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Final Report

Demonstration of Enhanced Human Service Transportation Models: Phase 1 - System Development and Design



The Purchase Area Regional Travel Management Coordination Center (TMCC)

March 23, 2009

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FINAL REPORT

Demonstration of Enhanced Human Service Transportation Models: Phase 1 - System Development and Design: The Purchase Area Regional Travel Management Coordination Center (TMCC)

March 23, 2009

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Foreword

In April of 2006, the United States Department of Transportation (USDOT), Federal Transit Administration (FTA), released a Request for Proposals for the Demonstration of Enhanced Human Service Transportation Models: Phase 1 – System Development and Design to design model coordinated human service and public transportation service centers. As it is known in the industry, the Federal Mobility Services for All Americans (MSAA) program, one of the USDOT's 11 Intelligent Transportation Systems (ITS) initiatives, was designed to enhance customer access to replicable and scaleable Travel Management Coordination Centers (TMCC) that would provide customers with access to transportation information and services.

In June 2006, the Paducah Area Transit System (PATS) submitted a proposal for MSAA Phase 1 funding and was selected in December 2006 as one of eight sites in the country to design a model TMCC for the eight county rural Purchase Area region of western Kentucky. Officially starting in April 2007, PATS and regional stakeholders held numerous meetings in multiple formats to develop a vision, mission, and the anticipated services to meet customer expectation to be provided by the TMCC. In addition, the project's Technical Committee, comprised of public transportation, human service agency, local government, and technology partners, assisted in the development of six technical project design deliverables following the USDOT's ITS Systems Engineering approach. Each deliverable was submitted to USDOT at identified intervals and comments received to improve the design. The project also included the eight county region's primary transportation providers, including PATS, Fulton County Transit Authority (FCTA), Murray-Calloway County Transit Authority (MCTA), and Easter Seals West Kentucky (ESWKY) addressing administrative, operational, and technical policy issues to ensure project success. The first phase of the project concluded on July 31, 2008, with the submission of the Phase 2 proposal for funding to assist in implementing the first year's ITS elements of the project.

The following report provides an overview of the Purchase Area TMCC project, including regional overview, project and service area description, stakeholder involvement, project technical design, implementation plan and schedule.

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LIST OF ABBREVIATIONS & DESCRIPTIONS

Acronym	Description
ADA	Americans with Disabilities Act (Federal law)
AIRS	Alliance of Information and Referral Systems
APTA	American Public Transportation Association
AVL	Automatic Vehicle Location (satellite navigation)
CAD	Computer Aided Dispatching (FR system)
CASD	Computer Aided Scheduling and Dispatching (DR system)
ConOps	Concept of Operations
COTS	Commercial Off The Shelf technologies
CSR	Customer Service Representative
Db	Database (of information)
DR	Demand Response service
DVR	Digital Video Recorder
ESWKY	Easter Seals West Kentucky
FCTA	Fulton County Transit Authority
FHWA	Federal Highway Administration
FR	Fixed Route service
FTA	Federal Transit Administration
GPS	Global Positioning Systems
I & R	Human Service Information & Referral Services
IEEE	Institute of Electrical and Electronics Engineers
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
KYTC	Kentucky Transportation Cabinet
JPO	USDOT's ITS Joint Program Office (technology)
MDC	Mobile Data Computer (onboard vehicle mini PC)
MCTA	Murray - Calloway Transit Authority
MSAA	Mobility Services for All Americans
MSU	Murray State University
NEMA	National Electrical Manufacturers Association
PATS	Paducah Area Transit System
PADD	Purchase Area Development District
RM	RouteMatch Software
TMCC	Travel Management Coordination Center
TMCC AC	Travel Management Coordination Center Advisory Committee (formerly Call Center Technical Advisory Committee)
UK	University of Kentucky
USDOT	United States Department of Transportation
USDHHS	United States Department of Health and Human Services
VoIP	Voice over Internet Protocol

Abstract

This report provides a comprehensive review of the policy, operational, and technical design and development of the Purchase Area Transportation Management Coordination Center (TMCC) for western Kentucky. The Purchase Area TMCC will facilitate simplified consumer access to transportation and human service information & referral services in the eight county region. This report specifically addresses information documented in the planning and development of the TMCC and in preparation of the Federal Mobility Services for All Americans (MSAA) project deliverables, including the technical Concept of Operations; System Requirements; Review of the region's ITS Architecture; System Design; and Project Implementation Schedule.



**Paducah Area Transit System, Paducah, KY,
Customer Service, Administration, Operations, and Maintenance Center**

Acknowledgements

The development of the Purchase Area TMCC system design would not be possible without first acknowledging the financial and technical support of the USDOT in selecting PATS as one of eight national sites awarded the development of this project. In addition, the financial and technical support of the KYTC also is greatly appreciated in support of Phase 1. In developing the TMCC's design, the project would not have been possible over a fifteen month period without the project's committed stakeholders, including the customers (riders); Fulton County Transit Authority (FCTA), Murray-Calloway County Transit Authority (MCTA), Easter Seals West Kentucky (ESWKY), the PATS Board of Directors and staff; Purchase Area Development District; RouteMatch Software; Advisory Committee members; Paducah/McCracken County United Way; City of Paducah; McCracken County; Murray State University, KW Communications, TranSystems Corporation (USDOT Technical Assistance Advisors), technology vendors, and US Senator Mitch McConnell, US Senator Jim Bunning, and US Congressman Ed Whitfield's offices.

The development of all deliverables rested on the shoulders of the project's Technical Team, which was led by the dedicated professionals at PATS, Paul Maxwell at FCTA, Bjarne Hansen at MCTA, Steve Byerly at ESWKY, Mark Davis at the PADD, Zana Renfro, a McCracken County Commissioner, and Todd Allen, Tom Coogan, Tim Quinn, David Churchill, Dale Kartushyn, Chris Campbell, Wayne Stevens, and Joe Hewes from RouteMatch Software. All deliverables were proactively managed and completed on-time.

Finally, a special acknowledgement goes to Mr. Todd Allen of RouteMatch Software for his dedication to PATS, its customers, and the region's primary transportation providers in the development of the Purchase Area TMCC.

I. Executive Summary

The Paducah Transit Authority, doing business as the Paducah Area Transit System (PATS), provides coordinated human service and public transportation services for approximately 200 organizations in the City of Paducah and McCracken County, KY. Through a cooperative partnership with human service agency, community organization, general public/system riders, and the three other primary transportation providers in the Purchase Area region of western Kentucky, PATS plans to implement a regional Mobility Services for All Americans (MSAA) Travel Management Coordination Center (TMCC). The Purchase Area TMCC will serve as a scalable & replicable single point of access for transportation, human service, and community information & referral services. TMCC services will be accessible through telephone, Internet, and walk-in services.

Commencing in April 2007 through the award of the USDOT's Demonstration of Enhanced Human Service Transportation Models: Phase 1 – System Development and Design grant, the design and development of the TMCC was shaped through June 2008 through the involvement of many diverse stakeholders from the original consideration of serving a single county changing over a fifteen month period to meet stakeholder transportation and human service information & referral needs on a regional level. As designed, the Purchase Area TMCC will serve as a scaleable single point of access for transportation, human service, and community information & referral services. TMCC services will be made available through a hybrid centralized/decentralized model to provide customers with access by telephone, Internet, and walk-in services. To provide the necessary customer services, the TMCC will be supported by the region's primary coordinated public and human service transportation providers, including PATS (as lead agency), Fulton County Transit Authority, Murray-Calloway County Transit Authority, and Easter Seals West Kentucky. The TMCC and primary transportation providers will utilize Intelligent Transportation Systems (ITS) advanced technologies to serve as a primary "enabler" for all TMCC services. All

primary providers and many other stakeholders are committed to developing the TMCC's services and deploying their necessary supporting technologies.

To support the TMCC's operations, ITS technologies will be phased in over a four year period starting with the "base" or foundation technologies being deployed, tested, and implemented as proposed in Year 1 (2009-2010) and subsequent or "expanded" technologies being added or phased into the system in Years 2-4 (2011-2013). These technologies will be vital in providing timely operational information to the TMCC and delivering accurate information directly to the customer either in person, through the telephone, or by Internet website.

Though the vision embodied by PATS, the region's primary transportation providers, the TMCC Advisory Committee, TMCC Technical Committee, Federal, state, and local governments, human service agencies, and all other stakeholders, the Purchase Area TMCC's receipt of USDOT Demonstration of Coordinated Human Service Transportation Models: Phase 2 – System Deployment project funding will enable the deployment of a replicable and scaleable detailed technology system, including a model for regional rural operations, the applicable use of technologies, appropriate interfaces, and detailed responsibilities. As defined by the project's stakeholders, the TMCC is critical to meeting the regional transportation and human service information and referral needs of the eight county Purchase Area region of western Kentucky.

The following report provides a detailed assessment of the Phase 1 design and development of the Purchase Area Transportation Management Coordination Center (TMCC).

II. Introduction

This section contains an introduction to the Purchase Area Transportation Management Coordination Center (TMCC) project. Included in this section is an overview of the project's local area and a discussion of the project's lead and other regional primary transportation agencies.

A. Local Area Overview

The Purchase Area TMCC is envisioned to serve the residents and visitors of the Jackson Purchase region of western Kentucky by providing transportation and human service information & referral services. The TMCC's region is geographically bordered by the Tennessee River to the east, Ohio River to the north, Mississippi River to the west, and the State of Tennessee to the south. See Figure 1. The Jackson Purchase region (herein referred to as the Purchase Area region) is officially so named for the area of land that was purchased by U. S. President Andrew Jackson in 1818 from the Chickasaw Indian Nation.

Figure 1: Jackson Purchase (aka the Purchase) region of Kentucky



Located in westernmost Kentucky, the Purchase Area region comprises eight counties including Ballard, Calloway, Carlisle, Fulton, Graves,

Hickman, Marshall, and McCracken. As of the 2000 Census, the region had a total population of 193,495 persons with the Cities of Paducah, Mayfield, and Murray being the largest populated cities in the region. The region encompasses over 2,569 square miles and features a diverse road network with Interstate 24 and many United States and state highways in the region. The Purchase Area is home to many diverse employers including agribusiness, river services, railroad, government, education, health care, technology, artisan, recreation, entertainment, and retail.

The Purchase Area region or western Kentucky is also home to four primary transportation providers, including the Paducah Transit Authority (doing business as Paducah Area Transit System) - PATS, Fulton County Transit Authority - FCTA, Murray-Calloway County Transit Authority - MCTA, and Easter Seals of West Kentucky. These agencies provide a total of 700,487 total coordinated public and human service agency trips annually. See Table 1 for additional information on primary the providers and services. For the TMCC project, PATS has been designated as lead agency to manage and oversee the development and implementation of its services.

Table 1: Purchase Area Primary Transportation Providers

Transportation Provider	Service Description
Paducah Area Transit (PATS), Paducah, KY	Provides fixed route, paratransit, dial-a-ride, Medicaid, human service, contract, shuttle, vanpool, and senior citizen transportation services in McCracken, Graves, Marshall, and Ballard Counties. PATS utilizes a fleet of 67 vehicles operating from 4am - 10pm, Monday-Sunday. PATS provides over 556,298 passenger trips annually.
Murray - Calloway Transit Authority (MCTA), Murray, KY	Provides fixed route, paratransit, Medicaid, human service, and university transportation services in Calloway, Marshall, and Graves Counties. MCTA utilizes a fleet of 11 vehicles operating 8:00 am - 5:00 pm, Monday through Friday. MCTA provides over 64,629 passenger trips annually.
Fulton County Transit Authority (FCTA), Fulton, KY	Provides paratransit, Medicaid, and human service transportation services in Fulton, Hickman, Carlisle, and Graves Counties. FCTA utilizes a fleet of 27 vehicles operating 6:00 am - 6:00 pm, Monday through Friday, and 6:00 am - 1:00 pm on Saturdays.

Transportation Provider	Service Description
	FCTA provides over 79,560 passenger trips annually.
Easter Seals West Kentucky (ESWKY), Paducah, KY	Provides agency and Medicaid transportation services. Easter Seals operates in Graves, Marshall, Ballard and McCracken Counties. Easter Seals operates 5 days/week utilizing 5 vehicles.

B. TMCC Project Lead Agency Overview - PATS

As the Purchase Area TMCC’s locally designated lead agency, the Paducah Area Transit System (PATS), is a KRS 96-A Kentucky transit authority that began operations in February of 1981. A board of directors whose members are appointed by the mayor and commissioners of the City of Paducah, KY, oversees the system. PATS operates in the City of Paducah and McCracken County and provided a total of 556,298 public and coordinated human service transportation passenger trips in fiscal year 2007. According to the 2000 U.S. Census, McCracken County was considered rural and estimated to have a population of 65,514 with the City of Paducah having a population of 26,307. McCracken County covers a total of 251 square miles.

As a coordinated or shared ride public and human service community transportation provider, PATS provides a wide array of transportation services to meet their customers needs including public, coordinated human service, contract (i.e. barge lines, FedEx, etc.), trolley, taxi, airport shuttle, and other transportation services. PATS also provides ongoing transportation services for approximately 200 organizations throughout the region as well.

PATS - Public Transportation Services

To meet the public transportation needs, PATS provides fixed route, ADA paratransit, demand response, and dial-a-ride (taxi) public transportation services. All PATS public transportation services are open to all members of the general public, except the ADA paratransit services which is based on

Federal guidelines and functional eligibility requirements. Through a partnership with the United States Department of Transportation (USDOT)/Federal Transit Administration (FTA) and the Kentucky Transportation Cabinet (KYTC), PATS receives annual allocations of Federal Section 5311 Non-Urbanized Area Formula Program funding to assist in providing needed public transportation in the services area. The following are narrative descriptions of the public transportation services provided.

- Fixed Route. PATS provides six fixed route services in the City of Paducah and McCracken County operating from 5:50 AM to 6:30 PM, Monday through Friday, and 9:00 AM to 6:30 PM on Saturday's. The passenger fare is \$1.00 per ride. Multi-ride passes are available at a cost of \$6.00 per book of 10 tickets and a monthly bus pass is available for \$24.00 for unlimited number of rides. Ridership on all fixed route services continues to increase 16% annually.
- ADA Paratransit. When a passenger is not able to utilize the fixed route system due to functional disability, PATS specialized paratransit service provides transportation services consistent with the requirements of the Americans with Disabilities Act (ADA) of 1990. Over the past few years, this service has experienced heavy utilization by mobility impaired individuals of all ages and has a cost of \$2.00 per trip. This service has experienced an annual increase of 50% in ridership primarily due to employment, medical, and educational trip purposes.
- Demand Response. PATS provides a demand response (DR) system for the general public with a 24 hour advanced reservation requirement for the Paducah/McCracken County area as defined in KRS 96 A. This service has a fare of \$1.75 per mile (similar to the ADA Paratransit services) with a \$3.50 minimum charge. Ridership using the DR vehicles has increased by 11% in the past few years.

- Dial-a-Ride. PATS offers a general public dial-a-ride program offering same day taxi-like transportation services in the region and out-of-state (IL, TN, MO) for a rate of \$2.00 per mile with a \$4.00 minimum charge.
- Paducah Downtown Circulator. To expand services within Paducah's downtown central business district, PATS manages a free circulator route that transports passengers between main transfer points and downtown destinations by utilizing a replica-era trolley. The route runs every 30 minutes and operates from 8:00 AM to 5:00 PM, Monday-Saturday.

PATS - Coordinated Community Transportation Services

As a community transportation provider, PATS also provides contracted coordinated transportation services for human service agencies and other community organizations. PATS provides services to approximately 200 organizations including the KY Department of Medicaid Services, KY Department of Vocation Rehabilitation, KY Department of The Blind, KY Department of Disability, Medicaid-Private Auto Transportation Program, the Paducah Housing Authority (funded by the United States Housing & Urban Development R.O.S.S. Elderly & Disabled Program), United States Department of Veterans Affairs, Paducah-McCracken County senior services (funded by United States Department of Health & Human Services Administration on Aging Title 3B Program), Oscar Cross Boys & Girls Clubs (KY Department of Juvenile Justice), United Way, dialysis, hospital services, and for many other organizations.

PATS also provides the following additional transportation services in the region.

- Intermodal Connections
 - Greyhound Bus Lines. PATS provides service connections for its customers to and from the Paducah Greyhound Bus Station.

- Barkley Regional Airport. Under contract with the Barkley Regional Airport located in McCracken County, PATS meets every arriving passenger airplane and provides demand response service for arriving/departing passengers. PATS also provides airport shuttle service for Paducah area hotels and for Northwest Airlines flight crews.
- Employment transportation. PATS provides transportation for many area employers, including local marinas, river barge lines, hotels, and railroad companies. PATS also provides vanpool services for the U.S. Army Corps. of Engineers and the Olmstead Lock & Dam Corporation.
- Pharmaceutical courier service. Separate of its public transport services, PATS provides a pharmaceutical courier service transporting needed medicines from area pharmacies to hospitals and skilled nursing facilities throughout the region.

III. Research Methodology/Approach

A. Proposed TMCC and System

Since the official kick-off meeting of the Travel Management Coordination Center (TMCC) project in April 2007, through stakeholder input, the development of the TMCC system changed from being a locally operated system with a future regional & statewide focus to being a system that is focused on meeting the transportation and human service information & referral needs of the entire Purchase Area region. This change in scope is reflected within this document, which is more current than selected MSAAs deliverables also referenced herein.

As defined by project stakeholders, the vision of the Purchase Area Travel Management Coordination Center (TMCC) is “To facilitate greater personal mobility” for all individuals in the region. The Purchase Area TMCC will provide customers with a single point of access to receive regional transportation, human service agency, and other community information & services in the Purchase Area region of western Kentucky. The TMCC will serve McCracken, Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, and Marshall Counties. See Figure 2 for a service area map. Customers will be able to access the TMCC system through telephone, Internet, community location kiosks, and walk-in services. See Figure 3 as an illustration of the services to be provided. Through a regional quasi-centralized/decentralized service delivery model, customers throughout the region will have the option of contacting either the region’s primary TMCC location to be housed at PATS or satellite locations to be available at FCTA in Fulton, KY, MCTA in Murray, KY, and ESWKY in Paducah, KY.

Figure 2: Purchase Area TMCC Service Area and Primary Transportation Provider Locations

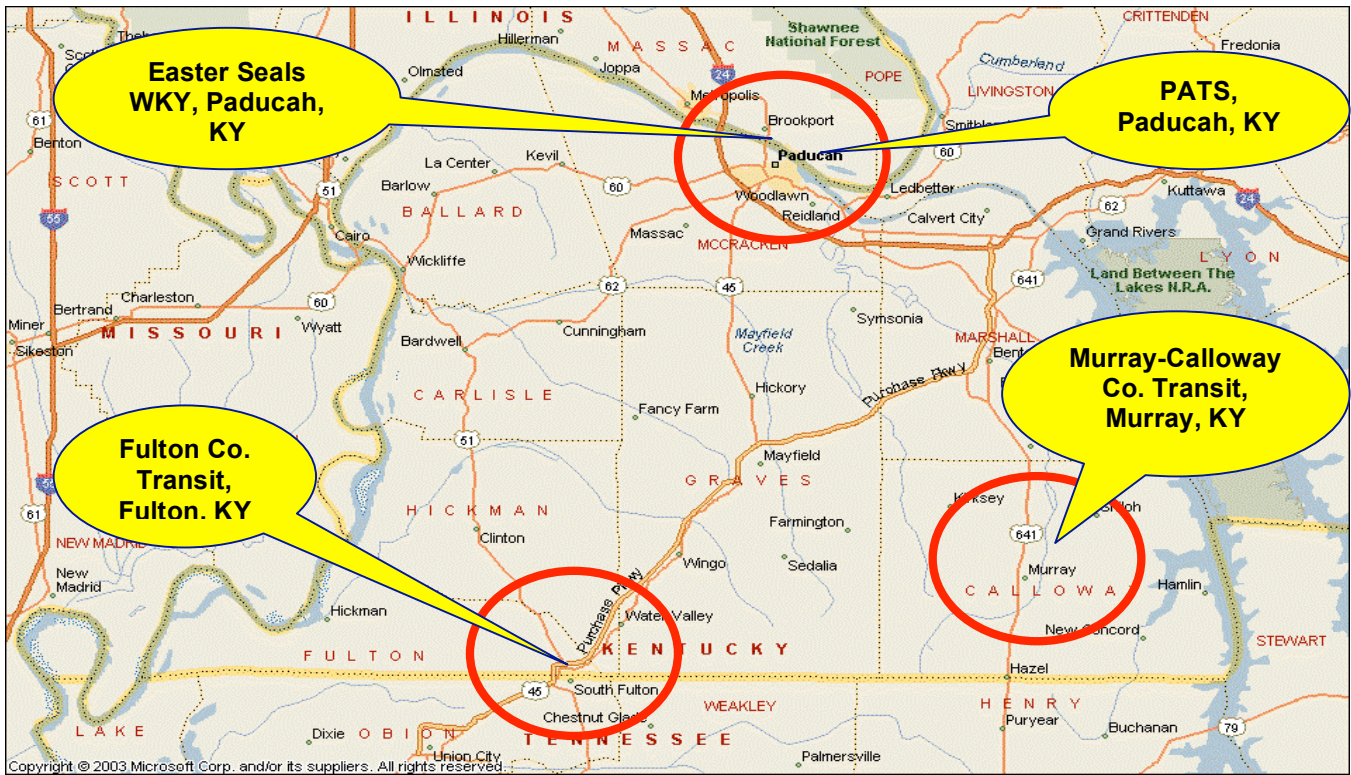
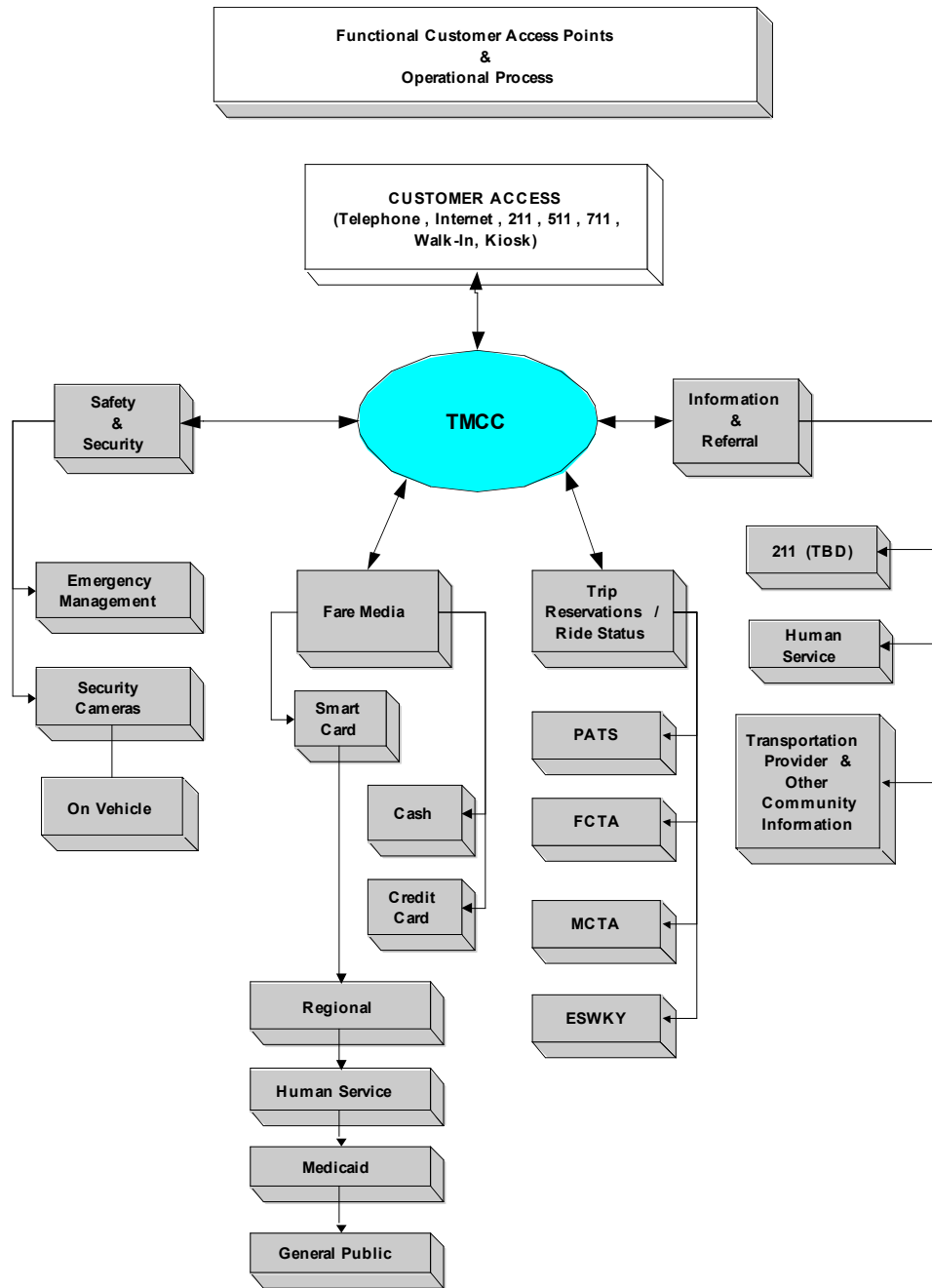


Figure 3: TMCC Functional Design



Through many diverse stakeholder input sessions held from April 2007 through June 2008, the Purchase Area TMCC was designed with the user or customer in mind. In the core development process, many different groups of stakeholders took part in the design of the regional TMCC, including the riders/users of the system and staff from the USDOT, KYTC, local and state government agencies, TMCC Advisory Committee (formerly Call Center Technical Advisory Committee or CCTAC) members, human service agencies, community organizations, hospitals, primary transportation providers, PATS, and private sector firms. See Appendix 1 for a list of all project stakeholder organizations. The TMCC AC (formerly CCTAC) served as the project’s advisory committee to ensure stakeholder needs are met in the project development process. See Table 2 for a list of TMCC AC members.

Table 2: TMCC Advisory Committee (formerly CCTAC) Members

TMCC AC Member Name	Organization Representing
Vickie Bourne, Della Davis, Jeremy Thompson	Kentucky Transportation Cabinet
Mark Davis	Purchase Area Development District & PATS Board Member
Janice Everett	US Congressman Ed Whitfield’s office
Martie Wiles	US Senator Mitch McConnell’s office
Bjarne Hanson	Murray – Calloway County Transit Authority
Paul Maxwell	Fulton County Transit Authority
Lisa Carrico, Steve Byerly	West Kentucky Easter Seals
Guelda Wooldridge	Paducah – McCracken County Senior Citizens Center
Andrea Dade	JU Kevil Center (Medicaid supported)
Clarence Nunn	Oscar Cross Boys & Girls Club
Zana Renfro	McCracken County Commissioner
Cal Ross, Ann Simpson	Paducah Housing Authority
Shawn Turner	KW Communications / United Way
Ashley Wright	Paducah/McCracken County United Way
Johanna Whelan	Four Rivers Mental Health
Patti Monahan Doug Parker	TranSystems Corporation (Federal technical assistance team under Federal contract)
Kim Adair, Chuck Simpson	PATS
Todd Allen, Tom Coogan	RouteMatch Software

In the development of the TMCC’s operational and technical design, the project’s local Technical Team has served as the core project management and project development committee with different staff members working with the primary transportation providers, private firms, and other interested parties to design the overall system. See Table 3 for a list of Technical Team member organizations.

Table 3: TMCC Technical Team Member Organizations

Technical Team Member Organizations	
Paducah Area Transit System	Murray – Calloway County Transit Authority
Fulton County Transit Authority	Easter Seals West Kentucky
RouteMatch Software	KW Communications
City of Paducah & McCracken County	Purchase Area Development District
Paducah/McCracken County United Way	Murray State University

As previously discussed, the TMCC’s primary call center, technology infrastructure, administration, training, and project management will be overseen by PATS in cooperation with the region’s primary transportation provider partnership. To accommodate the TMCC and other spacing needs, PATS received a \$2 million USDOT/FTA Section 5309 Bus & Bus Facilities discretionary grant in the winter of 2008 to expand the PATS administration and transit center facility. Through this Congressional grant sponsored by US Congressman Ed Whitfield and US Senators Mitch McConnell and Jim Bunning, PATS will significantly expand their existing administrative facility to accommodate the TMCC’s operations and technology systems. PATS is planning to also provide for additional office space for staff and partnering human service and community organizations (to enable one stop location visits to these agencies by transit customers). See Figure 4 for a photo of the current PATS Call Center.

Figure 4: PATS Call Center, spring 2008



211 Human Service Information & Referral

During the initial year of the TMCC (2009-2010), it is envisioned the TMCC in partnership with the region's United Way agencies and Murray State University will make application to the Kentucky United Way and Alliance of Information and Referral Systems (AIRS) for accreditation of a 211 Center. The 211 program is a national human service information and referral initiative with three currently licensed centers operating in the urban areas of Kentucky. Customers dial 211 on their telephones to reach a live CSR to receive human service and referral information. Technology to support the needed 211 infrastructure will be put in place at PATS and through MSU during TMCC implementation. To receive licensing in KY, the 211 initiative must serve one million persons according to the state's United Way organization. For the Purchase Area TMCC to receive the fourth and final 211 license in Kentucky, in addition to serving the Purchase region's counties, the 211 Center will also be required to provide services to

all remaining 83 non-urban counties stretching geographically from eastern to western KY. The technology foundation provided by the TMCC will serve in meeting the needs of the 211 Center, which is planned to be operational in Years 2 or 3 of this plan (2011-2012)

IV. Results/Discussion/Applications

A. TMCC Technology System

Overall, the TMCC is considered a hybrid system from the customer service perspective, both centralized and decentralized, depending on the access method. TMCC services will be made available to the public through the use of telephone, Internet website, and in person at all primary provider offices during regular business hours. TMCC telephone services will be made available to the Purchase Area region through PATS and through direct dial connection (as available today) to FCTA, MCTA, and ESWKY. All after business hours, calls will be forwarded from the providers to the primary regional TMCC located at PATS. Internet website maintenance, services (i.e. trip reservations, ride statuses, etc.), emergency notices, and content revisions will be administered through PATS. System redundancy will be maintained through location of back-up servers at the PATS and primary transportation provider locations. Upon commencement of the 211 Center's services, the TMCC's telephone system will be modified to accommodate a new incoming 211 telephone number and to bypass the IVR for the caller to reach a live CSR only. The 211 program's AIRS certification requires direct access to live staff only.

To enable the necessary customer services, the TMCC will be supported by the use of ITS technologies. As discussed in detail in [MSAA Phase 1 Deliverable #4: System Design](#), the ITS technology systems to be utilized in the TMCC system will comprise of the base and expanded technology systems. The base technology system consists of the existing ITS systems in place at PATS today (with appropriate hardware/software upgrades) also

being implemented consistently at all primary transportation provider locations. Once the base technologies are tested and implemented in Year 1, the system will focus attention on the integration engineering, testing, and deploying the expanded technologies in Years 2-4. See Appendix 2 as an illustration of the overall system design. The TMCC's technologies consist of the following.

TMCC Base Technology System

- Personal Computers, monitors, printers - existing (in place)
- Operating system: Microsoft XP - existing (in place)
- Microsoft Office 2003 - existing (in place)
- Agency server (all other non-ITS applications - existing - in place)
- Telephone system: Iwatsu - Year 1
- Radio system: 800 MHz - existing (in place)
- Mobile phone for communication with vehicle operators - existing (in place)
- Internet service: High speed (connection for data transfers, etc.) - Year 1
- Paratransit Computer Assisted Scheduling & Dispatching (CASD) software: RouteMatch Software TS 4.0 and server in the TMCC and networked to all provider offices. - Year 1
- Automatic Vehicle Location (AVL) / Mobile Data Computer (MDC): Mentor MDC's on all revenue service vehicles and supporting hardware & software in each provider office. - Year 1
- On-board cameras and DVR: Radio Engineering Industries, Inc. (REI) 4.0, on all revenue service vehicles with supporting hardware/software housed at the TMCC & each provider office. Video feed may be saved and shared with other providers on network. - Year 2

TMCC Expanded Technology System

- Interactive Voice Response (IVR) - Year 1

- Internet website - Year 1
 - Internet-based services access (i.e. trip scheduling, ride status, etc.)
- Fixed route computer aided dispatching (CAD) - Year 2
- Fare Management (smart card, onboard vehicle interface, IVR interface, internet interface, etc.) - Year 3
- Information Kiosks - Years 3-4
- Google Transit trip planner - Year 1
- Human Service (I&R) services database/website (through MSU) - Year 1
- Medicaid brokerage software integration (date - TBD)
- KY511 Internet link - Year 1

In transitioning to the ITS technology systems provided by the TMCC, all primary transportation providers agreed they will need enhanced training and support in utilizing the new technologies prior to implementation. All Phase 2 technology vendors will be expected to provide detailed training and “go-live” on-site technical support, especially on the first few days of TMCC operations. PATS staff will be upgrading their current technologies, learning to use the new expanded technologies, and learn their new role as the TMCC with operational policies and procedures. The FCTA, MCTA, and ESWKY staff will also have to learn the new technology systems and TMCC business rules to interact with PATS (there is existing experience given all providers worked with each other when PATS was the Medicaid transportation broker). The TMCC will have a new manager position that is anticipated to serve as a circuit rider that will be responsible for managing day-to-day operations, be a staff trainer, and a trouble-shooter for the technical systems. The primary providers also plan to develop a detailed marketing and outreach plan prior to the TMCC “go-live” period to provide customer education on how to access and utilize TMCC services.

B. Needs to Requirements and Traceability Matrix

Throughout the development of the TMCC (over 15 month period) services and technology system, the project’s Advisory Committee (formerly CCTAC) and local Technical Team continued to focus on the needs of the stakeholders. Committed to meeting stakeholder needs, as referenced in the revised MSAA Deliverable #3: System Requirements, the local Technical Team utilized the project’s Traceability Matrix as a guide in designing the project’s technical requirements and system design. The purpose of the Traceability Matrix is to identify the stakeholder need, corresponding identification number, and level of priority from the revised MSAA Deliverable #2: Concept of Operations with the corresponding System Requirement identification number and category, the high-level System Design component, and the level of project significance (mandatory or optional). See Table 4 as the project’s Traceability Matrix.

Table 4: Traceability Matrix

Stakeholder Need ID# (from ConOps)	Stakeholder Need* (from ConOps)	Requirement ID#	High-Level System Design Component	Project Requirements (M=Mandatory; O=Optional)
1.0	TMCC to provide transportation provider, human service agency, & other community organization information & services provided	IV.A.1-24; IV.B.1-29; IV.C.1-23; IV.D.1-27	VII.B.1; VII.B.2	M
1.1	Knowledge of fixed route bus locations	IV.A.15; IV.A.19; IV.B.23; IV.B.24; IV.C.1-23	VII.A.3; II.B.1.r; VII.B.3.u; VII.B.5	M
1.2	Dependability / Reliability - 24 hour access	IV.A.5; IV.B.4; IV.C.3	VII.A.1; VII.B.1.d; VII.B.2.d; VII.B.3.c; VII.B.5.c	M

Stakeholder Need ID# (from ConOps)	Stakeholder Need* (from ConOps)	Requirement ID#	High-Level System Design Component	Project Requirements (M=Mandatory; O=Optional)
1.2	Dependability / Reliability - 24 hour access	IV.A.5; IV.B.4; IV.C.3	VII.A.1; VII.B.1.d; VII.B.2.d; VII.B.3.c; VII.B.5.c	M
2.0	Telephone Access	IV.A.1-24	VII.A.2.c; VII.B.1	M
2.0.1	Speak with a "live person"	IV.A.8; IV.A.10	VII.B.1.g; VII.B.1.i	M
2.0.2	Interactive voice response (24/7 access)	IV.A.1-24	VII.B.2.d	M
2.0.3	Transportation provider services information	IV.A.15; IV.A.16; IV.C.15	VII.A.2.c; VII.B.1.n	M
2.0.3.1	Schedule trip reservations	IV.A.18; IV.A.21	VII.A.2.c; VII.B.1.q	M
2.0.3.2	Retrieve trip reservations	IV.A.18; IV.A.21	VII.A.2.c; VII.B.1.q	M
2.0.3.3	Vehicle arrival status & notifications	IV.A.18; IV.A.19	VII.A.2.c; VII.B.1.q; VII.B.1.r; VII.B.1.t	M
2.0.3.4	Cancellations / Delays	IV.A.18	VII.A.2.c; VII.B.1.q	M
2.0.3.5	Purchase fare cards - fare card management	IV.A.22; IV.D.1-27	VII.B.1.u; VII.B.3	M
2.0.4	Simple telephone #	Non-ITS element	Non-ITS element	M
2.0.5	Universal access - TDD/TTY, 711 KY Relay, Fax	Non-ITS element	Non-ITS element	M
2.0.6	English and "other" language options	IV.A.9	VII.B.1.h	M
2.0.7	Voice Over Internet Protocol (VOIP) - Use of Internet technologies for telephone services	Non-ITS element	VII.B.1.a	M
2.0.8	Safety & Security information	IV.A.14; IV.A.24	VII.B.1.m; VII.B.1.w	M
2.0.9	Human Service and Community organization information	IV.A.17	VII.B.1.p	M

Stakeholder Need ID# (from ConOps)	Stakeholder Need* (from ConOps)	Requirement ID#	High-Level System Design Component	Project Requirements (M=Mandatory; O=Optional)
2.1	Internet access	IV.B.1-29; IV.C.14; IV.C.20; IV.D.8	VII.A.2.c; VII.B.2.a-z; VII.B.3.h; VII.B.4.a-j; VII.B.5.i; VII.B.6	M
2.1.1	Transportation provider services information	IV.B.12; IV.B.13; IV.B.17; IV.B.25; IV.B.28; IV.B.29; IV.B.30; IV.B.31; IV.B.32; IV.C.15; IV.C.23	VII.B.2.q; VII.B.2.o; VII.B.2.	M
2.1.2	Schedule trip reservations	IV.B.12; IV.B.14; IV.B.15; IV.B.16; IV.B.21; IV.B.22; IV.B.24	VII.A.2.c; VII.B.2.t; VII.B.2.v	M
2.1.3	Retrieve trip reservations	IV.B.12; IV.B.14; IV.B.15; IV.B.16; IV.B.22	VII.A.2.c; VII.B.2.l-m; VII.B.2.t	M
2.1.4	Vehicle arrival status & notifications	IV.B.12; IV.B.14; IV.B.15; IV.B.16; IV.B.22; IV.B.23; IV.C.6	VII.A.2.c; VII.B.2.t; VII.B.2.u;	M
2.1.5	Purchase fare cards online - fare card management	IV.B.12; IV.B.13; IV.B.15; IV.B.16; IV.B.26; IV.D.1-27	VII.B.2.l-m; VII.B.2.o; VII.B.2.t; VII.B.2.x; VII.B.3.h	M
2.1.6	Safety & Security information	IV.B.7; IV.B.19; IV.B.29	VII.B.2.q	M
2.1.7	Human Service and Community organization information	IV.B.11; IV.B.16; IV.B.18; IV.B.19	VII.B.2.f; VII.B.2.p-q	M
2.1.8	Kiosks placed at major public and service centers	IV.B.34	VII.B.4	M
2.1.9	Cell phone/PDA information and access to Internet	IV.B.22	VII.A.2.c; VII.B.2.s	M
2.1.10	Accessible website: Section 508 and languages options	IV.B.8-10	VII.B.2.h-j	M
2.1.11	KY 511: Coordinate services w/ TMCC	IV.B.20	VII.B.2.r	M

Stakeholder Need ID# (from ConOps)	Stakeholder Need* (from ConOps)	Requirement ID#	High-Level System Design Component	Project Requirements (M=Mandatory; O=Optional)
2.3	Develop Smart Card or contact-less cards and a fare management system for regionwide seamless use on all primary provider vehicles.	IV.D.1-27	VII.B.3.a-cc	M
2.4	System Safety & Security information - coordination w/ public safety, emergency management, National Weather Service, etc.	Non-ITS element	Non-ITS element	M
2.5	Coordinate transportation services with the region's other transportation call centers.	Non-ITS element	Non-ITS element	M

C. Technical Plan

The following section contains a comprehensive Technical Plan that will address how the Purchase Area TMCC will move from the system design to a complete deployment. Details included in the Technical Plan section below includes a description of how the TMCC's technical and logistical details will be implemented, address completion of the project's Phase 2 deliverables to the USDOT, describe the institutional and regulatory issues to be addressed, illustrate how the TMCC will be measured to ensure success, and the development of a project implementation timeline.

Project Task Technical and Logistical Details

As the designated TMCC lead agency, PATS will serve as the overall project management and oversight agency for the implementation and completion of all TMCC deliverables as identified in the USDOT's MSAA Demonstration of Coordinated Human Service Transportation Models: Phase 2 - System Deployment Proposal Guide Version 1.0. PATS Acting General Manager, Kim Adair, will be overall responsible for the project. On a daily basis, Ms. Adair and the new TMCC manager (to be hired after project award) will cooperatively manage the project's

implementation and task completion in partnership with the management of primary transportation provider, including Paul Maxwell, FCTA, Bjarne Hansen, MCTA, and Steve Byerly, ESWKY. In addition, Ms. Adair and the TMCC manager will ensure the coordination and task completion with the members of the Technical Team, TMCC technology firms (vendors), and the Advisory Committee. The project’s deliverables, associated tasks, organizations responsible, and associated acronyms are listed in Table 5. The project’s Technical Team will continue to meet on a regular basis to address TMCC implementation tasks before, during, and after start-up. Project technology vendors will also be invited to attend these meetings to ensure a high level of communication. The TMCC Advisory Committee will also continue to meet on a quarterly basis (at a minimum) to receive project updates from PATS & the primary providers and to provide stakeholder feedback into the project.

Table 5: Project Deliverables, Tasks, and Logistical Details

List of Acronyms and Abbreviations	
KYTC = Kentucky Transportation Cabinet	RM = RouteMatch Software (consultant)
Mentor = Mentor Engineering (consultant)	AC = TMCC Advisory Committee
PATS - Paducah Area Transit System	TT = Technical Team
PADD = Purchase Area Development District	USDOT = United States Department of Transportation
Providers = FCTA, MCTA, and ESWKY	Vendors = Base and/or Expanded Technology Vendors
Public = Customer and general public input	

Green Highlight = Project Phase Task

Blue Highlight = Deliverable Task

Task	Organization(s) Responsible
Submit MSAA Phase 2 Proposal	PATS
I. Phase 1: Pre-Award Activities	
A. Develop Expanded Technology Request for Proposals	PATS, Providers
B. Develop TMCC business rules and coordination policies	PATS, Providers
C. Develop Phase 2 vendor contract templates	PATS
D. Conduct building expansion planning and development	PATS
E. Develop TMCC detailed training plan	PATS, Providers
F. Develop TMCC detailed marketing plan	PATS, Providers
G. Hold Technical team and Provider Meetings	PATS, Providers, TT
H. Hold TMCC Advisory Committee Meeting	PATS, TMCCAC
I. Develop regional fares, financial agreements & procedures (fare media)	PATS, Providers
J. Discuss self-evaluation methodology with the PADD	PATS, PADD
II. Phase 2: TMCC Award	
A. Phase 2 award by USDOT	USDOT
B. Complete agreements with USDOT	PATS, USDOT
C. Enter and set up reporting data in TEAM	PATS, USDOT, KYTC
D. Inform Year 1 Base Technology vendors of award	PATS
E. Seek USDOT approval to release expanded technology RFP's	PATS
F. Receive Year 1 Expanded Technology System proposals	PATS
G. Select & notify Year 1 Expanded System approved vendors	PATS
H. Contract with selected ITS vendors	PATS, Vendors
I. Hire TMCC Manager	PATS, Providers
III. Phase 3: TMCC Phase 2 Project Commencement	
A. Attend USDOT Phase 2 project kick-off meeting, Washington, DC	PATS, RM
B. Revise initial project task timelines as appropriate.	PATS, RM, TT, Vendors
IV. Deliverable #1 - Detailed Project Plan	
A. Prepare Detailed Project Plan Deliverable & Submit to USDOT	PATS, TT
B. Receive USDOT feedback on the Detailed Project Plan	USDOT

Task	Organization(s) Responsible
V. Phase 4: TMCC Implementation	
A. Hold TMCC Advisory Committee meeting in Paducah	PATS, TT, TMCCAC
B. Hold a vendor detailed design meeting (for integration)	PATS, TT, Vendors
C. Contract with PADD for Self Evaluation Plan	PATS, PADD
D. Base Technology Deployment	CCTAC
1. Telephony deployment, interfaces, testing, training, and go-live	PATS, Telephony Vendors
2. CASD and CAD deployment, testing, interfaces, training, and go-live	PATS, Providers, RM
a. Interface with Medicaid brokerage software	PATS, Providers, RM
3. AVL/MDC deployment, testing, training, interfaces, and go-live	PATS, Providers, Mentor
4. On-board camera/DVR deployment, testing, training, and go-live (Year 2)	PATS, Providers, REI
E. Base technology go-live	PATS, Providers, Base Vendors
F. Base & Expanded Technology vendor interface engineering	PATS, Vendors
G. Expanded Technology implementation, testing, and go-live	PATS, Providers, Vendors
1. Interface engineering with base and expanded technology Vendors	Vendors
2. IVR system implementation, interfaces, testing, training, and go-Live	PATS, Vendors
3. Fare Management system implementation, interfaces, testing, training, and go-live (Years 2-4)	PATS, Vendors
4. Internet website system design & development, interfaces, links, testing, training, and go-live	PATS, Vendors
a. Google Transit website link	PATS
(1) Develop data needs consistent with GTFS & submit to GT	PATS
(2) Google Transit linkage to website	PATS, Vendor
(3) Google Transit go-live	PATS
b. KY 511 website link - deployment	PATS, KYTC, Vendor
c. MSU Human Service I&R website linkage	PATS, MSU, Vendor
5. Kiosk deployment/placement, testing, interfacing, and go-live (2-4)	PATS, Vendors

Task	Organization(s) Responsible
VI. Deliverable #2: TMCC Detailed System Design	
A. Develop the detailed system design deliverable	PATS, TT, Vendors
B. Technical team meeting - review design details	PATS, TT, Vendors
C. Ensure design compatibility with ITS standards	PATS, TT, Vendors
D. Submit to USDOT (deadline: TBD)	PATS
E. Receive USDOT feedback on the Detailed System Design	USDOT
VII. Deliverable #3: Self Evaluation Plan	
A. Develop the self evaluation plan	PATS, TT, PADD
B. Submit to USDOT (deadline: TBD)	PATS
C. Receive USDOT feedback on the Self Evaluation Plan	USDOT
VIII. Phase 5: TMCC Start-up	
A. Start-up of all TMCC services and technology in operation.	PATS, TT, Vendors
IX. Deliverable #4: Monthly Progress Reports	
A. Develop monthly progress reports and submit to USDOT	PATS
X. Deliverable #5: Evaluation Report	
A. Develop an evaluation report summarizing results	PATS, PADD
B. Submit to USDOT	PATS
XI. Deliverable #6: Final Project Report	
A. Develop a final project report identifying lessons learned	PATS, RM
XII. Other Deliverables (Meetings)	
A. Project Kick-Off Workshop in Washington D.C.	PATS
B. Project Meetings with USDOT x 2 (dates/locations: TBD)	PATS
C. Invited Conference Attendance x 2 (dates/locations: TBD)	PATS
D. Work with Federal Interdisciplinary Technical Assistance Team	PATS
E. TMCC Advisory Committee Meetings	CCTAC
F. Hold Public information forums (2)	CCTAC
G. Provider Meetings	PATS, Providers, RM
H. Oversight Review & FTA Quarterly Reports (TEAM)	PATS, KYTC, USDOT

Institutional & Regulatory Issues

In providing coordinated transportation services for the region's human service agencies and other community organizations, the TMCC's primary transportation providers have current service agreements in place and have worked through institutional issues. The TMCC's primary transportation providers are working under contract with a regional Medicaid transportation broker to provide coordinated Medicaid transportation services in the region. The providers are working closely with the broker to ensure that all customers are informed of the changes and know whom to contact for services. As the TMCC is deployed, the providers are interested in working with the new broker to identify an ITS solution to electronically link their scheduling, reporting, and billing functions.

Overall, the transportation providers in the Purchase Area have experienced a cooperative spirit in working with area organizations and each other in meeting the region's transportation needs. During the development of the TMCC Phase 1 system design, this cooperative spirit extended throughout all stakeholders that were involved in designing the project. For example, the Paducah/McCracken Co. United Way in partnership with Murray State University (MSU) developed a human service I&R database and will create a website to support its implementation. This database and corresponding website (originally not intended to do so) will also be utilized by the TMCC as the I&R services resource database and serve as a foundation for the future 211 Center's services. As the TMCC is deployed, additional community partnerships, such as the TMCC/United Way/MSU cooperative initiative, will continue to be illustrated in many other forms throughout the Phase 2 period of the project. Ultimately, all of the Purchase Area TMCC's project partners are committed to leveraging each others resources to ensure project success.

In developing TMCC's administrative and operational policies and procedures, the primary transportation providers will be developing their business rules for interaction. This initiative includes items such as financial items, such as regional general public trip cost allocation and billing rules & requirements; operational issues such the scheduling

trip for other providers and regional trip sharing/coordination on each others vehicles; start-up and ongoing training needs of TMCC staff; passenger marketing and information needs; and other items. For a listing of non-ITS issues to be addressed by the primary providers and Technical Team (TT), please visit MSAA Phase 1 Deliverables #2 Concept of Operations, #3 System Requirements, and #6 Implementation Plan. The TMCC and primary transportation provider staffs will continue to be mindful of managing institutional and regulatory issues related to the project.

Project Timetable / Schedule

The timeline and schedule for all proposed task development & completion is listed in Table 6.

Table 6: TMCC Project Timeline / Schedule (Phasing Implementation)

List of Acronyms and Abbreviations	
KYTC = Kentucky Transportation Cabinet	RM = RouteMatch Software (consultant)
Mentor = Mentor Engineering (consultant)	AC = TMCC Advisory Committee
PATS - Paducah Area Transit System	TT = Technical Team
PADD = Purchase Area Development District	USDOT = United States Department of Transportation
Providers = FCTA, MCTA, and ESWKY	Vendors = Base and/or Expanded Technology Vendors
Public = Customer and general public input	

Green Highlight = Project Phase Task

Blue Highlight = Deliverable Task

Task	Organization(s) Responsible	Calendar Year										Calendar Year			
		2008			2009				2010		2011			2012	2013
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	2011	2012	2013		
Submit MSA Phase II Proposal	PATS														
I. Phase 1: Pre-Award Activities															
A. Develop Expanded Technology Request for Proposals	PATS, Providers														
B. Develop TMCC business rules and coordination policies	PATS, Providers														
C. Develop Phase II vendor contract templates	PATS														
D. Conduct building expansion planning and development	PATS														
E. Develop TMCC detailed training plan	PATS, Providers														
F. Develop TMCC detailed marketing plan	PATS, Providers														
G. Hold Technical team and Provider Meetings	PATS, Providers, TT														
H. Hold TMCC Advisory Committee Meeting	PATS, AC														
I. Develop regional fares, financial agreements & procedures (fare media)	PATS, Providers														
J. Discuss self-evaluation methodology with the PADD	PATS, PADD														

II. Phase 2: TMCC Award													
A. Phase II award by USDOT	USDOT												
B. Complete agreements with USDOT	PATS, USDOT												
C. Enter and set up reporting data in TEAM	PATS, USDOT, KYTC												
D. Inform Yr. 1 Base Technology vendors of award	PATS												
E. Release Yr. 1 Expanded Technology system RFP's	PATS												
F. Receive Expanded Technology System proposals	PATS												
G. Select & notify Expanded System approved vendors	PATS												
H. Contract with selected ITS vendors	PATS, Vendors												
I. Hire TMCC Manager	PATS, Providers												
III. Phase 3: TMCC Phase II Project Commencement													
A. Attend USDOT Phase II project kick-off meeting, Washington, DC	PATS, RM												
B. Revise initial project task timelines as appropriate.	PATS, Providers, RM, TT, Vendors												
IV. USDOT Deliverable #1 - Detailed Project Plan													
A. Prepare Detailed Project Plan Deliverable & Submit to USDOT	PATS, Providers, RM, TT, Vendors												
B. Receive USDOT feedback on the Detailed Project Plan	USDOT												
V. Phase 4: TMCC Implementation													
A. Hold TMCC Advisory Committee meeting in Paducah	PATS, TT, AC												
B. Hold a vendor detailed design meeting (for integration)	PATS, TT, Vendors												
C. Contract with PADD for Self Evaluation Plan	PATS, PADD												
D. Base Technology Deployment	PATS, Providers, Vendors												
1. Telephony deployment, interfaces, testing, training, and go-live	PATS, Telephony Vendors												

VI. USDOT Deliverable #2: TMCC Detailed System Design													
A. Develop the detailed system design Deliverable	PATS, TT, Vendors												
B. Technical team meeting - review design details	PATS, TT, Vendors												
C. Ensure design compatibility with ITS standards	PATS, TT, Vendors												
D. Submit to USDOT (deadline: TBD)	PATS												
E. USDOT feedback on the Detailed System Design	USDOT												
VII. USDOT Deliverable #3: Self Evaluation Plan													
A. Develop the self evaluation plan	PATS, TT, PADD												
B. Submit to USDOT (deadline: TBD)	PATS												
C. USDOT feedback on the Self Evaluation Plan	USDOT												
VIII. Phase 5: TMCC Start-up													
A. Public start-up of TMCC services	PATS, TT, Vendors												
X. USDOT Deliverable #5: Monthly Progress Reports													
A. Submit monthly progress reports to USDOT	PATS												
XI. Deliverable #6: Evaluation Report													
A. Develop an evaluation report summarizing results	PATS, PADD												
B. Submit to USDOT	PATS												
XII. Deliverable #7: Final Project Report													
A. Develop a final "lessons learned" project report	PATS, RM												
XIII. Other Deliverables (Meetings)													
A. Project Kick-Off Workshop in Washington D.C.	PATS, RM												
B. Project Meetings with USDOT x 2 (TBD)	PATS												
C. Invited Conference Attendance x 2 (TBD)	PATS												

D. Work with Federal Interdisciplinary Technical Assistance Team	PATS																		
E. TMCC Advisory Committee Meetings	CCTAC																		
F. Hold Public information forums (2)	CCTAC																		
G. Provider Meetings	PATS, Providers, RM																		
H. Oversight Review & FTA Quarterly Reports (TEAM)	PATS, KYTC, USDOT																		

D. Management and Staffing Plan

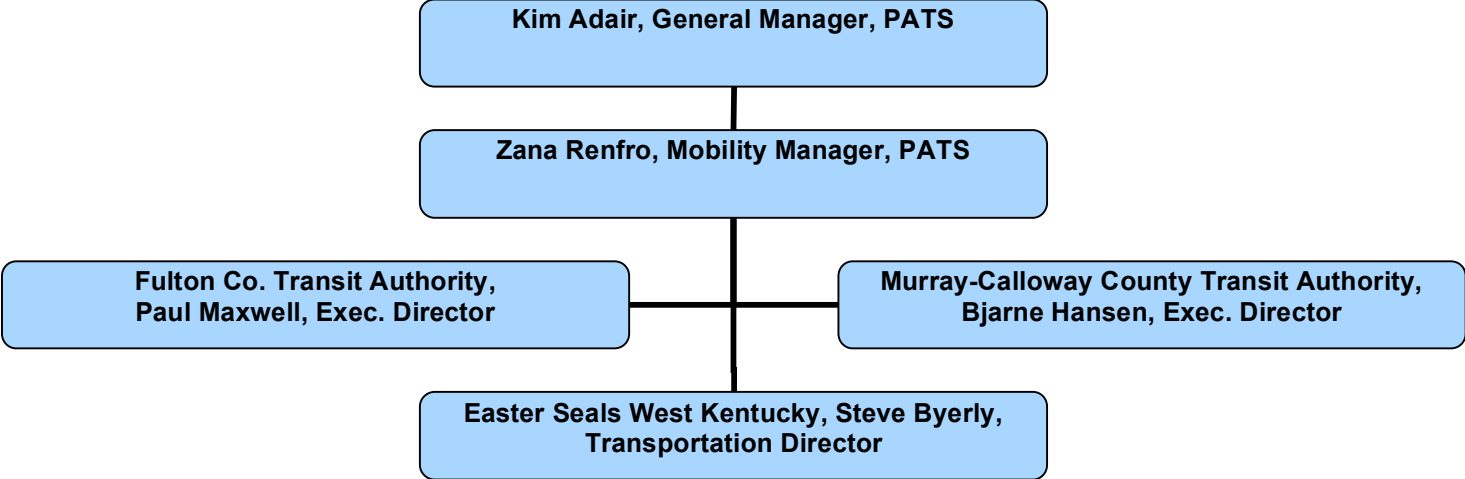
The following section contains a discussion of the Management and Staffing Plan for the Purchase Area TMCC. Details of the Management and Staffing Plan includes key project management and responsibilities, the projects primary point of contact, a demonstration of staffing capabilities and commitment, biographical information for all key personnel, the estimated number of hours by task for each job classification, and a review of project management and oversight mechanisms.

Key Management & Responsibilities

As the principal contact for the TMCC lead agency, Kim Adair, PATS Acting General Manager, will overall be responsible for this project. A new TMCC manager will be hired by PATS to manage and oversee the implementation of this project in cooperation with the directors of the primary transportation providers, including Paul Maxwell, FCTA, Hansen, MCTA, and Steve Byerly, ESWKY. Under a new, separate contract, RouteMatch Software is being retained from the MSAA Phase 1 system design period to provide technical consulting services in the preparation of the required Report Deliverables. See Figure 5 for an illustration of the Purchase Area TMCC management team. In coordination with these organization partners, Ms. Adair and the future TMCC manager (to be hired after project award) will also oversee and coordinate the TMCC ITS and non-ITS elements involved in the project, including managing the technical consulting firms

and carrying out the day-to-day responsibilities of managing the completion of the project's tasks and deliverables on time. Professional biographical information for these individuals may be found in Section IV, D, Biographical Data, of this proposal.

Figure 5: Purchase Area TMCC Project Management Team



TMCC - Staffing

In addition to the addressing the TMCC's management support, as referenced in MSAA Phase 1 Deliverable #6: Implementation Plan, in the initial start-up year (projected as mid-2010), the TMCC's customer service representative (CSR) operational staffing will stay at a consistent level as today's levels at all primary transportation provider locations. PATS plans to maintain its current level of six total Full Time Equivalent (FTE) staff persons to provide the TMCC's call center and walk-in services. FCTA, MCTA, and ESWKY will maintain their one FTE staff person at each location. In project years 2-4, with anticipated increased call volume from TMCC customers, the start of the 211 initiative, and other new call center partners, the primary transportation providers anticipate adding up to five FTE CSR positions at the regional TMCC location at PATS. See Table 7 as an illustration of the operational staffing needs by project year. The planned facility

expansion and call center at the PATS Transit Center will adequately address necessary call center spacing and other staff support needs.

Table 7: Projected TMCC Staffing Levels (Years 1 - 4)

Provider Name	Projected Total TMCC FTE Staffing Levels			
	Year 1 (2009-2010)	Year 2 (2010-2011)	Year 3 (2011-2012)	Year 4 (2012-2013)
PATS	7*	9	10	12
FCTA	1	1	1	1
MCTA	1	1	1	1
ESWKY	1	1	1	1
TOTAL	10	12	13	15

* Note: Includes the hiring of a TMCC Manager position (1 FTE).

E. TMCC Operations Plan: Project Sustainability

The TMCC will be deployed in Year 1 (2009-2010) through the financial assistance of the USDOT, other Federal agencies, KYTC, other state agencies, local governments, human service agency, contracts, and other revenues. Once operational, the TMCC will sustain annual fiscal year (July-June) costs in Years 2-4 (FY2011-2013) to maintain and scale up the existing operations and technologies. The four Purchase Area TMCC primary transportation providers are committed to the TMCC’s ongoing success and will continue to utilize their existing annual budget revenues in support of the TMCC’s administrative and capital budget needs in Years 2-4 and beyond. The primary transportation providers will continue to utilize existing and new revenues from Federal, state, local, human service, contract, and other community organization resources to provide TMCC and coordinated community transportation services. During and after TMCC deployment and “go-live,” the primary transportation providers plan to concurrently seek additional new call center service contract revenues. These new funding sources will assist the TMCC in meeting new future community needs such as the 211 initiative. Table 8 illustrates the projected annual Years 2-4 fiscal year

expenses related to the TMCC. Costs not listed in the budget (i.e. electricity) will be funded through other primary provider budget resources.

Table 8: Projected TMCC Years 2-4 Budget

Budget Item	Fiscal Year Total Costs (July-June)		
	Year 2 (FY 2011)	Year 3 (FY2012)	Year 4 (FY2013)
Expenses			
Administrative			
Personnel (salary + fringe)			
TMCC Manager	\$ 53,560	\$ 55,167	\$ 56,822
Customer Service Representatives	\$ 37,440	\$ 57,283	\$ 96,442
Other Admin. Expenses	\$ 3,000	\$ 3,000	\$ 3,000
<i>Subtotal</i>	\$ 94,000	\$ 115,450	\$ 156,264
Capital			
Technologies Support & Maintenance	\$ 20,000	\$ 160,000	\$ 227,716
Years 2-4 Technology Hardware/Software	\$ 700,000	\$ 350,000	\$ 297,774
Telephone Infrastructure Expenses	\$ 32,089	\$ 32,089	TBD
<i>Subtotal</i>	\$ 752,089	\$ 542,089	\$ 525,490
Total Expenses	\$ 846,089	\$ 657,539	\$ 823,264
Revenue			
Contracts (211, human service, other)	\$ 272,937	\$ 228,137	\$ 297,532
Grants (USDOT/FTA, KYTC, other)	\$ 573,152	\$ 429,402	\$ 525,732
<i>Total Revenue</i>	\$ 846,089	\$ 657,539	\$ 823,264
NET TOTAL	\$ 0	\$ 0	\$ 0

F. Financial Plan

The total cost for the deployment of the Purchase Area TMCC is \$ 2,748,824. The project deployment will be phased in two sections over a four year period from 2009-2013. The total cost for Year 1 (FY2009-2010) is \$ 1,837,421 and is illustrated in Table 9. The total technology deployment costs for Years 2-4 is \$ 1,185,699. For more information on the TMCC's projected revenues and expenses for Years 2-4, refer to Tables 8 and 10 for more information.

Table 9: Purchase Area TMCC Costs and In-kind Local Match - Year 1 (2009-2010)

Cost Element	Total Cost	Federal Matching Share (80%)	Local Matching Share (20%)
Project Management & Other Expenses	\$ 139,080	\$ 111,264	\$ 27,816
Technical Consulting Services: Deliverables Completion	\$ 135,216	\$ 108,173	\$ 27,043
Technology Systems	\$ 1,563,125	\$ 1,250,500	\$ 312,625
Total	\$ 1,837,421	\$ 1,469,937	\$ 367,484

TMCC Project Management & Other Expenses - Year 1

As illustrated in Table 9 above, the expenses for Year 1 of the TMCC are broken into three categories, including Project Management & Other Expenses, Technical Consulting Services to complete all USDOT required deliverables, and the Technology Systems deployment.

In Year 1, the Project Management & Other Expenses category contains all relevant expenses to manage the project and provide for other necessary administrative costs. The Project Management expenses will include salary and fringe for the TMCC project manager and cover a small portion of the PATS general manager's salary as executive project manager. The project's Other Expenses include those for travel to attend USDOT required events, copy services, supplies, and Section 508 document formatting compatibility.

TMCC Technology System Expenses - Year 1

Throughout MSAA Phase 1, the TMCC transitioned from being a PATS locally managed deployment to a Purchase Area regionally focused project. With this increase in project coverage and scope, PATS, the Technical Team, and TMCC Advisory Committee designed the Purchase Area TMCC with stakeholder input to be reflective of its regional character, proposed operation, and technical needs. As referenced in MSAA Phase 1 Deliverable #4: System Design, the Purchase Area TMCC's technology system will be comprised of base and expanded technologies that will be utilized at PATS, FCTA, MCTA, and ESWKY. The TMCC's base technologies will consist of those hardware and software elements that are in use at PATS today (with updates to make current) and will be expanded to the other provider locations to comprise the entire TMCC. All expanded system technologies will consist of Commercial-Off-The-Shelf (COTS) components with the requirement of either having an existing interface with a base technology system or being of open architecture.

To develop a technology system budget for the Purchase Area TMCC's hardware and software needs, price quotes were obtained through communication with both base and expanded technology systems vendors. The information contained in vendor pricing quotes includes items such as technology hardware and software, engineering costs for interface/integration work, on-site installation & professional services, and system support & maintenance costs. Each proposal addresses these elements uniquely to the vendor's understanding of the TMCC's requirements. Table 10 provides an overview of the technology systems budgets based on information contained in vendor pricing quotes for Years 1-4.

Table 10: TMCC Technology Budget

Project Phase	MSAA Technology System	Company Name (quote from)	Task	Cost (100%)	Years 2-4 Support & Other Costs	# of Units
Year 1 (2009-2010)	Computer Aided Scheduling & Dispatching (CASD) & Modules	RouteMatch Software	Software, modules, engineering, and implementation services	\$ 699,702	\$ 256,428	N/A
	Automatic Vehicle Location/Mobile Data Terminals (AVL/MDT)	RouteMatch Software & Mentor Engineering	Hardware, software, engineering, and implementation services	\$ 475,538	\$ 105,139	45*
	Telephony	KW Comm. and Gaither Technologies	Telephone system infrastructure, hardware, and networking	\$ 80,725	\$ 64,177	N/A
	Interactive Voice Response	Unified Dispatch, Inc.	Hardware, software, engineering, and implementation services	\$ 247,160	\$ 58,500	N/A
	Internet Website	(1) KY Lake Productions & (2) Octagon Technologies	Engineering and implementation services	\$ 60,000	\$ 0	N/A
	Subtotal				\$ 1,563,125	\$ 484,244
Years 2-4 (2010-2013)	CASD: Certification & Incidents Modules	RouteMatch Software	Software & implementation services	\$ 189,195	\$ 56,250	N/A
	Onboard cameras/DVR	REI	Hardware, Software, and implementation services	\$ 432,146	\$ 0	113
	Fixed Route CAD/AVL	RouteMatch Software	Software, engineering, and implementation services	\$ 97,774	\$ 67,716	N/A
	Fare Management/ Swipe Card	MJM	Engineering and implementation services	\$ 306,600	\$ 375,000	N/A
	Advanced Traveler information System (Kiosks)	FutureTouch	Hardware, software, engineering, and implementation services	\$ 159,984	\$ 0	12
	Subtotal				\$ 1,185,699	\$ 498,966
Overall Total				\$ 2,748,824	\$ 983,210	N/A

* Note: AVL/MDT # of Units quoted based on 40 new units for FCTA, MCTA, & ESWKY, and 5 spares. PATS will utilize existing equipment installed on all vehicles.

Revenue - Year 1

The Paducah Transit Authority's application for the United States Department of Transportation's Demonstration of Coordinated Human Service Transportation Models: Phase 2 – System Deployment grant to fund Year 1 (FY2009-2010) deployment costs is estimated to be \$1,837,421, including \$1,469,937 Federal and \$367,484 non-Federal matching sources. The non-Federal matching sources for this project will be comprised of Commonwealth of Kentucky Toll Credits and In-kind matching sources. The In-kind matching sources will comprise a total of 395 project management hours committed by the directors of all four primary transportation providers in deploying the TMCC. The revenue sources for the In-kind matching hours are human service agency contract and other general fund revenues. The local matching requirements are in compliance with the items listed in the USDOT's MSAA Phase 2 Proposal Guide.

V. Conclusion

From the initial stakeholder involvement meetings, the Purchase Area TMCC has been designed with a goal of meeting customer expectations. The TMCC will provide an array of transportation and human service information & referral services on-site, by telephone at the four primary transportation provider locations and over the Internet. To provide the necessary services, the TMCC will be complimented by many forms of advanced ITS technologies. These technologies will serve as the backbone of the TMCC and are necessary to meet customer expectations.

VI. References

The following reference materials were utilized in the preparation of the MSAA Phase 1 final report and deliverables.

- **PATS TMCC Documents/Meetings/Stakeholder Involvement Meetings**
 - April 2007 - July 2008

- **USDOT MSAA Phase 1 Deliverables:**

- Concept of Operations, Revised, 1/18/08
- System Requirements, Revised, April 30, 2008
- Architecture and Standards Gaps, May 30, 2008
- System Design, June 30, 2008
- Implementation Plan, June 30, 2008

- **MSAA Phase 1 References:**

- USDOT Federal Transit Administration Mobility Services For All Americans Request for Proposals, Number 71 FR 19606, April 14, 2006
- USDOT MSAA “Kick-off” meeting, March 20-21, 2007, Washington, DC – Meeting Notes and Supporting Documentation
- PATS website (www.paducahtransit.com)
- Kentucky Medicaid Transportation program, Kentucky Transportation Cabinet
- Paducah Area Transit System, Proposal, United States Department of Transportation, Demonstration of Enhanced Human Service Transportation Models: Phase 1 - System Development and Design, June 13, 2006
- Mobility Services for All Americans Phase 2: Foundation Research, USDOT/SAIC, July 29, 2005
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- MSAA Enhanced Human Services Transportation Model Planning & Design Site Technical Assistance Plan, USDOT/FTA/SAIC/ TranSystems, August 2007
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- USDOT Federal Transit Administration Mobility Services For All Americans Request for Proposals, Number 71 FR 19606, April 14, 2006.
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<http://management.energy.gov/documents/SystemsEngineeringInterfaceMgmt.pdf>

- Patti Monahan and Doug Parker, TranSystems, Corp., Federal technical assistance team members
- **211 References:**
 - PATS - Paducah United Way 211 Project Meetings
 - 211, 511, and Human Services Transportation, Federal Transit Administration and Volpe National Transportation Systems Center, December 2004
 - “511/211 International Best Practices Symposium,” USDOT/American Public Transportation Association, August 20-21, 2007, Philadelphia, PA
 - The “United Way of America (UWA) and the Alliance for Information and Referral Systems (AIRS) 211.org” website (<http://www.211.org/>)
 - United Way 2-1-1: Its impact on Kentucky, Kentucky United Way, Meeting presentation, Paducah, KY, July 2007
 - The United Way of Kentucky 211 website (<http://www.uwky.org/211/211.htm>)
 - Conference call: PATS, Paducah United Way, USDOT, USDHHS (AoA), Easter Seals, National Association of Area Agencies on Aging, KYTC, and TranSystems to discuss 211 and MSAA integration; September 14, 2007
 - USDOT MSAA Webinar: “Structure Design Approach Overview,” September 10, 2007, Presenter: Carol Schweiger, TranSystems
- **511 Research:**
 - The “Resource 511” website (<http://www.deploy511.org/index.htm>)
 - Profiles of 511 Traveler Information Service - Update 2007, USDOT, Federal Transit Administration, July 2007
 - USDOT, Federal Highway Administration, 511 Deployment Website (<http://www.ops.fhwa.dot.gov/511>)
 - KYTC Transportation Operations Center (TOC), Frankfort, KY 511 communications and research,
 - Mr. Wayne Bates, KYTC TOC: KY511 and ITS Architecture research and compatibility
 - Mr. Larry Lyons, KYTC TOC: KY511 integration
 - Kentucky Transportation Cabinet - KY 511 website and telephone number (<http://511.ky.gov/>)
 - University of Kentucky Transportation Center, Mr. Joe Crabtree, transit ITS Architecture updates research
 - USDOT ITS JPO website: MSAA and associated resources (<http://www.its.dot.gov/msaa/index.htm>)

- APTA MSAA website and associated “community” resources (<http://blue.isoph.com/apta/mobilityServicesAllAmericans.aspx>)
- ITS Applications for Coordinating and Improving Human Services Transportation, FHWA, August 2006.
- **ITS Architecture Research:**
 - USDOT ITS JPO website: National ITS Architecture, (http://itsdeployment.ornl.gov/technology_overview/default.asp)
 - USDOT National ITS Architecture website, (<http://www.iteris.com/itsarch/>)
 - USDOT ITS By State website (<http://www.itsdeployment.its.dot.gov/>)
 - Statewide/Rural Intelligent Transportation Systems (ITS) 2004 Summary Report, USDOT/JPO, July 2005 (http://www.itsdeployment.its.dot.gov/pdf2004/statewide_rural_summary_report2004.pdf)
 - USDOT/FHWA Kentucky Division Office, Frankfort, KY, Regional ITS Architecture research
 - KYTC Operations Center (Frankfort) and Paducah Division Office, Regional ITS Architecture research
 - Kentucky ITS Strategic Plan, Joe Crabtree and J.R. Walton, KYTC/FHWA/University of Kentucky Transportation Center, June 2001
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 - Sample Regional ITS Documents: http://ops.fhwa.dot.gov/its_arch_imp/examples.htm
- **Systems Requirements References:**
 - System Requirements Sample Outline, Carol Schweiger, TranSystems, Corp., Federal technical assistance team, December 4, 2008.
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- USDOT/FHWA, Systems Engineering Guidebook for ITS, Section 3.5.1 - Requirements Development, (http://www.fhwa.dot.gov/cadiv/segb/views/document/Sections/Section3/3_5_1.htm)
- USDOT/FHWA, Systems Engineering Guidebook for ITS, Section 8.4.6 - Requirements Template, (http://www.fhwa.dot.gov/cadiv/segb/views/document/Sections/Section8/8_4_6.htm)
- IEEE Standard 1233, Guide for Developing System Requirements Specifications, (http://standards.ieee.org/reading/ieee/std_public/descriptions/se/1233-1998_desc.html)
- USDOT, Recommended Key Elements of Focus for Sites, February 2008
- **Implementation Plan References:**
 - Guide for the System Phasing and Implementation Plan, USDOT, June 16, 2008
 - Miami Valley Final ITS Strategic Deployment Plan, Miami Valley Regional Planning Commission, September 1997, <http://www.itsdocs.fhwa.dot.gov/edldocs/9943/sec7.pdf>
- **System Design References:**
 - USDOT/TranSystems Presentation: “System Design Overview,” Carol Schweiger, January 24, 2008, Alexandria, VA
 - USDOT Federal Transit Administration Mobility Services For All Americans Request for Proposals, Number 71 FR 19606, April 14, 2006.
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- **USDOT MSAA Phase 2 Proposal Guide**, March 2008
- **Purchase Area TMCC MSAA Phase 2 Proposal (Revised)**, December 18, 2009

VII. Appendices

Appendix 1: Project Stakeholders

Primary Stakeholders

Commonwealth of Kentucky	
<i>Transportation Cabinet – Office of Program Delivery</i>	Department for Community Based Services
Department of Medicaid Services: - Medicaid Transportation - Medicaid – Private Auto Transportation Program	Department of Disability – Louisville
	Department of the Blind
	Department of Juvenile Justice
Department of Vocational Rehabilitation	Department of Disability – Frankfort

Human Service and Other Contracting Agencies	
Paducah-McCracken County Senior Services	Baptist Home Health
Paducah Housing Authority	Bechtel Jacob's
Oscar Cross Boys and Girls Clubs	Bluegrass Marina
Paducah-McCracken County Boys and Girls Clubs	Brian Katz Attorney
Heartland Clinic	Broadway Church of Christ
American Red Cross	Calvert City Convalescent Center
Adult Day Care & Support for Community Living Centers	Calvert City Nursing Home
Western Baptist Hospital	Canal Barge Lines
Lourdes Hospital	Commonwealth Attorney Office
Purchase Area Development District	Community Christian Academy
Family Service Society	Cooper Whiteside Public School
ACBL Barge	Cornerstone Church
Access Transportation	US Army Corp. of Engineers
Alnet	Department of Disability Louisville
Arbor Place	Excell Marine

Human Service and Other Contracting Agencies, cont'd.

First Christian Church	Jeremiahs Pub and Restaurant
Four Rivers Mental Health	Kentucky Insurance Guaranty Association
Friends Family Resource Center	Kentucky Health Department
Grace Episcopal Church	Kentucky Organ Donors Association
Heartland Cares (HIV Clinic)	Kids Company #1
Heartland Worship	Kindred Healthcare
Helping Hands	Kirby Marine
Heritage Manor Healthcare	KY Disability Coalition
Hibbs Insurance	Life Care Center of La Center
Hope Unlimited	Lourdes Behavioral Health
Ingram Barge	Lourdes Dialysis
Jackson Oaks	Magnolia Marine Transport
Jackson Purchase Electric	Magnolia Power
Jackson Purchase Medical Center	Manpower Temp. Service
James Marine	Marquette Transport
Marshfield Labs	Paducah Parks Services
Med Care	Paducah River Port Authority
Medco	Paducah Tilghman
Memco	Pharmerica
Merryman House	Public Guardian
Midwest Aviation	Radiology Group
Mills Manor Nursing Home	Rape Crisis Center
Morningside Assisted Living	River Boat Explorer
Ninth Street Tabernacle	River City Mission
Oakview	River Express
Paducah & Louisville Railroad	Salem Spring Lake Convalescent Center
Paducah Center	Southland Baptist
Paducah Civic Beautification	Spouse Abuse Center
Paducah Cooperative Ministry	STOPS Transport
Paducah Middle School	Superior Care
Paducah Nurse Register	Teen Link
Tilford Contractors	Veterans Affairs
TVA	Voc. Rehab
United Way (211 - to be completed in early 2008)	West Kentucky Community & Tech. College
UPA	West Kentucky Reporting Services
US Bank	Western Baptist
USEC	Western KY Navigation
VAMC Clinic	Whayne Supply

Technology Providers	
RouteMatch Software	Kelly-Willmore (telephone infrastructure)
Mentor Engineering	GTS (hardware infrastructure)
Visions Communications Incorporated (telephone support)	
Customers/Riders/Users of the TMCC	
Riders: PATS, MCTA, FCTA, and ESWKY	
PATS Rider Focus Group	
<i>Citizens of the City Paducah and McCracken, Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, & Marshall Counties</i>	

Secondary Stakeholders

United States Department of Transportation ✓ Federal Transit Administration ✓ Research and Innovative Technology Administration (including the ITS Joint Program Office) ✓ Federal Highway Administration	United States Congress ✓ Congressman Ed Whitfield ✓ Senator Mitch McConnell ✓ Senator Jim Bunning
United States Department of Health and Human Services ✓ Centers for Medicaid & Medicare Services ✓ Administration on Aging ✓ Administration for Children & Families ✓ Substance Abuse & Mental Health Services Administration	Package Delivery ✓ Advanced Express ✓ DHL ✓ Federal Express ✓ United Parcel Service Logistics
United States Department of Housing and Urban Development	United States Department of VA
United States Department of Education	United States Department of Labor
United States Department of the Army	

Other Interested Stakeholders

McCracken County	Bass Pro Fishing Tournament
City of Paducah	RouteMatch Software
Paducah/McCracken Visitors Bureau	Mentor Engineering
Paducah/McCracken County Chamber of Commerce	Visions Communications Incorporated (telephone support)
National Quilt Show Committee	Kelly-Willmore (telephone infrastructure)
GTS (hardware infrastructure)	Kentucky Relay (TDD/TTY) service
American Medical Response (PATS is a national on-call FEMA Tier II disaster response contractor to AMR)	

Appendix 2: TMCC Technology & Interaction Diagram

Technologies:

Base = **Yellow Highlight**

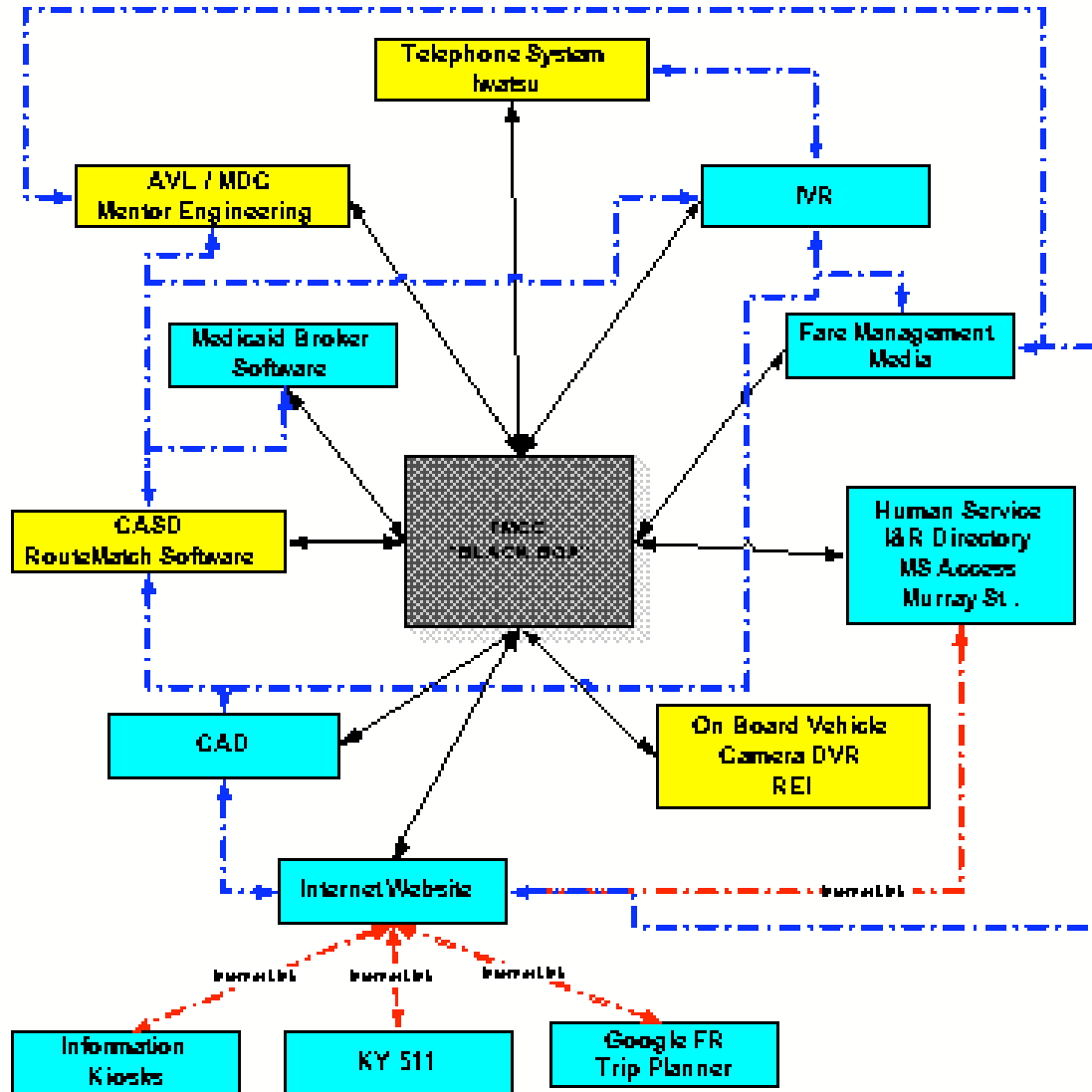
Expanded = **Blue Highlight**

Interaction Lines:

Black Solid = TMCC connection

Blue Dashed = Interface

Red Dotted = Internet website link



Appendix 3: PATS MSAA TMCC Website (<http://www.paducahtransit.com/MSAA.html>)



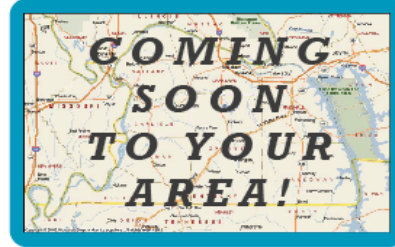
The screenshot shows a Windows Internet Explorer browser window displaying the website <http://www.paducahtransit.com/MSAA.html>. The browser's address bar shows the URL, and the search bar contains the text "Google". The website's header features the PATS logo, which includes a bus icon and the text "PATS". Below the logo, the main heading reads "Paducah Area Transit System". A navigation menu is located below the heading, with links for "Home", "Bus Routes", "Dial A Ride", "Medicaid", "Driver Training", "Advertise", "MSAA", "News", "Jobs", "ADA", "Links", and "Contact Us". The main content area is titled "Mobility Services for All Americans (MSAA)". The text on the page describes the MSAA initiative, stating that PATS is proud to be one of 8 transits in the nation chosen to take part in Phase One of the United States Department of Transportation's Mobility Services for All Americans (MSAA) Initiative. It further explains that the MSAA initiative is very important to PATS because of the volume of people in their region who need transportation assistance, and that PATS wants to simplify the process for these people. The goal of MSAA is to use the latest technology (Intelligent Transportation Systems) and coordination of services to make transportation easier and more efficient for everyone. Finally, it mentions that Paducah Area Transit System's plan for incorporating advanced technology was explained to Purchase Area agencies and organizations during a Mobility Services for All Americans (MSAA) meeting on Tuesday, June 17th at the Purchase Area Development District Office in Mayfield, Kentucky. Acting General Manager *Kim Adair* explained PATS' plan for the technological evolution of transportation systems.

Appendix 4: Purchase Area TMCC Marketing Brochure

INTRODUCING THE NEW:

Transportation Management Coordination Center (TMCC)

You will easily have access to the following:



Detailed Services Information:

- Find the transportation services provided and their hours of operation.
- See the transportation providers available in your county.

Bus Arrival and Departure Information:

- Quickly get an answer to - "Where's my ride?"

Scheduling Transportation:

- Schedule a trip and receive trip information.
- Determine eligibility for transportation services.

Fare Media Information:

- Receive your fare card available balance and reload funds.

Safety and Security Information:

- Check service availability due to weather conditions or other issues.

211 Human Service & Community Information and Referral:

- Find information on various community organizations, programs, and services offered.
- Get connected directly!

“Your one stop shop to gaining simplified access to transportation and human service information in the Purchase Region 24 hours/day 7 days/week.”

Access the TMCC in a number of ways:

These services will be available in multiple languages and accessible by the hearing impaired.



PHONE

(speak to a live person or use our automated system)

WALK-UP KIOSK



INTERNET



IN PERSON



Additional Information:

- Paducah Area Transit (270) 444-8700; www.paducahtransit.com
- Murray Calloway Transit (270) 753-9725; www.murraytransit.com
- Fulton County Transit (270) 472-0663; www.westernkytoday.com/fultontransit.html

Learn More!

U. S. Department of Transportation's Mobility Services for All Americans (USDOT MSA) - www.its.dot.gov/msaa

Appendix 5: Metric Conversion Chart

Quantity measured	Unit	Symbol	Relationship
Length, width, distance, thickness, girth, etc.	Millimeter	mm	10 mm = 1 cm
	Centimeter	cm	100 cm = 1 m
	Meter	m	
	Kilometer	km	1 km = 1000 m
Mass ("weight")*	Milligram	mg	1000 mg = 1 g
	Gram	g	
	Kilogram	kg	1 kg = 1000 g
	metric ton	t	1 t = 1000 kg
Time	Second	s	
Temperature	degree Celsius	°C	
Area	square meter	m ²	
	Hectare	ha	1 ha = 10 000 m ²
	square kilometer	km ²	1 km ² = 100 ha
Volume	Milliliter	mL	1000 mL = 1 L
	cubic centimeter	cm ³	1 cm ³ = 1 mL
	Liter	L	1000 L = 1 m ³
	cubic meter	m ³	
Speed, velocity	meter per second	m/s	
	kilometer per hour	km/h	1 km/h = 0.278 m/s
Density	kilogram per cubic meter	kg/m ³	
Force	Newton	N	
Pressure, stress	Kilopascal	kPa	
Power	Watt	W	
	Kilowatt	kW	1 kW = 1000 W
Energy	Kilojoule	kJ	
	Megajoule	MJ	1 MJ = 1000 kJ
	kilowatt hour	kW·h	1 kW·h = 3.6 MJ
Electric current	Ampere	A	

Source: US Metric Association: <http://lamar.colostate.edu/~hillger/common.html>



**Office of Research, Demonstration and Innovation
U.S. Department of Transportation
1200 New Jersey Avenue, SE
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www.fta.dot.gov/research

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