Procuring Software to Support Transit Asset Management

Abstract: This recommended practice helps transit agencies make good business decisions when purchasing software to support their transit asset management (TAM) business requirements, drawing on industry lessons learned to identify success factors to consider and pitfalls to avoid.

Keywords: asset inventory, condition assessment, enterprise asset management (EAM) system, National Transit Database, state of good repair, transit asset management plan (TAMP)

Summary: Transit agencies across the United States are required to develop and cyclically refresh a TAMP, which consolidates information on asset inventory and its age, condition and performance; describes how investment decisions are made; and identifies capital projects for improving the state of good repair of assets. With the completion and self-certification by transit agencies of their TAM plans, many are now looking to determine their software solutions. Software is a tool that can enable asset inventories, condition assessments and prioritized investment decision-making. It also can include functionality to support other business areas, such as maintenance and supply chain management, procurement and others. Therefore, software procurement involves much more than the asset management function. The software selection evaluation for an agency must consider the total cost of ownership to ensure an affordable approach that can be maintained and represents a good business choice.

Scope and purpose: This recommended practice addresses the software systems required to store information, support analysis and report data required to prepare TAM plans and support the asset management process. It is intended to provide guidance for agencies that are looking to establish an effective ongoing process for the TAMP and to discuss the strengths and limitations of such information systems.

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Introduction

This introduction is not part of APTA SUDS-TAM-RP-008-19, "Procuring Software to Support Transit Asset Management."

With the completion and self-certification by transit agencies of their TAM plans, many are now looking to determine their software solutions. There has been a tendency in many agencies to look to software as the solution. Industry experience is that software is a powerful enabler, but it is only a tool. However, software procurement involves much more than the asset management function. In transit agencies, the scope of EAM software extends well beyond the core functionality required by the asset management organization to manage and monitor SGR and meet federal TAMP requirements. This includes functionality to support other business areas, such as maintenance and supply chain management, procurement and others.

For most agencies, much organizational and process change needs to take place to establish enterprise-wide processes from which TAM plans are prepared and SGR-related data reported into the National Transit Database. Software can enable asset inventories, condition assessments and prioritized investment decision-making. The lesson learned in the industry is that, when procuring EAM systems for the asset management organization, it is important to focus on the foundational functionality required for effective asset management, establishing and managing the inventory of record as a single source of information, monitoring and reporting asset condition, and providing SGR data to drive the decision-making that results in the capital program. This provides the basic asset information that is foundational for TAMP development and improving the maturity of asset management practices. Industry experience is that procurement should start with the processes to be supported, the fit or "architecture" with existing systems, and who will use it and for what purposes. The software selection evaluation for an agency must consider the total cost of ownership to ensure an affordable approach that can be maintained and represents a good business choice.

Procuring Software to Support Transit Asset Management

1. Introduction and background

Effective asset management requires contemporary software solutions. Under the impetus of federal rulemaking, asset management programs and asset management systems have become part of the language of transit asset management. Asset management requires information about the asset inventory and its condition, performance and costs across the lifecycle. This information is collated and reported into transit asset management plans and to the Federal Transit Administration (FTA) through the National Transit Database (NTD). The management and analysis of this information requires an information systems solution that is suited for the size and scale of an agency's asset base. This recommended practice is designed help transit agencies make good business decisions when purchasing software to support their transit asset management business requirements. It identifies success factors and pitfalls to avoid.

The asset management organization is defined as that part of the transit agency where the leadership and/or execution of the TAM plan and related responsibilities are. This recommended practice focuses on guidance on addressing software requirements for this function. When acquiring enterprise asset management software, the major business risks that agencies face are the same as those in any major software or technology procurement. Therefore, this guidance does not address the broader software procurement and implementation risks. Instead, the focus is on the core functionality required by the asset management organization in a transit agency to address federal requirements and to provide the foundation for mature enterprise asset management practices.

1.1 Problem statement

Transit agencies across the United States are required by FTA to develop and cyclically refresh a transit asset management plan (TAMP), which consolidates information on their asset inventory and its age, condition and performance; describes how investment decisions are made; and identifies capital projects for improving the state of good repair of their assets. Many transit agencies have already generated their first TAMP. In doing so, some of these have found their asset information to be in poor shape and their information systems not able to support effective asset management. As a result, preparing TAM plans and making informed, confident decisions about their assets across the life cycle proves challenging.

This recommended practice addresses the information systems required to store information, support analysis and report data that is required to prepare TAM plans and support the asset management process. It is intended to provide guidance for agencies that are looking to establish an effective ongoing process for the TAM plan and to address recent experience with the information needed for that document and the strengths and limitations of their agencies' information systems to support the requirements. A second document, APTA SUDS-TAM-RP-004-18, "Improving Asset Management Through Better Asset Information," provides guidance on ensuring that the right data is available.

Figure 1 maps the required TAM plan elements to their associated business requirements that are supported by asset information systems. These are the foundational or core EAM requirements for any transit agency.

FIGURE 1
TAM Plan Requirements Supported by EAM Information Systems

TAM Plan Element	Business Requirements
1. Inventory of Capital Assets	Enterprise asset registry process: • Repository for inventory and associated attribute data used for SGR planning and management • Attribute data used for multiple other business functions
2. Condition Assessment	Repository for asset condition data, at a minimum data required for NTD reporting and to support SGR analysis
3. Decision Support Tools	Supports evaluation of backlog and future SGR needs using baseline condition information, useful life benchmarks and/or remaining service life information to inform project development, selection and prioritization
4. Investment Prioritization	Supports project selection and prioritization, including ability to monitor and link impact of planned projects on SGR
5. TAM and SGR Policy	
6. Implementation Strategy	Process to monitor how capital program implementation addresses SGR needs
7. List of Key Annual Activities	
8. Identification of Resources	
9. Evaluation Plan	

2. What is asset management software?

This document defines asset management software as any IT system that supports the management of an agency's capital assets in its delivery of safe, reliable and cost-effective transit service. For the purposes of this recommended practice, "software" can be as simple as a spreadsheet or database, as complex as an enterprise asset management software suite, or something in between. Agencies may choose a single off-the-shelf product, or a suite of programs that may or may not be integrated and may be implemented at different stages of an agency's asset management maturity.

2.1 Functionality and systems solutions

When considering software for asset management, it is imperative to start by defining and establishing organizational clarity and top-down support for the business functions that are to be supported by the software. The analysis steps are listed below. The technical analysis is straightforward. The greatest challenge is that the process and change management required to agree on a solution and ensure implementation alignment across the agency are highly complex for two reasons:

- **First,** the foundational asset management processes of providing the single source of asset information through a managed process that is enterprise-wide requires considerable change management in many agencies. This typically can be effected only through established policies and procedures providing the required governance. Importantly, the implementation of asset management information systems is a powerful enabler to drive this, as it provides the management controls and implementation tools. In short, the software enables the agency to establish, manage and control asset information.
- **Second,** for the areas of functionality that are supported through enterprise asset management information systems, such as maintenance/work order management, MRO materials management and others, there are multiple agency functional areas and stakeholders who are users and customers for

the software. Addressing these functional areas involves much more than the asset management organization alone. For these functions, the asset management organization is just one among many involved in procurement and decision-making.

For these reasons, transit agencies need to focus on the evaluation of the business processes, and from these define requirements for asset management. The lesson learned from the industry is that, from the asset management organization's perspective, it is important to focus on the foundational requirements. This includes managing the inventory as a single source of information, monitoring and reporting asset condition, and providing SGR data to drive the decision-making that results in the capital program.

2.1.1 From Functional requirements to data requirements

While software selection should be driven by functionality required, it is important to understand early on the data and high-level workflow requirements for frontline maintainers. Implementation will require strict prioritization of data items to be entered in the field by maintainers.

2.2 Aligning software with business processes

Software is a tool, not a solution. To be used successfully, software must align with business processes. Transit agencies should start with the end in mind by defining what successful asset management looks like for them. They should focus on the foundational processes required to do asset management. Agencies should start by evaluating information system requirements to support the foundational TAM plan processes listed in **Figure 1**.

2.2.1 Functional groupings

In considering systems, it is important to determine the boundaries for analysis. **Figure 2** lists functional groupings that can be addressed through asset management systems. Working on these boundaries is important, because outside of what are labeled "the foundational processes," the asset management organization and managing across the lifecycle of the asset are among many functions supported by the software.

FIGURE 2
Enterprise Asset Management Functional Groupings

Asset Life Cycle Information: Inventory, Condition, Performance, Cost
Capital Program Management
Work Order Management
MRO Materials Management
Labor Management
Service Contract Management
Financial Management
Reporting, Analytics and Decision Support

2.2.2 Business processes

Asset management is a management process. The starting point is understanding how technology can make these processes more effective. From this the systems requirements are identified. To aid in this, transit agencies should consider the broad groupings of processes listed in **Figure 3** and determine the boundaries for

their analysis. These processes provide the foundation from which the next level capabilities of a data-driven asset management program can be realized.

For each process area, transit agencies should define and clarify their software requirements.

FIGURE 3
Foundational Processes

Asset Life Cycle Information: Inventory, Condition, SGR and TAM Plan Support Level
Asset registry and hierarchy, inventory and asset attributes
Asset condition and assessment
Asset status and location
Asset criticality and risk assessment
Life-cycle costing
Asset onboarding
Asset disposal
NTD reporting
Work Order Management (Maintenance Management) Process
Problem/incident reporting and tracking
Planned maintenance program management
Work planning, scheduling and management
Warranty tracking
Usage and maintenance history
External contract maintenance
Failure analysis
Maintenance costing
Activity-based costing
Inventory Management/ MRO Processes
Item definition and location
Warehouse/storeroom configuration and management
Inventory transactions and material usage tracking
Material replenishment
Cycle counting and physical inventory
Serialized item and lot tracking
Inventory accounting and valuation
Capital Planning and Financial Management Process
Capital projects portfolio of projects to achieve a state of good repair
Capital project execution

2.3 Integration requirements

A further consideration for the systems solution is the integration requirements. Solutions can integrate data from multiple systems to support foundational asset management processes. For other aspects, integration with enterprise systems such as the financial management system, HR/payroll and document management, will be sought to enable asset management processes. **Figure 4** identifies some of these areas.

FIGURE 4
Process Integration

| Document management (images, as-builts, BIM models) |
| HR and payroll |
| Financial |
| Regulatory compliance |

2.4 Types of software

- **Commercial off-the-shelf (COTS):** This is often a one-time purchase of software with pricing based on numbers of user licenses and expectation that you will pay for future upgrades. Many suppliers have integrated product suites that address multiple functional areas in a transit agency's business.
- **Application-platform-as-a-service (aPaaS) or platform-as-a-service (PaaS):** This is a cloud computing service model, along with software-as-a-service (SaaS) and infrastructure-as-a-service (IaaS). It provides end users with the hardware, operating systems, storage or network capacity over the cloud to be able to run asset management applications. This is highly configurable and is subscription-based.
- **Custom development:** This is software built in-house.

2.5 Software procurement and development options

- **Out-of-the-box:** Functionality shipped directly from the software supplier or that can be configured by a business user and does not require internal IT to configure. This is usually done using built-in workflow tools, templates and/or best practices provided by the vendor.
- **Configurable:** Functionality that is created using workflow tools and often done using the support of system integrators that know the software. It is important to be clear about the distinction between configuration and customization. Configuration should result in functionality that is forward-compatible with future releases.
- **Customizable:** Functionality that is configured by the supplier or third-party integrators, which may not be forward-compatible with future releases. This often includes other functionality not supplied by the vendor. Customization raises the risk of being costly to maintain over time and is likely to require reworking to ensure forward-compatibility.

3. Software selection

3.1 Fit-gap analysis

With a TAM plan prepared and agencywide visibility to asset management, there is a sound basis from which to establish a software solution. Any assessment of existing software packages should include a gap analysis, as discussed in this section. The analysis should include the following:

- An assessment of how technology can enable asset management processes and the accomplishment of the organization's near-term target state for asset management
- A systematic identification of the processes to be enabled and supported using the technology

- An assessment by a representative of each asset group to determine which business functions can be accomplished using the software

The following lists the steps in a structured process that agencies should go through:

- Define or confirm the key ongoing TAM plan processes
- Define the functional (that is, business) requirements for each process
- Prioritize these requirements and identify dependencies, using a rating scale such as (1) mandatory; (2) must-have or highly desirable; (3) desired
- Consider also technical requirements, such as mobile capabilities or user ability to perform analysis
- Evaluate how well existing systems meet or could meet these requirements (this is sometimes called a "fit-gap analysis")
- Use the results of this analysis to establish the strategy options for a solution
- Evaluate the relative feasibility of the solutions that considers costs, benefits and risks for the options to a level of analysis that can be used to make a good business decision (guidance on evaluation considerations is provided below)
- Define the "high-level" technology solution and conduct implementation planning
- Implement

3.2 Defining the software solution

The fit-gap analysis maps existing information systems to the business requirements detailed in the previous section. This defines the gap between the requirements and what is currently met. The arrived-at solution to addressing this gap can be called the asset management software solution. The key then is to define a solution that is right for the transit agency. When an agency conducts the prior analysis, the analysis task is to find the systems solution that best fits their context in terms of the target state for asset management processes over a two- to four-year horizon, organizational capabilities, and budgeted (or likely to be budgeted) resources.

The general systems solutions available are the following:

- **Build on what the agency has.** This could involve using the same software for multiple asset classes or using more than one type of software and ensuring integration.
- **Maintain inventory and asset information in a single system,** and then use other software to support other processes such as work order management.
- **Move toward a single EAM solution** that addresses multiple business processes through different modules with the applicable integration.

The approach to these solutions will be different depending on the size of the agency's asset base.

3.3 Strategic issues for an EAM procurement

EAM software includes the functional needs of its users and business processes that address the entire organization. The foundational asset management function of managing inventory and the state of good repair, preparing the TAM plan and NTD reporting is a small portion—albeit a foundational one—of the potential requirements to be met through an EAM solution addressing multiple functional areas. Therefore, the following key questions must be addressed at the outset:

- What are the user's objectives and EAM functions that are needed? This determines the scope of the software application.
- Which software suppliers have had success in the transit industry?
- What are the best practices of other peer agencies that are EAM users?
- How do SaaS, mobile applications and the internet of things affect EAM?

- What organizational capabilities will be required for the ongoing effective use of the software?
- Is the organization ready to embark on such a major project?
- What is the total cost of ownership for the software or software services?

3.4 Implementation considerations

Understanding what is required to implement and the full costs should be considered in defining software ambitions. The following considerations should be addressed:

- Initial data capture and data cleansing from other inventory sources is a heavy lift which needs to be sized and carefully planned.
- Data required in the detailed requirements and configuration should be subject to two key questions: who is going to use the data and for what purpose?
- Required data must be prioritized and care taken to address usability and the user experience for the maintainers and other front-line employees. This is critical to maintain data integrity.
- Maintaining asset data information and establishing enterprise registry with the applicable attribute information to support multiple business processes is a large undertaking.
- Reporting flexibility must be maintained.
- Key agency personnel will need to be assigned time to ensure that implementation is done right and addresses the needs of users.
- The agency will need guidance and to learn about the best practices enabled by the software.
- The agency should be aware of the labor required to maintain and use the software.
- Most likely there will be a need for new roles, responsibilities and positions to perform the functions enabled by the technology. Offsetting efficiencies may be found elsewhere.
- The agency should start small but think bigger, planning for expansion and integration.
- Milestones for process compliance and data quality should be met for initial releases before expanding functionality.
- The agency should always be a few steps ahead in terms of system architecture; it can expect lots of data and a growing user base.
- The agency should build network infrastructure for acceptable user response speeds with the future configuration in mind, not just today's needs.

3.5 From Foundational to Next Level Capabilities

This paper addresses the foundational functionality to support TAM Plan processes that address FTA requirements and agency-wide requirements for an enterprise inventory of record and work order management. Next level capabilities draw on this data; however, pending implementation and historical data many agencies use the Transit Economic Requirements Model (TERM-Lite) that FTA has made available for free.

TERM-Lite can be used to help address federal requirements pending other more robust solutions. It requires a high-level inventory of major assets that includes basic data that can be used to populate a more extensive TAM system. With this basic inventory information, TERM-Lite will provide a projection of funding needs, a current evaluation of backlog, and tools that allow an agency to calculate these numbers in both an unconstrained and investment-limited scenario. FTA also provides training tools on the use of this system.

Related APTA standards

APTA SUDS-TAM-RP-005-19, "Improving Asset Management Through Better Asset Information"

Definitions

asset management organization: That part of the transit agency where the leadership and/or execution of the TAMP and related responsibilities are.

asset management software: Any IT system that supports the management of an agency's capital assets in its delivery of safe, reliable and cost-effective transit service.

fit-gap analysis: An evaluation of how well existing systems meet or could meet an agency's requirements.

Abbreviations and acronyms

aPaaS	application-platform-as-a-service
BIM	building information modeling
COTS	commercial off-the-shelf
EAM	enterprise asset management
FTA	Federal Transit Administration
IaaS	infrastructure-as-a-service
MRO	maintenance, repair, operations
NATSA	North American Transportation Services Association
NTD	National Transit Database
PaaS	platform-as-a-service
SGR	state of good repair
SaaS	software-as-a-service
TAMP	transit asset management plan
TERM	Transit Economic Requirements Model

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