



Human Factors in Traffic Management Centers : A Literature Review

UMTRI Technical Report 99-5
Nowakowski, C., Green, P., and Kojima, M.

University of Michigan
Ann Arbor, Michigan, USA

1 Background

Building more roads to meet the increasing traffic demands is often not feasible due to the high construction costs and the lack of available space in urban areas. To support more efficient use of the existing road network, the United States passed the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991. The Transportation Equity Act for the 21st Century (TEA-21) replaced the ISTEA in 1998 and guarantees funding for many intelligent transportation systems (ITS) and safety-related projects from 1998 to 2003. Advanced traffic management systems (ATMS) is one of the primary ITS applications. Two key aspects of ATMS have been efforts to communicate information about traffic congestion to the public and efforts to manage traffic congestion.

2 Issues

Traffic management centers (TMCs) are one core element of ATMS. If TMCs are to be effective, they should be easy to operate and provide useful information to the public and to traffic control personnel in a timely manner. The purpose of this report was to review the current literature on human factors considerations in the TMC. Additionally, supporting interviews were conducted at local Michigan traffic management centers. From the literature review and the interviews, future research needs were identified. The following 4 issues were examined in this report:

- 1) What are the goals, methods, and technologies currently used by TMCs?
- 2) How is traffic management both similar to and different than other domains?
- 3) What TMC human factors issues have already been studied?
- 4) What guidelines already exist for the design of TMCs?

3 Findings

1. What are the goals, methods, and technologies currently used by TMCs?

According to Folds et al. (1993), the mission of an ideal traffic management center is "*to facilitate the safe movement of people and goods, with minimal delay, throughout the roadway system.*" In support of this mission statement, the following 5 objectives or goals universal to all TMCs were identified:

- 1) *Maximize the available capacity of the area-wide roadway system.*
- 2) *Minimize the impact of roadway incidents (accidents, stalls, and debris).*
- 3) *Contribute to the regulation of demand.*
- 4) *Assist in the provision of emergency services.*
- 5) *Create and maintain public confidence in the TMC.*

2. How is traffic management both similar to and different than other domains?

The Devoe et al. (1979) study revealed many human factors problems with the design of vessel traffic service centers that were also common to traffic management centers. Although there are many similarities between them, little evidence of human factors considerations was found in regards to the design vessel traffic services centers.

3. What TMC human factors issues have already been studied?

At the time of this report, several published empirical human factors studies specific to issues encountered in traffic management centers were found in the literature. The studies were conducted at the Georgia Tech Research Institute, the Texas Transportation Institute, and the University of Michigan among others. These papers cover the following topics:

	<u>GT</u>	<u>TTI</u>	<u>UM</u>
1) Required operator capabilities	_____	_____	_____
2) Monitor-viewing distances and camera controls	_____	_____	_____
3) Usability of computer based operator support systems	_____	_____	_____
4) Design of incident detection support systems	_____	_____	_____
5) Design of message posting systems	_____	_____	_____

4. What guidelines already exist for the design of TMC's?

The only well known set of guidelines, *Human Factors Handbook for Advanced Traffic Management Center Design* (Kelly, 1995), was written at the Georgia Tech Research Institute. Most of the guidelines in the handbook tend to be very general in nature (e.g., Guideline 3/10 - Consider Operator Workload); however, given an audience with limited human factors expertise, the guidelines and format appear to be very useful and easy to follow. Topics include:

- 1) Principles and methods of user-centered design
- 2) Function allocation
- 3) Basic human error and error-analysis methods
- 4) Basic human performance limits (stress, attention, memory, and decision making)
- 5) Job design and workload
- 6) Anthropometry and physical ergonomics in design
- 7) Displays, data presentation, and controls
- 8) Basic user-computer interface design

4 Conclusions & Recommendations

The Georgia Tech guidelines seem fairly complete and detailed, so to prioritize the guidelines and identify gaps would not be the best use of remaining resources. It was apparent, however, that there was not much data to guide system developers with regards to information dissemination. Further, an examination of current practice identified a growing use of the web as an information dissemination, but no guidelines specific to map-based web sites. Therefore, it is recommended to shift the attention of the project to the following topics:

- 1) What are the advantages and disadvantages of various information dissemination mechanisms ?
- 2) What design guidelines should be followed for an easy-to-use traffic-information web site?

5 References

- 1) Devoe, D.B., Abernathy, C.N., Royal, J.W., Kearns, K.J., and Rudlich, R.A. (1979). *Vessel Traffic Service Watchstander Performance in Routine Operations*. (Document No. CG D-44-79). Washington, D.C.: U.S. DOT, United States Coast Gaurd, Office of Research and Development.
- 2) Folds, D., Brooks, J., Stocks, D., Fain, W., Courtney, T., & Blankenship, S. (1993). *Functional Definition of an Ideal Traffic Management System*. Atlanta, Georgia: Georgia Tech Research Institute.
- 3) Kelly, M.J. (1995). *Human Factors Handbook for Advanced Traffic Management Center Design*. Atlanta, Georgia: Georgia Tech Research Institute.