STAFF REPORT

MEETING DATE:	**10/14/14**
SUBJECT:	**Accept the Transit Technology Plan**
AGENDA ITEM:	**5-10**
STAFF CONTACT:	**Jennifer Pollom, Associate Transportation Planner**

STAFF RECOMMENDATION:
It is recommended that the board of directors accept the Transit Technology Plan.

DISCUSSION:
The board of directors approved a contract with IBI Group in May 2014 to investigate the potential of transit technology to improve transit data collection and the delivery of public transit services. The attached Transit Technology Plan (Plan) summarizes Redding Area Bus Authority's (RABA) current use of technology and prospective new technologies, including costs and practical benefits.

The recommended projects are:

- **Smart bus system** – Integrates information from automated vehicle locators with onboard computers, audible service announcements, and message signs located inside the bus;
- **Integrated electronic fare boxes** – Accommodates pre-paid fare cards to simplify fare collection and provide accurate and detailed ridership data, including boarding locations, time of day, and fare type;
- **Automatic passenger counters** – Consistently and accurately records passenger boarding and alighting;
- **Advanced traveler information systems** – Provides real-time transit information via phone, web, mobile devices, and kiosks; and
- **Traffic signal priority/preemption** – Facilitates on-time arrivals and coordinated transfers.

ALTERNATIVES:
The board of directors may delay acceptance of the final plan to request additional information.

OTHER AGENCY INVOLVEMENT:
The Plan was developed in partnership with RABA with participation from the Consolidated Transportation Services Agency (Shasta Senior Nutrition Programs) and the Social Services Transportation Advisory Council. RABA staff will be presenting the Plan at their next regularly scheduled board meeting on October 20, 2014. The Technical Advisory Committee concurs with the staff recommendation.

FINANCING:
The Plan, along with a concurrent study for coordination of transit services, was financed with $34,080 in Federal Transit Administration Section 5303 funding programmed in the FY 2013/14 Overall Work Program under Work Element 706.02. Pending acceptance by the board of directors, SRTA and RABA will utilize the Plan to guide future investments in transit technology.

Daniel S. Little, AICP, Executive Director

Attachments: Transit Technology Plan

Shasta Regional Transportation Agency

TRANSIT TECHNOLOGY PLAN

SEPTEMBER 2014

IBI GROUP

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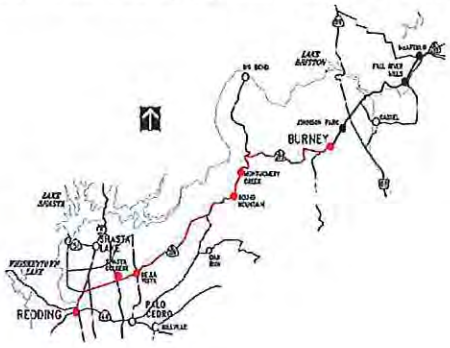
1. INTRODUCTION

The Shasta Regional Transportation Agency (SRTA) retained IBI Group to prepare a transit technology plan to address current and future transit technology needs of the Redding Area Bus Authority (RABA).

The SRTA is the Metropolitan Planning Organization (MPO) and the Regional Transportation Planning Agency (RTPA) for Shasta County.

The primary public transportation provider in Shasta County is RABA. RABA provides fixed-route and complementary paratransit service in the urbanized area and some unincorporated areas of Shasta County. The operation and service delivery of fixed-route and complementary paratransit is contracted to Veolia Transportation. Fixed-route and complementary paratransit service is not available outside of the urban boundary. Many social service and non-profit agencies transport clients to and/or from services or programs they offer. These agencies, in coordination with transit agencies and private transportation providers, make up the landscape of special needs transportation.

Senior and disabled over age 18 transportation services are provided by Shasta Senior Nutrition Programs, which is the designated Consolidated Transportation Services Agency (CTSA) for Shasta County. The CTSA is eligible for up to 5% of Local Transportation Fund revenue. The County contracts with SSNP to provide County Lifeline transit service to persons with disabilities living outside of the RABA service area.



The MPO has prepared a "Need a Ride?" brochure, which identifies transportation providers within the County. Trip planning is available through Google Maps/Transit.

Under contract with Shasta County, RABA operates the Burney Express, an express route service between the community of Burney and Redding.

RABA fixed route service consists of ten local routes and three express routes. The local routes operate 13 to 14 service hours per day, Monday to Friday, starting at either 6:00, 6:30, or 7:00 am. Saturday service commences three hours later than the Monday to Friday RABA time, but ends at the same times. There is no Sunday service.

RABA's complementary paratransit transportation service provides curb-to-curb transportation for individuals with a disability that are not able to use an accessible fixed-route bus service. RABA's complementary paratransit service provides Americans with Disability Act (ADA) Paratransit service. The service area provision for ADA service is limited to ¾ mile from fixed route service. Service is provided during the same operating hours as fixed route services Monday to Saturday.

This paper responds to SRTA's need to evaluate technological applications that would enhance public transit services and provide better performance and ridership data and improve customer service. An ancillary consideration is that of addressing opportunities for ITS applications within a CTSA environment.

The Transit Technology Plan will act as a roadmap to let RABA and their contractor (Veolia Transportation) deploy transit technologies in a systematic way that will help it achieve prescribed objectives.

In recent years there have been significant advances of Intelligent Transportation System (ITS) applications for transit and paratransit, including community-based transit services. Transit ITS can provide a positive benefit-cost ratio through improved productivity, data management and reporting, reduction on staff workload, and specific paratransit operations: reduced no-shows; better managed bookings and cancellations (including the ability to do trip insertions); and route optimization. These latter points are currently addressed within the StrataGen application.

This paper profiles the existing transit ITS environment (Section 2); provides a primer (background) on transit ITS elements (Section 3); and User Needs – Operations and Service Delivery, Service Planning and Customer Service, and Administration (Section 4). Considering the set of technologies that provide the best overall investment, as well as improved transit efficiencies, reduced workload, and increased level of service to passengers, *A Way Forward*, including recommended projects, is presented in Section 5. Consideration of opportunities for transit ITS applications within a Consolidated Transportation Services Agency (CTSA) framework are also discussed in Section 5.

2. EXISTING CONDITIONS

The current transit ITS environment is relatively lean with many processes being done manually. RABA (staff from the City of Redding's Public Works Department) administers the operating contract with Veolia Transportation. The former has basic management tools in place for contract administration – monitoring performance and service planning. Veolia is responsible for operations and service delivery.

RABA's current fleet consists of 16 conventional transit buses and 20 complementary paratransit purpose-built buses.

2.1 Fixed-Route Transit Services

Fixed-route transit scheduling and run-cutting (building of runs) is done remotely by Veolia Transportation/corporate and transferred electronically to the Redding site.

Other observations/functionalities are addressed as follows:

- Each bus is equipped with on-board camera equipment to enhance the overall safety and security of both customers and bus operators. *SmartDrive* and *Apollo Video Technology* products are used on each bus.

- GFI (GENFARE) CENTSaBILL electronic registering fareboxes are used for bus fare collection. Staff report that the data generated is problematic in terms of generating reports (boardings by fare type, by route and stop). Staff further report that the accuracy and consistency of data is suspect[1]. The GFI units are 8 or 9 years old and targeted to be replaced.
- Stop annunciation – currently operators call-out stops.
- Vehicle maintenance including preventative maintenance schedules are tracked with an in-house software application. There are no plans to update or replace this application.
- *Google Transit* is available for trip planning purposes.

- *Luminator Bus* displays (destination signs) are currently being phased out. *Hanover Displays* destination signs have been installed on five buses. It is anticipated that the remaining fleet will be equipped with the Hanover product.
- Transit supervisors providing for on-road monitoring and problem resolution, are equipped with tablets – providing for the tracking of vehicle schedules and reporting. These tablets do not have cellular capability.
- The Downtown Transit Center is staffed, providing for customer service/information and monitoring of passenger behavior/security. Schedule information is posted. No automated or real-time schedule information is provided.

2.2 Complementary Paratransit Services

Veolia uses *StrataGen Adept* (version 6.1) scheduling software. Within the StrataGen application, Veolia is able to maintain a comprehensive client database; record reservations; generate batch schedules (advanced booked and regular/subscription trip bookings) utilizing the StrataGen scheduling algorithm; undertake trip management/dispatch functions; and generate standard management reports.

- DDS Digital Dispatch mobile data terminals (MDTs) have been installed on twenty vehicles. Each complementary paratransit bus is equipped with automatic vehicle locating (AVLs) capability providing for the tracking of real-time vehicle location.

StrataGen's *Manage My Trips* (MMT) (a web-based application designed to let riders view, cancel, and schedule their own trips online) has yet to go live and is waiting on the resolution of identified problems.

[1] Staff suggests that inconsistencies in driver procedures may also be an issue in the validity of data being generated.

2.3 Opportunities

In discussions with RABA and Veolia officials and the recognition of the limited application of technology in the respective operations, there is an opportunity to upgrade and/or automate several key functional elements including:

- Automatic vehicle locating (AVLs) capability on the fixed-route transit busses
- Digital communication (MDTs);
- Announcements and message signs;
- Transit passenger and fare management (fare collection technologies);
- Automatic Passenger Counting (APCs) providing for more detailed service monitoring (and subsequently assist in planning and reporting capabilities) at the bus trip and bus stop level;
- Transit maintenance – on-board diagnostics;
- Improved customer service/information including real-time vehicle arrival/departure information; etc.

3. BACKGROUND ON TRANSIT ITS TECHNOLOGIES

A broad range of transit technologies that are mature and available, and could potentially be relevant for RABA, are discussed briefly in the following paragraphs.

3.1 Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) System

CAD/AVL technology forms an integral part of ITS, as deployed at many transit agencies. CAD/AVL provides the central functionality and on-board logic/data storage, to support many "smart bus" technologies, while also offering agencies significant operational and planning/scheduling benefits. Based on these factors, CAD/AVL often rises to the top of the priority list.

While Automatic Vehicle Location (AVL) is used to identify where buses are at any given point in time, computerized fixed route scheduling systems are needed to identify where buses are supposed to be. There will need to be an electronic database in place at RABA (or their contractor) capable of interfacing with a CAD/AVL system. In addition, this information will be needed in the transit technology system to support technologies such as Automatic Vehicle Announcement (AVA) and Automatic Passenger Counters (APC).

Mobile Data Terminals (MDTs) and On-Board Computers (OBCs) are the core of the on-board information and communication systems, serving as the information link between control centers and vehicles. CAD/AVL solutions can be integrated with a whole host of other transit technologies including integrated Automatic Vehicle Monitoring (AVM), APC, and Onboard Video Monitoring (OVM), as well as integration with existing vehicle components such as fareboxes, AVA, and headsigns. The OBC provides the core AVL capability using an integral GPS receiver, and also manages and is integrated with the other on-board technologies. This allows OBCs to automatically

send information collected by these systems from the vehicle to the control center such as vehicle location, passenger counts, engine performance and mileage.

MDTs are the driver interface for the OBC, which serves as the "nerve center" for the onboard technology. OBCs relay current status information to dispatch such as location, operator, block, route, trip, and schedule adherence. MDTs also display short text messages from dispatch including typical "canned" messages and free-form text messages, and allow canned text messages to be sent from the bus operator back to dispatch. Mechanisms can be designed into the system, if desired, to limit which features the driver can access while driving. This offers the benefit of replacing much routine voice radio communications, leaving voice for atypical or emergency events. This reduces the load on the voice radio communications network and the associated audio clutter, while also avoiding costs for voice radio capacity.

CAD/AVL functionality is a potentially important part of the solution because it will allow operating personnel to know where buses are at any given time. Dispatchers will be able to monitor bus locations in real-time without the need for voice radio communications to request the location from the operator, and can then intervene as necessary to keep fixed route buses on schedule and evenly spaced. CAD/AVL also accumulates substantial data on operations that can become available for reporting.

It is also important to recognize that there are different tiers of CAD/AVL vendor solutions, with vastly different functions and different levels of associated implementation costs. The major CAD/AVL vendors offer robust and extremely feature rich solutions, while "second tier" CAD/AVL vendors offer significantly more affordable solutions, which still provide the fundamental CAD/AVL functionality that agencies require. These solutions can be procured separately from a variety of vendors, or as an 'integrated' solution from a single vendor. The "right solution" will balance a system that supports future expansion and long term operational desires with budgetary requirements, and will maximize the use of functionality to provide operational value to RABA throughout its lifetime.

3.2 Automatic Vehicle Announcement (AVA) System

AVA systems allow transit agencies to fulfill requirements of the Americans with Disabilities Act (ADA) of 1990, which include notification of the bus route, stops, transfer points and major intersections to passengers with cognitive, visual and auditory disabilities, achieving the consistency that comes with relieving the bus operator from this responsibility.

AVA systems typically consist of LED signs and speakers inside and outside of the vehicle (the exterior LED often is already in place in the form of the headsign). The interior signs and speakers provide announcements of the next stop, transfer point and major intersections to onboard passengers. The exterior signs and speakers announce the route and destination of the vehicle to boarding passengers. The speaker system may incorporate means to capture ambient noise levels and adjust the announcement volume automatically. This ensures that for exterior announcements the announcement is audible when the bus is stopped at a busy intersection, but does not disturb the peace of a quiet street late at night.

Many AVA systems also provide the "stop requested" audible and visual notification and can also be used to provide public service announcements. The AVA system can also be used to present agency messages, such as "See Something, Say Something", in a manner that does not conflict with core next stop announcements function.

To be robust, an AVA system needs to be highly integrated with the CAD/AVL system. For example, to ensure that the correct stop is being announced, an AVA system needs to detect if a vehicle has gone off route. If this occurs, the AVA system should suspend announcements until the vehicle returns to the scheduled route.

The AVA system also needs to be tightly integrated with the scheduling software so that updates to the schedule are reflected in the announcements as soon as the new schedule comes into effect.

3.3 Communication System Enhancements

High quality, reliable voice communication between drivers and dispatch is essential to operating a public transit system. Emergencies, vehicle problems, re-routing and other information must be communicated in real time. For CAD/AVL applications, a reliable wireless data link is also required, with frequently transmitting GPS coordinates the minimum. Modern CAD/AVL systems typically need to transmit much more data. In short, deploying transit technology depends on the communications system to move voice and data between the buses operating throughout the service area; bus stations, stops and other remote facilities, and the control/dispatch center. The objective will be to establish a communications system that can support the voice and data traffic that will be driven by transit services and the transit technologies that will be deployed.

Evaluation of radio system capacity: Many transit ITS technologies rely on wireless communications for data exchange. These technologies can include CAD/AVL, Traveler Information, APC and Traffic Signal Priority/Preemption (TSP). To assess whether a communications system alternative has the ability to support the technologies, both the available network capacity and the total expected demand must be understood.

3.4 Real-Time Traveler Information

The ability to provide accurate real-time transit traveler information to transit customers is one of the most powerful and visible benefits of transit technology investments. Transit traveler information directly impacts the quality of the transit customer experience by reducing uncertainty, supporting itinerary planning, and feeding useful information to customers during service delays and emergencies.

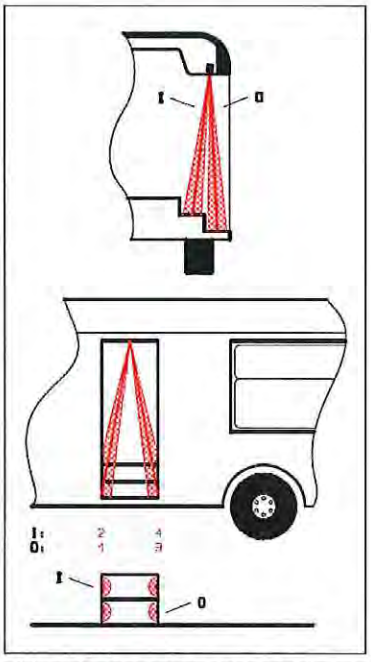
Transit traveler information systems typically are supported by an underlying systems infrastructure that provides schedule information; route and stop location data, vehicle position, and service "awareness" (e.g. service disruptions due to vehicle breakdowns or weather conditions). The level of accuracy and sophistication of the information that can be provided is contingent on these underlying tools. For example, scheduled bus arrival information can be provided from a scheduling software package directly, but real-time position and schedule adherence data requires the added intelligence of a CAD/AVL system.

Commercially available CAD/AVL products offer additional modules to develop arrival predictions, and to distribute this data to customers for web/telephone access and via variable LED/LCD text displays at selected stops. Additionally, there is a current proliferation of emerging tools and services offering transit traveler information in new and innovative ways. One example is *Google Transit*, for which the required data table format can now be automatically created and updated by the entire major fixed route scheduling software products. Stop-level arrival predictions data and other real-time data such as locations can be also published via data feeds that enable the development of additional traveler information distribution methods independently from the original CAD/AVL system vendor (either in-house, through a third party vendor, or by simply publishing the feed for open use by the vibrant community of "app" developers for mobile personal devices). The technological landscape in this area is advancing rapidly and it is essential to maintain close attention to current industry trends.

3.5 Traffic Signal Priority/Preemption (TSP)

Within the City's Public Works Department, RABA may be able to make arrangements for transit vehicles to receive priority access to green at selected traffic signals. This involves equipping both the vehicles and intersections with devices to allow priority to be provided on a negotiated basis. By integrating the onboard device with an onboard computer that monitors schedule adherence status and location, the vehicle can request priority at the appropriate location on the approach to the intersection and only when needed based on running late. Alternatively, approaches are available that involve implementing TSP using a direct backend linkage between the CAD/AVL system and a traffic signal control system.

3.6 Automatic Passenger Counters (APC)



APCs record passenger boarding and alighting activity at each stop along a route. The benefits of APCs are a reduced cost to collect ridership information and an increase in the consistency and comprehensiveness of the information gathered.

An effective APC installation can provide a wealth of highly useful data on passenger activity at the stop, segment and trip level for planning and scheduling. Stop level passenger activity data can be used to plan route changes and street hardware investments at bus stops. Furthermore, vehicle loading data is useful to monitor passenger volumes and adjust service levels. APCs also do away with the requirement for onboard ride checks.

The most common APC technology currently used by North American transit systems utilizes infrared beams projected in a vertical or horizontal orientation to count passengers. Horizontal beam technology has proven more reliable than treadle mats installed in bus stairwells, and generally is less expensive than vertical beam systems. The horizontal beam units, however, are susceptible to being knocked out of alignment by passengers on occasion and can be more susceptible to error with wider doorways. Vertical orientation units can be both more accurate and protected, although these often need more extensive calibration.

APC systems can be installed either as a stand-alone system or as a component of an integrated CAD/AVL/APC system. A stand-alone system requires more post-processing of the raw data, but

also allows greater flexibility in choosing an APC vendor (i.e., in a CAD/AVL procurement, the agency often has limited influence on the APC vendor to be used). An integrated system avoids much of the post-processing and simplifies data transfer from the vehicle to the RABA/Veolia data repository.

3.7 Automatic Vehicle Monitoring (AVM)

AVM continuously monitors conditions of the transit vehicle components by interfacing with the built-in computers for various vehicle systems and components (e.g., engine, transmission, air conditioning). Data collected includes the amount of time that the engine has been running, fuel and other fluid levels, engine temperature, pressure, and voltages. The system can also monitor mechanical components such as brakes, electrical, and heating, ventilation, and air conditioning and check for out of tolerance readings.

The collected monitoring data is assessed and filtered by the ITS onboard computer, to be either transmitted in real-time to the control center using the radio data communications network, or stored for uploading when the vehicle returns to the garage. The driver, dispatcher, or maintenance can be alerted in real-time for particular out of tolerance readings or component failures.

Key information collected from the engine such as engine running times are critical for ongoing maintenance and repair. The data can also be used to support trend analysis for condition-based maintenance and to establish proactive replacement intervals for parts to minimize road calls. When connected to the CAD/AVL system the AVM system can be used identify and schedule preventive maintenance for vehicles that are in need of repair or are underperforming.

3.8 Onboard Public Internet Access

Buses can be equipped with a ruggedized mobile access point router that allows a variety of onboard equipment to share a single cellular data modem. In addition, this device can incorporate a WLAN access point that also uses this cellular data link to provide onboard public wireless internet access. Recently, the popularity of public onboard internet access has been increasing even for shorter routes as a result of the increasing number of mobile personal devices that can quickly access a public WLAN access point.

3.9 Farebox And Headsign Integration

Existing onboard equipment such as fareboxes and headsigns can be linked to the on-board computer (OBC) to enhance performance and data, and reduce operator workload.

An integrated farebox or headsign can automatically receive log-in data based on the operator login to the MDT. Similarly, diagnostic alarms generated by any integrated devices can be sent to the central system in real-time by the OBC and updated

firmware received by the OBC can be installed for these devices (as well as configuration data such as farebox and new sets of headsign messages). Rather than the operator needing to manually press a button on the headsign or farebox controller at the end of each trip, this can be automatically signaled to each device by the OBC. Farebox transactional database entries can be tagged with the current location from the OBC.

3.10 Paratransit Scheduling And Dispatch Management Software

Paratransit software has been used since the mid-1970s and its capabilities have improved dramatically in the past 10-15 years. The potential benefits resulting from the combination of CAD/AVL with advanced paratransit scheduling software are considerable. Most commercially available packages[2], are designed to interface with MDTs/MDCs sold by multiple vendors. These systems typically are designed as a series of modules briefly described as follows:

- AVL/MDC Communications Module provides ability to pinpoint current and past vehicle locations via GPS coordinates;
- Supports MDC functions enabling paratransit drivers to log on at the beginning of a shift, send/receive trip information for a single trip or the vehicle's complete daily run, ongoing status changes for a trip pickup, drop-off, no-show or cancellation; and
- Transmit static or free form text messages and emergency alarm messages.

Fixed Route Interface Module works with fixed route bus stop location data and verifies customer eligibility for service based on the ¾-mile ADA criterion. It accepts fixed route files in defined formats and supports graphic display of fixed routes and bus stops overlaying the requested trip, as well as ADA service boundaries and descriptive text.

Intermodal Trip Planning Module automatically builds optimal trip itineraries based on a client's ability to ride the fixed route system. It considers multiple modes, routes, service schedules, and fare structures by time of day and day of week. Efficiency gains are facilitated by suggesting multiple combinations of fixed route and complementary paratransit services that meet the travel constraints of persons with disabilities.

Web Client and Interactive Voice Response (IVR) Modules enable customers to receive password-protected access to their recent trip history via the Internet or telephone to review or cancel pending reservations. They also allow customers to request a reservation and receive confirmation of such by email or automated call-back.

Dispatcher Alert Module automatically receives location reports from vehicles in revenue service to provide dispatchers with current information on vehicles that are delayed, have slack time or may be speeding. It also estimates pick-up times for trips remaining in the vehicle itinerary and flags these if they fall outside the promised pick-up and drop-off windows. Dispatcher alert includes built-in mapping to display the current route selected, pick-up points along that route, closest vehicles, and more.

[2] Veolia uses StrataGen scheduling software.

3.11 Revenue Systems Enhancements

Modern farebox systems offer features including cash validation, transactional database, smart card reader integration, as well as related systems for secure farebox data collection, secure cash collection, and revenue data reporting/analysis. Smart card systems include not only the onboard reader (integrated with the farebox or as a stand beside model) but also a smart card issuance/revaluing infrastructure, and central system account management software.

3.12 Security/Surveillance Systems

Transit security and surveillance (video and audio) systems have proliferated in recent years due to a variety of factors, including:

- Perception (and reality) of improved passenger and operator safety;
- Risks of terrorism or other security threats;
- Deterrent effect against criminal activity, including vandalism and assault;
- Investigation of customer/criminal complaints;
- Reduction of frivolous tort claims and therefore agency liability insurance premiums; and
- Operator training purposes.

The declining cost and increased quality of surveillance systems has also spurred increased implementation in the transit industry. In most existing installations, facility and onboard security and surveillance systems function independently of one another and of many other transit technology systems. However in recent years there has been an increased convergence of systems technology as well as increased functionality to identify ("flag") and retrieve video information.

Several key features of surveillance systems on the marketplace today include: metadata-encoded video and audio files (incorporating into the video frames, based on integrating the Digital Video Recorder DVR with other onboard equipment, the GPS coordinates, brake status and other J1939 vehicle inputs, etc.), map-based user interfaces, accelerometer (G-Force) sensor automated event flagging, remote event flagging, remote video retrieval, automated system failure notifications, and other ease of use features.

One of the most significant developments is new methods to access video beyond the more established approach to 'pull' the video hard drives from the onboard DVR. When a vehicle pulls in to the garage, flagged video segments can be set to automatically upload via an 802.11 WLAN. The DVR can also be set to serve as a WLAN access point so that an authorized adjacent vehicle can access stored or live streaming video (e.g., emergency response vehicle in a hostage situation). With a suitable wide area broadband mobile data network (e.g., cellular data, WiMax[3], LTE[4]), central software can access on demand streaming vehicle from vehicles in operation.

[3] Worldwide Interoperability for Microwave Access is a wireless communications standard designed to provide 30 to 40 megabit-per-second data rates

[4] LTE, (Long Term Evolution), commonly marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals.

3.13 Business Intelligence

Data from the numerous disparate databases of the various central software applications (in addition to the reporting capabilities provided by each individual software application) can be combined for various types of powerful combined analysis and presentation. One such Business Intelligence approach is the concept of a data warehouse, where selected data from multiple systems is imported frequently into a central repository to enable reporting on cross-cutting data. Another such approach is the use of "dashboards," which provides charts to users such as management that present real-time combined data in a manner that helps enable the proactive identification and response to issues as they emerge. Business Intelligence applications can be quite powerful ways to access, analyze, and report on data – in particular for making connections between data from multiple sources.

3.14 Electronic Pre-Trip And Post-Trip Vehicle Inspection System

A range of potential solutions are available in this area of functionality. A basic system would simply use the MDT to present a form to the driver before pullout and/or after pull-in. The form would present a series of questions for which the driver would be required to select pass, fail or skip. The data from these forms would be collected from the vehicles and passed to maintenance. Such systems have been quite commonly deployed as an integral element of the onboard CAD/AVL, OBC and MDT systems.

4. FIXED-ROUTE & COMPLEMENTARY PARATRANSIT NEEDS / OPPORTUNTIES

This section builds on the issues identified by RABA and Veolia officials for the existing technologies. Section 4.1 through 4.3 presents a series of needs and opportunities according to three functional areas: (1) Operations; (2) Service planning and customer service; and (3) Administration. For each, a set of current user needs are established. In addition, an associated priority level has been allocated. Below are definitions of the different priority levels:

- Low Priority – The issue somewhat impacts RABA or their contractor's operational, fleet maintenance, service planning and administrative performance;
- Medium Priority – The issue moderately impacts RABA's operational, fleet maintenance, service planning and administrative performances; and
- High Priority – The issue significantly impacts RABA's operational, fleet maintenance, service planning and administrative performances.

Section 4.4 presents a discussion of the benefits of a select number of ITS elements, from a national perspective.

4.1 Operations

4.1.1 DISPATCH

Technology Functionality	Priority	Application	Benefit / Commentary
A. A system to monitor vehicle location and system performance remotely.	High	Fixed route Currently available on complementary paratransit	• Enhanced monitoring of on-time performance • Enhanced ability to modify service in real-time.
B. The system should allow for the storage and playback of Automatic Vehicle Location (AVL) data.	High	Fixed route Currently available on complementary paratransit	• Assist in complaint resolution • Assist in service planning and monitoring
C. The system should also store and provide reports for historical operation performance (early, late, on-time) data.	High	Fixed route Currently available on complementary paratransit	

4.1.2 FIXED ROUTE & COMPLEMENTARY PARATRANSIT

Technology Functionality	Priority	Application	Benefit/Commentary
D. A system with electronic login.	High	Fixed route Currently available through farebox (upgraded needed) Currently available on complementary paratransit through MDTs	• Reconcile operator & route assignments
E. A login system that interfaces with the HR/finance system.	High	Fixed route Currently available through farebox (upgraded needed) Currently available on complementary	• Validates operator hours & payroll

		paratransit through MDTs	
F. There should be a single point of logon.	High	Fixed route Currently available through farebox (upgraded needed) Currently available on complementary paratransit through MDTs	• Ensure consistency & avoid redundancy
G. A system that provides RABA/Veolia with real-time service adjustment tools, such as: • Short-turns. . • Add or remove trips.	Medium High	Fixed route Complementary Paratransit	• Address service adjustments in real-time • Maximize scheduling efficiencies
H. A system that allows RABA/Veolia to replay information in real-time (i.e. bread crumb vehicle tracking)	High	Fixed route Currently available on Complementary Paratransit	• Assist in complaint resolution • Assist in service planning and monitoring
I. System that allows the driver to covertly notify dispatch about an incident.	High	Currently available on Fixed route & Complementary Paratransit	
J. The system should allow for dynamic Complementary Paratransit scheduling[5], which provides operators with automatic updates to their manifests while they are on-route. • Operators will be able to see cancellations • Dispatch can add in new trip requests and Operators will see the new trip pickup time/location and drop off location	High	Currently available on Complementary Paratransit Mobile Data Terminals (MDTs) installed on 20 vehicles	• Ability to eliminate use of paper driver manifests/logs • Reduction in radio communication • Ability to communicate schedule changes, trip insertions in real-time

[5] Complementing Veolia's current use of the StrataGen ADEPT scheduling software.

K. The system should also allow the operators to log certain information, such as (non-exhaustive list): • successfully picked-ups (passenger info, time) • passenger drop-offs (passenger info, time) • No-show passenger			
L. A system that supports scheduling Complementary Paratransit service based on the routing and business rules.	Medium	Complementary paratransit	• Building on current StrataGen application, ability to incorporate multiple transport providers and agency populations (potential benefit for CTSA application)
M. A system to support transit passenger and fare management and generate reports including boardings by fare type, by route and stop. N. Integrated on-board equipment such as fareboxes and headsigns can be linked to the on-board computer (OBC) to enhance performance and data, and reduce operator workload. Such system integration can automatically receive log-in data based on the operator login to the MDT.	High	Fixed route	• Benefit for planning annual *Transit Needs Assessment* and every five year *Short Range Transit Plan*
O. A system that allows transit vehicles to be given priority at traffic lights (Traffic Signal Priority/Preemption - TSP).	High	Fixed route	• Enhanced on-time performance, fuel efficiency and customer satisfaction

4.2 Service Planning

Current Need	Priority	Application	Benefit/Commentary
A. A system that can assign operators and vehicles to the next day's rosters based on RABA's business rules.[6]	Low	Fixed route	• A variation of current scheduling/run cutting done remotely by Veolia corporate
B. A system that logs operational performance statistics (e.g. schedule adherence) and allows RABA to assess schedule performance.	High	Fixed route	• Benefit for planning annual *Transit Needs Assessment* and every five year *Short Range Transit Plan* • This will provide RABA with objective metrics in-order to refine future schedules.
C. A system that keeps track of passenger boarding and alightings (APCs) at stops to more effectively plan service.	Medium	Fixed route	• Important to note that similar capabilities (& benefit) may be derived through enhanced farebox technologies.

Customer Service

Current Need	Priority	Application	Benefit/Commentary
D. All systems must be ADA compliant.	High	Fixed route & Complementary paratransit	• Legislative requirement
E. A system that can disseminate real-time passenger information (e.g. predicted arrival times) to customers, whether via: • wayside signs; • web; • telephone service; and • mobile devices.	Medium	Fixed route & Complementary paratransit	• Enhanced customer service • Reduction in inquiries to customer service, hence a reduction in administrative burden
F. A system that can automatically provide customers with schedule information or if need be to redirect to a person (e.g. in case of a complaint).	Medium	Fixed route	• Enhanced customer service • Reduction in inquiries to customer service, hence a reduction in administrative burden

[6] This is a responsibility of the service provider – Violia.

4.3 Administration

Current Need	Priority	Application	Benefit/Commentary
A. A system that should allow RABA to create maps (e.g. route maps).	Low	Fixed route	• Enhancements to customer service and operations monitoring and reporting/data management • Lessen administrative burden in addressing these functionalities
B. A system to track the various types of customer interactions and allow for reporting to management.	Medium	Fixed route & Complementary paratransit	
C. A system to allow for the automatic tracking of complaints (e.g. issue type, who is resolving the issue, when it was resolved and how).	Low	Fixed route & Complementary paratransit	
D. An automatic interface between systems to streamline the report creation process.	Medium	Fixed route & Complementary paratransit	
E. A system to automatically track sales and distribution of tickets and passes.	Medium	Fixed route & Complementary paratransit	
F. Central systems should be both established and low maintenance products, and provided as hosted services.	High	Fixed route & Complementary paratransit	

4.4 Benefits of Select Transit Technologies: A National Perspective

The deployment of various ITS deployments address benefits in one or more of the following:

- **Mobility:** Increase the ability of all to travel by public transportation quickly, reliably, and comfortably to their desired destinations, and also when they would like to travel.
- **Efficiency:** Provide efficient transportation services that make the most productive short and long-term use of transit funds and overall transit resources.
- **Economic Growth & Trade:** Facilitate a more efficient domestic and local transportation system that enables economic growth and development.
- **Environmental Stewardship:** Promote transportation solutions that enhance communities and protect the natural and man-made environment.

- **Security:** Provide a safe and secure transportation system that is prepared for and responds to emergencies and natural disasters, and that balances homeland and national security requirements with the mobility needs of both the community and the nation.

This section summarizes findings on benefits of select transit technologies through a review of the national ITS literature. It is important to note that the quantification of benefits and costs is less precise than desired. Reported benefits are still more qualitative than quantitative in nature. Reported costs vary widely, in part because there is not a one-size-fits-all application for new technologies and also because installation and integration costs may or may not be included in specific reports.

4.4.1 AUTOMATIC VEHICLE LOCATION (AVL) SYSTEMS

AVL Reported Benefits

- Schedule adherence improved by 4.4 percent to 23 percent:
    - Denver: 21% increase (in on-time arrivals)
    - Kansas City: 12.5% increase
    - Baltimore: 23% increase
    - Milwaukee: 4.4% increase
    - Hamilton, ONT: 8.5% increase
    - Portland, OR: 9.4% increase
- Improved accuracy of schedule adherence reports from 70 percent to 95 percent in Milwaukee
- Reduction in fleet requirements of one to five percent:
    - Kansas City: base fleet reduced by 1.5%, p.m. peak fleet reduced by 2%
    - Reno: assumed reduction of 1 to 2 percent in fleet requirements
- Reduction in emergency response times by up to 40 percent in Kansas City
- Reduction in assaults on operators/passengers of 20 percent in Denver

- Reduction in non-revenue miles and non-revenue hours:
    - Three percent reduction in non-revenue miles reported from national study
    - Five to eight percent reduction in non-revenue miles and two percent reduction in operating fixed-route vehicle hours assumed in Reno
- Increase of three percent in vehicle revenue miles
- Increase of one percent in farebox revenues assumed in Reno
- Decrease of 26 percent in customer complaints in Denver; AVL playback revealed that 50 percent of customer complaints in Milwaukee were not valid
- Reduction of 20 percent assumed in liability claims – assumes video cameras used in conjunction with AVL
- Non-quantified benefits:
    - Better command and control of the transit system

- Facilitate systems integration
- Provide better operations support
- Reduce street supervision effort
- Simplify operation of vehicle for operator

RABA can expect benefits in the areas of schedule adherence, safety and security, and customer complaints from an AVL system. Costs vary widely, because there is no "standard" AVL installation. Many agencies acquire add-ons such as computer aided dispatching and automated passenger counters to enhance the functionality of an AVL system.

4.4.2 AUTOMATED (ADVANCED) TRAVELER INFORMATION SYSTEM (ATIS)

ATIS Reported Benefits

- In-vehicle ATIS such as annunciators ensure compliance with ADA regulations regarding stop announcements
- European experience suggests that wayside ATIS is most useful at transit centers to alert riders to real-time wait for the next bus and whether they have missed their bus
- There is no solid information that real-time information would increase ridership
- Customers view pre-trip information delivered through traditional means as most valuable, but have some interest in real-time wayside information
- New Jersey Transit: an interactive voice response system reduced average wait time from 85 to 27 seconds, resulting in a call volume increase of over 40,000 per month
- San Diego: an automated voice response system increased productivity of its call center by 21 percent
- Rochester: calls increased by 80 percent, and four part-time positions were eliminated with an automated call system
- ATIS can generally be expected to increase ridership and revenue by two percent, improve service and visibility, and increase passenger convenience

ATIS encompasses pre-trip, wayside, and on-vehicle information for customers. There is uncertainty regarding both benefits (ridership response to provision of amenities is very hard to measure) and cost, although there seems to be general agreement on costs of certain elements of ATIS such as an automated phone system or kiosks displaying real-time information. AVL is necessary for any real-time information applications. Recent research has suggested that customers prefer time-tested means of providing information; although this could reflect unfamiliarity with how new technologies would work or affect them. RABA could consider real-time information at transit centers and major stops as an add-on to an AVL system.

4.4.3 MOBILE DATA TERMINALS (MDTS)

Mobile Data Terminals Reported Benefits

- Ann Arbor, MI: MDTs reduced voice radio traffic by 70 percent Mobile Data Terminals is often packaged with communications or AVL systems.

4.4.4 AUTOMATED PASSENGER COUNTERS (APCS)

APC Reported Benefits

- More frequent data collection, ability to analyze ridership at the stop and trip level, greater timeliness and responsiveness, and reduced costs resulting from discontinuation of manual data collection
- Reduction of costs associated with manual checks:
    - Hamilton, ONT: $45,000 annually
    - Reno: $27,000 annually

APCs provide current ridership information that can be used proactively in managing the transit system. Costs have fallen in recent years as APCs have been integrated with AVL systems, removing the need for a separate means of vehicle location in an APC system.

5. A WAY FORWARD

A future system concept will include the following key system interfaces:

- Between the CAD/AVL system RABA (and their contractor's) administrative functions (e.g. payroll, attendance, transit revenue calculator);
- Between the CAD/AVL system, Vehicle Health Monitoring (VHM) system, and the current or future Veolia Maintenance Management system for tracking of fuel, parts, and work orders; and
- Between on-board devices (AVL, Mobile Data Terminals [MDT], Farebox, Destination Signs, Automatic Passenger Counters [APC] Automatic Stop Announcements [ASA], etc.) and the On-Board Computer (OBC) to improve transit operation and simplify the bus operators' login procedure. With this interface, bus operators will have fewer distractions while driving.

Overall, the deployment of this complete system will help to improve customer satisfaction, promote efficiency in the organization, and address organizational needs that may be lacking. The new system will integrate existing reporting systems and streamline reporting and management tasks.

5.1 Recommended Projects

A series of projects have been defined and presented for discussion (Table 5-1). These projects represent distinct work packages that may be pursued in order to fully achieve the proposed system concept. Within these projects, there are certain technologies requiring significant integration that are best implemented as a bundle through a single contractor to reduce both the cost and the risk to RABA and their project (and funding) partners.

The recommended projects and the respective deployment schedule is consistent with those identified in the April 2014 Draft Short Range Transit Plan (SRTP). This technology plan presents unit, installation, system integration and operating and maintenance (O&M) costs estimates based on recent national experience for transit agencies of a comparable size to that of RABA. There are some discrepancies in the costs presented in the SRTP vs. those presented here. The author is unable to validate the source of costs presented in the SRTP as well as unable to determine specifically what is included (i.e., installation, system integration, etc.) in the costs presented in the SRTP. O&M costs were not included in the SRTP.

These project packages could be undertaken as part of a complete year-over-year initiative, or as individual separate projects. However, one key consideration is that since the CAD/AVL plays such a central role in the operation of the other systems, it will be necessary for it to be deployed first.

In going forward, it is important to note the differences between data generated by electronic fareboxes vs that of APCs.

Farebox Data: Farebox data is automatically collected (and sometimes analyzed) by modern fareboxes made by companies such as GFI and Cubic. While fare media that are either magnetic stripe or "smart" and are thus either swiped through or tapped on the farebox can be accurately counted, fare media that are shown to the driver rely on the driver to press the correct button to register. Cash is a special case; while drivers often allow passengers to board without paying the full cash fare, it is difficult for fareboxes to know if the odd amount of money represents an actual passenger or something else. Another limitation is that unless passengers have to interact with the farebox on both entering and leaving the vehicle no information can be gathered on where the passenger alights (or in certain circumstances, boards). Despite these problems farebox data is the only place to acquire a breakdown of how passengers pay their fares, which makes it an indispensable data source for the service planning and finance departments.

APC Data: APCs provide a highly accurate count of the number of passengers boarding and alighting at each stop, faltering only maybe at the terminus point where routine activities such as the driver leaving and returning to the bus can result in a distorted passenger count. If less than 100% of the fleet is equipped with APC devices then it is important that the buses so-equipped be rotated systematically through all blocks in order to obtain accurate ridership information. How APCs work - typically, two sets of two sensors each at the same height level are installed at both the front and rear door. When passengers enter or exit the door they break an infrared beam, which causes a computer to record a boarding or alighting depending on the order in which the two beams are broken. The sensors are enough to provide a gross level of ridership; if stop-level ridership is required geographic information must be provided by a GPS system such as an Automated Vehicle Locator (AVL) program. Data is then downloaded to a computer for analysis.

Table 5-1: Recommended ITS Projects

Recommended Project	Description	Benefit	Cost	Implementation Schedule
1. Smart Bus System Deployment (Fixed Route & Complementary Paratransit)	Deployment of new integrated CAD/AVL system to the entire RABA conventional and complementary paratransit vehicle fleet. • **AVL:** Central System deployment that allows the tracking of vehicle location and schedule adherence in real time • Full compatibility with various existing and future ITS technologies. • Provision of interfaces for communication between driver and dispatcher/in-vehicle ITS systems. • Interface the CAD/AVL to the engine control to monitor engine diagnostic messages. • Integrate CAD/AVL with other onboard security systems such as camera, alert button, and video recorders. • Provide and configure Supervisor's laptops to enable full in-vehicle access to the CAD system.	• Improved schedule adherence • Enhanced safety and security • Reduced customer complaints • Enhanced ability to address trip insertions (respond to available capacity as a result of cancellations & no-show. Applicable to complementary paratransit only.	$4,000/unit	FY 2014/15 FY 2015/16
	• Installation of new **MDTs** on all RABA vehicles.	• Reduction in radio communication	$2,500/unit	FY 2016/17 FY 2017/18
	Installation of **onboard annunciators** (internal and external) as well as **internal variable message signs** in order to meet ADA requirements. Applicable to fixed route only.	• Ensure legislative compliance (ADA)	$4,500/unit	FY 2016/17

Recommended Project	Description	Benefit	Cost	Implementation Schedule
2. Integrated Electronic Fare Boxes	Procure and install upgraded (integrated) electronic fareboxes • Integrate with Hanover destination signs.	• More robust data collection and reporting capability • Allows for the flexibility to accommodate magnetic stored-value cards (for monthly passes & multi-ride tickets. • Allows for the flexibility to migrate to Smart Cards	$7,500/unit	FY 2015/16
3. Advanced Traveler Information Systems	Configure central system to provide a real-time data feed to other applications and potentially third parties to enable the provision of ATIS via Interactive Voice Response(IVR), web, mobile devices, and VMS at stations • Procure, install, and configure IVR system. • Procure, install, and configure VMSs at downtown terminal; • Procure and install a Kiosk at the downtown terminal, providing real-time information • Develop website to provide transit information via internet and mobile phone.	• Increase customer convenience – reduction in average wait times • IVR - Increase productivity of RABA customer service/call center and reduction of administrative burden • Expectation of increased ridership and revenue	TBD	TBD

Recommended Project	Description	Benefit	Cost	Implementation Schedule
4. Automatic Passenger Counters (APCs)[7]	Procure and install APCs. • Interface APCs with the in-vehicle systems for full integration with CAD/AVL.	• More frequent data collection, ability to analyze ridership at the stop and trip level, greater timeliness and responsiveness, and reduced costs resulting from discontinuation of manual data collection • Reduction of costs associated with manual checks	$5,500/unit	FY 2016/17
5. Traffic Signal Priority/Preemption (TSP)	To give transit vehicles priority in advancing through equipped intersections • Consideration of using Prop 1B grant funds to partner with the City's emergency responders to put emergency vehicle preemption (EVP) equipment on major arterial corridors within the City. (Currently many signals within the City already have such devices and it is standard practice to include them on any new design.)	• Enhanced on-time performance, fuel efficiency and customer satisfaction	$8,000 to $35,000 per intersection[8] $1,500 per emitter (bus)	FY 2015/16

[7] Funding allocated and approved in FY2012/13 budget – for installation on select buses in fleet.
[8] The cost of TSP per intersection is dependent on the ratio of buses and intersections, the level of control, and the technology deployed.

5.2 Cost Estimates

Table 5-2 presents an overview of the cost estimates for the recommended technology plan. Unit costs in the table are taken from the high range of estimates, to be conservative, and do not reflect any economies of scale unless these were documented in the literature (such as for APCs as an add-on to an AVL system). In addition to cell/GPS[9] data services costs, other additional costs may be incurred for installation, systems integration and operations and maintenance (O & M). Industry experience suggests that the installation and system integration elements are approximately ten percent of the capital cost. O & M costs are typically another ten percent of the capital costs.

The cost estimates presented are based on recent national experience for transit agencies of a comparable size to that of RABA.

Table 5-2: Cost Estimates for the RABA Technology Implementation Plan

Technology	Unit Cost	# Units	Estimated (Capital) Cost	Installation & Systems Integration Cost [1]	Annual O & M Cost
On-Board VLU & AVL	$4,000	36	$144,000	$14,400	$8,600
Color/touch MDT	$2,500	36	$90,000	$9,000	$4,300
Electronic fare boxes/upgrades	$7,500	36	$270,000	$27,000	$27,000
Annunciators In-vehicle displays	$2,500 $2,000	10	$25,000 $20,000	$2,500 $1,000	$1,000 $ 800
APC	$5,500	10	$55,000	$5,500	$5,500
Automated Traveler Information System (ATIS)	TBD	TBD	TBD	TBD	TBD
Traffic Signal Priority/Preemption (TSP)	$8,000 per intersection + $1,500 per transit bus emitter	TBD	TBD	TBD	TBD
Kiosks for real-time information	$3,000	1	$3,000	$600	$160
Smart Card – processing unit (stand-alone)	$2,000	TBD	TBD	$200 each	$150 each
Total Estimated Costs: Near/Medium Term			$565,000	$60,000 +	$47,360 +

[1] Installed cost of stand-alone system elements (i.e., not part of a smart-bus onboard architecture in which location data and route schedule tracking are already being done by a unified location system).

[9] Cell/GPS data services costs must be determined locally (typically by City's IT staff) to reflect local market conditions and any economies of scale to be realized through the procurement of packaged services (i.e., ability to collaborate with other City departments/services such as emergency/first responder services).

5.3 Deployment Schedule

Task Name	Year				
	2014/15	2015/16	2016/17	2017/18	To Be Determined
Fixed Route & Demand Response AVL					
Fixed Route Annunciators					
Mobile Data Terminals (MDTs)					
Automatic Passenger Counters (APCs)					
Transit Signal Preemption (TSP)					
Advanced Traveler Information					
Fare Collection					

5.4 Deployment Considerations

The literature is replete with transit agency experience with ITS deployment. Transit agencies are always willing to pass along advice based on their experiences, particularly in areas that were new or out of the traditional realm for them. Advice and observations include:

Process and Procedures

- Invest heavily in training and cross-train as many people as you can. Recognizing periodic staff-turnover, there are significant advantages to *train-the-trainer* – that is having senior staff trained in all aspects of ITS applications in order to ensure in-house training capabilities for new staff.
- Avoid unique or specialized technology that requires support from an IT department. This also includes entering into a maintenance agreement with the selected vendor to ensure on-going support and problem resolution.
- Hire an experienced consultant to (1) identify technology needs, true cost of operating and managing the new technology, and return on investment, (2) prepare specifications, and (3) manage the project, including implementation and training. An experienced consultant will also typically assume responsibility for ensuring system integration, validate vendor's demonstrable experience (including the checking of client references) and identify other peer agencies for possible site visits.
- Identify agency staff to be available for project support throughout the project. Make sure that it remains an agency project. That said, through the use of maintenance contracts and vendor hosting responsibilities will minimize the administrative burden for agency staff.
- Budget a sufficient contingency; there will be bumps in the road.

- Cooperation with regional partners is an effective means to implement technology advances (examples: automated trip planning, smart card).

- Vendors that include upgrades created for other users at no additional cost offer an added bonus and help to keep costs manageable.

- Define project deliverables clearly, keeping in mind that what the sales folks show you and what the actual technology can deliver are often not the same. Back-end functions such as reporting or integrating with the agency's databases can be particularly problematic with new technologies such as smart card.

- Problem areas were: integration into existing programs, software, and radio frequencies.

- Typical agency (and/or their project partners) resource requirements include: a project manager; staff assigned for *train-the-trainer* responsibilities; IT personnel (to ensure reliable web access and support hardware and communication requirements of selected software/ITS applications); and planning/data analysis resources.

System Integration: In the past, ITS application integration was no easy task. Such integration had to deal with multiple applications running on multiple platforms in different locations, making the term 'simple integration' pretty much an oxymoron. Today, software vendors offer suites of product that provide cross-platform, cross-language integration as well as the ability to interface with many popular packaged ITS applications. Much of this is accomplished through the use of open architecture and strategic partnerships resulting in a wealth of successful integrated deployment demonstrable experience. Further, RABA (and it's project partners) are able to minimize any risk of integration issues by ensuring that such responsibilities are incorporated in any procurement instrument and subsequently the sole responsibility of the selected vendor. Certainly, several vendors including INIT, Trapeze, Clever Devices, and others will commit to assuming integration/"design-build" responsibilities - a project in which the design and implementation services are contracted by a single entity.

Appendix A provides a comprehensive list of suppliers of ITS applications. While likely prudent to advertise or solicit responses from a broad range of vendors or suppliers, there is typically a select number of vendors able to respond to any specification document prepared by or on behalf of RABA and their partners.

5.5 Opportunities – CTSA Framework

The application of technology for the enhanced coordination of community based services (within a CTSA framework) is dependent upon decisions made regarding governance and functionalities to be deployed.

There is an opportunity to purchase the Brokerage capability as part of the available suite of products from StrataGen to compliment to current Adept complementary paratransit scheduling software used by Veolia. The brokerage product would allow a CTSA coordinator to assess and prioritize trips on a case-by-case basis determined by operational capacity or preferentially route passengers to the lowest cost provider (for maximum expense control).

Appendix A: Suppliers of ITS Applications

Appendix A: SRTA Technology Plan - LIST OF POTENTIAL TRANSIT ITS VENDORS

COMPANY NAME	PRODUCTS	ADDRESS	CITY, STATE, ZIP	TEL/FAX	EMAIL/INQUIRY FORM
ActSoft	AVL	10006 N. Dale Mabry Hwy Suite 100	Tampa, Fl 33618	T: 888-732-6638 T: 813-936-2331 F: 813-936-7541	sales@actsoft.com
Advantech	RISC –Based Vehicle Mounted Computers, Vehicle Computing Solutions			T: 1-888-576-9668	Buy@Advantech.com
Aero Data, Inc.	AVL	5990 South Hillsdale Road	Hillsdale, Michigan 49242	T: 517-357-4110 F: 517-357-4150	king.robert.j@gmail.com
Agile Assets	Maintenance management software	3144 Bee Caves Road	Austin, TX 78746	T: 512-327-4200 F: 512-328-7246	sales@agileassets.com
Almex Transport Solutions	TVM (Ticket Vending Machines)	65 Woodford Grove	Stamfordhill, Durban South Africa	T: +27 (031)-312 4360 F: +27 (031)-312 0784	info@almextransport.com
Alstom Transport Information Solutions	DMS, CCTV, announcements	296 Avenue D. Suite #20	Williston, Vermont USA 05495	T: 514-333-0888 F: 514-333-0496	
Amano McGann	TVM, Faregate	2699 Patton Rd	Roseville, MN 55113	T: (612) 331-2020 ext. 6188 F: (612) 331-5187	http://www.amanomcgann.com/Page/Index/Contact%20Us

COMPANY NAME	PRODUCTS	ADDRESS	CITY, STATE, ZIP	TEL/FAX	EMAIL/INQUIRY FORM
AngelTrax	AVL, Alarm, Cameras,	9540 US Hwy 84 W	Newton, AL 36352	334-692-4600	Mark.moore@angeltrax.com Dave.breslin@angeltrax.com Angela.putnam@angeltrax.com
Aon Smart Drive	Video event data recorder			T: 800-837-6780	
Apollo Video Technology	CCTV	24000 35th Ave. SE	Bothell, Washington 98021	T: 425-483-7100 F: 425-483-7200	sales@avt-usa.com http://www.apollovideotechnology.com/about-us/contact-us/ james.geary@apollovideo.com
Apple	iBeacon location sensing technology				http://www.networkworld.com/news/2014/021014-apple-ibeacon-278571.html

COMPANY NAME	PRODUCTS	ADDRESS	CITY, STATE, ZIP	TEL/FAX	EMAIL/INQUIRY FORM
Avail Technologies, Inc.	CAD/AVL	1960 Old Gatesburg Rd., #200	State College, PA 16803	T: 814-234-3394 F: 814-234-3393	tpw@availtec.com cah@availtec.com
AVAYA	Call Centers, IVR, WFMS	Avaya Inc. 211 Mt. Airy Road	Basking Ridge, NJ 07920 USA	T: 1-866-GO-AVAYA	https://www.avaya.com/usa/how-to-buy/contact-avaya-sales/
Avego	Real-time management system	1050 17th St NW, Suite 810	Washington, DC 20036	T: 202-318-0180	sales@avego.com
Axion Technologies	LED signs	Main Office 151 rue du Parc-de-l'Innovation USA 8 Kaycee Loop	Main Office La Pocatiere, PQ, Canada G0R 1Z0 USA Plattsburgh, New York, USA 12901	T: 418-856-1454 F: 418-856-5978 T:518-566-0369 F: 518-566-8775	info@axiontech.ca
Bytemark	Mobile ticketing	268 W 44th Street 3rd Floor	New York, NY 10036	T: 617-600-7560	sales@bytemark.co
Cale	TVM	13808 Monroe's Business Park	TAMPA, FL 33635	T: +1 813 405 3900	info@caleamerica.com
CES Wireless Technologies Corp	AVL	925-122 S. Semoran Blvd	Winter Park, FL 32792 USA	T: 800-327-9956 T: 407-679-9440 F: 407-679-8110	sales@ceswireless.com plohan@ceswireless.com

COMPANY NAME	PRODUCTS	ADDRESS	CITY, STATE, ZIP	TEL/FAX	EMAIL/INQUIRY FORM
Chilin Displays	Display technology	9375 SW Commerce Crcl 7	Wilsonville, OR 97070	T: 503-570-3366 F: 503-570-6111	http://www.agiledisplaysolutions.com/contact/sales
Cisco Systems, Inc.	Call Centers, IVR,	170 West Tasman Dr.	San Jose, CA 95134 USA	T: 1 800 553 NETS	https://www.cisco.com/cisco/web/siteassets/contacts/index.html
Clear Creek Computer	Paratransit software			T: 970-223-9061	spts@clearcreekcomputer.com
Clever Devices	CAD/AVL, RTPI, AVM, AVA, Reporting, APC, TSP, MDT	300 Crossways Park Drive	Woodbury, NY 11797	T: 800-872-6129 T: 617-527-9796 C: 617-512-4151 T: 516-433-6100 F: 516-433-5088	jcohn@cleverdevices.com sbennett@cleverdevices.com sgraman@cleverdevices.com amiller@cleverdevices.com
Clever Devices (formerly Digital Recorders, Inc.)	AVL, APC, Passenger Information, Annunciation	4018 Patriot Drive, One Park Center, Suite 100 P.O. Box 14068	Research Triangle Park, NC 27709-4068	T: 919- 361-2155 F: 919- 361-2947 T: 919-313-3057 T: 919-452-7002	Saundrag@digrec.com amadab@digrec.com

COMPANY NAME	PRODUCTS	ADDRESS	CITY, STATE, ZIP	TEL/FAX	EMAIL/INQUIRY FORM
Clever Devices (formerly GreyHawk Technologies, Inc.)	MDT	11500 NE 76th St. #A-3	Vancouver, WA 98662	T: 360-891-1951 F: 360-891-5720	sales@greyhawktech.com
Collective Data	Maintenance management software	230 2nd St SE, Suite 414	Cedar Rapids, IA 52401	T: 319-362-1993 F: 319-364-4306	sales@Collective data.com
Com-Net Software	Digital Signage	3278 Benner Road	Miamisburg, OH 45342	T: 937-859-6323 F: 937-859-7511	sales@comnetsoftware.com
CompassCom, Inc.	AVL	12353 E. Easter Ave.	Centennial, CO 80112	T:800-787-0651 T: 303 627-4058 F: 888 766-2488	solutions@compasscom.com
Computerized Fleet Analysis	Maintenance management software	1020 West Fullerton Avenue Suite A	Addison, IL 60101	T: 630-543-1410 F: 630-543-1904	sales@cfasoftware.com
Connexionz Ltd.	Real Time Passenger Information Systems	6045 Wilson Boulevard , Suite100	Arlington Virginia	T: 866 254-4140 T: 661-451-1005 x325 (Rod) C: 703-593-8776	Rhod.pickavance@connexionz.us
CooCoo	Real-Time Schedules (Phone Texts), Mobile Tickets	N/A	N/A	N/A	support@coocoo.com
CPE APE	TVM, faregate	7050 Telford Way, Unit #8	Mississauga, Ontario L5S 1V7	T: 905-673-0093 F: 905-673-6687	webinfo@cpeape.com

COMPANY NAME	PRODUCTS	ADDRESS	CITY, STATE, ZIP	TEL/FAX	EMAIL/INQUIRY FORM
Cubic Transportation Systems (includes NextBus)	Fare Systems	5650 Kearny Mesa Road	San Diego, CA 92111	T: 858-268-3100 F: 858-292-9987	http://cts.cubic.com/ContactUs/Inquiryform/tabid/440/language/en-US/Default.aspx
Daytech Manufacturing	Smart Shelter	70 Disco Road	Orchard Park, NY 14127	T: 416-675-1195	info@daytechlimited.com
DDS Wireless (formerly Stratagen Systems)	MDTs and Paratransit Operations Software	4040 Lake Washington Blvd NE Suite #201	Kirkland, WA 98033	T:425 821-8454 F: 425 823-6959	sales.@strategen.com
DILAX Systems	APC	200 Rue MacDonald, Suite 305	Saint-Jean-sur-Richelieu, Quebec J3B 8J6	T: 450-358-3898 F: 450-358-1124	alexander.okapuu@dilax.com
DoubleMap	CAD/AVL, AVA, APC, traveler information	748 E Bates Street, Suite 300W	Indianapolis IN 46202	T: 885-463-6655	info@doublemap.com tyler@doublemap.com
Eagle Eye Network, Inc.	Cloud Based Security Camera VMS	411 Brazos St. #101	Austin, TX 78701	T: 1-512-473-0500	sales@eagleeyenetworks.com

COMPANY NAME	PRODUCTS	ADDRESS	CITY, STATE, ZIP	TEL/FAX	EMAIL/INQUIRY FORM
Ecolane	Paratransit software	1150 1st Ave. Suite 910 4130 Main St.	King of Prussia, PA 19406 Elk Horn, IA 51531	T: 888-378-3872 F: 888-712-2499 T: 712-764-7101	Ryan.larsen@ecolane.com Dom.bonhomme@ecolame.com Daniel.andrlik@ecolane.com info@ecolane.com
Electromega	TVM	105 Avenue Liberte, Canidac	Quebec, CA J5R 3X8	T : 450-635-1020 T: 1-800-363-7481 F: 450-635-1021	general@electromega.com
Enghouse (formerly TranSched Systems LLC and Ontira Communications)	Fixed route/Paratransit software, IVR, scheduling	80 Tiverton Court Suite 800 Markham, Ontario (Toronto) L3R 0G4	Toronto ON M9P 3V4	T: 416-915-9593 F: 416-915-9594	dhendricks@enghouse.com info@enghouse.com
EnGraph Software	Demand Response / Paratransit scheduling, billing, reporting, AVL, dispatch, manifest	13100 W 95th St, Suite 101	Lenexa KS, 66215	T: 913-735-6651 (Sales) T: 913-370-4423 (Support)	info@engraph.com kylearcher@engraph.com

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ETA Transit Systems	AVL, Public Information Dissemination			T: 888-720-0121	jpmaglio@etatransitsystems.com sales@etatransitsystems.com
Eurotech	AVL, APC, AVA, Passenger Information, Security, Fleet Management , farefox, comm..	10260 Old Columbia Road	Columbia, Maryland, 21046	T: 301-490-4007 T: 800-541-2003 F: 301-490-4582	sales.us@eurotech.com
Eurotech (formerly Parvus)	Mobile router APC	3222 South Washington Street	Salt Lake City, UT 84115	T: 801-433-6343 F: 801- 483-1523	ahunt@parvus.com
Federal ADP	TVM	28100 Cabot Dr., Suite 200	Novi, Michigan 48377	T.: (248) 374-9600 F: (248) 374-9610	
GE Security	On-board surveillance	8985 Town Center Parkway	Bradenton, FL - 34202-5129	888-GE-SECURITY	suprasupport@fs.utc.com
Geofocus	Rail tracking and passenger info systems	3651 FAU Blvd., Suite 215	Boca Raton, FL 33431	T: 561-955-1480 F: 561-955-1481	

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GFI GENFARE	Fare Systems	751 Pratt Boulevard	Elk Grove Village, IL 60007	T: 847 593-8855 F: 847-593-1824 T:847-871-1130 T: 704-543-9414 T: 702-655-6719	larry.chefalo@spx.com sandy.galli@spx.com mark.mahon@spx.com
GIRO, Inc.	Operations Software HASTUS Scheduling Software Demand-Response Scheduling Passenger Rail Scheduling	75 Port-Royal Street East, Suite 500	Montréal, Québec H3L 3T1	514-383-0404 514-383-4971	francois.carignan@giro.ca info@giro.ca
Guardian Mobility Corporation	Tracking software	43 Auriga Drive	Ottawa, ON K2E 7X1 Canada	T: 613-225-8885 F: 613-225-7762	inquiries@guardianmobility.com

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Hanover Displays	Headsigns VMS/ASA Infortainment Wayside Displays	358 Lively Boulevard,	Elk Grove Village, Illinois, 60007 USA	T: 773-334-9934 T: 201-815-6849	tmark@hanoverdisplays.com (Canada contact) mgnerre@hanoverdisplays.com sales@hanoverdisplays.com (head office UK)
HB Software Solutions	Paratransit software	1075 Westford St	Lowell, MA 01851	T: 978-379-0010 F: 978-379-0014	hb@hbssonline.com
Hell	APC	Rixbecker Straße 75	59552 Lippstadt /Germany	T: 49 2941 38 - 31940 F: 49 2941 38 – 47 31940	peoplecounter@hella.com
Hitech Electronic Displays	DMS (Data Management Systems)		Tampa, FL	T: 727-531-4800 F: 727-524-6655	sales@hitechled.com
Hogia	CAD/AVL Real Time Information	SE-444 28	Stenungsund Sweden	T: 46-303-666 00 F: 46-303-666 98	sales@hogia.se
Icertis	Public Transport Management, Fleet Management solutions	14711 NE 29th Place, Suite 100	Bellevue, WA 98007	T: 425 869 7649	sanjay.menon@icertis.com
Indra USA, Inc.	Ticketing, Fare Systems, Access Control, CAD/AVL	800 Brickell Avenue, Suite 1270	Miami, FL 33131	T: 305-373-7749 F: 305-373-7754	wmartinez@indrausa.com indrausa@indracompany.com

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INEO Systrans Canada	CAD/AVL RTIS	Avenue de Conflans – 2, Allee Edouard Branly	78260 Acheres France	+33 (0)1 39225928	baudouin.huon@ineo-gdfsuez.com delphine.chauvin@cofelyineo-gdfsuez.com charlotte.quiedeville@cofelyineo-gdfsuez.com
Info Dev	APC	1995 Jean Talon South, #202	Ste-Foy, QC, G1N 4H9	T: 418-681-3539 F: 418-681-1209	info@infodev.ca
Ingenico	Payment solution (e.g. card readers, pin pads)	3025 Windward Plaza, Suite 600	Alpharetta, GA 30005 United States	T: 1-678-546-1200 F:1-678-456-1201	Online form at http://www.ingenico.com/en/contact-us/ Suzan.Denoncourt@ingenico.com
Innovations in Transportation, Inc. (INIT)	AVL and paratransit software Scheduling Software	1420 Kristina Way, Suite 101	Chesapeake, VA 23320	T: 877-GO2-INIT x 308 (Bryan) T: 757-413-9100 F: 757-413-5019	rstaib@initusa.com bcunningham@initusa.com
Inova Multimedia	Information Display Systems	610 Ten Rod Road	North Kingstown, RI 02852	T:401-667-7218 F:401-667-7486	GOT GERMAN CONTACT INFO

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Intellisys Technology	Smart card systems	2625 Butterfield Road, Ste. 203N	Oak Brook IL 60523	T: 630-522-1111 F: 630-455-1333	SystemsInt@intellisystechnology.com
Intuicom, Inc.	Wireless Data Networks	1880 S. Flatiron Ct.	Boulder, CO 80301	T: 303-449-4330 F: 303-449-4346	sales@intuicom.com
I/O Controls	Integrated control system, monitoring, wireless network	101 E. Park Blvd., Suite 817	Plano, TX 75074	T: 972-424-6488 F: 972-578-2230	rodstorer@iocontrols.com
ISR	CAD/AVL Fleet Management RTIS Video Monitoring	1502 Joh Ave, Suite 170	Baltimore, MD 21227	T: 800-477-5989 T: 410-536-9989 F: 410-536-9982	sales@isrtransit.com
IVU Traffic Technologies AG	Scheduling CAD/AVL Fleet Management Fare Systems Real Time Information Business Controlling	Bundesallee 88	12161 Berlin	Tel. +49.30.8 59 06 -0 Fax +49.30.8 59 06 -111	post@ivu.de
King Communications, USA Inc	AVL	1080 Santa Cruz Ave	Titusville, FL 32780	321-267-5491	king@kingusa.com
Lecip (formerly Arcontia Technology)	Smart fare systems	Gruvgatan 35a	Västra Frölunda, Sweden, S-421 30	T:+46 31 49 99 30 F:+46 31 49 30 95	olaf.henrixon@arcontia.se

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Logic Tree	IVR	1732 Wazee St Suite 202	Denver, CO 80202	866-492-0420	bchism@logictree.com support@logictree.com
Luminator	DMS, next stop announcements, MDT/AVL Infotainment	900 Klein Road,	Plano, TX 75074	T: 248-853-2097 T: 800-388-8205 T: 972-424-6511 F: 972-423-1540	thayman@luminatorusa.com lmtsales@luminatorusa.com online form at: http://www.luminatormasstransit.com/%20index.php?option=com_contact&view=contact&id=12
Luminator (formerly Twin Vision)	Transit Communication and Security Solution	13760 Noel Road, Suite 830	Dallas, Texas 75240	T: 214-378-8992 F: 214-378-8437	ir@digrec.com
Lumiplan	Onboard and Wayside VMS, CCTV, Real-time information			T: +33 2 40 92 15 43	transport@lumiplan.com
Lytx (former name DriveCam)	Video and event data recording system	8911 Balboa Ave	San Diego, California 92123	T: 858-430-4000 F: 858.430.4001	support@lytx.com

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Mackay Meters	TVM	1342 Abercrombie Road, PO Box 338	New Glasgow, NS Canada, B2H 5C6	T: 902-752-5124 F: 902-752-5955	sales@mackaymeters.com
Mackenzie Laboratories	Onboard announcements	1163 Nicole Court	Glendora, CA 91740	T: 909-394-9007 F: 909-39-9411	nkhattar@macklabs.com
Maior	Scheduling Software	Piazza Vieusseux, 2 7304 Eads Avenue	50134 Firenze, Italy La Jolla, CA 92037	T: +39 340 2523318 T: 619-417-2444	luca.masnata@maior.it 5hafner@multimodalsolutions.org
March Networks	CCTV	303 Terry Fox Drive	Ottawa, Ontario Canada K2K 3J1	T: 613-591-8181 F: 613-591-7337	sales@marchnetworks.com
Masabi	Mobile ticketing	56 Ayres Street	London SE1 1EU UK	T: 44-(0)20-7089-8860	contact@masabi.com
Minuteman Security Technologies, Inc.	Security Solutions, Emergency Communications, Surveillance Systems	One Connector Road	Andover, MA 01810	T: 978-783-0018 F: 978-783-0019	webmaster@minutemanst.com
MJM Innovations	Smart card payment system	1501 Sulgrave Avenue, Suite 200	Baltimore, MD 21209	T: 410-664-0700 F: 410-664-4018	info@mjminnovations.com
Mobile Knowledge (formerly SiGEM, GMSI and Gandalf)	MDTs	5353 John Lucas Dr., Suite 100,	Burlington Ontario, Canada, L7L 6G5	T: 905-335-4090 F: 905-335-0073	info@mobile-knowledge.com

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Mobile Mark	Wireless , Cellular, and GPS Antennas	1140 W. Thorndale Ave	Itasca, IL 60143, USA	T: +1 847 671-6690 F: +1 847 671-6715 Toll Free: 1-800-648-2800 :	General:info@mobilemark.com C Walgren: cwallgren@mobilemark.com
Mobilitat	Easy Rides paratransit software	1605 Green River Way	Green River, WY 82935	T: 888-806-6595	easyrides@mobilitat.com Cliff.hales@mobilitat.com
MOBOTIX	Security Vision Systems	80 Broad Street Suite 702	New York, NY 10004 USA	T: +1 (212) 385 6126 F: +1 (212) 385 6129	simone.rodriguez@mobotix.com sercan.zor@mobotix.com http://www.mobotix.com/other/Contact/Contact-Form
Parkeon North America	Ticketing	40 Twosome Drive, Suite 7	Moorestown, NJ 08057	T: 856-234-8000 F: 856-234-7178	http://www.parkeon.us/
PCTrans	Scheduling & Dispatch, reporting, maps, MDT, AVL	2699 Salisbury Ln.	Ann Arbor, MI 48103	T: 734-669-2976 T: 734-645-2385	donr@pctrans.com

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Peerless-AV	Outdoor protected LED displays	2300 White Oak Cir	Aurora, IL 60502	T: 630-375-5100 F: 630-820-8537	info@peerless-av.com
Precise Park Link	TVM, faregate	100 Floral Parkway	Toronto, M6L 2C5 Ontario / Canada	T:1 416 398 4052 F: 1 416 398 6391	llato@precisebi.com
QUALCOMM Wireless Business Solutions	Wireless Solutions	5775 Morehouse Drive	San Diego, CA 92121	T: 800-348-7227 858-587-1121 F: 858-658-2100	
Radio Engineering Industries	CCTV, CAD/AVL	6534 L Street	Omaha, NE 68117	T: 402-339-2200 F: 402-339-1704	Sales1@radioeng.com
Radio Satellite Integrators	CAD/AVL	19144 Van Ness Avenue	Torrance, California 90501	T: 310-787-7700 F: 310-787-7435	info@radsat.com
Ramos Systems, Inc.	Scheduling Software	1725 Timberway Drive	Richardson, TX 75082-4529	T: 469-261-6575	sales@ramos.com
REI	Audio/video, radio, VMS, demand/response scheduling, fleet management, communications, infotainment	6534 L. St.	Omaha, NE 68117	T: 402-339-2200	podonnell@radioeng.com
Ride Cell	CAD/AVL	75 5th Street NW	Atlanta GA 30308	T: 404-661-4939	questions@ridecell.com
RouteLogic	Paratransit software	8815 Conroy Windermere Road, Suite 330	Orlando, FL 32835	T: 407-909-1270 F: 866-223-2321	info@routelogic.com

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RouteMatch Software	Paratransit scheduling and dispatch software CAD/AVL	1201 West Peachtree NW, #3300	Atlanta, GA 30309	T:404-876-5160 888-840-8791 F: 404-898-1145 T: 404-253-7885 C: 404-493-6276 T: 404-721-5441	sales@routematch.com chris.campbell@routematch.com dan.hawkins@routematch.com
RSM Services	APC management software	2600 Southwest Freeway, Suite 900	Houston, TX 77098	T: 713-650-0654 F: 713-650-1576	
Safety Vision	CCTV	6100 West Sam Houston Parkway North	Houston, TX 77041	T: 713.896.6600 F: 713-896-6640	email@safetyvision.com
Saucon Technologies	CAD/AVL	2455 Baglyos Circle	Bethlehem, PA 18020	T: 484.241.2514	TDSinfo@sauconntech.com
Schedule Masters	Fixed route scheduling software	300-1B Conestoga Drive, Suite 300	Brampton, Ontario, Canada L6Z 4N5	T: 905-495-5402 F: 905-495-5404	sales@schedule-masters.org
Scheidt and Bachmann	TVMs, smart card payment	31 North Avenue	Burlington, MA 01803	T: 781-272-1664 F: 781-272-1654	rsimpson@s-b-usa.com
SEON Design Inc	Video Surveillance	Unit 111, 3B Burbidge Street	Coquitlam, BC Canada V3K 7B2	T: 877-630-7366 F: 866-664-3677	sales@seon.com
Shah Software	Paratransit sw	P.O. Box 9445	Midland, TX 79708	T: 800-968-2748 F: 432-224-1014	info@shahsoftware.com

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Shere	TVMs	10 Deacon Field	Guildford Surrey GU2 8YT	T +44 (0)1483 557400 F +44 (0)1483 557401	enquiries@shere.com
Sierra Wireless (formerly InMotion Technology)	Mobile Router Wireless WAN	625 Agnes Street, Suite 350	New Westminster, B.C V3M 5Y4	T: 604-523-2371 F: 604-648-9629	sales@inmotiontechnology.com
Sinclair	Antennas			T: 1-800-263-3275	salescan@sinctech.com
Singlepoint	WiFi hardware, WiFi analytics software, GPS tracking software			T: 1-866-959-9434 F: 503-726-2401	info@yoursinglepoint.com support@yoursinglepoint.com
SmartDrive	On-board video cameras, video analysis services, operator coaching tools	9276 Scranton Road, Suite 500	San Diego, CA 92121	T: (858) 225-5550 Toll-free: (866) 447-5650 F: (858) 638-1757	info@smartdrive.net
SPX Genfare	Fare systems	751 Pratt Blvd.	Elk Grove Village, IL 60007	T: 847-871-1145	tony.sharma@spx.com http://www.spx.com/en/genfare/resources/customer-support-sales/
Strategic Mapping	CAD/AVL, next arrival predictions	40 Eglinton Avenue East Suite 500	Toronto, Ontario Canada M4P 3A2	(416) 483-7522 x 230 F: 416-483-9074	info@mapstrat.com

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Syncretic Software Inc.	Paratransit software	228 Philadelphia Pike	Wilmington, DE 19809	T: 302-762-2600 x202 F: 302-762-2390	srosenberg@syncretic.com
Syncromatics	AVL tracking	5455 Wilshire Blvd, Suite 1800	Los Angeles, CA 90036	T: 310-728-6997 T: 213-973-1215 (Chris)	info@syncromatics.com chris@synchromatics.com
T2 Systems	TVM	8900 Keystone Crossing Suite 700	Indianapolis, IN 46240	T: 317-524-5500 T: 800-434-1502 F: 317-524-5501	
Telexis	Smart card systems	Laan van Zuid Hoorn 55 2289 DC	Rijswijk The Netherlands	T: +31 (0) 70 319 3938 F: +31 (0) 70 319 1759	info@telexis.nl
Telogis (formerly NavTrak, Inc.)	AVL	20 Enterprise, Ste 100	Aliso Viejo, CA 92656 U.S.A.	T:1-866-835-6447 T:1-949-389-5500 F:1-866-422-4096	
Thales Systems Canada, Inc.	Smart card systems	1 Chrysalis Way	Nepean, ON K2G 5X3	T: 613-723-7000 F: 613-723-5600	michael.laezza@thalesgroup.com

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thingtech LLC	Asset management, vehicle & asset tracking (CAD/AVL), route planning (scheduling software), mobile field apps	Atlanta Tech Village 3423 Piedmont Rd.	Atlanta, GA 30305	T: 678-463-9224 T: 404-493-6341	tim.quinn@thingtech.com brian.corcoran@thingtech.com sales@thingtech.com
TransIT Solutions	Asset tracking, GP5, map, cloud management	114 W. Grandview Ave.	Zelienople, PA 16063	T: 913-451-7029	Craig.cole@mytransitsolutions.com
Transit Video Security Systems	On-board Video	89 Fox St.	Owego, NY 13827-1401	T: 607-687-TVSS, F: 607-687-3474	sales@TVSSInc.com
Transitvue Communication Systems	Passenger Information Systems Control Center Monitoring Intrusion & Derailment Detection		Los Angeles, CA	T: 213-222-8831	sales@transitvue.com
TransLoc	AVL RTIS eAlerts	3344 Hillsborough St. Suite 100	Raleigh, NC 27607	T: 888-959-3120	info@transloc.com
Trapeze (formerly Fare Logistics)	Fareboxes and TVMs	#10 - 4223 Commerce Circle	Victoria, BC V8Z 6N6	T: 250-360-0012 F: 250-360-0066	tamara.sears@farelogistics.com

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Trapeze (formerly Mentor Engineering, Inc)	CAD/AVL Paratransit	10, 217S - 29th Street NE	Calgary, AB Canada T1Y 7H8	T: 403-777-3760 F: 403-777-3769	sales@mentoreng.com
Trapeze Enterprise Assets Management (formerly Maximus AssetWorks)	Maintenance sw	998 Old Eagle School Road, Suite 1215	Wayne, PA 19087	T: 610-687-9202 F: 610-971-9447	http://www.assetworks.com/contact-us/contact-fleet
Trapeze Group	Operations software Fixed Route Scheduling Software Demand Response Scheduling Passenger Rail Scheduling	5800 Explorer Drive, 5th Floor 8360 E. Via De Ventura, Ste L-200	Mississauga, Ontario L4W 5L4 Scottsdale AZ, 85258	T: 905-629-8727 F: 905-238-8408 T: 480-315-5023 F: 480-627-8411	rick.bacchus@trapezegroup.com peter.hallsworth@trapezegroup.com Johnny.young@trapezegroup.com
Trapeze Group (formerly Continental)	CAD/AVL	5265 Rockwell Drive NE	Cedar Rapids, IA 52402	T: 319-743-1136 F: 319-743-1025	
Trimble Navigation Ltd	CAD/AVL, Customer Solutions	Main Office 935 Stewart Drive	Sunnyvale, CA 94085	T: 408-481-8000 T: 800-TRIMBLE F: 408-481-7808 Sales: T: 877-728-7623 T: 408-456-6600	mrminfo@trimble.com

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TSS Wireless	MDT	500 N Brand Blvd., Suite 560	Glendale, CA 91203	T: 323-954-7744 F: 323-954-9544	info@tsswireless.com
Ubisense	AVL/"Real Time Location Solutions"	St Andrew's House St Andrew's Road,	Chesterton, Cambridge, CB4 1DL. UK	T: +44 1223 535170 F: +44 1223 535167	enquiries@ubisense.net
Unified Dispatch	IVR	2400 Lincoln Avenue	Altadena, CA 91001	T: 410-552-9494 F: 410-510-1673	info@unified-dispatch.com
Urban Transportation Associates	APC	4240 Airport Rd Suite 212	Cincinnati, OH 45226	T: 513-961-0099	David.bosshammer@fuse.net info@usatransit.net
Utility	AVL, Routers, Access Points	1484 Brockett Road Suite 200	Tucker, GA 30084	T: 404-816-0330	info@utility.com can find region specific sales emails at: http://utility.com/company/salesteam
Ventek	TVMs	975 Transport Way	Petaluma, CA 94954	T: 707-773-3373 F: 707-773-3381	info@ventek-intl.com

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Vix Technology USA (includes former ERG)	Smart card systems	411 First Avenue South, Suite 1N	Seattle, WA 98104	T: 206-749-5500 F: 206-749-9670 T:508-918-9221	seattle@reception.vixtechnology.com
WebTech Wireless	Browser-based fleet tracking and next arrival predictions	215 - 4299 Canada Way	Burnaby, British Columbia Canada V5G 1H3	T: 604 434 7337 T: 1 866 287 0135 F: 604-434-5270	sales@webtechwireless.com
XEROX TMS (formerly ACS Transport Solutions, Inc. and Orbital TMS)	CAD/AVL	45 Glover Ave	Norwalk CT 06856	T: 800-275-9376	http://services.xerox.com/contactrequest.aspx
Zonar	AVL VHM	18200 Cascade Avenue S.	Seattle, WA 98188	T: 877-843-3847 T: 206-878-2459 F: 206-878-3082	Info@zonarsystems.com