

Transportation Infrastructure Services in the 21st Century

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For the past 50 years, surface transportation infrastructure development has been characterized by a stable and well-defined institutional framework. Programs, organizations, and financial arrangements evolved to support the mission of constructing and preserving a basic network of major public facilities—highways, ports, airports, and mass transit. As we move into the 21st century, however, a new focus—the provision of high-quality customer-responsive services—challenges the effectiveness of this inherited framework.

Dramatic new developments, both external and internal, challenge state, local, and regional transportation agencies today. Travel and transport needs are growing and changing, and with them the mix of services and improvements that must be delivered to improve transportation quality and efficiency. At the same time, funding constraints and agency downsizing limit the ability of transportation institutions to capitalize on new technology and innovative approaches in response to these changes.

The Intermodal Surface Transportation Efficiency Act of 1991 recognized these important trends in the surface transportation sector with its emphasis on flexibility, management, and performance. Since 1991, several state departments of transportation and other regional and local agencies have experimented with new program development concepts and organizational changes. Yet to date there is no clear consensus on the appropriate institutional and financial response to these challenges on the part of infrastructure owners at the state and local levels. Indeed, a striking feature of the current debate over federal-aid surface trans-

portation legislation (NEXTEA) is the nearly exclusive focus on federal funding, eclipsing any critical discussion of how transportation entities—state, regional, and local—can best respond to emerging needs, opportunities, and constraints.

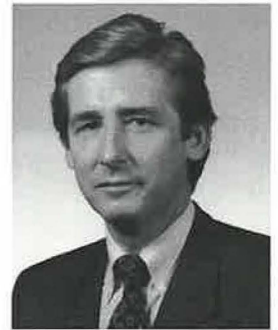
Given the stakes for productivity and competitiveness, there is clearly a need for increased emphasis on systems performance and service quality, with consideration of needed adjustments in agency missions, programs, service delivery, financing, and roles. Setting the appropriate direction for transportation institutional policy into the 21st century is a critical challenge facing infrastructure owners, the surface transportation industry, and transportation professionals.

FORCES FOR CHANGE

A number of forces, both external and internal, are driving fundamental changes in the institutional framework for transportation infrastructure services.

External Driving Forces: Service Challenges

The service needs of today's transportation user are increasingly diverse, intermodal, and performance oriented, especially in expanding urban areas. In our knowledge-based society, users place a high premium on just-in-time efficiency, convenience, and responsiveness. Yet the services offered by the transportation infrastructure in larger metropolitan areas are characterized by chronic peak-period congestion and unpredictable delay-inducing incidents. Growth in travel has simply exhausted the available capacity of urban systems, while suburban and exurban expansion has placed new burdens



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on modest suburban and exurban networks. Two-thirds of metropolitan peak-hour travel now takes place under congested conditions. And the delay caused by accidents and breakdowns actually exceeds that of peak periods.

Even in smaller urban and rural areas, transportation service is characterized by significant intermodal gaps; a lack of information regarding mode, routing, and system status; and an absence of travel choices—at any price. Extensive maintenance schedules and lengthy new-construction

response, navigation, and yellow-page services, that travelers are coming to expect. These new service objectives require the application of advanced traffic and transit operations, the organization of incident response teams, support for personal traveler information dissemination, the automation of payment systems and safety regulations, and a range of other new activities, many of which are facilitated by emerging intelligent transportation systems technology.

Overall, maintaining and improving transportation service will depend on intensive real-time operations and management of existing facilities as an integrated system on an intermodal basis at a region-wide scale. This new mission cannot easily be accommodated within the existing institutional framework.

Internal Driving Forces: Resource Constraints and Governmental Reinvention

The context for the provision of transportation infrastructure services is influenced not only by changing travel demands, but also by forces affecting the public sector overall, including transportation agencies. Surveys indicate a generalized reduced public confidence in government. Authorities at all levels—state, local, and regional—are being “rightsized” in an economy now looking to private enterprise as a model of efficiency and market responsiveness. Balanced budgets are constrained by tax revolts. Staffs are being reduced. Federal-aid dollars are no longer as dominant or dependable. State programs have been squeezed by a combination of the four “D’s”: deficits, downsizing, and deregulation are reducing their resources, while federal devolution is burdening them with increased responsibilities. Local governments are experiencing similar stresses.

These constrained resources are further burdened by the costs and management requirements of maintaining an aging infrastructure and higher standards of environmental mitigation. Thus the need to respond to new demands for service adds to an already difficult set of inherited institutional challenges.

NEW INSTITUTIONAL ARCHITECTURE

A higher priority on service provision in the face of competing demands for limited resources implies the need to undertake a fundamental reconsideration of both the institutional and financial arrangements best able to support the new priorities. It is also likely to introduce functional requirements

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periods contribute additional disruption and postpone needed improvements. Across all modes, deteriorated service levels undercut productivity and convenience.

Some relief can be expected from such conventional capacity-oriented improvements as widening and extending facilities, filling gaps, improving interchanges, and providing key intermodal connections. Yet conventional facility construction alone will not preserve service levels at today’s high volumes or cope with the peaks, imbalances, and disruptions that increasingly characterize metropolitan travel. Moreover, the opportunities for major system expansion and additions are finite: a combination of community values, environmental constraints, and fiscal limitations places significant bounds on traditional construction solutions.

Furthermore, the expectations of increasingly diverse users cannot be accommodated through piecemeal additions in the absence of active system operations. Driven by just-in-time lifestyles and encouraged by their experiences as customers in other service sectors, travelers increasingly expect the transportation system to offer greater responsiveness beyond “passive” basic capacity, including reliable and predictable service levels, provision of information about system conditions, and availability of premium options for a price. Nor will traditional facilities provision support improved intermodal interchanging and the wider range of service attributes, such as accident

that imply a substantial reorientation in current agency organization, programs, and institutional relationships. This reorientation is needed because during the last 50 years, public-sector transportation infrastructure institutions—federal, state, and local—have converged on a single institutional model oriented principally to the construction and preservation of major transportation facilities. Key characteristics of this model include the following:

- A public-agency monopoly on the delivery of infrastructure, with federally driven standardized solutions focused on major capital investments
- Tax-dependent funding, subject to political determination and a step-wise, pay-as-you-go project delivery system
- Institutional fragmentation, both vertical and horizontal, within state and local government, combined with an arm's length relationship with private service and technology providers
- Bureaucratic organization with limited customer responsiveness and limited incentives for performance

Key features of conventional roles, relationships, programs, resources, and activities that currently characterize the surface transportation sector may not be well suited to the efficient provision of the operational and intermodal management orientation needed to meet today's transportation challenges. For example, funding constraints have now reduced the reliability of tax funds, operations and management introduces special resource demands, pay-as-you-go financing causes delays in needed improvements, systems-oriented solutions are hampered by jurisdictional boundaries, and new technology requires closer collaboration with the private sector. Indeed the existing institutional characteristics, suited to an era dominated by capital construction of national networks such as the Interstate system, may now be part of the problem, not the solution.

Precedents from Other Public Utilities

The external and internal pressures faced by the surface transportation sector are not without precedent in other public infrastructure sectors. Regulated monopoly public utilities and facilities, such as power and telecommunications, airports and ports, and to a lesser degree water and waste management, are facing many of the same challenges associated with such forces as reduced public subsidies, deregulation, new service demands, and changing technology. Most important, they are responding to customer demands for a range of new, improved services.

The increased use of such terms as “telecommunications deregulation,” “retail wheeling” in power, “managed competition” in water supply, and airport “privatization” reflect the efforts of each sector to respond to these challenges with some reconfiguration of both services and service-provision institutions, consistent with each sector's unique physical infrastructure characteristics, its policy history, and especially the opportunity for commercialization through financing based on user fees. Despite important physical differences, the general trend is toward an approximation of a business enterprise model with such characteristics as priced services, market feedback, competition, and private-style management. At one end of the spectrum are tax-supported, bureaucratically administered facility systems with limited market contact and modest incentives for efficiency; at the other end are self-supporting, priced, customer-responsive competitive entities—true “enterprises.”

Among the networked services, the furthest along in the evolution to a business enterprise model are power and telecommunications, which exhibit continuing service innovations and growing investment. They are increasingly deregulated, multiregional, enterprise organizations that are investor owned and financed by user fees, and use prices to respond to market demands and competition. The competition and innovation in telecommunications following the breakup of the national monopoly and deregulation are well known. The changes within the power sector may be more relevant, however. Deregulation has led to both service and institutional reconfiguration—despite the constraints of major fixed infrastructure—including restructuring into separate generation and distribution entities, the introduction of power supply competitors using common transmission facilities across traditional franchise lines, and the advent of priced competitive choices of vendor at the retail level.

These sectors offer some useful examples in considering the future evolution of surface transportation institutions.

Surface Transportation Pioneers

Outside the United States, national transportation facility systems—highway, airport, and port—are also increasingly being developed along enterprise lines, delivering improved service at reduced cost through both commercialization and outsourcing of systems and services. A few countries, such as New Zealand, Australia, the United Kingdom, and Sweden, are undertaking or considering major devolution and privatization efforts at the sector level.

Even within the U.S. surface transportation sector, there are signs of a move toward new institutional models as some bellwether state and local transportation institutions undertake to modify both service orientation and related institutional arrangements. Despite the absence of market forces, such factors as financial shortfalls, constituency pressures for improved service, staffing constraints, and new technology are leading some transportation institutions in new directions. Some of the more visible evidence includes the following:

- New institutions such as TransStar in Houston, a compact among state and local agencies to provide a consolidated traffic management and bus/HOV system on Houston's freeways
- The use of performance measures, associated with efforts to reengineer organization and administration in states such as Minnesota and Oregon in order to achieve improved efficiency and customer responsiveness
- Commercialization of services through the creation of new toll entities, such as the Orange County Toll Agency, to construct and operate a new generation of highways, and the privatization of concessions at airports such as Pittsburgh
- Public-public consortia formed to support collaboration in coordinating the application of new operations or regulation technology, such as the I-95 Corridor Coalition and the HELP commercial vehicle consortium
- Improved project development processes, as represented by the increased use of turnkey development projects, such as the federally supported I-15 design-build contract in Salt Lake City, and the outsourcing of Interstate maintenance and operations in Virginia

AGENDA FOR SURFACE TRANSPORTATION INSTITUTIONAL REFORM: NINE VECTORS OF CHANGE

The direction in which both the transportation and other public-service sectors are headed to achieve service improvement (within given resource constraints) is strongly associated with certain common features of institutional change. These features include (1) a priority on service provision, (2) performance monitoring to track and provide incentives for improvement, (3) a strong orientation to systems management, (4) a streamlining of the conventions of project delivery to improve agency efficiency, (5) organizational structure and management modeled on private enterprise, (6) new

sources of revenue and commercialization of services to augment scarce conventional funds, (7) a reduction in jurisdictional fragmentation, (8) increased roles for the private sector, and (9) the emergence of strong leadership and cross-institutional negotiation. If "progress" is equated with improved service, increased efficiency, and reduced public costs, these nine features provide a useful framework within which to identify and track the principal vectors of needed institutional change throughout the surface transportation sector. Together, these vectors of change describe a high-level institutional architecture for 21st-century transportation infrastructure services that capitalizes on the most progressive public utility service experience to date.

1. Customer Service Mission Focus

Mission definition is necessarily related closely to the substantive programs of transportation agencies—what they do to meet customer needs. Surface transportation lacks the discipline of prices or the example of competitors to guide its understanding of user needs within both passenger and freight transport. Nor have state economic development programs offered significant long-term guidance, except for isolated facility needs, while statewide land use planning has nearly disappeared.

Several state and local government transportation agencies are undertaking a systematic review of agency activities and organization from a mission-based perspective, using feedback from both industry and traveler surveys. States ranging from Texas to Delaware have undertaken statewide transportation plans. Yet the principal focus has been on facilities, not service, and typical mission statements accommodate a broad range of competing priorities.

Reorganization around a service framework appears to require the development of mechanisms for establishing a credible dialogue with stakeholders, such as freight shippers and carriers. This closer contact seems to be heightening awareness of a broader set of customer-oriented service attributes beyond traditional levels of service and safety. These attributes include features more closely related to the contemporary logistical needs of both private and commercial transportation, such as reliability and advanced delay warnings and the private automobile traveler's interest in security. Such a dialogue must overcome the historically constrained relationship between state departments of transportation and their commercial vehicle customers.

Responding to a new set of service needs may require an explicit reordering of the overall functions, organization, and resources of infrastructure owner agencies to place priority on support for cus-

tomers/user transportation and mobility needs as the principal “output” of agency activities.

2. Performance Measurement and Accountability

Performance measurement has long been an accepted part of infrastructure management programs, its value deriving from an ability to track the life-cycle relationship between investment and functionality. There has recently been an increasing shift in the emphasis of performance evaluation within state and local transportation agencies from physical conditions to operations, including measures of productivity (Pennsylvania) and partnering (Arizona), as part of internal strategic management reviews. At the other extreme, “global” measures of external transportation trends have also been reported, as in Oregon’s well-known Benchmark series.

Popular and political scrutiny has now generated an increased need for external accountability, thus shifting the focus beyond improved inputs and intermediate outputs to actual customer-service-related outcomes. This new focus introduces the measurement challenge of relating specific agency actions to actual system service impacts. In its regular performance audits, Minnesota interprets optimization of the transportation investment according to systems performance (user cost, time, safety), public values (economic development, environmental protection, security, access), and organizational performance (productivity, privatization, progress).

The identification of appropriate performance measures for priority programming and for evaluation of the effectiveness of investment and operations strategy represents the current frontier for both capital programming and the “tuning” of facility operations in real time. There is a need for a new generation of planning and evaluation tools capable of addressing incident delays, life-cycle costs, and systems interaction issues. The advent of ITS technology applications is facilitating the development of a new generation of performance measures for real-time performance management and an expanded range of service monitoring.

A focus on measurement is naturally leading to an emphasis on accountability. While the tradition of the federal-aid highway program has long discouraged explicit comparisons, the increased emphasis on performance has introduced benchmarking—comparisons among similar entities—as a means of encouraging performance improvement among several state, regional, and local transportation entities. A number of states (Oregon, Idaho, Florida, Minnesota), regions, and associations currently publish their own comparison series, and the University of North Carolina annu-

ally ranks state DOTs by their relative efficiency using statistics published by the Federal Highway Administration.

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3. Systems Operations and Management Priority

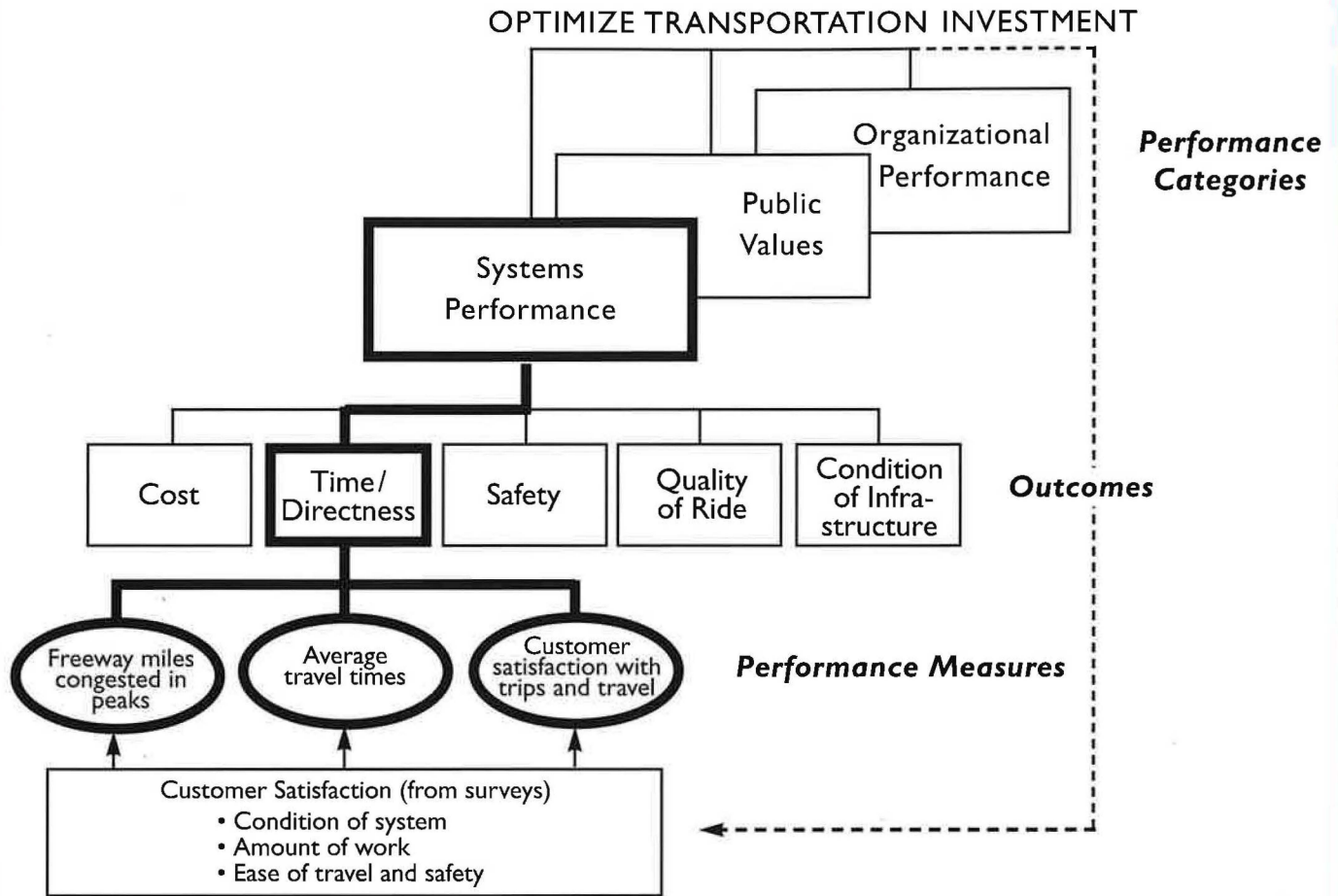
Increased priority of system management appears to be the inevitable result of a growing focus on customer service and system performance. Such an emphasis requires institutionalizing real-time network operations, intermodal coordination, demand management, and intelligent systems service innovations.

While these approaches can improve service at a modest cost, with low impacts and high returns within short time horizons, they require significant institutional adjustment, including organizational and staff changes and a set of new relationships among system owners and other responsible (and interested) parties. A fundamentally new regional systems perspective must be adopted to capture the benefits of most operational strategies. Also required is a new type of planning focused on evolutionary, performance-based increments—many resulting from improvements in operational regime instead of additional capital facilities.

The ongoing ITS Model Deployment Initiatives supported by FHWA indicate the range of institutional challenges to be met in metropolitan areas as varied as Phoenix and Manhattan. These challenges include the following:

- Coordination across jurisdictions within the public sector, both vertical and horizontal, including responsible nonowners such as law enforcement and emergency service providers
- Provision of adequate staff and operating funds, and outsourcing to acquire needed technical capability in light of staffing and financial resource constraints
- Partnerships with private providers and a focus on market-related measures, including user-responsive priced service options to generate revenue

Minnesota Department of Transportation Performance Measures



MnDOT's organization-wide "family of measures" exemplifies the new generation of performance monitoring and reporting being developed to better optimize transportation investments. The department-level development of performance measures began in late 1993 in response to an Agency Performance Report requirement of the legislature as part of the budgeting process.

MnDOT's performance measurement effort is tied into the strategic planning process through public goals and customer needs reflected in three major categories: systems performance, public values, and organizational performance. A set of associated performance measures has been identified that represents a mix of input, process, output, and outcomes used to evaluate the effectiveness of strategic actions. In addition, customer satisfaction is to be measured through market surveys as a check on the value of the performance measures.

As an example, systems performance is reflected in five outcomes: cost, time/directness, safety, quality of ride, and condition of infrastructure. Time/directness, for example, is focused on maintaining a predictable time travel for the length of a trip so that customer expectations are met. Each of these outcomes in turn is reflected by several performance measures. Time/directness is measured by freeway miles congested in peaks, average travel times, and customer satisfaction with trips and travel. In addition to direct performance monitoring of time/directness, surveys will be used to determine customer perceptions of system conditions, safety, improvement activities, and ease of travel through construction work zones.

Outcomes and related measures have been developed for each of the three major performance categories. The process is now being extended to the division and office levels, where related hierarchical families of measures are being generated.

Modification of user demand through variable pricing represents the “full market” end of the operations and management spectrum. The first applications of variable road pricing by time of day and occupancy are appearing, led by the SR 91 high occupancy vehicle/toll lanes (HOT lanes) in Orange County, California. Technology now on the horizon, such as “smart” credit cards, is expected to encourage broader applications of pricing to moderate congestion, even where tolls are not present.

It will be important to identify new tools, concepts, and processes needed to structure a coordinated multijurisdictional process focused on continuous system operational adjustments to provide incremental service improvements. This effort may require the identification of “good practice,” and can benefit from organized interchange among agencies with similar levels of commitment.

4. Streamlined Project Delivery

Managing the timing and cost of implementation is of increased importance in resource-constrained settings where improvements need to be effected in step with planned development or where revenue streams must be accelerated. Critical to such objectives is an efficient improvement-delivery system based on streamlined program development to achieve improved schedule and cost assurances, and removal of procurement barriers to accessing the best available technology.

The traditional stepwise, low-bid, public specification style of procurement and contracting does not respond well to increased pressures for cost and schedule certainty, especially in an environment of constrained agency staff resources and management capacity. The need to respond to these pressures is therefore leading to increased federal and state attention to nontraditional project development arrangements, such as consolidated design/construction (turnkey) procurements, fast tracking, broadened use of contractor incentives and disincentives, and utilization of private program management expertise.

New technology introduces its own challenges within the procurement process, such as the need to accommodate proprietary systems while preserving interoperability. Removal of these barriers requires development and adoption of industry standards, as well as clarification of intellectual property rights within the contracting framework.

Major bellwether projects, both conventional and high tech, reflect large commitments to innovative project delivery. There are more than 100 highway turnkey projects in various stages of development nationwide. Other examples include the

“super turnkey” development of the Hudson-Bergen transit improvement project, which includes operations and management responsibilities, and the private franchise for electronic toll collection systems for Orange County toll roads, which includes financing as well as implementation. Because of their scale, these projects are being closely watched as potential models for more widespread emulation.

5. Enterprise-Style Management

In attempting to increase capacity for specific service mission-related performance, some agencies have recognized the importance of restructuring their basic organization and staffing. Formalized strategic business planning, adapted from private-sector practice, is being widely applied within various components of transportation institutions. These planning efforts range from the Government Performance and Results Act at the federal level to the “business process” and “strategic information systems” studies that are almost routine at progressive state and regional transportation agencies.

At one level, public agency administrators are analyzing their own operations for efficiency and service quality gains through performance monitoring, new information systems, process reengineering studies, and benchmarking. Organizational development and staff training also appear to be important features of this vector. The outcomes include systems that measure status and change in order to track the efficiency of organizational units and system performance, adoption of private-enterprise-style employment (including incentives for achievement), and the elevation of operational managers to senior positions.

The search for increased institutional efficiency is also powering the development of new hybrid institutions that combine the features of public agencies and private enterprises. Mirroring their private-sector counterparts, state and local transportation agencies, faced with downsizing and restaffing, are increasingly outsourcing to private entities both new functions and responsibilities previously performed in house. When outsourcing involves significant staff impacts, “managed competitions” that allow agency staff to organize as entities and compete against private contractors offer a means of assessing relative productivity. A variety of other approaches are apparent, with examples ranging from traditional functions, such as Virginia DOT contracts for maintenance, to the outsourcing of ITS operations, such as the New York State DOT Traffic INFORM Operations Center on Long Island.

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