FTA RESEARCH

FEDERAL TRANSIT ADMINISTRATION

Kent, Ohio Traveler Management Coordination Center (TMCC)

Final Report

MARCH 2014

FTA Report No. 0063
Federal Transit Administration

PREPARED BY

Portage Area Regional Transportation Authority

COVER PHOTO

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PREPARED BY

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SPONSORED BY

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Metric Conversion Table

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

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13. ABSTRACT

A project team consisting of the Portage Area Regional Transportation Authority (PARTA), Geauga County Transit, Trapeze Group, and Kotting Consulting assembled a proposal to design a model system of human service transportation coordination using Intelligent Transportation Systems Technology (ITS). This project was one of eight demonstration grant sites, and although each began with similar assumptions and a prescribed methodology, each developed a unique approach to the problem and generated different models.
This report summarizes the system development and design work conducted to support a Traveler Management Coordination Center (TMCC) for Human Service Transportation (HST) for the residents of Portage and Geauga counties in Ohio. The TMCC has been designed for the residents of these counties through the cooperation of two transit systems; two county governments; State, regional, and local human service agency leadership; and several public and private transportation and transportation-service related organizations. This TMCC is known as NEORide and has been structured to employ the transportation resources of its members, obtain greater efficiencies and effectiveness through the capture and application of information, and enhance the range and utility of shared-ride transportation.

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FOREWORD

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The study addressed broad issues of public policy, constituent interest, and client needs as well as significant technical issues. This report is , however, primarily non-technical and is suitable for a general audience with interest in a comprehensive approach to improved delivery of transportation services.

Both transit systems have experience in the use of computer-based scheduling software, and the Portage Area Regional Transportation Authority (PARTA) has additional experience with Mobile Data Terminals (MDT) and Automatic Vehicle Location (AVL) technologies. The applications of the technologies have begun to deliver expected efficiencies and carry the promise of considerably greater effectiveness.

While both transit providers were steadily enhancing services via the use of technologies, and public support for transit and human services remained high, several common perceptions existed before the start of this project. Specifically:

- Buses and vans were too often running near empty or empty.
- Response times were excessive.
- The public was not aware of transportation alternatives.
- Many transportation needs were not being met.
- Shared-ride transportation was for someone else.

The United We Ride/Mobility Services for All Americans ITS demonstration grant program, however, created a real opportunity to rapidly transform the basis of interagency relationships in the same manner that the Internet has transformed other industries.

ABSTRACT

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This study partnership brought together a highly diverse team with demonstrably different motivations to focus on the development of such a model. That diversity sponsored some understandings regarding fundamental approaches to the project. Those understandings addressed:

- How to define the desired outcomes.
- How to manage appropriate technologies.
- How to assure implementation.
- That technical design would be determined by local stakeholder consensus.
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EXECUTIVE SUMMARY

This report documents the major results of a 15-month effort to design a system of human service transportation coordination using Intelligent Transportation Systems (ITS) technologies in Portage and Geauga counties, Ohio. This report is intended for use by the Federal Transit Administration (FTA) for project evaluation and as a record of local transportation coordination efforts.

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This report includes and amends content from a prior Final Report submitted in August 2008.

The geographical focus for the project is Northeast Ohio, specifically Geauga and Portage counties. These two adjacent counties are suburban/semi-rural and are located amid the more populous and urban centers of Cleveland, Akron, Canton, and Youngstown. Portions of the two counties are suburbs of the larger surrounding urban concentrations. Thus, communities on the western boundary of Geauga County and the northwest corner of Portage County are oriented strongly toward Cleveland; communities along the eastern boundary of both Geauga County and Portage Counties are oriented toward the Youngstown/ Warren area, and communities in the south and west of Portage County are oriented toward Canton and Akron, respectively.

Portage County is divided into political subdivisions consisting of 5 cities, 7 villages, and 18 townships. Townships contain about 51 percent of the population, cities 43 percent, and villages 6 percent. Geauga County is divided into 1 city, 4 villages, 2 unincorporated census-designated places, and 16 townships. Only the County Seat, Chardon, exceeded 5,000 in population in the 2000 census.

Gross comparisons of Geauga and Portage counties show that Geauga County is less populous and is uniformly less densely-populated than Portage County. Portage County's population is more concentrated in a few communities. The Metropolitan Planning Organization (MPO) for Geauga County is the Northeast Ohio Areawide Coordinating Committee,(NOACA); Portage County is served by the Akron Metropolitan Area Transportation Study (AMATS).

Both counties are served in their entirety by publicly-funded transit systems. Geauga County Transit operates as part of the County's administrative structure, and the Portage Area Regional Transportation Authority (PARTA) is a Regional Transit Authority organized under Section 306 of the Ohio Revised Code. Both transit providers are deeply involved in the delivery of human service transportation. Geauga County Transit provides transportation to 20 human service agencies through contract, and these services form the core of all publicly-available services in Geauga County. Geauga County Transit provides

approximately 225 door-to-door trips per day. Because Geauga County is rural in nature, there is little demand for fixed-route transit services.

PARTA, like Geauga County Transit, historically has been based on contracted services with human service agencies. PARTA's Dial-A-Ride service provides 500–700 door-to-door trips per day. While it maintains contracts with a wide variety of human service agencies, it is also a provider of "big bus" transit services, linking the larger communities in Portage County with daily scheduled services. PARTA operates 2–7 local fixed routes using approximately 3–19 buses depending on the time of year. Periodic changes in the level of service result from providing contract transit service to Kent State University's Campus Bus Service. Service to Akron is provided seven times a day, and service to Cleveland is provided twice a day.

Geauga County Transit receives rural transit funding, and PARTA qualifies for urban area funding. In addition to publicly-funded services, private charter coach operators and non-emergency medical transportation services are available in both counties. Taxi services also have been operated in both counties, although there is little continuous experience with taxi services in either county.

The two counties are served by two Area Agencies on Aging: Geauga County is within the Western Reserve Area Office's district, and Portage County is within the 10b Area Agency's district. The leadership of the Western Reserve agency has a proven record with regard to transportation coordination, having been a key partner in the development of Cuyahoga County's Senior Transportation Connection. The 10b Office on Aging is also highly supportive of coordination efforts.

Both counties also have substantial fleet operations associated with their Board(s) of Mental Retardation and Developmental Disability (MRDD) programs. Veteran's Services Offices in each county provide services, principally access to Cleveland area VA hospitals. A number of other social services programs and agencies operate transportation on a very small scale for specific population(s).

In both counties, the contracts between human service agencies and the transit operator may include special services to agency clientele or fare subsidy on generally-available services. Travel information services are provided through multiple, though uncoordinated, means. Both transit systems support telephone and Web inquiries. In addition, each county has 211 information and referral services provided by their respective United Way offices. At present, regional Information & Referral resources provide relatively little transportation-specific information.

There are a variety of specialized transportation services, including employer-sponsored vanpools, ambulettes and volunteer driver programs. In addition, Geauga County is served by a number of individuals who operate transportation

service tailored to the Amish and Mennonite communities. These services have been quietly operated without much notice, but they could bring useful capabilities to a coordinated transportation system. Portage and Geauga counties have demonstrated sustained interest in the coordination of human services transportation for decades. In each county, transit services initially were based on contracts with human service agencies, and both transit operators continue to explore service relationships with public and private organizations. Both transit systems have experience in the use of computer-based scheduling software, and PARTA has additional experience with Mobile Data Terminals (MDT) and Automatic Vehicle Location (AVL) technologies. The applications of these technologies have begun to deliver expected efficiencies and carry the promise of considerably greater effectiveness.

While both transit providers were steadily enhancing services via the use of technologies, and public support for transit and human services remained high, several common perceptions existed before the start of this project. Specifically:

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SECTION

1

Introduction

Background

With more than 60 federal programs having transportation components, hundreds of regional agencies with oversight responsibilities and literally thousands of local agencies charged with the administration of these programs, it should come as no surprise that there are significant barriers to coordinating human service transportation. Despite the evident logic of sharing the ride and some high-level support for coordination of publicly-funded transportation, there has been remarkably little progress over the last 30 years. When coordination has arisen, it typically has relied upon exchanges of financial resources, which, in turn, rely upon rare levels of commitment and trust sufficient to overcome institutional reluctance. To create a model of coordination that could be replicated and scaled, trust could not be assumed, even if present locally. It was necessary to find something to substitute for resources as a medium of exchange and something to replace trust as the basis of mutual assurance.

The first step in determining how coordination could be continuously assured was an inventory of local institutional assets, strengths, and weaknesses that would be germane to new organizations and relationships.

There are 16 human services agencies and transportation providers that have some type of transportation capabilities in Portage and Geauga counties. Two organizations that have demonstrated unusual creativity in their development are Coleman Professional Services and Family and Community Services in Portage County. Both of these organizations have applied new models to the delivery of human services, addressing public policy issues and objectives with entrepreneurial energy. They have proven themselves able to assess opportunities and risks accurately and establish exceptional new means and methods of service development and delivery and are continuously altering the landscape of local human services. To the extent that the objectives of the Transportation Management Coordination Center (TMCC) and these organizations dovetail, these organizations could be important participants.

The Geauga County Board of Commissioners has been a vital force behind coordination efforts to date. During the course of surveys and interviews with County staff, it has been uniformly clear that the Commissioners see coordination as a good business practice that should be advanced.

The Portage Metropolitan Housing Authority has a legacy of innovation that resulted in its designation as one of two dozen such authorities (known as "Moving to Work") nationwide that enjoy substantial regulatory relief. While the

Authority has noted that it does not wish to provide transportation, it recognizes that transportation is an essential element in helping individuals and families to break out of subsidized housing and attain economic independence. The relative autonomy of the Authority, its history of leadership, and the consonance of Authority goals with those of the TMCC suggest early opportunities for coordination.

Portage County's Office of Job and Family Services has provided the most eloquent, clear, and motivating statement of the relation of transportation to human services: "Transportation is the single greatest barrier to getting out of poverty." The Director made it clear that transit has not supplanted a private car as an absolute necessity for the working poor. When combined with the need for daycare stops to and from work, the Director noted a need for a revolutionary change in how transportation services are provided.

Other Portage and Geauga county organizations with interest in transportation include client advocate agencies, transportation providers, regional program administrators such as Emergency Management, and the Ohio Department of Transportation. All of these organizations have quickly grasped the potential for coordination through the application of technologies and have expressed individual and collective visions for a system of coordinated human service transportation. The only stakeholders that have transportation management technology are PARTA and Geauga County.

One of the structural weaknesses encountered was the administrative boundaries set by the State of Ohio's Medicaid policy. Although immediately contiguous, the two counties are in different Medicaid districts. In Ohio's Medicaid management, each district has a separate catalog of providers, and although there are good policy reasons for the organization, it creates unfortunate additional complication in the implementation of a system of coordination.

Technological innovations applied to transportation services have suggested that a means of providing transportation coordination can be realized through the exchange of timely information rather than agency resources. Further, the technical developments of the Internet and online purchases have suggested that immediacy of response and accurate reporting can substitute for the rarest of community attributes—trust.

That information can take many forms—from the notice of an open seat on a trip to a regional hospital to an audit-ready periodic report—but the expectation is that sharing information can create opportunity, reduce costs, allow greater utilization of existing resources, and contribute to quality of life. While some applied elements of ITS technologies have resulted in remarkable returns, the full application of an integrated system of ITS-based coordination has yet to be seen or evaluated.

Although these newer technologies have only been employed in two locations, there was a uniform realization in initial meetings with potential stakeholders that ITS applications could bring greater efficiencies and more productive services. Further, it was seen that advanced transportation policies and technologies may go beyond the provision of a human service safety net and actually assist human service clients to reduce their need for continuing support.

Through surveys, interviews, facilitated group processes, and presentations, the study team and early stakeholders established a detailed vision of a system of transportation coordination using IT technologies.

Defining the Desired Outcomes

The U.S. Department of Transportation's vision for coordination was expressed as a Travel Management Coordination Center or TMCC. The TMCC was further defined as a coordinated, simplified point-of-access, customer-based travel reservation, information, and trip planning service. In the course of local interviews, surveys, and group processes, participants determined specific characteristics for the TMCC.

In doing this, it was important not to constrain concept development or to direct concepts to products created by Trapeze Group, one of the project team members. It certainly would have been simpler to turn their technical expertise loose on the problem, but that would not have provided assurance of the design's suitability in other locations. Therefore, the team diverted discussion of specific IT technologies with stakeholders until they largely had determined a TMCC vision for the two counties.

The team decided that local team members would work within existing personal and professional networks to determine the details of human service transportation funding (especially service definitions) and to establish a foundation for coordination of services. There was an expectation of a federal cost allocation agreement (whereby federally-sponsored transportation programs could recover some part of the cost of services by transporting the clients of other federally-sponsored programs). This team felt that such an agreement would have removed much of the resistance to coordination that arises from scarce agency resources.

The Trapeze staff would be engaged in the development of tools to support coordination. From a technical standpoint, many of these technologies are currently available; however, each logistics platform maintains proprietary designs and algorithms. The new assignment for Trapeze was to design a means for the varied vendor platforms to share information appropriately without disclosing proprietary information. This demanded broad participation in the determination of what would be provided. The project employed multiple means of inquiry including:

- Surveys of companies and agencies to create a basic inventory of services provided, needs, usage, customer base, and relation to coordination of services
- Interviews at local and regional human service agencies, companies employing entry-level workers, transportation providers, and human service agency client families
- Facilitated group process with agency heads, client advocates, and transportation providers
- Informal discussion and presentations among all stakeholders

Throughout the inquiry, there was growing interest from outside the study area, and the participation of State and regional administrative and planning officials supported and guided the efforts.

Managing Appropriate Technologies

The basis of the TMCC is a virtual center known as NEORide. NEORide's functions were defined through a commercial product development model. The focus on marketable products arose from an early realization that outside funding for the operation of the TMCC could be unlikely or tenuous, no matter what value the TMCC brought to the community. The growth of the freight transportation logistics industry and travel websites such as Expedia, however, suggested that the provision of high-quality information services for local transportation was an economically viable enterprise.

The study team and stakeholders concluded that information itself—especially when captured efficiently, stored, and processed correctly and reported accurately—added considerable value to every aspect of transportation service provision. Each function that was conceived for the TMCC yielded a service enhancement such as efficiency, convenience, or security, and many of the enhancements could generate revenue for the operation of the TMCC.

Planning Implementation

Throughout the project, the study team maintained direct engagement with the State of Ohio's comprehensive coordination efforts through Department of Transportation's Office of Transit, The Transportation Partnership of Ohio (formerly the Ohio Transportation Coordination Task Force), the State's 511 activities, and Ohio's Executive Medicaid Management Administration (an independent, cabinet-level office that will coordinate the management of the Ohio Medicaid program across state agencies). NEORide's plan for transportation coordination was further endorsed by the Akron Metropolitan Area Transportation Study (AMATS) Coordinated Plan, which not only endorsed the

NEORide program for Portage County but effectively directed Akron METRO RTA to engage NEORide as provider of coordination services. The integration of UWR (United We Ride) and Mobility Service for All Americans (MSAA) efforts with State and regional policy and programming allowed the program's potential to be seen and embraced.

Institutional stakeholders typically were represented by the senior leadership of each organization, each of whom has been engaged in discussions of service coordination for years. To retain their participation and maximize involvement, the study team sought to make every opportunity for contact a special occasion. Every effort was made to respect the time constraints of key people and, thus, meetings were short, convenient, and meaningful and were held over lunch. The means of soliciting comments and suggestions were varied, including face-to-face interviews, a carefully-facilitated group process, and presentations. Efforts were made to make it clear that this project was indeed something new. In short, team members strove to attract participation in the study and succeeded in doing so. As a process technique, the insights of well- informed persons were obtained in an economical way and permitted local, regional, and state leadership to meet collegially and define a new and higher potential.

SECTION 2

Research Approach and Methodology

Study Methodology

The conduct of the research was largely directed by the application of a systems design methodology adopted by the UWR/MSAA team. Working from a vision enthusiastically expressed by local, State, and regional stakeholders, the study used this systems design methodology and progressively identified service and performance gaps, barriers, and opportunities and established general system requirements for coordination using ITS technologies and, finally, a detailed system design. The basis of the design is a TMCC that, in this case, is a virtual center known as NEORide.

Research Approach

Although potential stakeholders consistently endorsed these technological enhancements, it was also apparent that they would not, by themselves, deliver any measure of human service transportation coordination. Every element of human service provision has evolved to balance Congressional intent, regulatory oversight, local administration, and the management of staff in a complex set of procedures, and nothing in these procedures will yield simply because ITS technologies constitute a better idea. At the same time, a complete understanding of agency policies and procedures, if not adjustments to those policies and procedures, would be required to permit the technologies to function well.

For those coupled reasons, the study team sought to maximize the involvement of human service and transportation professionals and to be certain that the technological applications were directed by human service goals rather than mere enthusiasm for technology. The team was careful to avoid what the UWR/MSAA leadership described as "technology looking for a solution" (or application).

Creating a Vision

Via surveys, interviews, a facilitated group process, and group presentations, the local TMCC vision was established. Products desired by the human service community included:

- cost control tools
- accurate and audit-friendly reports

- shorter time between service request and service performance
- efficient multiple stop (home-daycare-work) trip scheduling
- some level of service at any time
- consistent access to service – subscriptions, late night and weekend services

Their clients wanted:

- privacy
- ease of use
- improved service quality and ease of use

Service providers sought:

- quick payment
- opportunities for group purchase
- opportunities to control costs and improve return on investment

Employers desired:

- consistent on-time performance

All of the individual expressed concerns as well as the objectives of the design process were assembled, presented, and subsequently endorsed as the vision for the TMCC. The overall vision of the TMCC includes the following items to enhance the service accessibility and operational efficiency of the system:

- Portage and Geauga County's transportation resources will develop new partnerships and employ new technologies to provide substantially more convenient and responsive transportation services in support of the health, welfare, and happiness of its citizens.
- This system will allow people to make work trips more easily on all shifts. Combining those work trips with access to child and adult daycare will be practical, i.e., use customer time and provider resources efficiently.
- More convenient access to medical and service facilities, including out-of-county facilities, will be provided. The measures of convenience inherently conflict. For example, operator on-time performance is vital and, yet, medical and service trips are of unknown duration. A new capability may need to be embedded into the culture and protocols at medical and service facilities, not unlike a concierge service.
- End-users will dial one number for transportation service. Trip scheduling, reservation, and dispatch will be much closer to real-time. Also, travel

information and scheduling capability will originate from a single (NEORide-branded) source and be convenient for customers, caregivers, and advocates. Information will be available 24 hours a day, 7 days a week by print, Web, phone, kiosk, TTY, and more.

- The system will allow for dynamic response to customer and community needs, yet will support responsible management of assets. The resources of the system will be ready, willing, and able to assist effectively in disasters. Group travel will be provided.
- The provision of transportation service will resemble a civic entitlement at street level, and billing and cost allocation will occur in the background.
- Vehicle specification and operator capability training and procedures will be appropriate for each passenger and every type of clientele.
- Customer personal information will be secure.
- Funding will be aggregated as needed without creating auditing dilemmas.
- The system will exchange information accurately between multiple data and communications systems throughout the region without repeating inputs.
- Public interest will be protected, with systems of indemnity for organizations within the coordination compacted.
- The system will be replicable and scalable in order to add or remove participating agencies easily by importing any new provider or agency's client data into the TMCC database. The system may be replicated in surrounding counties such as Stark, Lake, and Summit.

Modeling the Integration of Transit and the TMCC

The preceding vision also was reconfigured and restated in the context of regional transportation policies and the policies of the two countywide transportation agencies. These policies and objectives were organized via the discipline of Management by Objectives (MBO; see Warfield, Societal Systems) and yielded a structured assembly of an overarching goal and increasingly specific objectives.

It is important to note that the integration of TMCC objectives with transit agency policy in this manner resulted in the expression of objectives that are outside the scope of the TMCC project. For example, providing assistance in the establishment of employer-sponsored vanpools is outside the technical scope of the TMCC project. Vanpools were seen as a community resource that could provide additional utility, especially for human service agency clients, when combined with the functions of the TMCC.

Each level in the MBO structure defines either "how" or "why" an adjacent element is to be attained. As a result of this approach, the overarching goal of the

TMCC includes more than just actions to gain efficiencies and productivities in transportation services; it also include actions to reduce the need for continuing human service support. To paraphrase a vital, early participant: "Transportation is the single most important factor in our clients' potential for success." That statement transformed this study and the attentions of the study team.

Project MBO Structure

A. To provide regional access for employment, health care, education, and training.

- Provide convenient work trip transportation available for all shifts a. Facilitate employer based vanpools where practical.
  - Identify major employers and concentration of employment.
  - Survey potential participants and aggregate them for scheduling.
  - Develop incentives for employer-based vanpools.
- Accommodate split trips (i.e., home/daycare/work) efficiently.
- Provide convenient and efficient access to and from medical facilities throughout the region.
  - Negotiate shared access with all providers.
  - Develop systems that allow medical staff to alert dispatcher of near term release of patients.
- Simplify access to transportation.
  - Develop alternatives to cash fares and complex billing procedures.
  - Develop access to transportation that is not dependent upon specific program eligibility.
  - Provide up-to-the-minute transportation information through any media.
  - Provide trip scheduling, reservation, and dispatch in near real-time.
  - Develop a sharable database for scheduling, trip confirmation and dispatch.
  - Employ cost allocation formulae for inter-agency invoicing and recordkeeping.
  - Distribute travel information from a single source that is convenient for customers, caregivers, and advocates.

B. To deliver services efficiently.

- Aggregate service requests across program boundaries.
- Establish service relationships with surrounding providers.
- Exchange information within the system without repeating inputs.

- Assign services to providers according to capability and real-time availability.
- Increase utilization of key resources.
- Generate "keystroke" reports in appropriate formats for participating entities.
- Aggregate funding while costs are allocated correctly.
- Integrate private and public transportation capabilities and yet preserve the characteristics of each.
  - Develop and support coordinated services under a unifying identity, NEORide.
  - Provide new service opportunities for private sectors operators.
  - Maintain public agency responsibility for services provided pursuant to public policy.

C. To respond to special community needs.

- Seamlessly integrate system capabilities with that of the Emergency Management Agencies.
- Facilitate economical non-transit group travel.

D. Use transportation access as a tool to reduce an individual's future need for human service support.

- Encourage the consideration of proximity of home and work in employment or housing decisions.
- Train in the use of shared ride services.
- Establish training liaison with private industry council, vocational training, one-stop, etc.
- Minimize the stigma associated with human services.
  - Develop a family of products that address the transportation needs of all client groups.
    - o Use technologies for rideshare matching.
    - o Develop new services on the basis of aggregate travel demand iii. Provide service with characteristics appropriate for each customer.
  - Assure that customer personal information is secure.

E. Remove arbitrary programmatic barriers.

- Engage state, regional, and local decision makers with program and budget discretion in a negotiated transportation investment strategy.

  - Establish priorities while conducting fund allocation.
  - Advocate for distribution of 5310 funds to participating members of NEORide who will use for coordinated effort.
- Establish the region as a transportation enterprise zone.
  - Obtain regulatory relief and agreed basis for record submission and audit procedures, guaranteed auditable records.
  - Technology tracks records and eliminates duplication of entry.
    - NEORide and regulatory bodies agree upon data standards.
- Work with State Transportation Coordination Task force to obtain relief from Medicaid service boundaries, establish region as a test for eliminating Medicaid boundaries.
  - Establish mechanisms to allocate operational risk.
  - Determine indemnification understandings.
  - Develop low-cost insurance/risk pooling for participants.
  - Establish training and certification uniformity for participants.
- Establish opportunities for cooperative purchasing:
  - Fuel pooling
  - Maintenance pooling
  - Vehicle purchase

Modeling the Integration of the TMCC and Emergency Management

The images of the devastation caused by Hurricane Katrina were still fresh when the study was begun. Logically, the team sought to establish TMCC tools that could support regional Emergency Management and were gratified that two Emergency Management Assistance (EMA) districts were involved from start to finish.

With both transit systems having participated in tabletop simulations, field deployment exercises, and the subsequent analysis of those exercises, and the team adopted the same approach for the integration of the TMCC with EMA functions. Thus, specific products for the EMA districts were not proposed within the 15 months of the study. Discussions and demonstrations of ITS applications showed, however, that the same TMCC tools could make evacuation, especially for mobility-impaired persons, more efficient and effective.

SECTION 3

Results: TMCC as Envisioned

Concept of Operations

One of the UWR/MSAA grant requirements, the Concept of Operations, provided an opportunity to express, clarify, and restate the roles of participants in the TMCC. The broad capabilities of the TMCC were defined for all customers, including clients, advocates, caregivers, agency staff, board members, and oversight agencies. As noted in the discussion of technical design informed by local stakeholder consensus, the concept of operations described the capabilities, but not the specific means by which the capabilities were to be obtained.

The basis of interagency exchange was agreed to be no longer the dollar, the van, or the seat. The basis of exchange was seen as information in real time, and every portion of the service delivery model was to be transformed by it.

The concept of operations established that every customer could have up-to-the-minute travel information; every caregiver could know when their loved one would arrive at home; every commuter could, through the sharing of information, know of an alternative to single occupancy. The concept of operations suggested that if Google was any indication, information itself could become a valuable product of transportation providers.

The concept of operations also acknowledged that the public transportation industry in the U.S. slept while these technologies revolutionized every other industry. The application of the integrated technologies for transit and human service transportation was seen as now virtually inevitable—largely a matter of investment.

The concept of operations established for the stakeholders that independent but parallel eligibility determination processes, schedule revisions conducted by multiple fax transmissions, a bewildering array of advance scheduling requirements, and uncertain and largely unknowable demand responsive schedules could be made rational. On a higher level, the concept of operations illustrated how coordination could reduce duplicative effort, increase efficiencies, and utilize capital resources more wisely. The concept of operations also established that the capabilities conceived by human service stakeholders were equally valuable capabilities for the general public.

The concept of operations and the stakeholder consensus support also defined the local TMCC as NEORide. NEORide and the stakeholder agreement specified

an extremely lean organization making use of existing resources wherever possible. For example, participants saw no need to build a call center when several 211 service providers served the region, when each of the transit systems operated call/scheduling centers, and when a virtual call center was within our current capabilities.

The concept of operations established that the NEORide TMCC would train people to use the technology and, importantly, would continually strive to make such training unnecessary. The relationship between the TMCC and the regional one-stop employment and training center was described.

The concept of operations expressed how NEORide could play a positive role in emergency evacuations and established that those capabilities would be developed through tabletop exercises, field deployment exercises, and follow-up analysis.

The concept of operations also established that NEORide would be developed as a brand uniting the public and private operations under a unifying identity.

Agency data types and sources were described, and the boundaries for their uses were determined. To some degree, this stage of our TMCC design benefitted from Trapeze Group's experience with the types and uses of data used for human service and transit trip scheduling. To that point, the team did not conduct on-site inquiries of agency data processes. The concept of operations established that protocols for the sharing of eligibility information could be based upon the arrangements that were being tested at Geauga County's Department of Job and Family Services and its Metropolitan Housing Authority.

System Description

Requirements

The systems requirements document was the final statement of local intent before the development of the TMCC mode's technical tools were to be shifted almost entirely to the Trapeze team. As such, it describes what the TMCC would do, but not how (technically) it would do it. The systems requirement document is a comprehensive statement of the intent. After its presentation to the stakeholders and its approval by acclamation, it was apparent that the means and feel of coordination services using a TMCC had been roughed out. In addition, a culture of cooperation had been transformed or awakened that had not been present before.

The System Requirements Matrix described below has been structured so that every sub-requirement is necessary to fulfill the requirement that is a step above it. Traceability is used to show how the requirements will eliminate the gaps in the system. The requirements are linked to the GAP Analysis. Every requirement

has a traceable gap, and any sub-requirement with a direct correlation to a gap has been listed.

NEORide will facilitate the capture and exchange of information through the installation of Mobile Data Terminals (MDTs) in the vehicles of participating agencies and provision of data transmission services.

NEORide will supply the data analysis required for accurate and timely reporting.

NEORide will provide much greater levels of public access to constantly refreshed travel information, through the Web, phones, reverse 911, Interactive Phone Response techniques, and kiosks.

NEORide will operate, on behalf of member organizations, a market for transportation service, permitting the matching of available capability to needs, the collection of aggregate travel demand data, and the selection of the most economical provider consistent with their suitability for the purpose.

NEORide will provide a single point of access for all shared-ride transportation information, public and private.

NEORide will generate revenues from the sale of services provided to members, services not available without economies of scale provided through coordination.

NEORide will develop, encourage and negotiate consistent operating and service standards within funding agency requirements.

NEORide will provide a portal to collect and aggregate travel demand for the purpose of generating new or temporary services.

System Features

A. System shall provide regional access for employment, health care, education, and training through brokerage transportation resources.

A.1 System shall provide convenient work trip transportation available for all shifts.

A.1.a System shall facilitate employer based vanpools where practical.

A.1.a.i System shall identify major employers and concentration of employment.

A.1.a.i.1 Shall identify worksites via Portage and Geauga county planning, NOACA, AMATS and other nearby counties.

A.1.a.i.2 System shall prioritize areas and employers for initial effort.

A.1.a.ii System shall survey potential participants and aggregate them for scheduling.

A.1.a.iii System shall facilitate incentives for employer based van pools.

A.1.a.iii.1 Shall provide guidance on tax benefits.

A.1.a.iii.2 Shall provide guidance on Non-tax based incentives.

A.1.b TMCC/NEORide shall deliver services that accommodate split trips (i.e., home, daycare, work) efficiently.

A.1.b.i Shall establish partnerships with public & private care providers to locate daycare facilities where individuals, transportation providers, and employers can benefit from efficiencies.

A.1.b.ii System shall allow for the uniform scheduling and dispatching of split trips.

A.2 System shall provide access to and from medical facilities throughout the region.

A.2.a Political boundaries are transparent to NEORide users.

A.2.b System shall eliminate Medicaid boundary between Portage and Geauga County.

A.2.c System shall eliminate Medicaid boundary between Portage and Cuyahoga County.

A.3 System shall simplify access to transportation.

A.3.a System shall develop alternatives to cash fares.

A.3.a.i System shall have no collection of physical payments or vouchers.

A.3.a.ii System shall have secure and unique identifications for each passenger.

A.3.a.iii System shall have no collection of unnecessary information f or storage or privacy reasons.

A.3.a.iv System shall collect passenger information for auditing, billing and reporting purposes.

A.3.b Shall develop access to transportation that is not dependent upon specific program eligibility.

A.3.b.i System shall increase locating a subsided ride with the TMCC/ NEORide shall function as an omnibus human service transportation funding vector.

A.3.b.ii If no funding is available, the TMCC/NEORide system shall extend temporary authorization of service to anyone.

A.3.c System shall provide current transportation information directly from NEORide through any media to customers, caregivers, advocates and human service agencies such as 511.

A.3.c.i System shall offer passenger information, scheduling, confirmation, and cancellation by phone, kiosk, and PDA's in multiple languages.

A.3.c.ii System shall have the ability to transmit pre-recorded messages, emergency bulletins and instructions by phone.

A.3.c.iii System shall have the option for a rider to speak to a TMCC/NEORide representative when using the automated telephone system.

A.3.c.iv System shall deliver summary and detailed trip information to riders for scheduled and unscheduled casual or subscription trips by phone.

A.3.c.v System shall have live customer service representative 24/7.

A.3.c.vi System shall allow riders and human service agencies to receive immediate service information based on their preference of e-mail, text message, or IVR.

A.3.d System shall provide trip scheduling, reservation and dispatch for same day service.

A.3.d.i System shall share data with all TMCC/NEORide members.

A.3.d.ii Shall communicate data to and from TMCC/NEORide vehicles.

A.3.d.ii.1 System shall integrate intelligent vehicle technology such as Mobile Data Computers (MDC), Automatic Vehicle Location (AVL), and handheld devices to provide more effective dispatching.

A.3.d.ii.2 System shall have the ability to automatically mark incidents/events as either unsent or sent by a particular mode (MDC, radio, log sheet).

A.3.d.ii.3 System shall have a back-up plan in case of wireless communication loss.

A.3.d.iii System shall allow riders to book casual or subscription demand-response trips over the phone without speaking to a TMCC/NEORide representative.

A.3.d.iv System shall have the ability to allow riders to cancel their trip by phone or Internet.

A.4 System shall develop new transportation partnerships to assist people in gaining access to education and training.

A.4.a Shall work with vocational training centers.

A.4.b Shall work with private industry council training.

A.4.c Shall work with apprenticeship programs.

A.4.d Shall work with business colleges.

A.4.e Shall work with universities.

A.5 System shall provide weekend, evening and overnight transportation service.

A.5.a.i System shall establish ridership thresholds for test of route services.

A.5.a.ii Where practical, system shall exchange information leading to casual ridesharing rather than operating a service.

A.5.a.ii.1 Shall establish a relationship with Ohio statewide rideshare program.

A.5.a.iii Shall identify existing providers that perform weekend, evening and overnight services.

A.6 System shall establish NEORide as the Franchisor to encourage the development of new transportation service providers and integrate existing providers into NEORide.

A.6.a Shall set standards for NEORide participants (driver training, vehicle safety, operation performance, incident management).

A.6.a.i Shall identify regulatory baseline for each of the region's transportation resources.

A.6.b Shall identify standards for NEORide providers.

A.6.c System shall create new service providers when there are service gaps and where funding is available.

A.6.d System shall provide safety and training programs.

A.6.e System shall provide financial incentives such as fuel, maintenance, leasing options and access to funding sources otherwise not available.

A.6.f Shall integrate private and public transportation capabilities and yet preserve the characteristics of each.

A.6.f.i System shall develop and support coordinated services under a unifying identity – NEORide.

A.6.f.ii System shall provide new service opportunities for private sectors operators.

A.6.f.iii Shall maintain public agency responsibility for services provided pursuant to public policy.

A.7 TMCC/NEORide will establish seamless integration with scheduling, reservation, dispatch and monitoring systems of regional transportation providers.

B. System shall deliver services efficiently.

B.1 Wherever possible, the TMCC/NEORide system shall use local existing resources in new ways rather than creating new structures, organizations and cost centers.

B.1.a System shall use staffing resources of stakeholders.

B.1.b System shall use vehicle resources of stakeholders.

B.1.c System shall use facilities of stakeholders.

B.1.d Shall seek service relationships with all potential service providers.

B.2 Shall integrate passengers and requests from different funding sources and programs when possible.

B.2.a System shall identify trip combinations that will not be desirable.

B.2.b System shall identify trip combinations that do not have barriers.

B.2.c System shall obtain agreements with different funding sources to allow their respective clients to ride together.

B.3 System shall exchange information within the system without repeating inputs.

B.3.a System shall have one time entry of trip request information.

B.3.b System shall have one time entry of trip booking.

B.3.c System shall have one time entry of dispatch information.

B.3.d System shall have one time entry of trip performance.

B.3.e System shall have one time entry trip reporting and billing.

B.4 System shall assign services to providers according to capability and real-time availability.

B.4.a System shall have centralized trip booking.

B.4.a.i System shall have the ability to negotiate with the client for the most efficient trip while considering customer service issues.

B.4.a.ii System shall have the ability to add trips to schedules on the day of service.

B.4.b System shall update provider's schedules in real-time.

B.4.b.i System shall schedule any number of days in advance up to same-day scheduling.

B.4.b.ii System shall have the ability to re-optimize a schedule on the day of service.

B.4.b.iii System shall have the ability to produce multiple scheduling solutions for the same run.

B.4.b.iv System shall have the ability to filter schedule information according to trips, runs, run itineraries, slack time, and deadhead time.

B.4.b.v System shall have the ability to receive alerts about scheduling violations as they occur.

B.4.b.vi System shall have the ability to monitor and dispatch schedule changes for all providers (un-dispatched events, pick-ups, breaks) throughout the day.

B.4.b.vii System shall monitor all provider vehicle's current activity and on-time performance.

B.4.b.viii System shall have the ability to automatically reassign all provider trips to appropriate runs in the event that a vehicle is taken out of service.

B.4.c System shall support interfaces to other vendor software, data sources and applications, including legacy systems.

B.4.c.i System shall establish a prototype combined medical appointment/transportation scheduling approach.

B.4.c.ii System shall provide alerts of near-term release of patients.

B.4.d System shall use an industry standard Relational Database Management System (RDBMS).

B.4.e System shall provide immediate pickup at locations with sufficient demand.

B.5 System shall generate reports in appropriate formats for participating entities.

B.5.a System shall allow for ad-hoc reports and export.

B.5.b System shall produce a variety of standard reports for the TMCC/NEORide including Cancelled, Missed, No Show trips, Daily Operations, Denials, NTD Standard, On-time Compliance, Optimization, Route Productivity, Time and Distance, Driver Manifest, Trip Count, Trip Hours Productivity Details, Trip Distance Productivity Details, Funding Source.

B.5.c System shall track, analyze, and compare performance indicators from the TMCC/NEORide including, passenger per vehicle hour statistics year-by-year and quarter-by-quarter, determine which provider is providing the best overall service, shared ride percentage, average trip distance, vehicle utilization, compare routes and providers.

B.5.d System shall manage daily operations with TMCC/NEORide specific performance indicators.

B.5.e System shall track commendations and complaints for reporting purposes.

B.6 Shall aggregate funding while costs are allocated correctly.

B.7 System shall automate complex billing procedures.

B.7.a Shall study agency and auditing requirements.

B.7.b System shall have the ability to send electronic billing to funding sources.

B.7.c System shall have the ability to receive funding electronically.

B.8 Use wherever possible the TMCC/NEORide system shall use local existing resources in new ways rather than creating new structures, organizations and cost centers.

C. System shall respond to special community needs.

C.1 Shall seamlessly integrate system capabilities with that of the Emergency Management Agencies.

C.1.a System shall integrate communications and logistics platforms.

C.1.b Shall develop mutual aide agreements.

C.1.c Shall model, test and evaluate the use of TMCC/NEORide resources in Emergency response.

C.2 TMCC/NEORide system shall aggregate non-transit travel requests.

C.2.a System shall provide group travel requests.

C.2.a.i System shall contract with charter companies.

C.2.a.i.1 System shall require charter carrier to provide a percentage of their trips at a charity rate.

C.2.b System shall facilitate individual non-transit travel needs.

D. System shall use transportation and access as a tool to reduce an individual's future need for human service support.

D.1 System shall influence public transportation decisions.

D.1.a Shall encourage the consideration of fixed route services for work trips.

D.1.a.i TMCC/NEORide shall market to case workers and end users on what the system offers.

D.1.b Shall encourage public transportation to be responsive human service recipients' needs.

D.1.b.i System shall encourage continuing relationship between NEORide and the human service agencies.

D.2 Shall encourage simplicity in system design.

D.2.a System shall require typical users to have no training to utilize system.

D.2.b For those individuals who need training, system shall require only need minimal training.

D.3 System shall minimize the stigma associated with human service transportation.

D.3.a Shall address the transportation needs of all client groups via similar technologies.

D.3.a.i System shall apply same technologies for all services.

D.3.a.ii System shall develop new services on the basis of aggregate travel demand.

D.3.a.iii System shall provide service with characteristics appropriate for each customer.

D.3.a.iv System shall create a unifying graphic identity for all service types.

D.3.b System shall assure that customer personal information is secure.

D.3.b.i System shall ensure that providers who have client information responsibly stores it.

D.3.b.ii System shall ensure that riders who use the service are not differentiated by funding source or lack of funding source.

E. System shall remove arbitrary programmatic barrier.

E.1 System shall engage state, regional, and local decision makers with program and budget discretion in a negotiated transportation investment strategy.

E.1.a Shall establish priorities while conducting funding allocation.

E.1.b System shall ensure 5310, 5316, and 5317 funds to members of compact who will use for coordinated effort.

E.2 Shall establish region as a transportation enterprise zone.

E.2.a System shall obtain regulatory relief and agreed basis for record submission and audit procedures, guaranteed auditable records.

E.2.a.i System shall track records and eliminate duplication of entry with technology.

E.2.a.i.1 NEORide and regulatory bodies shall agree upon data standards.

E.2.a.ii Shall establish routine periodic checks of standards and procedures.

E.2.b System shall work with State Transportation Coordination Task force to obtain relief from Medicaid service boundaries, establish region as a test for eliminating Medicaid boundaries.

E.2.c Shall establish relationship with state Executive Medicaid Management Administrator.

E.2.d Shall obtain administrative indemnity letters from appropriate Federal agency.

E.3 Shall establish mechanisms to allocate operational risk.

E.3.a Shall determine indemnification understandings.

E.3.b Shall develop low cost insurance/risk pooling for participants.

E.3.c Shall establish training and certification uniformity for participants.

E.4 System shall establish opportunities for cooperative purchasing.

E.4.a Shall pool fuel resources.

E.4.b System shall have pooled maintenance.

E.4.c System shall have cooperative vehicle purchasing

E.5 System shall employ cost allocation formula for inter-agency invoicing and record keeping.

With the completion and presentation of the systems requirement document, several parties signed memoranda of understanding (MOU) pledging their best efforts to realize the NEORide TMCC promise (see Appendix A).

System Design

The TMCC will have a single, centralized telephone number and website that will integrate with the existing transportation delivery systems already in place and will be supported by leaders from the local transportation and human service communities.

The TMCC will provide prompt, courteous, efficient service to agency customers, private transportation providers, and the riding public.

The TMCC will have the ability to request transportation reservations for public transit lines, paratransit companies, human service agencies, Medicaid transportation, non- emergency medical service, and private fleet control customers. The TMCC will be able to digitally collect and organize resources to provide NEORide with brokered transportation service.

The TMCC will provide centralized reservations, scheduling, and reporting functions. Each individual provider will be responsible for dispatching. Advanced ITS products will be used for the call center such as Interactive Voice Response (IVR), customer trip reservations made via the Internet, Automatic Vehicle

Location (AVL) technology, automated dispatch, travel planning, and automated real-time reporting for the demand-response management system.

Demand-response scheduling software, which both PARTA and Geauga County Transit already have installed, will be used by both agencies with no need to migrate to a new software platform. The four additional providers in the TMCC use Trapeze NOVUS. An interface using Simple Object Access Protocol (SOAP) and Extensible Markup Language (XML) protocols will be the primary medium for coordinating data and requests between the TMCC and integrated software systems the providers will have. At its core, the TMCC will utilize a relational database system (e.g., Oracle or Microsoft SQL Server) for the centralized storage and retrieval of all transportation data. This protocol will allow providers with different software to coordinate services in real time through a TMCC Module developed by Trapeze assuming the third party develops this interface. Providers that have a different vendor software system will also have the ability to participate in the TMCC through this interface. This system will enable all agencies involved to administer a coordinated or brokered system to provide service throughout the region.

Call center representatives will take reservations routed by a virtual Private Branch Exchange (PBX). This will allow calls into the TMCC to be routed anywhere NEORide would like, such as an agency, provider, or a staff member working from home. This system will enable call center representatives to broker the lowest cost transportation solutions for demand-response clients by selecting from multiple providers, and it will ensure that all trips are scheduled according to the specific requirements of individual service providers and funding sources. The ITS system will integrate the scheduling operations of brokers and service providers while tightly controlling access to agency-specific information.

To make the TMCC system be truly real-time, the Trapeze CAD/AVL system will coordinate with the TMCC Module. With the Web-enabled architecture, information will be disseminated to the NEORide staff and the public with a click of the mouse. The system provides a real-time command and control to maximize the efficiencies of the operation. With the integrated on-board standard mapping, drivers will see where they are at and where they are going. Customers can be assured that their bus is really just three minutes away through frequently updated displays, client advocates can remotely monitor the delivery of service, and detailed service information can be captured automatically.

The NEORide TMCC is inherently economical, choosing to use existing resources and capabilities, linked through new technologies, wherever possible. NEORide is essentially a contracting authority operating with the capabilities of the member entities. The technologies allow NEORide to avoid “bricks and mortar” solutions and the addition of duplicate staff, thus controlling costs.

Scalability and Replicability

The NEORide TMCC is inherently scalable and replicable. The design of this TMCC does not require huge resources or travel demand for benefits to be developed. Where demand is slight and resources tight, NEORide's inter-agency information sharing protocols will allow periodic batch scheduling among a region's human service agencies and will yield incremental efficiencies. Where demand is greater, the same information sharing protocol is the basis for updates to the driver manifest and "on-the-fly" service optimization. In communities with still greater travel density, the NEORide TMCC model supports "big bus" service and optimized routing, even if it is only needed for a single day.

The TMCC software system will be scalable to any number of transit authorities or other transportation providers virtually any site that requests, books, or schedules trips for any purpose, including but not limited to employment transportation, medical care, education, dial-a-ride, daycare centers, nursing homes, etc. Typically, a transit authority will, at the very least, have an existing software system for assisting in booking, scheduling, and maintaining client and vehicle data, but may also have software for AVL, dispatching, operations, a Web booking interface, and so on.

The NEORide TMCC enhancements for human service clients have applications for any shared ride transportation services, and it is intended to employ this model wherever appropriate. Characteristics that are key to the broad application of the NEORide model are:

- Flexible deployment
- Predictable financial feasibility at a variety of scales
- Risk limitation through data capture and analysis
- Market identification
- Application of XML and SOAP to establish a non-proprietary data exchange service

The system architecture incorporates technologies such as SOAP and XML messaging to provide a secure means by which multiple partners can exchange both document and procedure-oriented messages/information. These protocols will use Web services to transfer the information throughout the TMCC. Web services make the TMCC more scalable in the overall system design since it will be easy to add new providers and more replicable since it will be easy to duplicate at another location.

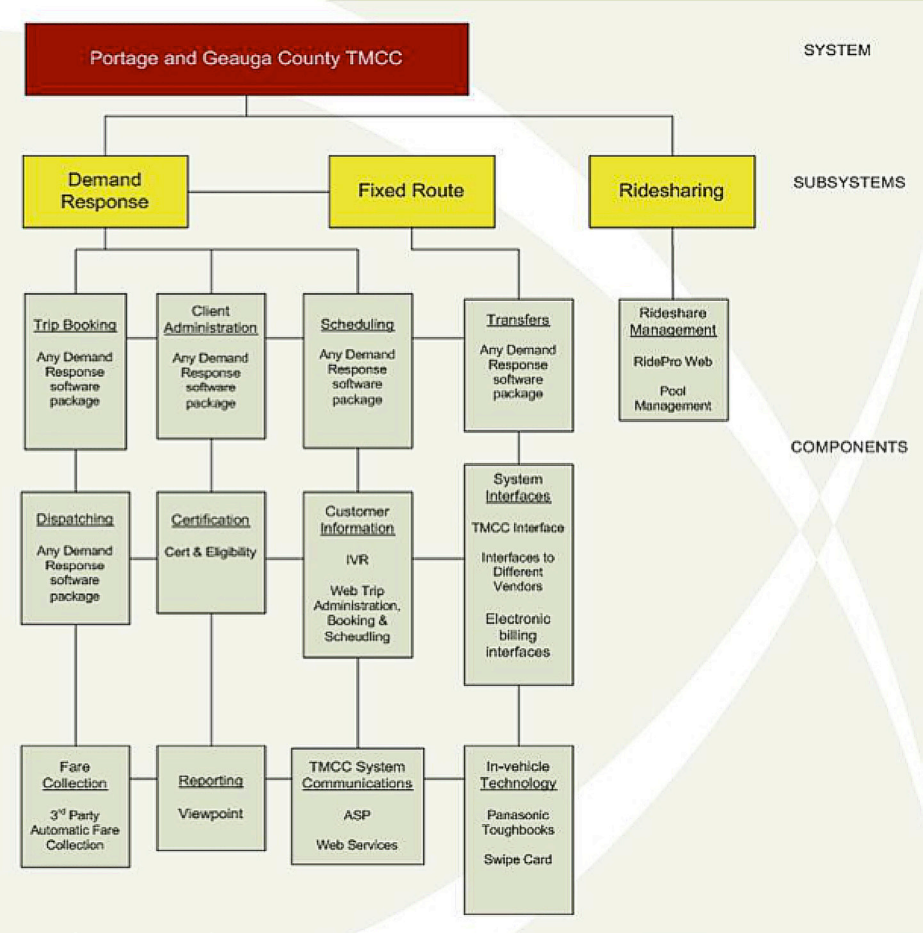
The design does not require wholesale adoption of new methods or procedures. It does not require "muscle" or political leadership—or really much sacrifice at all. This model has identified critical products for transportation consumers and providers. These NEORide products will be available "a la carte," and the sale of

those products will support the operation of the TMCC. As population densities and travel patterns vary, the market for those products will scale the TMCC appropriately

The issue of replicability for any TMCC has become less of an issue in the short time since this work has begun. The word if" is no longer used when speaking of transportation coordination. The question is, more appropriately, when will Web-based transportation coordination exist seamlessly nationwide?

Figure 3-1

Portage and Geauga County TMCC structure



Detailed System Architecture

An overview of the TMCC system architecture is shown in Figure 3-2. The public can contact the TMCC through one phone number and have the choice to use the automated system or speak to a live representative. Citizens of Geauga and Portage counties can also log on www.neoride.org for online trip booking, scheduling, and information.

Calls will be routed through a virtual PBX and can be answered anywhere within the system. Staff can be working at home or in a provider office, or they can be a

call taker with PARTA or Geauga County Transit. All demand-response functions will be completed through a TMCC interface and a centralized database, allowing each transportation provider to operate independently.

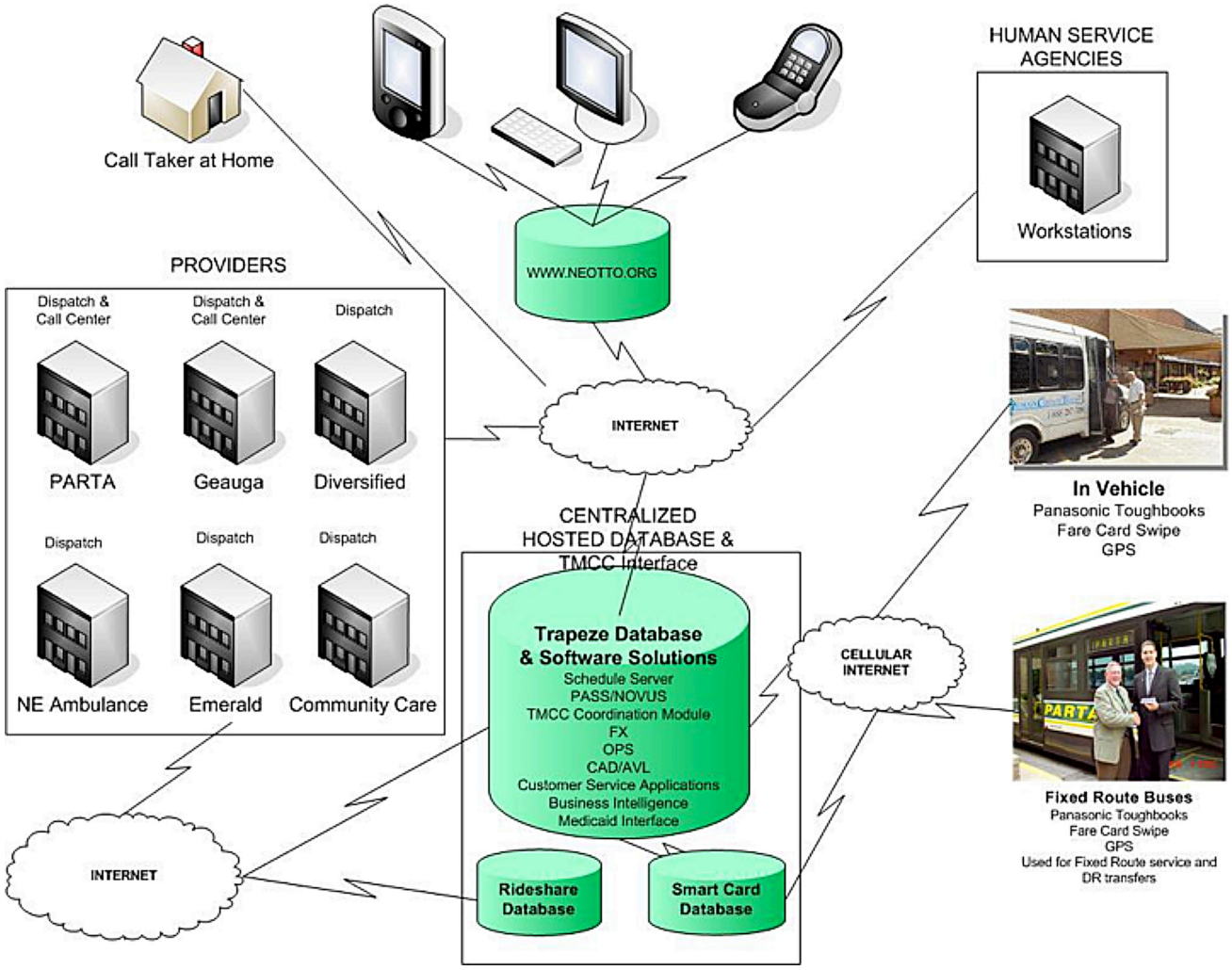


Figure 3-2

Kent TMCC system architecture

The TMCC will have a centralized database integrated with existing transportation delivery systems already in place at PARTA and Geauga County Transit through the TMCC Module. Other service providers, including Diversified, Northeast Ambulance, Emerald Transportation, and Community Care, will each have access to Trapeze NOVUS demand-response management software via a secure hosting environment and also be interfaced with the TMCC Module. The TMCC staff such as reservationists and dispatchers will be located at all transportation providers. The NEORide TMCC will administer the system at PARTA for Phase II deployment.

The TMCC will coordinate trip requests from multiple sources such as transit providers, call centers, or directly from the public via a website. Trip requests may come from one centralized source or from multiple external sources. A single trip may require transportation from more than one service or geographical region and may involve transfers between those services and/or regions; it will be the TMCC software's role to coordinate these trips by requesting partial solutions to each portion of the transportation from the regional providers scheduling systems, then automatically recomposing the potential partial solutions into optimized, complete solutions that are presented in a list ordered by provider cost to the TMCC user. Once a final solution is negotiated between the requester and the call-taker, a synchronization process will ensure that all affected transportation providers are notified of the final trip details.

The TMCC will exchange data with its external transportation providers' software systems through a uniform Web-based protocol. Existing Trapeze systems, PASS and NOVUS, will be adapted to support data synchronization with the Kent TMCC's centralized database through the SOAP based protocol. The synchronization from the TMCC to external systems will be two-way; the TMCC will be able to "push" new data, such as trip requests, client data, and so on, while also being able to "pull" new data from external applications, including but not limited to scheduled trip data, client updates, and real-time vehicle positioning.

Any change to a booking (such as an update to the client's home address on a subscription booking, or the outright deletion of a subscription booking), will require a synchronization update. Synchronization process will differ based on the TMCC functions such as booking, client information, etc. The synchronization may occur in real-time, on a timed-basis, or only nightly, depending on the nature of the data. For example, AVL data will be sent in real time.

Other third-party scheduling systems besides Trapeze will need to be modified by their vendors to comply with TMCC's synchronization and interfacing requirements. These external applications will behave as they normally do on their local database, with the exception that data updates (i.e., changes to existing schedule, client, or booking data) require notification and update of the centralized database. An external system must support at least one method of data synchronization, such as real-time, in order to be integrated with TMCC, but need not support all of them.

System Software

This section describes the TMCC system software, listing each software module for demand-response and rideshare. PARTA will use its already-implemented fixed route solution as a transfer point for demand-response trips when applicable. No other transportation provider has the need for fixed-route capabilities.

Demand-Response Technology

The TMCC technology will manage all transportation-related functions to provide an efficient, productive, cost-effective, and secure system from any location within the TMCC. The software is a thin client, Web-enabled technology for simplified installation, deployment, and training. Automating the demand-response scheduling process will create optimized, cost-effective, on-demand schedules. Customer service will also improve by streamlining and simplifying requests for information and trip booking through one TMCC number and website. The TMCC will avoid costly errors by maintaining complete, accurate client records, and operations data.

Using the software will optimize TMCC vehicle use and increase passengers per hour by updating schedules in real-time on the day of service. Monitoring daily operations closely and notifying vehicle operators of situations affecting service in real-time will be key in coordinating services. TMCC employees and transportation providers can have access to the software through the Internet in a secure environment. Microsoft Internet Explorer will be the user interface, available on all PCs.

Interactive Voice Response (IVR)

The TMCC will use IVR technology to enable passengers, caregivers, and service providers to request, book, confirm, or cancel trips. Clients will also be able to set up callback reminders, promoting punctuality and reducing missed trips.

The IVR system will provide 24-hour access to information without taxing the agent-attended resources. Clients will receive automated responses to common queries, enabling customer service representatives to be more effective in assisting clients with special needs or inquiries. The IVR system will reduce the volume of calls to the agent-attended call center and reduce call waiting time, busy signals, and unanswered passenger requests. The TMCC will offer passenger information services in both English and Spanish.

Clients will be able to review trip bookings through the computerized voice system to confirm that they are accurate; access summary or detailed information for all bookings, including casual, subscription, scheduled, unscheduled, and cancelled trips; and access trips for a particular date. Also, clients will be able to cancel scheduled and unscheduled trips without having to speak with a call center agent.

A system parameter will be set using TMCC guidelines that will allow cancellations only a certain number of days in advance. The IVR system will also send clients an automated notification that the trip has been canceled and provide a cancellation number.

TMCC clients will be able to book trips to and from locations that have been registered previously in the system. As designed, the system will “speak” booking

information back to callers, prompt them to confirm it, and then report to the caller that the trip has been successfully booked and will provide a booking ID.

The design permits clients to receive automatic reminders for upcoming scheduled trips, calling the client at a prescribed date and time with an automated voice message of the details of the trip. Reminders can be set up for all scheduled trips or for specific trips. Clients can also receive notices of changes to pick-up times.

Web Booking

By logging on www.neoride.org, TMCC clients will be able to perform all IVR information management, trip booking, and trip scheduling functions mentioned above online. Trip reminders and changes can be e-mailed directly to the clients, or a text message can be sent to their mobile phone.

System Interfaces

SOAP is a protocol for exchanging XML-based messages over secure networks using HTTPS. SOAP and XML will be the primary media for coordinating data and requests between the TMCC and its integrated software systems. At its core, the TMCC will use a relational database system (e.g., Oracle or Microsoft SQL Server) for the centralized storage and retrieval of all transportation data.

TMCC Module

In general, data synchronization from a demand responsive scheduling program to the TMCC centralized database may be achieved through any of four actions:

- TMCC "pushes" data to an external system.
- TMCC "pulls" data from an external system.
- External system "pushes" data to the TMCC.
- External system "pulls" data from the TMCC.

Each of these four actions will be able to be configured to occur in real-time (as data are created, updated, or deleted), on a timed-basis (for example, every 10 minutes, every hour, or once a day at 1 AM), or only on demand. A TMCC system administrator will be able to configure the frequency of the data updates; at the external system's end, synchronization being pushed back to the TMCC, if desired, should similarly be configurable. Additionally, the update frequency from the TMCC may differ per external transportation provider; for example, the TMCC may send its updated client list to system X in real-time, but it may need to send updates to system Y only on a nightly basis.

The actual strategy to choose for the data synchronization depends on the time-critical nature of the data and on any technological limitations imposed on the external system. Ideally, all data entered in one system would be instantly synchronized with all other systems; however, in reality, there may be practical limitations (network bandwidth or software technological barriers) that prevent

this from being feasible. The important point is that the TMCC system is flexible enough to adopt any synchronization policy deemed appropriate.

In addition to requests for data synchronization, the TMCC system will act as the hub of communication between the external systems and will disseminate requests for such things as the scheduling of trips, confirmation of cancellation, and notification of a vehicle breakdown. Some of these requests require a specific, structured response; some will require a simple acknowledgement; and some purely informational broadcasts may not require a response at all. Any required response will be asynchronous in nature, meaning that the requester does not need to be blocked while waiting for the reply.

Service Architecture

A service request will emanate either from the TMCC or from the external third-party transportation management software system. Each request will be accompanied by a standardized protocol description of the entities that participate in the request (e.g., clients to be scheduled, and their bookings).

The TMCC will be implemented as a broadcaster of service requests, but it is also a listener. The external systems will be used primarily as listeners for requests, but also may broadcast their own requests. The sophistication of the integration is in the hands of the third-party vendor; described later in this report is a minimal set of functionality that needs to be supported by a third-party system in order to integrate with the TMCC. The TMCC deliverables will include a Software Design Kit (SDK) to support third-party integration.

The services coordinated by the TMCC will include the following:

- Refresh client data
- Refresh booking data
- Refresh schedule data
- Schedule trip request
- Scheduled trip solution set
- Scheduled trip solution selection
- Scheduled trip solution confirmation
- Cancel booking request
- Un-schedule trip request
- Refresh viewpoint performance data
- Refresh provider data
- Refresh funding source data

The three key types of entities that could be included with a service request are a booking, a client, and a scheduled event. A booking within the TMCC protocol will consist of the following attributes:

- TMCC Booking ID
- External system booking identifier
- Client ID
- Date of booking
- Maximum on-board time
- Maximum number of transfers allowed
- Modes of transport allowed (e.g., taxi, fixed route, etc.)
- Maximum walking distance
- Mobility aids
- Seating space type (wheelchair, adult space, child space, stretcher, etc.)
- Fare type
- Subscription Information (e.g., days of the week for recurring bookings)
- Set of at least two booking legs (destination and origin), which include:
  - Requested time window (earliest, desired and latest time of pick-up for first leg, drop-off time for all subsequent legs)
  - Longitude and latitude of pick-up/drop-off coordinate
- Booking status (active, canceled, deleted)

A client in the TMCC protocol will include the following attributes:

- TMCC client ID
- External system identifier
- Default home address
- Default seating space type
- Mobility aids
- Load time, unload time
- First name, last name
- Gender
- Identification number (e.g., Social Security number, SSN)
- Birthdate
- Preferred language
- Client status (active, suspended, deleted)

A scheduled event in TMCC protocol will include the following attributes:

- Date
- TMCC event ID
- Client ID
- Booking ID
- Event type (pick-up, drop-off etc.)
- Event status (scheduled, performed, arrived, no-show, etc.)
- Scheduled time window
- Estimated time window
- Longitude, latitude coordinates

For example, the XML structure for a client may look like this:

```
<client>
        <clientId>74</clientId>
        <homeAddress>
                <lat>74.123343</lat>
                <lon>-123.4593</lon>
                <streetName>Glenmore Rd.</streetName>
                <streetNo>18</streetNo>
                <city>Dayton</city>
                <state>Ohio</state>
        </homeAddress>
        <spaceType>AS</spaceType>
        <loadTime>60</loadTime>
        <firstName>Melvin</firstName>
        <lastName>Taylor</lastName>
        <birthDate>19241225</birthDate>
        <comments>Please speak up, client is going deaf</comments>
</client>
```

Should new attributes be required in the future, they may be added directly into the TMCC's XML Schema Definition. There will be standard XML message schema developed as part of the system design for the above definitions. This schema is what makes the NEORide TMCC system scalable and replicable, since they can be reused or changed slightly if other locations were to deploy a similar system.

Client Administration

When an individual applies for demand-response service with the TMCC, all pertinent information about that client will be registered and maintained. These data subsequently will be used each time a trip is booked for that client. Call takers can register new clients, capturing information about addresses, disability type, space requirements, load/unload times, fares, payment options, eligibility conditions, funding sources, etc. Also, call takers can search for a specific client record using partial name, client number, SSN, date of birth (DOB), and phone numbers, and can edit a client record, mark it as inactive, or delete it from the system. Statistics will be logged about each client including last trip date, cumulative trips, no-shows, cancellations, and late cancellations.

Trip Booking

The TMCC system will book trips for clients on a demand-response and subscription basis. The reservationist can either schedule that trip individually or reserve it for subsequent batch scheduling using the software. Reservationists can view the client history and employ previously booked trips to streamline the trip-booking process. Booking and scheduling multiple trips at once without re-entering address and location information (for individual or group trips) will allow for further efficiencies.

TMCC booking types include:

- casual
- group
- subscription
- medical

Staff will receive alerts about conditions of a client's eligibility when entering a new trip request. Automatic warnings will be received when booking a trip that will conflict with another trip previously booked for that client. Also, the software will automatically generate reverse trips and multi-leg itineraries with minimal data entry.

The TMCC system will create a subscription booking, optionally specifying beginning and end dates, dates during which the service is suspended (e.g., holidays), and exception days (i.e., days that the client does not travel). It will be possible to specify service combinations as preferred to accommodate customer needs and then have those service patterns be the basis of recurring or subscription services. Staff will be able to create group bookings, including exclusive bookings that prevent other passengers from being scheduled on that vehicle. The design will permit service requests to be saved for later batch

scheduling or directed to real-time, interactive scheduling. The booking process will track the identity of the creator or modifier of a reservation.

Scheduling

It will be possible for persons with appropriate security clearance to view all scheduling solutions for TMCC participants, although, unless specified, each transportation provider will have access to view only its schedules. Same-day trip scheduling will be supported, and TMCC staff will view all possible scheduling scenarios in order to select the most cost-effective one. Detailed run itineraries will be shown for each vehicle in service, and certain staff will have the ability to adjust parameters such as capacities, time on vehicle, and costing weights to optimize scheduling solutions. Pick-up and drop-off window times will be calculated taking into account trip distance, route, time of day, physical barriers, client board/alight time, etc.

Batch scheduling will assemble all the trip requests for a specified day, schedule them in the most cost-efficient manner, and place them on provider runs within the TMCC. This form of scheduling is often used to create a template of subscription trips that will be used as the basis of the live schedule for each day. The design permits schedule re-optimization on the day of service, if necessary, pushing new schedules to each independent operator. The TMCC administrators will have the ability to "freeze" booked trips to preserve current schedules.

Independent Dispatching

Dispatching in the TMCC system will be done at each independent transportation provider using the demand-response software to monitor the service and dispatch events throughout the day. Changes made to schedules will instantly be dispatched to vehicle operators in real-time using the mobile computing systems that are integrated with the demand-response software. Some features of each provider's TMCC dispatching system will include:

- View in detail all changes to schedules and vehicle itineraries on the day of service.
- View either all vehicles, runs, and run itineraries or only those with violations.
- View run itineraries for selected runs.
- View unscheduled and unassigned runs, and assign vehicles and drivers as required.
- Mark trips as arrived, performed, cancelled, or "no-show."
- Configure the system so that dispatchers view only the runs they dispatch.
- Monitor the on-time performance and location of vehicles at all times.
- Track vehicle locations on the integrated system map.

- Monitor the actual location of vehicles.
- Dispatch events such as breaks, refueling stops, etc., throughout the day.
- Flag incidents deemed urgent.
- Take vehicles out of service and assign remaining trips to other runs.
- Identify which incidents/events have been sent and the mode by which they were sent (e.g., MDC, radio, log sheet)
- Send changes to itineraries and other messages to in-vehicle, mobile computing devices..
- Assign a vehicle and a driver to a run.

The TMCC reservationists will use a schedule editor for optimizing schedules and making changes to the schedule before the operational day or in real-time on the day of service. Changes made to schedules can instantly be dispatched to individual provider vehicle operators using MDCs.

Certification and Eligibility

The TMCC system will manage the client certification process, from the initial request for an application and/or information to final approval or denial of service, including appeal processes.

The software will closely monitor the client certification process, including interviews and appeals, and receive automated notices of deadlines. Many tasks associated with the certification process, including client correspondence and mailings will be streamlined automatically. Using the Certification and Eligibility software will ensure that the TMCC is in compliance with the regulations imposed by the Americans with Disabilities Act (ADA) and/or site-specific procedures.

Record requests will be converted into client certification records with the click of a button. This will minimize data entry and streamline the certification process. When the TMCC creates a new record of a request for information, the software will search for possible matches in the existing database of requests and clients. This will minimize the duplication of records within the system.

Data will be tracked on how many requests are being received and how many responses are occurring in the system. Client registration and updates will create a full and detailed profile of each TMCC client. The software will assign one or multiple funding sources to clients based on ancillary data entered during system setup and store client pictures and additional documentation online, eliminating the need for a paper-based system.

Each client will have a clearly-defined eligibility status and level of service, using pre-defined parameters such as window of pick-ups and drop-offs, dead-head times, and more. The system will record all activities related to certification

renewals. Eligibility reviews will be monitored as will both legal and operational deadlines. The software will maintain an extensive log of all activities related to an individual client, including total number of trips, no-shows, and cancellations.

The software will automatically generate and print notification letters, ID cards, and labels from client records. TMCC reservationists will be able to search for fixed-route bus stops within a predefined radius of a client's address to identify alternatives to demand-response services.

Customer Access

Building loyalty with TMCC customers may depend on how easily customers can access and use information about the services supplied by the TMCC. In the "anywhere, anytime" information era, travelers expect quick answers to questions such as how to get from A to B with the fewest transfers. The TMCC will make it easier to obtain accurate information and interactive communication services to the public through a variety of media, including the call center, websites, automated phone (IVR) system, and wireless devices.

Data Inputs and Outputs

Data Consolidation and Data Dictionary

Initially, after the TMCC software is installed, its client database will be empty. It will, therefore, send a Refresh Client Data request to its connected external systems. All refresh commands will include an attribute to specify "Request All" or "Request All Since Last Update"; the latter option is feasible only if the external system is implemented in such a way as to track which entities have been updated since the last data refresh command was received. The response to this refresh request will be an XML set of clients, with as much information about each client as possible. If certain attributes are unknown (DOB, home address, etc.), the XML schema will allow for tags to be omitted.

The TMCC will be able to perform data consolidation. Consider that the same client may exist in two different regional databases and likely will have a different client identifier in each. For example, the client with first name "Donald" and last name "Banks" may exist in the database of system X with ClientId 100, but may also be present in system Y with PersonId 987DONB, first name "Mr. Don," and last name "Banks III."

Therefore, the TMCC will, wherever possible, consolidate redundant records into one. In the case of client records, some combination of home address and name or, if provided, the SSN can be used to disambiguate. In addition, the TMCC will maintain a data dictionary to map its identifiers to each of the external system identifiers. By doing so, when a request to schedule is received by the TMCC for a particular client, when disseminating that request to system

X, the correct identifier for that system can be used, and, likewise, a different unique ID for system Y will be used when exchanging data with that system.

Data Synchronization and Refresh Client Data

Generally speaking, the TMCC centralized database will contain a master list of all clients associated with all external systems data. Each client will be assigned an identifier unique to the TMCC software. The system also will maintain a data dictionary that maps the TMCC ClientId to the identifier in each external system (which, depending on the structure of the external system's storage mechanism, may be composite key, such as address + last name + first name + middle initial).

Clients may be registered directly through the TMCC interface. For example, if a Portage County citizen calls NEORide to book a trip and is doing so for the first time, the call-taker may take the caller's personal information and register him/her as a client, and then proceed to accept the booking information. In this case, the new client data will be "pushed" to the relevant external system immediately.

However, clients may also be registered by external, third-party transportation agency software, such as an employer's Excel spreadsheet of people who wish to participate in vanpooling. This manner of client entry would necessitate a synchronization update from the external agency to the TMCC. The important point is that the TMCC will not be imposing a workflow on its integrated participants (e.g., "All new clients must be entered directly at the NEORide office"); rather, it will be flexible enough to accommodate different policies.

The Refresh Client Data service request may be thought of as both a command and a request. As a command, it may be sent by the TMCC to its external agencies with a list of all newly-registered clients. As a request, it may be sent by the TMCC to its external agencies, expecting a response containing a list of all newly-created clients from those agencies. Likewise, the command may be sent in real-time by an external system to the TMCC, which may, in turn, relay the collection of all new clients received that day to all other external agencies on a nightly basis.

The TMCC, upon receipt of a Refresh Client Data Command, will consolidate the new clients with its centralized database and may choose to ignore redundantly-entered clients (for example, a client already registered in two different counties with both systems pushing their updates to the TMCC).

Refresh Booking Data

Bookings will be taken and entered primarily through the TMCC call center. Bookings may be casual (one-time only) or subscription-based (recurring on various days of the week). Bookings may also be entered as multi-leg itineraries and may be tagged as group bookings, i.e., clients who must travel together as a group. The requested times on a booking may be entered on the pick-up (e.g.,

"Pick me up no later than 9 AM") or on the drop-off ("Get me to school no earlier than 8:45 and no later than 9 AM). When a new booking is entered, such as a casual booking, it may be scheduled immediately, which will necessitate pushing the booking data (and possibly the client data if the client is new) to the external systems.

Subscription bookings also will need to be synchronized between systems, but should need to be done only once and not on a daily basis, assuming the external scheduling system supports the concept of subscriptions.

Any change to a booking (such as an update to the client's home address on a subscription booking or the outright deletion of a subscription booking) will require a synchronization update.

While bookings will be sent primarily from the TMCC to external systems, it will also be possible for reverse updates from external agencies. For example, when the TMCC software is first installed, its booking database will be empty, and the external systems will exchange their subscription and currently-entered casual bookings with the TMCC's centralized database.

Refresh Schedule Data

In the following sections, the TMCC scheduling process is described in greater detail; however, at this stage, the notion of refreshing schedule data is introduced.

As described for the synchronization of clients and bookings, an update to scheduled events by external systems should also require notification of the TMCC. Although the TMCC will never alter the schedule times produced by external systems, those systems may, in fact, allow times or run assignments to change after events have been scheduled. For example, the software scheduling systems in use at PARTA and Geauga County Transit has a "drag and drop" interface that allows events to be moved from one vehicle to another, which may necessitate all times to be recalculated. As such, the Refresh Schedule Data command may send updated times back to the TMCC's centralized database. In this manner, a rider may, for example, be able to consult the TMCC website for the most up-to-the-minute estimated times of arrival for all of his/her trips throughout all counties. Likewise, as external CAD software marks pick-ups and drop-offs as being performed, these data updates can also be sent via this command back to the TMCC.

Scheduling Process and the Trip Parser

Schedule Trip Request

When the TMCC initiates a request to schedule a trip, it will first parse the trip based on its origin, destination, services allowed by the booking, and number of

transfers allowed by the client, in order to understand which providers could participate in facilitating all or a portion of the trip. The TMCC software will include a geographical map of each external provider's area of coverage, as well as the permissible transfer points between each service area. (A transfer point may be configured as an "in-seat" transfer in the case where a fixed route, such as a public bus line, extends from one providers coverage area to another.)

Parsing the trip will enable the TMCC system to break down the trip into the smaller portions that can independently be optimally solved by the external providers scheduling software. The Schedule Trip Request can be sent from the TMCC to the external system containing pick-up and drop-off coordinates that are within that providers area of coverage, i.e., potentially a "sub-booking" of the rider's desired booking. The TMCC will maintain in its centralized database the link between an actual client booking and the sub-bookings created by external systems between transfer points.

The Schedule Trip Request will include:

- Booking XML structure
- N, the number of the top solutions desired
- Schedule Trip Solution Set – this command is designed as a response to the Schedule Trip Request and will be sent by the external scheduling software back to the TMCC

Each solution will include:

- A solution identifier
- A set of Scheduled Events (corresponding to the pick-up and drop-off, which may be multiple events in the case of transfers within a region)
- Solution cost to the provider

At this point, the events will not actually be scheduled, but will serve as an indication of availability at the moment of the request.

The TMCC may receive schedule solution sets from multiple providers in the case of trips that cross geographical boundaries. It will be the TMCC's responsibility to coalesce the results that join together at transfer points, such that the overall provider cost is minimized. The top N solutions will then be presented to the TMCC reservationist, who may negotiate with the rider as to which is the preferred solution.

Schedule Trip Solution Selection

Once the call-taker and rider have negotiated and chosen the preferred solution, the selection will necessitate the transmission of the Schedule Trip

Solution Selection request to all of the affected providers. Each Solution Selection request sent to a provider will include the following

Solution Identifier

The final solution will not be considered final until all external systems respond to the Solution Selection request with the Solution Selection Confirmation.

Solution Selection Confirmation

Since it is possible that space on the vehicle promised at the time the solution was generated can have been filled by a different rider, the confirmation layer to this process will add a degree of protection. It will ensure that all providers have saved (acknowledged) their portion of the trip and that the final itinerary can be communicated to the rider.

In the event that not all external systems provide confirmation of their solution, an error message will be displayed in the TMCC call-taking interface, and a subsequent solution may be negotiated. It may also be necessary to unschedule the portions of the trip whose provider had, in fact, transmitted a confirmation of the solution selection.

Once all external providers have received confirmation, the trip can be considered scheduled, and no further communication is needed.

Note that the above process described for some commands will apply when the TMCC interface is the initiator of the scheduling request, i.e., during the course of the phone call. However, the external providers will be free at any time to initiate their own "batch schedule" requests of all trips in their area of coverage for the purposes of re-optimization or to account for changes in vehicle availability or other different conditions. This scenario would not necessitate any communication of scheduling commands back to the TMCC; however, it may require the usage of Refresh Schedule Event requests if schedule times or run assignments have changed.

It is also possible for a provider to abandon a previously-scheduled trip (perhaps due to resource unavailability, accident, etc.) and will be able to request the TMCC to broker it back to all other external providers. If this trip is a portion of a transfer between geographical areas, the TMCC would need to re-broker the entire trip.

Figure 3-3 shows a typical scenario of scheduling a trip between regions illustrates the service requests that would be sent between the TMCC and its integrated agencies.

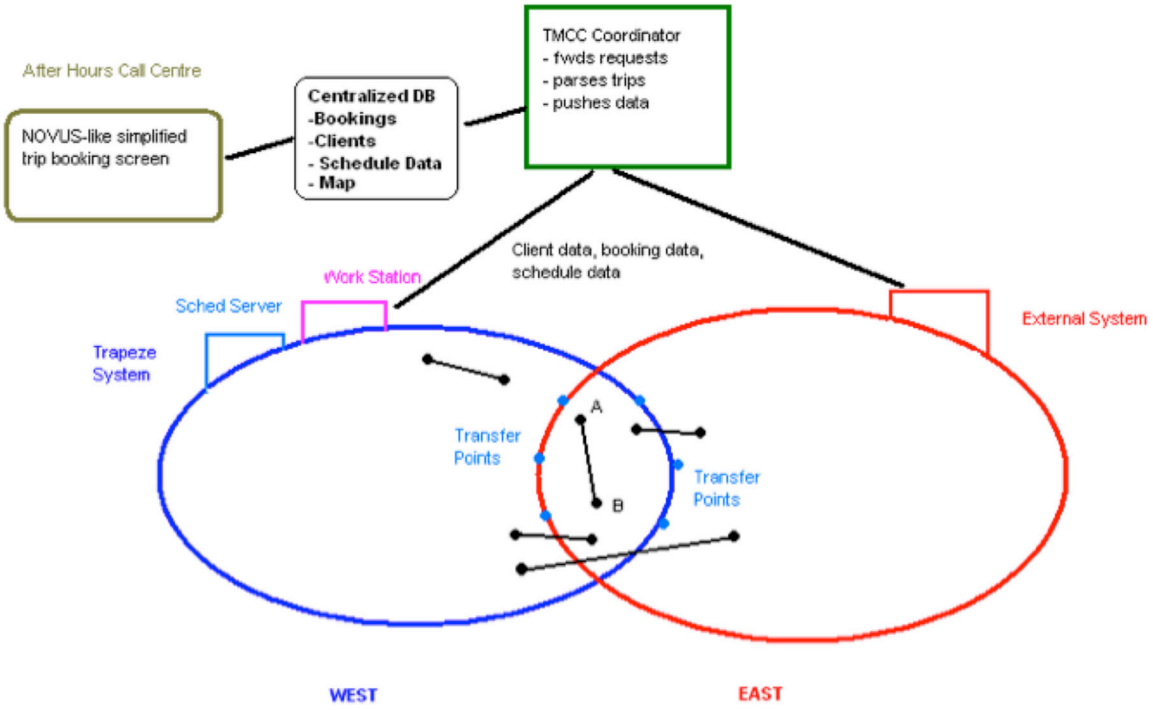


Figure 3-3

Example inter-regional trip booking scenario

Cancel Booking Request

Cancellation of a booking is initiated by the TMCC when, for example, a rider calls NEORide and indicates he no longer requires the trip booking.

Interface to Vendors and Other Software

Previously, the potential XML structure was discussed, as was the nature of the Service Oriented Architecture to be used by the TMCC. By exposing its functionality to external applications with Internet access, any product should be able to invoke through HTTP the service requests needed to synchronize data and respond to scheduling requests. The simplest method of coordinating data synchronization with the TMCC software is through a database listener implementation. The TMCC will include a Software Development Kit (SDK) that easily allows TMCC service requests to be both "heard" and responded to. The database listener will need to be configured by the vendor or external provider to map its own data structures into the XML structures required by the TMCC. It will also need to be configured to read from the data source used by that system (e.g., Oracle, SQL Server, FoxPro, Excel spreadsheet). Essentially, the listener will continually poll the database and be aware when changes to clients, bookings, or scheduled events are made, then send that updated information back to the TMCC in the required protocol. Ideally, the

database listener also could have the access to perform data updates (e.g., the creation of new bookings) when needed.

At no point in time will the vendor need to expose its own code-level implementation or proprietary data structures to the outside world.

The scheduling layer will be more complex, depending on the implementation of the third-party scheduling system. Ultimately, the software will need to respond to requests that previously may have been possible only to be initiated through its graphical user interface, e.g., by pressing a button.

The following three functions minimally would need to be support by a third-party system:

- Refresh Client/Booking/Schedule Data (refresh all)
- Schedule Trip Request (may always return one solution and automatically include confirmation in the response)
- Un-schedule Trip Request (replaces cancel if this cannot be supported)

Revenue Issues

Electronic Billing Interface – Medicaid

The NEORide project partners will work with the State of Ohio to import trip eligibility data information needed for Medicaid and other agency reports. The TMCC will have the ability to submit claims electronically and verify eligibility in the State of Ohio. The electronic billing process will include:

- Calculation of flat rate, zonal, or per-mile rate for each trip based on distance from pick-up
- Selection of trips based on date range and funding source
- Processing of trips for single or multiple providers
- Setting of unique rates for trips by fare type, funding source, space type, para service type, etc.
- Submittal of data in Electronic Data Interchange (EDI) format, including client name, Medicaid number, gender, SSN, DOB, provider name, provider tax ID, provider Medicaid ID, distance, trip start and end times, and amount charged.

The Electronic Billing Interface will streamline the import of State agency data through the use of clear and easy data entry screens and an integrating function that now requires manual tasks and external lookups to complete. When the data import is complete, a summary message will be displayed providing information as to the results of the import.

Fare Collection

Fare collection in the TMCC system will be done through a third-party vendor with an interface to the NEORide system. The system will use proximity card readers on each vehicle to collect fares, making the TMCC a "cashless" system. Cards will be filled with fares at a number of locations in Portage and Geauga counties as well as human service agencies.

The NEORide TMCC team is researching stored-value card technology and may choose either a completely outsourced solution or an "à la carte" system. Special interest in implementation will be directed to the use of "proximity cards" to allow people with disabilities to pay easily when entering the vehicle.

Reporting

The TMCC will use a self-contained report-writing shell and produce a variety of standard types of reports, including National Transportation Database (NTD) information; data diagnostics; fare/funding sources; operational, productivity, and statistical data; manifests; taxi manifests, and other ad hoc reports. The TMCC will also go a step further and use additional software products to have instant access to system information, typically called a "dashboard." This software will aggregate key performance indicators of NEORide system service providers and present them in intuitive, graphical "dashboard" screens. Interactive, browser-based applications can present both executive and management level information. The program will give the TMCC management a 360-degree view of the operation in order to make decisions on the fly. Features of such software include the following:

- Track, analyze, and compare performance indicators from each TMCC participant.
- Graphically visualize the performance of the system and drill down to a wide array of multidimensional metrics such as overall NEORide trips per day, miles per trip, and other statistics.
- Understand how well NEORide's demand-response service is meeting the needs of the customers with the latest data.
- Manage daily operations with personalized access to the latest performance indicators for the TMCC.
- Track commendations and complaints and drill down to the details of the level of customer service provided in the NEORide TMCC.

The dashboards graphically present analytics as gauges, charts, and reports, allowing users to drill down to the information underlying key performance indicators. TMCC management will use the data to identify ways to deploy vehicles and staff more efficiently and reduce the need to generate and consult paper-based reports.

The software and dashboard will support comparisons of, for example, passenger per vehicle hour statistics year-by-year and quarter-by-quarter, determination of which provider is providing the best overall service, and metrics such as shared-ride percentage, average trip distance, vehicle utilization, and garage deadhead to ensure that garages are optimally located. Also, the software will allow for quick access to the latest data on fares, costs, and more for each provider in the TMCC.

Other

Fixed Route

PARTA will continue to use its fixed-route software to transfer demand-response trips when feasible for cost efficiency. No other provider in the TMCC has fixed-route capabilities.

Rideshare

Features of the TMCC rideshare system will include:

- Fast, automated matching of NEORide rideshare participants using GIS-based techniques to perform specific matches by time of day, obstacle recognition, employer restriction, same-sex matching, route-to-work corridor matching, time flexibility, and more. Results will be provided in seconds with even the largest databases.
- Web interface to www.neoride.org to allow commuters to register online and perform self-service ride matching. Employers can manage registrants over the Web. Single database design eliminates need to transfer or replicate data.
- Integrated vanpool matching and rostering to define the entire vanpool service area, routes, and stops graphically on a map. Tracking of drivers and riders and performance of cluster analyses quickly and easily.
- Advanced reporting to reduce time and effort spent tracking matching activities and marketing efforts using numerous predefined reports plus a built in report generator.
- Integrated mapping to maintain mapping data through high-performance graphical map displays. Geocoded locations by address, cross street, postal code or by clicking on map image.
- Efficient communication tools to keep NEORide users up to date in print or email, with easy-to-use email merge features. Automatically contact commuters for online renewal of registration.
- Guaranteed Ride Home (GRH) tracking to manage GRH trips, track funding sources, and monitor the cost of each voucher. Coordination with neighboring rideshare service providers in Lake, Summit and Cuyahoga counties.
- Support of multiple agencies using a single database while keeping data separated for reporting purposes.

System Communications and Hardware

In this section, the overall hardware and communications within the system, such as LANs, vehicles, etc., are described.

Communication

Communications technologies, including fast, reliable Internet connection for all TMCC members, are fundamental to the TMCC. Other aspects of communication include a hosted service, a Cellular Data Network for TMCC / vehicle communications, and in-vehicle technologies.

Hosting Services

A dedicated hosting service will lease the TMCC an entire server that will not be shared with anyone. This is more flexible than shared hosting, as the TMCC will have full control over the server(s), including choice of operating system, hardware, etc. Server administration will be provided by the hosting company Rampant in Cleveland. The dedicated server will offer less overhead and a larger return on investment for the TMCC and will provide redundant power sources and an HVAC system. The server hardware will be owned by the provider, who will provide support for the TMCC operating system and software applications.

The TMCC hosting server provider will use extreme security measures to ensure the safety of TMCC data stored on its network of servers. Providers often will deploy various software programs for scanning systems and networks for obtrusive invaders, spammers, hackers, and other harmful problems such as Trojans, worms, and eggdrops. Linux and Windows will use different software for security protection.

Cellular Data Network

Communication with the TMCC vehicles will be done through a cellular data network with wireless air cards. These will give TMCC vehicles mobile, wireless broadband access to the Internet. A TMCC disaster recovery plan will incorporate the cellular data network and define procedures if the network is down.

In-Vehicle Technology

For in-vehicle technology, the TMCC will use Mobile Data Computers (MDC) and proximity fare card readers for paperless fare transactions. Building on the existing rugged laptops installed at PARTA, the TMCC will install ruggedized PCs on all vehicles for use as MDCs (see Figure 3-4).

Figure 3-4
Rugged laptops for MDT installations

Currently, there are 56 rugged laptops mounted in PARTA's fleet using software to monitor the vehicle locations and relay information to drivers, improving the quality of service to passengers (see Figure 3-5). This system ensures that the TMCC can locate the vehicles anytime and anywhere and cab update a driver's route instantly so more passengers can be picked up in a shorter period of time.

Figure 3-5
PARTA's mounted rugged laptop

The TMCC system will use proximity card readers on each vehicle to collect fares making NEORide a "cashless" system. Cards can be loaded at a number of locations in Portage and Geauga counties and at human service agencies. The reader has a built-in antenna and is designed for integration for e-ticketing fare collection and validation. The reader/writer unit is optimized for maximum data throughput rates on both the air interface and the serial interface. The proximity card allows for communication with the card reader through Radio Frequency Identification (RFID) induction technology. These cards require only close proximity to an antenna to complete a transaction. They are often used when

transactions must be processed quickly or hands-free, such as on mass transit systems, on which smart cards can be used without removing them from a wallet. Examples of widely-used contactless smart cards are Hong Kong's Octopus card and Japan Rail's Suica Card (see Figure 3-6).

Figure 3-6
Contactless card reader

There are dual-interface cards that implement contactless and contact interfaces on a single card with some shared storage and processing. Like smart cards with contacts, proximity cards do not have a battery. Instead, they use a built-in inductor to capture some of the incident radio-frequency interrogation signal, rectify it, and use it to power the card's electronics. In the future, this type of contactless card system can be integrated to use mobile phones instead of cards.

Back Office Hardware

The back office configuration is focused on high performance and availability. Careful consideration has been given to designing an environment that can meet both demands equally. This infrastructure uses clustering services to provide high-availability servers, and each device contains best-of-breed components for optimal performance. Starting with the infrastructure's network devices or appliances, all such devices should be industry standard products. Firewalls are redundant (active/passive failover). All switches will be from the Cisco Catalyst product line that feature wire speed transmissions.

All servers are to be configured in an Active-Passive failover cluster, which ensures maximum uptime in the event of server interruption or system maintenance. This configuration permits flexibility in managing servers over the

course of time. The servers are industry-leading rack servers, each configured with optimal 15k RPM hard drives, Quad-core processors, Redundant Array of Independent Disks (RAID) arrays for storage fault tolerance, optimal amounts of RAM, and redundant components such as power supplies, fans, and network cards.

Every device will be actively monitored from within the hosting facility and remotely. Monitoring applications are in place to notify support staff immediately if a device or service is near maximum capacity or in danger of stopping. These tools create a proactive support environment in which technicians are one step ahead of potential issues and in a position to monitor and configure devices for maximum performance.

The focal point of this infrastructure is an industry-leading Storage Area Network (SAN) device that is highly scalable and redundant. This SAN provides load balanced storage using 15k RPM drives in a RAID array. It is scalable to grow as needed and comes complete with a large library of software tools to allow such functions as full and differential snapshots, load balancing, disk monitoring, and volume management.

System Recovery Plan

Disaster recovery includes the process, policies, and procedures of restoring operations critical to the resumption of business, including regaining access to data (records, hardware, software, etc.), communications (incoming, outgoing, toll-free, fax, etc.), workspace, and other business processes of the TMCC after a natural or human-induced disaster. To increase the opportunity for a successful recovery of the TMCC, a well-established and thoroughly tested disaster recovery plan must be developed in the next phase. This task requires the cooperation of all members of NEORide and Trapeze. A disaster recovery plan will also include plans for coping with the unexpected or sudden loss of communications and/or key personnel, the focus of which is data protection.

Future Maintenance of the System

The future maintenance of the system will be through a joint effort of all NEORide partners. The technology inevitably will evolve throughout the lifetime of the TMCC. Strategy and cost considerations must be put into place in the next phase to manage the maintenance. As the system becomes self-sustaining (see next section), costs need to be included in each budget year for maintenance.

SECTION 4

Results: TMCC System as Designed

Background

This report contains a second results chapter because of the extended nature of the project. PARTA was first awarded a UWR grant in 2007 to envision the system that was described in Section 3. This section outlines the TMCC that was designed with the Phase II funds ($100,000). Appendix B includes a complete functional requirements document.

Overview of Coordinated Transportation Operations

Demand response agencies are constantly looking for more operational efficiency, productivity, and greater customer satisfaction. Coordination of service with other agencies or organizations is one way to achieve this. Agencies covering proximal geographical areas, such as the Portage Area Rural Transportation Authority and Geauga County, for example, or that sharing portions of a client base have great potential for coordination and its benefits. The overall capacity of a coordinated system is greater than the sum of individual efforts due to this cooperation, similar to the concept of synergy.

Given an overlap in geography and client base, another provider or organization participating in the coordination effort may have a less costly (lower mileage, driver hours, etc.) or more convenient solution than the original provider. In addition, the original transportation provider may deny a trip altogether due to a lack of capacity (e.g., filled schedules, not enough drivers). However, with coordination, the trip could be performed. Also, trips that traverse through different provider service areas can be accommodated with "transfers," similar to the concept of synergy, in which the whole is greater than the sum of the parts—individually, these trips do not get the client to where he/she must go, but together they do. Thus, coordination can benefit agencies in multiple ways and should be applied.

To exemplify these benefits and others, a recent simulation study done by Gross and Torng (2013) demonstrated that by coordinating pools of trips (in their example, Medicaid trips combined with all other types of trips) and sharing vehicles, major operation efficiencies arise. Total vehicle hours, total revenue hours, total vehicle distance, and total revenue distance all showed significant decreases when coordination was applied, versus when the trip pools were performed separately. These decreases point to fewer hours of driver wage, less

fuel consumption, and lower maintenance costs—all real operating cost savings. Furthermore, the number of vehicles was shown to decrease drastically (by roughly 20%) when coordination was applied, which, in turn, drove down capital costs. Ridership and productivity also benefitted from coordination, as a dramatic increase in passengers per revenue hour rose by about 20 percent in the study. Finally, customer service also was improved. Average trip times were significantly reduced. Trips that were far longer than their Google estimated time (non-direct trips) were reduced significantly, meaning routes were more direct and efficient from the rider's point of view.

However, to attain these efficiencies, agencies and organizations must first be capable of communicating with and understanding each other. As agencies are trending towards computer-aided scheduling and dispatching, a big hurdle in this process of coordination is the presence of different policies and conventions honored by individual providers and software products that may conflict with each another. With its Dictionary feature, the presented TMCC solution provides translations for the standards, conventions, and data structures between providers and, thus, communication is facilitated and shared records (e.g., clients, trips) can be synchronized. Providers that can effectively communicate with each other can subsequently coordinate their efforts.

Following Phase I, the planning phase for the TMCC, funded by the UWR Program via the MSAA initiative, PARTA and Trapeze worked together to make the plan materialize. As part of earlier legislation (the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, SAFETEA-LU), Programs 5316 and 5317 were essential to developing the blueprint for the software system.

The following sections describe how the requirements of PARTA and its One-Call, One-Click initiative came to be a reality in the form of the Trapeze Community Connect module. With this piece of software, not only do agencies benefit in the ways mentioned above, but clients can ultimately place a call to one number or go to one website where booking a trip is seamless, the solutions from all providers can be seen, and the preferred solution can be selected. This means that travelers also can reap the benefits of the greater network of trip solutions available to them with one unified hub on which to search. Registration and update recordkeeping also are simplified via centralization and the TMCC's data dictionary, used to synchronize data through the central module.

TMCC System Description

Functional Requirements

Appendix B includes the full set of Functional Requirements.

System Feature Set

The presented TMCC system has a multitude of features designed specifically to facilitate and enhance the process of coordination in demand-response transportation along the philosophy of the One-Call, One-Click initiative. Main components include Client Record Management, Trip Booking and Scheduling, and Dispatch Management.

- Client Record Management
  - Automated publishing of newly registered clients to be shared as specified on the TMCC centralized database.
  - Automated synchronization of updates made to client's information.
  - Dictionary translation incident management.
- Trip Booking and Scheduling
  - Automated publishing of newly-saved or scheduled trips associated to certain providers on the TMCC centralized database.
  - Automated synchronization of updates made to trip information and rescheduling logic if updates cause scheduling issues.
  - Transfer trip creation logic to search for both single provider solutions and solutions which incorporate transfers.
  - Management of service area breadth and transfer logic.
- Dispatch Management
  - Automated cancellation and no-show publishing to the TMCC centralized database.
  - Automated cancellations of transfer trips if no-shows occur.
  - Real-time AVL data publishing, including position, date and time, vehicle number, travel direction, speed, and odometer readings.
  - AVL playback functionality to display historical AVL information from all coordinating providers on a map.

General System Design

The presented TMCC system comprises two main components:

- The centralized TMCC system (Server), including the database and logical "router":
  - Contains pointers and connection information with respect to each connecting provider.
  - Automatically polls all providers at a regular to ensure that the connection is up.

  - Houses all GIS, service area, and time data as well as real-time and historical AVL information.
  - Contains all transfer points between connecting providers.
  - Contains transfer trip creation logic that concatenates individual trips from separate providers and includes settings for searching for and prioritizing solutions.
  - Houses and allows for management of the Dictionary data.
  - Contains the logic for dispatch (i.e., no-show and cancellation publishing logic).

- The provider connecting to the TMCC system (Partner):
  - Contains pointers and connection information for the TMCC Server.
  - Houses the API, which interacts with the TMCC Server for client records, trip information, AVL data, etc.
  - Has securities to ensure that only what the provider would like to share is actually synchronized with the TMCC Server.

Detailed System Architecture

Appendix B includes Detailed System Architecture.

System Software – Trapeze Community Connect

Client Administration Component

Overview

When a client requests demand-response service with the TMCC, all relevant client information is recorded and maintained. These data are used each time a trip is booked for that client. The system can register new clients and capture information about addresses, contacts, disability type, space requirement, load/unload time, fares, payment options, eligibility conditions, funding sources, and so on. Clients ultimately will be able to access the system through a variety of media. The aim for this system in the Greater Akron Area is to allow for users to call to one number or access a website that would be able to talk to the system, consistent with the One Call, One Click model. Also, system administrators and users can search for a specific client record using a partial name, client number, DOB, and phone number and edit a client record, mark it as inactive or ineligible, or delete it from the system. Statistics are logged about each client, including last trip date, cumulative trips, no-shows, cancellations, and late cancellations.

Registering a Client

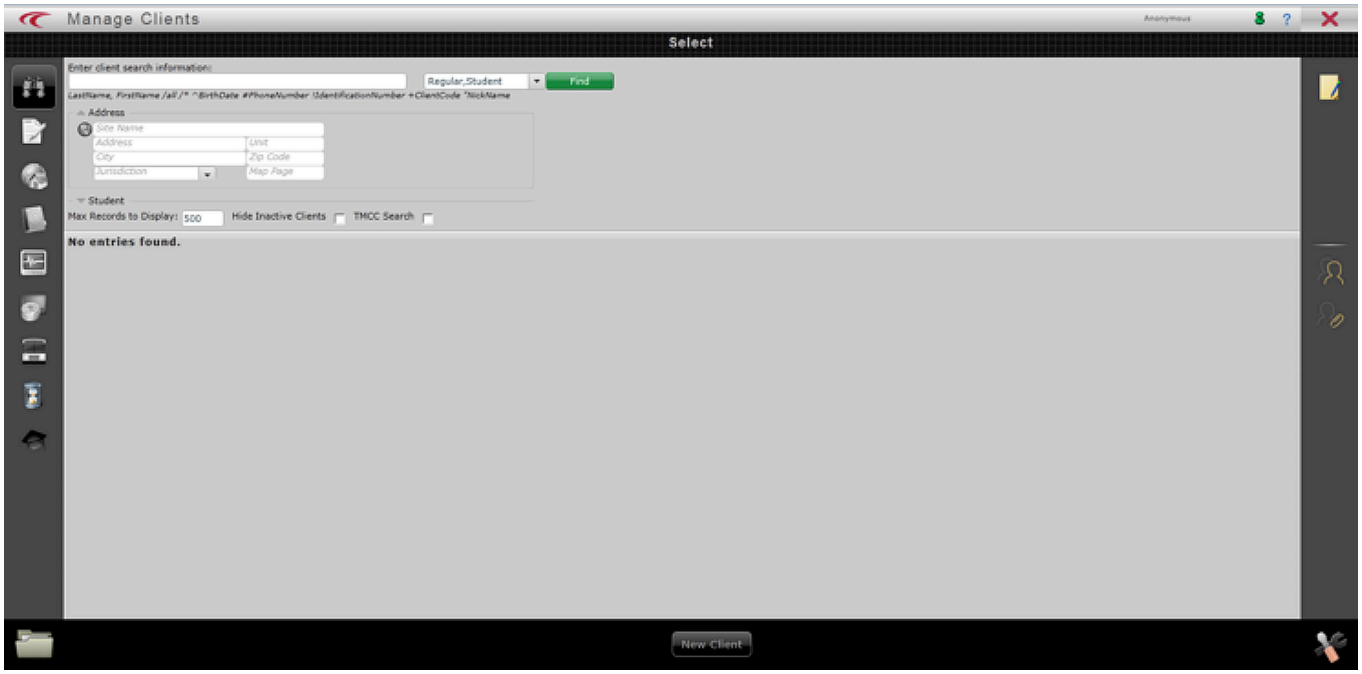
All client information is kept in the TMCC central database and is accessible in real-time. When a client calls in to register to a One-Call, One-Click Center, the

call-taker inputs the client record into the system. Once the new client record is successfully registered, a unique identifying number (ID) is assigned to this client by the TMCC and shared with the external provider systems. This unique ID is used by all provider sites when referring to the client and his/her data. The TMCC also maintains a separate external ID from each provider site for every client registration record. To illustrate this, for the same client, IDs may be very different on the local systems (e.g., Geauga vs. PARTA), but they will be linked for mapping purposes with the unique TMCC identifier.

Prior to registering a new client, it is recommended that each provider site-search the TMCC client database to identify an existing registration record. There are logical checks to make sure that clients of the same client code do not get duplicated, but if any erroneous data entry were to occur and the code is new to the system, the TMCC will register a new client based on this.

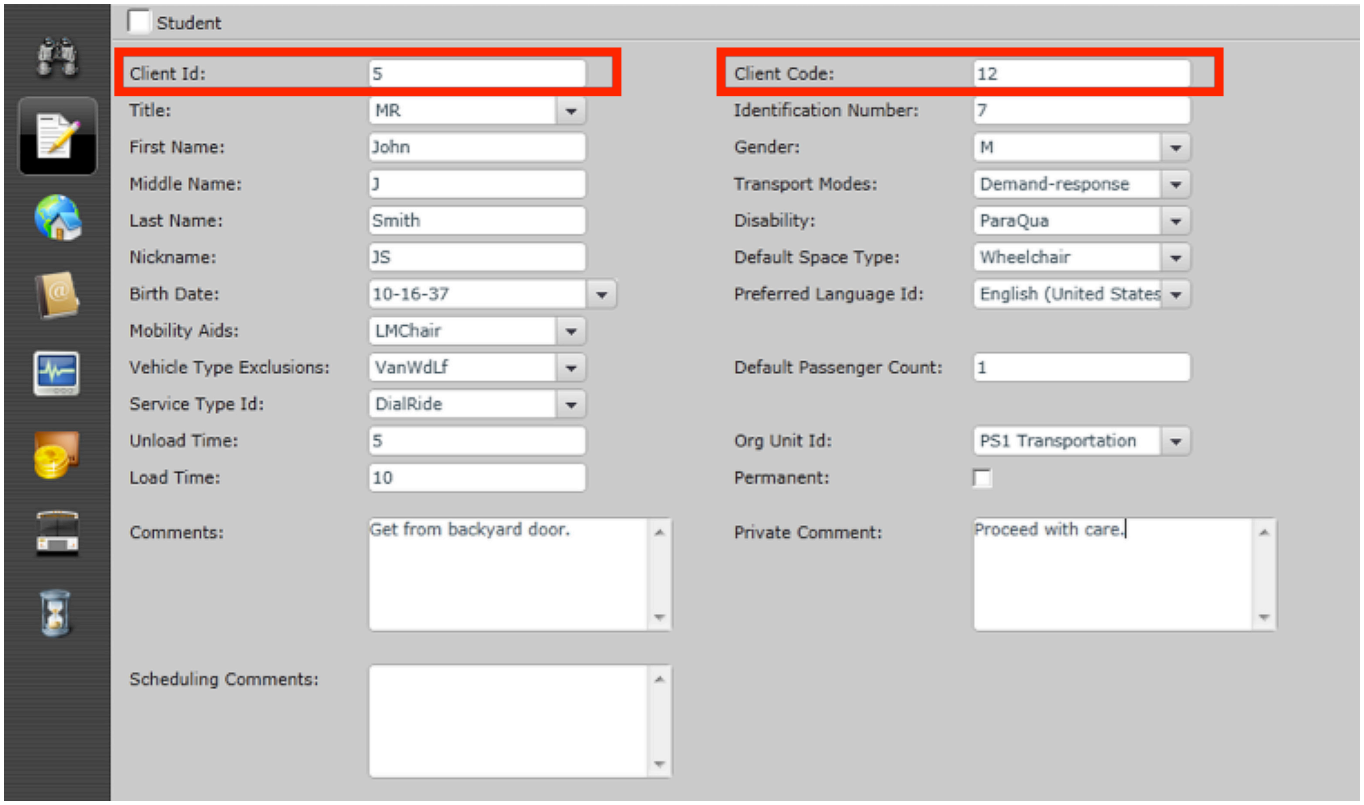
Step-by-Step Software Process Example

1. In the Manage Clients screen, click on the New button in the top-right corner.



Manage Clients screen

2. Fill out all client details, including the Client Code, which will act as the unique TMCC identifier. The Client Id field, the provider's own client ID, is automatically populated.



Client Information screen

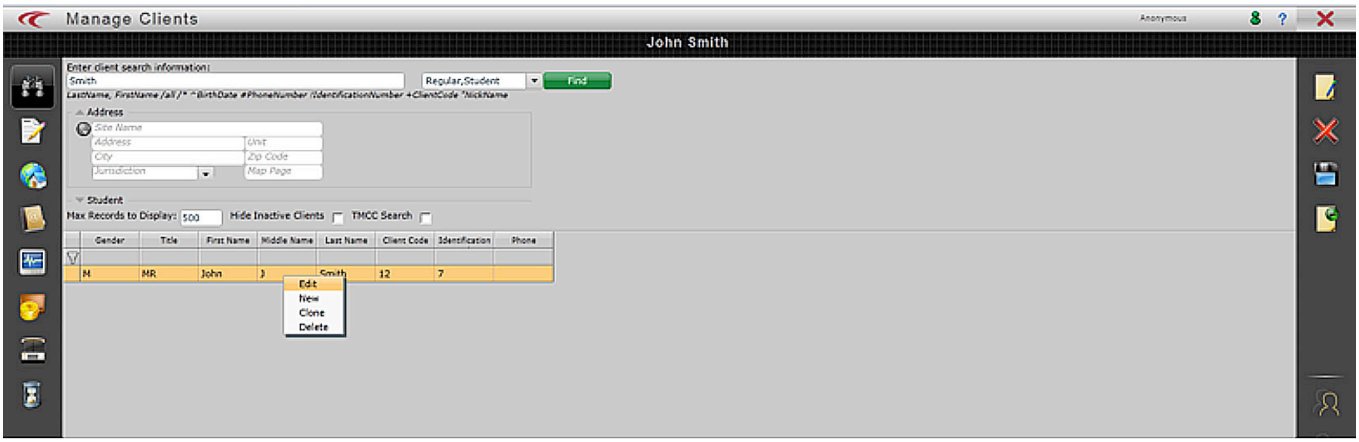
3. It is up to the provider's site software to determine if the client record is published centrally. If the provider wants the record published, ensure the TMCC connection is up, and save this newly-registered client by clicking the Save button on the right side of the screen. This pushes the client record to the TMCC central database, registers the client centrally, and assigns him/her a TMCC identification number.

Updating a Client

Client updates are sent to the central TMCC registration database via a real-time interface. Clients can be accessed from local provider sites and external provider sites if they are published in the TMCC. Once accessed through the interface, client records can be modified within the local provider or by an external provider through the TMCC. When the record is modified, it is updated centrally on the TMCC. For example, if a client were to call in to PARTA to request a change to his/her address, this information would be pushed to Geauga and updated automatically and in real-time. This eliminates the necessity for Geauga to replicate this update in their system.

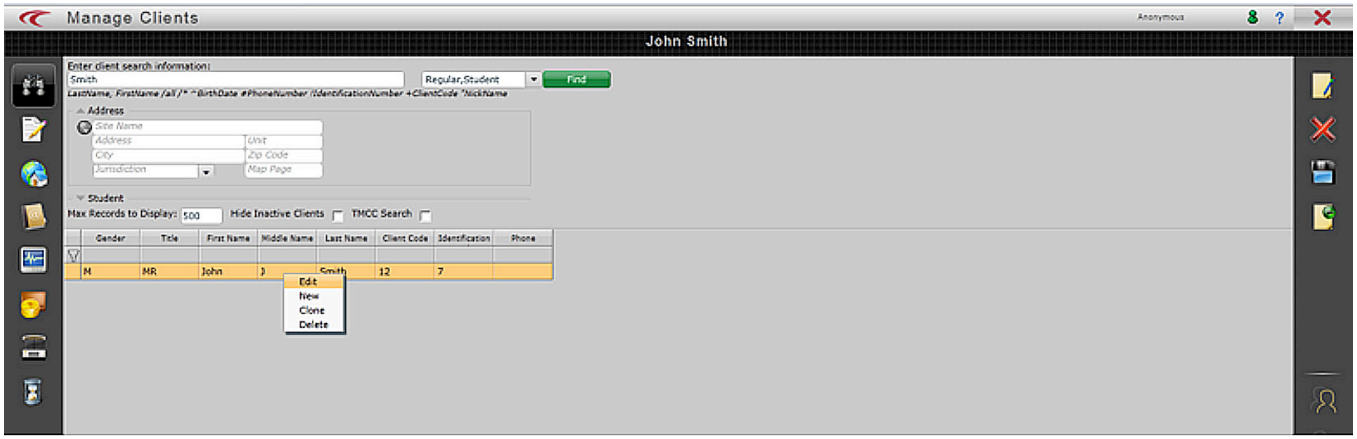
Step-by-Step Software Process Example

1. Perform a search for the desired client in the Manage Clients screen. Right-click on the desired client in the search results and select Edit from the dropdown menu.



Client Search

2. Make desired changes to the client's information and then click the Save button to push the changes to the central TMCC database.



Client Information Save

Client Synchronization

The TMCC ensures that all provider sites have the most recent client registration information by automatically sending client information updates from the TMCC to the provider sites and making the consequent changes, if necessary, in real time. Regardless of communication issues, the TMCC continues attempting to send the information until the provider site has successfully received the information.

In the context of the Ohio TMCC, this would eliminate double data-entry and data asynchrony between, for example, PARTA and Geauga. A client update that is reported to PARTA and updated within its scheduling system automatically would be synchronized to the TMCC "brain" and subsequently to Geauga.

Confirmation of Updates and Additions

The TMCC enables a user to identify which external provider systems have successfully registered new client records and updates. This information is visible on the TMCC via the client registration user interface. Each client registration record has a corresponding external provider system verification record indicating which provider systems successfully received the updates. The following example illustrates this point:

Client Registration Record 123

External Provider System	TMCC Connection?	Registered Client	Received Latest Updates
External Provider Site "A"	Yes	Yes	Yes
External Provider Site "B"	Yes	Yes	No
External Provider Site "C"	No	No	No

In this example, Client 123's Registration Record has been input to Provider A's system. Since provider A's system is linked to the TMCC, the record will be queued into the TMCC "Outbox," where this message (which requests a registering the client record in other systems) is stored. Since Site B is connected to the TMCC, it has received the message and, in turn, has registered the client. Site C, on the other hand, is not connected to the TMCC and, thus, will not have received the message; therefore, the client is not registered.

The column in the example titled Received Latest Updates pertains to synchronization of the client record after it has been created. It may occur that, due to the rates of pinging the TMCC, Site B is temporarily out-of-sync with Site A's record; however, given enough time (in the order of seconds), the synchronization occurs. Incorrect data—asynchronous to the Dictionary—also will prevent a client update message from effectively updating other systems. Then, only by correcting the data record will it be able to synchronize with the TMCC and, subsequently, to others' systems.

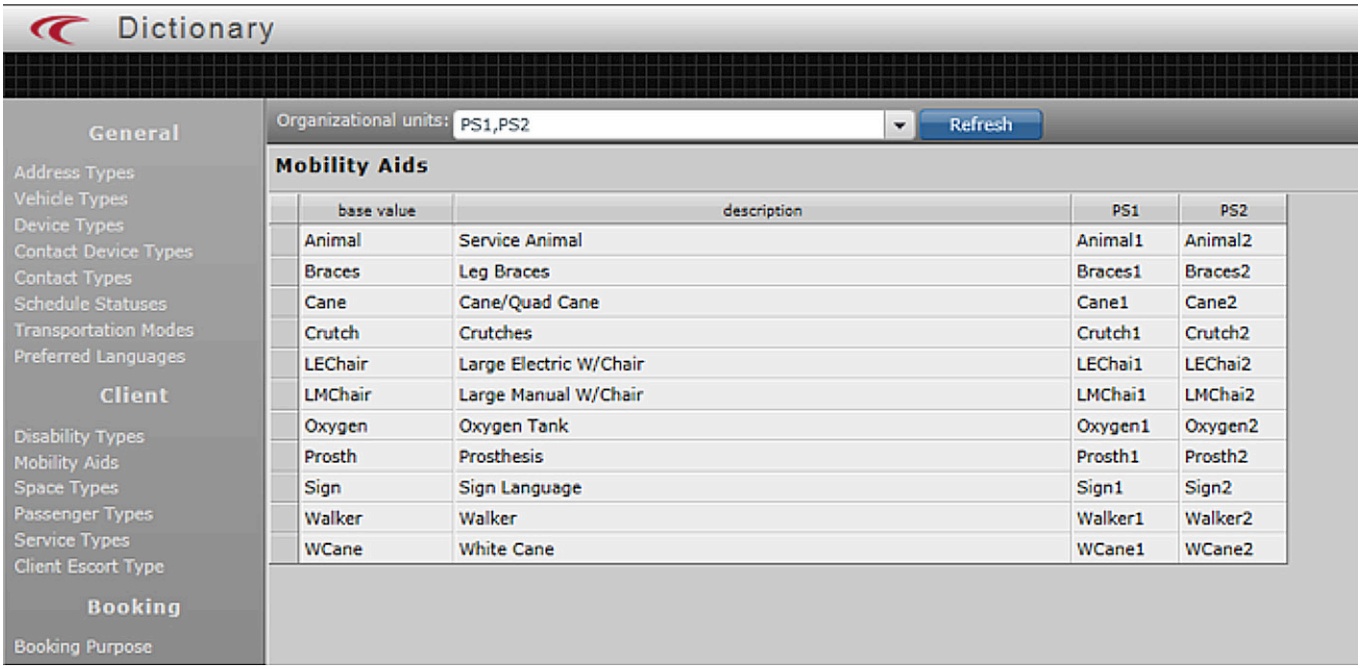
Client Data Elements

The TMCC enables provider sites to record the following information for each client registration record:

- Personal information (e.g., disability type, mobility aid, space type requirement)

- Address (e.g., home, work, emergency)
- Contacts (e.g., home, work, emergency)
- Service type (e.g., ADA, Medicaid)
- Eligibility status

An administrator can flag mandatory data elements. Because each TMCC provider site operates under its own specific business policies and procedures, it is unrealistic to expect that all sites will adhere to a common data standard. For example, a provider site might refer to a client's defined space type as "large electric wheelchair," whereas another provider site may refer to it as "scooter." The TMCC is designed to host a number of translation tables to convert provider definitions of ancillary data. The screenshot below provides an example of such a translation table:



Dictionary example

Each provider site can choose a different name for ancillary data elements. The software allows translations for the following data elements:

General Data	Client-Specific Data
• Address types (e.g., home, work) • Vehicle types (e.g., van, sedan) • Contact device types (e.g., home phone, mobile) • Contact types (e.g., emergency, work) • Schedule statuses (e.g., arrived, no show) • Transportation modes (e.g., demand-response, fixed-route) • Preferred languages (e.g., English, Spanish)	• Disability types (e.g. ,arthritis, dementia) • Mobility aids (e.g., crutch, walker) • Space types (e.g., home, work) • Passenger types (e.g., ambulatory, scooter) • Service types (e.g., dial-a-ride)

Information updates about shared clients are kept up-to-date at all times with the TMCC "brain." which ensures that all providers have the latest version of the client record. This means that if a certain client attribute is changed by a provider linked to the TMCC, the change will be sent to the TMCC "brain," which, in turn, will send the updated attribute(s) to the remaining providers. This translated automatic update ensures that each member of the coordinated environment is kept in the loop for every client update, eliminates double-data entry, and prevents conflicting data records. Client records will reside in the TMCC central database, saved with the "base values" for the data elements. The records will also reside in the individual providers' systems.

Thus, if PARTA and Geauga were to have different naming conventions for a certain mobility aid, the TMCC would use the base value as a means for translating the data element so that the system receiving the update would get the information in a recognizable format. This facilitates the maintenance of client records so that changes are made correctly across the TMCC, in sync with the Dictionary, in real-time.

Interface

All client information is kept in the TMCC central registration database through a real-time interface. The following methods show the TMCC request and response message structure used to support the client registration component:

- ClientUpdateRequest – request for updating changes externally on client records triggered by a local change.
- ClientUpdateResponse – external response for the client update. Indicates whether the update was successful.
- ClientLinkRequest – requests for the TCC central server to create a link for coordination purposes between two or more sites for a given client.
- ClientSearchRequest – request for searching client records based on certain criteria in the Client Record structure.
- ClientSearchResponse – response of the search with a list of clients in the form of a collection.

- GetClientDataRequest – method which pulls information for one specified client from the TCC. This is triggered when importing a client who does not exist locally.
- GetClientDataResponse – response returning Client Info structure for the requested client.

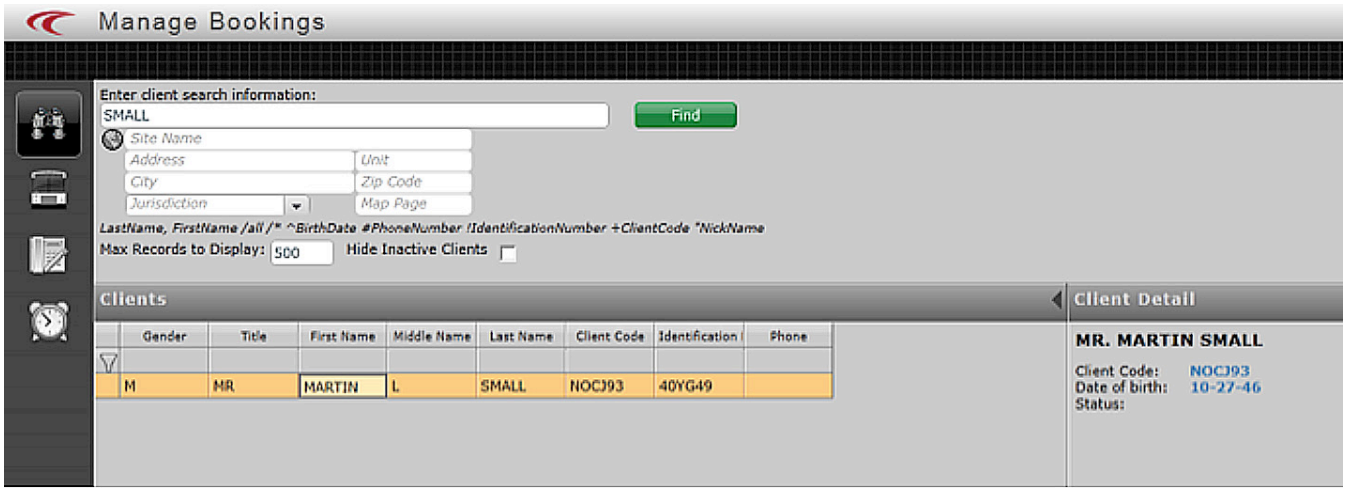
Booking and Scheduling Component

Trip Booking: Creating and Saving

Every trip booking that the TMCC processes, via a real-time interface, is maintained within the TMCC's centralized database. Each successful entry of a trip booking record generates a unique booking ID by the TMCC and delivered to the external provider system. This unique booking ID is used by all partner sites when referring to a trip booking record. Thus, in the Ohio TMCC, all participating providers will be able to access any of trips which are booked through the TMCC. The unique TMCC booking ID is what the system will use to identify this trip.

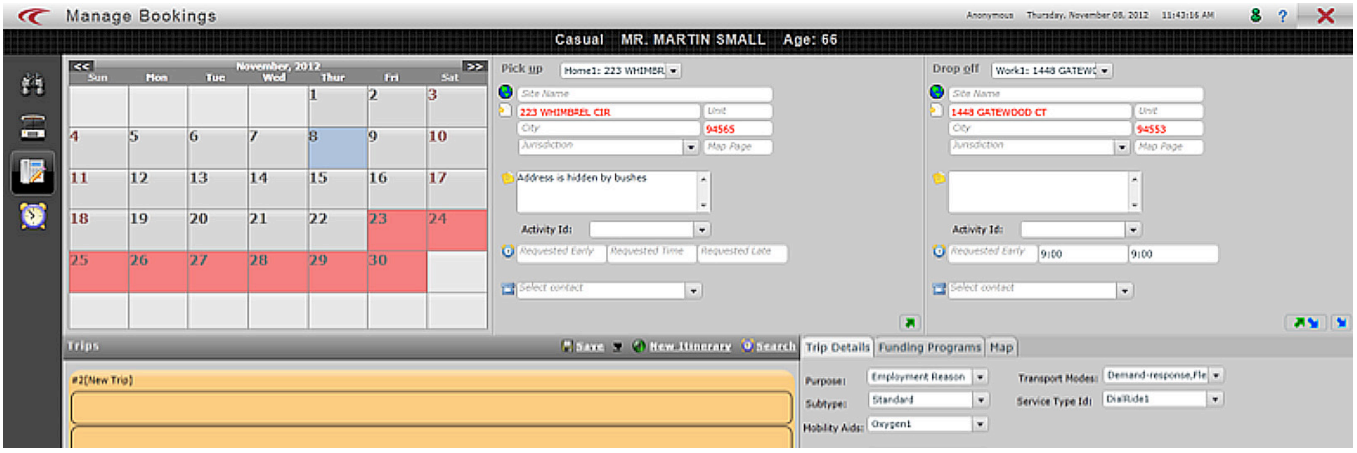
Step-by-Step Software Process Example

1. Search and select the desired client in the Manage Bookings screen.



Manage Bookings screen

2. Enter booking details, including date, pick-up and drop-off locations, requested times, travel purpose, mobility aids, transport modes, service type and then click the Save button.



Trip Booking

Trip Booking: Finding Solutions, Scheduling, and Confirming

Trips can be serviced by one provider only (local relative to the origin of the booking or external to it) or classified as transfer trips and served by multiple providers. A primary feature of the TMCC is to allow providers to search for possible solutions and schedule trips through different providers linked to the "brain." This task may be performed for many reasons, including a local lack of capacity, a less-expensive externally-offered solution, or an inability to perform the trip within the local service area or time.

The pick-up in the example in Step 5 below is outside the service area for Geauga. Thus, alone, Geauga cannot perform this trip; however, it lies within the service area for PARTA. Fortunately, with the help of the TMCC, a transfer solution can be provided: a trip that makes use of multiple providers and their service areas to provide a trip that would otherwise be impossible (or at least undesirable). The TMCC has logic to find solutions that involve transfers.

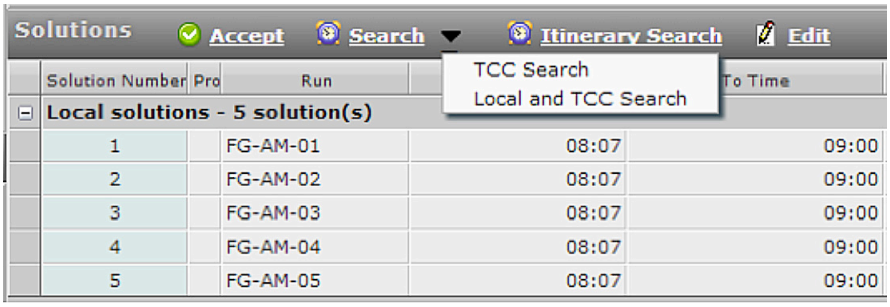
Step-by-Step Software Process Example

1. Create a Booking (Step 1 of the previous section).

2. Press Search (instead of Save) to find scheduling solutions. The default search is only for local solutions.

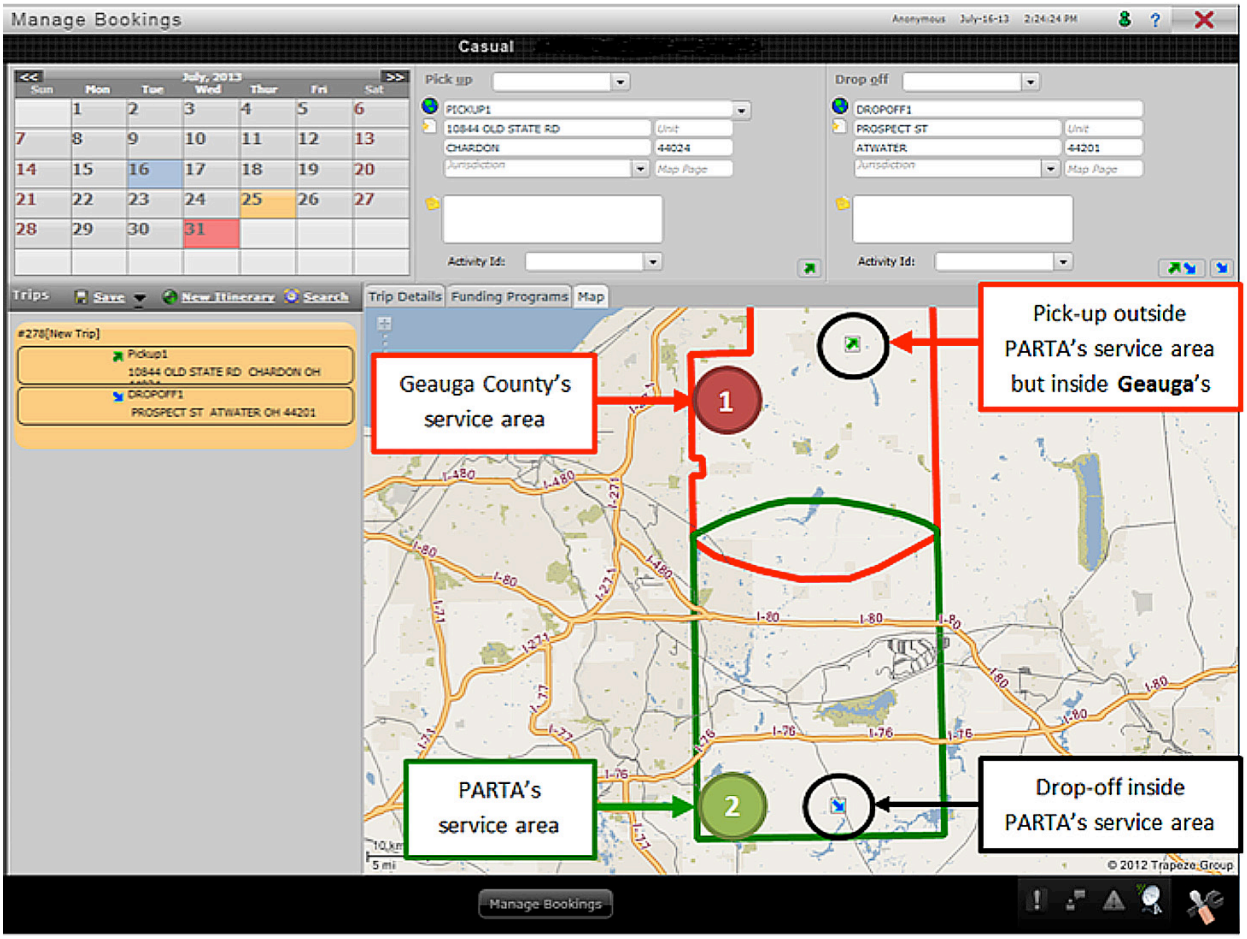
3. Given this default local search scope, and given that the trip that can be performed by the local provider, scheduling solutions from the only the local provider will be displayed. This can be modified with the dropdown activated by the down arrow and selecting "Local and TCC" (returns solutions from local

provider, other providers, or transfer solutions) or "TCC Search" (solutions for other providers or transfers involving other providers only).



Solution view

4. Given a trip that traverses multiple provider service areas, there will be no local solutions or solutions offered by any one provider. The following graphic shows a trip booking that would traverse between one provider and another's service areas:



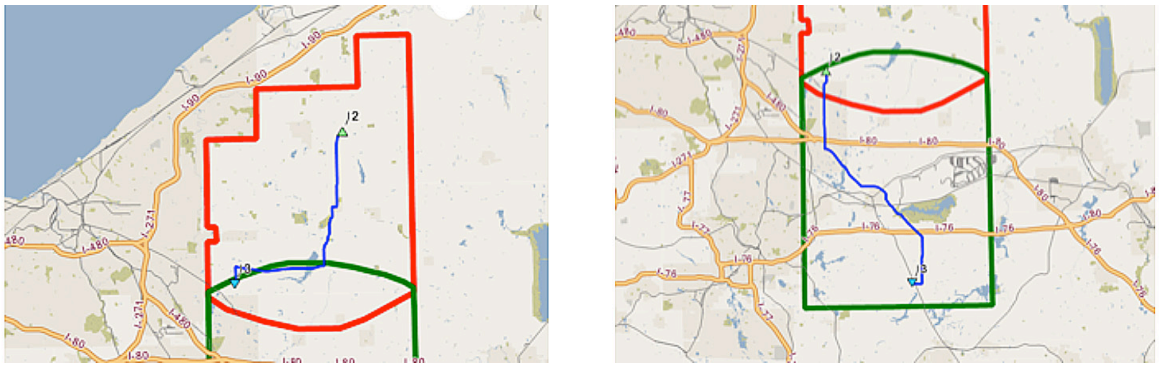
Transfer Trip Booking

Thus, booking such a trip could only be through a transfer trip where two individual trips are joined at a common location called a transfer point.

Solutions | Accept | Search | Itinerary Search | Edit

Solution Number	Run	From Time	To Time
Local solutions - 0 solution(s)			
Geauga - No solutions			
Solution(s) with 1 transfers. - Received 5 solution(s)			
0	Geauga_37	06:10	[07:15]
	PARTA_104	[07:20]	08:48
1	Geauga_37	06:10	[07:15]
	PARTA_107	[07:20]	08:48
0	Geauga_37	06:10	[07:03]
	PARTA_104	[07:10]	08:30
1	Geauga_37	06:10	[07:03]
	PARTA_107	[07:10]	08:30
0	Geauga_37	06:10	[06:56]
	PARTA_104	[07:01]	08:17

Solution Result View



TMCC transfer

4. To accept a solution, click Accept. The system will show a pop-up to indicate that the confirmation process in underway. This indicates that the TMCC is ensuring that, at the time of clicking Accept, all other providers are still capable of performing the trip.

5. "Solution is saved" will appear if the trip is successful. Otherwise, the dialog will read "Solution rejected."

Trip Booking Editing

Often, clients will call in to a provider connected to the TMCC to make changes to trip bookings they previously created. This would require the call taker to be able to bring up the booking in question and make changes to it as requested by the client. This could entail editing a trip that is booked locally on the call-taker's system or on an external system or a trip that belongs to a transfer comprising a local trip and external trip(s). For example, a client with a booked transfer trip between PARTA and Geauga's service areas could call in to PARTA, Geauga, or a central line to change the time of his/her trip or destination. Regardless of which entity takes the trip edit call, the TMCC will enable the trip to be rescheduled seamlessly across both providers and update all booking segments. This editing process via the TMCC differs based on who is editing the trip bookings and whose trips they are. For single-provider trips (same provider editing trip as scheduled to provide the trip), the editing process is simple. Fields (such as comments, booking activity type, pickup or drop-off memos) that have no scheduling ramifications can be updated on the fly without needing to reschedule the trip. However, when updating other fields, such as pick-up or drop-off times or locations or service type, which are directly operationally linked to scheduling and the actual manifests, the trip is first unscheduled and then rescheduled given the updates.

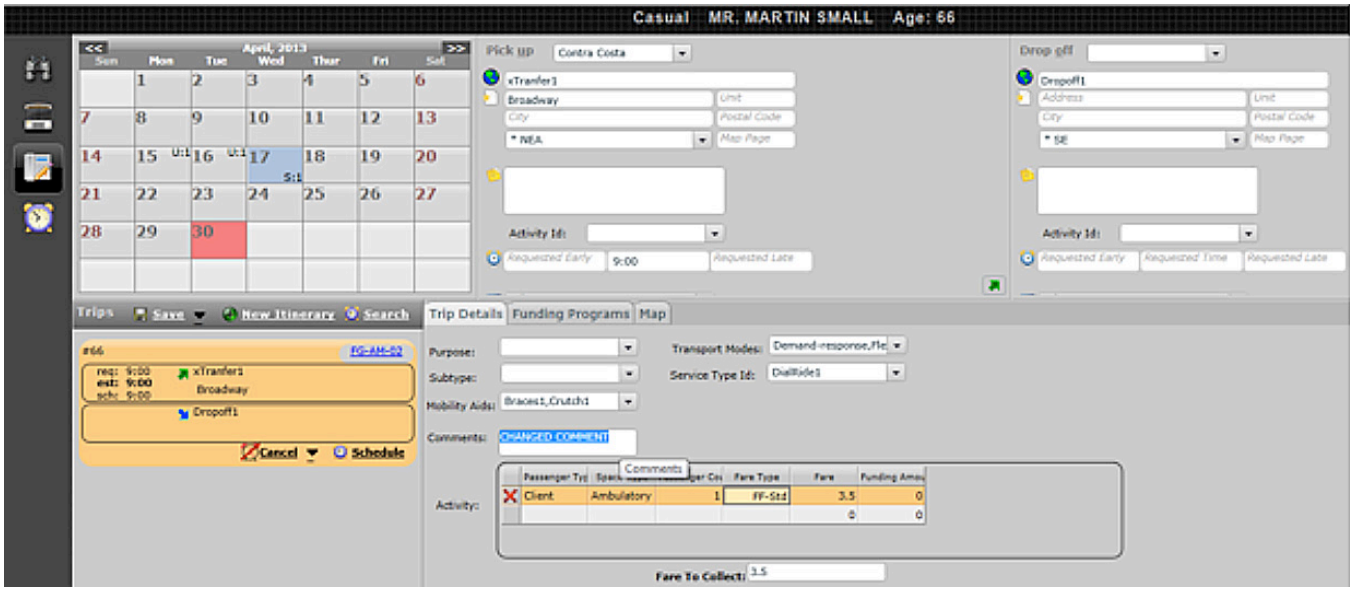
For transfer trips (which are essentially multiple trips belonging to multiple providers linked by transfer points and times), there is an extra layer of complexity when editing bookings. Just as with single-provider trips, fields that have no bearing on scheduling can be updated without the need to reschedule the trip. Where this process differs is when updating fields that do impact scheduling. Such an update will not only un-schedule the trip that is updated, but because the linked transfer trips are out of sync, they are automatically unscheduled as well.

Step-by-Step Software Process Example –
Updating External Booking: No Impact to Scheduling

1. Open the client's active trips for the desired day and right-click to bring up a set of options. Click Edit Booking.

TMCC External Trip Edit

2. If this is a transfer trip, click OK in the pop-up dialog box.
3. Make the update and click Save when finished.



TMCC External Trip Saved update

Step-by-Step Software Process Example – Single External Provider Trip with Scheduling Impact

1. Follow Steps 1 and 2 for Updating with No Impact to Scheduling.
2. A dialog box will pop up showing that re-scheduling is required as the system has noted a change that affects scheduling. Press Schedule to continue.
3. The trip is now edited with the change to the booking applied. The system will re-compute the possible solutions and present them again.

Step-by-Step Software Process Example – Transfer Trip with Scheduling Impact

1. Follow Steps 1 and 2 for Updating with No Impact to Scheduling.
2. Make the update and click Save.
3. A dialog box will pop up showing that re-scheduling is required as the system has noted a change that affects scheduling. Press Schedule to continue.
4. The system will re-compute the possible transfer solutions and present them again.

Booking Data Elements

The TMCC enables provider sites to record the following information for each client registration record:

- Personal information (e.g., comments, mobility aid, space type requirement)
- Address (e.g., pick-up, drop-off)
- Timing information (pick-up, drop-off times and time windows or constraints)
- Contacts specific to booking, origin, or destination
- Service type (e.g., dial-a-ride, special education, Medicaid)
- Fare type (e.g., flat fare, zone-based, etc.)

Interface

The following methods show the TMCC request and response message structure used to support the booking component:

- BookingScheduleRequest – request for a booking to be scheduled; the scope of the request can be as follows: Local, Local and TMCC or TMCC only.
- BookingScheduleRelay – if the TMCC is involved in a booking, this is the method that pushes the trip information to all partners.
- SolutionSetResponse – response from the TMCC of all the possible solutions for the trip given the constraints set in the TMCC and the local system.
- SaveSolutionRequest – request from a partner to the TMCC to save a booking; essentially confirmation from the partner of ability to perform the trip.
- SaveSolutionResponse – confirmation from the TMCC that the booking saved is valid; could return an error in the case of a transfer solution to which not all required providers accepted or could perform the trip.
- UpdateBookingScheduleInfoRequest – request triggered and sent to the TMCC server when a partner tries to update any field in a scheduled booking.
- GetBookingDataRequest – method that pulls information for one specified booking from the TMCC; triggered when importing a trip which does not exist locally and will be triggered in the case of accessing transfer trips as the external portions are not stored locally.
- GetBookingDataResponse –response returning Booking information for the trip.
- UpdateBookingDataRequest – request triggered and sent to the TMCC server when a partner tries to update any field in a booking
- UpdateBookingDataResponse – response of whether the TMCC server accepts the update to the booking or whether there is an issue with the Update requested.

Dispatch Management Component

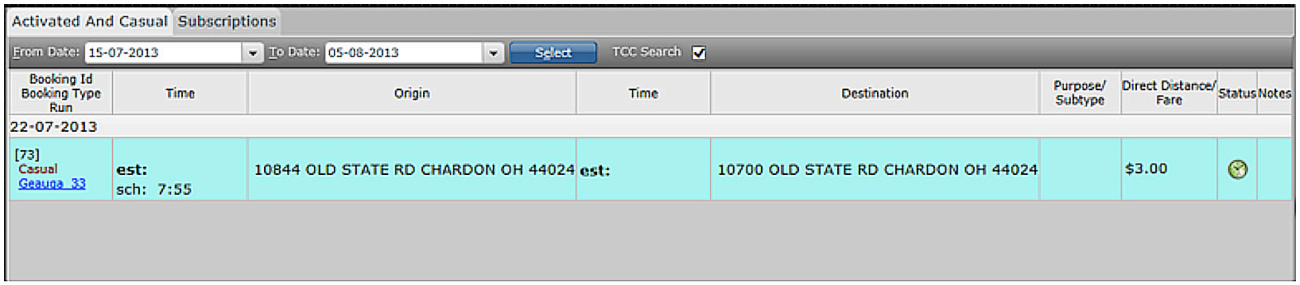
Dispatch Management: Canceling and No-Shows

Trip booking cancellation and no-show messages will be sent to the TMCC centralized registration database in real time as the cancellation or no-show occurs. When a client calls in and would like to cancel their trip (e.g. Same Day, Advance, Late, etc.), the reservationist can access the booking record (local, external, or transfer) and make the cancellation effective. This cancellation message is shared with providers through the TMCC in real time, so that it is visible in all partners' systems immediately.

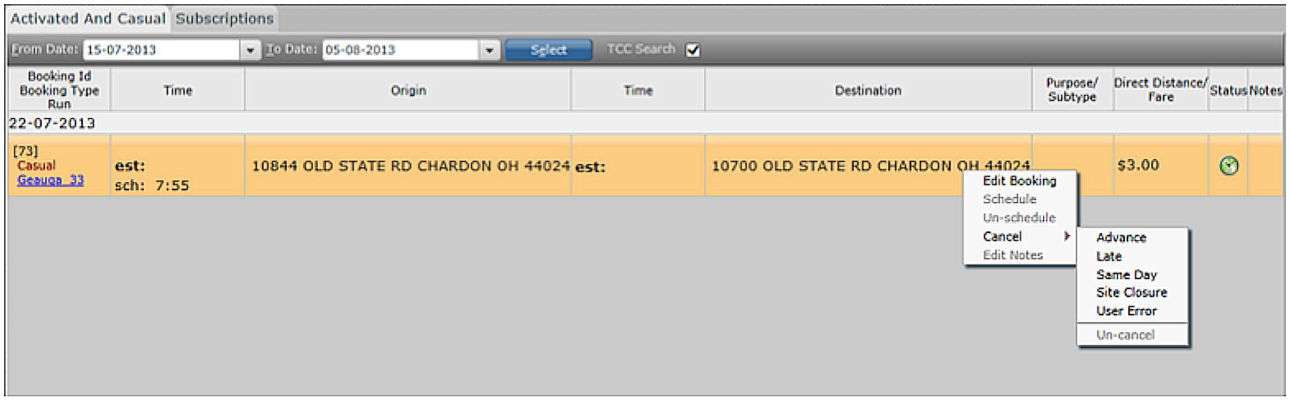
On the other hand, if a driver gets to a client's house and they, for some reason, do not come to the door within the required time, the driver can generate a no-show through an MDT interface or by calling the scheduler. The scheduler can then access the booking record and make the no-show effective. If the trip happens to belong to a transfer solution, the TMCC has a property which, if turned on, will cancel the rest of the trips that belong to that itinerary. The cancellation code which is triggered by this action is configurable in the TMCC's central system.

Step-by-Step Software Process Example – Canceling

1. Open the Client's active trips for the desired date range and right click to bring up a set of options. Click Cancel, and, in the drop-down, select the Cancel Code (in this example, Advance).



TMCC External Trip



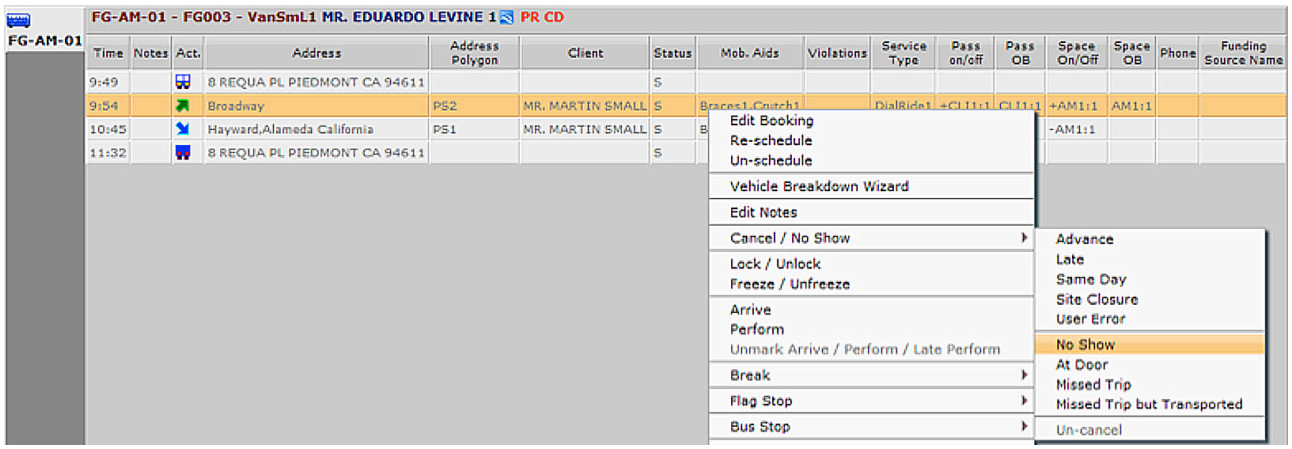
TMCC External Trip Cancel

Step-by-Step Software Process Example – No-Show

1. Open the Client's active trips for the desired date range and right click to bring up a set of options. Click on the run name hyperlink (blue) in the leftmost cell of the row for that trip. This will bring up the itinerary for that run. Note, this can only be done for local trips or local portions of transfer trips – these are indicated with white cells whereas blue cells are external.

TMCC Transfer Trip

2. Once in the itinerary for the run, right click on the pickup, go to the Cancel/ No Show option and select *No-Show* from the dropdown.



TMCC Transfer Trip No-Show

3. This is how the booking will look in the list of trips for the client. The red symbol on the right indicates a No-Show.

TMCC Transfer Trip No-Show

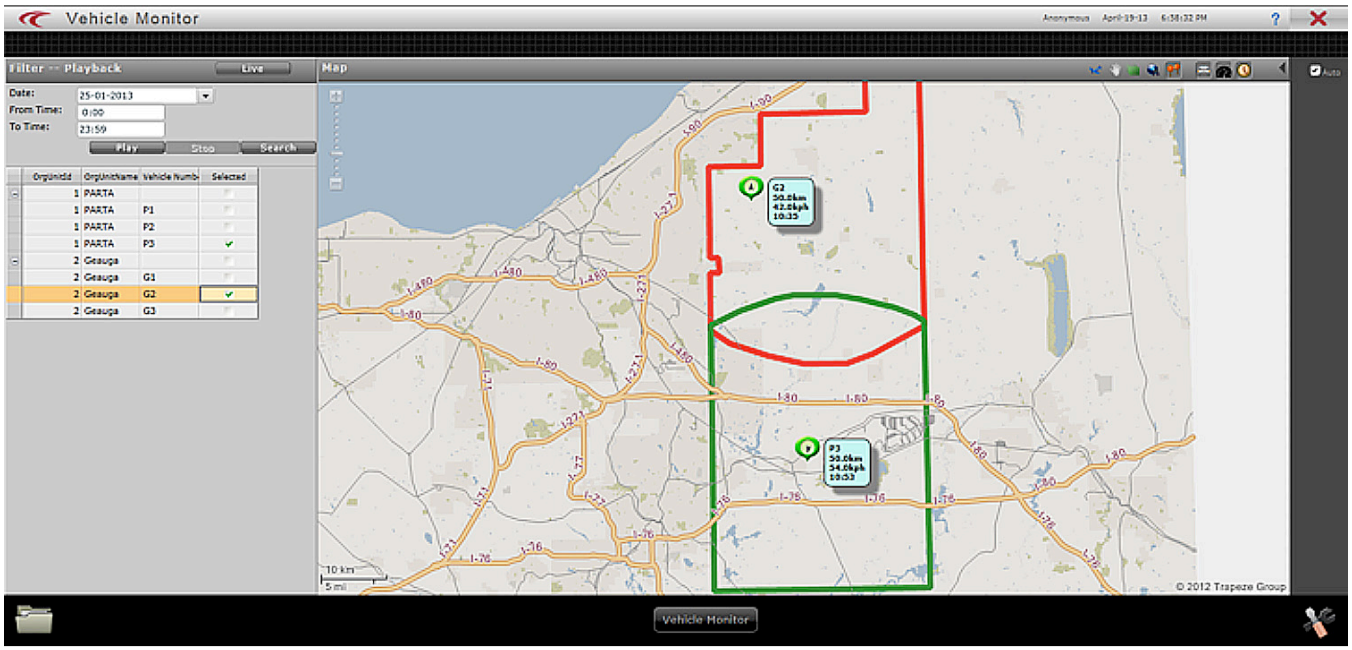
4. If the trip happened to be a transfer trip, the other (external) portions of the trip will be cancelled with a code based on a setting in the TMCC "brain" (shown below, where 430 is the code for Same Day Cancellations).

No-Show Generated Cancel Code Setting

Dispatch Management: AVL Mapping

Vehicles equipped with Mobile Data Terminals (MDT's) can be tracked and viewed via through the TMCC's Vehicle Monitor. The Vehicle Monitor can be used by dispatchers to actively determine where vehicles are, how fast they are going, their odometer readings, etc.

The following is an example view of the Playback functionality of the TMCC Vehicle Monitor. The time interval and date can be selected as shown below. The Live view is very much the same except the source of the data is real-time. In fact, this real-time data is stored on the TMCC (if configured as such) to make the datasets for the historical playback.



Vehicle Monitor AVL view

This screenshot shows how individual vehicles are organized under different providers (indicated by different "OrgUnitNames" in the screenshot) in a hierarchical fashion. Vehicles can dynamically be seen or hidden based on selection. Security can also limit providers to only see their own vehicles in case the TMCC manager does not want the information to be shared.

Interface

The following methods show the TMCC request and response message structure used to support the dispatch management component:

- BookingCancelRequest – request for a booking to be cancelled; also used for no-shows and has logic that cancels linked trips in the case of a transfer
- BookingCancelResponse – response that validates that the cancellation is effective on the TMCC Server.
- AVLInfoUpdateRequest – response from the TMCC of all possible solutions for the trip given the constraints set in the TMCC and the local system.

SECTION 5

Conclusions, Summary, and Recommendations

Phasing and Implementation

The greatest effort of the TMCC implementation process will be software development, most of which will occur away from the implementation site. Locally, however, the team will be collecting information and meeting with transportation service providers, local human service agencies, regional agencies, and state officials to establish the foundation for coordination.

To this point in the process, all parties have been exceptionally receptive to the concept and the potential that it presents. This project enjoys the vocal support of everyone to whom it has been presented, from local business people to State and federal elected officials. It is clearly understood, however, that the "buzz" will not substitute for detailed understandings and agreements. Clearly delineated contracts for products and services ultimately will provide the foundation for coordination; however, the technologies assist. The promise is indeed certain, but the products are yet only defined in a technical sense.

The first step toward implementation was defined through Memoranda of Understanding that are simple statements of willingness to work together for common goals and are intended for all parties to this effort, from the project team to potential contractors and clients. They set out the expectations for the conduct of the project as well as describing proposed products in general terms (see Appendix A).

Conclusions and Recommendations

At this point, it would be largely premature to address findings substantiated by results. The Phase I effort was directed to the design of a model of coordination, not the testing of the model. Some observations can be provided, however, based upon the experience of the project to this point.

Throughout the study, the State of Ohio provided substantial and critical leadership in transportation coordination. The Ohio DOT Bureau of Public Transit and the Ohio Transportation Coordination Task Force (now the Transportation Partnership of Ohio) have provided technical guidance and a crucial sounding board throughout the study. Ohio's leadership is almost certainly the most critical element in NEORide's design.

A public/private partnership such as the one assembled for this study team carries some inherent conflicts between private interest and public good. Nevertheless, that tension has proven valuable, if not essential in this project.

The issues of coordination are only secondary issues of system design. They are primarily issues of local politics. Every agency and every provider has basic loyalties to its own mission, its clients, and its employees. The mechanisms of coordination must permit each participating entity to maintain autonomy and must respect those loyalties. Having acknowledged this at the outset, the study team is particularly gratified by the steady and enthusiastic dedication to the tasks of this project.

Public transportation has not done a good job of addressing the information needs of potential passengers, whether human service clients or the general public. It seems that public transportation lags behind virtually every other consumer industry in the application of consumer-useful technologies. Until a potential first-time rider can know with confidence that a transportation system will provide the service that he/she requires, publicly-available transportation will not fully measure up.

ITS technologies are costly, especially upon start-up. The central economic test of ITS applications probably will not occur in the first or even fourth year. As a strategic investment, the benefits probably lie in the out years, when marginal cost per additional unit of service may decline through the growth of population served, providers involved, and area of service.

No matter how a rational coordination of human service programs is achieved, organizations will have to address the complexities of funding, oversight, and regulation at federal, state, and local levels—the very complexities that made coordination by the sharing of resources so difficult. Until and unless there is an agreement detailing a cost allocation formula among all federal transportation programs, local coordination efforts will be compromised.

APPENDIX

A

Memorandum of Understanding

I. PARTIES

This document constitutes an agreement between The Portage Area Regional Transportation Authority (acting on behalf of the NEORide Travel Management Coordination Center) and _____.

II. PURPOSE

A. Background

For decades, virtually every organization involved in Human Service transportation has been concerned with the rational coordination of transportation services. As each agency has struggled to maintain or enhance the efficiency and effectiveness of all services, rising energy costs and diminishing real budgets have undercut those efforts and compromised the quality of life for many. In the last few years, however, we have seen revolutions in every area of human endeavor that have been stimulated by the application of newer technologies.

Recently, the Portage Area Regional Transportation Authority and Geauga County Transit have been engaged in the design and planning of a system of transportation coordination that makes use of these technologies to enhance the delivery of services. This plan relies upon the use of existing public and private investments and capabilities linked through advanced logistics and communications technologies.

B. Purpose

In order to implement and appropriately configure this plan, the parties above mutually require assurances that:

- Personal and proprietary information will be protected throughout the course of the project.
- Good faith efforts will be applied to gain for each party and the broader community, the desired improvements in efficiency and effectiveness for which the plan was designed.
- The project will produce products and services that have real value and assist in making the best use of resources.
- Each agency participating in this project within the initial one-year implementation period will have its direct labor expenses compensated at 80%.

- Each agency participating in this project within the initial one-year implementation period will be required to supply documentation of the contribution of direct labor expenses to the project.
- Each agency participating in this project will continue to support the project for three years after the implementation period with the understanding that the project benefits will be self-sustaining, requiring no further compensation for participation.

In the project, the parties will cooperate in the design, development and testing of the mechanisms, methods, and procedures to carry out the following functions:

- Sharing of ride request and scheduling data
- Communication of fleet vehicle utilization, capacity, capability
- Adoption of reasonable standards for vehicle operator safety, training certification
- Creation of reports in appropriate formats
- Maintenance of data for agreed upon periods
- Supply, maintenance and distribution of hardware and software as required
- Training in the use of new technologies

The Parties will jointly conduct these efforts without disrupting the functional operations of other partners. The Parties will participate in the preparation and delivery of reports, presentations and communication related to the project.

C. The Principles

The Parties will abide by the following principles:

1. Stability – This memorandum promotes stability in the provision of each agency's core services. While substantial changes in the manner in which the parties will operate can be anticipated, those changes will only be done with full communication, explicit mutual approval and the retention of duplicate or parallel procedures when required.
2. Flexibility – This memorandum cannot reasonably anticipate all opportunities or challenges that will be encountered in the course of the project. The Parties will strive to reason together to seek mutual value, efficiency and effectiveness.
3. Public / private cooperation – The parties to this memorandum recognize that the responsibilities and capabilities of public agencies are different from private sector entities. Those differences create opportunities and mutual benefit.

4. Why here? – That this opportunity exists at all is a reflection of hard work, good public policy, inspired private effort and more than a little luck. We owe each other our best efforts because this sort of opportunity does not come often.

III. MUTUAL INTEREST OF THE PARTIES

Each party to this and other identical agreements have a mutual interest in the development of a model of transportation coordination using technology that has relevance and potential application throughout the United States.

IV. PERIOD OF AGREEMENT AND MODIFICATION/TERMINATION

This Agreement will become effective when signed by both parties. The Agreement will terminate three years after the completion of the implementation phase of the project but may be amended at any time by mutual agreement of the parties or may be replaced by contract. Either party may terminate this Agreement by providing thirty (30) days written notice to the other party. In the event this Agreement is terminated, each party shall be solely responsible for the payment of any expenses it has incurred. This Agreement is subject to the availability of funds from a United We Ride Phase II Implementation Grant.

APPENDIX

B

Design & Specification Document

Design & Specification Document

Prepared for

PARTA

for the

Transportation Management Control Center

Prepared by: Jarrod Clark

Overview

The purpose of this project is to produce a detailed functionality requirements specification for the TMCC and TMCC Interface. These two components comprise as system that will allow for coordinated paratransit transportation efforts with neighbouring providers.

The TMCC will coordinate trip requests from a transit provider's call center. A single trip may require transportation from more than one service or geographical region, and may involve transfers between those services and/or regions. It will be the TMCC software's role to coordinate these trips by requesting partial solutions to each portion of the transportation from the regional providers scheduling systems, and then automatically recomposing the potential partial solutions into optimized, complete solutions which are presented in a list ordered by provider cost to the TMCC user. Once a final solution is negotiated between the requester and the call-taker, a synchronization process will ensure that all affected transportation providers are notified of the final trip details. The TMCC Interface component will allow for the exchange of data with its external transportation providers' software systems through a uniform web-based protocol. The synchronization from the TMCC to external systems will be required, and those requirements will need to be defined.

To develop such a detailed specification, numerous areas of investigation have been identified, and are being analyzed in great detail to produce specific functional and system requirements. These include:

- GIS
- Client Administration
- Trip Booking and Scheduling
- Dispatching
- Funding Sources
- Billing Module
- Software Development Kit

The deliverable of this consultation effort is the detailed specification that follows. This will allow the consultant to accomplish two tasks: determining the best method of designing such a system taking into account the numerous areas of investigation outlined above; and second, the full cost analysis for a system implementation outlining required and possible optional elements can be determined.

Document History

Revision #	Author	Date	Description
1.0	Trapeze Project Team	March 23, 2010	First Draft
1.1	Trapeze Project Team	March 25, 2010	Updated each section with most recent edits by Jarrod
1.2	Trapeze Project Team	April 27, 2010	Updated each section with most recent edits by Jarrod
1.3	Trapeze Project Team	June 14, 2010	Included the billing module summary and requirements
1.4	Trapeze Project Team	June 21, 2010	Included BIL.014, included page numbers.

Table of Contents

Graphical Information System

Overview

The GIS (Graphical Information System) component is one of the fundamental building blocks of the TMCC, and will enable the system to make decisions regarding trip booking scheduling solution requests. This section will describe each GIS element required for the TMCC:

- Polygons
- Street Network
- Geocoding

Polygons

A polygon is a defined boundary for a specific geographic area on the Earth's surface. The shape of a polygon is defined by vertices that can be created, viewed and edited visually on an interactive map. By utilizing polygon information, the TMCC will be able to determine which providers will be appropriate scheduling solution candidates based on the following polygon service attributes:

- Identify service areas for each participating provider
    - By date range
    - By day of week
    - By time of day
- Identify pickup and drop-off rules for each participating provider
    - Pickup only
    - Drop-off only
    - Pickup and drop-off
    - Pickup or drop-off
    - Pickup with drop-off
- Identify service types for each participating provider
- Used to designate transfer points between neighboring provider zones. These transfer points are then utilized as meeting places for vehicles to exchange passengers
- Used to identify the location of all geocoded addresses that enter the system

The TMCC will provide a web enabled user interface that will enable each provider to define their service areas and attributes. The following illustration (figure 1) is a basic example of two (2) providers within the TMCC and their defined service area and time availability:

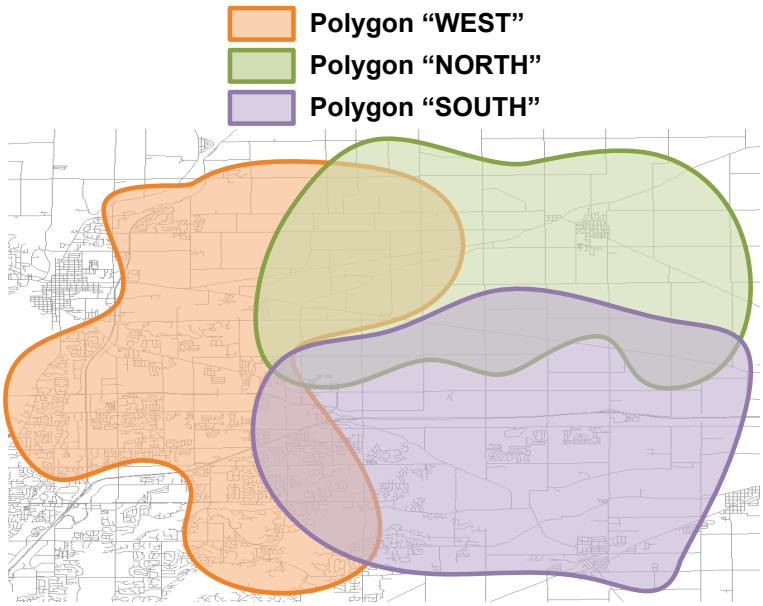


Figure 1

Provider A

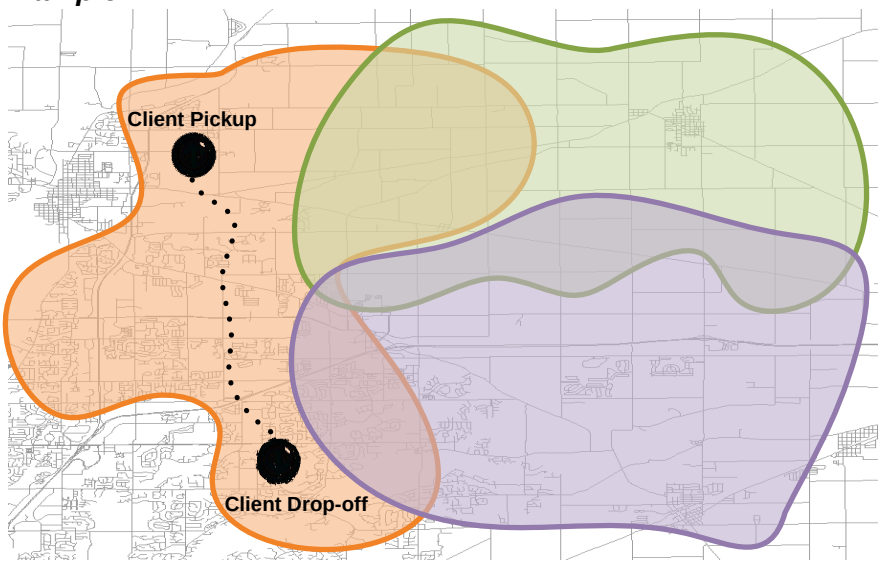
- Polygon "WEST”
  - Pickup & Drop-offs - Monday through Friday from 6:00 to 22:00 for services:
    - Medicaid
    - ADA
  - Pickup & Drop-offs - Saturday from 9:00 to 20:00 for services:
    - ADA
  - Pickup & Drop-offs – Sunday from 9:00 to 18:00 for services
    - Veterans
    - ADA
- Polygon “NORTH”
  - Drop-offs only - Monday through Friday from 6:00 to 22:00 for services:
    - ALL Services
  - Drop-offs only - Saturday from 9:00 to 20:00 for services:
    - ALL Services
  - Drop-offs only – Sunday from 9:00 to 18:00 for services:
    - ALL Services

Provider B

- Polygon "SOUTH”
  - Pickup & Drop-offs - Monday through Friday from 6:00 to 22:00
  - Pickup & Drop-offs - Saturday from 9:00 to 20:00
  - Pickup & Drop-offs – Sunday from 9:00 to 18:00
- Polygon “NORTH”
  - Pickups only - Monday through Friday from 6:00 to 22:00
  - Pickups only - Saturday from 9:00 to 20:00
  - Pickups only – Sunday from 9:00 to 18:00

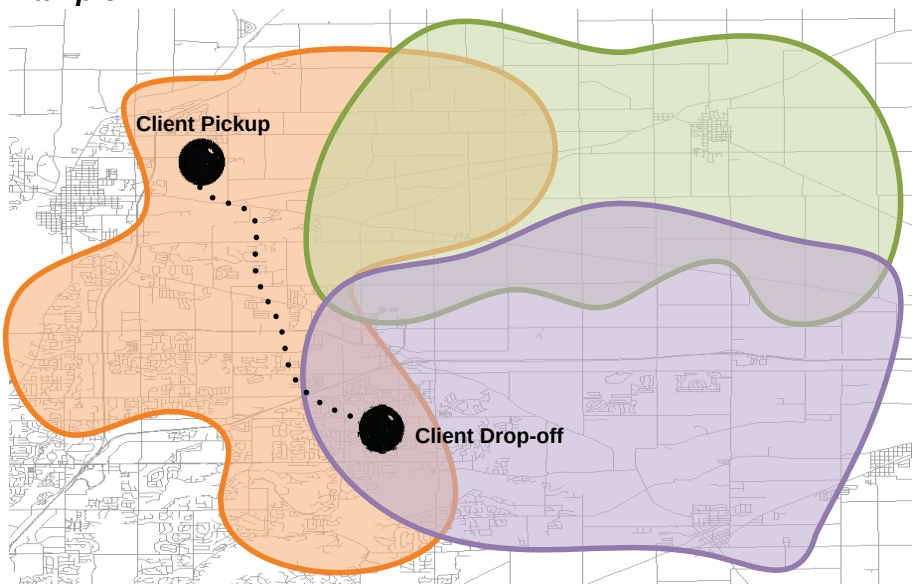
Utilizing the information that has been defined by each service provider, the TMCC will be able to determine which provider can offer scheduling solutions for each trip booking request. The following are examples of how this will work within the TMCC.

Example 1



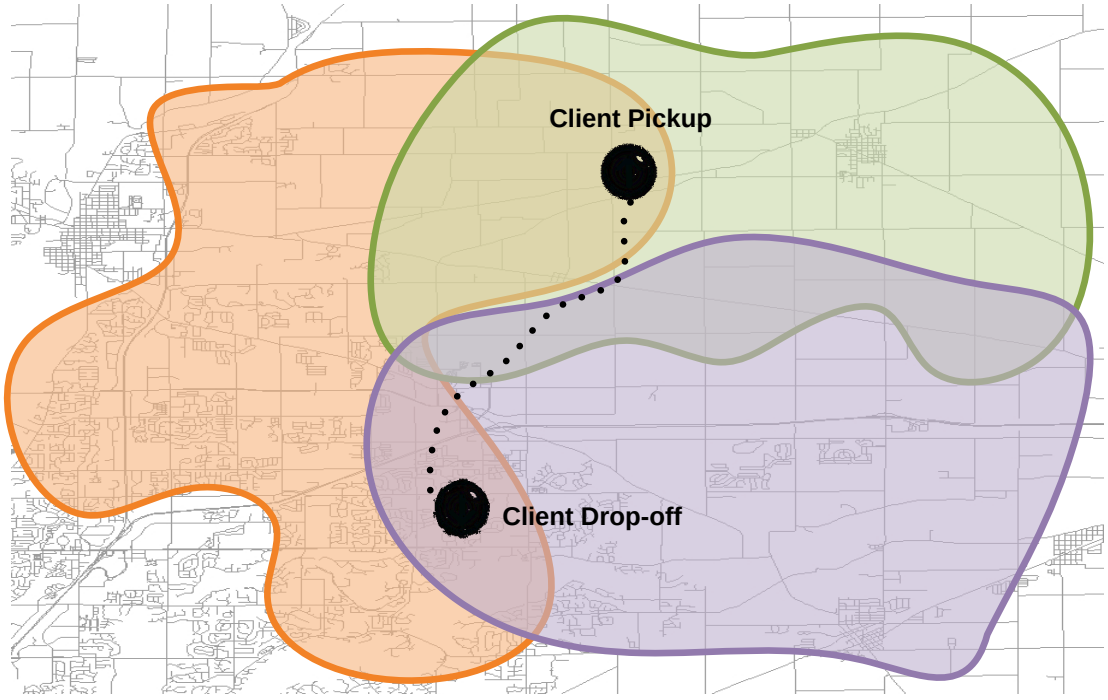
In the example above (example 1), a client requests a pickup and drop-off within Provider A's service area, with a requested pickup time of 13:00 on a Monday. Based on the service information defined by each provider, the TMCC will only request scheduling solutions from service Provider A. All other providers will not be consulted for scheduling solutions.

Example 2



In the example above (example 2), a client requests a pickup and drop-off within Provider A's service area, with a requested pickup time of 13:00 on a Monday. You can also see that the drop-off sits within Provider B's area. Based on the service information defined by each provider, the TMCC will only request scheduling solutions from service provider A. Provider B has been excluded because the pickup is not within B's defined service area.

Example 3



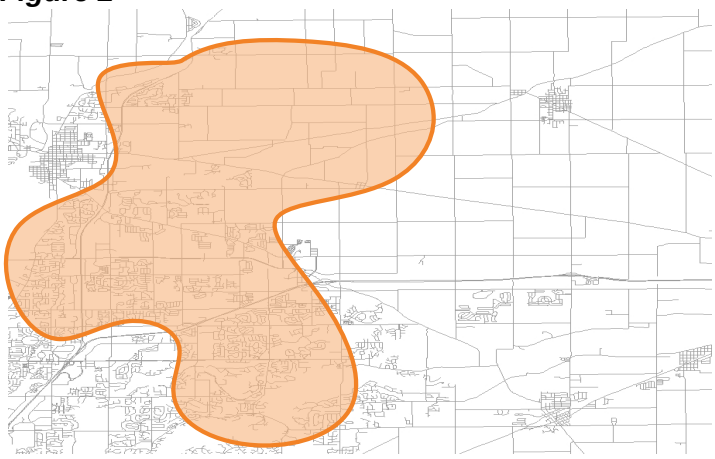
In the example above (example 3), a client requests a pickup and drop-off within Provider A's service area, with a requested pickup time of 13:00 on a Monday. You can also see that the

pickup sits within the “NORTH” polygon and the drop-off sits within the “SOUTH” polygon. Since provider B has configured the TMCC to do pickups in the “NORTH” polygon, the TMCC will request scheduling solutions from both Provider A and Provider B.

Street Network

A street network is a system of interconnecting lines and points that represent a system of roads for a given area. This information will be used as a visual layer within the GIS component of the TMCC so that provider’s may have a reference point when defining (drawing and/or importing) polygons.

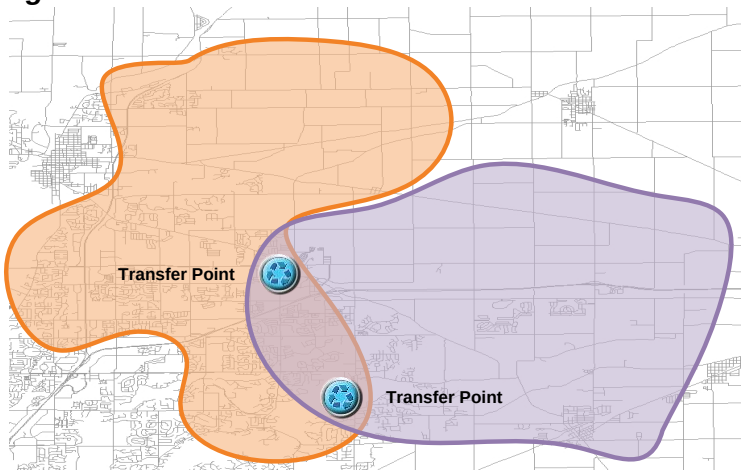
Figure 2



Geocoding

Geocoding is the process of finding associated geographic coordinates, expressed as latitude and longitude. The TMCC will enable each provider to geocode transfer points between neighbouring polygons. An explanation of how transfer points will be utilized within the TMCC will be provided within the Trip Booking & Scheduling section of this document.

Figure 3

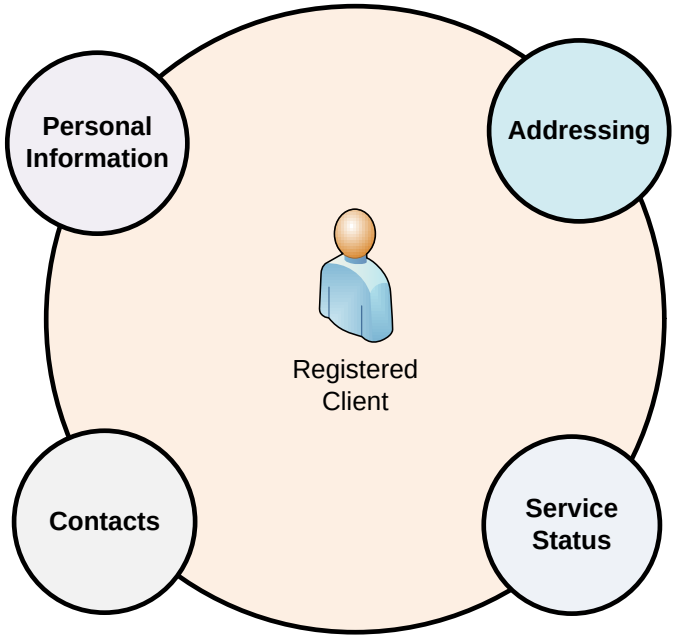


Client Registration

Overview

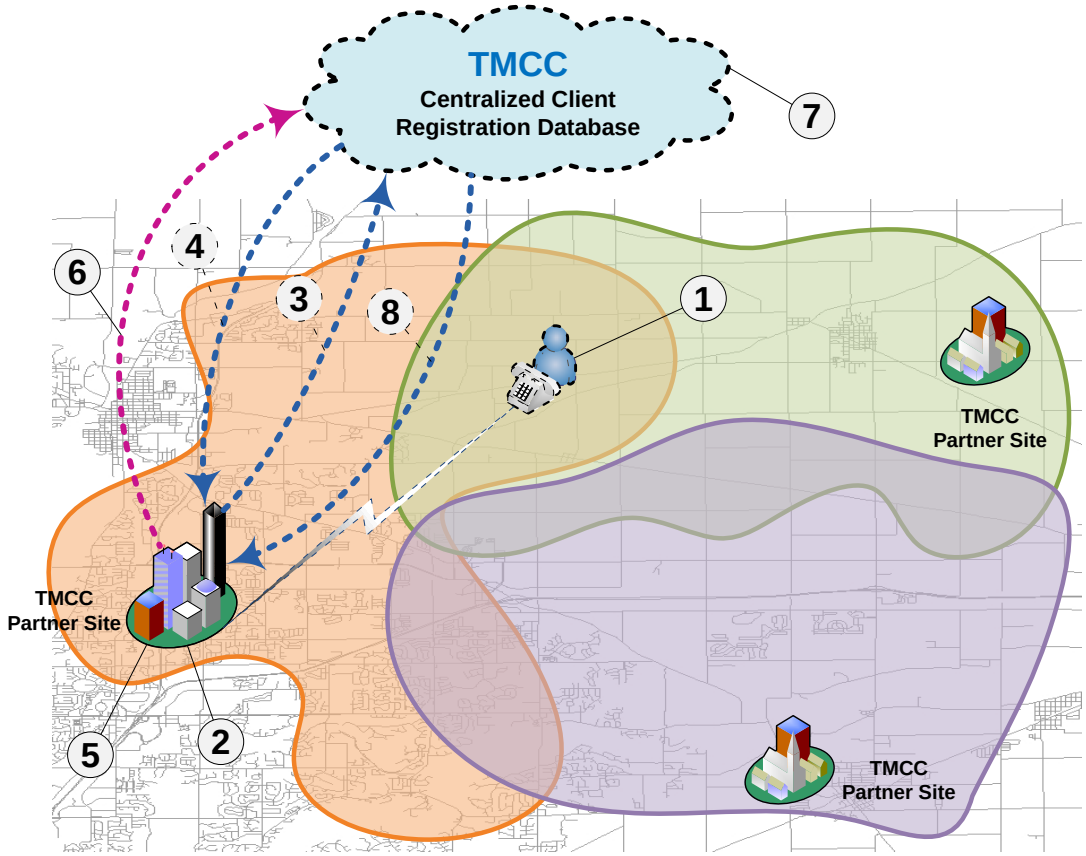
The TMCC will support a centralized database that will contain a master list of client registration records from all participating partner sites. When an individual applies for service with the TMCC, all pertinent information about that client is registered and maintained. This data is subsequently used each time a trip is booked for that client.
This section of the document will define the following elements of the TMCC client registration component:

1. Actions - Interaction with the TMCC client registration database
    a. Registering a new client
    b. Updating client information
    c. Replication of client data
2. Data - Client data elements that will be maintained on the TMCC
    a. Personal information
    b. Addressing
    c. Contact information
    d. Service status
3. Functional Requirements – functionality that will be supported by the TMCC

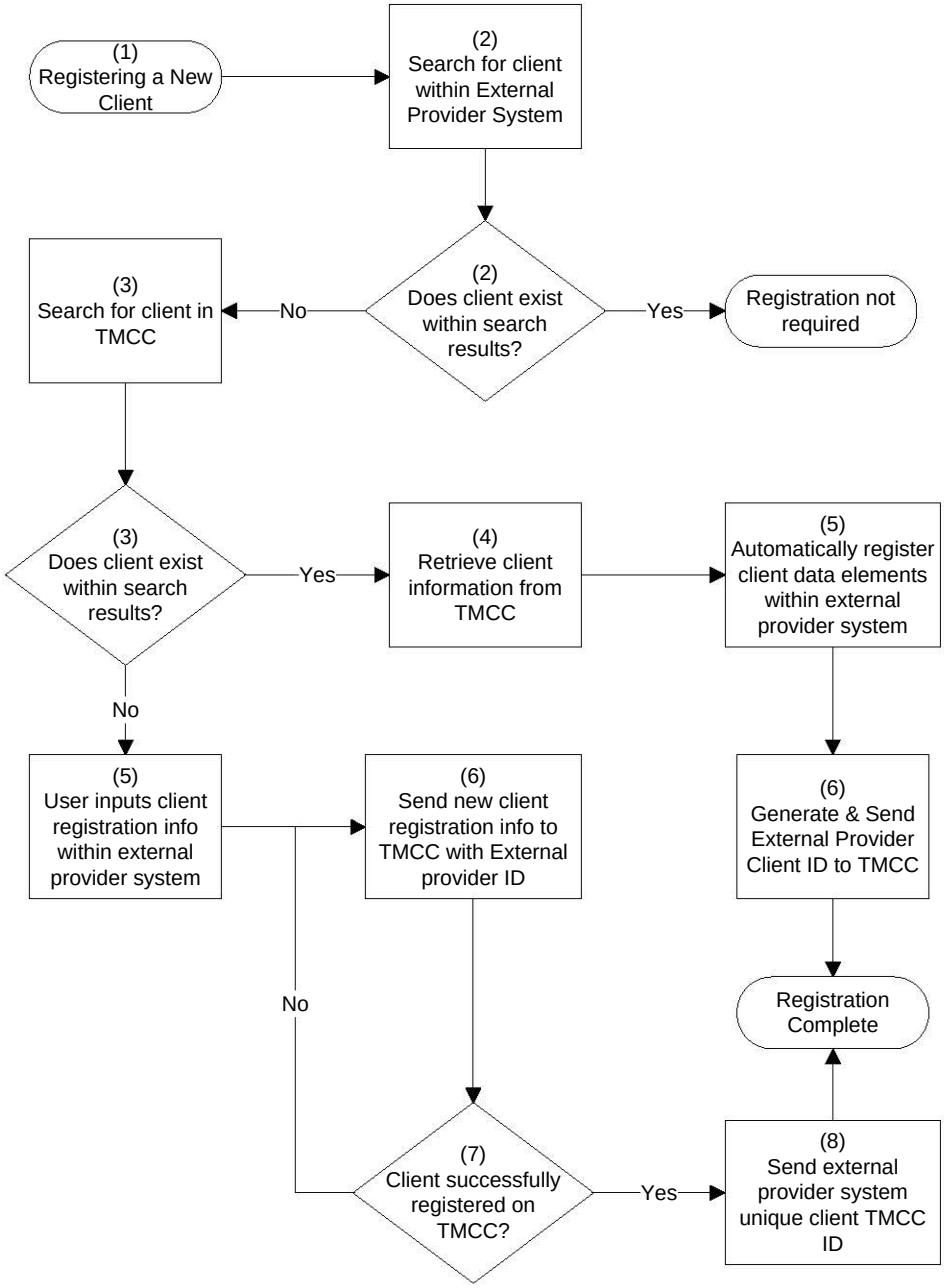


Registering a Client

All client information will be maintained within the TMCC centralized registration database via a real-time interface. Upon successful registration of a new client record, a unique ID will be generated by the TMCC and delivered to the external provider system. This unique TMCC ID will be used by all partner sites when referring to the client data. The TMCC will also maintain an external provider client id from each partner site for every client registration record. The following diagram and flowchart illustrates the interaction between the external provider system (partner site) and TMCC when registering a new client.

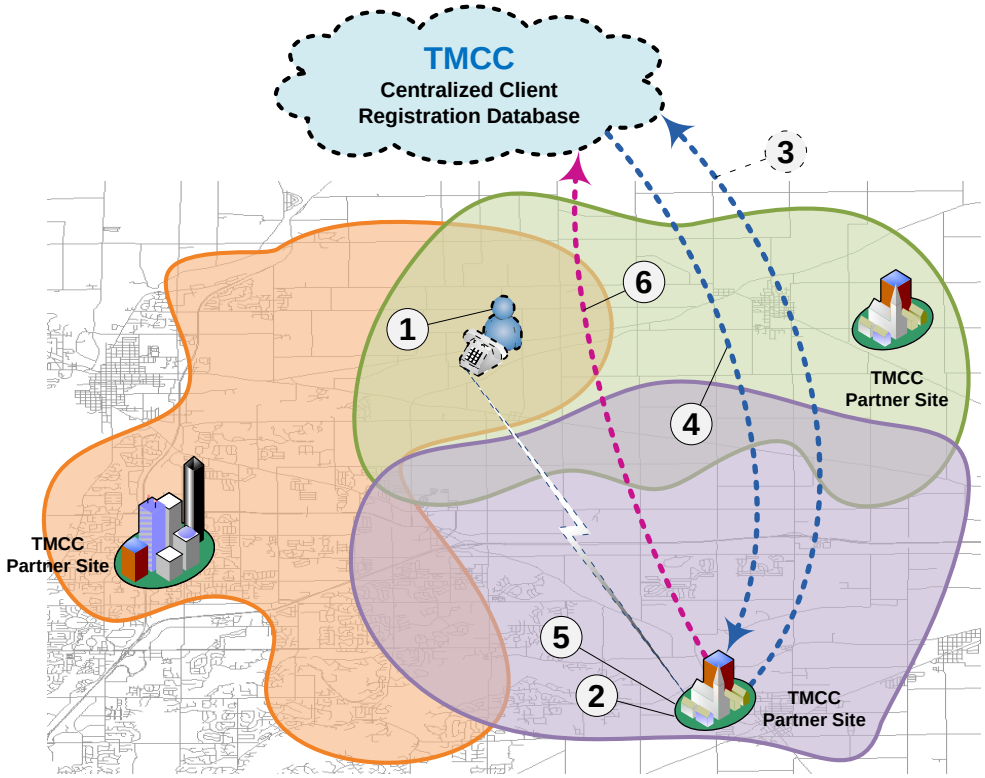


Prior to registering a new client, it is recommended that each partner site searches the TMCC client database to identify an existing registration record. Although all partner sites will have an up to date copy of all client registration records, this recommendation will minimize duplication of client records. The following flowchart provides a step-by-step walkthrough of the above diagram. The numbers within each box correspond to the numbers on the diagram.

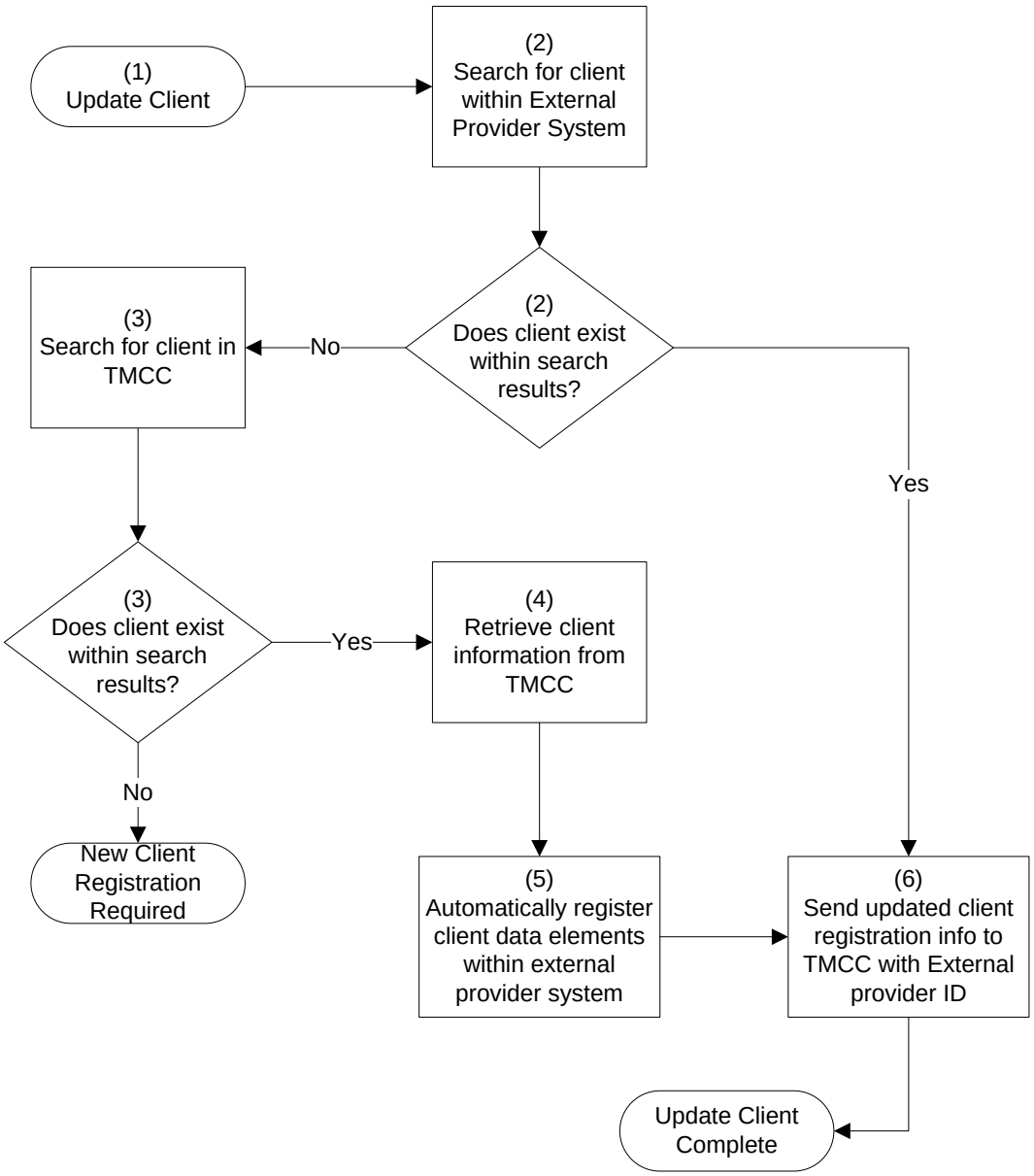

(1)
Registering a New Client
(2)
Search for client within External Provider System
(2)
Does client exist within search results?
No
(3)
Search for client in TMCC
Yes
Registration not required
(3)
Does client exist within search results?
Yes
(4)
Retrieve client information from TMCC
(5)
Automatically register client data elements within external provider system
No
(5)
User inputs client registration info within external provider system
(6)
Send new client registration info to TMCC with External provider ID
(6)
Generate & Send External Provider Client ID to TMCC
No
Registration Complete
(7)
Client successfully registered on TMCC?
Yes
(8)
Send external provider system unique client TMCC ID

Updating a Client

Client updates will be sent to the TMCC centralized registration database via a real-time interface. The following diagram and flowchart illustrates the interaction between the external provider system (partner site) and TMCC when updating a new client.

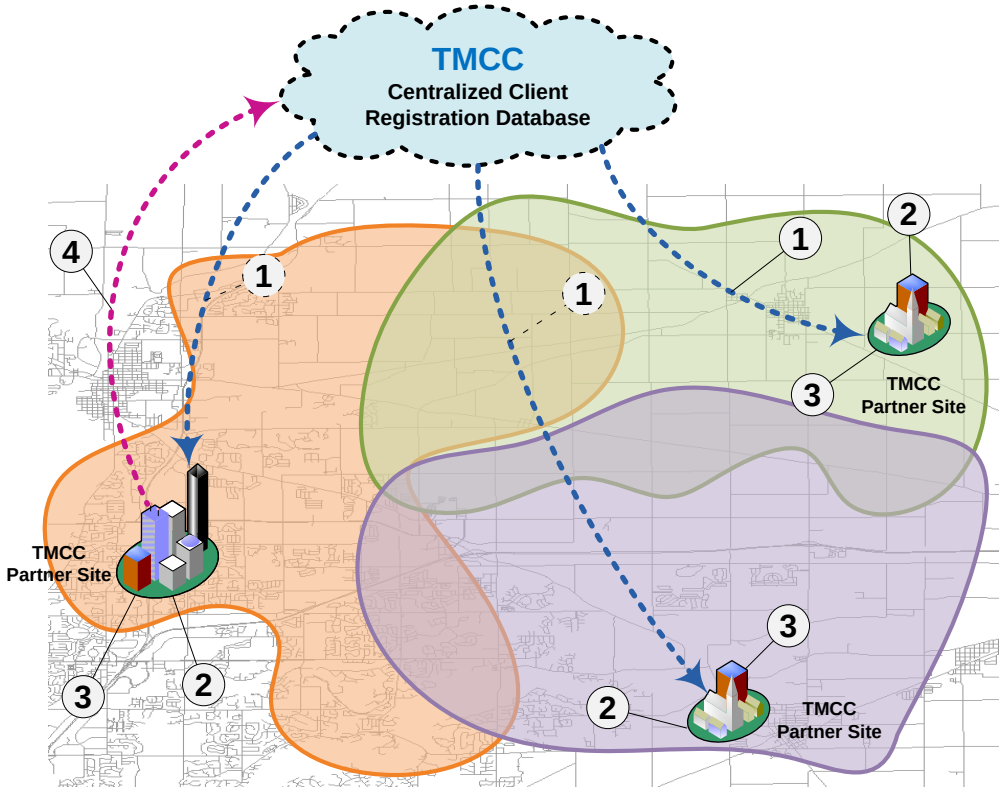


The following flowchart provides a step-by-step walkthrough of the above diagram. The numbers within each box correspond to the numbers on the diagram.

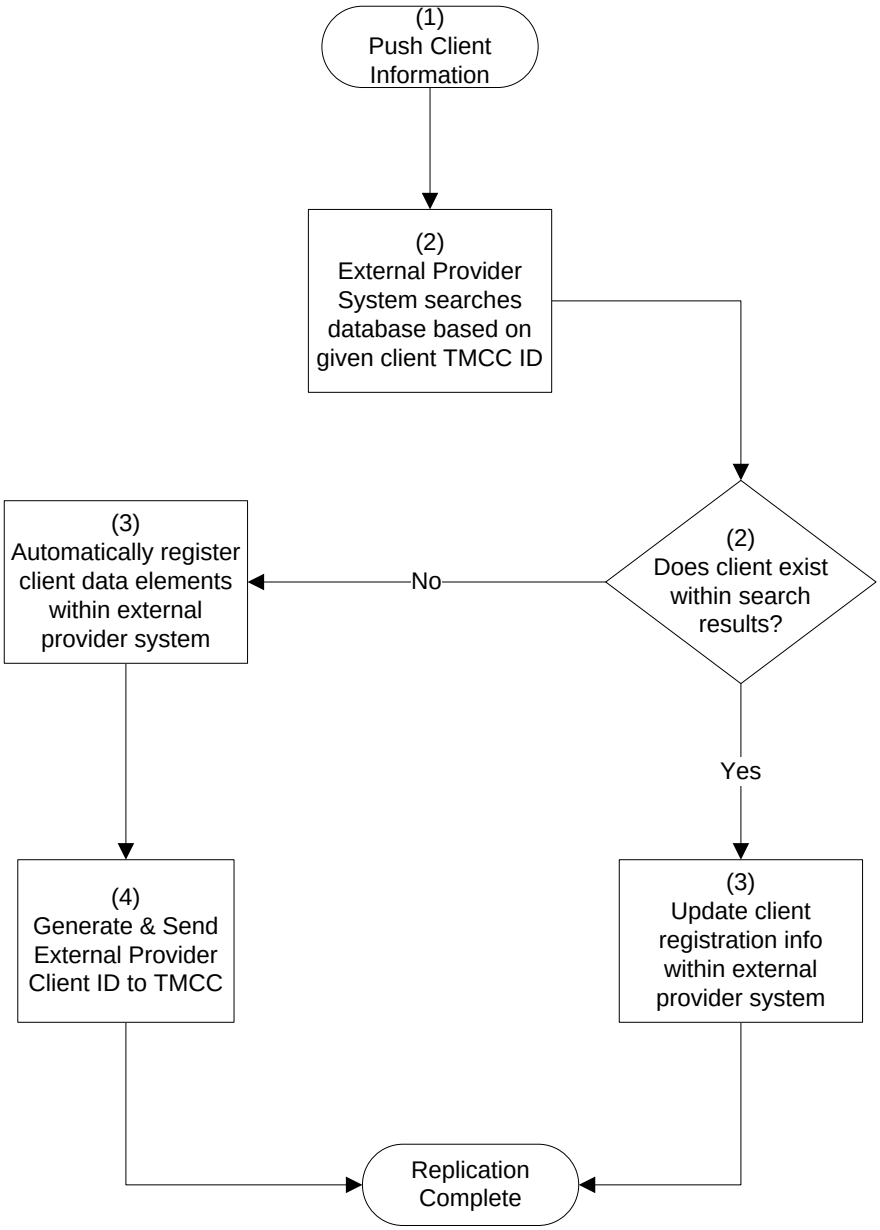


Client Replication

The TMCC will ensure that all partner sites have the most recent client registration information. This will be accomplished by automatically "pushing" client information updates from the TMCC to the partner sites. If the TMCC is not successful in pushing the client update to a partner site (e.g. partner site communication link to TMCC is temporarily disabled), the TMCC will continuously attempt to send the information until the partner site has successfully received the information. This will ensure that all sites have the most recent client registration data. The following diagram and flowchart illustrates this "pushing" process of client information.



The following flowchart provides a step-by-step walkthrough of the above diagram. The numbers within each box correspond to the numbers on the diagram.



Confirmation of Updates and Additions

The TMCC will enable the user to identify what external provider systems have successfully registered new client records and updates. This information will only be made visible on the TMCC via the client registration user interface. Each client registration record will have a corresponding external provider system "acknowledgement" record indicating what provider systems successfully received the updates. The following example illustrates this point:

Client Registration Record 123

External Provider System	Registered Client	Received Latest Updates
External Provider Site "A"	Yes	Yes
External Provider Site "B"	Yes	No
External Provider Site "C"	Yes	Yes
External Provider Site "D"	No	No

Client Data Elements

The TMCC will enable partner sites to record the following information for each client registration record:

- Personal Information (e.g. disability type, mobility aid, space type requirement)
- Addressing (e.g. home, work, emergency)
- Contacts (e.g. home, work, emergency)
- Service Status (e.g. ADA, Medicaid)

Supported Data elements for each of these categories are defined within the Data Element Appendix of this document and will describe their data types. If however the TMCC does not support a required data element, the TMCC administrator will be enabled to create user defined fields to capture the information. The administrator will also be enabled to flag data elements as mandatory. This means that each participating partner site will need to ensure that when transmitting new client registration records to the TMCC data is provided for the mandatory data elements.
Since each TMCC partner site operates under its own specific business policies and procedures, it is unrealistic to expect that all sites will adhere to a common data standard. For example, a partner site might refer to a client's defined space type as "Large Electric Wheelchair," while another partner site may refer to the same thing as "Scooter." Therefore the TMCC will host a number of translation tables that will be defined within the Data Element Appendix of this document. The table below provides an example of such a translation table:

Space Types

Generic TMCC Term	Partner Site A	Partner Site B	Partner Site C
Ambulatory	Amb	Walking	Ambulatory
Wheelchair	Chair	Wheelchair	Manual Chair
Scooter	Large Chair	Electric Chair	Scooter
Transferable	Amb & Chair	Transferable	Transferable

Every translation table will contain a "Generic" TMCC term. It will be the responsibility of the TMCC administrator to maintain the proper translation between all partner sites. In this example, a "Space Type" translation table is used. If Partner Site "A" registers a new client and this client's defined space type is "Ambulatory," the space type being transmitted to the TMCC would come in the form of "Amb." The TMCC will then utilize the translation table to register the client as "Ambulatory" within the centralized database. As the TMCC replicates the new client registration record to partner sites, it will ensure that the correctly translated space type information is sent. For example, if the client registration record was to be replicated to Partner Site "B," the space type information would be sent as "Walking."

The following data elements will have a corresponding translation table:

- Mobility Aids (e.g. Walker, Cane)
- Vehicle Type Exclusions (e.g. Van Lift, Car)
- Disabilities (e.g. Visual Impairment)
- Space Type (e.g. Ambulatory, Wheelchair)
- Preferred Language (e.g. English, Spanish)
- Address Types (e.g. Home, Work)
- Contact Types (e.g. Emergency, Work)
- Contact Device Types (e.g. Home Phone, Work Phone)

Interface

All client information will be maintained within the TMCC centralized registration database via a real-time interface. This interface is defined within the TMCC Interface Appendix of this document. The following methods will be used to support the client registration component:

Action	Method Name	Description
Searching Clients	TMCCSearchClient	External system provider requests a list of clients from the TMCC based on search criteria
Adding & Updating Clients	TMCCUpdateClient	External system provider sends a new or updated client registration record to the TMCC
Retrieve Client Information	TMCCGetClientInformation	External system provider requests all relevant registration information for a client.

Booking & Scheduling Component

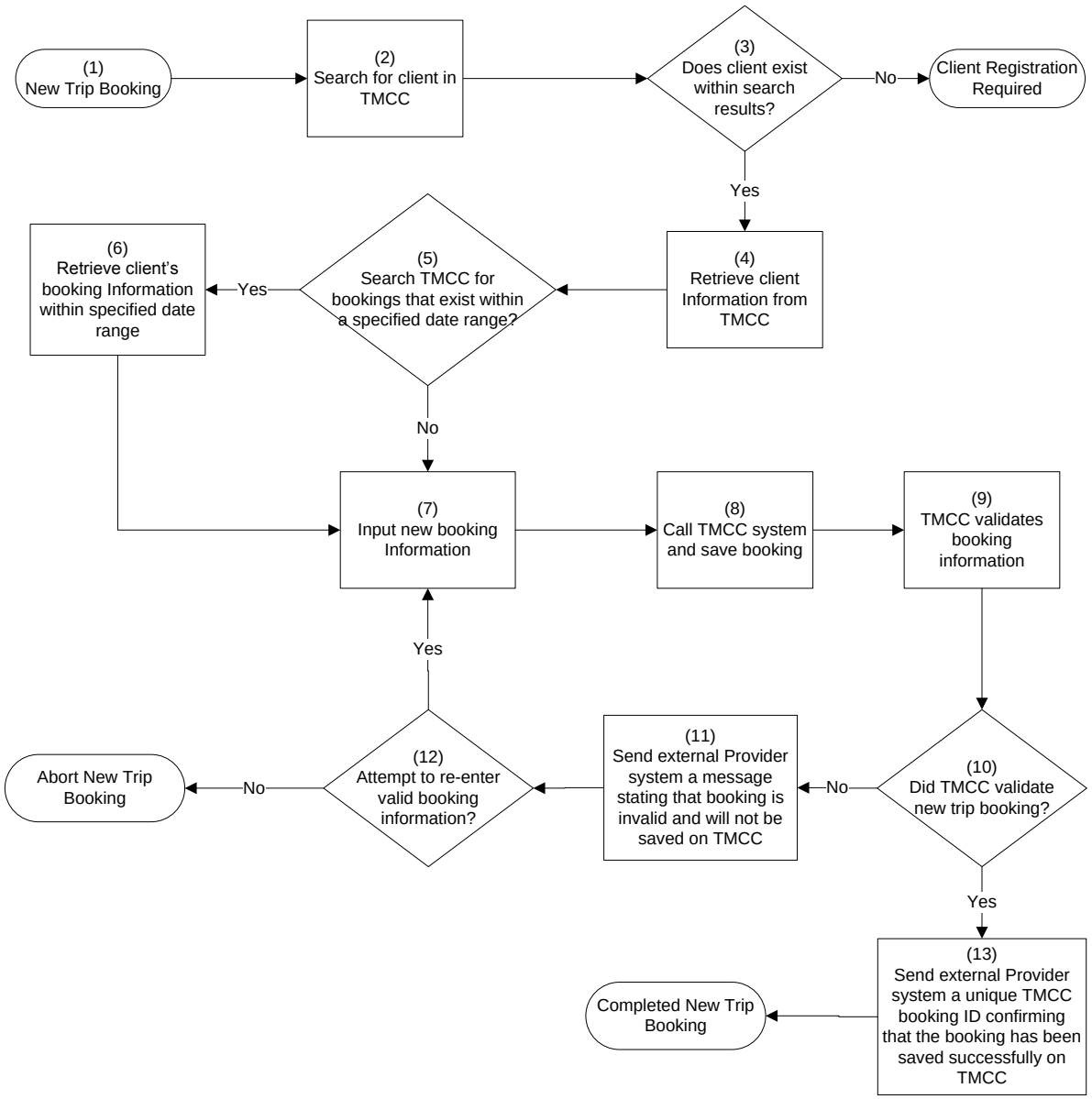
Overview

The TMCC will support casual type trip bookings only, and will not be supporting subscription type bookings. This section of the document will define the following elements of the TMCC booking & Scheduling component:

1. Booking Actions – Booking interaction with the TMCC
    a. Create a new booking
    b. Editing an existing booking
    c. Cancelling and confirming a booking
2. Scheduling Actions – Scheduling interaction with the TMCC
    a. Finding scheduling solutions
    b. Cancelling or removing a booking
    c. Updating a scheduled booking
3. Data - Booking data elements that will be maintained on the TMCC
    a. Origin & Destination information
    b. Booking attributes (e.g. Requested service, maximum onboard time, booking purpose)
    c. Passenger information (e.g. Passenger type, space type)
    d. Funding source information
4. Functional Requirements – functionality that will be supported by the TMCC.

Trip Booking - Creating

Every trip booking that the TMCC processes, via a real-time interface, will be maintained within the TMCC's centralized database. Each successful entry of a trip booking record will generate a unique booking ID by the TMCC and delivered to the external provider system. This unique booking ID will be used by all partner sites when referring to the trip booking record. The following flowchart illustrates the interaction between the external provider system (partner site) and TMCC when booking a new trip.

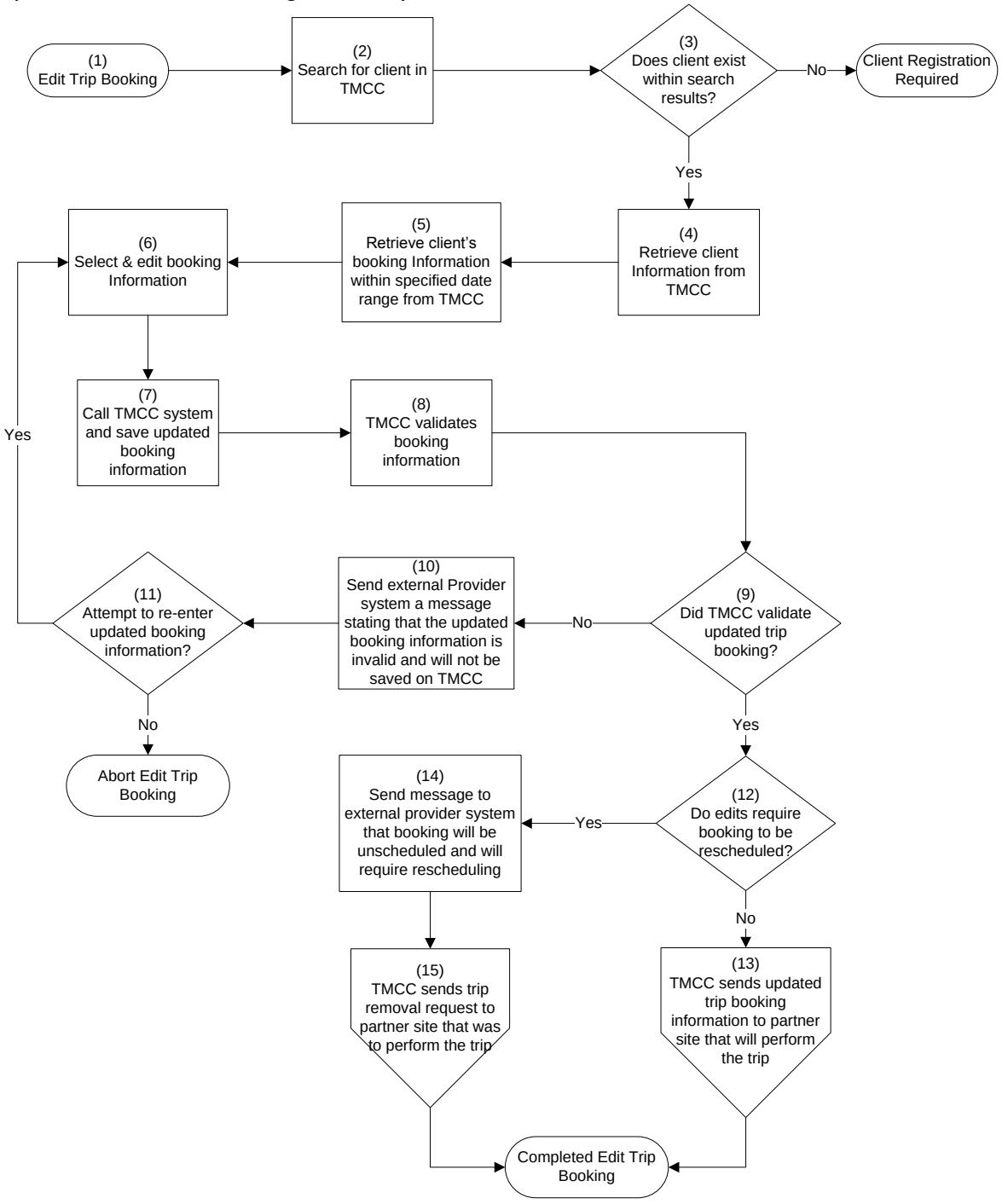


The above flowchart provides a step-by-step walkthrough of a new trip booking. The numbers within each box correspond to the steps below.

1. New trip booking is initiated by client call
2. The external provider system will search the TMCC to confirm that the client exists within the TMCC database.
3. If the client does not exist within the TMCC, the external provider system will be required to register the new client.
4. The client information retrieved from the TMCC will contain the following data elements so that a new booking can be entered:
    a. TMCC ID, Last Name, First Name
    b. List of registered addresses (e.g. home, work)
    c. Unique list of locations that client has travelled to in the past
    d. Contact information (e.g. home phone, work phone)
    e. Eligible services including affective start and end dates (e.g. ADA, Medicaid)
    f. Disabilities, Mobility Aids, Space Type, Escort Requirements
    g. Allowable transportation modes (e.g. demand response, fixed route)
5. The external provider system will be given the option to retrieve bookings within a specified date range.
6. Once the bookings within the specified date range have been returned, the end user will be able to determine if there is an existing booking. This will help minimize duplicate bookings.
7. The end user will input the new booking information within the external provider system.
8. The new booking information is sent to the TMCC requesting to be saved.
9. The TMCC analyzes the new booking data and ensures all required data elements exist.
10. The TMCC then determines if the new booking is valid.
11. If the new booking data was not valid, an error message is sent back to the external provider system.
12. The external provider system will either attempt to re-enter valid booking information or abort.
13. If the new booking data is valid, a confirmation message, including a unique TMCC booking id, is sent back to the external provider system.

Trip Booking - Editing

Trip booking updates will be sent to the TMCC centralized database via a real-time interface. The following flowchart illustrates the interaction between the external provider system (partner site) and TMCC when editing a new trip.

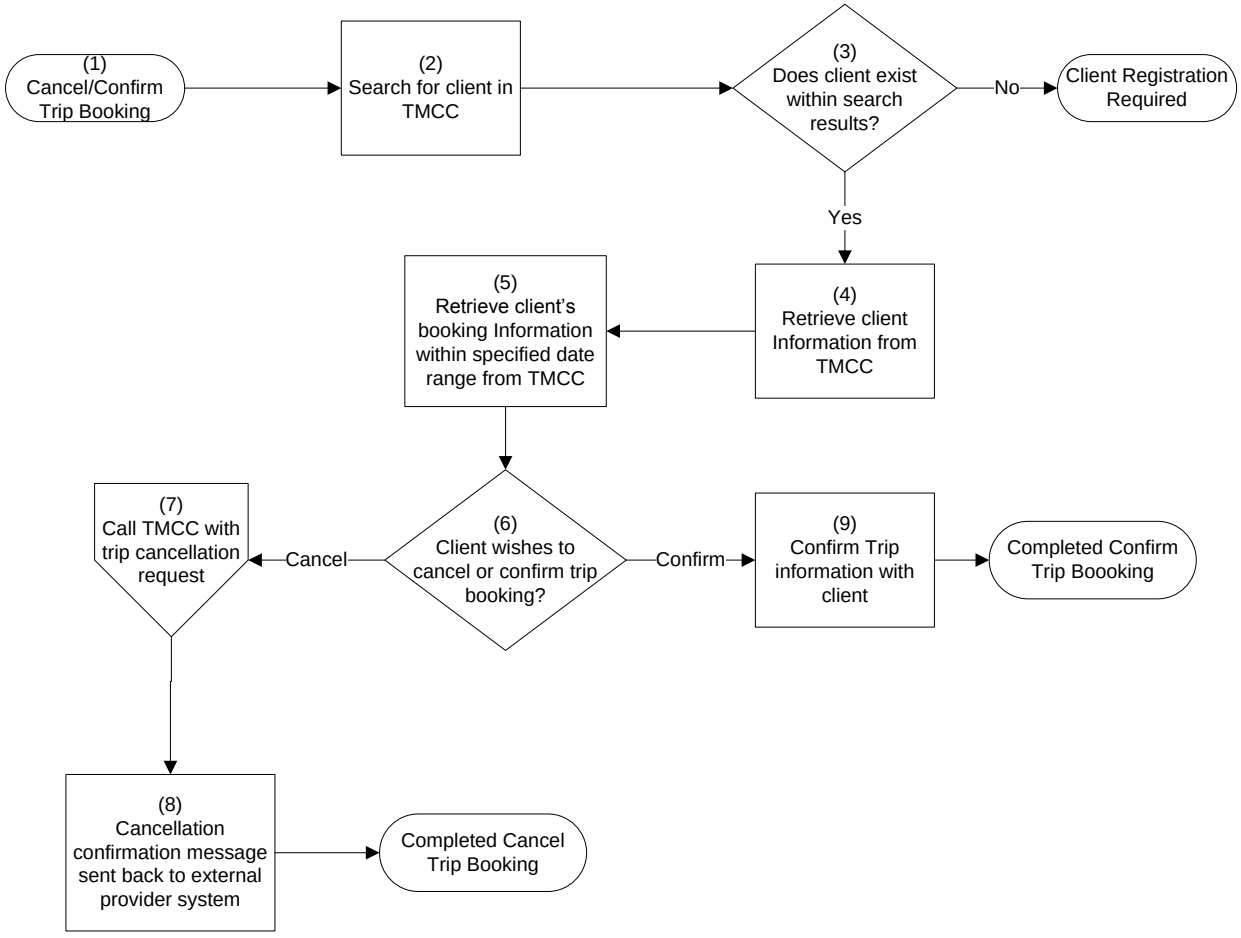


The above flowchart provides a step-by-step walkthrough of a trip booking edit. The numbers within each box correspond to the steps below.

1. Trip booking change request is initiated by client call
2. The external provider system will search the TMCC to confirm that the client exists within the TMCC database.
3. If the client does not exist within the TMCC, the external provider system will be required to register the new client.
4. The client information retrieved from the TMCC will contain the following data elements so that a new booking can be entered:
    a. TMCC ID, Last Name, First Name
    b. List of registered addresses (e.g. home, work)
    c. Unique list of locations that client has travelled to in the past
    d. Contact information (e.g. home phone, work phone)
    e. Eligible services including affective start and end dates (e.g. ADA, Medicaid)
    f. Disabilities, Mobility Aids, Space Type, Escort Requirements
    g. Allowable transportation modes (e.g. demand response, fixed route)
5. The external provider system then queries the TMCC to retrieve bookings within a specified date range.
6. The end user will then select one of the bookings to edit and update the booking information within the external provider system.
7. The updated booking information is sent to the TMCC requesting to be saved.
8. The TMCC analyzes the updated booking data and ensures all required data elements exist.
9. The TMCC then determines if the updated booking is valid.
10. If the updated booking data was not valid, an error message is sent back to the external provider system.
11. The external provider system will either attempt to re-enter valid booking information or abort.
12. If the booking data is valid, the TMCC will determine if the updates require the booking to be rescheduled.
13. If the booking is not required to be rescheduled, the updated information is sent to the partner site that will perform the trip. The partner site will simply update the booking information and not attempt to reschedule the trip.
14. If the booking is required to be rescheduled, the external provider system is sent a message that the booking will require rescheduling.
15. A message is sent to the partner site requesting that the booking be removed from the schedule.

Trip Booking – Cancel & Confirm

Trip booking cancellation and confirmation requests will be sent to the TMCC centralized registration database via a real-time interface. The following flowchart illustrates the interaction between the external provider system (partner site) and TMCC when performing either one of these functions.



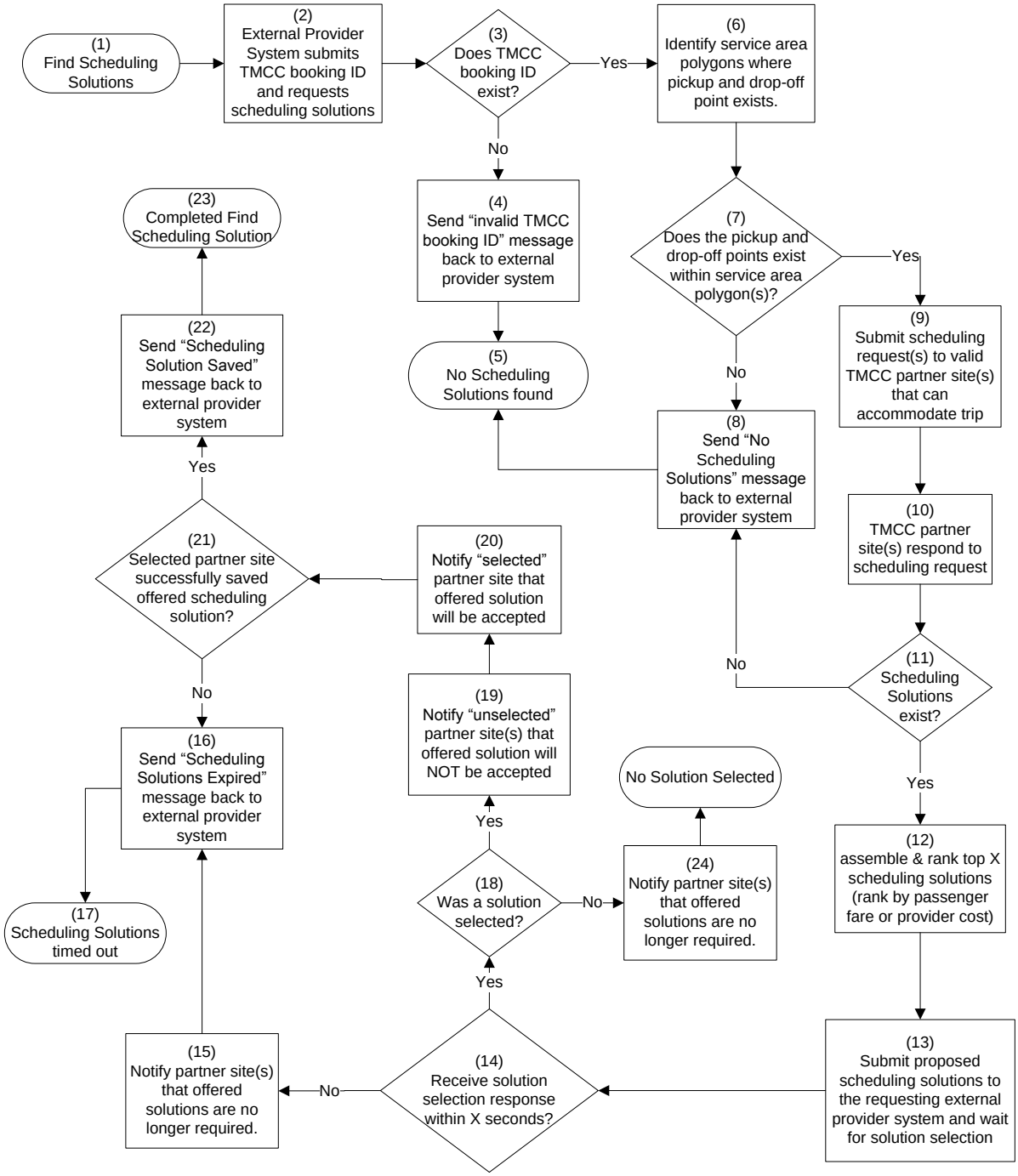
The above flowchart provides a step-by-step walkthrough of a trip booking edit. The numbers within each box correspond to the steps below.

1. Trip booking cancellation or confirmation request is initiated by client call
2. The external provider system will search the TMCC to confirm that the client exists within the TMCC database.
3. If the client does not exist within the TMCC, the external provider system will be required to register the new client.
4. The client information retrieved from the TMCC will contain the following data elements so that a new booking can be entered:
    a. TMCC ID, Last Name, First Name
    b. List of registered addresses (e.g. home, work)
    c. Unique list of locations that client has travelled to in the past
    d. Contact information (e.g. home phone, work phone)
    e. Eligible services including affective start and end dates (e.g. ADA, Medicaid)
    f. Disabilities, Mobility Aids, Space Type, Escort Requirements

   g. Allowable transportation modes (e.g. demand response, fixed route)
5. The external provider system then queries the TMCC to retrieve bookings within a specified date range.
6. Client determines if he/she wishes to confirm their trips, or request a cancellation.
7. If the client wishes to cancel a trip booking, the external provider system calls the TMCC with a cancellation request.
8. A cancellation confirmation message is then sent back to the external provider system acknowledging that the booking is successfully cancelled.
9. Client confirms trip information.

Scheduling – Finding Solutions

Once a trip booking record has been successfully saved on the TMCC, external provider systems may request to schedule the booking via a real-time interface. The following flowchart illustrates the interaction between the external provider system (partner site) and TMCC when scheduling a trip.

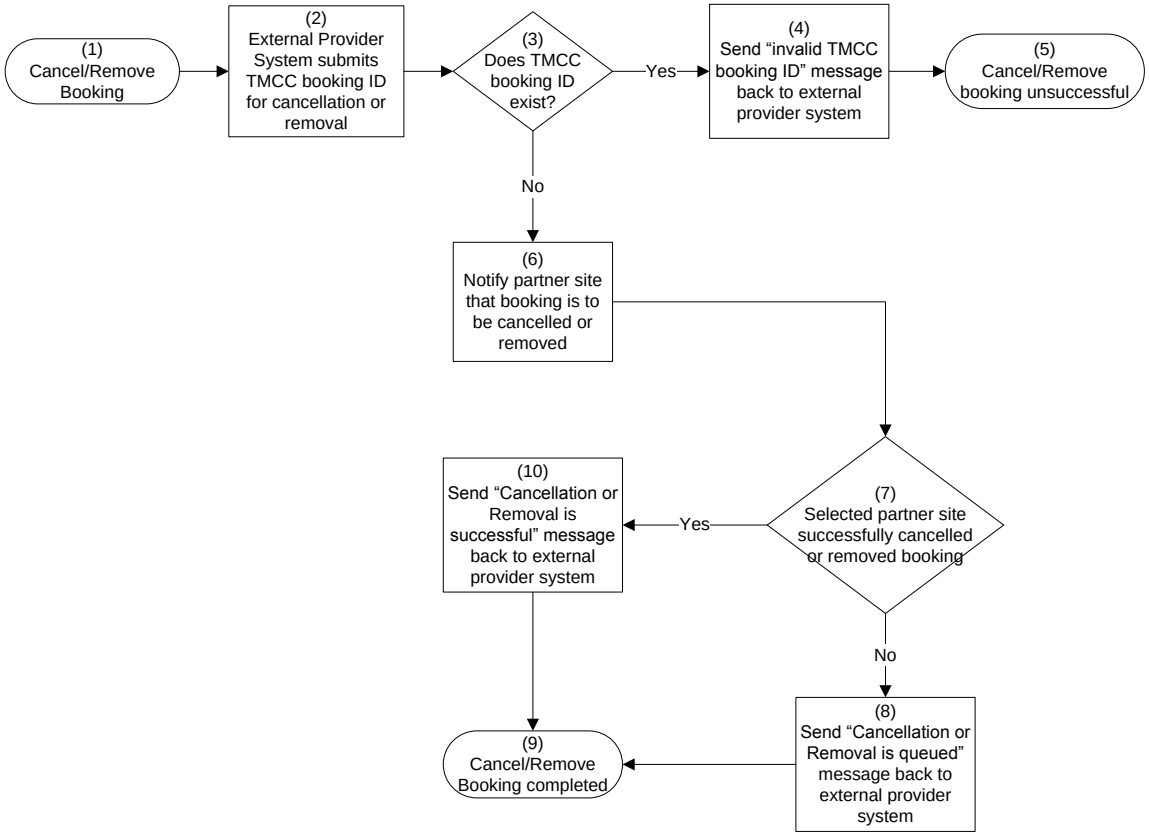


The above flowchart provides a step-by-step walkthrough of a trip booking edit. The numbers within each box correspond to the steps below.

1. The process to find scheduling solutions for a booking begins.
2. External provider system requests to find scheduling solutions for a booking that is identified by the TMCC booking ID.
3. The TMCC verifies that the actual booking record exists within the TMCC.
4. If the booking does not exist, the TMCC send the external provider system an error message.
5. The find booking solutions process is terminated.
6. The TMCC analyzes the booking information, and its attributes, in preparation for finding scheduling solutions.
7. The TMCC determines which partner sites could potentially offer scheduling solutions.
8. If the TMCC identifies that none of the partner sites will be able to offer scheduling solutions, a message is sent to the external provider system.
9. A scheduling solution request is sent to each partner site that the TMCC has identified as potential candidates.
10. Partner sites then respond to the request. A partner site will either submit potential scheduling solutions or respond with no scheduling solutions.
11. The TMCC analyzes the responses from partner sites and determines if scheduling solutions exist.
12. If scheduling solutions do exist, the TMCC will then sort the scheduling solutions from best to worst.
13. The sorted scheduling solutions are then sent to the external provider system.
14. The external provider system must respond with a selected solution within a system defined time period. This time period is based on how long partner sites will maintain a potential scheduling solution before it expires.
15. If the external provider system does not respond within the allotted time frame, a message is sent to partner sites to drop offered scheduling solutions.
16. Notification is then sent to the external provider system stating that the proposed scheduling solutions have expired, and are no longer valid.
17. Finding scheduling solution process has timed out, and external provider system will need to restart process.
18. The external provider system will either respond with a scheduling solution selection, or inform the TMCC that none of the scheduling solutions will be accepted.
19. The TMCC will notify all partner sites that were not selected to drop all offered scheduling solutions.
20. TMCC notifies the partner site that has been selected for the scheduling solution.
21. The selected partner site will then notify the TMCC if the scheduling solution was successfully saved.
22. Notification is sent to the external provider system stating that the selected scheduling solution has been saved
23. Find scheduling solutions process has successfully terminated.
24. The TMCC will notify all partner sites to drop offered scheduling solutions.

Scheduling – Cancel or Remove

External provider systems will be enabled to cancel or remove existing trip booking records via a real-time interface. The following flowchart illustrates the interaction between the external provider system (partner site) and TMCC when performing either one of these actions.

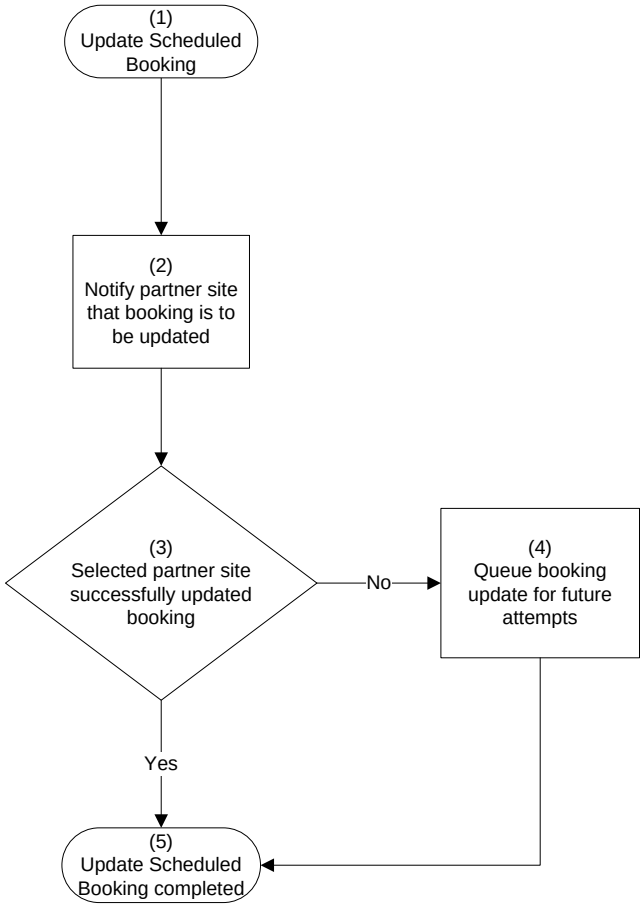


The above flowchart provides a step-by-step walkthrough of a trip booking edit. The numbers within each box correspond to the steps below.

1. The process to cancel or remove a trip booking begins.
2. The external provider system will submit a cancellation or removal request to the TMCC for a specified TMCC booking ID.
3. The TMCC will confirm if the TMCC booking ID exists.
4. The external provider system is notified that the TMCC booking ID does not exist, and cannot be removed or cancelled.
5. Cancel or remove trip booking process terminates.
6. If the trip is scheduled, the partner site is notified to cancel or remove the booking from the schedule.
7. The partner site then responds if the trip was successfully cancelled or removed.
8. If there is no response from the partner site, the request is queued by the TMCC for another attempt. The TMCC will continue to request the cancellation or removal until the partner site responds. The external provider system is notified that the cancellation or removal request is queued, and will be performed at a later time.
9. Cancellation or removal process terminates
10. The external provider system is notified that the cancellation or removal request has been successfully completed.

Scheduling - Update

External provider systems will be enabled to update existing trip booking records that are currently scheduled via a real-time interface. The following flowchart illustrates the interaction between the external provider system (partner site) and TMCC when performing a trip booking update.



The above flowchart provides a step-by-step walkthrough of a trip booking edit. The numbers within each box correspond to the steps below.

1. The process to update a scheduled trip booking begins.
2. The partner site is notified to update the currently scheduled booking with the attached information.
3. The partner site then responds if the trip was successfully updated.
4. If there is no response from the partner site, the request is queued by the TMCC for another attempt. The TMCC will continue to request the update until the partner site responds. The external provider system is notified that the update request is queued, and will be performed at a later time.
5. Update booking process terminates

Booking Data Elements

The TMCC will enable partner sites to record the following information for each Booking record:

- Booking Information (e.g. Trip date, purpose, mobility aids)
- Booking Leg information (e.g. pickup & drop-off address, comments)
- Booking Activity (e.g. passengers travelling, space type requirements)
- Faring & Funding Information (e.g. Fare codes, provider costs)

Supported Data elements for each of these categories are defined within the Data Element Appendix of this document and will describe their data types. If however the TMCC does not support a required data element, the TMCC administrator will be enabled to create user defined fields to capture the information. The administrator will also be enabled to flag data elements as mandatory. This means that each participating partner site will need to ensure that when transmitting booking information to the TMCC, data is provided for the mandatory data elements.

Since each TMCC partner site operates under its own specific business policies and procedures, it is unrealistic to expect that all sites will adhere to a common data standard. For example, a partner site might refer to a client's defined space type as "Large Electric Wheelchair," while another partner site may refer to the same thing as "Scooter." Therefore the TMCC will host a number of translation tables that will be defined within the Data Element Appendix of this document. The table below provides an example of such a translation table:

Space Types

Generic TMCC Term	Partner Site A	Partner Site B	Partner Site C
Ambulatory	Amb	Walking	Ambulatory
Wheelchair	Chair	Wheelchair	Manual Chair
Scooter	Large Chair	Electric Chair	Scooter
Transferable	Amb & Chair	Transferable	Transferable

Every translation table will contain a "Generic" TMCC term. It will be the responsibility of the TMCC administrator to maintain the proper translation between all partner sites. In this example, a "Space Type" translation table is used. If Partner Site "A" creates a booking and the passenger's space type is defined as "Ambulatory," the space type being transmitted to the TMCC would come in the form of "Amb." The TMCC will then utilize the translation table to register the booking as "Ambulatory" within the centralized database.

Interface

Booking information will be maintained within the TMCC centralized registration database via a real-time interface. This interface is defined within the TMCC Interface Appendix of this document. The following methods will be used to support the trip booking & scheduling component:

Action	Method Name	Description
Searching Clients	TMCCSearchClient	External system provider requests a list of clients from the TMCC based on search criteria
Retrieve Client Information	TMCCGetClientInformation	External system provider requests all relevant registration information for a client.
Search for Bookings	TMCCGetBookings	External system provider requests all bookings within a defined date range
Create Booking	TMCCBookingSave	External system provider requests to save a new booking
Update Booking	TMCCBookingUpdate	External system provider requests to update a booking
Cancel/Remove Booking	TMCCBookingCancel	External system provider requests to cancel or remove booking
Find Scheduling Solutions	TMCCSchedFindSolution	External system provider requests scheduling solutions
Select scheduling solution	TMCCSchedSelectSolution	External system provider selects offered scheduling solution
Drop scheduling solutions	TMCCSchedDropSolutions	External system provider refuses scheduling solutions
Save selected solution	TMCCSchedSaveSolution	Message sent to partner site to save scheduling solution

Dispatching Component

Overview

It is not the goal of the TMCC to offer a complete dispatching module, but rather to use the TMCC as a centralized location to track trip arrival and perform times, AVL data, and No Shows.

Arrival & Perform Times
The TMCC will offer a real-time interface for partner sites to record actual arrival & perform times for trip bookings. Although this is not a mandatory requirement for partner sites, it will provide additional information regarding the trip. This communication interface is defined within the TMCC Interface Appendix of this document.

AVL Data
The TMCC will enable partner sites to stream vehicle AVL data to the centralized system and view the current location of their vehicle, via a web based system. The functional requirements within this section will define the supported data elements of the AVL message and the offered user functionality.

No Shows
Partner sites will be required to send the TMCC No Show trip messages via a real-time interface. The TMCC will not only record this information, but will also support scheduling update logic for future trips. For example, if a client No Shows a trip and future trips exist for the client, the TMCC can be configured to automatically cancel these trips. The functional requirements within this section will define the supported logic.

Interface

The real-time interface is defined within the TMCC Interface Appendix of this document. The following methods will be used to support the dispatching component:

Action	Method Name	Description
No Show Booking	TMCCBookingNoShow	External system provider requests to no show booking
Cancel Booking	TMCCBookingCancel	TMCC requests external provider system to cancel booking
Update Arrive Time	TMCCDispatchArrive	External provider system delivers arrival time of trip booking
Update Depart Time	TMCCDispatchDepart	External provider system delivers departure time of trip booking
AVL Data	TMCCDispatchAVL	External provider system delivers AVL position of vehicle

Funding Source & Faring Management Component

Overview

Generally there are three (3) types of cost categories when providing a transportation service:

1. Client Fare
2. Provider Cost
3. Funding Source Subsidy

Client Fare
A client fare is a cost associated to the passenger that is requesting the service. This cost is usually referred to as the "passenger" or "client" fare. There are many different ways that a client fare can be calculated:

- Zonal (e.g. travelling from one zone to another zone)
- Distance (e.g. mileage based rate)
- Time (e.g. time based rates)
- Flat Fare (e.g. fixed rate)

Provider Cost
A provider cost is associated to the entity that provides the transportation service for the requesting passenger. This cost is usually referred to as "provider costing" or "provider fees." Again, there are many different ways that a provider cost can be calculated:

- Cost based on space type being transported (e.g. Ambulatory, Wheelchair)
- Distance (e.g. mileage based rate)
- Time (e.g. time based rates)
- Service Rates (e.g. ADA, Medicaid)

Funding Sources
Funding sources are entities that either subsidizes provider costs and/or client fares. Usually there are a set of rules when determining these subsidy amounts:

- Criteria
    - Specific booking Purpose (e.g. medical, education)
    - Specific passenger Types (e.g. client, companion, child)
    - Picking up or dropping off at a specific set of locations
    - Specific fare types
    - Specific Services (e.g. ADA, Medicaid)
    - Age
    - Space Type
    - Disability Type
    - Requested Times Ranges
    - Requested Date Ranges
    - Day of Week (e.g. Mon, Wed, Fri)
- Calculations
    - Will only subsidize a percentage of trip cost
    - Client must contribute a minimum copayment
    - Provider must contribute a minimum amount

- Limits
    - Will only be subsidize X number of trips per client by:
        - Day
        - Week
        - Month
        - Year
    - Will only be subsidize client trips up to a defined amount by:
        - Day
        - Week
        - Month
        - Year

TMCC Responsibility

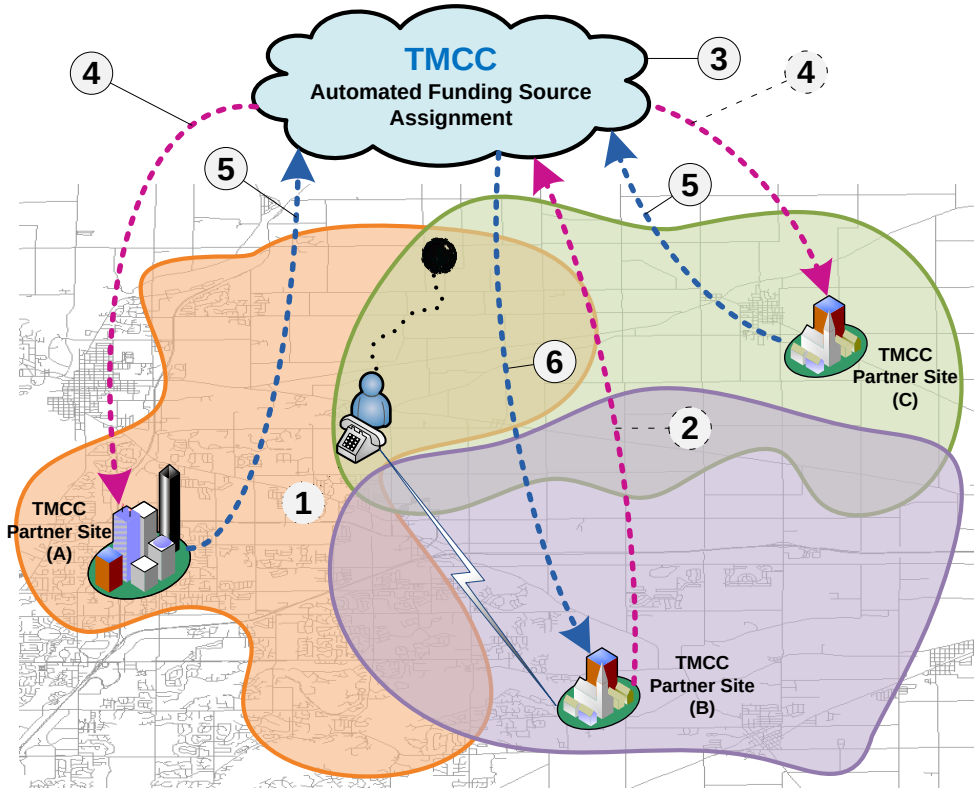
The TMCC will NOT be responsible for Client Fare and Provider Cost calculations, but will maintain the amounts for each booking that a partner site submits to provide the service. Therefore, all client fare amounts and provider cost calculations will be performed by the partner site and submitted with all scheduling solution responses. The TMCC will then save this information on the trip booking record within the TMCC.
However, the TMCC will enable the system administrator to setup and maintain Funding Source entities. The TMCC will use this information to automatically assign funding sources to booking records that meet defined criteria (as stated above), and automatically adjust fare/cost collections.

Registering Funding Sources

The TMCC will be responsible for automatically assigning (matching) the appropriate funding source for each trip booking. Therefore, it will be necessary that all Funding Source information be registered within the TMCC.
The system administrator will be enabled to specify a default order for funding programs. Doing this determines the order in which funding programs contribute to fare/cost subsidization when multiple funding programs are available for a trip. The default order affects all trip bookings that match the funding programs' criteria.
When more than one funding source meets the trip booking criteria, calculations start with the first program in the selected order, with any remaining fare/cost amount being subsidized (and limited, if applicable) by subsequent programs on the list.
The following pages provide an example of how funding sources will be utilized by the TMCC.

Funding Sources for Passenger Fares			
Funding Source	**Matching Criteria**	**Subsidy Calculation**	**Subsidy Limits**
FS-PASS-A	Service: ADA Purpose: Medical Passenger: Registered Location: ALL Age: ALL	Subsidy % or max amount: 50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None
FS-PASS-B	Service: ADA Purpose: Medical, Education Passenger: Registered Location: ALL Age: > 65	Subsidy % or max amount: 20% Max amount on %: $0.50 Min Passenger Contribution: $0.00	None
FS PASS-C	Service: Medicaid Purpose: Medical, Education Passenger: Registered Location: ALL Age: ALL	Subsidy % or max amount:50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None
FS PASS-D	Service: ADA, Medicaid Purpose: ALL Passenger: Registered Location: Mercy Hospital Age: > 65	Subsidy % or max amount:50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None
FS PASS-E	Service: ADA Purpose: ALL Passenger: Registered, Companion Location: ALL Age: < 16	Subsidy % or max amount:50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None

Funding Sources for Provider Fees			
Funding Source	**Matching Criteria**	**Subsidy Calculation**	**Subsidy Limits**
FS-PROV-A	Service: ADA Purpose: Medical Passenger: Registered Location: ALL Age:ALL	Subsidy % or max amount:100% Max amount on %: $35.00 Min Provider Contribution: $0.00	None
FS-PROV-B	Service: ADA Purpose: Education Passenger: Registered Location: ALL Age: > 65	Subsidy % or max amount:50% Max amount on %: $20.00 Min Provider Contribution: $0.00	None
FS-PROV-C	Service: Medicaid Purpose: Medical, Education Passenger: Registered Location: ALL Age: ALL	Subsidy % or max amount:100% Max amount on %: $65.00 Min Provider Contribution: $0.00	None
FS-PROV-D	Service: ADA, Medicaid Purpose: ALL Passenger: Registered Location: Mercy Hospital Age:> 65	Subsidy % or max amount:50% Max amount on %: $15.00 Min Provider Contribution: $0.00	None
FS-PROV-E	Service: ADA Purpose: ALL Passenger: Registered, Companion Location: ALL Age: < 16	Subsidy % or max amount:50% Max amount on %: $5.00 Min Provider Contribution: $0.00	None



1. Client calls TMCC partner site B and requests a trip booking. Partner site B inputs the booking information within their software system (external provider software) with the following attributes:
    - Service: ADA
    - Booking Purpose: Medical
    - Passengers: Only registered client
    - Pickup Address: Home (123 main street)
    - Drop-off Address: General Hospital
    - Age: 68
    -
2. Partner site B then transmits the trip booking information to the TMCC.
3. The TMCC analyzes the origin and destination of the trip booking, along with other booking attributes, and identifies TMCC partner sites that can offer potential scheduling solutions. In this example, the TMCC has identified that TMCC partner site A & C are candidates to provide scheduling solutions for the requested trip.
4. The TMCC transmits the booking information to TMCC partner site A & C for scheduling solutions.
5. Both TMCC Partner sites process the trip booking request, find a scheduling solution, and then transmit the solution to the TMCC. The scheduling solution that is transmitted to the TMCC also includes the Passenger Fare and Provider Fee amounts for each partner site:
    - Partner Site A
        - Passenger Fare - $3.50
        - Provider Fee - $10.00
    - Partner Site C
        - Passenger Fare - $2.00
        - Provider Fee - $15.00
6. The TMCC automatically assigns the appropriate funding sources to the trip booking and makes the appropriate funding source deductions. Based on the matching

criteria, subsidy calculations and limits, the following information will be transmitted to partner site C:

Funding Sources for Passenger Fares			
Funding Source	**Matching Criteria**	**Subsidy Calculation**	**Subsidy Limits**
FS-PASS-A	✓Service: ADA ✓Purpose: Medical ✓Passenger: Registered ✓Location: ALL ✓Age: ALL	Subsidy % or max amount:50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None
FS PASS-B	✓Service: ADA ✓Purpose: Medical, Education ✓Passenger: Registered ✓Location: ALL Age: > 65	Subsidy % or max amount:20% Max amount on %: $0.50 Min Passenger Contribution: $0.00	None
FS PASS-C	x Service: Medicaid ✓Purpose: Medical, Education ✓Passenger: Registered ✓Location: ALL ✓Age: ALL	Subsidy % or max amount:50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None
FS PASS-D	✓Service: ADA, Medicaid ✓Purpose: ALL ✓Passenger: Registered x Location: Mercy Hospital ✓Age: > 65	Subsidy % or max amount:50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None
FS PASS-E	✓Service: ADA ✓Purpose: ALL ✓Passenger: Registered ✓Companion Location: ALL x Age: < 16	Subsidy % or max amount:50% Max amount on %: $2.00 Min Passenger Contribution: $0.00	None

Funding Sources for Provider Costs			
Funding Source	**Matching Criteria**	**Subsidy Calculation**	**Subsidy Limits**
FS-PROV-A	✓Service: ADA ✓Purpose: Medical ✓Passenger: Registered ✓Location: ALL ✓Age: ALL	Subsidy % or max amount:100% Max amount on %: $35.00 Min Provider Contribution: $0.00	None
FS-PROV-B	x Service: Medicaid ✓Purpose: Medical, Education ✓Passenger: Registered ✓Location: ALL ✓Age: > 65	Subsidy % or max amount:50% Max amount on %: $20.00 Min Provider Contribution: $0.00	None
FS-PROV-C	x Service: Medicaid ✓Purpose: Medical, Education ✓Passenger: Registered ✓Location: ALL ✓Age: ALL	Subsidy % or max amount:100% Max amount on %: $65.00 Min Provider Contribution: $0.00	None
FS-PROV-D	✓Service: ADA, Medicaid ✓Purpose: ALL ✓Passenger: Registered x Location: Mercy Hospital ✓Age: > 65	Subsidy % or max amount:50% Max amount on %: $15.00 Min Provider Contribution: $0.00	None
FS-PROV-E	✓Service: ADA ✓Purpose: ALL ✓Passenger: Registered, Companion ✓Location: ALL x Age: < 16	Subsidy % or max amount:50% Max amount on %: $5.00 Min Provider Contribution: $0.00	None

- Partner Site A
  - Total Passenger Fare = $3.50
    - FS-PASS-A = $1.75
    - FS-PASS-B = $0.50
    - Fare to Collect = $1.25
  - Provider Cost - $10.00
    - FS-PROV-A = $10.00
- Partner Site C
  - Total Passenger Fare = $2.00
    - FS-PASS-A = $1.00
    - FS-PASS-B = $0.60
    - Fare to Collect = $0.40
  - Provider Cost - $15.00
    - FS-PROV-A = $15.00
    -

The remainder of the document will list all functional requirements that the TMCC will provide when supporting the funding source & billing elements of the system.

Billing Module

Overview

The TMCC billing module will be designed to work with 3rd party web based systems for tracking and submitting electronic billing requests. It is possible that the 3rd party systems will have different interface specifications, therefore the TMCC billing component will be flexible and have the ability to adapt. Since no defined specification currently exists, assumptions will be made on possible interface options.
One such option is to create a billing file in an approved format. This file then needs to be transmitted using a defined communication protocol. The general process should be as follows:

- Run a pre-billing process that may require some kind of data manipulation such as assigning clients to their home county
- Create the billing file.
- Generate reports.
- Review reports for accuracy.
- Make any required corrections.
- Repeat the above steps until the reports are accurate.
- Transmit the file to the 3rd party web based billing system

Appendix A – GIS Functional Requirements Matrix

Graphical Information System (GIS)			
ID	**Component**	**Description**	**Priority**
GIS.001	Polygon	The system will provide a web based user interface component that will enable a provider to manually create and maintain polygon information.	High
GIS.002	Polygon	The system will have the ability, on user command, to instantly utilize new or modified polygon information without the need for a system restart or incur any downtime.	High
GIS.003	Polygon	The ability to mark a polygon as “Active” or “Inactive.” When marked as “Active” the system will instantly utilize the polygon information without the need for a system restart or incur any downtime. When marked as “Inactive,” the system will instantly unload and no longer utilize the polygon information.	High
GIS.004	Polygon	Each defined polygon will have a unique, system generated, identification number.	High
GIS.005	Polygon	Providers will only have the ability to maintain their polygon information and will not have privileges to modify other provider’s polygon information.	High
GIS.006	Street Network	The system will display a street network layer so that it can be used as a reference point when creating, editing or viewing polygon boundary information.	High
GIS.007	Polygon	Providers will have the ability to view another provider’s defined polygon and its corresponding attributes.	High
GIS.008	Polygon	Providers will have the ability to “clone” (create a copy) another provider’s polygon for their use. Only the defined polygon boundary information will be cloned, all other attributes, such as service times will not be copied into the newly cloned polygon.	Medium
GIS.009	Polygon	The ability to define and maintain the following naming attributes for each defined service polygon: • Owner (Provider’s ID) • Polygon Name • Polygon Abbreviation Code	High
GIS.010	Polygon	The ability to define and maintain the following service time attributes for each defined service polygon: • Date Range • By Day of Week • By Time of Day (Time Bands)	High
GIS.011	Polygon	The ability to define and maintain the following pickup and drop-off rules for each defined service polygon: • *Pickup Only* – Provider will only perform pickups • *Drop-off Only* – Provider will only perform drop-offs • *Pickup and Drop-off* – Provider will perform any pickup and/or drop-off • *Pickup or Drop-off* – Provider will pickup a passenger within the polygon, but cannot drop-off the same passenger within the same polygon. Also, the provider will have the ability to drop-off a passenger within the polygon, as long as the passenger was picked up in a different polygon. • *Pickup with Drop-off* – Provider will pickup and drop-off the same passenger within the polygon. The provider is not allowed to drop-off the passenger in a different polygon	Low
GIS.012	Polygon	The ability to define and maintain the following color and fill attributes for each defined service polygon: • Border Line Color • Border Line Thickness • Fill Area Color • Fill Area Pattern	High

Graphical Information System (GIS)			
ID	**Component**	**Description**	**Priority**
GIS.013	Polygon	The system will provide the following functionality when defining, or editing, boundary information for a polygon: • *Snap the line to the street* – While drawing the polygon, the line traces (boundary line) will automatically snap to the closest street. This will enable the user to draw a perfect line down the middle of a street. • *Snap to the closest street vertex* - While drawing the polygon, the end point of segment line traces (boundary line) will automatically snap to the closest vertex point of a street segment. • *Freeform drawing* - While drawing the polygon, the end point of segment line traces (boundary line) will automatically snap to the position of the user's mouse pointer.	High
GIS.014	Polygon	A Provider will have the ability to delete a service polygon only if no future bookings exist that utilizes the information.	High
GIS.015	Polygon	A Provider will have the ability to import polygon information into the TMCC system. The polygon information being imported must conform to the following data specification: • *File format* - ESRI shape file • *The projection and datum* - unprojected lat/long NAD 83	Medium
GIS.016	Street Network	A Provider will have the ability to import a new street network layer into the TMCC system (note: updates and appends will not be supported by the TMCC system). The street network information being imported must conform to the following data specification: • *File format* - ESRI shape file • *The projection and datum* - unprojected lat/long NAD 83	High
GIS.017	Polygon	A Provider will have the ability to export polygon information from the TMCC system. The polygon information being exported will conform to the following data specification: • *File format* - ESRI shape file • *The projection and datum* - unprojected lat/long NAD 83	Low
GIS.018	Addressing	Addressing will be used to identify transfer points	Medium
GIS.019	Street Network	Google maps used to provide point of reference	Low
GIS.020	Polygon	The ability to define what services will be supported within the defined polygon area	High
GIS.021	Addressing	The ability to automatically stamp the polygon designation for each geocoded address that enters the system.	Low

Appendix B – Client Registration Functional Requirements Matrix

Client Registration			
ID	**Component**	**Description**	**Priority**
CLI.001	User Interface	The system will provide a web based user interface component that will enable a provider to manually create and maintain client information.	High
CLI.002	Interface	The system will enable a provider to interface with the TMCC utilizing an external provider system.	High

CLI.003	Searching	The user will be able to search for a client registration record by specifying any of the following information:
		• External Provider Client Id
		• TMCC Client Id
		• Last Name
		• First Name
		• First and Last Name
		• Date of Birth
		• Phone Number
		• Address
		  ○ Site Name (e.g. Forest Oaks Senior Center)
		  ○ Street Name
		  ○ City
		  ○ Zip Code
			High

CLI.004	Client Info	The system will enable the user to create and maintain details about clients. The detail categories that the system must enable the user to record about each client are: • Base Client Information • Addresses • Contacts • Service Status • Funding Sources	High
CLI.005	Client Info	The base client information that the system must enable the user to record about each client are: • Client ID • Title • First Name • Middle Name • Last Name • Nickname • Birth Date • Mobility Aids • Vehicle Type Exclusions • Load Time • Unload Time • General Comments • Private Comments • Scheduling Comments • Gender • Identification Number • Transport Modes • Disabilities • Client Code • Permanent Condition • Default Space Type (e.g. Ambulatory, Wheelchair) • Escort Option (e.g. Mandatory Escort, Optional Escort, Escort not allowed, Co-driver required) • Preferred Language • Provider ID • Maximum number of transfers allowed	High
CLI.006	Addressing	The address information that the system must enable the user to record about each client are: • Multiple Address Types as defined by user (e.g. Home Address, Emergency Address) • Specify which address type is the mailing address	High

Client Registration			
ID	**Component**	**Description**	**Priority**
		• Specify which address type is the default pickup or drop-off • Specify additional load/unload times for address • Address date validity (e.g. move to a new home address starting next month)	
CLI.007	Contacts	The contact information that the system must enable the user to record about each client are: • Multiple Contact Information Types as defined by user (e.g. Client Contact Info, Emergency Contact Info) • Contact First and Last Name • Contact Comments • Multiple Contact Device Types as defined by user (e.g. Home Phone, Work Phone, Work E-mail, Home E-mail) • Specify the primary contact device type	High
CLI.008	Service Status	The service status information that the system must enable the user to record about each client are: • Multiple status types as defined by user (e.g. Active, Suspended) • From/To date range for each status • Status Comments • Multiple service types as defined by user (e.g. Dial a Ride, School) • From/To date range for each Service Type • Service Type Comments	High
CLI.009	Client Info	The system will enable the administrator to add "user defined fields" if required client information attributes is not available within the system.	Medium
CLI.010	Client Info	The system will enable the administrator to configure the client information screen (e.g. add/remove fields from screen) and design a different screen layout by user group. This will enable the administrator to create a screen that will meet the provider's business policies and procedures.	Medium
CLI.011	Client Info	The administrator will be able to specify which client information fields require mandatory data entry, optional data entry, editable, and non-editable.	High
CLI.012	Client Info	A unique TMCC identifier will be automatically generated for each client registration record	High
CLI.013	Client Info	The TMCC will support and include each external provider system's client id	High
CLI.014	Interface	The TMCC will enable the external provider systems to search for clients using the web based service call "TMCCClientSearch." The specification for this search method is documented in the attached appendix.	High
CLI.015	Interface	The TMCC will enable the external provider systems to retrieved client information using the web based service call "TMCCGetClientInformation." The specification for this method is documented in the attached appendix.	High
CLI.016	Interface	The TMCC will enable the external provider systems to add or update for client information using the web based service call "TMCCUpdateClient." The specification for this search method is documented in the attached appendix.	High
CLI.017	Addressing	Create multiple registered addresses for a client (home, work, etc.); specify effective dates for the client addresses.	High
CLI.018	Contacts	Register client contact information; specify contact devices (phone, pager, etc.).	High
CLI.019	Client Info	The application should be capable of displaying the passenger's usage history (e.g. their most recent trip, and the number of cancellations) on the screen at the same time as the passenger details.	Low
CLI.020	Client Info	The ability to flag a client's registration record as "exclusive travel." This will mean that the client will be the only passenger on the vehicle for the duration of their trip.	Low
CLI.021	Client Info	The application should be capable of capturing a confirmation message, for each client registration record, that a partner site has successful received a new, or updated, client registration record. This information will be made available when viewing the client registration record on the TMCC.	Low

Appendix C – Trip Booking and Scheduling Functional Requirements Matrix

Booking and Scheduling			
ID	**Component**	**Description**	**Priority**
BOO.001	User Interface	The system will provide a web based user interface component that will enable a provider to create and trip bookings.	High
BOO.002	Interface	The system will enable a provider to interface with the TMCC utilizing an external provider system.	High
BOO.003	Searching	The user will be able to search for a booking record(s) by specifying any of the following information: • TMCC Client Id • TMCC Booking Id • Date Range	High
BOO.004	Booking Info	The system will enable the user to create and maintain details about bookings. The detail categories that the system must enable the user to record about each client are: • Booking Information (e.g. Trip date, purpose, mobility aids) • Booking Leg information (e.g. pickup & drop-off address, comments) • Booking Activity (e.g. passengers travelling, space type requirements) • Faring & Funding Information (e.g. Fare codes, provider costs)	High

BOO.005	Booking Info	The base information that the system must enable the user to record about each booking are:
		• Client ID
		• Booking ID
		• Trip Date
		• Pickup address
		• Pickup comments
		• Pickup Times (e.g. no earlier, no later, requested time)
		• Pickup contact info
		• Drop-off address
		• Drop-off comments
		• Drop-off Times (e.g. no earlier, no later, requested time)
		• Drop-off contact info
		• Booking Purpose
		• Booking Service (e.g. ADA, Medicaid)
		• Mobility Aids
		• Vehicle Type Exclusions
		• Load Time
		• Unload Time
		• General Booking Comments
		• Transport Modes
		• Passenger information
		  ○ Passenger Type (e.g. Companion, Escort)
		  ○ Space Type (e.g. Ambulatory, Wheelchair)
		  ○ Passenger Fare Code & Amount
		• Provider Costs
		• Funding Amounts
			High

BOO.006	Booking Info	The system will enable the administrator to add "user defined fields" if required booking information attributes is not available within the system.	Medium
BOO.007	Booking Info	The system will enable the administrator to configure the booking screen (e.g. add/remove fields from screen) and design a different screen layout by user group.	Medium
BOO.008	Booking Info	The administrator will be able to specify which booking information fields require mandatory data entry, optional data entry, editable, and non-editable.	High
BOO.009	Client Info	A unique TMCC identifier will be automatically generated for each booking record	High
BOO.010	Interface	The TMCC will enable the external provider systems to search for clients using the web based service call “TMCCClientSearch.” The	High

Booking and Scheduling			
ID	**Component**	**Description**	**Priority**
		specification for this search method is documented in the attached appendix.	
BOO.011	Interface	The TMCC will enable the external provider systems to retrieved client information using the web based service call "TMCCGetClientInformation." The specification for this method is documented in the attached appendix.	High
BOO.012	Interface	The TMCC will enable the external provider systems to retrieve booking information using the web based service call "TMCCGetBookings." The specification for this method is documented in the attached appendix.	High
BOO.013	Interface	The TMCC will enable the external provider systems to create new bookings using the web based service call "TMCCBookingSave." The specification for this method is documented in the attached appendix.	High
BOO.014	Interface	The TMCC will enable the external provider systems to update bookings using the web based service call "TMCCBookingUpdate." The specification for this method is documented in the attached appendix.	High
BOO.015	Interface	The TMCC will enable the external provider systems to cancel bookings using the web based service call "TMCCBookingCancel." The specification for this method is documented in the attached appendix.	High
BOO.016	Interface	The TMCC will enable the external provider systems to find scheduling solutions using the web based service call "TMCCSchedFindSolution." The specification for this method is documented in the attached appendix.	High
BOO.017	Interface	The TMCC will enable the external provider systems to select a desired scheduling solution using the web based service call "TMCCSchedSelectSolution." The specification for this method is documented in the attached appendix.	High
BOO.018	Interface	The TMCC will enable the external provider systems to abort the find scheduling solution process using the web based service call "TMCCSchedDropSolutions." The specification for this method is documented in the attached appendix.	High
BOO.019	Interface	The TMCC will enable the external provider systems to save an offered scheduling solution using the web based service call "TMCCSchedSaveSolution." The specification for this method is documented in the attached appendix.	High
BOO.020	Booking Info	The TMCC must be capable of sending the external provider system a list of distinct locations that the client has travelled to in the past	Medium
BOO.021	Parameters	The TMCC must be able to define an allowable trip booking date range. The external provider system will be notified, and the trip will not be saved, if the requested trip is outside of this defined range	High
BOO.022	Parameters	The TMCC will enable the user to specify the timing of the requested trip in any of the following ways, and should be capable of automatically converting the details, when necessary, into times that the scheduling facility can understand: a) Earliest and latest pick-up time b) Earliest and latest drop off time	High
BOO.023	Parameters	The TMCC will enable the user to specify a search time window to find allowable scheduling solutions	High
BOO.024	Parameters	The TMCC must support the pickup time window for an offered scheduling solution. This time window must be honoured when rescheduling a trip	High
BOO.025	Parameters	The TMCC must enable the user to input a maximum onboard time setting for the booking.	High
BOO.026	Parameters	The TMCC must enable the user to input allowable transportations modes when finding scheduling solutions (e.g. demand response, fixed route, flex route)	High
BOO.027	Costs	Faring information must be captured and transmitted to the external provider system requesting scheduling solutions. (also refer to the Faring & Funding Source section within this document)	High
BOO.028	Costs	Funding information must be automatically calculated and save with the trip booking (also refer to the Faring & Funding Source section	High

Booking and Scheduling			
ID	**Component**	**Description**	**Priority**
		within this document)	
BOO.029	Parameters	The TMCC must enable the system administrator to define the "maximum" number of scheduling solutions that is returned to the external provider system.	Medium
BOO.030	Parameters	Prior to returning scheduling solutions to a requesting external provider system, the TMCC must be capable of filtering potentially "bad" scheduling solutions. This will be accomplished by utilizing the following system priorities: • Maximum Client Fare • Maximum Provider Cost • Maximum Onboard Time	Medium
BOO.031	Interface	The TMCC must capture the reason why a partner site cannot offer scheduling solutions. This information must be saved on the TMCC and also sent to the requesting external provider system. This information will be in the form of scheduling solution "failure codes" that is determined by the TMCC. The following are a list of scheduling solution failure codes: • Passenger Not Registered – The client on the requesting trip booking does not exist within the TMCC. • No Available Capacity – If a valid partner site cannot provide scheduling solutions for the requested trip booking, the TMCC will determine this to be a "No Available Capacity" failure code. Each site that responds without a solution will be tagged with this failure code. • Cannot Communicate with Partner Site – If the TMCC cannot communicate with a partner site that could offer scheduling solutions, the TMCC will determine this to be a "Cannot Communicate" failure code. • Cannot Support Defined Space Type - If a valid partner site cannot provide scheduling solutions because the space type is not supported, the TMCC will determine this to be a "Cannot Support Defined Space Type" failure code. • Does Not Provide Service – If the TMCC determines that a partner site will not be able to provide scheduling solutions based on service time attributes, the partner site will be tagged with this failure code.	Low
BOO.032	Interface	The TMCC must enable a user, at a partner site, to define the following travel exclusion rules: • Exclude specific passenger types (e.g. dogs, children, etc.) • Exclude specific disabilities • Exclude specific mobility aids This is very similar to how a partner site would define its service times and areas. These travel exclusion rules will enable the partner site to set limitations based on trip booking attributes.	Low

Appendix D – Dispatching Functional Requirements Matrix

Dispatch			
ID	**Component**	**Description**	**Priority**
DISP.001	Adherence	The TMCC will be capable of receiving trip arrival times from an external provider system and update the booking record.	Low
DISP.002	Adherence	The TMCC will be capable of receiving trip departure times from an external provider system and update the booking record.	Low
DISP.003	No Show	The TMCC will be capable of receiving No Show updates and update the booking record accordingly.	High
DISP.004	No Show	If a trip is “No Showed,” the TMCC will be capable of sending trip cancellation messages to external provider sites for the client’s remaining trips. This must be a configurable option on the TMCC	Medium
DISP.005	AVL	The TMCC will be capable of receiving AVL message data and provide partner sites the ability to view this information via web.	Low
DISP.007	AVL	The following data elements must be supported within the AVL message: • TMCC Partner Site ID • Date & Time of AVL capture • Vehicle Number • Direction of travel (e.g. North, South, South East) • Current Speed • Odometer Reading	Low
DISP.008	AVL	The web user interface must enable the partner site to query one or more vehicle, and present current location on map.	Low
DISP.009	AVL	The web user interface must enable the partner site to view the speed, odometer reading, and direction of the vehicle.	Low
DISP.010	AVL	The web user interface must enable the partner site to view historical AVL information on the map by specifying a date and time.	Low
DISP.011	AVL	The web user interface must enable the partner site to “playback” historical AVL information on the map.	Low
DISP.012	AVL	The web user interface will provide the necessary security measures so that partner sites do not have the ability of viewing other sites AVL information.	Low
DISP.013	Adherence	The following external provider updates must be accepted and supported by the TMCC: • Estimated time updates for pickup and drop-off • Odometer readings for pickup and drop-off within the "arrival" message • Fare collected on pickup record within the "perform" message • Passenger information updates within the "perform" message (e.g. change of space type, or added passenger)	Medium
DISP.014	Post Data	The following information must be accepted/supported by the TMCC, from external provider systems: • Odometer readings for pickup and drop-offs events • Fare collected on pickup record • Passenger information updates (e.g. change of space type, or added passenger)	Medium

Appendix E – Funding Source Management Functional Requirements Matrix

Funding Sources			
ID	**Component**	**Description**	**Priority**
FUN.001	Funding	The TMCC must be capable of automatically matching funding sources to trip booking records as partner site scheduling solutions are received.	High
FUN.002	Funding	The TMCC must support the following criteria, or any combination of, when matching funding sources to booking records: • Booking Purpose(s) • Passenger Type(s) • Pickup Address • Drop-off Address • Fare codes • Booking Service • Client's Age • Space Type • Disability Type • Requested Times Ranges • Requested Date Ranges • Day of Week (e.g. Mon, Wed, Fri)	High

FUN.003	Funding	After the TMCC has successfully matched funding source(s) to the trip booking record, the TMCC must be capable of supporting the following methods when calculating subsidy amounts:
		• Percentage of Trip Cost
		• Copayment Amounts
		  ○ Client
		  ○ Provider
			High

FUN.004	Funding	The TMCC will also monitor, in real-time, funding source subsidy limits. The following limit categories must be supported:
		• Will only be subsidize X number of trips per client and/or provider by:
		  ○ Day
		  ○ Week
		  ○ Month
		  ○ Year
		• Will only be subsidize client and/or provider trips up to a defined amount by:
		  ○ Day
		  ○ Week
		  ○ Month
		  ○ Year
			High

FUN.005	Billing	The TMCC will enable a partner site to access a web based billing component that will enable them to generate Funding Source Billing Reports.	Medium
FUN.007	Funding	The ability to specify a default order for funding programs. Doing this determines the order in which funding programs contribute to fare subsidization when multiple funding programs are available for a trip. The default order affects all trip bookings that match the funding programs' matching criteria.	High
FUN.008	Funding	Alternatively another method will be supported by the TMCC when determining the order in which funding programs contribute to the fare subsidization. This method, known as "weighted matching," will enable the TMCC to automatically rank funding sources based on matching criteria between the trip booking attributes and a funding source's "matching criteria."	Medium

Appendix F – Billing Module Functional Requirements Matrix

Billing Module			
ID	**Component**	**Description**	**Priority**
BIL.001	General Settings	The ability to define Billing Funding Sources and the associated interface specification. For example, a funding source may utilize a specific Medicaid billing interface.	Low
BIL.002	General Settings	The ability to support Share of Cost Funding Sources. Share of Cost riders are riders who must pay up to a specified minimum amount for their own trips each month before a billing entity will start covering them.	Low
BIL.003	General Settings	The ability to support zone-based billing rules	Low
BIL.004	General Settings	The ability to associate a county with each registered passenger	Low
BIL.005	Billing Settings	The ability to define billing rates based on Space Type	Low
BIL.006	Billing Settings	The ability to define a minimum age for passenger copayments	Low
BIL.007	Billing Settings	The ability to define distance precision when performing cost calculations (e.g. calculate to tenths of a mile)	Low
BIL.008	Billing Settings	For each space type, you must enter the following: • Flat charge • Mileage charge • Additional client charge	Low
BIL.009	Billing Settings	The ability to charge administrative fees as part of the billed amount for each trip.	Low
BIL.010	Billing Settings	The ability to tag what trip bookings have been billed and the corresponding date.	Low
BIL.011	Billing Settings	The ability to support a unique Trip Billing ID field.	Low
BIL.012	Billing Settings	The ability to define what trips can be billed based on schedule status. For example, If a trip is no-showed, it may still be valid under some defined guideline that a trip can still be billed.	Low
BIL.013	Billing Settings	The ability to specify the start and end date to batch process a number of bookings for billing	Low

BIL.014	Billing Settings	The TMCC must be capable of supporting the following methods when calculating billing amounts:
		• Percentage of Trip Cost
		• Copayment Amounts
		  ○ Client
		  ○ Provider
			Medium

Appendix G – TMCC Interface Component

Overview

The TMCC and External provider systems will communicate client information updates using SOAP messages and HTTP/HTTPS as a transport protocol.
All TMCC notification attempts will be stored for auditing purposes using the Action Tracking log (standard Novus feature).
The TMCC will provide a synchronization mechanism to guarantee consistency of the information in both systems. The synchronization can be triggered automatically or manually.

Data Types

Since XML itself does not define any data types except character strings there is need to define data types, which will be used in the messages. Receiver of a message must convert character data to a proper data type upon parsing of the message. All described below data types are declared as parameter entities within DTD. Those entities are used to describe types of elements and attributes, so receiving software will know how to convert such elements and attributes.

Table 1. Data Types

Data Type	Description
INTEGER	An integer value in range from -32,768 to 32,767
LONG	An integer in range from -2,147,483,648 to 2,147,483,647
BOOLEAN	Can have values of '0' (NO) or '1' (YES), only first character will be analyzed if more than one character is passed
DATE	An integer containing date as YYYYMMDD, where YYYY is year, MM is month and DD is day
TIME	An integer containing time of the day in military format as HHMMSS, where HH is hours, MM is minutes and SS is seconds
TIMESPAN	An integer containing time span as HHMMSS, where HH is hours, MM is minutes and SS is seconds
DISTANCE	An integer containing distance in meters

TMCCSearchClient Method Specification

This method is called to search for Clients-within the TMCC centralized database, as specified by <TMCCClientId>, <ExternalClientId>, <LastName>, <FirstName>. <DateOfBirth>, <PhoneNumber>, <Address>.

Request Format
At least one of the elements must be specified in the request (an error will be returned otherwise)

```
<TMCCSearchClient>
        <TMCCClientId>                  TCF_Int32, optional
        <ExternalClientId>          TCF_Int32, optional
        <LastName>                      TCF_String, optional
        <FirstName>                     TCF_String, optional
        <DateofBirth>               TCF_Int32, optional
        <PhoneNumber>                   TCF_String, optional
        <Address>
                <SiteName>              TCF_String, optional
                <StreetNo>              TCF_String, optional
                <OnStreet>              TCF_String, optional
```

```
                <City>                  TCF_String, optional
                <ZipCode>                       TCF_String, optional
        </Address>
</TMCCSearchClient>
```

Result Format

<Validation> will contain an <Item> node of code RESULTOK:
RESULTOK determines that the method was successful

The result <TMCCSearchClientResult> will be the specified client's data from the TMCC:

```
<TMCCSearchClientResponse>
        <TMCCSearchClientResult>
        …
        </ TMCCSearchClientResult >
        <Validation>
        …
        </Validation>
</ TMCCSearchClientResponse >
<TMCCSearchClientResult>
        <TMCCClients>
                <TMCCClientId>                  TCF_Int32
                        <ExternalClientId>      TCF_Int32
                        <LastName>                      TCF_String
                        <FirstName>                     TCF_String
                        <DateofBirth>           TCF_Int32
                        <PhoneNumber>                   TCF_String
                        <Address>
                                <SiteName>              TCF_String
                                <StreetNo>              TCF_String
                                <OnStreet>              TCF_String
                                <City>          TCF_String
                                <ZipCode>               TCF_String
                        </Address>
                </TMCCClientId>
                <TMCCClientId>                  TCF_Int32
                …
                …
                </TMCCClientId
        </TMCCClients>
```

Validation Codes

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	**Meaning**	**Contained In <Extra>**
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
NOCLIINFO (41146)	No Client table records that matched the identifiers provided were fetched.	

TMCCGetClientInformation Method Specification

This method is called to retrieve a Client's registration data, as specified by <TMCCClientId>.

Request Format

The TMCCClientId must be specified in the request (an error will be returned otherwise)

```
<TMCCGetClientInformation>
        <TMCCClientId>                  TCF_Int32, mandatory
</TMCCGetClientInformation>
```

Result Format

<Validation> will contain an <Item> node of code RESULTOK:
RESULTOK determines that the method was successful

The result <TMCCGetClientInformationResult> will be the specified client's data from the TMCC:

```
<TMCCGetClientInformationResponse>
        <TMCCGetClientInformationResult>
        …
        </TMCCGetClientInformationResult >
        <Validation>
        …
        </Validation>
</ TMCCGetClientInformationResponse >

<TMCCGetClientInformationResult>
        <TMCCClientId>                  TCF_Int32
        <ExternalClientId>          TCF_Int32
        <Title>                         TCF_String
        <LastName>                      TCF_String
        <FirstName>                     TCF_String
        <DateofBirth>               TCF_Int32
        <Gender>                        TCF_String
        <SpaceType>                     TCF_String
        <MobAids>                       TCF_String
        <PhoneNumber>                   TCF_String
        <TransportationMode>        TCF_String
        <Address>
                <AddressType>       TCF_String
                <SiteName>              TCF_String
                <StreetNo>              TCF_String
                <OnStreet>              TCF_String
                <Unit>              TCF_String
                <City>              TCF_String
                <State>             TCF_String
                <ZipCode>               TCF_String
                <Lon>                   TCF_Int32
                <Lat>                   TCF_Int32
        </Address>
        <Address>
                …
                …
        </Address>
        <Contacts>
                <ContactType>       TCF_String
```

```
            <ContactName>                   TCF_String
            <ContactPhone>                  TCF_String
        </Contacts>
        <Contacts>
            …
            …
        </Contacts>
        <Services>
            <ServiceType>                                       TCF_String
                <ServiceTypeList>
                    <ServiceType>                               TCF_String
                    <ServiceStartDate>                          TCF_Int32
                    <ServiceEndDate>                                TCF_Int32
                    <ServiceActiveStatus>                       TCF_Int32
                    <ServiceActiveStatusDescription>            TCF_String
                </ServiceTypeList>
                <ServiceTypeList>
                    …
                    …
                </ServiceTypeList>
            </ServiceType>
            <ServiceType>
                …
                …
            </ServiceType>
        </Services>
        <FrequentAddressList>
            <FrequentAddress>
                <SiteName>                      TCF_String
                <StreetNo>                      TCF_String
                <OnStreet>                      TCF_String
                <Unit>                  TCF_String
                <City>                  TCF_String
                <State>                 TCF_String
                <ZipCode>                       TCF_String
                <Lon>                           TCF_Int32
                <Lat>                           TCF_Int32
            </FrequentAddress>
            <FrequentAddress>
                …
                …
            </FrequentAddress>
        </FrequentAddressList>
</TMCCGetClientInformationResult>
```

Validation Codes

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	Meaning	Contained In <Extra>
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
NOCLIINFO (41146)	No Client table records that matched the identifiers provided were fetched.	

TMCCUpdateClient Method Specification

This is the method used to create/update a Client registration record. If the TMCCClientID is not included with the request, it will be considered to be a new client registration record. Technically, all of these parameters are optional except for <ExternalClientId>.

Request Format

```
<TMCCUpdateClient>
        <TMCCClientId>                          TCF_Int32
        <ExternalClientId>              TCF_Int32     Mandatory
        <Title>                         TCF_String
        <LastName>                              TCF_String
        <FirstName>                             TCF_String
        <DateofBirth>                   TCF_Int32
        <Gender>                                TCF_String
        <SpaceType>                             TCF_String
        <MobAids>                               TCF_String
        <PhoneNumber>                           TCF_String
        <TransportationMode>            TCF_String
        <Address>
                <AddressType>           TCF_String
                <SiteName>                      TCF_String
                <StreetNo>                      TCF_String
                <OnStreet>                      TCF_String
                <Unit>                  TCF_String
                <City>                  TCF_String
                <State>                 TCF_String
                <ZipCode>                       TCF_String
                <Lon>                           TCF_Int32
                <Lat>                           TCF_Int32
        </Address>
        <Address>
                …
                …
        </Address>
        <Contacts>
                <ContactType>           TCF_String
                <ContactName>                   TCF_String
                <ContactPhone>                  TCF_String
        </Contacts>
        <Contacts>
                …
                …
        </Contacts>
        <Services>
                <ServiceType>                                           TCF_String
                        <ServiceTypeList>
                                <ServiceType>                           TCF_String
                                <ServiceStartDate>                      TCF_Int32
                                <ServiceEndDate>                                TCF_Int32
                                <ServiceActiveStatus>                   TCF_Int32
                                <ServiceActiveStatusDescription>        TCF_String
                        </ServiceTypeList>
                        <ServiceTypeList>
                                …
                                …
                        </ServiceTypeList>
                </ServiceType>
```

```
                <ServiceType>
                        …
                        …
                </ServiceType>
        </Services>
</TMCCUpdateClient>
```

Result Format

<Validation> will contain an <Item> node of code RESULTOK:
RESULTOK determines that the method was successful

The result <TMCCGetClientInformationResult> will be the specified client's data from the TMCC:

```
<TMCCUpdateClientResponse>
        <TMCCUpdateClientResult>
        …
        </TMCCUpdateClientResult >
        <Validation>
        …
        </Validation>
</TMCCUpdateClientResponse>
```

Validation Codes

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	**Meaning**	**Contained In <Extra>**
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
NOCLIINFO (41146)	No Client table records that matched the identifiers provided were fetched.	

TMCCBookingSave Method Specification

This is the method used to create a booking. It will accept a trip-creation request, load client and relevant data, utilize extensive logic to generate a booking. Technically, all of these parameters are optional except for <PickUpLeg> and <DropOffLeg>. However many of them have dependencies between each other (e.g. at least one of ReqTime, ReqEarly or ReqLate must be present in one of the booking legs).

Request Format

```
<TMCCBookingSave>
        <TMCCClientId>                  TCF_Int32
        <Date>                  TCF_Int32
        <ServiceType>           TCF_Int32
        <BookingPurpose>                string
        <ProviderId>            TCF_Int32
        <MobilityAids>          TCF_String
        <Comments>                      TCF_String
        <TransportationMode>    TCF_String
        <EscortMode>            TCF_String
        <PickUpLeg>
                <ReqTime>               TCF_Int32
                <ReqEarly>              TCF_Int32
                <ReqLate>               TCF_Int32
                <LoadTime>              TCF_Int32
```

```
            <RequestAddress>
                  <AddressType>          TCF_String
                  <SiteName>                   TCF_String
                  <StreetNo>                   TCF_String
                  <OnStreet>                   TCF_String
                  <Unit>                 TCF_String
                  <City>                 TCF_String
                  <State>                TCF_String
                  <ZipCode>                    TCF_String
                  <Lon>                        TCF_Int32
                  <Lat>                        TCF_Int32
            </RequestAddress>
      </PickUpLeg>
      <DropOffLeg>
            <ReqTime>                    TCF_Int32, TX_TIME
            <ReqEarly>                   TCF_Int32, TX_TIME
            <ReqLate>                    TCF_Int32, TX_TIME
            <LoadTime>                   TCF_Int32
            <RequestAddress>
                  <AddressType>          TCF_String
                  <SiteName>                   TCF_String
                  <StreetNo>                   TCF_String
                  <OnStreet>                   TCF_String
                  <Unit>                 TCF_String
                  <City>                 TCF_String
                  <State>                TCF_String
                  <ZipCode>                    TCF_String
                  <Lon>                        TCF_Int32
                  <Lat>                        TCF_Int32
            </RequestAddress>
      </DropOffLeg>
      <Passengers>
            <Passenger>
                  <PassengerType>              TCF_String
                  <SpaceType>                  TCF_String
                  <FareType>                   TCF_Int32
                  <PassengerCount>             TCF_Int32
            </Passenger>
            …
            …
            …
      </Passengers>
</TMCCBookingSave>
```

Operations

As the procedural flow of this method is described, various situations may produce an error (e.g. the client is invalid or the origin is not geocoded). Unless specified otherwise, any citing of “an error will be returned” in this section will cause the method to abort and no booking will be created.

Initial Parsing of Request

- <PickUpLeg> and <DropOffLeg> must be present in the request. At least one <passenger> must be specified.
- <TMCCClientId> must be supplied. If <TMCCClientId> is non-zero then it will be the ClientId of the new booking being created. Of course, the TMCCClientId must match that of a record in the Clients table.

- If <ServiceType> is specified and non-zero then it will be the ServiceType of the new booking record. A service must be specified.
- If the same request is submitted to TMCCSaveBooking more than once, an error will be returned for all requests beyond the first. This is a safety-valve to prevent internet service attacks.

Initial Verification and Trip Creating

The following rules apply for times that are specified in the <PickUpLeg> and <DropOffLeg> of the request, any violation of them will result in an error being returned:

- Either a pick-up <ReqTime> or a drop-off <ReqTime> must be supplied, and not both
- <ReqLate> cannot be earlier then <ReqTime> when both are supplied (either leg)
- <ReqEarly> cannot be later then <ReqTime> when both are supplied (either leg)
- <ReqLate> cannot be earlier then <ReqEarly> when both are supplied (either leg)
- drop-off <ReqLate> cannot be earlier than pick-up <ReqTime>
- pick-up <ReqEarly> cannot be later than drop-off <ReqTime>

Result Format

```
<TMCCBookingSaveResponse>
    <TMCCBookingSaveResult>
    …
    </TMCCBookingSaveResult>
    <Validation>
    …
    </Validation>
</TMCCBookingSaveResponse>
```

Validation Codes

<Validation> will at least contain <Item> nodes of BOOKIDRET and RESULTOK:

<Code>	Meaning	Contained In <Extra>
BOOKIDRET	A new booking was successfully created	
RESULTOK	The method was successful	

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	Meaning	Contained In <Extra>
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
REQINVFLD (41160)	A field in the request was invalid	<InvalidField> - name of the invalid field or structure
REQINVTMFLD (40964)	A time-based field in the request was invalid	<InvalidField> - name of the invalid time field
CLIMIS (41066 or 41067)	There was no Clients record that matched the supplied <TMCCClientId>	<TMCCClientId>
CONSECCRBOOK (40960)	An attempt was made to submit the same TMCCBookingSave request twice.	
INVPARAM (40962)	A parameter is invalid	<InvalidParameter> - name of the invalid parameter
ONEREQTIME (41159)	Both a pick-up <ReqTime> and a drop-off <ReqTime> were specified, or neither were specified	
TVALLTLESSRT (41118)	<LateTime> was specified as less than <ReqTime> in one of the legs	<BookingLeg> - the pick-up leg [0] or drop-off leg [1] that has the bad time field

<Code>	Meaning	Contained In <Extra>
TVALETMORERT (41119)	<EarlyTime> was specified as more than <ReqTime> in one of the legs	<BookingLeg> - the pick-up leg [0] or drop-off leg [1] that has the bad time field
TVALLELESSET (41120)	<LateTime> was specified as less than <EarlyTime> in one of the legs	<BookingLeg> - the pick-up leg [0] or drop-off leg [1] that has the bad time field
TVALDOLTLESSPURT (41121)	Drop-off <LateTime> was specified as less than pick-up <ReqTime>	
TVALPUETMOREDORT (41122)	Pick-up <EarlyTime> was specified as more than drop-off <ReqTime>	
NOPARASRVID (41156)	<ServiceType> was required but not supplied	
BKPURPNOTDEF (41114)	<PurposeId> was required but not supplied	<PurposeId> - as supplied in the request
BKAFTADVDAYS (41115)	The <Date> of the booking exceeds the number of advanced booking days allowed	<AdvanceBookingDays> - number of days in advance that a booking was allowed
CLIINELIGSUSP (41127)	The client is either ineligible or suspended on the <Date> or <FromDate>/<ToDate> of the trip	
INACTCLICREBK (41128)	The client is inactive but was required to be active for creating new trips	<InActive> - from the client's Clients record
NOFORMLEGQ (41108)	Address data could not be fetched for either the pick-up leg or the drop-off leg of the new trip	<InvalidParameter> - the leg whose address data could not be fetched <ResultCode> - error code
LEGBADGEOC (41133)	One of the legs was not geocoded but was required to be	<InvalidParameter> - the leg whose Lon, Lat or GeoStatus was zero
BOOKDTTMEXP (41130)	The new trip was made for a date/time earlier than the current time, but was required not to be	<ReqTime>, <LDate> - the ReqTime and LDate that have expired
COMMISSPT (41134)	PassType & SpaceType were found to be blank when creating default BookingActivity records for the client, or when creating Activity records for a Passenger that was supplied	<PassType>, <SpaceType> - that were to be used for the Activity records
NOBOOKID (41107)	After numerous attempts the new Booking record could not be inserted (rare)	<NumberOfAttempts> - the number of attempts that were made
NOBOOKLEGID (41104)	After numerous attempts one of the new BookingLeg records could not be inserted (rare)	<NumberOfAttempts> - the number of attempts that were made

TMCCBookingUpdate Method Specification

This is the method used to update a booking. It will accept a trip-update request, load client and relevant data, utilize extensive logic to generate a booking.

Request Format

<TMCCBookingUpdate>
- **<TMCCClientId>** **TCF_Int32**
- **<Date>** **TCF_Int32**
- <ServiceType> TCF_Int32
- <BookingPurpose> string
- <ProviderId> TCF_Int32
- <MobilityAids> TCF_String
- <Comments> TCF_String
- <TransportationMode> TCF_String
- **<EscortMode>** **TCF_String**
- <PickUpLeg>
  - **<ReqTime>** **TCF_Int32**
  - <ReqEarly> TCF_Int32
  - <ReqLate> TCF_Int32

```
            <LoadTime>                  TCF_Int32
            <RequestAddress>
                  <AddressType>         TCF_String
                  <SiteName>                  TCF_String
                  <StreetNo>                  TCF_String
                  <OnStreet>                  TCF_String
                  <Unit>                TCF_String
                  <City>                TCF_String
                  <State>               TCF_String
                  <ZipCode>                   TCF_String
                  <Lon>                       TCF_Int32
                  <Lat>                       TCF_Int32
            </RequestAddress>
      </PickUpLeg>
      <DropOffLeg>
            <ReqTime>                   TCF_Int32, TX_TIME
            <ReqEarly>                  TCF_Int32, TX_TIME
            <ReqLate>                   TCF_Int32, TX_TIME
            <LoadTime>                  TCF_Int32
            <RequestAddress>
                  <AddressType>         TCF_String
                  <SiteName>                  TCF_String
                  <StreetNo>                  TCF_String
                  <OnStreet>                  TCF_String
                  <Unit>                TCF_String
                  <City>                TCF_String
                  <State>               TCF_String
                  <ZipCode>                   TCF_String
                  <Lon>                       TCF_Int32
                  <Lat>                       TCF_Int32
            </RequestAddress>
      </DropOffLeg>
      <Passengers>
            <Passenger>
                  <PassengerType>             TCF_String
                  <SpaceType>                 TCF_String
                  <FareType>                  TCF_Int32
                  <PassengerCount>            TCF_Int32
            </Passenger>
            …
            …
            …
      </Passengers>
</TMCCBookingUpdate>
```

Operations

As the procedural flow of this method is described, various situations may produce an error (e.g. the client is invalid or the origin is not geocoded). Unless specified otherwise, any citing of “an error will be returned” in this section will cause the method to abort and no booking will be created.

Initial Parsing of Request

- <PickUpLeg> and <DropOffLeg> must be present in the request. At least one <passenger> must be specified.
- <TMCCClientId> must be supplied. If <TMCCClientId> is non-zero then it will be the ClientId of the new booking being created. Of course, the TMCCClientId must match that of a record in the Clients table.

- If <ServiceType> is specified and non-zero then it will be the ServiceType of the new booking record. A service must be specified.
- If the same request is submitted to TMCCSaveBooking more than once, an error will be returned for all requests beyond the first. This is a safety-valve to prevent internet service attacks.

Initial Verification and Trip Creating
The following rules apply for times that are specified in the <PickUpLeg> and <DropOffLeg> of the request, any violation of them will result in an error being returned:

- Either a pick-up <ReqTime> or a drop-off <ReqTime> must be supplied, and not both
- <ReqLate> cannot be earlier then <ReqTime> when both are supplied (either leg)
- <ReqEarly> cannot be later then <ReqTime> when both are supplied (either leg)
- <ReqLate> cannot be earlier then <ReqEarly> when both are supplied (either leg)
- drop-off <ReqLate> cannot be earlier than pick-up <ReqTime>
- pick-up <ReqEarly> cannot be later than drop-off <ReqTime>

Result Format

```
<TMCCBookingUpdateResponse>
    <TMCCBookingUpdateResult>
    …
    </TMCCBookingUpdateResult>
    <Validation>
    …
    </Validation>
</TMCCBookingUpdateResponse>
```

Validation Codes

<Validation> will at least contain <Item> nodes of BOOKIDRET and RESULTOK:

<Code>	Meaning	Contained In <Extra>
BOOKIDRET	A new booking was successfully created	
RESULTOK	The method was successful	

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	Meaning	Contained In <Extra>
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
REQINVFLD (41160)	A field in the request was invalid	<InvalidField> - name of the invalid field or structure
REQINVTMFLD (40964)	A time-based field in the request was invalid	<InvalidField> - name of the invalid time field
CLIMIS (41066 or 41067)	There was no Clients record that matched the supplied <TMCCClientId>	<TMCCClientId>
CONSECCRBOOK (40960)	An attempt was made to submit the same TMCCBookingSave request twice.	
INVPARAM (40962)	A parameter is invalid	<InvalidParameter> - name of the invalid parameter
ONEREQTIME (41159)	Both a pick-up <ReqTime> and a drop-off <ReqTime> were specified, or neither were specified	
TVALLTLESSRT (41118)	<LateTime> was specified as less than <ReqTime> in one of the legs	<BookingLeg> - the pick-up leg [0] or drop-off leg [1] that has the bad time field
TVALETMORERT (41119)	<EarlyTime> was specified as more than <ReqTime> in one of the legs	<BookingLeg> - the pick-up leg [0] or drop-off leg [1] that has the bad time

<Code>	Meaning	Contained In <Extra>
		field
TVALLELESSET (41120)	<LateTime> was specified as less than <EarlyTime> in one of the legs	<BookingLeg> - the pick-up leg [0] or drop-off leg [1] that has the bad time field
TVALDOLTLESSPURT (41121)	Drop-off <LateTime> was specified as less than pick-up <ReqTime>	
TVALPUETMOREDORT (41122)	Pick-up <EarlyTime> was specified as more than drop-off <ReqTime>	
NOPARASRVID (41156)	<ServiceType> was required but not supplied	
BKPURPNOTDEF (41114)	<PurposeId> was required but not supplied	<PurposeId> - as supplied in the request
BKAFTADVDAYS (41115)	The <Date> of the booking exceeds the number of advanced booking days allowed	<AdvanceBookingDays> - number of days in advance that a booking was allowed
CLIINELIGSUSP (41127)	The client is either ineligible or suspended on the <Date> or <FromDate>/<ToDate> of the trip	
INACTCLICREBK (41128)	The client is inactive but was required to be active for creating new trips	<InActive> - from the client's Clients record
NOFORMLEGQ (41108)	Address data could not be fetched for either the pick-up leg or the drop-off leg of the new trip	<InvalidParameter> - the leg whose address data could not be fetched <ResultCode> - error code
LEGBADGEOC (41133)	One of the legs was not geocoded but was required to be	<InvalidParameter> - the leg whose Lon, Lat or GeoStatus was zero
BOOKDTTMEXP (41130)	The new trip was made for a date/time earlier than the current time, but was required not to be	<ReqTime>, <LDate> - the ReqTime and LDate that have expired
COMMISSPT (41134)	PassType & SpaceType were found to be blank when creating default BookingActivity records for the client, or when creating Activity records for a Passenger that was supplied	<PassType>, <SpaceType> - that were to be used for the Activity records
NOBOOKID (41107)	After numerous attempts the new Booking record could not be inserted (rare)	<NumberOfAttempts> - the number of attempts that were made
NOBOOKLEGID (41104)	After numerous attempts one of the new BookingLeg records could not be inserted (rare)	<NumberOfAttempts> - the number of attempts that were made

TMCCBookingCancel Method Specification

This method is used to change the schedule status of a trip in the system, typically to CA (cancelled-in-advance) or U (unscheduled).

Request Format

<TMCCBookingCancel>
    <TMCCBookingId> **TCF_Int32**
    <SchedStatus> TCF_String, optional
</TMCCBookingCancel>

Operations

<TMCCBookingId> must that of a valid booking, otherwise an error will be returned.

<SchedStatus> can be any one of these schedule states (otherwise CA will be assumed):

Code	Meaning
U	Unscheduled
CA	Cancelled in Advance
CL	Cancelled Late
CS	Cancelled Same-Day
CC	Cancelled Site Closure
CE	Cancelled User Error

Result Format

<TMCCBookingCancelResponse>
    <TMCCBookingCancelResult>
    …
    </TMCCBookingCancelResult>
    <Validation>
    …
    </Validation>
</TMCCBookingCancelResponse>

<Validation> will contain an <Item> node of code RESULTOK:

<Code>	Meaning	Contained In <Extra>
RESULTOK	The method was successful	<BookingId>, <SchedStatus> - as supplied in the request

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	Meaning	Contained In <Extra>
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
BOOKMIS (41077)	There was no Booking record that matched the supplied <TMCCBookingId>	<BookingId>, <SchedStatus> - as supplied in the request
NOBOOKINFO (41163)	Unable to retrieve booking data for the booking that matched the supplied <TMCCBookingId>	<BookingId> - as supplied in the request
NOCANCPRVDY (41135)	The booking's requested pick-up time is before the current time/date but the context key	<TMCCBookingId>, <SchedStatus> - as supplied in the request <CurrentDate>, <CurrentTime> - the current date and time

TMCCSchedFindSolution Method Specification

This method will make the call to the TMCC to obtain booking solutions for a trip. One of these solutions can then be saved [committed] by a subsequent call to TMCCSchedSelectSolution.

Request Format

<TMCCSchedFindSolution>
    <TMCCBookingId> **TCF_Int32**
    <PassSaveSolution> TCF_String, optional
</PassScheduleTrip>

Operations

<TMCCBookingId> will be that of the trip to be scheduled.

Firstly, if the trip is currently cancelled or no-show then it will be made unscheduled by an internal call to **TMCCBookingCancel** (SchedStatus to be 0). Any <Validation> codes that TMCCBookingCancel may generate in this situation will appear in this method's final result.

No Solutions

No solutions were returned by the Schedule Server (the trip was denied) or a solution set was returned but it has a SolutionSetNumber of 0 (a bad result). <Validation> will contain an <Item> node of NOSOLNSFOUND.

One or More Solutions

This is the basic success condition of this method – that one or more scheduling solutions were returned by the TMCC in a solution set with a positive SolutionSetNumber. <Validation> will contain an <Item> node of SOLNSFOUND.

Any of the remaining solutions can be manually submitted in a subsequent call to TMCCSchedSelectSolution, to give the client an opportunity to choose one of them (e.g. by run name).

Result Format

```
< TMCCSchedFindSolutionResponse>
        < TMCCSchedFindSolutionResult>
        …
        </ TMCCSchedFindSolutionResult>
        <Validation>
        …
        </Validation>
</ TMCCSchedFindSolutionResponse>
```

<Validation> will contain <Item> nodes of code RESULTOK and code SOLNSFOUND (success). It may also contain an <Item> node of code SOLNSAVED (success and the first scheduling solution was saved/committed):

<Code>	**Meaning**	**Contained In <Extra>**
SOLNSFOUND	Scheduling solutions were found	<TMCCBookingId> - as supplied in the request <NumberOfSolutions> - the number of scheduling solutions in the result <SolutionSetId> - ID of the solution set
SOLNSAVED	The scheduling solution was successfully saved	<SolutionSetNumber>, <SolutionNumber>, <TMCCBookingId> - as supplied in the request
RESULTOK	The method was successful	<TMCCBookingId> - as supplied in the request

The result (as <PassScheduleTripResult>) will contain the parameters and results of the trip's scheduling:

```
<TMCCSchedFindSolutionResult>
        * <SolutionSetNumber>          TCF_Int32
        * <TMCCBookingId>              TCF_Int32
        <TripSolutions>
                <TripSolution>
                        …
```

```
                </TripSolution>
                …
                …
                …
        </TripSolutions>
        ** <ScheduledTime>              TCF_Int32, TX_TIME
        *** <Run>                               TCF_String
        <Desc>                          TCF_String
        *** <Provider>                  TCF_String
</TMCCSchedFindSolutionResult>
```

In turn, each <TripSolution> node will represent one of the scheduling solutions:

```
<TripSolution>
        <SolutionNumber>                        TCF_Int32
        <Activity>                              TCF_Int32
        * <EarlyTime>                   TCF_Int32, TX_TIME
        * <ScheduledTime>                       TCF_Int32, TX_TIME
        * <LateTime>                    TCF_Int32, TX_TIME
        <NumberOfTransfers>             TCF_String
        <Run>                                   TCF_String
        <Desc>                          TCF_String
        <Provider>                              TCF_String
</TripSolution>
```

* these are NewSchEarly, NewSchTime, NewSchLate as they had appeared in the scheduling solution result from the TMCC

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	**Meaning**	**Contained In <Extra>**
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
BOOKMIS (41077)	There was no Booking record that matched the supplied <TMCCBookingId>	<TMCCBookingId>, - as supplied in the request
NOBOOKINFO (41163)	Unable to retrieve booking data for the booking that matched the supplied <TMCCBookingId>	<TMCCBookingId> - as supplied in the request
NOSOLNSFOUND (41065)	No scheduling solutions were found for the booking	<TMCCBookingId> - as supplied in the request

TMCCSchedSelectSolution Method Specification

This method asks the TMCC to save one of the solutions of a solution set it had previously generated, which will finalize the scheduling of a trip.

Request Format

```
<TMCCSchedSelectSolution>
        <SolutionSetNumber>             TCF_Int32
        <SolutionNumber>                        TCF_Int32
        <TMCCBookingId>                         TCF_Int32, optional (but recommended)
</PassSaveSolution>
```

Operations

<SolutionSetNumber> are those that were present in the result of a successful call to the TMCC. <SolutionNumber> is from the desired scheduling solution

The actual saving of scheduling solutions is independent of TMCCBookingId, hence why <TMCCBookingId> as a parameter is optional. However, if <TMCCBookingId> is provided then this method will verify against the database that the trip is scheduled (SchedStatus is 1) after the call for the TMCC to save the solution is made.

Result Format

<TMCCSchedSelectSolutionResponse>
    <Validation>
    …
    </Validation>
</TMCCSchedSelectSolutionResponse>

<Validation> will contain <Item> nodes of code SOLNSAVED and RESULTOK:

<Code>	Meaning	Contained In <Extra>
SOLNSAVED	The scheduling solution was successfully saved	<SolutionSetNumber>, <SolutionNumber>, <TMCCBookingId> - as supplied in the request
RESULTOK	The method was successful	<SolutionSetNumber>, <SolutionNumber>, <TMCCBookingId> - as supplied in the request

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	Meaning	Contained In <Extra>
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure
SOLNNOSAVE (41155)	The SchedStatus of the booking is not 1 (scheduled) though it should be after this operation	<SolutionSetNumber>, <SolutionNumber>, <TMCCBookingId> - as supplied in the request

TMCCSchedDropSolution Method Specification

This method asks the TMCC to drop a solution set it had previously generated.

Request Format

<TMCCSchedDropSolution>
    <SolutionSetNumber> **TCF_Int32**
</TMCCSchedDropSolution>

Operations

<SolutionSetNumber> are those of a solution set that was generated by a previous call to the TMCC

Result Format

<TMCCSchedDropSolutionResponse>
    <Validation>
    …
    </Validation>
</TMCCSchedDropSolutionResponse>

<Validation> will contain an <Item> node of code RESULTOK:

<Code>	Meaning	Contained In <Extra>
RESULTOK	The method was successful	<SolutionSetNumber> - as supplied in the request

<Validation> will contain one or more <Item> nodes whose codes describe why the call was not successful:

<Code>	Meaning	Contained In <Extra>
REQMISFLD (40962)	Request was badly formatted, or was missing one or more non-optional fields	<MissingField> - name of the missing required field or structure

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