

ITS Management and Operations—ITE Adopts Recommended Practices

FOR THE PAST FIVE YEARS, MEMBERS of the Institute of Transportation Engineers (ITE) with the support of the Federal Highway Administration (FHWA) of the U.S. Department of Transportation (U.S. DOT) have been developing recommended practices for the management and operations of Intelligent Transportation Systems (ITS). This activity was prompted by a concern with the rapid growth of technology, the many elements that comprise ITS and the lack of proper management and operations procedures that are essential for a successful system. The intent of the recommended practices is to provide ITS professionals with guidelines to assess and further their own management and operations needs and practices.

CONCEPTS

A number of concepts guided the development of the recommended practices, which are described below.

EVOLUTION OF TRANSPORTATION

Transportation has been evolving since the first person took a step as a means of transportation. This evolution has been greatly impacted by related evolutions in communications and technology. Communications has evolved from a verbal form that required a limited spatial separation to the Internet that lets us communicate with other computer users anywhere in the world on a real-time basis. Technology has enabled us to travel faster on land, sea and air with advances in vehicle design and propulsion systems. It also has helped us to expand our

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capabilities with the use of computers.

The evolution of transportation requires us to think and act differently. In the past, we have been providers of roadway infrastructure; now we must be providers, operators and managers. This concept will require changes to the orga-

nization and functions of our transportation agencies, stable funding for these new functions and new institutional arrangements among regional organizations to support the new functions.

EVOLUTION OF ITS

The concept of ITS is not new. Probably the first use was when the first actuated traffic signal controller was installed in Baltimore, Md., USA, on Feb. 22, 1928. At that installation, vehicles from the side street activated the green signal by sounding their horn, which was registered by an acoustical device. A signal was then transmitted to the traffic controller indicating that a vehicle had approached from the side street. The information was summarized and at the appropriate time the green light was terminated on the main street and illuminated on the side street. ITS has been evolving in varying stages since that time and will continue to evolve in the future.

DEFINITIONS

The acronym "O&M" is commonly known as operations and maintenance. Operations and maintenance for highways and bridges is clearly defined and frequently that definition is used for ITS. However, this definition is inappropriate for ITS since many of the traditional maintenance items are, in reality, operations items for ITS. For example, a freeway management system cannot operate if the central computer in the control center or the devices in the field are not in a state of readiness. Similar analogies could be presented for traffic signal systems and other ITS elements. Readiness for ITS includes many of the traditional maintenance items and determines whether the ITS is operational. Therefore, the acronym "O&M" has been changed to "M&O" and has been redefined as Management and Operations.¹

The concept of M&O requires common terms and definitions. The following definitions, with respect to ITS, are used in the recommended practices.

- **Operations:** All actions necessary for the proper functioning of a system, such as information gathering, synthesis and dissemination, including those previously associated with response, preventive and design modification maintenance;
- **Response Maintenance:** Actions performed on an as-needed basis. Also known as emergency maintenance, it is required when equipment breaks down or malfunctions. Upon notification, the responsible agency is expected to dispatch a repair service team to secure the site, diagnose the problem, perform the repairs and record their activities as quickly as possible²;
- **Preventative Maintenance:** Actions performed on a regularly scheduled basis using a set of procedures to preserve the intended working condition of the traffic signal system²;
- **Design Modification:** Actions invoked to correct a recurring problem, to accommodate changes in prevailing traffic or physical conditions, or to update installations to the current state-of-the-practice²; and
- **Management:** The allocation of necessary resources for the proper functioning of the system where the system could be the regional transportation system or an individual ITS, such as a traffic signal system.

Management should be viewed as having a number of levels. At one extreme is the management of an individual system. At the other extreme is the management of all transportation systems in a region. There are many levels in between these extremes.

SYSTEM BALANCE

An imbalance among system elements can develop as ITS is deployed. Figure 1 depicts a simplified system model that is typical of many ITS projects. Information is gathered and sent to a central depository for record keeping (database), fusion (synthesis) and analysis (decision making). The information is then distributed to many outlets. For the system to be in balance, each of its elements must have the same strength. In other words the information being distributed must not give more than the information is capable of describing. Furthermore, the fusion element must provide a truthful synthesis of the information input. For example, a traffic signal controller cannot make traffic flow through an intersection more effectively unless detectors provide data to the controller.¹

DEVELOPMENT OF THE RECOMMENDED PRACTICES

With the intent of having the recommended practices being used by ITS professions, an inclusive process was developed, which included conferences, committee meetings, solicitations for comments and field test sites. The first conference was held in Dallas, Texas, USA, on Oct. 15–16, 1994. It brought together ITS owners, designers, implementers, operators and maintainers to raise issues, develop recommendations, identify champions and prioritize actions. The second conference was held in Minneapolis, Minn., USA, on Sept. 14–15, 1996, to discuss the topic of “Operating and Maintaining Advanced Traffic Management System Centers.” A third conference was held in Tampa, Fla., USA, on March 22–23, 1997, to discuss “Operating and Maintaining ITS Field Devices.” Attendance at each of these three conferences included about 90 invitees. The format of these three conferences included plenary sessions and workshops. White papers were prepared on selected topics, distributed before each conference and refined to reflect the discussions at the conferences. The selected topics were discussed at the workshops and recommended practices were defined.

A fourth conference was held with the members of the ITS Council Committee on Management and Operations of ITS

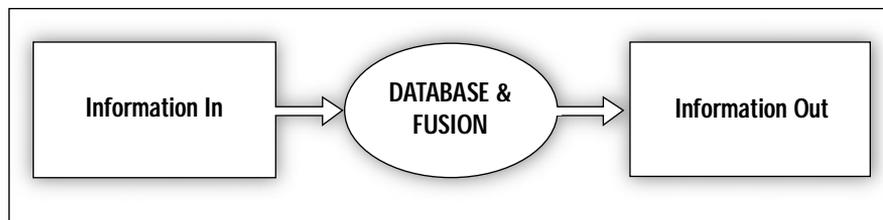


Figure 1. Simplified system model.

on Aug. 2–3, 1997, in Boston, Mass., USA, to synthesize the recommended practices of the previous three conferences. This conference resulted in a report entitled “Operations and Management of Intelligent Transportation Systems—An ITE Proposed Recommended Practice” dated August 1998, which was made available by ITE for review and comment.

Training courses based on the recommended practices were held in Monterey, Calif., USA (1997), Toronto, Ontario, Canada (1998) and Las Vegas, Nev., USA (1999). Each course was scheduled for one-and-one-half days and included lecture sessions and workshops. Evaluations from each course were used in the development of the final recommended practices.

During the five-year period, a number of agencies asked if they could review the recommended practices. These requests were formalized into a review process at the following 12 agencies:

- Broward County, Fla.;
- City of Daytona Beach, Fla.;
- City of Lewisville, Texas;
- City of Newark, N.J.;
- City of Portland, Ore.;
- Colorado DOT;
- Florida DOT;
- Michigan DOT;
- New Jersey DOT;
- Utah DOT;
- Virginia DOT; and
- Washington DOT.

Committee members provided instructions to the agencies by mail, telephone and personal visits. A survey form was developed and used by the agencies to evaluate each key recommendation and each recommendation by answering the following questions:

- Was the recommended practice understood by the staff/evaluators?
- Is the recommended practice useful to the agency?
- What changes should be made to

this recommended practice?

Each agency selected those recommended practices that they were interested in evaluating. At least three agencies evaluated each recommended practice.

On March 27–28, 1999, the ITS Council Committee on Management and Operations of ITS met in Orlando, Fla., to develop a final draft of the recommended practices. The draft was prepared based on the comments received, the course evaluations and the evaluations from the test sites. The draft was approved by the Committee on Management and Operations, the ITE ITS Council Review Panel and the ITE Board of Direction.

RECOMMENDED PRACTICES

The efforts of over 500 participants during the past five years have resulted in recommended practices that were developed through an inclusive process by and for those that will use them. The recommended practices are contained in the following 10 chapters:

- 1.0–System Management Practices;
- 2.0–Planning;
- 3.0–Funding;
- 4.0–Design;
- 5.0–Procurement;
- 6.0–Installation;
- 7.0–Computer Systems;
- 8.0–Resource Sharing/Joint Operations/Integration;
- 9.0–Staffing/Training; and
- 10.0–Operational Issues.

Each of the recommended practices contains key recommendations and subsequent recommendations.

Recommended Practice 1.0–System Management Practices contains five key recommendations and focuses on a number of issues. The establishment of strong and effective working relationships among all participating agencies and disciplines is stressed in addition to maintaining system reliability. Other key

recommendations include information on a public education and information program, development of an agency specific ITS Strategic System Plan and the need for high-level support of ITS M&O.

Recommended Practice 2.0—Planning focuses on the need to develop two types of ITS plans. An ITS Regional Strategic Plan should be developed to identify the “big picture” vision for the future development of ITS in a region and/or state. An ITS Strategic System Plan should be developed based on an identified operational strategy for an agency or group of stakeholders.

Recommended Practice 3.0—Funding has one key recommendation, which states that agencies should estimate and fund recurring costs. Four recommendations support this key recommendation.

Recommended Practice 4.0—Design has one key recommendation, which states that agencies should prepare a System Design Plan to guide the development and deployment of each component of the system identified in the ITS Strategic System Plan. This is supported by eight recommended practices.

Recommended Practice 5.0—Procurement has two key recommendations dealing with the assignment of responsibilities and identification of performance measures. A third key recommendation addresses the fact that the procurement method for software may be different from the procurement method for the rest of the system. References are provided for more information.

Recommended Practice 6.0—Installation focuses on the statement that the installation of ITS devices and systems should be planned and coordinated by installation staff and M&O staff. Seven recommendations detail this key recommendation.

Recommended Practice 7.0—Computer Systems primarily focus on computer system’s software. The use of generally accepted software system practices is stressed. In addition, it is recommended that operating agencies undertake a long-term program for maintaining computer systems, including software and hardware support.

Recommended Practice 8.0—Resource Sharing/Joint Operations/Integration is a chapter that combines a number of issues. One key recommendation encourages

close coordination with all agencies/disciplines in the early planning stages and continued coordination throughout every phase of the project. Others suggest agencies should look for opportunities to share information and joint operations. Another suggests that the integration of systems should be based on the need to share information among agencies.

Recommended Practice 9.0—Staffing/Training addresses the issues of providing sufficient, qualified and experienced staff; developing and maintaining an ongoing training program; and including M&O personnel in all phases of the project. References for more information are provided.

Recommended Practice 10.0—Operational Issues discusses how operating agencies should develop and maintain operations plans, manuals and documentation. Also discussed are how operating agencies should include policies and procedures for incident management.

USE OF RECOMMENDED PRACTICES

It must be remembered that ITS is different from other traditional transportation projects and that there are a wide range of factors to consider when planning, implementing, managing and operating a successful system. The above recommended practices should be used as guidelines for ITS professionals to consider. Furthermore, many of the recommended practices are interrelated and should not be viewed as discrete statements.

Many of the recommended practices can only be accomplished to the extent that adequate funding is provided. For this reason, the recommended practices are a compilation of goals for all ITS programs subject to each agency’s individual needs and budgetary constraints.

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References

1. *Final Draft, Management and Operations of Intelligent Transportation Systems—An ITE Recommended Practice, May 1, 1999*; prepared by the ITS Council Committee on Management and Operations of Intelligent Transportation Systems. For information on ordering this publication, please see pages 67–68 of this issue of *ITE Journal*.
2. NCHRP Project 20-5, Synthesis Topic 27-11, Traffic Signal Control Systems Maintenance Management Practices, June 1997.



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