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| Requirements for CAD/AVL System  City of Saint John  Prepared for City of Saint John  By Arcadis | IBI Group |

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# Introduction

## Background

The Saint John Transit (SJT) is operated by the City of Saint John. SJT offers bus and paratransit services within the Saint John, NB area. SJT strives to make quality service available that people need and use. SJT’s primary objectives are to (1) Build a transit system that provides access to where people want to go, (2) Foster sustainability and economic prosperity, (3) Increase brand and service awareness, and (4) Optimize the return on the investment in transit. The guiding principles behind these objectives include: ensuring service and communications are relatable to the full suite of target SJT customers, rather than skewing towards certain neighbourhoods, locations, or population groups, assuming that there is merit to each of SJT’s current service; Drawing the link between transit and prosperity to reinforce the notion that there is economic return in investing in transit and it is important to always consider costs and benefits; and ensuring we are keeping the customers front of mind in the use of language such as ‘connected’, ‘sustainable’, and ‘desirable’, to focus on moving people rather than buses.

SJT operates over 22 fixed routes, with approximately 46 buses. The current SJT system map can be found on their website here: <https://saintjohn.maps.arcgis.com/apps/MapSeries/index.html?appid=835773aa511845568f56b1aed27f5e0f>

The City of Saint John is procuring a CAD/AVL system to automate current manual processes and replace onboard equipment nearing the end of its life expectancy. SJT finds they are performing significant manual workarounds to complete everyday tasks. This is causing processes to be inefficient and increases opportunity for human error through manual data entry. The downstream effects can be felt as customers are not receiving the necessary updates for schedules and on time performance in a timely manner. SJT currently does not use a CAD/AVL system.

The new CAD/AVL system will provide SJT with the tools required to cater to the new wave of customer and user demands as best practices transition to a more automatic, and near real-time based solutions. Tasks that SJT currently performs manually include runcutting, scheduling, blocking, circle checks, service adjustments, reporting, customer communications, etc. To streamline these processes, the new CAD/AVL system will interface with or replace the functionality from selected existing or planned systems to provide an increased level of service to all SJT stakeholders. Existing or planned systems that will interact with the new CAD/AVL include:

* OnDemand for location information and connection requests (currently provided by Spare Labs);
* Destination sign management & programming
* Seon Camera system for live look in and video functionality
* Onboard systems for data collection, displaying of information, and single point logon functionality. These systems include:
  + Odometer;
  + Destination sign;
  + Farebox and fare collection systems;
  + DVR;
  + APC;
  + AVA;
  + OnDemand System;
  + Cradlepoint IBR1700 router;
  + Battery Charge Monitoring; and
  + TSP Emitters.

SJT has identified the following key objectives associated with this implementation:

* Organization and Consolidation of manual operations processes including runcutting, blocking, and scheduling.
* Addition of functionalities including but are not limited to:
  + APCs
  + Audio/Visual Announcements
  + Driver Behaviour Modules
  + GTFS-RT
  + Destination Signs
* Improved integration between systems. Notable areas for improvement include:
  + Maintenance and Asset Management information
  + Providing service and service adjustment (e.g. detours) information to customers;
  + Integration with third party systems (e.g. TSP integration, Masabi eFare, OnDemand service).
* Improving system performance. Notable areas for improvement include:
  + Timely and accurate information reporting from vehicles
  + Streamlined service adjustment (e.g. detour) implementation process for controller
* Improved data storage and database structure, easy query retrieval and data availability for Key Performance Indicator development and overall reporting.
* Provisioning for future procurements to continue increasing functionalities. Potential procurements include destination signs, scheduling software, Enterprise Asset Management software, Operations Management software, onboard camera system, etc.
* Provisioning for the future such as battery electric vehicles and fleet expansion.

## Logical System Architecture

The following diagram provides the anticipated logical system architecture for the new CAD/AVL system, providing an overview of new and existing components and their connections.



## Operational Concept

Though not forming part of the contract requirements, this section provides context for how SJT business stakeholders anticipate the new system will be used. The CAD/AVL shall be able to operate without daily intervention once the system is installed and operational. The following functional groups will regularly use the system and have responsibilities once the system is fully operational:

### System Administrator

The system administrator will assist the Successful Proponent during the system configuration phase of the project. As the party with the highest level of system access, the system administrator will set security parameters, approve system access, administer passwords, coordinate decisions regarding configuration settings, and ensure standard operating procedures are in place. The system administrator will also work with the Successful Proponent to coordinate design and approval of standard reports.

On an on-going basis, the system administrator will perform a regular health check on the system, execute requests for the download of archive data files, manage updates and configuration changes.

### Dispatchers

Dispatchers will use the CAD/AVL system to communicate with drivers via voice and text, to monitor vehicle locations, monitor events (late pull out, schedule/route adherence, etc.), respond to covert alarms, as well as document and control incidents and incident reports on the road and from circle checks. Dispatchers will also be responsible for managing and adjusting service to meet operational needs as required (e.g. creating detours, adding service).

### Road Supervisors

Road supervisors will remotely access the system from their vehicles, or on foot when they exit their vehicles. They will require a portable device that can easily be used both in and out of their vehicles. This portable device will allow the supervisors to monitor performance in real time and communicate with operators and dispatchers through voice and text. They will monitor and investigate on time performance of service vehicles in events the dispatch centre and determine, in communication with the central controllers, next steps.

### Vehicle Operations

Operators will use the CAD/AVL system in their every day operations including: receiving assignments; performing circle checks, log ins and log offs; communications with controllers and inspectors; receiving instructions for navigation and service adjustments; displaying schedule and headway adherence information; and reviewing paddle information. The interface to the CAD/AVL will be through the onboard mobile data terminal (MDT). Tasks such as circle checks and information dissemination will be automatically uploaded/downloaded through the CAD/AVL to ensure all relevant parties are privy to the existing operating conditions.

### Information Technology

The information technology (IT) department will support much of the system administrator functionality including regular health checks for the central systema and associated applications, maintaining the communications network, and software configuration. The IT department will liaise with the Successful Proponent via the support agreement for software bug fixes, server maintenance, and software upgrades.

### Scheduling and Planning

The planning department will use reporting information from the new CAD/AVL system to help build accurate schedules from schedule performance data. SJT is looking to procure an Optibus Scheduling system to begin moving away from manual scheduling. Schedulers will also use the reports generated by the new CAD/AVL system to inform activities like service changes, route changes, and timetable changes. Schedule and route data would be regularly exported from Optibus to the current CAD/AVL system.

### Customer Experience

The customer experience department will use historical and real-time information provided by the CAD/AVL system to communicate ad-hoc service adjustments and investigate customer complaints. The system will provide data feeds to provide real time customer information to third party developers/applications. This process to feed data to customer facing media will be streamlined by having automatically generated communications ready with staff approval as necessary.

## Table of Acronyms

|  |  |
| --- | --- |
| Acronym | Definition |
| **AGC** | **Automatic Gain Control** |
| **AIL** | **Action Item List** |
| **APC** | **Automatic Passenger Counters** |
| **API** | **Application Programming Interface** |
| **APN** | **Access Point Name** |
| **AVA** | **Automated Vehicle Announcements** |
| **BEB** | **Battery Electric Buses** |
| **CAD/AVL** | **Computer Aided Dispatch/Automatic Vehicle Location** |
| **CAN** | **Controller Area Network** |
| **DMS** | **Digital Message Sign** |
| **FDD** | **Final Design Document** |
| **GIS** | **Geographic Information System** |
| **GPS** | **Global Positioning System** |
| **GTFS** | **General Transit Feed Specification** |
| **GUI** | **Graphical User Interface** |
| **SJT** | **Saint John Transit** |
| **ICD** | **Interface Control Document** |
| **IT** | **Information Technology** |
| **KPI** | **Key Performance Indicator** |
| **LED** | **Light Emitting Diode** |
| **LRT** | **Light Rail Transit** |
| **MaaS** | **Mobility as a Service** |
| **MDT** | **Mobile Data Terminal** |
| **MGR** | **Mobile Gateway Router** |
| **ODBC** | **Open Database Connectivity** |
| **OEM** | **Original Equipment Manufacturer** |
| **PA** | **Public Address** |
| **PDD** | **Preliminary Design Document** |
| **PRTT** | **Priority Request to Talk** |
| **PTT** | **Push To Talk** |
| **RTT** | **Request to Talk** |
| **SAE** | **Society of Automobile Engineers** |
| **SaaS** | **Software as a Service** |
| **SIM** | **Subscriber Identity Module** |
| **SLA** | **Service Level Agreement** |
| **SQL** | **Structure Query Language** |
| **TCP/IP** | **Transmission Control Protocol/Internet Protocol** |
| **TSP** | **Transit Signal Priority** |
| **VAC** | **Voltage Alternating Current** |
| **VHM** | **Vehicle Health Monitoring** |
| **VLU** | **Vehicle Logic Unit** |
| **WAAS** | **Wide Area Augmentation System** |
| **WLAN** | **Wireless Local Area Network** |

# Requirements Matrix

The City of Saint John acknowledges that Proponent may not be able to fully meet certain requirements, so have created the following requirements matrix for Proponents to indicate any areas where a requirement cannot be met as stated, can be partially met or meets the intent of the requirement but not exactly as stated, or fully meets the requirement as stated. This information is required for The City of Saint John to evaluate Proposals, request best and final offers, and/or enter into any negotiations or contract with a Proponent. Any proposed exceptions or modifications to the requirements that the Proposer requests consideration or negotiations of must be described in this requirements matrix.

Using the following tables, Proponents shall indicate compliance with each requirement as Fully Compliant (F), Complies with Modification (CM), or Does Not Comply (N). A single response of “F”, “CM”, or “N” shall be provided for each requirement in the “Compliance” column of the table. Proposals submitted without a completed requirements matrix may be considered non-responsive as the City of Saint John is unable to complete an evaluation of the Proponent’s system solution without this information.

* **Fully Compliant (F).** Proposer commits to fully meet the requirement as written. Responses must not include comments, limitations, conditions, qualifications, or explanations, and no further elaboration or explanation is required.
* **Complies with Modification (CM).** Proposer is unable to fully meet the requirement as written but commits to meeting a modified version of the requirement. For each “CM”, Proposer must propose modified requirement language to which they commit to comply.
  + As an example, if a Proposer can only meet part of the requirement, “CM” should be used in conjunction with modified requirement language written in the cell to indicate which part of the requirement the Proposer commits to meet. Similarly, if a Proposer feels they can meet the intent of the requirement but with a different approach, a “CM” in conjunction with proposed modified requirement language is the correct response.
* **Does Not Comply (N).** Proposer is unable to commit to fully meet the requirement as written. Proposer is not required to elaborate, but may provide an explanation to be considered by the City of Saint John.

# Information Technology (IT) Infrastructure Requirements

This section outlines functional requirements for information technology infrastructure to be used by the proposed solution.

## General Requirements

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | System software shall fully run in the user context without requiring elevated permissions or administrative permissions on the desktop, except for functionality explicitly defined as having system administrator only privileges. |  |  |
|  | The system shall have context sensitive help and in-app help that includes provision of term definitions, example answers, and links to appropriate manuals and help documentation. |  |  |
|  | The system shall be compatible with existing SJT operating system and database environments, including the following: |  |  |
| 1. Microsoft Office Suites: 2016, 2019, Office 365; |  |  |
| 1. Microsoft Windows 10 and 11 (OS); |  |  |
| 1. Microsoft Windows Server OS: Windows Server 2016, 2016 R2, and Windows Server 2019; and |  |  |
| 1. Microsoft Structured Query Language (SQL) Server: SQL Server 2016 and newer |  |  |
| 1. Web Browsers - MS Edge, Google Chrome, Firefox |  |  |
| 1. VMware |  |  |
| 1. ESRI GIS |  |  |
|  | System software shall have a site license that allows its usage at SJT facilities and on mobile equipment. |  |  |
|  | System software shall not place limitations (through licensing or otherwise) on the number of concurrent workstation or mobile sessions. |  |  |
|  | System software shall not place limitations (through licensing or otherwise) on the total number of users. |  |  |
|  | System software shall support role-based security. |  |  |
|  | System software shall be the current version in production at the time of final system acceptance. |  |  |
|  | System software shall scale without modification to newer, higher performance hardware, operating systems and other solution components. |  |  |
|  | System software shall be modular in design and scalable to support service expansion. Service expansion may include new modes, fleet size increase of up to two times of the current fleet, faster data rates, and a wider geographic coverage area. |  |  |
|  | The Successful Proponent shall comply with SJT’s change management process when making any changes to provided systems. |  |  |
|  | To ensure that SJT has unrestricted access to and use of the source code if the Successful Proponent ceases to exist, ceases to support the application, or otherwise terminates its relationship and/or ownership to the product, the Successful Proponent shall: |  |  |
| 1. Establish an escrow account that continues to maintain the exact version of the source code in operation at SJT, for SJT to access in such an event; or |  |  |
| 1. Provide an alternative solution acceptable to SJT |  |  |
|  | The system shall follow an open architecture model, allowing SJT to develop system interfaces independently or enable integration with other internal or third-party systems. |  |  |
|  | The system software shall use of standard network communication protocols (e.g., Transmission Control Protocol/Internet Protocol (TCP/IP) and system interfaces (e.g., open database connectivity (ODBC) for databases). |  |  |
|  | The Successful Proponent shall enable SJT to transfer all software licenses between physical units, including servers and all peripheral equipment (e.g., workstations and mobile dispatching devices), with no impact to system performance. |  |  |
|  | The system software shall be transferable to other workstations using compatible hardware, database software and operating system without any modifications or use of hardware keys. |  |  |
|  | All equipment shall be new and unused. Equipment procured for prototype and development purposes may be reused in the final system with the permission of SJT. |  |  |
|  | The Successful Proponent will install all required server and client Software. At SJT discretion, selected server Software will be implemented as virtual servers operating on SJT provided VMware environments. SJT will set up the VMware environments for these virtual servers using processor and memory requirements for each server to be virtualized, defined as part of the Design Phase. |  |  |

## Central System Equipment

This section lists requirements for installing systems in the central environment.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall supply the specifications for hardware for servers, databases, and any required networking infrastructure to connect with the existing SJT network, at a location that SJT identifies. SJT will supply the equipment. |  |  |
|  | All Successful Proponent-provided servers, and storage devices shall have a minimum of 40,000 hours MTBF measured quarterly from mini-fleet acceptance. |  |  |
|  | The Successful Proponent shall provide recommended workstation specifications including Monitors, CPU and peripherals. SJT will supply the equipment.  SJT desires to use existing standard workstation hardware if it meets the recommended specification. Current standard PC specifications are:  • Processor: Intel i5 12th gen,  • RAM: 16GB  • Drive: 256GB SSD  • Monitors: 22 inches |  |  |
|  | The Successful Proponent shall provide any required proprietary central system equipment. |  |  |
|  | Equipment installed in SJT offices or facilities shall operate from a nominal line voltage of 120 Voltage Alternating Current (VAC), within voltage tolerances of +10% to -10%, and a frequency range of 57 to 64 Hz. |  |  |
|  | Central system equipment shall be designed for use in a normal office and transit dispatch centre environment and shall maintain specified performance under the following environmental conditions: |  |  |
| 1. Operating Temperatures: Between +0°C to +45°C; and |  |  |
| 1. Humidity: 10-90% relative humidity, non-condensing |  |  |
|  | Where equipment does not comply with environmental conditions, equipment shall be protected with environmentally protected enclosures or cabinets. The enclosures or cabinets shall internally maintain the operating environment required by equipment within, under the above required environmental conditions. |  |  |

## Test Environment

This section lists requirements for the test environment.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide licensing and applications necessary to establish a test environment, on duplicate server hardware at SJT. |  |  |
|  | Software updates and configuration changes shall be tested in the test environment prior to being implemented in the production system in coordination with the hardware test bench. |  |  |
|  | The test environment shall represent the exact system configuration of the production environment, including databases and interfaces. |  |  |
|  | The Successful Proponent shall test any onboard firmware, application, database, and configuration changes on a hardware test bench setup before installing them on vehicles. |  |  |
|  | The test bench shall include the onboard equipment (VLU, MDT, antennas), and any other hardware required for simulated functionality (such as speakers and LED signs), configured exactly as on the vehicle. |  |  |
|  | The test bench shall simulate onboard vehicle functionality including: |  |  |
| 1. Data communications; |  |  |
| 1. Voice communications; |  |  |
| 1. Internal and external audio announcements; |  |  |
| 1. Internal visual announcements; |  |  |
| 1. Destination sign code changes; and |  |  |
| 1. Other functions required for SJT training and testing activities |  |  |
|  | The test bench shall be portable such that a single SJT staff representative shall be able to move a test bench into a vehicle to perform testing while driving. |  |  |
|  | The Successful Proponent shall provide simulation functionality, or alternatively access to playbacks of actual data, to run within the testing environment and accept input from the test bench units. |  |  |
|  | The test environment shall allow SJT staff to perform end-to-end testing of data entered from scheduling, configuration files, test bench units, and virtual or physical the dispatch centre workstations. |  |  |
|  | The test environment shall include at least one workstation with voice communications functionality for testing and training purposes. |  |  |
|  | The test environment shall enable SJT to test voice communications, including updates and patches to voice communications software, applications, and settings prior to transferring this data to the production environment. |  |  |
|  | The test environment shall allow SJT staff to setup and configuration of separate test scenarios where resulting data is stored and retrievable by SJT. |  |  |
|  | The Successful Proponent shall supply a test database to support the test environment. |  |  |
|  | The test database shall store a complete copy of data from the reporting database used in the production system, updated at an SJT-configurable frequency. |  |  |
|  | All data ownership, retention, and access requirements pertaining to the production historical database shall apply equally to the test database. |  |  |
|  | The system shall allow SJT staff to remotely direct a production vehicle to communicate with the test environment. |  |  |

## Data Management

This section defines requirements for data logging, data and database ownership, management, access, documentation, security, and maintenance.

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall make all of the solution’s database-related components (e.g. tables, scripts, extensible markup language (XML) schema, and related information) available and fully accessible for use and maintenance support by SJT. |  |  |
|  | The Successful Proponent shall use prescribed standards for SQL Server virtualization to develop and configure their solutions. These solutions shall be flexible enough to run in consolidated database environments with other applications using different schemas and virtualization. |  |  |
|  | All database queries shall be logged for audit purposes. SJT shall have the ability to view these logs when required. |  |  |
|  | The online data storage system shall ensure data integrity in case of storage drive or SAN failure. This may be achieved through fail-safe fallback data storage, archiving transaction data, or through a restoration of data from an archive while the system is operating. It shall not be necessary to shut the database down while performing a successful backup operation. |  |  |
|  | The Successful Proponent shall not use the system administrator account with SQL server applications. |  |  |
|  | No data shall be stored outside of Canada. |  |  |
|  | No confidential data (network, financial, employee, etc.) shall be hosted on any third-party or vendor system without the expressed written permission of SJT. |  |  |
|  | The system shall store and report data in metric units. |  |  |

### Production Database

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | All incoming and outgoing data shall be stored in a historical database for retrieval, analysis, display, printing and playback. This historical information shall include all data exchanged between vehicles and the dispatch centre (e.g., location data, route/schedule adherence data, vehicle logon/logoff data, covert alarms, device alarms, text messages, and RTT/PRTT call begin and end time) and all central system user logons and logoffs. |  |  |
|  | The historical database shall enable authorized SJT users to retrieve system data for all normal business functions without having to re-import data from external storage, and without support from in-house IT staff or the Successful Proponent. |  |  |
|  | The historical database shall have sufficient capacity to retain all data generated by all systems provided under this contract for a period of at least two years before archiving would be required. |  |  |
|  | The system shall restrict access to all data within the historical database to SJT-designated users in accordance with SJT-specified data access policies. |  |  |
|  | The system shall allow all data to be retrieved whether active or archived. |  |  |
|  | The stored data shall be time and date stamped and shall contain sufficient information to enable selective sorting and retrieval based on user-specified selection criteria. At a minimum, the following sorting and selection criteria shall be supported for accessing the historical data from both the online and archived storage: |  |  |
| 1. Date and time, |  |  |
| 1. GPS latitude/longitude, |  |  |
| 1. Vehicle number, |  |  |
| 1. Operator number, |  |  |
| 1. Controller ID, |  |  |
| 1. Run number, |  |  |
| 1. Signup Period/Poster/ID, |  |  |
| 1. Service Type/ID, |  |  |
| 1. Direction Name/ID, |  |  |
| 1. Route Number/ID, |  |  |
| 1. Block Number/ID, and |  |  |
| 1. Incident type |  |  |
|  | Historical database records shall be readily accessible in a form that that directly accessible or importable into any third-party database retrieval/report writing and creation applications (i.e. Power BI, Excel, Etc.) |  |  |
|  | The system shall automatically generate and distribute notifications to an SJT-configurable email list when a data error or event is detected. Events shall include: |  |  |
| 1. Detection of invalid or erroneous data (i.e. data corruption), including data import errors from external systems; and |  |  |
| 1. Detection of a device or system fault. |  |  |
|  | All alarm notifications, error details, and the actions taken in their response shall be logged in the database for later review and archiving. |  |  |

### Archive Database

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall supply a data archiving and archive retrieval solution. There shall be sufficient space to store all archived data generated by the provided system for a minimum of seven years plus an additional fifty percent for additional data and fleet expansion. |  |  |
|  | The Successful Proponent shall provide a backup and recovery plan that includes hardware specifications, storage requirements, and configuration parameters. The backup and recovery procedures must integrate with the existing SJT backup process. |  |  |
|  | The system’s backup and recovery functions shall allow SJT to create backup copies of all archive database content, stored externally from the system. |  |  |
|  | The system shall allow the archive database to be restored from a backup in case of database crashes. |  |  |

### Data Ownership

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | All data and the database where the data resides shall be SJT property and shall be available immediately to SJT. |  |  |
|  | SJT shall be allowed royalty-free access, use, reproduction, and dissemination of interfaces and data tables inclusive of data, data formulas, table structure, and table headers. SJT shall be allowed to extend such access and use to third party vendors for integration purposes. |  |  |
|  | Provisions shall be made for enabling SJT to integrate the database with other applications, if so desired by SJT in the future. Any security or access concerns related to the database components shall be clearly identified (e.g. any specific database tables that are used in real-time operations should be identified to indicate that running queries on those tables might impact operations). |  |  |

### Data security

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall follow SJT’s IT security policies. |  |  |
|  | All software security shall be provided in accordance with best practices. |  |  |
|  | Proposers shall provide evidence of security audit of the proposed solution to verify that proposed solution is free of any security vulnerabilities. |  |  |
|  | Any vulnerabilities or exploits the Successful Proponent or others discover shall be reported to SJT immediately with a proposed mitigation strategy. |  |  |
|  | All software applications shall use Windows Authentication based upon Active Directory setup. |  |  |
|  | All software applications shall support single sign on based upon Active Directory authentication. |  |  |
|  | Activation and deactivation of single sign on authentication shall be configurable by SJT. |  |  |
|  | Stored passwords shall be encrypted using industry standard encryption methods. |  |  |
|  | The Successful Proponent shall support Microsoft security patches and updates within fifteen (15) days of release. Testing shall be completed before patches are moved to production. |  |  |

### Data Documentation

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide the following: |  |  |
| 1. Scripts to recreate the database; |  |  |
| 1. An entity relationship diagram; |  |  |
| 1. A database schema with a data dictionary detailing all database entities (e.g. tables, columns, and attributes); and |  |  |
| 1. A recommended practices document for supporting and maintaining the database |  |  |

### Data Maintenance

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall propose and supply a data archiving and archive retrieval solution to be approved by SJT in writing. |  |  |
|  | The Successful Proponent shall provide a backup and recovery plan that shall include hardware specifications, storage requirements and configuration parameters. The backup and recovery procedures must integrate with SJT’s existing backup process. |  |  |

## Performance and System Monitoring Requirements

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide real-time, SJT-configurable, system monitoring dashboards, to enable SJT staff to monitor the status of all CAD/AVL software and databases. At minimum, the system shall track and report on the following metrics: |  |  |
| 1. System availability; |  |  |
| 1. System usage; |  |  |
| 1. System security breaches and attempted breaches; and |  |  |
| 1. System errors (server hardware/software malfunctions) |  |  |
| 1. Send notification by email or mobile text to a specific user group reporting a system degradation event. |  |  |
|  | The Successful Proponent shall work with SJT staff to design and implement the monitoring dashboards. |  |  |
|  | The Successful Proponent may choose to integrate with SJT’s network management and monitoring software or provide their own solution. |  |  |
|  | The overall system availability (i.e. up-time for data and applications access to all systems implemented under this contract divided by the total time not including time scheduled in advance for system maintenance) shall meet or exceed 99.9% measured quarterly from mini-fleet acceptance. |  |  |
|  | Commonly used database queries, queue displays, information windows, and map displays shall be displayed within one second from user initiation for physical and virtual workstations. |  |  |
|  | All physical and virtual workstation displays and information shall be consistent and show current and identical status within 10 seconds of one another. |  |  |
|  | The central system shall be designed to allow for at least 10 simultaneous users without a noticeable reduction in system response times. The system shall allow users to work simultaneously in CAD/AVL without creating data conflicts with or overriding actions by other users. |  |  |
|  | The central system shall be designed to transmit data from at least 100 vehicles without any noticeable increase in communications latency or changes to configured reporting frequency. |  |  |
|  | The central system shall be designed to receive external vehicle tracking information from at least 100 vehicles without any noticeable performance degradation. |  |  |
|  | The system shall be designed for continuous operation without the need to manually “reboot” computers or devices on an unscheduled basis. Necessary scheduled reboots will not impact day-to-day operations. |  |  |
|  | The performance and output of the CAD/AVL data and mapping software shall accurately and reliably identify the location of each vehicle on the street network, showing the vehicle on the correct street and within 10 metres. |  |  |

## Disaster Recovery and Redundancy

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall clearly describe their approach for enabling redundant server configuration in accordance with SJT disaster management policy. |  |  |

## Hosted Solution (Option)

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide a proposal where all CAD/AVL back office primary functionality is hosted in the cloud at a remote data center located within Canadian jurisdiction.  Selection of this option shall not relieve the Successful Proponent from meeting any other requirements except where explicitly agreed by SJT. |  |  |
|  | The remote data centre shall be SOC 2 compliant. |  |  |
|  | The Successful Proponent shall set-up the hosted central system with application redundancy. |  |  |
|  | Hosted central system application redundancy shall ensure no loss in the ability to process interactions due to: |  |  |
| 1. Failure of the production environment; and/or |  |  |
| 1. Lost communications connection to the production environment. |  |  |
|  | The Successful Proponent shall provide a test environment within the hosted system, with all primary functional components duplicated, where software updates and configuration changes can be tested prior to being implemented in the production system. |  |  |
|  | The Successful Proponent shall provide licensing and applications necessary to establish an independent central system testing environment in the hosted environment. |  |  |
|  | The Successful Proponent shall be responsible for interfacing the SJT private network with the CAD/AVL hosted servers through a secure connection. |  |  |
|  | The end-to-end network communications shall enable data communications between fixed-route vehicles and the hosted servers, on-site inspection workstations, and other remote inspecting equipment within the identified locations. |  |  |

# Wireless Voice and Data Communications

This section defines hardware and software requirements for voice and data communications between vehicles and control center and vehicle and garage/yard communication equipment.

Included in this section are requirements for integration Cradlepoint IBR1700 routers.

## General requirements

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall interface the CAD/AVL workstation hardware and software to the existing public cellular head end for data communication. |  |  |
|  | The system shall integrate with existing SJT communication infrastructure to support the following communication needs for this project: |  |  |
| 1. One-way and two-way wireless voice and data communication between the SJT central system, and fixed-route vehicles while located in yards; |  |  |
| 1. One-way and two-way wireless voice and data communication between the SJT central system and fixed-route vehicles while on-route within SJT's coverage area; |  |  |
| 1. One-way and two-way wireless voice and data communication between the SJT central system and inspector/maintenance/support vehicles, while located in yards; and |  |  |
| 1. One-way and two-way wireless voice and data communication between the SJT central system and inspector/maintenance/support vehicles, while they are in the field within SJT's coverage area. |  |  |
|  | Where existing infrastructure alone is not sufficient the Successful Proponent shall provide supporting communications infrastructure and applications. |  |  |
|  | The communications infrastructure shall comply with all applicable local, provincial, and federal standards and regulations. |  |  |

## Onboard Equipment

### Antenna

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall either supply new or reuse existing SH-IN2440 5 in 1 antennas. |  |  |
|  | If new cellular and Wi-Fi antennas are required, the Successful Proponent shall provide and install, for each vehicle, a combined omnidirectional roof-mounted antenna with low-profile fiberglass radome. This new antenna installation, if required, shall also include the Global Positioning System (GPS) antenna, for connection to the new Vehicle Logic Unit (VLU). |  |  |
|  | Antennas shall be designed, installed, and placed such that any device, whether or not it is designed to transmit RF, shall not interfere with or degrade the performance of any other SJT device or with different components within the same device. |  |  |
|  | If new cellular and Wi-Fi antennas are required exterior antenna installation shall not allow for water ingress into the vehicle under any weather conditions. |  |  |

### Operator Handset and Speakers

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall either supply new or reuse existing handsets with an integral PTT button and a cradle assembly. |  |  |
|  | Operators shall be able to adjust the volume of the speaker, within SJT configurable maximum and minimum volumes, at any time during the voice communication. |  |  |

## Integration with Existing Mobile Gateway Router

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The SJT fleet is currently equipped with Cradlepoint IBR1700 mobile gateway routers ("Existing MGR"). The Existing MGR is equipped with dual SIM card slots one of which is currently used by SJT’s cellular provider Rogers.  SJT will provide communications over the cellular network directly to the SJT network. |  |  |
|  | The Successful Proponent shall be responsible for the following: |  |  |
| 1. Integration between the Existing MGR and CAD/AVL onboard components for the purpose of data exchange; |  |  |
| 1. Performing the installation of any necessary integration components; and |  |  |
| 1. Interfacing the commercial cellular provider devices with the CAD/AVL central system via APN-protected internet connection. |  |  |
|  | The Successful Proponent shall integrate with the Existing MGR to the onboard components provided by the Successful Proponent for the new CAD/AVL system, such that the Existing MGR is the primary communication pathway for wireless transmission of operational data between the fixed route vehicles and the central system.  For any onboard interfaces, the Successful Proponent shall assume that only one Ethernet port is available on the Existing MGR and the Successful Proponent is responsible for proposing any needed switches if additional ports are needed. |  |  |
|  | The system shall be capable of operating with a replacement device to the Existing MGR, so long as this device is capable of providing an IPv4 or IPv6 gateway to the provider private network, and Wi-Fi uplink capability. The CAD/AVL system's design shall not preclude the upgrade of the Existing MGR's cellular modem in order to accommodate emerging technologies. |  |  |
|  | The Successful Proponent shall incorporate Existing MGRs into the equipment layout design for each type of vehicle. If relocation of existing or installation of a new MGR is required for an appropriate and ergonomic layout, the Successful Proponent will provide all associated materials and labor necessary to relocate the existing or install the new router. |  |  |
|  | Wherever private SJT wireless local area network (WLAN) access is available (e.g. at yards), all data exchanged between the vehicle and central system shall be completed over WLAN connection, in order to minimize metered data charges. |  |  |
|  | The Successful Proponent shall utilize the Existing MGR's LTE cellular connection to transfer CAD/AVL data in a duplex manner from the vehicle to the central system, whenever the vehicle is outside the range of an SJT Wi-Fi Access Point. |  |  |
|  | The Successful Proponent shall utilize and configure quality of service (QoS) management features on the Existing MGR to ensure that a minimum protected bandwidth is available for operational CAD/AVL uplink data, while the Existing MGR continues to service internet traffic for other data (e.g., closed-circuit television (CCTV)) via a single LTE cellular uplink connection. |  |  |
|  | Each Existing MGR deployed in SJT’s fleet shall have a unique identifier linking the devices to a bus, and shall support routing of traffic to/from a specific bus, and to/from a specific IP-addressable device on that bus. |  |  |
|  | The full commercial carrier data pathway between the onboard end devices and central system applications shall be of sufficient bandwidth to support receiving timestamped location updates from every operating vehicle as frequently as every five seconds. |  |  |
|  | Communications latency between onboard devices and the dispatch centre consoles in both directions shall not exceed two seconds ninety-five percent of the time. |  |  |
|  | The onboard system shall support bidirectional communications with the existing SJT WLAN infrastructure as vehicles move within the WLAN coverage range, including session persistence and handoff between WLAN access points. |  |  |
|  | All data communications with vehicles shall be exchanged as soon as communications capability is restored, if the vehicle was out of communications when the message was originated. |  |  |

## Mobile Voice Communications

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall either provide handsets or integrate with existing SJT handsets on fixed route, maintenance, and inspector vehicles. SJT will arrange that any new vehicles purchased during the Contract Period will have handsets preinstalled by the Original Equipment Manufacturer (OEM) before delivery. |  |  |
|  | The Successful Proponent shall provide a VoIP solution for voice communications. |  |  |
|  | The Successful Proponent shall be responsible for the following: |  |  |
| 1. Reviewing the technical requirements, features and functions of the installed handsets and ensuring that their CAD/AVL system is compatible with this handset for the purpose of voice integration; |  |  |
| 1. Providing VoIP voice communication; |  |  |
| 1. Planning the integration of existing handsets (if applicable); and |  |  |
| 1. Installing necessary interconnecting cables and power conditioning equipment for voice communication. |  |  |
|  | The Successful Proponent shall provide or reuse all necessary user-interface devices and capabilities (e.g., headsets, microphones, speakers, push-to-talk [PTT] devices) as required to meet performance requirements. |  |  |
|  | The system shall manage interfaces with handsets and speakers and covert microphone for radio communications. |  |  |
|  | Onboard audio input and output devices for general communication (i.e. excluding the covert microphone) shall: |  |  |
| 1. Have a hook switch, PTT handset and speaker; |  |  |
| 1. Use speaker output when handset is on hook; and |  |  |
| 1. Use handset audio output when handset is off hook. |  |  |
|  | Audio user-interface devices (e.g. speakers and handsets) shall have volume levels appropriate for typical public transit environments. The speaker shall have a maximum volume so as not to be heard beyond the operator area. |  |  |
|  | Microphone design shall reduce ambient noise levels to improve transmitted voice quality. |  |  |
|  | The covert microphone audio input quality shall allow listeners to clearly understand speech from the bus front area surrounding the operator compartment. |  |  |
|  | The covert microphone audio input shall pick up conversational level ambient voice from the bus front area surrounding the operator compartment. |  |  |
|  | The CAD/AVL shall notify the operator visually and by tone when a call has connected or dropped. |  |  |
|  | For revenue vehicles, the radio system shall enable half-duplex functionality. |  |  |
|  | For portable unit users (e.g., road inspectors), the CAD/AVL application shall provide PTT or full-duplex functionality. The application shall provide options to assign the PTT-function to momentary contact buttons resident on the smartphones and tablets |  |  |
|  | The system shall allow portable unit users to select a talk path or conference session to listen in to an ongoing conversation. |  |  |
|  | Successful Proponent-provided equipment shall not introduce more than 25ms latency into the end-to-end communication path. |  |  |

## Yard and Transit Center Communication

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide end to end IP network communications within and between the various SJT locations. The Successful Proponent shall work with SJT's IT/Networking group to verify that isolated virtual local area networks (VLANs) for CAD/AVL data backhaul are defined and implemented. SJT will work with the vendor to identify VLAN requirements and SJT shall have the ability to extend the VLANs to new locations as desired. |  |  |
|  | The end to end network communications shall enable data communications between revenue, non-revenue vehicles, the central servers, workstations, and other remote dispatching equipment within the identified locations. |  |  |
|  | The Successful Proponent shall evaluate and utilize existing WLAN access points and networking infrastructure already installed at the SJT facilities. SJT shall provide information regarding the WLAN and other networking capabilities during the design phase. |  |  |

### WLAN Data Transfer Support Software

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall manage WLAN data transfers between vehicles and the central software. |  |  |
|  | SJT Personnel shall be able to select or assign the data/software to be updated, assign it to an individual bus, subset of buses, or the entire fleet, and specify the date and time for which the upload/download shall take place. |  |  |
|  | The system shall upload/download all of the required bulk data from/to SJT vehicles once they enter into the Wi-Fi coverage area, including: |  |  |
| 1. Fixed-route schedule data to vehicles; |  |  |
| 1. Configurations, firmware upgrades, and patches to vehicles; |  |  |
| 1. AVA annunciation files to vehicles; |  |  |
| 1. APC data download from vehicles; |  |  |
| 1. Flagged Video clips from Digital Video Recorder (DVR); |  |  |
| 1. Vehicle Health Monitoring data from revenue vehicles over J1939; |  |  |
| 1. Operational data recorded by the VLU from revenue vehicles; |  |  |
| 1. Destination Sign files to vehicles; and |  |  |
| 1. Battery Electric Bus (BEB) energy consumption information. |  |  |
|  | When the WLAN data transfer software has a download available for a vehicle that has successfully associated with an SJT WLAN access point, the system shall check with that MDT whether it has already received that download and if not, initiate and complete that download. |  |  |
|  | File transfers shall be initiated with each vehicle as soon it has successfully associated with an SJT WLAN access point and shall not be interrupted as long as the VLU remains on (including for a time period after the ignition is turned off). . |  |  |
|  | Interruption of a configuration data download/transfer shall not cause a failure of the onboard equipment, corruption of data, or prevent such equipment from being fully functional. |  |  |
|  | If an upload or download is interrupted, the upload or download shall resume from the point of disconnect. No data shall be lost or duplicated as a result of an interrupted transfer. |  |  |
|  | The system shall report in real-time and offline on the current status of downloads/uploads (e.g., in progress, scheduled or completed/failed) for the entire SJT fleet at any given point. For in-process download/upload, the system shall provide the download/upload status. |  |  |
|  | SJT shall be able to download updates or changes to fixed-route schedule data before their effective service date. These updates or changes shall be accessible the first time an operator logs on for service for that effective date. |  |  |

# Onboard Systems

This section defines hardware and software requirements for onboard system for revenue and non-revenue fleet.

## General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Onboard equipment shall be designed for use in the transit industry, with specific attention to ergonomics, reliability, efficiency, and safety of all system users. |  |  |
|  | The onboard system shall be capable of providing all text and voice communications and displays in English and French. |  |  |
|  | The onboard system shall display all measurements in metric units. |  |  |
|  | Individual onboard components shall be carried by a single person, and as such, shall not exceed 5 kilograms. |  |  |
|  | Operation of onboard equipment shall not affect or be affected by vehicle components, such as engine ignition, or other onboard equipment including vehicle power supplies, radios, automatic vehicle identification systems, fare collection systems, onboard video surveillance and onboard data collection and processing equipment. |  |  |
|  | Onboard equipment shall be protected against radio frequency interference (RFI) and electromagnetic interference (EMI) emission sources, as well as internal conductive or inductive emissions. |  |  |
|  | The onboard equipment shall have light emitting diode (LED) indications for power and circuit breakers. |  |  |
|  | Onboard equipment shall have a minimum 20,000 hours mean time between failures (MTBF) on average across the fleet, measured quarterly from min-fleet acceptance. |  |  |
|  | Onboard systems shall be fully operational within one-hundred and twenty seconds of ignition on. |  |  |
|  | The Successful Proponent shall include reasonable provisions to protect all onboard and publicly accessible equipment and components from common vandalism, unauthorized access and physical abuse as may be expected on transit vehicles and at stops. |  |  |
|  | Onboard equipment shall not pose a hazard to SJT staff or passengers when operated in accordance with manufacturer recommendations. |  |  |
|  | Onboard equipment shall include hardware circuitry and software functionality to automatically reboot or restart an onboard device in the event of a software or hardware freeze, crash or process failure. |  |  |
|  | Logged data shall be stored in non-volatile memory, and shall not become corrupted due to any power condition, including: spike, drop, or loss (e.g. vehicle start-up, power-down, battery disconnection). |  |  |
|  | System operation shall not be interrupted due to intermittent power loss or voltage drops. |  |  |
|  | All communication equipment shall be certified by Industry Canada. |  |  |
|  | All onboard equipment shall be designed for a minimum 10 years of useable life. The Successful Proponent shall guarantee a minimum ten years of availability of devices for replacement or fleet expansion. Newer versions of devices may be supplied, provided that they are backwards compatible with existing devices and systems. |  |  |

## Environment

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE  (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Unless otherwise approved by SJT, onboard equipment shall meet the following environmental specifications: |  |  |
| 1. Operating temperatures between -30°C and +74°C for exterior equipment; |  |  |
| 1. Operating temperatures between 0°C and +43°C for interior equipment; |  |  |
| 1. Storage temperatures between -30°C to +74°C; |  |  |
| 1. Humidity: 5-95% relative humidity non-condensing; |  |  |
| 1. SAE J1455 |  |  |
|  | Unless otherwise approved by SJT, onboard equipment, including all exterior connectors and exposed ports, shall be rated for IEC IP 54 or better for interior equipment and IEC IP 56 or better for exterior equipment and designed for use in a mobile environment subjected to dirt, water, oil, and cleaning solvents. |  |  |
|  | Where compliance with the environmental specifications presented here is not achievable for particular equipment, the equipment shall be shielded within environmentally protected enclosures or cabinets that comply with said environmental specifications, while maintaining the necessary operating conditions for the equipment within. |  |  |
|  | Equipment modules, cables, mounting hardware, and connectors shall be designed to withstand the full range of operating environments where they are to be installed and shall not interfere with the operation of existing onboard equipment. |  |  |

## Electrical

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Onboard wiring and cabling shall meet the following requirements: |  |  |
| 1. The Successful Proponent shall be responsible for the provision of all wiring, cabling, connectors, and terminations; |  |  |
| 1. Wire dress shall include strain relief and include a sufficient service loop on either end of a cable for re-termination if needed at a future date; |  |  |
| 1. Terminations and cables shall be clearly indexed, labeled and schematically identifiable; |  |  |
| 1. Where components must be connected to each other through individual wires, the wiring shall be incorporated into a wiring harness; |  |  |
| 1. Protected against abrasion and moisture/dirt ingress. All openings to provide cable pass through shall be sealed after installation; and |  |  |
| 1. Protected against incorrect cable connections in the event equipment is removed and replaced. |  |  |
|  | All in-vehicle equipment shall incorporate power conditioners/filters. |  |  |
|  | The Successful Proponent shall protect equipment inputs and outputs to absorb “routine” electrostatic discharges, over-voltages, and reverse polarity conditions. In the event of “extraordinary” conditions, the Successful Proponent shall design equipment to sacrifice inexpensive and easily identifiable components when necessary to protect more expensive components or those less easy to troubleshoot. |  |  |
|  | Devices shall not freeze up in the event that power is applied in the incorrect order (ignition sense versus continuous power on the load side of the master switch), or due to short-term power interruptions (e.g., vehicle startup or power-down), including complete loss of vehicle power. |  |  |
|  | Onboard components shall operate at a nominal +12.5 volts direct current (VDC) or +24 VDC, and be fully functional within operating supply voltage ranges of +9 VDC to +37 VDC. Voltages shall be measured at the power connector to the device. |  |  |
|  | The Successful Proponent shall securely mount onboard equipment in the vehicle’s interior, clear of obstructions and interference-generating devices. The Successful Proponent shall collaborate with SJT staff to determine the installed location of onboard components. |  |  |
|  | Cabling to all roof or exterior mounts shall incorporate a drip loop. |  |  |
|  | The equipment shall be tested and proven capable of withstanding power transients, electromagnetic interference and radio frequency interference without degradation at levels encountered in typical transit operations. |  |  |

## Vehicle Area Network and Vehicle Local Area Network

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F –CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall install communications cabling and connections compliant with the most recent version of Society of Automobile Engineers (SAE) J-1939 or SAE 1708/1587 network standard, to form a vehicle area network connecting the VLU/MDT, destination sign, farebox, APC controller, AVA controller (if separate than VLU), and interior AVA sign for common login, operating control, status indication and other integrated functionalities. |  |  |
|  | As necessary, the Successful Proponent shall use the Existing MGR to create Ethernet-based vehicle LAN with other onboard units for Ethernet-based communications. Examples of such components include DVR, Destination Sign, and APC. |  |  |

## Vehicle Logic Unit and Mobile Data Terminal

This section provides hardware requirements for operator terminals and the vehicle processing units that will provide onboard CAD/AVL and other functions. Operator terminal is referred to as MDT and the processing unit is referred to as VLU.

### General Requirements

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The VLU shall act as the central processor, data storage, and device manager for all onboard devices. |  |  |
|  | The VLU and MDT will operate using the latest version of a commercially available operating system, and the Successful Proponent shall demonstrate that the operating system supplied will have a minimum of five years support according to supplier information. |  |  |
|  | The VLU shall allow for maintenance reset without opening the equipment cabinet. |  |  |
|  | The VLU and MDT shall allow for remote reset and configuration without being on the bus or within Wi-Fi range. |  |  |
|  | The VLU shall include physical ports, sufficient processing capacity, and storage capacity for all functions of the proposed onboard components including optional and future interfaces (e.g., TSP emitters, contactless badge logon). |  |  |
|  | All storage for onboard devices shall be solid-state. |  |  |
|  | The VLU shall include a standard port to connect an external portable computing device for manual data configuration using provided utility software. |  |  |
|  | The VLU and MDT shall turn on automatically when the vehicle power is turned on and shall shut down at an SJT-configurable time after the vehicle power is turned off. |  |  |
|  | The VLU and MDT shall automatically reboot after a fatal error. All such actions shall be automatically recorded in MDT logs and shall not be overwritten until downloaded. |  |  |
|  | The VLU shall provide the master time sync available to all other devices based on time available from SJT time server, as obtained at the time of logon. The VLU time shall be synchronized at least daily. |  |  |
|  | The VLU shall monitor and log the following existing discrete external circuits where available by vehicle type: |  |  |
| 1. Odometer; |  |  |
| 1. All door contacts; |  |  |
| 1. Battery status; |  |  |
| 1. Kneeling function; |  |  |
| 1. Lift or ramp deploy, and return from deploy (stow); |  |  |
| 1. Bicycle rack use; |  |  |
| 1. Stop request activation; |  |  |
| 1. Headlight activation and deactivation; |  |  |
| 1. Turn signals, activation and deactivation; |  |  |
| 1. Hazard lights, activation and deactivation; |  |  |
| 1. Master-run switch status and change in status (off, day-run, night-run, park); |  |  |
| 1. Ignition activation and deactivation; and |  |  |
| 1. Covert alarm use. |  |  |
| 1. Camera status |  |  |
|  | The VLU shall include physical and software interfaces or multiplexer modules to connect to the vehicle Controller Area Network(s) (CAN(s)) where needed to receive required discrete inputs. |  |  |
|  | The VLU shall, when connected to SJT WLAN, check for and download bulk data files (e.g. containing schedule service information, operator assignment) required for system operation. |  |  |
|  | Onboard equipment shall have sufficient storage for at least three full schedule changes of data. |  |  |
|  | The system shall include provisions to restrict the size of downloads transmitted during log-in to avoid pull-out delays. |  |  |
|  | The VLU shall provide a versioning mechanism for files to be wirelessly downloaded to the vehicle, but for the VLU to delay implementation of the file until some later date. Any stored version may be initiated and made current at any time, when scheduled or requested by the system administrator. |  |  |
|  | The VLU shall store accumulated data in a non-volatile memory with sufficient capacity to hold thirty days of data assuming up to 24 revenue hours per day. |  |  |
|  | The VLU shall allow a maintenance staff person to manually access and download stored data as a redundant back-up option. This may be accomplished using a service laptop connected to a USB port or through the use of removable media. If removable media is used, the VLU operating system must not reside on the same removable media as other data. |  |  |
|  | The VLU shall automatically log and reports faults or failed communications with all onboard devices integrated to the VLU. |  |  |
|  | The VLU fault logs for integrated devices shall be available at vehicle startup and end of operating period or upon request from SJT system administrator. |  |  |
|  | The MDT shall contain a speaker and tone generator to be used to provide audio alerts. The MDT shall include a volume control for these functions that is accessible to the operator. |  |  |
|  | MDT brightness and volume settings shall be SJT-configurable including pre-defined defaults and predefined limits, both globally by authorized SJT users, and within the global limits by individual operators. All settings modified by operators shall return to their default values when a different operator logs onto the MDT. |  |  |
|  | The MDT shall automatically switch between daytime and nighttime brightness and display settings based on visible light for the bus. This function shall allow for operator override. |  |  |

### MDT Graphical User Interface (GUI)

This section lists requirements for the visual look and feel of the operator terminal.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The GUI shall include general function menus and context-sensitive menus for specialized functions, where available options are customized to be relevant to the application, view, and feature set that the user is interacting with. |  |  |
|  | Menus shall be SJT-configurable. |  |  |
|  | The MDT shall have a colour backlit display that the operator can read from the seated position under the full range of ambient illumination conditions. |  |  |
|  | The MDT shall be equipped with a colour display touch-screen that meets the following requirements: |  |  |
| 1. Able to be used by operators wearing gloves; |  |  |
| 1. Readable by operators wearing polarized lenses; |  |  |
| 1. Sufficient brightness to be readable in direct sunlight; |  |  |
| 1. Dimmed or night mode operation; |  |  |
| 1. A minimum size of 7 inches as measured diagonally; |  |  |
| 1. A minimum resolution of 800x600 pixels; |  |  |
| 1. Scratch resistant; and |  |  |
| 1. Zoomable |  |  |
|  | The colour combination to be used on the MDT terminal shall provide legibility for people who are colour blind. |  |  |
|  | The MDT display shall include functionality to display both text and icon-based messages and key labels. |  |  |
|  | The MDT display shall include functionality to display different font sizes, icons, colours, and styles on the screen. |  |  |
|  | The operator terminal shall be operated using touch screen programmable buttons with visual and audible feedback. |  |  |
|  | The MDT shall notify the operator about data communication connectivity status through a distinct symbol on the operator screen. |  |  |
|  | The MDT shall notify the operator about GPS connectivity status through a distinct symbol on the operator screen. |  |  |
|  | The operator shall not be able to manually shut off or disconnect the operator terminal power or manually shut down the MDT application software. |  |  |
|  | If tactile buttons are present on the MDT, then they shall be reconfigurable to various uses with appropriate labels without limitation. |  |  |
|  | The MDT shall display messages from the dispatch centre on the screen (e.g. active detour, service adjustments, text) |  |  |
|  | The MDT shall clear messaged displayed on the screen through: |  |  |
| 1. Operator acknowledgement; and |  |  |
| 1. Configured display duration |  |  |
|  | The MDT shall allow the operator to make alternative service ride requests. |  |  |
|  | The MDT shall allow operators to manually record stop passbys. Passbys refer to cases where an operator is unable to pickup all passengers waiting at a stop. |  |  |
|  | The MDT shall allow the operator to reach any messaging function (e.g. read message, view message, confirm message, etc.) within two buttons presses. |  |  |

### Safe Driving Mode

This section lists requirements for activating a safety mode on the screen when the vehicle is in motion to deter operators from interacting with MDTs.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The MDT shall have the safe driving mode enabled when the vehicle is moving above an SJT-configurable speed limit (e.g., 5 kilometers/hour) for an SJT-configurable amount of time (e.g., 1 minute). |  |  |
|  | The MDT shall allow SJT to enable the following screen configurations under safe driving mode: |  |  |
| 1. Blank display on the screen; |  |  |
| 1. Disabled MDT buttons to stop operators from performing any actions on the screen; and |  |  |
| 1. Display of information relevant to operators when of high priority (e.g., route and schedule adherence status, navigation screen, missed messages or calls from controller). |  |  |
|  | All screen configurations shall support continued use of emergency alarm, PRTT, RTT, and passyby functions during safe mode if configured by SJT. |  |  |
|  | All screen configurations shall support continued use of turn-by-turn navigation functions during safe mode if configured by SJT. |  |  |
|  | SJT shall have the ability to remotely change configurations for the safe driving mode. This ability will be limited to a select set of user that can be defined and configured by SJT. |  |  |
|  | SJT shall be able to change the safe driving mode configurations by operator login. For example, the safe driving mode could be disabled for maintenance or training purposes. |  |  |

### Vehicle Operator Logon and Logoff

This section lists operator logon and logoff requirements.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The MDT shall allow operator logon using their operator ID and block/run ID. The VLU shall check with the central system to validate that the operator ID and block/run ID are valid and not already in use. In the event of a conflict, the system shall notify the operator of an “invalid” logon. |  |  |
|  | Once the system validates the operator and block/run IDs, the VLU shall complete the logon. |  |  |
|  | After logon, the MDT shall display the current block/run, route, trip, next time point, and operator ID for fixed-route operations. Also, the display shall provide operator paddle based on logon information. |  |  |
|  | After logon the MDT shall allow the operator to display their scheduled paddle. |  |  |
|  | The MDT shall include a log-over feature to allow a new operator to login directly as the replacement operator for the current block. |  |  |
|  | The MDT shall allow the operator to logoff. |  |  |
|  | The VLU shall send a message to the controller as a confirmation of the operator logoff. |  |  |
|  | The VLU shall automatically log the vehicle off after an SJT-configurable time has passed once the vehicle has been detected as having returned to the garage, if the operator has not already completed a manual logoff. |  |  |
|  | The VLU shall periodically attempt to send a logon or logoff message until it receives an acknowledgement message from the central system. If no response was received from the central system within an SJT-configurable time, the MDT shall provide the operator with a “no logon response” message. |  |  |
|  | When a no-logon response message is received the system shall allow an operator to logon to work without central system validation. Activation of this functionality shall be SJT-configurable. |  |  |
|  | The system shall allow the operator to lock out the MDT without logging off, to prevent unauthorized access anytime the operator is away from the bus (for instance, on break at a layover). |  |  |

### Operator Contactless Badge Logon (Option)

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall supply a contactless card reader to support operator logon. |  |  |
|  | The contactless card reader shall be compliant with ISO 14443 Type A or B. |  |  |
|  | The Successful Proponent shall supply a contactless cards to support operator logon. |  |  |
|  | The contactless cards shall be compliant with ISO 14443 Type A or B. |  |  |
|  | Each contactless card shall have a unique serial number. The serial number will be clearly printed on each card. |  |  |
|  | The contactless cards shall be provided with full colour pre-printed graphics. The design of the card graphics shall be as directed by SJT. |  |  |
|  | Smart cards shall be designed to protect all pre-printed card graphics from wear and abrasion during normal use. |  |  |
|  | The system shall allow SJT to associate each card with an individual operator to support operator logon. |  |  |
|  | The system shall allow SJT to edit card to operator associations. |  |  |
|  | Additional compatible Operator Contactless Cards shall be available to SJT directly multiple suppliers that service Canada. |  |  |
|  | The system shall populate operator ID for logon using the operator contactless cards. Operators shall complete logon by entering their block/run ID. |  |  |

### Pre- and Post-Trip Inspection

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Upon successful logon, the MDT shall display an SJT-configurable pre-trip inspection screen that shall be filled in by the operator after conducting their pre-trip inspection of the vehicle. Activation of this feature shall be an SJT-configurable parameter. |  |  |
|  | As part of the pre-trip inspection, functionality shall be provided to test all onboard components and integrations provided under this contract. |  |  |
|  | Activation of the covert alarm switch during the pre-trip inspection shall not initiate an emergency alert or require manual intervention from a controller. The central system shall record and acknowledge receipt of the alarm test and indicate to the operator that this covert alarm switch is functioning properly. |  |  |
|  | The VLU shall track whether the wheelchair lift was cycled before the vehicle moved an SJT-configurable distance after logon and report it in real time to central software if it was not cycled. |  |  |
|  | The system shall record results of the pre- and post-trip inspections conducted by operators |  |  |
|  | The Successful Proponent shall design the inspection forms in coordination with SJT to comply with the existing SJT inspection process. |  |  |
|  | The system shall record the operator id, vehicle id, and date, time and location of pre- and post-trip inspection completion when the inspection form is completed and submitted. The system shall provide a prompt on the MDT screen for operators to confirm all input before the report is finally submitted. |  |  |
|  | The inspection data shall be uploaded automatically to the central system in real-time and shall be available to the authorized staff to review as needed. SJT will decide at the time of design review on what inspection items shall be displayed on the controller screen or should be available for offline reporting. |  |  |
|  | Prior to log off, the MDT shall display an SJT-configurable post-trip inspection screen that shall be filled in by the operator after conducting the completion of a run. Activation of this feature shall be an SJT-configurable. |  |  |

### Vehicle Location Tracking

This section lists hardware and software requirements for tracking revenue and non-revenue fleet with GPS receivers built into the onboard units. When GPS receivers are not available, alternate methods such as dead reckoning will be used.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | GPS receivers used by the VLU and shall be designed for operation in downtown urban, suburban, and rural areas, including the ability to continue logical vehicle position tracking when a GPS signal is not available or is degraded. This could include, but is not limited to, environments such as mountainous areas, heavily forested areas, office tower "Urban Canyons", tunnels, multimodal transit centers, garages and transit yards. |  |  |
|  | The VLU shall compute the vehicle position, speed, and direction based on multiple positioning systems and inputs including the following: |  |  |
| 1. A wide area augmentation system (WAAS)-enabled GPS receiver; and |  |  |
| 1. A dead-reckoning system. |  |  |
|  | The GPS Receiver shall be integrated with the GPS Antenna to continuously gather signals from available GPS satellites. |  |  |
|  | The GPS Receiver shall in response to a command from the VLU report absolute location (latitude, longitude), speed, time, direction of travel (heading) and whether the receiver has a GPS position lock. |  |  |
|  | The GPS Receiver shall be at least sixteen channel parallel tracking, capable of simultaneously tracking at least eight GPS satellites in the best available geometry, while also tracking at least the four next best and/or upcoming (rising). |  |  |
|  | The GPS Receiver shall include multi-path rejection capabilities to help eliminate spurious signals caused by reflections of buildings, other structures, or natural features. |  |  |
|  | The GPS receiver shall have a cold start solution time of 120 seconds or less. |  |  |
|  | The GPS receiver shall have a warm start solution time of 45 seconds or less and a re-acquisition time of 15 seconds or less. |  |  |
|  | The GPS Receiver shall instantly report loss of its GPS lock to the VLU. |  |  |
|  | The GPS Receiver shall report the loss of WAAS service to the VLU. |  |  |
|  | The GPS Receiver shall be able to calculate and provide an accurate position fix within five seconds of signal re-acquisition. |  |  |
|  | The GPS equipment’s speed measurements shall be accurate to within 0.1 meters per second. |  |  |
|  | The GPS antenna shall be securely mounted on the vehicle’s exterior. The antenna, mounting and sealants shall be impervious to physical and chemical damage by automatic bus washing equipment, and to high wind situations such as during hurricanes. |  |  |
|  | If location data is not available from the GPS receiver, the VLU shall be able to calculate vehicle location based on the dead reckoning system. |  |  |

### Location Data Management and Reporting

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The VLU shall compute and update onboard vehicle position information every one second or less and shall provide that position information to other onboard devices as needed. |  |  |
|  | Vehicle location computation lag time (i.e. the time it takes to compute position information, correct it, and update the onboard systems) shall not exceed one second. |  |  |
|  | Location data shall be sufficiently precise to accurately and reliably identify the location of each vehicle on the street network. At a minimum, vehicle location shall be accurate to within 3 meters 97% of the time. |  |  |
|  | The VLU shall provide position reports to the central system as follows: |  |  |
| 1. Routine position reports shall be provided every 10 seconds while the vehicle is in operation, regardless of whether it is logged-on or not; |  |  |
| 1. Event-based position reports shall be provided every time the vehicle passes a stop or time-point, regardless of whether the vehicle stops or not; and |  |  |
| 1. At transit centers, position reports shall be provided when the vehicle enters the transit center, when it arrives at the designated bay, when it departs the bay, and when it leaves the transit center. |  |  |
|  | All transmitted data shall be stamped with the following information: date and time, “GPS lock” status, latitude and longitude, heading, run number, vehicle number, operator ID number, and status of the GPS receiver. |  |  |
|  | The VLU shall store the most recent location received from the GPS receiver. |  |  |
|  | The VLU shall provide logging capability to record every positional input (raw GPS, raw secondary input(s)) at least every one second, in addition to all calculated positions (raw GPS position, raw secondary position(s), and estimated position). SJT's system administrator shall have the ability to enable or disable this functionality. |  |  |
|  | The VLU shall alert the dispatch centre if a logged on vehicle has not moved between a number of successive location reports. The threshold for successive location reports shall be SJT-configurable. |  |  |
|  | The VLU shall support SJT-configurable trigger points (e.g. for use at transit centers, layovers, and other SJT defined locations) where system actions could be programmed based on the vehicle being detected at the trigger point, and any combination of the following: |  |  |
| 1. Route |  |  |
| 1. Direction |  |  |
| 1. Schedule adherence; and |  |  |
| 1. Remaining layover |  |  |
|  | SJT shall be able to configure these trigger points centrally using a satellite or map based background and point, draw, drag type GUI. |  |  |
|  | The VLU shall be able to distinguish with 99% accuracy the difference between a next trip departure and a maneuver repositioning within the transit center, station, layover area and shall properly assign passenger counts and related data to the actual start of trip. |  |  |
|  | The VLU shall retain information from the start and end of the trip and assign passenger counts and times based on door open actions and time if it detects that it has started the route one or more stops along the trip pattern. |  |  |
|  | If the VLU detects that it has not arrived at the first stop of the trip, it will create a special flag that is passed to and stored in the central system for data analysis. |  |  |

### Voice Call Management

This section provides requirements for initiating and completing radio sessions using CAD/AVL software.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The MDT shall provide Request to Talk (RTT) and Priority Request to Talk (PRTT) buttons to allow the operator to ask a controller to set up a voice call. |  |  |
|  | The MDT shall display the queue position of the request to the operator once it has been submitted. |  |  |
|  | When the dispatch centre enables a one-way voice call to one or more vehicles, the MDT shall provide a distinct audible tone and visual alert. The audio shall be routed through the operator speaker; if the operator picks up the handset, the audio shall instead be routed through the handset. |  |  |
|  | When the dispatch centre enables a two-way voice call to the vehicle, the MDT shall provide a distinct and visual alert tone. The audio will be routed through the handset once the operator picks up the handset audio, until the end of the timed voice call after which the MDT shall automatically end the voice call. |  |  |
|  | When the operator hangs up the handset during a two-way voice call, the MDT shall detect it and the voice call shall end. The MDT shall send a data message to notify the dispatch centre that the voice call has ended. |  |  |
|  | A controller shall have the ability to end a timed voice call at any time while the call is in progress. |  |  |
|  | At any time while the MDT is on, the MDT shall allow the operator to adjust the voice communications system speaker volume within an SJT-configurable range. The MDT shall not enable the operator to mute the speaker audio. |  |  |

### Canned Data Messaging

This section provides requirements for sending pre-configured data messages as stored on the MDTs.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The MDT shall allow the operator to select a set of pre-defined messages to send a canned data message to the central system. All canned messages to the dispatch centre shall include the date, time, location (latitude and longitude) vehicle ID and operator ID. |  |  |
|  | The MDT's pre-defined messages to the dispatch centre shall include: |  |  |
|  | 1. Logon/Logoff/system test/maintenance; |  |  |
| 1. Critical messages |  |  |
| 1. Vehicle status report (on time, early, late, on route, off route); |  |  |
| 1. Out of service; |  |  |
| 1. Call for a road inspector; |  |  |
| 1. Vehicle mechanical problem; and |  |  |
| 1. Capacity for a minimum of fifty other routine or "canned" messages from vehicle to controller. |  |  |
|  | The MDT canned messages shall allow up to three different message sets based on logon types (e.g. inspectors, maintenance, fixed route bus). |  |  |
|  | Canned messages shall be able to be grouped into a minimum of two levels allowing some message categories to contain specific sub-options for canned messages. |  |  |
|  | The system shall allow SJT staff to add, edit, delete, or reorder the listing of canned data messages to be stored on MDT without Successful Proponent assistance or intervention using Successful Proponent provided tools/software. |  |  |
|  | The MDT shall be able to display free form text messages from the dispatch centre up to at least 254 ASCII characters in length per page and shall paginate longer messages at appropriate word and sentence boundaries. |  |  |
|  | The VLU shall store an SJT-configurable number of canned data messages received from the dispatch centre. |  |  |
|  | The MDT shall indicate when there are unviewed messages in the incoming message queue and how many messages are in that queue. |  |  |
|  | The MDT shall allow stored messages to be viewed. |  |  |
|  | The MDT shall allow stored messages to be deleted only after they have been viewed. |  |  |
|  | The MDT shall allow the operator to send the following responses to certain messages received from the central system: |  |  |
| 1. Acknowledgement; |  |  |
| 1. Yes/No; and |  |  |
| 1. Numeric keypad response up to 10 digits |  |  |
|  | The MDT shall periodically attempt to send a canned data message or response until it receives an acknowledgement message from the central system. |  |  |
|  | The MDT shall issue a distinct audible tone and visual alert to confirm that messages have been sent. |  |  |
|  | The MDT shall issue a distinct audible tone and visual alert to indicate when a canned data message is received from the dispatch centre. |  |  |
|  | Messages received by the MDT shall be displayed to the user in a large typeface readable by a user with 20/20 eyesight from a distance up to one meter. |  |  |

### Wireless Data Communication Gateway

This section lists requirements for the central component that will act as a message gateway between the vehicle and central systems.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The VLU shall use wireless data communications through the Existing MGR to send and receive messages with the central software at any time. |  |  |
|  | The data protocol used for transmission shall accommodate the required functionality for up to at least 100 vehicles at a 5-second polling interval. |  |  |
|  | The VLU shall store data if communications are interrupted and forward data to the central system once communications are restored. |  |  |

### Covert Alarm Switch and Covert Microphone

This section lists requirements for covert/silent alarm activation and VLU support for related necessary actions and clearing of the event.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide a new covert alarm switch. The switch shall be mounted at a location that can be easily pressed by the operator in a discreet manner but unlikely to be accidently activated (e.g. surrounded by a guard ring that still allows the button to be pressed from above). |  |  |
|  | The VLU shall be equipped with a covert microphone having adjustable orientation and sensitivity. |  |  |
|  | The VLU shall detect if the covert alarm switch circuit is closed for at least one second and automatically send an alarm message to the dispatch centre and place the MDT into covert alarm mode. |  |  |
|  | Pressing the covert alarm switch shall allow the VLU to activate the covert microphone. The VLU shall begin recording audio via the covert microphone within one second, and the controller shall be able to hear the audio feed within three seconds of the covert alarm switch being pressed. |  |  |
|  | Pressing the covert alarm switch shall allow the VLU to flag video footage from the onboard cameras within one second. |  |  |
|  | The VLU shall allow the dispatch centre to activate audio transmission from the covert microphone only after the operator has activated the covert alarm. |  |  |
|  | The VLU shall allow the dispatch centre to activate a “live look in” only after the operator has activated the covert alarm switch. |  |  |
|  | Vehicle vibration shall not activate the covert alarm switch. |  |  |
|  | The VLU shall disable the receipt of voice calls or the sending/receiving of text messages while in the covert alarm state but shall leave the RTT and PRTT buttons activated. |  |  |
|  | Only the dispatch centre shall be allowed to terminate the covert alarm state once the covert alarm state has been activated. |  |  |
|  | The VLU shall periodically attempt to send the covert alarm message until it receives an acknowledgement message from the central system. |  |  |
|  | The VLU shall increase the frequency of vehicle location information polling to an SJT-configurable time (e.g. 5 seconds) when the covert alarm is activated. |  |  |
|  | When the MDT is in the covert alarm mode display shall provide subtle symbols or icons SJT approves, signifying that a controller has accepted the covert alarm and SJT is monitoring the covert microphone. |  |  |

### Schedule Adherence

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | When an operator is logged on to a fixed-route run, the MDT shall continuously display: |  |  |
| 1. Schedule adherence time and status |  |  |
| 1. Distance to the previous and next bus |  |  |
| 1. Actual headway to the previous and next bus |  |  |
|  | The estimated schedule adherence time between timepoints shall be based on the typical link running times for the relevant service type and time period. |  |  |
|  | The VLU shall send the most recent schedule adherence data as part of each location report. |  |  |
|  | The VLU shall calculate an updated schedule adherence time, every thirty seconds, with an accuracy of within one second and with no more than one second of latency. |  |  |
|  | The VLU shall support free running mode (i.e. where scheduled timepoints are not included in the on-time performance) but continue to report stops in free running mode with arrival, departure, and dwell times. |  |  |
|  | The MDT shall indicate to operators the current schedule adherence in the form of a text-based display (e.g. + or – 2 minutes) and a stylistic display (e.g. ahead of schedule is red, behind schedule yellow, on time is green). |  |  |
|  | The MDT shall provide SJT-configurable distinct audio alerts to operators when they are an SJT-configurable time ahead of or behind schedule. |  |  |
|  | The MDT shall provide an SJT-configurable visual alert to operators when they are an SJT-configurable time ahead of or behind schedule. |  |  |
|  | The VLU shall send an incident message to the dispatch centre when a vehicle is determined to be running an SJT-configurable time ahead of or behind schedule. |  |  |
|  | The MDT shall provide an alert to the operator when the bus in front has gone out of service |  |  |

### Headway Adherence

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | For headway-based service, the system shall calculate schedule adherence status based on headway adherence; the VLU shall not utilize an underlying schedule. |  |  |
|  | For headway-based service, the VLU will report departure from each stop to the central system for comparison purposes. |  |  |
|  | For headway-based service, the MDT shall display headway information to the operator including: |  |  |
| 1. Distance to the previous and next bus |  |  |
| 1. Actual headway to the previous and next bus |  |  |
| 1. Scheduled headway to the previous and next bus |  |  |
| 1. Variance of vehicle from default headway as configured by SJT |  |  |
| 1. Notifications when the bus in front has gone out of service |  |  |
|  | The system shall calculate scheduled headway based on the number of vehicles servicing the route and typical run times for the route. |  |  |
|  | The system shall allow SJT to manually configure a scheduled headway for a route.. |  |  |
|  | For headway-based service, the MDT shall indicate, both audibly and visually, when an operator is required to hold at the next feasible location to address a headway maintenance issue. SJT shall be able to configure the headway threshold at which the alert is generated. |  |  |
|  | For headway-based service, the MDT shall indicate both audibly and visually when an operator should proceed, including: |  |  |
| 1. At the start of trips; |  |  |
| 1. At transit centers; and |  |  |
| 1. After holding to correct headway issues. |  |  |

### Route Adherence

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Based on SJT-configurable thresholds, the onboard system shall compute whether a fixed-route vehicle is running on-route or off-route. |  |  |
|  | The system shall not consider a bus to be off-route if it is following an applicable detour routing. |  |  |
|  | The VLU on fixed-route vehicles shall send a message to the central software when a vehicle is determined to have gone off-route or have come back on-route. |  |  |
|  | The VLU shall periodically attempt to send an off-route message until it receives an acknowledgement message from the central system. |  |  |
|  | The MDT shall display whether the vehicle is on-route or off-route. |  |  |

### Navigation Assistance

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The VLU shall be equipped with a navigation assistance module to provide visual map-based and audible turn-by-turn instruction for operators of fixed-route vehicles. Whether or not this feature is enabled shall be SJT-configurable. |  |  |
|  | Once the operator logs on, the MDT shall provide an option to activate turn-by-turn navigation showing the current location of the vehicle, the location of bus stops and timepoints, and the routing between them. As the vehicle travels, the map view will automatically pan and zoom to follow the vehicle. |  |  |
|  | The MDT shall allow operators to override the map zoom level or pan the map display, and to select for the display to return to the default mode that automatically follows the routing. |  |  |
|  | The driving instructions shall include both the turn directions and the name of the street, and this information shall be provided at an SJT-configurable distance in advance of the turn. |  |  |
|  | The navigation module shall allow operators to toggle between map and text based turn-by-turn direction. |  |  |
|  | The navigation module shall allow the operator to activate and deactivate the navigation map display and/or the audible instructions as desired. The MDT shall provide a way to increase or decrease audio volume for navigation instructions. The audio volume should be interrupted for any audio alert generated for an incoming message from the dispatch centre. |  |  |
|  | The navigation map shall be updateable over the bulk data transfer using the WLAN. |  |  |
|  | The turn-by-turn instructions shall follow the routing set by service planning in the scheduling software. |  |  |
|  | The turn-by-turn instructions shall be updated to reflect active detours in real time. |  |  |
|  | The navigation map shall indicate visually that the operator is on a detour. |  |  |

## Automated Vehicle Announcements (AVA)

This section provides requirements for an automated announcement.

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall integrate with the existing REI public address (PA) equipment to provide: |  |  |
| 1. Audio announcements over an internal speaker system to inform onboard passengers; |  |  |
| 1. Audio announcements over an external speaker to inform intending passengers; and |  |  |
| 1. Visual announcements on SJT's existing interior digital message signs (DMS) that provide a text version of onboard audio announcements. |  |  |
|  | The Successful Proponent shall determine any upgrades needed to meet requirements. The Successful Proponent shall implement any required upgrades needed to meet system requirements. |  |  |
|  | The system shall have the ability to play both human-recorded and text-to-speech audio files. |  |  |
|  | The Successful Proponent shall supply all text-to-speech software and any other software/hardware required to record or generate audio messages for the system. |  |  |
|  | The system shall include the ability to broadcast live text-to-speech audio transmitted from the dispatch centre. |  |  |
|  | As each fixed-route vehicle departs a stop or other designated location, a digitally recorded announcement shall be made automatically over the existing onboard PA system speakers and displayed on DMS inside the vehicle to inform passengers about upcoming stops, transfer opportunities, major intersections, and landmarks. |  |  |
|  | SJT shall be able to configure the announcements so they are made in either one language or multiple languages. |  |  |
|  | The system shall make automated announcements without requiring any operator input. |  |  |
|  | The system shall include functionality to generate the following messages and provide SJT the ability to prioritize the type of messages being announced/displayed at any given time: |  |  |
| 1. Internal audible and visual location-based announcements; |  |  |
| 1. Internal time-based (e.g., reoccurring scheduled message at a time interval) audible and visual customer service announcements; |  |  |
| 1. Internal operator initiated audible and visual customer service announcements; |  |  |
| 1. Location-based audible and visual customer service announcements; and |  |  |
| 1. External audible bus arrival announcements. |  |  |
|  | The external arrival announcements may be configured by SJT to repeat in a loop while the door is open. If on a repeating loop, the repeat interval shall be SJT-configurable. |  |  |
|  | As part of the pre-trip inspection, functionality shall be provided to test the announcements by playing an audio and visual test message. The system shall alert the operator and the dispatch centre of any fatal error condition that occurs during pre-trip tests. |  |  |
|  | The system shall include self-diagnostic capabilities and shall log every error condition, including but not limited to: |  |  |
| 1. Inability to begin any announcement, within one second of being triggered; |  |  |
| 1. Inability to load a "current" announcement data set;. |  |  |
| 1. Any hardware failure; and |  |  |
| 1. Any time update, which is more than +/-5 seconds from current AVA time. |  |  |
|  | The system shall record all AVA faults and errors and display error conditions affecting announcements on the MDT. The system shall log any faults as part of maintenance reporting. |  |  |
|  | The system shall allow the dispatch centre to disable announcements on a single bus or a group of buses. For instance, in the event of an AVA malfunction or error. |  |  |
|  | The system shall enable the dispatch centre initiated service adjustments and detour management actions to disable stop announcements, or trigger modified announcements to support out of service or newly added/created stops. |  |  |

### PA Integration

This section lists requirements for interface vehicle public address system for using internal and external speakers for announcements and for volume control.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall include an automatic gain control (AGC) circuit to automatically and independently adjust internal volumes depending on vehicle speed or ambient noise level. Each audio announcement played using AGC shall be played at a consistent volume determined by sampling the AGC immediately prior to playing the announcement. |  |  |
|  | The system shall include an automatic gain control (AGC) circuit to automatically and independently adjust external volumes depending on vehicle speed or ambient noise level. Each audio announcement played using AGC shall be played at a consistent volume determined by sampling the AGC immediately prior to playing the announcement. |  |  |
|  | The system shall provide maintenance technicians with a means of testing and setting both the internal and external audio default volumes and ambient noise through the AGC circuits. |  |  |
|  | The system shall provide the capability to adjust the external speaker volume levels based on time of day and location settings, as SJT pre-configures (e.g., maximum volume at the downtown transfer center between 6 a.m. and 9 a.m. and minimum volume at specific neighborhood stops). |  |  |
|  | The system shall provide the capability to adjust the minimum and maximum volume levels separately for interior and exterior announcements. The operator will not be able to manually adjust the volume below or above these levels. |  |  |

### AVA Triggers

This section defines requirements for geo triggers that will be used for activating announcements.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall use the vehicle location information from the AVL system to trigger the appropriate announcements onboard the vehicle whenever the vehicle enters a “trigger zone.” A trigger zone is a user-defined area where an announcement is to be played. For example, the trigger zone may begin 250 meters before a stop as well as at selected other announcement locations. |  |  |
|  | The central software for AVA trigger management shall pre-define trigger zones and download them to the controller over WLAN. |  |  |
|  | Trigger zones shall be SJT-configurable by stop to accommodate for differences in operations, including but not limited to the direction of approach and size of stop. |  |  |
|  | Time-based announcements and displays shall be programmed to be made onboard the vehicle at specific times of the day or at a set frequency within specified time periods on specific days of the week. |  |  |
|  | Location-based announcements and displays shall be programmed to be made onboard the vehicle when that vehicle passes any designated location(s). |  |  |
|  | Both audible and visible messages shall begin playing within one second of being triggered. |  |  |
|  | Automated announcements shall continue to operate normally when the vehicle is in covert alarm mode. |  |  |
|  | The automated announcements/displays shall not be made if a vehicle is operating off-route. Once the route is reacquired, the system shall automatically determine and announce the next valid bus stop or other designated location. |  |  |
|  | Off-route and on-route detection and recovery shall be automatic and not require operator intervention or action. |  |  |

### Manual Announcements

This section describes the requirements of the system in case of manual announcements. For example to override automated announcements in the event of malfunctions or in other situations.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The operator shall have the ability to trigger the activation of any pre-recorded announcements manually. |  |  |
|  | Operator-initiated announcement and/displays (e.g., safety-related announcements) shall be programmed to be made at the operator’s discretion. |  |  |
|  | Operator use of the onboard PA system shall override any automated announcements. |  |  |
|  | Operators shall be allowed to override AVA announcements for manual PA announcements. |  |  |

### AVA Text Display

This section describes the requirements for the text display as a part of the AVA system.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The AVA system shall provide text announcements for SJT-configurable durations. |  |  |
|  | As any fixed-route vehicle enters a trigger zone, the AVA system shall provide a stored text announcement that triggers at the same time as the corresponding interior audio next stop announcements. AVA and text announcements can also be configured to operate independently. |  |  |
|  | The AVA system shall provide stored text for location triggered, periodic or operator-activated announcements. |  |  |
|  | The DMS shall be SJT-configurable to display the current date and time or the next stop when not displaying a triggered announcement. |  |  |
|  | The controller shall have the ability to send a free form announcement message to the AVA interior DMS on one bus or a group of buses. |  |  |

### “Stop Requested” Functionality

This section specifies the requirements of the “Stop Requested” functionality.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall include functionality to display a “stop requested” message on the DMS and make an audible "stop requested" announcement when a customer activates a stop request or wheelchair area stop request. Activation of this functionality shall be SJT-configurable. |  |  |
|  | If the stop request signal is received while another message is being displayed/announced, the AVA system shall show and announce the stop requested message after the current message is completed. |  |  |
|  | Stop announcements and text will always have precedence over stop request announcements and text. If a stop announcement is triggered while a stop requested message is being displayed/announced, the stop requested message shall be interrupted by the stop announcement. |  |  |

## Vehicle Health Monitoring (VHM) (optional)

This section describes the requirements of the Vehicle Health Monitoring system.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The onboard system shall include a vehicle health monitoring (VHM) subsystem that shall interface with existing multiplex and powertrain systems using a physical interface method compatible with interface adaptor kits available for these systems. |  |  |
|  | The Successful Proponent shall describe the need for installing any hardware or software upgrades required for this interface, including any needed updates to the multiplex and powertrain onboard computer software and the installation of any needed interface adaptor kits. |  |  |
|  | The system shall immediately report alarms detected through monitoring the MDT, destination sign, multiplex system and powertrain onboard computer, as device alarm data messages to the central system. |  |  |
|  | The MDT shall be integrated with existing J1708/1587 and J1939 network on the fixed-route fleet to collect codes from engine control module, transmission control module and automatic braking system. |  |  |
|  | The VHM shall monitor over J1708, J1939, multiplex, or through discrete, as applicable, the following: |  |  |
| 1. Pressures - air, oil, hydraulic; |  |  |
| 1. Braking events - hard braking events, fast acceleration events, anti-lock brake system activity; |  |  |
| 1. Turning events – harsh turning,high speeds, high G |  |  |
| 1. Temperatures - engine, oil/fluid; |  |  |
| 1. Voltage; |  |  |
| 1. Heating, ventilation, and air conditioning; |  |  |
| 1. Wheelchair /Bus Kneel; |  |  |
| 1. PA system |  |  |
| 1. Door Open/Close; and |  |  |
| 1. Odometer reading |  |  |
| 1. Battery charge status |  |  |
|  | VHM records shall be tagged with system date/time and current vehicle latitude/longitude information. |  |  |
|  | The VHM system shall use SJT-configurable frequency and duration thresholds, as available for sensor data, to determine which data shall be stored in the system as system warnings. These shall be transmitted to the central software in real-time or as part of bulk data transfer and available through maintenance reporting. |  |  |
|  | The VHM system shall use a separate set of SJT-configurable frequency and duration thresholds for sensor data as available, to determine which data shall be sent immediately to the central software as critical system alerts data messages. These thresholds shall be initially configured by the Successful Proponent at the time of vehicle installations. Only users authorized by SJT shall be allowed to modify these thresholds. |  |  |
|  | The VHM system shall periodically attempt to send device alarm and critical alert data messages until it receives an acknowledgement message from the central system. |  |  |
|  | The MDT shall provide access to maintenance diagnostic and troubleshooting information screen to appropriately authorized users. |  |  |
|  | Diagnostic information displayed shall update (at a minimum) once every second. |  |  |

## Onboard Integration

This section lists integration requirements between VLU and other onboard equipment and inputs.

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide all necessary interfaces and interface control document’s (ICD's)to onboard systems including: |  |  |
| 1. Odometer; |  |  |
| 1. Destination signs (internal and external); |  |  |
| 1. Masabi Electronic Fare System; |  |  |
| 1. DVR; |  |  |
| 1. OnDemand System (Option); |  |  |
| 1. Battery Charge Monitoring; and |  |  |
| 1. TSP Emitters. |  |  |
|  | The system shall support a single point of logon from the MDT for all interfaced onboard components. |  |  |
|  | The VLU shall synchronize the controller date/time for all integrated systems at least daily with the SJT system time. |  |  |
|  | The CAD/AVL system shall enable patches and updates to external system integrations to be tested without affecting live operations, prior to deploying these updates enterprise-wide. |  |  |

### Odometer

|  |  |  |  |
| --- | --- | --- | --- |
| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
|  | The VLU shall interface with the existing odometer, receiving the digital or analog signal and determining the distance traveled since the MDT was logged on, including the ability for SJT to adjust the odometer’s calibration. |  |  |
|  | The accumulated mileage data that the VLU collect shall be calibrated within 5% of observed mileage. |  |  |
|  | The system shall reconcile the signal received from the vehicle odometer with the system’s GPS-odometer to correct inaccuracies in the vehicle’s reported position. |  |  |

### Destination Signs

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The VLU shall be capable of integrating with the existing destination sign controllers to display text on destination signs.  SJT buses currently use 4 different destination sign models as outlined in Appendix A: Fleet List |  |  |
|  | The Successful Proponent shall confirm if any upgrades to the destination sign or destinations sign controller firmware are needed to implement this interface. SJT will coordinate these upgrades. |  |  |
|  | The system shall enable fully automated and manually triggered downloads of new destination sign data whenever updates are available, as part of routine data synchronization with the central system. |  |  |
|  | The operator shall continue to be able to use all features of the existing destination sign controller, regardless of whether the operator has logged into the MDT or whether the MDT is operational. |  |  |
|  | The system shall automatically display the appropriate destination sign message(s) based upon the route/block of service the vehicle is logged on to perform. |  |  |
|  | The system shall automatically update the destination sign display message for service adjustments (e.g. detours). |  |  |
|  | The system shall allow operators and controllers to override the destination sign code. Overrides shall be logged and reported in real time to the central system. |  |  |
|  | At an SJT-configurable distance before each trip starts, the system shall change the destination sign message to display an SJT-configurable message (e.g. next trip destination, layover). |  |  |
|  | When the vehicle is logged into a run using the MDT but operating on deadhead from the garage to the first trip of the run, the system shall automatically command the destination sign to display a message that SJT can configure. This message could be “OUTBOUND”, “INBOUND”, “OUT OF SERVICE”, “FROM GARAGE”, the message the vehicle will display during the first trip, or an alternate message configured by SJT in the schedule data. |  |  |
|  | When the vehicle is logged into a run using the MDT but operating on deadhead to the garage from the final trip of the run, the system shall automatically command the destination sign to display a message that SJT can configure. This message could be “OUT OF SERVICE”, “TO GARAGE”, the message the vehicle will display during the final trip, or an alternate message configured by SJT in the schedule data. |  |  |
|  | When the vehicle is logged into a run using the MDT but operating on deadhead for interlining between trips in the course of a run, the system shall automatically command the destination sign to display a message SJT can configure. This message could be “OUT OF SERVICE”, the message displayed during either the previous or upcoming trip, or an alternate message configured by SJT in the schedule data. |  |  |
|  | When the vehicle is logged into a “special” run using the MDT, the system shall automatically command the destination sign to display a message SJT can configure for that run (e.g., “OUT OF SERVICE”, “IN TRAINING”). |  |  |
|  | When the vehicle is logged into any run using the MDT, the operator shall be able to manually command the destination sign to display one of a set of preconfigured messages SJT can configure (e.g., “OUT OF SERVICE”, “IN TRAINING”). |  |  |
|  | When the vehicle is in covert alarm mode, the system MDT shall automatically command the destination to display one of a set of preconfigured messages SJT can configure (e.g., “CALL POLICE”, the message for the current trip). |  |  |
|  | The MDT shall notify the operator of destination sign malfunctions. |  |  |
|  | The system shall generate a fault and log all destination sign malfunctions onboard the vehicle, as reported by the sign system. Logs shall include block, route, operator ID, vehicle ID, date, time, GPS location, and status of the GPS receiver. These logs shall be available either through a system reporting function or through WLAN communications within the vehicle. |  |  |

### Masabi Electronic Fare System

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The VLU shall be designed to interface with SJT's Masabi Electronic fare payment system over standard connections to enable single point logon for the operator. The single point logon shall negate the need for operators to logon to the Masabi fare payment system. |  |  |

### Digital Video Recorder (DVR)

This section provides requirements for integration with existing cameras and video recorder to tag video with meta data and provide live look-in capabilities. Bulk video will also be downloaded by the WLAN system at garages for video management software.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall describe the ability for their solution to integrate with SJT CCTV/DVR equipment to enable the following functions: |  |  |
| 1. Setting the event flag on the DVR when the covert alarm is triggered; |  |  |
| 1. Tagging live and recorded video images with metadata including: 2. Vehicle number; 3. Vehicle location; 4. System time; 5. Operator ID; 6. Trip ID; and |  |  |
| 1. Showing the controller a live video feed from a vehicle when a covert alarm is active. This can be accomplished by either: 2. Integrating the video feed directly into the CAD/AVL software; or 3. Automatically opening the CCTV/DVR video software and loading video feeds from the relevant vehicle. |  |  |
|  | The Successful Proponent shall determine any need for CCTV/DVR upgrades to accomplish functionalities listed in this section. SJT shall implement any upgrades needed to meet functional requirements. |  |  |
|  | The Successful Proponent shall be responsible for connecting and testing all interfaces, label all sources, and confirm that video is correctly tagged and stored. |  |  |
|  | The system shall alert the operator, the dispatch centre and the central video surveillance system of any CCTV/DVR hardware and software that is disabled or malfunctioning. |  |  |
|  | The system shall receive status messages that the CCTV/DVR transmits, including fault codes, and notify the operator, the dispatch centre, and the central video surveillance system of any system faults. |  |  |
|  | The system shall provide current latitude/longitude data to the onboard surveillance system in real time but not less frequently than every two seconds. |  |  |
|  | The VLU shall provide time synchronization to the CCTV/DVR system. |  |  |

### Automatic Passenger Counter (APC) System

This section provides requirements for supply of and integration with APC sensors and controllers to collect passenger count data for communication to CAD system in real-time. APC data will also be downloaded by the WLAN system at garages for offline processing, correlation and reporting.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | For each type of vehicle, the APC system shall consist of APC sensors installed to monitor each doorway completely, integrated with one or more APC controller devices, and including any necessary communication interfaces. |  |  |
|  | The Successful Proponent shall provide automatic passenger counters (APC) to enable passenger count collection and current passenger load reporting to Agency inspection. |  |  |
|  | The following data shall be recorded by the APC: |  |  |
| 1. The number of boarding passengers (by door); |  |  |
| 1. The number of alighting passengers (by door); |  |  |
| 1. Wheelchair lift or ramp deployments; and |  |  |
| 1. Errors. |  |  |
|  | The Successful Proponent shall integrate to the APC sensor and controller equipment to enable the following functions: |  |  |
| 1. Upload passenger count data to the CAD/AVL central software through a bulk WLAN upload when in range; |  |  |
| 1. Report passenger loads in real-time to the dispatch centre; |  |  |
| 1. Provide operator ID and block/trip ID logon information to the APC controller; |  |  |
| 1. Provide route, direction of travel, trip and fare set info to the APC controller; |  |  |
| 1. Update the APC controller when there is a change to the run, route, trip, or operator; |  |  |
| 1. Provide stop ID to the APC controller; |  |  |
| 1. Provide time synchronization to the APC controller; |  |  |
| 1. Provide geolocation data to the APC controller for the purpose of tagging boardings and alighting records with time and location information; and |  |  |
| 1. Receive fault codes from the APC controller. |  |  |
|  | The system shall alert the operator and the dispatch centre if the APC is disabled or malfunctioning. The system shall log any faults as part of maintenance reporting. |  |  |
|  | The system shall detect and track door openings correlating to actual transit stops and provide this information to the APC controller. It shall be possible to account for temporary stops, or temporary bus stop closures and detours. |  |  |
|  | The system shall employ strategies to account for “drifting” of counts received from the APC system to provide realistic loading information to the dispatch centre controllers (e.g. zeroing load at end of trip). |  |  |
|  | The APC shall identify and flag passenger boardings and alightings occurring at Agency defined Bus Yard/Base and exclude these from revenue service ridership reports. |  |  |
|  | The system shall use APC data to determine when the passenger load on a vehicle exceeds an Agency-configurable threshold. |  |  |
|  | It shall be possible to account for siting of temporary stops, or temporary bus stop closures and re-routes. |  |  |
|  | If the vehicle goes off-route, the system shall continue to log the longitude and latitude of all locations where the doors open/close. |  |  |
|  | Utility software shall be provided that supports the doorway sensors’ calibration and a review of stored data records. |  |  |
|  | The APC shall meet the following accuracy requirements for a sample count of 1,000 persons: |  |  |
| 1. Stop-level boarding and alighting counts shall have an error rate of less than five (5) percent error for at least ninety (90) percent of all stop locations; and |  |  |
| 1. Stop-level boarding and alighting counts shall have an error rate of less than ten (10) percent error for at least ninety-nine (99) percent of all stop locations. |  |  |

### Automatic Passenger Counter (APC) Controllers

This section provides requirements for APC controllers to collect passenger count data for communication to CAD system in real-time.

|  |  |  |  |
| --- | --- | --- | --- |
| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
|  | For each stop, the APC controller shall create a data record to store the number of boarding and alighting passengers for: |  |  |
| Each doorway; |  |  |
| The number of mobility device/wheelchair boardings; and |  |  |
| The number of errors. |  |  |
|  | The APC shall re-register current onboard passenger counts as the starting count for an interlined trip on a block where passengers opted to stay onboard during the layover rather than alighting. |  |  |
|  | Each data record shall also include: |  |  |
|  | The current GPS location’s latitude and longitude; |  |  |
|  | The current date/time; |  |  |
|  | Vehicle number; |  |  |
|  | Vehicle operator ID; |  |  |
|  | Run/block number; |  |  |
|  | Route number; |  |  |
|  | Trip number; and |  |  |
|  | Stop ID number. |  |  |
|  | Data records may be stored either in the APC controller or the VLU with sufficient onboard memory capacity to allow for storage of at least 168 hours of APC data. |  |  |
|  | The system shall transmit current onboard passenger count information to the central system via the MGR’s current WLAN interface. |  |  |
|  | Contractor shall provide utility software for use on a laptop computer connected via a serial communications connection to either the APC controller or the VLU. |  |  |

### OnDemand System (Option)

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall support integration with the current Spare Labs OnDemand system to: |  |  |
| 1. Provide single point sign on; |  |  |
| 1. Perform onboard automatic stop announcements based on OnDemand drop off and pick up locations; |  |  |
| 1. Display OnDemand vehicles on the CAD/AVL application user interface; |  |  |
| 1. Display routing information for controllers on the CAD/AVL application user interface |  |  |
| 1. Provide routing and driving directions on the MDT |  |  |
| 1. Support connection and hold requests between OnDemand and conventional transit. |  |  |

### Battery Charge Monitoring System

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall support integration with future battery charge monitoring systems on Battery-Electric Buses (BEBs) to provide: |  |  |
| 1. Time synchronization with the battery charge monitoring system; |  |  |
| 1. Single-point operator log-on; |  |  |
| 1. Block data to the battery charge monitoring system; and |  |  |
| 1. Real-time battery charge levels to controllers within the CAD/AVL application user interface. |  |  |

### Transit Signal Priority (TSP) Emitters

This section lists requirements for future onboard equipment integration for TSP emitters.

|  |  |  |  |
| --- | --- | --- | --- |
| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
|  | The system shall support the future installation and integration of emitter or RF-based conditional TSP systems. |  |  |
|  | The TSP Emitter equipment shall be interfaced with VLU for conditional signal priority request. |  |  |
|  | Conditions for creating signal priority requests shall be SJT-configurable. |  |  |

# Road Inspector/Remote Equipment

## General

This section defines requirements for non-revenue fleet for vehicle tracking and voice communication .

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide technical requirements for equipment to allow remote mobile access for road inspector vehicles to the central CAD/AVL system over a cellular data connection. |  |  |
|  | The system shall allow remote mobile access through: |  |  |
| 1. An Android application |  |  |
| 1. An iOS application |  |  |
| 1. A mobile optimized web interface |  |  |
|  | The Successful Proponent shall provide specifications for portable mobile devices (e.g. tablets) for road inspector vehicles that support access to the application. The devices shall allow road inspectors access to the system after exiting their vehicles. SJT shall supply the equipment. |  |  |
|  | The Successful Proponent shall provide system, installation, and integration assistance for the road inspector vehicles including necessary equipment for docking stations and connectivity. |  |  |
|  | SJT shall have the ability to track the location of all road inspector and maintenance/service devices using the remote mobile access software. |  |  |
|  | Software functions and views to be displayed on the mobile system shall be SJT-configurable and shall provide CAD/AVL functionality similar to the central site CAD, optimized for the remote access equipment. Minimum functions include: |  |  |
| 1. Tracking vehicle locations; |  |  |
| 1. View vehicle information (e.g. operator, block/run, route, trip) |  |  |
| 1. Tracking adherence status to vehicle schedule and headway |  |  |
| 1. Receiving system generated alert/event notifications; |  |  |
| 1. Receiving operator and controller generated messages; and |  |  |
| 1. Initiating and receiving VoIP voice calls with controllers, individual vehicles and groups of vehicles. |  |  |
|  | The mobile system shall allow road inspectors to navigate to alternate apps and programs (e.g., email) while maintaining logon status, configuration, and connectivity to their remote access session. |  |  |

## Equipment Supply (Option)

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall supply the remote access equipment. |  |  |

# Central System

This section describes functional and performance requirements for central system components

## General

This section lists central system requirements as they relate to system and user environment configuration and operation.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The central system shall be capable of providing all text and voice communications and displays in English and French. |  |  |
|  | The central system shall display all measurements in metric units. |  |  |
|  | The Successful Proponent shall leverage the existing infrastructure and equipment wherever possible. The Successful Proponent shall be fully responsible for implementing these interfaces. |  |  |
|  | The Successful Proponent shall lead the effort with the suppliers of existing systems as needed to confirm requirements and designs, prepare and review ICD’s, and coordinate installation and upgrade work. |  |  |
|  | All software shall integrate with standard printer drivers to allow reports to be printed directly from within the software. |  |  |
|  | The central system and all CAD/AVL subsystems shall automatically recognize any stoppage, failure, failover, or lock-up of a system process and automatically log the problem, attempt a restart if appropriate, and notify the dispatch centre and system administrator. |  |  |
|  | The central system shall provide a single-point interface for the management of user accounts, groups, and associated privileges. |  |  |
|  | Once a user is logged on to the system via a desktop client on a workstation, the central system software shall enable automatic logon to other software packages installed on that workstation supporting CAD/AVL operations. |  |  |
|  | The system shall not place limitations (through licensing or otherwise) on the number of concurrent workstations sessions running on virtual or physical workstations. |  |  |
|  | The central system shall have full capability to add, delete, or modify users, groups, or roles in any systems and shall have full administrative rights to do so. |  |  |
|  | The central system shall allow the system administrator to manage user access permissions for specific user groups. |  |  |
|  | The central system shall enable role-based access control to allow the system administrator to delegate management of certain user access permissions to other authorized users. |  |  |
|  | All central system components shall record all logons and logon attempts in the Central system database. |  |  |
|  | All central system components shall lock out the user after a number of successive failed logon attempts within a set time frame. The number of permissible failed logon attempts and the time frame shall be SJT-configurable. |  |  |
|  | All central system components shall continuously monitor for unauthorized access to managed functions. |  |  |

## Built-in Maps

This section provides requirements for basemap, built-in mapping and spatial visualization tools used by AVL and other products.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The central system shall have a map-based GUI. The GUI shall support various map views, with full zoom, pan search, and auto-centering capability. |  |  |
|  | The map-based GUI shall allow users to search for at minimum points of interest, addresses, vehicles, and stop locations. |  |  |
|  | Base mapping for all applications (central and onboard) shall utilize an SJT-approved mapping source that provides current and base map data that’s updated, at a minimum, quarterly. |  |  |
|  | The system shall include mechanisms to allow for periodic independent updates by SJT to built-in maps in the central and onboard systems. |  |  |
|  | SJT shall be able to edit and update map layers used in vendor provided GIS modules (e.g. addition of private roads). |  |  |
|  | The system shall support the display and use of peripheral GIS information provided by SJT in ESRI format. This information will be integrated into the GUI, and will be displayed as a list and/or layer on the GIS map. The map view will allow users to toggle the display of map data layers. |  |  |
|  | The system shall incorporate maps to support the functionality, comprised of a selection of individually selectable theme layers (e.g., streets, street names, water features, parks, major buildings). |  |  |
|  | The system shall allow SJT to develop additional overlay map layers that can include polygons (e.g., municipal boundaries, fare zones), lines (e.g., route traces) and points (e.g., landmarks, transfer locations, time points, SJT stop locations, OnDemand stop locations), with the colour, shape and thickness being selectable. |  |  |
|  | The system shall allow the user to calculate the distance along a line drawn on the map as a sequence of straight lines between points (e.g. the distance of a route trace). |  |  |
|  | The system shall allow SJT system users to save and reload a map view. |  |  |
|  | The system shall include mechanisms to accept real-time traffic or event based roadway conditions. |  |  |
|  | The system shall identify vehicle types on the map-based on GUI (e.g. out of service vehicle, vehicle on detour, vehicle on shuttle service, OnDemand vehicle). |  |  |

## Data Import and Integration Interfaces

This section defines requirements for interface between future schedule data management software from Obtibus and the new systems provided by the vendor.

### Scheduling Interface

This section defines requirements for importing standard export provided by OptiBus.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall have the ability to independently import scheduling data from a future scheduling data management software as part of an automated procedure with the central system checking for files or views in a predetermined directory, or database table, or as a real-time service. The system shall support scheduling dataset imports: |  |  |
| 1. Immediately, in response to a manual trigger by authorized users; and |  |  |
| 1. As part of an automated procedure at an SJT-configurable frequency. |  |  |
|  | The system shall accept and correctly incorporate the following data imported from the future scheduling system: |  |  |
| 1. Stops; |  |  |
| 1. Timepoints; |  |  |
| 1. Combined stop/Timepoints; |  |  |
| 1. Routes; |  |  |
| 1. Route traces/Shape files; |  |  |
| 1. Route variants; |  |  |
| 1. Patterns; |  |  |
| 1. Blocks; |  |  |
| 1. Runs; |  |  |
| 1. Trips; |  |  |
| 1. Timetables; |  |  |
| 1. Service calendars; |  |  |
| 1. Sign-up period; |  |  |
| 1. Day types; |  |  |
| 1. Service types; |  |  |
| 1. Polygons; |  |  |
| 1. Exceptions; |  |  |
| 1. Any other Supplementary Data Fields; |  |  |
| 1. Any other relevant schedule data to support CAD/AVL functions; and |  |  |
| 1. Runs without spatial data (e.g. OnDemand Runs) |  |  |
| 1. Runs with “dummy” non-customer facing data (e.g. OnDemand Runs) |  |  |
|  | The system shall perform a series of internal consistency checks on all imported data prior to using the data in active or production modes for the system. For any missing imports or errors in imported data, the system shall generate logs and send automated alarms to the SJT system administrator. Internal consistency checks will be performed on import. |  |  |
|  | Any faults or errors that occur during the automatic conversion or transfer of data either within internal subcomponents of the central system, or from external data sources to internal subcomponents, shall be logged and an error message/alert will be generated by the system. |  |  |
|  | The system shall store at least one future scheduling dataset with a set future validity start date. |  |  |
|  | At the start of the validity period for a new scheduling dataset, the system will automatically transition to using the new scheduling dataset in production, including publishing the dataset to all buses. |  |  |
|  | The system shall enable authorized SJT users to extend the end date for a scheduling dataset as needed. |  |  |
|  | The system shall enable automated exports of all recorded real operating data to the run-time and performance analysis module of the scheduling system. |  |  |

### Operations and Workforce Management

This section defines requirements for interface between future operations software and CAD/AVL software.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall be capable of interfacing with a future operations software to provide the following functions: |  |  |
| 1. Receive the active employee roster and associated personnel data, and any updates to the information, including:    1. Name;    2. Operator ID;    3. Badge number;    4. Employee portrait;    5. Working hours/availability |  |  |
| 1. Receive real-time updates on operator schedule as available in operations software; |  |  |
| 1. Receive real-time updates on operator assignments as available in operations software; |  |  |
| 1. Receive real-time updates on vehicle assignments as available in operations software; and |  |  |
| 1. Provide real-time updates on work performed by operators as recorded by the CAD system to generate exceptions in operations software for reporting on payroll hours (e.g. logon, logoff, pullout). |  |  |
| 1. Provide event details and information, including: 2. Vehicle ID; 3. Vehicle location; 4. Operator ID; 5. Date of event occurrence; 6. Event type; 7. Event description; and 8. Event fields from incident form |  |  |
| 1. Provide incident details and information, including all information submitted by the controller and inspector. |  |  |
|  | The Successful Proponent shall provide an API for providing event details information to additional third parties in addition to operations software (e.g. Saint John Police Services, Emergency Medical Services). |  |  |
|  | Data exchange between operations software and CAD system shall be automated and not require any manual intervention from SJT staff. |  |  |

### Wayside Signage Information

|  |  |  |  |
| --- | --- | --- | --- |
| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
|  | The system shall be capable of interfacing with future wayside signage systems to provide the following information in real-time: |  |  |
| 1. Service adjustment information (e.g., service notice, service and stop cancellation, delays, detours, schedule adjustments, block overloads); |  |  |
| 1. APC data; |  |  |
| 1. Vehicle location information; and |  |  |
| 1. Automatic route and schedule adherence reports. |  |  |
|  | The Successful Proponent shall provide an API for providing the above information to the future wayside signage system in real-time. |  |  |
|  | Service adjustment information for detours shall include updated route trace mapping information. |  |  |
|  | The frequency of real time information updates shall be SJT-configurable. |  |  |
|  | Data exchange between the wayside signage system and CAD system shall be automated and not require any manual intervention from SJT staff. |  |  |

## CAD/AVL System

This section defines requirements for the CAD/AVL central hardware and software and interfaces.

### CAD/AVL Workstations

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall use typical Microsoft Windows-style graphical user interface (GUI) conventions including resizable windows, point and click, right click context menus, drop-down menus, toolbars, colour displays, icons, drag and drop, scroll bars, scroll wheel mouse and status bars. |  |  |
|  | The GUI shall support all windows functions such as concurrent display of multiple windows, including map display windows or tabular windows, paging, scrolling. |  |  |
|  | The GUI shall support repositioning and resizing each window as desired, including across monitors, to present the maximum amount of useable information. |  |  |
|  | The system shall support mouse and keyboard inputs with all key features supported by keyboard shortcuts. |  |  |
|  | The system shall provide easy-to-read displays when the user is situated a standard distance from the display (i.e. 20/20 vision at a distance of one meter). |  |  |
|  | The system shall permit SJT to configure the appearance of GUI elements enterprise-wide, including agency branding, and general icon sets. |  |  |
|  | The system shall permit individual users to customize the appearance of select GUI elements, configured by SJT, per user preference, including map colours, backgrounds, and font sizes. |  |  |
|  | The system shall save all user preferences by user logon so that users may access their saved preferences from any workstation. |  |  |
|  | All windows with static data shall open and populate within one second. |  |  |
|  | All windows with dynamic data shall open and initially populate within two seconds and thereafter, any updates shall result in page population within one second. |  |  |
|  | Movement (e.g. panning, zooming, scrolling, dragging of the cursor bar) through GUI displays shall be smooth, without perceptible lag, and without disruption to displayed graphics and text. |  |  |
|  | The system shall permit the user to filter stops on the GUI displays by criteria including: |  |  |
|  | 1. A subset of routes; |  |  |
|  | 1. In-service status (e.g. in-service, temporarily closed, temporary stops); and |  |  |
|  | 1. Stop amenities |  |  |

### Remote Access

This section list requirements for accessing CAD/AVL software remotely over secure SJT network.

|  |  |  |  |
| --- | --- | --- | --- |
| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
|  | The Successful Proponent shall provide remote access to the CAD/AVL system for customer service, maintenance, inspectors for off-site dispatching, staff at transit centers, and other authorized SJT locations. |  |  |

### MDT Logon Verification

This section describes the functional requirements of the system for verification of logon/logoff process on MDTs.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall receive and validate logon requests from VLUs. |  |  |
|  | The system shall validate operator vehicle and work assignments against the assignments received if available. |  |  |
|  | The system shall allow controllers to override an invalid operator work assignment logon to operate service that was assigned to another vehicle or operator. |  |  |
|  | The system shall allow controllers to initiate a remote logon for a vehicle. |  |  |
|  | The system shall allow operators to logon to new work to supplement service if more vehicles are needed on a particular day or event. |  |  |
|  | The system shall receive and immediately process a logoff message from a VLU. |  |  |
|  | The system shall provide a pull-in/pull-out summary display for controllers that can be sorted by status of lateness, depot, vehicle ID, operator number, and first and last name. |  |  |
|  | The system shall notify the dispatch centre of the following types of vehicle status exceptions: |  |  |
| 1. Late vehicle logon; |  |  |
| 1. Vehicle movement when not logged on; |  |  |
| 1. Logon request that is not unique or authentic; |  |  |
| 1. Missed operator relief; and |  |  |
| 1. Late vehicle pull-out. |  |  |
|  | Vehicle status exception thresholds shall be SJT-configurable. |  |  |
|  | Operator and vehicle assignments shall update as operators logon/logoff their vehicle’s MDTs either directly or by controller action. |  |  |

### Vehicle Location Tracking

This section describes the requirements of the vehicle tracking functionality of the system.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall be able to process and provide real-time location and mapping of revenue and non-revenue vehicles (e.g. inspector vehicles). The system shall receive location reports from revenue and non-revenue vehicles after a time period SJT configures has passed after receiving the last location report. The location reporting interval shall be SJT-configurable to at least every five seconds. |  |  |
|  | The system shall provide access to all vehicle location tracking functions through a map-based and schematic interface. |  |  |
|  | The system shall track and report on vehicle locations regardless of whether a user is logged into the CAD/AVL, and regardless of whether the vehicle power is turned on, within the window when the CAD/AVL is configured to remain active. |  |  |
|  | After the onboard CAD/AVL components have shut off on a vehicle, the system will continue to indicate the vehicle’s last known location. |  |  |
|  | The system shall indicate any vehicle that is not reporting its status and location within an SJT-configurable time period. |  |  |
|  | The display shall provide an indication if the last reported location being displayed is older than the reporting interval. If a vehicle’s location on the AVL map is shown to be older than a minute, the system shall let the controller manually poll/locate a vehicle. |  |  |
|  | The system shall receive and store latitude and longitude information stamped with the following information from the VLU: |  |  |
| 1. Date, |  |  |
| 1. Time, |  |  |
| 1. Vehicle, |  |  |
| 1. Operator, |  |  |
| 1. Run, |  |  |
| 1. Route, |  |  |
| 1. Block; |  |  |
| 1. Direction; |  |  |
| 1. Speed; |  |  |
| 1. Odometer reading and |  |  |
| 1. Trip information |  |  |
|  | The controller shall be able to center a map view on a vehicle, or track a vehicle by: |  |  |
| 1. Selecting the vehicle on the map display; |  |  |
| 1. Entering the block, vehicle, operator ID, or route; |  |  |
| 1. Selecting the vehicle from a list of vehicles; |  |  |
| 1. Selecting a communication event/message; |  |  |
| 1. Selecting the operator from a list of operators; and |  |  |
| 1. Selecting the block from a list of blocks. |  |  |
|  | The controller shall be able to choose what label(s) vehicle points on the map view will display including |  |  |
| 1. Vehicle number; |  |  |
| 1. Block number; |  |  |
| 1. Route number; |  |  |
| 1. Operator number; and |  |  |
| 1. Operator hours worked/availability if available from operations system |  |  |
|  | The system shall enable the controller to select a bus and view: |  |  |
| 1. The current vehicle block and all associated scheduled activities; and |  |  |
| 1. The current operator paddle (the full work assignment for the operator’s shift). |  |  |
|  | The system shall receive and store information related to event types and event data with event-triggered automatic location reports. Event types that trigger location reports shall include: |  |  |
| 1. Location and schedule/route adherence reports; |  |  |
| 1. Text and pre-defined messaging; |  |  |
| 1. Data upload and download; |  |  |
| 1. Software updates; |  |  |
| 1. Device parameter changes; |  |  |
| 1. Onboard device status, changes, and error reports; |  |  |
| 1. System ignition/shutdown; |  |  |
| 1. Operator log-on/off/over; |  |  |
| 1. Arrival/departure at stop and time-point; |  |  |
| 1. Start and stop motion; |  |  |
| 1. Door open and close; |  |  |
| 1. Destination sign changes; and |  |  |
| 1. Onboard logs and alerts from the MDT. |  |  |
|  | The system shall reconcile all data received from vehicles through location and schedule adherence reports with the detailed information downloaded from the VLU after the vehicle returns to its storage depot to ensure data integrity if some reports are not received at central in real time. |  |  |

### Vehicle Data Replay

This section describes the requirements for replay of recorded vehicle data.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall supply a tool to enable integrated playback of all historical data from the CAD/AVL system regardless of vehicle logon status. |  |  |
|  | The system shall be able to run playback functions without interrupting live dispatching functions. |  |  |
|  | The playback functionality shall be visually distinct from the live system. |  |  |
|  | All users accessing the CAD/AVL system including workstation users, remote access users and mobile access users shall be able to access the vehicle data replay function. |  |  |
|  | The system shall allow users to review the chronological sequence of reported locations for a specified vehicle(s) or route(s) over a specified time period. |  |  |
|  | The replay data shall include all data available to controllers in the live dispatching system including but not limited to: |  |  |
| 1. Location reports; |  |  |
| 1. Schedule headway and route adherence status; and |  |  |
| 1. All messaging (e.g. time point crossings, RTT, canned messages, APC). |  |  |
|  | The system shall allow replay for a single vehicle, selected set of vehicles or all vehicles on a selected map view for selected time period. |  |  |
|  | The system shall allow replay for a single route, selected set of routes or all routes on a selected map view for selected time period. |  |  |
|  | The system shall allow selection of any time period for the historical data stored in the database. |  |  |
|  | The system shall provide controls to view the entire sequence of reported locations from the beginning of the time period. |  |  |
|  | The system shall provide playback controls to view the entire sequence of data from the beginning of the time period, including: |  |  |
| 1. Pause; |  |  |
| 1. Play forward; |  |  |
| 1. Skip forward; and |  |  |
| 1. Skip reverse. |  |  |
|  | The system shall allow users to store vehicle data replay in a video file format that can be exported for viewing on a different computer equipped to view such files using a standard video file format such as .avi or .mpg. |  |  |
|  | The system shall allow users to export a still image of the vehicle data replay view as a .pdf, .jpg, or .png. |  |  |
|  | Any exported video or still image vehicle data replay export shall indicate for each vehicle icon the vehicle and operator number as well as the date and time. |  |  |

### Voice Call Management

This section describes the functional requirements for the voice call management feature.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall allow the controller to view RTT, PRTT, and emergency alarm messages received from VLUs on a tabular communications display together with the time received. |  |  |
|  | The voice call functionality shall allow the controller to set up a quick voice call response to the initiating operator by selecting RTT, PRTT or emergency alarm from the communications display. |  |  |
|  | Controllers shall be able to initiate voice communications by double-clicking RTT, PRTT and emergency alarm message types. |  |  |
|  | Only one RTT, PRTT, or emergency alarm shall be active in the communication display queue for each vehicle attempting to make a call. A PRTT will replace a RTT should the vehicle change from RTT to PRTT, whereas repeated presses of RTT or PRTT will update the existing message in the communications display queue. An emergency alarm will replace either a PRTT or an RTT. |  |  |
|  | Once connected, emergency alarm, PRTT and RTT messages will display as being handled by the connecting controller on all workstations displaying that message. |  |  |
|  | When an RTT/PRTT/emergency alarm is received, the system shall produce an audible alert and a visual indicator. The visual indicator shall not disappear off the communications display queue until the RTT/PRTT/emergency alarm is dealt with by a controller. |  |  |
|  | The audible RTT/PRTT/emergency alarm alert shall be individually SJT-configurable, including the option to disable the alert. |  |  |
|  | Covert alarms shall take top priority in the communications display queue, followed by PRTT and RTT respectively. |  |  |
|  | The system shall allow controllers to direct audio to the operator handset, operator speaker or PA speaker as desired |  |  |
|  | The system shall allow set up of a one-way broadcast voice call to: |  |  |
| 1. A single vehicle, |  |  |
| 1. A predefined group of vehicles, |  |  |
| 1. All vehicles within an area selected on the map display, |  |  |
| 1. All vehicles operating on the same route, and |  |  |
| 1. All vehicles. |  |  |
|  | The system shall provide the capability to set up a two-way voice call with an individual vehicle, individual operator, all vehicles in a fleet group, all vehicles on a route or set of routes, all vehicles in a selected group or all vehicles within a selected geographic area on the map. |  |  |
|  | The system shall require the controller to establish a timeout interval for any voice call. |  |  |
|  | The voice call timeout setting shall offer a default interval and alternative intervals determined by SJT. |  |  |
|  | The system shall automatically notify controllers after an SJT-configurable amount of time has passed, that a call or event has not been resolved/closed. |  |  |
|  | The system shall allow controllers to seamlessly switch voice communications between their handset and telephone headset. |  |  |
|  | The system shall allow controllers to utilize a single headset for VoIP and telephone communications. Initiating any outgoing VoIP communications shall mute the controller’s voice towards the telephone system. Likewise, controller audio intended for the telephone shall not be conveyed over the VoIP communications system. Telephone and communications audio into the headset shall be SJT-configurable as summed or provide priority for communications messages (e.g., muting or attenuating the telephone audio) while selected communications traffic is present. |  |  |
|  | Voice communications requests shall be separately highlighted and displayed in the communications display queue. |  |  |
|  | The system shall notify the controller when the call cannot be setup and present the controller with a choice to cancel the call or to continue trying for an SJT-configurable number of retry actions to set up the call and notify the controller when it was successful. |  |  |
|  | The system shall allow controllers to manually restart the VoIP system remotely. |  |  |
|  | The system shall notify the controller visually and by tone when a call has connected and the controller may begin speaking. |  |  |
|  | The system shall automatically and immediately locate and update vehicle information when a controller makes a call. |  |  |
|  | The remote access for inspectors to the CAD/AVL system via the vehicle mobile workstation shall allow inspectors the ability to set up a voice call with one or more operators. Further, the system shall allow inspectors to listen in to an ongoing call. |  |  |
|  | Calls initiated from portable radios to the dispatch centre shall provide a unique radio ID, which will be correlated with a name assigned to the radio and displayed to the controller. |  |  |
|  | The system shall record all voice communications and will restrict access to voice recordings to users authorized by SJT. Recordings will include metadata that allow ease of searching the voice recording database (e.g. call time, user, location, call type). |  |  |

### Data Messaging

This section describes the requirements for data messaging functionality.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall support data messaging functionality to communicate between controllers and operators, including text and static images. |  |  |
|  | All messages and metadata (e.g. time sent and received, acknowledgements) shall be considered CAD/AVL system data and logged for reporting and archiving accordingly. |  |  |
|  | The system shall transmit data messages of unlimited length, and shall automatically paginate messages exceeding the display limit. |  |  |
|  | The messaging interfaces shall inform the controller of the number of pages that will be needed to display a message as the message is created. |  |  |
|  | The system shall transfer messages between a controller workstation and the cellular data gateway within one second. |  |  |
|  | The system shall allow the controller to view received data messages in a tabular display that also indicates the vehicle ID and the time of the message. |  |  |
|  | The system shall allow the controller to send a message to |  |  |
| 1. A single vehicle; |  |  |
| 1. A predefined group of vehicles; |  |  |
| 1. All vehicles within an area selected on the map display; |  |  |
| 1. All vehicles operating on the same route; |  |  |
| 1. All vehicles operating on the same route; |  |  |
| 1. All active vehicles. |  |  |
|  | Active scheduled messages well be automatically sent to operators when they logon to relevant work. |  |  |
|  | The system shall allow the controller to select one of a set of predefined messages (canned data messages) or enter a free text message. |  |  |
|  | The system shall store of at least 50 canned data messages for controller use. Canned text messages shall be SJT-configurable. |  |  |
|  | The system shall store recently sent messages (canned or free text) available for the user to easily select from. |  |  |
|  | The system shall indicate when a data message has been viewed by the operator (i.e. a read-receipt). |  |  |
|  | The system shall allow for any message sent by the dispatch centre to be flagged as requiring operator acknowledgement, a Y/N or numeric response and shall allow the controller to view a list of such messages that have not yet been acknowledged. |  |  |
|  | The system shall allow for triggered, automatic messages. Automatic message triggers shall be defined by: |  |  |
| 1. Time of day; |  |  |
| 1. Calendar date(s); |  |  |
| 1. Trigger location; and |  |  |
| 1. Trigger boundary (i.e. enclosed area). |  |  |
|  | Triggered automatic messages shall be controller-configurable by identifying that they be sent when a vehicle starts specified; |  |  |
| 1. Route(s); |  |  |
| 1. Trip(s); |  |  |
| 1. Block(s); |  |  |
| 1. Shuttle Service; and |  |  |
| 1. Detour. |  |  |
|  | The system shall indicate the status (i.e. successful, failed, or pending) of sent messages. |  |  |
|  | The system shall indicate when a data message has been received by the VLU onboard the recipient vehicle. |  |  |
|  | The system shall be SJT-configurable to allow for audible and visual alerts for incoming messages. |  |  |
|  | The system shall receive data messages from operators. Unviewed messages shall be clearly distinguished in the GUI. |  |  |
|  | The system shall allow the controller to reply to a message in the queue. |  |  |
|  | When a controller receives a message, the system shall display the route, block, vehicle, vehicle ID, operator’s name, employee number, location, schedule adherence, status, and time. |  |  |
|  | Messages shall be displayed in an SJT-configurable priority order. Within this priority order, messages shall be ordered chronologically. |  |  |
|  | The system shall support audible and visual alerts for incoming messages that are clearly distinguishable for each priority level and read/unread status. These alerts shall be SJT-configurable. |  |  |

### Central Covert Alarm Handling

This section lists the requirements with regards to covert alarm handling on the central system side.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | When a covert alarm signal is received from a vehicle, the central CAD/AVL system shall display the event to all controllers, using SJT approved visual and audio alerting methods, and the system shall monitor that vehicle continuously until otherwise specified by the dispatch centre. |  |  |
|  | When acknowledging a covert alarm, the system shall zoom and center the map display on the alarming vehicle and locate the nearest road inspector vehicle when selected by the dispatch centre. The scale for the zoom shall be SJT-configurable. |  |  |
|  | Activation of a covert alarm shall place the vehicle in a priority status for frequency of location and message updates which will result in vehicle location and status updates at a more frequent rate. The frequency of the location report interval shall be SJT-configurable. |  |  |
|  | Once one of the controllers selects the covert alarm event, this shall be indicated to that controller and other authorized staff. |  |  |
|  | Once a controller has selected the covert alarm event, the controller shall be able to opt whether to monitor the covert microphone audio and separately whether to monitor the onboard video feed. |  |  |
|  | The controller can opt at any time to end the covert microphone monitoring or the overall covert alarm event. |  |  |
|  | The system shall send signals back to the VLU that generated the alarm when a controller has selected the event, when covert microphone monitoring has started or ended, and when the event has been ended. |  |  |
|  | During a covert alarm event, the system shall not allow controllers to initiate voice calls with the vehicle or send a text message, but all other location/performance monitoring and the ability to receive an RTT/PRTT signal shall remain operational. |  |  |
|  | The system shall allow controllers to terminate the covert alarm status and restore two-way voice and text communication functions without closing the event and clearing the covert alarm from the controller’s screen. |  |  |

### Incident Management and Reporting

This section lists requirements for built-in incident management and reporting feature of the CAD software.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall automatically generate an incident record when certain SJT-configurable CAD incidents (e.g. covert alarms, specific canned messages). |  |  |
|  | The controller shall be able to initiate an incident/event by: |  |  |
| 1. Selecting an incident/event generation function via hotkey, drop down menu, or button on a toolbar; |  |  |
| 1. Selecting an incident/event generation function in relation to a particular vehicle from the AVL map or message queue, with the appropriate CAD available information populating the incident/event automatically; and |  |  |
| 1. Selecting an incident/event generation function from a vehicle list, block table, or stop list display with the appropriate CAD available information populating the incident/event automatically. |  |  |
|  | The system shall generate a unique, progressive identification for each incident/event regardless of re-booting the system. |  |  |
|  | Incidents shall be classified according to numerical codes for ease of grouping. These codes shall be: |  |  |
| 1. Be SJT-configurable; and |  |  |
| 1. Support multi-level sub-codes to enable finer classification and continuity. |  |  |
|  | The system shall impose no effective limit on the number of incident codes and sub-codes that can be defined. |  |  |
|  | The controller shall be able to center and quickly locate a vehicle on a map once an incident is generated. |  |  |
|  | The system shall allow SJT to configure controller and road inspector workflows for different incident types. Configuration options shall include: |  |  |
| 1. Required controller and road inspector actions (e.g. complete a voice call to the vehicle); |  |  |
| 1. Required incident form fields (e.g. incident due to mechanical reasons or operational reasons); |  |  |
| 1. Optional incident form fields; |  |  |
|  | The system shall automatically populate the incident form with all known information. |  |  |
|  | The system shall automatically update the incident form as the controller or road inspector proceeds through the configured workflow (e.g. time of voice call). |  |  |
|  | The system shall maintain one central report associated with each incident, accessible from a server so all authorized users see the same current report information, but only one instance of the report can be open at a time for editing. |  |  |
|  | The system shall allow authorized users the ability to tag an incident report with an index or link to specific CCTV frame(s)/snippets or vehicle data replay. |  |  |
|  | The system shall provide a summary display for all currently active incidents. |  |  |
|  | The user shall be able to select from a list of currently open incident reports that can be sorted by: |  |  |
| 1. Date/time; |  |  |
| 1. Incident type; |  |  |
| 1. Keyword; and |  |  |
| 1. Initiating controller. |  |  |
|  | The users shall have the ability to attach files of any type, such as an image file, to the incident report. |  |  |
|  | The system shall be able to set limits on which users can open, modify or close incident reports. These roles shall be SJT-configurable. |  |  |
|  | The system shall ensure that all incidents are assigned to a controller for response. |  |  |
|  | The system shall track the user and date/time associated with every action performed on an incident report, including generation, modification or closure. |  |  |
|  | The system shall allow authorized users to close an existing open incident report. The user shall be asked to confirm the selected incident report before the incident is closed. |  |  |
|  | Once an incident report is closed, the system shall not permit further modifications, unless by personnel with specific authorization to do so. |  |  |
|  | Immediately upon closing an incident report, it shall be available for review by other users. |  |  |
|  | The incident report database shall indicate, for each incident report, |  |  |
| 1. the date/time of opening the report, |  |  |
| 1. the incident type, |  |  |
| 1. the initial incident text, |  |  |
| 1. the initiating controller, |  |  |
| 1. the date/time of each subsequent modification, |  |  |
| 1. each modified version of the text, |  |  |
| 1. the modifying controller, |  |  |
| 1. the date/time the incident was closed, and |  |  |
| 1. the closing controller. |  |  |
|  | The system shall allow the controller to forward specific incident types to distribution groups via e-mail and text to cell phone numbers. Types of incidents and distribution groups shall be SJT-configurable. |  |  |
|  | The system shall allow the controller to set up automated email distribution for selected incident types. |  |  |
|  | The system shall enable authorized personnel to mute selected incident types for an SJT-configurable time period (e.g. delays in case of severe weather). |  |  |

### Route and Schedule Adherence Tracking

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall provide access to all route and schedule adherence tracking functions and arrival time predictions through the GUI. |  |  |
|  | The system shall utilize trip-based timepoint arrivals and scheduled headway as imported for the purposes of determining schedule adherence. |  |  |
|  | The system shall receive automatic route and schedule adherence reports from vehicles at identified time points and at an SJT-configurable rate with a minimum resolution of once every 5 seconds. |  |  |
|  | Route and schedule adherence reports shall be stamped with the following data: |  |  |
| 1. Date, |  |  |
| 1. Time, |  |  |
| 1. Stop, |  |  |
| 1. Vehicle, |  |  |
| 1. Block, |  |  |
| 1. Operator, |  |  |
| 1. Run, |  |  |
| 1. Route, |  |  |
| 1. Trip, |  |  |
| 1. Speed; |  |  |
| 1. Passenger loading, and |  |  |
| 1. Latitude, and longitude. |  |  |
|  | The system shall account for temporary changes in route and schedule adherence tracking (e.g. in the case of a detour or service curtailment) for any given route or portions of a route and for groups of vehicles as defined by the controller. |  |  |
|  | Based on SJT-configurable thresholds, the system shall use the reported schedule adherence data to designate when vehicles are “early,” “late,” or “on time.” The system shall provide a separate SJT-configurable “late” parameter specifically to support TSP and other needs. |  |  |
|  | The system shall provide an alert to the dispatch centre for vehicles that are “early” or “late” based on the SJT-configured thresholds. |  |  |
|  | Early and late thresholds shall be SJT-configurable by route. |  |  |
|  | The system shall provide an alert to the dispatch centre for vehicles that remain at layover points late or leave layover points late. |  |  |
|  | Based on SJT-configured thresholds, the system shall designate when vehicles are deemed off-route and when off-route vehicles have returned to route. |  |  |
|  | The system shall not designate a vehicle as of-route when it is following a detour or alternate routing implemented by a controller. |  |  |
|  | The system shall generate off-route message for vehicles designated as off-route. |  |  |
|  | The system shall display schedule and route adherence, gapping/bunching, headways, and status by route and allow "drill-down" selection by controller to view associated vehicles. |  |  |
|  | The system shall highlight the vehicle IDs of those vehicles that are operating early, late, or off-route, using tabular and map displays to indicate their current schedule and route adherence status to the controller. The tabular display entries and the map display symbols for these vehicles shall use distinct and SJT-configurable colour codes for early, late, and off-route status. |  |  |
|  | The system shall allow for a global change to an alternate set of behind/ahead of schedule threshold parameters and headway threshold parameters (e.g. in the case of inclement weather). The alternate set of threshold parameters shall be SJT-configurable. |  |  |
|  | The system shall flag buses when out-of-service to avoid triggering route and schedule adherence alerts, and visibly indicate this out of service status to controllers. |  |  |
|  | The system shall calculate and provide estimated vehicle destination arrival time utilizing real time vehicle location tracking data. |  |  |
|  | The system shall allow controllers to switch a route between headway based and schedule based adherence tracking. |  |  |
|  | The Successful Proponent shall provide solution to automate the nighttime hold and all call release. |  |  |

### Headway Management

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The schematic vehicle display shall visually show geographic location of each vehicle on a route along with timepoints and shall allow controllers to take necessary actions to avoid bunching and gapping. |  |  |
|  | The system shall allow controllers to communicate necessary actions to operators via any available communication channel, including data messaging and radio, to hold, depart, slow down or speed up (e.g. drop off only mode) for managing headways. |  |  |
|  | The system shall provide an alert to the dispatch centre for bunching and gapping vehicles; based on SJT-configured thresholds. |  |  |
|  | Bunching and gapping thresholds shall be SJT-configurable by route. |  |  |

### Service Management

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall include management for a series of standard service restoration/correction functions including: |  |  |
| 1. Detour: Activate ad-hoc and predefined detours; |  |  |
| 1. Ad-hoc Detour: Create short term detours (e.g. for accidents/incidents and events); |  |  |
| 1. Delete/Add a Block: Delete or add a block (e.g. to support operating unscheduled specials); |  |  |
| 1. Delete/Add a Trip: Delete or add trip to a block; |  |  |
| 1. Replace a Vehicle/Operator: Assign a replacement vehicle and/or operator to take over service from a scheduled block that cannot continue for any reason; |  |  |
| 1. Skip Stop: Notify an operator to bypass a series of, with the ability to identify and log the starting and stopping point for the skip stop measure; |  |  |
| 1. Drop-off Only: Notify or approve an operator to serve alighting passengers only; and |  |  |
| 1. Initiate headway management instead of schedules: The headway mode will automatically evenly distribute the vehicles on the route. This function shall communicate the revised “schedule adherence” to all affected vehicles. |  |  |
|  | The dispatch centre initiated service adjustments shall be able to prompt the AVA system to disable stop announcements, or may trigger modified announcements to support out of service stops. |  |  |
|  | All the dispatch centre service adjustments shall be logged and disseminated to the SJT's customers, predefined notification groups, and other staff via email and social media channels. Information dissemination triggers, timing, and staff to be contacted shall be SJT-configurable. |  |  |
|  | For all controller service adjustments, lost service kilometers and hours shall be calculated and stored for later reporting. Lost service hours and kilometers shall be displayed to the dispatch centre. |  |  |

### Detour Management

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall include features to manage detours in real-time, including maintaining accurate route and schedule adherence in the event of a detour. |  |  |
|  | The system shall allow controllers to create a detour by designating road segments and stops to define the trip pattern and indicating at which existing stops the detour connects with a scheduled trip pattern. The system shall support this function through a map-based click-and-draw feature within the controller user interface. |  |  |
|  | The system shall allow SJT to classify roads as suitable or unsuitable for bus operations. |  |  |
|  | The system shall visually depict unsuitable roads when controllers create detours using the map based user interface. |  |  |
|  | The system shall enable controllers to edit both active and inactive detours and distribute updates to active detours in real-time. |  |  |
|  | The system shall permit the controller to define temporary stops for use during a detour, including existing stops from the stop database and new stops that are not part of the stop database. |  |  |
|  | The system shall automatically create a detour shape file connecting the start and end existing stops following the designated road segments and stops. |  |  |
|  | The system shall permit detours to be created that relocate the start and end point of a route to a location not on the regular routing (e.g. if a terminal is out of service and buses are diverted to a temporary location). |  |  |
|  | For detours that relocate the start/end point of a route, the system shall automatically adjust scheduled trip start and end times and schedule adherence for the operator, so that buses maintain their schedule at timepoints not affected by the detour. |  |  |
|  | The system shall automatically generate full text descriptions of detours including turn-by-turn text directions and the stops to be serviced based on the controller’s input on the map-based user interface. |  |  |
|  | The system shall allow controllers to create ad-hoc and scheduled detours by specifying a start date and time and an end date and time for a detour. By default, the Central system shall indicate the detour to start at the current date and time, and end at the end of the current operating day. |  |  |
|  | The system shall allow controllers to update existing detours. |  |  |
|  | The system shall allow controllers to identify specific blocks shall use the detour. Detoured blocks shall be recorded in the Central system as an appropriate status, with the start and end time of the detour recorded as an event. |  |  |
|  | Once the controller has created a detour, the system shall automatically apply the detour to all affected blocks. The system shall successfully transmit all relevant detour data to buses such that it is available from the time they logon to affected blocks, and remains available for the duration of the detour. For affected blocks that are already in service, the system shall push the relevant detour data and adjust the block in real-time, providing a visible and audible alert to the operator. |  |  |
|  | The system shall save the routing and active stops of all created detours for future use. |  |  |
|  | The system shall provide controller with a list of previously created detours for use as templates, with controller-configurable start and end times. |  |  |
|  | The system shall enable controllers to search previously created detour templates by: |  |  |
| 1. Identification code; |  |  |
| 1. Keyword (found in turn-by-turn directions, including street names); and |  |  |
| 1. Associated route(s). |  |  |
|  | The system shall allow users to modify the routing and active stops of a selected detour template and save this as a new detour template. |  |  |
|  | The system shall allow controllers to indicate that a bus stop is not in service, and have that information propagate to all routes and lines serving that stop. |  |  |

### Transfer Connection Protection

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall provide user-requested connection protection. |  |  |
|  | The system shall allow operators to request connection protection to a specific route, direction, and a selected stop through the MDT. |  |  |
|  | The system shall allow operators or controllers to cancel a requested connection protection. |  |  |
|  | The system shall use real-time vehicle arrival and departure predictions to support connection protection. |  |  |
|  | The system shall evaluate whether the connection can be protected based on the SJT-configurable parameters when connection protection is requested by the operator. |  |  |
|  | Connection protection parameters shall be SJT-configurable and include: |  |  |
| 1. Maximum schedule deviation; |  |  |
| 1. Maximum hold time; |  |  |
| 1. Transfer time between stops; |  |  |
|  | The system shall send hold instructions to the MDT of the connecting vehicle(s) if the CAD/AVL system evaluates that the requested connection can be protected. |  |  |
|  | The system shall notify the requesting vehicle, and appropriate controller as applicable, if the receiving vehicle has been told to hold and if it has been released. |  |  |
|  | The system shall notify the requesting vehicle of the receiving vehicle’s estimated arrival time at the connection point. |  |  |
|  | The system shall continuously evaluate any connection protection for whether the connection can be protected based on the SJT-configurable parameters. |  |  |
|  | The system shall send release instructions to the waiting connecting vehicle if the connection can no longer be protected based on the SJT-configurable parameters. |  |  |
|  | The system shall provide an interface for controllers to view connection protection requests and status. |  |  |
|  | The system shall allow controllers to manually indicate the receiving vehicle should hold for longer than the pre-determined duration. |  |  |
|  | The system shall allow controllers to manually retract release instructions. |  |  |
|  | The system shall allow controllers to initiate, on an ad hoc basis, a protected transfer from a selected vehicle to a specific route, direction, and a selected stop. |  |  |
|  | The system shall allow controllers to adjust default parameters when controller is initiating a protected transfer. |  |  |
|  | The system shall record all successful and unsuccessful connection protection attempts in the central system database. |  |  |

### Alternative Service Ride Requests (e.g. OnDemand, Paratransit) (Option)

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall allow operators to request alternative service rides for passengers through the MDT. |  |  |
|  | The system shall evaluate whether the ride can be requested based on the SJT-configurable parameters when a ride is requested by the operator. |  |  |
|  | The system shall provide the following information to the taxi system in ride requests: |  |  |
| 1. Pick up location |  |  |
| 1. Pick up time |  |  |
| 1. Number of passengers transferring to the alternative service |  |  |
|  | Ride request locations shall be SJT-configurable. |  |  |
|  | The system shall notify the requesting vehicle, and appropriate controller as applicable, if the requested ride has been accepted by the alternative system. |  |  |
|  | The system shall notify the requesting vehicle of the receiving vehicle’s estimated arrival time at the connection point. |  |  |
|  | The system shall allow operators and controllers to cancel requested rides. |  |  |
|  | The system shall notify the operator and controllers when the third-party ride service has cancelled the ride after initially accepting the request. |  |  |
|  | The system shall provide an interface for controllers to view alternative service requests and status. |  |  |

## AVA Software

This section defines requirements for configuring announcement triggers and preparing announcement database with pre-recorded announcements and text-to-speech phonetic text.

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The AVA software module shall be installed centrally and be capable of remotely managing the AVA onboard equipment for vehicles. |  |  |
|  | The system shall provide an integrated software package for preparing all information to be downloaded to the fleet, including the interior/exterior announcements, SJT's onboard signs, announcement trigger locations, and destination sign trigger locations. |  |  |
|  | SJT shall be able to download updates or changes to announcements before their effective service date. These updates or changes shall be accessible the first time an operator logs on for service for that effective date. |  |  |
|  | Once approved by the administrator, the scripts shall disseminate to the vehicles via WLAN when within range. |  |  |
|  | All onboard AVA logs shall automatically upload to the central system via WLAN when the vehicle is within range. |  |  |
|  | All onboard AVA logs stored within the central software shall be accessible through the central software and shall be capable of export into standard formats including .txt, .csv, .doc, and .xls. |  |  |

### Announcement File Preparation

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The AVA software shall include a function to generate voice recordings for the Audio Annunciators using a text-to-speech (TTS) engine. |  |  |
|  | The TTS engine shall support multiple voice engines, and also multiple languages including at least English and French. |  |  |
|  | The TTS voice engines shall support the use of punctuation, phonetic spelling, and pronunciation marks to create a more natural sounding recording. |  |  |
|  | The system shall allow users to preview text-to-speech messages and generate alternate phonetic text for planned and ad-hoc announcements. |  |  |
|  | The AVA software shall support separate fields for DMS display string and pronunciation string (e.g. “Mount Vernon” and “Mount Vehr-Nun Street”). |  |  |
|  | The AVA software shall provide software to create recorded message files in-house. |  |  |
|  | The AVA software shall be able to use professionally-recorded messages that use a designated file format. |  |  |
|  | The AVA software shall provide the ability to create announcement messages that concatenate selected portions of recorded message files with timed pauses and TTS segments. |  |  |
|  | The AVA software shall provide the ability to create announcement messages that concatenate French and English TTS segments. |  |  |
|  | The AVA software shall provide the ability to create the DMS display text associated with each announcement message. |  |  |
|  | Parameters shall allow the software user to configure the following for announcements: |  |  |
| 1. Repeat cycle for announcements (i.e. time interval between announcements); |  |  |
| 1. Number of announcement repeats; |  |  |
| 1. Maximum announcement duration; |  |  |
| 1. Activation and deactivation trigger geofence; and |  |  |
| 1. Announcement priority (e.g. interrupt, play prior to, or play after standard stop announcements). |  |  |
|  | The AVA software shall allow users to associate internal announcements to specific routes, stops, days, and time-of-day. |  |  |
|  | The AVA software shall allow users to specify global parameters (e.g. all announcements as activated by trigger). |  |  |
|  | The AVA software shall allow users to store internal announcements in the onboard VLUs for activation on demand. |  |  |
|  | The AVA software shall allow users to map such announcements to applicable MDT controls. |  |  |
|  | The AVA software shall allow users to generate ad-hoc announcements including pronunciation audio and visual text. |  |  |
|  | Ad-hoc announcements shall be capable of distribution through the cellular data network to a vehicle(s), route(s), and geofence(s), if so configured by the user. |  |  |
|  | The AVA software shall allow users to be able to associate external announcements to specific: |  |  |
| 1. Destination codes; |  |  |
| 1. Routes; |  |  |
| 1. Stops; |  |  |
| 1. Days; and |  |  |
| 1. Time-of-day. |  |  |
|  | External announcements shall trigger when the operator opens the front door. |  |  |
|  | The AVA software shall allow users to trigger both ad-hoc and canned announcements text info from the dispatch centre in real time. |  |  |

### Announcement Trigger Locations Configurations

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The AVA software shall allow the announcement message files and associated DMS display text files to be linked with individual announcement trigger locations. |  |  |
|  | The AVA software shall provide a utility that allows the user to configure announcement trigger locations. Both activation and deactivation triggers shall be SJT-configurable. |  |  |
|  | SJT shall be able to configure trigger zones using a satellite or map based background and point, draw, drag type GUI. |  |  |
|  | The AVA software shall allow trigger locations to be adjustable on a global basis. |  |  |
|  | The AVA software shall allow trigger locations to be adjustable individually and in groups by specifying geofence parameters from a selected point(s). Points shall include stops, and locations a user-configurable distance before or after a stop(s). |  |  |
|  | The AVA software shall begin playing announcements within one second of being triggered. |  |  |

## Vehicle Health Monitoring Software (Optional)

This section provides requirements for vehicle heal monitoring software for processing of and reporting on downloaded vehicle health data.

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The central system shall support transfer and logging of diagnostics obtained via the VLU to the Vehicle Health Monitoring (VHM) software. |  |  |
|  | The VHM software shall allow for the configuration of thresholds on a vehicle-specific or vehicle-type-specific, and engine-specific basis for diagnostic information. Configuration of thresholds for diagnostic information shall include: |  |  |
| 1. Diagnostic information breach threshold; |  |  |
| 1. Granularity of data logging; |  |  |
| 1. Priority level; and |  |  |
| 1. Action(s). |  |  |
|  | The VHM software shall allow for multiple, independent thresholds on diagnostic information. |  |  |
|  | Threshold updates shall be SJT-configurable simultaneously for the following vehicles groups: |  |  |
| 1. By equipment model (i.e. all vehicles with a particular piece of equipment); |  |  |
| 1. By vehicle; |  |  |
| 1. By vehicle model; |  |  |
| 1. By vehicle energy type; |  |  |
| 1. By range of vehicles; and |  |  |
| 1. Fleet wide. |  |  |
|  | The VHM software shall receive fault data notifications over the air in real time as defined by priority level for a given threshold. |  |  |
|  | The VHM software shall receive all fault data, diagnostic logs, and summary reports from the vehicles via WLAN when a vehicle is within range. |  |  |
|  | The VHM software shall allow the configuration of fault data distribution and frequency for any given priority levels. |  |  |
|  | Changes to thresholds shall be downloaded to vehicles via WLAN when within range. |  |  |
|  | The VHM software shall distribute notifications on faults received, to various subgroups as defined by SJT. |  |  |
|  | The VHM software shall interface with the central system CAD/AVL for the purposes of notifying controllers of faults as defined by threshold action and priority level. |  |  |

### Onboard Configuration Management

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The software shall have the capability to reset configuration or status of onboard vehicle components. |  |  |
|  | The software shall allow configuration of threshold values for warning and critical alarms in stored data for bulk data upload to filter VHM data. |  |  |
|  | The software shall allow the configuration of thresholds for real-time notification of VHM status. |  |  |
|  | The software shall allow configuration of thresholds for filtering data based on for frequency and time duration. |  |  |
|  | The software shall allow filtering VHM data by vehicle type. |  |  |

### Pre- and Post-Trip Inspection

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall obtain pre-trip and post-trip inspection reports from the onboard VLU in real-time over SJT’s wireless network. |  |  |
|  | Based on the pre-trip and post-trip inspection reports, the system shall generate alerts for the authorized staff based on defined thresholds. |  |  |

### Reporting

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The software shall provide standard reports based on the VHM data. |  |  |
|  | The software shall have the capability to generate reports based on exceptions as per vehicle component monitoring thresholds set by SJT staff. |  |  |
|  | The VHM Software shall have a reporting feature, capable of generating the following reports: |  |  |
| 1. Vehicle maintenance alerts for selected vehicle(s); and |  |  |
| 1. Selected vehicle maintenance alerts for all vehicles. |  |  |
|  | The VHM Software shall allow for SJT to specify the automation of reports and the distribution of said reports to various subgroups. |  |  |
|  | All report shall have the capability to export information into a common analysis and text editing software such as Microsoft Excel and Word. |  |  |

## Data Feeds and Application Programming Interfaces

This section lists requirements for standard data feed for passenger information application development by third parties and APIs for obtaining datasets for third party application developments.

### Vehicle Tracking Interface for External Systems

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall have the capability to receive, store, and display vehicle location data received from multiple external systems. |  |  |
|  | The system shall be capable of receiving and displaying vehicle location information from the following services. |  |  |
| 1. Saint John Transit vehicles |  |  |
| 1. OnDemand vehicles |  |  |
| 1. Handi-Bus vehicles |  |  |
|  | SJT shall be able to activate and deactivate display of each service individually. |  |  |
|  | The Successful Proponent shall provide documentation regarding the standardized data interface formats (GTFS-realtime, SIRI, or other standards) and retrieval mechanisms supported by the CAD/AVL system for the external vehicle tracking data. |  |  |
|  | The system shall support multiple methods for receiving the external vehicle tracking data interface feeds, including: |  |  |
| 1. Direct integration through a client-server mechanism (such as through APIs) |  |  |
| 1. Data retrieval mechanism where a standard format file is located at an identified URL |  |  |

### Center –to-center TSP

This section defines requirements for center-to-center TSP feature.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The system shall support the future integration with the City of Saint John’s traffic control system to enable center-to-center TSP. |  |  |
|  | The Successful Proponent shall provide an ICD to enable this future integration. |  |  |
|  | The central system shall be integrated with the City of Saint John’s traffic control system to send conditional priority requests. |  |  |
|  | Conditions for creating signal priority requests shall be SJT-configurable. |  |  |

### Schedule Information Data Feed (GTFS)

This section defines requirements for the GTFS feed to be generated by the Successful Proponent.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The CAD/AVL system shall export schedule data in General Transit Feed Specification (GTFS) format. |  |  |
|  | The exported data (hereinafter referred to as the ‘GTFS dataset’) shall include all the required GTFS files as well as optional files designated by SJT as part of the design review process. |  |  |
|  | For each GTFS file, the GTFS dataset shall include all the required fields as well as optional fields designated by SJT as part of the design review process. |  |  |
|  | The Successful Proponent shall verify that the exported GTFS datasheet shall result in zero (0) critical warnings when tested using the Google-provided schedule validator. |  |  |
|  | All data generated by the GTFS schedule module including the GTFS dataset shall be the property of SJT. SJT shall have the right to store and use this data and provide it to third parties.  SJT shall be provided a perpetual and royalty free license for access to the GTFS dataset including the right for SJT to provide the data to third-party contractors of other software for integration purposes. |  |  |
|  | The Successful Proponent shall coordinate with SJT to ensure that any abnormal situations in trip planning, including but not limited to the following, are resolved: |  |  |
| 1. Excessive walking to/from an origin/destination transit stop; |  |  |
| 1. Stops connected by a straight line on the map instead of following the appropriate route trace; |  |  |
| 1. Excessive wait-time suggested for transfers; and |  |  |
| 1. Major and minor stop locations not marked on the map. |  |  |
|  | The Successful Proponent shall provide the option to host GTFS feeds for access by third parties. |  |  |

### GTFS-Real Time

This section defines requirements for the GTFS –real time feed to be generated by the Successful Proponent.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The CAD/AVL system shall generate and output the following GTFS-real-time feeds: |  |  |
| 1. Vehicle positions; |  |  |
| 1. Trip updates; and |  |  |
| 1. Service alerts |  |  |
|  | The Vehicle Positions feed shall include: |  |  |
| 1. Locations for all vehicles in service; |  |  |
| 1. Status of a vehicle with respect to which stop it is stopped at, incoming at, or in transit to (i.e. current status field); and |  |  |
| 1. Buses that have been taken out of service |  |  |
|  | The Trip Updates feed shall include: |  |  |
| 1. Predicted arrival and departure times; |  |  |
| 1. Trip additions and cancellations (i.e., schedule relationship field at the trip-level); and |  |  |
| 1. Skipped stops (i.e., schedule relationship field at the stop-level). |  |  |
|  | The Service Alerts feed shall include, for all current and future service alerts, the following: |  |  |
| 1. Header and description; |  |  |
| 1. Cause and effect; |  |  |
| 1. Active period(s); |  |  |
| 1. Affected entities including agency, route, mode, trip and stop; and |  |  |
| 1. A web link, where entered. |  |  |
| 1. A uniform resource locator (URL), where entered. |  |  |
|  | The Service Alerts feed shall include all of the latest service alerts entered by controllers through the CAD/AVL system. |  |  |
|  | The Service Alerts feed shall incorporate alerts that are categorized by at least the following entity types: |  |  |
| 1. Route; |  |  |
| 1. Trip; and |  |  |
| 1. Stop. |  |  |
|  | Recipients of the Service Alerts feed shall be able to identify if certain Service Alerts are associated with only specific routes (in the case of route entity identification), only specific trips (in the case of trip entity identification), only specific stops (in the case of stop entity identification), or some combination of these. |  |  |
|  | The CAD/AVL system shall update the GTFS-real-time data feeds 1) immediately after new content is available, OR 2) every 30 seconds, whichever is more frequent. |  |  |
|  | The GTFS-real-time data feed shall be designed to be consistent with the CAD/AVL System's GTFS data. |  |  |
|  | The Successful Proponent shall validate GTFS-real-time feed for accuracy. |  |  |
|  | The Successful Proponent shall provide the option to host GTFS feeds for access by third parties. |  |  |

### CAD/AVL API

This section lists requirements for an API to obtain real-time data on operations and passenger counts.

|  |  |  |  |
| --- | --- | --- | --- |
| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
|  | The Successful Proponent shall provide an API for obtaining key data fields from the CAD/AVL system. |  |  |
|  | When requested, the API shall provide the following data: |  |  |
| 1. Current vehicle location data; |  |  |
| 1. Current route and schedule adherence data; |  |  |
| 1. Active incidents; |  |  |
| 1. Current vehicle speed; |  |  |
| 1. Current vehicle capacity; and |  |  |
| 1. Service adjustment information (e.g. detour, shuttle cancellation) |  |  |

### VHM Data API (Option)

This section lists requirements for an API to obtain real-time data on vehicle component health

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The CAD/AVL system shall be capable of outputting the real-time vehicle maintenance and diagnostics data through an API. |  |  |
|  | The CAD/AVL system shall provide the following information through API calls: |  |  |
| 1. Monitored component status (by vehicle); |  |  |
| 1. Critical faults or equipment failures (by vehicle or by monitored component), expressed as J1939 SNP/FMI (PID) data or diagnostic trouble codes; |  |  |
| 1. Pre-trip and post-trip inspection results; |  |  |
| 1. Information required generating repair requests. |  |  |

### OnDemand API (Option)

This section lists requirements for an API to obtain real-time data for OnDemand service integration.

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The CAD/AVL system shall be capable of receiving and outputting the real-time data with the OnDemand system through an API. |  |  |
|  | The CAD/AVL system shall provide the following information through API calls: |  |  |
| 1. Real time vehicle location; |  |  |
| 1. Vehicle route and stops; |  |  |
| 1. Vehicle schedule; and |  |  |
| 1. Vehicle estimated arrival time |  |  |
|  | The CAD/AVL system shall receive the following information through API calls: |  |  |
| 1. Vehicle speed; |  |  |
| 1. Pick up location; |  |  |
| 1. Drop off location; |  |  |
| 1. OnDemand to conventional transit connection requests; |  |  |
| 1. Estimated OnDemand vehicle arrival time; and |  |  |
| 1. Number of OnDemand passengers transferring to fixed-route transit. |  |  |

## Business Intelligence, Reporting and Dashboards

This section defines requirements for importing data from various data sources as provided by the Successful Proponent and related systems to develop an operations management datastore.

### Reporting Database

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall supply an operations reporting database. |  |  |
|  | The reporting database shall support querying and data extraction using SQL to support broader SJT business functions, including with the existing SJT data analysis, business intelligence, and report generation tools. |  |  |
|  | An ICD and data dictionary shall be provided by the Successful Proponent, as well as a user’s manual to allow SJT to manage the centralized reporting database after delivery |  |  |
|  | The Successful Proponent shall automate the data transfer process between the system and the reporting database, so as not to require SJT staff’s day-to-day involvement. |  |  |
|  | The data transfer process will generate a daily log of data upload activities and will alert staff in the event of a centralized reporting database upload failure. |  |  |
|  | The data transfer process logic shall have exception handling built-in to avoid uploading any unwarranted data. |  |  |
|  | Data transfer settings and status shall be accessible to monitor and configure through an administrative interface and dashboard. The system administration tool shall also allow management of user roles and privileges for accessing reports. |  |  |
|  | The system’s backup and recovery functions shall enable SJT to create backup copies of all operations reporting database content, stored externally from the system. |  |  |
|  | The system shall enable the reporting database to be restored from a backup in case of database crashes. |  |  |

### Reporting Tool

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall supply a reporting tool and any required software interfaces to automatically retrieve real-time and historical data from the system databases. |  |  |
|  | The reporting tool GUI shall include analytical functionality in addition to raw data reporting functionality including: |  |  |
| 1. Addition, subtraction, multiplication and division; |  |  |
| 1. Grouping and summaries; |  |  |
| 1. Percentile calculations; |  |  |
| 1. Filtering; |  |  |
| 1. Sorting; |  |  |
| 1. Graphs; |  |  |
| 1. Map based data visualizations; and |  |  |
| 1. Conditional formatting. |  |  |
|  | The Successful Proponent shall provide all standard reports and dashboards generated by the system in their existing state. |  |  |
|  | All dashboards and reports shall support custom SJT branding, including colours, fonts, and logos. |  |  |
|  | The reporting tool shall provide a set of SJT-configurable graphics used to represent key performance indicators (KPIs) as defined by SJT. |  |  |
|  | The reporting tool shall report all KPIs in real-time, where data is available to support real-time reporting. The delivered system shall provide real-time displays for schedule performance and service adjustment data by default. |  |  |
|  | The reporting tool shall incorporate levels of data to allow the user to filter by |  |  |
| 1. Date and time; |  |  |
| 1. Route; |  |  |
| 1. Route Direction |  |  |
| 1. Block; |  |  |
| 1. Operator; |  |  |
| 1. Facility; |  |  |
| 1. Municipality; |  |  |
| 1. Geographical area; |  |  |
| 1. Keywords (e.g. for incident records). |  |  |
| 1. Sign Up Period |  |  |
| 1. Vehicle ID; and |  |  |
| 1. Any stored data field |  |  |
|  | The reporting tool shall have an easy-to-use GUI that allows the standard user to create reports, KPIs, and dashboards as desired without requiring intervention from the system administrator. |  |  |
|  | Each user shall be able to save a configuration and set of KPIs for future use. This configuration shall be automatically loaded the next time the user opens the tool. |  |  |
|  | Each created dashboard, KPI, and report shall be shareable with other users through an email link. The system shall identify if the recipient does not have sufficient permissions to access the form and alert the sender prior to sending. |  |  |
|  | The reporting tool shall be intuitive and require no training or prior knowledge of databases and query methods for basic use. |  |  |
|  | All reports and dashboards provided by the reporting tool shall be filterable, and shall provide information in real-time, and in SJT-configurable historical time intervals to time increments as short as one minute. |  |  |
|  | The reporting tool shall allow SJT system administrators to define user groups and the permissions, reports, and dashboards available to each user group. |  |  |
|  | The reports shall allow the export of data to a common export format (e.g., text file, CSV, Microsoft Excel, and portable document format [PDF]). |  |  |
|  | The reports shall provide the ability to drill-down and drill-through reported information. |  |  |
|  | The reporting interface shall allow SJT to generate ad-hoc reports, including customizing variants of standard reports. |  |  |
|  | The reports shall include the date generated, the system user ID of the report generator, and the filters applied to the report when generated. |  |  |
|  | The reporting interface shall provide spatial or temporal segmentation of summary data ‘on the fly’ (if applicable) by the following parameters: |  |  |
| 1. Sign-up/Board Period; |  |  |
| 1. Route and direction; |  |  |
| 1. Variation/Pattern; |  |  |
| 1. Stop and node; |  |  |
| 1. Operator; |  |  |
| 1. Controller; |  |  |
| 1. Event type (applicable only to incident and event based reports); |  |  |
| 1. Communication type (applicable only to communication reports for SJT canned message types, for example, major technical, route blocked and covert microphone events); |  |  |
| 1. Service day (e.g. weekday, Saturday, Sunday, Holiday) |  |  |
| 1. Jurisdiction/Agency; |  |  |
| 1. Trip; |  |  |
| 1. Run; |  |  |
| 1. Block; |  |  |
| 1. Vehicle; |  |  |
| 1. Time of day, |  |  |
| 1. Day of week, |  |  |
| 1. Month; |  |  |
| 1. Year; and |  |  |
| 1. Adjustment status (i.e. if route has active detour, shuttle, cancellation). |  |  |

### Reports

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall work with SJT as part of the design review to determine the requirements and develop each of the following reports. Reports are expected to include the following parameters for the segmentation and summary of data: |  |  |
| 1. Sign-up/Board period; |  |  |
| 1. Route and direction; |  |  |
| 1. Variation/Pattern; |  |  |
| 1. Stop and node; |  |  |
| 1. Operator; |  |  |
| 1. Controller; |  |  |
| 1. Event type (applicable only to incident and event based reports); |  |  |
| 1. Communication type (applicable only to communication reports for SJT canned message types, for example, major technical, route blocked and covert microphone events); |  |  |
| 1. Service day (e.g. weekday, Saturday, Sunday, Holiday) |  |  |
| 1. Jurisdiction/Agency; |  |  |
| 1. Trip; |  |  |
| 1. Run; |  |  |
| 1. Block; |  |  |
| 1. Vehicle; |  |  |
| 1. Time of day, |  |  |
| 1. Day of week, |  |  |
| 1. Month; |  |  |
| 1. Year; and |  |  |
| 1. Adjustment status (i.e. if route has active detour, shuttle, cancellation). |  |  |
|  | The Successful Proponent shall automate the data extraction and report generation process for the following reports. |  |  |
|  | **Logon/logoff summary report**: shall report on operator logon and logoff statistics comparing scheduled and actual times for logon and logoffs. |  |  |
|  | **Operator workpiece summary report**: shall report on the actual piece of work operators performed in the field in comparison with the scheduled piece of work for each run by comparing the following data: logon/logoff times, timepoint crossings, and logon/logoff operators. |  |  |
|  | **Operator performance summary report**: shall report on operator performance with respect to schedule adherence at timepoints. |  |  |
|  | **Added trips report:** shall report on additional runs or trips that were not prescheduled and were introduced to meet passenger demand in real-time. |  |  |
|  | **Mobility Aid and Bicycle Boarding Summary:** Shall report on boardings reported in CAD/AVL that involve mobility aids and bicycles; |  |  |
|  | **Revenue Vehicle Dwell time summary report:** shall report on dwell times at fixed route and on-demand stops including a heat map, with SJT configurable parameters, identifying areas with frequently high dwell times. |  |  |
|  | **Non-** **Revenue Vehicle Dwell time summary report:** shall report on dwell times and locations of non-revenue vehicles during their shift, including a heat map, with SJT configurable parameters, identifying areas with frequently high dwell times. |  |  |
|  | **Space-time diagram report:** shall provide a visualization of scheduled and actual trips by creating a scatterplot of timepoint locations and arrival/departure times. |  |  |
|  | **Missed trips summary report:** shall report on trips that could not be performed. |  |  |
|  | **Deadhead summary report:** shall report on deadhead miles and distinguish pullout and pull-in events from other deadheads (e.g., when start or end point of a deadhead in not the garage). |  |  |
|  | **Headway reliability summary report:** shall provide a comparative summary of actual and scheduled headways for each timepoint. |  |  |
|  | **Voice and data communication (or event log) summary including response times report:** shall report on a chain of activities tied to inbound and outbound communications. For example, when an operator initiates a low priority message requiring a voice call and upgrades to a higher priority message. As a result, the controller could place a 45 second outbound call. The report should be able to link these activities to create a record of activities tied to the original RTT request. |  |  |
|  | **Off route summary report:** shall report on start and end point and start and end times of an off route event. |  |  |
|  | **System health summary report:** shall report on current health of each equipment and computer hardware that is part of the ITS system. |  |  |
|  | **Automated announcement summary report:** shall report on a comparative assessment of scheduled and actual onboard AVA events. |  |  |
|  | **Road call summary report:** shall report on the road calls operators/controllers make, including a heat map of locations with frequent calls |  |  |
|  | **Incidents and accidents summary report:** shall report on any incidents and accidents and relevant information. |  |  |
|  | **Real-time vehicle availability report:** shall be able to provide the current availability of a vehicle based on the current health of maintenance components and onboard ITS equipment on that vehicle. |  |  |
|  | **Maintenance work summary report:** shall report on identified problem, resolution, and cause for ITS and non-ITS maintenance works. |  |  |
|  | **Repeat failures summary report:** shall report on recurring maintenance issues. |  |  |
|  | **Onboard equipment status report:** shall report on the functional status of hardware and software versions (e.g., MDT software version, route version, farebox software version, destination sign software version). |  |  |
|  | **Vehicle uploads and download summary report**: shall report on the status of the WLAN data exchange by indicating successful, in progress, or failed downloads. |  |  |
|  | **Real-time information accuracy report:** shall report on the accuracy of disseminated real-time information on predicted arrival/departure. |  |  |
|  | **Real-time information usage on web and other personal media devices report**: shall report on the use of dissemination media. |  |  |
|  | **Response Time report:** Individual and average time from RTT or PRTT to controller initiated communications. |  |  |
|  | **Service Adjustment Management report:** Service measures implemented by type of measure. |  |  |
|  | **Detour report:** AVL and APC information for all detours and all detour data traces/segments/shape file. |  |  |
|  | **Incident Management report:** Incidents created, duration the incident was open, and number of incidents closed. |  |  |
|  | **Dispatch Work report:** Number of average vehicles and routes active. |  |  |
|  | **Session Time report:** Duration of log-on. |  |  |
|  | **Daily Report:** includes operational data for each vehicle such as pull out data, driving speed, OTP, incident summaries. |  |  |

# Project Implementation

This section defines requirements for the Successful Proponent project implementation services.

## Project Management

### Project Staff

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall appoint a Project Manager, who will be the primary point of contact with SJT. |  |  |
|  | The Project Manager or their deputy shall participate in all scheduled project activities, attend scheduled meetings, and promptly respond to new meeting requests, requests for information, technical support, or other necessary communication activities. |  |  |
|  | The Successful Proponent shall appoint specific resources to the following key personnel roles: |  |  |
| 1. Project Manager; |  |  |
| 1. Technical Lead/Project Engineer; and |  |  |
| 1. Training Lead. |  |  |
|  | The Successful Proponent shall provide written notice to SJT at least two weeks in advance of any change in key personnel indicating the specific reason, and the qualifications of the new personnel. The change in key personnel must be approved by SJT before the change can occur. |  |  |
|  | The Project Manager and/or key staff shall be onsite at SJT for critical project management meetings, resolution of major issues, equipment installation and oversite, onsite testing, design reviews (non-key personnel can participate remotely), and periodic senior management presentations. |  |  |
|  | The Successful Proponent shall notify and request approval for all other onsite meetings and onsite presence of Successful Proponent staff. |  |  |

### System Implementation Plan (SIP)

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall prepare a System Implementation Plan (SIP), including the detailed implementation activities, a project schedule, roles, and responsibility of parties in the proposed project team, progress milestones/status and assigned staff. |  |  |
|  | The SIP shall include details on transitioning from the current system to the new system provided by the Successful Proponent. The Transition Plan shall be developed such that SJT operations are not impacted in any way due to project implementation activities. |  |  |
|  | The Project Schedule shall be implemented in PERT, GANTT, or equivalent form to show SJT and any third party responsibilities and activities and their associated dependencies. |  |  |
|  | The Successful Proponent shall also include a Safety Management Plan in their SIP, which shall detail their responsibilities and procedures for safety during the different phases of the project, including (1) conducting pre-installation surveys to identify potential project safety hazards; (2) identifying project hazard control procedures, including occupational (worker) and public hazards; (3) providing project safety orientation and training to its subcontractors and SJT staff who will be involved in the project; and (4) furnishing procedures and training for project accident reporting and investigations.  Additionally the Successful Proponent shall provide documentation on safety certification process that highlights areas of concern, for example, how the new system will impact bus operators, controllers, and or inspectors, if measures have been considered and dealt with relating to potential safety concerns that the new system and or sub components of the system may have on SJT daily operations |  |  |
|  | The initial draft of the SIP shall be provided to SJT within two weeks from notice to proceed (NTP). |  |  |
|  | The revised SIP, addressing comments from the first onsite meeting, shall be provided to SJT within two weeks after this meeting. |  |  |
|  | The SIP must be approved and accepted by SJT before it can become effective. |  |  |
|  | The SIP shall be updated by the Successful Proponent on a monthly basis to reflect the progress attained in the previous month and the anticipated changes in the future. The updated SIP shall be submitted to SJT at the beginning of each month. |  |  |
|  | Any updates to the SIP including the project schedule shall be detailed and clearly expressed to SJT. The updated Project Schedule shall clearly identify all affected tasks new start and end dates, and updated task duration. |  |  |
|  | The SIP shall include a rollout plan for all SJT vehicles. |  |  |
|  | The SIP shall identify planned delivery of documentation. |  |  |
|  | The Successful Proponent shall include in the SIP, the necessary time and resources to modify documentation to incorporate comments from SJT. The Successful Proponent should assume a minimum of two weeks for SJT to provide comments on submission. |  |  |
|  | The Successful Proponent shall include in the SIP the time for SJT to review the revised documentation. |  |  |

### Coordination Meetings

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall participate in a kick-off meeting between the SJT project team and the Successful Proponent team at the start of the project. |  |  |
|  | The Successful Proponent shall convene regular progress review meetings, such as: |  |  |
| 1. Weekly or bi-weekly design/contract review meetings with SJT and any applicable consultants; and |  |  |
| 1. Technical and contractual interface meetings with subcontractors, if any. |  |  |
|  | The agenda for these meetings shall be to discuss the most current status of and plans related to all issues identified in the recent releases of the SIP and action item list (AIL). |  |  |
|  | SJT reserves the right to identify for discussion any additional issues beyond those in the SIP and AIL. |  |  |
|  | A status report shall be issued to SJT at least two days prior to each virtual meeting, including: |  |  |
| 1. An agenda for the upcoming virtual meeting highlighting key discussion items; and |  |  |
| 1. An updated AIL with the updates incorporating the discussions of the previous bi-weekly virtual meeting as well as other subsequent developments since the previous AIL release. |  |  |
|  | The Successful Proponent shall be available to meet the SJT Project Manager in person upon request for resolution of major obstacles or significant schedule delays. |  |  |
|  | The Successful Proponent shall be represented in these virtual meetings by at minimum their Project Manager as well as any additional Successful Proponent staff necessary to properly address the current issues and project status. |  |  |
|  | SJT will be represented by its designated implementation management representatives. |  |  |
|  | Virtual meetings shall be arranged and paid for by the Successful Proponent. |  |  |
|  | The Successful Proponent shall submit minutes within two days of each virtual meeting. |  |  |

### Action Item List

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall maintain an AIL, indicating for each item the following: |  |  |
| 1. Item number; |  |  |
| 1. Date generated; |  |  |
| 1. Item priority; |  |  |
| 1. Brief item descriptive title; |  |  |
| 1. Assigned person with lead resolution responsibility; |  |  |
| 1. Date resolved; and |  |  |
| 1. Ongoing dated notes on resolution status. |  |  |
|  | The Successful Proponent shall sort AIL primarily by unresolved vs. resolved items, priority, and by the date the item was generated. The Successful Proponent shall provide AIL a day before the meeting. |  |  |

## System Design

### Requirements Review

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall participate in a requirements review (RR) to discuss the contractually agreed requirements for design. The RR meeting shall review the following for each contract requirement: |  |  |
| 1. SJT’s design intent; |  |  |
| 1. The intended Successful Proponent design approach; and |  |  |
| 1. The Successful Proponent’s approach to demonstration through the acceptance testing process. |  |  |
|  | The Successful Proponent shall prepare a traceability matrix with finalized contract requirements after the RR meeting. This matrix will be referred to as the requirements matrix hereafter. |  |  |

### Preliminary Design

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The preliminary design document (PDD) shall include the following materials: |  |  |
| 1. A conceptual diagram illustrating all elements in the system and data flow; |  |  |
| 1. An overview of the equipment, system, and configuration proposed for implementation; |  |  |
| 1. Detailed technical documentation for each equipment item; |  |  |
| 1. Detailed technical documentation on all software, addressing    1. Each module’s functions,    2. The format of all user interface screens,    3. The format of all reports,    4. The data fields to be included in all data exchange interfaces, and    5. Any other software aspects warranting advance agreement with SJT before system customization/configuration; and |  |  |
| 1. A table providing cross-references for each section of the PDD to the appropriate element of the requirements matrix. |  |  |
|  | As part of the technical documentation for the system equipment, the Successful Proponent shall provide specifications and diagrams for the recommended controller workstation layout, and a concept showing the Successful Proponent’s suggested arrangement of application windows on all screens. |  |  |
|  | The PDD shall include the necessary ICDs. |  |  |
|  | An ICD shall be included for the following interfaces: |  |  |
| 1. All data inputs; |  |  |
| 1. All configuration files; |  |  |
| 1. All application programming interfaces (APIs); and |  |  |
| 1. Other interfaces in the proposed solution. |  |  |
|  | The ICDs shall include: |  |  |
| 1. Description of data formats into and out of the interface; |  |  |
| 1. Description of the data structure; |  |  |
| 1. Description of the data protocol; |  |  |
| 1. Description of the timing of data transfer; and |  |  |
| 1. A data dictionary. |  |  |
|  | SJT shall retain exclusive and perpetual license to reproduce and share ICD with third parties for the purposes of integration and contracted work. |  |  |
|  | The RR and PDR meetings shall include a review of the facility and available resources that may need to be updated to accommodate the added technologies. The Successful Proponent shall determine and detail the exact demand of resources such as electrical power and HVAC. |  |  |

### Final Design

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall update the PDD based on SJT feedback and submit the updated documentation as the final design document (FDD). |  |  |
|  | The FDD shall include the following materials: |  |  |
| 1. Updated PDD incorporating SJT feedback and comments; |  |  |
| 1. Final list of equipment to be procured; |  |  |
| 1. Final design and configurations of the system to be built including all customizations to be made to the system; and |  |  |
| 1. An updated table providing cross-references between sections in the FDD and elements of the requirements matrix. |  |  |
|  | The PDD and FDD are intended only to reduce the chance of any misunderstandings on the design intent or interpretation of the contract requirements. The PDR and CDR shall not alter the need for each requirement’s successful formal demonstration through Acceptance Testing process. |  |  |
|  | The FDD shall be modified as necessary to address feedback and comments from SJT, until the FDD is accepted. |  |  |

## Documentation

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | All documentation shall be in English and utilize Canadian customary units. |  |  |
|  | All documentation shall be submitted directly to SJT electronically in one of the following formats, as relevant: |  |  |
| 1. MS Office formats (DOC, XLS, PPT, VSD) |  |  |
| 1. Adobe PDF (searchable) |  |  |
| 1. Scanned documents consisting of signatures, etc. may be approved for submittal. |  |  |
|  | All submissions to the SJT Project Manager shall be via email or via an online repository used for sharing files, such as SharePoint, as approved by SJT. |  |  |
|  | Equipment installation drawings shall be prepared and submitted in AutoCAD and Adobe Acrobat formats and accompanied with calculations, material specifications, process specifications, and test data required to support review and approval of the drawings. |  |  |
|  | Electrical and electronic drawings shall be supplied to show engineering changes made to any component or module up to the end of the warranty period of the system supplied. |  |  |
|  | All revisions necessary to the documentation shall be done by the Successful Proponent at no additional cost to SJT. |  |  |
|  | Manuals shall be complete, accurate, up-to-date, and shall contain only information that pertains to the system installed. |  |  |
|  | All pages of the documentation shall carry a title, version number and issue date, and they shall contain a complete subject index. The Successful Proponent shall be responsible for fully coordinating and cross-referencing all interfaces and areas associated with interconnecting equipment and systems. |  |  |
|  | Documentation shall require re-issues if any change or modification is made to the equipment proposed to be supplied. The Successful Proponent may re-issue individual sheets or portions of the documentation that are affected by the change or modification. Each re-issue or revision shall carry the same title as the original with a change in version number and issue date. |  |  |
|  | Submission of revisions shall be accompanied with a comment-by-comment response to SJT prior comments. |  |  |
|  | The System Documentation shall include at least the following: |  |  |
| 1. System Implementation Plan (SIP); |  |  |
| 1. Preliminary and Final Design Documents (PDD) (FDD); |  |  |
| 1. Acceptance Test Plan (ATP); |  |  |
| 1. Installation Design Document (IDD); |  |  |
| 1. Interface Control Documents (ICD); |  |  |
| 1. Test Results Documentation (TRD); |  |  |
| 1. Maintenance and Operations Support Plan; |  |  |
| 1. As-Built Document (ABD); and |  |  |
| 1. Operations, Maintenance, Training and User Manuals. |  |  |

### System Configuration

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall create a detailed list of all system configurations by individual system component. The Successful Proponent shall also indicate which of these configurations is user-configurable and which require intervention by the Successful Proponent. |  |  |
|  | The Successful Proponent shall document configurations of the fixed-end computer hardware and networking infrastructure (e.g., list of IP addresses). |  |  |

### Installation Document

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall submit IDD for SJT approval before any modifications to SJT equipment or installations are performed. |  |  |
|  | The IDD shall provide adequately detailed text, drawings, illustrations, and images to allow a technician’s quality installation without further training or installation instructions from the vendors of the individual equipment components. |  |  |
|  | The IDD shall include details on |  |  |
| 1. Equipment installation locations/mounting; |  |  |
| 1. Routing, conductors, colour-coding, labeling, and connectors for power, communications, and vehicle ground circuits; |  |  |
| 1. Connections with, any required modifications to and restoration of existing infrastructure; |  |  |
| 1. Work area and equipment storage requirements; |  |  |
| 1. Methods and quality standards; and |  |  |
| 1. Supervision and quality assurance procedures. |  |  |
|  | The IDD shall include procedures for pre- and post-installation checklists for tests that the installers shall perform. The installations shall not be considered complete unless SJT signs off on the pre- and post- installation checklist for each vehicle. |  |  |
|  | No adjustments, modifications, or substitutions to the IDD shall be made by the Successful Proponent during installation, except with written approval by SJT. |  |  |

### As-Built Documentation

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Following the conclusion of all installations and testing and as a condition of Final System Acceptance, the Successful Proponent shall update and provide copies of all engineering and design reports, “as-built” drawings, data, and other material produced for the equipment installed and/or procured as part of this contract and submit them to SJT. |  |  |
|  | The ABD shall include: |  |  |
| 1. An inventory of all components supplied including supplier, model number, serial number and installation location; |  |  |
| 1. An inventory of all spare parts supplied including supplier, model number, serial number and storage location; |  |  |
| 1. All reference and user manuals for system components, including those components supplied by third parties; |  |  |
| 1. All warranties documentation, including that for components supplied by third parties; |  |  |
| 1. A diagram indicating the as-built interconnections between components; and |  |  |
| 1. The version number of all software, including that supplied by third parties. |  |  |
|  | SJT shall retain exclusive and perpetual license to reproduce and share ABD with third parties for the purposes of integration and contracted work. |  |  |

## Installation

### Prototyping

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall be responsible for locating all vehicle equipment for each unique vehicle configuration, and prepare all shop, installation, material fabrication, and wiring drawings. A prototype installation for each type of bus will be performed and approved by SJT prior to proceeding with installation of additional busses of the same type. |  |  |
|  | A prototype installation for each sub-fleet of vehicle types shall be performed by the Successful Proponent. The prototype installations shall be approved by SJT before proceeding with the installation of remaining buses. The Successful Proponent shall document the approved installations by creating photos or AutoCAD drawings of the equipment locations and electrical wiring routing, and electrical schematic of wiring installation in the IDD. The IDD shall be submitted to and approved by SJT prior to production installation. All installations shall be consistent and uniform with the prototype installations in quality, equipment location, and wire routing. |  |  |
|  | The Successful Proponent shall supply any electrical equipment necessary to operate system components using existing DC electrical power available on SJT vehicles and existing AC electrical power at fixed facilities. If existing power arrangements are unsatisfactory, the Successful Proponent must specify proposed alterations. |  |  |

### General Installation Requirements

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | For storage of all equipment prior to installation in SJT facilities and vehicles, the Successful Proponent shall either: |  |  |
| 1. Store equipment at off-site facilities and transport the equipment to the SJT-approved installation location(s); or |  |  |
| 1. Provide suitable secure storage facilities (e.g. portable storage containers) at the SJT-approved installation location(s). |  |  |
|  | Equipment shall be properly grounded with onboard equipment connected as directly as possible to the chassis ground. |  |  |
|  | Equipment components shall be replaceable as discrete units and identified by unique serial numbers. Each connector shall be keyed or otherwise configured to prevent inadvertent mis-wiring during MDT replacement. |  |  |
|  | The Successful Proponent shall protect equipment inputs and outputs to absorb “routine” electrostatic discharges, over-voltages, and reverse polarity conditions. In the event of “extraordinary” conditions, the Successful Proponent shall design equipment to sacrifice inexpensive and easily identifiable components when necessary to protect more expensive components or those less easy to troubleshoot. |  |  |
|  | The Successful Proponent shall house equipment in enclosures that cannot be opened with standard hand tools and can resist damage from vandalism. |  |  |
|  | All cables shall be fully labeled at both ends and uniformly colour coded or permanently marked in compliance with established SJT or industry standards where applicable. The Successful Proponent shall provide a Cable Colour/Labeling Plan as part of the design documentation subject to approval by SJT. |  |  |
|  | Wire dress shall include a sufficient service loop at terminals to provide for shock and vibration induced movements, equipment lifting, alignment, cover removal and component replacement. |  |  |
|  | All cables, wiring, inter-connectors, switches, circuit breakers/fuses shall be designed for their purposes and for transit onboard applications. |  |  |
|  | All wire sizes and insulations shall be based on the current carrying capability, voltage drop, and mechanical strength, temperature, and flexibility requirements. All communication and signal wires and connectors shall be selected to minimize signal loss. |  |  |
|  | All circuits shall be protected by fuses or circuit breakers. The main power circuit from the vehicle to the system shall be protected by a circuit breaker similar to what already exists in the vehicle. All circuit breakers and fuses shall be permanently labeled to show their functions. |  |  |
|  | Unless otherwise specified, the Successful Proponent shall provide a complete installation solution, including all materials, parts, interconnect cables and connectors. This includes mounting brackets, stanchion extensions, hardware, cable labels, grommets, cable clamps and harnesses, and other materials required to install and make operational the equipment. |  |  |
|  | The Successful Proponent shall be responsible for all work and expenses relating to the design, manufacture, and delivery of the equipment at each location specified by SJT. |  |  |
|  | System implementation shall not impact the performance of existing infrastructure affected by or to be integrated into the new system (e.g. SJT’s LAN and WAN) at any time. |  |  |
|  | Vehicles will be provided for installation throughout the workday on a schedule to be provided by SJT. |  |  |
|  | SJT reserves the right to limit that no more than 5% of its vehicle fleet be out of service within any given 24-hour period to accommodate vehicle installations. SJT reserves the right to change this allowable percentage to allow for unrelated ongoing maintenance. |  |  |
|  | All equipment shall be installed in a manner that allows for simple component level replacement by SJT maintenance personnel in the event of failure. |  |  |
|  | Equipment shall allow for easy installation/ removal in transit vehicles through the doors without requiring door disassembly. |  |  |
|  | Onboard system devices shall be identical in installation characteristics for each vehicle type and model. |  |  |
|  | Equipment components shall be able to be replaced in a vehicle in 10 minutes or less by a trained technician, when the proper tools and a spare unit are available. |  |  |
|  | The Successful Proponent shall be responsible for determining the final location of MDT installation on each different vehicle type and configuration, subject to approval from SJT. |  |  |
|  | The Successful Proponent shall securely mount onboard equipment in the vehicle’s interior, clear of obstructions and interference-generating devices. The Successful Proponent shall collaborate with SJT staff to determine the installed location of onboard components. |  |  |

### Successful Proponent Installation Services

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide all labor, materials, integration, and services to enable complete system delivery. |  |  |
|  | Onboard installations shall take place at an SJT garage, as space and availability permit. |  |  |
|  | The Successful Proponent shall conduct a pre-installation inspection for each installation site, documenting the existing condition of any existing infrastructure that the installation may affect. SJT shall only authorize installations after approving each pre-installation inspection. |  |  |
|  | The Successful Proponent shall perform installations at specific times during the day that SJT approves. SJT may require the Successful Proponent to perform installations over nights and weekends and may require installations performed at the vehicle’s home base. |  |  |
|  | The Successful Proponent shall perform installations in designated spaces made available at SJT facilities. |  |  |
|  | The Successful Proponent shall ensure that all onboard and central system material and components are delivered to the installation site(s). |  |  |
|  | The Successful Proponent shall be responsible for removing existing equipment, connectors, and cables before installing the new equipment. Existing equipment shall be transferred to an on-site storage location designated by SJT. SJT shall be responsible for salvaging or disposing of all removed equipment. All containers used to ship new equipment will become the property of SJT and may be used to store or ship salvaged equipment. |  |  |
|  | An SJT designated representative may be present during the onsite installation to monitor quality control of the installation process. The SJT representative shall have full authority to halt or suspend installation work in the event that, in the sole opinion of the SJT representative, work is being unsatisfactorily conducted. |  |  |
|  | Regular, clear, and consistent communication with SJT personnel during the installation process is of utmost importance. Installers shall check in with designated SJT staff at the start of the workday and check out to report the work progress at the end of the workday. |  |  |
|  | All Successful Proponent, subcontractor, and/or supplier employees shall comply with SJT policies, procedures, and safety regulations while on SJT property. |  |  |
|  | Equipment shall be installed in a neat and professional manner, in accordance with good practice, by competent technicians or mechanics. |  |  |
|  | For each vehicle, following onboard system installation the Successful Proponent shall test the communications systems between the bus and the dispatch centre, including all forms of calls, Emergency Alarms, and data message formats. Evidence of successful transmission of all communications shall be required for SJT to approve the vehicle to enter operation. |  |  |
|  | The Successful Proponent shall ensure that all vehicles made available for overnight installation work are ready for revenue service by the start of the next service day. |  |  |
|  | The Successful Proponent shall provide all necessary personnel, tools, test equipment, transportation, hardware, and supplies for the successful and complete installation of all equipment and software. |  |  |
|  | The Successful Proponent shall be responsible for their own and subcontractors' performance and safety. |  |  |
|  | Installations shall be performed in accordance with all Federal, State, and local laws and regulations. |  |  |
|  | System implementation shall not impact the performance of existing infrastructure affected by or to be integrated into the new system (e.g. SJT’s LAN and WAN) at any time. |  |  |
|  | After installations, the Successful Proponent shall be responsible for restoring the condition of any affected existing infrastructure at the installation sites to their pre-installation condition. |  |  |
|  | The Successful Proponent shall remove all decommissioned equipment, and properly dispose of all equipment not eligible for resale. Decommissioned equipment remains the property of SJT. |  |  |
|  | Installation site and vehicles shall be left clean and free from rubbish and debris. All material associated with site preparation, unpacking of shipping materials, and/or installation of new equipment related to this project shall be removed from the premises by the Successful Proponent and properly disposed. All dumpsters, and related containers for the use of proper disposal are the responsibility of the Successful Proponent. Removal of rubbish and debris shall be performed daily. |  |  |
|  | Any damage to SJT property or equipment due to the mistake or negligence of the Successful Proponent during installation shall be corrected at the Successful Proponent’s expense. |  |  |
|  | SJT reserves the right to suspend installation upon significant failures during testing. |  |  |

## Training

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall complete all documentation and training before equipment installation. |  |  |
|  | The Successful Proponent shall provide training courses for at least the following: |  |  |
| 1. Management and supervisory staff; |  |  |
| 1. Equipment installers/maintainers; |  |  |
| 1. Trainers for operators; |  |  |
| 1. Users of the fixed-route CAD/AVL software; |  |  |
| 1. Users of any supplemental software provided; |  |  |
| 1. Service planning staff; |  |  |
| 1. Customer service staff; and |  |  |
| 1. Data management and IT staff/systems administrators |  |  |
|  | Training sessions shall be held in-person at SJT facilities. |  |  |
|  | The Successful Proponent shall record the training lessons that will be made available to SJT for use in future training of new staff. |  |  |
|  | The Successful Proponent will describe the necessary pre-requisite computer skills and knowledge expected for each of the training courses to develop training classes based on user skill level. |  |  |
|  | The Successful Proponent shall also provide all training materials in common electronic formats and storage media. |  |  |
|  | The training plan, including the training schedule and course outlines, shall be provided to SJT for review at least three weeks in advance of the start of training. At least the following topics must be included in the training plan for each training session: |  |  |
| 1. Course objective; |  |  |
| 1. Topics to be covered; |  |  |
| 1. Required SJT staff; |  |  |
| 1. Time required for training; |  |  |
| 1. Resources required from SJT (including staffing, room, audiovisual, and IT); |  |  |
| 1. Follow-up need (in-person or webinar); |  |  |
| 1. Prerequisites for trainees; and |  |  |
| 1. Evaluation procedure for students. |  |  |
|  | The training plan shall be approved by SJT before the start of any training. |  |  |
|  | The Successful Proponent shall furnish all special tools, equipment, training aids, and any other materials required to train course participants, for use during training courses only. SJT will provide a board room and projector that may be used for training sessions. |  |  |
|  | The instructors shall demonstrate a thorough knowledge of the material covered in the courses, familiarity with the training materials used in the courses, and the ability to effectively lead students in a classroom setting. |  |  |
|  | If any instructor is considered unsuitable by SJT, either before or during the training, the Successful Proponent shall provide a suitable replacement within five business days of receiving such notice from SJT. |  |  |
|  | Following initial in-classroom training, the Successful Proponent shall provide over the shoulder training in the dispatch office with controllers as they use the system in day to day operations for a duration of 2 weeks. |  |  |
|  | The Successful Proponent shall provide brief refresher versions of each training course to the original trainees between three to six months after system acceptance (SA) for the system at no additional cost. |  |  |
|  | The Successful Proponent shall provide additional training to the original trainees after system administrator for the system at no additional cost if major modifications are made to the system after the initial training due to system upgrades or changes made under warranty and/or system administrator occurs at least three months after the completion of training, due to delays for which the Successful Proponent is responsible. |  |  |
|  | The training course for management and supervisory staff shall provide an overview of the system and project, including but not limited to: |  |  |
| 1. A physical and operational overview of the system; |  |  |
| 1. Identification of major system, subsystems and components; |  |  |
| 1. Description of system capabilities and limitations; and |  |  |
| 1. Summary of roles and responsibilities for SJT Operations, Maintenance, Schedule, and IT departments. |  |  |
|  | The training course for equipment installers/maintainers shall provide instruction on, at minimum: |  |  |
| 1. Equipment installation procedures; |  |  |
| 1. Onboard system components overview; |  |  |
| 1. Troubleshooting procedures; and |  |  |
| 1. Equipment replacement procedures. |  |  |
|  | The training course for operator trainers shall provide instruction on, at minimum: |  |  |
| 1. Onboard system operations and relevant controller capabilities (e.g. in response to operator actions); |  |  |
| 1. Step-by-step descriptions of any required operator interaction; and |  |  |
| 1. Common problems and procedures for reporting system faults. |  |  |
|  | The training courses for software users shall provide instruction on, at minimum: |  |  |
| 1. An overview of the software; |  |  |
| 1. Description of software capabilities and limitations; and |  |  |
| 1. Common issues and troubleshooting techniques |  |  |
|  | The training course for data management and IT staff shall provide instruction on, at minimum: |  |  |
| 1. Data management; |  |  |
| 1. Configuration data management; |  |  |
| 1. Data transfer functions and procedures; |  |  |
| 1. System backup and recovery functions and procedures; |  |  |
| 1. Off-line operations; |  |  |
| 1. System interfaces; |  |  |
| 1. Troubleshooting and help procedures; |  |  |
| 1. Log management; and |  |  |
| 1. Report development, including data dictionaries required to prepare ad-hoc and custom reports. |  |  |

### Training Manuals

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | All manuals shall make extensive and appropriate use of diagrams and graphics. |  |  |
|  | The Successful Proponent shall provide maintenance manuals documenting |  |  |
| 1. How the system components were installed; |  |  |
| 1. How to install and configure spare components; and |  |  |
| 1. The schedule/procedures for preventative maintenance, inspection, fault diagnosis, component replacement and warranty administration on each system component. |  |  |
|  | The Successful Proponent shall provide user manuals for the fixed-route controllers, documenting use of all software functions. |  |  |
|  | The Successful Proponent shall provide operator manuals documenting use of the MDTs and onboard equipment. In addition, drivers shall be provided short form manual (1-2 pages) as quick reference guide during daily operations. |  |  |
|  | The Successful Proponent shall provide a systems manual, documenting |  |  |
| 1. The configuration and topology of system hardware and software; |  |  |
| 1. Central systems software functions and operations; |  |  |
| 1. Start up and shut down procedures; |  |  |
| 1. Backup and recovery procedures; |  |  |
| 1. System diagnostics and performance analysis procedures; |  |  |
| 1. Report creation capabilities and procedures; |  |  |
| 1. Scheduled maintenance required for all system components; |  |  |
| 1. Datastore structure and documentation and data dictionary for all databases; |  |  |
| 1. Disaster recovery capabilities, highlighting how the system can function and prevent any data loss in the case of a natural disaster or other unexpected events; and |  |  |
| 1. A full glossary of descriptions and context for any abbreviated data points provided by the Successful Proponent within the system. |  |  |

## Testing and Acceptance

### General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall submit an Acceptance Test Procedures document (ATP), for SJT’s approval at least three weeks before undertaking any testing. |  |  |
|  | The Successful Proponent shall submit a notice of readiness to SJT for approval, indicating that all dry run testing has been completed satisfactorily at least one week before undertaking formal testing. |  |  |
|  | The ATP shall clearly address: |  |  |
| 1. How each testable specification requirement will be demonstrated, including the method for performing the test; |  |  |
| 1. A list of supporting equipment required; |  |  |
| 1. The results that will constitute success for each test; |  |  |
| 1. Entry and exit criteria; |  |  |
| 1. Responsibilities of both Successful Proponent and SJT’s representatives during each test; and |  |  |
| 1. Which contract requirements from the Requirements Matrix each test addresses and how it addresses them. |  |  |
|  | SJT reserves the right to make the following changes to the Test Plans and/or Procedures including during test stages: |  |  |
| 1. Procedural changes, adjustments, or reasonable additions to ensure conformance with requirements; and |  |  |
| 1. Explanations from Successful Proponent staff as necessary to clarify the purpose, specific methods, functions, and/or results of tests. |  |  |
|  | The ATP shall include an updated requirements matrix indicating the test stage at which each contract requirement will be demonstrated and a cross-reference to the test procedure(s) that serve to address each contract requirement. |  |  |
|  | The ATP shall incorporate the following distinct testing stages for the proposed system: |  |  |
| 1. Factory testing; |  |  |
| 1. Mini-fleet testing; |  |  |
| 1. System acceptance testing; and |  |  |
| 1. Burn-in testing. |  |  |
|  | The Successful Proponent shall demonstrate each contract requirement during the distinct test stages unless otherwise waived by SJT. |  |  |
|  | SJT may authorize the Successful Proponent to proceed to the next testing stage with certain deficiencies not yet resolved. |  |  |
|  | The Successful Proponent shall provide written notice to SJT at least two weeks in advance of any testing, indicating the specific tests to be completed as well as the date, time, and location. |  |  |
|  | Testing shall be witnessed by SJT or SJT's representatives. |  |  |
|  | The Successful Proponent shall be required to reschedule testing if SJT’s witnessing representatives cannot be present or if other circumstances prevent testing from taking place. |  |  |
|  | The Successful Proponent shall provide written results documentation after completing each stage of testing. |  |  |
|  | The test results documentation shall include: |  |  |
| 1. Detailed equipment information including type, model number, and serial number of each component tested; |  |  |
| 1. Detailed description of test environment; |  |  |
| 1. Test results recorded on approved test report forms. For commercial off-the-shelf products, this includes stamped quality testing documents from before it leaves the factory environment; |  |  |
| 1. The Requirements Traceability Matrix listing linking each requirement proposed to be demonstrated in the test to applicable test results; |  |  |
| 1. Any additional submittals required by the equipment Item specification; and |  |  |
| 1. Documentation of all system equipment and configuration changes required to meet System Requirements following test failures. |  |  |
|  | SJT shall approve the results documentation before granting acceptance of the test stage. |  |  |
|  | The Successful Proponent shall use the requirements matrix as a “punch list” to track which requirements have not yet been demonstrated at each stage of testing. |  |  |
|  | SJT can subsequently redefine a requirement that was classified as “demonstrated” during a certain acceptance testing stage as “not demonstrated” if compliance issues emerge before system acceptance. |  |  |

### Factory Testing

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Factory testing shall be performed to ensure that the supplied and developed components meet all functional and environmental requirements and specifications. |  |  |
|  | Factory testing shall be performed at the Successful Proponent’s manufacturing or development site prior to any delivery of equipment to SJT. |  |  |
|  | The Successful Proponent shall develop a comprehensive factory testing program consisting, at a minimum, of the following individual test programs: |  |  |
| 1. Hardware test to verify the operating parameters of all equipment; |  |  |
| 1. Functional test to demonstrate that all functional and operational requirements and specifications applicable to the device/subsystem have been delivered; |  |  |
| 1. Documents supporting appropriate certifications showing environmental and electrical compliance; |  |  |
| 1. Human factors test for all devices/subsystems with a user interface; and |  |  |
| 1. Scenario or use-case testing to demonstrate end-to-end connectivity and correct processing/handling of data. |  |  |
|  | All equipment types shall be tested. A minimum of two units of each equipment type, identically configured to all other units of that same equipment type, shall be subject to factory testing unless waived by the SJT Project Manager. |  |  |
|  | Any device certifications required by regulatory agencies shall be the responsibility of the Successful Proponent. |  |  |
|  | All required certifications shall be submitted with each shipment of devices or subsystems. |  |  |
|  | Any changes to the hardware or hardware configuration shall require a factory retest. |  |  |

### Mini-Fleet Testing

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Mini-fleet testing shall be performed to ensure that the supplied and developed components meet all functional and environmental requirements and specifications in onsite use on a limited fleet of SJT vehicles and utilizing SJT's central system software. The fleetwide installation of equipment shall not commence until successful completion of mini-fleet testing. |  |  |
|  | The Successful Proponent shall complete mini-fleet testing for at least one type of each vehicle in SJT’s fleet for any onboard system. The Successful Proponent shall rectify any deficiencies observed in a four-week period following MFT before initiating system testing. (i.e. The vehicles used during MFT will be in operation for four (weeks to observe issues that arise in daily operations). |  |  |
|  | Before the commencement of mini-fleet testing, the Successful Proponent shall validate all routes in the SJT system to ensure that the geographic parameters relevant to the system operation (e.g., stop locations, route traces, and trigger zones) have been accurately configured in the system database. |  |  |

### System Testing

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | System testing can be initiated only once all of the system elements have been installed and configured and all pre-installation and installation Quality Assurance and Quality Control have been completed successfully. In addition, all deficiencies from mini-fleet testing must be rectified before system testing. The system testing looks at the entire system, and tests are completed to ensure that the overall functional requirements are met. The system testing is typically done from the central software out to each device and is also known as an end-to-end test. Where the software interfaces with other software, this interface shall be tested through the system testing for each piece of software. |  |  |
|  | Each requirement listed in the specification shall be tested. In case it may not be feasible to test certain functions in the operational environment, evidence for correct function is to be provided. |  |  |
|  | The Successful Proponent shall complete system testing after the entire system has been installed and shall rectify any deficiencies before initiating burn-in/rigorous testing. |  |  |

### Burn-in Testing

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Burn-in testing shall involve revenue service use of the system over a 30-day period after system testing is completed. Through burn-in testing, the system is tested under full operations with full scale deployment to ensure that the performance requirements are met, and to measure the system performance metrics, including reliability and availability. |  |  |
|  | System failures will be rated as significant, moderate, or minor by SJT based on operational impact. Significant system failures will result in restart of burn-in testing. Minor failures will result in suspension of the 30-day burn-in testing clock until resolved. Moderate failures may result in suspension and partial rollback of the 30-day burn-in testing clock as per SJT’s unilateral judgement (i.e. if the clock is suspended on day 15 for a moderate failure, SJT may decide to set the clock back to day 7). |  |  |
|  | The classification of a failure shall be the Successful Proponent’s responsibility, and accompanied by a justification. SJT will not be required to accept the Successful Proponent’s classification, and may, at it’s own discretion, modify the classification. In such cases, SJT will provide a justification for not accepting the Successful Proponent’s recommendation. |  |  |
|  | SJT will not grant final system acceptance until the Successful Proponent has rectified any outstanding deficiencies and formally met all contract requirements through burn-in testing. |  |  |

# System Warranty and Support

## General

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall prepare a support plan, including the support hours availability, communication approach, method of tracking tickets and software-related incidents, support team, and severity classifications and response times. The support plan shall be in conformance with any finalized SLAs under this project. |  |  |
|  | For on-site support, the support plan shall include a list of the support firms, their support responsibilities, and the response arrangements. |  |  |
|  | The support plan shall be approved by SJT as part of final system acceptance and before the initiation of the warranty period. |  |  |

## System Warranty Coverage

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The base warranty period for the system, during which the Successful Proponent shall provide ongoing technical and maintenance support, shall be through to 3 years from the date of final system acceptance. |  |  |
|  | The Successful Proponent shall offer separate and distinct options to extend the system’s warranty period in eight one-year increments, beginning from the conclusion of the base warranty period, and concluding ten years after the date of Final System Acceptance. The Successful Proponent shall document any differences in the warranty terms for these option years in their Proposal. |  |  |
|  | The Successful Proponent shall warrant that it has good title to the system and its components and the right to sell to SJT, free of any proprietary rights of any manufacturer (if the Successful Proponent is not the manufacturer) or other party, and free of any lien or encumbrance. |  |  |
|  | The Successful Proponent shall warrant that it has good title to all system software or that it has the right to license the use of such software, or both, free of any proprietary rights of any other party and free of any other lien or encumbrance. |  |  |
|  | The Successful Proponent shall warrant that SJT shall acquire permanent title to all equipment and non-proprietary software provided under the Contract, free and clear of all liens and encumbrances. |  |  |
|  | The Successful Proponent shall warrant that all installation work and all system hardware furnished by the Successful Proponent, including but not limited to all such work and system hardware provided by the Successful Proponent or other suppliers or manufacturers shall: |  |  |
| 1. Be fit for their intended purpose as a component of the overall transit management system in the SJT environment in conformity with this Contract; and |  |  |
| 1. Be new and shall be of good quality and free of any defects or faulty materials and workmanship for the warranty period. |  |  |
|  | The Successful Proponent shall warrant that the documentation provided shall completely and accurately reflect the equipment and software’s operation and maintenance and provide SJT with all information necessary to maintain the system. |  |  |
|  | If there is a change in the production configuration of any equipment or software being installed before Final System Acceptance, SJT may require that all previously installed equipment and software be upgraded to match the updated configuration. |  |  |
|  | The Successful Proponent shall warrant compliance with all applicable laws and regulations relating to the project. |  |  |
|  | The Successful Proponent shall warrant that its employees, agents, and subcontractors assigned to perform services under this contract shall have the required skill, training, and background to perform in a competent and professional manner and that all work will be so performed. SJT reserves the right to remove any subcontractors if their work is deemed incompetent or unprofessional. |  |  |
|  | During the warranty period, the Successful Proponent shall at no cost to SJT furnish such materials, labor, equipment, software, documentation, services and incidentals as are necessary to maintain the system in accordance with the warranty. |  |  |
|  | It is recognized that the original manufacturer or supplier warranties may expire before the end of the warranty period. The Successful Proponent shall therefore provide extended warranties for all such products or equipment (software, hardware, spare parts) and must assume full responsibility for replacement or repair for the duration of the warranty period, the full cost of which must be included in the contract price. |  |  |
|  | In addition to the foregoing warranties, the Successful Proponent shall assign to SJT, and SJT shall have the benefit of, any and all subcontractors', Suppliers', and Vendors' warranties and representations with respect to the deliverables provided. |  |  |
|  | In its agreements with subcontractors, Suppliers, and Vendors, the Successful Proponent shall require that such parties |  |  |
| 1. Consent to the assignment of such warranties and representations to SJT; |  |  |
| 1. Agree that such warranties and representations shall be enforceable by SJT in its own name; and |  |  |
| 1. Furnish documentation on the applicable warranties to SJT. |  |  |
|  | The Successful Proponent shall provide a single point of contact for all warranty administration during the warranty period. |  |  |
|  | Any patches, updates, and version upgrades to hardware or software, (including operating systems), shall not void CAD/AVL warranty. |  |  |

## Repair or Replacement of Faulty Components

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | For each system component or workmanship failure during the warranty period, SJT shall determine whether to correct the failure by repair or replacement of part(s) within an assembly, or by replacement of the entire assembly. |  |  |
|  | SJT shall perform removal of failed parts or assemblies and installation of spare parts or assemblies for accepted system elements under warranty with no impact on the warranty validity, unless SJT and the Successful Proponent agree to other arrangements for such work. The Successful Proponent may provide technical supervision for such removal or installation work by SJT. |  |  |
|  | The Successful Proponent shall receive removed failed parts or assemblies at a location on SJT premises to be designated, unless the Successful Proponent requests shipment of such failed parts or assemblies to its facilities; in such case, SJT will ship such failed parts or assemblies at the Successful Proponent's expense. |  |  |
|  | The Successful Proponent shall deliver to SJT a replacement or repaired part or assembly for each such returned failed part or assembly within five business days of the Successful Proponent's receipt of each failed part or assembly. |  |  |
|  | If the Successful Proponent determines through comprehensive testing that a returned component is not faulty, SJT shall receive the original component back in working order within two days of the Successful Proponent originally receiving the returned component. |  |  |
|  | Repaired, replaced, or returned components shall be packaged, organized and labeled in the same manner as the original supply of spare components. |  |  |
|  | All components received back at SJT from the Successful Proponent will be tested in accordance with the original ATP and shall be returned to the Successful Proponent if faulty accompanied by a certification. |  |  |
|  | In the event that a failed onboard part or assembly is manufactured to order only and cannot be repaired or replaced within the five business day period, the Successful Proponent and SJT mutually shall consider whether the defective unit is to be repaired or replaced. The decision as to which alternative will be used shall be based on minimizing down time of the system, and the Successful Proponent shall return the repaired or replaced unit at the earliest possible date. |  |  |
|  | The Successful Proponent shall provide during the warranty period the latest compatible version of the failed part/hardware with the latest firmware. |  |  |
|  | The Successful Proponent shall retain full responsibility for replaced or repaired parts or assemblies throughout the duration of the warranty coverage period for all parts and assemblies replaced by SJT. |  |  |
|  | Any materials, parts or components used for replacement under the initial warranty period shall be warranted again, such that the new warranty period shall begin upon date of replacement as recorded in SJT’s system maintenance records, and be of the same duration as the original warranty period (i.e. 3 years from replacement if the original warranty period was 3 years), regardless of the timeframe of the failure. In the case of components that are replaced pursuant to a modification program but have not yet failed, the new warranty period shall be computed from the date of SJT notification to the Successful Proponent of a requirement for the particular modification program. |  |  |

## Systemic Failures

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | Systemic failures shall be defined as the occurrence of component failures in excess of 5% during the warranty period |  |  |
|  | In the event of systemic failures during the warranty period, the Successful Proponent shall at their expense, within 30 days of notification of such instance, commence a modification program to repair or replace all such components, including those that have passed beyond the warranty period, to correct the cause(s) of such failures. The design of the repair or replacement for the component(s) involved in each such modification program shall be developed by the Successful Proponent to remedy the nature and probable cause of the component failures and shall be approved by SJT. |  |  |
|  | Repair and/or replacement of components pursuant to a modification program shall be according to the same provisions herein as if such components were failed components requiring warranty repair and/or replacement, whether or not actual failures for some or most of the involved components have occurred following notification of a requirement for a modification program. |  |  |
|  | Even if the systemic failure replacement activity extends beyond the end of the two -year warranty period, the Successful Proponent shall be obligated to complete it if the need was documented before the end of the warranty period. |  |  |
|  | The Successful Proponent shall warrant replacement of parts or assemblies due to systemic failures for 3 years from replacement. Warranty terms and conditions shall be the same as for the original system warranty. |  |  |

## Spare Components

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall propose for consideration a list of spare parts to be provided. This list shall include replacement parts, components or sub-assemblies for all items of equipment provided, in sufficient quantities to meet the estimated need for warranty and maintenance purposes for a period of 3 years, this shall include a minimum of 10% of the installed quantity for each component (with a minimum quantity of 1). The Spare Parts List shall include complete sets of all necessary replacement parts. |  |  |
|  | The spare parts list shall contain a set of all specialized tools and equipment necessary to install, calibrate, test and maintain the system. All wiring, cabling and adapters shall also be provided. Each item on the spare parts list shall include all ancillary components (e.g., cables, hardware) needed to complete a rapid onboard replacement for the component. |  |  |
|  | The Successful Proponent shall provide spare parts in accordance with the agreed spare parts list, the full cost of which shall be included in the contract price. |  |  |
|  | The spare parts shall be placed into the spare parts inventory and become the property of SJT upon handover. |  |  |
|  | SJT shall receive replacement spares within 7 calendar days of notice of shipment of the defective part to the Successful Proponent. |  |  |
|  | SJT shall have the option to purchase additional spare components at the proposed price at any time within the warranty period. Additional purchased spares shall be received within 7 calendar days of order. |  |  |

## Software Updates

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | All software and software updates provided by the Successful Proponent shall be covered by the Warranty. |  |  |
|  | The Successful Proponent shall supply compatible software versions across the fleet over the term of this contract including the warranty. |  |  |
|  | As part of system support, the Successful Proponent shall update all applicable software with the then-current software version at no additional cost to SJT. |  |  |
|  | The Successful Proponent shall provide training to SJT users for changes to the system associated with software updates. |  |  |
|  | The Successful Proponent shall notify SJT at least two weeks in advance of the installation when new software releases become available. |  |  |
|  | The Successful Proponent shall notify SJT at least twelve months in advance when it is expected that the current releases and related systems will no longer be supported. |  |  |
|  | The Successful Proponent shall coordinate and request SJT approval for the implementation of any maintenance activities, including patches or software upgrade. |  |  |
|  | The Successful Proponent shall conduct all software maintenance activities as per a defined protocol approved by SJT. The protocol shall be documented in the Maintenance and Operations Support Plan and shall indicate: |  |  |
| 1. Communications before, during, and upon completion of planned activities; |  |  |
| 1. Template of communications prior to planned activity, including:    1. Expected timing of start and completion of activity (including expected downtime);    2. Anticipated impact(s) of activity on system and ongoing operations; |  |  |
| 1. Template of communications during or after planned activity, including    1. Mitigation plan and associated updates, (if applicable in case of unsuccessful completion of activity).    2. Notice of successful completion of activity, (in case of successful completion of activity) |  |  |
|  | SJT shall be notified at least 48 hours prior to any scheduled system downtime (or alternative time period per approved maintenance protocol) required for any software maintenance activities, with SJT approval required to proceed with the planned activities. |  |  |
|  | The Successful Proponent shall ensure that all existing and previous software configurations are protected (through configuration backups or data archives) after the system has been upgraded or updated for the entire duration of the time when SJT uses the product. |  |  |

## Technical Support

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide, license, install, and integrate all released software patches and updates for the proposed solution and provide technical support during the warranty period, including technical support for all proposed hardware and software and a 24/7 support line. |  |  |
|  | The Successful Proponent shall, in collaboration with SJT, enable the ability for the Successful Proponent to access the central software remotely, using a VPN connection approved by SJT (or an approved alternate secured remote access method). |  |  |
|  | All system components shall be supported under a Service Level Agreement (SLA). |  |  |
|  | The Successful Proponent shall present a proposed SLA for SJT consideration. The final SLA shall be negotiated between SJT and the Successful Proponent based on SJT needs. The proposed SLA shall describe the following: |  |  |
| 1. Description and scope of service provided, clearly defining:    1. Coverage;    2. Restrictions;    3. Exclusions; and |  |  |
| 1. System monitoring services provided by the Successful Proponent (e.g. monitored parameters, automatic or manual monitoring, system security services);    1. Service standards, including:    2. Service request categories and priority levels;    3. Average and maximum service request response times for on-site and remote requests at each priority level;    4. Response protocols such as channels and documentation; and |  |  |
| 1. Expected SJT responsibilities. |  |  |
|  | The Successful Proponent shall arrange for support from one or more qualified firms to be available on-site according to the SLA when SJT needs help with fault diagnosis or component replacement. |  |  |
|  | If a support firm does not respond within the agreed response timeframe, or when a support firm is not able to provide the needed support, the Successful Proponent shall provide during the warranty period supplementary support in accordance with an agreed escalation procedure. The escalation procedure can initially involve telephone support but must culminate in the Successful Proponent providing on-site support, if needed. The Support Plan must define the proposed support escalation procedures. |  |  |
|  | The Successful Proponent shall provide an online issue reporting and tracking system for SJT users to input support requests. SJT shall be able to view the status of all support request(s) at any time through the online tracking system. |  |  |
|  | The Successful Proponent shall provide a reliable method for telephone problem notification. Maintenance issues should be resolved in a timely manner, as agreed to per the SJT-approved maintenance plans. |  |  |
|  | The Successful Proponent shall designate a specific Technical Support contact person (e.g., an account manager) to handle all SJT reported issues. This contact person should be the first point of contact for the SJT to report all new issues and to follow up on previously reported issues and shall be available during normal SJT service operating hours. |  |  |
|  | The Successful Proponent shall notify SJT of the availability of enhancements, releases, and newer versions of the software (including third party software), including all bug fixes, patches, and modifications. The Successful Proponent shall conduct all testing to ensure the enhancements or upgrades do not impact the system, and shall consult with the SJT concerning the advisability of incorporating such enhancements and newer versions and shall provide supporting materials. |  |  |
|  | The Successful Proponent shall only implement the enhancements upon SJT’s approval. On SJT's request, significant enhancements, new releases, or new versions shall first be implemented on the test server, and then on the production server once SJT staff have tested the updated version on the test server. This testing will be in addition to testing the Successful Proponent will conduct. Following installation of the enhancement, new release, or new version on the production system, the Successful Proponent shall be responsible for ensuring system availability. |  |  |

## Follow-Up Analysis

| REQ. ID | REQUIREMENT TEXT | COMPLIANCE (F – CM – N) | PROPOSED MODIFIED REQUIREMENT (FOR CM ONLY) |
| --- | --- | --- | --- |
|  | The Successful Proponent shall provide on-site follow-up analysis, including a written report on this analysis’ findings and about how SJT is using the system. The Successful Proponent shall provide training to address the identified issues. The Successful Proponent shall conduct this follow-up analysis every six months under the warranty period and conduct the first visit six months after SJT accepts the system. The follow-up analysis report shall categorize discovered issues into the following categories: |  |  |
| 1. Issues due to lack of training; |  |  |
| 1. Issues that require configuration changes; |  |  |
| 1. Issues that require system enhancements, such as upgrading to the system's more recent version can address; |  |  |
| 1. Issues that require system enhancements and will require additional development for the Successful Proponent. |  |  |

Appendix A: Fleet List

Table : Full Fleet List

| BUS NUMBER | BUS TYPE | SIGN TYPE | CONNECTION TYPE | LAST UPDATE |
| --- | --- | --- | --- | --- |
| 38899 | NOVA | MCU | USB | OCT 1,2022 |
| 38898 | NOVA | MCU | USB | OCT 1,2022 |
| 38897 | NOVA | MCU | USB | OCT 1,2022 |
| 38896 | NOVA | MCU | USB | OCT 1,2022 |
| 38895 | NOVA | MCU | USB | OCT 1,2022 |
| 38894 | NOVA | MCU | USB | OCT 1,2022 |
| 38893 | NOVA | MCU | USB | OCT 1,2022 |
| 38892 | NOVA | MCU | USB | OCT 1,2022 |
| 38891 | NOVA | MCU | USB | OCT 1,2022 |
| 38890 | NOVA | MCU | USB | OCT 1,2022 |
| 38889 | NOVA | MCU | USB | OCT 1,2022 |
| 38888 | NOVA | MCU | USB | OCT 1,2022 |
| 40687 | NOVA | MCU | USB | OCT 1,2022 |
| 40586 | NOVA | MCU | USB | OCT 1,2022 |
| 40585 | NOVA | MCU | USB | OCT 1,2022 |
| 44284 | ORION | AXION | USB | OCT 1,2022 |
| 44283 | ORION | AXION | USB | OCT 1,2022 |
| 44982 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 44981 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 44980 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 44877 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 44876 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 44875 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 44874 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43773 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43772 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43771 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43770 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43769 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43768 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43767 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43766 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43765 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43764 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43763 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43662 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43661 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43660 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| 43559 | ORION | MARK 1V | DATA CARD | OCT 7,2022 |
| - | KARSAN | POLARIS | USB | - |
| - | BYD | I/O CONTROLS | USB | AUG-22 |