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Minnesota Intelligent Transportation Systems

ITS Component
Specification

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1 Introduction

The objective of the Polaris Project is to define an Intelligent Transportation Systems (ITS) architecture for the state of Minnesota. An architecture is a framework that defines how multiple ITS Components interrelate and contribute to the overall ITS objectives and requirements. Minnesota ITS Components include things like Freeway Traffic Management Center, Regional ITS Mangement Center, Emergency Vehicle, Freeway Roadside Equipment, etc.

The Polaris architecture provides multiple benefits including a) definition and optimimization of the location of system functions, b) identification of critical interfaces, c) illustration of how associated systems can be integrated to share resources and information, and d) identifying where opportunities exist to establish standards for communications and physical components so that interoperability can be maintained as the system evolves to incorporate new capabilities and technologies.

The Minnesota Statewide ITS Architecture incorporates National ITS Architecture requirements with the prioritized wants and needs of the state's transportation users and stakeholders, as well as the Minnesota As-Is infrastructure. The following project deliverables document the information collected and the resulting architecture for the Polaris Project:

Minnesota Traveler Wants and Needs - documents the transportation wants and needs information collected from Minnesota residents during 10 end user sessions held across the state.

Minnesota Transportation Agency Wants and Needs - documents the wants and needs information collected from Minnesota stakeholder institutions during 7 institutional sessions held across the state.

ITS Architecture Wants and Needs Analysis - uses the information from the Minnesota Traveler and Transportation Agency Wants and Needs documents to establish and prioritize ITS service requirements.

Statewide ITS As-Is Agency Reports for Minnesota - documents information about existing transportation systems that establish the starting point for the ITS Architecture Implementation Plan and physical architecture trade-offs.

ITS System Specification - identifies the functions, interfaces and requirements associated with

the Minnesota ITS User Services and Components. Sources of requirements include the ITS National Architecture user services, end-user and institutional wants and needs, and as-is infrastructure constraints.

ITS Component Specification - identifies the physical interface and requirements allocation for each Minnesota ITS component.

ITS Architecture Implementation Plan (future document) - describes the recommended ITS deployment strategy for future state initiatives (e.g., Orion Project).

1.1 Purpose

The Minnesota Statewide ITS architecture was developed to help the various Minnesota transportation related agencies participate as a whole in deploying future transportation systems.

The goals associated with this architecture include:

- Deliver a system that meets end-user and institutional needs

- Deploy projects efficiently by reducing duplication of effort among agencies

- Provide compatibility with transportation equipment and hardware that is used nationwide

To achieve these goals, the Minnesota Statewide ITS architecture was developed in such a manner that it:

- Incorporates what the traveler and institutional representatives stated they wanted and needed.

- Documents the system level requirements that transportation system development engineers and public/private agency representatives can use to define new projects.

- Defines the component level requirements and interface baseline that serves as a basis for evaluation and control of system design changes.

- Provides requirements traceability to enable the transportation system engineer to accurately assess the impact of system enhancements and new technology, before deciding to implement a change.

1.1.1 Scope

This Component Specification defines a requirements baseline for a Minnesota ITS Architecture and can apply to all new ITS infrastructure, products, and equipment packages to be deployed across Minnesota.

1.2 Document Organization

This Component Specification documents the physical Polaris Architecture Components from the perspective of requirements and interfaces.

The main body of this document is organized alphabetically by component or group name. For each component, a summary description including descriptions of the subfunctions that have been allocated to each component is provided. For each group, a corresponding list of components contained by the group is provided to point the reader to the correct sections.

Appendix A describes the requirements that have been allocated to each component. Appendices B and C describe all the input and output data flows associated with each component.

1.2.1 Applicable Documents

1.2.1.1 Government Publications

"Intelligent Vehicle-Highway System (IVHS) Phase II User Service Requirements',
DTFH61-95C-00038 Attachment 6, July 4, 1994

1.2.1.2 Other References

ITS Architecture - Physical Architecture, June 1995, LFS/Rockwell
ITS Architecture - Mission Definition, June 1995, LFS/Rockwell
ITS Architecture Browsing Site - www.rockwell.com/~jblarson/homepage.html
Minnesota Guidestar Strategic Plan, June 1994, Minnesota Guidestar

1.3 Methodology

This Component Specification documents the ITS architecture and requirements baseline for the Minnesota components as a result of the following process:

1. Requirements were extracted from the Intelligent Vehicle-Highway System (IVHS) Phase II User Service Requirements, the Minnesota Traveler and Transportation Agency Wants and Needs documents, and the Minnesota Guidestar Strategic Plan. To maximize the benefit of this task for Minnesota, requirements were extracted from the 21 highest

priority IVHS user service groups listed in Table I below. This activity produced a set of requirements were sometimes redundant across multiple IVHS User Service groups, and were written at different levels of detail.

2. The extracted requirements were then grouped into 11 Minnesota Service categories to reduce requirements redundancy and to make the ITS architecture easier for Minnesota transportation agency users to understand and apply. A functional architecture with data flows for each of the 11 services was then synthesized from these requirements. The Minnesota services did not include any Commercial Vehicle Operations (CVO) services because Minnesota is using Commercial Vehicle Information Systems and Networks (CVISN) for their CVO architecture. Minnesota services also did not include Travel Demand Management at this time.

3. A set of top-level testable system requirements was generated from the extracted requirements to quantify what each of the high priority services should do. Traceability to the original requirement sources was captured to support future maintenance of the architecture.

4. A physical architecture was developed to explain the architectural interfaces and requirements to public and private sector individuals that will be implementing the architecture. The physical architecture is described for components that are tangible real world entities. These components include Centers (e.g.; Freeway Traffic Management Center, Traffic Signal Centers, Dispatch Center), Inter-jurisdictional Systems that operate across multiple agencies, Roadside Equipment (e.g.; Freeway Roadside Equipment, Toll Collection Roadside Equipment, Parking Management Roadside Equipment), Vehicles (e.g.; Basic Vehicle, Transit Vehicle, Emergency Vehicle) and User Interface Equipment (e.g.; telephone, computer, pager, kiosk).

Physical Architecture development for each service began by analyzing the Minnesota ITS As-Is Baseline information in conjunction with the testable service requirements to show how multiple Minnesota components could interact with each other to meet the service requirements. An As-Is physical architecture and several physical architectural candidates for each of the high priority Minnesota ITS Services were developed as a part

of this activity.

5. The physical architectures were reviewed with working teams that represented the various agencies that are involved in the architecture. Advantages and disadvantages for each architectural candidate as well as evaluation criteria were collected from the working teams. A trade-off analysis was performed on the architecture candidates to select the best physical architecture for the service.

6. System requirements and data flows were then allocated to the components based on the selected physical architecture for each service. The result of this activity documented the component interfaces and requirements needed to implement the Minnesota ITS architecture.

Table I. User Service Mapping

IVHS User Service
Associated Minnesota User Services

Pre-Trip Travel Information
Ride Matching and Reservation
Travel Conditions Information
Trip Planning and Directions
Traveler Services Information

En-Route Driver Information
Travel Conditions Information
Trip Planning and Directions

Route Guidance
Travel Conditions Information
Trip Planning and Directions

Ride Matching and Reservation
Account Management
Ride Matching and Reservation

Traveler Services Information
Traveler Services Information

Traffic Control
Traffic Control

Incident Management
Incident Management
Traffic Control
Travel Conditions Information

Travel Demand Management
(future service)

Public Transportation Management
Account Management
Incident Management
Maintenance
Public Travel Security
Public Transit Fleet Management
Trip Planning and Directions

En-Route Transit Information
Travel Conditions Information
Public Transit Fleet Management
Trip Planning and Directions

Personalized Public Transit
Account Management
Ride Matching and Reservation
Public Transit Fleet Management

Public Travel Security
Account Management
Incident Management
Public Travel Security
Public Transit Fleet Management

Electronic Payment Services
Account Management
Public Travel Security
Ride Matching and Reservation
Public Transit Fleet Management

Commercial Vehicle Electronic Clearance
Commercial Vehicle Information
Systems and Networks
Account Management

Automated Roadside Safety Inspection
Commercial Vehicle Information
Systems and Networks

On-Board Safety Monitoring
Commercial Vehicle Information
Systems and Networks

Commercial Vehicle Administrative
Processes
Commercial Vehicle Information
Systems and Networks
Account Management

Hazardous Material Incident Response
Commercial Vehicle Information
Systems and Networks
Incident Management

Commercial Fleet Management
Commercial Vehicle Information

Systems and Networks

Emergency Notification and Personal Security

Incident Management

Emergency Vehicle Management

Incident Management

Traffic Control

Travel Conditions Information

Trip Planning and Directions

2 Account Management Provider(s)

2.1 Component Description

The Account Management Provider is a privately owned component that can provide invoicing and payment tracking services for private companies or public agencies. Examples of the Account Management Provider component include:

- Service Billing Companies
- Credit Card Companies

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Account Management Provider can provide multiple public agencies and/or private companies with consolidated billing services such as, a) creation and maintenance of user account information for the billing of transportation services, b) calculation of charges for transportation services and c) collection of payments for transportation services. Public agencies and private companies have the option to use the services of an Account Management Provider, or they can perform these services themselves.

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

3 Broadcast Information Provider(s)

3.1 Component Description

The Broadcast Information Provider is a privately owned component that collects travel-related information from the public sector and private information sources, and broadcasts that information to its customers via a variety of user interface equipment (e.g.; radio, television).

Examples of the Broadcast Information Provider component include:

- AM/FM Radio Stations (KTSP)
- Television Stations (WCCO)
- Metro Traffic
- Cable Companies
- Paging Companies

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Travel Conditions Information Service: The Broadcast Information Provider a) collects travel conditions data from public agencies and private information sources, b) filters and consolidates the travel conditions data and c) distributes travel conditions information to its listeners and viewers via a variety of user interface equipment (e.g.; radio, television).

Incident Management Service: The Broadcast Information Provider is utilized to provide information to travelers regarding the status of planned and unplanned incidents which may impact their travel plans. In addition, they may provide an incident detection service by notifying dispatch center(s) of incidents reported by their listeners.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

4 Centralized Control Signal Center(s)

4.1 Component Description

The Centralized Control Signal Center is a public controlled component that is used to manage Centralized Roadside Equipment components and communicate traffic related data to other Traffic Management Centers. Centralized roadside equipment components are connected to and operated by the Centralized Control Signal Center. Centralized Control Signal Center functional operation includes data collection and data sharing with other traffic management centers and roadside equipment. This is achieved via dedicated communication lines that perform real time or near real time control and data collection on the individual devices. Examples of the Centralized Control Signal Center component include:

St. Paul Department of Public Works
Minneapolis Department of Public Works

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Public Transit Fleet Management Service: The Centralized Control Signal Center distributes traffic surveillance data and signal timing plan information to Transit Management Center components to support schedule and route planning as well as fleet schedule adherence tracking and control functions.

Traffic Control Service: The Centralized Control Signal Center provides arterial traffic management functions including: a) timing plan distribution, and b) collection of data from centralized roadside equipment located on arterial roadways. Data distribution of traffic control conditions to other Traffic Management Centers is performed by the Centralized Control Signal Center. The frequency of data being distributed to other traffic management centers is determined by each agency that wants another agency's traffic data. Real time or near real time data collection and control of Centralized Roadside equipment is performed by this component.

Travel Conditions Information Service: The Centralized Control Signal Center a) collects traffic surveillance data from centralized roadside equipment located on arterial roadways, b) determines traffic conditions along arterial roadways and c) distributes

traffic conditions to other public agencies and the Regional ITS Management System

(which further filters and distributes the information to private companies). It also distributes travel conditions information, such as traffic conditions or road surface conditions, to travelers through Centralized Roadside Equipment (e.g., variable message signs and changeable message signs).

Incident Management Service: The Centralized Control Signal Center provides incident

detection and traffic control functions to route traffic around incident locations and allow

faster response to incidents by emergency resources. These functions are accomplished

by utilizing Centralized Roadside Equipment that is controlled by the Centralized Control Signal Center.

Figure 1 and Figure 2, Centralized Control Signal Center - Component Interfaces, show the data flow relationships between the Centralized Control Signal Center Component and other associated components.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

5 Centralized Roadside Equipment

5.1 Component Description

The Centralized Roadside Equipment is a public controlled component that consists of signs, signals and surveillance equipment used for the control and management of traffic. Detecting and collecting data about traffic conditions is also performed by this component. Centralized Roadside Equipment is connected to and operated by Centralized Control Signal Centers or Inter-Jurisdictional Traffic Systems. Operation of Centralized Roadside Equipment is achieved via dedicated communication lines that perform real time or near real time control and data collection on the individual devices. Examples of the Centralized Roadside Equipment component include:

- Traffic Signals
- Loop Detectors
- Surveillance Cameras
- Local Intersection Controllers
- Signal Priority/Pre-emption Equipment
- Portable Workzone System
- Portable Traffic Management System
- Railroad Crossing Detectors
- Changeable Message Signs, Variable Message Signs

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Traffic Control Service: The Centralized Roadside Equipment provides the localized arterial traffic functions including: a) control sign and signal modes, b) implement/adapt sign and signal timing plans, and c) sense traffic surveillance data. Data collection and device control are communicated in real time or near real time with the Centralized Control Signal Centers or Inter-Jurisdictional Traffic Systems.

Travel Conditions Information Service: The Centralized Roadside Equipment provides traffic, road surface and weather surveillance data through sensors, probe vehicles and camera equipment along arterial roadways. This data is communicated to Centralized Control Signal Centers or Inter-Jurisdictional Traffic Systems and is used in determining travel conditions along arterial roadways. The Centralized Roadside Equipment also distributes travel conditions information to travelers along arterial roadways through changeable message signs and variable message signs.

Incident Management Service: The Centralized Roadside Equipment provides for incident detection to identify any incidents or emergencies that require support from appropriate resources. It also allows for adjustments in traffic control to enable faster response by incident resources and to reduce impacts due to incidents by allowing traffic to be diverted to alternate routes and by alerting the travelers to conditions that they may encounter due to on-going incidents.

Public Transit Fleet Management Service: The Centralized Roadside Equipment provides signal priority control that allows the Public Transit Vehicles to regain schedule adherence through adjustments in traffic control.

Additional architectural details about this component are located in separate database report documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

6 Centralized/Decentralized Roadside
Equipment Goup

6.1 Component Description

The Centralized/Decentralized Roadside Equipment (Group) is a collection of individual roadside equipment components consisting of:

Centralized Roadside Equipment

Decentralized Roadside Equipment

Each item associated within this group is individually described in this Component Specification.

7 Communication (Group)

7.1 Group Description

The Communications (Group) is a collection of individual communication components consisting of:

External Data Distribution Network

Internal Data Distribution Network

Security Firewall System

Each item associated within this group is individually described in this Component Specification.

8 Decentralized Control Signal Center(s)

8.1 Component Description

The Decentralized Control Signal Center is a public controlled component that is used to manage Decentralized Roadside Equipment components and communicate traffic related data to other Traffic Management Centers. Decentralized roadside equipment components are connected to and operated by the Decentralized Control Signal Center. Decentralized Control Signal Center functional operation includes data collection and data sharing with other traffic management centers and is performed as negotiated between agencies. Decentralized Roadside Equipment is controlled and managed at the center, but the frequency of control is not a real-time operation. Examples of the Decentralized Control Signal Center component include:

Hennepin County Department of Public Works
MnDOT Metro Division -- Oakdale

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Decentralized Control Signal Center provides traffic control functions to route traffic around incident locations and allow faster response to incidents by emergency resources. These functions are accomplished by utilizing Decentralized Roadside Equipment that is controlled by the Decentralized Control Signal Center.

Public Transit Fleet Management Service: The Decentralized Control Signal Center distributes traffic surveillance data and signal timing plan information to Transit Management Center components to support schedule and route planning as well as fleet schedule adherence tracking and control functions.

Ride Matching and Reservations Service: The Decentralized Control Signal Center provides a capability to request and track the location of paratransit and other demand responsive resources (e.g.; drivers and buses) needed to resolve incidents.

Traffic Control Service: The Decentralized Control Signal Center provides on demand arterial traffic management functions including: a) timing plan distribution, and b) collection of data from Decentralized roadside equipment located on arterial roadways.

Data distribution of traffic control conditions to other Traffic Management Centers is also performed by the Decentralized Control Signal Center. Data may not be distributed with a predetermined frequency due to the type of arterial roadways monitored by Decentralized Roadside Equipment.

Travel Conditions Information Service: The Decentralized Control Signal Center a) collects traffic surveillance data from decentralized roadside equipment located on arterial roadways, b) determines traffic conditions along arterial roadways and c) distributes traffic conditions to other public agencies and the Regional ITS Management System (which further filters and distributes the information to private companies). It also distributes travel conditions information, such as traffic conditions or road surface conditions, to travelers through Decentralized Roadside Equipment (e.g., variable message signs and changeable message signs).

Figure 3 and Figure 4, Decentralized Control Signal Center - Component Interfaces, show the data flows relationships between the Decentralized Control Signal Center Component and other associated components.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

9 Decentralized Roadside Equipment

9.1 Component Description

The Decentralized Roadside Equipment is a publicly controlled component that is used to manage traffic flow and provide appropriate information to the traveler. Detecting and collecting data about traffic conditions is also performed by this component. Decentralized Roadside Equipment is connected to and operated individually by Decentralized Control Signal Centers.

Examples of the Decentralized Roadside Equipment component include:

- Traffic Signals
- Loop Detectors
- Surveillance Cameras
- Master Intersection Controller
- Local Intersection Controllers
- Signal Priority/Pre-emption Equipment
- Portable Workzone System
- Portable Traffic Management System
- Railroad Crossing Detectors
- Changeable Message Signs, Variable Message Signs

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Traffic Control Service: The Decentralized Roadside Equipment provides the localized arterial traffic functions including a) control sign and signal modes, b) implement/adapt sign and signal timing plans, and c) sense traffic surveillance data. Data collection and device control are communicated as required with the Decentralized Control Signal Centers.

Travel Conditions Information Service: The Decentralized Roadside Equipment provides traffic, road surface and weather surveillance data through sensors, probe vehicles and camera equipment along arterial roadways. This data is communicated to Decentralized Control Signal Centers and is used in determining travel conditions along arterial roadways. The Decentralized Roadside Equipment also distributes travel conditions information to travelers along arterial roadways through changeable message signs and variable message signs.

Incident Management Service: The Decentralized Roadside Equipment implements incident response timing and sign plans to enable faster response by incident resources and reduces the impact of an incident by a) diverting traffic to alternate routes and b)

alerting travelers to conditions that they may encounter due to on-going incidents.

Public Transit Fleet Management Service: The Decentralized Roadside Equipment

provides signal priority control that allows the Public Transit Vehicles to regain schedule

adherence through adjustments in traffic control.

Additional architectural details about this component are located in separate database report documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

10 Demand Responsive Transit Center(s)

10.1 Component Description

The Demand Responsive Transit Center is a publicly controlled component that is used to manage demand responsive transit systems, which reside outside of the jurisdiction of the Regional ITS Management Center. Demand responsive transit systems provide door-to-door transit service for paratransit and elderly individuals that are unable to use the standard public transit services. Examples of the Demand Responsive Transit Center component include:

- Metro Mobility
- Metro Mobility Contracted Operators
- Plymouth Dial-A-Ride
- ZIPS (Rochester)
- STRIDE (Duluth)
- Specialized Service Program (St. Cloud)

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Demand Responsive Transit Center a) creates its own pricing strategies and sets prices for its services, b) creates and maintains service profiles for users of the Ride Matching and Reservations service and provider profiles for companies or individuals providing rides as part of the Ride Matching and Reservations service, c) collects service usage data and generates service usage statistics that are used in planning changes to the Ride Matching and Reservations service and d) creates and maintains user account information for billing, calculates charges and tracks payments for Ride Matching and Reservations services (as an alternative, the billing and payment functions can be contracted out to an Account Management Provider company). This component communicates with User Interface Equipment to collect service profile data from users. Service usage data and service billing/payment information is also collected from Transit Vehicles by this component.

Incident Management Service: The Demand Responsive Transit Center requests the necessary resources needed to resolve an incident in a timely manner. During the incident, the center tracks the progression of the incident status, monitors the location of

resources in order to determine estimated time of arrival of resources, determines estimated time to clear an incident, monitors the condition of the dispatched resources, and dispatches additional resource requirements as needed. In addition, the various components used by the Demand Responsive Transit Center also provides for incident detection.

Public Transit Fleet Management Service: The Demand Responsive Transit Center coordinates transfers between Public Transit and Demand Responsive Vehicles.

Ride Matching and Reservations Service: The Demand Responsive Transit Center provides a self-contained Ride Matching and Reservations service which includes a) collection of rideshare requests from riders and rideshare offers from providers, b) distribution of information to riders and providers, c) matching of rideshare requests to rideshare offers, d) development of daily route plans for rideshare vehicles, e) collection of service usage data, f) management of rideshare vehicle schedule adherence, g) coordination of passenger transfers between vehicles, h) demand responsive operations, and i) planning capability to continually improve service performance.

Travel Conditions Information Service: The Demand Responsive Transit Center collects schedule adherence information from Transit Service Provider Vehicles and distributes transit conditions information to a) other transit agencies, b) Transit Information Distribution Equipment (for further distribution to transit users) and c) the Regional ITS Management System (for further distribution to private companies).

Trip Planning and Directions Service: The Demand Responsive Transit Center calculates detour routes for its own transit drivers in order to route them around incidents and other travel conditions with minimal impact to their schedule. The detour information is communicated to Transit Vehicles. The Demand Responsive Transit Center also maintains transit route, schedule and fare information for its own transit agency.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

11 Dispatch Center (Group)

11.1 Group Description

The Dispatch Center (Group) is a collection of individual dispatch center components consisting of:

Centralized Control Signal Centers

Decentralized Control Signal Centers

Division of Emergency Management Center

Emergency Vehicle (command center)

External Information Sources (event promoters)

Incident Dispatch Center(s)

Inter-Jurisdictional IM System

Regional ITS Management Center

State Patrol Dispatch Center

Each item associated within this group is individually described in this Component Specification.

12 Division of Emergency Management
Center

12.1 Component Description

The Division of Emergency Management Center is a public controlled component that is used to manage and coordinate Minnesota emergency resources during large-scale disasters. This center will utilize mobile communication centers to provide state level guidance during disaster recovery periods. Examples of the Division of Emergency Management Center component include:

Department of Public Safety -- Division of Emergency Management Office
Division of Emergency Management Mobile Center

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Division of Emergency Management Center will coordinate public and private agency emergency support across jurisdictional boundaries to provide optimum use of resources required to resolve a specific incident.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

13 Emergency Vehicle

13.1 Component Description

The Emergency Vehicle is a collection of vehicles that are utilized for responding to incidents and emergencies. Examples of the Emergency Vehicle Component include:

- State Patrol Vehicles
- City/County/Transit/Local Police Vehicles
- Ambulances
- Fire Vehicles
- Tow Vehicles
- Highway Helper Vehicles
- HAZMAT Vehicles
- Transit Supervisor Vehicles
- Emergency Mobile Communication Vehicles

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Emergency Vehicles are part of the resources used to resolve a specific incident.

Public Transit Fleet Management Service: The Emergency Vehicle provides communications between transit supervisor vehicles and transit centers. The Emergency Vehicle also monitors transit supervisor and transit police vehicle locations to determine which resources should be assigned to a specific incident.

Traffic Control Service: The Emergency Vehicles provide the traffic control service with the function of controlling signal modes. This function may be in the form of traffic signal pre-emption or manually overriding the a traffic signal controller. Not all of the types of Emergency Vehicles will be equipped with pre-emption capability.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

14 External Data Distribution Network

14.1 Component Description

The External Data Distribution Network is a collection of publicly and privately owned components that provides various communication links across multiple media and allows the transmission of information by audio, video, telecommunications, digital networks, etc. This system allows unlimited communication paths for providing information to users that have a connection to one or more components of the system. Examples of the External Data Distribution Network component include:

- AM/FM Radio Stations
- Television Stations
- Microwave Companies
- Cable Providers
- SATCOM Companies
- FM Subcarrier Radio Companies
- Internet Providers
- Phone Companies
- Private Dispatch Radios

15 External Information Sources

15.1 Component Description

The External Information Source(s) are those individuals or agencies that provide information to, or receive information from, Minnesota public agencies and private companies providing ITS services. This information is utilized by a number of the Minnesota ITS services as described below. Examples of the External Information Source(s) component include:

Event Promoters (e.g., sporting events, concerts, circus, conventions, etc.)

National Weather Service

Kavoris

3M, General Mills, other large employers

Map Providers

Department of Motor Vehicles

Drug and Alcohol Test Lab

Personnel Systems

Privately run Road Weather Information System (RWIS)

Travel Agencies, Tourist Agencies

Travel Guide Producers

Chamber of Commerce

State/County Department of Parks and Recreation

Historical Societies

Airline Companies

Rental Car Companies

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The External Information Source(s), such as the Department of Motor Vehicles, serve as a check point for public agencies and private

companies to validate provider profile information (e.g., driving record) received from

individuals and privately-owned transit companies offering rides as part of the Ride

Matching and Reservations service.

Incident Management Service: The External Information Source(s) provide an incident

detection service by notifying dispatch center(s) of incidents and special events.

Acknowledgement messages are returned to notify the source that the message was

received and an appropriate response has been requested.

Public Transit Fleet Management Service: The External Information Source(s) provide

a) airport flight times and airport access road traffic patterns information, b) a standard

link reference model, c) personnel availability and preference information,
d) driver
license expiration data, e) drug/alcohol test results, and f) driver
history and violations
information

Traffic Control Service: The External Information Source(s) provide the
traffic control
service with: a) requirements from private and public agencies, and b)
weather conditions
and forecasts from weather service bureaus.

Travel Conditions Information Service: The External Information Source(s)
provide
various Minnesota agencies and private companies with weather conditions
and road
surface conditions from the National Weather Service and other weather
services and
systems, and planned event information from event promoters (for parades
and special
events) and construction companies. They also provide the common link
reference model
(i.e., map) that all public agencies and information provider companies
will use to geo-reference travel conditions information.

Traveler Services Information Service: The External Information Source(s)
a)
distribute traveler service source data (e.g., restaurant, lodging, special
events, etc.), b)
provide the common link reference model (i.e., map) that all public
agencies and
information provider companies will use to reference traveler services
source data and c)
accept and confirm reservations and ticket purchases for travel, dining and
entertainment.

Trip Planning and Directions Service: The External Information Source(s)
provide the
common link reference model (i.e., map) that all public agencies and
information
provider companies will use to determine routes and detours.

Additional architectural details about this component are located in separate
database reports
document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

16 Financial Institution(s)

16.1 Component Description

The Financial Institution is a privately owned component that is involved in the payment of a user's invoice for transportation services. Examples of the Financial Institution component include:

- Banks
- Credit Unions
- Lending Institutions

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Financial Institution is responsible for the payment of a user's invoice for transportation services through an electronic funds transfer from the user's bank account to either an Account Management Provider, a public agency or a private information provider company (depending on which is handling the billing for the services).

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

17 Freeway Roadside Equipment

17.1 Component Description

The Freeway Roadside Equipment is a publicly controlled component that is used to control and collect data of continuous traffic flow for freeways. In addition, Freeway Roadside Equipment monitors the flow of traffic and detects incidents due to alterations in traffic flow or by use of video surveillance equipment. Traffic flow may be adjusted by use of alternate ramp timing plans or by use of changeable message sign (CMS) or variable message sign (VMS) to alert the traveler of impending traffic conditions and identification of alternate route opportunities. Freeway roadside equipment components are connected to and operated by the Freeway Traffic Management Center. Examples of the Freeway Roadside Equipment component include:

- Ramp Meters
- Loop Detectors
- Surveillance Cameras
- Traffic Radio Signs
- Portable Workzone System
- Portable Traffic Management System
- Changeable Message Signs, Variable Message Signs

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Traffic Control Service: The Freeway Roadside Equipment provides the localized traffic functions including: a) control sign and signal modes, b) implement/adapt sign and signal timing plans, and c) sense traffic surveillance data. Data collection and device control are communicated real time or near real time with the Freeway Traffic Management Center.

Travel Conditions Information Service: The Freeway Roadside Equipment provides traffic, road surface and weather surveillance data through sensors, probe vehicles and camera equipment. This data is communicated to the Freeway Traffic Management Center and is used in determining travel conditions along the freeway. The Freeway Roadside Equipment also distributes travel conditions information to travelers along the freeway through changeable message signs and variable message signs.

Incident Management Service: The Freeway Roadside Equipment provides for incident

detection to identify any incidents or emergencies that require support from appropriate resources. It also allows for adjustments in traffic control to enable faster response by incident resources and to reduce impacts due to incidents by allowing traffic to be diverted to alternate routes and by alerting the travelers to conditions that they may encounter due to on-going incidents.

Public Transit Fleet Management Service: The Freeway Roadside Equipment provides signal priority control that allows the Public Transit Vehicles to regain schedule adherence through adjustments in traffic control.

Additional architectural details about this component are located in separate database report documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

18 Freeway Traffic Management Center

18.1 Component Description

The Freeway Traffic Management Center is a public controlled component that is used to manage continuous traffic flow and provide appropriate information to the freeway travelers and other Traffic Management Centers. In addition, the Freeway Traffic Management Center manages and collects data from Freeway Roadside Equipment. The information collected from Freeway Roadside Equipment is used to monitor the flow of traffic and detects incidents due to alterations in traffic flow or by use of video surveillance equipment. Traffic flow may be adjusted by use of alternate signal timing plans, changeable message signs (CMS) or variable message signs (VMS), to alert the freeway traveler of impending traffic conditions and identify of alternate route opportunities. Freeway roadside equipment components are connected to and operated by the Freeway Traffic Management Center. Examples of the Freeway Traffic Management Center component include:

Metro Area TMC (includes KBEM radio station)

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Freeway Traffic Management Center provides for incident detection to identify any incidents or emergencies that require support from appropriate resources. It also allows for adjustments in traffic control to enable faster response by incident resources and to reduce impacts due to incidents by allowing traffic to be diverted to alternate routes and by alerting the travelers to conditions that they may encounter due to on-going incidents. Highway Helper Vehicles provide a patrol capability to find and assist in clearing incidents from the roadways such as to minimize disruptions to traffic flow.

Public Transit Fleet Management Service: The Freeway Traffic Management Center distributes traffic surveillance data and signal timing plan information to Transit Management Center components to support schedule and route planning as well as fleet schedule adherence tracking and control functions.

Ride Matching and Reservations Service: The Freeway Traffic Management Center provides a capability to request and track the location of paratransit and other demand responsive resources (e.g.; drivers and buses) needed to resolve incidents.

Traffic Control Service: The Freeway Traffic Management Center provides freeway management functions for a) managing traffic control requirements, strategies and plans, b) managing signal and signing resources, c) controlling signal and sign modes for freeway roadside equipment, d) sensing traffic surveillance data from freeway roadside equipment, e) collecting traffic surveillance data from freeway roadside equipment, f) determining traffic conditions, and g) distributing traffic conditions to other traffic management centers and freeway users.

Travel Conditions Information Service: The Freeway Traffic Management Center a) collects traffic surveillance data from freeway roadside equipment, b) determines traffic conditions along freeways and c) distributes traffic conditions to other public agencies and the Regional ITS Management System (which further filters and distributes the information to private companies). It also distributes travel conditions information, such as traffic conditions or road surface conditions, to travelers through Freeway Roadside Equipment (e.g., variable message signs and changeable message signs).

Figure 8, Figure 9, and Figure 10, Freeway Traffic Management Center - Component Interfaces, show the data flow relationships between the Freeway Traffic Management Center Component and other associated components.

Additional architectural details about this component are located in separate database report documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

19 Incident Dispatch Center(s)

19.1 Component Description

The Incident Dispatch Center(s) are public and private controlled components that are used to during incidents and emergencies. They provide the necessary resources required to resolve an incident. These centers communicate with various vehicle components which are utilized to assist in the resolution of incidents. Examples of the Incident Dispatch Center component include:

- Towing
- Medical
- Fire
- City/County/Transit Police
- HAZMAT
- Private Security
- Public Safety

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Incident Dispatch Center(s) request the necessary resources needed to resolve an incident in a timely manner. During the incident, the center(s) track the progression of the incident status, monitor the location of resources in order to determine estimated time of arrival of resources, determine estimated time to clear an incident, monitor the condition of the dispatched resources, and dispatches additional resource requirements as needed. In addition, the various components used by the Incident Dispatch Center(s) also provide for incident detection.

Traffic Control Service: The Incident Dispatch Center(s) provide traffic control service with requirements for traffic control when an incident occurs. An Incident Dispatch center will also dynamically create traffic sign and signal plans and detours/barricades to meet the incident traffic requirements.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

20 Information Provider(s)

20.1 Component Description

The Information Provider is a privately owned component that collects travel-related information from the public sector and private information sources, customizes and/or packages the information to the needs of its customers, and distributes the information via user interface equipment (e.g., telephone, computer, etc.). Examples of the Information Provider component include:

- Connect
- Taxi Companies
- Delivery Service Companies
- Auto Clubs (e.g., AAA)
- Travel Agencies

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Travel Conditions Information Service: The Information Provider a) collects travel conditions data from public agencies and private information sources, b) filters and packages the travel conditions data and c) distributes travel conditions information to its customers via User Interface Equipment (e.g.; telephone, computer).

Trip Planning and Directions Service: The Information Provider a) calculates the best single or multiple mode route between origin and destination points for travelers, b) computes step-by-step directions for travelers and c) assembles and distributes trip itinerary information to travelers via User Interface Equipment (e.g.; telephone, computer, fax, e-mail). The Information Provider also distributes public transit route and schedule information to transit users.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

21 Information Provider Roadside Equipment

21.1 Component Description

The Information Provider Roadside Equipment is a privately owned component that is used to monitor traffic, weather and road surface conditions through use of video surveillance equipment. Information Provider Roadside Equipment components are connected to and operated by Tailored Traveler Information Provider(s). Examples of the Information Provider Roadside Equipment component include:

Surveillance Cameras

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Travel Conditions Information Service: The Information Provider Roadside Equipment provides traffic, road surface and weather surveillance data through surveillance camera equipment. This data is communicated to Tailored Traveler Information Provider(s) and is used in determining travel conditions along freeways and arterials.

Additional architectural details about this component are located in separate database report documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

22 Inter-Jurisdictional Incident Management System

22.1 Component Description

The Inter-Jurisdictional Incident Management System is a public controlled component that assists in the management and coordination of inter-jurisdictional resources during incidents and emergencies. This system provides the coordination procedures which determine how a given incident is managed when multiple agencies are required to resolve an incident. This system is connected to various vehicle components which are utilized to assist in the resolution of incidents. Examples of the Inter-Jurisdictional Incident Management System component include:

Highway Helper Automatic Vehicle Location System

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Inter-Jurisdictional Incident Management System coordinates public and private agency support across jurisdictional boundaries to provide optimum use of resources required to resolve a specific incident.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

23 Inter-Jurisdictional Traffic System

23.1 Component Description

The Inter-Jurisdictional Traffic System is a public controlled component that is used to a) manage Centralized Roadside Equipment components and Freeway Roadside Equipment components, and b) distribute traffic related data to other Traffic Management Centers.

Centralized roadside equipment components and freeway roadside components are connected to, and operated by, the Inter-Jurisdictional Traffic System. It may be located within a centralized or decentralized control signal center, the freeway traffic management center, a separate location, or distributed at multiple locations. Examples of the Inter-Jurisdictional Traffic System component include:

Integrated Corridor Traffic Management System (ICTM)

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Public Transit Fleet Management Service: The Inter-Jurisdictional Traffic System distributes traffic surveillance data and signal timing plan information to Transit Management Center components to support schedule and route planning as well as fleet schedule adherence tracking and control functions.

Traffic Control Service: The Inter-Jurisdictional Traffic System provides traffic management functions for a) managing traffic control requirements, strategies and plans, b) managing signal and signing resources, c) controlling signal and sign modes for centralized roadside equipment and freeway roadside equipment, d) sensing traffic surveillance data from centralized roadside equipment and freeway roadside equipment, e) collecting traffic surveillance data from centralized roadside equipment and freeway roadside equipment, f) determining traffic conditions, and g) distributing traffic conditions to other traffic management centers.

Travel Conditions Information Service: The Inter-Jurisdictional Traffic System a) collects traffic surveillance data from centralized roadside equipment and freeway roadside equipment, b) determines traffic conditions along arterial roadways and freeways and c) distributes traffic conditions to other public agencies and the Regional

ITS Management System (which further filters and distributes the information to private companies).

Figure 11, Inter-Jurisdictional Traffic System - Component Interfaces, shows the data flows relationships between the Inter-Jurisdictional Traffic System Component and other associated components.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

24 Inter-Jurisdictional Transit System

24.1 Component Description

The Inter-Jurisdictional Transit System is a publicly controlled component that is used to manage passenger transfers and coordinate operations between transit systems that span transit agency jurisdictions.

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Public Transit Fleet Management Service: The Inter-Jurisdictional Transit System provides information that supports and facilitates passenger transfer timing and implementation between multiple transit agencies, and between transit agencies and ride matching and reservation service providers.

Ride Matching and Reservations Service: The Inter-Jurisdictional Transit System provides information that supports and facilitates passenger transfer timing and implementation between multiple ride matching and reservation service providers, and between transit agencies and ride matching and reservation service providers.

Trip Planning and Directions Service: The Inter-Jurisdictional Transit System calculates inter-jurisdictional transit routes and directions for transit users whose trip involves transferring between multiple transit and ride matching and reservation agencies.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

25 Internal Data Distribution Network

25.1 Component Description

The Internal Data Distribution Network is a collection of publicly owned components that provides various communication links across multiple media and allows the transmission of information by audio, video, telecommunications, digital networks, etc.. This system allows limited communication paths for providing information to public agency users that have a connection to one or more components of the system. Examples of the Internal Data Distribution Network component include:

- MnDOT Metro Area Intranet
- Telephone System
- Public Dispatch Radio (voice/data)

26 Maintenance Dispatch Center(s)

26.1 Component Description

The Maintenance Dispatch Center(s) are public controlled components that are used for planned incidents (i.e.; road maintenance, snow plowing) and unplanned incidents (i.e., inoperable signal equipment). They provide plans and resources required to resolve an incident where traffic is involved. Also, they provide an incident detection service by using some of the equipment used for their normal operations. These centers communicate with various vehicle components and equipment components utilized in the resolution of incidents. Examples of the Maintenance Dispatch Center component include:

- Waters Edge (MnDOT Metro Region)
- Other Regional Maintenance Dispatch Centers

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Maintenance Dispatch Center(s) provides some of the necessary resources needed to resolve an incident in a timely manner. During the incident, the center(s) track the progression of the incident status, monitor the location of its resources in order to determine estimated time of arrival of resources, determine estimated time to clear an incident, monitor the condition of the dispatched resources, and dispatch additional resources as needed. In addition, the various components used by the Maintenance Dispatch Center also provide for incident detection.

Traffic Control Service: The Maintenance Dispatch Center(s) a) manages traffic control requirements, strategies and plans relating to roadway maintenance activities, b) manages signal and signing resources for roadway maintenance activities, c) controls signal and sign modes for road maintenance roadside equipment, d) senses traffic surveillance data from road maintenance roadside equipment, e) collects traffic surveillance data from road maintenance roadside equipment, f) determines traffic conditions, and g) distributes traffic conditions to other traffic management centers.

Travel Conditions Information Service: The Maintenance Dispatch Center(s) collect information about planned events (e.g., road maintenance) and road surface conditions

(e.g.; current conditions of the roads, roads that have been plowed, etc.) and distributes

this information to other agencies and the Regional ITS Management System (which

further filters and distributes the information to private companies). It may also distribute

travel conditions information, such as road construction, to travelers through Road

Maintenance Roadside Equipment (e.g., variable message signs and changeable message signs).

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

27 Maintenance Garage

27.1 Component Description

The Maintenance Garage(s) are public and privately controlled components that are used for maintenance and repair of vehicles and equipment utilized to resolve incidents and emergencies.

Maintenance notices are generated to notify agencies of required maintenance to vehicles and equipment and completion notices are generated to notify the agencies that the vehicles and equipment are ready to be re-assigned. Examples of the Maintenance Garage component include:

- State Patrol Maintenance Garage
- MnDOT Maintenance Garage

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Maintenance Garage(s) will provide the necessary resources and work areas needed to repair and maintain vehicles and equipment utilized in incident management.

Maintenance Service: (The physical architecture and functional allocations were not performed for this service, and are left for future definition.)

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

28 Maintenance Vehicle

28.1 Component Description

The Maintenance Vehicle component is a collection of maintenance vehicles that are utilized to support road maintenance. Examples of the Maintenance Vehicle component include:

- Snow Plow trucks
- Salt/Sand Trucks
- Road Repair Trucks
- Signal Repair Trucks

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Maintenance Vehicles are part of the resources used to resolve a specific incident.

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

29 Management Center (Group)

29.1 Group Description

The Management Center (Group) is a collection of individual management center components consisting of:

- Division of Emergency Management Center
- Freeway Traffic Management Center
- Inter-Jurisdictional Incident Management System
- Inter-Jurisdictional Transit System
- Parking Management Center(s)
- Regional ITS Management Center
- Regional ITS Management System
- Road Weather Information Center
- Toll Authority Center(s)
- Transit Maintenance Garage
- Truck Center

Each item associated within this group is individually described in this Component Specification.

30 Mayday Service Provider(s)

30.1 Component Description

The Mayday Service Provider is a private controlled component that is used to detect incidents and emergencies. It provides a fee paid service that receives incident data from clients, identifying incidents or emergencies that require some type of resource to resolve the problem.

The Mayday Service Provider contacts the appropriate public or private agency to request a

resource assignment such that the incident is resolved in a timely fashion.

Examples of the

Mayday Service Provider component include:

Mayday Service Companies

This component may support multiple Minnesota ITS services. The following list summarizes

the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Mayday Service Provider a) creates its own pricing

strategies and sets prices for its services, b) creates and maintains service profiles for

users of the Mayday service, c) collects service usage data and generates service usage

statistics that are used in planning changes to the Mayday service and d) creates and

maintains user account information for billing, calculates charges and tracks payments for

the Mayday service (as an alternative, the billing and payment functions can be

contracted out to an Account Management Provider company). This component communicates with User Interface Equipment to collect service profile data from users.

Incident Management Service: The Mayday Service Provider will contact the appropriate dispatch center to request the necessary resources needed to resolve an

incident in a timely manner. Information will be transferred to Account Management

Service for appropriate billing.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

31 Other Public Agencies

The Other Public Agencies component includes Minnesota public agencies that are not directly involved in providing ITS services, but provide input to those agencies that do provide ITS services. Examples of the Other Public Agencies component include:

- State/County Economic Development Agencies
- Social Services Agencies

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: Other Public Agencies provide input to various Minnesota public agencies about pricing policies and structures (e.g., offering discounts on transit fares to senior citizens or students, or discounts on tolls or parking fees for carpool drivers) for the transportation services they provide.

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

32 Other Transit Management Center(s)

32.1 Component Description

The Other Transit Management Center is a publicly controlled component that is used to manage transit systems outside of the jurisdiction of the Regional ITS Management Center.

Examples of the Other Transit Management Center component include:

- Southwest Transit
- Minnesota Valley Transit
- Plymouth Metrolink
- School Bus Fleet Companies

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Other Transit Management Center a) creates its own pricing strategies and sets prices for its services, b) collects service usage data and generates service usage statistics that are used in planning changes to its transit services and c) creates and maintains user account information for billing, calculates charges and tracks payments for transit services (as an alternative, the billing and payment functions can be contracted out to an Account Management Provider company). Service usage data and service billing/payment information is also collected from Transit Vehicles and Transit Route Equipment by this component.

Public Transit Fleet Management Service: The Other Metro Transit Management Center provides a self-contained transit fleet management service which includes a) long term analysis and planning, b) planning of bus routes and schedules, c) management of vehicle and driver assignments, d) collection and management of rider usage data, e) management of vehicle schedule adherence, and f) coordination of passenger transfers.

Ride Matching and Reservations Service: The Other Transit Management Center monitors vehicle locations and coordinates passenger transfers between their vehicles and other connecting vehicles.

Travel Conditions Information Service: The Other Transit Management Center collects schedule adherence information from Transit Vehicles and distributes transit conditions information to other transit agencies, Transit Information Distribution Equipment (for

further distribution to transit users) and to the Regional ITS Management System (for further distribution to private companies).

Traveler Services Information Service: The Other Transit Management Center distributes traveler services source data (e.g. information about how to use the transit system) to the Regional ITS Management System (for further distribution to private companies).

Trip Planning and Directions Service: The Other Transit Management Center a) calculates the best transit route between origin and destination points for transit users, b) computes transit directions for transit users, c) calculates detour routes for its own transit drivers in order to route them around incidents and other travel conditions with minimal impact to transit schedules and d) distributes transit trip itinerary information to transit users via Transit Information Distribution Equipment or User Interface Equipment.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

33 Parking Management Center(s)

33.1 Component Description

The Parking Management Center is a public owned and controlled component that manages parking facilities and distributes information about parking conditions and parking facilities to the Regional ITS Management System. Parking Management Roadside Equipment components are connected to and operated by the Parking Management Center. It should be noted that the Parking Management Center component could be privately owned and controlled. Examples of the Parking Management Center component include:

- City of Minneapolis Transportation
- City of St. Paul Department of Public Works
- Privately Owned and Operated Parking Facilities

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Parking Management Center a) creates its own pricing strategies and sets prices for its services, b) collects service usage data and generates service usage statistics that are used in planning changes to its parking services and c) creates and maintains user account information for billing, calculates charges and tracks payments for parking services (as an alternative, the billing and payment functions can be contracted out to an Account Management Provider company). Service usage data and service billing/payment information is also collected from Parking Management Roadside Equipment by this component.

Travel Conditions Information Service: The Parking Management Center a) collects parking surveillance data from parking roadside equipment located in parking facilities, b) determines parking conditions in the parking facility (e.g., number of spaces left in the parking lot) and c) distributes parking conditions to the Regional ITS Management System (which further distributes the information to private companies). It also distributes travel conditions information, such as traffic conditions or road surface conditions, to travelers through Parking Management Roadside Equipment (e.g., monitors in parking facilities, changeable message signs, variable message signs).

Traveler Services Information Service: The Parking Management Center distributes traveler services source data (e.g. parking locations and parking facility information) to the Regional ITS Management System (for further distribution to private companies). The Parking Management Center also accepts and confirms reservations for parking.

Trip Planning and Directions Service: The Parking Management Center distributes parking rate information to the Regional ITS Management System. This information is used by providers of the Trip Planning and Directions Service in determining trip costs.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

34 Parking Management Roadside Equipment

34.1 Component Description

The Parking Management Roadside Equipment is a public controlled component that is used to manage traffic flow into and out of parking facilities, collect parking fee payment and service usage data and provide appropriate information to the traveler. Parking conditions data (e.g., number of parking spaces available, status of the lot, etc.) is also detected and collected by this component. Parking Management Roadside Equipment is connected to and operated by Parking Management Centers. It should be noted that the Parking Management Roadside Equipment component could be privately owned and controlled. Examples of the Parking Management Roadside Equipment component include:

- Parking Fee Collection System
- Parking Ramp Occupancy Signs
- AVI System
- Parking Lot Gates and Counters
- CMS/VMS Signs
- Television Monitors

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Parking Management Roadside Equipment calculates charges for parking services. It also collects payment or service usage data (to be used to create an invoice at a later time) from a Payment Instrument or Basic Vehicle component. Parking Management Roadside Equipment communicates with, and is controlled by, the Parking Management Center.

Travel Conditions Information Service: The Parking Management Roadside Equipment provides parking surveillance data through sensors located at the entrances and exits of parking facilities. This data is communicated to Parking Management Centers and is used in determining parking conditions in a facility. The Parking Management Roadside Equipment also distributes travel conditions information to travelers in parking facilities through the use of monitors or variable message signs and changeable message signs.

Additional architectural details about this component are located in separate database report documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

35 Payment Instrument

35.1 Component Description

The Payment Instrument is a collection of financial instruments that could be used for the payment of transportation services. Examples of the Payment Instrument component include:

- Smart Cash
- Smart Cards
- Credit Cards
- Debit Cards
- Subscription Tags or Passes
- Tokens

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Payment Instrument provides a means for the electronic payment of ITS services by either providing an electronic account from which service fees can be deducted, or by providing user identification information that can be used for charging an account and recording service usage. The Payment Instrument provides information to, and receives information from, Roadside Equipment (for tolls and parking fees), Transit Route Equipment and Transit Vehicles (for transit fares).

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

36 Probe Vehicle(s)

36.1 Component Description

The Probe Vehicle(s) is a vehicle that measures and reports traffic flow conditions to roadside devices for relay to a traffic control center. A probe vehicle is used when real-time data is required for traffic flow analysis and there are no other methods of measurement. Examples of the Probe Vehicle component include:

- Personal Vehicles
- Buses

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Traffic Control Service: The Probe Vehicle measures and collects traffic flow conditions data. The data is transmitted to roadside equipment components and forwarded to traffic centers. Data generated by the probe vehicle is used for analyzing traffic conditions along pre-determined routes.

Travel Conditions Information Service: The Probe Vehicle measures and collects traffic flow conditions data. The data is transmitted to roadside equipment components and forwarded to traffic centers. Data generated by the probe vehicle is used for analyzing traffic conditions along pre-determined routes.

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

37 Regional ITS Management Center

37.1 Component Description

The Regional ITS Management Center is a publicly controlled component used to manage and coordinate multiple ITS operations. This component is planned to be a shared facility that consolidates both MCTO and Metro Mobility central operations centers as well as other ITS organizations that could benefit from future consolidation efforts. This component also provides a home for multiple Inter-Jurisdictional Transit and Traffic Systems, and will allow the operations and maintenance cost of these systems to be optimized. Examples of the Regional ITS Management Center component include:

MnDOT's next generation TMC (i.e., shared facility that includes traffic control, incident management, transit, regional ITS management systems and inter-jurisdictional systems)

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Regional ITS Management Center a) creates its own pricing strategies and sets prices for its transit services, b) collects service usage data and generates service usage statistics that are used in planning changes to its transit services and c) creates and maintains user account information for billing, calculates charges and tracks payments for transit services (as an alternative, the billing and payment functions can be contracted out to an Account Management Provider company).

Service usage data and service billing/payment information is also collected from Transit Vehicles and Transit Route Equipment by this component.

Incident Management Service: The Regional ITS Management Center coordinates public and private agency emergency support across jurisdictional boundaries to provide optimum use of resources required to resolve a specific incident.

Public Transit Fleet Management Service: The Regional ITS Management Center provides a self-contained transit fleet management service which includes a) long term analysis and planning, b) planning of bus routes and schedules, c) management of vehicle and driver assignments, d) collection and management of rider usage data, e) management of vehicle schedule adherence, and f) coordination of passenger transfers.

Ride Matching and Reservations Service: The Regional ITS Management Center provides a self-contained Ride Matching and Reservations service which includes a) collection of rideshare requests from riders and rideshare offers from providers, b) distribution of information to riders and providers, c) matching of rideshare requests to rideshare offers, d) development of daily route plans for rideshare vehicles, e) collection of service usage data, f) management of rideshare vehicle schedule adherence, g) coordination of passenger transfers between vehicles, h) demand responsive operations, and i) planning capability to continually improve service performance.

Travel Conditions Information Service: The Regional ITS Management Center collects schedule adherence information from Transit Vehicles and distributes transit conditions information to other transit agencies, Transit Information Distribution Equipment (for further distribution to transit users), and to the Regional ITS Management System (for further distribution to private companies).

Traveler Services Information Service: The Regional ITS Management Center distributes traveler services source data (e.g. information about how to use the transit system) to the Regional ITS Management System (for further distribution to private companies).

Trip Planning and Directions Service: The Regional ITS Management Center a) calculates the best transit route between origin and destination points for transit users, b) computes transit directions for transit users, c) calculates detour routes for its own transit drivers in order to route them around incidents and other travel conditions with minimal impact to their schedule and d) distributes transit trip itinerary information to transit users via User Interface Equipment (e.g.; telephone, computer, fax, e-mail, kiosk). Detour information is distributed to Transit Vehicles.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

38 Regional ITS Management System

38.1 Component Description

The Regional ITS Management System is a publicly controlled component that acts as a central data repository, manages interfaces between public agencies and private companies, filters information being distributed from public agencies so that private companies only receive the information they need and are legally allowed to receive, distributes information from public agencies to private companies, and stores public agency information for backup and recovery purposes. This system may reside in a Regional ITS Management Center or other center depending on financial and other constraints. Examples of the Regional ITS Management System component include:

- Data Servers
- System Manager Software

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Public Transit Fleet Management Service: The Regional ITS Management System acts as a central data repository and collects and distributes information that supports the Public Transit Fleet Management Service and distribute daily transit fleet operations.

Ride Matching and Reservations Service: The Regional ITS Management System acts as a central data repository and collects and distributes information that supports the Ride Matching and Reservations Service and distributes daily operations.

Travel Conditions Information Service: The Regional ITS Management System a) collects travel conditions information being created and distributed by all the various public agencies, b) filters the information for distribution to private companies (e.g., Tailored Traveler Information Provider(s)), c) distributes travel conditions to private companies, d) retains the travel conditions information from public agencies for backup and recovery purposes and e) manages the information that defines the interfaces between public and private agencies.

Traveler Services Information Service: The Regional ITS Management System distributes public traveler services source data (e.g., parking information and transit mode

use information) to private companies and manages the information that defines the interfaces between public and private agencies.

Trip Planning and Directions Service: The Regional ITS Management System a) collects transit route and schedule information, parking rates and toll information created and distributed by various public agencies, b) distributes transit route and schedule, parking rate and toll information to private companies and c) manages the information that defines the interfaces between public and private agencies.

Figure 18 and Figure 19, Regional ITS Management System - Component Interfaces shows the data flow relationships between the Regional ITS Management System and other associated components.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

39 Rideshare Center

39.1 Component Description

The Rideshare Center component is publicly owned and manages carpool and vanpool operations. Examples of the Rideshare Center component include:

- Minnesota Rideshare for Twin Cities
- Minnesota Rideshare for St. Cloud
- Minnesota Rideshare for Duluth

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Rideshare Center component creates and maintains service profiles for users of the Ride Matching and Reservations service and provider profiles for companies or individuals providing rides as part of the Ride Matching and Reservations service. This component communicates with User Interface Equipment to collect service profile data from users.

Ride Matching and Reservations Service: The Rideshare Center component provides a) collection of rideshare requests from riders and rideshare offers from providers, b) distribution of information to riders and carpool/vanpool providers, c) matching of riders into available carpool and vanpool groups, d) development of route plans for rideshare vehicles, e) collection of service usage data, and f) planning capability to continually improve service performance.

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

40 Road Maintenance Roadside Equipment

40.1 Component Description

The Road Maintenance Roadside Equipment is a public controlled component that is used to manage traffic flow and provide appropriate information to the traveler in areas where

maintenance is required. Traffic flow may be adjusted by use of traffic control signing to alert the traveler of impending traffic conditions and identification of alternate route opportunities. Road

Maintenance roadside equipment components are operated by the Maintenance Dispatch Center.

Examples of the Road Maintenance Roadside Equipment component include:

- Arrow Boards
- Barricades
- Portable Changeable Message Signs
- Portable Variable Message Signs

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Traffic Control Service: The Road Maintenance Roadside Equipment provides portable and localized arterial and freeway traffic control functions including a) control sign and signal modes, b) implement/adapt sign and signal timing plans, and c) sense traffic surveillance data. Data collection and device control are communicated in several methods (i.e.; on-demand, real time or near real time) with traffic centers.

Travel Conditions Information Service: The Road Maintenance Roadside Equipment distributes travel conditions information, such as road construction, to travelers through changeable message signs and variable message signs.

Incident Management Service: The Road Maintenance Roadside Equipment provides for adjustments in traffic control to enable faster response by incident resources and to reduce impacts due to incidents by allowing traffic to be diverted to alternate routes and by alerting the travelers to conditions that they may encounter due to on-going incidents.

Components of Road Maintenance Roadside Equipment can also be utilized to detect incidents and monitor incident status and resource location.

Additional architectural details about this component are located in separate database report documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

41 Road Weather Information Center

41.1 Component Description

The Road Weather Information Center is a public controlled component that is used to manage Road Weather Roadside Equipment components and communicate weather and road surface conditions information to other agencies and the Regional ITS Management System.

Road Weather Roadside Equipment components are connected to and operated by the Road Weather Information Center. A privately run Road Weather Information Center is shown in the physical diagrams as a component called External Information Sources.

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

- Travel Conditions Information Service: The Road Weather Information Center
- a) collects road surface surveillance data and weather surveillance data from road weather roadside equipment located on freeways and arterial roadways, b) determines road surface conditions and weather conditions along freeways and arterial roadways and
 - c) distributes road surface conditions and weather conditions to other public agencies and the Regional ITS Management System (which further distributes the information to private companies).

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

42 Road Weather Roadside Equipment

42.1 Component Description

The Road Weather Roadside Equipment is a public controlled component that is used to collect data about weather, and weather-related road surface conditions, along freeways and arterial roadways. Road Weather Roadside Equipment components are connected to and operated by the Road Weather Information Center. Examples of the Road Weather Roadside Equipment component include:

- Road Surface Sensors (RWIS system)
- Weather Sensors (RWIS system)

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Travel Conditions Information Service: The Road Weather Roadside Equipment provides road surface and weather surveillance data through sensors in and along the roadway. This data is communicated to the Road Weather Information Center and is used in determining weather conditions and road surface conditions along freeways and arterial roadways.

Additional architectural details about this component are located in separate database report documents titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

43 Roadside Equipment (Group)

43.1 Group Description

The Roadside Equipment (Group) is a collection of individual roadside components consisting of:

- Centralized Roadside Equipment
- Decentralized Roadside Equipment
- Freeway Roadside Equipment
- Information Provider Roadside Equipment
- Parking Management Roadside Equipment
- Road Maintenance Roadside Equipment
- Road Weather Roadside Equipment
- Security Roadside Equipment
- Toll Collection Roadside Equipment
- Transit Route Equipment

Each item associated within this group is individually described in this Component Specification.

44 Security Firewall System

44.1 Component Description

The Security Firewall System is a collection of publicly owned components that provides communication links between the External Data Distribution Network and the Internal Data Distribution Network. This system allows limited communication paths for providing information to users that have a connection to one or more components of the Minnesota ITS. The main function of this system is to limit access by private individuals and agencies to internal data maintained by the public agencies in the Minnesota ITS.

45 Service Provider (Group)

45.1 Group Description

The Service Provider (Group) is a collection of individual service provider components consisting of:

Account Management Provider(s)

Broadcast Information Provider(s)

Financial Institution(s)

Information Provider(s)

Mayday Service Provider(s)

Tailored Traveler Information Provider(s)

Transit Service Provider(s)

Each item associated within this group is individually described in this Component Specification.

46 State Patrol Dispatch Center

46.1 Component Description

The State Patrol Dispatch Center is a public controlled component that manages Minnesota State Patrol resources and communicates incident data and resource requests to other public and private agencies. Emergency vehicle components are connected to and operated by the State Patrol Dispatch Center. Examples of the State Patrol Dispatch Center component include:

- Waters Edge (Metro Region) State Patrol Dispatch Center
- Other Regional State Patrol Dispatch Centers
- Mobile Command/Communication Center

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The State Patrol Dispatch Center dispatches emergency vehicles (State Patrol) to incidents, and notifies additional public and private agencies to request additional resources required to resolve a specific incident. In addition, State Patrol Dispatch Center collects incident detection data from its patrol vehicles, and provides an E-911 service for collection of incident information from private individuals.

Traffic Control Service: The State Patrol Dispatch Center(s) provides requirements for traffic control when an incident occurs. A State Patrol Dispatch Center will also dynamically create traffic sign and signal plans to meet the incident traffic requirements.

Travel Conditions Information Service: The State Patrol Dispatch Center(s) collects incident data and distributes incident conditions information to other public agencies and the Regional ITS Management System (which further filters and distributes the information to private companies).

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

47 Tailored Traveler Information Provider

47.1 Component Description

The Tailored Traveler Information Provider is a privately owned component that collects travel-related information from the public sector and private information sources, tailors the information to the needs specified in service subscriber profiles, and distributes the tailored information to the subscribers via a variety of user interface equipment (e.g., phone, fax, computer, pager, etc.) Information provider roadside equipment components are connected to, and operated by, the Tailored Traveler Information Provider component. Examples of the Tailored Traveler Information Provider component include:

- Traveler Information Center (future)
- Taxi Companies, UPS, FedEx (tailor travel conditions information for their own fleet use)

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions supported by this component.

Account Management Service: The Tailored Traveler Information Provider a) creates its own pricing strategies and sets prices for its services, b) creates and maintains service profiles for users of the Travel Conditions Information, Trip Planning and Directions and Traveler Information services, c) collects service usage data and generates service usage statistics that are used in planning changes to its services and d) creates and maintains user account information for billing, calculates charges and tracks payments for its services (as an alternative, the billing and payment functions can be contracted out to an Account Management Provider company). This component communicates with User Interface Equipment to collect service profile data from users.

Public Transit Fleet Management Service: The Tailored Traveler Information Provider a) maintains mode use instructions and transit conditions information for eventual distribution to transit users, b) monitors travel conditions along transit routes, and c) determines optimum detour routes around accidents and congestion.

Ride Matching and Reservations Service: The Tailored Traveler Information Provider a) maintains mode use instructions and transit conditions information for eventual

distribution to transit users, b) monitors travel conditions along rideshare vehicle routes, and c) determines optimum detour routes around accidents and congestion.

Travel Conditions Information Service: The Tailored Traveler Information Provider a) collects travel conditions data from public agencies, private information sources and information provider roadside equipment located on freeways and arterial roadways, b) determines travelers that are affected by the travel conditions through the use of user profiles, c) notifies travelers about the specific travel conditions affecting them through a variety of User Interface Equipment (e.g., phone, pager, computer, fax), and d) distributes travel conditions information to public agencies when requested.

Traveler Services Information Service: The Tailored Traveler Information Provider a) collects traveler services source data from public agencies and private information sources, b) tailors traveler services information to a user's specific request and to criteria in a user's profile, c) provides users with the capability to make reservations and/or purchase tickets for travel, dining, entertainment and parking, and d) distributes traveler services information to users via User Interface Equipment (e.g., phone, pager, computer, fax).

Trip Planning and Directions Service: The Tailored Traveler Information Provider a) calculates the best single or multiple mode route between origin and destination points for travelers, b) computes step-by-step directions for travelers and c) assembles and distributes trip itinerary information to travelers via User Interface Equipment (e.g., telephone, computer, fax, e-mail). The Tailored Traveler Information Provider also distributes public transit route and schedule information to transit users.

Figure 22 and Figure 23, Tailored Traveler Information Provider - Component Interfaces, shows the data flow relationships between the Tailored Traveler Information Provider Component and other associated components.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

48 Toll Authority Center(s)

48.1 Component Description

The Toll Authority Center is a publicly owned and operated component that manages toll roadways. Toll Collection Roadside Equipment components are connected to and operated by the Toll Authority Center. It should be noted that the Toll Authority Center component could be privately owned and controlled.

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Toll Authority Center a) creates its own pricing strategies and sets prices for its services, b) collects service usage data and generates service usage statistics that are used in planning changes to tolls and c) creates and maintains user account information for billing, calculates charges and tracks payments for tolls (as an alternative, the billing and payment functions can be contracted out to an Account Management Provider company). Service usage data and service billing/payment information is also collected from Toll Collection Roadside Equipment by this component.

Trip Planning and Directions: The Toll Authority Center distributes roadway toll information to the Regional ITS Management System. This information is used by providers of the Trip Planning and Directions Service in determining trip costs.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

49 Toll Collection Roadside Equipment

49.1 Component Description

Toll Collection Roadside Equipment is a public controlled component that is used to collect toll payments and service usage data. Toll Collection Roadside Equipment is connected to, and operated by, a Toll Authority Center. It should be noted that the Toll Collection Roadside Equipment component could be privately owned and controlled. Examples of the Toll Collection Roadside Equipment component include:

- Toll Collection Devices
- Toll Booths
- Toll Tag Readers

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Toll Collection Roadside Equipment calculates toll charges. It also collects payment or service usage data (to be used to create an invoice at a later time) from a Payment Instrument or Basic Vehicle component. Toll Collection Roadside Equipment communicates with, and is controlled by, the Toll Authority Center.

Additional architectural details about this component are located in separate database report documents titled:

- Appendix A. Component Requirements
- Appendix B. Input Data Flows for Components
- Appendix C. Output Data Flows for Components

50 Traffic Signal Center (Group)

50.1 Group Description

The Traffic Signal Center (Group) is a collection of individual traffic signal center components consisting of:

Centralized Control Signal Center(s)

Decentralized Control Signal Center(s)

Inter-Jurisdictional Traffic System

Each item associated within this group is individually described in this Component Specification.

51 Training Center

51.1 Group Description

The Training Center(s) are public and privately controlled components that are used for training of resources utilized to resolve incidents and emergencies. Training requests and training completion notices are generated to document needed training and the successful completion of that training. Examples of the Training Center component include:

- State Patrol Training Facilities
- Emergency Response Training Facilities
- Fire Training Facilities

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Incident Management Service: The Training Center(s) will provide the necessary resources and training facilities required for incident management.

Training Service: (The physical architecture and functional allocations were not performed for this service, and are left for future definition.)

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

52 Transit Information Distribution Equipment

52.1 Component Description

The Transit Information Distribution Equipment is a publicly controlled component that provides the interface for users to send requests for and/or receive transit-related information.

Examples of the Transit Information Distribution Equipment component include:

- Kiosks
- In-vehicle devices
- Variable message signs
- Annunciators
- Telephone

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Travel Conditions Information Service: The Transit Information Distribution Equipment provides users with transit conditions information such as schedule adherence information for transit vehicles.

Traveler Services Information Service: The Transit Information Distribution Equipment maintains comprehensive traveler services information relative to areas around transit stops and distributes traveler services information according to a transit user's specific request.

Trip Planning and Directions Service: The Transit Information Distribution Equipment can provide a range of capabilities depending on the type of equipment. It can consist of a kiosk that can calculate transit routes and directions, connecting to the network only for the latest transit conditions information, or it can be a telephone that only allows users to request transit directions or transit trip itineraries, with the actual route and directions calculations taking place on systems located elsewhere in the network. It can also be used to distribute public transit route and schedule information to transit users.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

53 Transit Maintenance Garage

53.1 Component Description

The Transit Maintenance Garage is a publicly controlled component used to house and maintain the transit vehicle fleet as well as coordinate and manage daily vehicle, route and driver assignments. Examples of the Transit Maintenance Garage component include:

MCTO Garages

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Public Transit Fleet Management Service: The multiple Transit Maintenance Garages house the transit vehicle fleet as well as coordinate and manage daily vehicle, route and driver assignments.

Maintenance Service: The multiple Transit Maintenance Garages provide the central focal point for all preventative and on-demand vehicle maintenance activities as supervised by the Maintenance Service.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

54 Transit Management Center (Group)

54.1 Group Description

The Transit Management Center (Group) is a collection of individual transit management center components consisting of:

Demand Responsive Transit Center(s)

Other Transit Management Center(s)

Regional ITS Management Center

Transit Service Provider(s)

Each item associated within this group is individually described in this Component Specification.

55 Transit Route Equipment

55.1 Component Description

Transit Route Equipment is a publicly controlled component that is used to monitor and collect data about transit fleet vehicle flow and transit service usage, collect payment for transit fares and provide appropriate information to the transit route planner. Examples of the Transit Route Equipment component include:

- Fare Collection Devices
- Fare Card/Token Dispensers
- Automatic Passenger Counting System

The following list summarizes the Minnesota ITS service function supported by this component.

Account Management Service: The Transit Route Equipment calculates transit fares. It also collects payment or service usage data (to be used to create an invoice at a later time) from a Payment Instrument component. Transit Route Equipment communicates with, and is controlled by, the Transit Management Center Group of components.

Public Transit Fleet Management Service: The Transit Route Equipment a) monitors and collects transit schedule adherence data, b) determines transit vehicle location, c) enables the collection of passenger usage data at transit stops, and d) provides a communication path from the transit stop to the corresponding Transit Management Center.

Additional architectural details about this component are located in separate database report documents titled:

- Appendix A. Component Requirements

- Appendix B. Input Data Flows for Components

- Appendix C. Output Data Flows for Components

56 Transit Service Provider(s)

56.1 Component Description

The Transit Service Provider is a privately controlled component that provides contracted transit service to riders. Examples of the Transit Service Provider component include:

- Paratransit Operators
- Taxi Service
- DARTS
- HSI

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Transit Service Provider a) creates its own pricing strategies and sets prices for its services, b) creates and maintains service profiles for users of the Ride Matching and Reservations service and provider profiles for companies or individuals providing rides as part of the Ride Matching and Reservations service, c) collects service usage data and generates service usage statistics that are used in planning changes to the Ride Matching and Reservations service and d) creates and maintains user account information for billing, calculates charges and tracks payments for Ride Matching and Reservations services (as an alternative, the billing and payment functions can be contracted out to an Account Management Provider company). This component communicates with User Interface Equipment to collect service profile data from users. Service usage data and service billing/payment information is also collected from Transit Vehicles by this component.

Public Transit Fleet Management Service: The Transit Service Provider coordinates transfers between Public Transit and Demand Responsive Vehicles.

Ride Matching and Reservations Service: The Transit Service Provider provides a self-contained Ride Matching and reservations service which includes a) collection of rideshare requests from riders and rideshare offers from providers, b) distribution of information to riders and providers, c) matching of rideshare requests to rideshare offers, d) development of daily route plans for rideshare vehicles, e) collection of service usage data, f) management of rideshare vehicle schedule adherence, g) coordination of

passenger transfers between vehicles, h) demand responsive operations, and
i) planning
capability to continually improve service performance.

Trip Planning and Directions Service: The Transit Service Provider
calculates detour
routes for its own transit drivers in order to route them around incidents
and other travel
conditions with minimal impact to their schedule. The detour information
is
communicated to Transit Vehicles. The Transit Service Provider also
maintains transit
route, schedule and fare information for its own transit agency.

Additional architectural details about this component are located in separate
database report
documents titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

57 Transit Vehicle

57.1 Component Description

The Transit Vehicle component is a collection of transit vehicles utilized to implement and support transit operations. Examples of the Transit Vehicle component include:

- Buses
- Jitneys
- Taxis
- Carpool Vehicles
- Vanpool Vehicles

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The Transit Vehicle contains equipment that calculates transit fares and collects payment or service usage data (to be used to create an invoice at a later time) from a Payment Instrument component.

Incident Management Service: The Transit Vehicle is used to support emergency evacuations, and is also a source of incident detection data for vehicle breakdowns and security incidents that occur on the vehicle.

Public Transit Fleet Management Service: The Transit Vehicle provides a) vehicle location information, b) vehicle condition information, c) transit condition information, d) service usage information, and e) schedule adherence information to Transit Management Centers. It also f) routes instructions from the Transit Management Centers to the vehicle driver, g) provides signal priority control signals to roadside equipment, and h) provides a communications link between the vehicle and Transit Management Center.

Ride Matching and Reservations Service: The Transit Vehicle provides a) vehicle location information, b) service usage information, and c) schedule adherence information to Demand Responsive Transit Centers, Transit Service Providers and the Regional ITS Management Center. It also d) routes instructions from the these centers to the vehicle driver, and e) provides a communications link between the vehicle and these centers.

Traffic Control Service: The Transit Vehicle provides control of signal modes via traffic signal priority.

Trip Planning and Directions Service: The Transit Vehicle contains communications equipment that allows the driver to request and receive detour information from the corresponding transit center or other designated provider of the Trip Planning and Directions Service.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

58 Truck Center

58.1 Component Description

The Truck Center is a public controlled component that collects and distributes planned event information (i.e., road maintenance) and unplanned event information (i.e., road surface conditions). It is also responsible for granting trucking permits for oversized and overweight vehicles and provides route plans for oversized and overweight vehicles. Examples of the Truck Center component include:

- Waters Edge (MnDOT Metro Region Truck Center)
- Other Regional Truck Centers

This component may support multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Travel Conditions Information Service: The Truck Center collects information about planned events (e.g., road maintenance) and road surface conditions (e.g.; current conditions of the roads, roads that have been plowed, etc.) and distributes this information to other agencies and the Regional ITS Management System (which further filters and distributes the information to private companies). It may also distribute travel conditions information, such as road construction and road surface conditions, through the use of a 1-800 telephone number that travelers can call.

Additional architectural details about this component are located in separate database reports document titled:

- Appendix A. Component Requirements
- Appendix B. Input Data Flows for Components
- Appendix C. Output Data Flows for Components

59 User Interface (Group)

59.1 Group Description

The User Interface (Group) is a collection of individual user interface components consisting of:

Payment Instrument

Transit Information Distribution Equipment

User Interface Equipment

Each item associated within this group is individually described in this Component Specification.

60 User Interface Equipment

60.1 Component Description

The User Interface Equipment component is privately owned and provides the interface by which users send requests for and/or receive travel-related information as well as send and receive Mayday related messages. Examples of the User Interface Equipment component include:

- Telephone
- Fax
- Pager
- Personal computer
- Kiosk
- AM/FM radio
- Television
- Communication devices
- In-vehicle devices

This component supports multiple Minnesota ITS services. The following list summarizes the Minnesota ITS service functions that are supported by this component.

Account Management Service: The User Interface Equipment provides users with the ability to send profile information to, and receive profile confirmations from, the various components that offer Advanced Traveler Information Services.

Incident Management Service: The User Interface Equipment provides users with the ability to send mayday requests to Mayday Service Provider(s) and to receive acknowledgment that their request is being handled by appropriate resources.

Ride Matching and Reservations Service: The User Interface Equipment component provides the rider with a) the ability to request rides, b) information about available rides, and c) imminent arrival notification.

Travel Conditions Information Service: The User Interface Equipment provides users with a) the ability to request travel conditions information, b) the ability to receive notification when travel conditions will affect their travel plans and c) the ability to receive travel conditions information.

Traveler Services Information Service: The User Interface Equipment can provide a range of capabilities depending on the type of equipment. It can consist of a personal

computer that can a) maintain comprehensive traveler service information, connecting to the network only for updates to the source information, b) tailor traveler service information to a user's specific request and to criteria in a user's profile and c) provide users with the capability to make reservations and/or purchase tickets for travel, dining, entertainment and parking. It can also be a telephone that only allows users to request traveler services information, with the actual maintenance and tailoring of the information being performed on systems located elsewhere in the network.

Trip Planning and Directions Service: The User Interface Equipment can provide a range of capabilities depending on the type of equipment. It can consist of a personal computer that can calculate the best single or multiple mode route and directions, connecting to the network only for the latest travel conditions information, or it can be a telephone that only allows users to request directions or trip itineraries, with the actual route and directions calculations taking place on systems located elsewhere in the network. It can also be used to distribute public transit route and schedule information to travelers.

Additional architectural details about this component are located in separate database reports document titled:

Appendix A. Component Requirements

Appendix B. Input Data Flows for Components

Appendix C. Output Data Flows for Components

61 Vehicle (Group)

61.1 Group Description

The Vehicle (Group) is a collection of individual vehicle components consisting of:

Basic Vehicle

Emergency Vehicle

Maintenance Vehicle

Probe Vehicle

Transit Vehicle

Each item associated within this group is individually described in this Component Specification.

AHS	Automated Highway System
AM	Account Management
AMP	Account Management Provider(s)
APTS	Advanced Public Transportation System
ARSI	Automated Roadside Safety Inspection
ARTS	Advanced Rural Transportation System
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AUA	Administer User Accounts
AVC	Advanced Vehicle Classification
AVI	Automated Vehicle Identification
AVL	Automatic Vehicle Location
AVO	Automated Vehicle Operation
AVSS	Advanced Vehicle Safety System
BIP	Broadcast Information Provider(s)
BTC	Determine Basic Travel Conditions and Travel Effects
BTI	Build Trip Itinerary
BTS	Manage Basic Traveler Services Information
BV	Basic Vehicle
CCSC	Centralized Control Signal Center(s)
CD	Compute Directions
CFM	Commercial Fleet Management
CGR	Communication (Group)
CMS	Changeable Message Signs
CRD	Pre-Crash Avoidance
CRE	Centralized Roadside Equipment
CRI	Classify and Record Incidents
CSM	Control Signal Modes
CSIM	Control Signing Modes
CTC	Collect Travel Conditions Source Data
CTD	Collect Traffic Surveillance Data
CTS	Collect Traveler Services Source Data
CV	Commercial Vehicle
CVAC	Commercial Vehicle Automated Clearance
CVAP	Commercial Vehicle Administrative Process
CVEC	Commercial Vehicle Electronic Clearance
CVO	Commercial Vehicle Operator
DAI	Detect and Acknowledge Incidents
DCGR	Dispatch Center (Group)
DCSC	Decentralized Control Signal Center(s)
DEMC	Division of Emergency Management Center
DETC	Determine Traffic Conditions
DITC	Distribute Traffic Conditions
DOT	Department of Transportation
DR	Determine Route
DRE	Decentralized Roadside Equipment
DRI	Distribute Rideshare Information
DRO	Manage Demand Responsive Operations
DRS	Provide Demand Responsive Services
DRTC	Demand Responsive Transit Center(s)
DTC	Distribute Travel Conditions Information
DTPD	Distribute Trip Plans and Directions
DTSI	Distribute Traveler Services Information
DTSPI	Distribute Transit Service Provider Information

DTTS Determine Tailored Traveler Services
 EA Emergency Assistance
 EDDN External Data Distribution Network
 EFM Emergency Fleet Management
 EIS External Information Source(s)
 ENPS Emergency Notification and Personal Security
 EP Electronic Payment
 ER Enforce Regulations
 ERDI En-Route Driver Information
 ERTI En-Route Transit Information
 ESGR External System (Group)
 ETC Electronic Toll Collection
 ETM Emission Testing and Mitigation
 ETS Enter Training Schedule
 EV Emergency Vehicle
 EVM Emergency Vehicle Management
 FHWA Federal Highway Administration
 FI Financial Institution(s)
 FRE Freeway Roadside Equipment
 FTA Federal Transit Administration
 FTMC Freeway Traffic Management Center
 GIS Geographic Information System
 GMP Generate Maintenance Plan
 GTP Generate Training Plan
 HAR Highway Advisory Radio
 HAZMAT Hazardous Materials
 HH Highway Helper
 HMIR Hazardous Material Incident Response
 HOV High Occupancy Vehicle
 IC Commercial Vehicle Inspection/Clearance
 ICA Intersection Collision Avoidance
 IDC Incident Dispatch Center(s)
 IDDN Internal Data Distribution Network
 IJMS Inter-Jurisdictional Incident Management System
 IJTR Inter-Jurisdictional Transit System
 IJTS Inter-Jurisdictional Traffic System
 IM Incident Management
 INCA Intersection Collision Avoidance
 IP Information Provider(s)
 IPRS Information Provider Roadside Equipment
 IRPPR Initiate Response Plans, Procedures, and Routes
 ISCP/STP Implement/Adapt Signing Control Plan
 ISTEAA Intermodal Surface Transportation Efficiency Act
 ITS Intelligent Transportation Systems
 ITSP Implement/Adapt Signal Timing Plan
 IVHS Intelligent Vehicle - Highway Systems
 LAC Lateral Collision Avoidance
 LOC Longitudinal Collision Avoidance
 MCGR Management Center (Group)
 MDC Maintenance Dispatch Center
 MER Manage Enforcement Regulations
 MFO Manage Fleet Operations
 MFR Maintain Fleet Resources
 MIL Manage Incident Log
 MIRA Manage Incident Resource Assignments
 MIRP Manage Incident Response
 MIRS Manage Incident Resources

MMA Manage Maintenance Activity
MMPI Manage Maintenance Planning Information
MMR Manage Mayday Requests
MMRD Manage Maintenance Records
MNT Maintenance
MNTG Maintenance Garage
MPR Manage Pricing Requirements
MPS Manage Pricing Strategies
MPT Manage Passenger Transfers
MPU Manage Passenger Usage Data
MR Make Reservations
MRC Manage Rate Changes
MRP Match Rider With Provider
MRPP Manage Response Plans and Procedures
MRR Manage Response Requirements
MRRO Manage Response Routes
MSA Manage Schedule Adherence
MSIR Manage Signing Resources
MSNEO Manage Signal Network Operations
MSNO Manage Sign Network Operations
MSO Manage Security Operations
MSP Mayday Service Provider(s)
MSPS Manage Service Price Structures
MSR Manage Signal Resources
MSU Manage Service Usage Data
MTA Manage Transit Assignments
MTACT Manage Training Activity
MTFC Manage Traffic Conditions
MTCRD Manage Training Credentials
MTC Monitor Traffic Conditions
MTCDD Manage Travel Conditions Data
MTCI Manage Travel Conditions Information
MTCP Manage Traffic Control Strategies/Plans
MTCR Manage Traffic Control Requirements
MTMC Metro Transit Management Center
MTPD Manage Trip Planning and Directions Data
MTR Manage Training Records
MTSD Manage Traveler Services Data
MTSE Manage Travel Security/Enforcement
MTSER Manage Travel Security/Enforcement Requirements
MTSPR Manage Travel Security Plans and Procedures
MTTP Manage Tailored Trip Plans and Directions
MTTS Manage Tailored Traveler Services
MUSA Manage User Service Accounts
MTTP Manage Tailored Trip Plans and Directions
MTTS Manage Tailored Traveler Services
MV Maintenance Vehicle
MVL Manage Violations Log
NMAS Non-Motorized Access & Security
NYSTA New York State Thruway Authority
OPA Other Public Agencies
OSM On-Board Safety Monitoring
OTMC Other Transit Management Center(s)
PCD Personal Communications Device
PCRD Pre-Crash Restraint Deployment
PDA Personal Digital Assistant
PFO Plan Fleet Operations

PFR Plan Fixed/Flexible Routes, Trips, and Runs
 PI Payment Instrument
 PIR Plan Incident Response
 PM Perform Maintenance Activity
 PMA Plan Maintenance Activity
 PMC Parking Management Center(s)
 PMRE Parking Management Roadside Equipment
 PMT Prioritize Maintenance Tasks
 PMU Personal Messaging Unit
 PPT Personalized Public Transit
 PRO Plan Rideshare Operating Procedures
 PRR Plan Rideshare Routes
 POP Plan Fleet Operating Procedures
 PPE Plan Public Education
 PSDI Plan System Deployment and Implementation
 PSO Plan Security Operations
 PSPS Plan Service Price Structures
 PTA Plan Training Activities
 PTC Perform Training/Certification Activity
 PTCS Plan Traffic Control Strategies
 PTFM Public Transportation Fleet Management
 PTM Public Transportation Management
 PTMS Portable Traffic Management System
 PTR Prioritize Training Tasks
 PTS Public Travel Security
 PTTI Pre-Trip Travel Information
 PV Probe Vehicle
 RC Research Center
 RE Regulation and Enforcement
 REGR Roadside Equipment (Group)
 RG Route Guidance
 RIMC Regional Incident Management Center
 RIMS Regional ITS Management System
 RITS Regional ITS Management Center
 RMR Ride Matching and Reservation
 RMRE Road Maintenance Roadside Equipment
 RRQ Manage Rider Requests
 RSA Manage Rideshare Schedule Adherence
 RSO Manage Rideshare Offers
 RSR Manage Rideshare Requests
 RTM Regional Transit Management Center
 RTMC Regional Traffic Management Center
 RWIC Road Weather Information Center
 RWIS Road Weather Information System
 RWRE Road Weather Roadside Equipment
 SBP Manage Service Billing and Payments
 SCAN Surface Condition Analyzer
 SFS Security Firewall System
 SIP Implement/Adapt Signing Plans
 SIP Service Improvement Planning
 SOV Single Occupancy Vehicle
 SPDC State Patrol Dispatch Center
 SPGR Service Provider (Group)
 SR Safety Readiness
 SRE Security Roadside Equipment
 STD Sensing Traffic Surveillance Data
 STSD Sense Travel Conditions Data

STT	Schedule Trip Times
TA	Travel Assistance
TAC	Toll Authority Center(s)
TC	Traffic Control
TCI	Travel Conditions Information
TCRE Toll	Collection Roadside Equipment
TDM	Travel Demand Management
TFM	Public Transit Fleet Management
TIDE	Transit Information Distribution Equipment
TIRS	Track Incident Resource Status
TMC	Traffic Management Center
TMG	Transit Maintenance Garage
TMGR	Transit Management Center (Group)
TMS	Traffic Management System
TNG	Training
TNGC	Training Center
TOC	Traffic Operations Center
TPD	Trip Planning and Directions
TRB	Transportation Research Board
TRE	Transit Route Equipment
TRKC	Truck Center
TRP	Track Response Progress
TRS	Track Resource Operational Status
TS	Travel Security
TSGR	Traffic Signal Center (Group)
TSI	Traveler Services Information
TSP	Transit Service Provider(s)
TTC	Determine Tailored Travel Conditions
TTE	Determine Tailored Travel Effects
TTI	Transit Traveler Information
TTIP	Tailored Traveler Information Provider(s)
TV	Transit Vehicle
UIE	User Interface Equipment
UIGR	User Interface (Group)
VEC	Vision Enhancement for Crash Avoidance
VGR	Vehicle (Group)
WIM	Weigh In Motion