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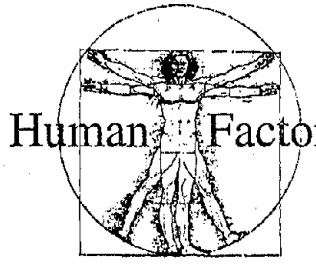
Summary Report



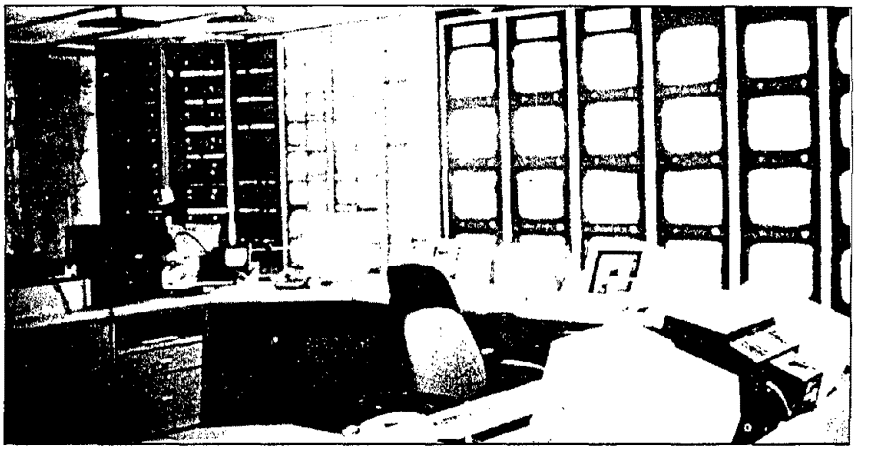
The Human Factors Research Program addresses human performance-related issues that affect highway system design. Current human factors research thrusts are in the areas of Highway Safety and Intelligent Transportation Systems (ITS).

FHWA is placing special emphasis on the U.S. trend toward increasing numbers of older drivers and implications of this trend on highway safety and ITS design. Human factors research products include highway system design guidelines and handbooks based upon empirical human performance data collected in the laboratory and in controlled, on-the-road tests.

U.S. Department of Transportation
Federal Highway Administration

Research and Development
Turner-Fairbank Highway
Research Center
6300 Georgetown Pike
McLean, Virginia 22101-2296

The Human Factors Handbook for Traffic Management Center Design



This handbook was designed to fill the void of information on human factors issues related to traffic management centers. The information for the handbook was derived from two main sources: (1) existing human factors standards, methods, and recommendations from other applications that could be applied to the TMC design environment and (2) lessons learned during the design construction and initial operation of a group of pioneering TMC's.

The handbook addresses the following topics:

Designing to human requirements. The concept of *iterative, user-centered design* is central to meeting human requirements. The handbook stresses tools and procedures (task analysis, flow charting, operational sequence analysis, function allocation, link analysis, rapid prototyping, mockups and simulation, and test and evaluation) and their systematic application at the appropriate points in the design process.

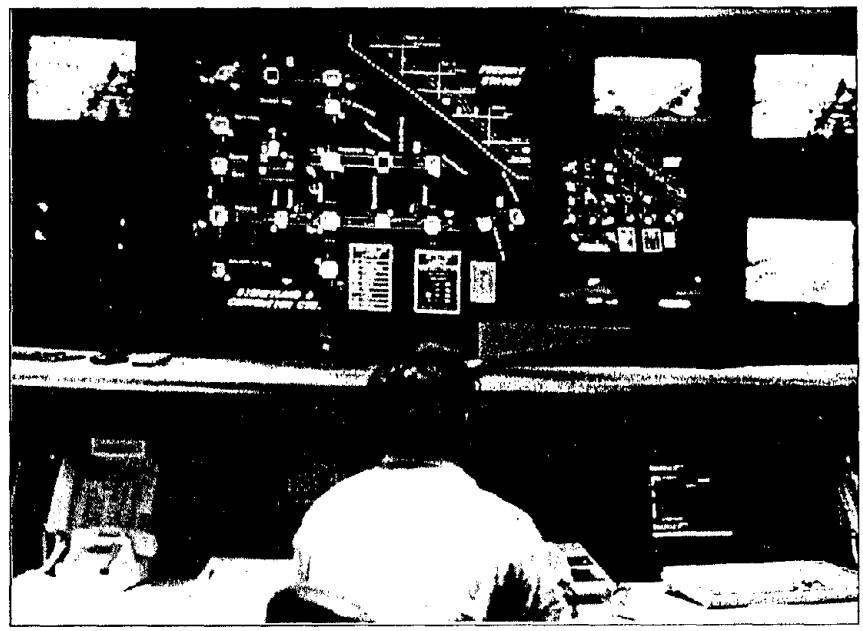
Analyzing functions, tasks, and human/machine systems. The design team must analyze the functional requirements of the TMC in a way that focuses on the user, on how functions are allocated to humans and machines, on how human tasks are analyzed and described, and on how to plan the TMC to enhance human performance.

Designing to reduce human error. Mistakes that appear in the human part of the system often have their origins in design flaws. They can have a significant impact on TMC operations, and they comprise the least understood aspect of design for most managers and engineers.

Designing to support human performance. Design decisions may profoundly influence the probability of operators making correct decisions and maintaining appropriate human control over the system. The design team should understand the nature of arousal, fatigue, memory, attention, and decision making and their interaction with design aspects of the TMC.

Applying the principles of job design. Effective job design reduces errors and their consequences, provides motivation to operators, paces work appropriately, and divides work evenly across teams that operate together.

Applying the principles of anthropometry. Anthropometry (the measurement of human operators' physical size and strength and design of workspaces that these factors take into account) is often ignored until deficiencies appear. Problems that result from ignoring anthropometry might include uncomfortable work chairs; inadequate leg and knee space at work stations; displays that cannot be seen because of poor line-of-sight from operator positions; and work-related injuries and conditions that accompany poor physical design of furniture and accessories.



Applying the principles and standards for displays and controls. The human/system elements of the TMC are concerned with displays and controls. Well designed displays support efficient operator response and reduce errors (because information is easy to read and interpret). Controls that are well designed also reduce operator errors and improve communication, accuracy of output, and operator confidence.

Applying the principles and standards for workplace design. The design team must apply knowledge of anthropometry, displays and controls, and other considerations to the physical design of the TMC workplace. Illumination, physical arrangement, furniture selection, temperature, noise levels, and work stations are important factors.

Applying the principles and standards of user interface with information systems. The user interface and information displays on monitors and input devices such as keyboards can be designed in accordance with numerous existing standards. The design team must be able to select the appropriate interface type and/or specify the characteristics of the information systems that will process and display information in the TMC. Poor interfaces promote errors, delay effective traffic control actions, and create frustration that reduces the operator's confidence in the technology of the center.

Applying the principles and standards of user aids. These aids include user manuals, online help, quick reference guides, and mnemonic devices designed to promote accuracy, reduce the probability of error, and make the operators confident of their ability to intervene appropriately when human decisions and actions are required.

Applying the principles and standards of data presentation. Data presentation is critical in helping the operator understand the status of the systems, the state of traffic flow, and the range of appropriate actions. The design team must be able to apply principles of data presentation, data fusion, and clarity and economy of display.

The handbook contains:

- More than 650 specific design guidelines that can be used to identify important design issues.
- Background information about human characteristics and performance to support understanding of the design guidelines.
- Human factors techniques for analysis, design, and evaluation.
- Instructive case studies and anecdotes describing design successes and failures related to many of the human factors design issues and guidelines.

For More Information

This research was conducted by Georgia Tech Research Institute. To obtain a copy of Human Factors Handbook for Advanced Traffic Management Center Design under an FHWA contract entitled "Human Factors in ATMS Design Evolution," contact Dr. Mike Kelly at Georgia Tech Research Center (GTRI) at 404-894-8240.

For more information, contact Nazy Sobhi, Highway Research Engineer, HSR-30, 703 285-2907.

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