Statewide Intelligent Transportation Systems
As-Is Agency Reports for Minnesota

Volume 3
Operational Tests

Prepared for the Minnesota Department of Transportation by:

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Statewide ITS As-Is Agency Report for Minnesota
Volume 3
Operational Tests

Volume 1  Mn/DOT Metropolitan Division
1.1  Generic Closed Loop Traffic Control Signal System
1.2  Mn/DOT Advanced Portable Traffic Management System
1.3  Mn/DOT Portable Traffic Management System
1.4  Mn/DOT Metro Division Lane Closure Information System
1.5  Mn/DOT Metro Division Construction Information System

Volume 2  Mn/DOT Traffic Management Center
2.1  Mn/DOT TMC Ramp Meter System
2.2  Mn/DOT TMC Video Surveillance System
2.3  Mn/DOT TMC Changeable Message Sign System
2.4  Mn/DOT TMC Communications System
2.5  Mn/DOT TMC Highway Helper AVL System

Volume 3  Operational Tests
3.1  AUSCI - Adaptive Urban Signal Control and Integration System
3.2  ICTM - Integrated Corridor Traffic Management System
3.3  DIVERT Incident Management System
3.4  Advanced Parking Information System

Volume 4  Metropolitan Council Transit Operations and Metro Mobility
4.1  MCTO Trapeze Scheduling/Planning System
4.2  MCTO Automated Passenger Counting System
4.3  MCTO Electronic Fare Collection System
4.4  MCTO TIC BusLine System
4.5  MCTO TIC Customer Phone Line Service System
4.6  Metropolitan Council Metro Mobility Reservation/Scheduling/Dispatch System
4.7  MCTO Construction Information System

Volume 5  City of Minneapolis
5.1  City of Minneapolis Fortran Traffic Signal Control System
5.2  City Of Minneapolis Parking Management System
5.3  City Of Minneapolis Construction Information System

Volume 6  City of St. Paul
6.1  City of St. Paul Computran Traffic Signal Control System
6.2  City Of St. Paul Construction Information System

Volume 7  Minnesota State Patrol
7.1  Minnesota State Patrol Mobile Data Terminal System
7.2  Minnesota State Patrol Laptop Mobile Data Terminal System
7.3  Minnesota State Patrol Emergency 911 Dispatch System

Volume 8  Miscellaneous
8.1  Minnesota Travel Partners Kiosk System
8.2  Mn/DOT Pavement Condition And Weather Reporting System
8.3  Hennepin County Medical Center Emergency Vehicle Dispatch System
8.4 Metropolitan Airports Commission Parking Management and AVI System
8.5 Gopher State One-Call Excavation Notification System
8.6 Mn/DOT Statewide Construction Information System
8.7 Hennepin County Construction Information System
8.8 Ramsey County Construction Information System
8.9 Mn/DOT ESS Gopher State One-Call Access System
Statewide ITS As-Is Agency Report for Minnesota
Volume 3
Operational Tests

1 Introduction ........................................................................................................... 1

2 Scope .................................................................................................................. 2

2.1 Document Overview ....................................................................................... 2

2.2 Methods, Assumptions and Procedures ........................................................... 2

2.2.1 System Identification .................................................................................. 2

2.2.2 Data Collection Guide .................................................................................. 3

2.2.3 Field Data Collection .................................................................................. 3

3 As-Is Baseline System Documentation ................................................................. 5

3.1 Operational Tests ............................................................................................. 7

3.3.1 AUSCI - Adaptive Urban Signal Control and Integration System ................. 9

3.3.2 ICTM - Integrated Corridor Traffic Management System ......................... 25

3.3.3 DIVERT Incident Management System .................................................... 45

3.3.4 Advanced Parking Information System ....................................................... 63

Appendices

Appendix A As-Is Agency Report for Minnesota Pre-Survey Candidate List

Appendix B As-Is Agency Report for Minnesota Data Collection Guide
1. INTRODUCTION

The purpose 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 a complex system, in terms of a set of smaller, more manageable systems which are fully defined in terms of their individual boundaries, functions, physical components, and interfaces. They illustrate how each of the systems interrelate and contribute to the overall ITS objectives and requirements.

A well defined architecture provides many benefits for a complex system. It defines and optimizes the location of system functions. It identifies critical interfaces, and illustrates how associated systems can be integrated to share resources and information. It establishes standards for communications and physical components so that inter-operability can be maintained as the system evolves to incorporate new capabilities and technologies.

The Minnesota Statewide ITS Architecture is a tailored version of the National ITS Architecture. Tailoring incorporates the prioritized wants and needs of the state's transportation users and stakeholders, as well as its existing ITS infrastructure. The functional architecture, physical architecture, system requirements and implementation plan are fully documented in the following project deliverables:

*ITS Traveler Wants/Needs* - Information obtained from Minnesota residents in ten end user sessions held across the state. Used to establish and prioritize end-user requirements.

*ITS Transportation Wants/Needs* - Information obtained from ITS stakeholder institutions. Used to establish and prioritize ITS service provider requirements.

*ITS Wants/Needs Analysis* - Final results and recommendations of the wants and needs research.

*Statewide ITS As-Is Agency Reports for Minnesota* - Information about existing transportation systems that establish the starting point for the Architecture Implementation Plan.

*ITS System Specification* - Incorporates the results of the functional and physical architectures into specification format. The specification will clearly identify ITS system level requirements for the identified Minnesota ITS services.

*ITS Component Specification* - Incorporates the results of the functional to physical allocation in specification format. The specification will clearly identify the Minnesota ITS component systems requirements.

*ITS Architecture Implementation Plan* - A recommended ITS deployment strategy for future state initiatives.
2. **SCOPE**

This document, *Statewide ITS As-Is Agency Reports for Minnesota*, consists of a collection of individual system survey reports related to transportation systems. The Polaris Project will use the survey information collected to derive the existing architectural framework. After the existing architectural framework is derived, this information will be used as the baseline for developing the Minnesota Statewide ITS Architecture.

Agencies identified and contributed to this document were:

- Minnesota Department of Transportation Office of Advanced Transportation Systems
- Minnesota Department of Transportation Traffic Management Center
- Minnesota Department of Transportation Metropolitan Division
- Minnesota Department of Transportation Electrical Services Section
- St. Paul Department of Public Works
- Minneapolis Department of Public Works
- Hennepin County Department of Public Works
- Ramsey County Department of Public Works
- Minnesota State Patrol
- Hennepin County Medical Center
- Metropolitan Council Transit Operations
- Metropolitan Airports Commission
- Gopher State One Call
- Minnesota Office of Tourism

### 2.1 Document Overview

This document presents the methods, assumptions and procedures used to collect the baseline information. The documentation of systems that were inventoried is presented in Section 3.

### 2.2 Methods, Assumptions, and Procedures

#### 2.2.1 System Identification

Agency and system candidates were based upon several factors prior to survey. Through market research, the highest wants and needs priorities for traveler and transportation related agencies identified the functional areas to be improved (i.e. Travel Conditions). The Polaris Project took the functional wants and needs and associated the wants and needs functions to current Minnesota Agencies. Another factor that contributed to identifying the candidate agencies was the presence of existing Intelligent Transportation Systems infrastructure that has been deployed to support integrating open systems for travelers, inter-agency and intra-agency needs.

One hundred twenty one pre-survey candidate systems identified by the process described previously, are listed in Appendix A. The pre-survey candidate list represents systems that were known by members of the Polaris Architecture working team, Mn/DOT Guidestar, and SRF Consulting Group, Inc. Of the 121 candidate systems, 38 system surveys were performed and
included in this document. The 38 systems were selected as best representatives of the 121 pre-survey candidates and provided a diverse base of information to use for developing the Minnesota Statewide ITS Architecture.

2.2.2 Data Collection Guide

The survey of systems required that a standard data collection approach be applied for the Statewide ITS As-Is Agency Reports for Minnesota. A data collection guide was prepared to help this effort.

The data collection guide was developed to provide interviewers with an overview of relevant information that needed to be collected during the survey for each system. The data collection effort focused on the following:

- A block diagram of the system and interfaces to external users and systems.
- All hardware elements that are interconnected to form the bounds of the system.
- All software components used by the hardware elements.
- All system interfaces that connect hardware components together and external systems to the system.
- All personnel using the system.

The Data Collection Guide is presented in Appendix B.

2.2.3 Field Data Collection

The survey collection activities were completed by two teams of interviewers. Prior to an on-site interview, an agency or system contact person was briefed as to the nature of the survey. In some cases, generally where agencies knew little of the Polaris project, a follow-up letter was sent to further outline the desired level of information.

The on-site interview was generally a free format discussion of the specific system elements. The data collection guide was only used to ensure all components were discussed. The interviewers recorded the audio portion of the interview in order to help with the documentation of the system. Where possible, the actual system components were also recorded on videotape, again, to help with the system documentation. In some cases, written documentation from the agency was reviewed to help describe the system.

A report of the surveyed system followed a standard format and consisted of two basic parts: 1) a system block diagram and 2) a data collection template. The block diagram is intended to depict the system components and interfaces while the template thoroughly describes the system configuration. The template is organized to step through the system related personnel, hardware, software and interfaces. All systems documented for the project used this standardized approach. The system documentation was separated by agencies into eight volumes.

The system reports contained in this volume follow in Section 3.
3. **As-Is Baseline System Documentation**
3.3 OPERATIONAL TESTS

3.3.1 AUSCI - Adaptive Urban Signal Control and Integration System
3.3.2 ICTM - Integrated Corridor Traffic Management System
3.3.3 DIVERT Incident Management System
3.3.4 Advanced Parking Information System
3.3.1 AUSCI - Adaptive Urban Signal Control and Integration System
AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY  CITY OF MINNEAPOLIS@

- Agency Type Department of Public Works/Transportation Division
- Agency Functions Manage Traffic Operations and Data
- Agency Location(s) Border Avenue Facility
  300 Border Avenue North
  Minneapolis, MN 55405-1528
- Contacts Michael J. Monahan
  Director of Transportation and Special Projects
  City of Minneapolis
  233 City Hall
  Minneapolis, MN 55415-1318
  (612) 673-5750 (voice) - (612) 348-7383 (fax)

2.0 SYSTEM  ADAPTIVE URBAN SIGNAL CONTROL AND INTEGRATION@

- Date of As-Is Data Collection 2/21/96
  System documentation based on information provided by
  Westwood Professional Services, Inc.
- Purpose Test the effectiveness and suitability of using Split Cycle
  Offset Optimization Technique (SCOOT) adaptive
  operation in an urban Central Business District (CBD)
  setting.
- Hours of Operation 7 days a week, 24 hours per day
- Geographic Coverage City of Minneapolis CBD including 56 intersections in
  the area bounded by: Hennepin Ave on the south, Lyndale Avenue on west,
  3rd Avenue North on the north and 1st Street South on
  the east.
- Contacts Marilyn Remer
  Minnesota Guidestar
  Mail Stop 320
  117 University Avenue Room 320
  St. Paul, MN 55155
  (612) 282-2469 (voice) - (612) 215-0409(fax)
  Mike Belrose
  Westwood Professional Services, Inc.
  14180 West Trunk Highway 5
  Eden Prairie, MN 55344
  (612) 937-5150 (voice) - (612) 937-5822 (fax)
  Dallas W. Hildebrand, P.E.
  Planning, Programming & Design Engineer
  City of Minneapolis
  Department of Public Works-Traffic Division
  300 Border Avenue North
- **Status**
  Phase 1 concept development completed and submitted for approval, Phase 2 implementation to begin April 1, 1996. System installation to be completed in December 1997.

- **Policies**
  Developed using Minnesota Guidestar and FHWA design policies. Implementation guided by City of Minneapolis operation philosophies.

- **Constraints**
  Implementation involves a new application effort, concept development with limited system information and implementation using Canadian and British contractors.

- **Block Diagram**
  See attached

- **Typical Operational Scenario**
  The test area intersections will be able to be controlled by both the existing city of Minneapolis Fortran system and the SCOOT system. Once the SCOOT system is operational, it will measure real time traffic flows (using video detection devices), model the operation of the network and traffic flows, attempt to minimize the total system delay under the given conditions and generate traffic signal timing plan(s) representing the minimum delay solution. The new traffic signal timing plan(s) will then be implemented in real time by the Fortran computer system. The process is repeated continuously with small but regular timing changes.
  (1) The Fortran traffic control system will perform all necessary functions for traffic control. See System 1.2 - City of Minneapolis Fortran traffic signal control system documentation.
  (2) The SCOOT system will supply optimized adaptive timing information to the Fortran system test.

- **Other**
  (1) 140 video detection devices will be installed to support SCOOT operation and to aid in evaluation of the system test. Approximately 4-6 of the video detection devices will be used to test the ability of the device to provide full motion video.
  (2) Eight video cameras will be installed in the test area for surveillance purposes. The video surveillance system will use twisted pair wire for communication to the traffic control office (This video surveillance system has similar hardware and software components as the St. Paul DIVERT System Operational Test - see System 3.4.2 documentation)
NOTE: There was no indication that the city of Minneapolis traffic signal system staff would change when the SCOOT system is operational. This description of personnel is the same as the system personnel that is operating and maintaining System 1.2 - Fortran Traffic Signal Control System.

2.1 PERSONNEL APPLANNING, PROGRAMMING AND DESIGN ENGINEER@
- Personnel Function Overseer traffic operations, planning, design and operational tests.
- Quantity 1
- Location City of Minneapolis, Department of Public Works - Transportation Division
- Workload 40 hours/week - Does not work directly with day to day operation of the Fortran system.
- Working hours Normal business hours
- Status Existing
- Contact Dallas W. Hildebrand, P.E.

2.2 PERSONNEL ATRAFFIC SIGNAL SYSTEMS ENGINEER@
- Personnel Function Oversee day to day Fortran system operation.
- Quantity 1
- Location City of Minneapolis, Department of Public Works - Transportation Division
- Workload 40 hours/week
- Working hours Normal business hours
- Status Existing
- Contact Roger Plum

2.3 PERSONNEL ATRAFFIC SYSTEMS OPERATORS@
- Personnel Function Monitor system operation in addition to other administrative duties.
- Quantity 2
- Location City of Minneapolis, Department of Public Works - Transportation Division
- Workload 75 percent of time on Fortran system
- Working hours 6:00 am - 7:00 pm, Monday - Friday
The operator shifts overlap from 10:00 am to 2:00 pm. The city does staff the control center during some special events that do occur during their normal working hours.
- Status Existing
2.4 PERSONNEL TRAFFIC SYSTEMS ANALYST
- Personnel Function: Works on Fortran system database and computer system.
- Quantity: 1
- Location: City of Minneapolis, Department of Public Works - Transportation Division
- Workload: 25 to 50 percent of time on Fortran/SCOOT system
- Working hours: Normal business hours
- Status: Existing

2.5 PERSONNEL ELECTRICIAN
- Personnel Function: Maintain traffic control signal systems and lighting systems.
- Quantity: 23 Total
  - 5 Foreman
  - 2 Signal service personnel
  - 1 Technician
  - 15 Electricians
- Location: City of Minneapolis, Department of Public Works - Transportation Division
- Workload: Normal work week
- Working hours: Normal business hours
- Status: Existing

3.1 HARDWARE DEC VAX COMPUTER
- Hardware Type: Computer
- Functions: Runs SCOOT traffic signal control optimization software application.
- Location: Minneapolis traffic control center
- Data Type: Data
- Status: New
- Other: Digital Equipment Corporation VAX computer
3.1.1 SOFTWARE SCOOT Version 3.1

- Software Type: Transportation software application
- Functions: Traffic control application and control, receives vehicle detection inputs and generates optimized timing plans for real time implementation to traffic signal controllers
- Application Language: Assembly code and other languages.
- Status: New
- Constraints: The SCOOT system has an implementation capacity of 300 intersections.
- Issues: Proprietary software. Owned and licensed to Mn/DOT by Siemens, no rights to observe or modify programs under limits of license, no distribution rights.
- Contacts:
  Supplier - Fortran Traffic Systems Limited
  470 Midwest Road
  Scarborough, Ont.
  M1P 4Y5, Canada
  (416) 288-1320 (voice)
  (416) 288-9914 (fax)
  1-800-265-1197 (toll free USA)
  Developer - Siemens Plessey Controls Limited
  Sopers Lane, Poole, Dorset,
  United Kingdom, BH17 7ER
  44-202-782000 (voice)
  44-202-782331 (fax)

3.1.2 SOFTWARE A/MS OPERATING SYSTEM

- Software Type: Operating system
- Functions: Control VAX CPU
  1) Run software application, manages disk space and memory.
  2) Perform data backups.
  3) Control hardware resources, printers, displays and controllers.
- Status: New
- Policies: None

3.2 HARDWARE CLOCK

- Hardware Type: Clock
- Functions: Send time data to CPU.
- Location: Minneapolis traffic control center
- Data Name/Contents: Time
- Data Type: Data
- Status: New
3.3 HARDWARE GRAPHICAL TERMINAL
- Hardware Type: Terminal/Workstation
- Functions:
  1) Displays system information.
  2) Reports system events including coordination errors and controller failures.
- Location: Minneapolis traffic control center
- Data Name/Contents: System information
- Data Type: Data
- Status: New

3.4 HARDWARE SYSTEM SWITCH
- Hardware Type: Switch
- Functions: Enable system
- Location: Minneapolis traffic control center
- Data Type: Data
- Status: New

3.5 HARDWARE SYSTEM TERMINAL
- Hardware Type: Terminal/Workstation
- Functions:
  1) Displays traffic count and timing plan data.
  2) Displays current timing plans.
  3) Receives parameters for creating timing plans.
  4) Used to control SCOOT and VAX operating system.
- Location: Minneapolis traffic control center
- Data Name/Contents: System and computer information
- Data Type: Data
- Status: New

3.6 HARDWARE LOG PRINTER
- Hardware Type: Printer
- Functions: Prints data
- Location: Minneapolis traffic control center
- Data Name/Contents: System information and timing plan data
- Data Type: Data
- Status: New
### 3.7 HARDWARE  **A**LAPTOP PC COMPUTER**@**
- **Hardware Type**: Laptop PC computer  
- **Functions**: Allows access to SCOOT computer from remote locations.  
- **Location**: Remote locations  
- **Data Name/Contents**: System operation and status data  
- **Data Type**: Data  
- **Status**: New

### 3.8 HARDWARE  **A**COMMUNICATION MODIFICATION UNIT (CMU)**@**
- **Hardware Type**: Communication unit  
- **Functions**: Special communication device used to interface the Fortran system and the traffic signal controller.  
- **Location**: Field controller cabinet  
- **Data Name/Contents**: Timing coordination information, traffic counts and controller status.  
- **Data Type**: Data  
- **Status**: Existing

### 3.9 HARDWARE  **A**TRAFFIC SIGNAL CONTROLLER**@**
- **Hardware Type**: NEMA traffic signal controller  
- **Functions**: Operates traffic control signal system  
- **Location**: Field controller cabinet  
- **Data Name/Contents**: Timing information, traffic counts and controller status.  
- **Data Type**: Data  
- **Status**: Existing  
- **Other**: Eagle EPAC NEMA

### 3.10 HARDWARE  **A**VIDEO DETECTOR**@**
- **Hardware Type**: Video detector system  
- **Functions**: Vehicle detection device, supplies count and occupancy information to SCOOT computer system.  
- **Location**: In field  
- **Data Name/Contents**: Traffic count and occupancy data  
- **Data Type**: Data  
- **Status**: New  
- **Other**: This video detection system is still under development but is very similar in operation to the Autoscope package.
3.11 HARDWARE SERIAL/PARALLEL CONVERTER
- Hardware Type: Converter
- Functions: Converts serial communication to contact closure output.
- Location: Field controller cabinet
- Data Name/Contents: Traffic count detector information
- Data Type: Data
- Status: New

3.12 HARDWARE VIDEO DATA COLLECTION COMPUTER SYSTEM
- Hardware Type: PC
- Functions: This computer will poll video detection devices at regular intervals to download detector data. The polling interval depends on the storage capability of video detection devices and what type of detector data is being collected. All image recognition and conversion to detector output is completed in the hardware that is located in the field.
- Location: Minneapolis traffic control center
- Data Name/Contents: Traffic count detector information
- Data Type: Data
- Status: New

3.12.1 SOFTWARE VIDEO DATA COLLECTION SOFTWARE
- Software Type: Traffic count data
- Functions: Store, analyze and report traffic count data
- Status: New

3.1.2 SOFTWARE OPERATING SYSTEM
- Software Type: Operating system
- Functions: Control PC
1) Run software application, manages disk space and memory.
2) Perform data backups.
3) Control hardware resources, printers, displays, and controllers.
- Status: New
- Other: Most likely DOS or Windows
3.13 HARDWARE ΩETHERNET CARD - SCOOT COMPUTER@
- Hardware Type: Communications
- Functions: Sends and receives information from the Fortran computer system.
- Location: Minneapolis traffic control center
- Data Name/Contents: Receives controller status and detector data from the Fortran computer. Sends table of timing parameters to the Fortran computer.
- Data Type: Data
- Status: New

3.14 HARDWARE ΩETHERNET CARD - FORTRAN COMPUTER@
- Hardware Type: Communications
- Functions: Sends and receives information from the SCOOT computer system.
- Location: Minneapolis traffic control center
- Data Name/Contents: Sends controller status and detector data to the SCOOT computer. Receives table of timing parameters from the SCOOT computer.
- Data Type: Data
- Status: New

4.1 INTERFACE VAX computer (SCOOT system)
- Connects to: VAX computer (Fortran system)
- Interface location: Minneapolis traffic control center
- Interface Type: Data
- Interface Direction: Both
- Interface Component: High speed ethernet data channel
- Protocol/Standard: Custom drivers form computer to computer communication
- Information Direction: Both
- Information Standards: Proprietary

4.2 INTERFACE VAX computer
- Connects to: Clock
- Interface location: Minneapolis traffic control center
- Interface Type: Data
- Interface Direction: Both
- Interface Component: RS-232
- Information Type/Content: Time
- Information Direction: Input
4.3 INTERFACE
- VAX computer
- Connects to ... Graphical terminal
- Interface location Minneapolis traffic control center
- Interface Type Data
- Interface Direction Both
- Interface Component RS-232
- Information Type/Content System data
- Information Direction Output
- Information Frequency Continuous
- Information Standards Proprietary

4.4 INTERFACE
- VAX computer
- Connects to ... System switch
- Interface location Minneapolis traffic control center
- Interface Type Data
- Interface Direction Both
- Interface Component RS-232
- Information Type/Content None
- Information Direction Input
- Information Frequency As needed
- Information Standards Proprietary

4.5 INTERFACE
- VAX computer
- Connects to ... Log printer
- Interface location Minneapolis traffic control center
- Interface Type Data
- Interface Direction Both
- Interface Component RS-232
- Information Type/Content System errors
- Information Direction Output
- Information Frequency Continuous
4.6 INTERFACE
- Connects to ... VAX computer
- System terminal
- Interface location Minneapolis traffic control center
- Interface Type Data
- Interface Direction Both
- Interface Component RS-232
- Information Type/Content System information
- Information Direction Both
- Information Frequency As needed
- Information Standards Proprietary

4.7 INTERFACE
- Connects to ... Master communication unit (MASCOM)
- Communication management unit (CMU)
- Interface location Minneapolis traffic control center and field controller cabinet
- Interface Type Data
- Interface Direction Both
- Interface Component Twisted pair wire
- Protocol/Standard Proprietary
- Information Type/Content Signal coordination parameters, traffic count data and system status information.
- Information Direction Both
- Information Frequency Once per second
- Other The city has six 50-pair trunk lines (300 pair total) running into the traffic control center. The city is currently using 70 pair for this system.

4.8 INTERFACE
- Connects to ... Communication management unit (CMU)
- Traffic signal controller
- Interface location Field controller cabinet
- Interface Type Data
- Interface Direction Both
- Interface Component Wire
- Information Type/Content Signal coordination parameters, traffic count data and system status information.
- Information Direction Both
- Information Frequency Once per second
4.9 INTERFACE

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connects to</td>
<td>Serial/parallel converter</td>
</tr>
<tr>
<td>Interface location</td>
<td>Field controller cabinet</td>
</tr>
<tr>
<td>Interface Type</td>
<td>Data</td>
</tr>
<tr>
<td>Interface Direction</td>
<td>Both</td>
</tr>
<tr>
<td>Interface Component</td>
<td>Twisted pair wire</td>
</tr>
<tr>
<td>Information Type/Content</td>
<td>Video detector count data</td>
</tr>
<tr>
<td>Information Direction</td>
<td>Both</td>
</tr>
<tr>
<td>Information Frequency</td>
<td>Once per second</td>
</tr>
</tbody>
</table>

4.10 INTERFACE

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connects to</td>
<td>Video detector device</td>
</tr>
<tr>
<td>Interface location</td>
<td>Field controller cabinet and video detector camera device</td>
</tr>
<tr>
<td>Interface Type</td>
<td>Data</td>
</tr>
<tr>
<td>Interface Direction</td>
<td>Both</td>
</tr>
<tr>
<td>Interface Component</td>
<td>Twisted pair wire</td>
</tr>
<tr>
<td>Information Type/Content</td>
<td>Video detector count data</td>
</tr>
<tr>
<td>Information Direction</td>
<td>Both</td>
</tr>
<tr>
<td>Information Frequency</td>
<td>Once per second</td>
</tr>
</tbody>
</table>

4.11 INTERFACE

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connects to</td>
<td>Field controller cabinet modem</td>
</tr>
<tr>
<td>Interface location</td>
<td>Field controller cabinet</td>
</tr>
<tr>
<td>Interface Type</td>
<td>Data</td>
</tr>
<tr>
<td>Interface Direction</td>
<td>Both</td>
</tr>
<tr>
<td>Interface Component</td>
<td>Twisted pair wire</td>
</tr>
<tr>
<td>Information Type/Content</td>
<td>Video detector count data</td>
</tr>
<tr>
<td>Information Direction</td>
<td>Both</td>
</tr>
<tr>
<td>Information Frequency</td>
<td>Frequency of information is a function of storage capacity of video detection system and amount/type of data being stored.</td>
</tr>
</tbody>
</table>
4.12 INTERFACE  
Field controller cabinet modem  
- Connects to ...  
  Traffic control center modem  
- Interface location  
  Field controller cabinet and traffic control center  
- Interface Type  
  Data  
- Interface Direction  
  Both  
- Interface Component  
  Twisted pair wire  
- Information Type/Content  
  Video detector count data  
- Information Direction  
  Both  
- Information Frequency  
  Frequency of information is a function of storage capacity of video detection system and amount/type of data being stored.

4.13 INTERFACE  
Traffic control center modem  
- Connects to ...  
  Video data collection computer system  
- Interface location  
  Traffic control center  
- Interface Type  
  Data  
- Interface Direction  
  Both  
- Interface Component  
  RS-232  
- Information Type/Content  
  Video detector count data  
- Information Direction  
  Both  
- Information Frequency  
  Frequency of information is a function of storage capacity of video detection system and amount/type of data being stored.

4.14 INTERFACE  
VAX computer  
- Connects to ...  
  VAX computer modem  
- Interface location  
  Traffic control center  
- Interface Type  
  Data  
- Interface Direction  
  Both  
- Interface Component  
  RS-232  
- Information Type/Content  
  SCOOT system information  
- Information Direction  
  Both  
- Information Frequency  
  As needed
3.3.2 ICTM - INTEGRATED CORRIDOR TRAFFIC MANAGEMENT SYSTEM
Baseline Data Collection
Integrated Corridor Traffic Management System

Roadside Cabinet
- Traffic Signal Controller (Delta 3)
- Autoscope Processor
  - Modem
  - Modem
  - PC

Mn/DOT Communications System
Type 170 Controller

Mn/DOT TMC
- Modem
- SCATTERM Workstation
- SCATS Traffic Control Computer
  - PDP 11/93
  - 8 line serial interface card (14)

Public Sector Providers
- Modem
- SCATTERM Workstation

Freeway Management System
- RS-232
AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY MINNESOTA DEPARTMENT OF TRANSPORTATION

2.0 SYSTEM ICTM - INTEGRATED CORRIDOR TRAFFIC MANAGEMENT

- Date of As-Is Data Collection 3/1/96
- Purpose
  1) Alleviate congestion in the I-494 corridor
  2) Reduce ramp queue/cross street conflicts due to queue backup into intersections
  3) Reduce short (less than 2-mile) trip usage of I-494
  4) Coordinate traffic management across jurisdictional boundaries
- Hours of Operation Continuous
- Geographic Coverage I-494 from 34th Avenue in Richfield to East Bush Lake Road in Edina
- Contacts Linda Taylor, ICTM Project Manager
  Mn/ DOT, Waters Edge Offices
- Status Currently in deployment phase. Final deployment in 1997
- Block Diagram See attached
- Typical operational scenario
  There are a wide variety of possible scenarios due to the complexity of the system. A typical scenario involves congestion detection through loop detectors or Autoscope video detection systems. The location and severity of the congestion is fed to the SCATS system computer which has built-in algorithms for ramp meter timing and intersection signal timing based on congestion levels. The intersection controllers are instructed to alter timing plans based on SCATS input and the Mn/DOT Freeway Management System (FMS) alters ramp metering rates based on SCATS data.
  
  Additionally, traffic can be diverted using changeable message signs and @trailblazer signs along alternate routes. This typically would be done as an incident management scenario and not as a congestion management mechanism.
### 3.1 HARDWARE | TRAFFIC SIGNAL HEAD

- **Hardware Type**: Intersection signal device (red/ yellow/ green)
- **Functions**: Displays stop /caution /go lights to motorists
- **Location**: At 21 intersections in the I-494 ICTM corridor
- **Data Name/Contents**: N/A
- **Data Type**: Indicator light
- **Status**: Existing
- **Recommended Improvements**: The number of intersections will be increased to 46 during the summer of 1996

### 3.2 HARDWARE | LOOP DETECTOR

- **Hardware Type**: Inductive vehicle detection device
- **Functions**: Detects the presence of vehicles
- **Location**: The ICTM System has loops in pavement on I-494 and receives loop detector data from the Freeway Management System (FMS) for the 27 ramps in the test corridor
- **Data Name/Contents**: Vehicle present / not present. This can be used to compute lane or ramp volume and occupancy.
- **Data Type**: On/off pulse
- **Status**: Existing

### 3.3 HARDWARE | AUTOSCOPE CAMERA

- **Hardware Type**: Vehicle detection video camera
- **Functions**: This unit is aimed and focused at a specific area of roadway. The video signal is sent to an Autoscope processor which analyzes the incoming video for vehicle detection. The processor sends a signal to a traffic signal controller interprets it as though it were a loop detector input.
- **Location**: Penn Ave., 24th Ave., and 34th Ave. near their I-494 crossings
- **Data Name/Contents**: Real-time video of detection zones
- **Data Type**: Video
- **Status**: Existing
- **Policies**: It is a general policy of Mn/DOT not to use video surveillance systems for law enforcement purposes
3.4 HARDWARE AUTOSCOPE CONTROL UNIT

- Hardware Type: Modular Intel 486SX based video signal processor
- Functions: Receives incoming signal from video cameras and emulates a loop detector signal to the Delta 3 Controller
- Location: At intersections (see HARDWARE 3.3)
- Data Name/Contents: 1) Incoming video of pre-defined segment of road. 2) Outgoing video of pre-defined segment of road to supervisor computer (when connected) 3) Loop detector signal to Delta 3 Controller
- Data Type: Data
- Status: Existing
- Other: The Autoscope system requires a Supervisor Computer to be set up and monitored. This computer must be a 386 or faster processor, which can be permanently attached via RS-232 connection or connected by dial up modem. The computer may also be a portable computer which is carried to the Autoscope Controller and manually connected through its serial port. It is not clear which method Mn/DOT uses in this system.

3.5 HARDWARE MODEM

- Hardware Type: Serial communications device
- Functions: Sends video and other calibration data to a supervisor computer
- Location: At intersections (see HARDWARE 3.3)
- Data Name/Contents: Video of road, detection zone definitions
- Data Type: Data
- Status: Existing

3.6 HARDWARE MODEM

- Hardware Type: Serial communications device
- Functions: Receives video and other calibration data to a supervisor computer
- Location: At Mn/DOT TMC
- Data Name/Contents: Video of road, detection zone definitions
- Data Type: Data
- Status: Existing
3.7 HARDWARE SUPERVISOR PC

- Hardware Type: Computer with 80386 or faster processor
- Functions: This computer is used to set up and monitor the operation of the Autoscope system. Functions include:
  - Defining detection zones on a video overlay
  - Defining vehicle types for detection
  - Visually verifying detections
- Location: At Mn/DOT TMC
- Data Name/Contents: Video of road, detection zone definitions
- Data Type: Data
- Status: Existing

3.8 HARDWARE DELTA 3 TRAFFIC SIGNAL CONTROLLER

- Hardware Type: Multifunction, multidrop intersection controller. These are designed to replace standard NEMA control units. They fit into standard NEMA cabinets and interface with NEMA load switches and conflict monitors.
- Functions: 1) Turns appropriate bulb in signal controller head on/off (using internally stored timing plans)
  2) Receives data from loop detector
  3) Receives data from Autoscope processor (as loop detector input)
  4) Communicates with FMS to report detector input and signal status. Can also receive revised/new timing plans.
- Location: At intersections (see HARDWARE 3.3)
- Data Type: Data
- Status: Existing
- Constraints: If operating in fixed, actuated, or time-of-day mode, the phase, red time, and maximum timings are held in a Personality PROM Module which is programmed off-site and installed into the unit.
  If the unit is operating in adaptive mode, phase timing may be altered by the SCATS computer.
3.8.1 SOFTWARE ADELTA 3 CONTROLLER SOFTWARE@
- Software Type AWA proprietary operating system
- Software Standards Proprietary
- Functions 1) Monitoring and data collection for vehicle detection
2) Minimum cycle length and clearance times
3) Pedestrian phase interval control
4) Traffic light interval control
5) Emergency vehicle signal pre-emption
6) Communications
7) Fall back modes
8) Fault monitoring and flash Fall back
- Other This software receives operating parameters from the APersonality PROM Module@ which is programmed with a utility called CGEN.

3.9 HARDWARE ACHANGEABLE MESSAGE SIGN SYSTEM@
- Hardware Type See documentation of system 2.3 Mn/DOT TMC CMS Control System@
- Recommended Improvements The two changeable message signs will be upgraded to variable message (matrix) signs during the summer of 1996.

3.10 HARDWARE AVARIABLE MESSAGE SIGN@
- Hardware Type Outdoor message sign
- Functions Display information to motorists
- Data Name/Contents Pre-defined messages for motorists
- Data Type Text
- Status Existing

3.11 HARDWARE ARAMP METERING SYSTEM@
Hardware Type See documentation of system 2.1 Mn/DOT TMC Ramp Meter System@

3.12 HARDWARE ATRAIL BLAZING SIGNS@
- Hardware Type On/Off blank out matrix signs
- Functions Displays an arrow indicating the proper direction for motorists following a detour to follow
- Location At intersections along the arterial routes parallel to I-494
- Status To be installed January 1997
3.13 HARDWARE CCTV CAMERA SYSTEM
- Hardware Type: See documentation of system 2.2 Mn/DOT TMC Video Surveillance System

3.14 HARDWARE TYPE 170 INTERSECTION CONTROLLER
- Hardware Type: Intersection signal controller
- Functions:
  1) Operate signal lights
  2) Monitor traffic using in-pavement loop detectors.
  3) Communicate intersection component status to a central management system.
- Location: at each intersection near I-494 in the test corridor
- Data Type: Data
- Status: Existing

3.15 HARDWARE Mn/DOT COMMUNICATIONS SYSTEM
- Hardware Type: See documentation of the Mn/DOT TMC Communications System
3.16 HARDWARE SCATTERM WORKSTATION

- Hardware Type
  Intel-based IBM PC (80486)
  4 MB RAM
  Color VGA Display
  30 MB available disk space

- Functions
  Allows user to access the SCATS system through either a dial-up or dedicated connection to the serial interface on the PDP-11
  Once connected, the user can view status of the system (i.e. receive system fault alarms, monitor operation, and access system log data). Based on security level, may be able to manually set ramp metering rates, activate the detour system, and change system parameters.

- Location
  Hennepin County
  Edina
  Richfield
  Mn/DOT ESS (Direct Connect)
  Bloomington
  Mn DOT TMC (Direct Connect)
  Mn/Dot Metro District Oakdale Office

- Data Name/Contents
  There are two types of displays available on the workstations:
  **Zone Display**
  Zone volume data
  • Balancing multiplier
  • Ramp target/ set/ actual volumes
  • Ramp occupancy/ threshold parameters/ weighting factor
  • Ramp red time and rate
  **Ramp Display**
  Similar to above but including:
  1. Downstream mainline detector volume and occupancy
  2. Degree of saturation for ramp volumes

- Data Type
  Data

- Status
  Existing

- Constraints
  For permanent connections, communication speeds should be at least 9600 bps. For dial-up connections, 4800 bps is the minimum with 9600 or faster recommended.

3.16.1 SOFTWARE DOS

- Software Type
  Operating system
3.16.2 SOFTWARE ASCATTERM®
- Software Type
  Communications/control software to permit interface
  with SCATS Regional Computer (PDP-11)
- Functions
  The Operator can view the following:
  1) Intersection status
  2) Current faults/subsystem operation
  3) Ramp metering status
  4) Adaptive control parameters
  5) System and controller settings
  6) Traffic data
  7) Graphics of intersections, subsystems, and regional
    operation
  The Operator can control/change the following:
  1) Intersection operation
  2) Ramp metering rates
  3) Adaptive control parameters
  4) System and controller settings

3.17 HARDWARE AFREEWAY MANAGEMENT SYSTEM®
- Hardware Type
  See documentation for systems under 2.1-2.4
- Other
  The software in this system will be modified to interface
  with the SCATS systems and local ramp meter
  controllers will have their communications hardware
  upgraded to the Type 170E specification.
3.18 HARDWARE EIGHT LINE SERIAL COMMUNICATIONS CARD

- Hardware Type
  I/O interface hardware (8 ports/card)

- Functions
  Allow communication between the PDP-11 and:
  1) Remote dial-up SCATTERM PC
  2) TMC and ESS direct connect SCATTERM PC
  3) Freeway Management System
  4) Video graphics terminal
  5) Laser printer

- Location
  TMC

- Data Name/Contents
  These units send:
  1) System status information to SCATTERM PC
  2) Display graphics to color graphics terminal
  3) Control commands to the FMS to sent through the Mn/dot communication system to ramp meters, intersection signals, changeable and variable message signs, and trailblazer signs
  4) System activity/error logs to Laser Printer

These units receive:
  1) System commands from SCATTERM PC
  2) System commands from color graphics terminal
  3) Volume/Occupancy data from detector loops and Autoscope system through the intersection signal controller.

- Data Type
  Data

- Status
  Existing
3.19 HARDWARE SCATS TRAFFIC CONTROL COMPUTER

- Hardware Type: Digital Equipment Corporation Minicomputer (PDP 11/93)

- Functions:
  1) Provides information to the SCATTERM Workstations
  2) Uses pre-defined algorithms to determine appropriate ramp metering rates, or, in the case of an incident detour, appropriate signal timings on parallel arterial routes.
  3) Activates Changeable/Variable message signs and selects appropriate message.
  4) Activate Trailblazer signs in the event of a detour
  5) Provides coordinated, adaptive control of intersection traffic signals.

- Location: TMC Computer Room

- Data Name/Contents: See HARDWARE 3.15. Computer also has some management capabilities including the capability to collect traffic volume data, system operation data, and system fault reporting for maintenance.

- Data Type: Data

- Status: Existing

- Issues: ICTM Project Implementation Plan specifies that a second PDP-11 could be added to the system if the number of ramps/intersections exceeds the capacity of the unit.

3.19.1 SOFTWARE MICRO RSX-11, V4.4

- Software Type: Operating system
3.19.2 SOFTWARE

SCATS REGIONAL MASTER SOFTWARE V5.0@

- Software Type
  Traffic management and control software
- Functions
  Can be operated to minimize overall stops and delays or maximize throughput based on volume. System software adapts each signal cycle, thus allowing adaptation to non-recurring demand peaks.
- Constraints
  Software will support 128 intersection or ramp metering controller devices. Since ICTM supplies ramp metering connections through the FMS, 128 intersections plus ramp meters can be supported.
- Issues
  The software has several modifications in this application:
  $ SCATS will communicate with the FMS using an Roads and Traffic Authority of New South Wales (RTA)-supplied protocol $ SCATS display will include ramp metering information $ SCATS ramp metering algorithms will be modified to match TMC algorithms and then upgraded to allow differential rates within zones.
- Contact
  Neal Gross
  AWA Traffic Systems, Inc.
  Detroit, MI
  (517) 349-6300
- Other
  Software was developed by the Roads and Traffic Authority (RTA) of New South Wales, Australia

3.20 HARDWARE

LASER PRINTER@

- Hardware Type
  Plain paper laser printer (8ppm simplex)
- Functions
  Produce hard copy system logs and reports
- Location
  TMC
- Data Type
  Data

3.21 HARDWARE

COLOR VIDEO GRAPHICS TERMINAL@

- Hardware Type
  Digital Equip. Corp. VT340-GA
- Functions
  Allow operator to control/program system.
- Location
  TMC computer room
- Data Type
  Data
### 3.22 HARDWARE MODEM®

- **Hardware Type**: Dial-up Serial Communications Device
- **Functions**: Allow communication between remote SCATTERM Workstations and the SCATS PDP-11 across voice grade telephone lines.
- **Location**: Modem pool at TMC computer room and at each of 6 remote locations
- **Data Name/Contents**: See SOFTWARE 3.13.2.
- **Data Type**: Data
- **Status**: Existing
- **Other**: The modems are configured in a roll-over pool of six total ports. ICTM project staff have exclusive access to port 1, public sector partners will use ports 2 through 6, and a miscellaneous group (U of M, evaluation team members, and others as necessary) will have access to port 6 when not in use by a public sector partner.

### 4.1 INTERFACE Traffic signal head

- **Connects to ...**: Delta 3 controller
- **Interface location**: At intersections
- **Interface Type**: Power lead
- **Interface Direction**: Input
- **Interface Component**: Wire
- **Information Direction**: Input
- **Information Frequency**: As required by timing plan

### 4.2 INTERFACE Loop Detector

- **Connects to ...**: Delta 3 controller
- **Interface location**: At intersections
- **Interface Direction**: Output
- **Interface Component**: Wire lead
- **Information Type/Content**: Vehicle present/not present
- **Information Direction**: Output
4.3 INTERFACE  
**Autoscope Camera**
- Connects to ...  
  
- Interface location  
  At intersections  
- Interface Type  
  Data (video signal)  
- Interface Direction  
  Output  
- Interface Component  
  RS-170  
- Protocol/Standard  
  Composite video  
- Information Type/Content  
  Live video of a predefined segment of road for vehicle detection  
- Information Direction  
  Output  
- Information Frequency  
  Continuous

4.4 INTERFACE  
**Autoscope Controller**
- Connects to ...  
  Delta 3 Controller  
- Interface location  
  At intersection (in roadside cabinet)  
- Interface Type  
  Data  
- Interface Direction  
  Output  
- Interface Component  
  Detector I/O port on Autoscope unit to Detector I/O port on Delta 3, Cable configuration not collected.  
- Protocol/Standard  
  Emulates in-pavement inductive loop detector  
- Information Type/Content  
  Vehicle present/not present.  
- Information Direction  
  Output  
- Information Frequency  
  Continuous

4.5 INTERFACE  
**Autoscope Controller**
- Connects to ...  
  Autoscope modem  
- Interface location  
  At intersection (in roadside cabinet)  
- Interface Type  
  Data  
- Interface Direction  
  Both  
- Interface Component  
  Serial connection, exact configuration not collected.  
- Information Type/Content  
  Autoscope calibration/vehicle detection zone setup data.  
- Information Direction  
  Output  
- Information Frequency  
  Continuous  
- Other  
  This interface is primarily used as a maintenance facility and to verify autoscope operation
4.6 INTERFACE
- Connects to ... Supervisor modem
- Interface Type Data
- Interface Direction Both
- Interface Component Cable configuration not collected
- Information Type/Content Autoscope calibration/vehicle detection zone setup data
- Information Direction Both
- Information Frequency Continuous
- Other This interface is primarily used as a maintenance facility and to verify autoscope operation

4.7 INTERFACE
- Connects to ... Supervisor PC
- Interface Type Data
- Interface Direction Both
- Interface Component Cable configuration not collected
- Information Type/Content Autoscope calibration/vehicle detection zone setup data
- Information Direction Both
- Information Frequency Continuous
- Other This interface is primarily used as a maintenance facility and to verify autoscope operation

4.8 INTERFACE
- Connects to ... Mn/DOT Communication System
- Interface Type Data
- Interface Direction Both
- Interface Component Twisted pair in multidrop configuration
- Information Type/Content 1) Reports: Intersection signal status and volume/occupancy data. 2) Receives: Commands to change signal timing
- Information Direction Both
- Information Frequency Continuous

4.9 INTERFACE
- Connects to ... Mn/DOT Communications System
- Other See documentation of system 2.3 Mn/DOT TMC CMS Control System@
4.10 INTERFACE Variable Message Sign
- Connects to ... Mn/DOT Communications System or Type 170 Controller
- Interface location It is not clear at this point whether the Type 170 controller will be integrated into the sign or will be located remotely in a free standing cabinet. If communication hardware is integrated, the sign unit will connect directly via twisted pair to the I-494 communications trunk. The precise configuration of this interface if the controller is external is not known.
- Interface Type Data
- Interface Direction Input
- Interface Component Twisted pair
- Information Type/Content Command to display one of several predefined messages
- Information Direction Input
- Information Frequency As Needed

4.11 INTERFACE Ramp Metering System
- Connects to ... Mn/DOT Communications System
- Other See documentation of system 2.1 Mn/DOT TMC Ramp Meter System@

4.12 INTERFACE Trail Blazing Sign
- Connects to ... Type 170 Controller in CCTV Camera System
- Interface Type On/Off signal
- Interface Direction Input
- Interface Component Twisted pair
- Information Direction Input

4.13 INTERFACE CCTV Camera System
- Connects to ... Mn/DOT Communications System
- Interface Direction Both
- Information Direction Both
- Information Frequency Continuous
- Other See documentation of system 2.2 Mn/DOT Video Surveillance System@
4.14 INTERFACE Mn/DOT Communications System
- Connects to ... Freeway Management System
- Interface Direction Both
- Information Direction Both
- Information Frequency Continuous
- Other See documentation of the Mn/DOT TMC Communications system

4.15 INTERFACE Freeway Management System
- Connects to ... 8 Line Serial Interface Card
- Interface location TMC Computer Room
- Interface Type Data
- Interface Direction Both
- Interface Component RS-232 serial cable
- Information Type/Content From FMS to SCATS:
  1) Volume and Occupancy data, with a faulty detector flag, every 30 seconds ± 10 seconds.
  2) All data for interval sent message
  3) Startup red times for each ramp for use in the SCATS algorithm
  4) Details of any manual override to a ramp metering rate
From SCATS to FMS:
  1) Red time for each ramp. 1/10 second increments from .1 to 99.9. This is sent within 1/10 second of receipt of detector data.
  2) Calculated metering rate number(0 to 7) for use in TMC terminal
  3) Flags to indicate if downstream or ramp occupancy are active in the determination of the rate for the ramp.
  4) Message indicating SCATS wants ramp metering control to be transferred between the two systems.

- Information Direction Both
- Information Frequency Continuous
4.16 INTERFACE
- SCATTERM Workstation
- Connects to ...
- 8 Line Serial Interface Card
- Interface location
- TMC Computer Room
- Interface Type
- Data
- Interface Direction
- Both
- Interface Component
- RS-232 Serial Cable
- Information Type/Content
- See SOFTWARE 3.13.2 Functions
- Information Direction
- Both
- Information Frequency
- Continuous
- Other
- This Interface uses port 8 on the serial interface card

4.17 INTERFACE
- SCATTERM Workstations (6)
- Connects to ...
- Modem
- Interface location
- TMC Computer Room
- Interface Type
- Data
- Interface Direction
- Both
- Interface Component
- Serial dial-up connection (US West)
- Information Type/Content
- See SOFTWARE 3.13.2 Functions
- Information Direction
- Both
- Information Frequency
- As Needed
- Other
- This interface comes into a modem bank in roll-over configuration at the TMC. There are a number of modems equal to the number of workstations, so all workstations could be connected simultaneously.

4.18 INTERFACE
- Modem
- Connects to ...
- 8 Line Serial Interface Card
- Interface location
- TMC Computer Room
- Interface Type
- Data
- Interface Direction
- Both
- Interface Component
- RS-232 Serial Cable
- Information Type/Content
- See SOFTWARE 3.13.2 Functions
- Information Direction
- Both
- Information Frequency
- As Needed
- Other
- The SCATS system has enough ports (numbers 1 through 6) to support all authorized dial-in user connections simultaneously.
4.19 INTERFACE Laser Printer
- Connects to 8 Line Serial Interface Card
- Interface location TMC Computer Room
- Interface Type Data
- Interface Direction Input
- Interface Component RS-232 Serial Cable
- Information Type/Content System operation and status reports, as well as error/fault logs.
- Information Direction Input
- Information Frequency As Needed
- Other The laser printer and color video terminal share port 0 on the eight line serial interface card

4.20 INTERFACE Color Video Graphic Terminal
- Connects to Eight Line Serial Interface Card
- Interface location TMC Computer Room
- Interface Type Data
- Interface Direction Both
- Interface Component RS-232 Serial Cable
- Information Type/Content System operation and status for graphical display, also displays error /fault messages. An Operator can also manually control the system and change algorithms from this terminal.
- Information Direction Both
- Information Frequency As Needed
- Other The laser Printer and color video terminal share port 0 on the eight line serial interface card
3.3.3 DIVERT INCIDENT MANAGEMENT SYSTEM
aseline Data Gathering Effort  
Management System

City of St. Paul City Hall Annex

- Operator
- DIVERT PC
- Modem
- Type 400 Modem
- DIVERT Relays
- MTCS Modems (COMPUTRAN System)
- COMPUTRAN System
- Video Monitor (2)
- American Dynamics Video Switcher
- American Dynamics Pan/Tilt/Zoom Control
- Mn/DOT Video from St. Paul Offices
- US West Telephone Service
- Modem
- Twisted Pair
- American Dynamics Pan/Tilt/Zoom Control
- Commercial Paging Service Provider
- Pager
- Twisted Pair
- CCTV Camera (6)
- Twisted Pair
- 330/334 Cabinet
- Type 170 Controller
- Type 400 Modem
- Twisted Pair
- Cellular Phone Service
- ADDCO Variable Message Sign (4)
- ED Blank Out Sign
- Intersection Signals
- Side-Street System Loop Detectors (38)
- Pan Tilt Zoom
- Receiver Driver
- Driver
- TMC
- DIVERT PC
- Twisted Pair
- C LAN
-Pager
- Commercial Paging Service Provider
- Paging Service Provider
AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY  CITY OF ST. PAUL®

- Agency Type  Public Works, Traffic Division
- Agency Functions  Manage traffic operations within the city of St. Paul. This includes signal and incident management
- Agency Location(s)  City Hall Annex
- Contacts  Sammuel Boyd
  Mn/DOTt Guidestar
  (612) 282-5317
  
  Paul T. Kurtz
  800 City Hall Annex
  St. Paul, MN 55102-1660
  (612) 266-6203

  Bob Sands/Gary Rylander
  Edwards & Kelcey, Inc.
  (612) 835-6411

2.0 SYSTEM  DIVERT INCIDENT MANAGEMENT SYSTEM®

- Date of As-Is Data Collection  1/25/96
- Purpose  This system is designed to decrease the congestion impacts of incidents in the I-35E/ I-94 commons area (capital interchange) near downtown St. Paul by redirecting traffic to designated city streets acting as alternate routes. This system is a FHWA sponsored one year operational test and will be evaluated after test period to determine the effectiveness and potential future use.

- Hours of Operation  6:00am to 6:30pm to coincide with Traffic Management Center (TMC) hours of operation. The system will automatically page an operator during non-work hours (24 hours/day).

- Geographic Coverage  City of St. Paul, Central Business District (CBD)
- Contacts  See above
- Status  To be activated 2/96
- Block Diagram  See attached
- Policies  The magnitude of incident which will warrant activation of the DIVERT system will be defined in an operations plan which is not yet complete

- Typical Operational Scenario  When an incident is detected in the pre-determined St. Paul freeway segment by the Mn/DOT Traffic Management Center (TMC) a telephone communication will go to the DIVERT operator at the St. Paul City Hall
Annex. The operator will assess the incident using a video feed from the TMC camera system. If the incident is significant, the DIVERT System will be activated and variable message signs will be used to direct motorists off the freeways to local streets. Once on local streets, blank out signs along the alternate route guide diverted traffic to an entry point where they may get back on the freeway. Traffic signals along alternate routes will implement an alternate timing plan which provides longer green times for the diverted traffic. Any of four predetermined alternate routes may be activated by the DIVERT operator depending on the incident location and the associated traffic impacts.

2.1 PERSONNEL DIVERT OPERATOR
- Personnel Function Assess incidents in the DIVERT corridor and activate/deactivate the DIVERT message signs and timing plans.
- Quantity One
- Location St. Paul City Hall Annex
- Working hours 7:00 am to 4:00 pm
- Status Existing personnel

2.2 PERSONNEL TMC PERSONNEL
- Personnel Function Monitors TMC video system for incidents; will notify St. Paul DIVERT personnel if an incident is detected in the DIVERT corridor
- Quantity N/A
- Working hours TMC operation hours, 6:00 am to 6:30 pm
3.1 HARDWARE VARIABLE MESSAGE SIGN

- Hardware Type: Outdoor changeable message sign, currently mounted on trailers,
- Functions: Display messages telling motorists where to exit I-35E or I-94 during an incident
- Location: Signs are located upstream of the last exit a motorist reaches before each of the following ans they travel along I-35E or I-94:
  - I-35E NB
  - I-35E SB
  - I-94 EB
  - I-94 WB
- Quantity: Four
- Data Name/Contents: Instructions to motorists to exit the freeway and use alternate route
- Data Type: Text
- Status: Existing
- Recommended Improvements: City is examining the possibility of using bridge/overpass mounted signs
- Other: Manufactured by ADDCO and operated by proprietary ADDCO software

3.2 HARDWARE LED BLANK-OUT SIGN

- Hardware Type: LED sign; on/off control lead connected to Type 170 signal controller
- Functions: Display the alternate route to diverted motorists
- Location: At intersections along pre-determined alternate routes
- Data Name/Contents: Trailblazer info (i.e. indicates correct route)
- Data Type: Text
- Status: Existing
- Other: Supplied by Warning Lights, Inc.

3.3 HARDWARE INTERSECTION TRAFFIC SIGNAL

- Hardware Type: Red-Yellow-Green Traffic control signal
- Functions: Control traffic flow through intersections. During DIVERT System operation, the signal will have longer green times along the alternate route and longer red times on the cross streets.
- Location: At intersections along the alternate routes
- Data Name/Contents: N/A
<table>
<thead>
<tr>
<th>Data Type</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Existing</td>
</tr>
</tbody>
</table>
3.4 HARDWARE SYSTEM LOOP DETECTORS

- Hardware Type: Wire-coil magnetic induction vehicle detection device
- Functions: Send a signal indicating that a vehicle has passed over the loop
- Location: At intersections along alternate routes
- Data Name/Contents: Vehicle present/not present
- Data Type: Data
- Status: Existing
- Other: A total of 38 loop detectors have been added to the system to facilitate detection of congestion in the downtown St. Paul area. These detectors are located on city streets which intersect the DIVERT alternate routes. If a queue is building on one of these cross-streets the DIVERT system can be suspended to avoid congestion on local streets.

3.5 HARDWARE CLOSED CIRCUIT VIDEO (CCTV) CAMERA

- Hardware Type: Panasonic Color Video Camera
- Functions: Provides real-time visual monitoring of locations within the St. Paul CBD
- Location: Selected intersections
- Quantity: 6
- Data Name/Contents: Images of intersections along the designated alternate routes
- Data Type: Analog video

3.6 HARDWARE PAN/ TILT/ ZOOM (PTZ) ACTUATOR

- Hardware Type: Electromechanical PTZ Device
- Functions: Provides remote control pan, tilt, and zoom functions for the camera
- Location: Attached to each camera
- Quantity: Six
- Data Name/Contents: N/A
- Data Type: N/A
- Status: Existing
3.7 HARDWARE 30/332 INTERSECTION CONTROLLER CABINET
- Hardware Type: Environmental housing for Type 170 Intersection controller
- Functions: Provides power and environmental protection for controllers and other at-intersection hardware components
- Location: At intersections
- Data Name/Contents: N/A
- Data Type: N/A
- Status: Existing

3.8 HARDWARE TYPE 170 INTERSECTION CONTROLLER
- Hardware Type: Traffic signal controller
- Functions: Process, control, and log signal events. Also activates LED blank-out signs and receives data from loop detectors
- Location: At each intersection. This hardware is part of field signal system
- Data Type: Data
- Status: Existing

3.9 HARDWARE TYPE 400 MODEM
- Hardware Type: Serial communication device
- Functions: Communicates intersection component status to the DIVERT PC and receives commands to change signal timing and turn blank out signs on/off
- Location: At each intersection-this HW is part of field signal system and at St. Paul City Hall Annex
- Data Name/Contents: Blank out sign on/off, loop detector presence, signal light status, and system commands to change sign status and change timing plan.
- Data Type: Data
- Status: Existing
### 3.10 HARDWARE DIVERT PC

<table>
<thead>
<tr>
<th><strong>- Hardware Type</strong></th>
<th>Desktop PC</th>
</tr>
</thead>
</table>
| **- Functions** | 1) Monitors and displays incoming loop detector data  
2) Activates and controls variable message signs (VMS).  
3) Communicates DIVERT system status to TMC |
| **- Location** | St. Paul City Hall Annex |
| **- Quantity** | 1 |
| **- Data Name/Contents** | Communicating with:  
1) Loop detector: volume and lane occupancy  
2) VMS: Sign status and commands to display messages  
3) TMC: System active/inactive message |
| **- Data Type** | Data |
| **- Status** | Existing |
| **- Other** | ZEOS Pantera with Intel Pentium CPU |

### 3.10.1 SOFTWARE MS-DOS OPERATING SYSTEM

<table>
<thead>
<tr>
<th><strong>- Software Type</strong></th>
<th>MS DOS/ Windows</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>- Software Standards</strong></td>
<td>Win16/Win32s</td>
</tr>
<tr>
<td><strong>- Status</strong></td>
<td>Existing</td>
</tr>
</tbody>
</table>

### 3.10.2 SOFTWARE ADDCO SIGN MANAGEMENT SOFTWARE

<table>
<thead>
<tr>
<th><strong>- Software Type</strong></th>
<th>Sign control and management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>- Software Standards</strong></td>
<td>Propriety ADDCO standard</td>
</tr>
<tr>
<td><strong>- Functions</strong></td>
<td>Activates sign and selects message to display</td>
</tr>
<tr>
<td><strong>- Status</strong></td>
<td>Being installed</td>
</tr>
</tbody>
</table>

### 3.10.3 SOFTWARE EXCALIBUR DIVERT SOFTWARE

<table>
<thead>
<tr>
<th><strong>- Software Type</strong></th>
<th>Multifunction system management software.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>- Functions</strong></td>
<td>Communicates instructions to Type 170 controllers for timing plans and blank out signs and receives loop detector data</td>
</tr>
<tr>
<td><strong>- Status</strong></td>
<td>Being installed</td>
</tr>
</tbody>
</table>
3.11 HARDWARE CITY HALL ANNEX DIVERT MODEM

- **Hardware Type**: Dial-up serial communications device
- **Functions**: Provide data communication between St. Paul City Hall Annex and TMC. Will be used to notify TMC DIVERT PC of incidents, receive confirmation that the DIVERT System has been activated, and notify an off-hours DIVERT Operator through an automated dial-out to a paging service provider.
- **Location**: St. Paul City Hall Annex
- **Quantity**: 1
- **Data Name/Contents**: Messages indicating DIVERT system activity
- **Data Type**: Voice or data
- **Status**: Existing

3.12 HARDWARE DIVERT RELAYS

- **Hardware Type**: Electromechanical relay
- **Functions**: Switches signal timing plan control from COMPUTRAN system to DIVERT system by switching control twisted pairs from Modified Traffic Control System (MTCS) modems to DIVERT PC
- **Location**: St. Paul City Hall Annex
- **Quantity**: 25
- **Data Name/Contents**: N/A
- **Data Type**: N/A
- **Status**: Existing

3.13 HARDWARE MODIFIED TRAFFIC CONTROL SYSTEM (MTCS) MODEMS

- **Hardware Type**: Serial Communications Modem
- **Functions**: Communicates with Type 170 intersection controllers over dedicated twisted pair connections
- **Location**: St. Paul City Hall Annex
- **Quantity**: 25
- **Data Name/Contents**: Timing plan selections, blank-out sign on/off, and loop detector data
- **Data Type**: Data
- **Status**: Existing
### 3.14 HARDWARE AMERICAN DYNAMICS PAN/TILT/ZOOM CONTROL

- **Hardware Type**: American Dynamics PTZ Control Panel
- **Functions**: Allows operator at City Hall Annex to interactively control the pan, tilt and zoom functions of the camera in real time
- **Location**: St. Paul City Hall Annex
- **Quantity**: 1
- **Data Name/Contents**: N/A
- **Data Type**: N/A
- **Status**: Existing

### 3.15 HARDWARE AMERICAN DYNAMICS VIDEO SWITCHER

- **Hardware Type**: American Dynamics Video Switcher and control panel
- **Functions**: Allows operator at City Hall Annex to select any of six St. Paul cameras or any of the Mn/DOT-TMC cameras for display on the City Hall Annex video monitors
- **Location**: St. Paul City Hall Annex
- **Quantity**: 1
- **Data Name/Contents**: N/A
- **Data Type**: N/A
- **Status**: Existing

### 3.16 HARDWARE COLOR VIDEO MONITOR

- **Hardware Type**: Video Monitor
- **Functions**: Displays incoming video signals from various outdoor cameras
- **Location**: St. Paul City Hall Annex
- **Quantity**: 2
- **Data Name/Contents**: N/A
- **Data Type**: N/A
- **Status**: Existing
- **Other**: Phillips color monitor
3.17 HARDWARE A TMC MODEM@
- Hardware Type: Dial-up serial communications device
- Functions: Provide data communication between St. Paul City Hall Annex and TMC. Will be used to notify TMC DIVERT PC of incidents, receive confirmation that the DIVERT System has been activated and notify an off-hours DIVERT Operator through an automated dial-out to a paging service provider.
- Location: Mn/DOT Traffic Management Center
- Data Name/Contents: Messages indicating DIVERT system activity
- Data Type: Voice or Data
- Status: Existing

3.18 HARDWARE A TMC DIVERT PC@
- Hardware Type: Desktop Computer
- Functions: Receives data from the DIVERT PC at the St. Paul City Hall Annex indicating system status. Automatically dials into the Commercial Paging Service Provider and sends an alert message/code to DIVERT personnel.
- Location: Mn/DOT TMC
- Quantity: 1
- Data Name/Contents: DIVERT system active/inactive information, Message to page DIVERT personnel
- Data Type: N/A
- Status: Existing

3.19 HARDWARE A COMMERCIAL PAGING SERVICE PROVIDER@
- Hardware Type: Service provider
- Functions: Sends messages to pagers carried by DIVERT personnel
- Data Name/Contents: Messages and/or codes which indicate the presence of an incident in the DIVERT corridor
- Data Type: Data
3.20 HARDWARE APAGER@
- Hardware Type: Alphanumeric pager
- Functions: Receives messages from paging service and displays them on an LCD screen
- Location: Portable
- Data Name/Contents: Messages an/or codes relating to incidents in the DIVERT Corridor
- Data Type: Data

3.21 HARDWARE ATMC LAN@
- Hardware Type: Local area computer network
- Functions: Supplies loop detector data to the DIVERT system
- Location: Mn/DOT TMC
- Data Name/Contents: Lane volume/occupancy data from loop detectors in the DIVERT corridor.
- Data Type: Data

4.1 INTERFACE VARIABLE MESSAGE SIGN
- Connects to: DIVERT PC
- Interface location: N/A
- Interface Type: Data
- Interface Direction: Both
- Interface Component: Commercial cellular telephone service
- Information Type/Content: Instructions to signs to display a given message, confirmation signal back to DIVERT PC
- Information Direction: Both
- Information Frequency: As Needed

4.2 INTERFACE LED BLANK OUT SIGN
- Connects to: Type 170 intersection controller
- Interface location: At intersections
- Interface Type: On/Off
- Interface Direction: Input
- Interface Component: On/Off lead wire
- Protocol/Standard: N/A
- Information Type/Content: N/A
- Information Direction: Input
- Information Frequency: N/A
- Information Standards  N/A
### 4.3 INTERFACE

**INTERSECTION SIGNAL**

- Connects to ...
  - Type 170 intersection controller
- Interface location
  - At intersections
- Interface Type
  - Power 110 VAC
- Interface Direction
  - Input
- Interface Component
  - On/Off lead wire
- Protocol/Standard
  - N/A
- Information Type/Content
  - N/A
- Information Direction
  - Input
- Information Frequency
  - As Needed
- Information Standards
  - N/A
- Other
  - Controls the Red-Yellow-Green signal head

### 4.4 INTERFACE

**LOOP DETECTOR**

- Connects to ...
  - Type 170 intersection controller (via detector card amplifier)
- Interface location
  - At intersections
- Interface Type
  - Data
- Interface Direction
  - Output
- Interface Component
  - Lead wire
- Protocol/Standard
  - N/A
- Information Type/Content
  - N/A
- Information Direction
  - Output
- Information Frequency
  - As Needed
- Information Standards
  - N/A
4.5 INTERFACE

TYPE 170 INTERSECTION CONTROLLER
- Connects to ... DIVERT relay bank
- Interface location City Hall Annex
- Interface Type Data
- Interface Direction Both
- Interface Component Twisted pair cable
- Protocol/Standard RS-232 to a Type 400 Modem
- Information Type/Content This interface carries the following information:
  1) Lane volume/occupancy (via loop detection)
  2) Intersection light status
  3) Blank out sign on/off command and status (DIVERT route intersection only)
- Information Direction Both
- Information Frequency Continuous
- Information Standards N/A
- Other This interface uses a Type 400 modem at each end. The modems are integrated into the intersection controllers and into the DIVERT/COMPUTRAN systems.

4.6.1 INTERFACE

CCTV CAMERA/PTZ
- Connects to ... American Dynamics Pan/Tilt/Zoom Controller
- Interface location City Hall Annex
- Interface Type Data
- Interface Direction Input
- Interface Component Twisted Pair (shared with video signal)
- Protocol/Standard N/A
- Information Type/Content N/A
- Information Direction Input
- Information Frequency As Needed
- Information Standards N/A
4.6.2 INTERFACE

**CCTV CAMERA/PTZ**

- Connects to ... American Dynamics Video Switcher
- Interface location City Hall Annex
- Interface Type Video
- Interface Direction Output
- Interface Component Twisted Pair (shared with PTZ signal)
- Protocol/Standard N/A
- Information Type/Content Real time color video signal from St. Paul CBD cameras
- Information Direction Output
- Information Frequency Continuous
- Information Standards N/A

4.7 INTERFACE

**DIVERT RELAYS**

- Connects to ... DIVERT PC
- Interface location City Hall Annex
- Interface Type Data
- Interface Direction Both
- Information Type/Content Signal status and loop detector information from 170 Controllers at intersections; also LED blank out sign on/off signals and timing plan select commands
- Information Direction Both
- Information Frequency As Needed

4.8 INTERFACE

**DIVERT RELAYS**

- Connects to ... MTCS Modems
- Interface location City Hall Annex
- Interface Type Data
- Interface Direction Both
- Interface Component Twisted Pair cables
- Information Type/Content Signal status and loop detector information from 170 Controllers at intersections; also LED blank out sign on/off signals and timing plan select commands
- Information Direction Both
- Information Frequency As Needed
- Other This is the default control information path connecting to the COMPUTRAN system
### 4.9 INTERFACE

**AMERICAN DYNAMICS VIDEO SWITCHER**

- Connects to...
  - Color Video Monitors
- Interface location
  - City Hall Annex
- Interface Type
  - Composite video
- Interface Direction
  - Output
- Interface Component
  - RCA cable
- Protocol/Standard
  - RGB Composite Video
- Information Type/Content
  - Video signal from video switcher, which selects the camera whose output is to be viewed
- Information Direction
  - Output
- Information Frequency
  - Continuous

### 4.10 INTERFACE

**AMERICAN DYNAMICS VIDEO SWITCHER**

- Connects to...
  - Mn/DOT Central Office Video Feed
- Interface location
  - City Hall Annex
- Interface Type
  - Data
- Interface Direction
  - Input
- Interface Component
  - Twisted pair cable
- Information Type/Content
  - Video from any of the TMC system cameras
- Information Direction
  - Input
- Information Frequency
  - Continuous

### 4.11 INTERFACE

**ST. PAUL CITY HALL ANNEX DIVERT MODEM**

- Connects to...
  - DIVERT PC
- Interface location
  - City Hall Annex
- Interface Type
  - Data
- Interface Direction
  - Both
- Interface Component
  - RS-232 Serial
- Information Type/Content
  - Communication about incident detection and DIVERT System status
  - Also sends Mn/DOT loop detector data to St. Paul City Hall Annex for loops in the DIVERT corridor
- Information Direction
  - Both
- Information Frequency
  - As needed
## 4.12 INTERFACE

**ST. PAUL CITY HALL ANNEX DIVERT MODEM**

- **Connects to ...**
  Mn/DOT TMC DIVERT MODEM (via US West)
- **Interface location**
  City Hall Annex
- **Interface Type**
  Voice/Data
- **Interface Direction**
  Both
- **Interface Component**
  Voice grade telephone service (US West)
- **Information Type/Content**
  Communication about incident detection and DIVERT System status
  Also sends Mn/DOT loop detector data to St. Paul City Hall Annex for loops in the DIVERT corridor
- **Information Direction**
  Both
- **Information Frequency**
  As needed

## 4.13 INTERFACE

**TMC DIVERT MODEM**

- **Connects to ...**
  TMC DIVERT PC
- **Interface location**
  Mn/DOT TMC
- **Interface Type**
  Data
- **Interface Direction**
  Both
- **Interface Component**
  RS-232 Serial connection
- **Information Type/Content**
  Communication about incident detection and DIVERT system status (active/inactive)
- **Information Direction**
  Both
- **Information Frequency**
  As needed

## 4.14 INTERFACE

**TMC DIVERT MODEM**

- **Connects to ...**
  Commercial Paging Service Provider
- **Interface location**
  Mn/DOT TMC
- **Interface Type**
  Data
- **Interface Direction**
  Both
- **Interface Component**
  US West voice grade telephone line
- **Information Type/Content**
  Message or code sent to commercial paging service provider to be relayed to the pager devices
- **Information Direction**
  Both
- **Information Frequency**
  As needed
4.15 INTERFACE
- Connects to ... COMMERCIAL PAGING SERVICE PROVIDER
- Interface Type DIVERT Pagers
- Interface Direction Data
- Interface Component Radio Pager transmission
- Information Type/Content Messages/codes indicating incident detection status
- Information Direction Both
- Information Frequency As needed

4.16 INTERFACE TMC LAN
- Connects to ... DIVERT PC
- Interface Type Data
- Interface Direction Both
- Interface Component Ethernet
- Information Type/Content Mn/DOT loop detector data for loops in the DIVERT corridor
- Information Direction Both
- Information Frequency Continuous
3.3.4 ADVANCED PARKING INFORMATION SYSTEM
Baseline Data Collection
Advanced Parking Information System

ASG Group Black Box
  Processing Unit
  Modem

US West T1 Service

City Hall Annex
  T1 Communications Device
  Pentium PC
    Operator

Electronic Matrix Signs
  (10)

Static Signs
  (38)

erification Signs at Ramp
  (10)

Radio Link

Radio Link

Radio Link

RAM Mobile
Data
AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY  CITY OF ST. PAUL - DEPARTMENT OF PUBLIC WORKS

- Agency Type  City of St. Paul, Department of Public Works
- Agency Functions  Manage traffic operations and data, including:
  $ Collect data through vehicle detection devices (i.e. loop detectors)
  $ Operate signal systems (installation, maintenance, programming)
  $ Traffic management planning
- Agency Location(s)  St. Paul City Hall Annex

2.0 SYSTEM  ADVANCED PARKING INFORMATION SYSTEM

- Date of As-Is Data Collection  1/25/96
- Purpose  Provide real-time parking availability information to motorists. This system uses dedicated hardware at each participating ramp to detect vehicle entries/exits and to contact a central PC with the number of spaces available at a given ramp. The PC then relays the information to RAM MobileData, which broadcasts the information to electronic matrix signs with special receivers. There are dedicated electronic matrix signs for each ramp and the signs will display the number of remaining spaces at the ramp.
- Hours of Operation  During special events.
- Geographic Coverage  Downtown St. Paul
- Contacts  Paul Kurtz, City of St. Paul, Department of Public Works.
- Status  To be implemented 2/96 at ten (10) participating ramps.
- Issues  This is an FHWA operational test; duration is one year
- Block Diagram  See attached
- Typical Operational Scenario  Will be activated and provide information to motorists during special events.

2.1 PERSONNEL  SYSTEM ADMINISTRATOR

- Personnel Function  As an operational test, details about staff responsibilities and workload were not available. However, the contact person for this system indicated that an administrative position and a staff position would be necessary for this system
2.2 **PERSONNEL**

**A STAFF@**

- Personnel Function See personnel 2.1

3.1 **HARDWARE**

**AAGS GROUP BLACK BOX@**

- Hardware Type Vehicle detection and space availability black box (AGS Group)
- Functions Monitors entries/exits from parking ramp and communicates data to computer at City Hall Annex
- Location At participating parking ramps
- Data Name/Contents Content is number of spaces available at ramp
- Data Type Data
- Status Being installed
- Contact AGS Group (European manufacturer)
- Other One unit with detectors at each of ten ramps

3.2 **HARDWARE**

**A VEHICLE LOOP DETECTOR@**

- Hardware Type Magnetic induction-type vehicle detector
- Functions Indicates presence of vehicle
- Location At entrances and exits of parking structures
- Data Type Data (on/off pulse)
- Status Existing

3.3 **HARDWARE**

**AAGS GROUP MODEM@**

- Hardware Type Dial-up modem
- Functions Sends information from AGS Group black box to US West T1 service
- Location At each ramp
- Data Name/Contents Number of spaces available at ramp
- Data Type Data
- Status Existing
- Other This hardware is a physical component of the AGS Group blackbox.

3.4 **HARDWARE**

**AUS WEST T1 SERVICE@**

- Hardware Type T1 Service
- Functions Receives data from AGS Group Black Box modems at each ramp, sends data to City Hall Annex on a single T1 line.
- Data Name/Contents Number of spaces available at ramp
<table>
<thead>
<tr>
<th>- Data Type</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Status</td>
<td>Being installed</td>
</tr>
</tbody>
</table>
3.5 HARDWARE AT1 COMMUNICATIONS DEVICE@
- Functions: Receives data from US West T1 service
- Location: St. Paul City Hall Annex
- Data Name/Contents: Number of spaces available at ramp
- Data Type: Data
- Status: Being installed

3.6 HARDWARE APENTIUM PC@
- Hardware Type: Intel-based Personal Computer
- Functions: Processes incoming space availability data and sends appropriate data to RAM Mobile Data for transmission to signs.
- Location: St. Paul City Hall Annex
- Data Name/Contents: Incoming data is ramp space availability; outgoing data is message sign display information
- Data Type: Data
- Status: Being installed

3.6.1 SOFTWARE ADOS@
- Software Type: Operating System
- Software Standards: MS-DOS

3.6.2 SOFTWARE AMICROSOFT WINDOWS@
- Software Type: Operating System/GUI
- Software Standards: Win16/Win32

3.6.3 SOFTWARE AASG GROUP SYSTEM SOFTWARE@
- Software Type: Integrated communications/sign management package
- Functions: Communicate with ramp black boxes for space data, process data, communicate with electronic matrix signs
- Status: To be deployed 2/96

3.7 HARDWARE APRINTER@
- Hardware Type: Dot-Matrix printer
- Functions: Print hard copies of log messages
- Location: City Hall Annex
- Data Name/Contents: System operations data, error messages
- Data Type: Data
### 3.8 HARDWARE RAM MOBILE DATA TRANSMITTER
- **Hardware Type**: Proprietary RF transmitter
- **Functions**: Sends data to RAM Mobile Data transmitter facility in Woodbury.
- **Location**: City Hall Annex
- **Data Name/Contents**: Number of spaces at ramps for display on the electronic matrix signs.
- **Data Type**: Data

### 3.9 HARDWARE ELECTRONIC MATRIX SIGNS
- **Hardware Type**: Outdoor electronic changeable message sign
- **Functions**: Display messages regarding parking space information to motorists
- **Location**: Curbside in downtown St. Paul
- **Data Name/Contents**: Number of available spaces at appropriate ramps/lots
- **Data Type**: RAM MobilData Radio information
- **Status**: Existing but inactive

### 3.10 HARDWARE STATIC SIGNS
- **Hardware Type**: Steel outdoor signs
- **Functions**: Direct motorists to ramps
- **Location**: City of St. Paul CBD, various sites
- **Data Name/Contents**: Ramp name, arrow showing direction
- **Data Type**: Text

### 3.11 HARDWARE VERIFICATION SIGNS AT RAMP
- **Hardware Type**: Steel outdoor signs
- **Functions**: Confirm ramp location to motorists
- **Location**: At participating ramps
- **Data Name/Contents**: Ramp Name
- **Data Type**: Text

### 4.1 INTERFACE AGS GROUP BLACK BOX MODEM
- **Connects to ...**: US West T1 Service
- **Interface Type**: Data
- **Interface Direction**: Both
- **Interface Component**: US West Voice Grade Telephone Line
- **Protocol/Standard**: Unknown/proprietary
<table>
<thead>
<tr>
<th>Information Type/Content</th>
<th>Parking space availability data for ramp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Direction</td>
<td>Output</td>
</tr>
</tbody>
</table>
4.2 INTERFACE | VEHICLE LOOP DETECTOR  
- Connects to ... | AGS Group black box  
- Interface location | At parking ramps  
- Interface Type | Data (on/off pulse)  
- Interface Direction | Output  
- Interface Component | Wire lead  
- Information Type/Content | Presence of vehicle  
- Information Direction | Output

4.3 INTERFACE | US WEST T1 SERVICE  
- Connects to ... | T1 Communications device  
- Interface Type | Data  
- Interface Direction | Both  
- Information Type/Content | Parking space availability data for each of the ten ramps  
- Information Direction | Output

4.3 INTERFACE | PENTIUM PC  
- Connects to ... | Printer  
- Interface location | City Hall Annex  
- Interface Type | Data  
- Interface Direction | Both  
- Interface Component | Parallel Cable  
- Information Type/Content | Information to be printed  
- Information Direction | Output

4.4 INTERFACE | UNKNOWN CONNECTION FROM PC TO RAM MOBILE DATA TRANSMITTER  
- Connects to ... | RAM Mobile Data transmitter on rooftop  
- Interface location | City Hall Annex  
- Interface Type | Data  
- Interface Direction | Both  
- Information Type/Content | Parking space availability data for each ramp  
- Information Direction | Output

4.4 INTERFACE | RAM MOBILE DATA TRANSMITTER  
- Connects to ... | RAM Mobile Data service in Woodbury, MN  
- Interface Type | Data
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Direction</td>
<td>Both</td>
</tr>
<tr>
<td>Information Type/Content</td>
<td>Parking space availability data for each ramp</td>
</tr>
<tr>
<td>Information Direction</td>
<td>Output</td>
</tr>
</tbody>
</table>
### 4.5 INTERFACE

- **Connects to ...**  
  Electronic Matrix Signs

- **Interface location**  
  RAM Transmitter: Woodbury, MN

- **Interface Type**  
  Data

- **Information Type/Content**  
  Parking space availability data for ramp

- **Information Direction**  
  Both
APPENDIX A

As-Is Agency Reports
Pre-Survey Candidate Systems List
PRE-SURVEY CANDIDATE SYSTEMS

Traffic Signal Control Systems
- City of St. Paul Computran traffic signal control system
- City of St. Paul traffic signal intersection hardware (field equipment)
- City of Minneapolis Fortran traffic signal control system
- Mn/DOT Metro Division/District traffic office closed loop traffic signal system(s)
- County closed loop traffic signal systems (Hennepin, Ramsey, etc.)
- City closed loop traffic signal systems
- Video detection/control of signal system (T.H. 65 & 53rd, Lyndale and Franklin Ave)
- Pre-emption of traffic signals for emergency vehicles (EVP)
- Pre-emption of traffic signal at fire stations
- Pre-emption of traffic signals at railroad crossings (20 locations in Metro area)
- Minneapolis AUSCI operational test

Freeway Management System
- Mn/DOT TMC ramp meter system
- Mn/DOT TMC video surveillance system
- Mn/DOT TMC CMS control system
- KBEM radio broadcast system
- Mn/DOT TMC cable TV information system - (Triple Vision system)
- Mn/DOT Metro Division/District portable changeable message signs
- TMC traffic history database (volume and occupancy data)
- TMC incident log database
- U of M Autoscope incident detection system
- Genesis operational test
- Trilogy operational test
- Mn/DOT workzone traffic management system operational test

Transit Management Systems
- MCTO "Trapeze" scheduling/planning system (creates bus/driver schedules)
- MCTO "radio" system (computer assisted radio system, 7 channels)
- MCTO automatic passenger counters (on some buses)
- MCTO electronic fare collection boxes (on all buses)
- MCTO TIC BusLine system (voice responses system, customer service system)
- MCTO customer service system for route/schedule planning (live telephone operators)
- MCTO transportation section (provides construction information to MCTO)
- MCTO bus stop database (contains the attributes of each bus stop)
- MCTO Police crime/incident tracking system
- MCTO Opticom emitters (EVP on 80 buses)
- MCTO speed light system (ramp meter pre-emption on selected ramps)
- MCTO Route-O-Matic system - vectors around incidents and congestion
- Metropolitan Council Rideshare system (Mn dial-a-ride)
- MCTO funded paratransit systems
- Metropolitan Council Metro Mobility passenger registration system
- Metropolitan Council Metro Mobility passenger reservation system
- U of M transit management
- Southwest Transit
- Minnesota Valley Transit
- Plymouth Metrolink
- School bus dispatch systems

Incident Management Program
- Mn/DOT TMC Highway Helper program (including AVL system)
- Private tow contracts
- U of M police incident management
- St. Paul DIVERT operational test

Electronic Fare Payment Systems
- City of Minneapolis Parking fare collection (smart card)
- City of Minneapolis electronic parking meter maid system
- Smart Darts operational test
PRE-SURVEY CANDIDATE SYSTEMS (CONTINUED)

Electronic Toll Collection Systems
- Toll road proposals (5 proposals in MN)
- Congestion Pricing Study
- Mileage based tax study

Multi modal Traveler Information Systems
- Travlink operational test

Administrative Systems
- Mn/DOT Electrical Services maintenance management system
- Mn/DOT Electrical Service gopher state one-call access system
- Mn/DOT TIS
- Mn/DOT automatic traffic recorder system
- Mn/DOT ISTEA management systems
- Mn/DOT CVO administrative systems
- DPS CVO administrative systems
- City of Minneapolis sign database

Other Information Systems
- Airline flight arrival/departure information - NW
- Airport rental car kiosk - Hertz
- MN Office of Tourism travel information center kiosks
- Mn/DOT TMC road weather information system access
- Mn/DOT Metro Division weather information access
- Mn/DOT Aeronautics weather information system
- Mn/DOT statewide road weather information telephone information
- Mn/DOT Pavement Condition and Weather Reporting System - future
- Internal distribution system Distribution of TMC loop data via the Internet
- RWIS - Mn/DOT future Road/Weather Information System

Emergency Response Systems
- Motorist call box system
- Mobile Data Terminals (MDT) in all State Patrol cars
- Laptop PC's in State Patrol cars to replace MDT's - pilot project in 1996
- Emergency 911 log system at State Patrol
- State Patrol information desk
- State Patrol South St. Paul information desk
- State Patrol access to drivers license information via 911 center
- Mn/DOT Mayday operational test
- Demand response dispatch systems - numerous standalone systems

Parking Management Systems
- Metropolitan airports commission parking management
- City of Minneapolis parking management systems
- U of M parking management
- St. Paul Advanced Parking Information System operational test

Miscellaneous
- Mn/DOT portable traffic management system
- City of Minneapolis police special event management
- City of St. Paul special event management
- U of M special event management
- Mn/DOT pilot differential GPS broadcast base station
- Mn/DOT maintenance vehicle AVL
- Mn/DOT Metro Division/District maintenance dispatch
- Hennepin County Medical Center emergency vehicle dispatch
- MN Pollution Control Agency air quality monitoring sites
- Met. Council Forecasting models - uses data from Mn/DOT TIS database
- U of M traffic management system proposal

Interagency Systems
- ICTM - Integrated Corridor Traffic Management System operational test
  (includes Autoscope)
- ARCTIC - operational test in Virginia, MN
PRE-SURVEY CANDIDATE SYSTEMS (CONTINUED)

CVO Systems
- List of systems from MN Guidestar
- CVO call-in number
- State Patrol toll free Information number

Construction Information/Notification Systems
- Gopher State One Call system for utility locations
- Mn/DOT construction information dissemination
- Counties' systems (Hennepin County)
- Counties' systems (Ramsey County)
- City system (Minneapolis)
- City system (St. Paul)
- Utilities' systems

Communications Systems
- Mn/DOT TMC Fiber optic data communications system
- Mn/DOT Microwave Communication System
- Mn/DOT T1 system
- Mn/DOT Wide Area Network
- MNET (STARS)
- Voice radio - State Patrol, Mn/DOT Maintenance, DNR
- 800 MHZ Trunked Radio system (Metro area)
- Internet Communications
- Traffic Signal Interconnect systems
- RBDS - Radio Broadcast Data Systems
- Mn/DOT Video Conferencing
APPENDIX B

As-Is Agency Reports
Data Collection Guide