Mobility Services for All Americans (MSAA)

Case Study Report

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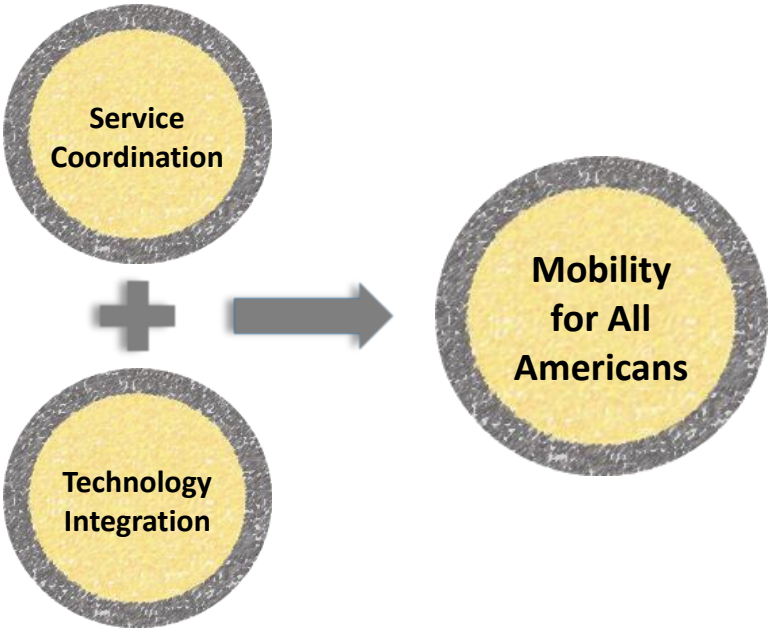

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16. Abstract

This report presents four case studies detailing what has been achieved through the Mobility Services for All Americans (MSAA) deployment planning, implementation, and/or Travel Management Coordination Center (TMCC) development. It additionally discusses whether MSAA funding or other federal assistance has had an impact on TMCC development, and what links exist between MSAA and its observed impacts. Prior to the detailed case studies, the report describes the selection process for the four agencies selected for detailed study, including the survey questions asked of the initially selected agencies. Following the case studies, the report finishes by summarizing results and conclusions of the case studies.

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Introduction

The purpose of conducting the case studies that are described in this report was to systematically document what has been achieved through the Mobility Services for All Americans (MSAA) deployment planning, implementation, or Travel Management Coordination Center (TMCC) development. Likewise, the report discusses whether MSAA funding or other federal assistance has had an impact - expected or unexpected - on TMCC development, and what links exist between MSAA and its observed impacts.

The contractor team identified and engaged eight (8) sites which are currently or previously engaged in MSAA TMCC deployments, are anticipating receiving MSAA Deployment Planning funds, or are currently engaged in some phase of TMCC deployment for the purposes of enhancing human service transportation operations. Sites that have made progress in the deployment of a TMCC operation under the Veterans Transportation and Community Living Initiative (VTCLI) were also considered. VTCLI was an innovative federally-coordinated partnership that makes it easier for U.S. veterans, active service members, military families, and others to learn about and arrange for locally available transportation services that connect them with work, education, health care, and other vital services in their communities.

As part of the case study effort, a questionnaire regarding transportation agencies' deployment of technology to facilitate coordinated transportation was issued to the eight (8) agencies under consideration. The survey (shown in Appendix A) contained questions regarding the following:

- Characteristics of responding agency/organization
- Challenges faced by the agency in terms of service coordination
- Technologies deployed
- How needs and requirements for technology were determined prior to and validated after implementation
- How the technology was procured
- Characteristics and level of automation in stages of the service provision.

Based on the results of the survey and with input from the Federal Transit Administration (FTA) and Intelligent Transportation Systems (ITS) Joint Program Office (JPO) contracting officers' representative/Government Technical Monitor, the contactor team identified four (4) agencies that would become subjects of the case studies. Phone interviews were conducted with the four agencies in addition to analyzing the completed survey results to ensure that each case study was a thorough investigation and to document the challenges, opportunities, pitfalls and successes experienced by each unique agency in planning and deploying TMCCs.

This report is organized as follows:

- Chapter 1 describes the characteristics of the original eight (8) agencies and the selection of the four (4) agencies on which the case studies were conducted

- Chapters 2 through 5 contain the case studies for the four (4) agencies
- Chapter 6 discusses the overall case studies results and conclusions.

Chapter 1. Characteristics of Eight Agencies and Selection of Four Agencies

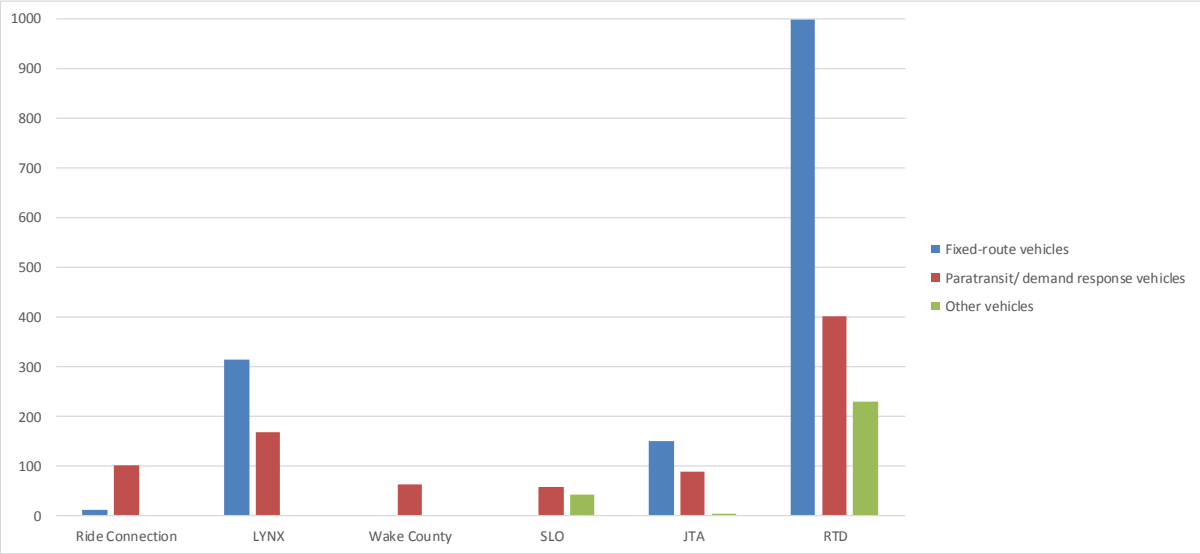
The eight agencies and their MSAA/TMCC-related projects that were selected at the beginning of the case study effort are shown in Table 1.

Table 1. Original Case Study Sites (Source: Schweiger Consulting, LLC; Battelle, 2017)

Agency Name	Location	Project Name
Berkshire Regional Transit Authority (BRTA)	Pittsfield, MA	VTCLI's multi-modal one call/ one click resource center
Central Florida Regional Transportation Authority (LYNX)	Orlando, FL	Model Orlando Regionally Efficient Travel Management Coordination Center (MORE-TMCC)
Jacksonville Transportation Authority (JTA)	Jacksonville, FL	TransPortal
Lower Savannah Council of Governments (LSCOG)	Aiken, SC	LSCOG TMCC
Regional Transportation District (RTD)	Denver, CO	Northwest Metro Denver Coordination System (Coordination of General Public and Human Service Transportation in Longmont, CO)
Ride Connection	Portland, OR	Demand-Response Transportation Clearinghouse
United Cerebral Palsy (UCP) San Louis Obispo (SLO) / Ride-on Transportation	San Louis Obispo, CA	SLO County TMCC
Wake County Human Services	Raleigh, NC	NC Tracks Software Interface as part of Wake Coordinated Transportation Service and City of Raleigh Americans with Disabilities Act (ADA) Mobility Management

The contractor team reviewed the questionnaire responses from each agency shown in Table 1[1] to determine which agencies would be most appropriate for further study. To get a sense of the relative size of the respondent agencies, we requested they provide the population in their service areas, as well as the size of the service area, the number of vehicles and the number of demand-response trips provided per month. The range of population in the service areas of the six responding agencies is 458,000 (San Luis Obispo, CA) to 2.39 million (Ride Connection, Portland, OR). The range of service areas are from 798 to 3,616 square miles.

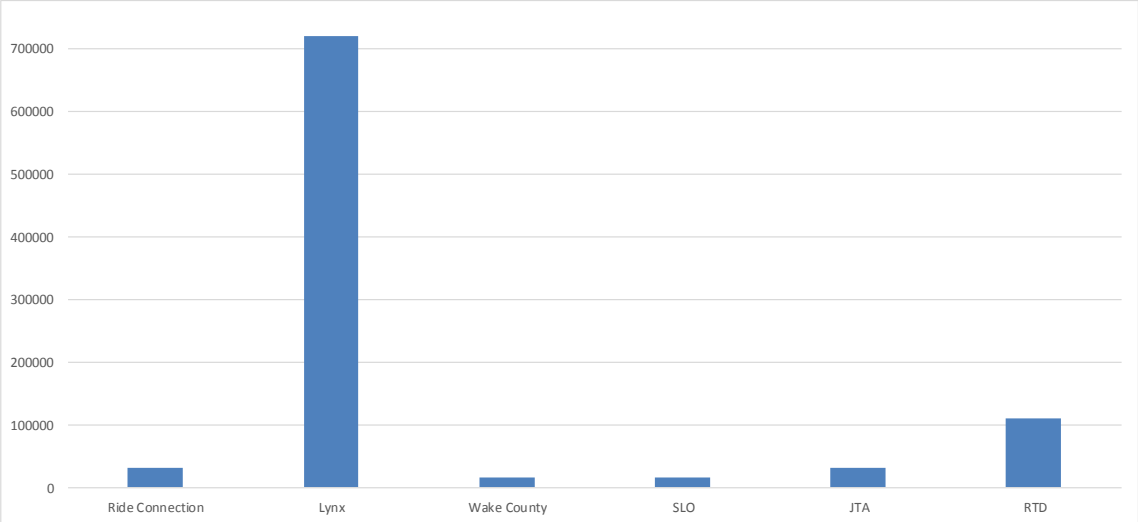
Figure 1 shows the number of vehicles reported by each responding agency. Figure 2 shows the number of demand response trips agencies reported providing per month.



Source: Schweiger Consulting, LLC; Battelle, 2017

Figure 1. Number of Vehicles in Respondent Agencies

[1] Two agencies did not complete the questionnaire: LSCOG and BRTA. LSCOG was one of the original MSAA TMCC sites and became fully operational in 2010. Since that time, some parts of the TMCC are no longer operational. BRTA was not able to complete the questionnaire within the amount of time allowed for consideration.



Source: Schweiger Consulting, LLC; Battelle, 2017

Figure 2. Number of Demand Response Trips Provided per Month

Table 2 shows the types of transportation services provided by the respondent agencies.

Table 2. Type of Transportation Services Provided

Type of Transportation Services Provided	Ride Connection	LYNX	Wake County	SLO	JTA	RTD
Paratransit/Demand responsive service	X	X	X	X	X	X
Fixed-route service		X			X	X
Route deviation (point deviation or route deviation) service	X				X	X
ADA paratransit service		X			X	X
Integration of demand responsive service for the general public Paratransit service		X				X
Automated guideway and ferry						
A wide range of transportation-related services: travel training, volunteer driver programs, mileage reimbursement for families & friends of people needing transportation, travel options counseling, driver training, and a wide range of support services for other social service organizations that do not specialize in transportation but provide it as part of their services	X					

Source: Schweiger Consulting, LLC; Battelle, 2017

All respondents had agency staff specializing in technology and/or systems engineering. Four of the six responding agencies had access to a staff member who specializes in technology and/or systems engineering in a different department or agency.

Finally, funding directly affects technology deployment, so we asked whether technology research and deployment was covered in each agency's budget. Five of the six respondents have a separate line item

in their budget for technology research and deployment, and the other respondent has a budget for technology research and deployment, but not as a separate item. Four of the six respondents' projects were funded either solely or in part by the FTA.

All six responding agencies utilized multiple partnerships in their projects, as shown in Table 3.

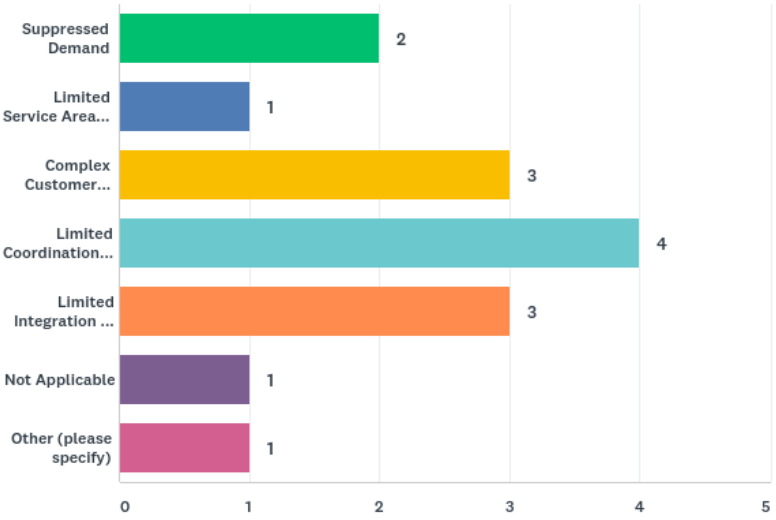
Table 3. MSAA/TMCC Project Partners

Agency Name	Project Partners	Project Name
LYNX	Central Florida Regional Transportation Authority, Polk County Transit Services, Lakeland Area Mass Transit District, Florida Agency for Persons with Disabilities, Area Agency on Aging, Florida Department of Children and Families, Seniors First, Seminole Community Mental Health, Goodwill Industries of Central Florida, Florida Commission for the Transportation Disadvantaged and Florida Department of Transportation	MORE-TMCC
JTA	Duval County, Clay Transit, Nassau Transit, Sunshine Bus, Ride Solution, Baker County Transit, and Suwannee Valley Transit	TransPortal
RTD	TransitPlus, RouteMatch, DemandTrans, RTD Seniors' Resource Center, Broomfield Easy Rides and Colorado Department of Transportation	Northwest Metro Denver Coordination System (Coordination of General Public and Human Service Transportation in Longmont, CO)
Ride Connection	Providence Health & Services of Oregon, RouteMatch and Mobilitat	Demand-Response Transportation Clearinghouse
SLO	United Cerebral Palsy of San Luis Obispo County, Ride-On Transportation, San Luis Obispo Regional Transit Authority, Community Health Centers, SLO Regional Rideshare, SLO Safe Rides, taxi cab providers, the US Department of Veterans Affairs, and partnering human service agencies	SLO County TMCC
Wake County Human Services	North Carolina Department of Transportation and Institute for Transportation Research and Education	NC Tracks Software Interface as part of Wake Coordinated Transportation Service and City of Raleigh ADA Mobility Management

Source: Schweiger Consulting, LLC; Battelle, 2017

The contractor team then reviewed the service-related challenges, technologies deployed, and other information provided in the questionnaire responses to determine which four (4) agencies should be selected for further analysis. Figure 3 shows the challenge categories experienced the six respondents, and Table 4 defines the challenge categories and shows the responses by each agency.

Table 5 presents the technologies deployed by each agency's project.



Source: Schweiger Consulting, LLC; Battelle, 2017

Figure 3. Challenges Faced by Respondent Agencies that Led to MSAA/TMCC Project

Table 4. Challenges Faced by Respondent Agencies that Led to MSAA/TMCC Project

Answer Choices Agencies--->	Ride Connection	LYNX	Wake County	SLO	JTA	RTD
Suppressed Demand: Unmet demand for human service transportation exists in general, and for specific trip purposes such as Medicaid and employment-related trips		X				X
Limited Service Area and Hours: Evening and weekend service offered by traditional and human service transportation providers is typically 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.						X
Complex Customer Communications: Currently, there is no comprehensive transportation information access point for customers. This complicates trip planning for the users of public transit and human service transportation, as well as referring agencies		X			X	X
Limited Coordination among Area Providers: Limited coordination exists among human service transportation providers. Opportunities exist to eliminate duplicative service, to extend service hours and geographic coverage through the coordination of public, non-profit, and other organizations	X			X	X	X
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				X	X	X
Not Applicable			X			
Other: Transportation information did not include private operators and did not give the cost for paratransit services				X		

Source: Schweiger Consulting, LLC; Battelle, 2017

Table 5. Technologies Deployed by Respondent Agencies

Answer Choices Agencies--->	Ride Connection	LYNX	Wake County	SLO	JTA	RTD
Automated scheduling, dispatching, and routing systems					X	
Travel Management Coordination Center (TMCC) Customer Interface (e.g., Interactive voice response [IVR], web portal, kiosks, other automated customer access interfaces)		X			X	
Automated traveler information and/or trip planning systems, particularly for customers with accessibility challenges		X			X	
Vehicle communications (e.g. Mobile Data Terminals/Computers and/or other mobile communications devices)		X				
Automatic vehicle location (AVL) and/or other systems that assist the operations of demand-response service		X				
Automated fare payment and management (collection and processing) systems						
Automated Third-party Billing			X			
Automated Eligibility Certification Process			X			
TDD/TTY						
Other: An automated trip exchange among service providers						X
Other: Grant is a planning grant. Implementation will begin after the completion of the planning grant				X		
Other: Worked in close collaboration with another agency (Providence) to evaluate gains from the ability to exchange trips between the two organizations	X					

Source: Schweiger Consulting, LLC; Battelle, 2017

Additional characteristics associated with each MSAA/TMCC project were reviewed prior to determining the four (4) agency projects. Additional project characteristics included:

- How the need for technology was determined.
- How the technology requirements that the new system or technology would have to meet were determined.
- Whether the technology was procured using a competitive process.
- What process was used to ensure that the technology/system met all requirements/specifications.
- The approaches used by each agency to perform each step of service provision.

Based on the questionnaire responses regarding these characteristics and the aforementioned factors, the contractor team along with FTA and the ITS JPO determined that the four agencies' projects that would be the subject of detailed study should include:

- LYNX Model Orlando Regionally Efficient Travel Management Coordination Center (MORE-TMCC)
- SLO County TMCC

- RTD Northwest Metro Denver Coordination System
- JTA TransPortal.

Chapters 2 through 5 provide details of each of these projects.

Chapter 2. LYNX MORE-TMCC

Basic Characteristics

The Central Florida Regional Transportation Authority (LYNX) is a public transportation agency located in Orlando, FL. LYNX's service area is 2,500 square miles and population in the service area is 1,873,359. Annual ridership for all services is 27,378,046; the number of demand response trips provided per month is 721,010; and the annual fare revenue is $282,225,494.

The types of services provided by LYNX are paratransit/demand responsive service, fixed-route service, ADA paratransit service, and integrated demand responsive service for the general public (sometimes referred to as Call-n-Ride or Zone Bus service, with eligibility-based ADA Paratransit service). The number of LYNX vehicles is 313 fixed-route vehicles and 168 paratransit/demand response vehicles.

"The Model Orlando Regionally Efficient Travel Management Coordination Center (MORE-TMCC) has been a joint effort on the part of the region's transit providers and human service agencies, with the primary goal to utilize existing resources to expand the customer's transportation options. The proposed system will use technologies already implemented by the stakeholders, and as the system transitions from the implementation phase into long term use, the MORE-TMCC can easily support and integrate additional transportation providers, human service agencies and funding sources on a larger scale. Since the proposed Central Florida system is a vendor technology independent system that will employ technologies provided by multiple communications, hardware and software providers, other markets will be able to implement our solution in their region using much of their current systems, technologies, and vendors."[2]

This project's sponsor was FTA and the partners were shown in Table 3. The project budget was $400,000. The project started on May 31, 2007 and ended on August 4, 2008, although LYNX is still making improvements as further changes are being made to optimize services. MORE-TMCC was included in the LYNX Transit Development Plan and the LYNX ITS Plan.

Approach to Determining Appropriate Technologies and Functional Requirements

The challenges faced by LYNX in terms of service coordination that led to MORE-TMCC was shown above in Table 4 (see Suppressed Demand and Complex Customer Communications). Based on these challenges and after asking stakeholders and customers about their needs for improved service(s), LYNX implemented (as shown in Table 5) a TMCC Customer Interface, automated traveler information and/or trip planning systems (particularly for customers with accessibility challenges), vehicle communications

[2] Doug Jamison (LYNX) in response to questionnaire, November 6, 2017.

(e.g., Mobile Data Terminals/Computers and/or other mobile communications devices), and AVL and/or other systems that assist the operations of demand-response service. The functional/system requirements associated with these technologies were determined by engaging stakeholders and customers. The technology was procured via sole source to a vendor that was already working with LYNX.

Finally, the process LYNX used to ensure that the technology/system met all requirements/specifications included three components, as follows:

- Used a "traceability" approach (one in which each requirement is documented, and whether it has been met or not is documented at every testing phase);
- Used a regularly-scheduled meeting or phone call to discuss the list of action items associated with the technology/system the vendor was implementing; and
- Used payment milestones, each of which needed to be completed in full to the agency's satisfaction before the vendor was paid for each milestone.

Characteristics of Stages of Service Provision

USDOT's soon-to-be-released TMCC Guidebook "defines nine key stages of the service provision path that starts at the point when a customer wishes to make a reservation, and ends when the final reporting and billing for the trip have been made."[3] The survey explored "the role of technology and the degree of shared resources for each of these stages"[2], as follows:

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

MORE-TMCC included technology in several of these stages. In terms of **customer access mechanisms**, the customer access the process for requesting a trip reservation is an automated hybrid centralized/decentralized (with manual option) approach in which stakeholders decide to retain their own individual customer access means, but create a centralized access point. This enables a "No wrong number" approach to customer convenience whereby the customer gains access to the same support for requesting a reservation regardless of the number called. At the same time, TMCC stakeholders decide to use technology (typically telephony in combination with interactive voice response (IVR)) to automate the access into the next stage.

[3] Final guidebook reference here

Automated interfaces for automating customer access to the reservation system were telephony with interactive voice response and a web portal, with potential for web-based mobile device.

Trip eligibility is determined using a manual centralized approach in which stakeholders decide to centralize their eligibility databases and share staff resources so that a call to the centralized access number leads the customer to a call center where a call agent makes an on-the-spot determination of trip eligibility. If the requested trip is not eligible, the call agent can carry out an Information and Referral service for the customer, or even conduct the primary steps towards certification. The nature of the centralized eligibility database is a centralized look-up trip eligibility database in which eligibility certification remains under the control of each respective stakeholder, and they maintain their own eligibility databases. However, they jointly create a centralized look-up database, which is updated frequently so that new eligible customers become incorporated and eligible for trip reservation.

A customer-requested trip is **scheduled** using a shared scheduling platform with shared coordination. In this approach, stakeholders agree to conduct a pooled purchase of the scheduling system in order to establish a common platform from which to work. Each stakeholder performs its own scheduling. A customer-requested trip is booked and confirmed using 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 all mobility service provider stakeholders based on pre-defined rules. The system optimizes schedules over all vehicles and can automatically determine the schedule and route of the trip. The booking of the trip is confirmed immediately to the customer. The method of confirmation depends on how the customer accessed the reservation system (i.e., by telephone, internet, or through a call agent).

The approach to **vehicle management** is an automated decentralized approach in which stakeholders decide to retain their own individual operational control in the field, but decide to use technology in the field operations such as dispatching, vehicle management, etc. The functionality in the vehicle management system included tracking of vehicle location (location and comparison to time predictions, or location only), navigation guidance for the driver, and pre-defined driver reporting/messaging capability (e.g., arrival, no-shows) with time/location stamp from the AVL system.

Data is managed using an automated decentralized approach with a common data repository. In this approach, individual stakeholders have deployed technology that enables the collection and synthesizing of data on customer trips, vehicle activity, and performance. Stakeholders have agreed to create a common data repository for the purpose of sharing select 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.

Project Impacts and Lessons Learned

According to LYNX, the benefit that resulted from MORE-TMCC was providing easier access to services for customers. One successful outcome from this project was that the customer trip booking portal was made available to provide easier access for customer trip reservations.

The key challenge faced by LYNX in adopting/deploying technology in this project was that this project was not selected for a further funding award, causing a lack of engagement of the project partners.

The key lessons learned from this project regarding planning and deploying technology are as follows:

- "Focus with a core team and not too many stakeholders as stakeholder group whittled itself down during the design process.
- Involve vendors early in the process, especially legacy vendors, and keep vendors informed of your expectations.
- Ensure that each team member has an understanding of the project and the Systems Engineering process to be used."

As a result of this project, LYNX was able to deploy the customer web portal. This has allowed customers who chose to reserve their own trips, resulting in less phone hold times for other customers due to reduced phone demand.

Other Characteristics and Success Factors

Stakeholder Engagement

According to Doug Jamison, Senior Intelligent Transportation Systems Developer, and Bill Hearndon, Deputy Director of Mobility Services, both at LYNX, the assessment of stakeholders' and customers' needs was determined by holding workshops that were conducted by LYNX. These facilitated discussions focused on the concepts and direction of the program. The process resulted in resolving conflicting needs by focusing on and identifying commonalities between expressed needs.

Stakeholder engagement at different stages of the project was an iterative process and a challenge for LYNX. It would have been easier to have all stakeholders at the beginning of the project since they recognized and expressed their needs at the first workshop. Subsequent stakeholder meetings had less in-person participation and relied more on communication by email.

Another challenge was that the location within the technology spectrum where various stakeholders reside differed. There were different levels of knowledge, understanding and acceptance of technology. For example, LYNX has performed numerous technology projects and understands systems engineering. Other partner agencies, such as Polk County Transit, provide services in rural areas and rely heavily on standards set by vendors and other providers. For LYNX, it was necessary to have mutual understanding of the objectives to be accomplished and extrapolate requirements that would ultimately be proposed to partners. It was important to stay technology-agnostic throughout the needs assessment process, but that was challenging.

Lynx provided training sessions for stakeholders about systems engineering to explain why the agency was taking this approach. It was explained that it is not about what a given software package does nor is it about how agencies operate their services. Instead, after being provided with an understanding of the systems engineering approach, stakeholders were able to identify their needs and look for what is needed to happen to meet real-world expectations.

Training sessions covered the different stages of the project to convey the purpose of the project. For example, stakeholders were provided with an explanation of what a Concept of Operations (ConOps) is, including the key items of the document such as stakeholders' roles, goals, and accomplishments for the project. Other steps, such as the needs assessment, were covered during the training sessions. It was

explained that changes made as the project unfolded would feed back into the ConOps. This training effort was successful in having stakeholders all playing by the same rules and in stakeholders understanding the path of the project.

On the customer side, engagement was limited to one-on-one interactions with key customers, advocacy groups and planning organizations. Although planning organizations are not direct customers on the street, these customers are very knowledgeable about how LYNX works and have an understanding of the service rules (e.g., of ADA) that must be met.

A successful approach for encouraging stakeholders' involvement was to hold group meetings on Fridays at 3 pm. More stakeholders were present since this meeting time presented a chance that the meeting would end early and participants could go home earlier than normal. This was an idea that the Director of Planning from an Ohio transit agency used successfully.

Having a different spectrum of experience and understanding with technology among stakeholders resulted in a tendency among the smaller partners to quietly agree on the recommendations given by LYNX. LYNX needed to confirm that these smaller agencies were involved by specifically asking about their needs. In this case, agencies categorized as human service agencies were not comfortable with technology and needed help.

Sustainability

Making the system sustainable has two key parts: technology and mobility. From the technology side, LYNX is trying to provide more information to customers such as real-time arrival times of paratransit vehicles, on-demand vehicle real-time arrival times, and real-time information for fixed routes. In addition, providing more information means allowing the customer to have more control of their trips. Customers can go online and book their trip. The ultimate goal is to allow the customer to do more. Other projects, such as on-demand public transit, have customers using technology (e.g., through a mobile app or web) for booking trips. Because of this, there has been a drop in call times and higher customer satisfaction.

Another aspect of the technology in the future is LYNX considering an approach such as Mobility as a Service (MaaS).

From the mobility side, LYNX will continue to enhance customer service. A recent task is merging LYNX's paratransit and Flex service dispatch – and moving them into the call center. Flex service dispatchers and paratransit customer service representatives, who were once contractor employees, are now LYNX employers.

The next step is to cross-train paratransit staff to provide information about fixed-route services. The goal is to have a fully integrated call center where any staff member can answer any questions related to paratransit, fixed-route, flex service, or agency-wide general information.

Following the cross-training, Lynx will focus on trip-by-trip conditional eligibility for paratransit services. They will use a detailed bus stop inventory including information about the surrounding area such as sidewalks, etc. If the customer is able to use another mode that is less expensive for LYNX to provide and less expensive for the customer based on the fare, LYNX will assist the customer in using a different mode.

In addition, LYNX performs in-person functional assessments to determine conditional eligibility. Customer eligibility information is updated every two years. Also, travel training is provided through a third party and through Lynx's customer service staff for groups.

The family of services that are currently offered by LYNX will eventually expand to include taxis and transportation networking companies (TNCs), particularly during off-peak hours (e.g., 8pm to 6am). If a customer cannot access fixed-route service, LYNX will provide a TNC due to the cost associated with the service. LYNX is incorporating services that are available and that will result in a lower cost for both the customer and the agency.

LYNX's overall approach has been integrative by bringing all appropriate staff into the call center and giving the customer an integrated perspective of their trip even if the service is not provided directly by LYNX. Eventually, project partners will have the same tools to construct and integrate a trip. Partners will be able to construct trips that include multiple modes and involve technology, though this is not fully automated yet.

As part of a veteran's community grant, as of November 2017, LYNX is in the process of building a centralized database to provide transit availability using a mobile app. The local 311 service provides information to the customer on what service(s) is available and connects to a trip planner that helps provide information about how to get from origin to destination.

Recommendations

LYNX recommends using the systems engineering process in order to conduct a project of this nature. Having a project vision is important, but the role(s) of stakeholders in each step is critical. This necessitates a plan that outlines key components about what the end result is expected to be and how it will be accomplished.

For some decision makers and stakeholders, it is difficult to agree on the money allocated and the time spent on planning the project. They may have other expectations. Agency Board needs must be identified up front, based on the different levels of understanding of technology as well as of the processes required by Federal agencies.

The ConOps was a critical tool that provided verification of stakeholder involvement and it was used to document additional needs as the project progressed. This document conveyed which stakeholders were part of the process, and that they agreed to review it (versus approving it). Agreements did not reflect or represent how Federal funding was allocated and the ConOps did not require a director-level or Board Chair signature.

Chapter 3. SLO County TMCC

Basic Characteristics

United Cerebral Palsy (UCP)/Ride-On Transportation is a human service transportation provider located in San Luis Obispo, CA. The service area is 3,616 square miles and population in the service area is 458,000. Annual ridership for Ride On services is 338,815; the number of demand response trips provided per month is 15,750; and the annual fare revenue is $3,783,353.

The type of service provided by UCP/Ride-On is paratransit/demand responsive service. The number of vehicles is 56 paratransit/demand response vehicles and 42 other vehicles.

The SLO County TMCC is currently utilizing a planning grant to look at developing a technology tool to improve customer choices for social service transportation. The technology tool would schedule and manage rides, and have a fare payment feature. The tool would also allow public and private transportation providers to exchange ride requests.

This project's sponsor is FTA and Ride-On Transportation, and the partners were shown in Table 3. The project budget is $224,400. The project started on October 1, 2015 and will end on March 31, 2018.

Approach to Determining Appropriate Technologies and Functional Requirements

The challenges faced by UCP/Ride-On in terms of service coordination that led to the TMCC project is shown in Table 4 (limited coordination among area providers, limited integration of human service transportation with traditional public transportation, and the fact that transportation information did not include private operators and did not give the cost for paratransit services). Based on these challenges and after asking stakeholders and customers about their needs for improved service(s), SLO County TMCC will implement technologies that meet these needs. The functional/system requirements associated with these technologies are being determined by asking stakeholders and customers.

Characteristics of Stages of Service Provision

As mentioned in Chapter 2, the survey explored "the role of technology and the degree of shared resources for each" stage of service provision.

The SLO County TMCC will include technology in several of these stages. In terms of **customer access mechanisms**, the customer access the process for requesting a trip reservation is expected to be an automated centralized approach (with manual option), in which stakeholders decide to pool their resources and centralize the access point for the customer through a single automated point - most

typically a toll free number that can be combined with other means such as internet or kiosks), but decide to use technology (typically telephony in combination with IVR) to automate the access into the next stage.

The interface for automating customer access to the reservation system is expected to be a web portal (enabling the potential for web-based mobile devices). Further, the special customer interfaces that are expected to be deployed include a Telecommunication Device for the Deaf (TDD)/ teletypewriter (TTY), and multi-lingual capability for the automated systems.

Trip eligibility is expected to be determined using an automated centralized approach in which stakeholders decide to build a centralized eligibility database and pool their resources to build an automated eligibility determination portal in order to automate the access into the scheduling stage. The nature of the centralized eligibility database is expected to be a unified eligibility process and database in which stakeholders pool their resources to create a unified certification portal and process that recognizes distinct eligibility rules of the different service providers. Further, it is expected that each provider will determine the eligibility of the caller and the software will send the ride request to the provider.

A customer-requested trip is expected to be **scheduled** using decentralized scheduling with a common trip-planning interface. In this approach, stakeholders are decentralized with respect to the control of their scheduling, and operate on independent system platforms, but are linked through a common automated trip-planning interface. Trip requests are forwarded to all potential transportation providers for potential scheduling, based on pre-defined business rules. 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. Stakeholders are decentralized, and they maintain their own autonomy for scheduling trips for their clients.

It is expected that customer-requested trips will be **booked and confirmed** using an automated decentralized marketplace booking and integrated confirmation. In this approach, stakeholders are decentralized with respect to the control of their scheduling, and operate on independent system platforms, but are linked through a common real-time trip-planning interface that is fully automated. Trip requests are automatically forwarded to all potential transportation providers for potential scheduling and the individual scheduling systems return available options for consideration by the customer. The customer chooses in real-time the most desirable option, which is then booked (accepted by the stakeholder system as scheduled and routed), and the confirmation is immediately provided to the customer or reservation agent. This is akin to the well-known approach used for trip planning in the air travel market (e.g. Travelocity, Expedia, etc.).

It is expected that a booked trip will be **dispatched** using an automated decentralized approach in which stakeholders decide to retain their own individual operational control in the field, but decide to use technology in the field operations such as dispatching, vehicle management, etc.

The approach to **vehicle management** is expected to be an automated decentralized approach, similar to that used by LYNX. The functionality in the vehicle management system is expected to include pre-defined driver reporting/messaging capability (e.g., arrival, no-shows) with time/location stamp from AVL system.

A new **fare collection** system is expected to be deployed as part of this TMCC using an automated commercial decentralized approach in which stakeholders decide to retain total control of their individual fare management systems, but decide to jointly procure a common fare technology by using a commercial financial institution credit card / debit card payment solution. Point-of-sales readers are expected to be located in all vehicles, and could be designed as stand-alone readers or integrated with on-board vehicle management computers. Transactions could be processed through a financial institution. The joint procurement could offer economies of scale in procuring the system. An automated commercial decentralized fare management system may require stakeholders to agree on common fare classification categories. Further, it is expected that the new system will include a customer billing capability that enables the creation of an account for each customer, and the billing, or collection from a preauthorized bank account, of fares after the trip has taken place.

Data is expected to be managed using an automated decentralized approach, similar to that used by LYNX. Further, the data on service provision is expected to be organized and processed for reporting and billing using an automated decentralized approach in which technology exists to facilitate data processing for reporting and billing, and processes are automated. Each agency is expected to conduct all reporting and billing on an individual basis.

Project Impacts and Lessons Learned

According to UCP/Ride-On, the benefits that are expected to result from the SLO County TMCC is increased coordination, better information for the customer, and on-line ride requests. Also, even though they are just in the planning stages, regional transportation providers are working together to create the TMCC.

The three key challenges faced by UCP/Ride-On in this project are as follows:

- Application programming interface implementation
- The cost associated with software systems
- Resistance to change.

The key lesson learned from this project is that technology that is currently available is not meeting the needs of their recently-determined system requirements.

Opportunities that UCP/Ride-On is currently experiencing due to this project include establishing agreements between transportation providers and sending rides to each other even though the system is not in-place yet.

Other Characteristics and Success Factors

Stakeholder Engagement

According to Mark Shaffer, Executive Director, UCP/Ride-On Transportation and Todd Allen, Director of Government and Community Relations, RouteMatch, stakeholders value their time and attend a variety of meetings. Stakeholders are reluctant to attend informational meetings. In order to keep stakeholders engaged, the TMCC project maintains communication in a simple way and presents advantages and

disadvantages to stakeholders, and considers their feedback. For stakeholders that were less engaged, it was necessary to reach out to them directly. For example, a phone call was helpful in discussing the benefits to their organization to get them on board again.

At the outset of this project, UCP/Ride-On's perspective changed from provider-driven to customer-driven. It now considers how to make it easier for the customer to use services and obtain information. The easier the process, the more likely that services will be used and more rides will result from it. Often, providers do not take into consideration the customer's point of view. To overcome this challenge, it is important to make all stakeholders aware of "why are we doing this." Agencies may only look for the benefit to their own organization, but when the eventual system is easy to use, it provides benefits to everyone. Also, there have been political and funding issues in the background. Despite these challenges, the process has been successful because stakeholders see a value in what they are doing. The phased approach is very important because it describes the project as a journey to improve communication and coordination rather than one final product. UCP/Ride-On gives credit to FTA and the MSAA program to continue to facilitate strategic activities during the planning processes for inter-agency coordination.

In terms of determining stakeholders' needs, some of the lessons learned for SLO have been:

- Identifying needs should be done early in the process.
- Validating requirements should be done with stakeholders.
- Having a website portal for the project can help to re-validate the project's vision.
- Consistently going back to the stakeholders, not only core members but also extended stakeholders and customers, should be done to revalidate and match vision and needs.
- Working with specific stakeholders directly involved in project delivery/project engagement should be done to make sure they are on-board.
- Partnering with FTA, local agencies, California Department of Transportation (CALTRANS) and Medicaid has been critical.

Sustainability

San Luis Obispo's design phase of the project ends late March 2018. Afterwards, the project will move forward to the implementation phase. The high-level design is the vision that the project is working toward, so future activities will include the steps required to achieve this vision, which includes a higher level of coordination using technologies that meet the identified needs. After March 2018, the working group will continue to meet.

Recently, the TMCC project presented at a California Association for Coordinated Transportation (CalACT) Conference and found stakeholders who did not know about the project and showed interest in getting involved. UCP/Ride-On is hoping to grow a coalition of providers through CalACT. A number of transportation providers have information technology (IT) "islands" so it may be challenging for some of them to conduct the software development. This coalition could start locally, but be expanded to cover the entire US. The coalition is intended to live on after this project is completed.

A common practice for transportation providers is to expect vendors to bring the products to them in order to buy them, which is one option for the TMCC. UCP/Ride-On's objective is to identify system

requirements to provide to vendors. In this manner, vendors will be made aware of the agency's needs upfront.

Another option for implementation is to use open source technology. An outcome of the coalition could be the identification of in-house IT staff to help develop the system. A higher return on investment could be achieved by making the tool available to other providers that will pay a reasonable fee to access the tool. Funds collected as a result of providing access to the tool can be re-invested to assist funding future development tasks.

UCP/Ride-On has aligned the tool's components in parallel with the process that the customer and provider goes through when reserving a trip. The process goes from obtaining information, to making a choice of a provider, to providing information to the transportation provider so they can schedule a ride, and, finally, to build a profile of a rider that is linked to a fare management system which has a credit card or open account on file to charge for the ride. An objective of the tool is to help people identify the least expensive mode of transportation and let them make the final decision. This can reduce some of the burden of paratransit system costs without relying only on reducing trips to save money, and also by including the private sector (e.g., taxis, TNCs).

Another advantage of such a tool is that a provider can share information with other providers through a mailbox system that encrypts the information. In this manner, a ride will have a reference number and personal information will not be released. This less sophisticated technology could be developed to be used among entities that share ride information. Agreements could be developed to share ride information. Brokerages outside the county could be considered in developing contracts to eliminate the red tape among different providers. There could also be an effort within the 511 system to be transportation information ready regardless of the phone number provided.

Another related effort is the preparation of a Coordination Guide for communities, in which model leadership processes and communication strategies are outlined. This includes how to obtain inputs from the community through surveys without either being an expensive process. Also, the Coordination Guide will explain how to facilitate communication in order to have all stakeholders on the same page. Communities in the SLO area meet every four years to work on their Coordination Plan, and this requires frequent discussions and a plan. The guidelines will be helpful for communities and advocates to promote a model process to use during the Coordination Plan development.

Recommendations

Some partners will not be comfortable with a systems engineering approach. They will want to know the cost of using this approach. In that case, it is necessary to explain what the objectives are and to ask those partners to trust the approach. There will also likely be resistance at the design phase, as was shown in this TMCC project. However, that resistance can be eliminated. For example, during the past year, the 511 system has evolved its services to be more like the TMCC's, with changes reflecting what is in the SLO County TMCC's system requirements.

Chapter 4. RTD Northwest Metro Denver Coordination System

Basic Characteristics

RTD is a public transportation agency located in Denver, CO. The service area is 2,000 square miles and population in the service area is 2.3 million. Annual ridership for all services is 100 million; the number of demand response trips provided is 110,000; and the annual fare revenue is $120 million.

The types of services provided by RTD are paratransit/demand responsive service, fixed-route service, route deviation service, ADA paratransit service, and integration of demand responsive service for the general public (referred to as Call-n-Ride) service. The number of vehicles is 1,000 fixed-route vehicles, 400 paratransit/demand response vehicles, and 230 other vehicles.

This project is building upon the two projects. First, it is building upon a current Via/RTD pilot project that coordinates Via Paratransit service with Call-n-Ride service in Longmont, CO. Via uses RouteMatch for trip scheduling; Call-n-Ride uses DemandTrans MobilityDR. The coordination project allows RTD and Via to transfer trips from one system/service to the other to maximize utilization of both resources. This project will expand upon this to include SRC in Thornton and Federal Heights, and include Easy Ride in Broomfield and their respective Call-n-Ride services. Second, this project is providing the participating agencies' call centers with the ability to efficiently, easily, and, with mutual benefits, book trips to the other agency's service in coordination with the Denver Regional Mobility and Access Council (DRMAC) centralized data exchange; providing a unified view of the status of all vehicles in the coordinated system. DRMAC is now preparing a request for proposal to build this centralized data exchange as part of a VTCLI project. This MSAA project will provide the technical components so that all TMCC participants host software systems for reservations and scheduling will be capable of using the full set of functionalities provided by the centralized data exchange and the TMCC application.

This project's sponsor is FTA and Via Mobility Services. The project budget is $300,000. The project started on October 1, 2015 and will end on March 31, 2018.

Approach to Determining Appropriate Technologies and Functional Requirements

The challenges faced by RTD in terms of service coordination that led to the TMCC project is shown in Table 4 (suppressed demand, limited service area and hours, complex customer communications, limited coordination among area providers and limited integration of human service transportation with traditional public transportation). Based on these challenges and the following three approaches, RTD will implement an automated trip exchange among service providers that meet these needs:

- Determines the need internally.

- Asks stakeholders and customers about their needs for improved service(s).
- Determine their needs after seeing another agency with that technology.

The functional/system requirements associated with this technology were determined by the following:

- Developing/determining the requirements internally.
- Asking stakeholders and customers to help the agency determine the system requirements.
- Using requirements from another agency that deployed the same technology/system.

The technology was procured using a sole-source award to an existing vendor. Finally, the process that RTD used to ensure that the technology/system met all requirements/specifications was a "traceability" approach – one in which each requirement is documented, and whether it has been met or not is documented at every testing phase; and a regularly-scheduled meeting or phone call to discuss as the action items associated with what the vendor is implementing for the technology/system.

Characteristics of Stages of Service Provision

As mentioned in Chapter 2, the survey explored "the role of technology and the degree of shared resources for each" stage of service provision.

The Northwest Metro Denver Coordination System will include technology in several of these stages. In terms of **customer access mechanisms**, the customer access process for requesting a trip reservation is an automated hybrid centralized/decentralized approach (with manual option), similar to LYNX's approach.

A customer-requested trip is **scheduled** using decentralized scheduling with a common trip-planning interface, similar to the SLO County TMCC.

The customer-requested trips will be **booked and confirmed** using an automated decentralized marketplace booking and integrated confirmation, similar to SLO County TMCC.

Data management uses an automated decentralized approach, similar to that used by LYNX and SLO County TMCC. Further, the data on service provision is expected to be organized and processed for reporting and billing using an automated decentralized approach similar to SLO County TMCC.

Project Impacts and Lessons Learned

According to RTD, the primary benefit resulting from this project is overcoming institutional barriers. This project established a mechanism for exchanging trips among providers.

The key challenge faced by RTD in this project was agreeing on needed specifications suitable to all providers.

The three lessons learned from this project are as follows:

- Talk through technical aspects.

- Determine the common, minimum requirements.
- Determine what can be left out to get it started (don't need to include all the bells and whistles).

One opportunity that RTD has experienced because of this project is that trips can be made by people that otherwise would be unable.

Other Characteristics and Success Factors

Stakeholder Engagement

According to Jeff Becker, Service Development Manager at RTD, the goal was to have coordinated transportation between two different agencies (RTD and Via), which is not common. This project started 15 years ago when it was realized that the agencies operated the same on-demand services in the same areas, and it would be easier to share the trips (Via was also providing ADA and Call-N-Ride services for RTD). The other reason for coordinating services was an overlap of resources between the two agencies. Over time, one of the agencies received a grant that allowed for moving forward with trip coordination. Trip coordination was a laborious task since trips traveling on similar paths were assigned to the same service provider manually. After some time, other cities and non-profit organizations that provided transit services wanted to be part of this systematic approach to coordination.

Self-identification of the players was needed, as the desire to coordinate resources was already known among regional service providers. But these same organizations needed an example of coordination in order to justify their participation. Now the need has changed to provide more transportation services with the resources available. More funding is not the only answer to coordination or participation in coordinated service. "Sometimes all that is necessary is to try it."

Sustainability

Denver RTD believes that system sustainability is not due to the technology or processes. Rather, it is an outcome of present changes in the transportation agency. The challenge is to "change or die." The evolution of mobility services can become standardized practice which depends on the state-of the-art/ state-of-the practice and the confidence of the people involved. Technology innovation becomes sustainable when the customer wants it. And it is more sustainable when it becomes standardized. From Denver's experience, it took seven years to go from concept to implementation. This timeframe depended on the evolution of technology and services. Innovation becomes sustainable because technology creates value to agencies (e.g., it is cost-effective to them).

Recommendations

Different from other agencies, Denver RTD had experience with service integration. This experience was crucial to demonstrate to other organizations what could be done as part of this project. Agencies reluctant to invest in a project without knowing the results eventually became the strongest advocates of coordination after recognizing the benefits of the project. Staff at the different levels appreciated solving problems with this new trip exchange process. One lesson learned for RTD was that the barriers for embarking on new projects like this are not technological, but institutional. It took a few years for RTD to move the project forward from the initial concept to implementation.

Another challenge was taking the top-level institutional problems and determining how to address them with the various stakeholders involved. The development of business rules was conducted as part of the MSAA grant. A key element to be considered was that stakeholders come to the table with their own objectives to accomplish and issues to resolve. This was recognized and addressed in the development of business rules where entities identify their particular needs and objectives, and determine how they will address both similar and different rules among the participating organizations. Using business rules development made it easier to recognize each agency as a contributor and identify a solution to meet their needs that sometimes will come from another entity's outcomes. RTD found that the context of the term "business rules" was appropriate in communicating that every stakeholder will accomplish more by participating in coordinated service.

Chapter 5. JTA TransPortal

Basic Characteristics

The Jacksonville Transportation Authority (JTA) is a public transportation agency located in Jacksonville, FL. The service area is 798 square miles and population in the service area is 1,021,371. Annual ridership for all services is 13,317,000; the number of demand response trips requested per month is 31,794 and provided is 30,833; and the annual fare revenue is $12,780,026.

The types of services provided by JTA are paratransit/demand responsive, fixed-route, route deviation, ADA paratransit, automated guideway and ferry service. The number of vehicles is 150 fixed-route vehicles, 88 paratransit/demand response vehicles and 1 other vehicle.

TransPortal, a One Call/One Click Transportation Resource Center, provides a single point of access to plan and book regional and local multimodal travel.

This project's sponsor was FTA. The annual maintenance is $38,000. The project started on March 1, 2014 and ended on September 1, 2014.

Approach to Determining Appropriate Technologies and Functional Requirements

The challenges faced by JTA in terms of service coordination that led to the TransPortal project are shown in Table 4 (complex customer communications, limited coordination among area providers and limited integration of human service transportation with traditional public transportation). Based on these challenges, JTA implemented the following technologies:

- Automated scheduling, dispatching, and routing systems
- TMCC Customer Interface
- Automated traveler information and/or trip planning systems, particularly for customers with accessibility challenges.

The functional/system requirements associated with these technologies were developed and determined internally, and requirements supplied from a vendor that provides these kinds of technology/systems were also used.

The technology was procured using a competitive process. Finally, the process that JTA used to ensure that the technology/system met all requirements/specifications was payment milestones – each of which needs to be completed in full to the agency's satisfaction before the vendor is paid for each milestone.

Characteristics of Stages of Service Provision

As mentioned in Chapter 2, the survey explored "the role of technology and the degree of shared resources for each" stage of service provision.

The JTA TransPortal will include technology in several of these stages. In terms of **customer access mechanisms**, the customer access the process for requesting a trip reservation is an automated centralized approach (with manual option), similar to SLO County TMCC's approach. One interface included for automating customer access to the reservation system is a web portal (with potential for web-based mobile device). Further, one special customer interface feature is a multi-lingual capability for the automated systems.

In terms of **trip eligibility** determination, the approach that JTA adopted is manual centralized, similar to that of LYNX. The nature of the centralized eligibility database is a centralized look-up trip eligibility database, similar to that of LYNX.

A customer-requested trip is **scheduled** using centralized scheduling in which the TMCC stakeholders decide to forward all trip requests to a single centralized scheduling system.

Customer-requested trips will be **booked and confirmed** using an automated centralized scheduling and booking, similar to LYNX's MORE-TMCC.

Project Impacts and Lessons Learned

According to JTA, the primary benefit resulting from this project is that the One-Click web application helps agencies support the mobility needs of all segments of the populations they serve. In addition to generally available travel options such as fixed-route transit, biking, walking, driving, and taxi, One-Click uniquely incorporates Demand Responsive Transport trip options, based on a rider's eligibility characteristics and any required special accommodations.

One successful outcome from the TransPortal project is unified regional trip planning.

The key challenge faced by JTA in this project is ensuring that the provider information is up-to-date.

The two lessons learned from this project are as follows:

- Plan for continual training of project partners.
- Thoroughly investigate project partners' technological capabilities

One opportunity that JTA has experienced because of this project is improved access to diverse transportation services.

Other Characteristics and Success Factors

Stakeholder Engagement

According to Brad Thoburn, Vice President of Long Range Planning and System Development at JTA, and Geanelly Reveron, Transportation Planner II at JTA, the stakeholder engagement mechanisms and process came through the development of the regional coordinated mobility plan in which a formal working group was established. JTA's system covers the entire county. They started to partner with smaller neighboring counties that provide transportation services. However, as the partnerships started to grow and trips started to extend beyond county lines, there was a need for a coordinating plan. This included a working relationship with these counties to establish 5310 and 5311 funding, and coordinate priorities. The outcome of the coordinated mobility plan and VTCLI funds resulted in a dialogue to seek additional funding to implement critical elements of the plan.

JTA shares best practices with non-technological stakeholders, but not necessarily as a result of TransPortal. For example, after Hurricane Irma, stakeholders shared lessons learned on how to provide safe transportation using scheduling software. Further, JTA is the technical support resource for other TransPortal stakeholders, particularly the smaller county providers and councils on aging.

Sustainability

Phase 2 of TransPortal recently began. This second phase is expected to provide the missing link between scheduling software and TransPortal, as well as integrate an updated user interface and increase customization of the website (e.g., will allow individual trip cancellations). Once changes to the website are completed, there is a plan to develop a process for service providers to share updated information to ensure that the TransPortal site is helpful to customers. Further, there is a regional fare study being conducted as of December 2017 that may provide some additional insights and elements for TransPortal.

Other transportation-related projects focused on regional coordination will facilitate maintaining TransPortal moving forward. For example, in the fare study, riders will be able to use one fare media to travel from one county to another. TransPortal could be used to make that trip reservation. Also, there is a regional project that will result in better information so that riders know any connections to regional travel at any given transit stop. This variety of projects are helping to keep TransPortal moving forward.

Another aspect of sustainability is accessibility features, which are available in the website, including multiple languages, assistance on how to create an account, and saving trip preferences. With the completion of Phase 2 of the TransPortal project, JTA expects that a rider will be able to reserve and cancel some parts of their trips. This will be very helpful for caregivers, as it will allow them to avoid waiting on the phone by allowing them to log in and book a trip as needed. This will create an added benefit to customers that have a medical condition that will require rescheduling services after receiving a treatment.

At this stage, JTA does not have a formal training program for agencies utilizing the service. However, after Phase 2 is completed, there will be a marketing plan that will help identify the future course of action for TransPortal. JTA wants to demonstrate to riders the advantage of creating an account and facilitating

travel to/from destinations such as Veterans Administration (VA) centers, medical providers, and main regional connection points.

There are no additional transportation services being provided as a result of TransPortal, but JTA is looking at different types of services models to be included in the region, such as express routes.

Recommendations

One of the partners in TransPortal is Councils on Aging (COAs). The challenges associated with COAs is that their technical and resource capacity is often limited. If a person from a COA retires, the institutional knowledge can be lost. To compensate for this, the region needs to provide the COAs with technical resources to create stability. Also, smaller agencies may have a fear that regional transportation will take over their services. Thus, JTA recognized that they needed to build trust with smaller systems.

One recommendation is to have one person from each provider dedicated to a project like TransPortal. For the stakeholders, including COAs, this was critical for their participation in TransPortal. While coordination of regional transportation involves political conversations, the staff involved in coordination and a project like TransPortal should be technical. Once TransPortal was part of bigger conversations in the public, it gained political support (without having political participation in the working group).

JTA is still working on fostering relationships with existing service providers and updating TransPortal. One of the updates planned includes creating processes for service providers to more easily update their information in TransPortal.

Given the success of TransPortal, JTA envisions their system being connected with other transportation modes such as bike sharing and TNCs (e.g., Uber, Lyft). The evolution of TransPortal will focus on enhancing mobility by providing information on all possible transportation options and creating a unified payment system. Thus, the traditional concept of mobility could be expanded, and services will not only be provided to seniors but to every traveler in the region.

Chapter 6. Overall Case Studies Results and Conclusions

While the projects described in each Case Study were unique in terms of the technology used to facilitate service coordination and approaches to each service stage, there were similar project results and lessons learned. The overall results of the Case Studies can be summarized as follows:

- TMCC stakeholders may require training to understand, adopt, and value the systems engineering approach to planning, developing, and deploying TMCCs
- TMCC stakeholders, regardless of their technical know-how, play a crucial role in TMCC development and deployment – without their participation in identifying needs, verifying requirements, and testing, TMCC deployments are not necessarily successful
- TMCCs can enable changes in transportation services and result in higher ridership due to higher levels of service coordination and improved information
- TMCC sustainability is not necessarily based on technology – it is based more on industry evolution and standardization

Typically, human service organizations and smaller transit agencies may not possess staff with skills in systems engineering or using a structured approach to develop and deploy technology systems. Further, stakeholders in TMCC projects may find it daunting to employ a process that they are not necessarily familiar with. This situation was experienced in the original series of MSAA projects that were conducted from 2006 to 2014. Recognizing this situation necessitated the delivery of several presentations that explained systems engineering to non-technical MSAA participants. The same situation happened in the most recent MSAA projects, prompting similar presentations.

The organization leading the TMCC development, such as those agencies that are the subject of the Case Studies, may need to educate project partners throughout the entire project on the systems engineering process so that they will understand not only the process, but the value of utilizing such a process for this and other similar types of projects. LYNX in particular used this approach successfully to educate stakeholders about the process.

Regardless of their technical know-how, stakeholders are necessary for a variety of reasons in TMCC projects. First, while TMCCs could be developed by individuals or single organizations, it is likely that they will not be able to identify all the user needs that the TMCC must satisfy. Second, insight by stakeholders who are very knowledgeable about various transportation service provision stages, social service, and healthcare clients and care-givers, and funding organizations is necessary to ensure that critical user needs are identified and verified. Finally, TMCC "ownership" is necessary for sustainability – this is required not only by the leading organization, but by all project participants. The best example of this is the strong and active participation in the SLO County TMCC project by a variety of stakeholders.

While TMCCs are not typically developed to add new transportation services to a region or local area, the deployment of TMCCs can enable changes in transportation services that result in higher ridership. In

areas that provide paratransit service, riders and individuals and organizations that assist riders (e.g., human service agencies) may not be aware that other more cost-effective services are available. Also, if regional or local services are not coordinated, duplication of services may occur, meaning higher costs for the service providers and riders. This was evident in the RTD project – both RTD and Via were providing duplicative services in the same areas. Their deployment of the trip exchange system resulted in people taking trips that they may not have ordinarily, as well as reduced costs to both coordinating agencies.

TMCC sustainability was an issue that resulted from a few of the original MSAA projects. In these situations, the TMCCs ceased operations because of changes in staffing (e.g., new General Managers). In some cases, new staff were not convinced of the value of the TMCC, so they determined that it was not worth continuing operations. It is clear from the Case Study agencies that sustainability was considered in TMCC development and it was not made dependent on technology or individuals. For example, the JTA TransPortal was developed as a part of a coordination plan and has become an integral part of transportation in the region, particularly for more vulnerable populations. The reason for this is the participation by key organizations that developed the regional coordination plan in TransPortal's development and continued support (not individuals). To ensure that the TMCC/system is sustainable, stakeholder participation must be at the organizational level, not at the individual level.

The four key conclusions of the Case Studies are as follows:

- A systems engineering approach results in a TMCC/system that meets users' needs.
- Partnerships and stakeholder engagement are critical to successful TMCC/system deployment, but they require leadership and significant efforts to foster and maintain, as well as to encourage useful participation and critical input throughout the whole process (from planning through deployment).
- Typically, the biggest challenges in TMCC/system development and deployment are institutional in nature, not technological.
- Phasing the TMCC/system deployment can ensure that something useful is delivered as soon as possible, and the impacts resulting from a new system can be experienced a little at a time.

Systems engineering has been proven to result in successful technology planning, design, development, and deployment. It is no different with TMCCs – this type of structured process has resulted in systems that meet users' needs and satisfy functional requirements. Three of the four case studies show the importance of using systems engineering, but they also highlight what is necessary to show project stakeholders the value of this approach. The term "systems engineering" may not be used explicitly in two of the three cases, but that is the process they followed. In one case, the SLO County TMCC project, Mark Shaffer has mentioned through the project that without this structured process they would not have been successful in designing a system that meets the needs of the stakeholders. Further, LYNX relied on systems engineering to successfully develop and deploy MORE-TMCC, as well as making other changes (e.g., co-locating and cross-training staff) after its deployment.

"Leadership is an important but often overlooked component of technical projects and programmes. It addresses the performance of people: their behaviours, their ability to think individually and collectively, their motivation and energy. Technical leadership in systems engineering creates the environmental conditions conducive to good performance, supporting shared understanding, innovation, problem

solving, resilience and learning."[4] In each Case Study, leadership helped to overcome the challenges associated with stakeholder participation, such as encouraging continued participation throughout the project and "buy-in" of the system being developed. For example, in the case of the SLO County TMCC, leadership by UCP/Ride-On Transportation has brought all possible stakeholders to the table even though some stakeholders' objectives compete with other stakeholder objectives. Collectively, the stakeholders came to consensus about the TMCC's vision and design under UCP's leadership.

As RTD pointed out in their phone interview, the biggest challenge in TMCC development is not technological but institutional. This conclusion stems from their example about the development of "business rules" that govern the trip exchange system. Each organization had its own business rules for operating service, and had to collaborate on identifying the rules to facilitate automated trip exchange. For example, as noted in their ConOps, business rules were defined as "user-defined rules describing how a system functions. Software scheduling systems have a set of business rules that define how the system responds to a variety of circumstances." Standardizing the term "business rules" greatly facilitated the work that needed to be accomplished to "establish business rules that will be consistent across all stakeholders."

Each Case Study took a phased approach to TMCC deployment. In a few cases, this was required due to MSAA funding, which provided support for the systems' planning and design, but the deployment would nonetheless be accomplished with different funding. However, in each case, a phased implementation resulted in the following benefits:

- A useful portion of the system was delivered as soon as possible, showing not only progress, but keeping stakeholders and funders engaged in the project.
- Impacts due to system deployment can be experienced a little at a time. The JTA TransPortal project exemplified this – Phase 1 deployed an initial system without a lot of marketing or training, while Phase 2 is focused on completing the link between schedules and TransPortal, updating the user interface, providing more functionality for an individual to cancel service, encouraging participating agencies to keep their information updated, marketing the system, and providing some training.

Spreading out the delivery may provide more opportunities to pursue new funding.

[4] "Technical Leadership in Systems Engineering," SEBoK: Guide to the Systems Engineering Body of Knowledge, http://sebokwiki.org/wiki/Technical_Leadership_in_Systems_Engineering, accessed December 12, 2017.

Appendix A. Case Study Survey Questions Administered via SurveyMonkey.com

Contact Information

The questions in this survey focus on the project we have previously contacted you about via email. We believe your project is a great example of how to plan and deploy technology to facilitate operations or service coordination and your expertise will benefit other agencies. We would like to thank you in advance for taking the time to complete this survey.

* 1. Name

* 2. Agency

* 3. Phone

* 4. Email

General Agency Information

* 5. Agency Type

- ◯ Public Transportation Agency
- ◯ Human service or faith-based transportation provider
- ◯ Human service agency with involvement in mobility programs
- ◯ Other entity with a similar purpose (please specify below)
- ◯ Regional planning or workforce development agency
- ◯ State or local transportation funding agency
- ◯ Contractor that provides transportation on behalf of a transit or health and human service agency

* 6. Agency Location *(City, State)*

* 7. Population in Service Area *(numeric field)*

* 8. Number of **Full-time** Staff:

- ◯ 1-5
- ◯ 6-10
- ◯ 11-15
- ◯ 16-20
- ◯ 21-25
- ◯ 25+

* 9. Number of **Part-time** Staff:

- ◯ 1-5
- ◯ 6-10
- ◯ 11-15
- ◯ 16-20
- ◯ 21-25
- ◯ 25+

* 10. Does your agency have a staff member who is specialized in technology and/or systems engineering?

- ◯ Yes
- ◯ No

* 11. Does your agency have access to a staff member who is specialized in technology and/or systems engineering in a different department or agency?

- ◯ Yes
- ◯ No

* 12. Type of transportation services provided. *Please select all that apply*

- ☐ Paratransit/Demand responsive service
- ☐ Fixed-route service
- ☐ Route deviation (point deviation or route deviation) service
- ☐ ADA paratransit 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
- ☐ Other (please specify)

* 13. Number of vehicles *(numeric fields)* :

Fixed-route vehicles	
Paratransit/demand response vehicles	
Other vehicles	

* 14. Total Annual Ridership including All Services *(numeric field)*

* 15. Number of demand-response trip requests per month*(numeric field)*

* 16. Actual number of demand-response trips provided per month*(numeric field)*

17. Annual Fare Revenue *(numeric field)*

* 18. Size of service area in square miles*(numeric field)*

* 19. Hours of operation

		hh	mm	AM/PM
Monday - Friday	**From**		:	-
Monday - Friday	**To**		:	-
Saturday	**From**		:	-
Saturday	**To**		:	-
Sunday	**From**		:	-
Sunday	**To**		:	-

* 20. Do you have a separate line item in your budget for technology?

- ◯ Yes
- ◯ No
- ◯ Have budget for technology research and deployment, but not as a separate item.

Project Information

The objective of this section is to gather details about the nature of your technology project. Not all questions may be applicable, particularly if your project does not include a specific aspect in question. For these questions, please answer 'Not Applicable'.

* 21. Project Title

* 22. Project Sponsor(s)/ Grantor(s)

* 23. Project Partners

* 24. Project Budget

* 25. Project Funding Source(s)

* 26. Project Start Date

Date MM / DD / YYYY

* 27. Project End Date

Date MM / DD / YYYY

* 28. Brief Project Description

* 29. Project Website

* 30. Was this project specified in a Transportation Plan or referenced as a program?

- Yes
- No

If Yes, which plan?

* 31. What challenges faced your agency in terms of service coordination that led to this project? *Please select all that apply*

- ☐ **Suppressed Demand**: Unmet demand for human service transportation exists in general, 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 is typically 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. This complicates trip planning for the users of public transit and human service transportation, as well as referring agencies
- ☐ Other (please specify)
- ☐ **Limited Coordination among Area Providers:** Limited coordination exists among human service transportation providers. Opportunities exist to eliminate duplicative service, to extend service hours and geographic coverage through the coordination of 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
- ☐ Not Applicable

* 32. What technology(ies) has your agency deployed or expect to deploy as part of this project? *Please select all that apply*

- ☐ Automated scheduling, dispatching, and routing systems
- ☐ Travel Management Coordination Center (TMCC) Customer Interface (e.g., Interactive voice response [IVR], web portal, kiosks, other automated customer access interfaces)
- ☐ Automated traveler information and/or trip planning systems, particularly for customers with accessibility challenges
- ☐ Vehicle communications (e.g. Mobile Data Terminals/Computers and/or other mobile communications devices)
- ☐ Automatic vehicle location (AVL) and/or other systems that assist the operations of demand-response service
- ☐ Other (please specify)
- ☐ Automated fare payment and management (collection and processing) systems
- ☐ Automated Third-party Billing
- ☐ Automated Eligibility Certification Process
- ☐ TDD/TTY
- ☐ Not Applicable

* 33. Project technology deployment status. *Please select only one phase of deployment*

	Planning	Design	Implementation	Testing	Fully deployed
What is the highest level of deployment that your project has achieved to date? (*Please select only* ***one***)	○	○	○	○	○

* 34. If your agency deployed technology as part of this project, how did you determine the need for the technology? *Please select all that apply*

- ☐ Determined the need internally
- ☐ Asked stakeholders and customers about their needs for improved service(s)
- ☐ Did not consider needs in planning and deploying the technology
- ☐ Other (please specify)
- ☐ After seeing another agency with that technology
- ☐ After seeing that technology at a tradeshow
- ☐ Not Applicable

* 35. If your agency deployed technology as part of this project, how did you determine the technology requirements that the new system or technology would have to meet? *Please select all that apply*

- ☐ Developed/determined the requirements internally
- ☐ Asked stakeholders and customers to help your agency determine the system requirements
- ☐ Did not use system requirements in the procurement and deployment of the technology
- ☐ Other (please specify)
- ☐ Used requirements from another agency that deployed the same technology/system
- ☐ Used requirements supplied from a vendor that provides this kind of technology/system
- ☐ Not Applicable

* 36. If your agency deployed technology as part of this project, was the technology procured using a competitive process?

- ◯ **Yes,** we used a competitive Request for Proposals (RFP) process
- ◯ **Yes,** we used a one-step Invitation for Bid (IFB) (low cost) process that required that the vendor provide the system described in the specifications provided in the IFB
- ◯ **Yes,** we used a two-step IFB process that first selected "qualified" vendors and then provided the specifications in an IFB to only those vendors that qualified in the first step
- ◯ Other (please specify)
- ◯ **No,** we were able to sole-source the work to a vendor
- ◯ **No,** we developed the technology/system internally
- ◯ Not Applicable

* 37. In this project, what process did your agency use to ensure that the technology/system met all requirements/specifications? *Please select all that apply*

- ☐ Used a "traceability" approach – one in which each requirement is documented, and whether it has been met or not is documented at every testing phase
- ☐ Used a regularly-scheduled meeting or phone call to discuss an Action Item List as the vendor is implementing the technology/system
- ☐ Used payment milestones – each of which needs to be completed in full to the agency's satisfaction before the vendor is paid for each milestone
- ☐ Allowed the vendor to determine whether or not the requirements are being met by the technology/system
- ☐ Required the vendor to update the project schedule on a regular basis
- ☐ Required that multiple stakeholders "sign off" on each of the vendor's invoices
- ☐ Not Applicable
- ☐ Other (please specify)

* 38. If this project included trip reservations, how does a customer access the process for requesting a trip reservation?

- ○ **Manual Centralized:** Stakeholders decide to 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 live to a 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):** Stakeholders decide to pool their resources and centralize the access point for the customer through a single automated point (most typically a toll free number, but can be combined with other means, such as internet or kiosks (as discussed below), but decide to use technology (typically telephony in combination with IVR) to automate the access into the next stage.
- ○ **Automated Decentralized (with Manual Option):** Stakeholders decide to retain their own individual customer access means, but decide to use technology (typically telephony in combination with Interactive Voice Response) to automate the access into the next stage.
- ○ **Automated Hybrid Centralized / Decentralized (with Manual Option):** Stakeholders decide to retain their own individual customer access means, but to create a centralized access point as well. This enables a "No wrong number" approach to customer convenience whereby the customer gains access to the same support for requesting a reservation regardless of the number called. At the same time the TMCC stakeholders decide to use technology (typically telephony in combination with IVR) to automate the access into the next stage.
- ○ Not Applicable
- ○ Other (please specify)

* 39. If this project included automated interfaces, what interfaces are included for automating customer access to the reservation system? *Please select all that apply.*

- ☐ Telephony with IVR
- ☐ Web portal (with potential for web-based mobile device)
- ☐ Kiosks located at key locations
- ☐ Not Applicable
- ☐ Other (please specify)

* 40. If this project included special customer interfaces, which customer interface features are included?
Please select all that apply

- [ ] TDD/TTY
- [ ] Multi-lingual capability for the automated systems
- [ ] Not Applicable
- [ ] Other (please specify)

* 41. If this project included trip eligibility determination, what approach have you adopted?

- ○ **Manual Centralized:** Stakeholders decide to centralize their eligibility databases and share staff resources so that a call to the centralized access number leads the customer to a call center where a call agent makes a determination on the spot of trip eligibility. If the requested trip is not eligible, the call agent can carry out an Information and Referral service for the customer, or even conduct the primary steps towards certification.
- ○ **Automated Centralized:** Stakeholders decide to build a centralized eligibility database and pool their resources to build an automated eligibility determination portal in order to automate the access into the scheduling stage.
- ○ **Automated Decentralized:** Stakeholders decide to retain separately their own individual customer certification process and eligibility databases (which are not shared). Technology is used to create an automated eligibility determination database portal.
- ○ Not Applicable
- ○ Other (please specify)

* 42. If this project included a centralized eligibility database, what is the nature of it?

- ○ **Centralized Look-up Trip Eligibility Database:** Eligibility certification remains under the control of each respective stakeholder, and they maintain their own eligibility databases. However, they jointly create a centralized look-up database, which is updated frequently so that new eligible customers become incorporated and eligible for trip reservation.
- ○ **Unified Eligibility Process and Database:** Stakeholders pool their resources to create a unified certification portal and process that recognizes distinct eligibility rules of the different service providers.
- ○ Not Applicable
- ○ Other (please specify)

* 43. If this project included a trip eligibility screening process, what technology have you instituted for the trip eligibility determination screening application?

- ◯ Automated web-based screening tool
- ◯ Automated IVR-based screening tool
- ◯ Not Applicable
- ◯ Other (please specify)

* 44. If this project included trip scheduling, how is a customer-requested trip scheduled? All options are automated and assume a computerized scheduling system.

- ◯ **Centralized scheduling:** In this option, the TMCC stakeholders decide to forward all trip requests to a single centralized scheduling system.
- ◯ **Shared scheduling platform with shared coordination:** In this option, stakeholders agree to conduct a pooled purchase of the scheduling system in order to establish a common platform from which to work. Each stakeholder performs its own scheduling. If there is One Call-One Click customer access, a stakeholder may be designated as lead or the stakeholders may share the scheduling responsibility to cover extended hours of service.
- ◯ **Decentralized scheduling with common trip-planning interface:** Stakeholders are decentralized with respect to the control of their scheduling, and operate on independent system platforms, but are linked through a common automated trip-planning interface. Trip requests are forwarded to all potential transportation providers for potential scheduling, based on pre-defined business rules. 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. Stakeholders are decentralized, and they maintain their own autonomy for scheduling trips for their clients.
- ◯ Not Applicable
- ◯ Other (please specify)

* 45. If this project included trip booking and confirmation, how is a customer-requested trip booked and confirmed?

- ○ **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 all mobility service provider stakeholders based on pre-defined rules. The system optimizes schedules over all vehicles and can automatically determine the schedule and route of the trip. The booking of the trip is confirmed immediately to the customer. The method of confirmation depends on how the customer accessed the reservation system (i.e. by telephone, internet, or through a call agent).
- ○ **Computer-Assisted Decentralized Trip Request-Sharing and Booking with Separate Confirmation:** Stakeholders are decentralized with respect to the control of their scheduling, and operate on independent system platforms, but are linked through a common automated trip-planning interface. Trip requests are forwarded to all potential transportation providers for potential scheduling. However, booking and confirmation happen as separate subsequent steps.
- ○ **Automated Decentralized Marketplace Booking and Integrated Confirmation:** Stakeholders are decentralized with respect to the control of their scheduling, and operate on independent system platforms, but are linked through a common real-time trip-planning interface that is fully automated. Trip requests are automatically forwarded to all potential transportation providers for potential scheduling and the individual scheduling systems return available options for consideration by the customer. The customer chooses in real-time the most desirable option, which is then booked (accepted by the stakeholder system as scheduled and routed), and the confirmation is immediately provided to the customer or reservation agent. This is akin to the well-known approach used for trip planning in the air travel market (e.g. Travelocity, Expedia, etc.).
- ○ Not Applicable
- ○ Other (please specify)

* 46. If this project included dispatching, how is a booked trip dispatched?

- ◯ **Manual Decentralized:** Stakeholders decide to share/pool their resources in the previous stages, but to maintain totally separate, and manual, processes for later stages. Manifests are distributed manually to drivers, and updated by radio / telephone. New 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 to the mobile devices (smart phones or tablet computers) of the drivers.
- ◯ **Automated Decentralized:** Stakeholders decide to retain their own individual operational control in the field, but decide to use technology in the field operations such as dispatching, vehicle management, etc. Joint procurement of the technology (e.g. CAD/AVL) may offer some modest economies of scale.
- ◯ **Automated Decentralized with Potential Transfer of Control:** Stakeholders decide to retain their own individual operational control in the field, but decide to use technology in the field operations (e.g. dispatching, vehicle management, etc.), and 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 (e.g. CAD/AVL) offers some modest economies of scale.
- ◯ Other (please specify)

  [ ]
- ◯ **Automated Centralized:** Stakeholders decide to 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.
- ◯ Not Applicable

* 47. If this project included vehicle management, what is your new approach to vehicle management?

- ○ **Manual Decentralized:** Stakeholders decide to share/pool their resources in the previous stages, but to maintain totally separate, and manual, processes for later stages. Manifests are distributed manually to drivers, and updated by radio / cellular communications. There is no technology used for tracking vehicle location, or logging data.
- ○ **Automated Decentralized:** Stakeholders decide to retain their own individual operational control in the field, but decide to use technology in the field operations such as dispatching, vehicle management, etc. Joint procurement of the technology (e.g. CAD/AVL) may offer some modest economies of scale.
- ○ **Automated Decentralized with Potential Transfer of Operational Control:** Stakeholders decide to retain their own individual operational control in the field, but decide to use technology in the field operations (e.g. dispatching, vehicle management, etc.), and to procure the system with a functionality that would allow potential transfer of operational control responsibility under conditions selected by stakeholders (e.g. for days of the week or hours that extend beyond a given provider's normal hours). Joint procurement of the technology (e.g. CAD/AVL) offers some modest economies of scale.
- ○ Other (please specify)
- ○ **Automated Centralized:** Stakeholders decide to 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.
- ○ Not Applicable

* 48. If this project included vehicle management, what functionality is in the new vehicle management system? *Please select all that apply*

- ☐ Integrated voice and data communications or separate systems
- ☐ Tracking of vehicle location: location and comparison to time predictions, or location only
- ☐ Navigation guidance for driver
- ☐ Other (please specify)
- ☐ Pre-defined driver reporting / messaging capability (e.g. arrival, no-shows) with time / location stamp from AVL system
- ☐ Alarm capabilities
- ☐ Not Applicable

* 49. Did this project include deploying on-board security systems?

- ◯ Yes
- ◯ No
- ◯ Not Applicable

* 50. If this project included fare collection, how is the new fare collection system managed?

- ◯ **Manual Decentralized:** Stakeholders decide to maintain totally separate and manual processes for fare collection. Fares are collected manually through cash or tickets.
- ◯ **Automated Commercial Decentralized:** Stakeholders decide to retain total control of their individual fare management systems, but decide to jointly procure a common fare technology by using a commercial financial institution credit card / debit card payment solution. Point-of-sales readers are located in all vehicles, and could be designed as stand-alone readers or integrated with on-board vehicle management computers (MDTs). Transactions would be processed through a financial institution. The joint procurement would offer economies of scale in procuring the system. The automated commercial decentralized fare management system may require stakeholders to agree on common fare classification categories.
- ◯ **Automated Centralized:** Stakeholders decide to pool their resources and acquire an automated and centralized fare management system. The system will include a common back-office clearinghouse, and readers on all vehicles; the readers may be stand-alone or integrated with on-board vehicle management computers (MDTs). The fare cards may provide pre-paid media (e.g. tickets and passes) and / or stored value cards. The clearinghouse system will be operated as a centralized integrated system, tracking all fare transactions and providing centralized reporting. In many cases, one of the larger stakeholders (such as a transit system) will lead the fare management system procurement, deployment, and operation. The automated centralized fare management system requires stakeholders to agree on common fare classification categories and an integrated fare structure.
- ◯ Not Applicable
- ◯ Other (please specify)

* 51. Does this project include a new process to validate a customer's identity through a personalized card with photo?

- ◯ Yes
- ◯ No
- ◯ Not Applicable

* 52. If this project included a new fare management system, does the new system include a customer billing capability that enables the creation of an account for each customer, and the billing, or collection from a pre-authorized bank account, of fares after the trip has taken place?

- ◯ Yes
- ◯ No
- ◯ Not Applicable

* 53. If this project included data management, how is the data managed now?

- ◯ **Manual:** No technology exists to collect and synthesize data on customer trips, vehicle activity, or performance. Any data collected is entered manually based on communications between drivers and dispatchers, or customers and transportation staff. No sharing of data exists between stakeholders.
- ◯ **Automated Decentralized:** Individual stakeholders have deployed technology that enables the collection and synthesizing of data on customer trips, vehicle activity, and performance. No sharing of data however exists among the stakeholders.
- ◯ **Automated Decentralized with Common Data Repository:** Individual stakeholders have deployed technology that enables the collection and synthesizing of data on customer trips, vehicle activity, and performance. Stakeholders have agreed to create a common data repository for the purpose of sharing select 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:** Stakeholders have deployed an integrated centralized system for scheduling, dispatching, and vehicle management. 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.
- ◯ Not Applicable
- ◯ Other (please specify)

* 54. If this project included new data or data management, how is the data on service provision organized and processed for reporting and billing now?

- ◯ **Manual:** 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:** 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:** The common depository has been designed to enable 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 stakeholder manages the reconciliation between the individual billing and fare management systems, as well as internal financial management needs.
- ◯ **Automated Centralized:** 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 provider receives from the centralized system all required internal management reports on an automated basis.
- ◯ Not Applicable
- ◯ Other (please specify)

Project Impacts

The objective of this section is to identify the benefits, outcomes, challenges, lessons learned and opportunities resulting from your technology project.

* 55. What benefits resulted from this project? *(For example: Expanded hours/increased flexibility for customers.)*

* 56. What are some successful outcomes from this project? *(For example: More efficient and less duplicative services.)*

* 57. What challenges did your agency face in adopting/deploying technology in this project?*(For example: A TMCC implies by its very nature the sharing of resources between agencies with different perspectives and objectives. Deciding what resources to share and how creates significant institutional challenges.)*

* 58. What are the lessons learned from this project regarding planning and deploying technology?

* 59. What opportunities have your agency experienced because of this project ?*(For example: Better use of limited public resources.)*

Source: Schweiger Consulting, LLC; Battelle

Appendix B. List of Acronyms

ADA	Americans with Disabilities Act
AVL	Automatic Vehicle Location
BRTA	Berkshire Regional Transit Authority
CALTRANS	California Department of Transportation
ConOps	Concept of Operations
COA	Councils on Aging
DRMAC	Denver Regional Mobility and Access Council
FTA	Federal Transit Administration
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
JPO	Joint Program Office
JTA	Jacksonville Transportation Authority
LSCOG	Lower Savannah Council of Governments
LYNX	Central Florida Regional Tranist Authority
MaaS	Mobility as a Service
MORE-TMCC	Model Orlando Regionally Efficient Travel Management Coordination Center
MSAA	Mobility Services for All Americans
RTD	Regional Transportation District
SLO	San Luis Obispo
TDD	Telecommunication Device for the Deaf
TNC	Transportation Network Company
TMCC	Travel Management Coordination Center
UCP	United Cerebral Palsy
VTCLI	Veterans Transportation and Community Living Initiative

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