

Managing Change in State Departments of Transportation

Scan 3 of 8: Innovations in Institutionalization of Operations

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FOREWORD

Change Management in State DOTs

State departments of transportation are operating in an environment of unprecedented change. Evolving demands for transportation services, new technologies, workforce composition, stakeholders' concerns, and a constantly changing political environment create continuing demands for institutional change. To address these challenges, many state DOTs are undertaking a range of initiatives such as strategic planning, organizational restructuring, performance measurement, process engineering, and outsourcing.

Both anecdote and survey suggest that change management is now the major preoccupation of senior management. However, the rate of change is very uneven and not well-understood. Indeed, there appears to be more *innovation* than *imitation* -- since the creative approaches being introduced are not documented or widely discussed. Little "literature" on state DOT change management has been developed -- either case studies or "how to" material.

AASHTO's Strategic Interest

A 1998 AASHTO report on "The Changing State DOT" identified drivers of change and approaches being taken by state DOTs in change management. AASHTO's Year 2000 Strategic Plan activities then introduced an element concerned with facilitating institutional change. Meanwhile, a newly reorganized TRB Committee on Strategic Management, through calls for papers and annual meeting sessions, focused on studying the range of changes occurring in transportation organizations. This led to the formation of a committee to plan a special workshop on strategic management under the joint sponsorship of the Transportation Research Board Committee on Strategic Management, AASHTO Standing Committee on Quality, and the Federal Highway Administration (FHWA).

The Strategic Management Workshop

The two-day workshop (June 25-27, 2000) in Minneapolis was organized to facilitate peer-to-peer discussions among the CEOs and senior staff of the state DOTs about their experiences in managing internal and external change. This workshop focused on sharing recent experiences with managing internal and external change and lessons learned. Twenty state DOT CEOs participated in the workshop, and 35 state DOTs were represented by CEOs or senior staff. Conference dialogue dealt with three principal management challenges:

1. Strategic planning-related initiatives
2. Workforce and reorganization-related initiatives
3. Process and program delivery-related initiatives

The discussions identified a wide range of specific issues within each area that attendees felt deserve organized review via case studies, assessment of the state of the practice, and identification of promising concepts, approaches, and tools. Workshop participants used the results of these discussions to identify research that would help state DOTs lead and manage their changing organizations. Twenty-two research problem statements were crafted around the three subject areas.

TRB, at the urging of AASHTO and participating CEOs, immediately set up an NCHRP panel, chaired by Mary Peters of Arizona DOT, to develop a multiyear NCHRP research program under the 20-24 program established for special AASHTO research related to DOT administration. The panel combined and prioritized problem statements into eight strategic management issues for priority research. In view

of the lack of written material on these subjects, the panel decided to start with broad "scans" of the state of the practice in each area to provide guidance for a substantive multiyear research program. Each scan would summarize the challenges, document examples of current innovations, and recommend the appropriate initial components of a research program. The eight-month scan program -- including presentations at AASHTO Board meeting roundtables -- represented a highly unusual rapid-response approach to the priority placed on these issues by AASHTO and TRB.

Cross-Cutting Findings from the Initial Eight Scans

The eight scans produced considerable evidence of the number and breadth of change management initiatives within state DOTs. In general, these initiatives are concerned with the agencies as institutions, their mission and leadership, organization and workforce, process, and resources. The principal, common forces of change include:

1. Deliberate reorientation of strategic objectives in response to program limitations (Scan 3, operations), new technology (Scan 6, information technology), or funding (Scan 8, innovative finance)
2. Evolution of new forms of cooperation for improved service delivery with other public agencies (Scan 7, partnerships) and the private sector (Scan 2, outsourcing)
3. Workforce strategies (Scan 5) in response to downsizing, retirements, competition, and the need for new capabilities
4. The need to institutionalize and measure change management (Scan 1, strategic leadership) and improve agency image in the overall constituent context (Scan 4, positioning)

Overall, state DOTs today appear to be evolving away from single-purpose entities with standard approaches to producing a limited number of well-understood products and services. Instead, they are moving toward more flexible organizations designed to respond to constantly changing missions with ever-increasing efficiency through a shifting coalition of partners and stakeholders. Managers of these changes can clearly benefit from access to collective experience, including a better sense of the state of the practice and specific resources based on the more promising approaches. The scans identify some of the most valuable experience and provide important pointers to key issues for further dialogue and research.

Individual Scan Highlights

Scan 1 -- Innovations in Strategic Leadership and Measurement for State DOTs: Strategic planning itself is increasingly widespread in state DOTs. However, many CEOs find that the process often breaks down in the implementation stage -- creating buy-in and "institutionalization" of key change vectors. Yet some promising solutions are being found, including widespread participation of a variety of stakeholders in the process, a customer focus in terms of strategy and priorities, top management commitment to implementing the strategic agenda, ongoing communication to promote it, and "omni-directional alignment" among goals, performance measures, and budgets. Further research in each of these areas is needed to strengthen and integrate strategic management practices. *(Scan by T.H. Poister and D.M. Van Slyke of Georgia State University)*

Scan 2 -- Innovations in Private Involvement in Project Delivery: Outsourcing -- commonly employed for construction and design services to cope with lumpy demands or staff downsizing -- is spreading to other functions within the project and service delivery functions. It is increasingly important to understand the relative costs and quality of work conducted in-house versus by external private firms. Current evidence is not conclusive, as cost comparisons may not have been systematic. More research and more collaborative efforts are required by transportation organizations to identify best practices and possible standard procedures. *(Scan by Dr. D. Hancher, P.E. and R. Werkmeister, P.E., University of Kentucky)*

Scan 3 -- Innovations in Institutionalization of Operations: Systems operations and management is already considered a mission priority by many state DOTs. However, the several types of operations-related activities -- ranging from ITS to maintenance of traffic -- are stovepiped and decentralized in most state DOTs. In most cases, there appears to be no common department-wide policy framework around which to organize for efficient integration of services and sustainable funding. Some member departments are establishing performance measures by conducting customer surveys, but implementation for program management is still in the very early stages. Further case study research into promising approaches is needed to connect customer interests and performance measures to integrated operations activities. *(Scan by Philip J. Tarnoff)* **This scan is the topic of this file.**

Scan 4 -- Innovations in DOT Communications, Image, and Positioning: The scan focused on states known to be addressing issues of communications, image, and positioning. Those that were most advanced focused on improving both internal communications with staff and external communications with the public, elected officials, and the media. Some innovative states are assessing their image and identifying ways in which to clarify and improve it with the public, recognizing that image enhancement and improved constituent communications may lead to an improved position for the agency, to new resources, and to a more supportive audience for the agency's work. Increasingly, states report that proactive efforts to better communicate and to position the agency positively with decision makers have led to increased public support and legislative funding for the DOTs. Additional research in communications, positioning, and marketing to various constituencies was felt to be needed. *(Scan by K. Stein and R. Sloane of Howard/Stein-Hudson Associates)*

Scan 5 -- Innovations in Work Force Strategies: State departments of transportation face severe challenges in recruiting and maintaining their workforces. Innovative approaches are being taken to recruitment of core competencies such as IT and senior civil engineering. Retention and succession approaches were also investigated, including mentoring and reverse mentoring. However, more case study and research are needed in defining, recruiting, and retaining the necessary workforce. *(Scan by C. Gilliland of the Texas Transportation Institute)*

Scan 6 -- Innovations in Organization Development as a Result of Information Technology: The rapidly changing environment of IT is challenging DOTs to deal with emerging opportunities and problems. This scan identified the range and types of new opportunities related to IT itself as well as related organizational development implications. Key issues include organization of the IT function, the cost-effective degree of outsourcing, and a range of management issues such as handling information overload, funding, procurement, and training. These areas suggest future research directions. *(Scan by C. Cluett and K. Baker of Battelle Seattle Research Center)*

Scan 7 -- Innovations in Public-Public Partnering and Relationship Building in State DOTs: A wide variety of partnerships among state DOTs; other state, local, and federal agencies; and public stakeholders are improving project and program delivery and increasing efficiency across agency or jurisdictional lines. Promising areas for partnering include achieving environmental streamlining, rationalizing state-local maintenance responsibilities, and joint community problem solving. Examination of successful partnerships and relationships identifies common elements of success and provides a starting point for the development of new partnering tools more applicable to longer-term, peer-to-peer relationships among DOTs; other state, local, and federal agencies; and non-governmental stakeholders. *(Scan by Mark Ford of HDR-Portland)*

Scan 8 -- Innovations in Project Financing: There is now a very rich menu of innovative revenue sources and finance techniques. New revenues are available from toll facilities, HOT lanes, value or congestion pricing, special assessments and fees, shared resource projects, and/or joint development. These revenues can be combined to leverage scarce federal aid through both debt and equity approaches, capitalizing on the new flexibility within the federal aid and some state programs. Such new approaches to project financing can also benefit from innovative project development approaches. Research is needed on promising approaches to mainstream these approaches within transportation agencies. *(Scan by A. Reno and L. Hussey of Cambridge Systematics, Inc.)*

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EXECUTIVE SUMMARY

As growth in travel demand exceeds the nation's ability to provide compensating increases in highway capacity, the need for effective management and operations (referred to as "operations" in this report) becomes critical. This project, which has been conducted to identify innovations related to the institutionalization of operations, represents one of a number of activities underway to improve the effectiveness with which operations is delivered by state DOTs. The initial objective of this work was to identify policy, program and organization approaches being employed by state DOTs that might be adopted to ensure that operations services are effectively delivered and fully integrated into the culture of transportation agencies throughout the United States. As the work progressed, it became clear that highway system operations could not be considered a unified discipline that can be analyzed as a coherent organizational activity. Instead, it is a set of disciplines that includes such diverse activities as emergency response to incidents, traffic control in work zones, signal timing, signs and markings, snow removal, maintenance, work-zone operations and emergency response, which are dispersed throughout most departments of transportation. In fact the diversity of these activities frequently requires the inclusion of other state agencies such as police, fire, EMS and offices of emergency preparedness. As a result, the institutionalization of highway operations cannot be accomplished through the relatively simple step of appointing an "operations czar" within a state DOT or highway department. Institutionalization is accomplished by establishing a culture of institutional cooperation and recognizing the importance of customer needs.

This report presents the results of a survey of several state departments of transportation performed with the objective of defining the characteristics associated with the institutionalization of operations and where possible, identifying innovations employed in the management and delivery of highway operations. This work includes executive level interviews, a review of documents, and drawing on the author's general knowledge of the activities of the subject state DOTs as well as current literature on the subject.

In this report, transportation management and operations is defined as the activities related directly to improving or maintaining the performance of the existing highway system – and contrasts with other departmental activities related to the expansion, preservation or maintenance of the system. By this definition, operations includes a range of activities, which while seemingly unrelated, all focus on maintaining and improving service to existing users under a variety of changing conditions such as:

- Routine capacity preservation activities -- Snow removal, enforcement of HOV operations, traffic signal timing and maintenance, etc.
- Public safety and regulatory responses -- Special event management, emergency plans, CVO regulatory automation, etc.

- Planned construction and maintenance activities -- Work zone traffic management, maintenance scheduling, etc
- Projects for real time system performance involving multiple jurisdictions ITS, incident management, etc.
- Initiatives for advanced traveler information systems often in cooperation with the private sector Roadway Weather Information Systems (RWIS), Internet pages, Mayday Systems, 511, etc.)

The report considers the entire range of factors that might be considered indicators of “institutionalization” and which impact operations effectiveness including clear organizational responsibility, integration of operations into the planning, programming and budgeting process, evaluation of operations effectiveness (performance measurement) and customer feedback, The report also identifies specific innovations associated with the delivery of operations, and discusses the manner in which these innovations can be encouraged and integrated into the operations institutional framework. This survey supports a series of conclusions that have been assumed from anecdotal evidence

- The definition of operations (in terms of the categories above) and the concept that a series of currently independent (and stove piped) activities can or should be integrated or coordinated is still not generally perceived or accepted. Indeed senior management interviewed in this survey appeared to have varying definitions of operations and limited perception of major shortfalls or missed opportunities. This definitional confusion hampers effective senior management dialogue about systems operations and management.
- With a few exceptions, most statewide policy and planning documents do not substantially focus on a commitment to maintaining performance (delay, reliability, etc) of the existing system. There were little identifiable relationships between statewide plans and STIPs and operations activities at the district level. Some states are developing statewide ITS plans, but even in these cases, objectives are often defined in terms of equipment installation rather than improved service to the motoring public.
- Senior management oversight regarding operations and management effectiveness, performance assessment and resource adequacy is largely absent. There is little expressed concern that “things are not right” at the headquarters level.
- There is no program category of specific funding for operations overall, defined as above. Funding for operations as defined above are fragmented and in some cases ad hoc.
- Many innovations exist for the delivery of effective operations. In most cases, these innovations are occurring at the working level and are not fully recognized or rewarded by the senior management of their respective organizations.

- Many of the operations activities as defined in the 6 categories above are decentralized to districts and are the responsibility of the district engineers. There is no department-wide policy regarding these categories that defines levels of intensity, specific warrants or applications, or personnel skill levels.
- Various types of operations activities are more or less dependent on external partners – both within the transportation sector (such as local government and transit authorities) and outside the sector (such as law enforcement fire and emergency services). These relationships appear to be substantially informal and in early stages of development.
- The ability of the senior management to exercise their responsibilities is limited by the absence of effective performance measures. However, it was possible to identify some examples of agencies that had established operations performance measures. These measures tend to focus on the establishment of performance improvement goals, in which current year's activities are compared with the previous year. In at least one case, there is emphasis on measurement of the public's satisfaction with the agency's performance.
- It was also observed, that with some notable exceptions, there appeared to be little effort made to evaluate customer satisfaction with operations services on a regular basis. Agencies that had conducted customer surveys found that the results were useful for the planning and delivery of their operations responsibilities.

CHAPTER 1

INTRODUCTION AND RESEARCH APPROACH

PROBLEM STATEMENT AND RESEARCH OBJECTIVE

This report is one element of an NCHRP project initiated to identify and classify a range of approaches affecting the management of state departments of transportation (DOTs). The project was initiated with the objective of identifying innovations, noteworthy characteristics, context issues, pros and cons, and challenges to implementing each approach. The underlying assumption of this objective is that specific actions might be taken within the management of state DOTs that will enhance the effectiveness of their service delivery. The topics covered by this project include:

- Strategic Leadership and Measurement
- Private Involvement in Project Delivery
- Institutionalizing System Operations
- Communications, Image and Positioning
- Workforce Strategies

Institutionalizing System Operations, the subject of this report, is unique among the topics included in this project, in that it addresses a specific functional responsibility of state DOTs. The other topics of the project tend to be crosscutting, influencing the broad range of DOT responsibilities. Operations has been singled out for particular emphasis in recognition of its emerging importance as an alternative to the construction activities that have traditionally been relied upon to satisfy the needs of increasing transportation demand.

Some types of systems operations activities are receiving increased attention as public opposition to new roads grows, and new tools become available for the management of existing facilities. Other types of operations are already performed routinely by state DOTs but not integrated within an overall program framework. The delivery of effective operations places a new set of demands on the organization, staffing, planning and management of the state DOT. This combination of increased travel demand and the need for organizational change, have resulted in the identification of operations as a subject for the study of institutional change within state DOTs.

SCOPE OF STUDY

This project was conducted with the initial objective of performing a scan of a limited number of state DOTs to identify innovative practices related to the administration of systems operations and management. As the work progressed, it became clear that because of its decentralized nature, senior level management tends to view operations as a collection of relatively independent, specialized activities occurring

throughout the organization. As a result, the emphasis of this work has been modified to consider the steps that must be taken to institutionalize operations including the characteristics associated with the management of a decentralized activity with emphasis on the need to evaluate its performance.

The issues initially examined included:

- The senior management conceptualization of systems operations and management as a department mission, priority and program
- The manner in which operations is managed including the visibility of systems performance in statewide policy and plans and Headquarters management oversight of systems operations and management activities
- The structure of planning, programming and budgeting as it relates to the various operational activities
- The level of responsibility organizationally for the various operations activities
- The way in which delivery effectiveness is managed and evaluated including focus on systems performance
- The types of relationships with external partners and customer/stakeholders

Throughout this effort, the scan was hampered by definitional fuzziness within the industry and profession. Indeed, some of the survey responses have had to be reinterpreted in light of obvious variations in perceptions on the part of senior managers

RESEARCH APPROACH

This research was conducted through interviews with the senior management of state DOTs and a review of relevant references. The interviews were conducted with personnel from the states of Arkansas, Arizona, Florida and Maryland. This mix of states provided both rural and urban representation as well as a geographically diverse sample. The references reviewed included the strategic plans of several states as well as the extensive set of material that has been developed in connection with the National Operations Dialog sponsored by the Federal Highway Administration.

This report begins with a definition of operations and the characteristics of operational institutionalization. These characteristics are used to establish benchmarks against which existing practices can be compared. The body of the research results that are organized in a manner that parallels the operations process - planning, delivery and evaluation, follows this discussion. Cross cutting issues such as budgeting and funding, and personnel management are considered as separate categories. Funding and personnel management are considered as cross cutting issues.

CHAPTER 2 FINDINGS

OVERVIEW

All state DOTs recognize the importance of operations in the management of their transportation infrastructure. To varying degrees operations is included in their planning processes, and actively monitored by senior management. Organizational and funding differences exist due to the size of the state, the role of local government and the span of departmental responsibilities. In all cases, operations is organized and managed as an activity that is both functionally and geographically disbursed. The challenge is to address this disbursed activity in a coherent manner that recognizes its importance, and maintains the interdependence of the planning, delivery and evaluation activities required to ensure its effectiveness.

WHAT IS OPERATIONS?

A broad definition of operations was provided during the interviews conducted for this study. Operations was defined as “including all the activities of a state DOT with the exception of capital improvement projects”. The breadth of this definition was intentional. It provided the flexibility to identify and discuss the complete range of activities defined as operations by the organizations included in the survey. It removed any constraints from the identification of innovative practices.

Predictably, this definition recognizes that the services associated with Intelligent Transportation Systems (ITS) such as freeway service patrols, electronic toll collection, dissemination of traveler information and traffic signal timing are considered to be operations by all of the individuals contacted. However, the operations responsibilities of state DOTs include many other activities such as traffic control in construction zones, commercial vehicle operations, snow plowing, signs and markings, trash removal, noise abatement, bicycle paths and traffic calming. Some may also include maintenance functions as an operations activity. As a result of this breadth of “operations” activities; responsibility for delivery tends to be assigned to multiple units within the organization. Elements of operations may be found in the maintenance, traffic engineering, planning, construction and many other parts of the organization. In spite of the fact that responsibility for operations is distributed, the single common characteristic is the focus on maintaining and improving service to existing users under a variety of changing conditions. It is this common characteristic that must be used as the basis for institutionalizing operations within state DOTs.

INSTITUTIONALIZATION OF OPERATIONS

Institutionalization of operations requires consideration of planning, organization, personnel policies, funding, delivery and evaluation of the process. While some

organizations have begun to recognize the importance of a unified approach to these issues, none have fully integrated these decentralized activities.

Table 1 addresses the question of centralization at an abstract level. It identifies functions that are typically performed at the headquarters level of transportation departments, and those that are performed at the district level. Many of these functions might be provided at either level depending on the geographical, demographic, legislative and organizational characteristics of the state. While the assignment of specific functions to various levels might differ, the following points are clear from this table:

1. It is not possible to establish a single headquarters-level unit with overall responsibility for the delivery of operations services. Many of these services are most appropriately provided at the district level.
2. Until senior management recognizes the interrelationship of the items included in this table (from the operations perspective), the institutionalization of operations will not have occurred. Neither the states surveyed nor the literature reviewed appeared to consider the management of operations in the totality represented by the table.
3. The district level of management is typically assigned significant responsibility for operations delivery. Success at this level requires comprehensive oversight, training and evaluation of district performance. With few exceptions, there is little evidence that this is occurring.

The relationship between the table and the institutionalization of operations is best demonstrated through a simple example. Figures 1a and 1b provide a comparison of an ad hoc approach to operations with that of a more holistic integrated approach. The figures have been developed for the routine task of scheduling a minor construction project taking operations into consideration. Figure 1a represents the most common approach to this activity. In this figure, construction activities are scheduled based on weather, availability of construction services, competing priorities and many other factors that are exclusively related to the construction process. By contrast, figure 1b demonstrates the integration of traffic operations including the use of simulation to estimate traffic delays during the construction process. Figure 1b also identifies the importance of an evaluation activity that permits modification of the preplanned construction activities, calibration of the simulation for future activities, and reporting to a management system that compares performance with predefined goals and objectives. While this simplistic example is rather obvious, it is used to illustrate the elements of a holistic approach that integrates operations into the construction planning and execution, and provides for a continuing evaluation of its effectiveness in comparison with objectives that should have been established by the statewide operations plan.

The approach defined by Figure 1b will not work by creating policies that are difficult to enforce that requires the cooperation of separate departments. The process will only succeed if:

- Operations objectives have been established for delays in construction zones

- State employees are provided with the incentives to meet these objectives
- Performance evaluation is included in all projects
- Adequate training is available to ensure that the correct tools are used and employees appreciate the importance of this activity.

Thus the institutionalization of operations will only occur with the full integration of all related management activities. Even in this simple example, success requires planning, inter-department coordination, evaluation and appropriate personnel policies. This process must be defined for every departmental activity involving operations, or the desired results will not be achieved. Many departmental activities will be more complex than the one provided in the example. These activities should also highlight the need for coordination with other agencies including local governments. Note that Figure 1b does not suggest that the delivery of operations be centrally managed. Instead it suggests that operations should be routinely coordinated with the relevant department functions. It also indicates that evaluation of all activities should be routinely performed to ensure that desired standards of performance are being met.

This example of the institutionalization of operations is provided as a benchmark against which the current state-of-the-practice is reviewed. The examples provided in the following sections represent the early stages of an evolving recognition of the importance of holistic management of operations. Obviously, there is much work yet to be performed. These sections are organized to correspond with the columns in Table 1 (planning, delivery and evaluation). A discussion of the cost cutting activities of funding and personnel policies is also provided.

PLANNING FOR OPERATIONS

All of the states contacted include operations as a fundamental element of their planning process. Approaches varied from listings of specific goals and objectives to fully supported and detailed discussions. Others covered it indirectly through discussions of broad issues of congestion and safety. Several considered customer satisfaction as part of the planning process through active solicitation of customer inputs. In some cases specific performance objectives are defined that will prove extremely useful for evaluating the plan's success. Two examples of plans that specifically addressed operations are summarized below. Both of these plans offer an operations orientation. Both provide quantitative objectives that can serve as the basis for the evaluation of agency performance. However, it is likely that further planning will be required to translate their objectives to a level of specificity that can be used to serve the needs of activities such as the one described by the example of Figure 1b.

2020 Florida Transportation Plan including the 2000 Short Range Component (1)

The Florida DOT has initiated an extensive planning process that includes the development of both long range and short-range transportation plans that includes goals

and objectives. The plan is used as “the policy framework that links these goals and objectives with the Department’s annual budget and 5-year work program.” This is a broad plan that covers the entire range of the DOTs responsibilities. It includes the following goals:

1. Safe transportation for residents, visitors and commerce – reduce accident and fatality rates, improve intermodal safety and improve emergency management. Obviously, there is a significant operations component to this goal that includes items such as work zone safety, refined data collection and improved data collection.
2. Protection of the public’s investment in transportation – Infrastructure maintenance
3. A statewide, interconnected transportation system that enhances Florida’s economic competitiveness – Complete the interstate system, a high speed rail system, and improve facilities and connections with other modes. Here again, operations is emphasized through strategies that specifically include the implementation of traffic operations improvements.
4. Travel choices to ensure mobility, sustain the quality of the environment, preserve community values and reduce energy consumption – Improve mass transit, support energy conservation and protect the environment.

This plan also includes quantitative objectives expressed at a high level. For example, one of the objectives under the goal of the statewide, interconnected transportation system is to “Maintain mobility trends on the Florida Interstate Highway System (FIHS) by keeping annual growth in traffic density at or below 4 percent.”

A Steering Committee made up of FDOT executives, citizens, representatives from other agencies and from local government was created to guide the development of this plan. The Steering Committee was supported by Advisory Committees on sustainability, mobility and economic development. In addition, public inputs were solicited through a major public outreach program that resulted in comments from more than 2,000 individuals. The results of this outreach program are clearly reflected in the contents of the plan.

Maryland CHART 2000 Business Plan (2)

CHART’s plan is a business plan rather than a strategic plan in that it associates specific actions with each of its goals. This plan emphasized operations, since it was focused on CHART, the statewide traffic management system. Its goals and objectives directly address operations issues. The plan establishes the following goals:

1. Traffic and Roadway Monitoring
2. Incident Management
3. Traveler Information
4. Traffic Management

5. Systems Integration and Communications

This plan associates a set of objectives with each of its goals. The objectives are then related to specific actions that will be taken in order to achieve them. The plan does not establish any quantitative criteria by which service to the motorist can be judged. Instead, it uses the implementation of specific capital improvements (such as the installation of closed circuit television cameras) as the criteria for success.

DELIVERY OF OPERATIONS

The key to successful operations is the implementation of the plans and policies on the highway system. Delivery is performed by multiple units of a transportation organization, and is frequently the responsibility of relatively low-level personnel. These personnel are rarely integrated into the overall operations process. They do not necessarily understand the relationship between their job responsibilities and the capacity, performance or safety of the highway system. Yet the greatest levels of innovation in operations can be found in the delivery category. In many cases, senior level management is unaware of their existence. These innovators rarely have the incentive or budgets to attend the national meetings at which information on operational innovations is exchanged.

An exhaustive discussion of innovative operational activities is beyond the scope of this report; some outstanding examples of these practices are presented to indicate the level of innovation that is occurring.

- Citizen calls regarding signal operations – All agencies responsible for the operations and maintenance of traffic signal systems, receive frequent calls from citizens. In several jurisdictions the state personnel responding to these calls, spend time with the caller explaining the details of the operation of the signal at the intersection in question. Following the dispatch of maintenance personnel to the intersection in question, the caller will be contacted to determine whether the reported problem has been corrected. The caller will then be asked to take responsibility for the intersection by reporting any future problems that may be observed including lamp failures, detector problems, unscheduled flash operation, etc. In this way, the caller is converted from a disgruntled citizen to an informed supporter. In addition to its public relations benefits, this approach provides supplemental assistance to the agency's staff.
- Regional Cooperation – The Metropolitan Washington Council of Governments sponsors a task force known as the M&O (Management and Operations)/ITS Technical Task Force. The objective of this task force is to coordinate the operations activities of the jurisdictions in the Washington, DC metropolitan area including Maryland, Virginia and the District of Columbia. The task force is currently sponsoring a region-wide training program that includes dozens of short-courses covering a broad spectrum of operations activities. It is also sponsoring and coordinating a number of projects such as

a region-wide e-commerce project, a wireless communications system interconnecting emergency services and transportation, and the development of a region-wide architecture that will provide inter-operability among the various ITS systems installed in the region. Future projects include the operational coordination of systems between jurisdictions. Perhaps most important, this task force provides a forum for the exchange of information including coordination of activities and best practices throughout the region.

- Working with the coroner's office – In most states, a fatal accident cannot be cleared until the coroner has arrived at the accident scene and performed a preliminary investigation of the death(s). In Maryland, it was determined that the time required for the arrival of the coroner typically adds 30 minutes to the accident clearance time, and in certain instances may add several hours. Discussions were initiated with the coroner's office and it was concluded that the delays were often caused by the inability of the coroner to travel through the traffic congestion caused by the accident. Steps taken to relieve this problem included the development of a preliminary investigation report to be completed by police at the accident scene to reduce the coroner's investigation time. In addition, police assistance may be provided to expedite the coroner's travel to the scene. While the policy is too new for a thorough evaluation, it is likely to have a significant impact on the time required for clearance of fatal accidents.
- Websites – The use of the Internet for the dissemination of traffic information is well known. However, the Internet is receiving increased attention as a tool for interacting with citizens. For example, several municipalities have currently implemented the capability for citizens to report signal problems using the Internet. One outstanding example is the City of Hampton, Virginia, which has developed a website for trouble reports that includes an extensive, well-written section of frequently asked questions. The page for trouble reports includes step-by-step instructions that begin with the following preamble:

Ask Yourself These Questions

- 1) What is the location?
- 2) Is it just one signal, or are there concerns about adjacent signals?
- 3) What day(s) of the week and/or time of day have you noticed the problem?
- 4) How long have you noticed the problem?
- 5) Describe any other conditions you may have noticed.
- 6) Customer's name and phone number so Traffic can call them back

This brief set of examples is provided to illustrate the benefits of providing the organizational incentives needed to integrate the front-line staff into the overall operations process. These incentives do not necessarily have to be financial, but can include training, seminars and participation in the planning and evaluation processes.

EVALUATION OF OPERATIONS

One anecdote related during an interview illustrates both the significance and deficiencies of available performance measures. When asked about the emphasis he placed on signal operations, an interviewee responded that he felt that this aspect of operations was extremely important. However, every time he questioned his staff about a location that appeared to be operating inefficiently, he couldn't understand their answer. As a result, he had stopped challenging them on the quality of their operation.

During the survey, similar problems arose. While all of the individuals interviewed described an organization that was operating effectively, it proved impossible to evaluate their responses in quantitative terms. For example, it was not possible to establish the effectiveness of the district engineers' management of operations, nor was it possible to determine the impact of various personnel policies on service delivery. However, several agencies have implemented programs for the measurement of operations effectiveness using either self-assessments (measurement of their own programs) or user surveys (measurement of highway users' degree of satisfaction with the services being provided).

Self-Assessment

Self-assessment refers to an agency's measurement of its own effectiveness. Self-assessment includes activities such as evaluation of the reduction in vehicle delays resulting from new signal timing, the evaluation of the reduction in incident clearance times, or the measurement of accident rates. This form of evaluation is frequently employed for monitoring operations effectiveness, although it is not generally applied to the entire range of operations activities as suggested by the example of Figure 1b.

Maryland State Highway Administration - Managing Mobility Council

The Maryland State Highway Administration's (SHA) Managing Mobility Council was established as one of several groups established within the SHA to define specific goals and objectives in eight critical areas, and to evaluate the degree to which they have been attained. Measures of success are identified for each of the goals. See Appendix B.

The objectives are extremely useful, in that they are quantified to permit direct evaluation of the degree to which they have been achieved. In this way, it is possible to evaluate the effectiveness of the operation, evaluate employee performance, and identify the need for additional resources. For example, under the goal identified as "Reduce the time it takes to restore normal traffic flow along state highways after incidents occurs", one of the objectives is to "Improve average response time to incidents by 5% by June, 2001". It is the manager's responsibility to identify the actions required to achieve that goal. These actions often include the important step of communicating the goal to all

members of the staff. Note that the objective defines both the percent improvement and the date by which it is to be achieved.

One very significant aspect of this approach is that it does not attempt to compare the SHA's operational performance with that of other agencies. Instead, it emphasizes improvement in performance over that of the past year. This approach eliminates the problem of identifying comparable agencies with similar measurement programs.

City of San Jose, Department of Streets and Traffic

The Department of Streets and Traffic (DST) of the City of San Jose provides another example of the application of operations measures to the evaluation of performance. (4) This document identifies four strategic goals and their associated key action measures. See Table 2. Here again, specific measures are identified by which the success of the program can be evaluated. See Appendix C.

The City of San Jose, like the SHA, makes no attempt to compare its performance with that of other jurisdictions. All measures are based on local priorities, and are designed for comparison of improvements made from year-to-year. It includes the following features:

- Goals are defined for each of the elements and measures listed, many of which are less than 100%. These goals recognize that attaining a 100% success rate for the elements may not be cost-effective in many cases.
- Customer satisfaction is included as a specific measure for each of the performance areas. The City is obviously very customer-oriented, and maintains this orientation throughout its planning and evaluation processes.
- Weights are provided for each of the measures to reflect their differing importance. The customer ratings receive the highest weights in each of the performance areas.

Through the definition of measures, goals and weights, the City is able to convey both to its staff and the public, that it is a customer driven organization. This perception is furthered through the publication of an annual report that informs its "customers" on the progress made during the past year. In some cases, degradations in performance are reported and explained based on increased demand on the affected facilities. The annual report to the public (analogous to stockholders in the private sector) provides some assurance of continuing public support for the Department's activities.

User Surveys

If one were to manage transportation operations in a manner similar to that of the private sector, significant emphasis would be placed on the priorities and perceptions of the organization's customers. Yet surprisingly few organizations perform regular controlled surveys of their customer's needs. The organizations that had performed surveys included the states of Florida and Arizona.

The state of Florida conducted a “Partner Outreach Program” in connection with the development of their 2020 Plan. The program included a poll of more than 2,000 residents taken at public workshops, exhibits at malls and transportation terminals, brainstorming and focus group meetings. The results of this poll are listed in the state’s strategic plan. The most important strategic actions included:

- A request for increased coordination between the state and local governments.
- A request for increased public involvement in transportation decisions; two actions that have a direct bearing on the manner in which operations is managed.

The Arizona DOT and the Florida Toll Road Commission have performed surveys of customer satisfaction. The Toll Road has a Patron Advisory Committee whose advice includes operations. The Arizona DOT has used an advertising firm to sponsor discussion groups related to their transportation requirements. The results of the discussion groups were described as “eye opening”.

Based on this limited sample and the successes that were reported, it is likely that significant benefits could be realized by state DOTs from regular surveys of their transportation customers.

CROSS CUTTING ISSUES

Funding

Funding issues varied greatly among the states interviewed. Although funding for operations is available part of the Federal Aid program, operations must compete with more visible capital programs. As a result, most agencies rely on state funding sources for their operations and maintenance activities. In almost all cases, some degree of legislative oversight accompanies the operations funding that ranges from micromanagement of personnel positions and equipment, to a general more programmatic approach that does not consider individual operations and maintenance activities. Samples of the actions taken to overcome the problems associated with detailed legislative oversight include:

- Outsourcing of operations functions to avoid personnel ceilings or to compensate for inadequate pay scales. This has been used by the states of Florida, Maryland and Virginia. For example, signal timing services are being outsourced in northern Virginia.
- Whenever possible, operations and maintenance activities have either been replaced by, or combined with capital improvements so that capital funding can be applied to these activities. One example is the inclusion of a period of “operational support” included in the acquisition of intelligent transportation systems.

- Developer fees are being charged for the cost of both operations costs and capital improvements.

Appropriately, secretaries and administrators spend a significant amount of their time with their legislators. For example, one of the individuals interviewed indicated that they spent 20% of their time “lobbying” legislators when the legislature is in session. Unfortunately, managers often find themselves in competition with other state agencies experiencing similar operations funding needs, and as a result, their effectiveness is limited.

Legislative involvement may also lead to operations and maintenance inefficiencies. This was illustrated through an example of pavement maintenance provided during one interview. Good maintenance policy would avoid pavement deterioration using thin overlays with crack and joint sealing. However, widespread use of this process diverts funding from the maintenance (and operations) budget. As a result, the state is forced to employ the relatively inefficient application of thick overlays, since this technique is considered a capital improvement. This brief example illustrates the problems associated with separation of capital budgets from operations and maintenance budgets.

There is a requirement, nationally for a stable and predictable source of operations funding. The absence of this funding source increases the importance of the planning process, which should include prioritization of activities and avoid establishing unrealistic operational objectives. Planning should be integrated with budgeting in a manner that is similar to that of the Florida DOT.

Personnel Management

Performance of operations managers should be evaluated with respect to their ability to satisfy pre-established objectives. The evaluation should reflect the relative priorities of the department as defined by these objectives. However, this process is handicapped by the absence of pre-established objectives as well as the inadequacies of existing evaluation processes. As a result, evaluations tend to focus on items that can be measured such as mowing and litter pickup. In some cases, operations effectiveness is evaluated in terms of related capital improvements such as installation of new closed circuit TV cameras.

Incentive and bonus programs were discussed during the interviews. One manager indicated reluctance to institute such a program based on prior experiences in which the program failed to produce the desired results. Two incentive programs were identified during the interviews. These included:

- An incentive plan for maintenance and construction personnel, based on the results of a quarterly poll of their co-workers.

- A cash award program for suggestions accepted by the agency, provided they are related to a subject that is outside of the employee's job responsibilities

Most of the agencies contacted are experiencing problems employing and retaining skilled staff. This is the result of a nationwide shortage of trained technical personnel, and the relatively low pay scales offered by public agencies. While outsourcing is a partial solution to this problem, there are limits to its effectiveness since supervisory personnel will still be needed to manage the contract under which the outsourced services are provided. This problem is likely to become more severe as senior agency members reach retirement age, and trained replacements become increasingly difficult to hire. It will be further aggravated as the demands placed on the agency increase due to increased traffic congestion and aging facilities.

Several states are attempting to relieve this problem through the use of tools and techniques that will increase employee productivity. Samples provided include increased use of automation for surveying and computer-aided design and engineering software. Potential for application of technology to further increase employee productivity exists.

Training is available from a number of sources including the Federal Highway Administration's National Highway Institute and its ITS Professional Capacity Building Program, professional societies, the state Local Technical Assistance Program (LTAP) Centers and courses offered by the private sector, universities and manufacturers. The Internet is rapidly becoming a source of training offered by the FHWA and some universities. Internet-based courses offer the advantage that they can be taken anywhere and anytime, saving the cost of travel and lost time on the job. Some departments are defining minimum training requirements for state personnel, to ensure that individuals at predefined levels of the organization have been instructed in the appropriate technologies, procedures and management skills for their job.

At least one state recognizes the benefits of providing training to local agency personnel, since this training offers the potential to relieve the burden on state personnel for continuing support and ensure effective regional cooperation. As a result, a scholarship program has been initiated in which safety funds are used to offset course tuition. This program allows local personnel to take courses that they might not otherwise attend due to the extremely limited training budgets of local agencies.

CHAPTER 3

INTERPRETATION AND CONCLUSIONS

The primary conclusion of this work is that institutionalized operations must include the following elements:

- Knowledge of customers (highway system users) expectations.
- A planning process that defines operational levels of performance (e.g. delay, incident response time, travel time predictability, congestion due to maintenance activities, etc.) in terms of customer expectations. The planning process must be adequately comprehensive to include all operations activities.
- Well-defined guidelines for coordination with other agencies (within the state, with neighboring states and with local agencies).
- A common understanding by all agency personnel throughout the organization of the operations performance objectives.
- Regular measurement of operations performance, and the existence of incentives in place to ensure that they are met.
- Training programs to ensure that all operations personnel are familiar with the latest technology and techniques and that they fully appreciate the impact of their activities on system performance, customer satisfaction and safety.

The following additional conclusions resulted from the scan of operations practices conducted for this project:

1. Operations activities are emphasized within most (but not all) state DOTs. In general, there is little need to convince these organizations of its importance. However, there is a need to increase the level of visibility and integration of operations activities within these organizations.
2. Resources are becoming an increasingly serious problem. Funding shortfalls, inability to hire skilled personnel, and legislative micromanagement are reducing the ability of organizations to provide effective operations programs.
3. While there are subtle differences among organizations in terms of the assignment of operations responsibilities, most state DOTs rely on their district engineers for delivery of effective operations.
4. Many innovative practices are occurring within the operations community. Unfortunately, these practices are rarely discussed outside of the organizations where they occur.
5. There is a significant need for measures that can be used to evaluate the quality of the operations services being provided. The absence of measures prevents effective management of operations staffs, precludes the ability to establish budget priorities, and inhibits effective communications with the public.

CHAPTER 4

SUGGESTED RESEARCH

The results of this project suggest the need for a number of high-priority projects in connection with operations. While elements of the work defined by this research have been addressed by previous work, the research defined in this chapter is focused on the development of measures that will improve the delivery of operations in an integrated manner:

1. Measures – There is a need for research into the measures for evaluation of traffic operations effectiveness. The public and legislators do not readily understand the traditional engineering measures. New measures such as travel reliability and customer satisfaction are emerging as higher concerns to the traveling public. While previous research has been conducted in this area, the proposed project is intended to be broad, focusing on the entire range of operations activities occurring within a state DOT. The results of this research should be a handbook that can serve as a tool to be used by planners and operations managers in order to establish objectives and evaluate their ongoing performance.
2. Public surveys – Several different instruments for conducting “customer satisfaction surveys” were identified during the interviews. These included discussion groups, advisory boards and survey forms. Research is needed that compares the effectiveness of alternative survey techniques, and to explore the potential of new techniques such as internet-based surveys. This research should include the development of sample survey tools that can be used by DOTs to conduct customer surveys within their states.
3. Automation for staff productivity – Research is required to advance the state-of-the-art in areas that will improve staff productivity in order to relieve staff shortages. This research might include items such automation for traffic management centers for improved operator productivity.
4. Establishment of training programs for district engineers – The effectiveness of operations delivery is relies on the capabilities and interests of the district engineers. Training programs for increased awareness of the importance of operations, and the availability of tools for operations delivery, evaluation and public interaction would enhance the effectiveness of this front-line activity. The result of this research would be course curricula that can be used to establish minimum training levels for district engineers. To the extent possible, these curricula should make use of existing training programs.

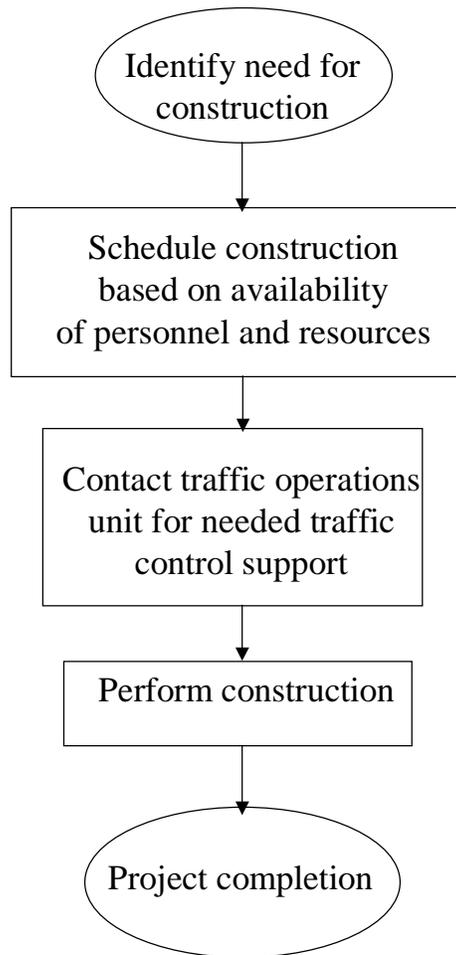


Figure 1a. Ad-hoc Approach to the Management of Maintenance Activities

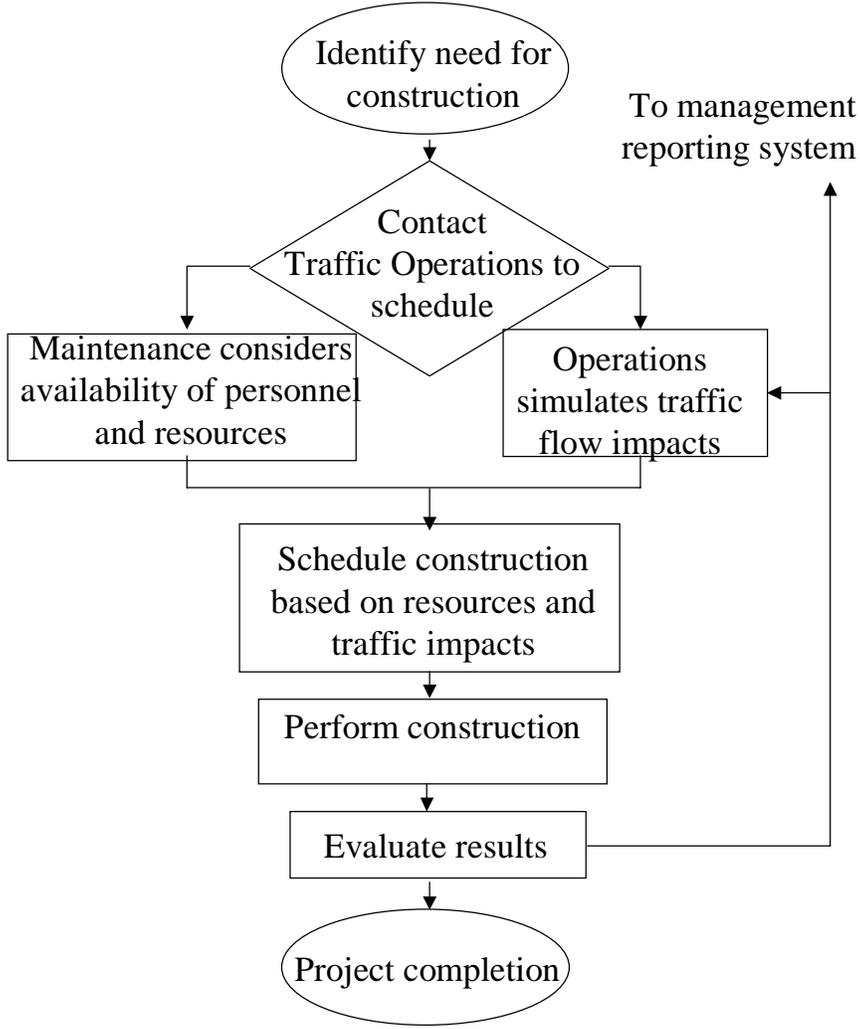


Figure 1b. Integrated Approach to the Management of Maintenance Activities

TABLE 1. Organizing for the Institutionalization of Operations

Organizational Level	Planning	Delivery	Evaluation
Headquarters	<ul style="list-style-type: none"> • Long and near term plans • Personnel policies • Training plans • Major event planning • Inter-state agreements • Inter-agency agreements • Partnership policies 	<ul style="list-style-type: none"> • Oversight of operations delivery • Coordinating major incident response • Specialized technical support 	<ul style="list-style-type: none"> • User satisfaction surveys • Evaluation of district effectiveness • Comparison of performance with goals and objectives of plans
May be either headquarters or district function depending on state size and organization	<ul style="list-style-type: none"> • Major event planning 	<ul style="list-style-type: none"> • Signal timing • Snow removal • Maintenance • Traveler information • Delivery of training 	<ul style="list-style-type: none"> • Performance monitoring
District	<ul style="list-style-type: none"> • Operating agreements with local jurisdictions 	<ul style="list-style-type: none"> • Work zones • Incident management • Service patrols • District personnel management 	<ul style="list-style-type: none"> • Developing performance criteria • Contacts with citizens

TABLE 2. DST Strategic Goals and Key Action Measures

Strategic Goals	Key Action Measures
Exceed the expectations of our customers	1. We measure performance
Make continuous improvement an intrinsic part of our culture	2. We measure our understanding of our customers 3. We measure our managers effectiveness as leaders of continuous improvement 4. We measure the creation of new high performing teams 5. We measure our perception of our culture
Create a highly skilled workforce	6. We measure our personal capacity
Support the well-being and development of everyone in the department	7. We measure our perception of our well-being 8. We measure data-based indicators of well-being

APPENDIX A. Interview Questionnaire

QUESTIONNAIRE TRB OPERATIONS SCAN For State CEOs

January 22, 2001

Interview conducted with: _____

Title: _____

Phone Number: _____

E-mail: _____

Date: _____

Provide background of the NCHRP project

Initiate general discussion of operations

Questions:

- 1) What would you estimate as the percentage of your time that you spend on all aspects of operations? This would include planning, organizational issues and dealing with emergency situations.
- 2) Would you consider operations to be one of the five highest priority activities of your organization?
- 3) Describe the assignment of operations responsibilities within your organization. Is it focused within a single unit? Is it assigned to multiple units? Do maintenance units share operational responsibilities?
- 4) Do you have a strategic planning process? If so, are operations included in the process? Does it include the establishment of operational goals?
- 5) Are you involved in a high-level review process that includes the review and establishment of priorities for operations activities? This would include routine activities such as signal timing, relamping, signing and striping are performed according to an agreed upon schedule.

- 6) Are operations activities funded as a separate, identifiable element of your budget? Alternatively, are they included with maintenance activities?
- 7) Is there political oversight of your operational budgeting? If so, what impact does this have on your ability to conduct an effective operations program?
- 8) Are you politically proactive in establishing and defending your operations budget? If so, what techniques have you found to be effective?
- 9) Do you accept calls from citizens and businesses related to operations issues? If so, do you follow up on these calls to inform caller on the disposition of their suggestion, complaint or request?
- 10) During your travels around your jurisdiction, do you observe operational problems (anything from poor signal timing to bulb failures) and report them to your staff?
- 11) Do you monitor and/or participate in response to major incidents?
- 12) Do you evaluate the performance of your operations unit(s)? Is performance evaluated with respect to pre-established objectives?
- 13) Do you survey your customers (motorists, commercial delivery services, trucking companies, taxi companies, etc.) to determine whether they are satisfied with the services provided?
- 14) Are you experiencing difficulties in the hiring and retention of operations staff?
- 15) Do you establish incentives, training, meetings, etc. for your operations staff?
- 16) Do you have any innovative practices related to operations that you would like to report?

APPENDIX B. Maryland State Highway Administration, Managing Mobility Council – Annual Plan

Goal: Reduce the time it takes to restore normal traffic flow along state highways after incidents occur.

- Establish a methodology and baseline for measurement of incident duration time by June, 2000
- Improve average response time to incidents by 5% by June, 2001
- Improve average clearing time of incidents by 5% by June, 2001

Measures of Success

- Complete baseline data collection by end of June 2001.
- % Reduction in average response time.
- % Reduction in average clearing time.

Goal: Provide timely and reliable mobility information to the traveling public.

- Install additional CHART/ITS devices by FY 2003.
- Integrate and coordinate regional traffic operations centers by FY 2002.
- Provide more real-time information on the Web by FY 2002.
- Provide more real-time information to the media by FY 2002.

Measures of Success

- # Cumulative CHART/ITS devices installed.
- # of Regional TOCs integrated with CHART
- % Increase in Web-site hits.
- % of Cameras that are media accessible.

Goal: Enhance mobility through improved inter-modal coordination and connections.

- Advertise 90% of final CTP projects that are intended to enhance inter-modal connections.

- Establish an inter-modal travel information Web site by June 2002.

Measures of Success

- % of FY 2001 projects that are intended to enhance inter-modal connections advertised
- # of users of State Highway Administration Park and Ride lots
- % of centerline miles along urban State Roads within 1 mile of a transit station that have sidewalks.
- Complete Web-site linkage by June 2002

Goal: Reduce recurring congestion at priority locations.

- Implement an annual program to identify locations experiencing recurring congestion by April 2000.
- Advertise 90% of each FY programmed projects that are intended to address recurring congestion, at selected locations.
- Achieve traffic improvements perceptible (Volume Capacity Ratio of .10% improvement or better) to the traveling public at 90% of project locations within one year of completion.

Measures of Success

- % of FY2001 projects intended to reduce recurring congestion advertised within the fiscal year
- % of intersection capacity projects where the Volume Capacity Ratio has improved .10% or better

APPENDIX C. San Jose Department of Streets and Traffic Performance Objectives

Element	Measure	Goal (%)	Weight (%)
Part 1: Operational Service Performance			
Condition	% of arterial corridors operating at optimal condition	90.0	15
Timeliness	% of traffic flow issues resolved within established guidelines	90.0	35
Customer	% of customer service ratings of 4.0 or better	90.0	35
Cost	% budget/cost ratio	100.0	15
Part 2: Install Traffic Improvements			
Condition	% of transportation system with appropriate traffic controls	95.0	15
Timeliness	% of traffic improvements investigated and installed within guidelines	90.0	50
Customer	% of customer service ratings of 4.0 or better	90.0	25
Cost	% budget/cost ratio	100.0	10
Part 3: Promote Traffic Safety			
Condition	% of safety studies/education programs performed at optimal levels	90.0	20
Timeliness	% of safety activities performed within estimated guidelines	90.0	35
Customer	% of customer service ratings of 4.0 or better	75.0	30

Element	Measure	Goal (%)	Weight (%)
Cost	% of budget/cost ratio	100.0	15
Part 4: Maintain Traffic Devices			
Condition	% of devices meeting visibility & operational guidelines	90.0	35
Timeliness	% of devices repaired within guidelines	90.0	35
Customer	% of customer service ratings of 4.0 or better	90.0	20
Cost	% of budget/cost ratio	100.0	10
Part 5: Maintain Street Lights			
Condition	% of street lights operational	98.0	22
Timeliness	% of devices repaired within guidelines	90.0	39
Customer	% of customer service ratings of 4.0 or better	90.0	24
Cost	% of budget/cost ratio	100.0	15

APPENDIX D. References

1. State Highway Administration, Maryland department of Transportation, “CHART 2000 Business Plan,” (Jan. 2001) 44 pp.
2. Florida Department of Transportation, “2020 Florida Transportation Plan,” (Feb. 2000) 41 pp.
3. City of San Jose, Department of Streets and Traffic, “The DST Way, “ (June 1999) 13 pp.