

NCHRP

SYNTHESIS 289

**NATIONAL
COOPERATIVE
HIGHWAY
RESEARCH
PROGRAM**

Corridor Management

A Synthesis of Highway Practice

TRANSPORTATION RESEARCH BOARD

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Corridor Management

A Synthesis of Highway Practice

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Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

*By Staff
Transportation
Research Board*

This synthesis report will be of interest to department of transportation administrators and transportation planning, right-of-way, economic development, and environmental planning staffs, as well as to the consultants that work with them. It would also appeal to regional and local government officials and staff, as well as to the private sector. It summarizes information about corridor management policies and programs at the federal, state, and local levels. An effort was made to select a diversity of methods and programs for the broadest treatment of the subject. The synthesis focuses more on roadway corridors than on transit or greenway corridors, but much of the information provided is relevant to any corridor management effort. This report examines state policies and programs, techniques applied, and coordination issues. A series of case studies provides more detailed study.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board documents successful partnerships. It presents examples of transportation agencies working together, proactively, with local governments and other stakeholders to achieve more cost effective and comprehensive solutions to transportation problems.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the available information was assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the author's research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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CONTENTS

- 1 SUMMARY

- 5 CHAPTER ONE INTRODUCTION
 - Overview, 5
 - Objectives, 5
 - Methodology, 6
 - Definitions, 6
 - Benefits of Corridor Management, 7

- 9 CHAPTER TWO CORRIDOR MANAGEMENT POLICIES AND PRACTICES
 - Federal Role, 9
 - State and Provincial Policies and Practices, 10
 - Regional and Local Practices, 14
 - Smart Growth and Sustainable Initiatives, 16
 - Summary, 17

- 18 CHAPTER THREE CORRIDOR MANAGEMENT PLANNING
 - Review of Corridor Management Plans, 18
 - Plan Structure and Contents, 18
 - Monitoring, 23

- 24 CHAPTER FOUR CORRIDOR MANAGEMENT TOOLS AND TECHNIQUES
 - Access Management, 24
 - Right-of-Way Preservation, 27
 - Land Development Regulations, 28
 - Scenic Management, 29
 - Community Design, 31
 - Street Network and Connectivity, 32
 - ITS and Operational Strategies, 33
 - Transportation Demand Management (TDM), 34
 - Traffic Calming, 35
 - Coordination and Public Involvement, 35
 - Funding, 36

- 40 CHAPTER FIVE CASES STUDIES
 - Scenic Corridor Management in Connecticut, 40
 - Woodward Avenue Corridor Study, 41
 - Corridor Access Management in the Bluegrass, 45
 - A Vision for U.S. Highway 1, 46
 - Interstate-5 ITS Corridor Management Plan, 48

51	CHAPTER SIX	CONCLUSIONS
53	REFERENCES	
55	APPENDIX A	SURVEY OF STATE TRANSPORTATION AGENCIES
58	APPENDIX B	LIST OF SURVEY RESPONDENTS

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Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 Committee and the Synthesis staff.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

CORRIDOR MANAGEMENT

SUMMARY

Transportation agencies are facing a fundamental challenge—meeting the growing demand for transportation service in a revenue-constrained environment. There is also growing recognition that new capacity alone will not solve transportation problems. Right-of-way constraints, unacceptable community impacts, and financial limitations all affect what agencies are able to provide and maintain in terms of roadway capacity. As a result, a growing number of transportation agencies are looking beyond capacity improvements in their efforts to improve the way they manage transportation corridors.

Contributing to the need for corridor management is the historic disconnect between land-use and transportation decision making. The separation of jurisdiction over transportation and land use continues to create numerous problems in the planning and development of transportation corridors. Examples include local zoning and subdivision practices that cause access problems on major roadways or roadway improvement projects that conflict with community redevelopment plans. Such conflicts in transportation and development planning could be better addressed or avoided by integrating roadway and land management practices through corridor management plans and programs.

The practice of corridor management can generally be defined as the application of multiple strategies to achieve specific land development and transportation objectives along a transportation corridor. A corridor is a transportation pathway that provides for the flow of people or goods within and between activity centers, and that includes one or more primary transportation facility and the abutting land uses and supporting street network. Corridor management strategies fall into five general categories:

- Coordination—improving linkages between the various agencies and institutions that have a role in advancing corridor management objectives.
- Transportation—planning, design, operations, capital improvements, and regulatory techniques for preserving or improving the function and performance of transportation systems.
- Land use—planning, design, and regulatory techniques for managing land-use and development outcomes.
- Public involvement—outreach, communication, and involvement strategies for improving public participation in corridor management decisions.
- Funding—identifying a variety of funding sources or resource contributions, both public and private, and institutional arrangements for carrying out needed studies and improvements.

Corridor management planning combines capital improvements and management strategies into a unified plan of action for a transportation corridor. Transportation corridors are designated for management because of their strategic role and function in the broader transportation system. An understanding of this function, and the level of priority that will be given to through traffic versus other important needs, provides a framework for

identifying needed future improvements and actions. Although the content of corridor management plans varies, many involve a similar overall process for plan development. Typical elements of the process include corridor designation, partnering agreements, visioning, corridor analysis, alternatives development and selection, and an implementation plan and agreements.

A common theme in current practice is the importance of public involvement in corridor management—not as a separate activity, but as an integral and ongoing part of the planning process. With so many stakeholders influencing the outcome, and the trade-offs involved, achieving successful corridor management is a continuing challenge. A defining characteristic of successful corridor management planning has been the level of acceptance or support achieved among the affected stakeholders. This is accomplished through a corridor management planning process that strives to incorporate the objectives or aspirations of a broad range of stakeholders.

The policy and planning environment is ripe for corridor management plans and programs. State and federal transportation policy is moving toward improved systems management, coordination of transportation and land use, context-sensitive design, and attention to livable communities issues—a shift that has paralleled the rise of growth management, smart growth, and sustainable development concepts in the land-use arena. Corridor management also reinforces the strategic goals of the U.S. Department of Transportation Strategic Plan (1997–2002) related to safety, mobility, economic growth and trade, and the human and natural environment.

Corridor management plans and programs benefit communities and transportation agencies in a variety of ways. Corridor management bridges the gap between long-range transportation plans and local comprehensive plans and promotes coordinated planning among the agencies responsible for transportation and development decisions. By providing a forum for joint planning on transportation and development issues, corridor management can lead to synergy in problem solving and more comprehensive solutions to transportation problems.

Corridor management also helps to minimize the adverse environmental, social, and economic impacts of transportation projects. The emphasis on capacity protection, and not just new lane miles, extends the life of existing facilities and reduces the need for costly and disruptive road widening projects. Corridor access management strategies improve roadway function and safety, and fewer crashes mean less cost to society. Corridor management planning is also the primary vehicle for preserving the intrinsic qualities of scenic roadways. From an economic perspective, well-managed roadways provide an image of stability that is attractive to investors and that can help to preserve long-term property values. Developers also benefit from greater clarity of public intentions regarding the location and timing of roadway improvements and a more coherent framework for future development and access decisions.

It is important that transportation agencies view corridor management as an ongoing process, not a one-time project. Corridor management involves both short- and long-range implementation strategies and often requires action from a variety of groups and agencies over a period of time. Because conditions on a corridor will change over time, it will be necessary to periodically update the plan. The process must also be opportunistic—agencies should be prepared to take action when a window of opportunity arises for implementing various aspects of the action plan.

The ongoing nature of corridor management suggests the need to establish a formal program or process for carrying out corridor management activities. Options include regular meetings among affected agencies on specific projects, an agency corridor management office, a steering committee to oversee plan implementation, or some combination thereof. Also needed is greater attention to performance evaluation and monitoring. Few of the state transportation agencies surveyed currently track the performance of their corridor management projects, although several engaged in special studies aimed at quantifying the influence of various techniques.

Transportation corridors represent a substantial public and private investment. Unless transportation and development in these corridors is effectively managed, both the public and private investment could be adversely affected. Through corridor management plans and programs, transportation agencies can achieve more cost-effective and comprehensive solutions to transportation problems. A broader range of groups that influence corridor outcomes can also be engaged in developing and implementing transportation solutions. For this to occur, however, agencies responsible for transportation improvements will need to work proactively with local agencies and other stakeholders to accomplish mutual objectives.

INTRODUCTION

OVERVIEW

Transportation agencies are facing a fundamental challenge—meeting a growing demand for transportation service in a revenue-constrained environment. Growth in automobile ownership, urban decentralization, and the increase in the female labor force have contributed to the rise in demand (measured in vehicle miles traveled) for such service. Financial limitations, however, are a symptom not only of growth in demand, but also of rising maintenance needs, spiraling right-of-way costs, environmental mitigation costs, and widespread voter opposition to tax increases. As a result, transportation agencies are paying more and getting less when it comes to roadway capacity improvements.

There is also a growing recognition that new capacity alone will not solve congestion problems. Although new lane miles are essential to an efficient transportation system, there are limits to capacity solutions. Right-of-way constraints, unacceptable community impacts, and financial limitations all affect what agencies are able to provide in terms of roadway capacity. Therefore, transportation agencies are also looking for better ways to manage the existing transportation system. Corridor management plans and programs are a means of combining capital improvements and management strategies into an integrated plan of action for a major roadway corridor.

Contributing to the need for corridor management is the historic disconnect between land use and transportation decision making. The separation of jurisdiction over transportation and land use continues to cause numerous problems in the planning and development of transportation corridors. Examples include local subdivision and strip zoning practices that chew up roadway frontage and create serious access problems; instances where development may be approved in the path of a roadway slated for future expansion, blocking the corridor or increasing right-of-way acquisition costs; or a major development may be approved in an area lacking sufficient transportation capacity, although the transportation agency that maintains the roadway has already committed resources elsewhere. Such conflicts between land use and transportation decision making increase the need for and cost of transportation improvements.

At the same time, communities are seeking greater responsiveness from transportation agencies on local needs

and community issues. Long-range transportation planning has traditionally been demand driven, focusing more on meeting future transportation needs through improvement projects than on local planning or policy issues. As a result, roadway improvement practices sometimes conflict with community objectives. For example, conflicts may arise where a transportation agency plans to widen a roadway through a scenic or historic area, with no clear process for identifying and preserving visual and aesthetic resources. Roadway widening projects may also conflict with community redevelopment plans and streetscaping or traffic calming objectives for older retail districts. Residents of corridor neighborhoods may object to transportation projects, as well as local development decisions, that they feel adversely affect them. Such conflicts in transportation and development planning could be better addressed or sometimes avoided by integrating roadway and land management practices through corridor management plans and programs.

The ultimate effectiveness of corridor management in accomplishing agency objectives, and the type of corridor management techniques that would be appropriate in a given situation, will depend on a host of factors. Some of these factors are specific to the actual corridor and others relate to the planning and regulatory environment. Nonetheless, corridor management planning can help bridge the gap between long-range transportation plans and local comprehensive plans and promote improved coordination among the agencies involved in transportation and development decisions. It is also a vehicle for the more direct and meaningful involvement of a broader range of stakeholders in corridor decisions. By providing a forum for joint planning and stakeholder involvement in transportation and development issues, corridor management can lead to synergy in problem solving and more comprehensive solutions to transportation problems.

OBJECTIVES

The objectives of the synthesis include:

- Establishing a working definition of corridor management;
- Summarizing corridor management policies and programs at the federal, state, and local level;
- Identifying typical elements of corridor management plans;

- Identifying effective tools and techniques; and
- Providing case examples of successful corridor management practices.

An effort was made to select a diversity of methods and examples for the broadest possible treatment of the subject. Although the synthesis focuses more on roadway corridors than on transit or greenway corridors, much of the information provided is relevant to any corridor management effort.

METHODOLOGY

Three basic methods were used to develop the synthesis: a survey of state agencies, review of the published literature, and follow-up questions with selected individuals. Thirty-four states responded to the survey, which addressed state corridor management policies and programs, techniques applied, and coordination issues (see Appendix A). Respondents were also asked to provide copies of corridor management plans, reports, and policies, and to identify any regional or local agencies they were aware of in the state that had engaged in corridor management planning. From the survey, a library of corridor management plans and reports was collected. The library was supplemented by a review of the published literature and Internet resources. From this information, a series of case studies was selected for more detailed summary, and interviews were conducted with individuals involved in the projects.

DEFINITIONS

A corridor is a transportation pathway that provides for the flow of people or goods within and between activity centers, and that includes one or more primary transportation facility and the abutting land uses and supporting street network. Examples range from roadway and rail transit corridors to greenways, which are oriented toward pedestrian and bicycle travel. Some corridors accommodate only one major transportation facility, whereas others may accommodate several facilities and transportation modes, such as arterial roadways and rail lines parallel to interstate highways.

Transportation corridors are complex environments that are often the focus of development pressure. Development is attracted to transportation corridors because of the physical or visual access they provide. Development of an urban scale cannot occur without the access provided by a major transportation artery. For these reasons, economic development initiatives are often linked to particular corridors, as are programs for managing growth and preserving scenic character. The challenge for transportation agencies is to preserve or improve the transportation function of

major corridors, while accommodating other reasonable public objectives.

Corridor management can be generally defined as the application of multiple strategies to achieve specific land development and transportation objectives along segments of a corridor. Corridor management strategies fall under five basic categories:

- Coordination—improving linkages across the various agencies and institutions that have a role in advancing corridor management objectives.
- Transportation—planning, design, operations, capital improvements, and regulatory techniques for preserving or improving the function and performance of transportation systems.
- Land use—planning, design, and regulatory techniques for managing land-use and development outcomes.
- Public involvement—outreach, communication, and involvement strategies for improving public participation in corridor management activities.
- Funding—identifying a variety of funding sources or resource contributions, both public and private, and institutional arrangements for carrying out needed studies and improvements.

Corridor preservation is a subset of corridor management that focuses primarily on right-of-way preservation programs and strategies. It also includes efforts to preserve the capacity of existing roadways through access management (1).

Corridor management planning is a process for identifying and addressing issues of strategic importance to the long-term functioning and character of a corridor. Typical elements of the process include corridor designation, partnering agreements, visioning, corridor analysis, alternatives development and selection, and an implementation plan and agreements.

Corridor management plans and projects address complex transportation and development problems and are as diverse as the areas involved. They focus on any issues that participants deem important, but often involve retrofitting older, developed areas with improved site access and circulation systems, as well as corridor preservation, access management, and developer mitigation strategies for developing areas. Operational strategies and intelligent transportation systems (ITS) are also attracting considerable interest as technology offers new and better ways to manage travel demand and roadway supply. From a land-use perspective, corridor management plans tend to emphasize intrinsic scenic or aesthetic qualities of corridors, as well as economic development and revitalization of declining commercial areas. There is also a growing emphasis

on alternative transportation modes and community design issues.

Overall, the objectives of corridor management initiatives included the following:

- Promote improved regional coordination on land-use and transportation issues along a corridor;
- Preserve the safety and operational efficiency of the primary roadway through access management;
- Encourage the establishment of an effective land-use or growth management plan for the corridor;
- Prevent or minimize development within the pathway of a planned transportation facility;
- Promote development of supporting street, sidewalk, and site circulation systems where land development is desired;
- Apply design, regulatory, and funding strategies to retrofit or revitalize older developed areas; and
- Address site-by-site development impacts on the roadway through traffic impact assessment and developer mitigation.

BENEFITS OF CORRIDOR MANAGEMENT

Benefits of corridor management flow from improved intergovernmental coordination and consistency in transportation and land-use planning, broader stakeholder involvement, and the potential for synergy in problem solving and plan implementation. Corridor management plans are especially helpful for coordinating land development and transportation decisions on roadways under state jurisdiction, and can be used to define the roles and responsibilities of all involved agencies. Joint planning between state and local agencies, as well as broader stakeholder involvement, can lead to opportunities for partnering on implementation, mitigation, or cost sharing that may not have otherwise been apparent.

Having a corridor management plan in place can benefit property owners and the local economy as well. Well-planned roads and access systems, along with corridor landscaping or other amenities, can attract investment and add value to abutting property. Many of the older corridors that are now experiencing disinvestment and high vacancy rates are characterized by poorly designed and closely spaced or wide-open access points, visual clutter, and little area for landscaping or other amenities (Figure 1). For higher quality development to occur, developers often must consolidate smaller lots and demolish existing structures, which can add greatly to development costs. Such corridors do not present the image of stability that investors seek.

Corporations and major retailers seek locations that are attractive and provide efficient transportation service.



FIGURE 1 Visual clutter, parking lots connecting to roadways, decline of businesses, and functional deterioration of major roadways are typical results of inadequate corridor management.

Economic studies of corridors over time further suggest that although land value increases initially with increased development pressure, land values begin to decline if the character of the corridor declines (2). Of course, these new corridors can also become casualties in the future without proactive measures to assure that access and development are properly managed.

The private sector also benefits from greater clarity of public intentions regarding the location and timing of roadway improvements and any policies and regulations that will apply to the corridor. This reduces risk associated with the timing and phasing of development projects and allows developers to plan projects and site improvements compatible with public plans for the corridor. Because corridor management plans provide a coherent framework for future development and site-access decisions, they can also help to facilitate fair and consistent treatment of applicants during development and access permitting.

In addition, corridor management can advance sustainable development and smart growth objectives. The emphasis on capacity protection, and not just new lane miles, extends the life of existing facilities and reduces the need for costly and disruptive road widening projects. Corridor access management improves roadway safety, and fewer crashes mean less cost to society in terms of property damage, personal injury or death, insurance and litigation costs, and lost productivity. For this reason, requests for direct arterial access will need to be carefully weighed against the safety impacts of these decisions on the surrounding community.

Attention to activity center strategies, economic development, and community design can lead to more efficient use of land and the improved character or quality of development. Corridor management can also help sustain the

character and quality of the natural and cultural resources of a corridor. From a federal perspective, corridor management programs assist in fulfilling the requirements of

transportation planning law concerning air quality and the management, operation, and preservation of transportation systems (3).

CORRIDOR MANAGEMENT POLICIES AND PRACTICES

FEDERAL ROLE

Passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) marked a shift in federal transportation policy toward improved systems management and operation. Highlights included stronger emphasis on multimodal and intermodal planning, ITSs, and improved coordination of transportation and land use. The Transportation Efficiency Act for the 21st Century (TEA-21) continues the national transportation policy directions established under ISTEA, with some changes aimed at furthering the emphasis on operations and clarifying the law or facilitating conformity.

With regard to planning, TEA-21 consolidated the 16 metropolitan and 23 statewide planning “factors” of ISTEA into 7 broad “areas” to be considered in the planning process. Although all seven areas can affect corridor management, two areas—promoting efficient system management and operation, and emphasizing preservation of the existing transportation system—are particularly supportive of corridor management. TEA-21 also reauthorized the federal ITS program, providing about \$100 million each year over the life of the bill for ITS deployment for a total of \$679 million over a 6-year period.

Of particular interest is a new TEA-21 pilot program called the Transportation and Community and System Preservation Pilot Program (TCSP). Under TCSP, state, local, and regional public agencies are eligible for discretionary grants to implement and evaluate current preservation practices and activities, as well as to develop new and innovative approaches. The program targets strategies that improve the efficiency of the transportation system, reduce environmental impacts of transportation, reduce the need for costly future public infrastructure investments, ensure efficient access to jobs, services, and centers of trade, and examine private sector development patterns and investments that support these goals. During its first year, 35 projects in 27 states were selected to receive funding under the TCSP, with an average grant of \$375,000. Twelve of the projects were either related to specific corridor development issues or were aimed at advancing corridor-planning practices.

The projects that received TCSP awards were diverse, addressing a range of factors critical to effective corridor management (see <http://tcsp-fhwa.volpe.dot.gov/grantees> for additional information). The Greater Wasatch Area in Utah is developing land-use and transportation strategies to

protect its environment, economic strength, and quality of life. Northern New Jersey is seeking to facilitate the redevelopment of abandoned industrial brownfield sites. Centre County, Pennsylvania, plans to establish a collaborative, multijurisdictional model interchange overlay district to guide development around 12 highway interchanges. Dane County, Wisconsin, plans to evaluate competing land-development scenarios and develop true costs and benefits of alternative growth patterns.

Two other new programs of interest, funded from a single source under TEA-21, are the National Corridor Planning and Development Program and the Coordinated Border Infrastructure Program. The National Corridor Planning and Development Program provides allocations for coordinated planning, design, and construction of corridors of national significance in terms of economic growth and international or interregional trade. Eligibility for funds is limited to states and metropolitan planning organizations (MPOs). Corridor Program funds are further limited to high priority corridors specifically identified in ISTEA, the 1995 National Highway Designation Act, and TEA-21, as well as any modifications made or additional corridors selected in succeeding legislation. Currently, there are 43 corridors identified as high priority [further information on these corridors can be found at <http://www.fhwa.dot.gov/hep10/nhs/hpcor.html> or by contacting the Federal Highway Administration (FHWA)]. The purpose of the Coordinated Border Infrastructure Program is to improve the safe movement of people and goods at or across the border between the United States and Canada and the border between the United States and Mexico.

Under the National Scenic Byways Program, technical assistance and grants to states are available for the purposes of developing scenic byways programs and undertaking related projects along roads designated as National Scenic Byways, All-American Roads, or State Scenic Byways. Originally established under ISTEA, the program is based on recommendations of an advisory committee regarding criteria, standards, and design review procedures. Some states, including Washington, Florida, and Connecticut, have established state scenic byways programs to further these scenic management objectives.

Of interest for corridor preservation are measures in TEA-21 aimed at streamlining the environmental review process established by the National Environmental Policy Act of 1969. Streamlining involves a coordinated federal

review process for the U.S. Department of Transportation (DOT) to work with other federal agencies in ensuring that major highway and transit projects are advanced according to cooperatively determined time frames. The coordinated process has concurrent, rather than sequential, federal reviews and allows states to include their environmental reviews in the coordinated review process. If a project-related environmental issue has not been resolved with another federal agency, the heads of the two agencies have 30 days to meet in an effort to resolve the issue.

STATE AND PROVINCIAL POLICIES AND PRACTICES

The review of corridor management programs and policies at the state level was conducted through a summary of survey responses and the review of published literature or agency manuals. The survey was distributed to each of the state transportation agencies for a generalized view of corridor management policies and programs at the state level. Thirty-four states responded to the survey, for a response rate of 68 percent. Responses were evenly distributed from across the United States. A detailed review of each state policy or program is beyond the scope of the synthesis. Instead, a general overview is provided below, with a more detailed review of a few state programs that exemplify the state of current practice.

Survey Results

The survey of current practice provided some indication of the growing number of state agencies with corridor management programs or policies. About one-half of the survey respondents (16) indicated that their agency has established a program or policy supporting corridor management, and one-half of the others indicated that they are in the process of establishing one. Of the 16 agencies with an established program or policy, 10 indicated having supporting legislative authority. In most cases, the state transportation agency was named as the implementing agency, along with local governments. In addition, nearly two-thirds of the agencies responding were aware of other regional or local agencies in the state that had prepared corridor management plans or studies.

From the survey it appeared that most state transportation agencies are pursuing corridor management in a piecemeal way, as opposed to a unified or coherent program. For example, several states provided more than one response to the survey, indicating that corridor management functions are spread across several divisions or functional areas within the same agency.

Because right-of-way preservation is an element of corridor management, statutes enabling state and local

agencies to engage in right-of-way preservation were included in responses regarding state policies and legislation. Nebraska, for example, indicated that state law provides for corridor management through the zoning authority of local agencies. After a corridor map is filed, no building permit may be issued in the corridor without review by the Nebraska Department of Roads. If a proposed building should interfere with future plans, the Nebraska Department of Roads is given the opportunity to acquire needed rights-of-way.

With regard to specific corridor management practices, the management strategies that respondents most frequently selected, in order of frequency, were: adding auxiliary lanes, ITSs, improved signal location or spacing, bicycle/pedestrian facilities, site development review, intergovernmental agreements, and acquisition of access rights. The least used strategies, in order, were acquisition of development rights, streetscaping, bus transit service and facility improvements, and site impact analysis.

All but two of the responding agencies indicated that they coordinated with regional and local agencies on corridor management issues, primarily by means of the planning process. Specific examples included Delaware, which indicated that it has a Corridor Capacity Preservation Program that includes active coordination with the Office of State Planning, Department of Natural Resources, Department of Agriculture, and local agencies along each corridor. The Maryland DOT indicated that it meets monthly with local agencies that are affected by proposed transportation facilities. In New Jersey, access management plans and Transportation Development Districts are established through a mandated joint planning process.

Only 12 of the 34 agencies that responded provide training or outreach on corridor management techniques. Different strategies were used to reach different audiences, including workshops, focus groups, surveys, more specific or technical information for those involved in the implementation process, and broader (nontechnical and policy) information for elected officials. One of the agencies with an extensive and ongoing training effort was the Florida DOT (FDOT), which provides training to both FDOT Districts and regional and local agencies on a variety of access management issues. This has increased local application of access management strategies on state and non-state thoroughfares through the comprehensive planning and land development process.

The survey of state practices revealed little monitoring of corridor management projects. Fewer than 30% of the respondents indicated that they monitor the effectiveness of their corridor management projects. Those agencies that responded affirmatively, primarily used before and after crash studies and operating characteristics (e.g., delay,

travel time, average travel speeds) to monitor the effectiveness of their efforts. According to respondents, the most effective corridor management techniques were consolidation/removal of access, median treatments, acquisition of access rights, and intergovernmental agreements. More than one-half of those who implemented monitoring activities stated that they incorporated the information into their corridor management activities, and most used the planning or programming process to do so. One agency indicated that they used the monitoring results to refine their manuals, as appropriate.

A variety of special agency monitoring studies were identified in the access management literature. These studies were aimed at assessing the effects of access management treatments, and the economic and operational impacts of median projects in particular. Extensive studies have been conducted in Oregon, Minnesota, Colorado, Washington, Florida, Texas, Kansas, and Iowa on these issues, and the list is growing (4).

For example, in 1999, the Kansas DOT (KDOT) studied 15 businesses that had previously filed inverse condemnation lawsuits against the department on access-related issues (5). In nearly every case, the landowner had claimed that the applicable regulation, ranging from driveway consolidation to mainline relocation, would have a significant adverse impact on their business and the highest and best use of their property. Some had been compensated for potential impacts. Each property was studied to determine if the economic impacts had in fact been realized. The study examined the specific economic impact claims of the landowners, as well as "before" and "after" aerial photography of the involved parcels and roadways, and historical land uses for each parcel.

In all but one of the Kansas cases either the claimant was still in possession of the property and operating the business, the property was being used the same way by a different operator, or the use of the property had been upgraded. The only exception was where a mainline was relocated with two gas stations remaining on the old mainline, which was converted to a frontage road. In this case, drivers had to travel about 2 miles out of their way to reach the frontage road, and consequently the gas stations went out of business. The results provided strong anecdotal evidence that except where a change in access resulted in extreme circuitry, the changes in access or traffic patterns did not adversely affect the commercial use of abutting properties.

FDOT has explored economic concerns related to medians by conducting opinion surveys following median reconstruction projects (6). To date, surveys indicate that the majority of businesses have perceived no adverse impact on sales, and the various user groups (truckers, commuters, and property owners) tend to rate these projects favorably

in terms of perceived safety and operations. Such efforts are essential in addressing the neighborhood and business concerns that typically surround access management projects.

Summary of Selected Programs and Practices

The review of agency publications and published literature provided a more detailed view of current practices. Some states, such as Kentucky and New York, are advocating corridor management through the development of corridor management plans on specific state corridors. The New York State DOT also produced a handbook on *Best Practices in Arterial Management*, which includes five case studies of corridor management practices and provides technical assistance to local agencies on developing and implementing access management ordinances.

The Kentucky Transportation Cabinet has engaged in several corridor management plans (see Bluegrass case study) and received a federal TCSP grant to develop a corridor master planning handbook and companion computer visualization techniques. The purpose of the project is to show communities in Kentucky how to improve the efficiency and visual qualities of roadways while reducing the need for costly improvements. The visualization tools will help portray the potential impacts of a wide range of corridor design decisions.

Other states have established more formal corridor management policies and programs. As might be expected, many of these programs relate primarily to right-of-way preservation and access management—the two areas where transportation and development practices intersect. The following sections provide an overview of varied approaches to corridor management in Kansas, Florida, British Columbia, and Michigan.

Kansas

KDOT adopted a state corridor management policy in 1997 that expanded the state access management program. A system of five access management categories has been applied to state highways based on the level of state importance. Subdivision or development requests that involve access to state highways are subject to access review and approval by KDOT, before they may obtain access to a state highway. Once an access permit has been granted, access may not change to a more intensive use without KDOT approval. KDOT may also assign higher than minimum access management standards to particular segments of state highways experiencing growth pressure and identified as being of greater local importance than the assigned classification, through an additional category called Protected Route Segments.

The new policy promotes development of corridor access management plans in cooperation with local agencies for designated Protected Routes. Once a corridor is designated, KDOT enters a Memorandum of Understanding with local jurisdictions, a nonbinding partnering agreement aimed at establishing a mutual commitment to management of the corridor, particularly in relation to access management and right-of-way issues. A corridor master plan with access policies and concepts is developed for each of the corridors and formally adopted by intergovernmental agreement, with each participating agency signing off on the plan. As an incentive, special funding is set aside annually for off-system improvements that support the access management plan. The off-system funding amount increases annually and will top out at \$5 million. The funds are authorized for local road improvements that will have a demonstrable benefit to the state highway.

Florida

FDOT has established a variety of programs and policies relevant to corridor management. In the 1990s, FDOT adopted a policy establishing a limit on the number of lanes for state highways. The policy restricts growth of the interstate system in urban areas to a maximum of 10 lanes and provides that other parts of the system may be expanded up to 6 lanes where they fail to meet state level of service standards. In urbanized areas of more than 200,000 persons, the Interstate highway master plans will also include four exclusive lanes (two in each direction) for through traffic, public transit, and other high-occupancy vehicles.

In 1995, the Florida legislature amended state and local planning law to promote an expanded local role in managing corridor development. The new law called for designation of state highway corridors in local comprehensive plans and specifically enabled local governments to adopt corridor management ordinances. The intent of these changes was to shift responsibility for preserving transportation right-of-way for state highways from FDOT to local governments. The policy shift emerged from two issues: (1) a successful legal challenge to state official mapping practices in 1990 [*Joint Ventures v. Dept. of Transportation*, 563 So. 2d at 625, 626 (Fla. 1990)] and (2) the recognition that local agencies were better suited than the state to preserve future transportation rights-of-way, given their expansive authority to manage land development provided by the Florida Growth Management Act (Chapter 163, F.S.).

Consistent with the legislative changes, FDOT enacted a Corridor Management Procedure in 1996. The procedure was aimed at establishing a process to:

- Guide FDOT Districts in identifying high-priority transportation corridors that would be candidates for corridor management,
- Encourage local governments to designate state corridors for management in their comprehensive plan and adopt corridor management ordinances,
- Facilitate development of FDOT District work programs,
- Monitor land development activity in designated corridors, and
- Fulfill requirements leading to advance right-of-way acquisition.

Under the procedure, each District office was to prepare a Corridor Management Report, identifying high-priority corridors in the District and documenting the need for including them on the Department's Corridor Management List. The Corridor Management List would then allow the District to prioritize projects and begin development of the work program. Local participation was made optional, rather than mandatory. Using these lists as a guide, local governments were to designate state highway corridors in their comprehensive plan and adopt transportation corridor management ordinances to manage development within and along designated corridors. The ordinances could accomplish corridor management through zoning, subdivision regulations, access controls, and right-of-way preservation requirements.

To date, progress in advancing the policy has been sketchy. The primary impediment, according to state officials, is the continued fear of legal reprisals and potential state liability for local actions in light of the Joint Ventures decision. With the state reluctant to move forward, many local agencies are taking a "wait and see" position on the new procedures. Despite the current impasse, several Florida communities do have right-of-way preservation and access management measures in place and are carrying out these activities through the land development process. In addition, FDOT continues to engage in corridor management through its comprehensive access management program, which has been active since 1988. The program assigns an access classification to all state highways for the purpose of applying standards governing the location, design, and spacing of access connections, medians, median openings, and signals. The program was supplemented in 1993 by a design policy calling for raised medians on all major multilane roadways with posted speeds of 45 mph or higher (8).

British Columbia

The Ministry of Transportation and Highways in the Canadian province of British Columbia is currently expanding its corridor management efforts. In 1992, the ministry

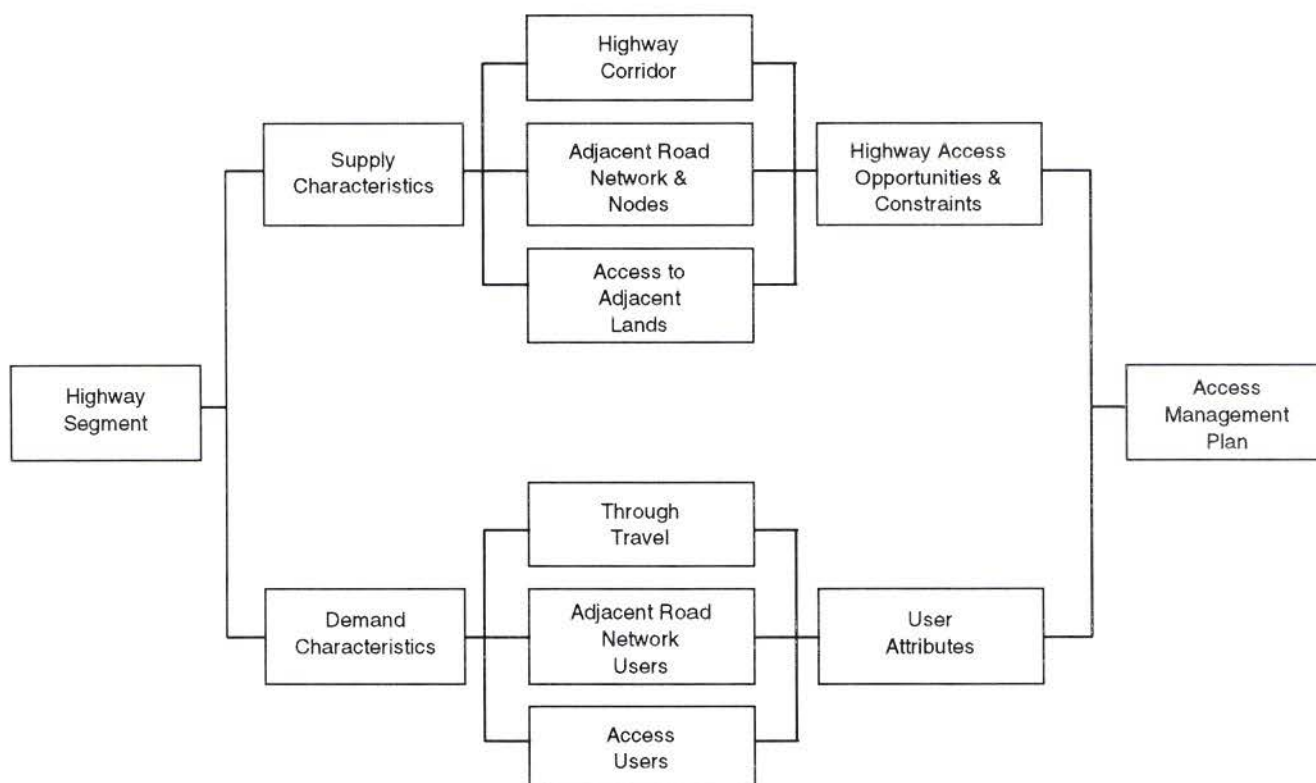


FIGURE 2 Relation of highway system attributes to access management plans (Source: *Draft Guide to Undertaking Access Management Plans*, Ministry of Transportation, British Columbia, Canada) (35).

introduced the *Highway Functional Classification Study* (9), which outlined a provincial classification system for roads and highways based on their function. In 1996, the ministry began developing corridor management plans to establish the strategic role and function for specific highway corridors and to provide a framework for identifying future highway improvements and investments. Where more detailed analysis is needed, the corridor management plans may recommend that funds be made available to develop an access management plan. The access management plans are to integrate roadway design, site access, and land development strategies for specific areas (Figure 2). A guide is being developed to promote a uniform approach to access management planning.

The Ministry of Transportation and Highways has had a provincial, controlled access highway program since 1977, but like many transportation agencies it has struggled with the connection between transportation and development practices. To address this issue, the ministry emphasizes the importance of proactive coordination and partnering with local governments and area stakeholders in the development of corridor access management plans. The planning process is designed to give equal consideration to community plans and growth strategies. As stated in the guide: "Both the Ministry and the local government must be fully committed to the Access Management Plan (AMP) in order for it to be effectively implemented . . . If the AMP fails to show the importance of the recommended

improvements to the community, experience has shown us that implementation will likely fail." Implementation is initiated with the signing of a formal agreement establishing agency responsibilities for managing corridor access.

The draft Access Management Planning guide emphasizes the need to be practical in already developed areas and to accommodate "the reality of the existing situation with the goal being to recover as much capacity and safety as possible." In some cases, where existing development and access characteristics preclude sufficient improvement, a bypass solution may be necessary. In addition to retrofit projects, which are reactive by nature, the guide calls for a proactive approach to access management in relatively undeveloped areas experiencing development pressures to maintain higher functioning facilities.

Michigan

The Michigan DOT (MDOT) lacks a formal corridor management program and instead has used a combination of strategies to manage highway corridors, including agreements with local governments, purchase of access rights, and right-of-way preservation strategies. Whether the strategies are pursued depends in large part on the level of intergovernmental cooperation that is provided, the nature of abutting land use, and the travel characteristics of a corridor.

For example, MDOT plans to widen a segment of M-59 from two to four lanes with a 60-foot median. Toward that end, MDOT entered into an intergovernmental agreement with three townships and the city of Howell regarding corridor preservation through land-use planning and zoning. MDOT defined a 300-foot right-of-way area for the improvement and completed a tier one environmental impact statement documenting the direct impacts of the project. Concurrently, the local agencies cooperatively developed a corridor land-use plan and zoning ordinance and agreed to work with developers to preserve the future right-of-way. Several developers have voluntarily revised their subdivision design to accommodate the boulevard plan. MDOT also recently established a right-of-way revolving fund, which is used to purchase properties from owners who indicate a hardship in selling their property. The fund has been used along the M-59 corridor.

The M-37/M-44 is another corridor project where MDOT plans to expand the roadway from two to four lanes with a median. Five local governments, the MPO, and the local chamber of commerce jointly invested in a corridor land-use plan and zoning ordinance for the corridor to in order to control the intensity of land development that would have access to the route. These agencies meet regularly to review proposed site plans or rezoning requests in relation to their impacts on the roadway. This process was established through the coordination efforts of the Grand Valley Metro Council, the MPO for the Grand Rapids metropolitan area.

In another example, MDOT plans to purchase access rights in order to control access along a 12-mile segment of US-131—a highway traversing a rural farming community. The initial focus of this effort will be on undeveloped farmland frontage. In addition, MDOT will be considering frontage road or backage road options to be constructed, along with the purchase of access rights to existing businesses and homes. MDOT will also purchase access rights from property owners who will be displaced by the facility. Access to these facilities will be allowed to continue, however, until each facility is converted to a controlled access route.

REGIONAL AND LOCAL PRACTICES

Corridor management is sometimes the subject of regional and local planning initiatives. The lead agency for corridor management at a regional level varies widely depending on the organizational structure of transportation and development planning responsibilities in the state. Typically, the lead agency is a regional planning agency, such as a regional council of governments or MPO. In some areas, a joint city-county government or planning agency may assume a leadership role. In a few instances, special nonprofit organizations or commissions have been established to advance specific corridor management objectives.

MPOs and other regional planning agencies can assume a leadership role in corridor management through their long-range planning and programming activities. Specific corridor studies, such as those described in chapter 3, can be included in the work program of MPOs or other regional agencies to provide a focal point for agencies and municipalities to collaborate on corridor management activities. Metropolitan transportation plans could include a corridor management element that addresses the need for corridor management, designates priority corridors, and establishes measures to be pursued.

Priority could also be given to funding corridor management plans and projects in the development of transportation improvement programs. For example, the Capital District Transportation Committee, the MPO for the broader Albany, New York, metropolitan region, screens projects for land-use and access management linkages before considering moving a project from the long-range plan into the transportation improvement program (10). In addition, specific projects are not included in the Albany area long-range transportation plan until a local land-use and transportation study, which includes detailed consideration of access management strategies, is completed.

Other roles for regional agencies include providing grants for special regional projects to develop corridor management policies and programs, conducting outreach or training on corridor management, providing technical assistance to local governments, and facilitating state and local coordination on corridor management issues.

Local governments play a major role in corridor management through their comprehensive plans and land development regulations. Comprehensive plans may include goals, objectives, and policies related to corridor management and may designate corridors that will be the focus of management activities. Local agencies in some states may also adopt official maps and ordinances for preserving transportation rights-of-way as development occurs, or enact access management plans and special corridor zoning or overlay regulations for selected thoroughfares. Rather than serving as a lead agency, local governments typically play a supporting role in state or regional corridor management initiatives because most major regional arterials are under state jurisdiction. Nonetheless, some local agencies have initiated local corridor or gateway planning projects that involve corridor management applications.

Summary of Selected Practices

If the number of local and regional corridor planning initiatives were any indication, it would appear that interest in corridor management planning is growing at the local and regional level. The objectives of regional planning

councils/commissions and local governments, however, differed from those of states or MPOs. Corridor management issues of particular interest to local and regional development planners included roadway design, alternative transportation modes, community design or scenic preservation, economic development, and access management. As a result, the corridor management plans initiated by local or regional development planning agencies tended to focus more on managing community design and economic development outcomes than on managing roadway efficiency. The corridor management studies initiated by MPOs, however, tended to focus on roadway performance and emphasized access management and right-of-way preservation strategies. The following is a sample of regional and local practices, illustrating the diversity of corridor management approaches. Other examples appear in chapter 5.

Charlotte–Mecklenberg Planning Commission

The Charlotte–Mecklenberg Planning Commission in North Carolina is a joint city–county agency charged with guiding growth and development for the city of Charlotte and the unincorporated areas of Mecklenburg County (for additional information see www.ci.charlotte.nc.us). The re-

gional plan of the Charlotte–Mecklenberg Planning Commission calls for a “centers and corridors” growth strategy. The plan builds on the radial structure of the Charlotte region, exemplified by five major transportation corridors radiating out of Charlotte to outlying urban centers. Each corridor currently accommodates a parallel configuration of transportation facilities including rail, arterial roadway, and interstate highway, thereby providing high potential for development activity. The regional plan calls for focusing centers off of major corridors, with direct connections to highways and transit lines (Figure 3). Core objectives are to:

- upgrade existing facilities and promote rail transit service in the corridors,
- focus growth along the corridors and within existing centers where infrastructure is already available, and
- minimize adverse traffic impacts on the region’s low-density residential “quadrants” through coordination of transportation and commercial development decisions.

Kentuckiana Regional Planning and Development Agency

The Kentuckiana Regional Planning and Development Agency (KIPDA) is a regional association of governments

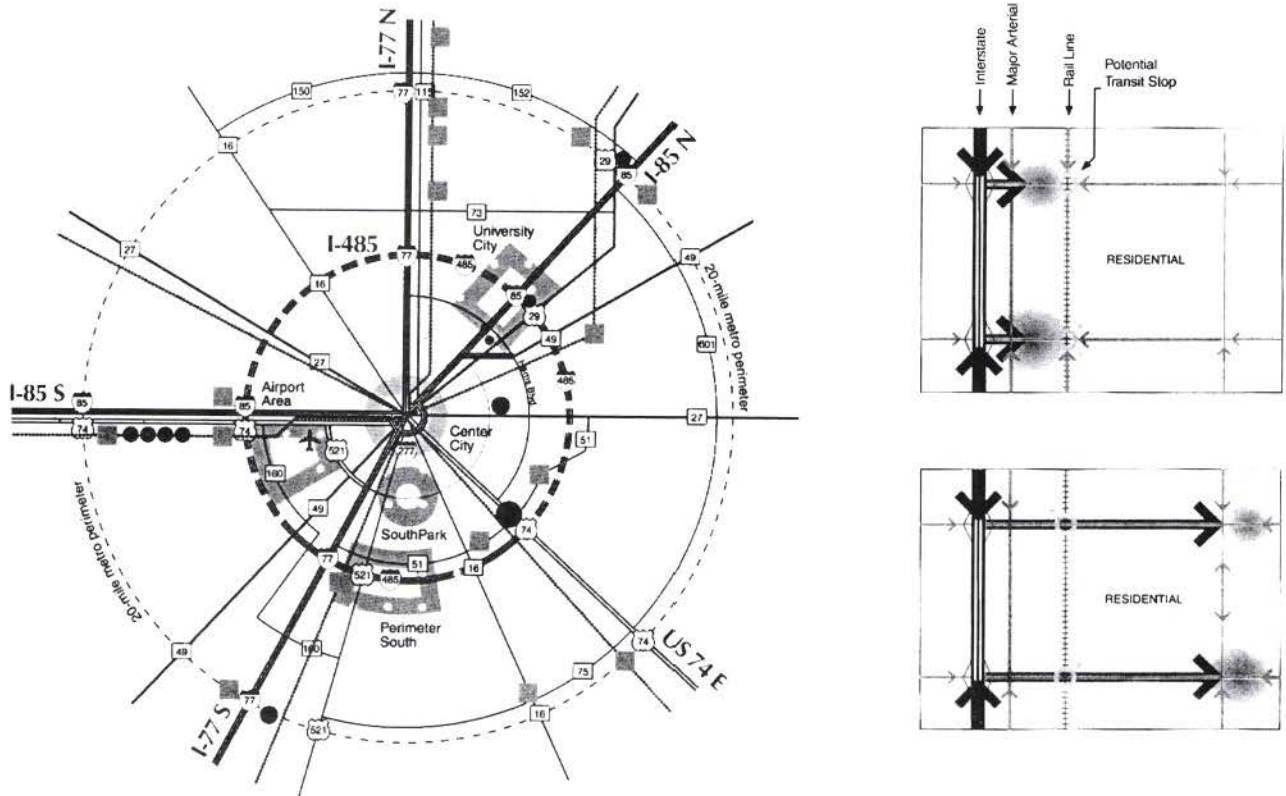


FIGURE 3 Charlotte–Mecklenberg centers and corridor growth strategy.

in a nine county region of southern Indiana and north-central Kentucky that serves as MPO to the region, along with other important planning and technical assistance functions. In 1998, KIPDA engaged in a project to establish access management, right-of-way preservation, and developer mitigation measures for the Louisville metropolitan area. The project involved the development of alternative systems that could be implemented on a local level, along with subarea plans illustrating applications for a variety of conditions, including older strip development, scenic corridors, and freeway interchange areas. To support the effort, KIPDA hosted a regional workshop on corridor management techniques, which included special presentations to selected area officials and interest groups. One-on-one technical assistance was also provided to specific local governments with an interest in integrating corridor management requirements into their land development regulations.

Metroplan Arkansas

Metroplan, the MPO for the Little Rock–North Little Rock metropolitan area, has taken a leadership role in advancing corridor access management in the region through its planning and programming activities. The MPO board engages in design review of state highway projects in the region to assure that median treatments, sidewalks, or other desired features are incorporated consistent with the goals and objectives of the long-range transportation plan. Metroplan also hosted a regional access management workshop for state and local agencies and policy makers aimed at increasing awareness of access management benefits and applications.

A recent example of Metroplan’s corridor management activities involved the proposed expansion of a major roadway corridor, State Highway 60, in the rapidly growing area of Conway. Concerned about the traffic conflicts and strip development typically associated with center two-way left-turn lanes, Metroplan worked with the state to replace the five-lane section with a raised median. A design concept for the median, detailing the location and design of partial and full median breaks, and future driveway spacing, was developed with the assistance of a consultant experienced in median design. Metroplan staff met individually with commercial property owners on the corridor to discuss access issues, address specific concerns, and obtain general support for the concept.

With approval from the Conway City Council, the median alternative is moving forward, and talks are underway to expand the median design along the next phase of the project and to incorporate landscaping. The state highway commission, Metroplan, and the city of Conway are developing a three-party interlocal agreement that will specify roles and responsibilities for the access management requirements and design concepts for State Highway 60. According to Metroplan, the agreement will require

unanimous approval from the three participating entities for any amendments to the corridor access management plan. Encouraged by these efforts and the potential benefits, other communities in the region are also expressing interest in median treatments and access management policies.

SMART GROWTH AND SUSTAINABILITY INITIATIVES

Sustainable development and “smart growth” initiatives have swept the country in the past decade. Elected officials, government agencies, nonprofit organizations, and citizen groups have rallied around these terms as they grapple with better ways to address problems such as urban sprawl, center city disinvestment, and degradation of the natural and built environment. Smart Growth is a nationwide movement that seeks to direct development in ways that preserve the livability and natural resources of a community, region, or state, while providing for economic opportunity. Sustainable systems can basically be defined as systems that function for the foreseeable future without collapsing or depleting the resource base they depend on.

Corridor management, or the lack thereof, has clear implications for smart growth and sustainability. For example, if development is not properly managed along a major roadway corridor, it will destroy the transportation functions of the very resource it relies upon. As a result, more financial resources must be brought to bear on fixing the problem, only for the potential to destroy the roadway again. If the roadway is expanded without attention to the intrinsic qualities or resources of the abutting area, the project may degrade the natural and built environment that it intends to serve.

Typical results of not managing these complex land-use and transportation systems are a loss of aesthetic quality, declining property values, reduced quality of transportation service, and gradual economic disinvestment. This cycle of “functional obsolescence” is at the heart of the sustainability problem and also the target of many corridor management plans and programs.

Smart growth initiatives often speak to transportation and land-use issues and the need for improved regional transportation and land-use planning. The city of Austin, Texas, for example, launched a Smart Growth Initiative in 1998 with the following broad goals:

- Designing with pedestrians and transit in mind,
- Creating incentives for infill and revitalization,
- Integrating land-use and transportation planning on a regional scale,
- Empowering neighborhoods, and
- Defining limits to urban growth (for additional information see www.ci.austin.tx).

The state of Maryland's Smart Growth Program lists three basic goals: (1) To save our most valuable remaining natural resources before they are forever lost, (2) to support existing communities and neighborhoods by targeting state resources to support development in areas where the infrastructure is already in place or planned to support it, and (3) to save taxpayers millions of dollars in the unnecessary cost of building the infrastructure required to support sprawl (for additional information see www.op.state.md.us).

The Minnesota DOT is pursuing a corridor management planning program as a means of developing intergovernmental partnerships and integrating transportation and land-use planning. A system of interregional corridors connecting trade centers throughout the state has been identified as part of the Year 2000 State Transportation plan. These highways will be the focus of the corridor management planning program that is linked to the Governor's Smart Growth Initiative, and will be a priority for major state transportation investments.

SUMMARY

State and regional transportation agencies are looking to corridor management as a way of improving coordination between transportation and land-use planning and thereby improving the performance and operation of major roadways. Local agencies and stakeholder groups are promoting corridor management for similar reasons, although the objectives of these groups tend to focus more on mode shift and community character than on roadway operations. From a land-use perspective, there is growing interest in traditional neighborhood development, transit friendly land use, and activity center strategies as methods of supporting alternative modes and improving the character of the built environment. Federal policy is supporting the move toward improved systems management and operation, livable communities, and smart growth—a shift that has paralleled the rise of growth management and sustainable development concepts in the land-use arena. As a result, the policy and planning environment is ripe for corridor management programs.

CORRIDOR MANAGEMENT PLANNING

Roadways have historically been built or improved with little subsequent monitoring or management. Instead, traffic signals, access connections, and developments have often been approved in a piecemeal fashion. As a result, the anticipated capacity and performance intended by the original project may not be achieved. Corridor management planning goes beyond the traditional roadway improvement study to address issues of strategic importance to the long-term performance of the corridor. It involves a more detailed assessment of roadway and land-use characteristics than would occur in a typical roadway improvement project.

From a transportation perspective, the purposes of such a plan are to evaluate traffic operations and roadway characteristics and propose changes that improve the safety and operation of the thoroughfare. Such changes may involve medians, signal location, auxiliary lanes, site access improvements, land-use changes, ITS and operational strategies, and improvements to the supporting roadway network. From a development perspective, corridor management plans address a variety of issues, including economic revitalization, scenic preservation, community design, and growth management. This chapter provides an overview of the typical structure and contents of corridor management plans.

REVIEW OF CORRIDOR MANAGEMENT PLANS

The corridor plans and studies reviewed for this synthesis reflected a diversity of objectives and approaches. Most were initiated because of one or more of the following issues: (1) failing or congested roadways, (2) the desire to revitalize or retrofit older commercial areas, or (3) the desire to preserve intrinsic scenic or aesthetic qualities of the natural or built environment. Few of the plans reviewed were comprehensive in their approach to corridor management, although several included more than one management strategy. Some plans were more traditional in their emphasis on roadway capacity improvements, with only minor treatment of other management strategies. Some plans dealt primarily with access management. Some emphasized land-use or economic development issues, as well as bicycle, pedestrian, and transit improvement strategies. One plan focused on safety management. As would be expected, plans for scenic corridors focused on defining and preserving intrinsic cultural or aesthetic resources and views.

Recommendations for correcting operational problems largely focused on widening, intersection improvements, or adding turn lanes, as opposed to medians, site access, or land development strategies. Exceptions were some of the corridor access management plans, which addressed both roadway design and site access issues. Although two of the plans reviewed were for new expressway facilities, neither included access management strategies for interchange areas. One area of commonality across the plans was the degree of attention given to retrofitting. Many of the corridor management plans included areas that were significantly built out, where problems were arising.

A common theme of the corridor management plans and literature was the importance of public involvement in corridor management—not as a separate activity, but as an integral part of the planning process. A defining characteristic of successful corridor management planning was the level of cooperation achieved among affected property owners and agencies involved in implementing the plan. Unlike a traditional roadway improvement project, which is viewed as the purview of the transportation agency, a corridor management plan must address issues of importance to local governments and citizens with an interest in the corridor. In this sense, the lead agency serves more as facilitator, with all involved agencies and stakeholders having roles and responsibilities in carrying out various components of the implementation plan.

For example, where a state highway is involved, the cooperation of local government agencies is critical to accomplishing long-term management objectives, because state agencies have little or no jurisdiction over land development issues that must be addressed to carry out the plan. Such authority rests with local planning and development agencies and is exercised through the political process—a process that is heavily influenced by affected property owners and the general public. Engaging a variety of interested parties and considering different opinions for the future of the corridor was an essential part of shaping a realistic plan with broad community support. This can also lead to synergism and partnering in plan implementation.

PLAN STRUCTURE AND CONTENTS

Although the content of corridor management plans reflected the planning objectives of the lead agency, many of these plans applied a similar overall process for plan

development. Typical elements of the process included corridor designation, partnering agreements, visioning, corridor analysis, alternatives development and selection, and an implementation plan and agreements. Some characteristics of these elements are described here.

Corridor Designation

The typical process begins with the designation of the corridor to be managed, either through a planning process, in relation to functional classification and priority setting, or as a result of "grassroots" interest. Some corridors were selected because of apparent problems or shortcomings, such as traffic congestion, loss of intrinsic scenic qualities, or decreasing economic vitality. Project selection also resulted from advance planning for anticipated future needs.

Corridor management planning requires an understanding of the strategic role and function of specific roadway corridors in the broader system to provide a framework for identifying future improvements. From a planning perspective, corridors may be designated for management because of their higher priority as transportation routes or because of unique economic or scenic characteristics. For example, major high volume routes, those providing service to major economic activity centers or tourism and recreational attractions, freeway interchange crossroads, or hurricane evacuation routes are among the corridors typically assigned high priority for transportation management. Corridor designation typically occurs through the state or regional transportation planning and improvement process, but sometimes is a result of the local comprehensive planning process or because of grassroots lobbying by property owners, environmental agencies, or other groups with an interest in the corridor.

The typical study area for corridor management plans includes abutting land uses and street intersections, but the depth of the study area varies depending on plan objectives, monetary resources, and study area characteristics. Scenic management plans, for example, tend to extend far beyond the abutting area to address locally important views and vistas. Factors considered in setting study area boundaries included physical features (highway intersections, waterways, open spaces, etc.), infrastructure for various transportation modes in the corridor, homogeneity of traffic or development characteristics, posted speed limits, extent of congestion and safety problems, the functional area of intersections, and jurisdictional or neighborhood boundaries.

Partnering Agreements

Corridor management planning requires partnering among the agencies and jurisdictions with responsibility for the

corridor. As part of the selection process, the principal agencies involved in the planning effort will need to be identified. This stage involves clarifying which agency will take the lead in facilitating plan development and which would be responsible for carrying it out. If the corridor traverses several jurisdictions, it is best if the cooperation and agreement of each local government is sought at the onset.

At this stage of the planning process, agency responsibilities and financial commitments need to be established for developing the management plan. This stage sometimes involves formation of an interagency partnership or agreement whereby participating agencies established conceptual agreement on guiding policies or mutual intentions. In some cases, this took the form of a local resolution in support of the corridor management plan or a Memorandum of Understanding establishing mutual agency roles and responsibilities.

Visioning

Corridor management plans often involve visioning activities, where participants are brought together in a workshop format and directly involved in establishing a future vision for the corridor. Establishing a common vision and supporting goals, objectives, and performance measures, provides a shared basis for weighing proposed changes. Visioning exercises are a way to move beyond day-to-day issues and allow people to articulate their hopes and ideals for the future.

Effective corridor management hinges upon stakeholder acceptance of the identified needs and proposed actions. With diverse involvement, competing interests and agendas will arise at different stages of the planning process. The perceived credibility of proposed alternatives and the level of cooperation achieved in implementation depends in part on whether the plan reflects and advances the vision and objectives of a broad range of stakeholders. Establishing a common future vision is an effective way of generating momentum for the planning effort and achieving broad-based support for implementation.

In some of the planning initiatives reviewed, including the Bluegrass case study, visioning occurred prior to plan development as part of a broader planning initiative and was gradually refined on a corridor basis. In other cases, visioning focused entirely on a specific corridor, as with US-1 on Florida's east coast or Woodward Avenue in the Detroit metropolitan area, as represented by the following vision statement:

Woodward Avenue will be a premier business and institutional location in the metro area. Surrounded by vibrant neighborhoods, it will be a vital corridor where people identify

with its history and want to maintain its importance into the future. Woodward Avenue will symbolize a partnership between business owners, property owners, and local governments. The vitality of Woodward Avenue will be reflected by:

- a variety of viable commercial uses;
- attractive store fronts, signage, and median plantings;
- easily located businesses with sufficient parking;
- increased patronage of business;
- a corridor that provides mobility to a variety of uses (11).

Corridor Analysis

The purpose of corridor analysis is to establish a baseline of existing conditions, identify problems and deficiencies, and gain insight into potential causes and solutions. Typical subjects of corridor management analysis include demographic and growth trends, land-use and transportation characteristics, and for scenic management, an assessment of intrinsic scenic and cultural resources and views.

Corridor management plans often involve a thorough inventory and analysis of land-use and transportation characteristics of the corridor (as cited here), as well as a review of broader trends affecting the area:

Land-use data

- existing land use
- property ownership and parcel boundaries
- lot width and depth
- existing zoning
- future land-use plan
- planned, proposed, and approved developments
- regional and corridor growth trends
- land cover and natural resources
- historic and cultural resources
- subarea development plans and studies.

Transportation data

- crash data
- traffic volumes
- pedestrian counts
- bike volumes
- historic traffic growth
- travel speed
- traffic delay
- projected traffic demand
- turning volumes
- vehicle classification counts
- queuing.

The land-use analysis is useful for the development of corridor management alternatives, and for visioning and other public involvement activities, as a means for exploring possible land-use changes that would help achieve the

plan's goals. Other elements, such as poorly located signs or confusing addressing systems, are sometimes identified as part of a corridor assessment and must be addressed, because they can lead to motorist confusion and unexpected weaving or turning movements. This exemplifies another important characteristic of corridor management planning—attention to small, but often critical details.

In some instances, land-use data are used to conduct more refined analyses of the relationship between corridor development and the ability of the road network to meet current and projected future traffic demand. In evaluating potential buildout for State Routes 441/250 in Penfield, New York, planners looked at current zoning as well as historic lot coverage (12). This produced an estimate of site-generated trips that was evaluated using traffic simulation and analysis to determine future intersection operation and queue conditions. Contour maps were then developed to highlight functional areas of key intersections where access should be avoided.

Traffic analysis involves the assessment of traffic and safety characteristics of roadway segments and intersections along the corridor. Through-traffic volumes (average daily trips), intersection turning volumes, and speed and delay are typically assessed, as are crash rates and access issues. Methods for identifying hazardous areas include observation, traffic analysis, and evaluation of crash data (13). Careful analysis of crash data at different locations also provides a means for identifying appropriate improvement options. Analysis of accident statistics at an interchange within Denver's West Corridor Study, for example, suggested that nearly three-quarters of the accidents occurred on one leg of the interchange (14). Of those, most were caused by unexpected turning movements, sideswipes, and rear-end collisions, most likely attributable to insufficient spacing between intersections, poor capacity of the left-turn bays, and inadequate sight distance.

Access management plans involve a thorough inventory of access characteristics of a corridor. Useful data include roadway design and geometrics, location and frequency of driveways and street intersections, and access "hot spots" or problem areas. The site design and traffic circulation patterns of existing developments may be assessed as well, to address problems such as inadequate sight distance, parking areas where drivers must back into the adjacent street when leaving, or high travel speeds through parking areas. A detailed assessment of the access characteristics of a corridor is useful for exploring potential opportunities for parcel interconnection, driveway consolidation, service roads, and improved circulation for delivery vehicles.

Some corridor management studies or plans also involve a policy analysis to identify issues or opportunities related to public policy. These assessments may address

issues such as planning and regulatory statutes, case law on specific issues, state access management policies and practices, local plans and ordinances, or environmental laws or programs that affect the corridor. A policy analysis can provide insight into needed changes in state or local policies, as well as any existing policies or standards that must be reflected in plan alternatives. Consistency with state laws and relevant government policies helps to prevent legal or coordination problems in implementation. Typically, the first important corridor management plan done by a state or local agency also serves as a good review and assessment of policies and standards that may have not had a serious review for many years. This can be of tremendous benefit to updating current practices.

One of the plans reviewed, the Woodward Avenue Corridor Study (II), also involved a detailed analysis of regional, county, and local markets. The market analysis addressed issues such as income and buying power, retail activity, retail vacancies, attractiveness as an office center, building permits, and traffic. A survey was also conducted of merchants, to identify perceived pros and cons of the corridor location, and users, to determine where customers were coming from, the purpose of their trip, and what types of shops or services consumers would like to see on the corridor in the future. The analysis concluded with a list of assets and liabilities that should be accounted for in the final plan.

Alternatives Development and Selection

The results of the corridor analyses, and vision or goal statements, serve as a basis for developing conceptual alternatives. The alternatives development process involves exploring potential solutions to existing problems and deficiencies, opportunities for accomplishing specific objectives, and any features that need to be preserved. Roadway improvements, technology infrastructure, access management options, right-of way needs, and development objectives are typical considerations in this process. Corridor access management plans address access issues in detail and often include existing and future access locations, the type of access (signalized/unsignalized, full or partial movement), modifications needed to existing access, and desirable changes in roadway design.

The policies and practices reviewed during the corridor analysis also need to be reconsidered to determine if regulatory or policy changes are needed. This may include plan amendments, land-use or zoning changes, updating state policies/standards/procedures, and revising design standards. One option commonly suggested is the development of a corridor management overlay district, whereby local agencies add additional requirements to those of the underlying zoning district. Typical applications of overlay

zoning involve access management, right-of-way preservation, and historic preservation or scenic management.

After conceptual alternatives are identified, they are evaluated to determine potential impacts. Issues considered vary from plan to plan and include topics such as roadway safety, traffic operations, impacts on connecting streets, accessibility of neighborhoods or commercial areas, and potential diversion of nonlocal trips through a residential area. Other considerations include financial feasibility (short- and long-term construction costs, long-term operation and maintenance costs), level of public support, aesthetics, and other criteria established by area stakeholders.

Selecting among alternatives involves extensive coordination with affected agencies and property owners, as well as broader public involvement activities. Affected parties are often contacted directly to identify their reactions and potentially acceptable solutions. One-on-one meetings with property owners are indicated in the literature as generally more effective than large public meetings in identifying mutually acceptable outcomes on specific issues. On a broader level, an effort was sometimes made to determine the extent to which each alternative is consistent with the established vision for the corridor.

One approach identified for evaluating alternatives was to involve the public in establishing specific evaluation criteria. For example, when conducting the Route 101/Mabury Road Area Freeway Access Study (San Jose, California), project planners worked with a task force of stakeholders to weigh the costs and benefits of each alternative against a set of common evaluation criteria before final selection. The task force was appointed by elected officials representing the study area to incorporate the diverse interests of the affected community. This approach helps to ensure that the selected alternatives reflect the interests and priorities of area stakeholders, including the affected agencies.

Another trend of relevance to alternative selection is the application of community impact assessment techniques. Concerns over environmental justice issues, and the need for more effective ways to address community issues in general, have led some state transportation agencies to develop community impact assessment programs as part of the National Environmental Policy Act of 1969 process for corridor evaluation. State transportation agencies with published handbooks or manuals related to community impact assessment include Florida, California, Illinois, and Wisconsin.

Implementation and Agreements

One of the last stages of corridor access management planning is a final public hearing to present the completed plan to the public and to make recommendations for

its approval. At that time, with public agreement and acceptance, each participating agency can move to adopt the plan. If multiple jurisdictions have been involved, final intergovernmental agreements need to be secured and the plan formally adopted in each jurisdiction. These agreements establish local responsibilities for carrying out the plan and may address needed updates of local regulatory codes and ordinances. It may also be appropriate within the context of the highway construction funding process to enter an agreement regarding each agency's role in helping fund the needed capital improvements and to reconfirm multijurisdictional commitment to the project. Including signed agency agreements with the completed plan helps to reinforce the ongoing commitment and support of the participating agencies.

A critical part of the corridor management process is to solidify strategies for implementing plan recommendations. An implementation action plan could be prepared to ensure that improvements are programmed and carried out systematically. Capital improvement programming requires estimation of roadway improvement costs, including the present and expected values of land, right-of-way, and any off-system improvements needed to implement the plan. The implementation plan may include immediate rapid response components or may incorporate major capital improvements. Full implementation of recommended improvements could take several years and be dependant on the availability of local, state, private, or federal funding, as well as on the support and action of different levels of government.

After final alternatives have been selected and funding sources for the improvements have been identified, an implementation schedule and timeline could be established to systematically phase in the improvements. This could address issues such as:

- Design and construction of other committed or essential projects, including those identified as needed for immediate improvements to safety;
- Design and construction of roadway and driveway projects;
- Design and construction of pedestrian, bicycle, or transit improvements;
- Off-system improvements, such as local street extensions;
- Design and placement of visual amenities, including signs and landscaping features;
- Comprehensive zoning or land-use amendments and development policy changes;
- ITS technology infrastructure;
- Other operational strategies and plans; and
- Identification and tracking of performance measures.

The recommended actions or improvements could then be scheduled and integrated into agency budgets, programs,

or work plans. An example is the Corridor Plan and the Access Control Plan for US-85 north of Denver, Colorado, which covers approximately 55 miles and identifies several million dollars of project needs over a 30-year period. The improvement plan sets forth priorities for annual and multiyear annual and multiyear budget approvals. The access control plan is a binding intergovernmental agreement that preserves the existing facility by governing day-to-day decision making on access permits to fit the goals of the long-range corridor plan. The access control plan establishes specific access points by type and location, directs the closure of certain points as opportunity is available, and allows access points that will support the goals of the long-range corridor plan.

Identified improvements in a corridor management plan may be funded by the state or regional transportation agency, the local government, the private sector, or some combination thereof. For example, if the plan calls for street extensions or service roads, the improvements could be implemented through public and private contributions. Developers could be required to set aside those rights-of-way needed for the road system as a condition of development approval, and the local government could construct and maintain the road. In some cases, developers may construct a portion of the road. In other cases, a municipality may opt to complete undeveloped segments of the roadway or initiate construction as an incentive for private participation.

Some state transportation agencies are prohibited from spending highway funds for off-system improvements. Others allow funding for specific improvements that fall within a given distance or that will help improve the safety or operation of the principal roadway. KDOT, for example, has a budget specifically for this purpose. The Colorado DOT engages in targeted local street improvements during highway reconstruction projects to advance its access management program. Philip Demosthenes, Colorado DOT stated: "When key elements and links in the local circulation hierarchy are missing, achieving greater access control during a major project is difficult and often a hardship on properties. Improving local circulation is in fact a project mitigation for certain social, economic, and community impacts."

Right-of-way preservation is another issue of importance to implementation. The time frame for completion of major capital improvements is typically 5 to 10 years or more, from concept to construction. During that time, property owners or developers may initiate development within the future right-of-way. The result is increasing right-of-way costs, business and severance damages, and legal fees associated with transportation improvements within a corridor that can break project budgets and impede the completion of necessary improvements. Therefore, the

implementation strategy should include methods for assuring the preservation of needed future rights-of-way.

Mapping future right-of-way needs allows developers and site designers to plan their site accordingly, so that the circulation patterns and building locations are compatible with the future roadway expansion. In turn, local agencies can place restrictions on building within the right-of-way of a planned facility without a variance and offset hardship on property owners by providing for interim use agreements, impact fee credits, density bonuses, or other mitigation measures (15).

Access rights could also be acquired to reduce access pressures in critical areas and to promote consolidated access. Establishing preplanned access points reinforces this technique and promotes coordinated development and the construction of local access roads.

MONITORING

Systematic monitoring of corridor projects over time is useful for determining progress in accomplishing corridor management objectives, as well as identifying the need for modifying the plan to accommodate changing circumstances. General recommendations for incorporating monitoring into corridor management include:

- Integrating monitoring requirements into project development,
- Developing a monitoring program and database at a state or regional level, and
- Conducting special studies to assess the effects of corridor management projects.

Through monitoring, government agencies can document the impacts of corridor management activities and provide feedback for similar future projects. Identifying actual impacts is particularly useful for addressing public

concerns related to various management strategies. It is also a way to identify and address any unforeseen adverse impacts of a transportation project on safety, operations, or the community. A commitment that significant unforeseen impacts will be addressed and resolved through monitoring may be useful for obtaining local support where anxiety is high over potential adverse outcomes.

A constraint in relation to monitoring is the need to improve the quality and consistency of data needed for corridor management. ITSs offer tremendous potential in this regard, as do geographic information systems. On a smaller scale is the need to improve documentation related to traffic accidents. Accident reports are frequently not detailed enough to determine whether issues related to the corridor (e.g., access, signage, addressing systems) were involved in the crash. One option is for transportation agencies to work with law enforcement officials and establish a traffic records system that enables them to correlate collision data with driver and roadway data.

Few of the state agencies responding to the survey of current practice had attempted to systematically track the performance of their corridor management efforts. One agency that is engaging in systematic monitoring is KDOT. KDOT has established baselines for various measures of effectiveness (MOEs) and is following up on these measures over time (16). The MOEs selected for monitoring were access density, crash rate, and travel time. A stacked line format was used to assess the MOEs as follows. Access density (points per mile) is plotted, then crash rate per million vehicle miles is added as the second series. Travel time, in hours per mile, is then added to plot the third series. All series are represented in one-mile increments. The results are assessed to determine appropriate solutions for the corridor. The plan is to repeat the assessment over time to establish a time series of the corridor MOEs and thereby determine progress, as well as use the information to assess relative costs and benefits of various types of corridor projects.

CORRIDOR MANAGEMENT TOOLS AND TECHNIQUES

Corridor management addresses two distinct elements—transportation and land use. Although these elements are distinct, they are also interdependent. Successful integration of transportation and land-use objectives requires flexibility and coordination. In addition, corridor management planning is both strategic and comprehensive. Agencies involved in corridor management must consider how each element interrelates and apply a variety of tools or techniques to accomplish the desired outcome. Below are some sample techniques used by state and local agencies to address corridor management objectives.

ACCESS MANAGEMENT

Access management is a process for providing and managing roadway access to land development, while preserving the safety and efficiency of traffic flow on surrounding roadways. It is achieved by managing the location, design, and operation of driveways, median openings, and street connections to a roadway. It also incorporates specific roadway elements to mitigate access impacts, such as auxiliary lanes, to remove turning vehicles from through traffic and raised medians to control left turns. Access management emphasizes the importance of maintaining a hierarchy of roadways, with greater control of access on roadways primarily intended to serve through traffic. Private access is directed to local and collector streets where feasible, and internal street systems and interparcel connections are promoted to improve overall accessibility. Access management can be carried out through roadway design, access permitting, subdivision or site plan review, and access management plans and regulations. Various elements of access management are described below.

Access Classification and Roadway Hierarchy

Roadway functional classification systems are used to establish and convey the purpose and function of each public road. Some public roads are intended to move traffic efficiently over long distances, whereas others are intended to provide convenient access to properties. Access classification systems help to carry out this concept on a system-wide basis by assigning access management standards to major roadways, based on roadway function and the desired level of access control. Access classification involves development of a hierarchical classification system,

determining appropriate access management standards for each classification, and assigning an appropriate classification to each roadway or roadway segment. Generally, the higher the classification, the greater the emphasis placed on through-traffic functions—with freeways being the highest classification. Lower classifications allow for increasingly less restrictive standards, such as more closely spaced access connections. Different access classifications may be assigned to segments of a particular roadway to accommodate existing circumstances or planning objectives.

Access Roads and Local Road Systems

A long-term planning objective for major corridors is to develop a system of side streets, parallel roads, and traffic control features to support existing and planned development. Access roads and other local roads can be used to provide access to developed areas along a major roadway corridor. Access roads are essentially local roads that run along the front (i.e., frontage roads) or rear of commercial properties and provide access to a specific developed area. They are useful for eliminating the need for driveway connections along major roadways. A preferred approach is to provide a well-planned network of local streets and parallel collectors. Benefits of an adequate supporting street system include improved accessibility of corridor businesses to abutting neighborhoods, more compact development patterns, and reduced need for individual driveway access to the principal roadway. Local roads, together with interparcel connections, provide alternative routes for short local trips, thereby helping reduce local traffic on the arterial.

Medians and Median Opening Spacing

Medians are effective for the control and management of left turns and crossing movements. They may be located at intersection approaches or along the full length of a road between intersections. There are a variety of median designs, allowing full or restricted turning movements. The presence, or absence, of a median barrier has a substantial effect on the safety and operations of major roadways. A synthesis of research on the impacts of median treatments concluded that the average crash rate on roadways with a nontraversable median is about 30% less than that of roadways with a continuous two-way left-turn lane (4). The safety benefits of medians are attributable to a variety of factors, including reduced potential for head-on collisions,

reduced traffic conflicts, and driver workload. Adequate separation of median openings provides space for deceleration and storage of turning vehicles out of the through-traffic lanes, thereby resulting in improved traffic operations and reduced potential for crashes. Medians can also serve as a refuge for pedestrians crossing a major roadway. Medians are especially useful for retrofitting problem areas, because they can be used to control left turns and reduce traffic conflicts in already developed corridors with frequent driveways.

Driveway Spacing Standards

Reasonable spacing between driveways is important to the safety and capacity of roadways, as well as the appearance of a corridor. Numerous studies of the safety effects of access spacing have found that crash rates increase as access density increases (4). This is because a proliferation of access points leads to numerous traffic conflicts that increase driver workload. Drivers make more mistakes and are more likely to have a collision when they are presented with complex driving situations. Conversely, simplifying the driving task contributes to improved traffic operations and fewer collisions. The minimum distance needed between driveways is greater on higher speed roadways, because at higher speeds drivers need more time and space to anticipate, react, and maneuver in response to a potential conflict.

Signal Location and Spacing

Management of traffic signals generally provides the greatest payoff for reducing congestion. Signalized access points on major roadways should fit into the overall traffic signal coordination plan. Failure to carefully locate driveways or median openings that later become signalized can cause substantial increases in arterial travel times. Poor signal placement may lead to delays that cannot be overcome by computerized signal timing systems. Uniform spacing of intersections and signals on major roadways enhances the ability to coordinate signals and ensures continuous movement of traffic at the desired speed. The degree of spacing necessary to maintain progression at reasonable speeds varies according to factors such as traffic volume and cycle length, and typically ranges from one-quarter to one-half mile.

Joint and Cross Access

Joint and cross access requirements provide for a unified on-site circulation plan serving several properties on a commercial corridor. They connect developments to allow for circulation between adjacent sites without using the arterial system and are a method of improving driveway

spacing where lot frontage is inadequate. Joint and cross access requirements are applied through development review, access permitting, or in accordance with an access management plan. On older developed strips, joint and cross access is achieved through individual negotiations with property owners. Some agencies offer incentives for cooperation, such as landscaping or assistance in driveway closure or reconstruction.

Where abutting properties are in different ownership, cooperation is generally encouraged but not required. However, the building site under consideration is still subject to the requirements, which are recorded as a binding agreement prior to issuing a building permit. A temporary driveway would be permitted for the site until abutting properties develop or redevelop, at which time the joint-use driveway would be constructed. Considerations in determining the feasibility of joint and cross access include existing and proposed buildings, parking and driveway locations, existing adjacent buildings, natural constraints, and compatibility of uses.

Corner Clearance

Corner clearance is the distance from an intersection of a public or private road to the nearest access connection. It is typically measured from the closest edge of the pavement of the intersecting road to the closest edge of the pavement of the connection along the traveled way. Corner clearance standards preserve good traffic operations at intersections, as well as the safety and convenience of access to corner properties. Supporting strategies in zoning include higher minimum lot size for corner properties or use limitations.

Driveway Location and Design

The location and design of driveways affect the ability of a driver to safely and easily enter and exit a site. If not properly placed, exiting vehicles may be unable to see oncoming vehicles and motorists on the roadway may not have adequate time to respond. If driveways connecting directly to the roadway are too narrow or have an inadequate turning radius, vehicles will be unable to quickly maneuver on and off the roadway. If a driveway and radius are too wide, it creates a safety hazard for pedestrians, bicycles, or other vehicles. Driveways also need to have adequate internal storage length, commonly referred to as throat length. Providing adequate throat length for driveways reduces the potential for conflicts at the driveway entrance, which in turn can result in vehicles having to wait in the through lane for entry to the site. Driveway location and design can be addressed through agency standards and through attention to these issues in the review of access or development requests.

Acquisition of Access Rights

Property owners have a bundle of rights in private property. Some of these rights can be separated and sold or acquired separately from the remaining property interest. For example, the right of access to an abutting roadway may be acquired through negotiation, purchase, or the power of eminent domain, and recorded in the county of record. This technique is most frequently used along freeways and at interchange crossroads, but increasingly is being used to preserve the function of major arterials and bypass facilities. The primary benefit of this technique is that the access restriction is recorded with the deed and therefore runs with the land, allowing the regulating agency to clearly retain the right of access control. Each new owner is subject to the requirement. Acquisition of access rights along cross streets is best done prior to development, when costs are low. This technique is particularly effective for preserving the function of freeway interchanges by acquiring access rights some distance from an interchange ramp along the crossroad.

Access Management Plans

Access management plans are best prepared in the context of a corridor improvement plan, when decisions are being made about future roadway design objectives. They provide for more specific treatment of the access management needs of a particular corridor segment and may be used to go beyond adopted spacing standards or to provide flexibility from standards in built-up areas. Access management plans identify median treatments, auxiliary lanes, signal location, and desired access points on a corridor, as well as opportunities to provide side-street access, consolidate access, or promote interparcel connections (joint and cross access).

An illustration of the access management plan for the K-150 Highway in Kansas is provided in Figure 4. The plan was established by the city of Overland Park, Kansas, when the corridor was largely undeveloped. The city enacted a development moratorium on new development proposals during the 2 years it took to complete the study. Since that time, the corridor has experienced substantial development. The plan provided for a divided multilane highway with median breaks at half-mile intervals, right-turn only access at quarter-mile points, and policies on driveway spacing. A system of parallel access roads was planned to help offset demand on the major roadway corridor and to provide alternative access for higher intensity development.

Access management plans are typically implemented through a combination of regulations, interagency or public/private agreements, and roadway improvement projects.

Some are more conceptual and serve as guidelines during development review or access permitting. Others are detailed plans or binding agreements that specifically indicate future property access on a parcel-by-parcel basis. In Colorado, for example, corridor access management plans on state highways are binding interagency agreements backed by regulatory powers and accompanied by a legal summary of the location and conditions for all current, temporary, and future access. This includes access points subject to future closure. Supporting information is kept on file, keeping the plan simple, direct, and enforceable.

Retrofitting Access in Built-Up Areas

Many corridors have sections that are already developed. These areas may never meet desirable or even minimum access management standards. In such situations, the existing property access is allowed to remain, but measures can be adopted to make some improvements or to avoid further deterioration. Retrofit strategies include the following:

- Selectively relocate or reconstruct existing substandard driveways.
- Negotiate driveway closure, reconstruction, or relocation during roadway resurfacing or improvement, or during development of an access management or corridor management plan.
- Require improvement of access during redevelopment or expansion of an existing use, including joint and cross access with abutting properties.
- Negotiate redesign of driveway access during sidewalk maintenance, reconstruction, or additions. (For example, the city of Cape Canaveral, Florida, used a sidewalk improvement project as an opportunity to selectively negotiate for the reconstruction or closure of substandard driveways along one of its major roadway corridors.)
- Consolidate access when adjacent parcels come under common ownership.
- Improve the traffic signal system through longer, more uniform intervals with advance traffic monitoring and control capabilities.
- Use raised medians or other traffic barriers at hazardous intersections or along certain roadway segments to control midblock turning movements and improve safety.
- Develop special corridor overlay zoning districts that are tailored to the circumstances of built-up areas.

Traffic Impact Assessment

Some issues in corridor management and site access may only be addressed at the development stage. Traffic impact

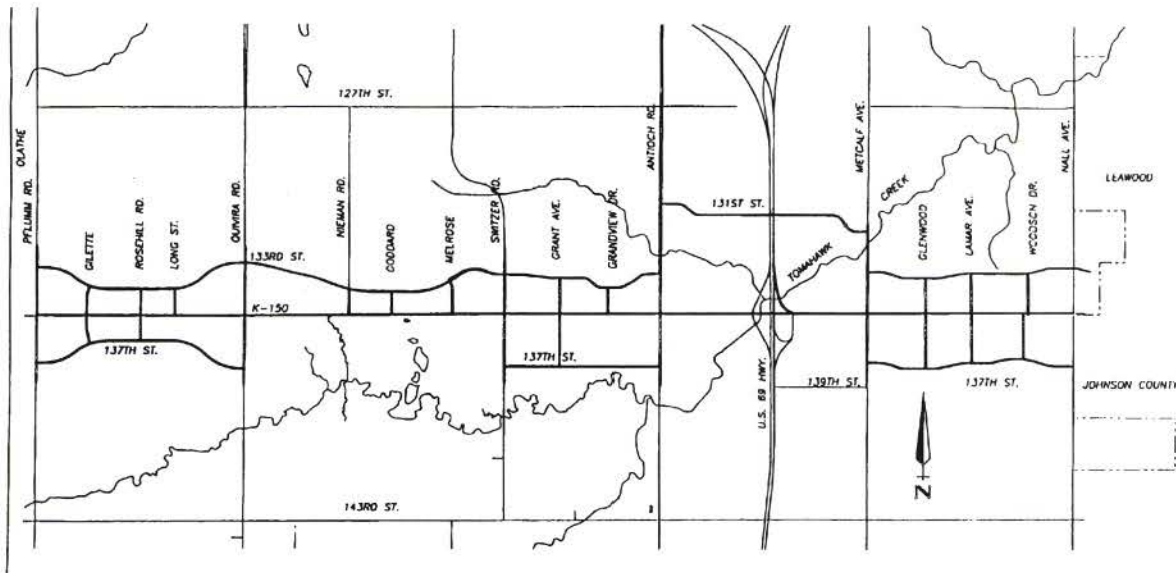


FIGURE 4 An access management plan for the K-150 Highway in Kansas.

assessment is a special study of the transportation needs and traffic impacts of development on surrounding roadway systems. Traffic impact assessment goes beyond the more general land-use and transportation analyses done for planning purposes to address the impacts of a specific development proposal on the transportation system. Such studies are typically used for development review, to identify needed roadway improvements, and to determine developer contributions to major roadway improvements.

Traffic impact analysis is essential for many access management decisions (17). Situations that may require a traffic impact analysis include rezoning, subdivision applications, building permits, plan amendments, permits for major driveways, site plan approval, and annexations (18). Traffic impact studies generally involve analysis of existing and future conditions, identification of mitigation alternatives, and site access and circulation review.

RIGHT-OF-WAY PRESERVATION

Right-of-way preservation is the application of various measures to prevent development in the right-of-way of a planned transportation facility. Several techniques have been identified for this purpose. Some of those relating to local government practices are described here. Not all of these techniques are authorized in every state.

Official Mapping

An official map establishes the location of future rights-of-way and guides the subdivision of land to ensure that new

plats conform to the existing and planned road system. It is an ordinance in map form, supplemented by regulations and administrative procedures. The map is usually, but not always, tied to an acquisition and funding schedule of capital improvements and may be extended and amended as needed. These maps are used to implement the traffic circulation system and capital improvements envisioned in the local comprehensive plan. Official maps translate the more general plan proposals for future streets, street extensions, and street widening into locations on a legally binding map. They are implemented through a regulatory ordinance that restricts building within mapped rights-of-way.

Local governments in Pennsylvania, for example, are authorized by enabling legislation to adopt official maps that establish the location of existing and proposed public lands or facilities outlined in the comprehensive plan. The maps may include public streets, transit rights-of-way, waterways, public parks, open spaces, pedestrian ways, floodways, and other public facilities.

Dedication and Exactions

Monetary payments or contributions of land may be required of an applicant by a local government as a condition of development approval. Such exactions are typically determined through open-ended negotiations between a local government and a developer. Subdivision regulations provide for dedication of land by developers for local streets and any site-related improvements that are needed to serve that development. This is different from mandatory dedication of rights-of-way for thoroughfares, which is subject to constitutional limitations because the

facility is needed by the general public, not just for the proposed development.

Mandatory dedication of rights-of-way for a major roadway improvement is best accomplished in the context of a capital improvement program. It is advisable to establish a method for determining the amount of land to be dedicated, based on the proportionate impact of a development on the major transportation facility. Compensation would need to be provided for any additional land needed.

Voluntary and informal measures can be effective in preserving transportation rights-of-way as well. Developers may voluntarily set aside or dedicate rights-of-way for improvements essential to the success of contemplated projects or redesign proposed developments to avoid structural improvements in the pathway of a planned future facility

Impact Fee Credits

Impact fees are assessed based on the number of new trips a development adds to the transportation network. If a development were assessed impact fees for transportation improvements, the local government could credit the developer for dedicating right-of-way and/or constructing the facility. The value of the dedication would be applied to and deducted from the total impact fees for that project. This effectively combines collecting the fee and purchasing the right-of-way into one transaction.

Interim Use Allowances

Right-of-way preservation programs seek to restrict structural improvements in transportation rights-of-way, but some uses may be allowed. These include uses with low structural investment, such as plant nurseries, outdoor storage yards, or stormwater retention that can be relocated or discontinued in the future. Allowances for interim use assure property owners of some economic use of property reserved for a future corridor until the right-of-way is acquired. Applicants must agree to relocate or discontinue the use in accordance with the terms and conditions of the development agreement.

Purchase of Development Rights

Development rights can be separated from other property rights or from the remainder of the property and purchased, donated, sold, or condemned for public purposes. A government agency may purchase development rights from a property owner, in essence, compensating the property owner for maintaining the property in an undeveloped

state. Property owners may typically farm the land or use it for purposes other than development.

Transfer of Development Rights (TDR)

TDR involves separating development rights on a parcel from the ownership of the land itself, and transferring these rights to another area or parcel. TDR programs establish a sending area and a receiving area. The sending area is usually established around a resource in need of protection from development and could include future transportation rights-of-way. The receiving area may be an area intended for higher intensity uses. The property owner has the ability to develop property in the receiving area at increased densities or sell the development rights on the open market to a prospective buyer. A typical application in Florida is a variation of this technique involving on-site density transfers from the right-of-way to the remainder of the site.

LAND DEVELOPMENT REGULATIONS

The ability to accomplish corridor management is greatly enhanced in areas where local governments participate in managing development through comprehensive planning, land development regulation, and development review. Local plans and ordinances provide a policy foundation for managing corridor development—a foundation that is carried out through development review and permitting actions.

Local governments manage development along new and existing corridors through land-use plans, zoning, subdivision regulations, and development review. These techniques can be used to preserve roadway capacity and effectiveness, and to promote an aesthetically pleasing environment. They are most effective when applied in combination to achieve the goals, objectives, and policies of an established plan. Local staff can work with applicants during development review to explore opportunities for preserving future rights-of-way or improving access through changes in subdivision or site design. Traffic impact assessment (described previously under access management) is one technique for identifying and mitigating the impacts of development on a transportation corridor. Other techniques are described here.

Flexible or Cluster Zoning

Flexible zoning relaxes land-use and lot dimensional criteria of conventional zoning to promote creative site design. It involves application of performance standards that specify a desired result without limiting how it will be achieved. Allowable density may be aggregated across an entire development site and transferred from one part of a site to another. This facilitates unified access and circulation

by integrating land uses into a unified design. It also increases opportunities for avoiding encroachment of development into future rights-of-way, by allowing flexibility to reduce lot dimensions while achieving the same gross density. A widely used regulatory technique that incorporates flexible zoning concepts is the planned unit development, which involves an extensive site plan review.

Lot Dimensional Requirements

Lot dimensional requirements are established in zoning and can be used to reduce access problems. Lots should be deeper and wider along arterials to provide adequate area for road widening and cross access or service drives, while maintaining sufficient area for development. Zoning district regulations establish the minimum lot frontage on the public roadway. For purposes of corridor management, it is best if the minimum lot frontage coincides with access spacing standards. This requirement could be waived where properties obtain access from an internal road.

Overlay Zones

Overlay zones add special requirements onto an existing zoning district, while retaining other requirements of the underlying zone. They are a popular method of managing access, because they can be used to tailor standards and requirements to the unique environment of each corridor. Overlay zones may be applied to a specified area on either side of a corridor and address a variety of issues, such as right-of-way preservation, allowances for interim use of right-of-way, setbacks, joint and cross access, driveway spacing, and limits on new driveways.

Setback Requirements

A setback is the area in which construction is prohibited, and is generally measured from the lot line to the point where improvements may be constructed. Adequate building setbacks help minimize property damage if the abutting roadway is widened. They also help to assure clear views at intersections, allow for emergency access, and buffer buildings from through traffic. In establishing setback requirements, it is important to account for ultimate street width and right-of-way needs. Setbacks may be increased along major transportation corridors for public safety, noise reduction, and aesthetics or other police power reasons. However, setback requirements imposed solely for the purpose of right-of-way preservation are likely to be viewed as unconstitutional if challenged. In areas where a pedestrian retail environment is desired, maximum setbacks are sometimes used to encourage the location of structures near the street. This strategy is beneficial to transit users, because it allows more direct pedestrian

access to commercial uses from the public sidewalk. Close setbacks are not appropriate, however, on roadways that are planned for future widening or where future widening is a strong possibility.

Subdivision Regulations

Subdivision regulations guide the division and subdivision of land into lots, blocks, and public ways. They are the means whereby a local government can manage the conversion of undeveloped land into building lots and assure that the necessary infrastructure is provided to serve those properties. They are also a means for assuring that access connections are properly placed and that lots in subdivisions abutting a thoroughfare are designed to obtain access from an interior road.

The importance of subdivision regulations cannot be overstated. They are essential for preventing substandard development and access problems, and they determine the pattern of land development in a community. Subdivision regulations establish review procedures for processing plats; information to be included on the plat; design principles and standards for lots, blocks, streets, public places, pedestrian ways, and utilities; required improvements, including streets, sidewalks, water, sewer, and curbs and gutters; and financing and maintenance responsibilities. They complement zoning, which establishes development standards related to land use, density, parking and loading, lot dimensions, and lot coverage.

Temporary Moratoria for Planning Purposes

Local governments may decide to temporarily suspend development activities for the purpose of studying a corridor and establishing appropriate plans and regulations. It is not unusual for property owners to attempt to push through development or rezoning approvals during the development of an access management plan or corridor management ordinance, to avoid being subject to new regulations. By enacting a temporary moratorium, the planning process is preserved and development pressures do not foreclose opportunities to protect right-of-way or manage access while the municipality is studying the corridor and developing a regulatory program. Temporary moratoria must be enacted in good faith, further a valid public purpose, and be of reasonable duration to withstand constitutional challenges. Legal authority to use this technique varies from state to state.

SCENIC MANAGEMENT

The primary threat to the integrity of scenic roads is the gradual, incremental change in land use along or within view of the road. The incremental nature of these impacts

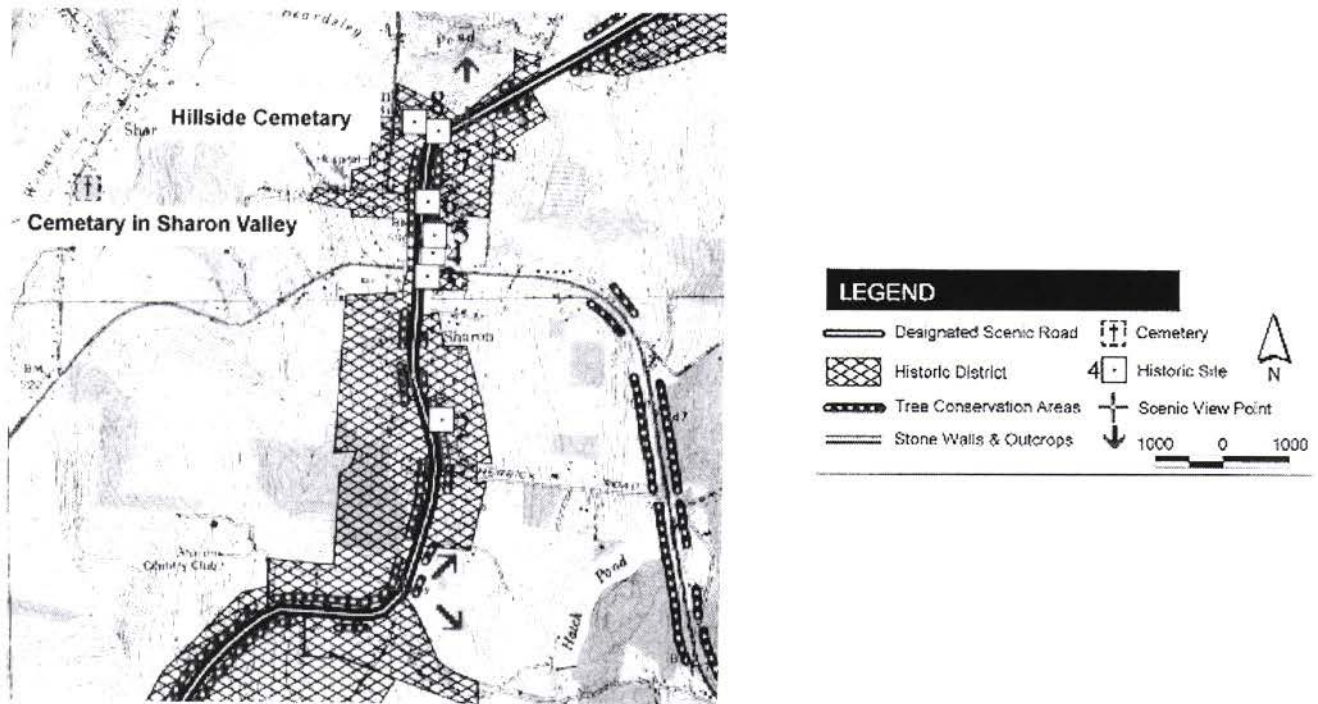


FIGURE 5 Significant features map for Scenic Routes 41 and 4 in Sharon Connecticut, Sharon Scenic Corridor Management Plan.

makes them especially difficult to manage, as does the diversity of features and views that combine to create scenic or aesthetic appeal. Every new structure, removal of mature trees, converted farm field, or drained wetland can reduce the scenic character of a road. Adding to the problem is that typically no one agency is responsible for managing corridor resources. Corridor management plans for scenic roads involve identifying corridor resources that contribute to the scenic character of the road and coordinating the management of those resources (Figure 5). Such efforts require a combination of proactive planning, broad-based collaboration, and extensive public involvement. Suggested elements of a corridor management plan for scenic highways are provided here (19).

1. A map identifying the corridor boundaries, location of intrinsic qualities, and land uses in the corridor.
2. An assessment of the intrinsic qualities and their "context."
3. A strategy for maintaining and enhancing each of those intrinsic qualities.
4. The agencies, groups, and individuals who are part of the team that will carry out the plan, including a list of their specific, individual responsibilities. Also, a schedule of when and how you will review the degree to which those responsibilities are being met.
5. A strategy of how existing development might be enhanced and new development accommodated to preserve the intrinsic qualities of your byway.
6. A plan for on-going public participation.
7. A general review of the road's safety record to locate hazards and poor design, and identify possible corrections.
8. A plan to accommodate commercial traffic while ensuring the safety of sightseers in smaller vehicles, as well as bicyclists, joggers, and pedestrians.
9. A listing and discussion of efforts to minimize anomalous intrusions on the visitor's experience of the byway.
10. Documentation of compliance with all existing local, state, and federal laws about the control of outdoor advertising.
11. A plan to make sure that the number and placement of highway signs will not get in the way of the scenery, but still be sufficient to help tourists find their way. This includes, where appropriate, signs for international tourists who may not speak English fluently.
12. Plans of how the byway will be marketed and publicized.
13. Any proposals for modifying the roadway, including an evaluation about design standards and how proposed changes may affect the byways' intrinsic qualities.
14. A description of what you plan to do to explain and interpret your byways' significant resources to visitors.

Effective scenic management requires obtaining a commitment from the many users and managers of corridor resources in order to be sensitive to the scenic character of

the corridor and to contribute to its preservation. For the road management agency, this may mean flexibility in the application of design standards or maintenance procedures. For land-use agencies, this may mean instituting overlay zoning with incentives or tighter building standards. For property owners or organizations, this may mean land preservation efforts through voluntary limits on development or fund raising for direct land purchase or preservation easements. For tourism organizations and economic development councils, this may mean advertising campaigns that build on the scenic nature of the local road network and discourage activities that would diminish the resources that contribute to their scenic beauty.

Another technique, aimed at minimizing environmental degradation from infrastructure projects, is to promote co-location of transportation and utility corridors. Infrastructure and utility projects, such as roads, telecommunications lines, railways, and pipelines are typically developed with minimal coordination. This results in redundant corridors, disruption to neighborhoods, and increased degradation of the landscape and natural ecosystems. Multi-use corridors offer the potential to minimize community and environmental impacts and reduce overall development costs. For example, an ongoing effort is underway in Florida to link natural areas with a network of greenways. Inevitably, large infrastructure projects must cross these greenways. Rather than disrupting a greenway in several locations, these projects could be co-located in multi-use corridors. However, the benefits of co-location may be outweighed by the costs of rerouting a facility or widening a corridor.

To evaluate these issues, a pilot project is currently being undertaken by the Hillsborough River Greenways Task Force—a broad coalition of industry, environmental, government, and civic leaders in the Tampa area formed to preserve the natural qualities of the Hillsborough River Greenway. The project, called Coordinated Linear Infrastructure Projects or CLIP, involves in-depth analysis (using geographic information systems) of the economic aspects of co-locating infrastructure projects in selected transportation corridors within the Hillsborough River Greenway area as compared with traditional infrastructure projects. The analysis of costs and benefits of co-location is addressing financing arrangements as well as incentives, such as streamlined environmental permitting.

COMMUNITY DESIGN

Increasingly, corridor management initiatives are looking to land-use changes and community design as a way to reduce traffic demand or support transit use on a major roadway corridor. Two of the more popular approaches include traditional neighborhood development (TND) and

transit-oriented development (TOD) or transit-friendly land-use strategies.

Traditional Neighborhood Development (TND)

TNDs are aimed at accomplishing compact, integrated neighborhoods and communities. Similar in emphasis to TOD, described in the following section, TNDs strive to bring the various activities of home, shopping, and work within walking distance. Design elements include short blocks, narrow streets, grid street systems, street trees, on-street parking, and wide sidewalks. Residential areas are located within a short walking distance of the town center and neighborhood services.

The combination of higher densities, compact form, and a mix of land uses offers the potential to reduce dependence on the automobile. The design concepts also produce an interesting and appealing living environment. As such, TND concepts are of growing interest as a corridor management technique—both to improve the character of the built environment and to reduce traffic demand. Clearly, TND strategies have the potential to improve the character of the built environment, promote walking and bicycling, and generally advance the aesthetic or economic development goals of corridor management programs. However, whether TND developments will have the desired effect on reducing automobile trips or shifting mode choice remains unclear (20).

Transit-Oriented Development (TOD)

TOD is a method of reinforcing transit use on transportation corridors. Land-use patterns can often be adverse to transit, especially in suburban areas. The tendency toward strip commercial development along major roadways and large single-use land areas increases individual reliance on the automobile and makes transit use impractical. Transit, walking, and bicycling tend to operate more efficiently in communities with a finer mix of land uses and an interconnected street system. Transit also benefits from a good pedestrian environment at the beginning and end of the trip. TOD is a design concept developed to address these issues.

TOD combines housing, shops, restaurants, and offices to create walkable, mixed-use neighborhoods. It applies a system of connected streets and sidewalks and a mix of commercial and residential land uses and densities within a one-quarter mile radius of transit stations or major transfer areas. Facilities needed on a regular basis (dry cleaner, grocery store, day care center, newsstand, video store, etc.) are placed at or near the transit station (Figure 6). Numerous transit agencies have incorporated TOD design guidelines

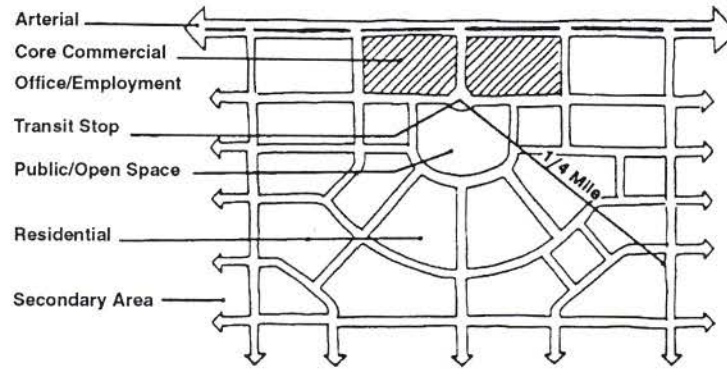


FIGURE 6 Design concept for transit-oriented development.

and other transit-friendly land-use strategies into their handbooks and manuals in an effort to advance these concepts.

TOD proposals often involve joint development strategies or public/private partnerships. For example, a popular concept is to use tax increment financing to finance infrastructure improvements to attract development, with revenue generated from development used to pay off revenue bonds. Joint development projects involve capturing the development potential around major transit station areas to offset the costs of providing transit. Land owned by a mass transit agency may be provided for dense private development that supports transit ridership, and revenue generated from the sale or lease of the land is used to support the transit system.

In 1999, the California legislature approved a bill authorizing Bay Area Rapid Transit (BART) and other Bay Area transit providers to acquire land around transit stations for transit-oriented joint development. The transit agencies will now be able to purchase private property within one-quarter mile of stations for joint development purposes. The bill requires the transit agencies to adhere to local zoning and planning regulations for this purpose, and limits them to purchases from willing sellers. The bill does not authorize acquisition by eminent domain.

Although TOD is typically associated with a particular design concept, not all transit development fits this mold. An example of joint development that supports transit is the Lindbergh Center site in Atlanta, which will be a multi-use development consisting of commercial office towers, retail stores, restaurants, and residential buildings (21). All of the planned development will be constructed on property already owned by the Metropolitan Atlanta Rapid Transit Authority (MARTA) surrounding the Lindbergh MARTA station and headquarters building. BellSouth will occupy over 1,000,000 square feet of commercial office space in this new development.

STREET NETWORK AND CONNECTIVITY

As communities grow and land is subdivided for development it is essential to assure continuation and extension of the existing local street system. A balanced and planned hierarchy of local, collector, and arterial roadways is essential to the overall efficiency of a transportation system. Dead-end streets, cul-de-sacs, and gated communities force more traffic directly onto major roadways, even for short local trips. Fragmented street systems also impede emergency access and increase the length of automobile trips. Providing alternative routes for short, local trips helps to reduce traffic demand on major roadways. Other benefits may include fewer vehicle miles traveled, improved accessibility of developed areas, fewer access problems on major roadways, and greater opportunities for walking, bicycling, and transit use.

Local and regional street patterns and connections can be established through the comprehensive planning process, capital improvement programs, and the use of official street maps, street design requirements, and subdivision regulations (see also, Right-of-Way Preservation, discussed previously). Subdivision regulations guide the division and subdivision of land into lots, blocks, and public ways. They provide an opportunity to ensure proper access and street layout in relation to existing or planned roadways. Subdivision regulations carry out the planned roadway hierarchy by establishing residential street classification and design standards.

Local subdivision codes may require new subdivisions to continue or extend planned streets or to connect to the surrounding street system. When land is subdivided, property owners could be required to design a cul-de-sac or right-of-way so that it terminates at the adjacent property line. When the abutting property is subdivided, the cul-de-sac may be removed and the road extended into the adjacent property. Neighborhoods can also be interconnected with dedicated pedestrian and bicycle easements for direct

connections to neighborhood stores, schools, community facilities, transit, or other neighborhoods.

Local governments can also promote the use of access spurs to interconnect residential and commercial areas. A spur road is an improved dedicated right-of-way that provides access between adjacent tracts. A temporary spur can also be provided for emergency access until an additional primary access can be provided. Joint and cross access requirements can be used to promote internal circulation between adjacent commercial developments. This could involve a system of dedicated easements to interconnect parking lots or to provide service roads.

The primary concern related to connectivity of residential street systems is the desire to limit through traffic in residential areas. Cul-de-sacs, dead-end streets, or gated neighborhoods are methods often used to discourage through traffic. These techniques are sometimes taken to the extreme, however, providing only one way into and out of the subdivision and forcing all trips onto the arterial system. A preferred approach is the use of modified grids, circuitous through streets, and curvilinear street designs that interconnect with the surrounding neighborhood, while discouraging convenience of the route for large volumes of through-traffic movement. Pedestrian ways can also be incorporated into site plans to interconnect neighborhoods, while excluding vehicles.

ITS AND OPERATIONAL STRATEGIES

The corridor management plan may call for implementing various operational strategies. Examples include improvements in signal coordination and timing, updating traffic control devices, providing high-occupancy vehicle lanes, and installing equipment for arterial surveillance and management. A complete overview of operational strategies can be found in the Institute of Transportation Engineer's text, *A Toolbox for Alleviating Traffic Congestion and Enhancing Mobility* (22). In the following section is a discussion of ITSs and incident management applications in corridor management.

Intelligent Transportation Systems

Intelligent Transportation System (ITS) is a term for technologies that can be applied to a transportation corridor to enhance its operation and performance. Some of the technologies are new and others have been in existence for many years. The technologies include advanced information processing, communications, and electronics systems. Through ITSs, real-time information can be gathered and exchanged by means of a variety of media with individual users and among public agencies. Potential applications

include, but are not limited to, incident management, traffic signal timing, data collection and monitoring, railroad crossing warning systems, in-vehicle navigation systems, warning signs to motorists, electronic toll collection and fare payment, and transit monitoring devices.

Effective deployment of ITSs can greatly improve traffic operations and safety and reduce vehicle emissions caused by stop-and-go traffic. For example, ITS technology could allow staff in a centralized information center to monitor corridor conditions and make immediate decisions to enhance corridor operation, such as observing a crash, sharing condition information with other agencies and service providers, dispatching a tow truck and emergency vehicles, and warning approaching vehicles of the incident and directing those vehicles over an alternate route around the incident location.

Additionally, ITS technologies could cost-effectively standardize and automate corridor and system-wide data collection activities for a wide variety of performance monitoring, data collection needs, and evaluation and reporting. Data needs that could be met include traffic volume, average speed, vehicle occupancy, access/egress, and pedestrian and bicycle activity. This information could be tracked over time to determine if corridor plans and policies have had the desired effect and to help spot improvement needs.

A primary obstacle to effective use of ITS technology has been the lack of coordination among the many agencies and jurisdictions with responsibility for managing a corridor or transportation system. Lack of coordination can lead to installation of incompatible ITS applications by neighboring managing agencies, thereby creating fiscal and operational inefficiencies. Establishment of an ITS "architecture" or plan for a transportation system or corridor is an effective mechanism for coordinating ITS decision making. It would also be beneficial to directly integrate ITS strategies into the long-range transportation planning and programming process.

In 1996, the USDOT funded four projects under the ITS Model Deployment Initiative as a first step toward building a coordinated intelligent transportation infrastructure across the United States and to showcase ITS technologies. One of these projects, called AZTech, involved applications on eight arterial corridors crossing various borders. Executive and technical oversight committees were formed with state, county, municipal, and private sector representatives to coordinate and guide project activities. AZTech objectives for the various corridors included:

- Establishing an integrated traveler information system, where up-to-the-minute statewide traffic information

will be made available to virtually any traveler through public-access telephone, television reports, and personal paging for subscribers.

- Coordinating with 911 emergency personnel, police and fire departments, and the Department of Public Safety on accident investigation and routing emergency vehicles.
- Installing ITS equipment in buses that operate on major corridors, allowing bus drivers to transmit their location to information centers and keep travelers apprised of schedule status.
- Expanding and integrating the existing transportation-management system for the Phoenix metropolitan area using new ITS technologies. An integrated transportation-management system will coordinate freeway and traffic signal systems across jurisdictional boundaries, thereby improving safety standards and facilitating regional mobility.

Montgomery County, Maryland, has invested extensively in ITS technologies to help manage its transportation system. Among these ITS infrastructure and operational strategies are changeable lane-use signs for two specific, high-traffic corridors, allowing reversible lane operations. One corridor is a six-lane facility with three lanes in each direction during the off-peak hours. During rush hour, the signs are activated to alter the lane configuration to four lanes in the peak direction and two lanes in the opposite direction. Another corridor includes a center two-way left-turn lane that is transformed to a through lane during peak hours in the direction of traffic. These options increase roadway capacity in the peak-hour direction without requiring the construction of additional through lanes. Other applications of these strategies include variable lane-use and turn restrictions at intersection approaches during specific times of day and plans to use the signs for turn lane control and to respond to actual demand on a real-time basis.

Incident Management

Even the best-planned corridors can fail on occasion because of an unexpected roadway incident. Roadway incidents, such as accidents, vehicle breakdowns, and dropped debris, are a common cause of roadway congestion and can result in hours of driver frustration and delay. To address this issue, a growing number of transportation agencies are establishing incident management programs, particularly through their ITS activities. Benefits of planned incident management include quick detection, verification of the incident, rapid response and clearance, greater safety of response personnel, coordinated diversion of traffic, and rapid dissemination of information to motorists. [See also, *NCHRP Synthesis 279: Roadway Incident Diversion Practices* (23)].

One example is the Incident Management Steering Committee for the greater Hartford (Connecticut) area, coordinated by the Capital Region Council of Governments. The committee is comprised of representatives of state and local police, local fire services, emergency medical services, towing companies, state agencies [Connecticut DOT (ConnDOT) and Environmental Protection], and regional planning agencies. The goal is increased coordination, cooperation, and communication among all responding agencies.

ConnDOT and local police identified and established preapproved traffic diversion routes in the event of an incident on area interstate highways. Considerations included traffic signal control, diversion signal timing plans, truck routing, and necessary police workforce. Information on the diversion routes was distributed to police departments along two of the Interstate highways and has been effective during major highway incidents. A formal notification procedure has also been developed establishing that local towns will be automatically notified when a highway closure of more than 5 minutes is expected. Radio facilities are being upgraded and portable radios will be provided for local fire department, state police, and state agency use when they are called upon to coordinate a major response effort. Other planned efforts include an educational campaign designed to encourage motorists to remove vehicles from through lanes during minor traffic accidents.

TRANSPORTATION DEMAND MANAGEMENT (TDM)

TDM involves a broad range of strategies aimed at influencing travel behavior and improving the efficiency of the existing transportation system. TDM includes measures aimed at encouraging alternatives to the single-occupant vehicle, such as carpools, vanpools, transit, bicycles, walking, limits on parking, and preferential parking for carpools. Other strategies include telecommuting and alternative work hour programs such as compressed work weeks or flextime, which remove commuters from peak-hour traffic or eliminate the commute altogether. Some strategies are applied on a regional basis, whereas others may be targeted to a corridor or activity center level.

TDM programs are often carried out by transportation management associations (TMAs). TMAs are nonprofit groups that provide TDM services and apply transportation demand management techniques for employers in major activity centers. A TMA in Orlando, Florida, for example, convinced the local university to stagger class schedules by 15 minutes. The result was an 18 percent reduction in vehicle trips during the peak period (24). In South Beach (Miami), Florida, the Miami Beach TMA operates a shuttle 20 hours per day, 7 days per week that carried nearly one million riders in its first year (1998). Most TMAs also sponsor

guaranteed ride home programs that usually provide free taxi rides home for carpoolers and transit riders who carpool but need to leave work early for a personal emergency.

Vanpooling programs have been established across the nation by employers, nonprofit organizations, and government agencies. In Minneapolis, Minnesota, 3M started its vanpool program as a more cost-effective option to building a huge parking deck, and saved the company millions of dollars. In Seattle, Washington, a combination of high-occupancy vehicle lanes and employer subsidies has resulted in over 1,200 vanpools operating each day (25). Considering that each vanpool typically removes eight or more vehicles from the road, vanpools can help reduce congestion in the peak period in given corridors.

Telecommuting programs that enable individuals to work at home are another method of reducing trips. The number of telecommuters in the United States rose to 15.7 million as of mid-year 1998, according to research conducted by Cyber Dialogue, a New York-based research and consulting firm (26). More than 11 million people reported working as telecommuters in 1997, compared with 8 million in 1995 (27). Today, most telecommuting arrangements are part-time, with the typical participant telecommuting 1 to 2 days per week. Although the transportation impacts of telecommuting may be relatively small in comparison with other techniques, shifting the need from travel on the highway network to the telecommunications network does relieve some of the peak-period vehicle trip demand on a given corridor, although studies indicate that teleworkers still make peak-hour trips for other purposes.

TRAFFIC CALMING

Traffic calming involves measures to discourage cut-through traffic in residential areas or to reduce speed where pedestrians and bicyclists conflict with motor vehicle traffic. It is essentially a method of dealing with conflicts between through traffic and nontraffic functions, such as walking, bicycling, shopping, and community life. Through minor changes in roadway design or landscaping drivers can be made to intuitively adapt their behavior and drive more slowly, thereby improving safety for pedestrians, bicyclists, and other motorists. Such changes may be as simple as landscaping a corridor (being careful to maintain adequate sight distance for turning and crossing vehicles and pedestrians) or as complex as road realignment. Design measures may include marked crosswalks, relocation or removal of parking, changes in the surface or texture of pavement, use of roundabouts, reduction of lane widths, or the use of bulb-outs or chicanes.

It is important to note that improved corridor management can also reduce traffic impacts on neighborhoods.

This is because corridor management helps to preserve the efficiency of the primary arterial roadway, thereby reducing the need for drivers to use local neighborhood roads to avoid congestion.

In response to growing interest in traffic calming and alternative roadway designs on state highways, FDOT established a policy called Transportation Design for Livable Communities (28). The policy establishes that FDOT will consider incorporating traffic calming and related design strategies and seeks to clarify when such features are appropriate. Principles for considering Transportation Design for Livable Communities features include:

- Safety of pedestrians, bicyclists, motorists, and public transit users;
- Balancing community values and mobility needs;
- Efficient use of energy resources;
- Protection of the natural and built environment;
- Coordinated land-use and transportation planning;
- Local and state economic development goals; and
- Complementing and enhancing existing standards, systems, and processes.

COORDINATION AND PUBLIC INVOLVEMENT

Coordination and public involvement are both integral to corridor management, whether for plan development or for implementation and monitoring. Corridor management initiatives reviewed for the synthesis typically involved establishing some level of formal stakeholder oversight, such as a project steering committee. Many also involved policy and technical working groups and citizen advisory committees to facilitate intergovernmental coordination and public involvement. Additional methods identified included stakeholder interviews, public meetings, workshops, one-on-one meetings, special events, opinion surveys, project newsletters, visioning initiatives, and conferences or symposiums.

A variety of strategies have been employed across the country in an effort to improve intergovernmental coordination on corridor management planning and implementation. In the mid-1990s, the Institute for Public Policy and Management at the University of Washington reviewed strategies used at various levels of government to strengthen the link between transportation and land use through corridor management (29). The primary strategies identified were:

- corridor management authorities or commissions,
- negotiated intergovernmental agreements, and
- grassroots initiatives and collaborative planning efforts.

A central challenge in corridor management is the separation of public authority over transportation and development

issues. One solution is to consolidate authority over corridor development and improvement planning under a single joint entity. In 1949, the California legislature enacted a statute called the Joint Exercise of Powers Act for exactly that purpose. The act enables two or more agencies to combine powers under a joint authority. The resulting authority has access to any of the powers of the sponsoring agencies. For example, an authority established to manage a transportation corridor would become a special purpose public entity with the powers of transportation and land-use planning, implementation, and operations. A corridor management authority offers powers to local public and private entities, independence, and a high degree of permanence. A written agreement would govern operations and specify the terms and conditions for decision making. To date, however, no agencies have established a joint authority under this act.

There are several collaborative planning efforts reported from around the country. The 76 member US-301 Task Force, established by the Maryland DOT and the Chesapeake Bay Foundation, was formed to explore environmental protection, transportation, and growth management issues in the US-301 corridor. The US-1 Collaborative (whose membership includes business, government, and other interested parties) was formed by the New Jersey DOT and the Tri-State Transportation Campaign to explore alternatives to road widening on a 10-mile segment of the densely developed highway. The Willamette Valley Livability Forum was formed by the Oregon DOT to explore ways to preserve open space, farmland, and the quality of life in the fastest growing 10 county area of the state.

In response to citizen concerns and legal challenges, a two-pronged strategy was developed in 1993 to coordinate land-use and transportation decision making for the improvement of scenic Paris Pike in the Bluegrass region of Kentucky. The first prong involved creating a task force comprised of government representatives and local nonprofit land trusts and empowering it to oversee roadway design and construction. A memorandum of understanding was signed by agencies and organizations on the task force, specifying the type of roadway and the process for its design and construction. The second prong was creation of a multijurisdictional Corridor Land Use Commission. The commission is a permanent entity managed by a governing board representing each of the local jurisdictions in the corridor. Responsibilities of the commission include development of a corridor land-use plan, ensuring its adoption by each jurisdiction, and monitoring implementation.

FUNDING

Identifying and obtaining funding, and sustaining funding for extended time periods, are pressing issues in corridor

management—whether the need is for special studies, plan development, or implementation. Characteristics of the more successful initiatives were imagination, partnering with other groups or agencies, and a willingness to seek additional funding sources. The survey of state practices indicated that TEA-21 surface transportation program funds were the most frequently used funding source for corridor management projects. Local agency partnering and TEA-21 enhancement funds were the next most frequent response, along with state funding sources. Transportation Development Districts funds were the least used.

A variety of funding sources were used in the corridor management programs and projects reviewed for the synthesis. The following is an overview of the possible funding sources that were identified. These sources can be applied in any number of ways, depending on regulations within each jurisdiction.

Bonds

A bond is a “certificate or evidence of a debt on which the issuing company or governmental body promises to pay the bondholders a specified amount of interest for a specified length of time, and to repay the loan on the expiration date” (30). Bonds are sold to finance improvements and may require voter approval (see also, Tax Increment Financing).

Development Agreements

A local government operating under fiscal constraints may not be able to provide certain capital facilities needed by a new development. In this situation, a local government may agree to approve the development plan provided the developer agrees to supply the transportation improvements, or in some cases the transportation right-of-way, needed to support the development. Any improvements are turned over to the public agency, which is responsible for maintenance and operation. This is a voluntary approach, in contrast to a legislated approach, although the resulting agreements are binding. The process also typically involves some concessions on the part of the municipality.

Enhancement and Safety Funds

These are part of the surface transportation funds, designated for special purposes, and are coordinated through each state DOT. Safety funds are allocated toward projects that increase safety or improve upon situations that may currently be hazardous. Enhancement funds are flexible and address a range of issues that may apply to corridor management efforts. According to the FHWA, activities

that qualify for TEA-21 funding as transportation enhancement activities include the following:

- Provision of facilities for pedestrians and bicycles.
- Provision of safety and educational activities for pedestrians and bicyclists.
- Acquisition of scenic easements and scenic or historic sites.
- Scenic or historic highway programs (including the provision of tourist and welcome center facilities).
- Landscaping and other scenic beautification.
- Historic preservation.
- Rehabilitation and operation of historic transportation buildings, structures, or facilities (including historic railroad facilities and canals).
- Preservation of abandoned railway corridors (including the conversion and use thereof for pedestrian or bicycle trails).
- Control and removal of outdoor advertising.
- Archaeological planning and research.
- Environmental mitigation to address water pollution due to highway runoff or reduce vehicle-caused wildlife mortality while maintaining habitat connectivity.
- Establishment of transportation museums.

Exactions

Monetary payments, contributions of land, or infrastructure improvements may be required of an applicant by a government agency as a condition of development approval. Such exactions are typically determined through negotiations between a municipality and a developer. Local authority to require off-site exactions and what constitutes an off-site exaction versus a site improvement varies from state to state. Regulatory exactions must be roughly proportional both in nature and degree to the impacts of the regulated activity.

Federal Programs

A variety of programs and funding sources exist within the realm of the federal government, beyond those already mentioned. Because of the numerous branches of the federal government and associated restrictions in each program area it can take time to explore possible funding sources. Some areas where funding may exist include the Department of Agriculture, Department of Commerce, Environmental Protection Agency, Small Business Administration, Economic Development Administration, Federal Emergency Management Agency, and the Department of Housing and Urban Development.

A new program under the FHWA is the National Corridor Planning and Development Program. This program

provides funding for planning, project development, construction, and operation of projects that serve high-priority corridors throughout the United States. States and MPOs are eligible for discretionary grants for corridor feasibility, corridor planning, multistate coordination, environmental review, and construction.

Fundraising

A variety of fundraising activities can be used to encourage local businesses, property owners, or philanthropic groups to contribute financial assistance to corridor management activities. Specific actions can be taken to encourage financial contributions toward capital improvements (see, for example, the Woodward Avenue Case Study in chapter 5).

Gas Taxes

In essence, a gas tax is a user fee that enables a government to tax gasoline for the purpose of funding transportation expenditures. Gas taxes are of central importance to assuring adequate transportation funding. Each state has its own legislation in regard to gas taxes, which determines how they can be applied. Florida, for example, is a leader in the use of local option gas taxes for transportation funding.

Grants

Grants come in a variety of forms and are offered by a variety of government and public agencies, private sources, and foundations. Grants are monetary contributions that do not have to be repaid. They are usually distributed through an application process, and may be used for any number of purposes including, but not limited to, scenic byways, historic preservation or renovation, transportation, transit, downtown redevelopment, neighborhood redevelopment, bicycle/pedestrian facilities, and environmental protection. Some corridor management projects may qualify for TEA-21 Enhancement Grants.

Impact Fees

Where state law allows, local governments may impose impact fees on development to help finance the cost of improvements or services, such as roads, utilities, stormwater management, and sometimes schools, parks, fire stations, libraries, or other public facilities. Impact fees are determined by assessing the projected impact a development will have on surrounding public facilities. The fees must be equitable and may not exceed the projected impact a development will have on the related facilities. In this way, developers

contribute their fair share of the cost of providing needed facilities.

Local Agency Partnering

Local agency partnering involves the uniting of local agencies to achieve an end that will benefit all parties. The parties voluntarily sign a contract that specifies a financial commitment, as well as a commitment to implementation. According to survey responses, this is the second most widely used form of financial support. A corridor management project may impact several districts and the lack of participation by any one of them could negatively affect the others.

Operations—Eligibility and Funding Sources

Operating costs for traffic monitoring and control systems, such as integrated traffic control systems, incident management programs, and traffic control centers, are eligible for federal reimbursement from the National Highway System (NHS) and Surface Transportation Program funding. Operating costs are defined as labor costs, administrative costs, costs of utilities and rent, and other costs associated with the continuous management and operation of traffic systems. Integrated traffic control systems, incident management programs, computerized signal systems, motorist information systems, TDM facilities, and traffic surveillance and control equipment are eligible under this program. Congestion Mitigation and Air Quality Program funds may be used for operating costs for a 3-year period, as long as those systems measurably demonstrate reductions in traffic delays.

Public/Private Partnerships

A public/private partnership is “the pairing and cooperation of public and private resources to achieve an end that will benefit both the private developer and the public sector” (31). Public/private partnerships can be beneficial to all participants in corridor management. The local government may benefit from the construction of a needed facility at a low cost and in a more expeditious manner than could be accomplished by the government. The private enterprise may benefit from the profits earned through operation of the facility. Two of the case studies reviewed for the synthesis, Woodward Avenue (the Detroit metropolitan area) and US-1 (Florida), involved private sector contributions as well as public resources.

Reserve Funds

In reserve fund financing, funds are accumulated in advance for capital improvements. The accumulation may result

from surplus or earmarked operational revenues, funds in depreciation reserves, or the sale of capital assets.

Sales Tax

Sales taxes are “a state or local-level tax on the retail sale of specified property or services. It is a percentage of the cost of such. Generally, the purchaser pays the tax, but the seller collects it, as an agent for the government” (30). In general, to levy a sales tax for the purpose of funding special projects (such as transportation) requires a public referendum.

Special Assessment Districts

Special assessment districts levy a tax on property owners who will benefit from specific improvements. These may be initiated by local governments, developers, or property owners wishing to expedite the improvement(s). Property owners must not pay more than they receive in special benefits, and the assessments are typically uniform across a district. Local governments must be careful in rezoning properties within the district to ensure that expected revenues are not reduced.

State Infrastructure Banks

The NHS Designation Act of 1995 established the State Infrastructure Bank (SIB) pilot program. The act authorized USDOT to enter into cooperative agreements with up to 10 states for the establishment of SIBs or multistate infrastructure banks for making loans and providing other assistance to public and private entities implementing or proposing to implement projects eligible for assistance. SIBs are intended to complement federal programs by supporting projects that can be financed with loans or that can benefit from credit enhancement. As loans are repaid the initial capital is replenished, and it can support a new cycle of projects. SIBs maximize the purchasing power of Surface Transportation Funds.

TEA-21 established a new SIB pilot program under which four states—California, Florida, Missouri, and Rhode Island—are authorized to enter into cooperative agreements to set up infrastructure revolving funds eligible to be capitalized with federal transportation funds. This new SIB program gives states the capacity to increase the efficiency of their transportation investment and leverage federal resources by attracting non-federal public and private investment. This program provides greater flexibility by allowing other types of project assistance in addition to the previous reimbursable grant. The 34 other states and Puerto Rico, which were approved under the earlier SIB

pilot program, will continue to operate under the NHS Designation Act. TEA-21 funds cannot be used to capitalize these SIBs.

Surface Transportation Funds

As indicated by survey responses, the majority of funding for corridor projects on state roads comes from surface transportation funds distributed by the state transportation agency. These funds were made available under ISTEA and TEA-21. Surface funding is somewhat flexible in its application, and it will be necessary to check with your state transportation agency to determine if the project (or what portions thereof) may be eligible.

Tax Increment Financing

This is a type of bond financing used in areas where large-scale redevelopment is feasible. A redevelopment district is designated and assigned a tax base equivalent to the value of all property within the district. The area is redeveloped with proceeds from the sale of tax increment bonds. These bonds are sold by the municipality or tax district to fund the improvements. Once redevelopment is completed, the developed property has a higher assessed value and yields more tax revenue. The tax "increment" above the initially established level is used to retire the bonds. Once the bonds are retired, the tax revenues from the enhanced tax base are distributed normally.

Transportation Development Districts

Transportation development districts are special assessment districts established for the purpose of funding a desired transportation improvement. They allow the imposition of special taxes in an area that would benefit from the transportation project. Special assessments are derived

from development that will be generated as a result of the transportation facility. Revenue bonds are often issued to cover the improvement, backed by anticipated increases in tax revenue. Examples include the Route 28 Highway Transportation Improvement District, which was established by the state of Virginia upon request of area business owners to generate revenue for roadway improvements along this major corridor serving the Dulles Airport. The city of Orlando, Florida, has used special tax assessments to help fund highway interchanges.

User Fees

User fees can be defined as "charges imposed on persons for the use of a particular facility" (30). This method has been used by governments for many decades to help pay for improvements and decrease demand. Examples of user fees may include entry fees for park and recreation facilities, tolls for bridges or roads, and fees for water, sewer, and parking. User fees could potentially be mixed and matched to address a range of corridor management issues. For example, the I-75 Alligator Alley project in Florida transfers excess toll revenue to the water management district to use for water quality restoration projects. This may set a precedent for allowing highway tolls to be used for other needs within the corridor (29).

A few of the plans reviewed for this synthesis were effective in obtaining funding and in-kind contributions from a variety of sources. This is helpful because it gets others to "buy into" the project before it begins and can lead to synergism in plan implementation. Of course, there is always the potential for government programs to experience budget cuts and not be able to provide the amount of support originally anticipated. Getting financial support from many sources also helps offset this problem and increases financial stability. For a case example of financial diversification and funding techniques, see the Woodward Avenue Corridor Study described in chapter 5.

CASE STUDIES

SCENIC CORRIDOR MANAGEMENT IN CONNECTICUT

In 1996, ConnDOT funded several corridor management plans on state-designated scenic roads. A key goal of this effort was to increase the role of local communities in preserving the scenic character of state-designated scenic roads. Developing a corridor management plan was a vehicle for bringing local communities into the preservation effort.

As part of this effort, corridor management plans were developed for two scenic corridors in the town of Sharon—State Roads (SR) 41 and 4. Sharon is a traditional New England village with an abundance of natural, cultural, and historic resources. SR 41 and 4 provide both physical and visual access to those scenic resources. Rapid development in the region raised concerns about the long-term scenic character of those roads. ConnDOT pursued the development of corridor management plans for these roadways as a method of preserving their existing scenic character.

One of the typical obstacles to effective corridor management is that no one agency has the responsibility or authority for managing the corridor. ConnDOT has responsibility for the road and right-of-way along SR 41 and 4. Land use and development responsibility lay with the town of Sharon and individual landowners. The corridor management plan was developed to (1) identify resources that contribute to the scenic character of the corridors, along with threats to those resources, and agency and individual responsibilities for managing those resources; (2) raise awareness of those resources; and (3) coordinate resource management activities for the purpose of preserving the existing scenic character.

A defining characteristic of successful corridor management efforts is the active involvement of people and organizations with a vested interest in the corridor. Toward that end, the governing body of the town of Sharon appointed an advisory committee to represent the varied interests of corridor stakeholders during the planning process. Members included elected officials, and representatives from government agencies, conservation organizations, environmental organizations, private companies, and historic preservation organizations. The advisory committee was used as a sounding board throughout development of the corridor management plan and was given final approval authority over the plan. In light of the potential for conflicts with state policy, ConnDOT established that the

plan recommendations would not, by default, receive ConnDOT endorsement and would still be subject to state procedures and policies.

With the help of the advisory committee, a detailed inventory was conducted of existing scenic and cultural resources along SR 41 and 4 (Figure 7), along with an inventory of the existing regulatory environment for managing those resources. A variety of features were identified and mapped for ease of display and analysis, including:

- Stone walls;
- Mature tree rows and roadside forests;
- High-quality vistas and visually prominent areas;
- Wetlands, waterways, steep slopes, and other sensitive environmental areas;
- Natural, scenic, and agricultural landscapes;
- Historic and recreational resources;
- Tourism and economic development resources, initiatives, and agencies;
- Existing land uses, land-use regulations, and agencies involved in land planning and regulation; and
- Roadway characteristics including physical geometry, capacity, classification, and safety.

Issues of local concern regarding land use and route management were also identified, with input from the public and the advisory committee. From this effort, a list of priority issues of concern was developed for consideration in the planning process. In general, the concerns related to continuity of the designated scenic roads through the town of Sharon and the region, traffic safety and speed on the routes, safe access to abutting properties along the corridors (particularly to an existing shopping center), preservation of the historic village green, designation of the routes as National Scenic Byways, roadside management (including application of road salt, loss of roadside trees, invasive species, and electric distribution lines), and roadside development that does not match the character of existing roadside development.

Through the planning process, goals were established to guide the plan. The goals related to (1) the preservation of roadside views and vistas and the rural and historic character of the scenic roads, (2) the cooperative development of standards and procedures for stewardship of the roads, (3) right-of-way and scenic resources outside of the right-of-way, (4) appropriate scenic corridor visitor promotion, and (5) appropriately scaled educational programs.

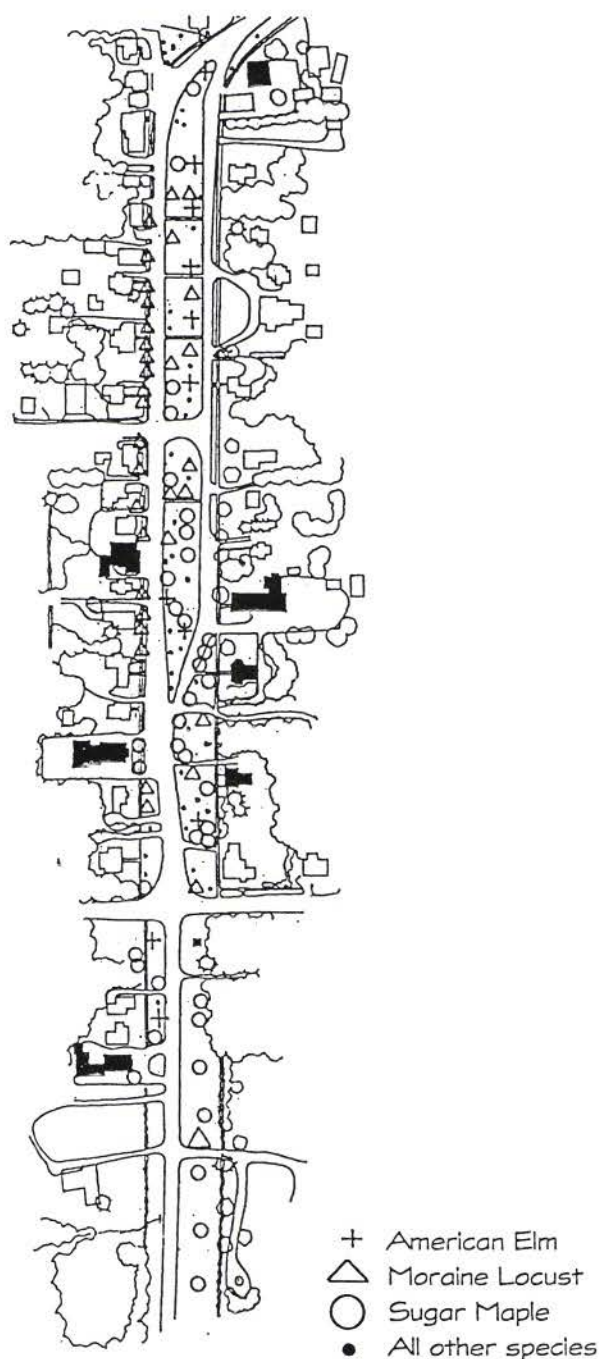


FIGURE 7 Inventory of trees by major series.

Strategies to preserve the integrity of Sharon's scenic roads addressed issues ranging from land use and development to roadway maintenance and tourism issues (Figure 8). Potential partners, funding opportunities, and implementation issues were identified for each plan element. Recommendations focused on (1) establishing priority land parcels and view sheds to protect through direct purchase, land-use regulation, or voluntary preservation measures; (2) identifying funding sources for specific projects to improve the operating and roadside characteristics of the

scenic routes (e.g., burying utility lines, improving access and egress at the Sharon Shopping Center, etc.); and (3) encouraging continued cooperation among the members of the advisory committee. The advisory committee unanimously endorsed the plan in September 1997.

Since completion of the *Sharon Scenic Corridor Management Plan* (36) some steps have been taken to implement the recommended strategies, although many of the recommendations have not yet been addressed. The existence of a detailed inventory of prime agricultural lands and resources allows Sharon to take advantage of a state program aimed at purchasing and permanently preserving prime agricultural lands.

Following the corridor management planning effort, ConnDOT formed an internal committee to seek federal scenic byway funds to help fund the identified capital improvement projects. ConnDOT also agreed to flexibility in project design to help preserve the scenic character of the corridors. In the town of Sharon, the Sharon Land Trust used the findings of the scenic corridor management plan to energize and focus its efforts on preserving the identified high-priority view sheds of the local scenic roads. The Plan of Development for the town of Sharon now strongly encourages the preservation of agricultural lands and other scenic resources within view of SR 41 and 4, although the zoning on these properties remains unchanged.

Several other Connecticut towns have strengthened their regulatory framework related to scenic road preservation by developing overlay districts or incorporating scenic preservation goals and policies into their town plans. Additionally, private landowners have started to manage their properties in a manner that respects the scenic character of their roads by taking such measures as clearing brush that blocks high-priority views and maintaining historic fencing instead of replacing it. Local tourism officials have attempted to incorporate the scenic designation into promotional materials.

WOODWARD AVENUE CORRIDOR STUDY

The purpose of the Woodward Avenue Corridor Study in the Detroit metropolitan area was to improve the visual, economic, and functional characteristics of this corridor, which is so important to the economy of local communities in Oakland County, Michigan, as well as to area commuters. The study was a community-based effort involving six communities (Berkley, Birmingham, Ferndale, Huntington Woods, Pleasant Ridge, and Royal Oak), Oakland County, numerous multifamily residences, and nearly 1,000 businesses. These factors alone created a challenge for coordination, which has since become a model for success.

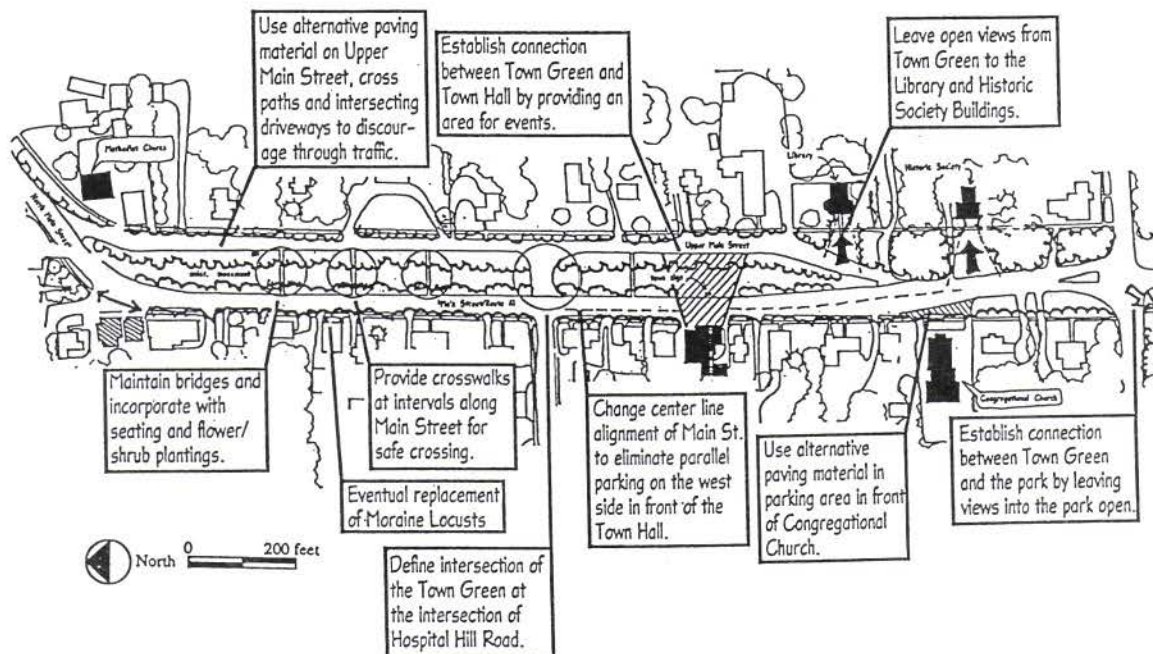


FIGURE 8 Preservation and management strategies for Sharon Green.

Woodward Avenue is a major arterial running from downtown Detroit to Pontiac, Michigan. Detroit and its surrounding suburbs are designed on a radial urban grid, and Woodward Avenue is a “spoke” in the grid. The study focused on an area one-quarter mile wide and 10 miles long, located just north of the Detroit city limits. This portion of Woodward Avenue is an eight-lane boulevard under the jurisdiction of MDOT, and maintained by the Oakland County Road Commission.

The Woodward Avenue Corridor Study was divided into three stages and took 2 years to complete. The first stage focused on data collection, the second stage on inventory and analysis, and the third and final stage was the development of a framework plan and recommendations. The study was governed by a 26-member steering committee, which included members of each community’s council or administration, planning commission, and business community or chamber of commerce. Members were elected by representatives of each of the six cities involved. The committee also included at-large members (representatives whose interests extended beyond a single city) and representatives from the Oakland County Road Commission and MDOT.

Woodward Avenue is rich in history, beginning as a route for trade with Indian tribes and evolving into a major part of the regional economy. The study team tapped into this heritage by chronicling the evolution of the corridor on a time line. Many of the events were unique to the area, but had an effect on the entire nation, such as the development of the automobile and later the assembly line, the first mile

of concrete paving, the nation’s first shopping mall and first K-Mart, Motown, Soupy Sales, and, unfortunately, the race riots. Looking back was a way to encourage each community to look forward, choose a plan of action, and be a part of the change. It also helped capture the interest of the broader public.

A computerized base map of the corridor was drawn using the plans and goals of all the affected communities. Transportation analysis was conducted to document current traffic conditions (volumes, crash data, speeds, and roadway characteristics) on and adjacent to the corridor, and identified public and private transit opportunities and bicycle paths or routes. This information was consolidated to form a picture of the existing features and issues. Overlay maps were then developed using the results of community focus groups, user surveys, and the transportation analysis. Common elements were identified to assist in drafting a vision statement for the unified plan. Preliminary goals were developed and grouped into five categories: organization (which included a study mission statement), design, promotion, economic restructuring, and implementation.

The next phase of the study included (1) inventories of physical (land use, aesthetics, access, signage, landscaping, and vacancy rate) and demographic (population, employment, income, age, education, travel patterns, and housing) features; (2) market analysis; (3) a vision statement with goals and objectives; (4) identification of financing options; (5) jurisdictional analysis; (6) business retention and enhancement inventory; and (7) a safety analysis. The business retention and enhancement inventory involved

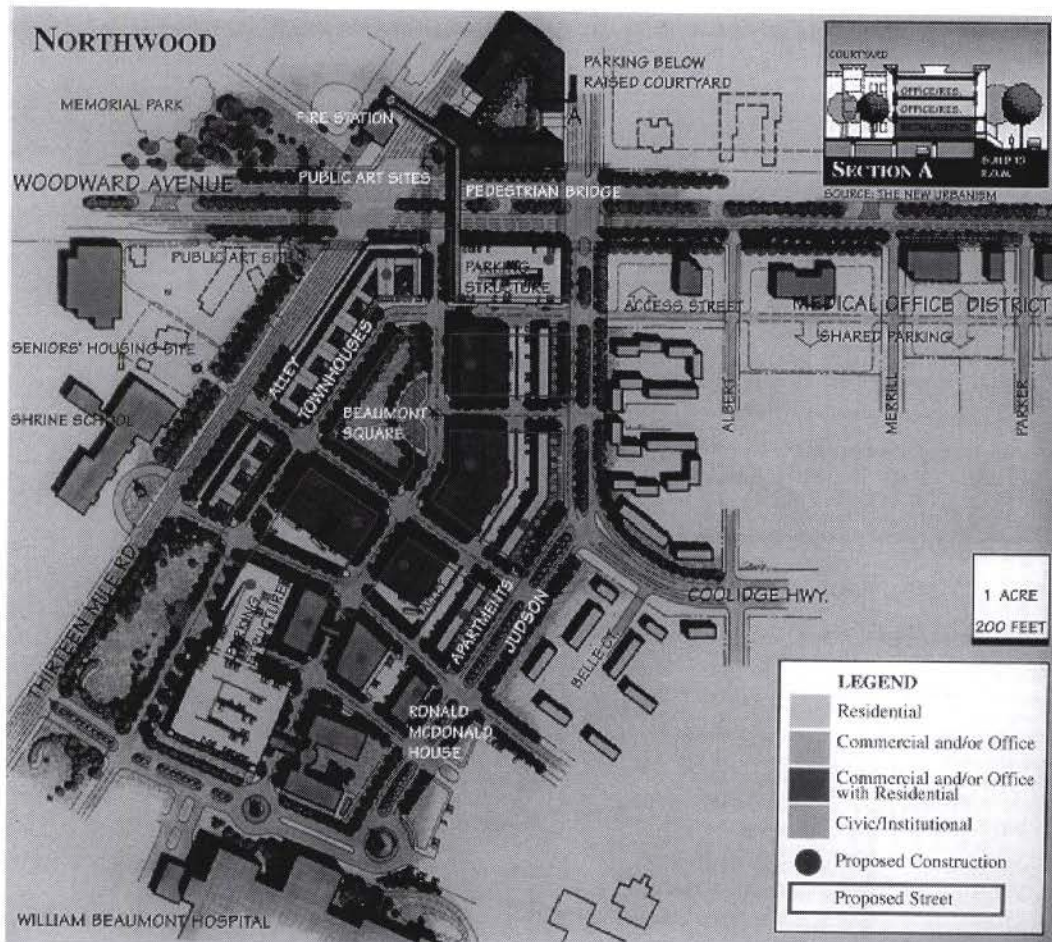


FIGURE 9 Woodward Avenue Corridor Study redevelopment concept.

gathering information from each community to determine methods used to attract and maintain businesses and improve or enhance local commercial districts.

The final stage of the study produced a master plan that identified recommended actions, the location of desired improvements, and specific action strategies—including responsible parties and time lines (Figure 9). Proposed recommendations were broken down into specific subject areas including median, open space, blocks (buildings and parking), districts, signs, transportation, financing, history, market potential, and promotion. Recommendations under each category were then prioritized. The master plan was

adopted as a resolution by all six communities in the corridor, and subsequently adopted by two other communities on the northern limits of Woodward Avenue—Bloomfield Township and Pontiac. To date, however, Royal Oak is the only community that has incorporated the master plan into its local comprehensive plan with supporting policies.

A major problem identified in the study was the property addressing system. Four distinct addressing systems across six communities caused odd and even addresses to alternate between the east and west sides of Woodward Avenue, with some addresses repeated several times along the corridor. These and other inconsistencies in addressing

resulted in customer confusion and traffic hazards because of sudden stopping or changing of lanes. Grants from the Metropolitan Affairs Corporation and MDOT provided for the establishment of a coordinated addressing system along the corridor.

The study recommended that an organization be established to oversee implementation of the recommendations, including applying for and administering grants. A non-profit organization, the Woodward Avenue Action Association, was established in 1996 for this purpose. The association is supported by dues from the county and each of the eight communities, based on their linear frontage along the corridor. It is governed by a board made up of the mayor and one business representative from each community.

Since inception, the association has worked to establish support for the Woodward Avenue corridor and has received financial commitments from the TEA-21 Transportation Enhancements Program for median landscaping and several local banks and businesses. The association was also instrumental in getting Woodward Avenue designated as an Urban Cultural Heritage Road. This state designation positions the corridor to receive financial assistance from a variety of sources and further elevates public recognition. The association is now pursuing designation of the corridor as an Auto Heritage Area by the National Parks Service, which would further promote its historic and cultural significance.

From its inception, promotion of the Woodward Avenue Corridor Study was a high priority. Public involvement consisted of more than a few meetings where a few people show up to provide input. The study team actively pursued local involvement in the project and developed innovative ways for people to be informed and involved. One of the first activities of the team was to conduct a survey by personal interview, choosing participants at random. The survey queried the respondents on the frequency of their visits to the corridor, and on their opinions regarding various aspects of the corridor, such as safety, convenience, access, and quality. The 423 responses were recorded, validated, and collectively analyzed for inclusion in the study.

For additional stakeholder input, the team asked each steering committee representative to submit the names of 20 individuals they felt would be interested in attending a focus group meeting. These individuals were then invited to attend the focus group meeting for their city. Most of the 2-hour meetings were devoted to allowing the participants to share their vision for Woodward Avenue, identifying problems and possible solutions, and making general comments. A compilation of all comments expressed at the focus group meetings revealed similar sentiments about the corridor in general, although some comments were unique to a particular community. This was helpful in identifying

area issues, goals, and possible solutions, and to creating an awareness of the governmental commitment to revitalization of the corridor.

Just after the study began, the first Woodward Avenue Dream Cruise was held—a promotional event whereby antique and classic cars were assembled to “cruise” up and down Woodward Avenue. The event tapped into a tradition of the 1960s and 1970s, when it was popular to cruise Woodward Avenue and challenge other drivers to race. A family occasion, people gather along the corridor to watch the day-long parade of cars. The event now attracts worldwide attention, and has rapidly gained in popularity during its 5-year existence. Many items promoting the event are distributed and sold, bringing additional attention to the Woodward Avenue corridor and the adjacent businesses.

Throughout the project, the study team developed and distributed detailed informational material that could be put directly into commission agenda packets. This provided each commission with continuous updates about the corridor project and encouraged ongoing discussion and input from each community. A logo has also been designed, and newsletters are distributed to continue building awareness of the corridor and to provide information regarding plans and activities. A map and business directory will be developed for corridor-wide distribution.

Funding for the Woodward Avenue Corridor Study was provided by both public and private organizations. The six local governments involved contributed a total of \$15,500, based on their individual linear frontage along the corridor. A fundraising luncheon was held, and a total of \$17,500 was received from several area businesses. MDOT committed \$50,000 toward the study, based on the merits of the study and its financial support from the six communities and financial institutions. In addition, the Metropolitan Affairs Coalition awarded the study a \$5,000 challenge grant. Staff support was provided by members of the Oakland County Department of Community and Economic Development, along with students from several local colleges.

Funding for implementation was an ongoing part of the study. Staff used the Catalog of Federal Domestic Assistance, which includes enabling legislation, to assist them in compiling an inventory of federal and state grant and loan programs. The viable financing options for public and private improvements for the Woodward Avenue Corridor are listed here. This diversity of potential funding sources illustrates the creativity of the project team in tapping into a range of opportunities for obtaining funding for the recommended corridor improvements.

- State and federal programs (grants and loans)
 - ISTEA
 - Community Reinvestment Act

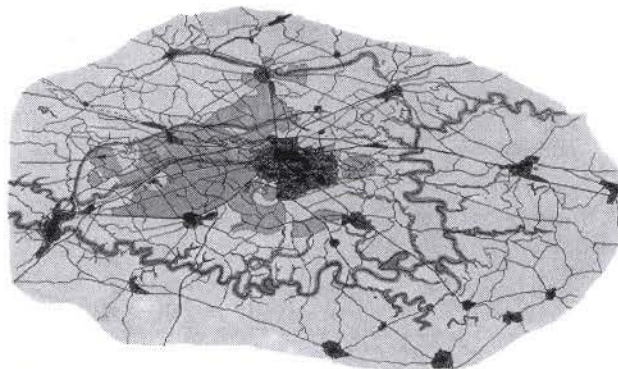
- Small Business Administration
- Surface Transportation Program
- National Highway System
- Michigan Capital Access Program
- Downtown Development Authority
- Principal Shopping District
- Local programs
 - Community Development Block Grants
- Local community development banks
- Business owners and banks in the corridor
- Chambers of Commerce
- Creation of improvement loan subsidy pool
- Creation of incentives for participation in the plan
- Foundation grants
- In-kind services
- Private donations and corporate sponsorship
- Special assessment district
- Transit district
- Fundraising events.

Although improvements are progressing slowly, supporters of the Woodward Avenue plan are pleased with its progress. Plans for median landscaping and lighting are underway that will soon provide a noticeable improvement. Most of the funding for median improvements is from TEA-21 Transportation Enhancement Program funds, with irrigation and maintenance costs to be covered by participating communities. The next phase of improvements will focus on signage, beginning with the development of an overlay zone that standardizes signs along the corridor. Some private funding has been secured for this purpose and other sources are being pursued.

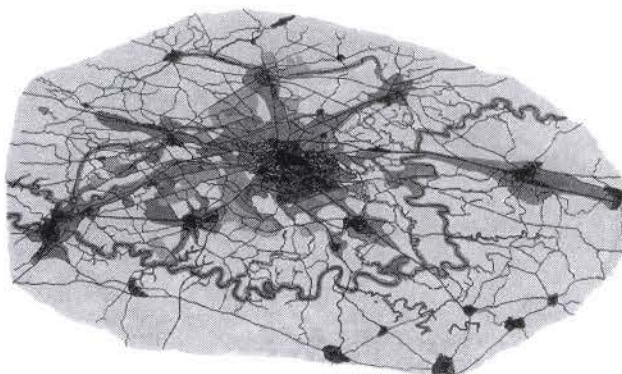
CORRIDOR ACCESS MANAGEMENT IN THE BLUEGRASS

In 1993, concerned over the impacts of corridor development on the scenic quality of the Bluegrass region, a nonprofit, community-based organization called Bluegrass Tomorrow began a regional planning initiative. The mission of Bluegrass Tomorrow is to ensure sound management of the physical, natural, and fiscal resources of the Bluegrass region, which includes Lexington, Kentucky, and its environs. Bluegrass Tomorrow led public and private representatives from each of the region's seven counties in a broad-based planning process aimed at establishing a regional vision for the future. The resulting vision seeks to preserve the scenic qualities of the region by means of land-use strategies and access management. A key objective is to avoid strip development along the major corridors that link the region's communities (Figure 10).

The plan advanced a variety of land-use and resource management strategies to support this vision. Among these were: (1) active preservation of the natural environment and historic resources; (2) encouraging local governments



THE REGION TODAY



THE VISION LOST

FIGURE 10 A vision for the Bluegrass region of Kentucky, which seeks to maintain a clear distinction between "town" and "country" by retaining the current pattern of scenic greenways radiating from the urban center city outward to a series of distinct satellite towns.

to guide development away from sensitive rural and agricultural lands through capital improvement plans that target infrastructure investment in already developed areas; (3) land-use strategies that promote compact, mixed-use development in urbanized areas and managed, small-scale rural development; (4) interjurisdictional coordination on land-use and resource management issues; and (5) development of corridor access management plans.

All parties recognized the importance of linking transportation improvements and development decisions. Corridor access management plans were advanced as one of the key tools to accomplishing this objective. As in many states without a comprehensive access management policy, access along Bluegrass corridors is managed through an ad hoc permitting process that provides for driveway access except in situations where it would pose a safety hazard. The Kentucky Transportation Cabinet (KTC) embraced the corridor access management plans as being a more systematic and proactive method for preserving the function of major state roadways and making the most of a limited transportation budget. It also provided a mechanism whereby the KTC could help reinforce the Bluegrass Regional Vision—a win-win situation.

To help advance the vision plan, a symposium on corridor access management planning was held in 1997. The symposium, "Bluegrass Choices—The Corridors That Connect Us," was sponsored by a consortium of 18 public and private organizations with an interest in the future form of the region. More than 200 participants, representing a variety of stakeholders, including neighborhood groups, community leaders, preservationists, local government planners, elected officials, business groups, developers, and design engineers, were in attendance. The symposium, described as a "watershed" event, further reinforced the momentum for corridor access management planning in the Bluegrass region.

The KTC developed corridor access management plans on three state-managed roads in the Bluegrass region. The three corridors were distinctly different. The first of the corridors was a rapidly developing segment of US-27 in southern Fayette County, which cuts across several jurisdictions. The character of the corridor is changing from rural farmland to commercial strip development. The goal of this particular corridor access management plan is to limit access points in order to: (1) influence land development patterns, (2) minimize the need for future traffic signals, and (3) allow more efficient traffic flow.

The second corridor studied was a segment of US-68 between Lexington and the small community of Wilmore—a narrow two-lane road designated as a Kentucky Scenic Highway. Commuter traffic on US-68 has been increasing over the past several years as residential development along the corridor has proliferated. Current traffic volumes justify widening the roadway to four lanes, an action that could further intensify residential development pressure on this rural scenic byway and one that is strongly opposed by preservation groups. The goal for this corridor access management plan is to accommodate high volumes of commuter traffic without compromising safety or the scenic character of the road. The KTC is also considering flexibility in highway design treatments to help preserve the scenic character of the area.

The third corridor access management plan covers US-460 between the two satellite communities of Georgetown and Paris. The primary issues along this two-lane road are safety, truck access to the town of Paris, and uncontrolled development, with little or no land-use planning in the two communities. Local residents wanted trucks banned from the road, speed limits lowered, and traffic signals installed, and opposed limits on development and access to the road from abutting properties. These local objectives have constrained the ability of the KTC to carry out corridor access management objectives.

Individuals involved in the corridor access management planning effort note that political sensitivities have run

high and a variety of lessons have been learned (32). These include the need for a local champion in the region to support corridor access management planning and the political will and private sector support to back sometimes unpopular decisions. In addition, although the potential for mutually beneficial outcomes is high, it is impossible to accommodate all potential agendas and expectations. In general, individual meetings with property owners worked better in negotiating desired outcomes than large public meetings, where property owners avoid public disagreements with neighbors. Public participation and local involvement and support was noted as essential for a successful plan, as was the need to involve a consultant with experience in access management planning.

A VISION FOR U.S. HIGHWAY 1

Stretching along the east coast of Florida, U.S. Highway 1 (US-1) was once a major highway corridor that linked southern Florida to the northeastern United States. Later replaced by Interstate 95, US-1 now functions more as a local collector road, particularly in Palm Beach County. Here, the roadway travels through unincorporated areas of Palm Beach County and seven municipalities—Jupiter, North Palm Beach, Riviera Beach, Palm Beach Gardens, Juno Beach, Lake Park, and Tequesta—and is home to "some of the worst-looking parts of each community" (33). The 16-mile segment is characterized by older strip developments in poor condition and newer buildings described as a "bland, corporate eyesore" (33). Excessive curb cuts, telephone wires, poles, and signs contribute to the visual clutter. Other problems include inconsistencies in roadway design, drainage facilities, and land uses, and a lack of continuous sidewalks, which discourages pedestrian activity.

In 1999, the Northern Palm Beach County Eastward Ho! Committee began discussing options for beautifying US-1 and improving the corridor as an "address" for business and investment. The committee consisted of mayors and staff from the affected municipalities who were brought together to spur redevelopment of an urban corridor along Florida's east coast to help channel growth away from the Everglades. Through the coordination efforts of the Treasure Coast Regional Planning Council and under the direction of a professional planning consultant, the committee members undertook the ambitious effort to develop a corridor plan. The corridor planning initiative was actively supported by a state representative, with financial contributions and in-kind support from the seven cities, the county, FDOT, the Florida Department of Community Affairs, the Port of Palm Beach, and the Treasure Coast Regional Planning Council.

Public participation was a key element in plan development. A series of meetings and two public planning

TABLE 1
BASIC DESIGN PRINCIPLES FOR U.S. HIGHWAY 1

Design Principles	Intended Results
Adequate sidewalk width Shade and shelter for pedestrians	Encourages walking and is a buffer between pedestrians and automobiles Adds to aesthetics with the addition of arcades and colonnades
Landscaping	Encourages walking Provides shade for pedestrians Improves aesthetics
Attractive building facades with doors and windows facing the street Buildings repositioned close to the street	Encourages walking by providing entertaining vistas for pedestrians Improves aesthetics by permitting buildings to abut front property line Encourages walking by requiring that the space between the curb and the building front be built as a sidewalk, not as yard space
Adequate, human-scaled lighting On-street parking	Enhances safety Shields pedestrians from moving cars Provides convenient parking Adds to street activity
Adequate (but not excessive) roadway width*	Reduces hot pavement Induces drivers to be more cautious
Well-maintained and appropriately sized signs	Allows for more landscaping, larger sidewalks, and on-street parking Improves aesthetics and safety

*The Corridor Plan recommended elimination of specific curb cuts in conjunction with reduced roadway width. Affected properties could gain access through shared access driveways, frontage roads, and/or alleys.

sessions were held to identify preferred visions for the corridor. Participants included property owners, neighborhood residents, business people, developers, elected officials, and city staff. The broad vision that emerged was to transform US-1 into "a grand, tree-lined boulevard that connects several town centers" (33). After identifying causes, needs, and potential solutions, the designers transferred these ideas into plans and explanatory drawings for each community. In late 1999, the final report, *Who Cares About US 1 Anyway?*, was completed and a corridor plan was set forth for the entire 16-mile segment. The plan specifically describes and illustrates improvements that should be made for each city. The basic principles that were advocated for corridor-wide application are listed in Table 1.

The plan identified several factors as having contributed to the blighted conditions on the corridor. These included existing zoning regulations, which mandated a wide separation between structures, and deep setback requirements, which impeded "street-oriented building design." High parking ratios were also identified, which resulted in excessive expanses of parking for larger businesses. Other problems noted included "bad habits" among developers and their consultants with regard to project aesthetics and "highway engineering ... that promotes convenience for high-speed vehicles at the expense of livability" (33).

A variety of ideas were presented for reducing parking lot spaces to complement the new boulevard design. These ideas included the use of shared parking between uses, parking garages, and on-street parking (Figure 11).

Another idea for reducing parking needs was a "park-once" environment, where customers park and then travel from shop to shop on foot. This would be accomplished by

providing a Main Street environment with tree-lined streets, on-street parking, and wide sidewalks, where people would want to walk and shop. According to the plan, the shared parking and park-once solutions could reduce required parking up to 45% of conventional requirements.

As seen in similar projects throughout the United States, road narrowing has also become a popular strategy for re-designing aging corridors. The Corridor Plan proposes either the elimination of travel lanes or a reduction in lane widths to "reduce hot pavement, calm traffic, make room for trees and wider sidewalks, and make room for on-street parking." If some travel lanes are eliminated, the plan called for simultaneously strengthening a parallel access network by requiring joint access or installing frontage roads or alleys. The plan also calls for reducing the number of curb cuts and encouraging the use of shared access driveways.

While developing the plan, the participants concentrated on a five-step program that they hope will eventually lead to the revitalization of US-1. An initial step was to convince the public that an improved US-1 would benefit both businesses and residents alike. The ultimate goal is to unify design and development ideas into one plan for the US-1 corridor that will be adopted by each agency having jurisdiction along the corridor as a guide for future decision making. The expectation is that this will form a reliable basis for FDOT and the MPO to develop a long-term funding and phasing plan for carrying out the enhancements.

Five-Step Program to Improve US-1

1. Educate the public about how good US-1 could be.
2. Correct mistakes in zoning and other government policies.

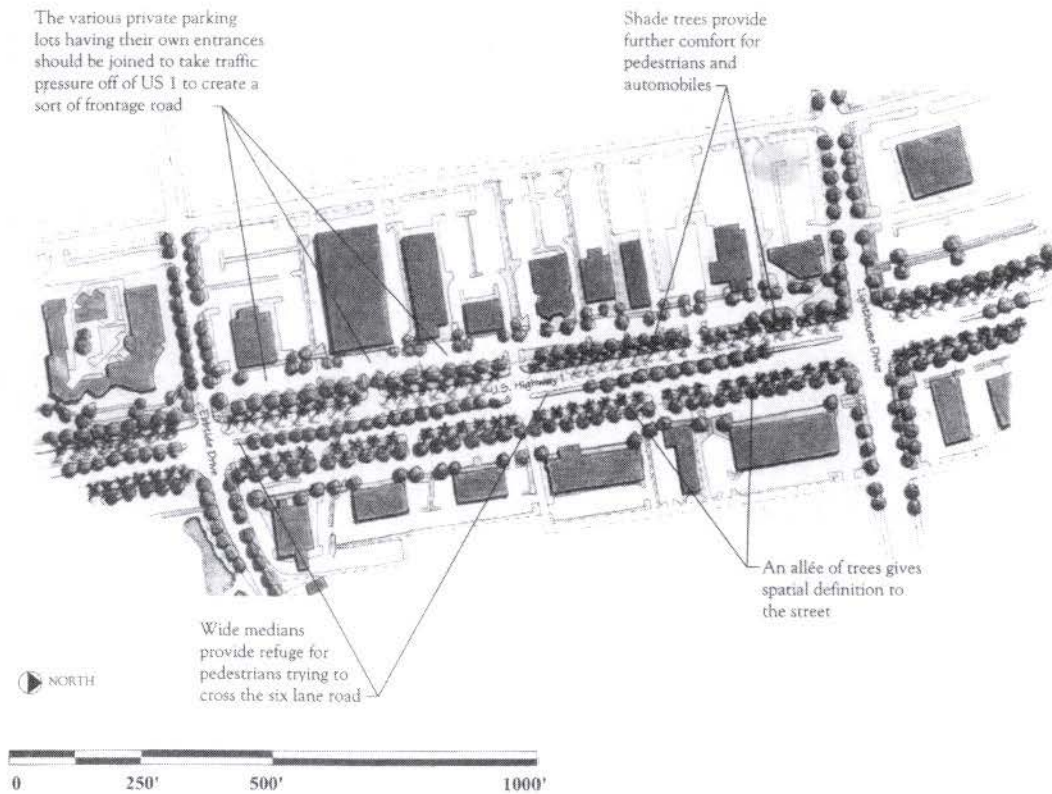


FIGURE 11 Shared parking concept for US-1 corridor (36).

3. Focus design on the corridor itself and not just on isolated properties.
4. Develop meaningful urban places at key points along the route.
5. Correct mistakes in the street details and design for pedestrians.

The planning initiative has already stimulated some changes. Because of lobbying by the involved communities, plans for widening US-1 to six lanes have been abandoned in favor of a more pedestrian friendly, four-lane section. In addition, the city of Riviera Beach has asked FDOT to remove a two-way center turn lane to provide on-street parking and widen sidewalks to 10 feet (34).

INTERSTATE-5 ITS CORRIDOR MANAGEMENT PLAN

Interstate 5 (I-5) is a major north/south corridor that links several major West Coast cities, including Los Angeles, Portland, Seattle, and Vancouver, British Columbia. Heavily traveled by tourists, commuters, and commercial vehicles, the highway suffers from congestion and traffic delays in many of the urban areas. The Washington and Oregon DOTs, together with a team of professional planners and other affected agencies, studied the northwest segment of the I-5 corridor, from Portland, Oregon, through Seattle, and from the Puget Sound to Vancouver, British Columbia.

Their goal was to develop a corridor management plan to increase safety, provide better information to travelers, improve traffic management, and move commercial goods more efficiently. Solutions centered on technology-based applications using ITSs. Two ITS reports were created: one for the Portland to Seattle segment and the other for the Seattle to Vancouver segment.

The I-5 corridor segment from Seattle to Portland bisects seven counties that are home to an estimated 3.43 million people. The majority of this population is concentrated at the north and south ends of the segment. However, forecasters predict that additional growth will continue to radiate out from these existing cores. This portion of I-5 accommodates a variety of travel patterns, including movement within the Puget Sound and Portland area, intercity trips, and commercial freight activity. The following eight transportation needs were identified along the Seattle to Portland corridor:

- Manage traffic congestion
- Facilitate passenger intermodal operations
- Expedite freight movements
- Mitigate highway construction traffic
- Manage incidents
- Improve safety
- Provide transportation monitoring and planning data
- Promote interjurisdictional cooperation.

TABLE 2
ITS STRATEGIES TO ADDRESS NEEDS FOR I-5—SEATTLE TO PORTLAND

Applications	Strategies
Travel and transportation management	Collect and process information and provide commands to traffic control systems
Travel demand management	Facilitate and encourage the use of other modes of travel
Public transportation operations	Improve the management, operation, and service delivery of public transportation
Electronic payment services	Provide electronic funds transfer for transportation services and fees
Commercial vehicle operations	Improve the efficiency of commercial fleet operations for both the public and private sector
Emergency management	Use advance technology to better manage and respond to emergencies
Advance vehicle safety systems	Provide in-vehicle systems to improve vehicle safety

The Corridor Plan focused on ways that ITS technology could improve the highway's efficiency and safety. Remedies ranged from electronic toll collection to automated commercial vehicle operations to emergency management. After reviewing all available systems, the team identified specific ITS applications that could satisfy the existing and future needs of the I-5 corridor (Table 2). The Corridor Plan then listed when proposed projects should be implemented—the near-term (1 to 6 years), mid-term (7 to 12 years), or long-term (12 to 20 years).

In an effort to address the needs listed previously, several ITS technologies were to be applied corridor-wide rather than just in select areas. First, the Corridor Plan proposed improving the existing commercial vehicle operation system to improve efficiency and safety, as well as to reduce workloads for government regulators. Modeled after programs in Florida and California, an automated electronic commercial vehicle clearance plan for I-5 would resolve intrastate, interstate, institutional, funding, and deployment issues. Afterward, commercial vehicle credentials could also be issued electronically and roadside safety inspections would be automated.

Second, emergency management measures that assist stranded motorists could also be applied corridor-wide. Currently, an operational test in the Puget Sound area is underway. This initiative, known as the Puget Sound Help Me (PuSHMe) Project, will serve as the basis for determining the feasibility of providing road assistance throughout the region and eventually throughout the corridor. Finally, the plan proposed ITS-based enforcement, which would be coordinated by the Washington State Patrol and other agencies. The agencies would monitor high-occupancy vehicle lanes, trucks equipped with automatic vehicle identification systems that include weigh-in sensors, and automated speed enforcement.

In addition to corridor-wide applications, the Corridor Plan lists ITS improvements that target specific segments, namely the Puget Sound region, the Portland region, and

the intercity area. In Puget Sound, travel and transportation management would build upon the existing Northwest Region's surveillance, control, and driver information system (SC&DI), the Olympic Region SC&DI, and the North Seattle advance traffic management system (ATMS). The plan calls for the expansion of the SC&DI and ATMS into other areas in Washington.

Travel demand management would also be improved by establishing a Regional Multimodal Traveler Information Center. Agencies such as the Cascade Mountain Pass Traveler Information System, the Ferry Information System, and the Transit Information System, would forward data to this center. Thereafter, the center would disseminate the information through radio, the Internet, cable television, traffic hotlines, and information kiosks. The plan also calls for electronic payment services to be introduced on the Washington State Ferries and King County Metro Transit systems. Currently, the Washington State DOT (WSDOT) is examining the feasibility of installing electronic payment services on state highways as well.

The remaining ITS applications in the Puget Sound area would aid commercial vehicles, transit, bicyclists, and pedestrians. With over 25 percent of West Coast port container movements passing through the ports of Tacoma and Seattle, a significant amount of commercial vehicle traffic travels to and from these ports. Automated operations would improve commercial access by combining traffic control, information sources, and communication to traffic signals along arterial routes leading to ports. The public transportation system would receive transit signal priority, automatic vehicle location, and fare collection information. Bicyclists and pedestrians would also benefit from ITS technology. Among other initiatives, they would be provided with information and security services.

Because the corridor straddles the Oregon/Washington border, intergovernmental coordination between WSDOT and Oregon DOT (ODOT) was a vital component in developing the ITS applications. According to the plan,

WSDOT's regional advanced traveler system, when deployed, should be able to share information channels with ODOT. In the Portland area, transit agencies such as Tri-Met (Oregon) and C-Tran (Clark County, Washington) are developing ITS applications that address transit signal priority, automatic vehicle location, information, fare integration, and demand management. Later, these programs could also be incorporated into the larger ITS effort.

In the intercity area, the plan proposes the testing of a "light infrastructure" SC&DI system. This system, centered in Centralia/Chehalis, Washington, would cover a large geographic area at a relatively low cost. Information would be disseminated to motorists through information kiosks at rest stops along I-5, along connecting highways, and at intercity train stations.

The second stage of the corridor study focused on I-5 from Seattle, Washington, to Vancouver, British Columbia. The 99-mile segment crosses three counties and is a primary north/south corridor that serves freight, tourists, and commuters. By means of interviews and corridor tours, the research team gathered information regarding safety, con-

gestion management, commercial vehicle operations, and the U.S./Canadian border crossing.

The majority of the information collected was furnished by WSDOT's existing SC&DI system set up along the corridor. The system is currently equipped with ramp meters, closed circuit television, cameras, data stations, variable message signs, and radio advisories. Although the system has been shown to improve efficiency and reduce crashes, only a portion of the I-5 corridor is equipped with SC&DI devices. WSDOT currently has plans to expand the system into other areas, such as Mt. Vernon and Bellingham.

Similar to the Portland/Seattle study, this Corridor Plan focused on existing and expected future needs, including emergency management, commercial vehicle operations, and information for commuters. Specific ITS applications were identified to address these needs and are summarized in Table 3. Costs involved with initiating these systems range from \$3 million for the expansion of the SC&DI system to \$22,000 for a license plate optical reader. However, prototype and "spot deployments" may initially be installed as a preliminary test, which, if successful, could be completed in subsequent phases.

TABLE 3
ITS STRATEGIES TO ADDRESS NEEDS FOR I-5—SEATTLE TO VANCOUVER

Applications	Strategies
Broadcast radio dissemination system	Transmit route, weather, and traffic condition information to local radio stations
Ice detection weather warning system	Install sensors to detect icy roadways and forward information to travelers and WSDOT personnel
Internet pre-trip traveler information	Post weather, travel, and traffic information on the World Wide Web
Rest area information kiosks	Install information kiosks at rest areas
Over-height detection	Provide an advanced warning system to notify commercial vehicles and other high profile vehicles of low bridge clearances
Portable traffic management system	Develop a portable TMS with systems to access control traffic signals, closed circuit TV, and vehicle detection systems for use during special events and construction projects
Speed detection/warning system	Install a warning system at steep upgrade and downgrade locations when hazardous conditions exist
Variable speed limit signing and weather warning system	Implement a variable speed limit system and warning system during inclement weather
Northwest region TSMC geographic expansion	Expand WSDOT's SC&DI network to provide better traffic management capabilities and increase safety
Mt. Vernon and Bellingham TMS	Install a TMS system that is consistent with the existing SC&DI system
Rest area security system	Increase public security by way of enhanced lighting, improved surveillance, and communication to emergency services
Portable license plate optical reader	Deploy reader technology to streamline weigh station inspections, assist in enforcement, and allow WSDOT to conduct origin and destination studies
U.S./Canadian border crossing systems	Develop a system to collect data to reduce travel times and improve efficiencies for border crossing locations

TMS = traffic management system; SC&DI = surveillance, control, and driver information; TSMC = Traffic Systems Management Center.

CONCLUSIONS

Corridor management links transportation, land use, economic development, and environmental planning. It also promotes improved coordination within and between government agencies. For this reason, it is an avenue for strengthening the quality of transportation and development decisions at every level of government.

Corridor management should be viewed as an ongoing process, not a one-time project. It involves both short- and long-range implementation strategies, and often requires action from a variety of groups and agencies over a period of time. Because conditions on a corridor will change over time, it is important to update the plan periodically. The process must also be opportunistic—agencies and others involved in corridor management should be prepared to take action when a window of opportunity opens for implementing various aspects of the action plan. Periodic updates may help uncover opportunities that would otherwise be missed. The Washington and Oregon DOTs, together with a team of professional planners and other affected agencies, have studied the northwest segment of Interstate 5, from Portland, Oregon, to Vancouver, British Columbia, in order to develop a management plan to increase safety, provide better information to travelers, improve traffic management, and move commercial goods more efficiently. Transportation needs were identified and proposed projects scheduled, both for the short- (near) and long-term. Solutions are centered on technology-based applications using Intelligent Transportation Systems. Travel information is to be widely disseminated and projects updated or modified over time depending on the success of in-place systems and existing and expected needs.

The ongoing nature of corridor management suggests the need to establish a formal program or process for implementing corridor management activities. Options include regular meetings among affected agencies on specific projects, an agency corridor management office, a steering committee to oversee plan implementation, or some combination thereof. In 1997, the Kansas DOT established baselines for various measures of effectiveness and ways to follow-up these measures over time. The measures selected were access density, crash rate, and travel time. Results are evaluated to determine appropriate solutions, and the assessment is repeated over time to gauge progress and assess costs and benefits. Also needed is greater attention to performance evaluation and monitoring. Few of the state transportation agencies surveyed

indicated that they systematically track the performance of their corridor management projects, although several engaged in informal monitoring or special studies aimed at quantifying the influence of various techniques. The Florida DOT has conducted opinion surveys designed to evaluate economic concerns following median reconstruction projects. The surveys are designed to determine if businesses along the project route have been adversely affected.

In terms of land use, the primary role in preserving transportation right-of-way and managing corridor development lies with local governments through their comprehensive planning and land development regulations. State and regional transportation agencies will need to work with local governments to develop appropriate corridor management strategies. Local agencies will need to further their understanding of regional transportation issues and adopt policies and regulations that support the transportation objectives of corridor management. Key among these is the need for greater local attention to right-of-way preservation and access management. The Michigan DOT, uses a combination of corridor management strategies, including agreements with local governments. The M-37/M-44 corridor management project involves five local governments, the Metropolitan Planning Organization, and the local Chamber of Commerce in the Grand Rapids metropolitan area in the development of a corridor land-use plan and zoning ordinance designed to control the intensity of land development with access to the roadway.

The contemporary emphasis on sustainable development practices in the community planning literature bodes well for corridor management. The corridor management techniques identified in the synthesis are aimed at managing and sustaining an essential resource—the nation's transportation system. At the same time they support economic development, environmental preservation, and programs for improving the quality of the built environment.

Transportation corridors represent a substantial public and private investment. Unless transportation and development in these corridors is effectively managed, both the public and private investment could be adversely affected. Through corridor management plans and programs, transportation agencies can achieve more cost-effective and comprehensive solutions to transportation problems. A broader range of groups that influence corridor outcomes can also be engaged in developing and implementing

transportation solutions. For this to occur, however, agencies responsible for transportation improvements will need

to work proactively with local agencies and other stakeholders to accomplish mutual objectives.

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APPENDIX A

Survey of State Transportation Agencies

CORRIDOR MANAGEMENT

NCHRP Project 20-5, Synthesis Topic 30-03

Since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21), transportation agencies are placing increased emphasis on managing the existing transportation system. No longer are agencies focusing on road widening as the primary solution to transportation problems. More and more are looking at corridor management.

Corridor management involves the application of strategies for coordinating transportation and land use along specific roadway segments, as well as tools and techniques for managing traffic. Objectives of corridor management may involve safety, community character, roadway efficiency, scenic qualities, economic development, or other transportation and development issues. Corridor management activities may include access management, right-of-way preservation, intelligent transportation systems, transportation demand management, growth management, funding innovations, and other strategies.

The purpose of this synthesis is to identify and discuss approaches to corridor management at the state, regional, and local level, along with case studies of innovative practices. Approaches that combine a variety of corridor management techniques are of particular interest.

Responses Received = 34

1. Has your agency established a program or policy that supports corridor management? Yes 16 No 18

Yes – Arizona, California, Colorado, Connecticut, Delaware, Florida, Kansas, Michigan (practice), Mississippi, Montana, Nebraska, New Jersey, New York, Oregon, Pennsylvania, Washington

No – Arkansas, Hawaii, Kentucky, Louisiana, Maine (under consideration), Maryland, Missouri, Minnesota, North Carolina, North Dakota, Oklahoma, South Carolina, South Dakota, Texas, Utah, Virginia, West Virginia, Wyoming.

- Is your agency in the process of establishing a program or policy that supports corridor management? Yes 9 No 16

Yes – Maryland, Minnesota, Mississippi, Missouri, Oregon, Pennsylvania, South Dakota, Utah, Washington.

If yes, under what legislative authority? WA – RCW 47.06; MN – Metropolitan Transportation System Planning; CO – Section 43-2-147(4) Colorado Statutes; OR – SAG, Appendix B; DE – Del Code Title 17 Section 145 (1996); ME – Title 23 MSRA; PA – Highway CMS Plan; FL – Chapter 337, Chapter 335, and Chapter 163 Florida Statutes; AZ – Title 28 Arizona Statutes; NJ – Highway Access Code. Other responses included “General transportation law.”

- Does the legislation specify the responsible implementing agency? Yes 13 No 6

What Agency?

UT – DOT; WA – DOT; KS – Secretary of Transportation; CO – Transportation Commission and local agencies; SD – DOT; OR – DOT and local agencies; MT – DOT; MS – DOT; DE – DOT; NE – DOT; FL – local governments; AZ – DOT, MPOs, and RPCs; NJ – DOT and local governments.

(Please provide a copy of the corridor management legislation and any written program or policy with this completed survey or provide us a contact we can call to obtain those items)

Contact _____ Tel: _____

2. Which of the following corridor management strategies has your agency used or actively promoted in lieu of or in addition to roadway widening?

- Raised medians (19)
(If yes, has your agency replaced a center two way left turn lane with a raised median?) Yes 5 No 10
- Acquisition of access rights (21)
- Acquisition of development rights (7)
- Improved signal location or spacing (25)
- Adding auxiliary lanes (27)
- Streetscaping (10)
- Driveway consolidation or removal (19)
- Service roads or interparcel circulation (16)
- Parallel facility improvements (16)
- Bicycle/pedestrian strategies or facilities (23)
- Bus transit service improvements (13)
- Bus transit facility improvements (15)
- Right-of-way preservation (20)
- Advance right-of-way acquisition (24)
- Intelligent Transportation Systems (26)
- Transportation Demand Management (20)
- Site development studies/review (22)
- Site impact analysis/site impact fee (14)
- Intergovernmental agreements or partnering (22)
- Scenic highway preservation/enhancement (19)
- Other? Maintenance accountability process, rerouting of local streets, local system completion, ramp metering, subdivision regulations, rezoning, site plan design standards, corridor management studies.

(Please provide examples of corridor management plans or studies which illustrate your use of any of the above techniques)

3. Does your agency monitor the effectiveness of its corridor management activities? Yes 10 No 24

If yes, how?

Through the planning process (4), Before and after crash analysis (5), Before and after travel speed and delay (2), operating characteristics, capacity via congestion management systems, Corridor Capacity Preservation Program, indirectly through ongoing interaction with localities and through standard monitoring and planning activities.

Does your agency have a mechanism for incorporating this information into its corridor management activities? Yes 7 No 22

If yes, please describe that mechanism?

The planning/programming process (4), identifying discrepancies in manuals and incorporating best practices, information from completed projects is used to evaluate proposed projects.

Based on your agency's monitoring program, which techniques seem to be the most effective?

Consolidation/removal of access, median treatments, purchase of access rights, intergovernmental agreements, accident and congestion studies, access management measures, highly dependent on specific situations addressed.

4. What funding mechanisms has your agency used to implement corridor management strategies?

- Transportation Development Districts (Special Taxing District) (4)
- Local Agency Partnering (16)
- Public/Private Partnering (12)
- TEA-21 Transportation Enhancement Funds (16)
- TEA-21 Surface Transportation Program Funds (23)
- Other? State funding (8), NCPD/CRI and Interstate maintenance funds, CMAQ funds, TEA-21 ITS Deployment Program, Scenic Byways Grants

5. Are you aware of regional or local agencies that have prepared corridor management plans or studies? Yes 21 No 13

(Please provide an agency or contact name, and telephone number we can use for follow-up. Also, please forward a copy of the plan or study)

Agency _____
 Contact _____
 Telephone _____

6. Does your agency coordinate with regional and/or local agencies on corridor management issues? Yes 32 No 2
 If yes, how?

Project by project basis (5), Planning process (10), Corridor management plans (4), Intergovernmental agreements (3), Design process (3), Financial support (2), Site plan review (2), Consensus building, Limiting adjacent land access, Construction and maintenance, Partnering, Advisory to local agencies, Special studies and plans, Committees.

7. Do you provide training, education, or outreach on corridor management techniques? Yes 12 No 21

- Do you use different strategies or techniques for different audiences (elected officials, agency staff, developers, local government agency staff, etc.)? Yes 8 No 15
- What strategies or techniques do you use for different audiences and why?
 - Broader information for elected officials that is non-technical (3).
 - More specific information for those involved in the process (implementation and technical information) (3).
 - Gear to the specific goals and objectives of the audience.
 - Information centers, workshops, focus groups, and surveys.

[Please forward relevant materials (brochures, handbooks, pamphlets, course materials, etc.) with your completed survey]

Thank you for your assistance. Please fax or mail the completed survey and supporting information to:

Kristine M. Williams, AICP, Center for Urban Transportation Research,
 University of South Florida, College of Engineering,
 4202 E. Fowler Ave., CUT 100, Tampa, FL 33620-5375.
 E-mail: kwilliams@cutr.eng.usf.edu. Tel: 813/974-3120, Fax: 813/974-5168.

APPENDIX B

List of Survey Respondents

Arizona Department of Transportation
Transportation Planning Group

Arkansas State Highway and Transportation
Department, Planning

Caltrans
Office of Advanced Systems Planning, Traffic
Operations Program

Colorado Department of Transportation
Region 4

Connecticut Department of Transportation
Intermodal Programming and Policy Planning

Delaware Department of Transportation
Planning Division

Florida Department of Transportation
Office of Policy Planning

Hawaii Department of Transportation
Statewide Transportation Planning Office

Kansas Department of Transportation
Bureau of Traffic Engineering

Kentucky Transportation Cabinet
Intermodal Programs

Louisiana Department of Transportation
Management Systems

Maine Department of Transportation
Division of Planning

Maryland Department of Transportation
Office of Planning and Preliminary Engineering

Michigan Department of Transportation
Bureau of Transportation Planning

Minnesota Department of Transportation
Office of Traffic Engineering

Mississippi Department of Transportation
Transportation Planning

Missouri Department of Transportation
Traffic Engineering

Montana Department of Transportation
Office of Multimodal Planning

Nebraska Department of Roads
Property Management Division

New Jersey Department of Transportation
Bureau of Mobility Strategies

New York Department of Transportation
Mobility Management Section

North Carolina Department of Transportation
Research and Development Unit, Project Development
and Environmental Analysis Branch

North Dakota Department of Transportation
Office of Transportation Program Services

Oklahoma Department of Transportation
Planning Division

Oregon Department of Transportation
Corridor Planning Section

Pennsylvania Department of Transportation
Bureau of Highway Safety and Traffic Engineering

South Carolina Department of Transportation
Planning Division

South Dakota Department of Transportation
Division of Planning and Engineering

Texas Department of Transportation
Systems Planning

Utah Department of Transportation
Planning Division

Virginia Department of Transportation
Transportation Planning, Traffic Engineering

Washington Department of Transportation
Statewide Planning

West Virginia Department of Transportation
Planning and Research Division

Wyoming Department of Transportation
Engineering and Planning

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medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

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