

# The EDAPTS Approach: *Defining Project Needs*



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**EDAPTS: The Efficient Deployment of Advanced Public Transportation Systems**

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## ABBREVIATIONS

APC	Automated Passenger Counter
APTS	Advanced Public Transportation Systems
ATMS	Advanced Transit Management System
AVL	Automatic Vehicle Location System
CAD	Computer Aided Dispatch
Cal Poly Pomona	California State Polytechnic University Pomona
Cal Poly SLO	California Polytechnic State University San Luis Obispo
Caltrans	California Department of Transportation
CCIT	California Center for Innovative Transportation
EMS	Emergency Medical Services
EPS	Electronic Payment Systems
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GPS	Global Positioning System
MDT	Mobile Data Terminal
MPO	Metropolitan Planning Organization
RID	Roadside Information Display
RTA	Regional Transportation Agency
SLO Transit	City of San Luis Obispo Transit Agency

## OVERVIEW

The purpose of this guide is to help transit agencies begin to envision Advanced Public Transportation Systems (APTS) for their transit systems. Mostly, this involves defining the agency's needs using a set of simple well-defined steps that are done before well before any hardware or software is purchased.

The approach that is used in this guide is called EDAPTS and it stands for Efficient Deployment of Advanced Public Transportation Systems. It was developed especially for rural and small urban transit agencies to help meet their specific needs and challenges. These challenges include lack of funding, procurement options, and technical assistance. In response to this, EDAPTS offers a procurement methodology and a set of tools that help transit agencies achieve low-cost and long-term APTS solutions for their transportation needs. The EDAPTS approach offers resources and tools to assist at various stages in the procurement process. This process and associated resources are described in detail in the section called *The EDAPTS Approach*.

Also included is a guide that will introduce APTS and help a transit agency determine which, if any, systems are needed. This ensures that money and time are not spent on unneeded changes to a transit system.

The first section will help a transit agency become familiar with APTS. It includes a list of the benefits of APTS and describes recommended APTS components. These components are focused on increasing efficiency and improving the transit experience for passengers.

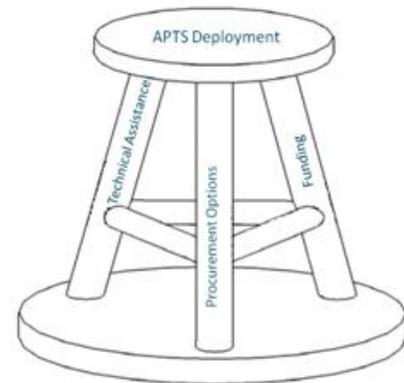
Because EDAPTS advocates lower life-cycle costs, an accurate needs assessment is critical to avoid spending valuable resources on unneeded features, systems and equipment. To assist with this, a step-by-step guide is included to help assess needs. The needs assessment guide has three steps. The first step is to identify and consult stakeholders. Once stakeholders are engaged, focus groups and surveys are used to determine their specific transportation needs and expectations regarding transportation improvements. Resources to facilitate this process are provided in the appendices. Overall, this guide helps transit agencies identify the needs of the community, the APTS that can address those needs, and the resulting benefits. Finally, the guide helps a transit agency communicate this information to decision-makers through the development of operational scenarios.

## THE EDAPTS APPROACH

The expanding array of Advanced Public Transportation System (APTS) technologies is constantly improving the performance of public transportation systems around the nation. As the cost of technologies decrease, these solutions are no longer limited solely to large transit systems, but are now seriously considered for use in small urban and rural environments.

The main reasons for the limited use of APTS technology in small urban and rural areas are the lack of discretionary resources for deployment, accessible procurement options and on-going technical assistance. These three problems make up the legs of the *three-legged stool* approach to APTS deployment. Successful deployment depends on each of these three elements. Through conversations with smaller transit agencies, some specific problems were discovered. For instance, it is often the case that these agencies have lower fare box collections, limited access to funding sources for new and better technology, and lack in-house personnel with the necessary skills for technical support required for APTS deployment.

In response to these challenges, a group of researchers and engineers has developed the Efficient Deployment of Advanced Transportation Systems (EDAPTS) approach that guides small urban and rural transit agencies through the process of acquiring APTS.



Three-legged stool of APTS deployment

## BACKGROUND

In 1998, the Federal Transit Administration (FTA) and the California Department of Transportation (Caltrans) teamed up with California Polytechnic State University at San Luis Obispo (Cal Poly SLO) and the City of San Luis Obispo Transit (SLO Transit) to investigate ways to make APTS more affordable for the small transit operator and to provide lower cost system growth and enhancements over time.

In 2007 Caltrans asked the California Center for Innovative Transportation (CCIT), along with Cal Poly SLO and California State Polytechnic University at Pomona (Cal Poly Pomona) to compile a comprehensive body of knowledge that could be utilized by any small urban or rural transit agency to deploy APTS more efficiently and at a lower life-cycle cost. The result of this research is the EDAPTS approach.

## DESCRIPTION OF THE EDAPTS APPROACH

EDAPTS is a set of analytic tools, a recommended procurement methodology, and information that facilitates implementation of APTS for small urban and rural transit providers. EDAPTS outlines procurement options, provides useful information on funding sources, and advocates open source designs and open interface protocols. Implementing APTS in a transit system is an exciting, yet challenging, process. By using the EDAPTS methodology and the tools provided, a transit agency can implement the technologies it needs at a lower life-cycle cost. Overall, the EDAPTS motto is: *Buy only what you can afford and really need now, but buy adaptable solutions that can grow as you and your needs change.*

More specifically, lower life-cycle costs are achieved by adhering to these principles:

1. Build APTS systems that meet specific transit needs. This means distinguishing between those systems that are desired and those that are required.
2. Promote the use and incorporation of non-proprietary subsystem interfaces that facilitate future expansion.
3. Make system performance trade-offs that significantly reduce life-cycle costs but do not adversely impact the intended usefulness of the deployed system.

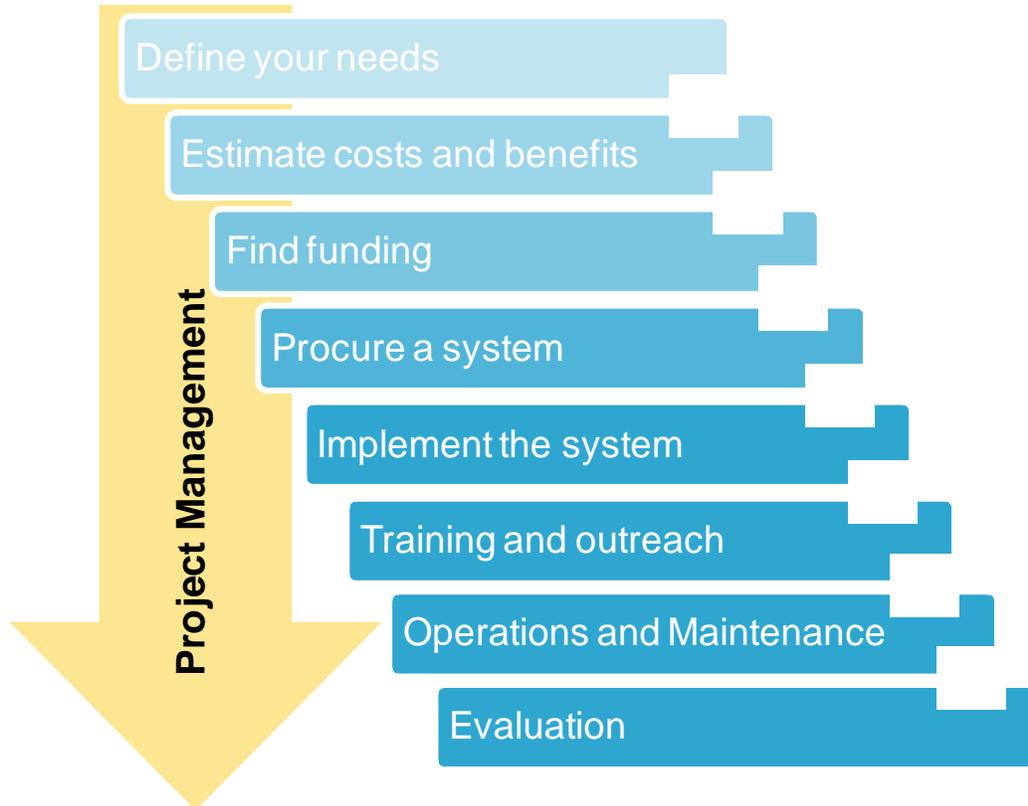
## THE EDAPTS PROCESS

EDAPTS outlines a process of obtaining APTS technology, as shown in the diagram on the next page. This is a comprehensive process, guiding a transit agency from pre-implementation through implementation to general operations and maintenance of the system. These steps are:

- **DEFINE YOUR NEEDS:** This step guides a transit agency through identifying stakeholders and collecting the needs and expectations of stakeholders before implementing an APTS project. This process also involves developing common operational scenarios to help formulate the benefits of APTS for a community.
- **ESTIMATE THE COSTS AND BENEFITS:** This process helps to estimate the costs and benefits of APTS that is needed during the pre-implementation phase. A tool that estimates cost and benefits based on transit agency characteristics is available.
- **FIND FUNDING:** This process involves identifying one or more potential grant programs or funding sources at the federal, state and local level for APTS implementation. A list of potential funding sources and possibly even a specific funding mechanism under State purview will be made available.
- **PROCURE THE TECHNOLOGY:** This process helps a transit agency procure APTS that is currently needed while making sure it can be expanded incrementally at a low life-cycle cost. A dynamic tool to develop the technical specifications and a data format standard along with a list of pre-qualified suppliers will be made available.
- **IMPLEMENT THE SYSTEM:** This is the actual implementation of the procured APTS through the processes described above. The supplier of the APTS is typically responsible for this process in close coordination with the transit agency.
- **TRAIN EMPLOYEES AND TRANSIT USERS:** Employees who use the APTS need to be trained to effectively utilize the enhanced system capabilities and transit riders need to be made aware of the system enhancements. This process helps you through the initial time period after implementation.
- **OPERATE AND MAINTAIN:** APTS solutions need continued up-keep and maintenance for reliable performance. An agency needs to identify a funding stream to meet this need. An APTS supplier can be hired for this service or the agency may choose to do this themselves.

- **EVALUATE:** Evaluating deployed APTS solutions is critical to justify investment to stakeholders and funding entities. This helps facilitate trust and acceptance of the system and enable future expansion of APTS.

The EDAPTS Process



**FOR MORE INFORMATION ON THE EDAPTS APPROACH**

Go to the EDAPTS website located at

<http://www.calccit.org/projects/EDAPTS.html>

Or contact a member of the project team listed below.

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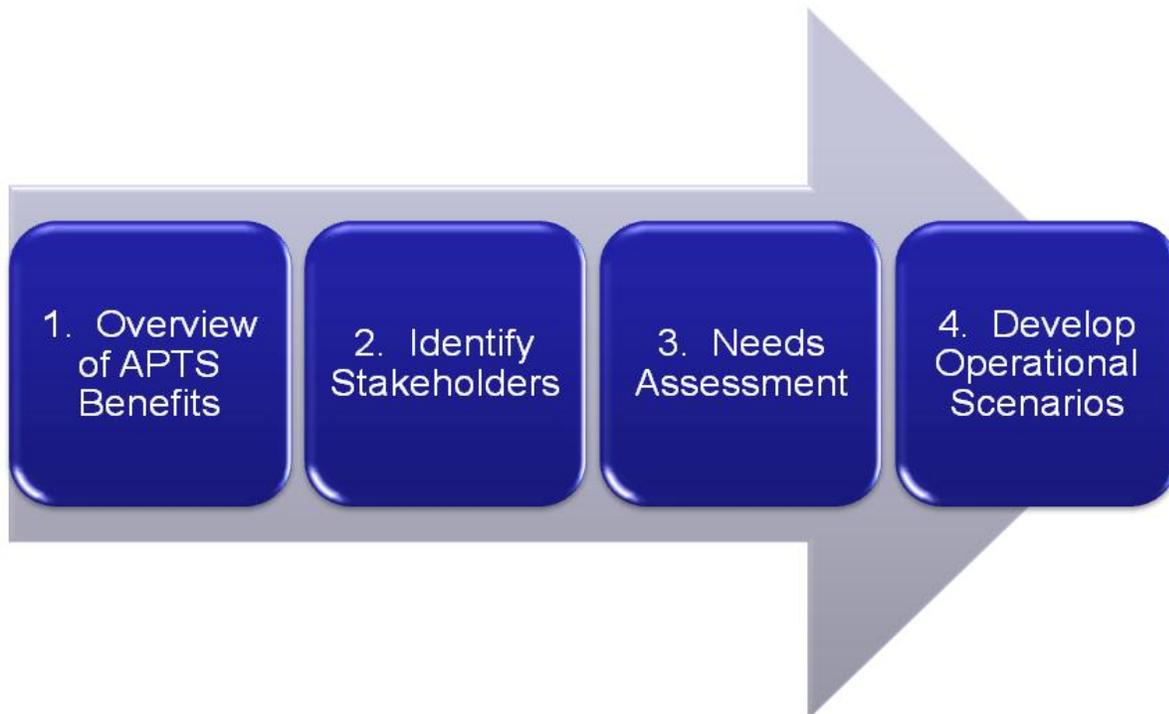
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## GETTING STARTED

The overall purpose of the guide is to assess a transit agency's need, if any, for APTS. The critical first step in doing this is to become familiar with APTS technology. This helps answer the question, "Why consider APTS?" In response to this question, the first section details the benefits of APTS including some unique benefits to rural and small urban transit agencies. One goal of the guide is to help a transit manager or operator start to envision the ways that APTS can improve his/her transit system.

The next section of the guide begins a process of assessing a transit agency's needs through stakeholder identification and needs analysis. To begin, it is crucial to correctly identify stakeholders, or groups of people that use, work, and/or interact with the transit system. Lessons learned from previous deployments have shown that this is an important step. By correctly identifying stakeholders, a shared understanding of the goals of the transit improvements is achieved. The second step is to communicate with stakeholders and find out what they need from their transit system. There are resources and suggestions to help facilitate this step. The third step is to connect the needs of stakeholders to available APTS components and describe system benefits through operational scenarios. This process is important for reducing the risk of schedule and cost excesses and increasing the likelihood that the implementation meets users' needs.



## AN INTRODUCTION TO ADVANCED PUBLIC TRANSPORTATION SYSTEMS (APTS)

Providing public transit service to small urban and rural communities involves a unique set of needs. For instance, users are often faced with uncertainty when trying to catch a bus that may only come once every hour to a rural bus stop. At the same time, the small transit system operator typically struggles to maintain schedules and has to deal with elevated safety concerns for drivers and passengers when buses are on long headway sections of a route, especially in remote areas. Advanced Public Transportation Systems (APTS) have been developed and deployed in large-scale transit properties as a means of increasing the efficiency and safety of transit services, as well as offering users easy access to real-time travel information.

### OVERVIEW OF THE BENEFITS OF APTS

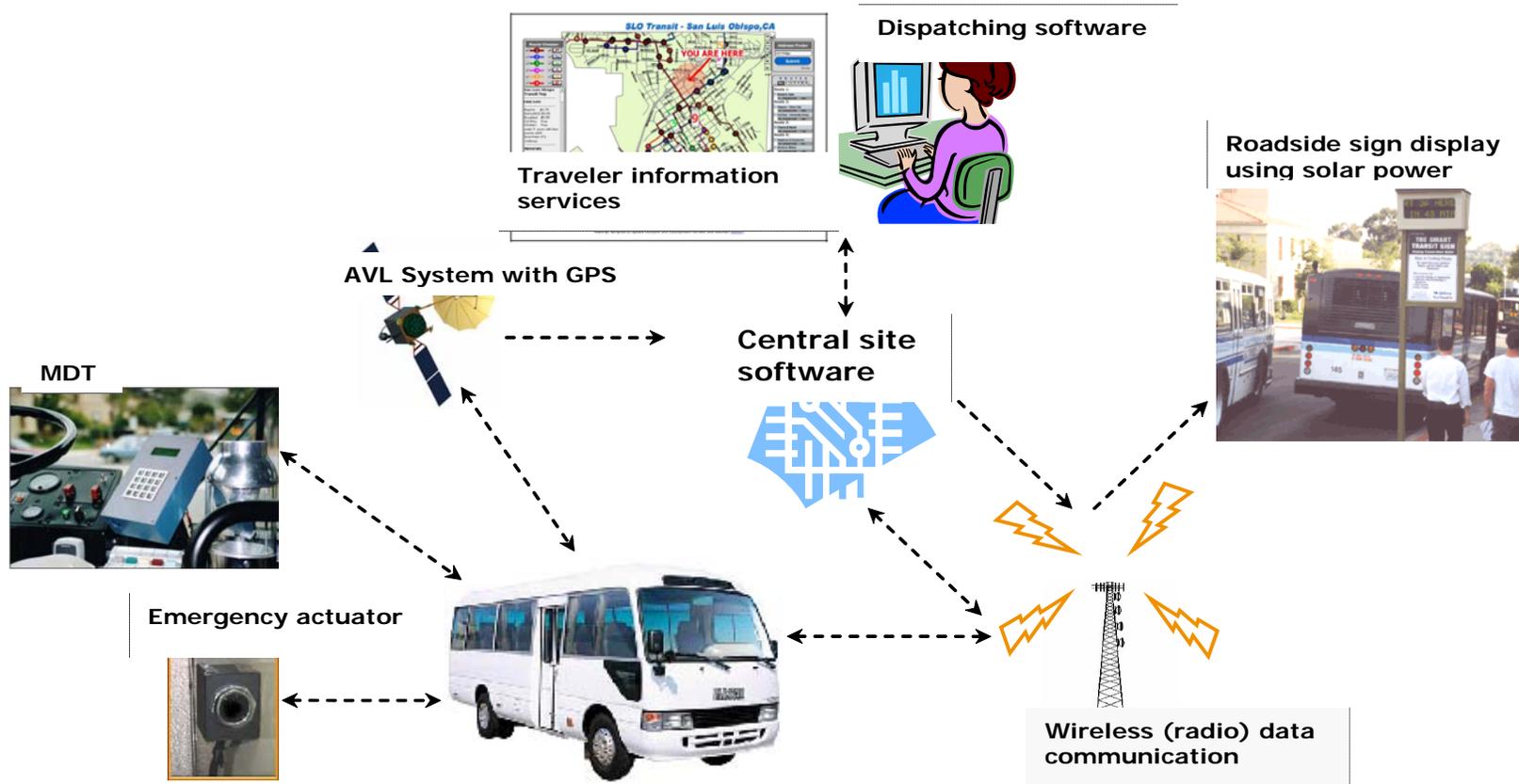
Every stakeholder, from passenger to transit operator, will benefit from APTS implementation using the EDAPTS approach. APTS technology provides more on-time arrivals and better time keeping so vehicle operators know when to depart from each vehicle stop. Real-time monitoring allows passengers to gauge arrival times and transit agencies to be continuously aware of drivers' and passengers' needs.

A list of benefits is provided below for easy reference.

- Due to real-time bus arrival times passengers no longer have to wait for the bus.
- On-line trip planning gives passengers the ability to use public transportation more effectively.
- Improved schedule adherence.
- Better response to changes in service needs if paratransit services are provided.
- Improved impression of public transit as a viable alternative to driving.
- Improved emergency response times.
- Streamlined and more efficient scheduling.
- Automated data collection and reporting which reduces time spent manually entering passenger information into a database. Also, transit managers can generate reports easily.
- Real-time monitoring of routes, incidents, driver and passenger needs.

Major components of the recommended APTS systems generally include the Vehicle On-Board Systems, Dynamic Roadside Information Displays, Central Transit Management Systems, Roadside Data Communications Systems, and Traveler Information Systems (see the following diagram for examples). As a quick reference, components of these systems are described in detail in Appendix I of this document.

APTS COMPONENTS



These systems were investigated as part of the EDAPTS research effort. Appendix I also briefly looks at other APTS applications that may have the potential to improve the operations of small urban and rural public transportation systems. Small urban or rural transit agencies can customize APTS deployment by using one or more of the components described. In some cases, it may be necessary to look at a broader list of APTS technologies to address new or unique problems and needs.

Now that there is an understanding of what is possible with regard to APTS, the following section begins the needs assessment process with stakeholder identification.

## IDENTIFYING STAKEHOLDERS

The first step is to identify all people and entities that have a stake in the operation of your transit properties. These stakeholders includes passengers, drivers, dispatchers, and managers, at a minimum. Table 1 provides a summary of the process of identifying these stakeholders. Appendix II is a sample worksheet that can also be used to help identify stakeholders.

**Table 1 Identifying Stakeholders**

<b>Objectives</b>	<ul style="list-style-type: none"> <li>▪ Identify high-level end-users, implementers and regulators whose needs should be understood and addressed by your project.</li> <li>▪ Improve continuity between planning and implementation by understanding who needs to be involved in each phase of the project.</li> </ul>
<b>Sources of information</b>	<ul style="list-style-type: none"> <li>▪ Affected transit agencies, partners, and associated local government organizational charts.</li> <li>▪ Typical transit system users based on agency records, surveys and other sources.</li> </ul>
<b>Key activities</b>	<ul style="list-style-type: none"> <li>▪ Identify individual stakeholders and groups that are affected by changes in the transit system</li> <li>▪ Generate a list of representatives for each entity.</li> <li>▪ Briefly describe and document roles and responsibilities of each stakeholder.</li> </ul>
<b>Results</b>	<ul style="list-style-type: none"> <li>▪ A comprehensive list of stakeholders and documented agreements on their roles and responsibilities for the project.</li> <li>▪ Consolidation of stakeholders into groups linked by common interests and attributes, such as the traveling public, public agencies and private organizations.</li> </ul>

The remainder of this section outlines a sample set of typical stakeholders for a typical APTS deployment. This section can be useful in identifying the stakeholders that should be contacted and considered as participants in selection of APTS components.

The major stakeholder groups are:

1. Public transportation passengers
2. Public/ government agencies

The following list is a collection of potential groups that may be considered. Some may not be relevant to specific transit systems; others may need to be modified for a particular transit organization's list.

EXAMPLE STAKEHOLDERS

PUBLIC TRANSPORTATION PASSENGERS	
	<p><b>FIXED ROUTE PASSENGERS</b> - Riders using services where vehicles run on regular, pre-designated, pre-scheduled routes. This group needs representation for the frequent riders as well as infrequent riders and visitors to the area.</p>
	<p><b>PARATRANSIT PASSENGERS</b> - Riders using on-demand transit services (i.e. paratransit). The users of these services <u>must be</u> represented if you provide this type of service. If voluntary representatives are not forthcoming, you should actively seek involvement from qualified representatives. This is an important stakeholder with special needs, many of them covered by the Americans with Disabilities Act. For more information on accessibility requirements see <a href="http://www.dot.gov/citizen_services/disability/disability.html">http://www.dot.gov/citizen_services/disability/disability.html</a>.</p>
PUBLIC/GOVERNMENT AGENCIES	
	<p><b>FEDERAL ENTITIES:</b></p> <ul style="list-style-type: none"> <li>• United States Department of Transportation (USDOT)</li> <li>• Federal Highway Administration (FHWA)</li> <li>• Federal Transit Administration (FTA)</li> </ul>
	<p><b>STATE AND REGIONAL ENTITIES:</b></p> <ul style="list-style-type: none"> <li>• California Department of Transportation (Caltrans)</li> <li>• Metropolitan Planning Organization (MPO)</li> <li>• Regional Transportation Agency (RTA) <ul style="list-style-type: none"> <li>○ County Commissions, County Councils and Transportation Congestion Management Agencies</li> <li>○ Transit District Board of Directors</li> </ul> </li> </ul>
	<p><b>LOCAL ENTITIES:</b></p> <ul style="list-style-type: none"> <li>• Transit Authority in the City Government</li> <li>• Department of Public Works</li> <li>• City / County Council</li> <li>• City / County Planning Department</li> </ul>

	<p><b>OPERATING AGENCIES AND OTHER SERVICE PROVIDERS:</b></p> <ul style="list-style-type: none"><li>• <u>Transit Service Provider (could be public or private)</u>: The agency that is responsible for the day-to-day operations of the public transportation system. Including:<ul style="list-style-type: none"><li>○ Maintenance staff who are responsible for vehicles and APTS</li><li>○ Management staff who are responsible for meeting the reporting requirements and administering the day-to-day activities of the agency</li><li>○ Operators who drive the vehicles</li><li>○ Dispatchers who are responsible for the coordination of vehicles and compliance to fleet schedules</li></ul></li></ul> <hr/> <p><b>FIRST RESPONDERS:</b></p> <ul style="list-style-type: none"><li>• <u>Transit Police or Public Law Enforcement</u>: The agency responsible for law enforcement on the transit vehicles or at transit facilities (bus stops, stations, etc.)</li><li>• <u>Emergency and Medical Services (EMS) Personnel</u>: The agencies that will be called upon to resolve emergency and medical situations</li></ul>
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## ASSESSING NEEDS

The next step in the EDAPTS approach is to assess the needs of identified stakeholders and stakeholder groups. The needs identification and analysis will only be successful if the stakeholders are engaged in this process. This typically involves actively seeking representation from each of the stakeholder groups.

Once the representatives of the stakeholder groups are identified, their needs can be determined through either individual interactions or group discussions. Appendix III and IV are worksheets that can be given to stakeholders to help assess their needs. The worksheet in Appendix III is directed at users/riders and Appendix IV is directed at dispatchers, managers and drivers. Table 2 is a summary of the needs assessment process.

**Table 2 Performing Needs Assessment**

<b>Objectives</b>	<ul style="list-style-type: none"><li>▪ High-level identification of APTS needs in terms that all stakeholders can understand</li><li>▪ Improved continuity between planning and deployment by identifying the most important needs for each of the stakeholders</li></ul>
<b>Sources of information</b>	<ul style="list-style-type: none"><li>▪ Stakeholder lists</li><li>▪ Needs assessment worksheets (see Appendices III and IV)</li></ul>
<b>Key activities</b>	<ul style="list-style-type: none"><li>▪ Define, prioritize and get approval on the needs for each stakeholder group. Signature approval by responsible individuals or corporate management is preferred.</li></ul>
<b>Results</b>	<ul style="list-style-type: none"><li>▪ A comprehensive, prioritized list of stakeholder issues and needs</li></ul>

Some examples are provided below to help you get started.

### EXAMPLE NEEDS

#### NEEDS OF THE TRAVELING PUBLIC

- **PUBLIC TRANSPORTATION PASSENGERS**

- Improved Confidence in Vehicle Arrivals and Departures at Stops and Transfer Points

Schedule adherence is important for all transit users. However, in small urban and rural areas it is very common for transit systems to have headways of 30 minutes or longer, making this parameter even more important to those users. Early departures or late arrivals clearly reduce the confidence among users in the viability of public transportation and discourage new users from relying on it as their primary mode of travel.

- Accurate Transit Schedules

The transit system should have reliable and readily accessible published timetables. Accurate timetables allow passengers to properly time their arrival at a stop and closely match their travel needs to the arrival of a specific transit vehicle.

- Accessible Real-time Vehicle Arrival Information

Disseminating real-time vehicle arrival information to users for all periods of the day when service is available provides additional benefits over published schedules and give a heightened comfort factor to users. Passengers may make informed decisions regarding whether to wait at a stop, use the available time for other tasks, seek alternate transportation, or walk to their destinations.

- Online Schedule Information

The proliferation of computers, cellular phones, personal digital assistants (PDAs) and similar wireless technologies has resulted in an increasing number of transit users that have anywhere/anytime access to travel-related information. Therefore, transit schedules and real-time arrival information can be posted online, further enhancing the ability of passengers to adjust their travel schedules and reduce waiting time.

- Simple Online/Phone Systems For Making Demand Responsive Transit Requests

Demand responsive transit systems allows passengers to access information and make transportation requests in a number of easy ways. These can include requests over the phone or using Internet-based applications. Using these technologies, passengers can enter their demand responsive transit requests through an online form or even through an automated voice menu using the telephone.

## NEEDS OF PUBLIC/GOVERNMENT AGENCIES

- **GOVERNMENT ENTITIES**

- Efficient Transportation System through Better Transit Services

Competitive alternate modes of transportation make the entire transportation system (including highways, freeways and street networks) more efficient and effective. All government entities responsible for transportation systems in the nation are interested in using APTS technologies to make transit a truly competitive alternate mode of transportation.

- Improved Reporting Accuracy

Automatically generated reports, using real-time (or near real-time) information on performance, ridership and revenues improves the accuracy of transit service reports. These reports and data assist regulatory agencies in efficiently allocating funding, and facilitate the mandatory reporting required by the Federal Transit Administration (FTA). Furthermore, information derived from an APTS solution can be used to improve transit services and positively affect regional planning efforts. They may facilitate access to additional funds for transit investments. Long-term data provides a “target rich” environment when assessing transit system performance over time.

- OPERATING AGENCIES

- Simple Mechanism to Improve Schedule Adherence

Providing drivers with ready access to route and schedule performance information facilitates better schedule adherence. Improved schedule adherence greatly improves the transit user's confidence that buses will arrive on schedule.

- Automated Logging of Information

Current small urban and rural transit systems often rely heavily on drivers to collect various system and operational data by hand. This frequently requires additional effort when drivers start and end their services, run their routes, board passengers, and fuel their vehicles. In some cases, it may even require additional personnel. Implementing automated data collection tools relieves the workload of drivers, improve the collection of data and minimize the need for temporary staffing in this area.

- Improved Security and Safety

Transit vehicle operators and passengers benefit from a safer transportation experience if there is a method to easily and discretely send a request for emergency assistance when there is a serious threat or dangerous situation on board the transit vehicle.

- Enhanced Fleet Management Capabilities

By knowing real-time information regarding the current location of all fleet vehicles through technologies like Automatic Vehicle Location System (AVL), dispatchers and operators are able to manage fleets of transit vehicles more efficiently. This information helps them better coordinate mechanical service calls, substitute transit vehicles in the event of malfunctions, replace drivers, and respond to requests for information. Dispatchers have a better understanding of current vehicle operations with respect to travel time, travel speed, vehicle spacing, and schedule adherence. AVL also allows dispatchers to respond more accurately and quickly to emergency situations.

- Ability to Ensure More Appropriately Spaced Bus Arrivals at Stops

An unintentional platoon of closely spaced transit vehicles operating on the same route and arriving at the same stops in close proximity significantly reduces the overall efficiency of bus service. APTS can help transit vehicles maintain assigned schedules, proper spacing and consistent headways to improve route efficiency and reduce bottlenecks.

- Easily Generated Performance Reports

Typically, transit providers must produce various reports detailing daily, weekly, monthly, quarterly or annual operations. They benefit from systems that automate this tedious and labor-intensive reporting task. Many of the newer APTS solutions can be instructed to automatically generate these reports to meet the specific reporting needs of the agency.

- **FIRST RESPONDER NEEDS**

- Improved Response to “Mayday” Requests

When drivers request emergency assistance, a system enabling dispatchers to alert local emergency providers with accurate vehicle location information is a crucial element of a prompt response.

AVL applications enable emergency responders to locate affected vehicles with minimal delay. Wireless communication technologies make it simpler for operators and dispatchers to coordinate safety issues with the police department, fire department and emergency responders.

## DEVELOPING OPERATIONAL SCENARIOS

A good way to communicate benefits to decision-makers is to create operational scenarios that describe how stakeholders will use APTS and the benefits they will receive. Operational scenarios are important in the final APTS design by showing how the parts of the system work together as a whole to improve the transit experience for various stakeholders. They can also serve as the basis for developing user manuals and acceptance test plans for the system. Finally, the scenarios are useful tools for vendors to verify that the APTS system design they propose satisfy the stakeholder needs and expectations, both now and in the future.

Defining stakeholders' needs and developing operational scenarios is a small, but important, step in the Federal Highway Administration (FHWA) Systems Engineering process. This process is important for reducing the risk of schedule and cost excesses and increasing the likelihood that implementation meets user's needs. Adherence to this process is also necessary when certain funding sources are used.

For more information about the Systems Engineering process and its requirements go to <http://ops.fhwa.dot.gov/publications/seitsguide/index.htm>.

Table 3 provides a summary of the process of developing operational scenarios.

**Table 3. Developing Operational Scenarios**

<b>Objectives</b>	<ul style="list-style-type: none"> <li>▪ High-level overview of how stakeholders interact with the new APTS system</li> <li>▪ Clear understanding of the benefits of APTS through improved passenger, driver, and transit agency experiences</li> </ul>
<b>Sources of information</b>	<ul style="list-style-type: none"> <li>▪ Stakeholder list</li> <li>▪ Needs assessment</li> <li>▪ Broad stakeholder input (through surveys, direct feedback, etc.)</li> <li>▪ APTS components descriptions</li> </ul>
<b>Key activities</b>	<ul style="list-style-type: none"> <li>▪ Using sample scenario tables to show how an APTS system improves the transit experience for your agency, drivers, passengers and any other stakeholders.</li> <li>▪ Note the benefits that each stakeholder receive.</li> <li>▪ Link each scenario to a list of the APTS components needed for that scenario (see <i>The EDAPTS Approach: an overview</i>, for an example of how to present these scenarios).</li> </ul>
<b>Results</b>	<ul style="list-style-type: none"> <li>▪ A set of clearly defined scenarios, user benefits, and APTS components needed (see following example scenario tables).</li> </ul>

The following sample scenarios show how an APTS works during typical daily operation. Using a sample list of potential stakeholders, operational scenarios are presented to describe how the trip experiences of each group improve following an APTS implementation. It is important to note that transit agencies may choose part (i.e., one or more) of the APTS systems included in the EDAPTS approach that meet their unique needs.

## SAMPLE SCENARIOS

In this section, a template for the creation of scenarios is provided, followed by a set of sample scenarios from the perspectives of passengers, drivers, and dispatch personnel. While the following scenarios often involve multiple stakeholders, they are organized based on which stakeholder is the main actor.

### SCENARIO TEMPLATE: FOR TRANSIT AGENCY USE

SCENARIO A	Describe the experience stakeholder(s) will have with some part of an APTS system
Benefit	Describe how this scenario improves the stakeholder experience <i>Example: Passenger and driver safety</i>
Stakeholders involved	List all stakeholders involved in the scenario <i>Example: Passenger and driver</i>
EDAPTS elements needed	List the components or APTS technologies required for this scenario <i>Example: Emergency actuator button, MDT, AVL, Dispatching Software, Central Site Software</i>

### PASSENGER SCENARIOS

SCENARIO 1A	A passenger walks to a bus stop and sees that the bus will not arrive for 4 minutes. He or she has time for a quick cup of coffee.
Benefit	Provides real-time information to waiting passengers giving them peace of mind as well as an opportunity to make better use of wait time. Passengers are more satisfied with the quality of service provided.
Stakeholders involved	Passenger Bus Driver Transit Manager
APTS components needed	Dynamic Roadside Information Sign Advanced Vehicle Location (AVL) Dispatching Software Mobile Data Terminal (MDT) Wireless Data Communication

SCENARIO 1B	A passenger wants to know when the next bus is expected to arrive at his/her regular stop. The passenger accesses information via internet or telephone. The information displays that the bus will arrive in 20 minutes allowing plenty of time for the passenger to walk to the bus stop.
Benefit	Passenger minimizes wait time Decreases passenger stress
Stakeholders involved	Passenger
APTS components needed	Dispatching Software Advanced Vehicle Location (AVL) Mobile Data Terminal (MDT) Wireless Data Communication Public Website and/or Automated Phone Systems

SCENARIO 1C	A passenger does not have exact change for the bus fare. The passenger is able to purchase a fare/pass using the electronic payment system at the bus stop before the bus arrives.
Benefit	Reduces boarding time because money is not exchanged while boarding the bus Reduces labor associated with counting and collecting money Improves customer experience
Stakeholders involved	Passenger Driver Dispatcher
APTS components needed	Electronic Payment System (EPS) Mobile Data Terminal (MDT)

## DRIVER SCENARIOS

SCENARIO 2A	A driver arrives at a stop. The MDT displays the bus stop location to the driver and automatically counts down the time until scheduled departure from the stop.
Benefit	Improved schedule adherence Drivers feel more comfortable and relaxed due to automatic countdown Passengers benefit from buses that are on-time
Stakeholders involved	Driver Dispatcher Passenger
APTS components needed	Mobile Data Terminal (MDT) Dispatching Software Central Site Software Automatic Vehicle Location (AVL) Wireless Data Communication

SCENARIO 2B	A driver arrives for his/her shift. The MDT screen allows the driver to log in with his/her name and the bus' odometer reading.
Benefit	Decreased labor needed to input driver logs and bus mileage data Eases the production of operational reports These reports can help: <ul style="list-style-type: none"> <li>• Fulfill funding requirements</li> <li>• Assist with future scheduling</li> <li>• Improve efficiency</li> <li>• Justify budget changes</li> </ul>
Stakeholders involved	Driver Dispatcher Transit Manager
APTS components needed	Mobile Data Terminal (MDT) Dispatching Software Central Site Software

SCENARIO 2C	A driver notices a disruptive passenger on board the bus and feels as though the situation is about to become dangerous. The driver discretely presses the emergency actuator, alerting central dispatch. The dispatcher can coordinate with emergency responders by providing accurate real-time location information.
Benefit	Allows discrete communication when radio communication is not possible Improves emergency response time due to location information

Stakeholders involved	Driver Passenger Dispatcher
APTS components needed	Emergency Actuator Dispatching Software Central Site Software Automatic Vehicle Location (AVL) Mobile Data Terminal (MDT)

SCENARIO 2D	A driver arrives at a stop; the automatic passenger counter (APC) counts passengers as they board and get off the bus.
Benefit	Reduces drivers' workload and stress Drivers can focus on passenger needs and safety Decreased manpower for ridership counts
Stakeholders involved	Driver
APTS components needed	Automatic Passenger Counter (APC) Mobile Data Terminal (MDT) Wireless Data Communication Central Site Software

## DISPATCH PERSONNEL AND TRANSIT MANAGERS

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SCENARIO 3A	Dispatch personnel and transportation managers use mileage data, arrival and departure times, and driver information to generate reports.
Benefit	These reports can help: <ul style="list-style-type: none"> <li>• Fulfill funding requirements</li> <li>• Assist with future scheduling</li> <li>• Improve efficiency</li> <li>• Justify budget changes</li> </ul>
Stakeholders involved	Passenger Driver Dispatcher Transit Manager Regulatory body
APTS components needed	Automatic Vehicle Location (AVL) Mobile Data Terminal (MDT) Central Site Software Dispatching Software

By choosing from the above list of operational scenarios and customizing them to meet your specific needs, the benefits of the improvements you envision can be easily communicated to community members and decision-makers. These operational scenarios are also displayed in picture form in Appendix V. Depending on what format is most comfortable, these can easily be made into a slideshow to present to decision-makers

## CONCLUSION

This guide helps a transit agency navigate the first steps toward APTS procurement. These steps include:

- **Getting familiar with APTS:** Find out ways that APTS can work for you! Many small urban and rural transit agencies have not considered using APTS technologies because of funding, procurement and technical challenges. These technologies, though, offer unique benefits to small urban and rural transit agencies. Some important benefits include real-time arrival notification for buses that may only come once or twice per hour and an emergency notification system that helps protect drivers and passengers on routes in remote areas.
- **Identifying Stakeholders:** Get people involved! Receiving input from many people and groups takes a lot of time, but it is an investment in the future success of the APTS deployment. When people get involved in the visioning process they have “buy-in” and the community can start to share a common understanding of the goals of the system changes.
- **Assessing Needs:** What is needed? This is a basic, yet critical, question to ask. Keeping APTS deployment low cost is essential and the first way to do this is through an accurate needs assessment. This will ensure that money and time is not wasted on needless systems. Also important, is prioritizing these needs. It may be that not all of the system improvements can be accomplished at once, so keeping a list of priorities is a good way to make long-term improvements.
- **Developing Operational Scenarios:** Communicate the benefits of APTS! While transit managers and operators may agree on what systems to implement, it is often the case that an external body, such as a city council or regional planning board, has to be convinced. One way to do this is with operational scenarios. These scenarios demonstrate the ways in which APTS functions and the benefits that are received by each stakeholder. They should be easy to understand, making it a good way to present system improvements to decision-makers.

There are many tools and resources located in this document for getting started with APTS procurement. For more information and technical assistance, please contact the California Center for Innovative Transportation by email at [ccitdesk@calccit.org](mailto:ccitdesk@calccit.org) or by phone at 510-642-4522.

## APPENDIX I: RECOMMENDED APTS SYSTEMS

This is a quick reference that describes various APTS components that can increase efficiency of transit operations, improve passengers' experience, and improve reliability and safety for rural and small urban transit systems. This information is an important reference when deciding which, if any, improvements to implement.

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### VEHICLE ON-BOARD SYSTEM

Vehicle On-Board components include the equipment and software elements installed in a transit vehicle. These may include:

1. **MOBILE DATA TERMINAL (MDT)** – the device that allows the driver to access schedule adherence status, collects passenger-boarding counts, records time of day and route being driven, etc. The MDT is connected to other elements of the Vehicle On-board System and to the Central Transit Management System via on-board communication links.
2. **EMERGENCY ACTUATOR** – the device used by drivers to send an emergency message to the dispatcher/manager. A button is typically installed near the driver's seat so the driver can press it without alerting anyone on the transit vehicle.
3. **ON-BOARD AUDIO ANNUNCIATOR** – the device that automates the announcement of stops and other information to passengers while onboard the vehicle.
4. **ELECTRONIC PAYMENT SYSTEM (PASS/FARE MEDIA READER)** – the device that reads and validates passes and other electronic fare payment (EFP) media.
5. **ON-BOARD ELECTRONIC SIGN** – one or more electronic signs that display dynamic messages to passengers within the vehicle.
6. **AUTOMATIC PASSENGER COUNTER (APC)** – the device that automatically counts passengers boarding the vehicle. It may also count passengers getting off the vehicle.

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### ROADSIDE SYSTEM

These are APTS components installed along transit routes or at vehicle stops. The roadside system typically includes an electronic, remotely-controlled display that presents information regarding estimated time of arrival of buses to passengers waiting at transit stops. These may include:

1. **DYNAMIC ROADSIDE INFORMATION DISPLAY (DRID)** – the device providing real-time information regarding vehicle arrival, based on transit vehicle progress along route.
2. **SOLAR POWER SOURCE** – an autonomous power option for the DRID to allow mounting at remote stops where AC line voltage is not available.

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## CENTRAL SYSTEMS

The Central Transit Management System components generally include Central Site Software that allows communication among the various APTS components. It may also include an Advanced Transit Management System (ATMS). ATMS are consoles that display vehicle location information and help transit dispatch personnel and system managers conduct effective real-time management of the transit system. These consoles can provide assistance in data collecting and storing (e.g., boarding counts and ridership information), driver information management, statistical analysis, and preparation of various operational reports.

1. **TRANSIT VEHICLE TRACKING** – powered by Automatic Vehicle Location (AVL) systems, this is a key component allowing transit agencies to monitor the location of vehicles. The location data may be used to determine schedule adherence and update the transit system’s schedule in real-time. Information regarding bus location and time is collected and displayed using the AVL and Central Site Software.
2. **DISPATCHING SOFTWARE** – the interactive software that provides a Graphical User Interface (GUI) for transit dispatchers and managers. It allows dispatchers and managers to communicate with and manage the vehicles and roadside displays. The capabilities provided by this software typically include real-time vehicle location, fleet management, schedule adherence displays, and emergency management.
3. **CENTRAL SITE SOFTWARE** – the software that runs at a fixed, central location to receive, transmit, store, and facilitate the exchange of data between other components. It typically communicates with on-board and roadside components. It also collects, stores, and retrieves real-time system data for the analysis of schedule adherence and provides Application Programming Interfaces (APIs) to dispatching software.

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## TRAVELER INFORMATION SYSTEM

Transit operators may choose to provide real-time information to travelers. Information can come in many forms and allows passengers to make better decisions regarding their travel plans.

1. **TRAVELER INFORMATION SERVICES** –This disseminates information on fixed bus schedules, real-time bus arrivals at specific stops, and passenger load status using the Internet, telephone, individual personal digital assistants (PDAs), text messaging service, etc.

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## DATA COMMUNICATIONS

The data communication system needs wireless capability to allow communication between the vehicle’s on-board system and central dispatch. In some limited instances, wired communication may be used. The information typically transferred includes bus location, stop arrival and departure times, boarding information, etc.

1. **WIRELESS DATA COMMUNICATION** – data transmission via radio, Wi-Fi, cellular, or other means, to provide the communication links among different components. This may require a wireless data communication system in the vehicles as well as a roadside wireless infrastructure.
2. **WIRED COMMUNICATION**– data transmitted between the roadside display and central dispatch may use existing telecommunications infrastructure to transmit data.

The components listed above are a set of recommended APTS technology. While there are many systems listed, it is not an exhaustive list. When customizing a unique APTS, additional systems may be needed to better fit a transit agency's specific needs. Information about additional APTS can be found at <http://www.itsoverview.its.dot.gov/TM.asp>.

# Stakeholder Assessment Worksheet

*The following worksheet is designed to help you identify the stakeholders that interact with your specific transit system.*

## Traveling Public

1. How many people reside in your service area? \_\_\_\_\_
2. Do you have a fixed route bus system? Yes \_\_\_\_\_ No \_\_\_\_\_ *(if no, please skip to #5)*
3. How many fixed route riders do you have in an average month? \_\_\_\_\_
4. Are there specific groups that are serviced by the fixed route system (i.e. a university students or hospital patients)? If so please list them below.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. Do you have a demand response system? Yes \_\_\_\_\_ No \_\_\_\_\_ *(if no, please skip to next section – Operating Agencies)*
6. How many demand response riders do you have in an average month? \_\_\_\_\_
7. Are there specific groups that are serviced by the demand response system? If so please list them below.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Operating Agencies

1. Who is responsible for day to day operations of your transit system (could include public agencies or private entities under contract)?  
\_\_\_\_\_  
\_\_\_\_\_

2. Locally, which of the following groups are involved in your transit system planning, operations and maintenance:

Transit authority in the city government  
Name of the transit authority \_\_\_\_\_

Department of Public Works

City Council

County Commission/Council

City Planning Department

County Planning Department

### Other Agencies

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1. Do you have transit police or do you rely solely on public law enforcement to respond to non-medical emergencies?

Transit Police Force \_\_\_\_\_

Public Law Enforcement \_\_\_\_\_

2. How do you receive technical support?

External contract with a consultant organization \_\_\_\_\_

On-going service contract with original vendor \_\_\_\_\_

I have internal technical support

3. Do you have any external funding? \_\_\_\_\_

4. If yes, where does this transportation funding come from (e.g. FTA, Caltrans, Earmarks, etc)?  
List all of your sources.

\_\_\_\_\_  
\_\_\_\_\_

**All of the entities identified above  
are the stakeholders of your transit system!**

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# *Needs Assessment Worksheet*

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*This worksheet is designed to capture input from passengers and end users.*

**Please answer the following questions to the best of your ability**

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1. I use public transportation
  - a) Very often
  - b) Somewhat often
  - c) Rarely
  - d) Never
  
2. I use a dial-a-ride or demand response bus
  - a) yes
  - b) no
  
3. I ride a fixed route bus
  - a) yes
  - b) no
  
4. Why do you choose to use public transportation?
  - a) Public transportation is convenient
  - b) I do not own a car
  - c) cost of driving is too expensive
  - d) Other (*please specify*) \_\_\_\_\_

5. On a daily basis what causes the greatest inconvenience? (please mark the level of inconvenience in the boxes next to the statements)

	Very inconvenient	Inconvenient	Somewhat inconvenient	Not applicable
Buses that do not arrive on-time				
Not knowing when the bus will arrive at the bus stop				
The line to get on the bus is long and moves slowly				
When I'm on the bus I'm not sure which stop is next				
Other (please specify _____)				

The following section is designed to help you prioritize between different technologies that could improve your transit experience. It is important to keep in mind your specific needs when responding to the options. *To complete this section read both option 1 and option 2 and indicate which option you prefer by checking the box next to it.*

Option 1 "I would rather..."	Option 2 "Or..."
Have <b>real-time bus arrival information</b> <input type="checkbox"/>	Have <b>electronic payment</b> capability <input type="checkbox"/>
Have <b>electronic payment</b> capability <input type="checkbox"/>	Have <b>automatic passenger counting</b> <input type="checkbox"/>
Have <b>automatic passenger counting</b> <input type="checkbox"/>	Have <b>real-time bus arrival information</b> <input type="checkbox"/>
Receive bus arrival information from a <b>website</b> <input type="checkbox"/>	Receive bus arrival information from a <b>text message</b> <input type="checkbox"/>
Receive bus arrival information from a <b>text message</b> <input type="checkbox"/>	Receive bus arrival information from a sign at the <b>bus stop</b> <input type="checkbox"/>
Receive bus arrival information from a sign at the <b>bus stop</b> <input type="checkbox"/>	Receive bus arrival information from a <b>website</b> <input type="checkbox"/>
Have next stop information displayed on a sign in the bus <input type="checkbox"/>	Have an automatic annunciator that announces the next stop on the bus <input type="checkbox"/>

6. Please use the space to indicate any improvements you'd like see to your transit system

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# Needs Assessment Worksheet

*The worksheet is designed to capture input from those people that work for/with your transit system.*

## Please answer the following questions to the best of your ability

1. How long have you worked for the transit agency/authority?
  - a) 0-2 years
  - b) 2-5 years
  - c) 5-10 years
  - d) 10 years or more
  
2. I am a
  - a) bus driver
  - b) transit manager
  - c) dispatcher
  - d) technical staff
  - e) maintenance staff
  - f) emergency personnel
  - g) Other (*please specify*): \_\_\_\_\_
  
3. Our transit system has
  - a) fixed route bus system
  - b) demand response vehicles
  - c) both demand response and fixed route systems
  - d) Other (*please specify*): \_\_\_\_\_
  
4. Do you use the transit system?
  - a) yes
  - b) no
  
5. If yes, then why do you choose to use public transportation?
  - a) Public transportation is convenient
  - b) I do not own a car
  - c) cost of driving is too expensive
  - d) Other (*please specify*): \_\_\_\_\_

6. While you are at your job what causes the greatest inconvenience? (please mark the level of inconvenience in the boxes next to the statements)

	Very inconvenient	Inconvenient	Somewhat inconvenient	Not applicable
Keeping buses on-time and evenly spaces				
Recording the number of passengers as they board the bus				
Stressful situations involving unruly passengers				
Inputting ridership data				
Writing reports				
Trying to schedule new routes				
Managing unexpected breaks for drivers				
Managing cash from bus fares				
Other (please specify _____)				

7. Please use the space to indicate any improvements you'd like see to your transit system

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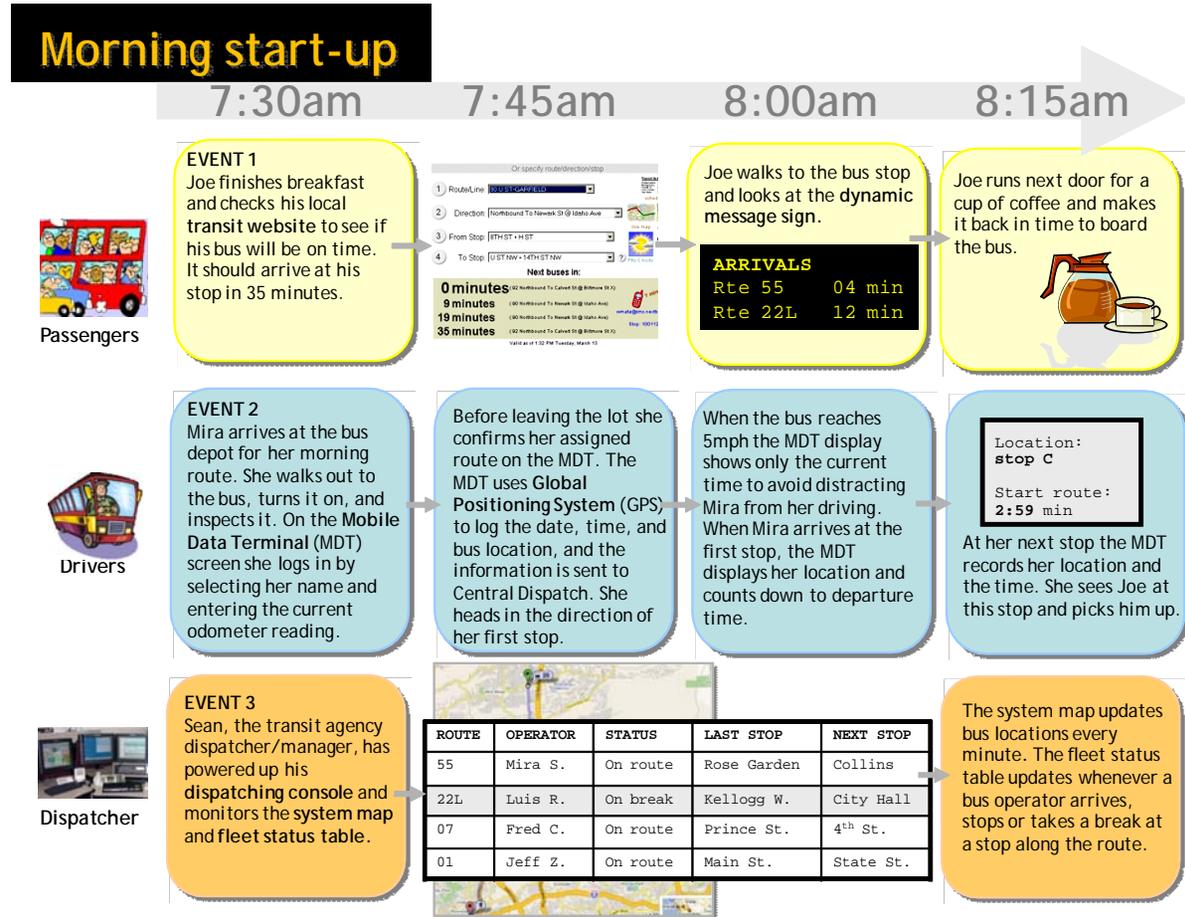


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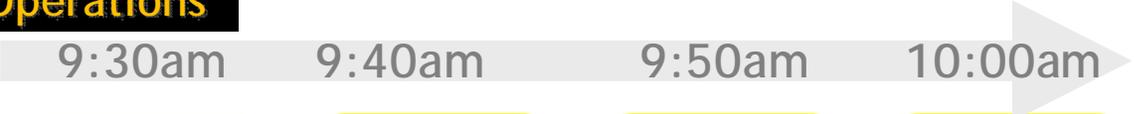


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APPENDIX V: OPERATIONAL SCENARIOS THROUGH PICTURES AND GRAPHICS



# Daily Operations



**EVENT 1**  
Sarah, a student at the local community college, is walking and late for class. She calls the transit hotline and learns that a bus will arrive at a stop close to her current location in 10 minutes.



She walks to the stop, catches the bus, and is on time for class.



**EVENT 2**  
Mira needs a restroom break but her next scheduled break is in 1 hour. She radios in a request to take a break at the Sunny St. bus stop, which she will approach in 15 minutes.

Mira uses the MDT to update the status of her bus to "On Break," then gets off the bus to use the restroom.  
  
Eight minutes later she resumes her route.

**EVENT 3**  
Fred, driving Route 7, gets a cell phone call. His wife is going to the hospital to deliver their first baby! He uses his two-way radio to contact dispatch and request a substitute driver.

Roy receives Sean's call and heads to the stop. The dynamic message sign at the stop indicates that the bus will arrive in 2 minutes. Fred logs out and Roy logs in. The MDT shows the next stop and when to start.



Sean receives the break request on his dispatching console and accepts the request.

OPERATOR	STATUS	LAST STOP
State Driver's Name	on route	Rose Garden
Idlaw Driver's Name		Building
Idlaw Driver's Name	On break	oggg West

Sean sees Mira's "On Break" message. The message signs at other stops on the route are updated to reflect this slight delay.

Sean answers the radio communication, sees the current location of the bus on his monitor, and looks up a list of available substitute drivers.

Sean tells Roy, an available substitute, to meet the bus at the Grand Ave. stop in 10 minutes.

# Demand Responsive Transit

11:00am      11:15am      11:30am      11:45am



Passengers

Linda, an elderly resident, needs to make an unexpected trip to the doctor. She calls the automated demand-response hotline and selects "1" to schedule round-trip service.



She speaks her start and end address and punches in the time and date of pickup. She receives an automated voice confirmation the shuttle will pick her up at 12:30pm the same day.



Drivers

Jerry, one of two demand-response drivers is finishing up another trip when he gets a radio call from Sean about Linda's trip. He says he should be able to make it in time and agrees to take on the trip.

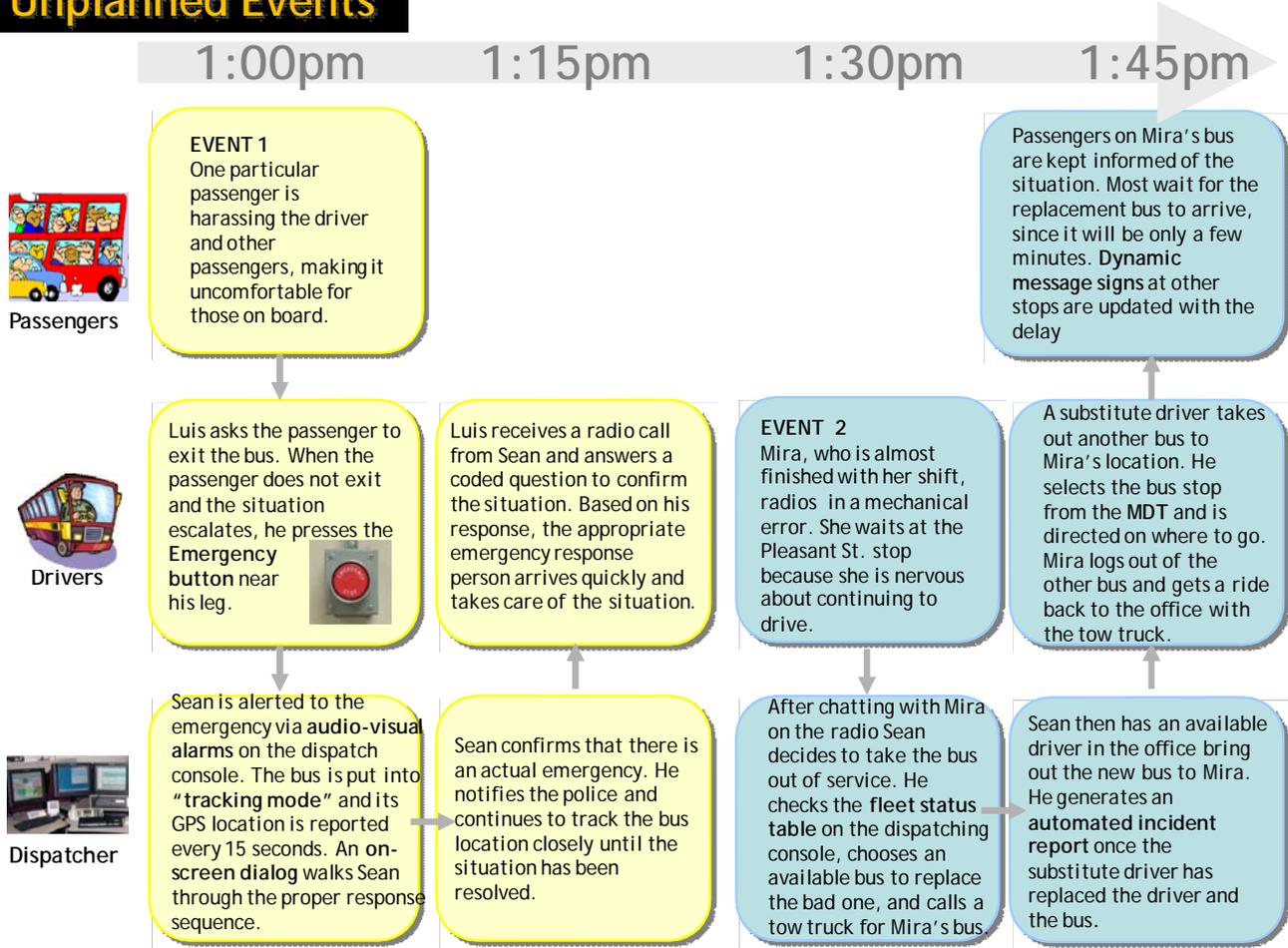
Once his last trip is complete Jerry heads to Linda's home. The MDT logs his previous and current trip time and distance.



Dispatcher

Sean sees Linda's request come through the automated phone system on his dispatching console and assigns a driver and a wheelchair accessible van to her trip.

# Unplanned Events



# Schedule & Route Maintenance



Passengers

**EVENT 1**  
A new shopping center has opened but the buses serving the area only arrive once an hour. Passengers form long queues waiting for the bus, especially in the afternoons and on weekends. One passenger calls to request more frequent service.



Drivers

**EVENT 2**  
Throughout the day, Jeff enjoys having the new MDT on his bus coordinate departure times - He no longer worries about maintaining proper spacing with other buses on the same route.

He presses a **passenger counter button** on the MDT each time a rider boards. This helps with reporting and route maintenance. He used to record this information manually with pencil and paper.



Dispatcher

Sean decides to run reports from the **dispatching console** for information on the shopping center routes. He clicks on **Ride Report** and chooses daily, monthly and yearly passenger loading and delay reports.

He also checks for service requests posted on the local website and through phone calls. The route to the shopping center is consistently over-capacity, and there is high demand for more frequent service.

Sean navigates to **Schedule Maintenance** and selects the "ADJUST" button. The system provides a recommended new bus schedule based on the patterns of delay and passenger load of buses on that route.

He selects the revised schedule and prints it for review at the next Board meeting. He will propose these changes to the routes, which, when ready, will be easily updated using the **dispatching console**.

## Vendor Support

4:00pm

4:15pm

4:30pm

4:45pm



Passengers

Passengers boarding Luis' bus are having problems using their smart transit cards. They have to swipe their cards several times before it is registered.



Drivers

Luis, after finishing his route, reports to dispatch that the magnetic card reader was having some small problems during the day.



Dispatcher

Sean calls the qualified dispatching vendor of the card reader, who has a contract to assist with maintenance. The vendor is able to walk Sean through the mechanics of fixing the reader.

# End of day tasks... & a bright EDAPTS future!



Passengers



**EVENT 1**  
Sarah is getting ready to leave the office for the day and gets a text message on her cell phone indicating the arrival of the next bus home. Instead of waiting in the rain, she leaves the office to catch the bus right when it arrives!



Drivers

**EVENT 2**  
At the last stop of his 8-hour shift, Jeff drives the bus to the fueling station at the lot. The MDT determines that the shift is over using its standard clock and GPS, and records the deadhead miles.

While refueling, Jeff selects the "Fueling" function on the MDT and enters in the number of gallons filled and the bus' odometer reading. This information is logged and kept for monthly reports.

At the bus lot, before leaving for the day, he selects "End Shift" from the MDT and is logged out of the system.



Dispatcher

**EVENT 3**  
In a neighboring city, a transit manager has seen how well EDAPTS works and is interested in purchasing certain components of the system. He navigates to the EDAPTS website and fills out information about his agency.

The web application determines the product package that best fits his agency's needs, possible funding sources, and a list of certified vendors with contact information that can sell him the products and help implement the solution.