

Roughrider Travel Management Coordination Center (RTMCC)

Concept of Operations

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Version 1

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Table of Contents

I. Introduction..... 1

II. Operational Needs..... 3

III. RTMCC System Overview..... 6

IV. Operational Scenarios..... 14

I. Introduction

This document describes the Concept of Operations for the Roughrider Travel Management Coordination Center (RTMCC). The RTMCC will act as a regional mobility brokerage and travel information clearinghouse in southwest North Dakota. The RTMCC will coordinate human services, student, public, and private transportation resources in the eight-county region through an institutional framework and the application of technology.

This Concept of Operations document describes the capabilities, goals, and objectives of the RTMCC; how the RTMCC will meet these goals and objectives; and what is required to transition from the current system to the RTMCC.

Background

In the eight counties that makeup southwest North Dakota the issue of personal mobility is intensified by regular long-distance, high-cost trips. Like in urban areas, student transportation dwarfs the level of service provided by other transportation agencies in southwest North Dakota. However, for many non-students, limited or no transportation service is available in much of the region.

Student transportation in southwest North Dakota is operated independently by local school districts. Service is limited to students with the vast majority of service provided within district boundaries. The exception is student travel for extracurricular activities.

Currently, there is little coordination of service among public transportation providers in southwest North Dakota. This is primarily a result of geography, with agencies providing service to specific areas with limited intercity or regional service. Transit is typically tailored to meet the needs of transportation-dependent groups such as the elderly and disabled.

The use of technology by school districts and public transportation agencies is limited. Under the current organization of technology providers, the cost of technology outweighs its benefit. However, with the falling cost of technology and growing benefits from reorganization, specifically coordination at the regional level, this will no longer be the case.

The Roughrider Travel Management Coordination Center

The mounting challenges facing transportation providers in southwest North Dakota have resulted in a new, region-wide willingness to reorganize transportation resources, including coordination between the student and non-student transportation systems. To coordinate such disparate entities and to fully realize available efficiencies the adoption of appropriate technology is necessary. The Roughrider Travel Management Coordination Center will serve as the technological hub of a regional, coordinated transportation system that meets the mobility needs of travelers in southwest North Dakota.

Document Overview

The Concept of Operations document consists of the following sections and content:

Section 3 (*Operational Needs*) identifies system needs that are currently not being met as well as institutional and technical considerations.

Section 4 (*System Overview*) provides an overview of the scope of the RTMCC, its users, and its capabilities.

Section 5 (*Operational Scenarios*) describes how the system operates from the user standpoint. Operational scenarios describe sequences of events and activities carried out by users, the system, and the environment.

II. Operational Needs

The Roughrider Travel Management Coordination Center will require a fundamental change in the organization and operations of transportation providers in southwest North Dakota. For school districts, it will involve allowing the transportation of students with non-students. For other transportation providers it will mean coordinating service, sharing resources and administrative power to improve the overall efficiency of the system. In addition, the application of technology will be necessary to integrate the transportation operations of different organizations and to best meet the mobility needs of the community and the requests of funding providers with the limited resources that are available.

Need

There are a number of needs that support the establishment of the RTMCC. These can be divided into (1) needs supporting increased coordination and (2) needs supporting the use of technology. Needs supporting increased coordination among transportation providers include:

- Unmet mobility needs throughout the region
- Limited resources to provide service
- Unused vehicle capacity, especially during rural and intercity trips
- Inefficiency from operating uncoordinated transportation systems (student and non-student transportation)
- Difficulty in making chained trips
- Need for increased regional service

Needs that support the use of technology include:

- Information about available transportation services
- Ability to accurately schedule trips at low-cost

- Ability to determine correct fare for diverse trip types
- Ability to optimally route vehicles
- Collecting information to manage and evaluate system performance
- Efficiency resulting from automating reporting and billing functions
- Service reliability, especially coordinated service
- Safety of riders

Vision

The vision of the Roughrider Travel Management Coordination Center is to support a sustainable, coordinated, accessible, mobility system for all people in southwest North Dakota that is affordable, safe, and reliable.

Barriers to System Implementation

There are a number of common barriers to the coordination of student and non-student transportation systems. TCRP Report 56 identifies many such barriers. Of particular interest to southwest North Dakota are:

- Federal regulations prohibiting recipients of public transportation funds from providing service exclusively to students or from competing with private school bus operators.
- Federal vehicle safety standards that differ for public transportation and school bus vehicles.
- Insuring vehicles against loss. (The North Dakota Insurance Reserve Fund does not necessarily preclude the transportation of student and non-student riders.)
- Safety and behavioral concerns resulting from commingling student and non-student riders.
- Legal requirements. (North Dakota state law does not preclude the commingling of students.)
- The willingness of non-students to ride school buses.

Institutional Considerations

The Roughrider Travel Management Coordination Center will require increased levels of cooperation among a number of organizations. Concerns over territorialism are real and must be addressed during the development and operation of the system. The transition from the current state of limited coordination to the regional concept embodied by the RTMCC is delicate and must be managed on an individual basis.

Technical Considerations

New technology used by the RTMCC must be compatible or replace existing technology. However, there is currently relatively little use of advanced technology by transit agencies or school district transportation operations in southwest North Dakota. The exception is ElderCare which uses scheduling software to assist in its operation.

The wireless communications infrastructure in southwest North Dakota does not provide universal service. However, those areas without wireless service are relatively remote. These regions will likely be provided little or no service making real-time communication between vehicles and dispatch, beneficial, but not necessary. Solutions, including the use of 3-watt boosters and repeaters, are also possible.

III. RTMCC System Overview

The Roughrider Travel Management Coordination Center (RMTCC) will act as a regional mobility brokerage and travel information clearinghouse. The RTMCC will coordinate human services, pupil, public, and private transportation resources in the eight-county region through an institutional/organizational framework and application of technology. Regional coordination will provide the economies of scale needed to facilitate the joint deployment of technology. Conversely, technology will make regionalization possible by providing the ability to coordinate resources among a number of diverse community transportation systems and providing a seamless, user-friendly interface.

As a mobility brokerage, the RTMCC will match riders with the appropriate service providers using information provided by the rider or a personal representative. Reservations will be able to be made by phone, internet, or paper. Intercity trips may require 24-hour notice, while dial-a-ride service will be retained in existing service areas. Inter-agency trips will be able to be scheduled seamlessly. The RTMCC will also coordinate non-student rides on traditional school buses. As a brokerage, the RTMCC will possess the flexibility to adapt to the addition or departure of transportation service providers.

As an information clearinghouse, the RTMCC will provide timely, accurate information on various transportation services available in the region. This information will be accessible by the internet, phone, in print, or kiosk. Riders and other members of the community will have access to schedule, reservation, and fare information for all participating transportation providers.

Service providers will be able to access data needed for reporting and billing and managing their operations. They will rely on the system to determine trip eligibility

using their own policies. Data for performance, fleet and maintenance management, and strategic planning will be made readily available.

Geographic Boundaries

The Roughrider Travel Management Coordination Center will serve the eight counties of southwest North Dakota: Adams, Billings, Bowman, Dunn, Golden Valley, Hettinger, Slope, and Stark. *In its initial phase of development, the system may be limited to the city of Dickinson and immediately surrounding areas.*

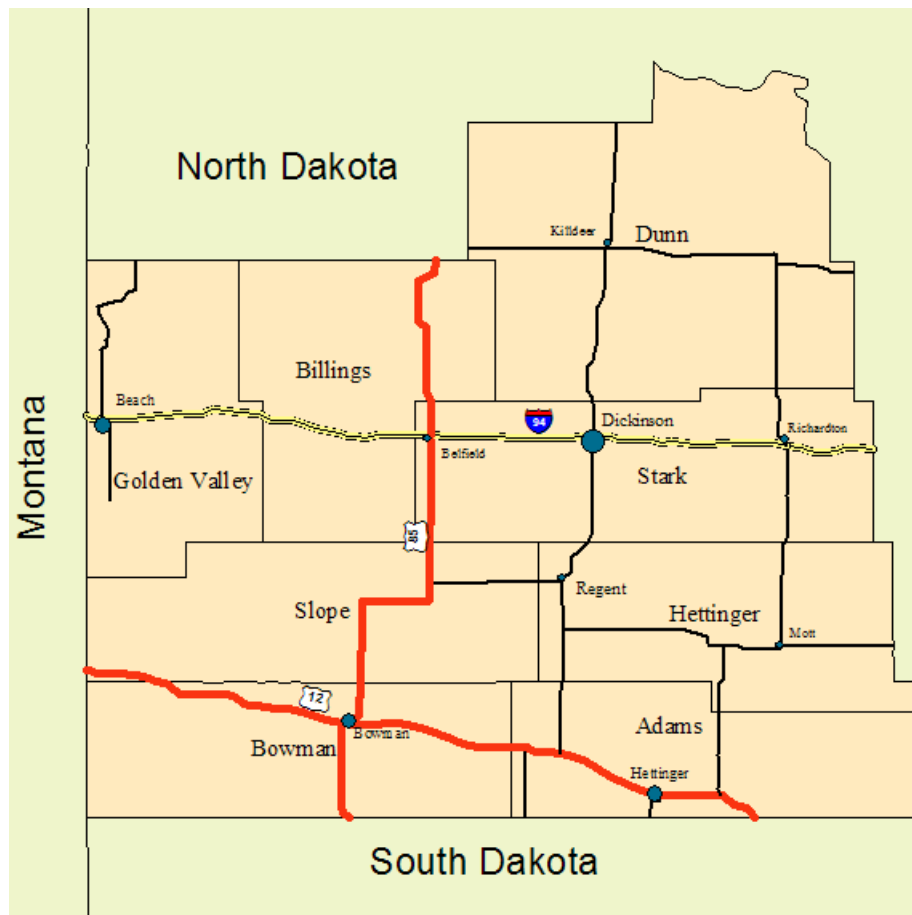


Figure 1. Southwest North Dakota

Stakeholders and Users

The primary stakeholders in the RTMCC are its operators including local transit agencies, human service transportation providers, and school districts. Secondary stakeholders include local human service agencies, the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), North Dakota Department of Transportation (NDDOT), North Dakota Department of Public Instruction (NDDPI), and the North Dakota Department of Human Services (NDDHS). System customers include riders, parents and guardians, and individuals seeking travel information.

Users of the system can be assigned to three parties: transportation providers, funding agencies, and customers. Transit agencies, human service transportation providers, private transportation providers (taxis, intercity bus, school transportation contractors), and school districts are members of the first group. Funding agencies include the NDDOT (transit and related programs), NDDPI (student transportation), and NDDHS (human services transportation). Customers of the RTMCC include riders, parent, custodians, and travel information seekers.

System Design

Transportation providers, customers, and funding agencies will use the RTMCC to meet diverse community and agency specific needs. These needs can be categorized into five core subsystems: travel information, scheduling, reporting and billing, fare management, and tracking. A high-level system diagram of the RTMCC is presented in Figure 2. The function provided by each subsystem and the roles and responsibilities of system users make up the remainder of this chapter.

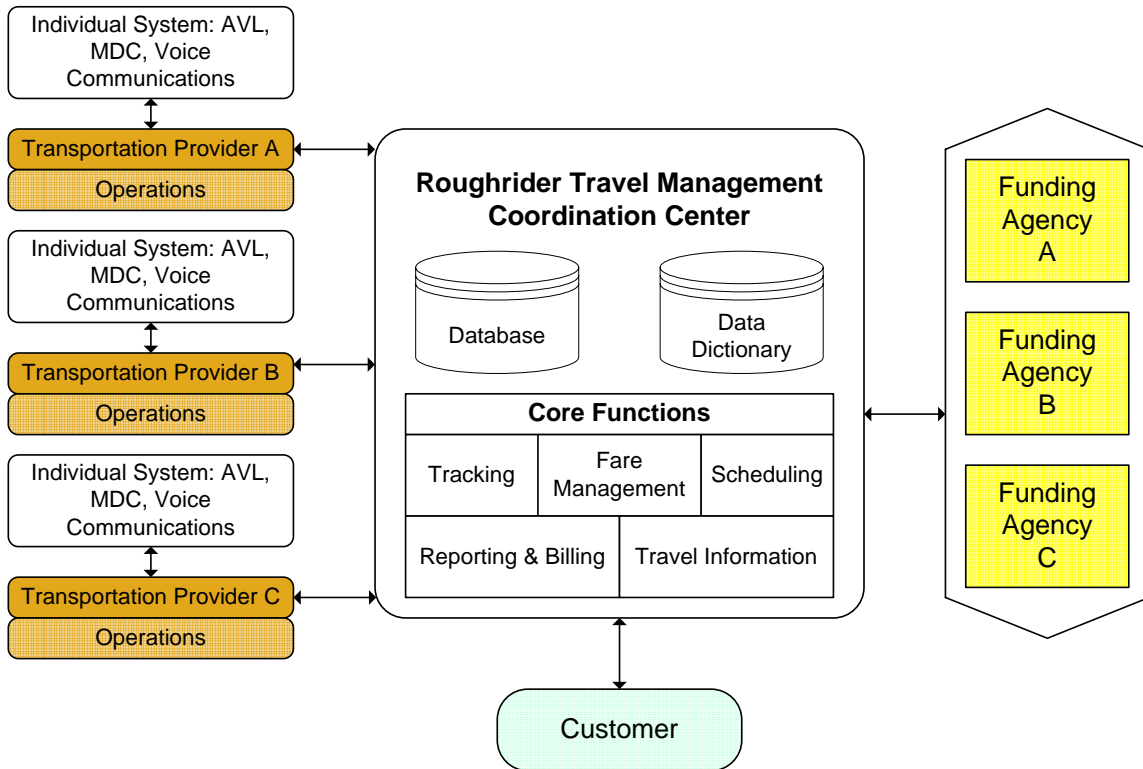


Figure 2. Roughrider Travel Management Coordination Center System Diagram

Users will only have access to those parts of the RTMCC to which they are authorized. In addition to providing service, transportation providers will maintain and operate their own individualized technology system which may include technology such as automatic vehicle location, mobile data computers, and voice communications.

Travel Information

The RTMCC’s travel information subsystem will provide information seekers with service information for all transportation programs supported by the RTMCC. Information including hours of service, stop times, eligibility and fares will be provided. The system will be accessible to customers by phone, kiosk, internet, or Web-enabled device. Transportation providers will be able to update information at any time.

Scheduling

The RTMCC's scheduling subsystem will allow customers to schedule trips on transportation providers that use the system. The scheduling subsystem will be accessible to customers by phone, kiosk, internet, or other Web-enabled device. Various types of service will be provided by transportation providers. These will include: fixed-route, subscription, advanced-schedule, and taxi service. Each transportation provider will retain their prerogative regarding service policy including trip requirements, eligibility, and fare to preserve their independence and comply with existing external agreements, requirements, and regulations.

Demand-response service trips will be routed using the system's routing algorithm to increase efficiency. Transportation providers will be able to reassign trips manually if desired.

Figure 3 graphically presents the process of trip scheduling using the RTMCC.

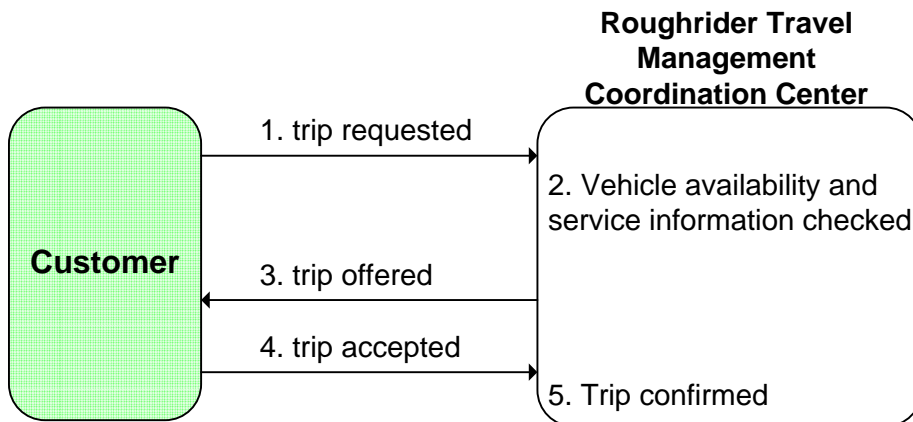
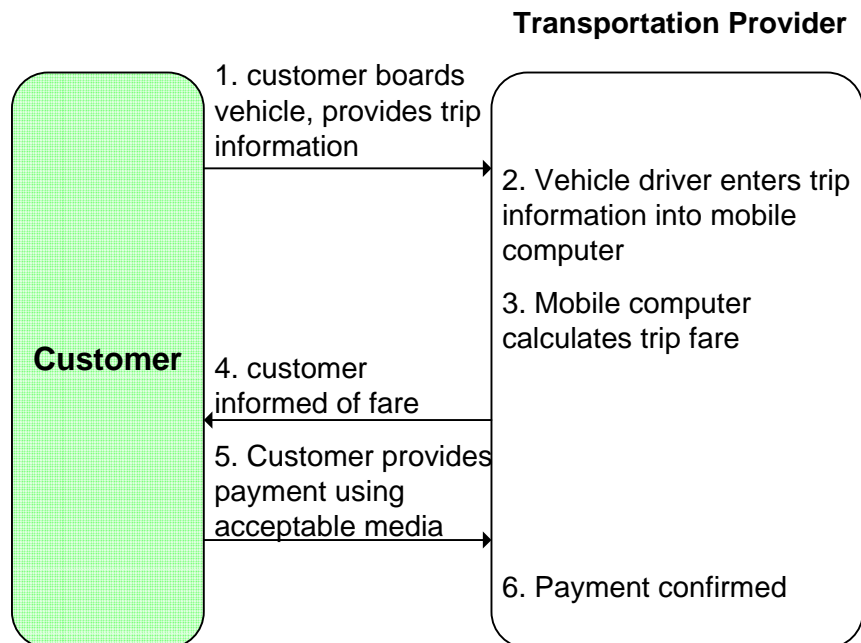


Figure 3. Trip Scheduling System

Fare Management

The RTMCC's fare management subsystem will facilitate the determination and collection of the correct fare on a trip-by-trip basis. Customers will be able to pay their fares either when scheduling the trip, using a prepaid electronic farecard, or with cash when boarding the vehicle. Regular riders, including students, will be required to carry electronic identification (Radio Frequency Identification) to facilitate the collection of rider information. The use of electronic identification will allow different fares to be determined and charged while preserving rider privacy. Many riders of public and pupil transportation have limited mobility, making relatively long-range reading of identifiers valuable.

Figure 4. presents the process of fare determination and collection during customer boarding. It relies on the on-vehicle mobile computer to have up-to-date information regarding the service fare structure. Alternatively, wireless communications could be used to access this information from the RTMCC remotely.



Tracking

The RTMCC's tracking subsystem will rely upon vehicle location technology to periodically generate coordinates of each vehicle in service. This information will either be stored by the on-vehicle mobile computer and uploaded each night to the RTMCC database or be communicated in real-time to the RTMCC wirelessly. Vehicle location information will be used to manage and improve operations, to measure performance, and to respond to emergencies.

The RTMCC's tracking subsystem will estimate vehicle arrival time. This will be communicated to customers awaiting pickup and to other system vehicles to coordinate service, including transfers. In cases of significant deviation from schedule, demand-response trips assigned to vehicles behind schedule will be transferred to other vehicles.

Reporting and Billing

The RTMCC's reporting and billing subsystem will provide operational and financial information to transportation providers and funding agencies. Reporting information will be used for management, planning, evaluation. Billing invoices will be able to be generated periodically and on-demand by transportation providers and funding agencies.

Roles & Responsibilities

Users of the RTMCC will have specific, known roles and responsibilities that relate to the system. These may change over time depending on system and agency needs.

Transportation providers will

- Maintain and operate their individual technology systems that will interface with the RTMCC.

- Maintain up-to-date service information for the travel information subsystem.
- Provide service according to their existing service policy to support coordinated trips.

The RTMCC will

- Provide 24-hour access to customers for travel information, scheduling, and fare payment.
- Provide 24-hour access to transportation providers to update service information, access operational and financial information, access scheduling information, and to track vehicles and riders.
- Provide 24-hour access to funding agencies to authorized portions of the reporting and billing subsystem.
- Provide for the regular and on-demand generation of reporting and billing information for transportation providers and funding agencies.
- Employ an IT professional to maintain the system.
- Provide adequate system backup and safeguards to protect against system failure.

IV. Operational Scenarios

Operation scenarios present the sequence of events, as well as user and system activities for various situations under normal and failure conditions. Operational scenarios for the RTMCC involve student transportation, demand-response, and fixed-route service; breakdowns, no-shows, and late arrivals.

Scenario 1A. Student Transportation: Normal Conditions

Description of the Event

Suzie Benson is a third grade student at Roosevelt Elementary School in Dickinson. Her family finds it most convenient for Suzie to ride the bus to and from school and uses the RTMCC to schedule her trips for the entire school year. Twice each school day Suzie rides the bus, boarding at her assigned neighborhood stop in the morning and at Roosevelt Elementary in the afternoon. An electronic reader identifies her each time she boards and departs the bus.

Stakeholders/Users

- Parent
- Student rider
- Transportation provider

Transportation Provider Assets

- Electronic reader
- Mobile computer

RTMCC Assets

- Trip Scheduling Subsystem
- Tracking Subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
Trip scheduling	Parents	Parents access the RTMCC by internet, plan and schedule regular rides for daughter
Generate routes and schedule	RTMCC	System uses information from many sources to generate annual fixed vehicle routes and schedules
Disseminate routes	RTMCC	Route information provided to regular users
Electronic traveler information collected	Transportation provider	Information about rider is collected by RFID upon boarding
Transmit electronic traveler information	Transportation provider	Information about rider is transmitted to RMTCC
Provide service	Transportation provider	Vehicle is operated according to guidelines transports Suzie to and from school
Electronic traveler information collected	Transportation provider	Information about rider is collected by RFID upon departing bus
Transmit electronic traveler information	Transportation provider	Information about rider is transmitted to RMTCC

Scenario 1B. Student Transportation: No Show**Description of the Event**

Ralph Singleton is a fourth grader at Heart River Elementary who regularly rides the bus. Not arriving home after school as planned, his father calls Heart River to inquire about his whereabouts. The secretary accesses the RTMCC system and learns that Ralph boarded the wrong bus and got off at the corner of 11th Avenue and 7th Street. Ralph's father recognizes that this is close to his son's best friend's house. Ralph's father calls the home to find that Ralph did in fact ride with his friend.

Stakeholders/Users

- Parents
- School district
- Transportation provider

RTMCC Assets

- Tracking Subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
School district contacted	Parent	Parent informs school of child's no show
RTMCC accessed	RTMCC School	School district employee accesses tracking subsystem learns that child boarded wrong bus
Parent informed	School Parent	School district informs parent of situation

Scenario 1C. Student Transportation: Delayed Arrival Notification**Description of the Event**

John Tabor, an eighth grader at Hagen Junior High, lives on a ranch in rural Stark County. Due to inclement conditions his bus is running late. The RTMCC contacts John's home by phone and informs him via the automated system that his bus will be arriving approximately 10 minutes late. Instead of waiting by the mailbox in freezing weather, John spends his time safe and warm visiting with his parents in the comfort of their home.

Stakeholders/Users

- Student rider
- Transportation provider
- School district

Transportation Provider Assets

- Vehicle location

RMTCC Assets

- Tracking subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
Vehicle falls behind schedule	Transportation provider	Vehicle location information communicated to RTMCC
Delay identified	RTMCC	RTMCC determines that vehicle will arrive outside of acceptable time window
Rider contacted	RTMCC	RTMCC using automated system to contact student about delay in vehicle arrival and estimated arrival time
Student waits for departure	Student rider	Student waits until approximate arrival time to wait for pick-up

Scenario 1D. Student Transportation: Vehicle Breakdown**Description of the Event**

Bus number 12 breaks-down while in service. The driver immediately notifies the RTMCC which is provided supporting information by bus 12's vehicle location system. Under the direction of a system manager, the RTMCC identifies and reroutes available vehicles to pick-up stranded riders who are eventually transported to their intended destination.

Stakeholders

- Riders
- Transportation provider

Transportation Provider Assets

- Vehicle Location
- Real-time communication

RMTCC Assets

- Tracking subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
Breakdown occurs	Transportation provider	While carrying passenger, vehicle breakdown
RTMCC notified by driver	Transportation provider	Bus driver contacts RTMCC using wireless voice communications
Vehicle condition communicated	Transportation provider	Vehicle location remains the same
Riders scheduled on other vehicles	RTMCC	Using the scheduling subsystem, stranded riders are scheduled for immediate pickup by other vehicles

Scenario 2A. Demand-Response Operation: Driver Perspective**Description of the Event**

Jane Stevens, a bus driver for Elder Care, arrives at 12:30 pm for her weekday afternoon shift. She conducts a pre-trip inspection of her vehicle and then boards and starts the bus. She checks her Mobile Computer and quickly reviews her first scheduled stops for the day. Her first stop is to pick-up Esther Johnson from the clinic for a return trip home. Jane will also pick-up Jack Wells at St. Joseph's Hospital. After picking up Esther, her computer tells her that John Phillips is also to be picked up at the hospital.

Stakeholders

- Transportation provider

Transportation Provider Assets

- Mobile data computer

RMTCC Assets

- Scheduling subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
MDC turned on	Transportation provider	
Route information uploaded	Transportation provider, RTMCC	Mobile data computer automatically uploads route information from RTMCC
First scheduled rider picked up	Transportation provider, Rider	
Route information uploaded	Transportation provider, RTMCC	New ride scheduled during real-time

Scenario 2B. Demand-Response Operation: Subscription Service**Description of the Event**

Sarah Smith needs to travel to St. Alexis Medical Center three times each week for dialysis. She has her daughter sign her up for subscription service using the Internet to access the RTMCC scheduling system. Sarah's daughter also prepays for a dozen trips while still online.

Stakeholders

- Rider
- RTMCC
- Transportation provider

RTMCC Assets

- Scheduling subsystem
- Fare Management subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
RTMCC accessed	Caretaker, RTMCC	RTMCC accessed by internet
Service scheduled	Transportation provider, Rider	Subscription service scheduled
Fares prepaid	Transportation provider, Rider	Fare determined, paid online

Scenario 2D. Demand-Response Operation: Taxi Service**Description of the Event**

John Adams calls the RTMCC and requests a trip to Ted's Barber Shop that morning. The RTMCC employee uses the scheduling subsystem to identify a possible trip for John. A vehicle would be able for pickup in 20 minutes with return service one hour later. John decides to book the trip which is confirmed by the RTMCC employee. Fifteen minutes later John is contacted by an automated call informing him that a vehicle will be in front of his home in approximately three minutes. John puts on his jacket and walks to the curb seeing the vehicle approach from a block away. John boards the bus. The driver asks for the regular fare which John pays in cash.

Stakeholders

- Rider
- RTMCC
- Transportation Provider

Transportation Provider Assets

- Vehicle location
- Mobile computer

RMTCC Assets

- Scheduling subsystem
- Tracking/notification system

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
Call Placed	Rider, RTMCC	Call placed, trip requested
Trip Offered	Rider, RTMCC	Availability determined
Trip Accepted	Rider, RTMCC	Trip confirmed in system
Vehicle Approaches	Trans. Provider Rider, RTMCC	vehicle location nears pickup address, RTMCC contacts rider by phone
Passenger boards	Trans. Provider Rider, RTMCC	
Passenger pays fare	Trans. Provider Rider, RTMCC	general transit fare charged

Scenario 2E. Demand-Response Operation: Vehicle No Show**Description of the Event**

Mark Esterhaus contacts Eldercare and notifies them that their vehicle did not arrive for a scheduled trip the previous day. The Eldercare customer service representative accesses the RTMCC to review the trip and finds that the scheduled vehicle did stop in front of his residence for six minutes during the agreed upon time window. The customer service representative kindly reminds Mark of agency policy. Embarrassed at the discovery, Mark attentively listens and thanks the Eldercare representative for the information.

Stakeholders

- Rider
- Transportation provider
- RTMCC

RMTCC Assets

- Tracking subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
Trans. Provider contacted	Transportation provider, Rider	Customer calls transportation provider
Tracking subsystem access	Transportation provider, RTMCC	Transportation provider accesses vehicle location record
Rider informed of stop, policy	Transportation provider, Rider	

Scenario 3A. Fixed-Route Operation: Local Service**Description of the Event**

Ron Smith, a bus driver employed by Harvey's, arrives for his daily shift at 7 am. He visits with his supervisor for a few minutes before conducting his pre-trip vehicle inspection on bus number 9. He boards and starts the bus and checks to see that the vehicle's mobile computer is operational. He leaves the bus barn at 7:40 to begin service on Route 3 which serves Roosevelt Elementary, Downtown Dickinson, the Sunset Senior Center, Hagen Junior High, and Dickinson High School. Riders include a number of students, teachers and staff, and other workers employed in Downtown Dickinson including the Senior Center. Students ride free while others pay their fare with cash or electronic fare cards. Students are automatically counted as they board the bus using RFID. Ron enters any necessary information about other riders into his mobile computer as necessary.

Stakeholders

- Riders
- Transportation provider
- RTMCC

Transportation Provider Assets

- Mobile computer
- Vehicle location

RTMCC Assets

- Tracking subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
MDC turned on	Transportation provider	driver ensures operation
regular riders ID scanned	Transportation provider, RTMCC	reader automatically scans rfid of regular riders including students
trip, fares determined	Transportation provider, Rider	mobile computer is used to determine correct fare

Scenario 3B. Fixed-Route Operation: Chained, Regional Service**Description of the Event**

Cindy Smith a resident of Dickinson needs to travel to Bismarck for a medical appointment. She calls the RTMCC and schedules a chained trip from her home to Bismarck. On the day of her trip Cindy boards the demand-response vehicle to which she was assigned. The bus continues its trip toward an in-town transfer location. However, the next stop takes longer than estimated to complete, putting the vehicle and Cindy off-schedule. The RTMCC estimates that the vehicle will arrive just after the scheduled departure of the intercity service vehicle. That vehicle's driver is informed of the situation and delays its departure time until Cindy arrives. On its trip east, the bus also stops in Richardton to pickup additional riders whose trips were also managed to accommodate the delay. Arriving in Bismarck the bus takes her to the front door of Medcenter One.

Stakeholders

- Rider
- Transportation provider
- RTMCC

Transportation Provider Assets

- Mobile data computer

RTMCC Assets

- Scheduling subsystem

Stakeholder Actions and Timeline of Events

Timeline of Event	Stakeholder	Activity/Operation
Trip scheduled	Rider, RTMCC	Rider books trip to Bismarck using RTMCC scheduling subsystem
Stop scheduled uploaded	RTMCC, Rider Trans. provider	Mobile computer presents stop location
Bus delayed	Transportation provider, RTMCC	
Delay identified	RTMCC	RTMCC tracking subsystem identifies delay, contacts next vehicle
Intercity vehicle delays departure	Transportation provider, Rider	Vehicle delays departure until arrival of rider
Rider boards intercity vehicle	Transportation provider, Rider	

Appendix A. References

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