof; and no other agreement, statement, or promise relating to the subject matter of this Agreement not contained herein shall be valid or binding.

9. Counterparts. Each Party agrees that this Agreement may be executed by electronic or facsimile signature, which shall be as effective as an original signature and which may be used in lieu of the original for any purpose, and in one or more counterparts, all of which together shall constitute one Agreement binding on both Parties

10. Compliance with Laws. Both Parties shall at all times comply with all applicable laws and regulations of the United States, the State of California, the City and County of San Francisco, and other regulatory agencies when performing under this Agreement.

11. Unavoidable Delay. Unavoidable delay is an interruption of the work beyond the control of CONTRACTOR and which interruption CONTRACTOR could not have avoided by the exercise of care, prudence, foresight and diligence. Such delays include and are limited to acts of God; acts of the public enemy; adverse weather conditions; fires; floods; windstorms; tornadoes; wars; riots; insurrections; epidemics; quarantine restrictions; strikes, lockouts, sit-downs, slow-downs, and other labor disputes; fuel shortages; freight embargoes; accidents; acts of a governmental agency; priorities or privileges established for the manufacture, assembly or allotment of materials by order, decree, or otherwise of the United States or by any department, bureau, commission, committee, agent, or administrator of any legally constituted public authority; changes in the work ordered by the contracting officer, board or commission insofar as they necessarily require additional time in which to complete the entire work; the prevention by TIMMA, and/or Transportation Authority, of CONTRACTOR from commencing or prosecuting the work; the prevention of CONTRACTOR from commencing or prosecuting the work because of the failure of TIMMA, and/or Transportation Authority to furnish the necessary materials, when required by the terms of a contract and when requested by CONTRACTOR in the manner provided in said contract; and, inability to procure or failure of public utility service. The duration of said unavoidable delays shall be limited to the extent that the commencement, prosecution and completion of the work are delayed thereby, as determined by TIMMA.

    Material shortages, inability of CONTRACTOR to procure materials, labor shortages, or inability of CONTRACTOR to procure labor shall not be considered causes of unavoidable delay under this Agreement except as specifically approved by the TIMMA.

12. Third Party Beneficiaries. Except as specifically provided herein, nothing in this Agreement is intended to create any third-party beneficiary status or any rights in any third party to enforce this Agreement, except for Transportation Authority's right to enforce provisions as necessary pursuant to its status as the recipient of funding for this Agreement, acting on behalf of TIMMA.

Section 26. ADDITIONAL REQUIREMENTS INCORPORATED BY REFERENCE

1. Nondiscrimination Requirements.

    a. **Nondiscrimination in Contracts**. In performance of this Agreement, CONTRACTOR agrees not to discriminate against any employee, and/or Transportation Authority employee working with CONTRACTOR, or applicant for employment with Contractor on the basis of race, color, creed, religion, national origin, ancestry, age, height, weight, sex, sexual orientation, gender identity, domestic partner status, marital status, or disability or AIDS/HIV status.

b. **Nondiscrimination in the Provision of Employee Benefits**. CONTRACTOR has read, understood, and agrees to comply fully with all provisions of the Transportation Authority's Equal Benefits Policy, and all rules and regulations adopted by the Transportation Agency and TIMMA pursuant to those provisions (hereinafter "Equal Benefits Policy"). The Equal Benefits Policy is incorporated herein by reference and made part of this Agreement as though fully set forth. Any willful failure by Contractor to comply with any of the requirements of the Equal Benefits Policy shall be deemed a material breach of contract.

2. Prevailing Wage. To the extent applicable, the local prevailing wage requirements, applicable State general prevailing wage rates determined by the Director of Industrial Relations, and the applicable federal prevailing wage rates in accordance with the requirements of the Davis Bacon Act (23 USC 113, 40 USC 3141) as determined by the United States Secretary of Labor, if higher, are hereby made a part of this Agreement. It is further expressly agreed by and between the parties hereto that should there be any conflict between the terms of this instrument and the bid or proposal of said CONTRACTOR, then this instrument shall control and nothing herein shall be considered as an acceptance of the said terms of said proposal conflicting herewith.

3. Alcohol and Drug-Free Workplace. TIMMA reserves the right to deny access to, or require CONTRACTOR to remove from, TIMMA facilities any personnel of CONTRACTOR or subcontractor who TIMMA has reasonable grounds to believe has engaged in alcohol abuse or illegal drug activity which in any way impairs TIMMA's ability to maintain safe work facilities or to protect the health and well-being of TIMMA employees and the general public. TIMMA shall have the right of final approval for the entry or re-entry of any such person previously denied access to, or removed from, TIMMA facilities. Illegal drug activity means possessing, furnishing, selling, offering, purchasing, using or being under the influence of illegal drugs or other controlled substances for which the individual lacks a valid prescription. Alcohol abuse means possessing, furnishing, selling, offering, or using alcoholic beverages, or being under the influence of alcohol.

   CONTRACTOR agrees in the performance of this Agreement to maintain a drug-free workplace by notifying employees that unlawful drug use is prohibited and specifying what actions will be taken against employees for violations; establishing an on-going drug-free awareness program that includes employee notification and, as appropriate, rehabilitation. CONTRACTOR can comply with this requirement by implementing a drug-free workplace program that complies with the Federal Drug-Free Workplace Act of 1988 (41 U.S.C. § 701).

4. Large Vehicle Driver Safety Training Requirements. CONTRACTOR agrees that before any of its employees and subcontractors drive large vehicles within the City and County of San Francisco, those employees and subcontractors shall successfully complete either (a) the SFMTA's Large Vehicle Urban Driving Safety training program or (b) a training program that meets the SFMTA's approved standards for large vehicle urban driving safety. The SFMTA's approved standards for large vehicle urban driving safety is available for download at www.SFMTA.com/largevehicletrainingstandards. This requirement does not apply to drivers providing delivery services who are not employees or subcontractors of the CONTRACTOR. For purposes of this section, "large vehicle" means any single vehicle or combination of vehicle and trailer with an unladen weight of 10,000 pounds or more, or a van designed to carry 10 or more people.

Section 27. NOTICES

All correspondence, notices, and other papers shall be delivered either in person or by certified or registered mail, postage prepaid, to the Parties hereto at the following addresses:

a) *To TIMMA*:

Attn: Lily Yu
Principal Management Analyst
Treasure Island Mobility Management Agency
c/o San Francisco County Transportation Authority
1455 Market Street, 22nd Floor
San Francisco, California 94103
415.522.4800
lily.yu@sfcta.org

b) *To CONTRACTOR*:

Attn:
Title
Company
street
city, State zip

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day first mentioned above.

TIMMA/Transportation Authority	CONTRACTOR
Recommended by:	
Cynthia Fong Deputy Director for Finance and Administration San Francisco County Transportation Authority	Authorized Signature Printed Name
Approved by:	Title
Tilly Chang Executive Director Treasure Island Mobility Management Agency	Company Name Address City, State, ZIP Phone Number

EXHIBIT A

REQUEST FOR PROPOSAL

EXHIBIT B

CONTRACTOR'S PROPOSAL

EXHIBIT C

PRICED STATEMENT OF WORK AND MILESTONES CHART

Fee Structure

For the services outlined in Appendix A, Contractor agrees to perform said services for a total amount not to exceed **$825,000**. This is a lump-sum contract, with progress payments made to Contractor upon the completion of milestones defined below. The timely submission of each deliverable is a necessary and material term and condition of this Agreement. The contract budget details can be found in the budget table below.

Budget

Milestone	Description	Prime Contractor	Subcontractor	Total Budget
Required Milestones				
Milestone #1	Contract Initiation			
Milestone #2	Permitting and Plans • Completion of Task 1.2 through 1.8 • Completion of Task 3			
Milestone #3	Vehicle Acceptance and Testing • Initiating Task 2 during test period to ensure compliance in later phases of work • Completion of Task 4 • Completion of Task 6			
Milestone #4	Pilot Service for Months 1-3 • Month 1-3 of Task 5 • Month 1-3 of Task 7 • Month 1-3 of Task 9			
Milestone #5	Pilot Service for Months 4-6 • Month 4-6 of Task 5 • Month 4-6 of Task 7 • Month 4-6 of Task 9			
Milestone #6	Pilot Service for Months 7-9 • Month 7-9 of Task 5			

Milestone	Description	Prime Contractor	Subcontractor	Total Budget
	• Month 7-9 of Task 7 • Month 7-9 of Task 9			
Milestone #7	Evaluation/Completion • Completion of Task 8			
Subtotal of Required Milestones				
Optional Milestone				
Milestone #8	Community Partnerships			
Subtotal of Optional Milestone				
Total Budget				

Invoice Payment

Contractor shall submit monthly invoices to TIMMA upon completion of each milestone. All approved invoices will be paid on TIMMA's behalf by Transportation Authority as the grant recipient. Contractor's invoice shall include:

- Narrative progress report, including the following information:
  - Description of activities performed during invoice period
  - Description and schedule of remaining implementation activities
  - Budget expenditures to date
  - Key project highlights (i.e., project status; feedback from the policy makers, stakeholders, and the public; implementation issues; etc.)
- Vendor and subconsultant invoices, if any
- Contact information for prime contractor and subconsultants for payment notifications

All invoices are to be sent to TIMMA via e-mail to ap@sfcta.org or mail to the following:

Accounts Payable
Treasure Island Mobility Management Agency
c/o San Francisco County Transportation Authority
1455 Market Street, 22nd Floor
San Francisco, California 94103

TOTAL **Not to exceed $825,000**

EXHIBIT D

FEDERAL REQUIREMENTS

I. DEFINITIONS

A. **Contractor** means the individual or entity awarded a third-party contract financed in whole or in part with Federal assistance originally derived from FHWA.

B. **Federal Highway Administration (FHWA)** is an operating administration of the U.S. DOT.

C. **Government** means the United States of America and any executive department or agency thereof.

D. **Project** means the task or set of tasks listed as described in the grant application and grant agreement between FHWA and the City and County of San Francisco, through the San Francisco Municipal Transportation Agency (SFMTA).

E. **Subrecipient** means the San Francisco County Transportation Authority, in its role as the Treasure Island Mobility Management Agency (TIMMA).

F. **Secretary** means the U.S. DOT Secretary, including his or her duly authorized designee.

G. **Third Party Contract** means a contract or purchase order awarded by the Subrecipient to a vendor or Contractor, financed in whole or in part with Federal assistance awarded by FHWA.

H. **Third-Party Subcontract** means a subcontract at any tier entered into by Contractor or a third-party subcontractor, financed in whole or in part with Federal assistance originally derived from FHWA.

I. **U.S. DOT** or **DOT** is the acronym for the U.S. Department of Transportation, including its operating administrations.

II. GENERAL

In performance of its obligations pursuant to this Agreement, CONTRACTOR agrees to comply with all applicable provisions of federal, state, and local laws, regulations, and directives. The terms of the most recent amendment to any federal, state or local laws, regulations, directives, and amendments to the grant or cooperative agreement providing funding for this Agreement that may be subsequently adopted, are applicable to this Agreement to the maximum extent feasible unless the applicable federal agency provides otherwise in writing.

III. FEDERAL CHANGES

CONTRACTOR shall at all times comply with all applicable federal regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Grant Agreement between Transportation Authority/SFMTA and the Federal Highway Administration

("FHWA"), as they may be amended or promulgated from time to time during the term of this Agreement. CONTRACTOR's failure to so comply shall constitute a material breach of this contract.

IV. NO FEDERAL GOVERNMENT OBLIGATION TO THIRD PARTIES

A. TIMMA and CONTRACTOR acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to TIMMA, CONTRACTOR or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

B. CONTRACTOR agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FHWA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

V. PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS OR RELATED ACTS

A. CONTRACTOR acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. §§ 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Agreement. Upon execution of the underlying Agreement, CONTRACTOR certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying Agreement or the FHWA-assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, CONTRACTOR further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on CONTRACTOR to the extent the Federal Government deems appropriate.

B. CONTRACTOR also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FHWA under the authority of 49 U.S.C. § 5307, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n) (1) on CONTRACTOR, to the extent the Federal Government deems appropriate.

C. CONTRACTOR agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FHWA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

VI. DEBARMENT AND SUSPENSION

A. This Agreement is a covered transaction for purposes of 2 CFR Parts 180 and 1200. As such, CONTRACTOR is required to verify that neither the

CONTRACTOR, its principals, as defined at 2 CFR 180.995, or affiliates, as defined at 2 CFR Part 180.905, are excluded or disqualified as defined at 2 CFR 180.940 and 180.945.

B. CONTRACTOR is required to comply with 2 CFR, Subpart C and must include the requirement to comply with 2 CFR, Subpart C in any lower tier covered transaction it enters into.

C. CONTRACTOR submitted the Debarment and Suspension Certification required by U.S. DOT regulations on government wide Debarment and Suspension (Nonprocurement), 49 CFR 29.100 as part of its Proposal.

D. In accordance with this provision and the Debarment and Suspension Certification submitted with the Proposal, CONTRACTOR by signing this Agreement and signing and submitting its Bid or Proposal, certifies as follows:

The certification in this clause and the Certification submitted with CONTRACTOR's Proposal are material representations of fact relied upon by TIMMA. If it is later determined that the Bidder or Proposer knowingly rendered erroneous certifications, in addition to remedies available to TIMMA, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment. The Bidder or Proposer agrees to comply with the requirements of 2 CFR, Subpart C while this offer is valid and throughout the period of any Contract that may arise from this offer. The Bidder or Proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

VII. BUY AMERICA

The CONTRACTOR agrees to comply with 23 U.S.C. 313, which provides that Federal funds may not be obligated unless steel, iron, and manufactured products predominately made of steel or iron used in FHWA-funded projects are produced in the United States, unless a waiver has been granted by FHWA or the product is subject to a general waiver.

VIII. CLEAN AIR ACT *(applicable to all contracts and subcontracts in excess of $100,000, including indefinite quantities where the amount is expected to exceed $100,000 in any year.)*

A. CONTRACTOR agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 et seq. CONTRACTOR agrees to report each violation to TIMMA and understands and agrees that TIMMA will, in turn, report each violation as required to assure notification to FHWA and the appropriate Environmental Protection Agency (EPA) Regional Office.

B. CONTRACTOR also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FHWA.

IX. CLEAN WATER REQUIREMENTS *(applicable to all contracts in excess of $100,000)*

A. CONTRACTOR agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. §§ 1251 et seq. CONTRACTOR agrees to report each violation of these requirements to TIMMA and understands and agrees that TIMMA will, in turn, report each violation as required to assure notification to FHWA and the appropriate EPA regional office.

B. CONTRACTOR also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FHWA.

X. PRIVACY

If Contractor or its employees administer any system of records on behalf of the Federal Government, Contractor and its employees agree to comply with the information restrictions and other applicable requirements of the Privacy Act of 1974, 5 U.S.C. § 552a (the Privacy Act). Specifically, Contractor agrees to obtain the express consent of the Federal Government before Contractor or its employees operate a system of records on behalf of the Government. Contractor acknowledges that the requirements of the Privacy Act, including the civil and criminal penalties for violations of the Privacy Act, apply to those individuals involved, and that failure to comply with the terms of the Privacy Act may result in termination of this Agreement. Contractor also agrees to include these requirements in each Third-Party Contract or subcontract to administer any system of records on behalf of the Federal Government financed in whole or in part with Federal assistance provided by FHWA.

XI. ACCESS TO RECORDS AND REPORTS

A. CONTRACTOR agrees to provide TIMMA, the City and County of San Francisco, the FHWA Administrator, the Comptroller General of the United States or any of their authorized representatives access to any books, documents, papers and records of CONTRACTOR which are directly pertinent to this Agreement for the purposes of making audits, examinations, excerpts and transcriptions.

B. CONTRACTOR agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

C. CONTRACTOR agrees to maintain all books, records, accounts and reports required under this Agreement for a period of not less than five (5) years after the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case CONTRACTOR agrees to maintain same until TIMMA, the City and County of San Francisco, the FHWA Administrator, the Comptroller General, or any of their duly authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto.

XII. LOBBYING

See Certification of Lobbying, submitted as part of Contractor's Proposal, and which is incorporated into this Agreement as though fully set forth.

XIII. AMERICANS WITH DISABILITIES ACT VEHICLE ACCESSIBILITY

CONTRACTOR must comply with all vehicle accessibility and maintenance requirements contained in 49 C.F.R. Parts 37 and 38 and the accessibility requirements referenced in Exhibit G of the RFP (Exhibit A of this Agreement).

XIV. CIVIL RIGHTS REQUIREMENTS

The following requirements apply to the underlying Agreement:

A. Nondiscrimination. In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and Federal transit law at 49 U.S.C. § 5332, CONTRACTOR agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, CONTRACTOR agrees to comply with applicable Federal implementing regulations and other implementing requirements FHWA may issue.

B. Equal Employment Opportunity. The following equal employment opportunity requirements apply to the underlying Agreement:

1. **Race, Color, Creed, National Origin, Sex**. In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e et seq., and Federal transit laws at 49 U.S.C. § 5332, CONTRACTOR agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor ("U.S. DOL") regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. Parts 60 et seq., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. CONTRACTOR agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, CONTRACTOR agrees to comply with any implementing requirements FHWA may issue.

2. **Age**. In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § § 623 and Federal Transit Law at 49 U.S.C. § 5332, CONTRACTOR agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, CONTRACTOR agrees to comply with any implementing requirements FHWA may issue.

3. **Disabilities**. In accordance with section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, the Americans with Disabilities Act of 1990, as amended, 42 U.S.C. § 12101 et seq., the Architectural Barriers Act

of 1968, as amended, 42 U.S.C. § 4151 et seq., and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against individuals on the basis of disability. CONTRACTOR agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FHWA may issue.

C. Subrecipients. CONTRACTOR also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FHWA, modified only if necessary to identify the affected parties.

D. Information and Reports. CONTRACTOR shall provide all information and reports required by the regulations, or directives issued pursuant thereto, and shall permit TIMMA, SFMTA, Transportation Authority, and FHWA access to books, records, accounts, other sources of information, and its facilities, as may be determined by TIMMA, SFMTA, Transportation Authority, and FHWA to be pertinent to ascertain compliance with the such regulations or directives. Where any information required by either TIMMA, SFMTA, Transportation Authority, or FHWA, or both, is in the exclusive possession of another who fails or refuses to furnish this information, CONTRACTOR shall so certify to TIMMA, SFMTA, Transportation Authority, and/or FHWA, as applicable, and shall set forth what efforts CONTRACTOR has made to obtain the information.

E. Sanctions for Noncompliance. In the event of CONTRACTOR's noncompliance with the nondiscrimination provisions of this Agreement, TIMMA/Transportation Authority shall impose such agreement sanctions as it, or the SFMTA or the FHWA may determine to be appropriate, including, but not limited to:

1. withholding of payments to CONTRACTOR under the Agreement within a reasonable period of time, not to exceed 90 days; and/or

2. cancellation, termination, or suspension of the Agreement, in whole or in part.

XV. ENERGY CONSERVATION REQUIREMENTS

CONTRACTOR agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

XVI. DISADVANTAGED BUSINESS ENTERPRISES

A. This Agreement is subject to the requirements of Title 49, Code of Federal Regulations, Part 26, Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs. The national goal for participation of Disadvantaged Business Enterprises (DBE) is 10%. TIMMA's overall goal for DBE participation is 3% for this Agreement. CONTRACTOR will be required to report its DBE participation obtained through race-neutral means throughout the period of performance.

B. CONTRACTOR shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. CONTRACTOR shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of this DOT assisted contract. Failure by CONTRACTOR to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as TIMMA deems appropriate, which may include, but is not limited to:

1. Withholding month progress payments;

2. Assessing sanctions;

3. Liquidated damages; and/or

4. Disqualifying the contractor from future bidding as non-responsible. (See 49 C.F.R. § 26.13(b).

Each subcontract CONTRACTOR signs with a subcontractor must include the assurance in this paragraph (see 49 CFR 26.13(b)).

C. CONTRACTOR is required to pay its subcontractors performing work related to this contract for satisfactory performance of that work no later than thirty (30) days after the contractor's receipt of payment for that work from TIMMA. In addition, CONTRACTOR is required to return any retainage payments to those subcontractors within thirty (30) days after the subcontractor's work related to this contract is satisfactorily completed.

D. CONTRACTOR must promptly notify TIMMA whenever a DBE subcontractor performing work related to this contract is terminated or fails to complete its work, and must make good faith efforts to engage another DBE subcontractor to perform at least the same amount of work. CONTRACTOR may not terminate any DBE subcontractor and perform that work through its own forces or those of an affiliate without prior written consent of TIMMA.

XVII. CONTRACT WORK HOURS AND SAFETY STANDARDS *(applicable to non-construction contracts in excess of $100,000 that employ laborers or mechanics on a public work)*

A. Overtime Requirements. No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

B. Violation; Liability for Unpaid Wages; Liquidated Damages. In the event of any violation of the clause set forth in paragraph A of this section, CONTRACTOR and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, the CONTRACTOR and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed

in violation of the clause set forth in paragraph A of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph A of this section.

C. Withholding for Unpaid Wages and Liquidated Damages. TIMMA shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by CONTRACTOR or subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph B this section.

D. Subcontracts. CONTRACTOR or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs A through D of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs A through D of this section.

XVIII. FLY AMERICA

CONTRACTOR agrees to comply with 49 U.S.C. 40118 (the “Fly America” Act) in accordance with the General Services Administration's regulations at 41 CFR Part 301-10, which provide that recipients and sub-recipients of Federal funds and their contractors are required to use U.S. Flag air carriers for U.S. Government-financed international air travel and transportation of their personal effects or property, to the extent such service is available, unless travel by foreign air carrier is a matter of necessity, as defined by the Fly America Act. CONTRACTOR shall submit, if a foreign air carrier was used, an appropriate certification or memorandum adequately explaining why service by a U.S. flag air carrier was not available or why it was necessary to use a foreign air carrier and shall, in any event, provide a certificate of compliance with the Fly America requirements. CONTRACTOR agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

XIX. TEXTING WHILE DRIVING; DISTRACTED DRIVING

A. As used in this clause, “Driving” means operating a motor vehicle on an active roadway with the motor running, including while temporarily stationary because of traffic, a traffic light, stop sign, or otherwise. The term does not include operating a motor vehicle with or without the motor running when one has pulled over to the side of, or off, an active roadway and has halted in a location where one can safely remain stationary.

B. “Text messaging” means reading from or entering data into any handheld or other electronic device, including for the purpose of short message service texting, e-mailing, instant messaging, obtaining navigational information, or engaging in any other form of electronic data retrieval or electronic data communication. The term does not include glancing at or listening to a navigational device that is secured in a

commercially designed holder affixed to the vehicle, provided that the destination and route are programmed into the device either before driving or while stopped in a location off the roadway where it is safe and legal to park.

C. Consistent with Executive Order 13513 "Federal Leadership on Reducing Text Messaging While Driving", Oct. 1, 2009 (available at http://edocket.access.gpo.gov/2009/E9-24203.htm) and DOT Order 3902.10 "Text Messaging While Driving", Dec. 30, 2009, Contractor should promote policies and initiatives for employees and other personnel that adopt and promote safety policies to decrease crashes by distracted drivers, including policies to ban text messaging while driving, and to include these provisions in each Third-Party Subcontract involving the project. Such policies and initiative may include:

1. Adopting and enforcing policies that ban text messaging while driving (i) company-owned or –rented vehicles or Government-owned vehicles; or (ii) privately-owned vehicles when on official government business or when performing any work for or on behalf of the government.

2. Conducting initiatives in a manner commensurate with the size of the business, such as (i) establishment of new rules and programs or re-evaluation of existing programs to prohibit text messaging while driving; and (ii) education, awareness, and other outreach to employees about the safety risks associated with texting while driving.

XX. CARGO PREFERENCE – USE OF UNITED STATES FLAG VESSELS

CONTRACTOR agrees: (a) to use privately owned United States-Flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to the underlying Agreement to the extent such vessels are available at fair and reasonable rates for United States-Flag commercial vessels; (b) to furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo described above to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the FHWA Recipient (through the Subrecipient in the case of a Contractor or subcontractor's bill-of-lading.); and (c) to include these requirements in all Third-Party Contracts or subcontracts issued pursuant to this Agreement when such a contract may involve the transport of equipment, material, or commodities by ocean vessel.

XXI. RECYCLED PRODUCTS

The Contractor agrees to comply with all the requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including, but not limited to, the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

XXII. PROCUREMENT OF RECOVERED MATERIALS

In accordance with the requirements of 2 CFR 200.323, CONTRACTOR must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery

Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

XXIII. PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES

CONTRACTOR must comply with 2 CFR. § 200.216, which implements Section 889 of the Fiscal Year (FY) 2019 NDAA (Pub. L. 115-232) and forbids Federal award recipients from using government funds to enter into contracts (or extend or renew them) to procure or obtain equipment, services, or systems with entities utilizing covered telecommunications equipment or services. Covered telecommunications equipment or services is defined as telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

XXIV. DOMESTIC PREFERENCES FOR PROCUREMENTS

In accordance with the requirements of 2 CFR § 200.322 and to the extent consistent with law, CONTRACTOR shall to the greatest extent practicable purchase, acquire, or use goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products).

For purposes of this section:

(1) “Produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

(2) “Manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

XXV. RIGHTS TO INVENTIONS MADE UNDER CONTRACT OR AGREEMENT

Any discovery or invention that arises during the course of the Agreement shall be reported to TIMMA. CONTRACTOR must comply with the requirements of 37 CFR Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by FHWA.

XXVI. FEDERAL MOTOR VEHICLES SAFETY STANDARDS PRE-AWARD AND POST-DELIVERY CERTIFICATION (FMVSS)

CONTRACTOR must comply with 49 CFR part 663, §§ 663.1- 663.43, which require certification to the FTA that the CONTRACTOR will conduct or cause to be conducted pre-award and post-delivery audits as described in 49 CFR part 663, prior to the procurement and after the delivery of “rolling

stock" including buses, vans, cars, railcars, locomotives, and trolley cars. §§ 663.1- 663.43 set forth the audit and certification requirements that must be completed and furnished to the FTA prior to entering into an agreement with a supplier and prior to transfer of title of the rolling stock.

XXVII. BUS TESTING CERTIFICATION

CONTRACTOR must comply with 49 CFR part 665, §§ 665.1-665.27, which require certification to the FTA that any new bus model acquired with federal financial assistance with funds obligated by the FTA has been tested and has received a passing score in accordance with the regulations contained in part 665. Buses includes a rubber-tired automotive vehicle used for the provision of public transportation service by or for a recipient of FTA financial assistance. §§ 663.1- 663.43 set forth the testing and operating requirements with which compliance is required,

XXVIII. INCORPORATION OF FHWA TERMS

The preceding provisions include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT are incorporated by reference. See, e.g., https://www.fhwa.dot.gov/cfo/contractor_recip/gtandc_generaltermsconditions.cfm and https://www.fhwa.dot.gov/construction/contracts/provisions.cfm.

Anything to the contrary herein notwithstanding, all FHWA-mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. CONTRACTOR shall not perform any act, fail to perform any act, or refuse to comply with any TIMMA requests which cause TIMMA to be in violation of the FHWA terms and conditions.

Under the Advanced Transportation and Congestion Management Technologies Deployment Program (ATCMTD) established by the Federal Highway Administration, grants funded by ATCMTD require vendors to comply with the Americans with Disabilities Act (ADA) compliance, Drug-Free Workplace ACT (DFWA) compliance, Equal Employment Opportunity (EEO), and Maintenance policy compliance. Prior to contract award, the selected proposer is required to demonstrate compliance with the requirements below.

A. **ADA.** Titles II and III of the ADA of 1990 provide that no entity shall discriminate against an individual with a disability in connection with the provision of transportation services. The law sets forth specific requirements for vehicle and facility accessibility and the provision of service, including complementary paratransit service.

Information required to meet ADA compliance:

- ADA complaint procedures, if written;
- ADA complaint form;
- ADA complaint record retention procedures, if written;
- Sample driver handbooks;
- Sample driver operating and training manuals;

- Sample vehicle specifications/information on annunciators;
- Sample internal service provision monitoring materials, such as surveys, checklists, interview forms, etc.;
- ADA reasonable modification policy, if written;
- Procedures for removing vehicles from service and for not placing vehicles into service for pre-trip inspection issues, including (vehicles with inoperative lifts, faulty annunciator, etc.);
- Copies of contracts or other agreements, or terms of other relationships (including, but not limited to, awards, subawards, or cooperative agreements) with private entities to operate fixed-route or demand-response service, including microtransit and commuter bus;
- Copies of vehicle procurements and bid specifications;
- Riders' guides, including paratransit guides. (Often information for general compliance issues such as service animal accommodation or wheelchairs are only found in paratransit information; however, as these issues are not specific to paratransit, they should be identified here.)

B. **DFWA.** Recipients are required to maintain a drug free workplace for all award-related employees; report any convictions occurring in the workplace timely; and have an ongoing drug free awareness program.

Information required to meet DFWA compliance:

- Written drug free workplace policy;
- Examples of drug free awareness notification such as brochures, posters, information on bulletin boards, employee assistance programs;
- Number of employees with a drug statute conviction during the review period.

C. **EEO.** The recipient must ensure that no person in the United States shall on the grounds of race, color, religion, national origin, sex, age, or disability be excluded from participating in, or denied the benefits of, or be subject to discrimination in employment under any project, program, or activity receiving Federal financial assistance under the Federal transit laws.

Information required to meet EEO requirements:

- Number of recipient employees working in the federally-funded program;
- Most recent EEO program;
- Sample documents used for internal dissemination of EEO program;

- Organizational chart identifying EEO officer;
- Designated employee and EEO officer job descriptions;
- Standard performance evaluation for managers/supervisors;
- "Employment Practices Chart" (or alternate documentation containing the same information). See FTA Circular 4704.1A Attachment 4 for the listed information;
- Number of persons hired in areas of underutilization;
- EEO complaint logs;
- List of subrecipients and/or contractors that meet the threshold to develop an EEO program.

D. **MAINTENANCE.** Recipients must keep federally funded vehicles, equipment, and facilities in good operating condition. Recipients must keep Americans with Disabilities Act (ADA) accessibility features on all vehicles, equipment, and facilities in good operating order.

Information required to meet maintenance requirements:

- Written vehicle (including vessels) and equipment maintenance plans;
- Written facility maintenance plan.

EXHIBIT E

CERTIFICATES OF INSURANCE

EXHIBIT H – Sample Cost Proposal

Milestone	Description	Prime Contractor	Subcontractor	Total Budget
Required Milestones				
Milestone #1	Contract Initiation			
Milestone #2	Permitting and Plans • Completion of Task 1.2 through 1.8 • Completion of Task 3			
Milestone #3	Vehicle Acceptance and Testing • Initiating Task 2 during test period to ensure compliance in later phases of work • Completion of Task 4 • Completion of Task 6			
Milestone #4	Pilot Service for Months 1-3 • Month 1-3 of Task 5 • Month 1-3 of Task 7 • Month 1-3 of Task 9			
Milestone #5	Pilot Service for Months 4-6 • Month 4-6 of Task 5 • Month 4-6 of Task 7 • Month 4-6 of Task 9			
Milestone #6	Pilot Service for Months 7-9 • Month 7-9 of Task 5 • Month 7-9 of Task 7 • Month 7-9 of Task 9			
Milestone #7	Evaluation/Completion • Completion of Task 8			
Subtotal of Required Milestones				

Milestone	Description	Prime Contractor	Subcontractor	Total Budget
Optional Milestone				
Milestone #8	Community Partnerships			
Subtotal of Optional Milestone				
Total Budget				

5106624.1

Exhibit I

Debarment and Suspension Certification

49 CFR Part 29 - Appendix A

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS--PRIMARY COVERED TRANSACTIONS

Instructions For Certification

1. By signing and submitting this proposal, the prospective primary participant is providing the certification set out below.

2. The inability of a person to provide the certification required below will not necessarily result in denial of participation in this covered transaction. The prospective participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective primary participant to furnish a certification or an explanation shall disqualify such person from participation in this transaction.

3. The certification in this clause is a material representation of fact upon which reliance was placed when the department or agency determined to enter into this transaction. If it is later determined that the prospective primary participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

4. The prospective primary participant shall provide immediate written notice to the department or agency to which this proposal is submitted if at any time the prospective primary participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

5. The terms covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded, as used in this clause, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.

6. The prospective primary participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

7. The prospective primary participant further agrees by submitting this proposal that it will include the clause titled ``Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion- Lower Tier Covered Transaction,'' provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

8. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

9. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

10. Except for transactions authorized under paragraph 6 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS--PRIMARY COVERED TRANSACTIONS

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification;

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

_____ _____

Signature/Authorized Certifying Official Typed Name and Title

_____ _____

Applicant/Organization Date Signed

Exhibit J – Terminated Contracts

Proposers must provide a list of contracts terminated (partially or completely) by clients for convenience or default within the past three (3) years. For each contract, the list must include the following information:

- Contract number;
- Contract value;
- Description of work;
- Sponsoring organization name; and
- Sponsoring organization key contact information, including name, title and current telephone number.

☐ Proposer does not have any terminated contracts by clients for convenience or default within the past three (3) years.

Authorized Signature	Date Signed
Printed Name	Title
Firm Name	

Exhibit K – Workforce Data Spreadsheet
#1 Breakdown of existing employees

Name of firm:_____ Address:_____

EMPLOYEE * CATEGORIES	TOTAL EMPLOYEE		AFRICAN AMERICAN		HISPANIC		ASIAN/ PAC. ISL.		AMER. IND./ ALAK. NTV.		TOTAL MINORITY		PERCENTAGE WHITE		PERCENTAGE MINORITY	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Officials																
Managers																
Professionals																
Technicians																
Admin. Support																
Trainees																
Others																
Full-time																
Part-time																
TOTAL																

COMPLETED BY Name: _____ Title: _____ Date: _____

* If the list of occupations on the left side of the workforce data form does not match your occupation titles, please modify the data form to indicate occupations particular to your organization.

Exhibit K – Workforce Data Spreadsheet #2
Breakdown of employees hired in last 12 months

Name of firm:_____ Address:_____

EMPLOYEE CATEGORIES	TOTAL EMPLOYEE		AFRICAN AMERICAN		HISPANIC		ASIAN/ PAC. ISL.		AMER. IND./ ALAK. NTV.		TOTAL MINORITY		PERCENTAGE WHITE		PERCENTAGE MINORITY	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Officials																
Managers																
Professionals																
Technicians																
Admin. Support																
Trainees																
Others																
Full-time																
Part-time																
TOTAL																

COMPLETED BY Name: _____ Title: _____ Date: _____

* If the list of occupations on the left side of the workforce data form does not match your occupation titles, please modify the data form to indicate occupations particular to your organization.

Exhibit L
Certification Regarding Lobbying

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Authorized Signature	**Date**
Name and Title	
Company Name	
Company Address	

Exhibit M

GUIDANCE FOR BIDDERS
COMPLETING THE GOOD FAITH EFFORT SUBMITTAL

The specifications in Section 2 of the project Special provisions for each federally-funded project state the following about documentation of adequate good faith efforts:

"The information necessary to establish the bidder's adequate good faith efforts to meet the contract goal should include:

A. The names and dates of each publication in which a request for DBE participation for this project was placed by the bidder.
B. The names and dates of written notices sent to certified DBEs soliciting bids for this project and the dates and methods used for following up initial solicitations to determine with certainty whether the DBEs were interested.
C. The items of work which the bidder made available to DBE firms, including, where appropriate, any breaking down of the contract work items (including those items normally performed by the bidder with its own forces) into economically feasible units to facilitate DBE participation. It is the bidder's responsibility to demonstrate that sufficient work to meet the DBE goal was made available to DBE firms.
D. The names, address and phone numbers of rejected DBE firms, the firms selected for that work, and the reasons for the bidder's choice.
E. Efforts made to assist interested DBEs in obtaining bonding, lines of credit or insurance, and any work which was provided to the DBEs.
F. Efforts made to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services, excluding supplies and equipment the DBE subcontractor purchases or leases from the prime contractor or its affiliate.
G. The names of agencies contacted to provide assistance in contracting, recruiting and using DBE firms.
H. Any additional data to support a demonstration of good faith efforts."

It is recommended that bidders consider the following in making efforts to obtain participation of DBEs, and when preparing the documentation to be submitted, demonstrating their good faith efforts:

- Advertising for DBE participation may be placed in newspapers, trade papers, minority focus papers and on the Internet.

- The more advertising the better. The wider the audience—especially in trade and focus publications—the better a prime contractor can "get the word out" they plan to bid a project, the better potential for DBEs to know about the project and to whom they should bid.

- Solicitations and follow-up telephone contacts should occur within reasonable time before the opening bid date to allow the subcontractor time to prepare a quote to submit to the bidder. Telephone or e-mail logs, and fax receipts may be used to corroborate follow-up contacts.

- Advertisements and solicitations should state which items or portions or work are being made available. The bidder should consider making as many items of work available as possible to meet the goal, including those items normally performed by the bidder with its own forces.

- Bidders are encouraged to assist DBE subcontractors in the areas of bonding (if required), lines of credit, and obtaining necessary equipment, supplies and materials, and inform DBEs of this assistance in their solicitations.

- The documentation to be submitted to the local agency should clearly demonstrate all efforts made by the bidder to meet the DBE goal. To assist in providing clear documentation, bidders should consider the following:

    - Be careful when referring to "See Attachments" without providing explicit information where to find the material. Clearly identifying these items as Attachment A, Attachment B, etc. is suggested.

    - Attachments may include copies of advertisements, solicitations and logs of telephone follow-ups, e-mail or fax receipts.

    - In documenting the work made available to DBEs, list the bid item number, description of the work and what portion of the item was offered, if applicable.

    - Include quotes from rejected DBEs and the quotes from the firms selected. If the bidder is doing the work at less cost, include the items to be performed and the costs.

    - Identify any contacts with agencies, organizations or groups used or contacted to provide assistance in contacting, recruiting and using DBE firms, and any responses or assistance received from them.

    - Describe any additional information which would demonstrate that adequate good faith efforts were made to meet the goal.

EXHIBIT 10-I NOTICE TO PROPOSERS DBE INFORMATION

(Federally funded projects only)

The Agency has established a DBE goal for this Contract of __3.00__ %

1. TERMS AS USED IN THIS DOCUMENT

- The term "Disadvantaged Business Enterprise" or "DBE" means a for-profit small business concern owned and controlled by a socially and economically disadvantaged person(s) as defined in Title 49, Code of Federal Regulations (CFR), Part 26.5.
- The term "Agreement" also means "Contract."
- Agency also means the local entity entering into this contract with the Contractor or Consultant.
- The term "Small Business" or "SB" is as defined in 49 CFR 26.65.

2. AUTHORITY AND RESPONSIBILITY

A. DBEs and other small businesses are strongly encouraged to participate in the performance of Contracts financed in whole or in part with federal funds (See 49 CFR 26, "Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs"). The Consultant must ensure that DBEs and other small businesses have the opportunity to participate in the performance of the work that is the subject of this solicitation and should take all necessary and reasonable steps for this assurance. The proposer must not discriminate on the basis of race, color, national origin, or sex in the award and performance of subcontracts.

B. Proposers are encouraged to use services offered by financial institutions owned and controlled by DBEs.

3. SUBMISSION OF DBE INFORMATION

If there is a DBE goal on the contract, Exhibit 10-O1 *Consultant Proposal DBE Commitment* must be included in the Proposal. In order for a proposer to be considered responsible and responsive, the proposer must make good faith efforts to meet the goal established for the contract. If the goal is not met, the proposer must document adequate good faith efforts. All DBE participation will be counted towards meeting the contract goal; therefore, all DBE participation shall be collected and reported.

Exhibit 10-O2 *Consultant Contract DBE Information* must be included in best qualified consultant's executed consultant contract. Even if no DBE participation will be reported, the successful proposer must execute and return the form.

4. DBE PARTICIPATION GENERAL INFORMATION

It is the proposer's responsibility to be fully informed regarding the requirements of 49 CFR, Part 26, and the Department's DBE program developed pursuant to the regulations. Particular attention is directed to the following:

A. A DBE must be a small business firm defined pursuant to 13 CFR 121 and be certified through the California Unified Certification Program (CUCP).

B. A certified DBE may participate as a prime consultant, subconsultant, joint venture partner, as a vendor of material or supplies, or as a trucking company.

C. A DBE proposer not proposing as a joint venture with a non-DBE, will be required to document one or a combination of the following:

1. The proposer is a DBE and will meet the goal by performing work with its own forces.
2. The proposer will meet the goal through work performed by DBE subconsultants, suppliers or trucking companies.
3. The proposer, prior to proposing, made adequate good faith efforts to meet the goal.

D. A DBE joint venture partner must be responsible for specific contract items of work or clearly defined portions thereof. Responsibility means actually performing, managing, and supervising the work with its own forces. The DBE joint venture partner must share in the capital contribution, control, management, risks and profits of the joint venture commensurate with its ownership interest.

E. A DBE must perform a commercially useful function pursuant to 49 CFR 26.55, that is, a DBE firm must be responsible for the execution of a distinct element of the work and must carry out its responsibility by actually performing, managing and supervising the work.

F. The proposer shall list only one subconsultant for each portion of work as defined in their proposal and all DBE subconsultants should be listed in the bid/cost proposal list of subconsultants.

G. A prime consultant who is a certified DBE is eligible to claim all of the work in the Contract toward the DBE participation except that portion of the work to be performed by non-DBE subconsultants.

5. RESOURCES

A. The CUCP database includes the certified DBEs from all certifying agencies participating in the CUCP. If you believe a firm is certified that cannot be located on the database, please contact the Caltrans Office of Certification toll free number 1-866-810-6346 for assistance.

B. Access the CUCP database from the Department of Transportation, Office of Business and Economic Opportunity Web site at: https://dot.ca.gov/programs/business-and-economic-opportunity/dbe-search.

1. Click on the link titled Disadvantaged Business Enterprise;
2. Click on Search for a DBE Firm link;
3. Click on *Access to the DBE Query Form* located on the first line in the center of the page.

Searches can be performed by one or more criteria. Follow instructions on the screen.

6. MATERIALS OR SUPPLIES PURCHASED FROM DBES COUNT TOWARDS THE DBE GOAL UNDER THE FOLLOWING CONDITIONS:

A. If the materials or supplies are obtained from a DBE manufacturer, count 100 percent of the cost of the materials or supplies. A DBE manufacturer is a firm that operates or maintains a factory, or establishment that produces on the premises the materials, supplies, articles, or equipment required under the Contract and of the general character described by the specifications.

B. If the materials or supplies purchased from a DBE regular dealer, count 60 percent of the cost of the materials or supplies. A DBE regular dealer is a firm that owns, operates or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the Contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. To be a DBE regular dealer, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A person may be a DBE regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone or asphalt without owning, operating or maintaining a place of business provided in this section.

C. If the person both owns and operates distribution equipment for the products, any supplementing of regular dealers' own distribution equipment shall be, by a long-term lease agreement and not an ad hoc or Agreement-by-Agreement basis. Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not DBE regular dealers within the meaning of this section.

D. Materials or supplies purchased from a DBE, which is neither a manufacturer nor a regular dealer, will be limited to the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on the job site, provided the fees are reasonable and not excessive as compared with fees charged for similar services.

Reset Form

EXHIBIT 10-O1 CONSULTANT PROPOSAL DBE COMMITMENT

1. Local Agency: _____ 2. Contract DBE Goal: _____

3. Project Description: _____

4. Project Location: _____

5. Consultant's Name: _____ 6. Prime Certified DBE: ☐

7. Description of Work, Service, or Materials Supplied	8. DBE Certification Number	9. DBE Contact Information	10. DBE %

Local Agency to Complete this Section		
17. Local Agency Contract Number: _____ 18. Federal-Aid Project Number: _____ 19. Proposed Contract Execution Date: _____ 20. Consultant's Ranking after Evaluation: _____ Local Agency certifies that all DBE certifications are valid and information on this form is complete and accurate. _____ _____ _____ _____ _____	**11. TOTAL CLAIMED DBE PARTICIPATION**	**%**

IMPORTANT: Identify all DBE firms being claimed for credit, regardless of tier. Written confirmation of each listed DBE is required.

_____ _____
12. Preparer's Signature 13. Date

_____ _____
14. Preparer's Name 15. Phone

_____
16. Preparer's Title

DISTRIBUTION: Original – Included with consultant's proposal to local agency.

INSTRUCTIONS – CONSULTANT PROPOSAL DBE COMMITMENT

CONSULTANT SECTION

1. Local Agency - Enter the name of the local or regional agency that is funding the contract.
2. Contract DBE Goal - Enter the contract DBE goal percentage as it appears on the project advertisement.
3. Project Location - Enter the project location as it appears on the project advertisement.
4. Project Description - Enter the project description as it appears on the project advertisement (Bridge Rehab, Seismic Rehab, Overlay, Widening, etc.).
5. Consultant's Name - Enter the consultant's firm name.
6. Prime Certified DBE - Check box if prime contractor is a certified DBE.
7. Description of Work, Services, or Materials Supplied - Enter description of work, services, or materials to be provided. Indicate all work to be performed by DBEs including work performed by the prime consultant's own forces, if the prime is a DBE. If 100% of the item is not to be performed or furnished by the DBE, describe the exact portion to be performed or furnished by the DBE. See LAPM Chapter 9 to determine how to count the participation of DBE firms.
8. DBE Certification Number - Enter the DBE's Certification Identification Number. All DBEs must be certified on the date bids are opened.
9. DBE Contact Information - Enter the name, address, and phone number of all DBE subcontracted consultants. Also, enter the prime consultant's name and phone number, if the prime is a DBE.
10. DBE % - Percent participation of work to be performed or service provided by a DBE. Include the prime consultant if the prime is a DBE. See LAPM Chapter 9 for how to count full/partial participation.
11. Total Claimed DBE Participation % - Enter the total DBE participation claimed. If the total % claimed is less than item "Contract DBE Goal," an adequately documented Good Faith Effort (GFE) is required (see Exhibit 15-H DBE Information - Good Faith Efforts of the LAPM).
12. Preparer's Signature - The person completing the DBE commitment form on behalf of the consultant's firm must sign their name.
13. Date - Enter the date the DBE commitment form is signed by the consultant's preparer.
14. Preparer's Name - Enter the name of the person preparing and signing the consultant's DBE commitment form.
15. Phone - Enter the area code and phone number of the person signing the consultant's DBE commitment form.
16. Preparer's Title - Enter the position/title of the person signing the consultant's DBE commitment form.

LOCAL AGENCY SECTION

17. Local Agency Contract Number - Enter the Local Agency contract number or identifier.
18. Federal-Aid Project Number - Enter the Federal-Aid Project Number.
19. Proposed Contract Execution Date - Enter the proposed contract execution date.
20. Consultant's Ranking after Evaluation – Enter consultant's ranking after all submittals/consultants are evaluated. Use this as a quick comparison for evaluating most qualified consultant.
21. Local Agency Representative's Signature - The person completing this section of the form for the Local Agency must sign their name to certify that the information in this and the Consultant Section of this form is complete and accurate.
22. Date - Enter the date the DBE commitment form is signed by the Local Agency Representative.
23. Local Agency Representative's Name - Enter the name of the Local Agency Representative certifying the consultant's DBE commitment form.
24. Phone - Enter the area code and phone number of the person signing the consultant's DBE commitment form.
25. Local Agency Representative Title - Enter the position/title of the Local Agency Representative certifying the consultant's DBE commitment form.

EXHIBIT 10-O2 CONSULTANT CONTRACT DBE COMMITMENT

1. Local Agency: _____ 2. Contract DBE Goal: _____

3. Project Description: _____

4. Project Location: _____

5. Consultant's Name: _____ 6. Prime Certified DBE: ☐ 7. Total Contract Award Amount: _____

8. Total Dollar Amount for **ALL** Subconsultants: _____ 9. Total Number of **ALL** Subconsultants: _____

10. Description of Work, Service, or Materials Supplied	11. DBE Certification Number	12. DBE Contact Information	13. DBE Dollar Amount

Local Agency to Complete this Section			
20. Local Agency Contract Number:		**14. TOTAL CLAIMED DBE PARTICIPATION**	**$**
21. Federal-Aid Project Number:			**%**
22. Contract Execution Date:			
Local Agency certifies that all DBE certifications are valid and information on this form is complete and accurate.		IMPORTANT: Identify all DBE firms being claimed for credit, regardless of tier. Written confirmation of each listed DBE is required.	
23. Local Agency Representative's Signature	24. Date	15. Preparer's Signature	16. Date
25. Local Agency Representative's Name	26. Phone	17. Preparer's Name	18. Phone
27. Local Agency Representative's Title		19. Preparer's Title	

DISTRIBUTION: 1. Original – Local Agency
2. Copy – Caltrans District Local Assistance Engineer (DLAE). Failure to submit to DLAE within 30 days of contract execution may result in de-obligation of federal funds on contract.

ADA Notice: For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

INSTRUCTIONS – CONSULTANT CONTRACT DBE COMMITMENT

CONSULTANT SECTION

1. Local Agency - Enter the name of the local or regional agency that is funding the contract.
2. Contract DBE Goal - Enter the contract DBE goal percentage as it appears on the project advertisement.
3. Project Description - Enter the project description as it appears on the project advertisement (Bridge Rehab, Seismic Rehab, Overlay, Widening, etc).
4. Project Location - Enter the project location as it appears on the project advertisement.
5. Consultant's Name - Enter the consultant's firm name.
6. Prime Certified DBE - Check box if prime contractor is a certified DBE.
7. Total Contract Award Amount - Enter the total contract award dollar amount for the prime consultant.
8. Total Dollar Amount for ALL Subconsultants – Enter the total dollar amount for all subcontracted consultants. SUM = (DBEs + all Non-DBEs). Do not include the prime consultant information in this count.
9. Total number of ALL subconsultants – Enter the total number of all subcontracted consultants. SUM = (DBEs + all Non-DBEs). Do not include the prime consultant information in this count.
10. Description of Work, Services, or Materials Supplied - Enter description of work, services, or materials to be provided. Indicate all work to be performed by DBEs including work performed by the prime consultant's own forces, if the prime is a DBE. If 100% of the item is not to be performed or furnished by the DBE, describe the exact portion to be performed or furnished by the DBE. See LAPM Chapter 9 to determine how to count the participation of DBE firms.
11. DBE Certification Number - Enter the DBE's Certification Identification Number. All DBEs must be certified on the date bids are opened.
12. DBE Contact Information - Enter the name, address, and phone number of all DBE subcontracted consultants. Also, enter the prime consultant's name and phone number, if the prime is a DBE.
13. DBE Dollar Amount - Enter the subcontracted dollar amount of the work to be performed or service to be provided. Include the prime consultant if the prime is a DBE. See LAPM Chapter 9 for how to count full/partial participation.
14. Total Claimed DBE Participation - $: Enter the total dollar amounts entered in the "DBE Dollar Amount" column. %**:** Enter the total DBE participation claimed ("Total Participation Dollars Claimed" divided by item "Total Contract Award Amount"). If the total % claimed is less than item "Contract DBE Goal," an adequately documented Good Faith Effort (GFE) is required (see Exhibit 15-H DBE Information - Good Faith Efforts of the LAPM).
15. Preparer's Signature - The person completing the DBE commitment form on behalf of the consultant's firm must sign their name.
16. Date - Enter the date the DBE commitment form is signed by the consultant's preparer.
17. Preparer's Name - Enter the name of the person preparing and signing the consultant's DBE commitment form.
18. Phone - Enter the area code and phone number of the person signing the consultant's DBE commitment form.
19. Preparer's Title - Enter the position/title of the person signing the consultant's DBE commitment form.

LOCAL AGENCY SECTION

20. Local Agency Contract Number - Enter the Local Agency contract number or identifier.
21. Federal-Aid Project Number - Enter the Federal-Aid Project Number.
22. Contract Execution Date - Enter the date the contract was executed.
23. Local Agency Representative's Signature - The person completing this section of the form for the Local Agency must sign their name to certify that the information in this and the Consultant Section of this form is complete and accurate.
24. Date - Enter the date the DBE commitment form is signed by the Local Agency Representative.
25. Local Agency Representative's Name - Enter the name of the Local Agency Representative certifying the consultant's DBE commitment form.
26. Phone - Enter the area code and phone number of the person signing the consultant's DBE commitment form.
27. Local Agency Representative Title - Enter the position/title of the Local Agency Representative certifying the consultant's DBE commitment form.

EXHIBIT 15-H: PROPOSER/CONTRACTOR GOOD FAITH EFFORTS

Cost Proposal Due Date _____ PE/CE

Federal-aid Project No(s). _____ Bid Opening Date _____ CON

The _____ established a Disadvantaged Business Enterprise (DBE) goal of 3.00% for this contract. The information provided herein shows the required good faith efforts to meet or exceed the DBE contract goal.

Proposers or bidders submit the following information to document their good faith efforts within five (5) calendar days from cost proposal due date or bid opening. Proposers and bidders are recommended to submit the following information even if the Exhibit 10-O1: Consultant Proposal DBE Commitments or Exhibit 15-G: Construction Contract DBE Commitment indicate that the proposer or bidder has met the DBE goal. This form protects the proposer's or bidder's eligibility for award of the contract if the administering agency determines that the bidder failed to meet the goal for various reasons, e.g., a DBE firm was not certified at bid opening, or the bidder made a mathematical error.

The following items are listed in the Section entitled "Submission of DBE Commitment" of the Special Provisions, **please attach additional sheets as needed**:

A. The names and dates of each publication in which a request for DBE participation for this project was placed by the bidder (please attach copies of advertisements or proofs of publication):

Publications	Dates of Advertisement

B. The names and dates of written notices sent to certified DBEs soliciting bids for this project and the dates and methods used for following up initial solicitations to determine with certainty whether the DBEs were interested (please attach copies of solicitations, telephone records, fax confirmations, etc.):

Names of DBEs Solicited	Date of Initial Solicitation	Follow Up Methods and Dates

C. The items of work made available to DBE firms including those unbundled contract work items into economically feasible units to facilitate DBE participation. It is the bidder's responsibility to demonstrate that sufficient work to facilitate DBE participation in order to meet or exceed the DBE contract goal.

Items of Work	Proposer or Bidder Normally Performs Item (Y/N)	Breakdown of Items	Amount ($)	Percentage Of Contract
	Pick			0.00%
	Pick			0.00%
	Pick			0.00%
	Pick			0.00%

D. The names, addresses and phone numbers of rejected DBE firms, the reasons for the bidder's rejection of the DBEs, the firms selected for that work (please attach copies of quotes from the firms involved), and the price difference for each DBE if the selected firm is not a DBE:

Names, addresses and phone numbers of rejected DBEs and the reasons for the bidder's rejection of the DBEs:

Names, addresses and phone numbers of firms selected for the work above:

E. Efforts (e.g. in advertisements and solicitations) made to assist interested DBEs in obtaining information related to the plans, specifications and requirements for the work which was provided to DBEs:

F. Efforts (e.g. in advertisements and solicitations) made to assist interested DBEs in obtaining bonding, lines of credit or insurance, necessary equipment, supplies, materials, or related assistance or services, excluding supplies and equipment the DBE subcontractor purchases or leases from the prime contractor or its affiliate:

G. The names of agencies, organizations or groups contacted to provide assistance in contacting, recruiting and using DBE firms (please attach copies of requests to agencies and any responses received, i.e., lists, Internet page download, etc.):

Name of Agency/Organization	Method/Date of Contact	Results

H. Any additional data to support a demonstration of good faith efforts: