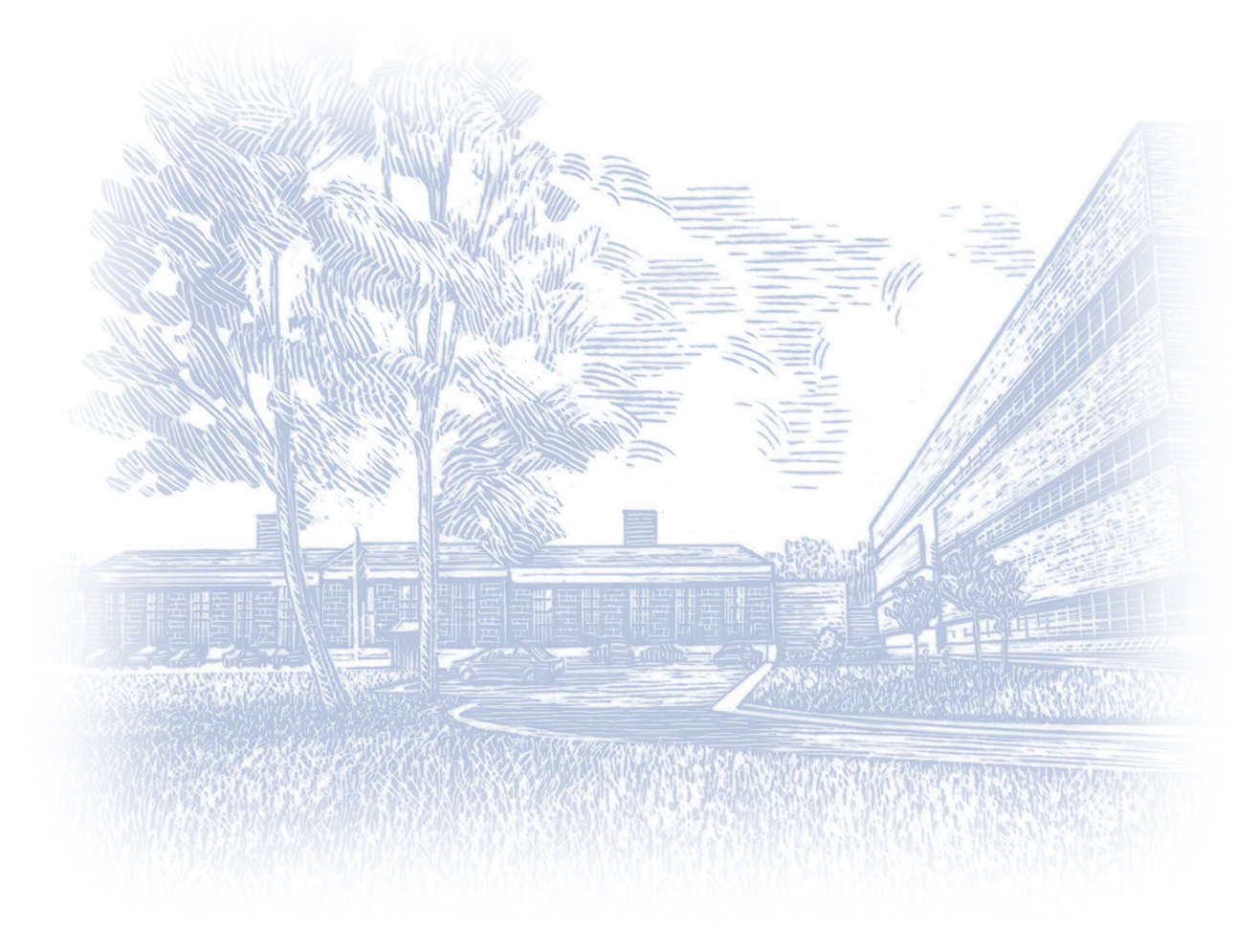
Lessons Learned From Similar Systems Aid In Traffic Management Center Design

Publication No.: FHWA-RD-95-127 **1995**



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Advanced Traffic Management Systems (ATMS) are appearing in an increasing number of cities. They use computers and advanced technology communications systems to support the efficient and safe flow of people and goods in a metropolitan area. The heart of the smart highway system is the Traffic Management Center (TMC). Here, all of the information about the roadway system is brought together and processed. Decisions are made and implemented for managing real-time and predicted traffic problems. Computers compile and display the data automatically collected on the roadway. They carry out routine computations and they store and communicate information.

However, even with powerful computers, much of the communication and most of the critical decisionmaking are done by human operators. Humans talk on telephones and radios; humans operate cameras that provide views of the roadway; humans monitor computers' actions and correct mistakes; and humans turn computers on and off.

Designing the center to optimize the performance of both computers and human operators is an important job for the designer. The center design must take into account the characteristics, capabilities, and limitations of people, communication systems, and computers in order to promote quality traffic management.

One of the best sources of information on which to base design recommendations is past experiences with similar designs. The purpose of this study was to identify and document human-related lessons learned in the design and operation of similar operation control systems.

Lessons Learned from Existing Control Centers

Much of today's new TMC technology is related to that developed for other control environments, such as military command centers. Several jurisdictions have begun to adopt advanced technologies for traffic management. Approximately two dozen of these pioneering TMC's and centers for similar control activities were visited in the United States, Canada, and Europe. Structured interviews were conducted with center managers and operators. Where available, the people involved with center design were identified and interviewed.

The study raised a series of human factors design issues: (1) a design process centered on user needs, (2) automation, (3) staffing, (4) management, (5) design of the interface between users and equipment, and (6) ergonomic and environmental considerations. The interviews revealed that during center design, little attention is typically paid to specific issues that could enhance operator performance. While a few of the centers visited used human factors consultants or universities to provide design guidance, only one adopted a user-centered design process that would have been recommended by human factors engineers.

The centers that were visited varied widely in their approaches to automation. One European system (figure 1) approached full automation of its responses to congestion. A Canadian center used automated responses to routine and incident-related congestion, but manual incident location and reporting to emergency agencies. Centers in the United States (figures 2 and 3) tended to be more labor-intensive in their procedures. Automated systems have the potential of improving the speed and precision of TMC actions; however, most are still too unreliable to be widely accepted and used by the operators.

All but the most highly automated centers depended heavily on the use of remote television cameras to identify congestion and traffic problems. Some centers provided the operators with large walls covered with dozens of television monitors, while other centers used relatively few.

There are important questions about how television can best be applied to support the operators and how the remote cameras can best be controlled. Centers also differ on the qualifications required of their operators. Some centers require only a high school diploma. Others hire college students for part-time employment. Still others require a college engineering degree. One center was staffed entirely by police officers, while several had police liaisons on their staff.

The design issues identified during the study will be addressed in a handbook of human factors guidelines and recommendations for ATMS design that is scheduled for 1995.

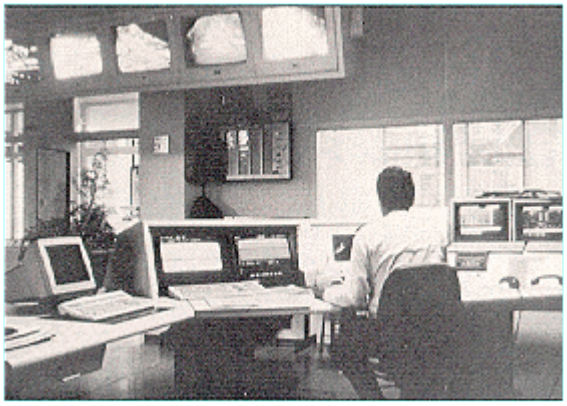

Figure 1. Public Transit Control Center at Amsterdam, Netherlands

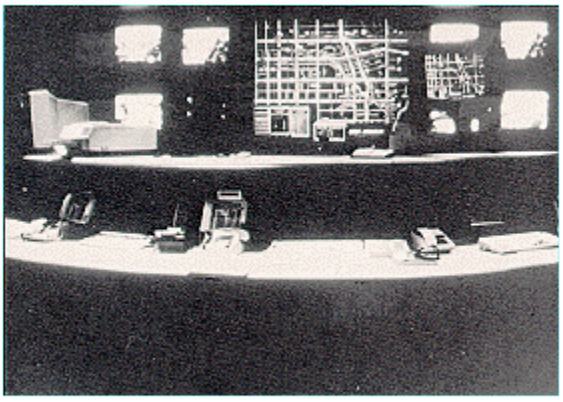

Figure 2. TMC at Anaheim, California

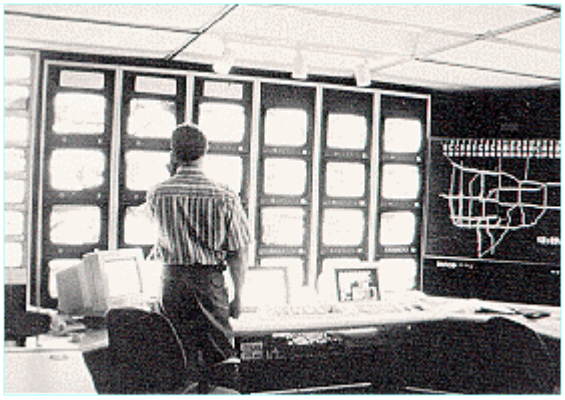

Figure 3. TMC at Minneapolis, MN

For More Information

A full report on comparable systems analysis is available from the FHWA R&D Report Center, phone no. 703 285-2144.
Title: Comparable Systems Analysis of 10 Command centers as Potential Study Sites.
Publication No.: FHWA-RD-93-158.

This research was conducted by the Georgia Tech Research Institute.
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