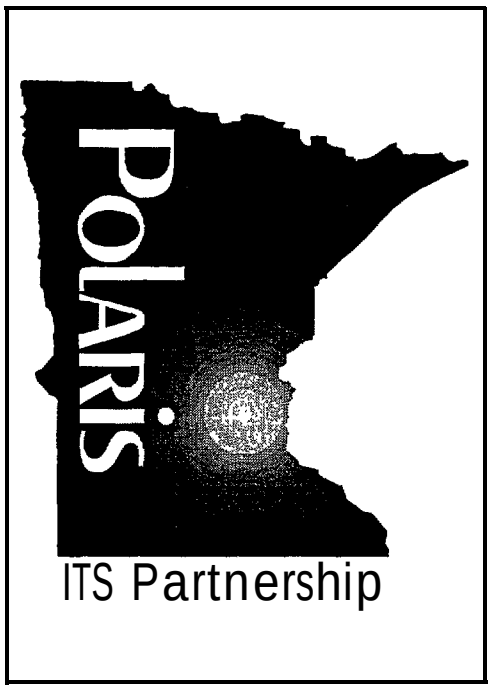
Minnesota Department of Transportation Agreement Number: 73807P

Minnesota Intelligent Transportation Systems

Statewide Intelligent Transportation Systems As-Is Agency Reports for Minnesota



Volume 2
Mn/DOT Traffic Management Center

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Statewide ITS As-Is Agency Report for Minnesota
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Appendices

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, M.n/DOT Guidestar, and SRF

Consulting Group, Inc. Of the 12 1 candidate systems, 3 8 system surveys were performed and included in this document. The 38 systems were selected as "best representatives" of the 12 1 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 where 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.

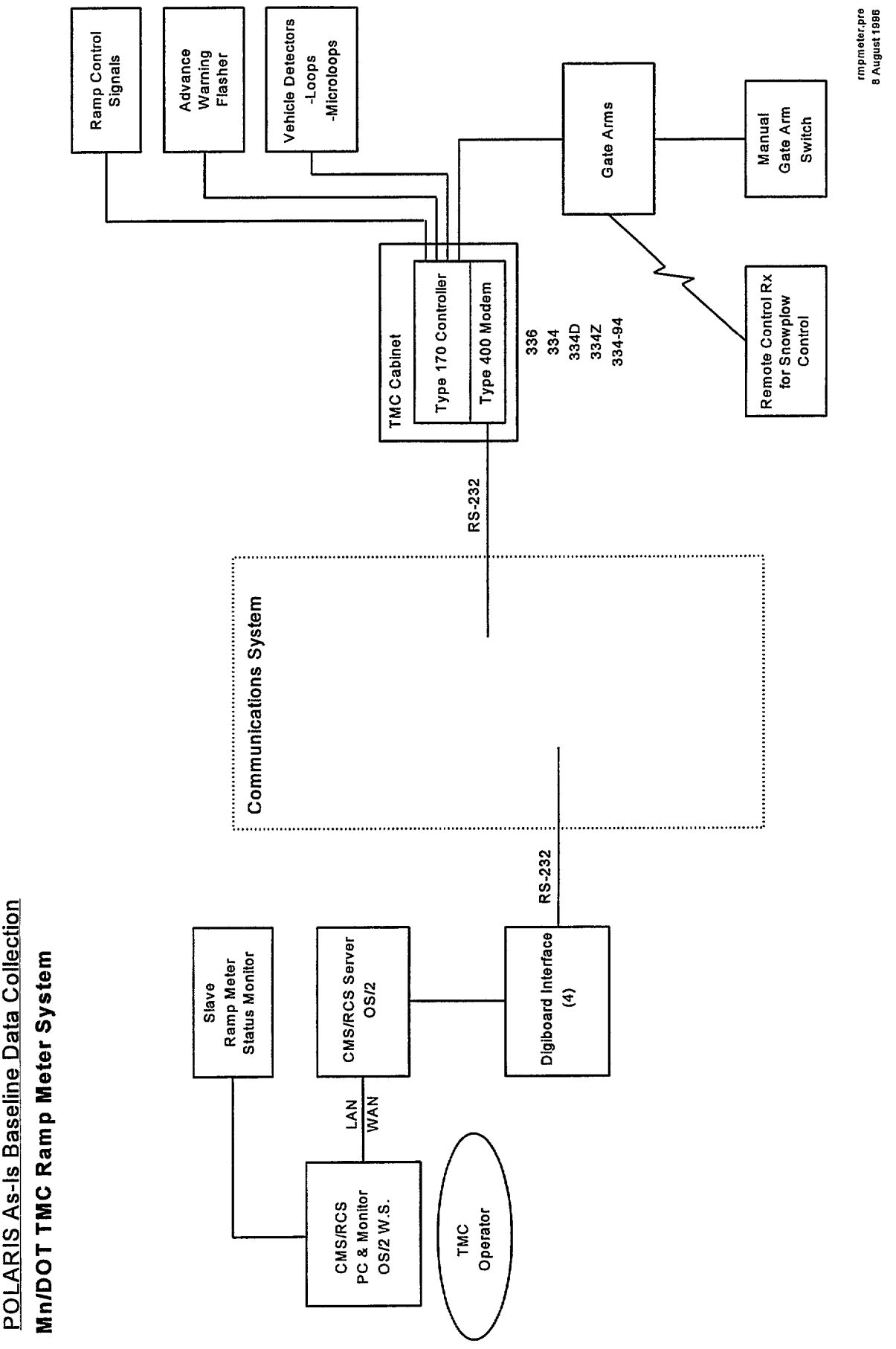
The system reports contained in this volume follow in Section 3.

3. As-Is Baseline System Documentation

3.2 MN/DOT TRAFFIC MANAGEMENT CENTER

3.1.1 Mn/DOT TMC Ramp Meter System
3.1.2 Mn/DOT TMC Video Surveillance System
3.1.3 MnDOT TMC Changeable Message Sign System
3.1.4 Mn/DOT TMC Communications System
3.1.5 Mn/DOT TMC Highway Helper AVL System

3.2.1 MN/DOTTMC RAMP METER SYSTEM


POLARIS As-Is Baseline Data Collection
Mn/DOT TMC Ramp Meter System
Ramp Control Signals
Advance Warning Flasher
Vehicle Detectors -Loops -Microloops
Gate Arms
Manual Gate Arm Switch
TMC Cabinet
Type 170 Controller
Type 400 Modem
336
334
334D
334Z
334-94
Remote Control Rx for Snowplow Control
RS-232
Communications System
RS-232
Slave Ramp Meter Status Monitor
CMS/RCS Server OS/2
Digiboard Interface (4)
LAN
WAN
CMS/RCS PC & Monitor OS/2 W.S.
TMC Operator
rmpmeter.pre
8 August 1998

AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY "MN/DOT TRAFFIC MANAGEMENT CENTER"

- Agency Type	Traffic Management
- Agency Functions	Manage traffic on Twin City area freeway system.
- Agency Location(s)	11014th Avenue South Minneapolis, MN 55404

2.0 SYSTEM "MN/DOT TMC RAMP METER SYSTEM'

- Date of As-Is Data Collection	2/15/96
- Purpose	To control the flow of traffic centering the freeway system to optimize the flow of traffic on the mainline.
- Hours of Operation	6AM-9PMM-F, llAM-6PMSat., l0AM-5PM Sun. and as needed for construction, special events and emergencies.
- Geographic Coverage	Twin Cities Metro Area (TCMA) freeways.
- Contacts	Rich Lau, Patty Bednarz, Terry Haukom
- Status	Existing - 380 ramps metered - 350 online (490 ramps will be metered by 1998). Approximately 160 miles of freeway covered by this system.

2.1 PERSONNEL "TMC OPERATOR"

- Personnel Function	Monitor traffic management system devices and utilize information to manage traffic congestion, incidents and provide motorist information.
- Quantity	2 operators work during peak period shifts, 1 operator during off-peak shifts.
- Location	Traffic Management Center control room.
- Workload	High. Each operator has a multitude of devices to monitor, assimilate information and make real time decisions.
- Working hours	Each operator works a shift of 3-4 hours. Weekend shifts are 8 hours.
- Status	Existing

3.1 HARDWARE "CMS PC & MONITOR"

- Hardware Type	Computer
- Functions	Display status of traffic management devices. Accept device control commands and forward to CMS/RCS PC Server.
- Location	TMC Control Room
- Data Name/Contents	1) Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) HAR sign status 5) Ramp Control Signal status
- Data Type	Data
- Status	Existing
- Other	Ron Dahl

3.2 HARDWARE "CMSRCS SERVER"

- Hardware Type	Computer
- Functions	1) Poll 170 controllers 2) Receive ramp meter status and loop detector data (volume/occupancy) from the Type 170 controllers. 3) Write loop detector data to database. 4) Compute ramp meter rates using loop detector data (30 second loop detector station volume and occupancy). 5) Send control commands to ramp meter 170 controllers. 6) Maintain traffic history database of 5 minute loop data. 7) Generate congestion status map.
- Location	TMC - Computer Room
- Data Name/Contents	l)Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) HAR sign status 5) Ramp Control Signal status 6) Loop detector volume/occupancy data
- Data Type	Data
- Status	Existing
- Other	Ron Dahl

3.3 HARDWARE "DIGIBOARD INTERFACE"

- Hardware Type	Router
- Functions	Allows a PC to interface to multiple (up to 256) RS-232 communication ports.
- Location	TMC Computer Room
- Data Name/Contents	l)Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) Ramp Control Signal status 5) Loop detector volume/occupancy data
- Data Type	Data
- Status	Existing

3.4 HARDWARE "TYPE 170 CONTROLLER"

- Hardware Type	Traffic Signal Controller
- Functions	Receives ramp metering rate commands from the TMC central computer and controls variable message signs and lane control signals.
- Location	In field cabinet near lane control signals or within the interchange where ramp meter is installed.
- Data Name/Contents	1) Line number 2) Drop number 3) Ramp number 4) Ramp metering rate (rate 1-6, or 7=flash) 5) Ramp meter status 6) Loop detector data (volume and occupancy)
- Data Type	Data
- Status	Existing

3.4.1 SOFTWARE "170 CONTROLLER SOFTWARE"

- Software Type	Transportation software application
- Software Standards	Custom - written by TMC personnel
- Functions	Operate devices which interface with 170 controller: - Detector Amplifiers - Power Distribution Assembly (Ramp Control Signals, Advance Warning Flashers, Gatearms) - Store loop detector data. - Communicate with CMS/RCS server. - Send loop detector data to CMS/RCS server when polled. - Receives verification/status signals from gatearms and provides status to CMS/RCS server.
- Application Language	Motorola 6800 Assembler Language
- Status	Existing

3.5 HARDWARE "RAMP CONTROL SIGNAL"

- Hardware Type	Traffic Signal
- Functions	Display visual indication to traveler to control traffic entering freeway on a ramp. Visual indication is either: 1) Yellow flashing bulb 2) Green - Yellow - Red cycling bulb.
- Location	On most entrance ramps onto freeways in Metro Area. One ramp control signal is required for each entrance ramp lane. Ramp control signals are usually placed approximately 250 feet from end of concrete nose. This allows vehicles to accelerate from a dead stop to 40-45 mph at the point of merge with freeway traffic.
- status	Existing - 380 ramps metered - 350 online 490 ramps will be metered by 1998.
- Policies	Most ramps have dual lane metering. With the exception of the 10th Street ramp to I-35W southbound, all ramp meters are one car per green.
- Constraints	Isolated ramp control signals are constrained to running by a fixed time clock. Two signal heads are required for each lane. Voltage drop/luminance standards.
- Issues	Ramp control signals getting knocked down in winter is a problem.

3.6 HARDWARE "ADVANCE WARNING FLASHER"

- Hardware Type	Traffic Signal
- Functions	Display visual indication to traveler approaching freeway entrance to warn driver that ramp is being metered and that a queue may exist. Visual indication is a yellow flashing bulb.
- Location	On high speed roadways approaching freeway entrance ramps where ramp meter and queue is not visible from approach roadway.
- Status	Existing, but not at all ramp meters.

3.7 HARDWARE "VEHICLE DETECTORS"

- Hardware Type	Detector
- Functions	Detect vehicles, record number of vehicles passing over a traffic lane (volume) and the time that the detector's detection zone was occupied by a vehicle (occupancy).
- Location	In traffic lane
- Data Name/Contents	Volume - number of vehicles passing over a traffic lane. Occupancy - the time that the detector's detection zone was occupied by a vehicle.
- Data Type	Data
- Status	Existing

3.8 HARDWARE "GATEARMS"

- Hardware Type	Gatearm - traffic control device
- Functions	Physically block the entrance to a the HOV lane when gatearm is in down position.
- Location	On lanes leading into I-394 HOV lane.
- Status	Existing
- Policies	Gatearms are connected to 170 controllers and the TMC control room to allow TMC operators to open and close gatearms. This method is not used. Gatearms (HOV lane) are opened in the field by Mn/DOT Highway Helper personnel.
- Other	Manual Gatearm Switch allows Mn/DOT personnel to open and close gatearms in the field. Remote Control receiver allows a Mn/DOT snowplow driver to open a set of gatearms long enough for a snowplow to pass through during plow operations.

4.1 INTERFACE	TYPE 170 CONTROLLER
- Connects to . . .	Ramp control signals, advance warning flasher, changeable message signs, variable message signs and lane control signs.
- Interface location	In field.
- Interface Type	Power
- Interface Direction	Both
- Interface Component	Power conductor cables and twisted pair cable.
- Protocol/Standard	120 VAC
- Information Type/Content	Power
- Information Direction	output

4.2 INTERFACE	TYPE 170 CONTROLLER
- Connects to . . .	Vehicle Detectors
- Interface location	In field.
- Interface Type	Data - low voltage current - frequency delta.
- Interface Direction	Both
- Interface Component	Detector amplifier in cabinet connected to detector lead-in cable which is connected to vehicle detector.
- Information Type/Content	Volume - number of vehicles passing over a traffic lane. Occupancy - the time that the detector's detection zone was occupied by a vehicle.
- Information Direction	Input
- Information Frequency	24 hour/day

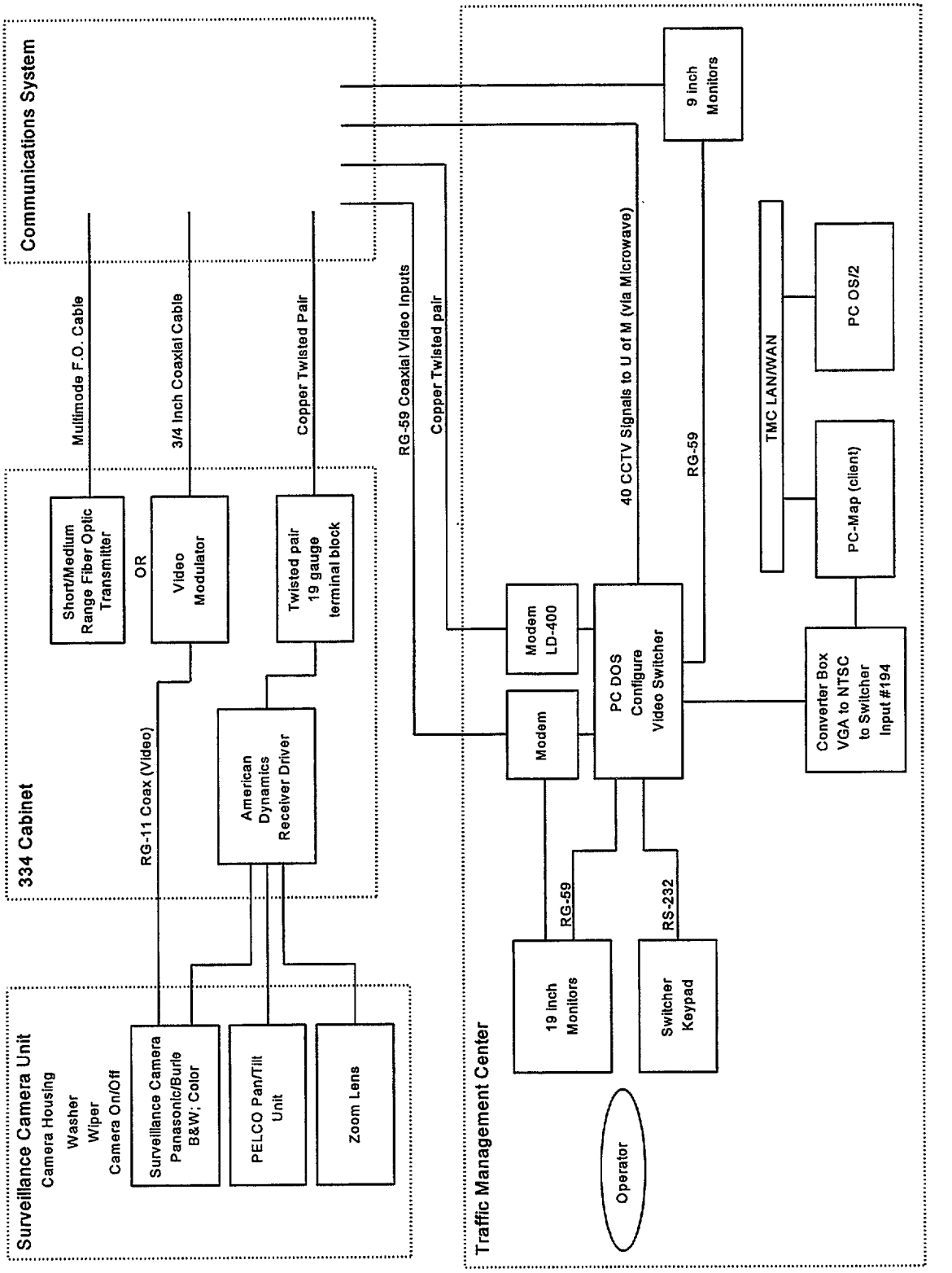
4.3 INTERFACE	TYPE 170 CONTROLLER
- Connects to . . .	Communication System
- Interface location	In field.
- Interface Type	Data
- Interface Direction	Both
- Interface Component	Type 400 modem connected to copper twisted pair, and fiber optic cable.
- Protocol/Standard	RS-232
- Information Type/Content	1) Detector volume - number of vehicles passing over a traffic lane. 2) Detector occupancy - the time that the detector's detection zone was occupied by a vehicle. 3) Station volume and occupancy - the average volume and occupancy data measured over all detectors in one detector station (freeway direction) for the last 30 second time interval. 4) 170 controller line number 5) 170 controller drop number 6) Ramp number 7) Ramp metering rate (rate l-6, or 7=flash) 8) Ramp meter status
- Information Direction	Both
- Information Frequency	30 seconds
- Information Standards	1200 and 2400 baud

4.4 INTERFACE	CMS/RCS SERVER
- Connects to . . .	TMC Communications System
- Interface location	TMC
- Interface Type	Data
- Interface Direction	Both
- Interface Component	Twisted pair and fiber optic cable
- Protocol/Standard	RS-232
- Information Type/Content	1) Detector volume - number of vehicles passing over a traffic lane. 2) Detector occupancy - the time that the detector's detection zone was occupied by a vehicle. 3) Station volume and occupancy - the average volume and occupancy data measured over all detectors in one detector station (freeway direction) for the last 30 second time interval. 4) 170 controller line number 5) 170 controller drop number 6) Ramp number 7) Ramp metering rate (rate l-6, or 7=flash) 8) Ramp meter status
- Information Direction	Both
- Information Frequency	Once per minute
- Information Standards	1200 and 2400 baud

3.2.2 MN/DOT TMC VIDEO SURVEILLANCE SYSTEM

POLARIS As-Is Baseline Data Collection

Mn/DOT TMC Video Surveillance System



AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY 'MN/DOT TRAFFIC MANAGEMENT CENTER"

- Agency Type	Traffic Management
- Agency Functions	Design, Operate, Evaluate Freeway Traffic Management System
- Agency Location(s)	1101 4th Ave. S., Minneapolis. MN 55404

2.0 SYSTEM "MN/DOT TMC VIDEO SURVEILLANCE SYSTEM'

- Date of As-Is Data Collection	l/15/96
- Purpose	1) Verification of incidents on Twin Cities Metropolitan Area (TCMA) freeways. 2) Verification of ramp meter operations 3) Traffic management aid 4) Incident management
- Hours of Operation	6:00 AM - 7:30 PM M-F, 10:00 AM - 6:00 PM Saturday, and 11:OO AM -7:00 PM Sunday at TMC 24 hrs/day at Metro District and St. Patrol
- Geographic Coverage	TCMA freeway system
- Contacts	Rich Lau, Patty Bednarz, Terry Haukom
- Status	156 Cameras are currently in place
- Policies	Install CCTV camera at intervals as needed for coverage of TCMA freeway system.

2.1 PERSONNEL "TMC OPERATOR'

- Personnel Function	Monitor traffic management system devices and utilize to manage traffic congestion, incidents and provide motorist information.
- Quantity	2 operators work during peak period shifts, 1 operator during off-peak shifts.
- Location	Traffic Management Center control room.
- Workload	High. Each operator has a multitude of devices to monitor, assimilate information and make real time decisions.
- Working hours	Each operator works a shift of 3-4 hours on weekdays. Weekend shifts are 8 hours.
- Status	Existing

3.1 HARDWARE "TMC VIDEO SWITCHER"

- Hardware Type	Video switcher
- Functions	Receiver video signal from up to 214 inputs and provide for routing of any incoming video signal to any one of 64 video outputs as directed by operator. Place identifiers on video output signal (CCTV #, locations, direction, time and date along freeway). Switcher computer maintains database of CCTV locations, identifiers, outputs, etc. Switcher manages requests from operator keypads based on administrator's controls.
- Location	TMC communications room (basement)
- Data Name/Contents	Surveillance video
- Data Type	Video
- Status	Existing
- Constraints	214 video inputs should be adequate capacity for TCMA freeway, however the 64 outputs is limiting the ability to transmit video signals to other agencies.
- Recommended Improvements	Project to replace switcher is funded and programmed for 1996.
- Other	American Dynamics Inc. Switcher will be replaced in 1996 to provide 256 inputs and 128 outputs.

3.2 HARDWARE "SURVEILLANCE CAMERA"

- Hardware Type	Camera
- Functions	Capture live video pictures, convert to analog signal.
- Location	Typically mounted on 50' pole adjacent to freeway on Mn/DOT R/W spaced at approximately 1 mile intervals. 7 cameras mounted atop 4 high rise buildings along I-94 corridor between Minneapolis and St. Paul.
- Data Type	Real time video signal - NTSC baseband video.
- Status	Existing at 156 locations. Planned for X locations.
- Policies	Install CCTV cameras along all 250+ miles of TCMA freeways.
- Constraints	Cameras can view % mile of freeway in each direction, therefore each camera can monitor 1 mile of freeway. Cameras limited to 350 degree rotation.
- Recommended Improvements	Existing Black & White cameras will be replaced with color cameras in the future.
- Other	Panasonic 350, 350C and Burle cameras.

3.3 HARDWARE "PELCO PAN/TILT UNIT"

- Hardware Type	Motors
- Functions	Pan and tilt the surveillance camera.
- Location	Typically mounted on 50' pole adjacent to freeway on Mn/DOT R/W spaced at approximately 1 mile intervals. 7 cameras mounted atop 4 high rise buildings along I-94 corridor between Minneapolis and St. Paul.
- Data Name/Contents	None
- Data Type	None
- Status	Existing
- Constraints	Since cables are attached to camera unit, camera can only rotate 350 degrees.

3.4 HARDWARE "ZOOM LENS"

- Hardware Type	Camera Lens
- Functions	Zoom in on incident to provide better view.
- Location	Mounted on end of camera.
- Data Name/Contents	Video
- Data Type	Video
- status	Existing
- Policies	Typically use a 12X lens, (15 --> 180)

3.5 HARDWARE "AMERICAN DYNAMICS RECEIVER DRIVER"

- Hardware Type	Communications receiver.
- Functions	Receives control command messages from video switcher, converts to power outputs to control camera devices. Converts RS-232 signal from the TMC to Manchester.
- Location	334 Cabinet near Camera pole.
- Data Name/Contents	Control for camera, lens, pan/tilt, washer/wiper.
- Data Type	Data
- Status	Existing

3.6 HARDWARE "SHORT/MEDIUM RANGE FIBER OPTIC TRANSMITTER"

- Hardware Type	Transmitter
- Functions	Converts NTSC baseband video signal to signal and transmits onto multi-mode fiber optic cable into Communication System.
- Location	334 Cabinet near Camera pole.
- Data Name/Contents	Surveillance video signal
- Data Type	Video
- Status	Existing
- Constraints	Short range Tx has maximum 1.5 mile transmission range. Medium range Tx has maximum 4.9 mile transmission range.
- Other	Short range transmits at 850 nm, Medium range transmits at 1300 nm.

3.7 HARDWARE "VIDEO MODULATOR"

- Hardware Type	Converts NTSC baseband video signal to AM RF signal with other camera signals and transmits onto coaxial cable into Communication System.
- Functions	Cabinet near Camera pole.
- Location	Surveillance video signal
- Data Name/Contents	Video
- Data Type	Existing

3.8 HARDWARE 'SWITCHER KEYPAD"

- Hardware Type	Keypad
- Functions	Via a joystick, number pad, and function keys, this keypad is used by the Operator to: 1) select cameras and route camera signal to video monitor 2) move cameras 3) control all camera functions such as pan, tilt, zoom, washer, etc
- Location	TMC Control Room, State Patrol Dispatch, Metro Maintenance Dispatch, MCTO, City of Minneapolis and City of St. Paul
- Data Name/Contents	Camera number, monitor number, camera control command, date and time.
- Data Type	Data
- Status	Existing
- Constraints	Maximum of 32 keypads allowed by existing switcher.

3.9 HARDWARE "'19 INCH AND 9 INCH MONITORS"

- Hardware Type	Video monitors
- Functions	Displays CCTV video signals
- Location	TMC Control Room
- Data Name/Contents	Surveillance video
- Data Type	Video
- Status	Existing
- Other	48-l 9" B/W monitors, 4-l 9" color monitors, 120- 9" B/W monitors.

3.10 HARDWARE "MODEM/LD-400"

- Hardware Type	Communications data converter.
- Functions	Receives control command messages from video switcher (RS-232) and transmits to communications system.
- Location	TMC communications room.
- Data Name/Contents	Control messages for camera, lens, pan/tilt, washer/wiper.
- Data Type	Data
- Status	Existing

4.1 INTERFACE	AMERICAN DYNAMICS BLACK BOX
- Connects to . . .	Camera, Lens, Pan/Tilt Unit
- Interface location	In field, from 334 cabinet to camera housing.
- Interface Type	Data
- Interface Direction	Both
- Interface Component	27 conductor #18 gauge cable from 334 cabinet to housing.
- Protocol/Standard	Manchester coded control
- Information Type/Content	Device control commands
- Information Direction	output
- Information Frequency	As operator needs to move camera/devices.

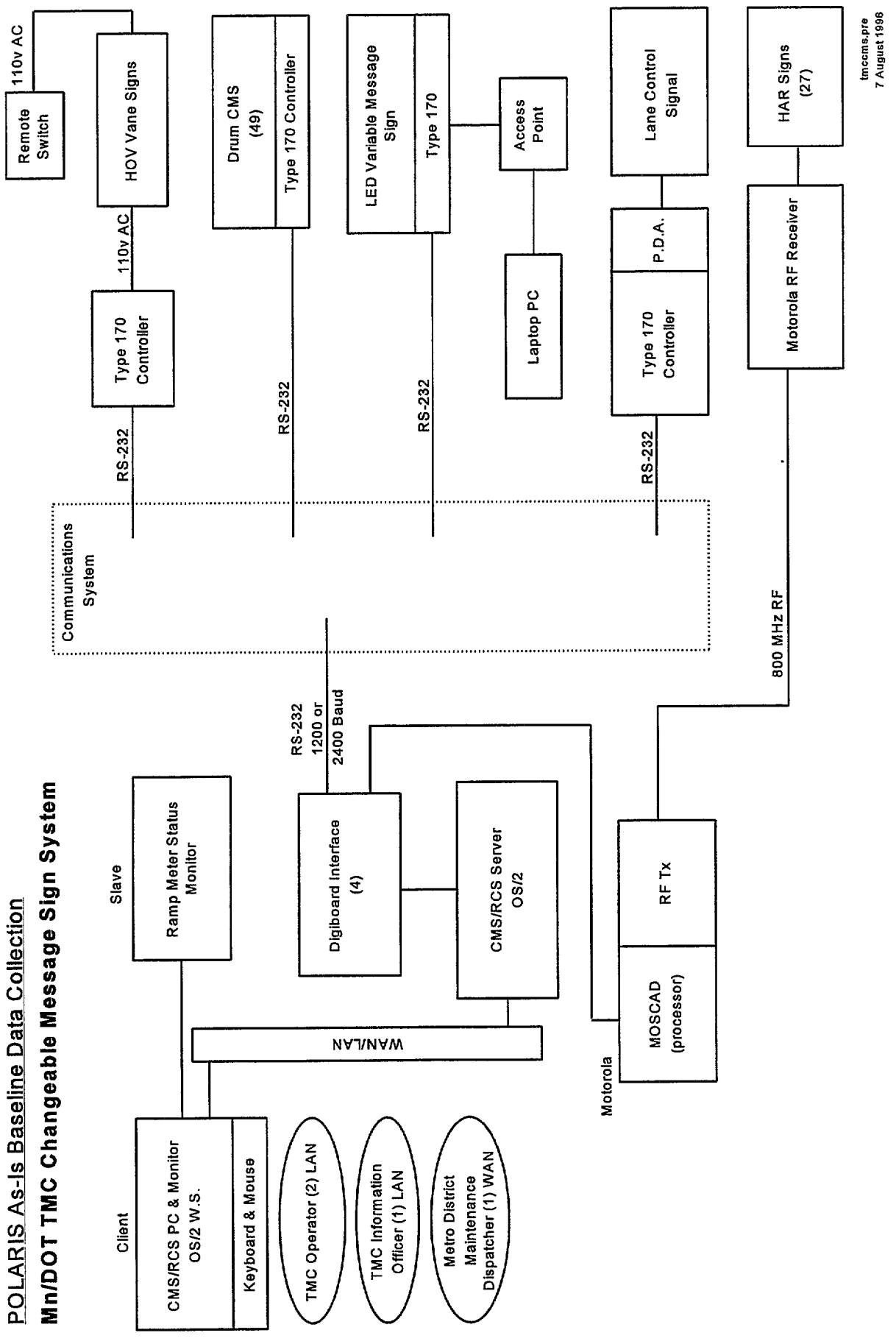
4.2 INTERFACE	SURVEILLANCE CAMERA
- Connects to . . .	Short/medium range transmitter, video modulator or video multiplexor
- Interface location	In field, from camera housing to 334 cabinet or shelter.
- Interface Type	Video
- Interface Direction	output
- Interface Component	RG-11 triaxial cable
- Protocol/Standard	NTSC baseband video
- Information Type/Content	Video
- Information Direction	output
- Information Frequency	Real time - X frames per second

4.3 INTERFACE	COMMUNICATIONS SYSTEM
- Connects to . . .	TMC Video Switcher
- Interface location	TMC Communications Room
- Interface Type	Video and Data
- Interface Direction	Output (Video from Comm. System to Switcher) Input (Camera control from Switcher to Comm. System)
- Interface Component	Coaxial cable (video), twisted pair (camera control) and Type 170 controller
- Information Type/Content	Video Signal, Camera control signals.
- Information Direction	Both
- Information Frequency	Real time

4.4 INTERFACE	TMC VIDEO SWITCHER
- Connects to . . .	19" and 9" monitors Fiber optic equipment
- Interface location	TMC
- Interface Type	NTSC baseband video
- Interface Direction	Output - from switcher to monitors.
- Interface Component	RG-59 Coax cable
- Protocol/Standard	NTSC baseband video
- Information Type/Content	NTSC baseband video
- Information Direction	Video signal goes from Communications system to the 9" monitors, and then is split off and sent back to the video switcher where video signal is then routed to appropriate 19" monitors (only 128) of the system video signals.
- Information Frequency	Real time - 24 hours/day.

4.5 INTERFACE	TMC VIDEO SWITCHER
- Connects to . . .	Switcher Keypad
- Interface location	TMC
- Interface Type	Data
- Interface Direction	Both
- Interface Component	RS-232 cable
- Protocol/Standard	RS-232
- Information Type/Content	Camera number, monitor number, camera control command.
- Information Direction	Both
- Information Frequency	24 hours per day.

3.2.3 MN/DOT TMC CHANGEABLE MESSAGE SIGN SYSTEM


POLARIS As-Is Baseline Data Collection
Mn/DOT TMC Changeable Message Sign System
Client
CMS/RCS PC & Monitor OS/2 W.S.
Keyboard & Mouse
TMC Operator (2) LAN
TMC Information Officer (1) LAN
Metro District Maintenance Dispatcher (1) WAN
WAN/LAN
Slave
Ramp Meter Status Monitor
RS-232 1200 or 2400 Baud
Digiboard Interface (4)
CMS/RCS Server OS/2
Motorola
MOSCAD (processor)
RF Tx
800 MHz RF
Motorola RF Receiver
HAR Signs (27)
Communications System
RS-232
Type 170 Controller
110v AC
HOV Vane Signs
Remote Switch
110v AC
RS-232
Drum CMS (49)
Type 170 Controller
RS-232
LED Variable Message Sign
Type 170
Access Point
Laptop PC
RS-232
Type 170 Controller
P.D.A.
Lane Control Signal
tmccms.pre
7 August 1998

AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY "MN/DOT TRAFFIC MANAGEMENT CENTER"

- Agency Type	Traffic Management
- Agency Functions	Manage traffic on Twin City area freeway system.
- Agency Location(s)	110 14th Avenue South Minneapolis, MN 55404

2.0 SYSTEM "MN/DOT TMC CHANGEABLE MESSAGE SIGN SYSTEM"

- Date of As-Is Data Collection	2/l 5/96
- Purpose	Display incident information to motorists to prevent accidents, manage congestion.
- Hours of Operation	24 hours/day via either TMC or maintenance.
- Geographic Coverage	Twin City Metropolitan Area (TCMA) freeways.
- Contacts	Patty Bednarz, Terry Haukom
- Status	Existing
- Policies	It is a TMC policy that changeable messages signs (CMS) will be used in the event of an incident or other situation (construction, special event, etc) that affects freeway traffic flow to alert motorists of unexpected circumstances.
- Constraints	Mn/DOT does not have the entire freeway system instrumented with changeable message signs.
- Block Diagram	See attached

2.1 PERSONNEL "TMC OPERATOR"

- Personnel Function	Monitor traffic management system devices and utilize to manage traffic congestion, incidents and provide motorist information.
- Quantity	2 operators work during peak period shifts, 1 operator during off-peak shifts.
- Location	Traffic Management Center control room.
- Workload	High. Each operator has a multitude of devices to monitor, assimilate information and make real time decisions.
- Working hours	Each operator works a shift of 3-4 hours. Weekend shifts are 8 hours.
- Status	Existing.

2.2 PERSONNEL "TMC INFORMATION OFFICER"

- Personnel Function	Information Officer is responsible for the collection/assimilation of congestion and incident information, and uses this information to determine appropriate messages to disseminate to the motorist via changeable message signs and radio.
- Quantity	One Information Officer works for each peak period **Shift.**
- Location	Traffic Management Center control room.
- Working hours	AM peak period 6AM - 9 AM PM peak period 3PM - 7 PM
- Status	Existing

3.1 HARDWARE! "DRUM CHANGEABLE MESSAGE SIGN (CMS)"

- Hardware Type	Changeable message sign
- Functions	Display messages to motorists traveling on the freeway to alert them of unexpected travel situations.
- Location	Mounted on bridges or sign bridges over the freeway traffic lanes throughout the TCMA See attached location map.
- Data Name/Contents	Sign messages
- Data Type	Text
- Status	Existing at 49 locations in the TCMA.
- Policies	- Line 1 of the sign is used to describe the type of incident. - Line 2 of the sign is used to give the incident location. - Line 3 of the sign is used to communicate the impact of the incident.
- Constraints	Each text line of a drum type CMS resides on one sign of a hexagon drum, therefore only 5 different messages may be displayed per line, with the 6th side used for a blank message.
- Recommended Improvements	Mn/DOT TMC will be installing Light Emitting Diode (LED) signs at locations in the TCMA where more sign message flexibility is required than currently available via Drum CMS.
- Other	Drum type CMS have been used extensively in the TCMA because of good durability, reliability, and low maintenance requirements.

3.2 HARDWARE "HOV VANE SIGNS"

- Hardware Type	Changeable message sign.
- Functions	The HOV Vane sign consists of a standard static freeway type guide sign with a changeable message module located in the bottom center portion of the sign. The changeable message module consists of multiple "vanes" (vertical sections of sheet metal) with a message on both sides of the sheet metal. An electric motor moves the vanes to display the appropriate message about the status of the HOV reversible lane.
- Location	On I-394, T.H. 100 and I-94 near the entrances to the I-394 reversible lane.
- Data Name/Contents	Sign message, for example: OPEN, CLOSED, LEFT LANE, or an arrow.
- Data Type	Data - via a sign display.
- Status	Existing.
- Policies	The HOV vane signs are connected to a Type 170 controller and the traffic Management Center communications and control system but the current operation of the sign is via manually controlling the sign in the field by a Mn/DOT Highway Helper.

3.3 HARDWARE "LED VMS"

- Hardware Type	Variable Message Sign
- Functions	Display messages to motorists traveling on the freeway to alert them of unexpected travel situations.
- Location	Mounted on a sign bridge over the freeway traffic lanes over the eastbound lanes of I-494 just west of the 1-494/I-94 interchange.
- Data Name/Contents	Sign messages
- Data Type	Text
- Status	Existing

3.4 HARDWARE "LANE CONTROL SIGNAL"

- Hardware Type	Changeable message sign.
- Functions	Displays a green arrow, yellow arrow, or red flashing X to indicate the condition each lane of traffic.
- Location	Mounted over I-94 on approaches to the Lowry Hill tunnel.
- Data Name/Contents	Sign display - green or yellow arrow, red X.
- Data Type	Data - sign display.
- Status	Existing
- Policies	Used only during incidents or non-typical congestion in the I-94 Lowry Hill tunnel area.

3.5 HARDWARE "LAPTOP PC"

- Hardware Type	Portable Computer
- Functions	Allows maintenance or other personnel to operate the LED Variable message sign from an access point near the sign.
- Location	Mobile
- Data Name/Contents	Sign control software.
- Data Type	Data - sign control
- Status	Existing

3.6 HARDWARE "TYPE 170 CONTROLLER"

- Hardware Type	Traffic Signal Controller
- Functions	Receives sign message requests from the TMC central computer and controls variable message signs and lane control signals.
- Location	In field cabinet near lane control signals or within the
- Data Name/Contents	l)Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status
- Data Type	Data
- Status	Existing

3.7 HARDWARE "CMS/RCS PC & MONITOR'

- Hardware Type	Computer
- Functions	Display status of traffic management devices. Accept device control commands and forward to CMS/RCS PC Server.
- Location	TMC Control Room
- Data Name/Contents	1) Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) HAR sign status 5) Ramp Control Signal status
- Data Type	Data
- Status	Existing
- Contact	Ron Dahl

3.8 HARDWARE "CMSRCS SERVER"

- Hardware Type	Computer
- Functions	1) Poll 170 controllers 2) Receive ramp meter status and loop detector data (volume/occupancy) from Type 170's. 3) Write loop detector data to database. 4) Compute ramp meter rates using loop detector data (30 second loop detector station volume and occupancy). 5) Send control commands to changeable messages signs. 6) Receives verify messages from changeable message signs. 7) Generate congestion status map.
- Location	TMC - Computer Room
- Data Name/Contents	l)Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) HAR sign status 5) Ramp Control Signal status 6) Loop detector volume/occupancy data
- Data Type	Data
- status	Existing
- Contact	Ron Dahl

3.9 HARDWARE "MOSCAD/RFTRANSMITTER"

- Hardware Type	Processor
- Functions	Transmits message to HAR sign.
- Location	TMC
- Data Name/Contents	Sign address and On/Off command.
- Data Type	Data
- Status	Existing

3.10 HARDWARE "MOTOROLA RF RECEIVER"

- Hardware Type	Radio receiver
- Functions	Receives transmission from MOSCAD/Transmitter and turns on/off HAR sign. Transmits confirmation messages back to MOSCAD including: Tamper Alarm, Power Off Alarm, Sign Active Verification
- Location	Mount on HAR sign in field.
- Data Name/Contents	Receives sign address and On/Off command transmission from MOSCAD/Transmitter.
- Data Type	Data
- Status	Existing

3.11 HARDWARE "HAR SIGNS"

- Hardware Type	Static Message Sign with flashing lights.
- Functions	Display flashing beacons to motorists traveling on the freeway to alert motorists to tune to KBEM radio to hear broadcast of information about traffic incident on roadway they are approaching.
- Location	Mounted on breakaway U-channel posts on shoulder along side of roadway.
- Data Name/Contents	Static sign displays message "Tune to Traffic Radio 88.5 FM when flashing". Lights alternate flashing to create a "wig-wag" strobe effect.
- Data Type	Text, flashing lights.
- Status	Existing
- Policies	TMC will turn on wig wag flashers only when major incident occurs which necessitates live continuous broadcast of traffic information on KBEM.
- Constraints	Sign legend cannot be changed.

3.12 HARDWARE "DIGIBOARD INTERFACE"

- Hardware Type	Router
- Functions	Allows a PC to interface to multiple (up to 256) RS-232 communication ports.
- Location	TMC Computer Room
- Data Name/Contents	l)Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) Ramp Control Signal status 5) Loop detector volume/occupancy data
- Data Type	Data
- Status	Existing

4.1 INTERFACE	Type 170 Controller
- Connects to . . .	TMC Communications System
- Interface location	Roadside
- Interface Type	Data
- Interface Direction	Both
- Interface Component	Twisted pair copper wire cable
- Protocol/Standard	RS-23 2
- Information Type/Content	1)Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) Ramp Control Signal status 5) Loop detector volume/occupancy data
- Information Direction	Both
- Information Frequency	Every 30 seconds

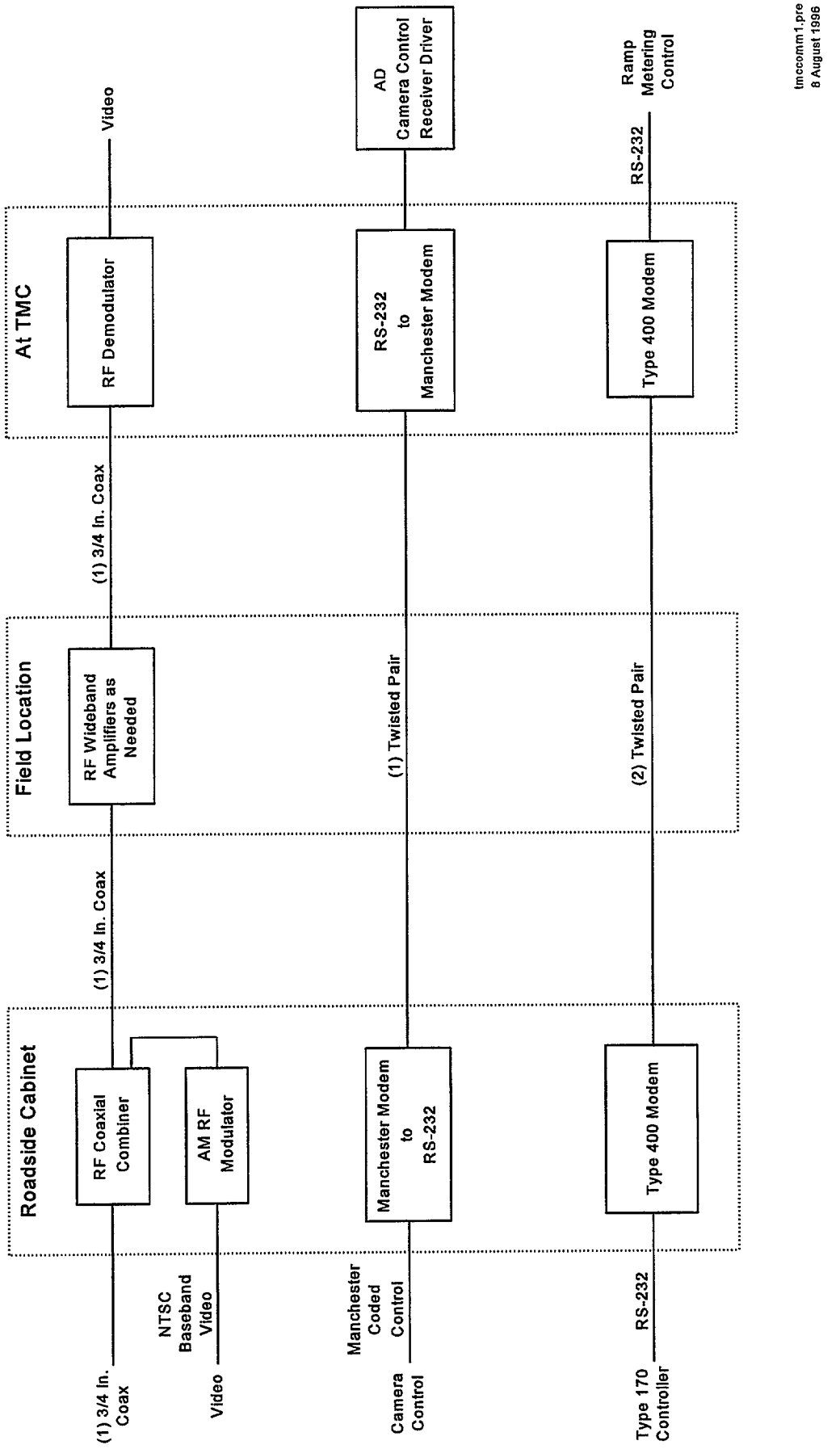
4.2 INTERFACE	CMS/RCS SERVER
- Connects to . . .	TMC Communications System
- Interface location	TMC
- Interface Type	Data
- Interface Direction	Both
- Interface Component	Twisted pair cooper wire cable
- Information Type/Content	l)Changeable Message Sign messages 2) Changeable Message Sign status 3) Lane Control Signal Status 4) HAR sign status 5) Ramp Control Signal status 6) Loop detector volume/occupancy data
- Information Direction	Both
- Information Frequency	Continuous

4.3 INTERFACE	MOSCKYTRANSMITTER
- Connects to . . .	Motorola RF Receiver
- Interface location	TMC to/from field
- Interface Type	Data
- Interface Direction	Both
- Interface Component	800 MHZ Radio Frequency
- Information Type/Content	Commands to turn HAR sign on/off. Confirmation messages back to MOSCAD including: Tamper Alarm, Power Off Alarm, Sign Active Verification.
- Information Direction	Both

3.2.4 MN/DOT TMC COMMUNICATIONS SYSTEM

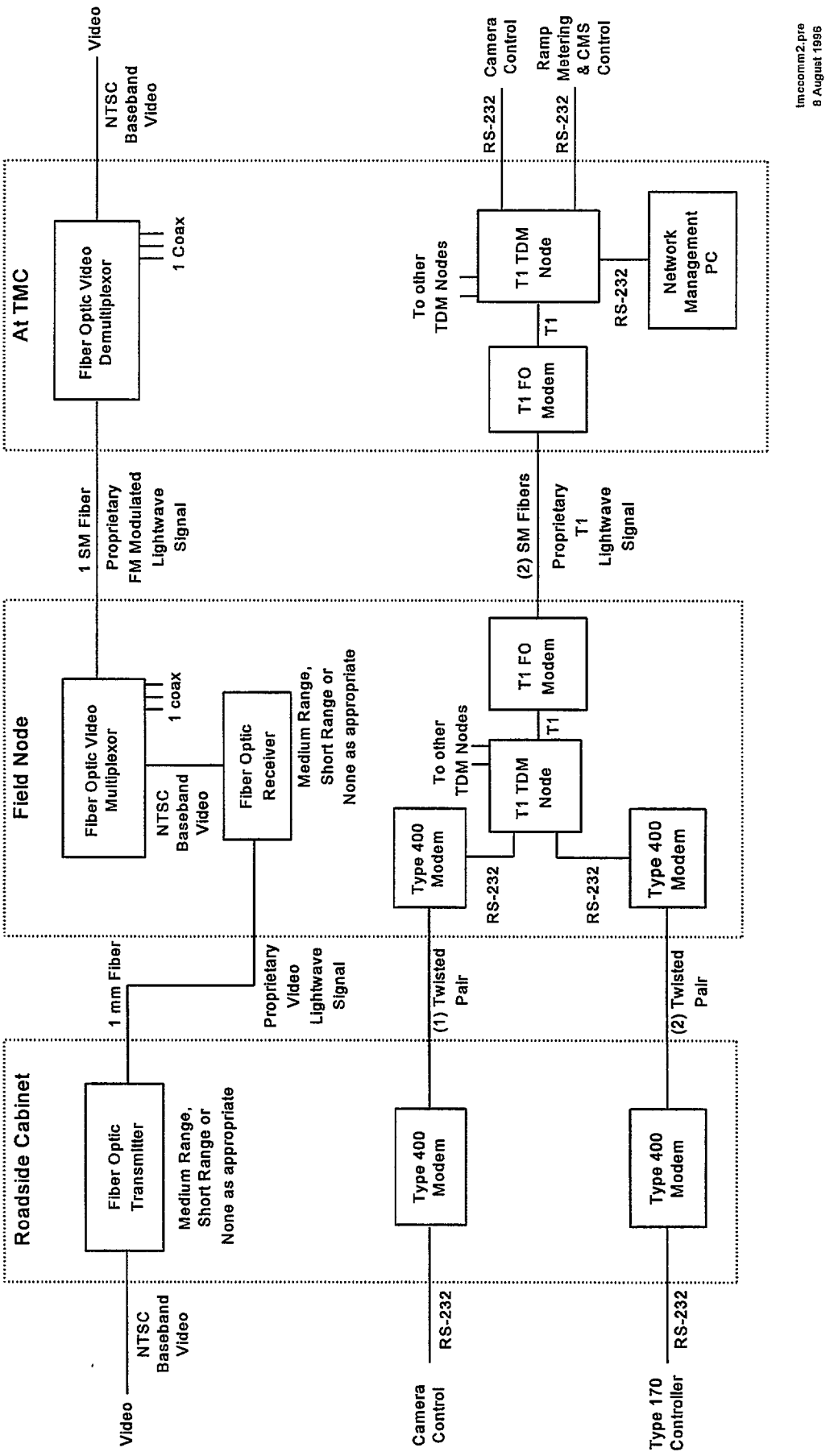
POLARIS As-Is Baseline Data Collection

Mn/DOT TMC Communication System Configuration #1



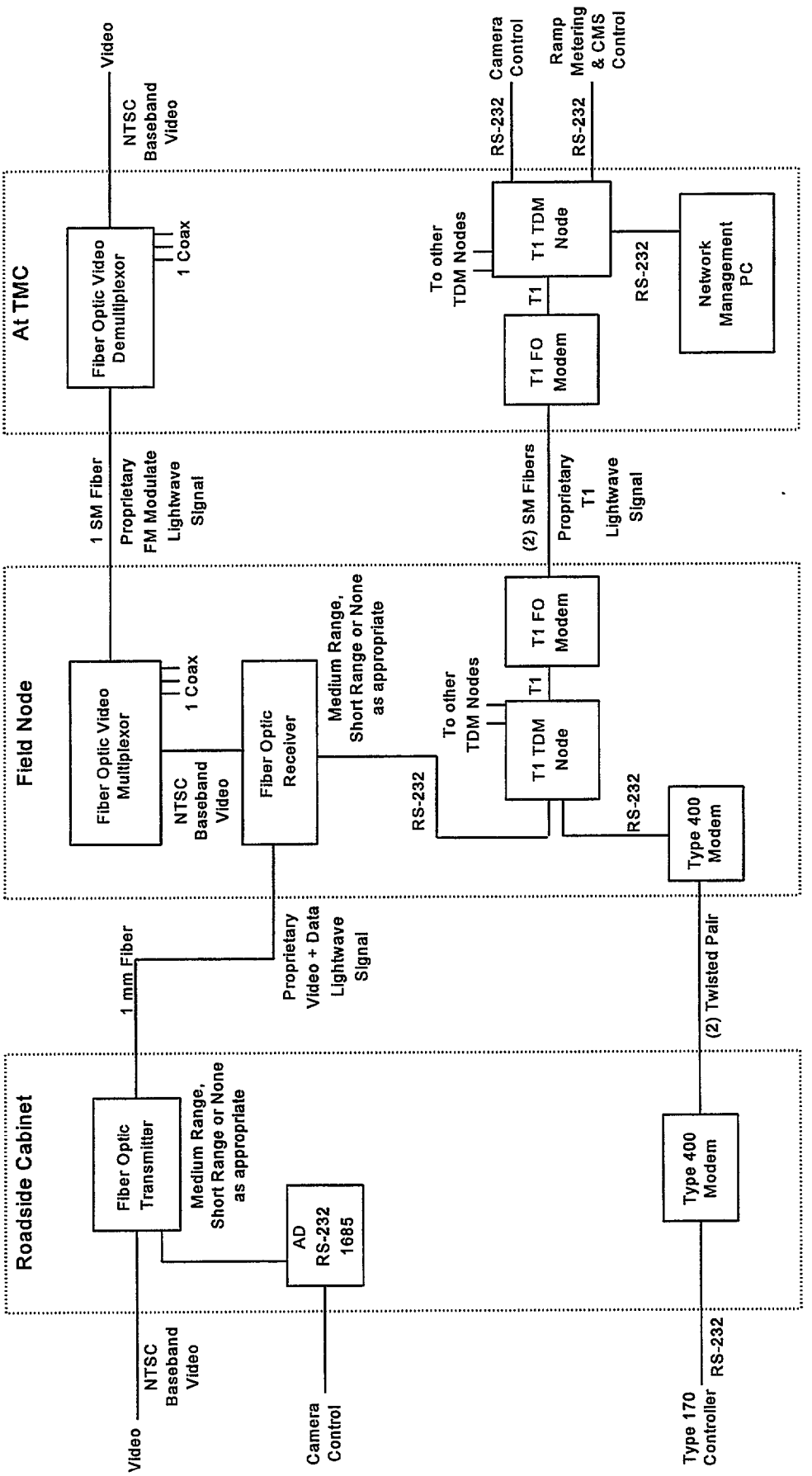
POLARIS As-Is Baseline Data Collection

Mn/DOT TMC Communication System Configuration #2



POLARIS As-Is Baseline Data Collection

Mn/DOT TMC Communication System Configuration #3



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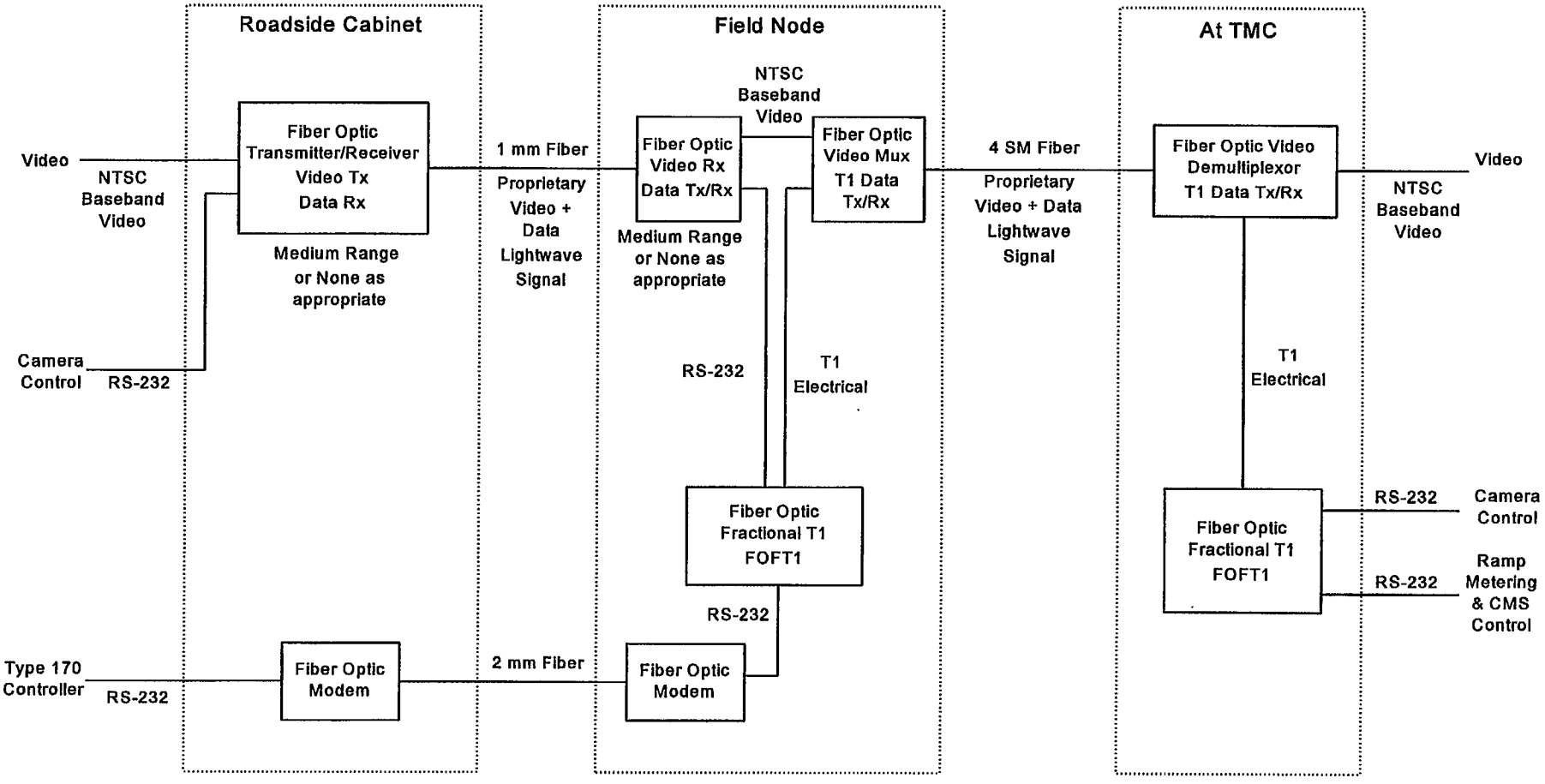
15 May 1996

POLARIS As-Is Baseline Data Collection

Mn/DOT TMC Communication System Configuration #4



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8 August 1996

AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY "Mn/DOT TRAFFIC MANAGEMENT CENTER"

- Agency Type	Traffic Management
- Agency Functions	Manage traffic on Twin City area freeway system.
- Agency Location(s)	11014th Avenue South Minneapolis, MN 55404

2.0 SYSTEM "MN/DOT TMC COMMUNICATIONS SYSTEM"

- Date of As-Is Data Collection	2/l 5/96
- Purpose	Provide communications between TMC and all traffic management devices in field.
- Hours of Operation	24 hours per day
- Geographic Coverage	Twin Cities Metro Area.
- Contacts	Rich Lau, Patty Bednarz, Terry Haukom
- Status	Existing
- Block Diagram	See attached

3.1 HARDWARE "TYPE 400 MODEM'

- Hardware Type	Modem
- Functions	Transmits and receives data
- Location	In 170 controllers, in TMC Communications room, in TMC shelters.
- Data Name/Contents	1) Changeable Message Sign control commands 2) Changeable Message Sign status 3) Lane Control Signal Status and control commands 4) Ramp Control Signal control commands and status 5) Loop detector volume/occupancy data
- Data Type	Data
- Status	Existing
- Constraints	1200 or 2400 baud rate with existing modems.

3.2 HARDWARE "MANCHESTER MODEM"

- Hardware Type	Modem
- Functions	Transmits and receives data
- Location	In field and in TMC Communications room.
- Data Name/Contents	Camera device control commands such as pan left, pan right, tilt up, tilt down, zoom in, zoom out, washer on, washer off, wiper on, wiper off and focus.
- Data Type	Data
- Status	Existing
- Other	9600 baud

3.3 HARDWARE 'AM RF MODULATOR"

- Hardware Type	Video transmission device
- Functions	Converts NTSC baseband video signal to AM RF signal with other camera signals and transmits onto coaxial cable into communication system.
- Location	Field cabinet
- Data Name/Contents	Surveillance video signal
- Data Type	Video
- Status	Existing
- Other	Gerold and Scientific Atlanta modulators

3.4 HARDWARE "RF WIDEBAND AMPLIFIER"

- Hardware Type	Video transmission device
- Functions	Receives incoming modulated video signal on coaxial cable from one direction and rebroadcasts stronger signal on coaxial cable. This device is used when there is a need to transmit video signal over long distances.
- Location	Field - in cabinets along right of way.
- Data Name/Contents	Broadband RF modulated video signal.
- Data Type	Video
- Status	Existing

3.5 HARDWARE "RF DEMODULATOR"

- Hardware Type	Video transmission device
- Functions	Receives incoming modulated video signal on coaxial cable, demodulates signal into NTSC baseband video and transmits to video switcher.
- Location	TMC Communications room
- Data Name/Contents	Broadband RF modulated video signal
- Data Type	Video
- Status	Existing

3.6 HARDWARE "FIBER OPTIC TRANSMITTER"

- Hardware Type	Video transmission device - transmitter
- Functions	Converts NTSC baseband video signal to FM analog signal and transmits onto multi-mode fiber optic cable into Communication System.
- Location	334 Cabinet near Camera pole.
- Data Name/Contents	Surveillance video signal
- Data Type	Video
- Status	Existing

3.7 HARDWARE "FIBER OPTIC RECEIVER'

- Hardware Type	Video transmission device - receiver
- Functions	Receives analog video signal and transmits to fiber optic multiplexor for re-transmission on single mode fiber optic cable.
- Location	TMC communication shelters.
- Data Name/Contents	Analog video signal
- Data Type	Video
- Status	Existing

3.8 HARDWARE "FIBER OPTIC VIDEO MULTIPLEXOR"

- Hardware Type	Video transmission device
- Functions	Receives multiple video signals, multiplexes them into one FM modulated analog signal, and transmits to TMC on single mode fiber optic cable.
- Location	TMC communication shelters
- Data Name/Contents	Analog video signal
- Data Type	Video
- Status	Existing
- Constraints	Up to 12 (18,24) video signals may be multiplexed into one signal for transmission on single mode fiber optic cable. 20 mile maximum transmission range.
- Other	Foundation Instruments, Fiberlign, Catel, Fiber Options. Transmits on single mode fiber at 1300 mn wavelength.

3.9 HARDWARE "FIBER OPTIC VIDEO DEMULTIPLEXOR"

- Hardware Type	Video transmission device
- Functions	Receives multiplexed analog video signal, demultiplexes (separates) into several NTSC baseband video signals, and transmits these on coax cable to video switcher.
- Location	TMC communications room
- Data Name/Contents	Analog video signal.
- Data Type	Video
- Status	Existing

3.10 HARDWARE "Tl TDM NODE"

- Hardware Type	Data transmission device - Time Division Multiplexor
- Functions	Accepts data from multiple sources/modems or other TDM's and multiplexes into a data stream onto single mode fiber optic cable and transmits to other TDM's in the field or at the TMC.
- Location	TMC communications shelters
- Data Name/Contents	1) Changeable Message Sign control commands 2) Changeable Message Sign status 3) Lane Control Signal Status and control commands 4) Ramp Control Signal control commands and status 5) Loop detector volume/occupancy data 6) Camera device control commands such as pan left, pan right, tilt up, tilt down, zoom in, zoom out, washer on, washer off, wiper on, wiper off, camera Id.
- Data Type	Data
- Status	Existing

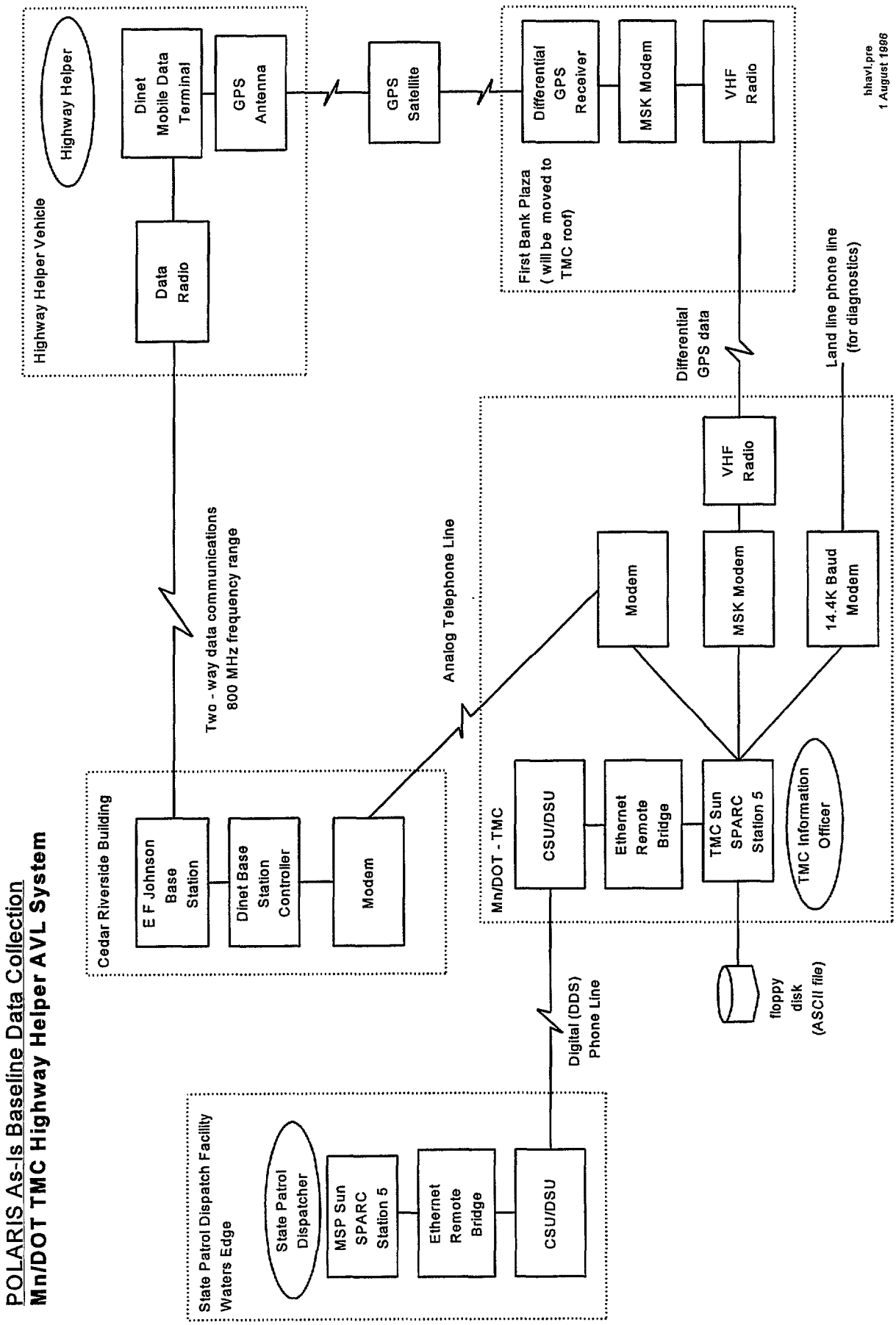
3.11 HARDWARE "NETWORK MANAGEMENT PC"

- Hardware Type	Computer
- Functions	Monitors the fiber optic data communications system for errors. Maintains network synchronization. Also maintains network configuration for primary and backup communications links and automatically re-routes communications if failure occurs.
- Location	TMC computer room
- Data Name/Contents	Node Id's, network configuration, transmission errors, device errors and communication re-route.
- Data Type	Data
- status	Existing

3.12 HARDWARE "FIBER OPTIC FRACTIONAL Tl (FOFTI)"

- Hardware Type	Data transmission device
- Functions	Receives data and multiplexes into one signal for transmission to the TMC.
- Location	TMC communications shelters
- Data Name/Contents	1) Changeable Message Sign control commands 2) Changeable Message Sign status 3) Lane Control Signal Status and control commands 4) Ramp Control Signal control commands and status 5) Loop detector volume/occupancy data 6) Camera device control commands such as pan left, pan right, tilt up, tilt down, zoom in, zoom out, washer on, washer off, wiper on, wiper off, camera Id.
- Data Type	Data
- Status	Existing - being installed in current projects.

3.2.5 MN/DOT TMC HIGHWAY HELPER AVL SYSTEM


POLARIS As-Is Baseline Data Collection
Mn/DOT TMC Highway Helper AVL System
Highway Helper Vehicle
Highway Helper
Dinet Mobile Data Terminal
GPS Antenna
Data Radio
GPS Satellite
First Bank Plaza
(will be moved to TMC roof)
Differential GPS Receiver
MSK Modem
VHF Radio
Differential GPS data
Land line phone line
(for diagnostics)
Two - way data communications
800 MHz frequency range
Analog Telephone Line
Cedar Riverside Building
E F Johnson Base Station
Dinet Base Station Controller
Modem
Mn/DOT - TMC
CSU/DSU
Ethernet Remote Bridge
TMC Sun SPARC Station 5
TMC Information Officer
Modem
MSK Modem
VHF Radio
14.4K Baud Modem
floppy disk (ASCII file)
Digital (DDS) Phone Line
State Patrol Dispatch Facility
Waters Edge
State Patrol Dispatcher
MSP Sun SPARC Station 5
Ethernet Remote Bridge
CSU/DSU
hhavl.pre
1 August 1996

AS-IS DATA COLLECTION TEMPLATE

1.0 AGENCY "MN/DOT TRAFFIC MANAGEMENT CENTER"

- Agency Type	Freeway Operations section of Mn/DOT Metro Division
- Agency Functions	Manage traffic on Twin City area freeway system.
- Agency Location(s)	1101 4th Avenue South, Minneapolis, MN 55404

2.0 SYSTEM "HIGHWAY HELPER AUTOMATIC VEHICLE LOCATION SYSTEM"

- Date of As-Is Data Collection	4/25/96
- Purpose	1) Track the location and status of Highway Helpers to enable Traffic Management Center dispatch personnel (Information Officers) to direct the most appropriate response vehicle to an incident. 2) Provide a quicker response to stalled vehicles or accidents on the freeway system. 3) Enhance communications between the Highway Helpers, TMC Information Officers and the State Patrol dispatchers. 4) Eliminate data entry of incident information. 5) Test AVL and GPS technology for Mn/DOT and the State Patrol.
- Hours of Operation	M-F(5AM-7:30PM) Saturday & Sunday (9 AM - 9 PM)
- Geographic Coverage	AVL system will communicate with HH vehicles within the Twin Cities Metropolitan area. Highway Helpers (HH) cover six freeway routes in Twin Cities: 1) I-94 from I-35E to Radio Drive (CR. 13) and T.H. 3 from I-94 to Concord St. 2) I-94 from T.H. 280 to I-35E and I-35E from I-94 to Little Canada Road. 3) I-94 from 49th Ave. to T.H. 280. 4) I-94 from T.H. 169 to I-694 and I-694 from I-94 to I-35w. 5) I-35W from Hennepin Ave. to I-494. 6) I-494 from East Bush Lake Road to 24th Ave. and I-35W from I-494 to T.H. 13.
- Contacts	Sue Groth 341-7227
- Status	Existing
- Constraints	System is capable of tracking up to 250 vehicles. Standalone system - not integrated with other control room equipment.

- Issues	1) Mapping data - Etak. Some roadway data is incorrect. 2) Differential corrections. (Not working as of 07/21/96) 3) Vehicle tracking in certain key locations is poor - experiencing some problems with vehicles transmitting data/locations when moving in certain geographic areas such as I-35E north of St. Paul and I-494. 4) Conversion of ASCII data to Highway Helper database. 5) System occasionally locks up. 6) Future enhancements.
- Recommended Improvements	Differential GPS receiver equipment will be installed on roof of TMC in near future to provide differential location corrections.
- Block Diagram	See attached
- Typical Operational Scenario	At the beginning of each shift the Highway Helpers sign into the system through the MDT located in their vehicle. They enter their name, route assignment, shift hours, beginning mileage and cellular phone number. While the HH are patrolling their routes their position and status is displayed at the TMC control room and the State Patrol dispatch center. A HH status is defined as "available", "en route to an incident scene", "on scene of an accident", "on scene of a stall", "transporting a motorist", or "out of service". As their status changes the corresponding color of their vehicle icon is changed on the MetroView workstation. When the HH arrives at a stalled vehicle they change their status to "on scene at a stall" by pushing the appropriate status key on the MDT. When their work is completed they push the "completed assignment" key and immediately enter information pertaining to the stop. This information includes the roadway identification, mile point, direction of travel, license plate of the vehicle assisted, what service was provided (e.g. tire change, gas, traffic control, push,), which lane the vehicle was in, and if the State Patrol or a tow truck was called. The system automatically logs the time and corresponding latitude and longitude with the incident record. When completed with the logging process the HH pushes the "available" status key and begins to patrol the route again. The TMC operator can also send a text message to the HH while they are out of their vehicle instructing them to attend another incident that was detected. The MDT will hold the message so it can be read when they return to their vehicle.
- Other	Total system costs approximately $130,000

2.1 PERSONNEL "TMC INFORMATION OFFICER"

- Personnel Function	Information Officer is responsible for identifying and monitoring incidents and coordinating the dissemination of information to various incident responders/dispatchers and news media. Information Officer dispatches the appropriate Highway Helper vehicle to an incident based on the HH location, status, ability to arrive to incident scene quickly, and response of the other emergency responders like the State Patrol.
- Quantity	One Information Officer works for each peak period shift. On
- Location	Traffic Management Center control room.
- Workload	Very high
- Working hours	AM peak period 6AM - 9 AM PM peak period 3PM - 7 PM Information Officer is working and available to support control room operations during off peak (9AM - 3PM).
- Status	Existing

2.2 PERSONNEL "HIGHWAY HELPER"

- Personnel Function	Patrol selected freeway routes and minimize congestion by quickly responding to stalls and accidents and removing these incidents from the freeway.
- Quantity	14 Highway Helpers, cover 6-7 routes. A minimum of 5 HH are working during a peak period, typically six working during peak period to cover all six routes. One HH works during weekend shifts.
- Location	Dispatched from TMC.
- Working hours	AM peak period 5:30 AM - 11:30 AM PM peak period 1:00 PM - 7:00 PM
- Status	Existing

2.3 PERSONNEL "STATE PATROL DISPATCHER"

- Personnel Function	Monitors the HH locations to aid in determination of dispatching of State Patrol Troopers to incidents. 1) Receive calls 2) Dispatch trooper to respond to calls 3) Notify Public Safety Answering Points of incidents. 4) Coordinate incident management activity with TMC, Mn/DOT Maintenance, Police, Fire, Tow companies, CVO inspection, Hazmat, etc.
- Quantity	16 full time dispatchers, 2 are supervisors.
- Location	State Patrol Dispatch Facility - Waters Edge, 1500 County Road B2, Roseville
- Workload	Very high
- Working hours	24 hours/day, 365 days/year. Have a minimum of 4 dispatchers on duty during AM and PM peak periods, i.e. 6-9 AM and 3 - 7 PM. Currently run dispatchers on a fixed schedule, i.e. each dispatcher has a fixed shift that they work such as 3PM - 11 PM.
- status	Existing
- Contact	Major Ron Bolin

2.4 PERSONNEL "STATE PATROL TROOPER - SARGENT CARTRIGHT"

- Personnel Function	This one Trooper has the AVL vehicle location equipment in his vehicle and is trying it out as a pilot project.
- Quantity	One
- Location	Twin Cities Metro Area
- status	Existing

3.1 HARDWARE "TMC SUN SPARCstation 5"

- Hardware Type	Computer
- Functions	1) Display location and status of Highway Helper vehicles and one Patrol vehicle on a GIS map. 2) Send text messages to HH MDT. 3) Stores incident record when HH completes incident report. 4) Automatically log time and HH vehicle's longitude and latitude with an incident record.
- Location	TMC Control Room

- Data Name/Contents	Metro area GIS map with street names and attributes. Map area being viewed. Vehicle status data such as: 1)Vehicle Location 2)Vehicle Speed 3) Location of nearest cross street 4) HH cellular phone number 5) HH hours of work 6) HH route number Highway Helper status data such as: 1) On scene accident 2) On scene stall 3) On scene debris 4) On scene other 5) Busy 6) En route 7) Available 8) Out of service 9) Transporting a motorist 10) Emergency Distress 1 l)Last time location was updated. Incident data from the HH is stored here, i.e. When the HH work is completed at an assist, they push the "completed assignment" key and immediately enter information pertaining to the stop. This information includes: 1) Roadway identification 2) Mile point 3) Direction of travel 4) License plate of the vehicle assisted 5) What service was provided (e.g. tire change, gas, traffic control, push,) 6) Which lane the vehicle was in 7) If the State Patrol or a tow truck was called 8) Incident ID number. The system automatically logs the time and corresponding latitude and longitude with the incident record.
- Data Type	Data
- Status	Existing
- Other	SPARC 5, 70 MHZ, 32 Mb memory, TGX graphics accelerator, Internal 1 gigabyte disk drive, 1 External QIC tape drive, 1 External modem 325 for data, 1 External modem for support, 1 Set Remote Ethernet Equipment

3.1.1 SOFTWARE "SUN SPARCstation OPERATING SYSTEM'

- Software Type	Operating System
- Software Standards	Unix
- Status	Existing
- Recommended Improvements	This may be upgrade to a Windows NT operating system in the future.

3.1.2 SOFTWARE "METROVIEW

- Software Type	Application - AVL software.
- Functions	1) Displays the location and status of Highway Helper vehicles and one State Patrol vehicle. As HH status changes the corresponding color of their vehicle icon is changed on the MetroView workstation (i.e. green = available, yellow = en route, blue = on scene, gray = off). 2) Send and receive messages to Highway Helper vehicles. 3) Playback a Highway Helper unit's previous day activities. 4) Add landmarks. 5) Creates incidents log for each incident that a HH responded to. 6) User can display two map views using split screen function or user can display a map view on one half of the screen and a window showing HH status on the other side of screen. Software has a "windows" look and feel and pull down menus are used to send messages while viewing map and perform other functions.
- status	Existing - System went online in fall of 1995.
- Constraints / Restrictions	TMC can go into map and add landmarks, but MetroView will not allow TMC to change map attributes.
- Other	System designed and installed by Ball Systems. Etak map was converted into ArcInfo format and then was converted into MapInfo which is used by the MetroView software.

3.2 HARDWARE "MSP SUN SPARCstation 5"

- Hardware Type	Computer
- Functions	Display location of Highway Helper vehicles and one Patrol vehicle on a GIS map.
- Location	Mn State Patrol Dispatch Room - Waters Edge
- Data Name/Contents	Metro area GIS map with street names and attributes. Map area being viewed. Vehicle status data such as: 1) Location 2) Speed 3) Location of nearest cross street 4) HH cellular phone number 5) HH hours of work 6) HH route number Highway Helper status data such as: 1) On scene accident 2) On scene stall 3) On scene debris 4) On scene other 5) Busy 6) En route 7) Available 8) Out of service 9) Transporting a motorist 10) Emergency Distress 1 l)Last time location was updated.
- Data Type	Data
- Status	Existing
- Constraints	Standalone system, not integrated into the State Patrol's dispatch console so the Patrol dispatcher has to leave dispatch station and walk over to this monitor to use system. Therefore it may not be used too much.
- Recommended Improvements	Future design of control room would have this integrated into dispatcher console.
- Other	SPARC 5,70 MHZ 16 Mb memory TGX graphics accelerator Internal 500 Mb disk drive 1 Set Remote Ethernet Equipment

3.2.1 SOFTWARE "SUN SPARCstation OPERATING SYSTEM"

- Software Type	Operating System
- Software Standards	Unix
- Status	Existing
- Recommended Improvements	This may be upgrade to a Windows NT operating system in the future.

3.2.2 SOFTWARE "METROVIEW

- Software Type	Application
- Functions	Displays the location and status of Highway Helper vehicles and one State Patrol vehicle.
- Status	Existing
- Constraints / Restrictions	Proprietary software

3.3 HARDWARE "DINET MOBILE DATA TERMINAL"

- Hardware Type: Data terminal and GPS receiver.
- Functions: Contains a GPS receiver which receives signals from GPS satellites and computes the vehicle's location. MDT used to receive text messages from TMC. MDT used to report status of HH vehicle and transmit incident information. Status options are:
  1) On scene accident
  2) On scene stall
  3) On scene debris
  4) On scene other
  5) Busy
  6) En route
  7) Available
  8) Out of service
  9) Transporting a motorist
  10) Emergency Distress
  1 l)Log On
  12) Incident summary

  As the Highway Helper pushes any of the above buttons, the message is sent to the TMC along with the vehicles latitude and longitude, as calculated by the MDT.
  HH types up a short summary of incident and transmits to TMC when completed with assistance. Incident data collected is:
  1) Method of Detection (Highway Helper, TMC, Mn/DOT Radio, other)
  2) Incident Type (Accident, Stall, Debris, other)
  3) Roadway Identification
  4) Direction (N, S, E, W)
  5) Lanes involved (Right/Left shoulder, Lane 1-5, Median, Auxiliary Lane, Entrance Ramp, Exit Ramp, HOV lane, Off Roadway)
  6) Mile point
  7) Arrival Time
  8) Departure Time
  9) Assistance Type (Coolant, Battery, Telephone, Directions, Fuel, Tag, Mechanical, other, Push, Ride, Tire Change, Remove Debris, Traffic Control)
  10) Vehicle License
  11) Other Assistance Required (Ambulance, City Police, Fire Truck, State Patrol, Tow Truck, other)
  12) Assistance Notify Time
  13) Did HH communicate with State Patrol troopers on the radio (Y/N).

- Location	In all Highway Helper vehicles and in one State Patrol vehicle.
- Data Name/Contents	Latitude and Longitude of vehicle is sent to TMC whenever a message is sent, or every 1 minute/l mile of travel, whichever occurs first. Type of assistance requested and provided including: 1) The roadway identification, mile point, direction of travel. 2) License plate of the vehicle assisted. 3) What service was provided (e.g. tire change, gas, traffic control, push) 4) Which lane the vehicle was in 5) If the State Patrol or a tow truck was called.
- Data Type	Data
- Status	Existing
- Constraints	Location accuracy is with 200 - 300 feet as calculated by MDT. Accuracy is improved to be within 3 meters using differential correction. Display screen is Liquid Crystal Display of two lines, approximately 60 -80 characters per line. A message sent between TMC and HH must be less than 180 characters
- Recommended Improvements	TMC would like to receive an acknowledgment when the HH receives the a message sent from TMC Information Officer.
- Other	Dinet Data Mate 3 100 MDT Includes a Motorola Oncore GPS receiver to provide position information. Ball Systems custom-configured the layout of the MDT user interface screen for MnDOT.

3.3.1 SOFTWARE "SOFTWARE #3"

- Software Type	MDT firmware
- Software Standards	Proprietary

3.4 HARDWARE "DATA RADIO"

- Hardware Type	Radio
- Functions	Sends/receives messages to/from TMC.
- Location	In all Highway Helper vehicles and in one State Patrol vehicle.
- Data Name/Contents	Text messages. HH latitude and longitude as calculated by MDT. HH vehicle status. HH entry commands.
- Data Type	Data
- Status	Existing
- Constraints	Proprietary data communications system.
- Other	Manufactured by EF Johnson

3.5 HARDWARE "E F JOHNSON BASE STATION"

- Hardware Type	Radio Base station
- Location	Roof of Cedar Riverside Building in Minneapolis.
- Data Type	Data
- status	Existing
- Constraints	Proprietary data communications system
- Other	Manufactured by EF Johnson

3.6 HARDWARE "DINET BASE STATION CONTROLLER"

- Hardware Type	Telecommunications device - base station.
- Functions	Converts data message from RF to phone lines. Performs some error checking of MDT operation, i.e. if the unit is the mode of on the scene of an incident and the HH makes an illogical entry (such as en route), the system will not accept the entry.
- Location	Roof of Cedar Riverside Building in Minneapolis.
- Data Type	Data
- status	Existing

3.7 HARDWARE "DIFFERENTIAL GPS RECEIVER"

- Hardware Type	GPS receiver.
- Functions	Receives signals from GPS satellites.
- Location	Roof of First Bank Plaza building in Minneapolis.
- Data Type	Data
- status	Existing
- Constraints	This system uses inverse differential corrections - i.e. locations corrections are made at TMC, not in vehicle. Existing differential GPS receiver does not broadcast message #17. Need message #17 (ensemeras message) to inversely make differential corrections at TMC, rather than having the GPS units make the differential corrections remotely. This is not a major problem at this point, the accuracy of location data is good enough to serve the purposes of TMC.
- Recommended Improvements	A new differential GPS receiver will be installed on the roof of the TMC building in the near future.
- Other	By using the signals received from GPS satellites at TMC, which is a known-fixed location, and comparing to the calculated signals received from the MDT's in the Highway Helper vehicles, this device computes the actual location of the HH MDT's within 3 meters.

4.1 INTERFACE	TMC SUN SPARCstation 5
- Connects to . . .	MSP Sun SPARCstation 5
- Interface Type	Data
- Interface Direction	Both
- Interface Component	Ethernet via digital phone line
- Information Type/Content	HH and Patrol vehicle location and status.
- Information Direction	Output - from TMC to MSP
- Information Standards	Vehicle latitude and longitude

4.2 INTERFACE	TMC SUN SPARCstation 5
- Connects to . . .	Dinet Base Station Controller
- Interface Type	Data
- Interface Direction	Both
- Interface Component	Analog phone line
- Information Type/Content	HH and Patrol vehicle location and status. Text messages to/from Highway Helpers.
- Information Direction	Both
- Information Frequency	Once per minute at a minimum, or as messages are sent from HH to TMC or a TMC polls HH locations.
- Information Standards	Vehicle latitude and longitude

4.3 INTERFACE	TMC SUN SPARCstation 5
- Connects to . . .	Differential GPS Receiver
- Interface location	TMC
- Interface Type	Data
- Interface Direction	Input - from GPS receiver to SPARCstation 5
- Information Type/Content	Differential GPS data
- Information Direction	Input - from GPS receiver to SPARCstation 5
- Information Standards	Latitude and longitude

4.4 INTERFACE	TMC SUN SPARCstation 5
- **Connects** to „	14.4K Baud Modem
- Interface location	TMC
- Interface Type	Data
- Interface Direction	Both
- Interface Component	Modem w/ phone line
- Information Type/Content	System diagnostics data
- Information Direction	Both

4.5 INTERFACE	E F JOHNSON BASE STATION
- Connects to . . .	Data Radio
- Interface Type	Data
- Interface Direction	Both
- Interface Component	RF - 800 MHZ frequency
- Information Type/Content	Text messages, HH vehicle location data
- Information Direction	Both
- Information Frequency	Once per minute at a minimum, or as messages are sent from HH to TMC or a TMC polls HH locations.

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-0-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 Mmneapolis 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

Intraagency 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

Minnesota Guidestar'

As-Is Transportation Systems Inventory Data Collection Guide

LORAL
Federal Systems-Owego

POLARIS As-k Transportation Systems Inventory
Data Collection Guide

PURPOSE

The purpose of this document is to provide information about the Polaris As-Is Transportation Systems Inventory Template. Information provided by this guide is representative but not inclusive as to the amount or all the types of information that may be found during a Polaris survey.

ORGANIZATION

Organization of this document is based on the Polaris As-Is Transportation Systems Inventory Template. For each template page in the Polaris As-Is Transportation Systems Inventory Template, a section in this document, will list the types of information to be collected, a description of how the data will be collected, recommended answers for known entities, and miscellaneous note area for unstructured items. The following list contains this documents sections:

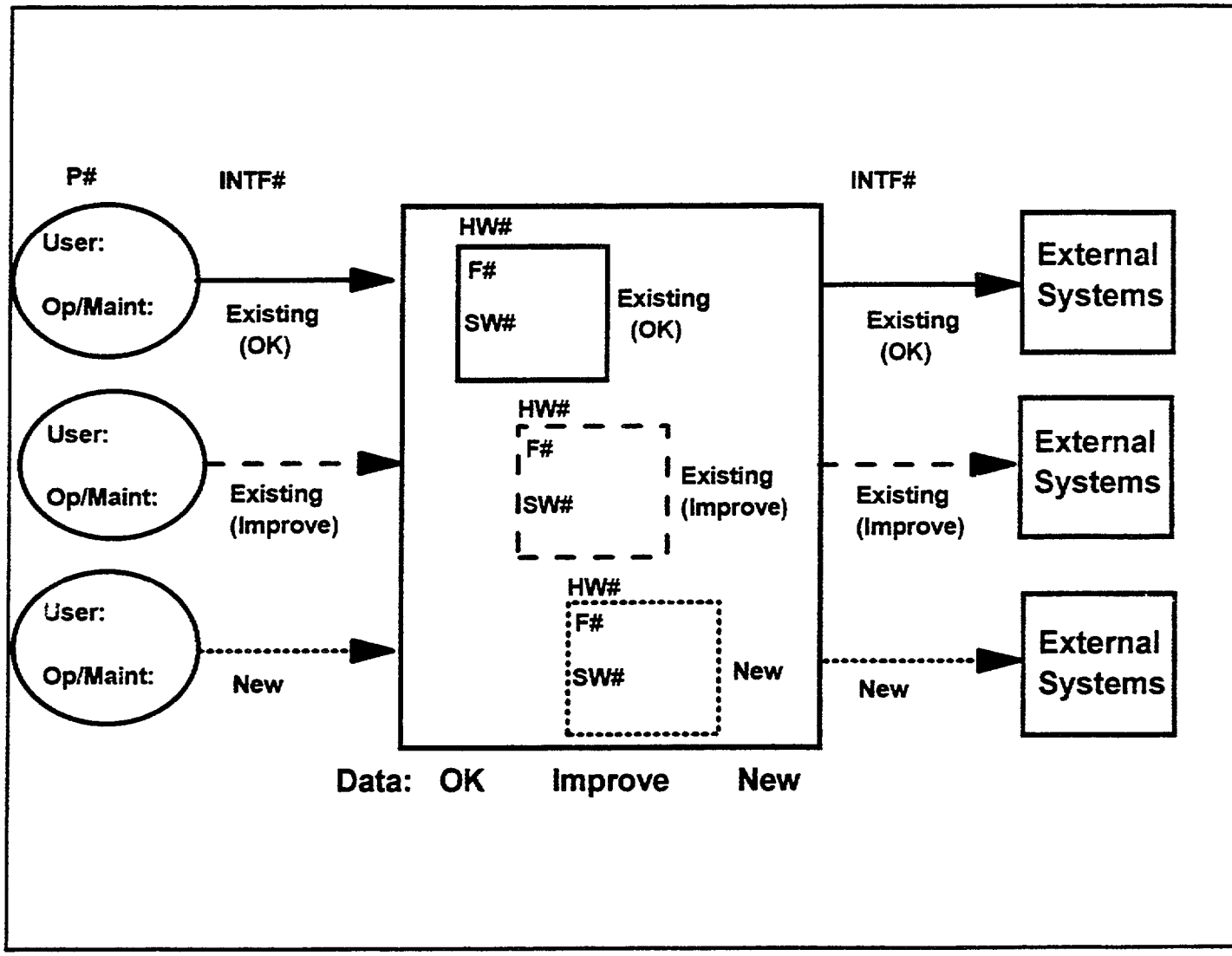
1.0 Systems
1.1 Hardware Components
1.2 Software Components
1.3 Software Interfaces
1.4 System Personnel
2.0 Agency
2.1 Agency Interfaces
2.2 Agency Systems

About the Template Document

The Polaris As-Is Transportation Systems Inventory Template is a document intended to assist the data collector in the field perform their task more expediently. The document is a collection of 8 sections that are identical to the sections in this document. Seven of sections are on one sheet of paper. One section expanded to two sheets of paper. The theory of the document structure was to duplicate each document section numerous until the entire system, or what ever thing you are collecting data on is captured on the templates.

1.0 Systems

In order to understand the system being surveyed, the surveyor shall draw the system in block diagram format. The block format shall conform to the following example. Template Page #1 is where the system block diagram shall be drawn.



1.1 Hardware Components

The purpose of Hardware Components, Template Page #1, is to list all the various hardware elements that are interconnected to form the bounds of the system to be described. For each hardware element, an identifier, HW#, shall be created and associated with hardware element graphic drawn in the System Block Diagram, Template Page #1.

Template Page #1 contains the following columns to be completed during the survey process. Definitions for each column is provided to assist in providing consistency in collecting data. Where possible, suggested recommendations for collecting data is provided.

HW# — Identifier for each component on the System Block Diagram (drawing). Each identifier used with the System Block drawing shall be unique for each System Block Diagram.

Hardware Name — A generic name for identification purposes within the user community. If no name is provided, then the Manufacturer and Model number is acceptable.

Hardware Type — Classifies the identifier, HW#, into a generic group.

If the type of component is not known, then Make and Model will be required.

Recommended choices for this column may be selected from the following list:

1. Computer Processors
2. Workstations
3. Telecommunication Devices
   a. Hubs
   b. Routers
   c. Transmitters
   d. Receivers
   e. Modems
   f. Decoders/Encoders
4. Peripherals
   a. Printers
   b. Displays

c. Barcode Readers
d. Magnetic Stripe Readers
e. Punch Cards
f. Magnetic Tape
g. Diskette
h. CD ROM
i. Cartridge Tape

5. Telephones
   a. Wire Based
   b. Wireless
6. Two way Radio Transmitters/ Receivers
7. Radio Receivers
8. Traffic Signals
9. Video Cameras
10. Loop Detectors
11. Message Signs
12. Temperature Sensors
13. Optical Transmitters / Receivers
14. Microwave

Functions - (F#)

Describes the major functions of the system. For each major function, a new entry lines shall be used for writing the description. For each function, the F# is associated to the respective HW# on the System Block Diagram, Template Page #1. The following list contains some recommended functions that may be used to describe a component.

1. Process
2. Control
3. Store
4. Communicate
5. Signal
6. Log
7. Record
8. Speak
9. Write
10. Print
11. Messaging
12. Locate
13. Search

Location

States where geographically the HW# is located.

Considerations should be given for : Multiple buildings within one community, multiple cities, multiple states, countries and other Agencies or private sector. Try to limit the information to Building Name and relevant geographic location versus room number or address. Detailed information is not required unless there is multi-jurisdictional or multi-organizations within one building.

Data Name / Content

A brief description of the data or information is processed and stored by the HW#. Some examples are:

1. Database of System Users
2. Database of construction projects
3. Collect incident information and reformat the data

Data Type

Classifies the data into a generic group. Choices for this group are:

1. Voice
2. Data
3. Video
4. Paper
5. Other _____(specify)_____

Status

An indicator about the existence, transition, or non-existence of the HW#:

E=Existing (Currently in place, No modifications planned)
D=Deleted (An agency has plans to delete this element in the future, but at the time of survey the element existed.)
I=improve (Currently in place, but requires modification due to element not meeting user needs, or system needs)
N=NEW (New system planned for future deployment, but at the time of survey is not currently deployed.)

Policies

List agency policies that are practiced with respect to the Hardware components. Listed below are a couple of examples of what would belong in this topic.

1. Maintenance of the radio equipment
2. Agency X requires all PC's to be hardware locked and anchored to a non-removable building structure.

Constraints / Restrictions

List agency constrained and/or restrictions with respect to

Hardware Components

1. The hardware is outdated and can no longer be upgraded.

2. Hardware maintenance is not available for the equipment because it is too old.

Issues — List any issues that are related to this specific component. If the issue is global to the system, then is only needs to be stated once.

Recommended improvements / Planned Changes

List any system or component recommended improvement that the contact person discusses. State whether the improvement is planned or a "wish" and explain why they system and component is being improved. If the improvement is global to the system, then is only needs to be stated once.

Contacts / Phone Numbers

List the contact person from which you received this information and their phone number.

Other — List anything else that may be relevant about the system, but does not fit in the above columns.

1.2 Software Components

SW# [Same description as HW# in Section 1 .1]

Software Name [Same description as Hardware Name # in Section 1 .1]

Software Type Classifies the identifier, SW#, into generic groups

1. Transportation Software Applications
2. Operating Systems
3. Communication Protocols
4. Database
5. Data interchange
6. User Interface
7. System Management
8. Office Applications
9. Controller Programs
10. Firmware

Software Standards Specify for each software type the associated product or standard. The following list is organized with the standards listed within software type.

1. Transportation System Applications
   a. Urban Traffic Control Sofware (UTCS)
   b. Sindney Control Adaptive Device Software (SCADS)
   c. SCOOTS
   d. 170 Software -WAPITI
   e. National Electrical Materials Association (NEMA) Software
   f. TRAPEZE
   g. AVL

2. Operating System
   a. DOS
   b. WINDOWS
   c. WINDOWS FOR WORKGROUPS
   d. WINDOWS95
   e. UNIX

f. OS/2
g. WINDOWS NT
h. Macintosh / System 7
i. OS/400
j. MVS
k. VM
l. VSE
m. VMSNSE
n. Other

3. Communication Protocols
   a. TCP/IP (UNIX, IBM, Microsoft, Beamon Whiteside, Exceed, FTP)
   b. SNA {IBM)
   c. lPX/SPX (Novell)
   d. osi
   e. DECnet (Digital Equipment)
   f. BISYNC
   g. Frame Relay
   h. x.25
   i. FDDI
   j. ATM
   k. NetBios (IBM, Microsoft)
   l. Other
4. Database
   a. Oracle
   b. Sybase
   c. lnformix
   d. Database 2
   e. FoxPro
   f. Microsoft Access
   g. Other
5. Data Interchange
   a. GIS
   b. Image
   c. Vector
   d. Vector Graphics
   e. Images
   f. Printing (PostScript, PCL, AFP)
   g. Computer Aided Logistics (CALS)
   h. Electronic Data interchange (EDl)
   i. Electronic Mail (Emaii)
   j. Electronic Documents

k. Traffic Messaging
l. Weather Messaging
m. Location Messaging
n. Construction Messaging
0. Other

6. User Interface
   a. Windows (Microsoft)
   b. Windows for WorkGroups (Microsoft)
   c. X-windows (UNIX)
   d. Presentation Manager (IBM 0S/2)
   e. Character Based
   f. Other
7. System Management
   a. Network
   b. Computer Devices
   c. Data
   d. Other
8. Office Applications
   a. Word Processors (WordPerfect, MS Word, DisplayWrite)
   b. Spreadsheets (123, Excel, Quattro Pro)
   c. Graphics (Corel Draw, MS PowerPoint, Freelance)
   d. Multimedia (Video Conferencing)
   e. Project Scheduling (Microsoft Project, Primivera)
   f. Other

Function — [Same description as Function in Section 1.1]

Application Language — This field is only applicable for Software Types of Transportation Software Applications when there is a software application that has been custom designed and coded for a specific need or requirements. (ie. There is only one or few software applications in existence) Then the programming language of the software application should be determined. The following list provides some of programming languages that may have been used:

1. c++
2. Visual C++
3. c
4. Visual C
5. Basic
6. Visual Basic

7. Pascal
8. COBOL
9. FORTRAN
10. Assembler
11. Ada
12. Other

Status — [Same description as Status in Section 1 .1]

Policies — List agency policies that are practiced with respect to Software Components. Listed below are a couple of examples of what would belong in this topic.

1. Agency X does not permit any non-business related software to be installed on PC's .

2. Agency X requires all PC's Operating Systems to have password protection to prevent unauthorized system access to the networks.

Constraints / Restrictions — List agency constrained and/or restrictions with respect to Software Components

1. The software is outdated and can no longer be upgraded.

2. Software maintenance is not available for the equipment because it is too old.

issues — List any issues that are related to this specific component. If the issue is global to the system, then is only needs to be stated once.

Recommended Improvements / Planned Changes

List any system or component recommended improvement that the contact person discusses. State whether the improvement is planned or a "wish" and explain why they system and component is being improved. If the improvement is global to the system, then is only needs to be stated once.

Contacts / Phone Numbers

List the contact person from which you received this information

	and their phone number.
Other	List anything else that may be relevant about the system, but does not fit in the above columns.

1.3 System Interfaces

The purpose of System Interfaces, Template Pages #5-7, is to list all the various interfaces that connect the Hardware Components together and External Systems to the system being surveyed. For each Hardware Component, HW#, listed, the interface, INTF#, between the two components shall be listed individually until ail the interfaces between Hardware Components are covered. For Systems outside the boundary of the system being surveyed, their respective interfaces shall be listed.

INTF#	[Same description as HW# in Section 1 .1]
External System Name	[Same description as Hardware Name in Section 1 .1]
Interface Locations	States which locations the interfaces are located. if the interface is co-located in the same location, then only one location is required.
Interface Type	Classifies the interface into a generic group. Choices for this group are: 1. Audio 2. Data 3. Video 4. Paper 5. Other ____(specify)_____
Interface Direction	Three choices are available for this item. Circle the applicable item.
Input	Flow of information is coming in to the surveyed system or component being described
output	Flow of information is going towards another component or external system.
Both	Flow of information is going both directions.
Interface Component	A name of the physical entity in which the interface is established. The following list contains some more popular types of interface Components:

1. Wire Based
   a. Token Ring
   b. Ethernet
   c. FDDI
   d. SONET
   e. Arcnet
   f. Applenet
   g. ATM
   h. ISDN
   i. RS-232
   j. RS-422
   k. SDLC
   l. Modems (Bell 202, 212, 213, V.24, V.32 V.34)
   m. Other _____
2. Wire Based Media (cabling), if there is an external network geographically located.

   For wire based media (cabling), the wire/fiber count should be captured to
   a. Level 3 Unshielded Twisted Pair (UTP), (Telephone Voice / Data 2 MB)
   b. Level 4 Unshielded Twisted Pair,(UTP) [Data 10 MB]
   c. Level 5 Unshielded Twisted Pair,(UTP) [Data 100 MB]
   d. Shielded Twisted Pair (STP) [Data rate at 10 MB]
   e. Shielded Twisted Pair (STP) [Data rate at 100 MB]
   f. Multimode Fiber
   g. Single Mode Fiber
   h. Service Provider (ie. US West)
   i. Other _____
3. Wireless Based
   a. FM (ie. Two way / Broadcast)
   b. AM (ie. Broadcast)
   c. CDPD (ie. Digital Cellular Data Network)
   d. Ardis (ie. Digital Cellular, Two way paging)
   e. AMP (ie. Cellular Telephone)
   f. Microwave
   g. Other

Protocol / Standard — The interface should have a protocol or other standard

associated with how it operates. In some instances there will be multiple protocols and standards associated with the interface. All protocols and standards shall be listed. The foilowing list identifies some of the protocols / standards that may be found.

a. TCP/IP (UNIX, IBM, Microsoft, Beamon Whiteside, Exceed)
b. SNA (IBM)
c. IPX/SPX (Novell)
d. OSI
e. DECnet (Digital Equipment)
f. BISYNC
g. Frame Relay
h. X.25
i. FDDI
j. ATM
k. NetBios (IBM, Microsoft)
l. Video (ie. Manchester Code Based)
m. Other

Information Type / Content	A description of the information that is being passed through the interface. (ie. road conditions, Traffic congestion, road construction information)
Information Direction	Three choices are available for this item. Circle the applicable item.

Input	Flow of information is coming in to the surveyed system or component being described
output	Flow of information is going towards another component or external system.
Both	Flow of information is going both directions.

Information Frequency	Specify what rate the data is exchanged between components

Information Standards

List any standards that are identified with the information being processed. Some areas where standards may be present presented listed in the following list:

1. If location information is provided, what is the units or other location attributes provided?
   a. Street Names of the nearest intersections
   b. Mile Markers
   c. Latitude / Longitude
   d. Addresses
   e. Internal Travel Interchange Standard
   f. State / Plane Coordinate
   g. Links / Nodes
   h. Other
2. Traffic Messaging
3. Weather Messaging
4. Location Messaging
5. Construction Messaging
6. Mapping Standards (GIS)
   a. Image
   b. Vector
7. Electronic Mail (Email)
8. Electronic Data Interchange (EDI)
9. Computer Aided Logistics (CALS)

Policies

List agency policies that are practiced with respect to System Interfaces. Listed below are a couple of examples of what would belong in this topic.

1. Agency X only operates the interface with System A Monday - Friday, 8AM - 5PM.
2. Agency Y requires authorization to use Agency X interfaces to their systems.

Constraints / Restrictions

List agency constraints and/or restrictions with respect to System Interfaces:

1. The interface hardware is outdated and can no longer be upgraded,
2. The maintenance of the interface is only supported by a vendor specializing in RF transmitters.

Issues

List any issues that are related to this specific component. If

the issue is global to the system, then is only needs to be stated once.

Recommended Improvements / Planned Changes

List any system or component recommended improvement that the contact person discusses. State whether the improvement is planned or a “wish” and explain why they system and component is being improved. If the improvement is global to the system, then is only needs to be stated once.

Contacts / Phone Numbers

List the contact person from which you received this information and their phone number.

Other

List anything else that may be relevant about the system, but does not fit in the above columns.

1.4 System Personnel

The purpose of System Personnel, Template Page #9, is to capture the interaction a human being with the system being surveyed. For each type of personnel using the system, a P# shall be created on the System Block Diagram to identify the personnel and where they interface with the system.

P# — [Same description as HW# in Section 1 .1]

Personnel Role — A description of the personnel interfacing with the system. Some examples of a role are:

1. System Maintainer
2. Data Input
3. Data Analysis
4. Data Collector
5. User
6. Other

Quantity — Approximate quantity of personnel who perform this particular role. A individual may have more that one personnel role in working with the system, therefore may be counted more that once.

Location — [Same description as HW# in Section 1 .1]

Workload — Approximate amount of time per week the personnel spends interfacing with the system. The amount should be estimated on the total quantity of personnel for each role. Circle the appropriate designator on the template. Each designator is described in the following list.

E Extensive Use = 90-100% Utilization
H High - average hours are >70 - 120 per week
M Medium - average hours are 30 -60 per week
L Low - average hours are <20 per week

Status — [Same description as Status in Section 1 .1]

Policies — List agency policies that are practiced with respect to System

Personnel. Listed below are a couple of examples that may be found in this topic.

1. Agency X only operates the System A with the System Administrator, Monday - Friday, 8AM - 5PM.
2. Educational requirements to operate System B is experience with UNIX.

Constraints / Restrictions — List agency constraints and/or restrictions with respect to Systems Personnel.

1. The personnel do not have the skills to maintain the system.

Issues — List any issues that are related to this specific component. If the issue is global to the system, then is only needs to be stated once.

Recommended Improvements / Planned Changes

List any system or component recommended improvement that the contact person discusses. State whether the improvement is planned or a “wish” and explain why they system and component is being improved. If the improvement is global to the system, then is only needs to be stated once.

Contacts / Phone Numbers

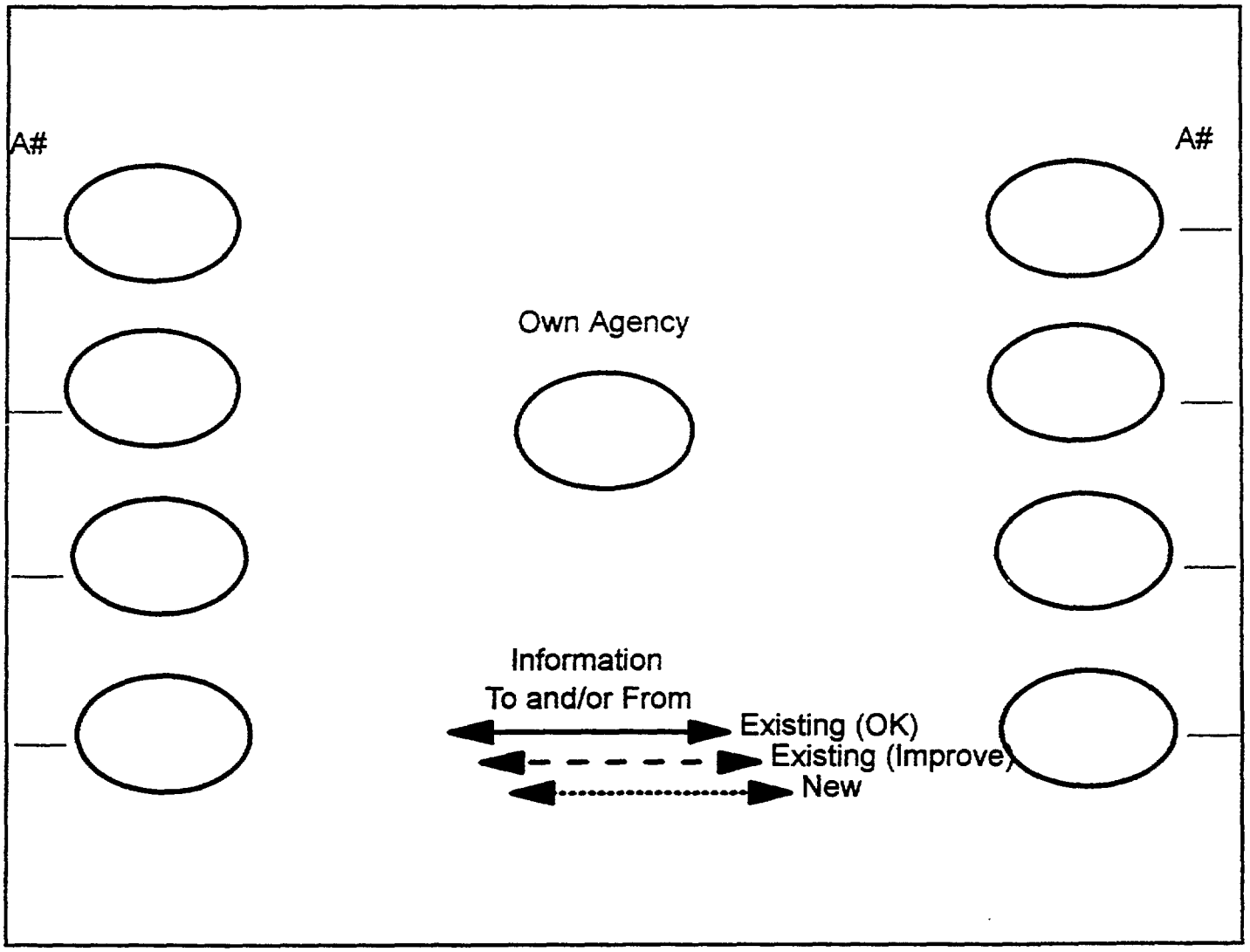
List the contact person from which you received this information and their phone number.

Other — List anything else that may be relevant about the system, but does not fit in the above columns.

2.0 Agency

Information about the organization which contains the system being surveyed is collected in this section. The purpose of this section is to identify any other systems or interfaces that an a agency has an established method for communicating.

Template Page #9 is a graphical view of who agencies have relationships with other agencies. For each agency surveyed, identify the external agencies by assigning an A# identifier, and placing the name of the external agency inside the oval. Indicate the type of interface between the agencies, by the legend in Template Page #7.



2.1 Agency Interfaces (Internal I External)

The purpose of Agency Interface, Template Page #11, is to further understand the type of relationship that is established with an external organization.

A##	[Same description as HW# in Section 1 .1]
Location	[Same description as Location in Section 1 .1]
Information Content	This column is a summary of the information exchanged between the agencies. An few examples of the how to complete this item would be: Road Weather Information, Road Construction, and Incident Reporting
Interface Method	How is the information being exchanged today? Some recommended methods are presented in the following list: 1. Telephone 2. Fax 3. Mail 4. Computer Information Network a. Internet b. America Online c. CompuServe d. Prodigy e. Bulletin Board Service f. Other g. Two Way Radio h. Television 5. Radio Broadcast 6. Visual 7. Newspaper 8. Hardcopy Handouts (ie. Flyers, pamphlets)
Frequency	The frequency of information exchange shall be expressed in some type of units over a time period. 1. One time / minute 2. One time / hour 3. One time / day

4. One time / week
5. One time / month
6. One time / year
7. As needed
8. Post unplanned event (ie. traffic accident)
9. Other

Status — [Same description as Status in Section 1 .1]

Policies — List agency policies that are practiced with respect to the environment. Listed below are a couple of examples that may be found in this topic.

1. Agency X only operates the System A with the System Administrator, Monday - Friday, 8AM - 5PM.

2. Educational requirements to operate System B is experience with UNIX.

Constraints / Restrictions — List agency constraints and/or restrictions with respect to Systems Personnel.

1. The personnel do not have the skills to maintain the system.

Issues — List any issues that are related to this specific component. If the issue is global to the system, then is only needs to be stated once.

Recommended Improvements / Planned Changes

List any system or component recommended improvement that the contact person discusses. State whether the improvement is planned or a “wish” and explain why they system and component is being improved. If the improvement is global to the system, then is only needs to be stated once.

Contacts / Phone Numbers

List the contact person from which you received this information and their phone number.

Other — List anything else that may be relevant about the system, but does not fit in the above columns.

2.2 Agency Systems and Programs

Template Page #13 is collecting all the systems that an agency being surveyed is using. It is intended that for each system listed, a set of templates in Section 1 is completed.