

Staffing and Resource Management Plan

SUBMITTED TO

Alameda County Transit

SUBMITTED BY

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1. Introduction

As AC Transit prepares to upgrade their CAD/AVL system, new or additional staff responsibilities may be necessary to implement and maintain the new system. This memorandum identifies the roles, responsibilities and staffing support needed during the procurement, implementation, operations and maintenance periods for the upgraded system.

The content of this document draws on industry best practices for CAD/AVL system implementation and operations/maintenance, and also considers the nature of the system (e.g., real time customer information and critical operations management support, driving a need for on-time fleet maintenance and repair responsiveness). Particular skill sets necessary to fulfill these functions will be addressed.

Sufficient agency staffing is crucial to success for the overall CAD/AVL and communication systems initiative. There is the obvious need to provide Operations and Maintenance support for the increased amount of equipment, communications, and central systems. In addition, there is an extensive need for involvement, by the O&M staff and by staff from other parts of the organization, in the initial phases to plan, design, install, test and be trained on using the new systems.

Additional discussion with AC Transit management will be needed to identify gaps between staffing requirements and the current AC Transit organization. AC Transit management should also consider whether any broader organizational restructuring would be warranted. For example, some agencies have found it useful to establish a cross-functional group that can facilitate the most coordinated support for such a critical system (rather than the support resources being spread across various parts of the organization).

2. System Upgrade Impacts

In this section a high level overview of the new CAD/AVL system is presented. The solution must be flexible, able to integrate with new systems, and address each operational need.

To drive development of new system requirements, the Concept of Operations (ConOps) outlines the various roles and functionality of the current system and identifies anticipated impacts of the new system on operations. The ConOps identified impacts in three areas: operational units (who uses the system and with what responsibilities), system units (what hardware, software, and integration the system includes and the functionality available), and scenarios for business processes (interactions with the system for various specific business process scenarios).

2.1. Operational Unit Impacts

Operational units refer to the groups and individual roles of the AC Transit organization. These include: Window Dispatchers, Maintenance, Road Supervisors, Bus Operators, and Controllers. The roles and responsibilities of these different operational units are not anticipated to change (unless AC Transit considers an organizational change to create a cross-functional unit responsible for the system). However, the time commitment to implement the new system may require additional staff hours dedicated to CAD/AVL. This is more critical during the design and deployment (i.e. cutover) stages of the Implementation phase when both the old and new systems will be operating in parallel.

Operationally, the new system should not create additional responsibilities for the agency. With deployment of the new CAD/AVL and onboard equipment and software, additional training and new standard operating procedures (SOPs) will need to be developed to facilitate proper use of the new system. Also, new data coming available in the system may increase the workload for data analysts and scheduling staff. This data would be used to generate new and meaningful reports for management, improved schedules, and more accurate real-time information to other business units within the agency and to other partnering agencies (e.g., Customer Service, regional 511).

2.2. System Unit Impacts

The system units are identified in the Concept of Operations in terms of the onboard and central system architectures. These systems will undergo some architectural changes through implementing a new system.

The vehicle will have an onboard network that connects the new (and some existing) devices to the vehicle logic unit (VLU) or mobile access router (MAR) to provide multi-path communications between the onboard equipment and central system. This will also provide a centralized onboard login and control point. Operationally, this will create efficiencies for system management and maintenance, and will provide a testing environment to reduce the risk of system failures.

The new CAD/AVL system will modify the existing voice and data radio communications architecture between onboard devices and the central system, to use cellular data communications and a regional shared voice radio system.

A number of business processes are expected to change under the new system, to simplify and enhance for positive impacts. The new system will give Controllers, Road Supervisors, Operators, and others involved the ability to respond to degraded operations more efficiently and effectively. Users will have access to better and more current data. Users will also have the ability to generate automated messages that can be distributed to individuals or groups, as needed, through the improved incident report forms.

In emergency conditions, the OCC will have access to the onboard emergency alarm equipment and the ability to override or downgrade current alarms. In addition, increased notifications automation will allow more efficient use of resources through timely notification on situational changes. Supporting processes will be improved with the new system, with better and more streamlined access to data used in decision making. Maintenance will have direct access to engine control monitoring data, and Controllers will have access to more accurate schedule adherence and location data.

3. Industry Review

3.1. General Staffing Impacts

In 2008 the Transportation Research Board (TRB)¹ published a comprehensive review of CAD/AVL systems in fixed route and demand responsive services, examining changes in agency practices for using AVL systems. The information for that report was gathered through literature review, a transit agency survey and case study interviews. Several important conclusions were drawn about agency best practices on staffing. Agencies reported that some of the biggest challenges with adapting the organization and operations for implementing and using bus CAD/AVL systems included:

- Underestimating the degree to which advance planning was needed;
- Ensuring support from Information Technology (IT), Maintenance, and other parts of the organization; and
- Adapting business practices and operating procedures.

Implementing CAD/AVL often leads to changes in organizational structure, staffing, and job duties. In the survey, most agencies indicated that the Operations, IT, Maintenance and Planning departments had the highest involvement in development and implementation.

This TRB survey found significant Maintenance impacts in both hiring and retraining. Implementation “leads to changes in the maintenance organizations’ staffing, and job duties” (TRB pg. 29). Agencies commonly reported needing to retrain Maintenance staff and increase the overall number of technicians. The need to increase the overall number of technicians is not surprising, as the new types of equipment require skills in electronics, radio, and networking, but there are limited opportunities to decrease the required maintenance on existing equipment.

IT departments also indicated hiring and retraining requirements. Agencies reported needing to hire System Administrators, Data Analysts, Onboard Networking Specialists, and Systems Integrators. There were also increased requirements on Network Administrators and other network support staff. Many TRB survey responses similarly indicated hiring new staffing for IT support. In some cases this was coupled with retraining existing IT personnel.

In general, survey responses indicated little effect on operations management hiring, but substantial demands for retraining. “Agencies could avoid hiring additional supervisors as a result of the increased capability for dispatchers to have real-time situational awareness for the fleet, with correspondingly less need to rely on supervisors to serve as their ‘eyes’” (TRB pp.28-29).

3.2. Staffing Impact Examples

The following discusses some available information about example staffing impacts at other agencies of similar fleet size, through the course of their transit technology development. These are intended as examples of how agencies often have needed to add staff to successfully deploy, operate and maintain systems of this type: Montgomery County Ride-On (Maryland): With an equipped fleet across fixed route service of about 390 vehicles, Ride-On reported adding four maintenance staff in a position called “Transit Information Technician”. Two Transit Information Technician positions were initially established early in the life of the system to maintain the radio and other onboard CAD/AVL system equipment. The number of positions was later expanded to four, owing to a combination of the increased fleet size and an expansion in the amount of onboard equipment (e.g., adding more onboard video equipment). (TRB, p.29)

- PACE Suburban Bus (Chicago): This CAD/AVL system serves a fixed route fleet of about 610 vehicles, and resulted in the addition of five FTE IT staff over four years. Four of these new FTEs were hired to help with the IT support requirements of the new system. These requirements include tasks such as maintaining support data required by the applications, system databases, and data interface and communications. The fifth new IT FTE transferred into an IT support role in Operations (with this IT position refilled with a new hire), to retrain operations and dispatch personnel in using system data. (TRB, p.31)

¹ TCP SYNTHESIS 73 AVL Systems for Bus Transit Update; TRANSIT COOPERATIVE RESEARCH PROGRAM (Research Sponsored by the Federal Transit Administration in Cooperation with the Transit Development Corporation) Consultant Doug Parker, Washington DC, 2008

4. Anticipated Staffing Requirements

Staffing requirements are directly related to the effects of integrating new information and communications technologies into daily operations. A spike in specialist labor requirements is expected during implementation, as the new system is installed and tested, and also during training. Ongoing support needs are directly tied to the need to rely on the integrated CAD/AVL and communications subsystems for efficient daily operations. In other words, to keep the operations and revenue business units at peak efficiency, the technology subsystems must be reliable and available. There can be little tolerance for broken and out of service equipment. This will become especially important with real-time customer information based on CAD/AVL system data.

Maintenance approaches to maximize availability of the new system for Operations will also enable the reliability needed to provide riders with reliable next stop announcements and with real-time information. The high availability approach needed will impact AC Transit staffing requirements.

Figure 1 and Table 1 identify the rough level of expected staffing impact for the new system.

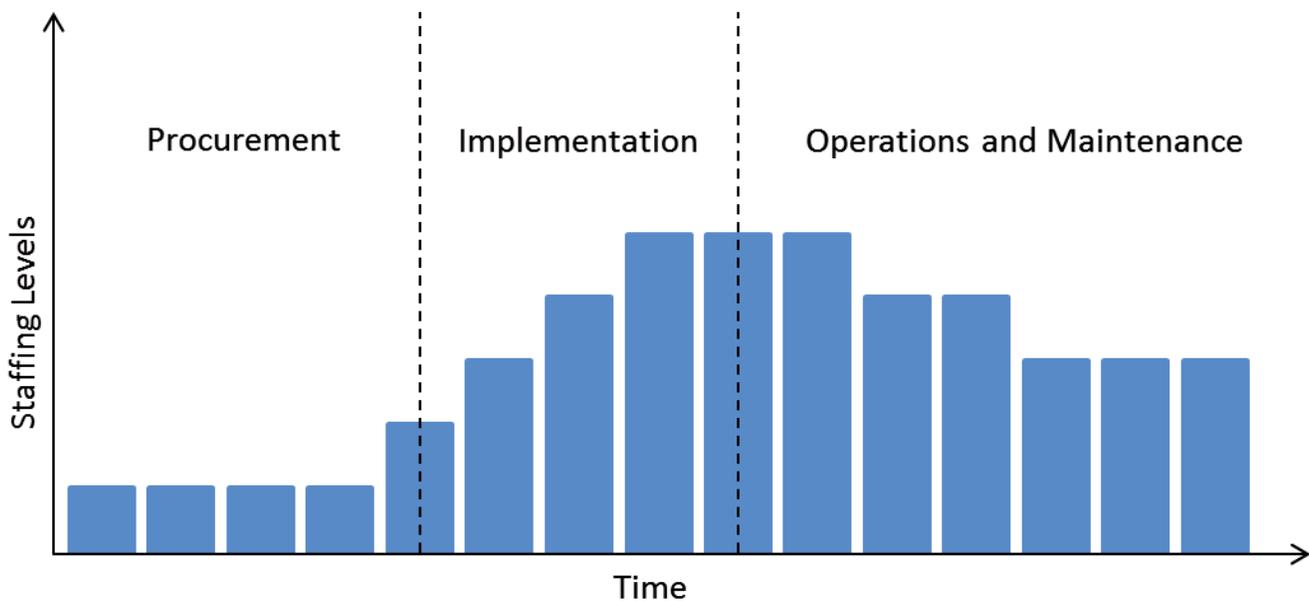


Figure 1: Ramping for Staffing Level Impacts

Figure 1 suggests conceptually the ramp-up of effort beginning in the procurement phase, and tapering off during the “steady-state” operations/maintenance phases, as the organization finishes implementation (with most of the tapering down anticipated to occur during the initial year following system acceptance).

Table 1 adds further granularity, providing a rough forecast of how transit agency job functions would be impacted during different phases of system development. These phases include the initial phase for procurement, design and implementation and also additional phases for the subsequent ongoing operations and maintenance phase.

The purpose of this table is to illustrate in general terms the wide range of staffing categories where deploying the replacement CAD/AVL system will have some level of impact, even though it is not yet determined in which positions additional staffing would be needed vs. addressing the required efforts with current agency staff:

- Once the CAD/AVL system contractor is chosen, activities will begin that impact Enterprise Software. This group will need to support the new systems once installed, and also plan for new reports and new technical systems interfaces. High system availability standards will require monitoring and response for the new central systems. It will also need to enable temporary support during the transitional period for both the new system and the current systems being replaced.
- Enterprise Networks and Telecommunications will also be impacted immediately, including new IP network planning that must begin for the integration and roll-out of three fleet communications wireless networks (802.11 WLAN, land mobile radio and cellular data). High system availability standards will require monitoring and response for the central and on-board communications/network elements.
- Major impacts will also begin immediately for Electronic Systems, for the design/testing of the mobile equipment.

Table 1: Labor Impacts by Function and Implementation Phases

		OPERATIONS / MAINTENANCE PHASE		
		Higher Impact	Modest Impact	Limited Impact
PROCUREMENT / DESIGN / IMPLEMENTATION PHASE	Higher Impact	<ul style="list-style-type: none"> • CAD/AVL Administrator • Onboard Equipment Technician • Computing Infrastructure Support 	<ul style="list-style-type: none"> • Vehicle Engineering • Database Administrator • Reports Development (Year 1) 	<ul style="list-style-type: none"> • Interfaces Development • Fixed Route Dispatchers • Trainers • Reports Development (ongoing)
	Modest Impact	<ul style="list-style-type: none"> • Data Analysis 	<ul style="list-style-type: none"> • Fixed Route Field Supervisors 	<ul style="list-style-type: none"> • Fixed Route Scheduling • Fixed Route Operators
	Limited Impact			<ul style="list-style-type: none"> • Customer Service

The Implementation phase will create a peak in staffing demand. During this time period the agency will need to keep current systems maintained even while the agency brings the new system into service. AC Transit will also need to support the contractor activities for design review, testing/evaluation, and system configuration.

During the Operations and Maintenance phases, impacts will settle down substantially in Enterprise Software as the cutover from current systems is completed. The involvement level for Enterprise Networks and Mobile Systems will remain high.

5. Staffing Classification Recommendations

The CAD/AVL replacement project will proceed in four identifiable phases from the perspective of AC Transit staffing requirements, as detailed in *Table 2*. Each phase will impact staffing differently.

5.1. Staffing Recommendations

This section discusses required staffing levels during each phase of the project (note that the positions are described here on a functional basis, as opposed to linking with specific existing AC Transit position titles). The functional positions highlighted here are those in O&M support that will see the most substantial direct impact, with a direct need to support new equipment and central systems.

Additional AC Transit consideration of the capabilities, workload and organizational structure

for current staffing levels will be needed to determine whether these incremental staffing requirements should be addressed using new hires, new duties for existing staff (including retraining), or temporary contract positions.

A variety of other positions are expected to have some incremental workload increase as a result of this project, relatively smaller but of significance. The overall nature of these positions is inherently to support the ever changing nature of current agency initiatives. These various other affected positions include:

- Project Management
- Procurement
- Legal
- Training
- Marketing
- Operations Management
- Senior Management

Table 2: Estimated Incremental Staffing by Project Phase (Full Time Equivalents)

FUNCTIONAL POSITION	PROCUREMENT AND DESIGN YEAR 1	IMPLEMENTATION YEARS 2-3	INITIAL YEAR OF O&M YEAR 4	LONGER TERM O&M YEARS 5+
CAD/AVL Central System Technician	0.5	0.5	0.5	0.5
Onboard Systems Technician	0.5	1.5	1.5	1.5
Database Administrator	0.5	0.3	0.3	0.3
Business Analyst	0.5	0.3	*	*
Software Quality Assurance	*	0.5	*	*
Interface Developer	0.5	1	*	*
Reports Developer	0.5	0.5	0.5	0.5
Network Engineer	1	1	1	1
Systems Administrator (Workstations)	0.5	0.5	0.5	0.5
Systems Administrator (Servers)	0.5	0.5	0.5	0.5

* Limited Impact

5.2. Phase One: Procurement and Design (Year 1)

AC Transit has already obtained expert assistance from IBI Group to help support the design part of the procurement phase, with the procurement process to be initiated at a to be determined time we will refer to as Year 1. During this initial phase, a staffing ramp-up is recommended to support this project.

Many senior staff will be called upon to contribute time for the design review effort as Subject Matter Experts, which will create an initial deficit in staffing support for their regular duties. Most of the positions initially added for this phase will continue to be needed throughout the subsequent project phases, transitioning from supporting design/implementation to operations/maintenance.

5.2.1. Central System

Positions Needed in Year 1 in Enterprise Software and Computer Operations: IBI Group has identified the need for the following staffing support for this division during the procurement period:

- **CAD/AVL Central System Technician:** The AC Transit CAD/AVL Central System Technician will be responsible for nearly all aspects of maintaining the CAD/AVL system, including the associated back end support systems and the CAD/AVL software. This will include the initial configuration and subsequent maintenance of the AVA sound files. During the procurement/design phase even more demands will be experienced on the staffing support, who will continue responding to daily operational system issues with the existing systems while at the same time participating in the procurement/design and subsequently the acceptance testing associated with implementing the new system.
- **Systems Administrator (Workstations):** Staffing support will be needed for the new mobile laptop and dispatcher workstations. This position will need to be in place to support the project beginning with design reviews in the procurement/design phase.
- **Business Analyst:** Enterprise Software will need to begin working with the CAD/AVL contractor immediately upon selection to identify requirements, for reports to be created from the new system for the entire AC Transit organization. There is a requirement to work with all AC Transit units to identify what new reports may be needed, as the new CAD/AVL will have more available data than the current system. Business Analyst staffing support is needed to begin the requirements definition and work with the contractor during the design process to define reports. This staffing support will also need to interconnect the system, contractor and user departments until the reporting requirements have been defined and designed. This effort is expected to last the duration of the procurement/design phase, but is no longer expected to be required for the subsequent phases beginning with implementation in Year 2.
- **Interface Developer:** The new CAD/AVL system will require data interfaces to existing AC Transit business systems. It is estimated that it could take at least 6-12 months to complete these interfaces, depending on how many people are working on them simultaneously.
- **Reports Developer:** A Reports Developer is needed to work with the contractor on developing customized reports, which will provide management, operations and maintenance data. The specifics of reports to be developed will depend on what is needed to complement the range of standard reports available from the selected contractor. During the installation phase, both the old system and new system will be operating in parallel. Part of the fleet will be reporting on one or the other, depending on whether the bus has been moved to the new CAD/AVL system or not. This will mean that both the old reporting system and the new reporting system will be reporting partial data.
- **Database Administrator:** A Database Administrator (DBA) will be needed in the procurement/design phase to manage the set-up and configuration of the new CAD/AVL database software. The DBA will be responsible for assisting with design review, preparatory to subsequent support on acceptance testing for overall functionality and its integration with other systems. Staffing support is needed in the procurement/design phase. This need will gradually decline over the subsequent phases.

5.2.2. Onboard Equipment

Positions Needed in Year 1 in Electronic Systems: IBI Group has identified the need for the following staffing support:

- **Onboard Systems Technicians:** The new CAD/AVL system will enable providing real-time information to the public. For this purpose, and to get best value from the new CAD/AVL system in its operations support and planning data roles, certain critical onboard equipment (i.e., the voice radio, MAR, cellular data card, VLU, and MDT) need to be operational for the start of service each day. To accomplish this, a CAD/AVL Technician needs to be onsite during the overnight shift at each AC Transit garage. This will allow any critical onboard equipment, where there is a reported issue, to be swapped out for known good equipped from the spares pool. This overnight shift AC Transit garage CAD/AVL Technician role could be supported by a less experienced person since the work would be limited to swap outs. Diagnosis or second level repairs on swapped out units could be done on the day shift by a more experienced person. Other available time on the overnight shift, when not doing such repairs, can be used to undertake pre-planned Preventative Maintenance and diagnostic background work (e.g., voltage standing wave ratio measurements, checking integrity of connections), which is expected to prevent or provide advance warning on future in-service issues. During the initial procurement/design phase, fewer of any new technician positions would need to be filled, initially to help with supporting procurement/design activities and to begin trial use of the new maintenance response procedures on the existing CAD/AVL system (i.e., to work out some logistical procedures before any of the new CAD/AVL equipment is installed).

5.2.3. Systems Infrastructure

Positions Needed in Year 1 in Enterprise Networks and Telecommunications: The new technology in the buses, as well as the associated introduction of onboard IP networks will have a significant impact on Enterprise Networks and Telecommunications. IBI Group has identified the need for staffing support in several areas. Each bus will constitute its own small Local Area Network (LAN), essentially adding these to the overall network monitoring and maintenance requirements. Vehicle equipment will be connected into the overall AC Transit network by way of three separate wireless networks, depending on where the vehicle is in the city (i.e., 802.11 WLANs available at garages, a cellular data network as the primary mobile data connection, and a land mobile radio network for voice communications). Voice will be coming to the network operations center from the regional land mobile voice radio system as an IP data stream. Each of these three networks will need to have high reliability. In addition, mobile workstations (e.g., for supervisors) will have remote access to the CAD/AVL central software over the cellular data network). The on-board router and the status of each communications network will need to be monitored by Enterprise Networks and Telecommunications. The new CAD/AVL system servers and workstations are expected to operate over the existing AC Transit corporate LAN, but some distinct Virtual LANs will likely need to be supported. Because the new CAD/AVL system will eventually provide real time data to customers, its reliability is critical. The network infrastructure will require ongoing provisioning and management.

- **Network Engineer:** Additional network engineer staffing support is expected to be required, beginning during the procurement/design phase. This will be needed to support the large number of mobile LANs, as well as to monitor the various third party communications networks, test environment, and Disaster Recovery site connections. These positions will need to be in place to support the project beginning with design reviews in the procurement/design phase.
- **Systems Administrator (Servers):** Staffing support will be needed to for the new servers. This position will need to be in place to support the project beginning with design reviews in the procurement/design phase.

5.3. Phase Two: Implementation (Years 2-3)

During the implementation phase, most staffing requirements will remain similar with support roles generally shifting from support for the design review process to support for implementation logistics and acceptance testing.

The need for a Business Analyst will recede as the reporting requirements identification is completed, but the need for Software Quality Assurance (Q/A) support emerges with development of contractor software and reports, and also AC Transit-developed interfaces. The Database Administrator function will begin to shrink from the more intense support level needed during the procurement/design phase.

Enterprise Networks and Telecommunications staffing requirements will remain fairly steady.

In the Onboard Systems Technician area, the implementation phase will bring with it the need for installations and Quality Assurance inspections. This will be the right time for any adjustments needed to Onboard Systems Technicians staffing so that there can be onsite coverage at each AC Transit garage (this coverage will continue during O&M phases).

5.4. Phase Three: Initial Year of Operations and Maintenance Phase (Year 4)

During the initial year of O&M following System Acceptance , most staffing requirements will remain similar. The needed staffing support for Software Quality Assurance and Interface Developer from the prior phase is expected to recede as these aspects are completed and stabilized. All other staffing support needs should remain fairly stable, but with the roles generally transitioning from implementation duties and concerns to those of operations and maintenance.

Once the cut-over from the current AC Transit-operated analog land mobile radio system to the digital regional P-25 radio system is completed, there would be no outside plant maintained at tower locations by AC Transit. This function would be covered via the lease agreements for AC Transit participation in the regional land mobile radio system. Existing staff freed up from those tasks are expected to transition to duties associated with using replacement third party government and commercial cellular infrastructures. These new duties will include configuration/management of talkgroups on agency-operating voice radio equipment and administering cell data accounts. If the staffing support responsible for maintaining the existing voice/data radio communications tower infrastructure is not replaced with contracted support, then these new duties would instead require additional staffing support.

5.5. Phase Four: Longer Term Operations and Maintenance Phase (Years 5+)

During the longer term O&M phase, most staffing requirements will remain similar. The need for the Report Developer incremental position from the prior phase is expected to continue as new needed reports continue to be identified after the initial year of operations. The requirement for the Database Administrator staffing support is expected to further diminish as the database adjustments become finalized.

6. Conclusion

The staffing recommendations in this report represent our current forecast based on the combination of projected needs. Evolving the necessary levels of staffing support over the course of the project is critical to successful implementation of the project under the required timelines and its ongoing success.

There is the need to provide O&M support for the increased amount of equipment, communications, and central systems. In addition, there is an extensive need for involvement, by the O&M staff and by staff from other parts of the organization, in the initial phases to plan, design, install, test and be trained on using the new systems.

Once the CAD/AVL implementation contract is negotiated, AC Transit should revisit and adjust these staffing forecasts. The implementation schedule and challenges are likely to become much clearer than today once this contract is in place. The sequencing and impacts will then also be clearer for other AC Transit technology projects, those planned but not underway today or likely to become resolved during the implementation timeframe.

We recommend immediate AC Transit consideration of the Year 1 projected procurement phase staffing support requirements, with a semi-annual review of staffing considerations throughout the subsequent four years, to ensure that project staffing support needs remain balanced with the work plans of existing staff and contractors.