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Reference Manual for Planning and Design of a Travel Management Coordination Center (TMCC)

DECEMBER 2017

FTA Report No. 0117
Federal Transit Administration

PREPARED BY
ITS America

U.S. Department of Transportation
Federal Transit Administration

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Metric Conversion Table

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC

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Intelligent Transportation Systems (ITS) and other technologies can serve a valuable role in the coordination of mobility services for the transportation-disadvantaged as provided by transit, paratransit, and human service transportation providers. These technologies are integrated through the concept of a Travel Management Coordination Center (TMCC), and this concept was developed and demonstrated through the U.S. DOT Mobility Services for All Americans (MSAA) Initiative. The objective of this reference manual is to build on the experience gained from the MSAA Initiative and provide guidance on how to plan and design a TMCC. The manual identifies four major steps: assessment of barriers and key unmet needs; development of a vision of the desirable customer experience; development of a TMCC Vision among stakeholders defining key organizational and technological choices across the nine stages of the provision of service; and the conduct of an ITS Systems Engineering project process. The manual also outlines key lessons learned from the MSAA Initiative as they relate to the institutional foundation needed to develop and sustain a TMCC and identifies many resources to assist those planning a TMCC.

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ABSTRACT

Intelligent Transportation Systems (ITS) and other technologies can serve a valuable role in the coordination of mobility services for the transportation-disadvantaged as provided by transit, paratransit, and human service transportation providers. These technologies are integrated through the concept of a Travel Management Coordination Center (TMCC), and this concept was developed and demonstrated through the U.S. DOT Mobility Services for All Americans (MSAA) Initiative. The objective of this reference manual is to build on the experience gained from the MSAA Initiative and provide guidance on how to plan and design a TMCC. The manual identifies four major steps: assessment of barriers and key unmet needs; development of a vision of the desirable customer experience; development of a TMCC Vision among stakeholders defining key organizational and technological choices across the nine stages of the provision of service; and the conduct of an ITS Systems Engineering project process. The manual also outlines key lessons learned from the MSAA Initiative as they relate to the institutional foundation needed to develop and sustain a TMCC and identifies many resources to assist those planning a TMCC.

SECTION 1

Introduction

Context–The Coordination Problem

Transportation-disadvantaged refers to individuals who meet at least one of the following conditions:[1]

- Persons with limited or no access to transportation
- Persons who cannot provide their own transportation
- Persons who cannot use existing travel options(or can only use them with great difficulty)

Human service transportation (HST) includes a broad range of transportation service options designed to meet the needs of transportation-disadvantaged populations, including older adults, people with disabilities, and/or those with lower income. As service needs can differ widely based on ability, human service agencies (such as Medicaid, local workforce development agencies, housing authorities, or veteran groups) have developed their own transportation programs. These programs are specifically designed to serve a particular population within their community and operate in parallel to public transit agency services, including both fixed-route transit and paratransit service, as required by the Americans with Disabilities Act (referred to as ADA paratransit). At a regional level, these multiple programs often result in fragmented, redundant, and unreliable transportation services with underutilized capacity (e.g., empty seats). The lack of coordination is a significant obstacle to effectively meeting the mobility needs of people who need these services most. Lack of coordination also results in expensive services, unmet customer needs, underutilized capacity, inefficient operations, and poor quality of transportation services. The presence of multiple services or multiple service providers can be confusing for some customers, leaving them unsure of who to call or how to access the service that best meets their needs in terms of accessibility, schedule, distance, or fare structure.

Numerous Federal programs that provide funding for the transportation-disadvantaged further complicate the situation. Currently, there are more than 80 Federal programs that fund transportation services for the general public and for the transportation-disadvantaged. The February 2004 Presidential Executive Order on Human Service Transportation Coordination (Executive Order 13330)

[1] Torng, G., Y. Gross, and, B. Cronin, "Mobility Services for All Americans–Unmet Mobility Needs and ITS Solutions," 2005 ITS World Congress; available at http://www.its.dot.gov/research_archives/msaa/docs/11MSAAWorldCongresS.htm.

established the Federal Interagency Transportation Coordinating Council on Access and Mobility (CCAM) to enhance accessibility and mobility for persons who are transportation-disadvantaged, especially individuals with low incomes, people with disabilities, and older Americans. This Council is chaired by the Secretary of Transportation with representation from 11 executive departments or agencies of the Federal government. The Executive Order requires all Federal agencies to work together to enhance transportation access, minimize duplication of Federal services, and facilitate the most appropriate, cost-effective transportation options for the targeted groups.

Mobility Services for All Americans (MSAA) Initiative

The MSAA[2] is a complementary effort to support the work of the CCAM by addressing the coordination challenge using technology. A research and demonstration program of the U.S. Department of Transportation (U.S. DOT), the MSAA initiative started in 2005 building upon several past and current U.S. DOT-led activities, including the United We Ride Program, now under the purview of the CCAM. The goal of the MSAA Initiative is to increase mobility and accessibility for the transportation-disadvantaged and the general public and achieve more efficient use of Federal transportation funding resources through technology integration and service coordination.

Intelligent Transportation Systems (ITS) present the opportunity to connect customers, agencies, and transportation providers seamlessly through a single point of access for the customer, thereby greatly enhancing the effectiveness and efficiency of the mobility services offered to the disadvantaged and to the general public. Through the application of ITS technologies, the MSAA Initiative is providing the technological backbone to realize this vision. The key to effective and efficient coordination is integrating ITS technologies into a physical or virtual Travel Management Coordination Center (TMCC) that networks all parties together and uses ITS technologies that are tested and proven and have demonstrated significant benefits and return on investment, including:

- Fleet scheduling, dispatching, and routing systems
- Integrated fare payment and management (payment, collection, and processing) systems
- Better traveler information and trip planning systems, particularly for customers with accessibility challenges
- Advanced geographic information system and demand-response systems to provide door-to-door service

[2] http://www.its.dot.gov/research_archives/msaa/index.htm.

The MSAA Initiative has the following three major objectives:

- To establish a comprehensive set of transportation services to meet the full range of transportation needs for all, including low-income individuals, older adults, and persons with disabilities in a target area by coordinating the resources of various human service and transit programs.
- To simplify points of access for consumers to obtain the transportation services needed from various programs.
- To use intelligent transportation systems to enhance transportation service delivery and system accessibility

Since its inception, the MSAA initiative has accomplished the following:

- Research on a range of issues related to the challenges of transportation coordination, unmet needs created by the lack of coordination, the potential role of ITS technologies, related opportunities and challenges, and documentation of the many lessons learned over the course of the MSAA Initiative.
- Implementation of a two-phase competitive demonstration program in 2005–2011to articulate and design (Phase 1) and then test (Phase 2) the TMCC concept in different demonstration sites that offer a wide variety of unique operational, institutional, geographic, demographic, and technological characteristics.
- Additional funding for deployment planning projects in 2015 to further improve HST coordination and delivery. The purpose of this deployment planning effort is to replicate and advance the success of TMCC phased-implementation by providing "seed" funding to leverage other federal, state and local resources to build up coordinated community transportation services. The new projects also incorporate new knowledge and concepts such as One Call–One Click.
- Promotion of the results of the Initiative across the nation through outreach, education, and knowledge transfer.

Initiatives Using Technology to Enhance Coordination

In parallel to the U.S. DOT MSAA program, several initiatives or research projects in recent years have explored the use of technology to enhance coordination in multi-provider environments, as described in the following sections.

Coordination of General Public and Human Service Transportation in Longmont, Colorado

The Longmont pilot coordination project was initiated in 2010 with the goal of using automated, mobile electronic manifests and communication technology to coordinate independently-run demand-responsive services in Longmont in the Denver metropolitan area. The Regional Transportation District (RTD) operates fixed-route rail and bus service in the metropolitan area, as well as the Call-n-Ride (CnR) demand-response service for the general public.

The intent of the pilot coordination project was to coordinate three services operating in Longmont, including:

- Via Mobility Services, which provides on demand, door-through-door, shared-ride service to eligible customers in 19 communities in 5 counties.
- RTD's CnR service, which operates in more than 20 low-density suburban communities in the metropolitan area, providing the general public with demand-responsive local distribution service or feeder service to timed transfers points on rail and major bus corridors; reservation is automated through various media.
- RTD's access-a-ride ADA paratransit service operated under contract by three regional providers; Via provides 25% of the service.
- Via Mobility Services and RTD are also partners in one of the recent MSAA planning projects selected for funding by the U.S. DOT. The goal of that project is to build on the success of the Longmont pilot and extend the coordination initiative to other locations by addressing key institutional, technical, and scaling issues.

The Via Mobility Services coordination project has resulted in an increase in ridership with a relatively insignificant increase in service and a significant increase in productivity. For example, from 2010 to 2012, boardings increased 36%, and boardings per hour increased 26%, whereas vehicle hours increased by only 8%

NCHRP Report 832: State DOTs Connecting Specialized Transportation Users and Rides

Under the National Cooperative Highway Research Program (NCHRP), the Transportation Research Board (TRB) recently published a two-volume study[3] aimed at assisting state departments of transportation in connecting customers with the best mobility options. "Volume 1: Research Report" discusses the main components to facilitate connection of specialized transportation users and rides and explores various issues, including planning considerations, the development process, marketing, and evaluation of current programs. It identifies five types of linkage programs and provides best practices for connecting specialized transportation users with their daily rides to access services. "Volume 2: Toolkit for State DOTs and Others" provides a toolkit for planning and implementing a

[3] Rodman, Q., D. Berez, S. Moser, and J. Choe, "National Cooperative Highway Research Program – State DOTs Connecting Specialized Transportation Users and Rides," NCHRP Report 832, Transportation Research Board, Washington DC, 2016; available at http://www.trb.org/Publications/Blurbs/174327.aspx.

range of linkage services, from identifying target geographies, users, and modes to determining effective evaluation and marketing strategies.

The five types of linkage programs identified in NCHRP Report 832 are the following:

- *Central Repository* – creation of, or linkage with, an existing centralized repository of transportation resources. This can vary from a hard-copy listing of services and programs to a web-based provider portal.
- *Matching Assistance* – customers supply search criteria or answer "triage questions" asked by a mobility specialist (call-taker) or prompted by an online system to reduce providers to viable options.
- *Trip Planning Assistance* – customers use an online system or call a mobility specialist to get detailed options to make a specific trip.
- *Trip Booking Assistance* – a mobility specialist call provider helps with customer requests and books a trip.
- *Direct Trip Booking* – occurs via automated links to paratransit systems (one system allows a scheduler from one partnering organization to schedule trips onto another partner's vehicle runs).

Technology can be used to assist in the search and planning phase, but it is essential for the direct trip booking type of linkage. There are, however, few existing examples of this most technologically-advanced type of linkage. The following sections describe a few exploratory initiatives.

Exploratory Examples

The above-mentioned NCHRP study identified and summarized various initiatives that enhanced "linkages." Two initiatives, Jacksonville Transportation Authority (JTA) in Florida and Utah Transit Authority (UTA), are pertinent to this manual, as they involve efforts beyond merely creating a one-call–one-click access portal. The following summaries are derived from the NCHRP 832 report.

JTA TransPortal

The first initiative was undertaken by JTA, which has developed a one-click application known as TransPortal. The application allows users to identify transportation options, create step-by-step itineraries, and determine pricing based on a set of triage questions. As of July 2015, 28 transit agencies and service providers were included within TransPortal. The software is connected with General Transit Feed Specification (GTFS) based transit scheduling information, an open-source taxi fare database, and Amtrak's dynamic fare system. These connections automatically update schedule and fare information, reducing the staff time needed to update service data.

JTA integrated paratransit trip booking directly into the TransPortal software package in August 2015. To facilitate trip booking, TransPortal accesses trip

information through a common software platform used by paratransit operators in the Jacksonville region. Using TransPortal, customers can enter their trip information, identify a paratransit service, and book a trip without having to speak with an operator. To ensure that TransPortal users qualify for paratransit services, JTA sends user names and passwords to each rider that has successfully completed the eligibility application process.

JTA is also integrating scheduling features for its flex-route transit services. Paratransit-eligible customers are not charged a fare on flex routes in the Jacksonville area. With full integration of both paratransit and flex-route trip scheduling, eligible riders will be able to understand better when flex-route or fixed-route service may provide a comparable alternative to paratransit. In some cases, riders may opt to use a free flex- or fixed-route service rather than a paratransit service that is subsidized more by JTA.

UTA 1-Click

UTA is developing a one-click portal, 1-Click|UTA, in support of the Wasatch Regional Mobility One-Click website initiative. Once implemented, the system will provide a unified multimodal trip-planning tool designed to meet the transportation needs of human service transportation clients, such as veterans, military families, older people, and those with disabilities, in the greater Salt Lake City region.

A primary goal of the UTA one-click program is to increase awareness of transportation services operated by the local human service providers. UTA also is working toward integrating the RidePilot open-source scheduling software package with the agency's one-click software. As part of this integration process, UTA will be supplying RidePilot software for a low cost to human service providers that currently use paper or spreadsheet-based scheduling. By increasing the number of providers using RidePilot, UTA hopes to enhance the range of direct booking options available on its portal and streamline the process of using specialized transportation service.

Wake Coordinated Transportation Service and City of Raleigh ADA Mobility Management

Wake Coordinated Transportation Service (WCTS) operates in Wake County in the Raleigh, North Carolina, metropolitan area. In partnership with the City of Raleigh ADA paratransit service, WCTS initiated a mobility management project that builds on a common technological platform.

The provided mobility management services include:

- Brokerage service leveraging multiple private providers with publicly- and privately-funded vehicles

- Bus passes and gas cards
- Centralized call center to migrate to a countywide one call-one click center.
- Connections to the human services call center, ADA paratransit call center, 211 information service, etc.

The technology objectives for the mobility management project are to use the shared platform to:

- Monitor/update access to service information, 211 access, and public, private, and volunteer transit options to assure accessibility.
- Provide customers with a 24/7-accessible, seamless one stop/one click access portal to local and regional service providers and transportation information.
- Provide customer access to websites and links for trip planning, customer reservation requests, and direct online access to Wake County transit services via an online platform and direct call center contact with capabilities allowing for data analysis of requests, services delivered, and areas needing improvement notated.
- Enable live trip planning and route tracking in concert with comment, complaint, and commendation functions that allow analysis of service delivery, customer satisfaction, and compliance with grant requirements.

A Vision for Enhanced Coordination through a TMCC

To date, the above efforts remain very limited. The concept of a TMCC, as developed through the MSAA Program, goes a step further to expand our understanding of how technology can enhance coordination. The concept of the TMCC involves:

- An integrated structure of various technologies, mostly related to ITS
- Coordination of human services transportation management and operations across various programs, providers, modes, and geographic areas

A successful TMCC provides the following range of benefits for different stakeholders:

- Provides customers with a simplified or single point of access to unified travel support services for information and referral and/or to arrange for transportation services.
- Provides human services, public transportation, and other agencies with the ability to coordinate transportation needs across service providers and modes, thus providing extended hours or geographic coverage for their services.

- Provides transportation providers with a method for matching availability, schedules, and capacity with customer demand, an ability to efficiently process financial transactions, an opportunity to eliminate redundancies, and tools to ensure security and customer eligibility to use the system.

The MSAA Initiative has illustrated that the concept of TMCC is pertinent to a wide range of potential types of communities, including:

- Small urban and surrounding rural areas
- Wide geographic rural areas
- Large urban and suburban areas
- Major cities

Figure 1-1 provides a sample visual representation of this integrated vision.

Through its various activities, the MSAA Initiative provided a better understanding of how to implement this integrated vision in real circumstances.

Objective of the Report

The objective of this report is to serve as a reference for planning and designing a TMCC using ITS and other technologies to enhance the coordination of mobility services for the transportation-disadvantaged. It is envisioned that this manual will facilitate, and thereby encourage, local efforts to pursue the use of technology for this purpose. This manual will be of particular value to those communities where:

- There are multiple human service and public transportation providers.
- Transportation coordination has already been recognized as a community priority.
- The key stakeholders have agreed to work together.
- The stakeholders have agreed to pursue technology as a key tool to enhance coordination.

The report may be of interest to any staff for the key potential stakeholders within such communities, which mainly include:

- Public transportation agencies
- Human service and faith-based transportation providers
- Human service agencies with involvement in mobility programs
- Regional planning or workforce development agencies
- State or local transportation funding agencies
- Other entities with a similar purpose

Figure 1-1

U.S. DOT MSAA Integrated Vision

Photo Credit: Pressfoto - Freepik.com

Premise: Technology as a Potential Enabler

The coordination of services for the transportation-disadvantaged is a very complex issue with many dimensions of policy, institutional, organizational, and human challenges, but it has been well documented, and a large volume of previous literature has explored the related experience and lessons learned.[4] The intent of this document is not to duplicate any of that literature, but to use it as a baseline for advancing the state of the practice, particularly in those communities that have already taken concrete steps to create an appropriate institutional framework. Concrete steps to creating an institutional framework would include:

- Carrying out a consultation process to identify the key stakeholders.
- Creating an institutional/organizational structure to conduct ongoing communications between key mobility stakeholders.
- Formal agreement among key stakeholders that *sharing* (of resources, tasks, and/or clients) is critical to enhancing the effectiveness and efficiency of the overall system and development of a governance process to pursue this agreement.
- Agreement to pursue the use of advanced technology (such as ITS) to enhance the sharing of resources, tasks, and/or clients, and the coordination of mobility services.

Although sharing agreements are an essential part of successful TMCC development and operations, this document does not address state DOT-led cooperative purchasing efforts to procure ITS technology on a state-wide basis. There are obvious benefits of state-coordinated cooperative purchase of technology and services. For example, standardized concepts of operations, system design, and a single-vendor platform would facilitate seamless system interfaces. However, this is somewhat different from the community-based effort to enhance multi-provider coordination through the development and implementation of a TMCC, which is the intent of the MSAA Initiative.

Section 2 discusses customer barriers, ITS technologies, and the TMCC concept. Section 3 presents an overview of a framework for planning and designing a TMCC. Sections 4 through 7 present the various components of the framework in more detail, and Section 8 summarizes some of the key challenges for developing and maintaining an institutional foundation that are required to make a TMCC feasible during its initial periods and sustainable over time.

[4] See Resources in Appendix A.

SECTION 2

Customer Barriers, ITS Technologies, and the TMCC Concept

Customer Barriers

The lack of transportation coordination creates many barriers to ensuring the mobility of transportation-disadvantaged persons. The MSAA demonstration sites carried out sophisticated processes to identify their individual requirements and to design the TMCC that would meet the requirements in their community. Although the individual designs varied, many of the demonstration sites found that the lack of transportation coordination created comparable challenges for their respective customers. One of the sites, Camden County, articulated the following challenges, which are likely applicable to other sites:[5]

- *Suppressed demand* – unmet demand for human service transportation exists in general in the county and for specific trip purposes such as Medicaid and employment-related trips.
- *Limited service area and hours* – evening and weekend service offered by traditional and human service transportation providers typically is limited, which hinders the ability of customers to access employment or meet basic needs (such as shopping and social trips). Access to industrial parks in areas of new growth and off-hours is particularly problematic, significantly hampering transportation-disadvantaged residents in both urban and rural areas from securing employment.
- *Complex customer communications* – currently, there is no comprehensive transportation information access point for customers within the county. This complicates trip planning for the users of public transit and human service transportation, as well as referring agencies.
- *Limited coordination among area providers* – limited coordination exists among the county's human service transportation providers. Opportunities exist to eliminate duplicative service, to extend service hours and geographic coverage through the coordination of [transportation services from] public, non-profit, and other organizations.
- *Limited integration of human service transportation with traditional public transportation* – there is currently limited use of human service transportation to provide feeder service to traditional transit at key transfer points and transit stations.

[5] Tanker, L., M. Dickinson, and R. Widing, "Camden County Workforce Investment Board, Toward a Coordinated System of Transportation: Camden County's Travel Management Coordination Center," August 29, 2008.

Potential Role of ITS Technologies

The MSAA Initiative conducted extensive consultation and research activities at the outset of the project. In particular, it convened five stakeholder discussion-group meetings in which stakeholders validated research findings and recommendations, formulated high-level views of an ideal human service transportation system, and identified opportunities and challenges. Participants included:

- Consumers and advocacy stakeholders
- Public transit stakeholders
- Community and not-for-profit transportation stakeholders
- Human service transportation administration stakeholders
- Private industry stakeholders

Based on literature review outcomes and stakeholder input from these meetings, the research identified 23 major barriers that have led to unmet mobility needs (gaps) facing certain population groups. These 23 barriers have been grouped into the five categories of:

- Service Availability
- Service Information and Knowledge
- Service Accessibility
- Service Reliability and Safety
- Service Flexibility

A research paper prepared as part of the MSAA Initiative, entitled "Mobility Services for All Americans—Unmet Mobility Needs and ITS Solutions"[6] analyzed each of the 23 barriers and identified high-level solutions as well as the potential application of technologies in addressing these barriers. For example, under the category of Service Availability, the principal barrier as perceived by customers (and their case workers) is the lack of service in terms of service hours and/or geographic coverage. The high-level solution to this barrier would be to increase service capacity and coverage by coordinating among human service transportation programs and providers to leverage resources.

From the perspective of service providers and administrators, addressing the barriers would require:

- More funding and/or resources to expand service
- An inter-operable transit management system

[6] Torng, Gross, and Cronin, available at http://www.its.dot.gov/research_archives/msaa/docs/11MSAAWorldCongresS.htm.

- Institutional support for inter-program coordination (e.g., eligibility verification, cost allocation, etc.)
- Tools to address time-consuming and labor-intensive preparation of reports and invoices for handling financial transactions with multiple funding sources

The paper identifies several technologies that would help to address these challenges, including:

- Automated trip planning system
- Automated reservation system
- Automated scheduling, routing and dispatching system
- Centralized/shared system operations, program administration and traveler management database
- Electronic fare payment/collection system
- Automated billing/reimbursing system through electronic transactions
- ITS architecture, standards, data requirements

Other valuable studies also have explored the potential benefits of applying ITS technologies for improving the coordination of transit, paratransit, and human service transportation.[7]

It is clear from these various assessments that ITS technologies can serve to address many of the mobility barriers faced by transportation-disadvantaged persons.

TMCC Concept

A TMCC is a system for integrating these technologies and is an essential component in delivering coordinated human services transportation management and operations across various programs and service providers, modes, and geographic areas. However, there is no "one-size-fits-all" model of a TMCC; eight MSAA demonstration sites have generated eight unique TMCC configurations. Nonetheless, certain technologies are commonly included in the design of TMCCs, including:

- Fleet scheduling, dispatching, and routing systems
- TMCC customer interface (e.g., telephone, interactive voice response [IVR], internet, etc.)

[7] U.S. DOT, "ITS Applications for Coordinating and Improving Human Services Transportation: A Cross- Cutting Study," August 2006; available at http://ntl.bts.gov/lib/jpodocs/repts_te/14140.htm; Ripplinger, D. and D. Peterson, "ITS Transit Case Studies: Making a Case for Coordination of Community Transportation Services Using ITS," Small Urban & Rural Transit Center Upper Great Plains Transportation Institute, North Dakota State University, 2005; available at http://www.ugpti.org/pubs/pdf/DP171.pdf.

- Better traveler information and trip planning systems, particularly for customers with accessibility challenges
- Vehicle communications (e.g., mobile data computers and other mobile communications devices)
- Automatic vehicle location (AVL), computer assisted dispatch (CAD) and other systems that assist the operations of demand-response door-to-door service
- Integrated fare payment and management (payment, collection, and processing) systems
- Eligibility certification and accounting systems

A TMCC can be a physical or virtual center that connects human services agencies with transportation agencies and providers, dispatchers, and brokers. A TMCC can be centralized, decentralized, or a hybrid of both. The design that is appropriate for any given community is driven by a host of factors, including:

- Customer needs
- Number and type of local providers and their assets (for instance, number of vehicles in their fleets)

Institutional context and level of participation by stakeholders

- Funding programs being used by local providers, and constraints created by these programs
- Degree of collaborative decision-making to which stakeholders agree
- Degree to which stakeholders agree to share data, and responsibilities for operations and maintenance
- Existing technologies and systems in place for operations

These technologies can be configured in a variety of ways to fulfill the vision of coordinated services provided to customers with different mobility needs served by multiple types of providers, with funding provided by different types of funding sources, as illustrated in Figure 1. The next sections of this manual are intended to help communities with the key choices they need to make in designing a TMCC that addresses their specific needs and fulfills the vision in their own community.

SECTION 3

TMCC Planning and Design Framework

Systems Engineering for ITS Projects

An array of technologies, including ITS technologies, are used to build a TMCC. Agencies that use Federal funding to acquire ITS technologies are subject to certain requirements. As provided in 23 U.S.C. § 517(d), any award that includes an ITS or related activity financed with appropriations made available from the Highway Trust Fund, including amounts made available to deploy ITS facilities or equipment, will conform to the appropriate regional ITS architecture, applicable standards, and protocols developed under 23 U.S.C. § 517(a) or (c).[8] All ITS projects funded by the Highway Trust Fund and the Mass Transit Account must conform to the National ITS Architecture, and U.S. DOT-adopted ITS Standards. They also must use a Systems Engineering approach in designing, procuring, and deploying an ITS project.

The U.S. DOT provides many valuable resources on systems engineering at various web sites.[9] One of these resources is entitled *Systems Engineering for Intelligent Transportation Systems*.[10] This guide is intended to introduce systems engineering and provide a basic understanding of how it can be applied to planning, designing, and implementing ITS projects. The guide leads step-by-step through the project life cycle and describes the systems engineering approach at each step and explains the value of using the Systems Engineering approach[11] in ITS projects.

Although ITS projects come in many shapes and sizes, they all use technology (computers, communications, sensors, etc.) and frequently include the exchange of information, either within a system or between systems. The technology and integration that set ITS projects apart also create challenges for the ITS project manager. What every ITS project manager wants is a successful result at the end of the project, with "success" measured by:

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[8] FTA Fiscal Year 2017 Certifications and Assurances, https://www.transit.dot.gov/sites/fta.dot.gov/files/FTA FY 2017 Certifications and Assurances.pdf.

[9] FHWA Systems Engineering, http://www.ops.fhwa.dot.gov/int_its_deployment/sys_eng.htm; "Systems Engineering Guidebook for ITS, Version 3.0," http://www.fhwa.dot.gov/cadiv/segb/index.htm; Systems Engineering and ITS References, http://www.fhwa.dot.gov/cadiv/segb/resources/index.htm.

[10] Systems Engineering for Intelligent Transportation Systems, http://ops.fhwa.dot.gov/publications/seitsguide/index.htm.

[11] http://ops.fhwa.dot.gov/publications/seitsguide/section2.htm.

- How well the implementation satisfies the needs of the people who use it
- How closely the project stayed within the budgeted cost and schedule

Systems engineering reduces the risk of schedule and cost overruns and increases the likelihood that the implementation will meet the user's needs.

U.S. DOT recognized the potential benefit of the Systems Engineering approach for ITS projects and included requirements for a systems engineering analysis in an FHWA Rule/FTA Policy enacted on January 8, 2001. The Rule/Policy requires a systems engineering analysis to be performed for ITS projects that use funds from the Highway Trust Fund, including the Mass Transit Account.

Another U.S. DOT Guide entitled Guidebook for ITS, Version 3.0 provides the following definition:[12]

> The International Council of Systems Engineers, https://www.incose.org/, (INCOSE) uses the following definition for "systems engineering": Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, and then proceeding with design synthesis and system validation while considering the complete problem:
>
> - Operations
> - Cost & Schedule
> - Performance
> - Training & Support
> - Test
> - Manufacturing
> - Disposal

Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. Systems Engineering considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs.

The entire Systems Engineering process and its various phases have been concisely portrayed in what is often referred to as the "Systems Engineering V Diagram," as seen in Figure 3-1.

[12] "Systems Engineering Guidebook for ITS, Version 3.0," http://www.fhwa.dot.gov/cadiv/segb/whatis/index.htm.

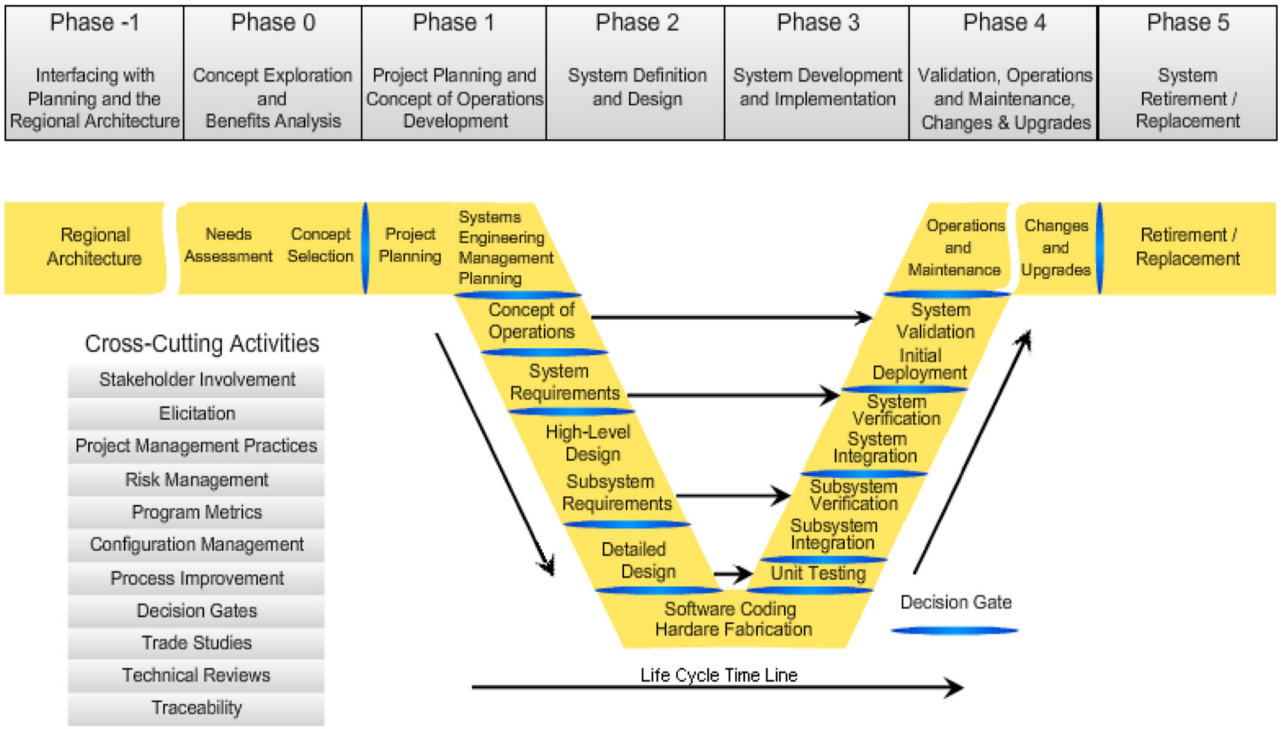

Figure 3-1 *Systems Engineering Process – V Diagram*

Source: U.S. DOT, FHWA California Division, "Systems Engineering Guidebook for ITS, Version 3.0," 2009, http://www.fhwa.dot.gov/cadiv/segb/views/process/index.htm.

A Framework for TMCC Planning and Design

The Systems Engineering process described above provides a comprehensive and detailed process for designing any ITS project by also helping to maximize the chances for the project(s) to succeed. However, experience with the MSAA project sites has demonstrated that there are specific challenges for communities in planning and designing a TMCC, including the following:

- By its very nature, a TMCC implies sharing of resources among agencies with different perspectives and objectives. Deciding what resources to share and how to share them creates institutional challenges.
- There is no one-size-fits-all design for a TMCC. In fact, the variety of technologies that can be deployed and the wide range of possible configurations create a considerable number of choices that must be duly considered in designing a TMCC. This makes the decision-making process complex and challenging for the stakeholders.

- The communities and agencies that might benefit most from sharing of technological resources through a TMCC often are those with few staff resources and little expertise or exposure related to relevant advanced technologies.
- Engaging in a Systems Engineering process involves the introduction of new concepts, processes, and terminology for TMCC stakeholders, which makes the process more challenging due to limitations in resources or the lack thereof for relatively smaller agencies/providers.

Experience from the MSAA demonstration sites showed that, without the availability of a guiding document, the initial steps into the Systems Engineering process to develop a "Concept of Operations" appeared to be an obstacle for the target communities and the stakeholders that might benefit from a TMCC. This was a confirmation of the expected challenges mentioned above and the need for developing a guiding document to assist the communities in planning and designing a suitable TMCC.

After reviewing all the experience and documents produced by the MSAA Initiative, it was decided that there was need for a special framework to help communities and related stakeholders plan and design a TMCC. This special framework, outlined in this manual, places emphasis on the initial steps required to develop a common TMCC Vision among the stakeholders. Development of a shared vision for the design of the TMCC will facilitate the process to help stakeholders for engaging into the Systems Engineering process.

Figure 3-2 illustrates the TMCC Planning and Design Framework, which consists of the following steps:

1. *Assessment of Barriers and Key Unmet Needs* – identify current barriers for customers and unmet customer needs.
2. *Vision of Desirable Customer Experience* – develop a vision of the ideal customer experience from trip request to trip completion.
3. *TMCC Vision* – develop consensus among stakeholders about the objectives of the TMCC.
4. *ITS Systems Engineering Project Process* – use the Systems Engineering steps from the V Diagram to design and deploy a TMCC project.

In addition, any effort to plan and design a TMCC must be based on an institutional foundation for transportation coordination to support the TMCC project from vision to deployment, and its sustainment thereafter. The focus of this manual is on the use of technology in a TMCC to enhance transportation coordination, but this cannot succeed if the necessary institutional foundation in the community is not present to make a TMCC conceivable and sustainable. Issues related to the institutional foundation are discussed in Section 8.

The institutional context also is likely to evolve over time with new stakeholders becoming participants. The TMCC design, therefore, should be scalable to allow future expansion with new stakeholders and services.

The different steps of the TMCC Planning and Design Framework are outlined in more detail in the following sections. Emphasized effort has been made to provide a visual tool for developing the TMCC Vision to facilitate the process and developing a consensus around a shared vision of a TMCC that best suits their community's needs.

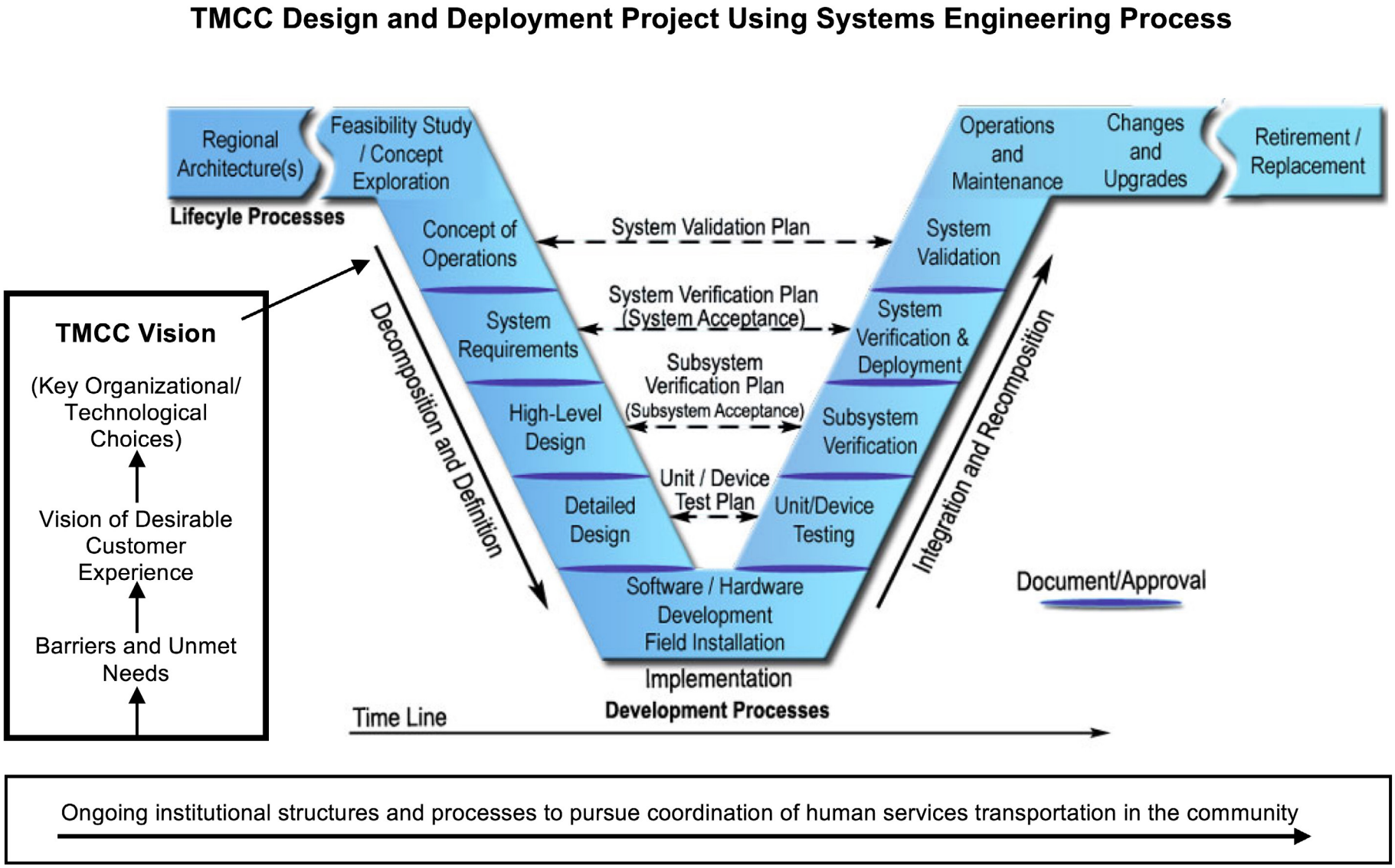

Figure 3-2 *TMCC Planning and Design Framework*

SECTION 4

Barriers, Unmet Needs, and Vision of Ideal Customer Experience

It is critical that the first focus in developing a TMCC is to be "the customer." This can be pursued in two steps:

1. Identify current barriers and unmet needs.
2. Develop a vision of the ideal customer experience.

Assessment of Barriers and Unmet Needs

Communities face challenges in serving the transportation-disadvantaged, and the reasons for those challenges may include lack of financial resources, lack of transportation providers, constraints related to geographic or time coverage, mismatch between the funding programs and the needs of customers, lack of information, etc. Although there are many similarities in the challenges communities face, it is important for a community to identify the barriers and unmet customer needs specific to their community.

Several examples of the unmet needs assessments were provided in Section 2. For example, Section 2 outlined the unmet needs as identified through the planning of the Camden MSAA project. The Lower Savannah Council of Governments (LSCOG) identified the following similar unmet needs as part of the planning of the Aiken (South Carolina) TMCC:

- Lack of customer knowledge of transportation resources and how to access them
- Limited areas of service
- Limited hours of service
- Limited service for some trip purposes or target groups
- Inefficiencies in coordination of trips throughout the region
- Less-than-optimal automation of data, ridership, scheduling, and reporting
- Lack of scalable technology infrastructure

Some of these barriers and unmet needs directly affect customers, whereas others are more indirect, affecting the effectiveness and efficiency of the mobility service provided to the customers to meet their needs.

Vision of Ideal Customer Experience: Questions to Ask

Having identified the limitations of the current services, the next step is to identify an ideal customer experience. The TMCC stakeholders must work together to discuss and develop a shared vision of the experience they would like their customers to have. During the development of the vision, the role of technology in fulfilling that positive experience should also be incorporated in the discussions.

The experience from the MSAA Initiative was used to develop a list of questions to be considered by TMCC stakeholders when developing the vision of an ideal customer experience and are listed below under five aspects of the customer experience.

Trip Reservation

- How should the customer access the TMCC to request a trip—by telephone, internet, kiosk, smart phone application, direct referral (human)?
- For telephone access, does the customer have a single number to call in the region regardless of which agency will provide the ride? Is there cellphone coverage in all areas?
- How should the TMCC's call center services be made available—live person (if so, what days and hours of operation), IVR, internet, kiosk?
- Does this call lead to a call agent, or does the customer have access to a self-service menu to request a trip reservation?
- Are calls made during business hours to an agent of the TMCC placed in a "queue" or directed to an agent's voicemail system for a return call? If queued, is the customer told how long the remaining wait time is? Are call metrics kept to measure quality?
- Does the customer experience different trip reservation procedures after business hours than during business hours?
- Does the customer have the choice to call either a central number or the number of the service provider with which they are familiar?
- Can the customer make a trip reservation through a website or a kiosk?
- Will the system automatically check if a customer is eligible and funded for the desired trip, or must he or she interact with a call agent for each trip request?
- Can the customer reserve an "ineligible" trip if he or she is willing to pay the "full" fare?

- Can the customer request a complex trip that includes multiple segments and multiple payers—for example, linking a trip to the doctor, then to the pharmacy, and return home?
- Can the customer combine mobility device requirements with escort needs through an automated system?
- Can the customer know at the time of booking how much that trip will cost? (Some may not book unless they know this in advance.) Is this amount written on the driver's manifest or mobile data terminal (MDT) so the driver and customer have the same payment expectation?

Confirmation of Booking (Paratransit/Deviated Fixed Route)

- Is the customer immediately guaranteed a booking for a trip during the same call as the trip request, i.e., is this a trip request with subsequent confirmation or a guaranteed "trip reservation"?
- If not, is there a guarantee for how long it will take to confirm a booking?
- Is the confirmation of the booking made by a computer or by a person?
- Does the customer receive an electronic confirmation via phone call, e-mail, mobile phone text, etc.?
- Will the customer be informed of the trip provider at the time of confirmation?
- How does the customer modify a booked reservation prior to the trip? Is there an automated process to do this?

Reminders about Trip

- Does the customer receive trip reminders?
- If so, how are the reminders sent? When is the customer reminded about the trip—the evening before, an hour before, 15 minutes before the pick-up?
- Will the customer be able to cancel the trip if necessary at the time of the reminder?
- What happens at the pick-up time in case of a no-show?
- Is there an automated message sent to the customer in the case of excessive no-shows, with warning or suspension?

Payment

- How can the customer pay for the trip—cash, tickets?
- If only tickets are used, where can they be purchased? Is there a mechanism for tickets to be purchased from drivers if advance notice was given?

- Is there an automated payment option—by transit system fare card, commercial pre-paid debit or bank account debit/credit card, mobile payment options?
- Is there a customer billing system in place to avoid the need for on-board payment?
- Is there a photo on the customer's fare card? If not (or if there is no fare card), does the customer need to show a photo ID card or sign a form (if trip is funded by a human service agency)?

"Will Call" Return Trip

- For customers with medical trips with uncertain return trips, how is the "will call" return trip requested?
- Is there an automated procedure?
- Can nurses or caregivers place a request for a return trip?
- Does the system provide an estimated time of pick-up?
- Is there an automatic time constraint related to "Will Calls"? In some cases, providers have up to one hour to pick up the passenger under their performance rules.

The above list is not exhaustive. Other questions may arise depending on the specific nature of services and customer needs in a community.

At the beginning of the planning process, developing an unconstrained vision for the ideal customer experience is a good starting point. Further along the development process, there will be many constraints that will limit what can be achieved in reality. Throughout the planning and design process, stakeholders should continue to work together to articulate a common vision of what the customer experience should be.

SECTION 5

Developing A TMCC Vision: Generic Stages and Key TMCC Choices

Overview and Generic Stages of Service Provision Process

Developing a TMCC stems from a fundamental decision to share resources, tasks, and clients among different stakeholders in an effort to enhance the customer experience and improve the effectiveness and efficiency of the services of different transportation providers. The key stakeholders, therefore, must decide which resources to share and how/where technology can enable sharing of resources.

As noted, there is no one-size-fits-all design for a TMCC; there are many possible configurations and choices. The Systems Engineering methodology provides a systematic and comprehensive approach to designing and deploying a specific ITS project. It is however recognized that the Systems Engineering approach may be challenging for communities in which the TMCC concept might be most beneficial.

As a result, this manual has developed a generic framework for the key high-level choices that will facilitate the community's vision for the TMCC and serve as the starting point for the subsequent systems engineering for a potential TMCC project.

As noted, the design of a TMCC should start with the customer, first by identifying barriers and unmet needs and then by creating a vision of the experience that the TMCC stakeholders would like each customer to have. However, each TMCC stakeholder has its own mandate, clientele, mode of operation, and organizational activities, and various factors will affect the objectives and perspectives of each TMCC stakeholder organization. Such factors might include:

- Organizational goals and objectives
- Sources of each organization's capital and/or operating funding and restrictions on how it can be used
- Nature/needs of specific clients served by each stakeholder and extent of personal attention clients need to receive
- Service hours

- Geographic boundaries of operation
- Available capacity
- Staffing (labor)
- Insurance considerations
- Experience with technology

These considerations will affect the stakeholders in any given community, their individual perspectives on where resources and tasks can be shared, and where technology should be applied as part of the TMCC.

This manual defines the following nine key stages of the service provision path that starts at the point when a customer wishes to make a reservation, and ends with the final reporting and billing for the trip. Table 5-1 also provides a brief description of the intended functions of the nine key stages along the service provision path.

1. Customer Access Mechanisms
2. Trip Request Classification
3. Scheduling/Routing
4. Booking and Confirmation
5. Dispatching
6. Vehicle Management
7. Fare Management
8. Data Management
9. Reporting/Billing

Table 5-1 *Functions of Nine Key Stages along Service Provision Path*

Stage	Stages of Service Provision Process	Function
1	Customer Access Mechanisms	Defines how customer accesses process to request reservation for a trip.
2	Trip Request Classification	Defines how eligibility for requested trip is validated prior to scheduling trip.
3	Scheduling/Routing	Defines how requested trip is scheduled and routed.
4	Booking and Confirmation	Defines how trip is booked (i.e., accepted in system after it has been scheduled and routed on a vehicle) and how booking is confirmed to customer.
5	Dispatching	Defines how booked trip is dispatched to drivers who will pick up and transport customer.
6	Vehicle Management	Defines extent to which technology is used in field for vehicle management and who retains responsibility for operational control.
7	Fare Management	Defines how fare collection process will be managed.
8	Data Management	Defines how data in the stakeholders, providers, or common platforms' databases are managed.
9	Reporting/Billing	Defines how data on service provision is organized and processed for reporting and billing.

The *TMCC Vision* is structured along two equally-important dimensions, organizational and technological; stakeholders must reach agreement for each stage of the service provision process on the degree to which they wish to share resources (i.e., organizational choice) and on the degree of automation (i.e., technological choice).

The *organizational* dimension addresses whether the TMCC stakeholders desire to have the activities for each stage conducted in a centralized or decentralized way. In the centralized approach, the resources are shared, and in the decentralized approach each stakeholder carries out the tasks on their own.

The *technological* dimension addresses whether the TMCC stakeholders would like to see the tasks for each stage carried out using a manual or automated process, where feasible. In several cases, hybrid choices also exist.

The framework outlines in the following pages the primary design choices that result from combining organizational and technological alternatives for each stage. The TMCC Vision results from stakeholders coming to consensus on the primary design choice for all nine stages of the service provision process.

At the same time, several other design features should be decided by stakeholders. These are mainly concerned with the details of the functionality such as technology, interfaces, security, etc. The stakeholders are expected to go through each of the nine stages to make decisions about both the primary design choice and the other design features.

The TMCC Vision framework can be used as an entry point for the stakeholders to work through the possible choices and designs for the TMCC at a very high level. This framework will enable stakeholders to do some quick sketching of the range of choices and then reflect on, discuss, and come to some consensus on the higher-level shared vision for the TMCC. This, in turn, will help to focus the subsequent detailed discussions that need to take place through the Systems Engineering process that will lead to a complete and detailed TMCC design and potential deployment. Although the TMCC Vision framework captures most of the alternative TMCC designs that have been developed or contemplated by others, hybrid variations are always feasible depending on local needs and circumstances.

Figure 5-1 provides a visual representation for planning a TMCC and developing the TMCC Vision, including the nine stages of service provision listed previously and the primary organizational and technological choices for each stage. The choices are generally laid out with manual approaches at the top of the figure and automated approaches toward the bottom.

Each of the stages is reviewed in the following sections in terms of the primary organizational/ technological choices that must be agreed upon by the TMCC stakeholders as they work together to define the TMCC Vision. Other choices are also discussed where applicable.

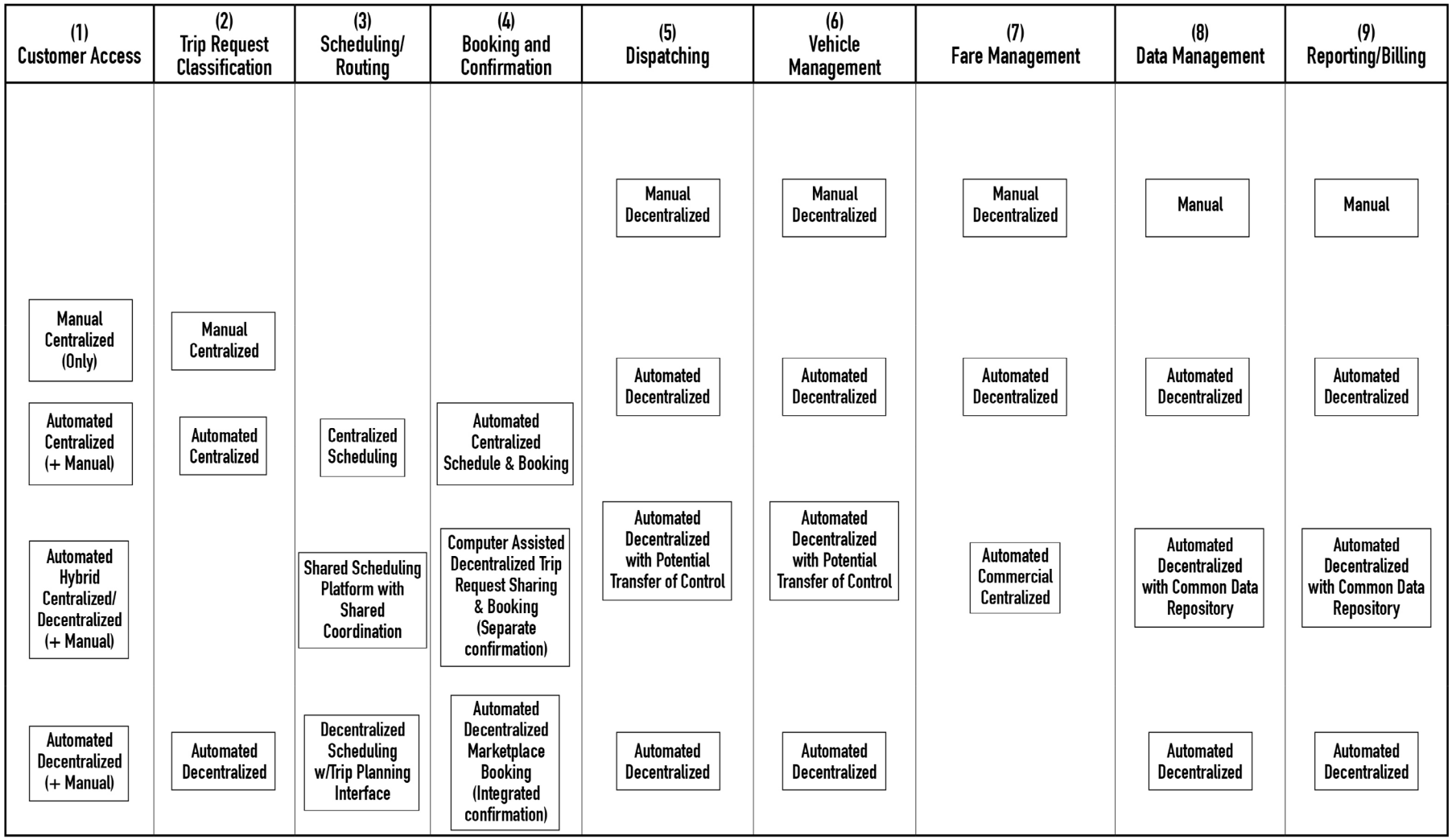

Figure 5-1 *Generic Stages of Service Provision and Primary Choices for Developing a TMCC Vision*

Customer Access Mechanisms

The first stage defines how the customer accesses the process to request a reservation for a trip.

Primary Choice for Customer Access

Four possible approaches are available for defining customer access:

- Manual centralized
- Automated centralized (with manual option)
- Automated decentralized (with manual option)
- Automated hybrid centralized/decentralized (with manual option)

Manual Centralized

TMCC stakeholders pool their resources and centralize the access point for the customer, either through a single toll-free number or by directing all previous access telephone numbers to a central call center. The customer access process remains manual, and the customer still talks to a live customer agent. The same call center may, in fact, serve multiple purposes, such as the 511 transportation information and the 211 human service information and referral services (in which live telephone services are required by the accreditation organization), in addition to receiving reservation requests from customers.

Automated Centralized (with Manual Option)

TMCC stakeholders pool their resources and centralize the access point for the customer through a single automated point. This single access point is typically a toll-free number in combination with IVR, but can also be combined with other means, such as internet or kiosks (as discussed below).

Automated Decentralized (with Manual Option)

TMCC stakeholders retain their own individual customer access means, but choose to use technology to automate the access into the next stage. The selected technology is typically telephony in combination with IVR.

Automated Hybrid Centralized/Decentralized (with Manual Option)

TMCC stakeholders retain their own individual customer access means but create a centralized access point as well. This enables a "no wrong number" approach to customer convenience, whereby the customer has access to the same support regardless of the number called. At the same time, TMCC stakeholders use technology for requesting a reservation to automate the access

into the next stage. The selected technology is typically telephony in combination with IVR.

For all three "automated" approaches, there must be an option available to reach a human customer agent. This is especially important for the human services customers who cannot always use fully-automated interfaces.

It is also important to note that considerable effort has been carried out by U.S. DOT to provide guidance on the development and deployment of centralized approaches for customer access, whether manual or automated. For example, the "One Call–One Click" project, sponsored by U.S. DOT and conducted by the Community Transportation Association of America (CTAA), examined and documented the lessons learned in designing and deploying centralized call centers and websites and has provided valuable guidance on this topic through the development of a toolkit. More information on the One Call–One Click guidance can be found on the CTAA website.[13]

Other Choices Related to Customer Access

Two other choices must be decided upon for the Customer Access stage.

Automated Interfaces to be Included

There are four types of interface for automating customer access to the reservation system; these can be used as stand-alone or in combination:

- Traditional telephony with IVR
- Web portal (with potential for web-based mobile device)
- Special-purpose mobile application
- Kiosks located at key locations (e.g., health centers, intermodal terminals, etc.)

Special Customer Interface Needs/Features

Another choice that must be considered is the required feature(s) for any special customer interface. Examples of interface features include:

- TDD/TTY
- Multi-lingual capability for automated systems

Trip Request Classification

The second stage defines how eligibility for the requested trip is validated prior to scheduling the trip. In many cases, TMCC stakeholders have restrictions on

[13] http://web1.ctaa.org/webmodules/webarticles/anmviewer.asp?a=2428&z=101.

who can use their services because of their funding source or type of service. Trip eligibility restrictions may be based on geographic boundaries, ADA paratransit requirements, type of customer served (e.g., workshops for persons with disabilities), and other considerations. In most cases, the TMCC must follow a process to determine that a customer is eligible for the trip that has been requested. The customer also may be eligible to use different services.

Primary Choice for Trip Request Classification

The following three approaches are for designing the classification of trip requests:

- Manual centralized
- Automated centralized
- Automated decentralized

Manual Centralized

TMCC stakeholders centralize their eligibility databases and share staff resources so a call to the centralized access number leads the customer to a call center and a call agent makes an on-the-spot determination of trip eligibility. If the requested trip is not eligible, the call agent can provide information and referral service for the customer or conduct the primary steps toward certification.

Automated Centralized

TMCC stakeholders build a centralized eligibility database and pool their resources to build an automated process for recognizing and classifying the customer and identifying the services available to that customer to automate access to the scheduling stage. Identification of service availability for a specific customer is based on pre-determined eligibility identified in the shared databases.

Automated Decentralized

TMCC stakeholders retain their own individual customer certification process and eligibility databases separately; these decentralized databases are not shared. Technology is used to create an automated process for recognizing and classifying the customer and identifying the services available to that customer (based on pre-determined eligibility). However, since the databases remain decentralized, the system requires an additional step. In this step, the system might include a user ID for the customer that refers to a look-up table including only limited information that would enable the request to be directed to the correct provider service. Alternatively, the system might be configured to query the different individual stakeholder databases sequentially or in parallel, and each would determine whether the customer has access to the requested services.

Other Choices Related to Trip Request Classification

Three other choices must be decided upon during the Trip Request Classification stage.

Nature of Centralized Database

If TMCC stakeholders centralize the database to facilitate and expedite the trip request classification stage, they must still make an important decision concerning the nature of the centralized database. The following are the choices for a centralized database:

- Centralized look-up trip eligibility database– eligibility certification remains under the control of each respective TMCC stakeholder, and it maintains its own eligibility databases. However, they jointly create a centralized look-up database, and each trip reservation request is automatically connected to the look-up database to classify eligibility. The database is updated frequently so new eligible customers become incorporated and can have their trip requests processed.
- Unified eligibility process and database–TMCC stakeholders pool their resources to create a unified certification portal and process that recognizes the distinct eligibility rules of the different service providers.

Choice of Technology Available for Trip Eligibility Determination and Classification

There are three automation choices for the trip request classification screening process:

- Automated IVR-based screening tool
- Automated web-based screening tool
- Automated special-purpose mobile application tool

In all cases, a choice must be made regarding the required information from the customer to search for and validate their eligibility (e.g., name, address, social security number, account ID, computer user ID with password, or a combination thereof).

Handling of a Non-Eligible Trip

TMCC stakeholders must decide on the action that will be taken if a trip request does not meet pre-defined eligibility criteria. In such a case, the customer should be transferred to the process (whether manual or computer-assisted) to pursue certification of eligibility.

Protection of customer privacy is an important consideration in the Trip Request Classification stage. Many transportation providers must adhere to the provisions

in the Health Insurance Portability and Accountability Act of 1996 (HIPAA),[14] and other Federal regulations also may apply, such as special regulations governing the protection of personal data of veterans. However, these provisions do not prevent the automation and/or centralization of eligibility data, but will warrant special consideration.

In addition to ensuring the protection of personal identity information, the process will need to ensure proper validation of the customer's identity to avoid abuse.

Scheduling/Routing

The third stage defines how a requested trip is scheduled and routed.

Primary Choice for Scheduling and Routing a Requested Trip

Three approaches define how a customer-requested trip is scheduled. All options are automated and are assumed to use a computerized scheduling system. The three design options are:

- Centralized scheduling
- Shared scheduling platform with shared coordination
- Decentralized scheduling with common trip-planning interface

Centralized Scheduling

In this approach, TMCC stakeholders forward all trip requests to a single centralized scheduling system.

Shared Scheduling Platform with Shared Coordination

In this approach, TMCC stakeholders agree to pooled-purchase the scheduling system to establish a common platform. Each TMCC stakeholder performs its own scheduling separately, but using the common technology platform. If the system includes One Call–One Click customer access, one of the TMCC stakeholders may be designated as the lead, or the TMCC stakeholders may share the scheduling responsibility to cover extended hours of service.

A shared coordination module, supplied by the common platform provider, enables a TMCC stakeholder to post on a common portal any trip reservation requests that cannot be accommodated by that stakeholder. The system further identifies another TMCC mobility service provider that can accommodate the trip. The coordination module can be configured to have pre-set scheduling

[14] https://www.gpo.gov/fdsys/pkg/PLAW-104publ191/pdf/PLAW-104publ191.pdf.

criteria such as geographic area, hours of service, etc., so requests are seen by only the stakeholders who can provide that service.

It is important to note that this approach is feasible only if the different providers have selected the same scheduling system supplier or can enter a joint procurement of a scheduling system to ensure a shared scheduling platform.

Decentralized Scheduling with Common Trip-Planning Interface

In this approach, TMCC stakeholders have decentralized scheduling and operate on independent system platforms. However, their systems are linked through a common automated trip-planning interface. Stakeholders agree on pre-defined business rules so trip requests are forwarded to potential transportation providers only for possible scheduling. The forwarding of trip requests can occur either through a fully-automated system (e.g., web portal, IVR) or be initiated by a call agent using computer-assisted tools. In this option, there is no requirement for a pooled purchase of a common scheduling software platform. TMCC stakeholders are decentralized and maintain their own autonomy for scheduling trips for their customers.

The automated transfer of requests to provider scheduling systems requires an agreement among stakeholders on the following:

- Inputs and outputs from the trip planning and scheduling systems
- Business rules for forwarding trip requests
- Technical tools to enable the interfaces (e.g., common data dictionary, data translator, server interfaces and communications, etc.)

Booking and confirmation may occur as a subsequent step or in an immediate automated fashion. The latter is akin to commercial travel planning systems (e.g., Travelocity®, Orbitz®, etc.).

Booking and Confirmation

The fourth stage defines how the trip is booked (i.e., accepted in the system after it has been scheduled and routed on a vehicle) and how the booking is confirmed to the customer.

Primary Choice for Booking/Confirmation

Three approaches define how a customer-requested trip is booked and confirmed include:

- Automated centralized scheduling and booking

- Computer-assisted decentralized trip request-sharing and booking with separate confirmation
- Automated decentralized marketplace booking and integrated confirmation

Automated Centralized Scheduling and Booking

In this approach, all trip requests are forwarded to a single centralized scheduling system, which has knowledge of all available vehicles across the TMCC mobility service provider stakeholders based on pre-defined rules. The system optimizes the schedules and routes of all vehicles and can automatically determine the optimal schedule and route of a requested trip. The booking of the trip is then confirmed immediately to the customer. Different methods of confirmation may be available (i.e., by telephone, internet, mobile application, etc.) using the stated preference of the customer.

Computer-Assisted Decentralized Trip Request-Sharing and Booking with Separate Confirmation

In this approach, control of the TMCC stakeholders' scheduling is decentralized, and their scheduling operates on independent system platforms. However, the individual scheduling system platforms are linked through a common automated trip-planning interface. Trip requests are forwarded to potential transportation providers for scheduling; however, booking and confirmation happen as separate subsequent steps.

In this approach, the trip request is communicated to one or more alternative providers, similar to placing the request on a shared bulletin board. Currently, this approach often is deployed using a common scheduling platform with a trip request-sharing module. Potential providers consider the trip request and, using their scheduling system, determine whether they can accommodate the trip request. If the trip can be scheduled and routed by a provider, the trip is booked, and the provider notifies the reservation system (or call agent) to confirm the booked trip. The booking confirmation is then provided to the customer.

Automated Decentralized Marketplace Booking and Integrated Confirmation

In this approach, control of the TMCC stakeholders' schedules is decentralized, and their scheduling operates on independent system platforms; however, the individual scheduling platforms are linked through a fully automated, common, real-time trip-planning interface. Trip requests are automatically forwarded to potential transportation providers for scheduling consideration, and the individual scheduling systems return available options from different providers for consideration by the customer. The customer chooses the most desirable option in real-time, which is then booked (i.e., accepted by the stakeholder system as scheduled and routed), and the confirmation is immediately provided

to the customer or reservation agent. This is similar to the approach used for trip planning in the air travel market (e.g., Travelocity®, Orbitz®, etc.). The automated transfers of requests to provider scheduling systems requires an agreement among stakeholders on the following:

- Inputs and outputs from the trip planning and scheduling systems
- Business rules for forwarding trip requests
- Technical tools to enable the interfaces (e.g., common data dictionary, data translator, server interfaces and communications, etc.)[15]

Dispatching

The fifth stage defines how a booked trip is dispatched to the drivers who will pick up and transport the customer.

Primary Choice for Dispatching

The following four approaches define how a booked trip is dispatched:

- Manual decentralized
- Automated decentralized
- Automated decentralized with potential transfer of control
- Automated centralized

Manual Decentralized

TMCC stakeholders share/pool their resources in the previous stages, but maintain separate and manual processes for later stages. Manifests are distributed manually to drivers and updated by radio/telephone. New mobile device technologies such as smart phones and tablet computers provide a semi-automated approach to the distribution of manifests. In these cases, the manifests created by the scheduling system are transferred as e-mails or texts to the mobile devices of the drivers.

Automated Decentralized

TMCC stakeholders retain their individual operational control in the field and use technology for the field operations such as dispatching, vehicle management, etc. Joint procurement of the technology (e.g., CAD/AVL) may offer some economies of scale.

[15] Although this last approach is well-established in the air travel market, it has not yet been deployed in the area of local public transportation. Nonetheless, it remains a commonly-held vision of a customer-friendly solution and should see technological deployment in the near future.

Automated Decentralized with Potential Transfer of Control

TMCC stakeholders retain their own individual operational control in the field and use technology for the field operations such as dispatching, vehicle management, etc. They also decide to procure the system with a functionality that would allow potential transfer of dispatching responsibility under conditions selected by stakeholders (e.g., for hours that extend beyond a given provider's normal hours). Joint procurement of the technology may offer some economies of scale.

Automated Centralized

TMCC stakeholders pool their resources and acquire a centralized system for operational control of the vehicles in the field, including dispatching and vehicle management. In many cases, one of the larger TMCC stakeholders (such as a transit system) will lead the transportation system procurement, deployment, and operation.

It should be noted that all automated versions of dispatch allow for automated two-way communications/transmittal protocols that allow transmittal of manifests to drivers via wireless communications, as well as confirmation and communications by drivers to the dispatch center.

Vehicle Management

The sixth stage defines the extent to which technology is used in the field for vehicle management and who retains responsibility for operational control.

Primary Choice for Vehicle Management

There are four approaches to structuring vehicle management:

- Manual decentralized
- Automated decentralized
- Automated decentralized with potential transfer of operational control
- Automated centralized

Manual Decentralized

TMCC stakeholders share/pool their resources in the previous stages, but maintain separate and manual processes for later stages. Manifests are distributed manually to drivers and are updated by radio/cellular communications. There is no technology used for tracking vehicle location or logging data.

Automated Decentralized

TMCC stakeholders decentralize operational control in the field and use technology in field operations such as dispatching, vehicle management, etc. Joint procurement of the technology, for example, may offer some economies of scale.

Automated Decentralized with Potential Transfer of Operational Control

TMCC stakeholders decentralize operational control in the field, and to use technology in field operations such as dispatching, vehicle management, etc. They also decide to procure the system with a functionality to enable transfer of operational control responsibility under pre-determined conditions selected by the stakeholders (e.g., for weekend days or hours that extend beyond a given provider's normal hours). Joint procurement of the technology (e.g., CAD/AVL) offers some economies of scale.

Automated Centralized

In this approach, the TMCC stakeholders decide to share/pool their resources and acquire a centralized system for operational control of the vehicles in the field, including dispatching and vehicle management. In many cases, one of the larger TMCC stakeholders (such as a transit system) will lead the transportation system procurement, deployment, and operation.

It should be noted that all automated versions of the vehicle management system offer at the very least real-time tracking of vehicle location, some level of real-time data communications (at the minimum texting of pre-defined messages), and some data logging capability. There remains however a wide range of other possible functionalities that might be included.

Other Choices for Vehicle Management

There are three other choices that must be decided upon during the vehicle management stage.

Vehicle Management System Functionalities

A wide range of possible vehicle functionalities exist that could be included in the design of the vehicle management system, and these should be determined before system procurement. Some of the more basic choices are whether to provide:

- Integrated voice and data communications or separate systems
- Tracking of vehicle location and comparison to time predictions
- Navigation guidance for driver

- Pre-defined driver reporting/messaging capability (e.g., arrival, no-shows) with time/location stamp from AVL system
- Alarm capabilities

On-board Security Systems

TMCC stakeholders must determine if they want to deploy on-board closed circuit televisions (CCTV) security systems.

Technology to be Provided On-Board Vehicles Operated under Third-Party Service Contracts

There is often a considerable challenge to determine what vehicle management systems should be provided to, and/or required of, third-party contractors, such as taxi companies, where the vehicles are not owned by the service provider. It can be a challenge to ensure the security of on-board equipment from theft or abuse, and this may significantly increase the cost of procurement. There also may be physical space or operational considerations.

Fare Management

The seventh stage defines how the fare collection process will be managed.

Primary Choice for Fare Management

There are three approaches to fare management:

- Manual decentralized
- Automated commercial decentralized
- Automated centralized

Manual Decentralized

TMCC stakeholders maintain separate and manual processes for fare collection. Fares are collected using cash, tickets, or vouchers.

Automated Commercial Decentralized

Fare management is decentralized and the TMCC stakeholders pooled-procure a commercial payment solution. A contracted financial institution provides a credit card/debit card and/or mobile payment solution. Point-of-sales (POS) readers are located in all TMCC vehicles, and on-board readers can be stand-alone or integrated with on-board vehicle management system equipment. Transactions are processed through the financial institution. Joint procurement offers economies of scale. The automated commercial payment system may require TMCC stakeholders to agree on common fare classification categories.

Automated Centralized

TMCC stakeholders share/pool their resources and acquire an automated and centralized fare management system. The system will include a common back-office clearinghouse and fare readers on all vehicles, which can be stand-alone or integrated with on-board vehicle management system equipment. The fare cards may provide pre-paid media (e.g., tickets and passes) and/or stored value cards. The clearinghouse system is operated as a centralized integrated system, tracking all fare transactions and providing centralized reporting. In many cases, one of the larger TMCC stakeholders (such as a transit system) will lead the fare management system procurement, deployment, and operation. The automated centralized fare management system requires TMCC stakeholders to agree on common fare classification categories and an integrated fare structure.

Other Choices for Fare Management

There are two other choices that must be decided upon during the fare management stage.

Identity Validation through Personalized Card

TMCC stakeholders must decide if the fare management system should include a process to validate a customer's identity through a personalized card with photo. The purpose is to ensure that the traveler is, in fact, the eligible customer who requested the trip. This reduces the potential for abuse in a TMCC in which customers may not be familiar to the drivers of multiple TMCC transportation providers. Personalization would consist of a photo ID incorporated into the magnetic or smart fare card. In the manual fare management or commercial financial payment approaches, customers would show drivers a government issued ID card.

Customer Billing System Capability

TMCC stakeholders must decide if the fare management system should include a customer billing capability that would enable the creation of an account for each customer. The system may enable post-trip billing, and/or collection from a pre-authorized bank account. The reduced handling of cash on-board the vehicle is a benefit to both customer and driver, and reduces the opportunity for fraud.

A customer billing system capability can be associated with any of the four primary choice designs, whether manual or automated. Some customers may not have access to a commercial institution financial account, and an alternative is to set up a "ghost card" debit account in which the customer pays into a special purpose debit account in advance, and the associated fare card can be used only for the specific transportation service.

Data Management

The eighth stage defines how the data in the stakeholders, providers, or common platforms' databases are managed.

Primary Choice for Data Management

There are four approaches to defining how data are managed:

- Manual
- Automated decentralized
- Automated decentralized with common data repository
- Automated Centralized

Manual

In this approach, no technology exists to collect and synthesize data on customer trips, vehicle activity, or performance. Any data collected are entered manually from information exchanged between drivers and dispatchers, and/or between customers and transportation staff. No sharing of data exists between the TMCC stakeholders.

Automated Decentralized

TMCC stakeholders deploy technology that enables the collection and synthesizing of data on customer trips, vehicle activity, and performance. No sharing of data exists between the TMCC stakeholders.

Automated Decentralized with Common Data Repository

TMCC stakeholders deploy technology that enables the collection and synthesizing of data on customer trips, vehicle activity, and performance. TMCC stakeholders have agreed to create a common data repository for the purpose of sharing selected data and facilitate reporting using a common format. Automated interfaces are created to automatically upload the pertinent data from the scheduling, dispatching, vehicle management, and/or fare management systems to the common repository.

Automated Centralized

TMCC stakeholders deploy an integrated centralized system for scheduling, dispatching, and vehicle management. TMCC stakeholders have established a governance process for the management of the centralized data system that protects individual organization and customer interests in terms of privacy, commercial confidentiality, etc. The system may be integrated with a centralized fare management system if one has been deployed.

It should be noted that the data management stage has been laid out as a sequential step in the TMCC Vision map because the data need to be managed to enable the final stage of reporting and billing. In reality, data are created at each stage of the service provision process. In addition, any stage that is automated also facilitates the collection and storage of data in a repository that can be shared.

Reporting/Billing

The ninth and final stage defines how data on service provision are organized and processed for reporting and billing.

Primary Choice for Reporting/Billing

There are four approaches for defining how data on service provision are organized and processed for reporting and billing:

- Manual
- Automated decentralized
- Automated decentralized with common data repository
- Automated centralized

Manual

In this approach, no technology exists to facilitate data processing for reporting and billing, and all processes are manual. Each agency conducts all reporting and billing on an individual basis.

Automated Decentralized

In this approach, the process is decentralized, technology exists to facilitate data processing for reporting and billing, and processes are automated. Each agency conducts all reporting and billing on an individual basis.

Automated Decentralized with Common Data Repository

In this approach, a common repository enables automated reporting and billing using common formats required by funding agencies. The common repository facilitates consistency and the efficient sorting of issues while maintaining a high degree of individual agency control. Each TMCC stakeholder manages the reconciliation between the individual billing and fare management systems, as well as internal financial management needs.

Automated Centralized

In this approach, an integrated centralized system exists to automate, on a consistent basis, the reporting and billing processes based on the data collected

by the centralized scheduling, dispatching, and vehicle management system. If an automated fare management system exists, the reconciliation between the billing and fare management systems is fully automated. Each TMCC provider receives from the centralized system all required internal management reports on an automated basis.

Other Organizational/Technological Choices

In addition to the organizational/technological choices that must be agreed upon by the TMCC stakeholders for each stage of the service provision path, there are other choices that must be made.

Comment Provision

All mobility service providers are required to have processes that enable customers to provide comments, complaints, or commendations. In most cases, this consists of a telephone number that connects to a call agent. TMCC stakeholders should consider the use of technology as a means to expand the options available to customers for providing comments, such as:

- Manual process through call agent
- Automated system through IVR
- Automated system through web portal

Integration with Fixed Route

The provision of mobility service in rural or small urban regions tends to rely primarily on demand-responsive services. However, these communities also may offer regular fixed-route or route-deviation transit services. The deployment of sophisticated computerized systems offers the possibility of more flexible integrated trip planning that may combine different types of services, including:

- Demand-responsive service
- Fixed-route service
- Route-deviation service
- Integration of demand-responsive service for the general public, sometimes referred to as Call-n-Ride or Zone Bus service, with eligibility-based ADA paratransit service

More comprehensive integrated trip planning systems may offer a wider family of services with which to meet growing demand, but they must be carefully designed to avoid excessive transfers and reduce the burden on travelers.

Such systems will need to incorporate sophisticated approaches to transfer notification/protection.

Ancillary Support Services

The focus of this manual is to provide guidance on how technology can be used to enhance the effectiveness and efficiency of mobility service provision in multi-operator environments. However, when TMCC stakeholders agree to work together to share technological resources, this also may lead to considering the sharing of non-technological resources. Examples worth considering include:

- Pooled development and implementation of travel training
- Pooled purchasing of products (e.g., fuel) or services (e.g., insurance)
- Shared maintenance facilities

SECTION 6

Applying the Framework

Building Stakeholder Consensus through Tabletop Exercises

The TMCC Planning and Design Framework can be used in different ways, but one approach might include the following steps and exercises to build consensus around a TMCC Vision among stakeholders.

Assessment of Barriers and Unmet Needs

The TMCC should be designed to address the wide range of needs of different stakeholders. It is, therefore, important to identify a list of service barriers and unmet needs. Operation of the TMCC and increased coordination among providers of transportation services in the region will help the system to better meet currently unmet needs.

In a first step, stakeholders, including users and their representatives, develop lists of current problems, barriers to the use of the service, and unmet needs in the community. In many cases, this already will have been achieved through the preparation of a Human Services Transportation Coordination Plan. Where no forum exists, workshops can be used as a method to stimulate discussion of the common vision and may be supplemented by interviews.

Listening to end-users is valuable since it helps identifies both current limitations and future customer concerns. At the same time, it helps to expand the discussion of needs among potential stakeholder agencies and may help bring together concerned parties around a common vision.

The discussion of unmet needs also should include an effort to identify priorities among the identified problems. A commonly-used approach in workshops is to post sheets with the needs on walls and give participants stickers to "vote" for the issues they perceive as highest priority.

Vision of Ideal Customer Experience

Section 4 provided a list of key questions that stakeholders should ask and discuss related to defining ideal customer experience. A tabletop exercise would have stakeholders answer the questions and then work to develop a consensus on a vision of the ideal experience. An indication of the relative priorities could be obtained again by "voting" with stickers.

TMCC Vision

In a similar fashion, Figure 5-1 can serve as a mapping tool for a tabletop exercise to identify stakeholders design preferences for each stage of the service provision process. Individual stakeholders can first select their preferred primary organizational/technological choice for each stage. These can then be reviewed by the entire group of stakeholders and discussed over the course of several meetings to identify areas and degree of consensus over a shared vision for the TMCC.

In all cases, it is desirable to use an independent facilitator to structure and facilitate the discussion among stakeholders to increase the level of trust among stakeholders who are likely to have concerns over loss of control.

ITS Project Systems Engineering

The previous steps and the development of a consensus among stakeholders around a vision for the TMCC, based on the organizational/technological choices at each stage, will provide a strong foundation on which to build the Systems Engineering process for the TMCC project. The identification of barriers and unmet needs will feed directly into the required Needs Assessment, and the TMCC Vision will serve to structure the Concept of Operations and subsequent System Requirements, Design, and other System Engineering steps.

Different Institutional Settings

Institutional settings vary tremendously depending on the make-up of the stakeholders involved, their objectives, their clientele, their resources, the history of the relationships between stakeholders, etc. The use of the TMCC Vision mapping tool provides a visual means of illustrating the shared TMCC Vision within the community. Figures 6-1 and 6-2 provide two examples of its use.

Figure 6-1 illustrates a TMCC for which the shared vision is defined by:

- Multiple means of customer access (no wrong number)
- Facilitating agency for coordination (e.g., regional planning agency)
- Decentralized service provision and field management
- ITS technologies deployed and operated independently by different mobility service providers
- No advanced fare collection system

Figure 6-2 illustrates a different type of vision, defined by:

- Multiple means of customer access (no wrong number)

- Centralized scheduling system, possibly provided by a larger transit agency on behalf of all TMCC transportation providers
- Decentralized service provision and field management
- ITS technologies deployed and operated independently by different mobility service providers, but with capability of potential transfer of control to larger transit agency after hours
- Commercial fare collection system, such as credit/debit readers on board vehicles, such as those used by taxis

The visual representation of the TMCC Vision can be useful to reduce misunderstandings between the stakeholders and, thus, can strengthen consensus.

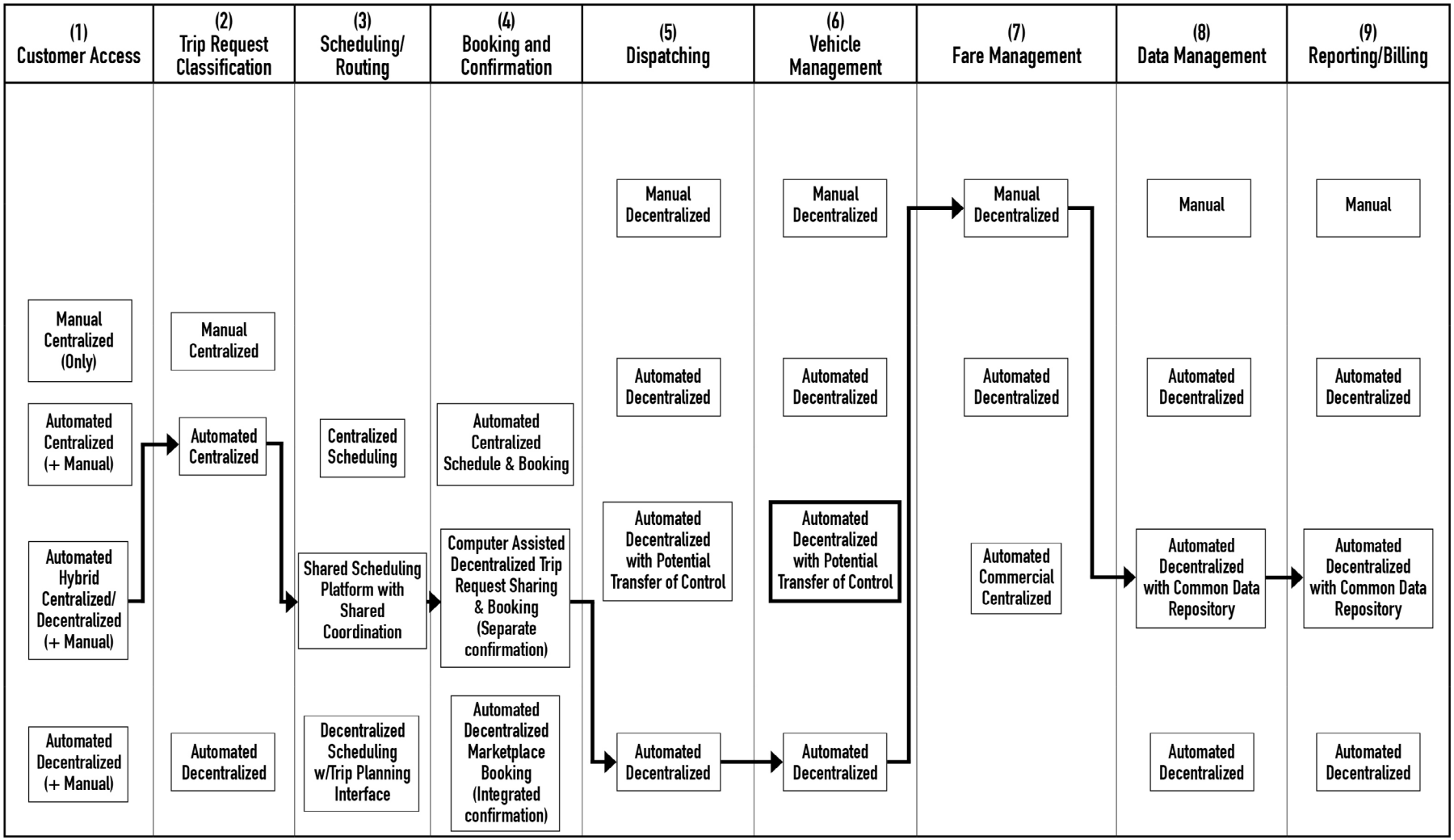

Figure 6-1 *Example I of TMCC Vision*

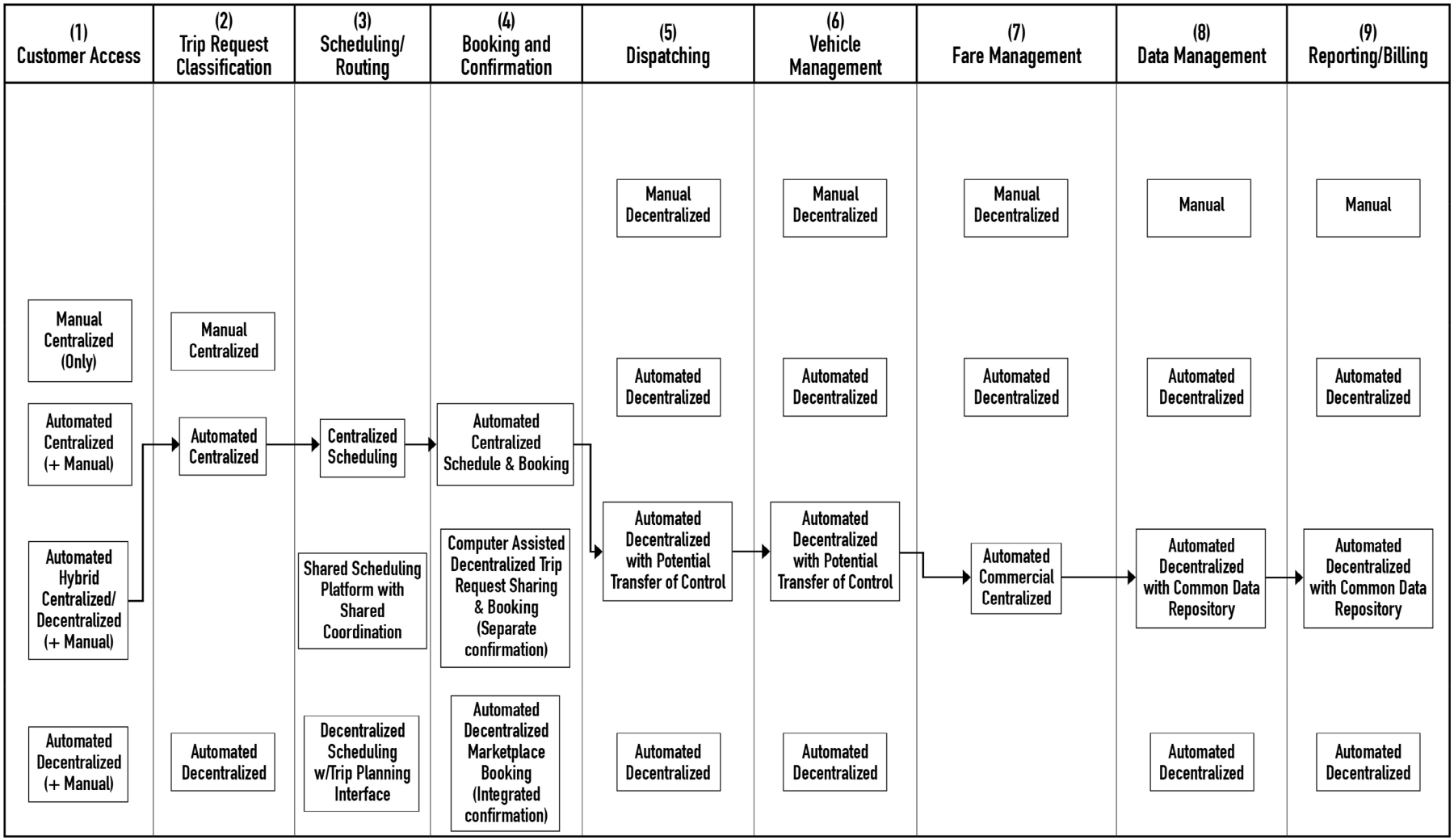

Figure 6-2 *Example 2 of TMCC Vision*

System Bundles and TMCC Phasing

In many cases, limitations of financial and staff resources will constrain the ability to deploy a TMCC, and the TMCC will have to be deployed incrementally over time. The TMCC Vision mapping tool can serve to define bundles of systems that are inter-related and explore at a high level the possible phasing of the deployment of these bundles. Phased TMCC implementation also provides the opportunity for participating agencies to experience some tangible benefits and gain more trust in the partnership before further commitment.

Figure 6-3 illustrates a One Call–One Click deployment that is limited to the automating of the customer access (through a toll free number and/or internet), but where all other stages are handled manually. This is typical of many of the initial deployments of the One Call–One Click concept.

Figure 6-4 illustrates a centralized customer access, reservation, and scheduling system bundle.

The bundling of systems can then be used to consider phasing of deployment. Figure 6-5 illustrates one potential example of TMCC with phase deployment:

- Phase 1 includes the deployment of a shared customer database among transportation providers that will be used for both trip request classification and for deploying a payment/ID card to reduce fraud by non-eligible users.
- Phase 2 builds on the shared database to create a centralized and automated customer access, reservation, and scheduling system.
- In Phase 3, a pooled-purchase of systems and hardware is conducted, enabling all transportation providers to benefit from ITS technology for dispatching, vehicle management, and sharing of data for purposes of reporting.

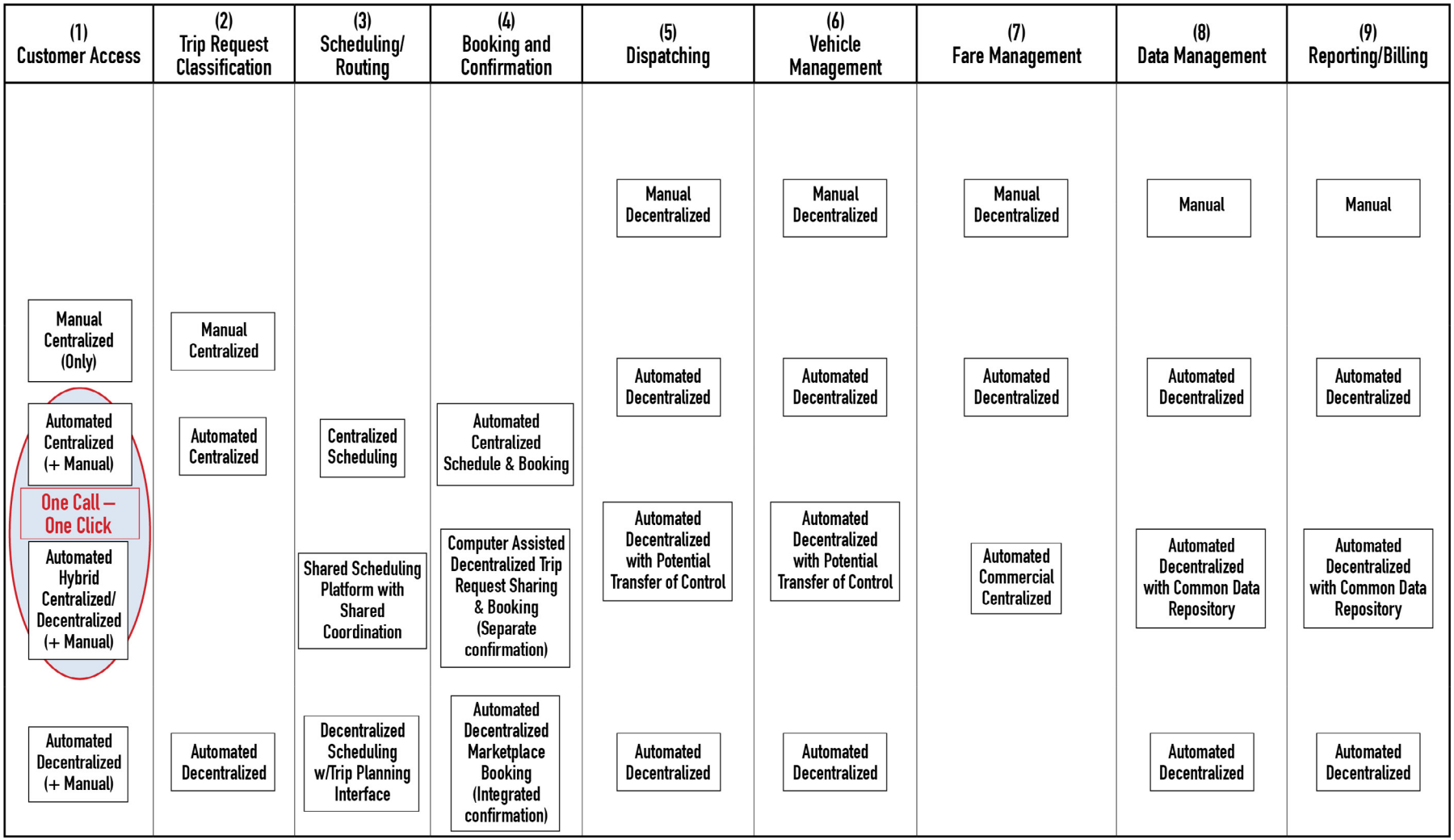

Figure 6-3 *One Call–One Click*

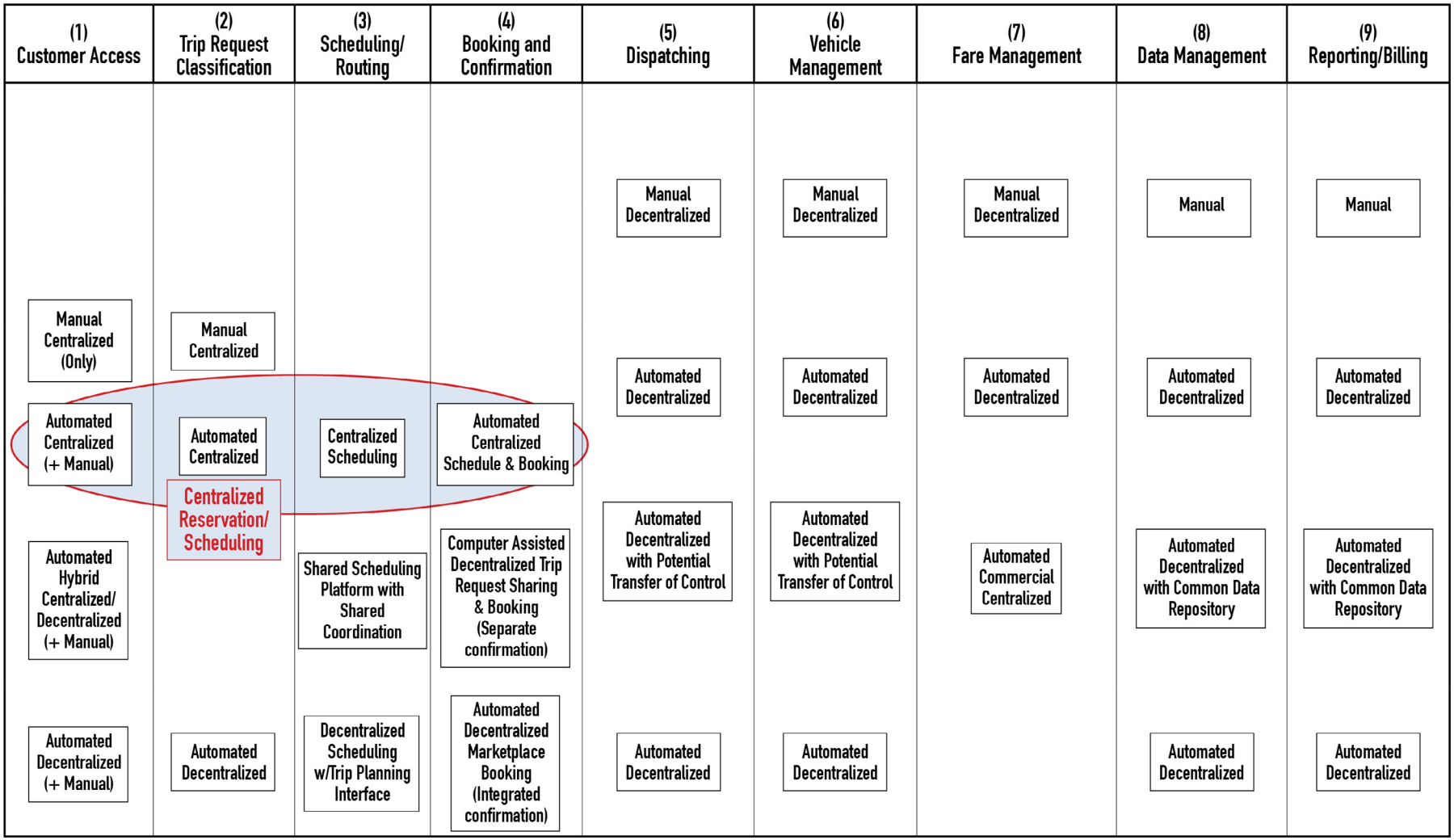

Figure 6-4 *Centralized Customer Access, Reservation, and Scheduling System Bundle*

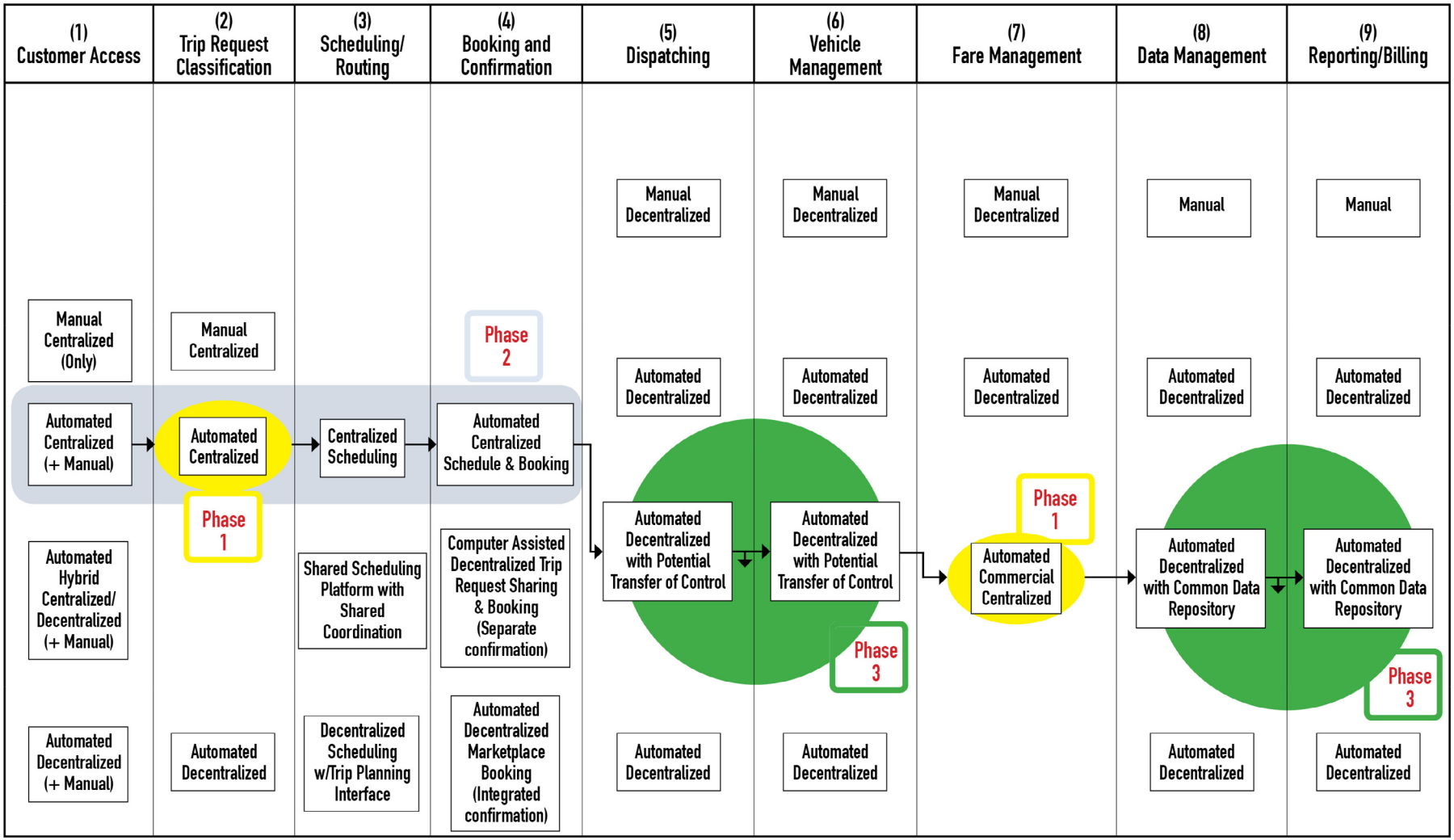

Figure 6-5 *Sample of Phased TMCC Deployment*

SECTION 7

Illustrating the Systems Engineering Process for the Planning and Design of a TMCC

Introduction

As noted in Section 3, all ITS projects funded by the Highway Trust Fund and the Mass Transit Account must conform to the National ITS Architecture. The regional ITS architecture may be unfamiliar to TMCC stakeholders if they previously have not been involved in ITS technology planning and deployment. In that case, they should consult FTA guidance and communicate with the appropriate agency responsible for the regional ITS architecture in their community.

Another federal requirement is that FTA grantees and subrecipients must conduct a Systems Engineering analysis of any ITS project. Section 3 identified various U.S. DOT resources that are available. In addition, communities planning and deploying a TMCC most likely will require external technical assistance in the form of consultants who can facilitate and guide them through the necessary steps.

It was noted during TMCC demonstration efforts that, depending on stakeholder composition and background, some communities preferred using the term "Structured Approach" rather than "Systems Engineering" because it has greater acceptance and understanding from local stakeholders.

The previous chapters provided a framework to move a community from an initial desire to enhance the coordination of community transportation through the use of technology, to the definition of a high-level shared vision of how a TMCC would be structured. The TMCC Vision defines the tasks to be shared or not and the tasks that would be automated or not.

With this common vision in hand, a community can then use the Systems Engineering process, as previously discussed and shown in Figure 3-1 to pursue the design and deployment of the TMCC.

This chapter highlights a few issues related to Systems Engineering for a TMCC that emerged from the MSAA Initiative and illustrates some of the concepts using

the Aiken TMCC experience and the documents that were prepared as part of the Aiken TMCC Systems Engineering process.

Aiken was one of the MSAA demonstration sites selected for the planning and deployment of a TMCC and is the site that has progressed the most fully in its deployment. The first phase of operations of the Aiken TMCC was launched in 2010, and it received much attention for its success, including serving as one of the case study sites for the One Call–One Click program.[16]

As there is no one size-fits-all design for a TMCC, Aiken represents only one possible configuration for a TMCC. The purpose here is not to promote it as a preferred model, but rather to illustrate some of the critical elements developed as part of the Aiken TMCC design process. This could assist other communities engaging in the Systems Engineering process for designing and deploying a TMCC.

The following sections use the sub-area of customer access (through telephony and IVR) to illustrate the Concept of Operations, System Requirements, and High Level Design Systems Engineering steps.

Needs Assessment

The first step in the Systems Engineering process is to conduct a Needs Assessment for the project. The TMCC should be designed to address the wide range of needs from the perspectives of different stakeholders. Operations of the TMCC and increased coordination among providers of transportation services in the region will help the system to address current barriers and unmet needs.

LSCOG led the TMCC design process and engaged its stakeholders to identify the needs to be addressed by the TMCC. The unmet needs identified by LSCOG include the following:

- Lack of customer knowledge of transportation resources and how to access them
- Limited areas of service
- Limited hours of service
- Limited service for some trip purposes or target groups
- Inefficiencies in coordination trips throughout the region
- Less than optimal automation of data, ridership, scheduling, and reporting
- Lack of scalable technology infrastructure

The complete list of needs as identified by LSCOG can be found in Appendix A.

[16] CTAA, "One-Call-One Click Profiles," Lower Savannah Council of Governments, Aiken, South Carolina, 2010; http://web1.ctaa.org/webmodules/webarticles/articlefiles/CaseStudy_LSCOG.pdf.

Concept of Operations

Concept of Operations: Purpose and Components

At a very high level, the purpose of the Concept of Operations is to answer the following questions:

- What will the system do?
- Who will the system affect?
- When and where will stakeholders interact with the system?

More specifically, the Concept of Operations for an individual TMCC:[17]

- Ensures that all users and supporters have the same understanding of the TMCC; by providing a description of the system functions and operations, stakeholder misunderstandings can be reduced and expectations can be managed.
- Clearly defines conditions for the use of the TMCC; this should minimize the risks associated with operating a TMCC.
- Includes non-technical descriptions of all TMCC users, the data and information that they need to operate and use the TMCC, and the conditions under which they use these data and information.
- Documents the operational needs of the users without defining specific technical issues.
- Provides the operational needs and proposed characteristics for the envisioned TMCC.
- Describes high-level user expectations and functions for the TMCC.
- Describes information sharing between programs and operators.

Aiken TMCC Concept of Operations

LSCOG pursued a vision of a regional system of centrally coordinated transportation that would:

- Ease customer access to knowledge of and access to transportation information and resources
- Improve coordination across multiple funding sources, programs and jurisdictions
- Improve coordination among transportation providers
- Develop a regionally-coordinated transportation system that appears more seamless to customers and efficiently meets customer needs

[17] SAIC, "Generic Traveler Management Coordination Center Concept of Operations," 2006.

The purpose for implementing the TMCC system was to continue to work toward this vision. As stated in the Concept of Operations document,

> The major goal of the TMCC is to establish a regional mobility and information center that will handle incoming requests for service from consumers and agencies needing human services information or referral, and regional transportation. The TMCC will have visibility and access to all transportation resources available for the benefit of referring, scheduling and assigning consumers to transportation providers at the time and date of service requested. The TMCC will operate on a 24 hour, 7 day a week basis providing after-hours support and operational availability to the stakeholders in the region.

A generic Concept of Operations and a description of its components can be found on the U.S. DOT website.[18]

Addressing Specific Problems: Customer Access

In the process of developing the Concept of Operations for the TMCC, LSCOG and its design team worked with stakeholders on a process in which the group identified and developed problem statements and then looked for solutions to these problems. From these problem statements, the stakeholders and design team developed some alternatives for addressing regional needs and problems through various operational scenarios for the TMCC. The problem areas addressed coordination, communications, and technology as well as roles and functions of the TMCC and local stakeholders. Several unmet customer needs are grouped under the heading of "uneven customer access," including:

- Lack of customer knowledge of transportation resources and how to access them
- Limited areas of service
- Limited hours of service
- Limited service for some trip purposes or target groups

The following section uses the specific problem of "uneven customer access" to illustrate how this unmet need might be addressed through the use of technology.

Problem Statement

Customers often do not know that transportation services exist, or where to call, or what funding sources and eligibility requirements might apply to them.

[18] https://www.its.dot.gov/research_archives/msaa/TMCC_ConOps.htm.

Possible Solutions

One important goal of the TMCC is to improve and streamline access and ease the process for customers to make travel reservations in the region. In addressing this problem, the TMCC would provide the following services in coordination with local transportation providers and stakeholders to mitigate the problem:

- *Customer focused transportation information and human service agency referral and assistance available from one source as both a telephone number and a website* – the TMCC would have visibility and knowledge of transportation resources, schedules and time slots for both demand response and fixed route for public and private providers in the coordinated network. The TMCC will make this information available to customers via the internet, telephone or by speaking with a Customer Service Representative through a single access number to allow customers to plan their travel in the region. The TMCC travel web site will provide routing and scheduling information, the cost or fare of the transportation and the available funding options that could be used to utilize the transportation services.
- *Hours of operation* – the TMCC would operate with extended hours of operation and ultimately on a 24/7 basis providing increased access to a centralized regional center. The TMCC in an after-hours model would be able to provide the same level and types of service that the local agencies provide during business hours and would make it more economically attractive for local providers to offer expanded service at these times.
- *Access to schedules/fares/routes* – the TMCC would make this information available via the internet, telephone or by speaking with a Customer Service Representative through a single access number to allow the customer to plan travel in the region. The TMCC travel web site will provide routing and scheduling information, the cost or fare of the transportation, and the available funding options that could be used to access the transportation services.

Having identified the problems facing the various user stakeholder groups, it is possible to develop a comprehensive set of User Needs. The following lists some of the User Needs extracted from the LSCOG TMCC for purposes of illustration:

- Customer Focused Information, Referral & Assistance available from one source as both a telephone number and a website
- Successful navigation of the phone reservation system and the ability to reach a "live" agent for assistance, when needed
- 24/7/365 access to travel information for the customer
- Translation services offered when interacting with the TMCC

- A quick and efficient way for a rider to make a travel reservation
- Advocacy on behalf of customers needing a ride (including negotiation with transit providers)
- Assistance with applying for and accessing ADA paratransit services

System Requirements

System Requirements Contents

Having defined the TMCC Concept of Operations, the next step is to develop the System Requirements (what is needed to realize the vision). The purpose and function of the System Requirements is to outline the requirements associated with the planning, implementation and deployment of the TMCC. The requirements in each of the sub-sections provides an understanding of what the TMCC will need as it relates to policies, functions in providing the services, and technology characteristics, as identified by the stakeholders in this project. Functional requirements identify "what the system will do." This includes the base system operations as well as the features and functions related to the sub-systems.

Table 7-1 outlines a sample table of contents for a TMCC System Requirements document, partially derived from the one for the LSCOG TMCC.

Table 7-1

Sample Table of Contents for TMCC System Requirements Document

Specific Requirements Related to Telephony

The issue of customer access is used again for purposes of illustration of how detailed system requirements are articulated. The following section builds on the LSCOG list of requirements to extract some of the detailed system requirements related to customer access to the TMCC through the telephony and IVR systems; these requirements partially address the identified problem of customer access.

Primary Telephone System – PBX

- The system must provide an option to connect local numbers to a centralized call center.
- The telephone system must receive calls from a remote access point for system users outside the physical location of the phone switch.
- The telephone system must make calls from a remote access point for system users outside the physical location of the phone switch.
- The telephone system must provide the option to:
  - direct telephone calls to target TMCC system users
  - direct telephone calls from customers requesting Information & Referral Services (I&R) to the case manager queues and staff
  - direct telephone calls from customers requesting transportation to the reservation queues and staff
  - direct overflow calls to the "next best" queue and staff member to assist the caller
- The system must handle inbound and outbound phone calls simultaneously.
- The system must include a voice mail system with the ability to retrieve voice mail via telephone or through an email system.
- The system must direct incoming TTY/TDD tones and forward them to the TTY device.

Interactive Voice Response (IVR)

- The system must enable speech/voice prompts to navigate through the system services.
- The system must enable touch-tone prompts to navigate through the system.
- The system must provide language options for English and a specified selection of non-English callers.
- The system must route calls directly to a live agent when the caller does not or cannot interact with the IVR, such as dialling from a rotary phone.
- The system must enable the request for human service information and referral services.

- The system must be configurable to set up scripts that enable requests for transportation services, including new reservations, changes to existing reservations, and cancellation of confirmed services.

One of the important objectives of the Systems Engineering process is to ensure a systematic link between identified needs (carried out as part of the Concept of Operations stage) and the system design. This is managed through the development of a Needs-to-Requirements Matrix, which is developed during the Systems Requirements stage. The process to define systems requirements should include the development of a TMCC User Needs-to-System Requirements Matrix for ITS related requirements. This matrix provides assurance that the stakeholders' needs are properly addressed with system requirements that will ultimately lead to appropriate design specifications for implementation of the TMCC.

The Needs-to-Requirements Matrix will identify for each User Need the following information:

- User need ID
- Pertinent stakeholder(s) and priority (e.g., customer, high priority)
- Related requirements, identified by Requirement ID(s)
- Requirement category (e.g., Customer Access)
- Importance of requirement to meet this need (e.g., Mandatory or Optional Requirement)

System Design

The System Design stage builds on the Concept of Operations and System Requirements stages to address what is needed and to describe the architecture of the technologies, including software components that are either commercial off the shelf, or software components where custom development are required, to meet the needs of the regional TMCC and its stakeholders. The resulting document also will identify the hardware infrastructure and interfaces necessary to support the TMCC and link the disparate systems for uniform and consolidated reporting and data management.

Other Steps and Considerations

Deployment

As outlined in the Systems Engineering V Diagram in Figure 3-1, the high-level design is then used to develop the Detailed Design and proceed through the various steps required for deployment, verification, validation, and then operations. Each step has been carefully designed so the end result addresses the needs and requirements outlined at the initiation of the project.

The U.S. DOT websites and guidance documents identified in Section 3 provide valuable resources for communities who wish to learn more about Systems Engineering.

Procurement

The high-level and detailed design documents will serve to procure the system, through a Request for Proposals (RFP) process that needs to meet all Federal, state, and local procurement requirements. Given the complexity of the technical choices related to the design of a TMCC, most communities may find it beneficial and necessary to retain external technical assistance, such as consultants, to go through the necessary steps that will lead to a successful TMCC procurement. However, building a common vision of the TMCC using the TMCC Planning and Design Framework in this manual will greatly facilitate the interaction with those providing technical assistance, resulting in a more efficient process that reduces time and costs.

One specific issue highlighted by the experience of the MSAA demonstration sites relates to the structure of the procurement process, whether to procure a single comprehensive system or structure a series of interrelated projects. In some cases, there may be reasons for procuring some parts of the system (e.g., telephony or IVR) separately from the scheduling and CAD/AVL systems of the TMCC including:

- Existence of legacy technologies shared with other departments or agencies
- Existence of commercial restrictions from existing sub-systems
- Restrictions on large scale procurement

Although there may be valid reasons for dividing up the procurement into sub-projects, it is clear that having multiple suppliers of different components is more difficult to manage than having a single system integrator. It also creates a risk that interfaces between systems do not work properly, and if this occurs, makes it difficult to clarify respective responsibilities among the various suppliers.

SECTION 8

Institutional Foundation to Build and Sustain a TMCC

As mentioned in Section 3, any effort to plan and design a TMCC must be based on an institutional foundation of structures and processes for coordination of human services transportation in the community. This will provide the necessary support to carry the TMCC project from the initial development of a vision through to deployment, and ensure its sustainability over time. The focus of this manual is on the use of technology in a TMCC to enhance transportation coordination, but this cannot succeed if there lacks the necessary institutional foundation in the community that makes a TMCC conceivable and sustainable.

Many resources provide advice on the challenges and related strategies to enhance and support the coordination of services for the transportation-disadvantaged in a community.[19] The MSAA and One Call–One Click projects highlighted similar challenges and strategies. This chapter summarizes some of the key topics that need to be considered in building the necessary institutional foundation. These include the following:[20]

- Partnership of Stakeholders
  - Diversity of Stakeholders
  - Addressing Stakeholder Concerns through Partnerships
  - Roles and Responsibilities through Inter-Agency Agreements
  - Special Partnership with the State
- Leadership, Champion, and Sustainable Cohesive Sustainable Project Team
  - Leadership
  - The Role of the Champion
  - TMCC Staff Roles
  - Cohesive TMCC Project Team
  - Stakeholder Involvement Over Time

[19] See TranSystems Corporation et al., "Strategies to Increase Coordination of Transportation Services for the Transportation Disadvantaged," TRCP Report 105, Transportation Research Board, Washington DC, 2005; available at http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_105.pdf.

[20] Much of this discussion is synthesized from the following documents: Carter, M., et al., "Mobility Services for All Americans Phase 2—Foundation Research: Final Report," July 29, 2005; available at http://www.its.dot.gov/research_archives/msaa/msaa2/index.htm; One Call–One Click Toolkit project, http://web1.ctaa.org/webmodules/webarticles/anmviewer.asp?a=2428&z=101.

- Understanding and Using Technology
  - Building Technology Awareness
  - Technical Assistance
  - Communicating Technical Issues to Stakeholders
  - The Importance of Training

Partnership of Stakeholders

Diversity of Stakeholders

As stated in Section 1, this manual would be of most benefit to those communities where:

- There are multiple human service and public transportation providers.
- Transportation coordination has already been recognized as a community priority.
- The key stakeholders have agreed to work together.
- The stakeholders have agreed to pursue ITS technology as a key tool to enhance coordination.

A TMCC, by definition, involves sharing among different stakeholders. The One Call–One Click toolkit found that partnerships are necessary to pursue the use of technology to enhance coordination.[21] They found that:

- The partnerships often grow out of existing groups focused on improving transportation services through coordination and other means. Examples include:
  - Existing association of transportation providers
  - Regional Mobility Council (human service and transportation providers)
  - Transit Advisory Committees
- It is easier to develop support for a service by leveraging existing relationships on related issues (e.g., assessments, referrals) with agencies whose clients/customers also contend with transportation issues.

Shared participation in local transportation committees or task forces provides an effective forum for developing cross-agency relationships on these issues.

There will be clearly different levels of interest among pertinent stakeholders (agencies and individuals) in pursuing a TMCC, including:

- Stakeholders with a clear and keen interest in creating a TMCC and that may become leaders in the process.

[21] http://web1.ctaa.org/webmodules/webarticles/articlefiles/Q&A.pdf.

- Stakeholders with interest in participating, but with significant concerns.
- Stakeholders that are critical to its success, but that will have possibly limited direct involvement (e.g., funding agencies).
- Others, such as users of the TMCC system, or their representatives.
- Others who have limited current interest in participating, but that are pertinent and possible future stakeholders, etc.

A delicate balance, therefore, must be struck between being inclusive in trying to capture all potential pertinent stakeholders and striking a partnership between a core group of stakeholders that agree to launch an immediate effort to implement a TMCC.

Additional providers or other stakeholders may wish to be involved over time. The concept of scalability is important in this respect, since a scalable TMCC system will allow future expansion of the TMCC to include other stakeholders and services.

Addressing Stakeholder Concerns through Partnership

The stakeholders that are pertinent or potentially interested in implementing a TMCC are clearly specific to a given community, but in all cases will represent a diversity of types of organizations and interests, including:

- Transportation providers
- Human service providers
- Funding agencies
- Planning agencies

Each stakeholder will have its own objectives, clients, practices, etc., and the TMCC will face several key challenges from the outset in trying to pursue a common effort with such a diversity of stakeholders. Examples of key challenges include:

- Stakeholder concern over "loss of control" with respect to well-established practices and the management of drivers and vehicles
- Stakeholder concern over the potential loss of its special relationship with its customers
- Stakeholder concern over the potential loss of funding
- Entrenchment of current consumers, operators, funders, and advocates
- Institutional inertia in existing organizations, agencies, and interest groups, including structure and culture.

The concern over potential "loss of control" will be a greater concern when the main proponent or most obvious leader for the TMCC is a larger agency with substantially more resources (e.g., more vehicles, staff, and financial resources). Such a situation may raise natural concerns of organizational dominance and loss of control for the other stakeholders. Building a partnership among stakeholders who share a common interest to enhance the coordination of services for the transportation-disadvantaged will be necessary to overcome this concern.

This partnership needs to be built through the articulation of a common vision, as discussed in the framework presented in the previous sections. However, it needs to be continuously reinforced through the institutional aspects of governance and organizational management that will structure the planning and deployment of a TMCC project. These processes need to recognize the diversity of interests among stakeholders, and address the specific needs of stakeholders in terms of benefits and concerns.

There are several mechanisms to build such a partnership:

- The governance of the TMCC must reflect the partnership, with both an oversight board representing the larger community of pertinent stakeholders and a project committee that includes the core stakeholders. Decision-making at both levels must explicitly reflect the partnership and not be subject to dominance by any specific agency.
- Specific benefits that will accrue to individual stakeholders must be explicitly identified, and steps should be taken to ensure that these benefits are realized.
- Specific concerns of individual stakeholders must be made explicit and addressed, and the specific concern was over "loss of control." This concern, in fact, may need to be reflected in the actual design of the TMCC through the design choices between centralized versus decentralized approaches to individual functionalities, as was outlined in Section 5.
- Some benefits may not be apparent to individual organizations, but rather to the whole system. There is need for the system and its implementers to be sensitive to the possibility of winners and losers when building the system.

Roles and Responsibilities through Inter-Agency Agreements

To address stakeholder concerns, it is critical to develop an appropriate governance structure that defines the roles and responsibilities of the various entities governing the TMCC. The specific governance and management structure will depend entirely on the various stakeholders involved in a given local context and their respective needs.

However, a valuable tool to ensure an effective partnership is through the articulation of inter-agency agreements. This is critical to clarify roles and responsibilities and to have them formally agreed to by all core stakeholders at the outset. This helps to avoid misunderstandings over time and ensures continuity in case of changes of key persons involved. Topics to be included in the inter-agency agreement include:

- Agencies involved
- Date of agreement
- Agencies roles, responsibilities, and commitments
- Frequency of meetings
- Governance and decision-making
- Transparency
- Financial arrangements for cost-sharing and reimbursement
- Inter-agency policies
- Dispute resolution mechanism
- Data security policies
- Any other item for multi-partner agreement

The agreement should contain a dispute resolution mechanism and security policies. These are important to ensure that all providers are satisfied when they join the Core Team.

In addition, there may be need for more specific inter-agency agreements related to the procurement of the TMCC systems. Appendix B provides a generic example of one such agreement document.

Special Partnership with the State

In discussing TMCC partnerships, it is important to highlight the importance of the state government. Although the State is not a local TMCC stakeholder *per se*, it plays a critical role, and there is need to develop a special partnership with state agencies to ensure the success of the TMCC.

First, the State is critical in its role as funding agency for several transportation and human service programs. These affect Federal subsidy programs that pass through the State for rural and small urban areas, as well as State subsidy programs. The State, therefore, has prime responsibility as a funding stakeholder, and this may affect different local stakeholders in different ways across different programs.

Building a strong partnership with the state government is critical for efforts to plan and implement a TMCC in several respects:

- Grant proposals to fund the development of the TMCC will need to be directed to State agencies responsible for pertinent funding programs.
- One of the potential functionalities of a TMCC may be to automate the billing and reporting activities of the participating stakeholders, and many of these involve reporting to State agencies. State agencies must validate the design of the new systems and ensure that the data that will be collected and reported will meet State requirements.
- Many communities will lack technical expertise concerning TMCC technologies and will need to rely on other sources of expertise. State staff may be able to provide assistance, either through their own staff or through the funding of technical assistance.

In all cases, it is critical to develop a special partnership with the pertinent State agencies so they are aware of, and involved in, any effort to plan and implement a TMCC.

The role of the State may go even further by standardizing functionalities, or even technological platforms. To date, 15 state governments have undertaken a pooled-procurement of transit software for trip planning, scheduling, and/or operational management of public transportation agencies in their state, most often aimed at small urban and rural communities. Such initiatives have many benefits, including:

- Providing technical assistance to identify functional requirements, develop procurement documents, and assist in evaluation, testing, and deployment.
- Enabling more attractive vendor prices as a result of the economies of scale.
- Providing, in some cases, favorable subsidies to local agencies to procure the standardized hardware and software.
- Providing a standardized reporting system to meet State requirements.
- Providing a standard vendor platform that simplifies interfaces.

Although these typically are designed primarily for transit agencies, they create a technological platform on which to build a wider TMCC for both transit and HST. It is important for any local TMCC effort that stakeholders be aware of any State plans to pursue pooled-procurement of software, as this will have significant implications for any local efforts.

Leadership, Champion, and Cohesive Sustainable Project Team

Planning and deploying a TMCC is a complex undertaking and requires sustained leadership, a champion, specific organizational tasks, and a cohesive project team that is sustainable over time.

Leadership

Given the complexity of TMCC projects, there is need for strong institutional leadership from the top that will make coordination and technology a priority and that will demonstrate leadership by developing the necessary incentives, resources, and pilot projects.

In the initial MSAA demonstration sites, the lead agency was frequently a transit provider or transportation broker that most often had the organizational stature and necessary staff resources. This placed it in a position to leverage its knowledge of transportation options and operations to lead the planning and implementation process. However, as mentioned, this sometimes creates a concern among other stakeholders over potential loss of control, which needs to be carefully addressed.

In other cases, the lead agency was a regional non-transportation entity (e.g., regional planning agency, workforce investment board, etc.). Such agencies can build on their experience with human service transportation but also on their knowledge of the local area and institutional arrangements. In these cases, the agency does not have actual responsibility for transportation provision, and may be viewed as somewhat more neutral among stakeholders. However, it is also less likely to have expertise with respect to transportation planning and technology.

There is no unique solution; the appropriate solution in any given community will depend on the local situation with respect to:

- Potential stakeholders
- Historical and institutional context for the development of coordinated services
- Local issues and priorities
- Available financial and staff resources
- Technology-related experience and expertise

Role of the Champion

In addition to having the above institutional leadership, it is often important to have an individual champion within the lead agency who has fully-embraced the concept and vision of the TMCC, has been provided the mandate to pursue the concept, and is committed to seeing the TMCC implemented.

The champion will need to:

- Generate the necessary institutional leadership and support
- Achieve consensus

- Seek out like-minded and progressive individuals within regional agencies
- Ensure that the TMCC design is recognized as a truly regional initiative through constant outreach
- Ensure that the TMCC design addresses the specific needs and concerns of core stakeholders
- Overcome cynicism and fatigue from the stakeholders
- Obtain and maintain senior-level and policy-level support within the agency as well as regionally

In many cases, it will be desirable for the champion to be the formal TMCC Project Manager.

TMCC Staff Functions

The planning, development, and deployment of a TMCC will require staff who will be responsible for a variety of functions. These include:

- Developing and supporting the TMCC organizational structure and project team
- Developing and administering the inter-agency agreement between stakeholders
- Preparing proposals for funding
- Administering grants
- Managing the TMCC planning, design, and Systems Engineering process
- Leading the capital procurement process
- Managing deployment of technology hardware and software systems
- Managing operational agreements and contracts
- Administering licensing and operational authority
- Managing insurance and liability
- Providing oversight to training
- Marketing the TMCC after deployment
- Developing performance evaluation structures
- Reporting to Federal and state agencies

Cohesive TMCC Project Team

The TMCC is a partnership to share technological resources among several stakeholders. As a result, a single champion and staff are not sufficient to ensure the success of this complex undertaking. It will also require a cohesive project team of individuals among the core TMCC stakeholders.

The experience from the MSAA demonstration sites and the One Call–One Click research shows that there is no single model with respect to the composition of the project team. However, teams need to be effective and responsive and, in many cases, composed of fewer than 10 persons.

The following are some of the team skills identified by the MSAA sites that were critical to project success:

- Local knowledge, especially institutional knowledge
- Credibility with local officials
- Facilitation skills
- Technology knowledge
- Operational knowledge and experience
- Outreach and communications experience
- Document production and editing

Cohesiveness is achieved by having a small TMCC Project Team size, but also by ensuring that the specific benefits and concerns of core stakeholders are always being addressed at each decision stage.

An additional challenge related to the TMCC Project Team is that the skills required of the team will change over the course of the project, moving from addressing institutional challenges at the initiation of the project to addressing technological and administrative ones as the TMCC is designed, procured, and then deployed.

The critical message is that the governance structure, including roles and responsibilities, needs to be articulated and adopted by the core stakeholders at the outset of the project. This will ensure that there are no misunderstandings or conflicts during the evolution of the project. This is even more important since individual participants may come and go over the course of the project. Having clear and early consensus on governance is even more important in smaller communities where there are fewer stakeholders and individuals play a more significant role.

Stakeholder Involvement over Time

Planning and deploying a TMCC is a lengthy process and requires careful management of stakeholder involvement. Developing a TMCC can take considerable time, possibly years, from the initial planning phase to full deployment and operation., The time required will vary with the complexity of the system and the level of technological sophistication of existing information and mobility services.

Maintaining stakeholder interest over this period will require a significant investment of time and effort. In the beginning, dealing with the number of stakeholders will be a major concern, as will be cultural or attitudinal differences about service and coordination.

Any lengthy project will need regular meetings among system providers, policy-makers, subcontractors, special interest user groups, and agency managers so problems and ideas can be shared and a consensus can be reached during system design, procurement, and deployment. The project is likely to suffer from "meeting fatigue" among even the most engaged stakeholders, and this will require careful attention.

In addition, the TMCC will evolve over time and will require a flexible process that is capable of managing change. Examples of changes that might occur include:

- Loss of a key staff person during the project
- Changes in the private broker selected for Medicaid transportation for the region, which may lead to lay-offs and downsizing of the transportation providers
- New stakeholders that decide to join the TMCC

Understanding and Using Technology

A TMCC involves the application of advanced technology, which requires technological awareness, some degree of expertise, and technical decisions. This is a significant challenge in the types of communities where a TMCC may be most valuable. There is unlikely to be much existing technology already in use by small transit and HST providers and, thus, little experience and expertise. Human services agencies, in fact, may be experiencing automated scheduling and dispatch technologies for the first time in a TMCC project. Building awareness, communicating technical issues and choices, and making technical decisions among stakeholders with different technological capabilities will be significant challenges.

Building Technology Awareness

It will be important to build at the outset a degree of technological awareness among core stakeholders. Several resources exist to assist in this respect, and are presented in more detail in the Resources section of the Appendices. Some of the principal resources include the following:

- **U.S. DOT** provides many resources devoted to ITS:
  - ITS Joint Program Office – http://www.its.dot.gov/

  - ITS Technical Assistance – http://www.its.dot.gov/tech_transfer/technical_assistance.htm
  - ITS Peer-to-Peer Program – https://www.pcb.its.dot.gov/p2p.aspx
  - ITS Applications: Transit Management – http://www.itsoverview.its.dot.gov/TM.asp
  - ITS ePrimer-Module 7: Public Transportation – https://www.pcb.its.dot.gov/eprimer/module7.aspx
  - ITS Deployment Statistics – http://www.itsdeployment.its.dot.gov/
  - National Transportation Library – http://www.its.dot.gov/research_areas/its_ntl.htm
  - Federal Transit Administration: ITS Reports – https://www.transit.dot.gov/research-innovation/intelligent-transportation-systems-its
- **National Transit Institute (NTI)** provides professional development for the transit industry and offers several training courses devoted to technology. Registration is free for US public sector officials. http://www.ntionline.com/
- **Transit Cooperative Research Program (TCRP)** is a Federally-funded program that conducts research of direct pertinence to the transit industry. Several reports specifically address the issue of Transit ITS:
  - TCRP web site – http://www.trb.org/TCRP/TCRP.aspx
  - TCRP On Line – http://www.tcrponline.org/
- **State DOTs** often offer technical assistance to transit agencies within the state. As mentioned, it will be critical to establish a special partnership with the state DOT at the outset of the TMCC project.
- **National transportation associations** (such as the American Public Transportation Association [APTA] or CTAA) offer various resources that may be pertinent. They organize trade shows at which one can meet and discuss with potential system suppliers and provide, in some cases, on-line buyer's guides that list ITS suppliers and consultants.
- **Other transit agencies** – it is always valuable to visit other transit systems that have already deployed pertinent technologies. In some cases, U.S. DOT offers grants for peer-to-peer exchanges that serve to build technological expertise.[22]

Technical Assistance during the TMCC Project

Although the above resources offer some degree of technical assistance, the scope of a TMCC will require sustained technical assistance to aid the TMCC stakeholders with Systems Engineering and technical design, procurement

[22] https://www.pcb.its.dot.gov/p2p.aspx.

preparation, bidder evaluation, supervision during installation, system testing, etc. This will most likely require retaining a technical consultant. Finding the resources for technical assistance is a significant challenge for smaller communities and agencies.

Communicating Technical Issues to Stakeholders

In addition to building technological awareness and securing technical support, there will be a need to carefully manage the technical communications with stakeholders during the TMCC design and implementation process. The following outline some of the lessons learned:

- Establish a core technical working group comprising key stakeholders who will be responsible for drafting the system design documents; this reduces the number of individuals who will require a higher level of technological expertise.
- Use tabletop exercises to illustrate and discuss concepts for the TMCC, thereby enabling the stakeholders to discuss technical concepts in an operational setting; these exercises will also help allay fears over cost, loss of control, etc.
- Keep it simple and focused.
- Limit the amount of material covered in a single meeting.
- Identify ways to group and separate the material to be covered during individual meetings; it may be overwhelming and exhausting to review and analyze all system requirements in one session.

Importance of Training

As the TMCC project progresses toward implementation, there will be an important need for adequate staff, operator, driver, and user training. This will help reduce employee apprehension and encourage them to work with and use the technology, as opposed to ignoring or resisting its use. Requirements for adequate training should be explicitly included in the TMCC procurement document.

Experience at the MSAA sites indicated that there is need for training at the launch of the technology and also on a continuous basis, especially given turnover of drivers and other staff. Although system suppliers provide some level of training at the beginning of operations, there is need for a mechanism to deliver follow-up training.

One possibility is to require from the TMCC system suppliers a more intensive "train-the-trainer" approach in training a designated internal staff person who appears particularly adept at using the technology. This staff person would become the in-house expert and be responsible for providing one-on-one

training with the other transportation provider staff and drivers over time. This designated trainer will also train new drivers as they join the organizations. This approach may be beneficial since individual drivers or staff may be intimidated by the technology, and therefore less likely to ask questions in the initial group training offered by the system supplier. Much care must go into helping those persons using the technology understand how the technology works at a very practical level. This is more likely to occur with one-on-one coaching. However, there remains the vulnerability of relying on a single person for the technology expertise, especially in smaller agencies with few staff. This should be taken into consideration in designing the training program.

SECTION 9

Looking to the Future: Developing Interfaces Between Different TMCC Software Platforms

A fundamental challenge exists to make the TMCC Vision a reality. As more and more communities and suppliers explore the feasibility of deploying a TMCC, there is a growing recognition that there is a need to develop interfaces so the TMCC is technology-agnostic. To date, TMCC deployments have relied on an architecture using a common software platform obtained from a single supplier. However, there is a need to develop interfaces between different systems to fulfill the longer-term vision of a multi-platform, multi-vendor TMCC system that would enable the TMCC to integrate multiple transportation providers using different scheduling systems. Recent initiatives have been carving out a path to fulfilling this vision and are described below.

Ride Connection Demand-Response Transportation Clearinghouse

Ride Connection is a private non-profit organization based in Portland, Oregon, dedicated to coordinating and providing transportation services to people with limited options in Clackamas, Multnomah, and Washington counties. Ride Connection has more than 30 non-profit and local government partners and has been linking transportation to people in these communities for more than 25 years.

Ride Connection provides the following services:

- Information and referral
- Travel training
- Door-to-door service for eligible customers
- Deviated-route bus service for general public use (called Community Connectors)

Ride Connection has multiple transportation provider partners of different sizes (small, medium, and large). In recent years, it embarked on a process to

enhance coordination of the "medium-size" providers by creating an open-source software clearinghouse that would enable coordination of the call center function, scheduling, dispatching, call-back, verification, and reporting of trips. The Ride Connection Clearinghouse is a website that allows ride services to share trips that cannot be fulfilled and claim trips shared by other services. The clearinghouse application programming interface (API) is internet-accessible and allows services and third parties to integrate the different software used by some of the providers with the clearinghouse to automate the sharing and claiming of trips.

One such system has already been developed—the Ride Connection Clearinghouse Adapter. It uses the clearinghouse API and any interfaces provided by scheduling and dispatch tools to transfer and translate data between the clearinghouse and the scheduling software. The adapter simplifies back-office integration with the Ride Connection Clearinghouse website. The software mirrors trip ticket information generated by each provider's software and can be used to help automate the process of sending and receiving new data through the clearinghouse API.

TCRP Study on Standardizing Data for Mobility Management

TRB sponsored a research project on "Standardizing Data for Mobility Management" (TCRP Web-Only Document 62)[23] that explored the exchange of computer-based data between transportation providers, brokers, customers, and human service agencies for successful mobility management undertakings. The research examined the types of data that are used in mobility management systems as well as the environment in which these software systems function. The recommendations address:

- Where data standards will provide value for mobility managers
- Specific data and related protocols needed for improved functionality
- Guidelines for procurement specifications for agencies purchasing new technology for mobility management

The study made a distinction between "discovery tasks" and "transactional activities." Discovery tasks have a customer focus and cover both fixed-route and demand-response transportation. Discovery data help customers find out what service options exist and are of primary concern to information and referral centers, individual passengers, one call–one click centers, or mobility managers concerned with assisting passengers with finding the most appropriate and cost-

[23] O'Neill, S., and R. Teal, "Standardizing Data for Mobility Management," TCRP Web-Only Document 62, Transportation Research Board, Washington DC, 2013; available at http://www.trb.org/Publications/Blurbs/170080.aspx.

effective means of transportation. Trip planners that may be found on transit agency or 5-1-1 websites are an important tool in the discovery phase.

Transactional activities are the primary content of scheduling and dispatch software, although such software is generally focused on an individual transportation provider's trips and not on how such data are exchanged among multiple transportation providers. Transactional data are of primary concern to transportation providers. The transaction phase occurs not with the end user or passenger, but rather with the transportation providers involved in delivering a trip on a demand-responsive service. Transactional data are needed to schedule a particular trip on a vehicle, provide the trip or job it out to another transportation provider, and verify the trip was made.

The TCRP study recommends a framework organized along these two dimensions of discovery and transactional data. The type of data needed for each facet is different, although related. The data needed to support service transactions include:

- Trip data
- Passenger data
- Organization data
- Financial data
- Vehicle data

The two primary data records are:

- Passenger record, consisting of 16 data elements, 8 of which are mandatory
- Trip record, consisting of 18 data elements, 16 of which are mandatory

The other record types—organization, financial, and vehicle—have a total of 17 data elements, of which 14 are mandatory. Overall, the study recommends a framework involving a total of 51 standardized data elements.

The study suggests that all data fields specified are present in the software applications currently being used for demand-response services. They may have names different from those used in the study, but the data itself are present in the databases used by the existing applications.

New TCRP Study Task G-16: Development of Transactional Data Specifications for Demand-Responsive Transportation

TRB initiated in 2016 a new TCRP study to build on the recommendations emerging from the previously-described study. The objective of this new research is to build on the framework presented in "Standardizing Data for Mobility Management" to develop technical specifications for transactional data for entities involved in the provision of demand-responsive transportation. The research will:

- Develop specifications that may evolve, at some future time, to standards for transactional data.
- Consider privacy and security in the transmission and storage of transactional data.
- Identify key strategies to encourage adoption of the proposed specifications.
- Propose and carry out an approach for testing the specifications.
- Create an open source tool for data producers to validate their data against the specifications.
- Create and convene a forum for consensus-based refinement of the technical specifications. This forum should have the potential to continue following completion of this research project to support implementation of the research results.

It is anticipated that the study will be completed in 18 months and may provide a practical framework to standardize the data and interfaces needed to one day deploy a multi-platform multi-operator TMCC.

Together, these efforts are becoming more important with the growing interest in deploying TMCCs across the country and eventually will lead to standardized data dictionaries and interchange protocols, thus fully enabling the promise offered by the concept of the TMCC to enhance coordination of mobility services for the transportation-disadvantaged.

SECTION
10

Conclusions

The MSAA Initiative served to explore the potential use of advanced technology to enhance the coordination of transit, paratransit, and HST services in communities in which there are multiple mobility service providers. The various ITS and other technologies were integrated through the concept of the Travel Management Coordination Center (TMCC). The MSAA Initiative has shown that a TMCC offers many potential benefits for customers with special needs, including:

- One-call access (with no wrong number) to the transportation system
- Improved accessibility and more choice of service
- Expanded hours/increased flexibility for customers
- Expanded service to currently underserved customers
- Expanded geographical coverage and/or improved cross-boundary service
- Increased ability for all to use public transportation, thereby maximizing mobility
- More efficient and less duplicative services
- Better use of limited public resources
- Increased level of customer service

A TMCC can be configured in many ways, offering choices in what tasks to automate at any stage of providing transportation service to a customer. This manual presents a framework to assist stakeholders to develop a common TMCC Vision and synthesizes many of the lessons learned with respect to building the necessary institutional foundation for designing, deploying, and sustaining a TMCC.

The concept of using technology to enhance the coordination of community transportation has evolved considerably. More and more communities are likely to explore the feasibility of a TMCC in the future, as shown by the current MSAA planning demonstration project. This manual will assist those communities wishing to pursue this vision.

Challenges

There are some significant challenges in designing and deploying a TMCC that suggest areas for future research, such as the following:

- The target audience for enhancing community transportation coordination through the deployment of a TMCC is often small agencies with very limited resources and little knowledge of technology options. This remains a sizable challenge, as a TMCC is a complex undertaking that will require technical assistance.
- There are common elements to the concept of a TMCC, but there are many variations, both great and small.
- The fact that there is no "one-size-fits-all" model of a TMCC creates great flexibility as well as considerable challenges. Each community must undertake efforts to assess its own context and develop a local consensus among stakeholders on a shared vision of a TMCC. This manual will assist in this process, but it will remain a lengthy and complex process, especially in communities with few resources and little experience with technology.
- Components and terminology are not standardized—for example, the term "reservation," which may mean different things in different contexts.
- There has been considerable planning of TMCCs because of the MSAA Initiative, but there remain few deployments to date and little actual experience from which others can benefit.
- The vision of a multi-platform, multi-vendor deployment is not yet a reality.

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ACRONYMS

ADA	Americans with Disabilities Act
API	Application Programming Interface
APTS	Advanced Public Transportation Systems
AVL	Automatic Vehicle Location
CAD	Computer-Aided Dispatch
CCAM	Coordinating Council on Access and Mobility
CCTV	Closed Circuit Televisions
CnR	Call-n-Ride
CTAA	Community Transportation Association of America
FTA	Federal Transit Administration
GPS	Global Positioning System
GTFS	General Transit Feed Specification
HIPAA	Health Insurance Portability and Accountability Act of 1996
HST	Human Service Transportation
JTA	Jacksonville Transportation Authority
ID	Identification or Identification Document
INCOSE	International Council of Systems Engineers
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
LAN	Local Area Network
LSCOG	Lower Savannah Council of Governments
MDT	Mobile Data Terminal
MSAA	Mobility Services for All Americans
NTI	National Transit Institute
NCHRP	National Cooperative Highway Research Program
PBX	Private Branch Exchange
POS	Point-of-Sale
RFP	Request for Proposals
RTD	Regional Transportation District (Denver, CO)
TCRP	Transit Cooperative Research Program
TDD/TTY	Telecommunications Devices for the Deaf/Teletype
TMCC	Travel Management Coordination Center
TRB	Transportation Research Board
U.S. DOT	United States Department of Transportation
UTA	Utah Transit Authority
UWR	United We Ride
VPT	Via Paratransit Services
VTCLI	Veterans Transportation and Community Living Initiative

APPENDIX

A

Resources

- **MSAA Program Website**, http://www.its.dot.gov/research_archives/msaa/index.htm. In 2004, U.S. DOT launched a significant ITS initiative entitled Mobility Services for All Americans to provide a coordinated effort and apply technological solutions to mobility barriers. A key objective was to develop Travel Management Coordination Centers (TMCCs) that promote mobility, accessibility, and coordination of services for the transportation-disadvantaged as well as for the public. In 2005, eight regions were selected for the first phase of system development and design. In 2009, three of these were selected for a second phase model deployment, evaluation, and technology transfer. These projects were finalized in 2011. In 2015, the MSAA Initiative funded additional deployment planning projects to further improve HST coordination and delivery in four communities. The purpose of this deployment planning effort is to replicate and advance the success of TMCC phased-implementation by providing "seed" funding to leverage other federal, state and local resources to build up coordinated community transportation services. The MSAA website contains information about the program, background research reports, descriptions of the demonstrations projects, and reference documents.
- **Carter, M., et al.**, "Mobility Services for All Americans Phase 2—Foundation Research: Final Report," July 29, 2005. http://www.its.dot.gov/research_archives/msaa/msaa2/index.htm.
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- **One Call-One Click Toolkit**, http://web1.ctaa.org/webmodules/webarticles/anmviewer.asp?a=2428&z=101. This Toolkit provides information for communities interested in working together, whether locally, regionally,

or statewide, to develop a one-call or one-click service for transportation. Communities can choose to start small, follow one of a number of different models, and develop technologically and functionally from information and referral to reservations, dispatching, and more. The Toolkit will empower communities to select the right fit for their own circumstances. The Toolkit is a set of on-line tools, including:

  - A guide for beginning one call–one click transportation services
  - Results from a survey of existing one-call services
  - Advice from the one-call services field
  - Local profiles and videos
  - Factsheets, a glossary, and links to more information

- **Veterans Transportation and Community Living Initiative (VTCLI) Grantee Resources & Technical Assistance**, http://www.fta.dot.gov/grants/12305_14198.html. VTCLI is a FTA competitive grant program to help veterans, military families, and others connect to jobs and services in their communities by improving access to local transportation options. The web site provides several resource documents.

Pertinent ITS-Related Resources

- **Advanced Public Transportation Systems (APTS) State of the Art**: Update 2006 – This document is more technical in nature and describes in detail the ITS-related challenges faced by the transit industry (in particular focusing on architecture and systems integration issues): http://ntl.bts.gov/lib/30000/30100/30101/APTS_State_of_the_Art.pdf
- **Federal Transit Administration ITS Reports**, https://www.transit.dot.gov/research-innovation/intelligent-transportation-systems-its
- **Intelligent Transportation Systems Benefits, Costs, Deployment, and Lessons Learned: 2011 Update** – This valuable document prepared by U.S. DOT summarizes all current knowledge on ITS (all applications) with respect to benefits, costs, and lessons learned based on experience with ITS deployment. http://www.itsknowledgeresources.its.dot.gov/its/benecost.nsf/files/bcllldepl2011update/$file/ben_cost_less_depl_2011 update.pdf (Document size: 6MB). The chapter specifically devoted to ITS applications related to Transit Management is Section 7. Other areas of potential interest covered in the complete report include Traveler Information and Electronic Payment and Pricing.
- **ITS Applications: Transit Management**, http://www.itsoverview.its.dot.gov/TM.asp
- **ITS Deployment Statistics**, http://www.itsdeployment.its.dot.gov/
- **ITS Joint Program Office**, http://www.its.dot.gov/

- **ITS Joint Program Office Technical Assistance**, http://www.its.dot.gov/tech_transfer/technical_assistance.htm
- **ITS Peer-to-Peer Program**, https://www.pcb.its.dot.gov/p2p.aspx
- **National Transportation Library**, http://www.its.dot.gov/research_areas/its_ntl.htm
- **Transit Cooperative Research Program (TCRP)** – Federally-funded program that conducts research of direct pertinence to the transit industry. Several reports specifically address the issue of Transit ITS, including TCRP main site, http://www.trb.org/TCRP/TCRP.aspx, and TCRP On Line, http://www.tcrponline.org/
- **Transit Technology Fact Sheets** – These fact sheets provide a summary of the most basic and useful technologies for different types of transit systems. https://www.pcb.its.dot.gov/factsheets.aspx

TCRP Reports on Transit ITS

- **Acumen Building Enterprise, "Strategies to Expand and Improve Deployment of ITS in Rural Transit Systems,"** TRCP Report 84 Volume 6, Transportation Research Board, Washington DC, 2005, http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_84v6.pdf
- **D. Parker, "Synthesis on Automatic Vehicle Location (AVL) Systems,"** TCRP Synthesis 73, Transportation Research Board, Washington DC, 2008, http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp_syn_73.pdf
- **Institute for Transportation Research and Education et al., "Guidebook for Selecting Appropriate Technology Systems for Small Urban and Rural Public Transportation Operators,"** TRCP Report 76, Transportation Research Board, Washington DC, 2002, http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_76.pdf
- **Transit Communications Interface Profiles (TCIP)** – TCIP is a standard that provides a library of information exchange building blocks to allow transit agencies and transit suppliers to create standardized tailored interfaces between ITS applications. In addition, a windows-based software application entitled TIRCE (TCIP Implementation, Requirements and Capabilities Editor) has been developed to assist the user in tailoring TCIP for a specific project. TCIP and TIRCE are available for free at http://www.aptatcip.com/ (background) and http://www.aptatcip.com/Documents.htm (actual TCIP documents).

APPENDIX

B

LSCOG TMCC Identified Needs

The Lower Savannah Council of Governments (LSCOG) in Aiken, South Carolina, is one of the sites that deployed a TMCC under Phase 2 of the MSAA Program. As discussed in Section 7, LSCOG conducted a needs assessment as part of its TMCC Systems Engineering process and identified a wide range of stakeholder needs. These needs were identified through numerous stakeholder meetings, public hearings, and site visits and were presented in LSCOG's Phase 1 Concept of Operations report.[24]

LSCOG User Needs are listed here by category of stakeholder user to illustrate the range of potential user needs that might be considered in the design of a TMCC.

Consumer Needs

C-1 Consumer Focused Information, Referral & Assistance available from one source as both a telephone number and a website

C-2 Successful navigation of the phone reservation system and the ability to reach a "live" agent for assistance, when needed

C-3 24/7/365 access to travel information for the consumer

C-4 Translation services offered when interacting with the TMCC

C-5 A quick and efficient way for a rider to make a travel reservation

C-6 Advocacy on behalf of consumers needing a ride (including negotiation with transit providers)

C-7 Receive assistance to apply for and access ADA paratransit services

C-8 Interview and screening for possible eligibility of additional human services programs

C-9 A more responsive transportation delivery system that does not require a three to five day travel reservations in advance

C-10 The ability to have transportation cross county lines

C-11 Expansion of transportation service hours throughout the region.

[24] Lower Savannah Council of Governments, "Mobility Services for All Americans (MSAA) Phase 1 – System Development and Design: Travel Management Coordination Center (TMCC) Concept of Operations," revised January 18, 2008.

C-12 Door-to-door or door-through-door service and other special transportation needs more widely available

C-13 Increased payments options for transportation services

C-14 More shared seat availability on vehicles so the general public has access to transportation too, not just clients enrolled in specific programs or in special target groups

Transportation Provider Needs

TP-1 Development of the transportation provider network to bring more service options into the region and more opportunities for building business

TP-2 Leadership from the TMCC to support providers working together to meet consumer needs instead of fostering competition against each other

TP-3 Acquisition of, and assistance with, the technology needed to bring about improvements in:

- TP-3.1 Data Collection
- TP-3.2 Fare Management
- TP-3.3 Eligibility Determination
- TP-3.4 Billing
- TP-3.5 Reservations & Scheduling
- TP-3.6 Trip Verification
- TP-3.7 Vehicle Tracking
- TP-3.8 Providing improved response time

TP-4 The need for an enhanced communication system among providers, consumers, and the coordination center (TMCC)

TP-5 Coordination with out-of-county trip requests

TP-6 TMCC leadership in grant management and monitoring

TP-7 Standardize policies and procedures, to the extent possible, among various participating transportation providers

TP-8 Collective efforts to provide all participating transit providers the benefits of:

- TP-8.1 Marketing
- TP-8.2 Driver Training
- TP-8.3 Fleet Maintenance
- TP-8.4 Customer Service Standards
- TP-8.5 Standardized Safety Guidelines
- TP-8.6 Regional Drug Testing Consortium
- TP-8.7 Coordinating fleet replacements and expansion to reduce capital cost

TP-9 TMCC advocacy to attract additional transportation programs and funding streams to the region with special interest in projects, which may provide:

- TP-9.1 Volunteer drivers/vehicles and reimburse volunteer drivers
- TP-9.2 Personal Attendants to accompany riders who need extra assistance

Human Service Agency Needs

HS-1 Assistance to agency staff to find transportation options for their clients to expedite service or care provision

HS-2 Educate staff on how to assess transportation needs for their clients and how to incorporate options for transportation in their case management

HS-3 More flexibility in eligibility determinations between/among funding streams

HS-4 Provide a mobility manager's individual attention to difficult case scenarios

HS-5 Assistance from the Aging and Disability Resource Center staff on behalf of the unmet needs outside of transportation

Funding Source Agency Needs

FS-1 Be provided with a transportation coordination model that is replicable in other parts of the region, state, or country

FS-2 Have the TMCC provide accurate, consistent reporting data from an entire region

FS-3 Function as the lead agency as designated by U.S. DOT for regional transportation coordination and planning efforts

Local Government Needs

LG-1 Ability to have mobility assistance from the TMCC transportation providers during an emergency evacuation, if called upon by local emergency officials

APPENDIX

C

Example of Inter-Agency Agreement Concerning TMCC Technology Management

Memorandum of Understanding
between
TMCC Project Management Agency (TMCC) and
Generic Partner Agency

Subject: Mobile Data Terminals and Automatic Vehicle Location Systems

The purpose of this Memorandum is to set forth the general understanding between the XYZ Council of Governments (referred to as TMCC) and Generic Partner Agency (or "Agency") regarding their respective roles and responsibilities and any assumptions tied to the Travel Management Coordination Center project.

The parties agree to and understand the following as they relate to the XYZ Council of Governments:

- TMCC procured an agreement with ITS Corporation Software, Inc. to provide, install, test, and support Mobile Data Terminals and Automatic Vehicle Location (MDT/AVL) Equipment to Generic Partner Agency to be utilized on their agency's vehicles to enhance their current transit operations and to participate in the coordination activities of the future Travel Management Coordination Center, currently under development and implementation.
- TMCC will provide Generic Partner Agency with MDT/AVL equipment and related services to interface seamlessly with Generic Partner Agency's upgraded ITS Corporation XYZ application on a 5.1 platform.
- TMCC will provide fourteen (14) MDT/AVL Software License(s). These licenses do not expire during the lifetime of the equipment.
- TMCC will provide a matching number of in-vehicle Units w/ Internal Modem Global Positioning System (GPS) as the procured MDT/AVL equipment associated with the above software licenses.
- TMCC has contracted with ITS Corporation Software to purchase licenses, hardware, and professional services for planning, installation, integration, project management, training, initial implementation and Go Live support on behalf of Generic Partner Agency.

- TMCC will provide for full payment for the above listed products and services used during the initial project installation. Generic Partner Agency is not expected to incur any charges in relation to the direct services and equipment listed above.
- TMCC will be financially responsible for a two year "premium support and maintenance" agreement for Generic Partner Agency to utilize their installed MDT/AVL equipment during this pilot project.

Further, the parties agree to and understand the following as they relate to Generic Partner Agency:

- Generic Partner Agency will commit to fully utilizing the installed MDT/AVL equipment and corresponding software applications to be utilized to increase operational efficiency, increase responsiveness to transportation consumers and enhance customer service, increase reporting accuracy, and explore opportunities to increase coordination activities; all goals of the Travel Management Coordination Center.
- Generic Partner Agency will commit appropriate staff for initial project planning, project conference calls and training for the MDT/AVL equipment. This training will involve agency staff at various positions, at various times, to include managers, dispatchers, schedulers, drivers, and any other identified staff needed to support the MDT/AVL implementation. Generic Partner Agency staff will continue to be available during the pilot phase of the project and commit to working with and collaborating with TMCC and ITS Corporation Software.
- Generic Partner Agency will maintain a local area network (LAN) High Speed Internet Access. If not already in place, a LAN, High Speed Internet Access must be installed. As part of its agreement with TMCC, ITS Corporation Software, Inc. will:
- Review existing customer LAN and High Speed Internet Connection.
- Determine High Speed Internet Connection technical requirements, if necessary.
- Order and Install High Speed Internet Connection, if required. (Note: The ITS Corporation services for assistance are inclusive for this phase of the project; however, any cost incurred for Generic Partner Agency's actual internet use and service will be the sole financial responsibility of Generic Partner Agency).
- Configure and initialize to match systems requirements.
- Generic Partner Agency will be responsible for financing adequate data airtime contracts with the selected network carrier after the two year pilot phase is complete in order to support the data transmitted by the MDT/AVL equipment back to the agency's home office.

- Generic Partner Agency will keep TMCC mobility management staff apprised of any ongoing concerns over the quality of the ITS Corporation software functions/ product or the need for excessive calls to their customer support help desk.
- Generic Partner Agency will be diligent in following the manufacturer's instructions on the use and care of any installed equipment and will maintain the equipment as instructed, fully utilizing any support services or warranties provided during the pilot project. Generic Partner Agency will report any equipment failures, warranty service and maintenance records to TMCC upon request.
- Generic Partner Agency will cooperate with functions or activities that are impacted by the use of the MDT/AVL equipment including coordination, project evaluation and reporting.

Additional Considerations:

- TMCC, Generic Partner Agency, and other RTA transit partners are working together to bring improved transportation coordination and transit service to passengers in the area as a result of the implementation of a regional Travel Management and Coordination Center. Stakeholders of the TMCC are currently working together to identify their partner roles and responsibilities as a member of the TMCC. Generic Partner Agency agrees to remain a stakeholder of the TMCC during the initial two-year pilot phase and retain the option to become a "virtual agent" with the TMCC for reservations and scheduling function; to be renewed on annual basis if agreed between parties.
- TMCC will make every effort to identify additional funding sources to support the ongoing use of MDT/AVL equipment for individual partner agency's continuing use. Agency understands that after the initial two year(s) of this pilot program, Generic Partner Agency will be responsible for any additional or "ongoing" professional cost/fees associated with use of the MDT/AVL equipment if said funding cannot be obtained. (The current cost of Premium Support & Software Maintenance for the ITS Corporation Software & Licensing for AVL/MDT Equipment and Services is $XXX per MDT/AVL license/and MDT/AVL unit; or $YYY per year for all 14 units combined). Generic Partner Agency will be required to uninstall and return to TMCC any MDT/AVL equipment listed on their inventory if Generic Partner Agency decides they can no longer afford to maintain and support the provided in-vehicle equipment. Generic Partner Agency will notify TMCC of its intention to return equipment at least 60 days in advance.

This Memorandum of Understanding is dated _____by and between:

TMCC Project Management Agency	Generic Partner Agency
_____	_____
XX, Executive Director	*XX*, Executive Director

U.S. Department of Transportation

Federal Transit Administration

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https://www.transit.dot.gov/about/research-innovation