Metropolitan Transportation Management Center

A Case Study

Arizona TrailMaster

Providing a Safe and Efficient Travel Environment for Users

October 1999

Foreword

Dear Reader,

We have scanned the country and brought together the collective wisdom and expertise of transportation professionals implementing Intelligent Transportation Systems (ITS) projects across the United States. This information will prove helpful as you set out to plan, design, and deploy ITS in your communities.

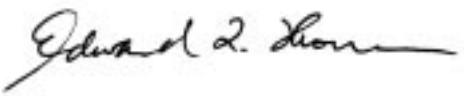
This document is one in a series of products designed to help you provide ITS solutions that meet your local and regional transportation needs. We have developed a variety of formats to communicate with people at various levels within your organization and among your community stakeholders:

- **Benefits Brochures** let experienced community leaders explain in their own words how specific ITS technologies have benefited their areas;
- **Cross-Cutting Studies** examine various ITS approaches that can be taken to meet your community's goals;
- **Case Studies** provide in-depth coverage of specific approaches taken in real-life communities across the United States; and
- **Implementation Guides** serve as "how to" manuals to assist your project staff in the technical details of implementing ITS.

ITS has matured to the point that you don't have to go it alone. We have gained experience and are committed to providing our state and local partners with the knowledge they need to lead their communities into the next century.

The inside back cover contains details on the documents in this series, as well as sources to obtain additional information. We hope you find these documents useful tools for making important transportation infrastructure decisions.

Christine M. Johnson
Program Manager, Operations
Director, ITS Joint Program Office
Federal Highway Administration



Edward L. Thomas
Associate Administrator for
Research, Demonstration and
Innovation
Federal Transit Administration

Preface

The following case study provides a snapshot of Arizona's TrailMaster statewide transportation management center. It follows the outline provided in the companion document, *Metropolitan Transportation Management Center Concepts of Operation — A Cross Cutting Study,* which describes operations and management successful practices and lessons learned from eight transportation management centers in the United States and Canada.

This case study reflects information gathered from interviews and observations at the TrailMaster transportation management center. The authors appreciate the cooperation and support of the Arizona Department of Transportation and its partners in the development of this document.

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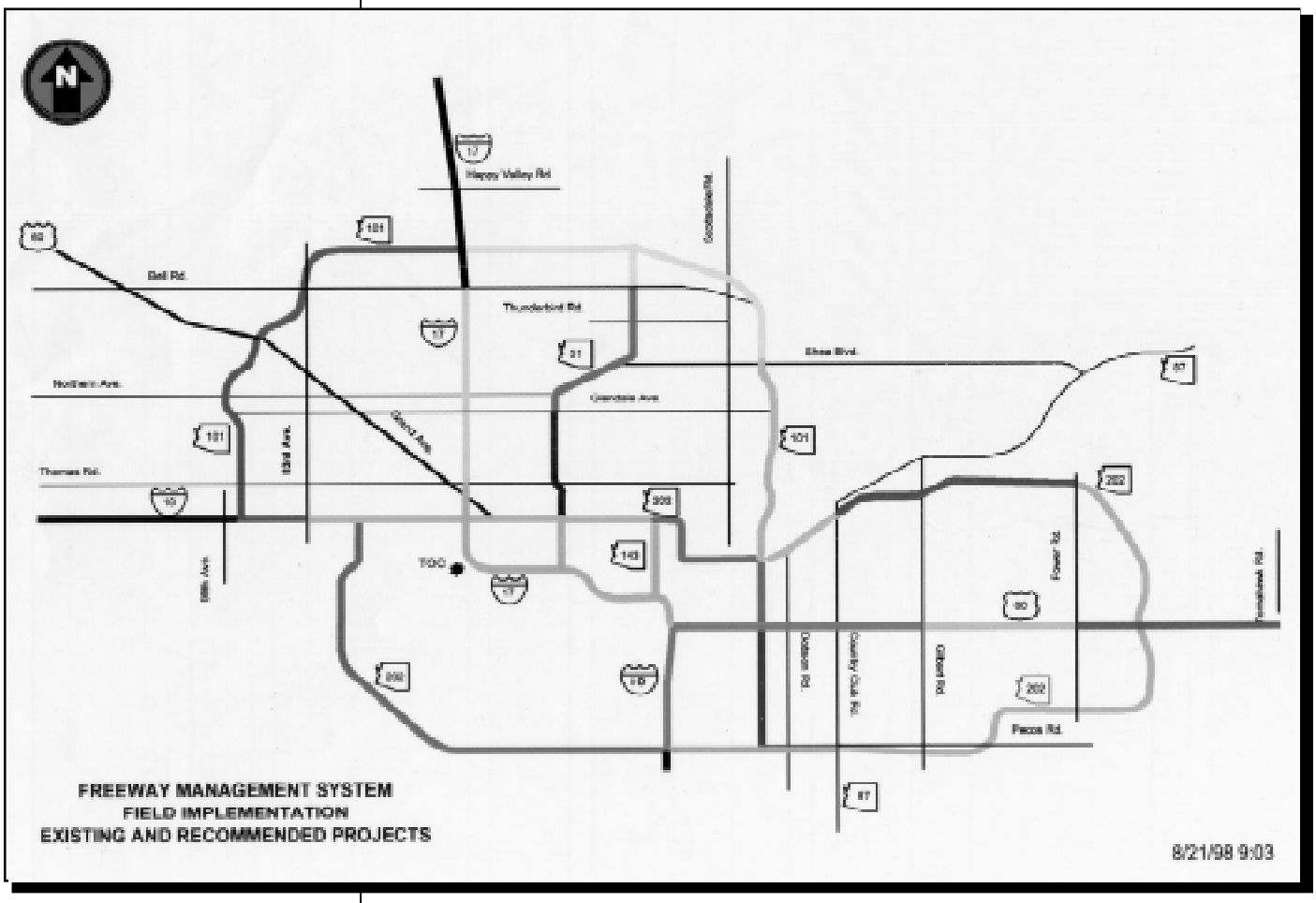
Background

In 1986, the Arizona Department of Transportation (ADOT) completed a study along I-17 and I-10. Based on the results of this study ADOT recommended that a freeway management system be implemented in metropolitan Phoenix. Consequently TrailMaster was developed to accomplish the following:

- Support optimum use of the freeway system
- Provide a safe and efficient environment for users
- Allow for more efficient use of ADOT resources.

Additional documents about the purpose and approach of TrailMaster include a feasibility study, a functional design document, and a statewide deployment plan.

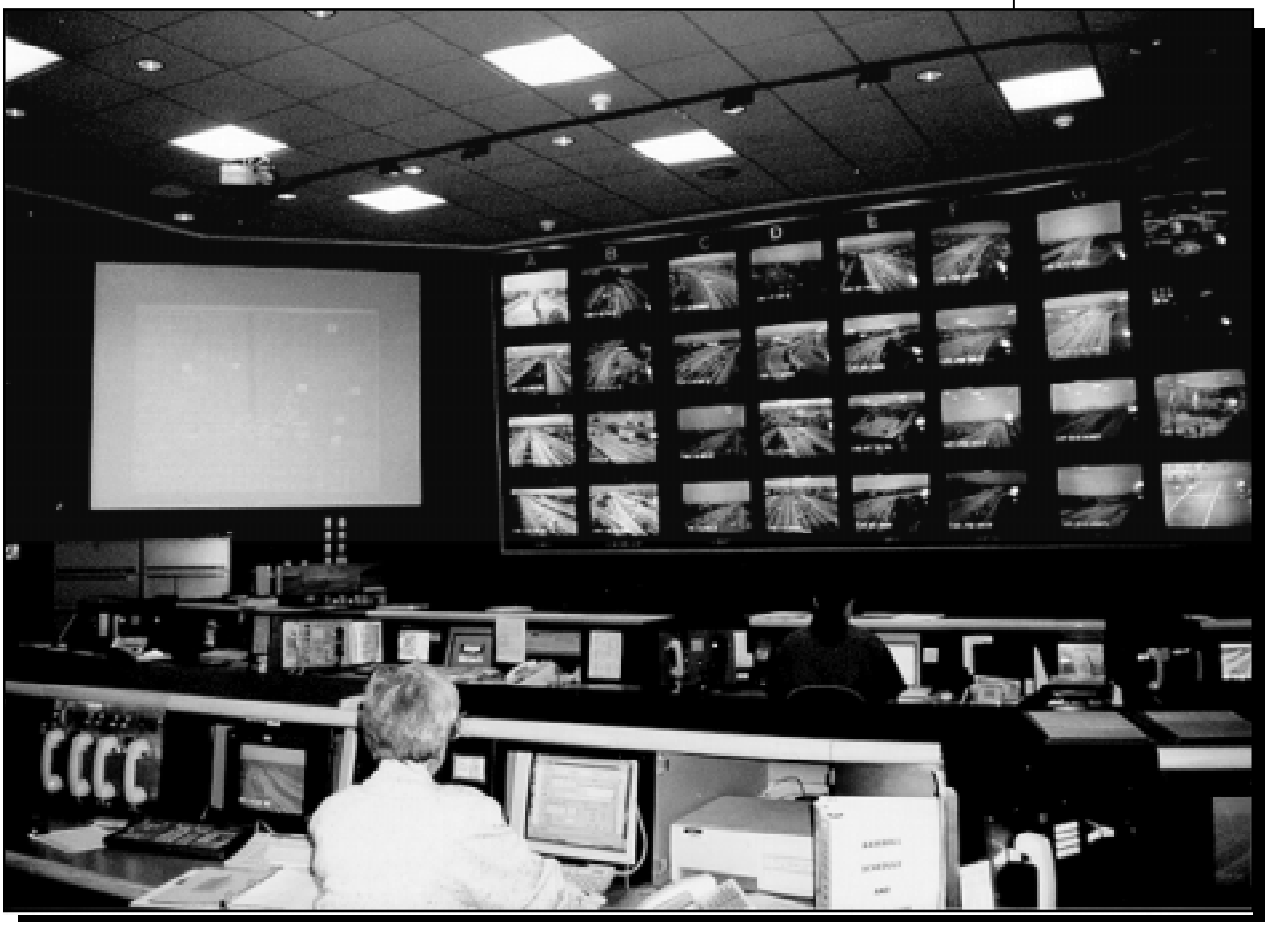


Design and Implementation

The general system design parameters for TrailMaster are the following:

- The TrailMaster transportation management center (TMC) is an 18,000 square-foot, two-level facility located in central Phoenix. Cost to build the facility was $2.8 million, not including the puchase of control room equipment. Expansion of the TMC's role to include statewide traffic management requires more space than the current control room provides, so remodeling is planned.
- The control room has five operator positions arranged in two rows, one tunnel operations position, one radio position, a station for local media, and a separate supervisor's office. Each console position has one or two computer workstations and a 13-inch video monitor. Thirty-two 25-inch video monitors, most of which scroll between camera images, are located in the front of the control room. At the side of the room, a 9-foot front projection system displays the system map; the TMC has plans to purchase a second unit to display a statewide map.
- TrailMaster will support 254 centerline miles of Phoenix metropolitan area freeway and eventually a significantly larger number of miles of rural interstate. Closed-circuit television and variable message signs are located at 1-mile intervals, detector pairs are positioned in every lane at 1/3 mile intervals in the metropolitan area. Communications is through a hybrid fiber optic network and dialup connection.

ADOT has reduced the deployment cost and helped standardize equipment by using multi-year purchase agreements.



Design and Implementation

Operations and Maintenance staff participate actively in TrailMaster's future by planning deployment projects and system improvements.

- Incidents are detected primarily by monitoring video images and through calls from cellular 911 and partner agencies. Incidents are entered manually in the computer system. Messages for individual variable message signs are selected by location and type of incident, and edited as appropriate. Closed-circuit television control is maintained through control panels separate from the workstations.
- Traveler information is provided via an on-site broadcaster, Web site, video feeds to other media, the AZTech metropolitan model deployment initiative kiosks, computerized telephone, and bulletin board systems.

Method of Implementation

- A local consultant was retained to design the TMC, which was procured through a conventional construction contract.
- The consultant prepared the Advanced Traffic Management System functional design and designed much of the field equipment, which was procured through low-bid contracts.
- This consultant also developed the computer system, costing $12 million for design and development.

Testing

- The system design consultant provided a test plan that included input from operations, project management, and consultant staff.

Training

- The system design consultant provided initial operations training. Field equipment training was provided via the first installation contract. Software development consultants provide informal hands-on training for new personnel.
- New hire training is primarily on the job, supervised by senior operators and the operations supervisor.

Documentation

- Documentation includes a systems users manual, plans and specifications, a functional decomposition, construction equipment submittals, "before" and "after" evaluation subsystem design documents, a two-volume software design, and an operations plan, which is being updated.
- The system does not provide a Help function.
- ADOT has staffed a main shift traffic analyst to perform analyses of incident and flow data and to provide system data to outside organizations.

Operations

Workload and Perfomance

- The control center is staffed 24 hours a day, seven days a week in three shifts, using staggered shifts with extended overlaps.
- At shift-change, incidents can be transferred between operators within the system.
- Operators review active incidents and equipment status problems and conduct other activities such as coordinating with law enforcement and maintenance, answering calls, and controlling facility access.
- Logs indicate 40 to 60 incidents occur daily within the Phoenix metropolitan area. (The system is not yet in statewide operation.)

Coordination

Several agencies coordinate TrailMaster operations:

- Arizona Department of Public Safety dispatchers will be stationed in the control room. At present, contact with the Department of Public Safety is by telephone.
- The ADOT district office maintains TrailMaster. Operators have radio access to ADOT maintenance offices and vehicles throughout the State and can perform computerized alphanumeric paging.
- The Highway Closure Reporting System, an inter/intra-agency system that receives input from all districts, is reported as one of the TMC's most successful tools for communicating planned road closures. The Highway Closure Reporting System also provides access to forecast information from the National Weather Service, and it will contain input from the State's road weather information system. Highway Closure Reporting System output is accessible via the Internet.
- Current information sharing between the TrailMaster TMC and the regional transit authority is through an electronic link to the AZTech model deployment initiative server. This provides transit with direct access to extensive raw traffic data on both freeways and arterials, and to the real time incident and construction data published by TrailMaster. AZTech transit schedules are available online to patrons, generating over 3000 hits per month. Future improvements include plans for video on arterials which will be shared with transit.

Conflict Resolution

- Decision making is supported by the operations supervisor and TMC manager, both of whom are available by pager.

Nonstandard Operations

- Rural interstate incidents which require coordination of widely dispersed resources, can take longer to detect and clear than metropolitan incidents and be more severe due to the higher speeds in those areas. Queues can grow to many miles, creating conditions hazardous to motorists and vehicles, particularly due to the region's intense heat, dry climate, and the isolation of its vast rural areas.

Maintenance

Data that TrailMaster archives onto CD-ROM provide an excellent source of information for analysis and long-range planning.

ADOT developed a comprehensive maintenance program for TrailMaster.

- Maintenance resources are supplemented by warranties on field equipment.
- ADOT personnel maintain the computer system and manage the local and wide area communications networks.
- ADOT implemented an extensive preventive maintenance program and has contracted filter replacement and fluid replenishment on field devices.
- Specialized maintenance techniques were developed for common problems such as gunshot damage.
- Maintenance personnel are developing a maintenance training program for personnel maintaining the intelligent transportation systems field equipment.

Fault Detection and Correction

- The system polls variable message signs for status every 20 seconds and notes loss of data from detectors. These are indicated by a change in icon color on the system map. Closed-circuit television failure is noted from visual observation of scrolling images. (Ramp meters are presently on local control and will be on central control in the long term.)

Configuration Management

- Configuration management of the system software is performed using a computer-aided software engineering tool.
- A database of devices, locations, and communications configuration has been developed.
- ADOT is assigning an employee to conduct formal configuration management.

Cost/Benefit Analysis

- A consultant has recently completed a study of the cost of maintenance of TrailMaster for the next 15 years.

Logistics

- Initial spares, tools, and test equipment are procured through the construction contracts.
- Additional spares are procured through purchase agreements.
- Spares are stocked centrally but will be distributed geographically as the system expands.

Maintenance

- An online multi-user maintenance management system is being developed that would allow operators to enter problems and view repair plans and status.

For further information, contact:

Federal Highway Administration Resource Centers

Eastern Resource Center
10 S. Howard Street, Suite 4000 – HRA-EA
Baltimore, MD 21201
Telephone 410-962-0093

Southern Resource Center
61 Forsyth Street, SW
Suite 17T26 – HRA-SO
Atlanta, GA 30303-3104
Telephone 404-562-3570

Midwestern Resource Center
19900 Governors Highway
Suite 301 – HRA-MW
Olympia Fields, IL 60461-1021
Telephone 708-283-3510

Western Resource Center
201 Mission Street
Suite 2100 – HRA-WE
San Francisco, CA 94105
Telephone 415-744-3102

Federal Transit Administration Regional Offices

Region 1
Volpe National Transportation Systems Center
Kendall Square
55 Broadway, Suite 920
Cambridge, MA 02142-1093
Telephone 617-494-2055

Region 2
1 Bolling Green
Room 429
New York, NY 10004
Telephone 212-668-2170

Region 3
1760 Market Street, Suite 500
Philadelphia, PA 19103-4124
Telephone 215-656-7100

Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Suite 17T50
Atlanta, GA 30303-3104
Telephone 404-562-3500

Region 5
200 West Adams Street
24th Floor, Suite 2410
Chicago, IL 60606-5232
Telephone 312-353-2789

Region 6
819 Taylor Street
Room 8A36
Fort Worth, TX 76102
Telephone 817-978-0550

Region 7
6301 Rockhill Road, Suite 303
Kansas City, MO 64131-1117
Telephone 816-523-0204

Region 8
Columbine Place
216 16th Street, Suite 650
Denver, CO 80202-5120
Telephone 303-844-3242

Region 9
201 Mission Street, Suite 2210
San Francisco, CA 94105-1831
Telephone 415-744-3133

Region 10
Jackson Federal Building
915 Second Avenue, Suite 3142
Seattle, WA 98174-1002
Telephone 206-220-7954

Notes

This Document Is One in a Series of Products That Address ITS Issues Pertinent to a Variety of Audiences

Elected and Appointed Officials • Senior Decision Makers
Transportation Managers • Technical Experts

Representing:

States • Cities • Counties • Transit Properties • Toll Authorities
Emergency Service Providers • Metropolitan Planning Organizations
Additional Transportation Stakeholders

Products Available in This Series:

- **Benefits Brochures** quote how ITS technologies have benefited specific areas

- **Cross Cutting Studies** present current data from related ITS applications

- **Case Studies** provide in-depth coverage of ITS applications in specific projects.

- **Technical Reports** include results from various Field Operation Tests.

- **Implementation Guides** assist project staff in the technical details of implementing ITS

ITS Topics Addressed in This Series:

- Commercial Vehicle Operations
- Emergency Services
- Enabling Technologies
- Emissions Management
- Freeway and Arterial Management
- Planning and Integration
- Real-Time Traveler Information
- Transit, Toll, and Rail Management
- Weather Information for Travelers and Maintenance

For a current listing of available documents, please visit our Web site at:
www.its.dot.gov

ITS Web Resources

ITS Joint Program Office:

http://www.its.dot.gov

ITS Cooperative Deployment Network (ICDN):

http://www.nawgits.com/jpo/icdn.html

ITS Electronic Document Library (EDL):

http://www.its.fhwa.dot.gov/cyberdocs/welcome.htm

ITS Professional Capacity Building Program Catalogue:

http://www.its.dot.gov/pcb/98catalg.htm

Federal Transit Administration:

http://www.fta.dot.gov

Intelligent Transportation Systems

U.S. Department of Transportation
400 7th Street, SW
Washington, DC 20590

Federal Highway Administration
Room 3416, HOIT-01
Phone: (202) 366-0722
Facsimile: (202) 493-2027

Federal Transit Administration
Room 9402,TRI-10
Phone: (202) 366-4991
Facsimile: (202) 366-3765

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