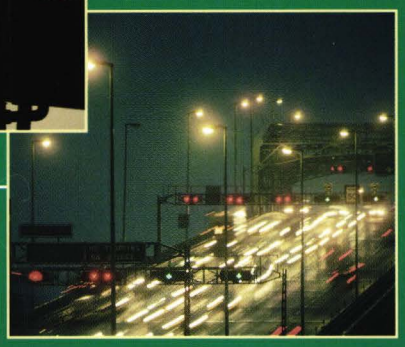
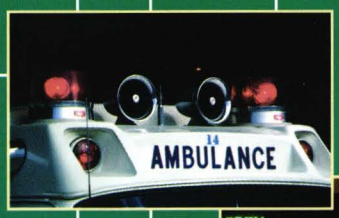
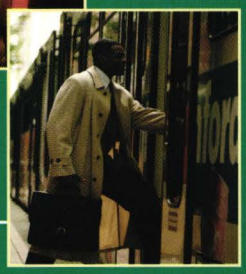
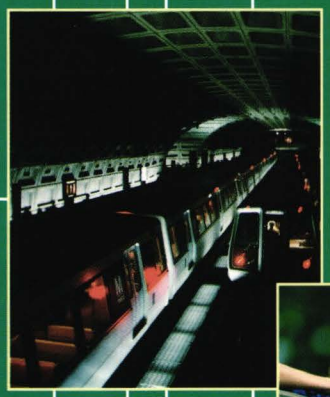
smart moves

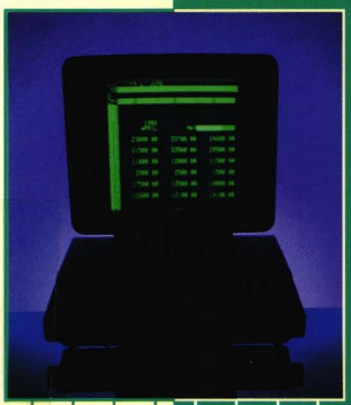
A DECISION-MAKER'S GUIDE TO THE INTELLIGENT TRANSPORTATION INFRASTRUCTURE

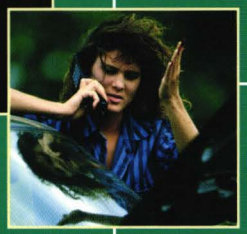












US Department of Transportation
Federal Highway Administration

PUBLIC TECHNOLOGY, INC.

Dear Official:

We are pleased to share with you *Smart Moves: A Decision-Maker's Guide to the Intelligent Transportation Infrastructure*, a guidebook developed by Public Technology, Inc. (PTI), under a grant from the U.S. Department of Transportation. Americans lost more than two billion hours to traffic gridlock last year, a loss that translates into higher costs of doing business, longer waits for emergency vehicles to respond at accident sites, an increase in air pollution, and a generally lower quality of life.

The time has come when building new roadways or expanding existing facilities can no longer answer those problems. Today, traffic volumes in most metropolitan areas are growing, at a time when transportation budgets are shrinking.

With the announcement of Operation TimeSaver, the U.S. Department of Transportation has launched a program that addresses this dilemma. The goal of this program is to build an Intelligent Transportation Infrastructure (ITI) across the United States within a decade—to save time and lives and improve the quality of life for Americans everywhere. Most states, regions, counties, and cities already have pieces of this infrastructure in place today.

The ITI is a telecommunications infrastructure for surface transportation. Many components of the ITI have cross-cutting relationships with the National Information Infrastructure (NII, or the "information superhighway") and provide the building blocks needed to integrate two or more of the following systems:

- Computerized traffic-signal systems;
- Freeway-management systems;
- Transit-management systems;
- Incident-management systems;
- Electronic fare- and toll-payment systems;
- Regional multimodal traveler-information systems;
- Railroad grade-crossing warning systems; and
- Emergency-management systems.

By integrating these systems, communities will realize enormous benefits from the smooth exchange of information, enabling agencies to provide better services to their citizens and customers.

This guide will help decision-makers in local government and regional agencies plan smart and buy smart for a better future. By purchasing technology that is integrated across agencies and in neighboring jurisdictions, your community can enjoy the full benefits of the ITI: reduced congestion, real-time information on public transit, faster emergency response, cleaner air, and an improved quality of life.

We hope you enjoy the guide, and we encourage you to find out how you can begin making smart moves for your community!

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smart moves

A DECISION-MAKER'S GUIDE TO THE INTELLIGENT TRANSPORTATION INFRASTRUCTURE

U.S. Department of Transportation
Federal Highway Administration

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25 YEARS OF PROGRESS

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Smart Moves: A Decision-Maker's Guide to the Intelligent Transportation Infrastructure was produced by Public Technology, Inc. (PTI), with funding from the U.S. Department of Transportation (DOT) Federal Highway Administration (FHWA).

From the outset, the book's intent was an ambitious one indeed: to help decision-makers in local government and in metropolitan planning organizations, especially, make sense of the many intelligent transportation technologies available to communities today—and apply those technologies as effective solutions not just to transportation dilemmas, but to a host of other concerns, including economic development, public safety, and quality of life.

Yet several people have risen to the challenge, shaping a tool useful to the elected official, government manager, and transportation expert alike.

Tod Newcombe, features editor of *Government Technology*, researched and authored the book. Supporting his efforts, Graham J. Norton, director of the Montgomery County, Md., Department of Transportation, and Douglas W. Wiersig, executive director of the Houston, Tex., TranStar, offered indispensable background. Special thanks go to Wayne Berman of the FHWA Office of Traffic Management and Intelligent Transportation Systems (ITS), and to others in the U.S. DOT ITS Joint Program Office, for their valuable critique of this book.

At PTI, Robert Hicks, business director for transportation programs, oversaw the project from concept to completion; Taly Walsh, director of communications, coordinated the book's design; and Shaden Tageldin, writer and managing editor, edited the book and managed its production. Arthur Morris, former research executive, provided overall management support.

Washington, D.C.-based AURAS Design, Inc., designed the publication.

PTI is the non-profit technology R&D organization of the National League of Cities, the National Association of Counties, and the International City/County Management Association. For 25 years, PTI has tapped collective research by its member jurisdictions and partnerships with private industry to create and advance technology-based products, services, and enterprises in cities and counties nationwide.

PTI's membership includes the Urban Consortium (UC), a special network of the nation's largest cities and counties. Working in four task forces—Transportation, Environmental, Energy, and Telecommunications and Information—UC jurisdictions identify and test new solutions to common concerns and share their findings with a wide audience of local governments, large and small.

The UC Transportation Task Force guides PTI's Local Government Intelligent Transportation Systems (ITS) Program, which ties advanced transportation technology research, planning, and implementation activities to the needs of local government. Through this program, city and county officials work actively with federal agencies and private technology firms to develop a nationally compatible ITS architecture and to ensure that new ITS applications meet local requirements.

Thanks go to all members of the task force for inspiring the development of this book and supporting its research.

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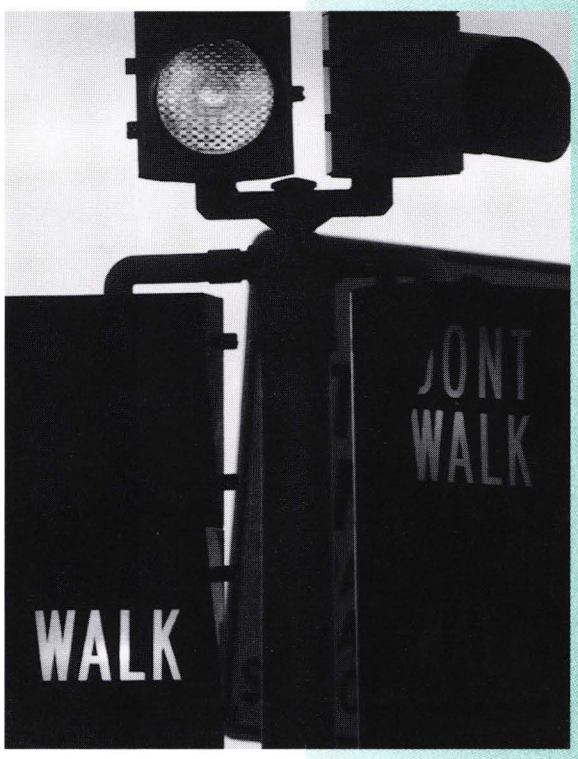
Introduction



Street Smarts: Building a Better Community Using Intelligent Transportation

"The use of advanced transportation technology to monitor and manage the transportation system and provide information to our citizens has played a key role in Montgomery County's ability to meet the ever-increasing traffic congestion associated with our rapid growth. Deployment of our Automated Transportation Management System has enhanced citizen safety and improved the efficiency of our highway and transit systems."

Douglas Duncan
County Executive
Montgomery County, Maryland

Montgomery County, Md., located in the Washington, D.C., metropolitan area, has experienced all the trials of rapid population growth: public safety problems, pollution, disappearing open spaces, and traffic congestion—lots of congestion, which is expected to double by the year 2015.

The county could have simply reacted to the various problems that came with development, paying more in taxes and quality of life as time passed and trouble escalated. Instead, county leaders acted early and decisively to solve these interrelated problems through better traffic and transit management.

In 1983, Montgomery County installed a small computerized traffic-signal system that controlled the intersections near a popular mall. From this experience, the county expanded into transportation management, adding computerized control to

When local officials identify the biggest problems their communities face today, congestion often tops the list. Intelligent transportation systems can unclog bottlenecks in urban and suburban neighborhoods—and make them more mobile, prosperous, and livable.

1,500 traffic signals, 200 video surveillance cameras, and 3,000 sampling detectors in the roadways. The county has equipped 250 of its buses with vehicle-location devices, so that the traffic-management center can track their routes and help them adhere to their schedules. The police and fire departments also are plugged into the transportation-management system, so that information on incidents and their locations is fed into computer-aided emergency dispatch systems. Using non-proprietary technology, the county has built its integrated systems at relatively low cost.

The net effect is that everybody—from the county's transportation managers, bus drivers, police officers, and fire personnel to the general public—has more information with which to make smart travel choices. Better choices, in turn, are helping the county's leaders make better decisions on managing growth.

Clearly, technology is helping government work smarter—and move better. Across the nation, cities and counties are linking basic government problems to problems with transportation, and tackling those transportation challenges with computers and telecommunications.

Every day, local governments work hard to address a spectrum of community issues: economic development, public safety, the environment, and quality of life. As they struggle to strengthen each of these core elements of community life, one problem—common to all—stands in the way. Our roads, highways, and public transportation systems have become a web of congestion and inefficiency. And caught in that web are the mechanisms that ensure the viability of our communities: how we create new jobs and keep existing ones, boost economic development, improve the air we breathe, keep our streets and neighborhoods safe, and sustain a healthy, satisfying life.

In the past, cities and counties have viewed surface transportation as an issue disconnected from others, a problem with only one solution. Simply build more roads and add more lanes to the highways, and—the reasoning ran—all the ills and side effects of traffic congestion would simply disappear.

Today, however, that strategy has become too costly to continue. Not only do we have fewer dollars to spend and less land on which to build, we also can no longer pay the price of bad air, static economies, deteriorating safety, inefficient transit, and an anxious society.

But a new solution exists. It's less costly than building new roads and it addresses your community concerns and your short- and long-term transportation problems. Instead of pouring more concrete and asphalt, you can turn to computer chips, fiber-optic cables, and software programs to manage traffic, inform travelers of transportation options, respond quickly to accidents, and collect toll and fare payments.

The term for this solution is the Intelligent Transportation Infrastructure (ITI). The benefits of a solid ITI include not only shorter commuting times, more travel options, and better safety, but also a stronger economy, cleaner environment, and a more livable community. These are concrete results, and the ITI can achieve them at remarkably reasonable cost to budget-strapped local governments.

The technology for smart traveling exists today. Your government is already buying the building blocks of a better future. By using existing telecommunications technology in smarter ways, your government can stretch its resources, reinvent bureaucracies, and better serve its citizens. Key components of the ITI have been tested and proven in some of the most congested urban areas in the country, helping to reduce congestion, provide better information to travelers, and improve traffic safety. Now it's time to integrate those components in your community.

WHY A GUIDE?

The purpose of this guide is to help you understand the concept of the ITI, its components, and how those components can be integrated to improve our mobility and enhance our communities for years to come.

You will learn how traffic congestion affects a community's economy, safety, tourism industry, and quality of life, and how you can implement cost-effective transportation solutions—based on technology and telecommunications—within a tight budget. You will discover how an integrated ITI can untangle not only your transportation problems, but also your government bottlenecks. The push to build a cohesive ITI will foster interdepartmental cooperation, information-sharing, and reengineering within your jurisdiction.

This guide will show you how to plan a successful ITI in your community; forge intergovernmental and public-private partnerships to leverage resources and build well-integrated systems; and buy smart, purchasing technology that works with, not against, your growing and changing transportation needs.

The guide will also explore financing options, including the range of federal and state funds available, some local approaches, and innovative public-private models.

Throughout this guide, you will see examples that show how communities have implemented various elements of the ITI, and discover the impact that intelligent transportation technology has had on their transportation and community concerns. At the end of this guide are lists of contacts and resources to help you get your local ITI initiative underway.

Communities large and small need smart solutions for today's complex transportation problems. By coupling proven technology with wise planning and decision-making, your jurisdiction can change the way people travel for the better. Already, technology allows cars, trucks, buses, and trains to communicate and navigate in ways that weren't possible a few years ago. But now we need to take the next step and create a seamless infrastructure that saves travelers time—and improves the quality of life for all Americans.

Executive Summary

Would you invest in a project that yielded between $8 and $11 in benefits for every dollar spent? Abilene, Tex., did, when it replaced outdated traffic signals with a computer-driven traffic-signal control system. The benefits came in the form of reduced traffic delays, faster travel for local drivers, and reduced pollution.

Across the country, pioneering local governments are going the way of Abilene, using technology to fix the transportation problems that plague so many communities: traffic, congestion, and inefficient public transportation. Gone are the days when government problem-solvers had just one or two high-cost alternatives. Now cities and counties can tackle their transportation problems with an arsenal of solutions that fit their resources and needs, thanks to a concept called the Intelligent Transportation Infrastructure (ITI).

The ITI uses information gathered by computers and telecommunications to cut traffic delays, reduce air emissions, improve

fast fact

To build and install the ITI from scratch in a metropolitan area the size of Washington, D.C., would cost about $300 million.

—U.S. Department of Transportation

emergency response, expand traveler information, and increase the efficiency of public transit as well as toll, parking-fee, and fare collection. More than 400 ITI projects are underway in the United States, involving a range of technologies that have been extensively researched and tested by federal, state, and local governments.

As Abilene and other cities and counties are discovering, investments in intelligent transportation technology can yield many happy returns. But the real impact of the ITI occurs when local governments begin to integrate that technology.

BRIDGING THE BOUNDARIES

When information from automated traffic-signal systems can be used to enhance emergency response, or when data gathered from public-transit computers can be shared with a traveler-information kiosk, the effects of the ITI begin to transcend transportation. Not only do traffic, transit, and congestion problems subside, but communities begin to see real progress in non-transportation sectors, such as the economy, tourism, the environment, and overall quality of life.

Businesses can jump-start their productivity by reducing the $40 billion in employee time they lose to congestion every year. Commuters can spend some of the two billion hours lost to traffic annually at home with family and friends. Tourists will be more inclined to visit communities where information on everything from bus schedules to road conditions is just a toll-free call away.

Integration also helps local governments tighten internal operations. Since sharing information means sharing ideas and then tasks and responsibilities, local leaders can use ITI integration to drive interdepartmental cooperation. Integration can also foster reengineering, by changing how information flows through government, and how government is organized to use information. Wise local officials will seize ITI development as an opportunity not only to improve transportation, but also to introduce new levels of government efficiency.

Local governments usually balk at the idea of spending scarce resources on advanced technology for transportation needs, but the concept of the ITI extends beyond using technology flexibly to having choices for funding as well. Some local governments are already using federal-aid funds to pay for a host

of ITI-related components. Certain projects intended to improve air quality or traffic safety, for instance, are eligible for full federal funding.

More innovative financing options also can provide the seed money needed to launch ITI projects. Through the newly created state infrastructure banks, states can set up accounts for local governments using existing highway funds. Public-private partnerships also can provide funds for building ITI components. Some approaches that have worked in the past include swapping rights-of-way for fiber-optic cabling or wireless transmissions, or negotiating agreements to test and use new products for free.

EMPOWERING COMMUNITIES

The latest trends in ITI planning and development channel options, resources, and benefits toward local government participation and control. At the community level, each local government should define its needs, and how the ITI can meet them, in a well-reasoned strategic plan. In this plan, citizens will have a major say, linking transportation priorities to community needs. Such plans can help local governments choose an appropriate systems architecture and establish an action plan for funding, building, and managing an ITI in their communities.

As an integrated solution to widespread transportation problems, the ITI also involves metropolitan planning organizations (MPOs), both as vehicles for short- and long-term regional planning and as bridges to federal-aid funds. Partnering with other governments in the MPO forum will advance the concept of building the ITI on an integrated, regional basis.

PARTNERING FOR PROGRESS

Local governments are also parting with the idea that government is the prime builder of transportation infrastructure. While local and state governments will be responsible for deciding what gets built, the private sector will supply the parts and services for the ITI, build the systems, and, in some cases, maintain them.

By forming partnerships with the private sector, local government will be rewarded with access to more effective products and services, greater risk-sharing in ITI development, and lower costs for taxpayers. Public-private partnerships also are useful ways to acquire the knowledge needed to operate and maintain ITI technologies.

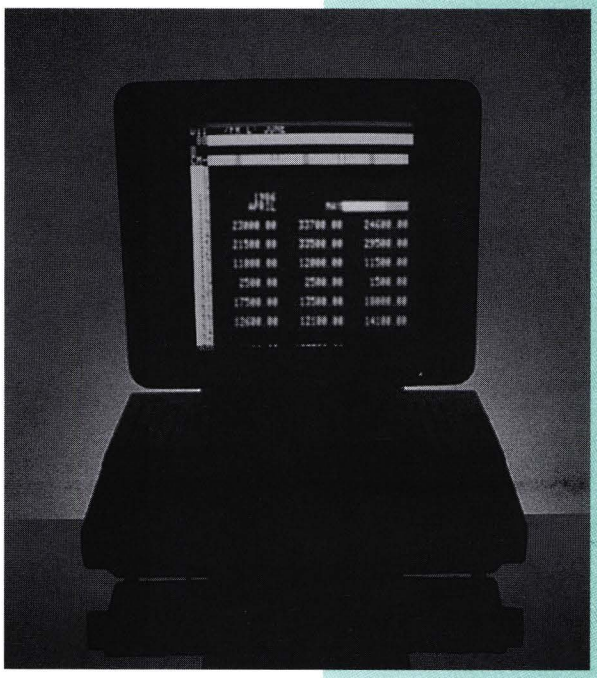
BUYING AND BUILDING SMART

That knowledge will serve local governments well. To hold down the costs of ITI technology and ensure its success, local governments need to buy smart. That means investing in open systems, which cost less than proprietary systems and can grow incrementally and according to available funds. Buying smart also means amending standard procurement practices to take into account the rapid pace of technological change, so that taxpayer money is wisely invested in the best technology—at the best possible value.

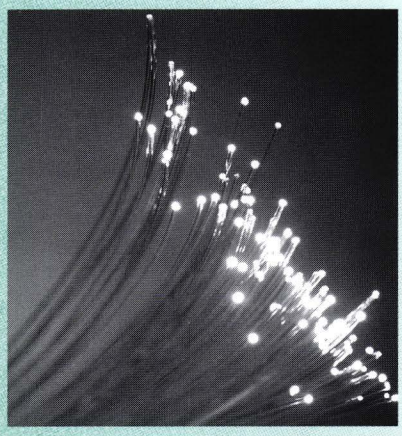
Finally, buying smart means building smart. ITI systems should be developed and installed in phases, so that bugs and problems can be caught and fixed in the early stages of a project. Computer systems that are built in stages are also more manageable. The private sector has learned and prospered by building technology in stages. So, too, should cities and counties.

PART ONE

What Is the Intelligent Transportation Infrastructure?



Making Your Move to a Better Community: The Intelligent Transportation Concept



Telecommunications advances are spawning a remarkable revolution in transportation systems, unleashing new ways for cities and counties to improve their citizens' quality of life. Shown here are several magnified optical fibers—each the approximate circumference of a human hair, and each carrying thousands of the myriad data transmissions that run today's traffic and transit technologies.

It's Monday morning, your weekly departmental meeting was supposed to start 20 minutes ago, and still not all the department heads have arrived. Then your chief-of-staff calls on her car phone and reports a major backup on the central corridor freeway. At the same time, the fire chief, who's made it to the meeting, gets a call: The backup is due to an overturned tank truck. There's a possible spill of hazardous materials. Traffic will have to be routed through local streets.

Then another call comes in. It's the police chief. He's going to be late, too. It seems that traffic from the freeway has spilled onto side streets, creating local congestion and slowing down police response to a big robbery in the business district. He and other officers have been delayed.

Well, the meeting has to be postponed, but the accident turns out to be not so bad after all, and traffic returns to normal in a couple of hours.

Nonetheless, a large number of commuters are once again late for work. A few are so fed up that they have decided to move away from the community. One of those people happens to be a business owner, who's thinking of moving his business to another location. Parents are late getting their children to school, and some tourists are rethinking their plans to stay and visit.

Everyone agrees that traffic congestion is a hassle, a pain-in-the-neck, and a hindrance to commuting and travel in general. But few local governments are aware of its full impact on the whole fabric of community life. The problems of congestion ripple through a community, affecting everyone from the police officers and emergency medical technicians (EMTs) fighting traffic to respond to emergencies to the parents trying to get their kids to school on time. The result is not just lost time, but lost productivity, increased pollution, and less-than-ideal living as well. And the problem is not going away.

Over the last decade, the number of vehicles using our interstate highway system has risen more than 30 percent, and demand is expected to grow by another 50 percent in the next generation. Meanwhile, businesses lose an estimated $40 billion a year to congestion.

In the past, our reaction to roadway congestion has been to build more highways and widen existing roads. But that response will no longer suffice. High costs, citizen opposition, lack of land, environmental concerns, and—most important—the knowledge that new highways don't absorb congestion for long—they simply spread it to other areas—are driving communities to seek another solution.

HARNESSING INFORMATION TO IMPROVE TRANSPORTATION AND COMMUNITY

The use of information technology to mitigate traffic congestion is not new. Many cities have installed traffic-management technology of one kind or another. Your jurisdiction probably has a signal-control system, for example. Other technology-based components may include electronic roadway signs that alert drivers to problems ahead and radio broadcasts of traffic conditions at peak commuting times.

But these components, operating in isolation, represent only a partial effort to resolve the problems that plague surface transportation today. What's missing is a comprehensive solu-

fast fact

To keep pace with the growth of vehicle miles traveled, the U.S. DOT predicts the United States would need to build 34 percent more highway capacity. For 50 cities, the 10-year cost would be $150 billion! For the same 50 cities, implementing an ITI—virtually from scratch—would cost just $10 billion, and buy two-thirds of the needed capacity.

fast fact

- Los Angeles, Calif., would have to build 197 miles of new freeway lanes and 468 miles of new arterial lanes annually to support 1990 levels of congestion.
- New York City would have to build 458 miles of freeway and arterial lanes to support 1990 congestion levels.

—Federal Highway Administration

local snapshot

Is your jurisdiction using ITI?

Yes	23.6%
No	76.4%

—PTI/ICMA ITS Needs Assessment, Fall 1995

tion to transportation problems: one that links proven components into an integrated system that reduces the traveling time of drivers and transit passengers while boosting public safety, protecting the environment, and preventing a range of community ills.

That is the essence of the Intelligent Transportation Infrastructure (ITI): Build individual systems that meet traffic, transit, public safety, parking, and other transportation needs, and then link those systems to achieve maximum effectiveness. The U.S. Department of Transportation (DOT) estimates that the ITI will reduce the travel time of Americans by at least 15 percent.

The ITI is a solution for today's tight government budgets. Because the concept is technology-based, it offers communities the flexibility to build only what they need, one step at a time.

Today's computer and telecommunications technology allows you to add more components—and more capacity—as the need arises. Can't afford to build an entire freeway-management system? Then just build those parts of the system that are most needed. Thanks to technology, you can build a solution that's in scale with your current budget, yet reserve the option to expand later, phasing in new features without starting from scratch.

PARTNERING TO HANDLE COMPLEXITY

The ITI is not a theory based on star wars technology. DOT has already invested $700 million to develop and test intelligent transportation technologies over the past five years. The private sector has invested even more. From this research and development (R&D), transportation experts have concluded that nine components or systems are the most effective in reducing travel time and improving safety. Together, they form the infrastructure for intelligent transportation.

These systems are: traffic-signal control, freeway-management, transit-management, incident-management, electronic toll-collection, electronic fare-payment, railroad grade-crossing control, emergency-response, and traveler-information.

To build and integrate these ITI components, your jurisdiction will need help, and partnerships will play a key

role. If departments in your jurisdiction are reluctant to talk to one another or to work with neighboring jurisdictions, then the development and deployment of the ITI, which demand cooperation, will present an opportunity to change the status quo.

Some of the partnerships you will develop will involve various departments within your government. The police, fire, emergency-management services (EMS), and public-transit departments are just a few that will have to share ideas and information to make the ITI a success. Joining them will be your business and community development departments, your environmental protection department, and your tourism bureau.

Others will involve regional teamwork, as regional transportation management is a key concept of the ITI. Indeed, your community will get its greatest return from its ITI investment through multi-jurisdictional cooperation and partnerships. Your metropolitan planning organization (MPO) will become a focal point for everything from a basic dialogue between communities to full-scale joint planning.

Your local government also will partner with private-sector firms to build, run, and help finance the ITI. By using public assets—such as rights-of-way—to reduce the cost of, or even pay for, private-sector ITI implementation, your jurisdiction can avail itself of critical integration and project-management expertise—skills private companies have honed.

To use public- and private-sector resources to the fullest, your local government will have to rethink how it procures technology and how it builds systems. To take full advantage of changing technology, you will need to invest in open systems, such as client/server computing, and consider waiving some of your jurisdiction's more restrictive procurement clauses.

The building of the ITI will also require the cooperation of citizens. The ITI, after all, is based on information, much of which comes from the cars on the roads. Locational transmitters, infrared transceivers for toll collection, and smart cards for fare and parking payments—all devices installed in cars or used by motorists—are just a sampling of technologies the public will use as the ITI evolves. It is important that your local government address the public's needs and preferences with ITI technologies and ensure that citizens understand the costs and benefits of such technologies before they are deployed.

Origins of the ITI

Today's ITI has its roots in intelligent systems. In 1991, Congress authorized a program exploring the use of advanced computer, communications, and sensor technologies to improve travel on highways and mass transit. Dubbed the Intelligent Vehicle-Highway Systems (IVHS) program, the effort was formally established under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA—pronounced "ice tea"). Since then the initiative has become known as the Intelligent Transportation Systems (ITS) program, to reflect its broader, more comprehensive scope as a testbed for developing technologies that enhance and improve the movement of people and goods.

Federal spending on ITS programs has risen from $20 million in 1991 to $227.5 million in 1995. During the same time, the private sector has invested even more to develop ITS products and services. The ITS budget is less than one percent of total federal spending on highways and mass transit.

To move ITS from research, prototyping, and pilot projects into routine usage, the U.S. DOT determined that decision-makers at the corporate, state, regional, and local levels need reliable information about the contribution that ITS products can make toward improving the safety and efficiency of our transportation systems.

The experience of the DOT has led to the current definition of the ITI, consisting of traffic detection and monitoring, communications, and control systems required to support a variety of ITS products and services in metropolitan and rural areas. Whether infrastructure is deployed by the public sector, the private sector, or a combination of the two depends on the locality.

PAYBACK: WHAT THE ITI CAN DELIVER

If you think the ITI is just another highway project, think again. Sure, it's going to cut travel time and congestion, but it's also going to give your community an enormous payback on its investment.

By reducing traffic congestion and improving the flow of travel information with the ITI, you can enhance the quality of life for businesses and neighborhoods. Shorter roadway travel times, along with more efficient public transportation, reduce pollution, improve worker productivity, and reduce the overall stress of commuting on a daily basis. Services that support tourism and public safety will no longer suffer from the problems created by congestion. For urban areas hard hit by air pollution, the ITI will enable your government to attain higher standards of air quality. And with the ITI's electronic toll-, fare-, and parking-fee-payment systems, your government can implement congestion pricing at peak travel hours to increase revenue streams.

An investment in the ITI also allows your government to manage its resources more effectively. With greater command and control of public-transit and emergency-response vehicles, cities and counties can improve services while squeezing more performance out of their fleets. These benefits spill over into police, fire, and even public works operations.

Your local government also can leverage its information and telecommunications assets to improve transportation. ITI development can drive the integration of once separate government computer systems, eliminating computer redundancies. The ITI also can reengineer how your departments use information. For many cities and counties, ITI planning and implementation will encourage more information-sharing across departments, which, in turn, can drive down the overall cost of managing various computer systems.

fast fact

The United States spends about $1 trillion, or one-sixth of the U.S. gross national product (GNP), on transportation products and services. A one percent improvement in the efficiency of this country's transportation system would save the American economy $100 billion over the next decade.

—U.S. Department of Transportation

16.6% of the U.S. GNP is spent on transportation products.

fast fact

In Washington, D.C., traffic congestion adds $1,500 to the cost of driving.

—U.S. Department of Transportation

Choosing Wisely: The Components of a Good ITI

Remember the days of "one size fits all"? If you wanted a stereo with a special feature, usually you had to buy the biggest, most expensive kind, which came with all sorts of additional features you didn't need. These days, stereos are made up of components. You can choose the features you want, integrate them in a custom system, and save some money as well.

The same applies in your jurisdiction. Take, for instance, your police department. In the old days, most police departments used to rely on one vendor to provide all the necessary hardware and software for basic operations. The problem? Not every police department could afford the large systems, and departments that could didn't need all the features of the single system.

Today, your police department probably uses one or more of the following technologies: computer-aided dispatching, mobile data terminals, fingerprint imaging, document imaging, geographic information systems (GIS) for crime analysis, and a records management system.

Integrated, these components build a police information system that, by all accounts, is improving public safety and reducing crime. Twenty-five years ago, few police departments would

local snapshot

Local government officials rank the worst transportation problems:

Speeding	65.1%
Rush-hour traffic	57.0%
Diversion of traffic	52.0%
Neighborhood traffic control	49.7%
Parking	49.0%
Signal coordination	45.0%
Stolen cars	36.2%
Enforcement of traffic lanes	32.9%
Air pollution	30.7%
Noise pollution	19.1%
Driver safety	9.8%
Transit security	8.0%
Lack of weigh station	8.0%
Emergency response	7.5%
Transit schedules	7.0%
Backup at tolls	4.8%
Carjacking	4.8%

—PTI/ICMA ITS Needs Assessment, Fall 1995

Congestion Crisis

Eighty percent of the U.S. population lives in areas with a population of 50,000 or more. In 1950, only 23 percent of the U.S. population lived in suburbs. By 1984, the number had risen to 44 percent. Travel demand far exceeds road supply, with 88 percent of Americans driving to work.

The result is congestion, with 40 percent of traffic moving at speeds of less than 35 miles per hour during rush hour in 1990, up from 30 percent in 1983. Over the next 20 years, traffic volume is expected to increase another 50 percent.

—U.S. Department of Transportation

local snapshot

Local Governments and Traffic-Management Systems

Currently use them	40.8%
Plan to implement them	8.7%
Are considering them	7.5%
Use systems provided by other jurisdictions	15.6%
N/A	27.4%

—PTI/ICMA ITS Needs Assessment, Fall 1995

have expected to be using such a wide array of information technologies to control crime. Today, every police department wants those technologies, and those that have them cannot imagine policing without them.

Your ITI, like a stereo or police information system, will consist of several computer- and telecommunications-based components designed to improve traffic management and the flow of travel information. Which components you choose, and how you put them together, depends entirely on the unique needs of your community. By first deciding what's best for your community, and then choosing the components that best fit those needs, you can create an ITI that's both cost-effective and efficient, and as fine-tuned as a well-planned stereo system.

CHANGING THE COURSE OF TRAFFIC: TRAFFIC-MANAGEMENT SYSTEMS

In some communities the problem is growth—double-digit growth that has filled streets and highways with cars faster than planners ever predicted. In older communities, the problem is lack of land. Suburb-to-suburb driving patterns have increased commuting in ways that overtax travel corridors, but existing development makes expansion of roads impossible. For other communities, it's the event: sudden torrents of cars that pour out of sporting and entertainment arenas and stadiums, creating massive traffic jams with negative ripple effects in nearby neighborhoods and business districts.

Traffic and congestion cause problems that plague every major urban area in the country today. Increases in pollution and car accidents, unreliable public transit, and lost productivity are some of the more glaring examples of what can go wrong. For local governments, all of these problems eat away at services and budgets that the years have stretched tinsel-thin.

To solve traffic problems, cities and counties often use automated traffic signals that synchronize changing lights to reduce congestion and bottlenecks. But traffic management is more than signal synchronization. It involves monitoring traffic flow, identifying and interpreting disruptions, and changing traffic patterns for the better.

These traffic-management tasks are handled in a number of ways, using different technology tools. Electronic sensors embedded in roadways can measure traffic flow, while video monitors attached to poles and visual reports from helicopters

and police cars can identify disruptions. All of this information is fed to traffic-control centers where managers can automatically adjust traffic-signal patterns to reduce congestion, or broadcast warnings and alternate routes via radio or, in some communities, via the community channel on cable TV.

A related system, using similar technology, is aimed at improving traffic flow on high-volume roadways. Ramp-metering systems can control the number of cars and trucks entering a congested highway, while large-scale electronic message boards and radio broadcasts can relay real-time traffic conditions to drivers.

Other traffic-management strategies include reversible-lane technologies, which double the number of lanes in the peak direction during morning and evening rushes.

For cities and urban regions that use traffic-management technologies, the results have been impressive:

- In Lexington, Ky., traffic management has reduced stop-and-go traffic delays by 40 percent, and accidents by 31 percent.
- Wichita Falls, Tex., has reported a 16 percent drop in stops, a 31 percent drop in delays, and an 8.5 percent drop in accidents—thanks to traffic-management technology.
- Seattle, Wash., and Minneapolis, Minn., have installed ramp-metering systems on certain high-volume freeways and have cut travel time in these corridors by as much as 37 percent.
- Dallas, Tex., has increased the rush-hour capacity of two older thoroughfares by 33 percent, using reversible-lane technology.
- In New York City's metropolitan area, 400 New Jersey Transit commuter buses receive real-time information about traffic conditions, allowing them to alter their routes and stay on schedule.

THE WAIT IS OVER: TRANSIT-MANAGEMENT SYSTEMS

For public-transit passengers, the problem is waiting and not knowing. Is the bus on time? Will it be full when it arrives? Why is the trip taking so long?

For your government, the questions differ. Are we using the buses as efficiently as we can? Why are we spending so much money on public transit and still seeing some routes overcrowded, and others hardly used?

fast fact

The United States has 60,000 buses for public transit. Approximately 11,000 now or will soon have AVL devices that enable control centers to ascertain their location, monitor their movement, and adjust schedules.

—U.S. Department of Transportation

local snapshot

Local Governments and Transit-Management Systems

Currently use them	6.4%
Plan to implement them	6.2%
Are considering them	8.2%
Use systems provided by other jurisdictions	24.2%
N/A	55.0%

—PTI/ICMA ITS Needs Assessment, Fall 1995

Finding Your Way with GPS

The ITI employs a number of high-tech tools, but one that stands out from all the rest is GPS. Why is it so special? Because GPS allows every square yard of the earth's surface to have a unique address.

GPS is a $12 billion U.S. Department of Defense (DOD) project that has put a constellation of 24 satellites in orbit high above the earth. Day and night, the satellites send out a radio signal that can be picked up by special receivers. GPS works by timing how long it takes a radio signal to reach us from a satellite and then calculating the distance from that time. By using a method known as triangulation, the receiver takes a measurement from three satellites to pinpoint your location.

The earth's ionosphere and atmosphere cause delays in the GPS signal that can translate into errors of position, but GPS receivers can correct the problem using mathematics. In addition, the DOD purposely degrades the accuracy of civilian GPS to keep hostile groups and countries from using the technology to their benefit. As a result, the armed forces can use GPS with an accuracy of 3 feet to three yards, while the rest of us have to be satisfied with an accuracy of about 50 to 100 feet.

Besides transportation managers, who rely on GPS to locate buses and other vehicles, users of the technology include surveyors, geologists, and hunters, as well as government agencies involved in electronic mapping.

Making bus travel a convenient and attractive alternative to driving while holding down costs is not easy. Passengers simply want better service. You want greater efficiency and better use of expensive resources. Fulfilling both needs might seem impossible, but with transit-management technology, there's a solution. If you know where your buses are and can relay information about traffic conditions to the drivers, then it's possible to raise service levels while stretching resources.

That's the role of transit management. By installing small vehicle-location devices in each bus, as well as two-way communications, transit systems can manage their bus operations based on real-time information. Automated vehicle-location (AVL) devices pick up signals from the U.S. government's global positioning system (GPS) and relay their precise geographic location, minute by minute, to dispatchers at a central command center. Dispatchers can then use wireless two-way radios to re-route buses and keep them on schedule.

With this kind of control, cities and counties can manage their buses better and reduce run times. That's what happened in Kansas City, Mo., allowing the city to eliminate seven buses from its fleet of 280. The savings paid for the AVL system in two years.

In Baltimore, Md., and Portland, Ore., computer-aided dispatching, combined with AVL technology, has cut travel time by 10 to 18 percent and has increased on-time performance by 12 to 23 percent.

PINPOINTING TROUBLE: INCIDENT-MANAGEMENT SYSTEMS

Remember the last time a tractor-trailer jack-knifed on the freeway in your community, or a hazardous-material spill shut down traffic in both directions? By the time your public safety crews were able to reach the site, traffic was backed up for miles, spilling into local streets. Your police, fire, and EMT crews put in loads of overtime because traffic slowed their response and cleanup efforts.

Fortunately, those mega-accidents are few. But every day, delays from simple fender-bender accidents quickly escalate into major emergency-response problems that drain your government's resources. And imagine the cost to the rest of the community and local business: in stress, lost productivity, and delayed delivery of goods.

With traffic accidents responsible for as much as 50 to 60 percent of rush-hour congestion, it's not surprising that incident management is a major component of the ITI. Incident-management programs identify and respond to vehicle accidents and breakdowns with the appropriate emergency services and help restore roadways to full service as quickly and safely as possible.

The systems range from the inexpensive—call-in numbers that drivers, equipped with cellular phones, can use to report an incident—to the expensive—video systems and loop detectors (sensors embedded in the roads) that monitor traffic speed and flow.

As in traffic-management systems, information in incident-management systems flows to dispatchers who can route assistance to the scene of an incident and, if possible, re-route traffic or alert drivers to pending delays via electronic message boards. Incident-management systems have proven highly effective in improving traffic flow, producing some of the largest recorded reductions in travel time.

Consider these examples:

- In Chicago, Ill., the city's incident-management system has reduced the time necessary to clear accidents by 50 percent.
- The San Antonio, Tex., TransGuide system features loop detectors embedded in every half mile of the local freeways, buttressed by cameras with zoom lenses. Using these tools, traffic engineers can detect slowdowns caused by accidents and initiate a response within 15 seconds of an incident. TransGuide has cut overall incident-response time by 15 to 30 minutes. Translated, that means faster incident clearance and less congestion.
- Minneapolis, Minn., reduced incident-clearance time by eight minutes, wrecker response time by five to seven minutes, and fatalities in urban areas by as much as 10 percent with its incident-management system.

FINDING A WAY AROUND TRAGEDIES: EMERGENCY-MANAGEMENT AND RAILROAD-CROSSING SYSTEMS

Few, if any, governments have the resources to provide extensive emergency services throughout their jurisdiction, especially if the outlying areas are rural. Deciding how to allocate resources for public safety can be a thorny issue for many local officials. But ITI technology can help mitigate this

fast fact

- A highway accident increases the risk of an additional accident by 6 times, according to a study of accident statistics on several California highways and expressways.
- Cities that monitor roads are able to remove stalled vehicles 50 percent faster.
- An incident-management system that costs $600,000 to operate can generate $1.4 million in benefits annually.

—U.S. Department of Transportation

local snapshot

Local Governments and Incident-Management Systems

Currently use them	6.4%
Plan to implement them	6.2%
Are considering them	8.2%
Use systems provided by other jurisdictions	24.2%
N/A	55.0%

—PTI/ICMA ITS Needs Assessment, Fall 1995

Will Vehicle-Control Systems Make Incident Management Passé?

First came seat belts, then anti-lock brakes. Today, it's air bags in the front and sides of cars for drivers and passengers. As protective as these safety devices are, they just don't compare to the next generation of safety controls.

Automated vehicle-control systems combine commercial and government-based technologies to enhance safety and increase roadway capacity. Soon, your cruise control will do more than maintain a steady speed on the highway: It will also use sensors and cameras to monitor the lane in front of your car and automatically adjust the set speed to maintain a safe distance from vehicles ahead.

Other technologies that are being tested or are in limited use include drowsiness detectors that keep drivers awake and infrared night-vision technology that detects objects obscured by rain, fog, or snow. If that's not enough, there's also the prospect of collision-avoidance systems that will automatically engage the brakes or steering wheel of your car when the computer senses an impending collision.

The same technology can be used to pack more cars onto highway lanes. Automated highways with dedicated lanes in which drivers steer but a centralized computer controls vehicle speeds can maintain close yet safe distances between cars, dramatically increasing highway capacity in some corridors. Some planners even envision fully automated freeways, with cars packed tightly side-by-side and front-to-rear. On such roads, computers would be in full control, with drivers remaining basically passive until they are ready to get off the freeway and do some real driving on local roads.

One big stumbling block for these high-end vehicle-control systems is their complexity and cost. Another concern is liability. Who bears the burden when these control systems break down, and thousands of tightly packed cars, gliding along at 70 miles per hour, suddenly veer and collide? Liability costs could shift from drivers to system manufacturers and infrastructure operators. That specter will probably keep high-speed vehicle-control systems on the back burner for some time to come.

problem, bringing rapid response and early warning capabilities to even the most remote areas.

In rural areas, the average time required to transport a victim from the scene of an accident to the nearest hospital is over 50 minutes. For victims of severe accidents, every minute counts. Technology can help your EMS personnel save lives, by immediately identifying the precise location of a crash and speeding response to the scene.

GPS technology can help locate vehicles precisely, while improvements in wireless telecommunications will allow emergency-response teams to trace the location of an emergency call from a cellular phone. Systems that give emergency vehicles a longer green light will also become more common. The city of Houston, Tex., already is installing a system that will let emergency vehicles control traffic signals. If a traffic light is about to turn yellow, an EMS driver can hold it on green until he or she clears the intersection.

Recent tragedies at railroad crossings have heightened our need for warning systems at these high-risk intersections. One relatively low-cost solution equips school buses and other vehicles with in-vehicle warning systems that alert drivers to approaching trains.

Houston's Railroad Grade-Crossing Monitoring System, a good example, will focus on several at-grade railroad crossings located on high-volume arterial roads and streets. The system will automatically track train movements through such corridors and feed information to the city's traffic-signal control and emergency-vehicle dispatch systems.

FOR WHOM THE FARE TOLLS: ELECTRONIC TOLL-COLLECTION SYSTEMS

Every local government would like to increase revenue without raising taxes. Charging motorists a toll for driving on high-volume roads, bridges, or tunnels seems one sure-fire way to do that. But current toll systems are costly—as much as $176,000 annually to operate an attended lane—and they contribute to roadway congestion and air pollution by forcing cars and trucks to stop and go.

Electronic collection of toll payments can reduce these disadvantages, however, while offering greater flexibility in how and when tolls are charged. Today, more than a dozen trans-

portation authorities around the country collect highway and bridge tolls electronically. Their systems allow non-stop payment of tolls using special radio-frequency identification (RFID) transceivers placed in vehicles. Each car's transceiver emits a special code that identifies the car as it passes the toll gate at a moderate speed. A receiver in the toll gate picks up the signal and transmits it to a computer system that debits the driver's account. Such systems not only speed up the flow of traffic, but also adjust toll fees automatically during different times of day, charging drivers congestion fees for travel during peak periods. Studies show that electronic systems cost far less to operate than attended systems.

In New York, speeds on the Tappan Zee Bridge during peak hours have soared from 8 miles per hour on attended lanes to 25 miles per hour on automated lanes. During peak travel periods an attended lane on the bridge can accommodate 350 cars per hour, while an electronic lane can easily handle 1,000.

fast fact

Electronic toll-collection systems increase fare collection by as much as 30 percent, cut operating expenses by as much as 90 percent, increase vehicle capacity by 250 percent, and reduce fuel consumption by as much as 12 percent.

—U.S. Department of Transportation

SMART CASH: ELECTRONIC FARE-PAYMENT SYSTEMS

Parking fees are a major source of revenue for many communities. Bus and subway fares help pay for public transit. But the business of collecting these fees and fares is not easy. The work is labor-intensive, requiring staff at parking lots, meters, and transit stations. Servicing and maintaining everything from meters to collection boxes to parking gates demands additional resources.

To alleviate these problems, jurisdictions have begun using various types of electronic fare-payment systems. In the case of parking, some cities have installed meters that accept electronic cash "keys" that motorists can purchase in advance and use in lieu of coins. Other cities are installing electronic tag systems in their large parking garages. The systems are similar to electronic toll systems, using electronic transmissions to automatically open the parking facility's gates, record a car's entry and exit, and debit a driver's parking account. Both electronic key and tag systems reduce the costs of fee collection and enhance revenue streams. The systems also collect valuable information on parking-usage trends.

Another fare-payment technology uses so-called "smart" cards, which have a computer chip embedded in the plastic. Your community can issue smart cards that consolidate all transit

local snapshot

Local Governments and Electronic Toll-Collection Systems

Currently use them	0.8%
Plan to implement them	0.8%
Are considering them	2.8%
Use systems provided by other jurisdictions	9.9%
N/A	85.8%

—PTI/ICMA ITS Needs Assessment, Fall 1995

and parking transactions for user convenience and centralized information to your transit agency managers. Smart cards are a proven technology, used by the commercial sector for financial transactions, and by state government to streamline human-service programs.

To understand how smart cards work, imagine an ATM card in reverse. Instead of withdrawing cash from a bank machine, the smart-card user transfers a cash value from his or her bank account to the card's microchip. The card can then be used to pay subway, bus, or parking fees. In one study, Los Angeles found the benefits of smart cards were more than double their costs.

local snapshot

Local Governments and Electronic Fare-Payment Systems

Currently use them	1.8%
Plan to implement them	2.1%
Are considering them	4.9%
Use systems provided by other jurisdictions	11.6%
N/A	79.7%

—PTI/ICMA ITS Needs Assessment, Fall 1995

TRAVELING WITH CHOICES: TRAVELER-INFORMATION SYSTEMS

When your community's tourism trade suffers because of traffic and congestion, that's bad news. When local travelers are unaware of alternative means of travel, that's also bad news. Without the right information, many drivers who might use your transit service won't, while tourists, who might enjoy their stay better if they knew how to reach their destinations, stop visiting your community. Either way, your government and community lose revenue, business, and quality of life.

Up-to-date travel information that is easy to access and use can offer out-of-town visitors and local travelers alternatives to driving in congested corridors. Such information can be conveyed very simply, through electronic variable-message signs, highway-advisory radio broadcasts, and other relatively low-tech mechanisms. Travelers can also gather information via low-cost telephone message systems. At a more sophisticated level, touch-screen kiosks in travel centers along interstates and in downtown locations can provide information and directions that lead travelers to their destinations. Personal computers also can offer access to similar information.

local snapshot

Local Governments and Regional Multimodal Traveler-Information Centers

Currently use them	2.1%
Plan to implement them	4.5%
Are considering them	12.5%
Use systems provided by other jurisdictions	16.9%
N/A	64.1%

—PTI/ICMA ITS Needs Assessment, Fall 1995

That information can tell the traveler the fastest and most direct driving routes to his or her destination, point the way to the nearest bus or subway stop, provide information on car pools, and flag upcoming parades and other events that could disrupt travel plans.

What's important is that the information be as up-to-date as possible. Traveler-information systems that stay current have been proven to reduce travel times for both local commuters and out-of-town visitors.

Bringing It All Together: The Value of Integration

Your jurisdiction has just installed a brand-new traffic-management system that can adjust traffic signals on the fly, altering the flow of cars and trucks during peak commuting periods or when a special event breaks out at the city's convention center.

But lately the phones have been lighting up with complaints about bus service that's going downhill, thanks to delays and schedules that are no longer accurate. The problem? Your transit department is getting no information about traffic fluctuations from the new traffic-management system. Cross-town buses are getting snarled in traffic caused by changes in the signal timing. Schedules are off, and passengers are angry.

Had your jurisdiction simply integrated its traffic-management system with its transit system's dispatching center, it could have avoided these problems. Prior knowledge about the traffic center's timing plans would have enabled transit staff to adjust bus schedules and routes accordingly, avoiding delays and complaints.

The scenario might seem obvious, but it's the kind of problem that needs to be foreseen and solved, if the ITI is going to work.

Going for the Gold with Traveler Information

During the summer of 1996, Atlanta, Ga., was awash with visitors navigating their way to the various sites and events of the centennial Olympic Games. A select group of visitors and residents had a chance to try out a $14 million showcase traveler-information system, built by the U.S. DOT in partnership with the Georgia Department of Transportation, the Metropolitan Atlanta Rapid Transit Authority (MARTA), and nearly a half-dozen private firms.

The system's goal was to support a seamless exchange of real-time transportation information with the public, helping travelers determine not only the best route to a destination but also the best mode of transportation.

During the morning rush hour, select local residents were able to watch color-coded maps on a cable TV channel for the latest travel speeds. Once they hit the road, cars equipped with on-board navigation systems used GPS and other data signals to keep them up to speed with route information and suggestions. At work, these commuters were able to check the latest traffic conditions on color-coded maps similar to those on cable TV, this time via a home page on the World-Wide Web.

Some visitors to Atlanta accessed information with personal communication devices similar to handheld computers. The devices provided up-to-date transit information and itineraries via wireless transmissions between the devices and a MARTA computer system containing bus and rail routes, schedules, and fare information. They also displayed maps with real-time locations of incidents and congestion, and—based on conditions at the time—provided route-planning suggestions.

Hotels featured interactive TV services that enabled visitors to request personalized travel information, in the form of maps and textual instructions, from their rooms, and pick it up at the front desk.

Hints from Houston

Booming Houston/Harris County, Tex., is located within one of the nation's major travel corridors. With cost and environmental concerns restricting physical improvements to the existing transportation infrastructure, the region is deploying a smart solution based on integrated technology and services.

Under development by the city of Houston, Harris County, the Metropolitan Transit Authority of Harris County, and the Texas Department of Transportation is the Houston Intelligent Transportation System, which combines traffic management and transit management with incident response and travel information.

A network of fiber-optic lines will link computerized traffic signals, roadway sensors, video cameras, and electronic variable-message signs. Along major freeways, high-occupancy-vehicle (HOV) lanes are under construction.

Using an automatic vehicle-identification system and closed-circuit television, the traffic control center will monitor access to lanes and manage remote-controlled barrier gates, changeable messages, and signals. More than 1,300 traffic signals along bus-route streets will be computerized to communicate with one another. Buses will be able to preempt the smart signals in order to maintain their schedules. Emergency vehicles will also enjoy priority signal privileges.

To encourage the use of mass transit, the Houston Intelligent Transportation System will offer information on bus schedules, routes, costs, and real-time status via kiosk, personal computer, and touch-tone phone. In areas that are not well-served by bus routes, a rideshare-matching service will encourage carpooling.

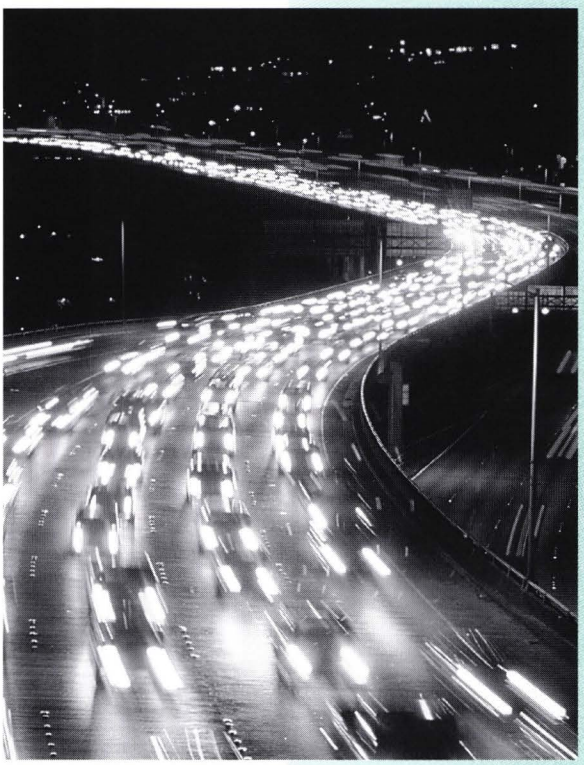
By carefully integrating intelligent transportation components, your local government will build an effective infrastructure that reduces congestion—and spend less money in the process. The components of an ITI must not be implemented as stand-alone systems; rather, they should be selected and managed as building blocks integral to an overall solution. Different agencies can operate the various components, but they must work together, sharing information seamlessly so that the advantages of one system don't cancel those of another.

Integration offers several key advantages:

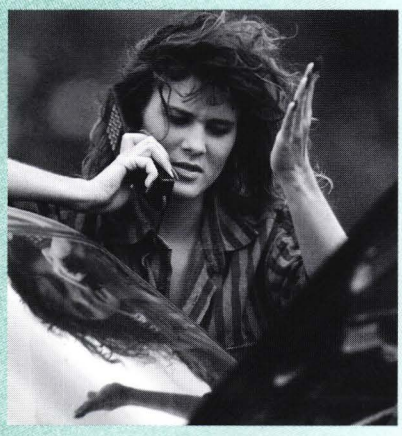
- Improving the responsiveness of your government services. Share transportation information across traffic-management, public-transit, police, EMS, and fire authorities, and your jurisdiction will drive down congestion while improving overall safety.
- Reviewing traffic data with information from other ITI systems to forecast potential transportation needs. In comparing data on fluctuations in transit ridership with reports on traffic incidents, for example, you may find a possible correlation. Your response might be to proactively schedule more buses or trains the next time there's a major accident.
- Making both transit and traffic information widely available, encouraging more commuters and travelers to weigh transportation alternatives. You can set up one toll-free number that commuters can use to get the latest information on roadway congestion, bus routes and fares, and so on. Don't make them call the public works department to find out which roads are closed for construction, the transit department for bus-schedule news, and the traffic department for congestion reports.
- Reducing repetitious data in your information systems. Maintaining separate databases is expensive, especially if some of the data is redundant. Your government can, for example, reduce technology costs by building one base GIS map for transit, utilities, and public works. These agencies, despite their different uses of geographic data, share the same reference points. One GIS is expensive to build and maintain; building three or four is wasteful.

PART TWO

Why Do We Need an Intelligent Transportation Infrastructure?



Rx for Travel: The Benefits of Smart Transportation



When accidents strike, victims need rapid police and emergency response—and others on the road need instant information on alternative routes, so they can bypass accident sites and move smoothly to their destinations. A well-integrated intelligent transportation infrastructure offers both.

We've learned that the key to a healthy life includes a well-balanced diet and lots of exercise. Both cost little, yet pay rich dividends. In contrast, eating too much of the wrong foods and getting no exercise can cost a person money, health, and ultimately life.

Maintaining the economic, social, and environmental health of your community today demands much the same prescription as prolonging life. Ignore a balanced transportation infrastructure, and the price could be a declining economy and poor quality of life, as traffic congestion runs its course.

But invest in the relatively low cost of a comprehensive transportation solution that meets the needs of your community, and you can create more travel choices for everyone, paving the way to a better economy and an improved quality of life.

Not only does the ITI cost less than traditional transportation solutions, but it offers a flexibility for local travel that benefits everyone. Your government can customize the infrastructure and tailor it to fit today's budgets and needs, while allowing for future modifications as situations and financial resources change.

Building an ITI also presents your government with a unique opportunity to parlay its existing computer and communications assets—and existing ITI components—into a more sophisticated and better integrated system. This intelligent infrastructure, with its multi-disciplinary approach, encourages cross-departmental and cross-jurisdictional information-sharing, allowing your government to reengineer its information flow. You can use ITI development to dissolve stovepiped programs into virtual government services that rely on multiple sources of information.

fast fact

Launched to alleviate travel difficulties after the 1994 Northridge earthquake, the Los Angeles Smart Traveler project used kiosks in office lobbies and shopping plazas to dispense travel information. Half the kiosks' users requested train and bus information.

—U.S. Department of Transportation

FINDING THE WINNERS: HOW THE ITI HELPS EVERYONE

So who benefits from the ITI, and how? Five sectors of your community can, in many demonstrable ways:

1. THE TRAVELING PUBLIC.

A sound ITI will improve the reliability of both your transit and traffic systems, reducing travel time and stress—and improving travel safety. With easier access to information, travelers and commuters will explore the whole range of travel choices, choosing a transportation mode that gets them to their destination as quickly, efficiently, and safely as possible.

fast fact

Automated traveler-information call-in systems increased requests for travel information by 80 percent in Rochester, N.Y., and by 138 percent in Boston, Mass.

—U.S. Department of Transportation

2. BUSINESS.

For businesses, the ITI can reduce the time required to transport goods, services, and personnel. Translated, that means lower transportation expenses, improved employee morale, and easier access for customers. Businesses will also increase their productivity, recouping the $40 billion they lose to congestion every year.

3. GOVERNMENT.

The ITI can help your transportation authority better allocate resources for public transit, and your public safety department better handle traffic incidents. With it, your city or county can collect more revenue—more easily—from bridge and highway tolls, as well as from mass-transit and parking facilities. Moreover, the ITI can help your government use information technology and telecommunications more effectively, tapping those assets to improve cooperation across jurisdictions and among service providers.

fast fact

Freeway-management systems

- Shrink travel time by 20 to 48 percent;
- Increase travel speed by 16 to 62 percent; and
- Increase freeway capacity by 17 to 25 percent.

—U.S. Department of Transportation

fast fact

Electronic fare-payment systems

- Increase fare collection 3 to 30 percent; and
- Slash data-collection costs by $1.5 million to $5 million.

—U.S. Department of Transportation

4. THE ENVIRONMENT.

More efficient use of your transportation systems will reduce the need for land to build more roads, arterial lanes, and highways. The ITI helps reduce fuel consumption and vehicle emissions by cutting delays and unnecessary stops. It also will encourage people to drive less and use public transit more.

5. TAXPAYERS.

The ITI saves taxpayer dollars by extending the life of your jurisdiction's transportation resources, and by cutting the costs of existing programs. By offering mechanisms for congestion pricing, the ITI also can increase revenue. Electronic tolls on highways and major arterials can be automatically adjusted, charging more to drivers who travel during peak periods.

fast fact

Traffic-signal systems

- Decrease travel time by 8 to 15 percent;
- Increase travel speed by 14 to 22 percent; and
- Shorten travel delays by 17 to 37 percent.

—U.S. Department of Transportation

MORE BANG FOR YOUR BYTE: LEVERAGING TECHNOLOGY ASSETS WITH THE ITI

Over the years, your government has invested heavily in computer and communications technology to process and transmit information. This technology includes everything from mainframe computers and dispatch centers to fiber-optic lines, 911 service, and wireless radio systems. Like your roads, bridges, and highways, these systems are assets you can leverage to build an ITI.

Few, if any, local governments will have to build their ITI from scratch. Some already have intelligent transportation components in place, such as a transit-management system, or a traffic-signal control system. And virtually all, including yours, boast information and communications components that can find their way into an ITI. These components may be phone lines, computers, fiber-optic lines, or computer networks. By finding ways to use some of this existing technology, your jurisdiction can hold down the overall cost of implementing an ITI.

fast fact

Reducing the time it takes to notify your jurisdiction's EMS personnel of a freeway accident from the current national average of 5.2 minutes to 3 minutes would reduce fatalities 10 percent annually.

—U.S. Department of Transportation

Your government can also use some of its other assets—rights-of-way along highways and utility poles, for instance—as part of its ITI. Working with private-sector partners, you can lower the overall cost of your ITI investments by using these existing channels for video cameras, wireless transceivers, and high-speed data cables, rather than building a more expensive infrastructure from scratch.

A BETTER WHEEL: REINVENTING GOVERNMENT WITH THE ITI

Reengineering is a buzzword that gets a lot of attention these days, but few cities or counties actually try to reengineer their services. Those that do reengineer often achieve new levels of efficiency, so why is the concept so difficult to embrace?

One problem is finding the right catalyst to move departments off dead center and on the road towards efficiency. The ITI can be that catalyst. It combines the tools of technology with information-sharing across departmental boundaries. Developing and using an ITI will force your departments to examine how information is gathered, and how it is shared. As your jurisdiction redraws the patterns of information flow, it will begin to reexamine and retool the management, coordination, and delivery of services.

For example, you can use the ITI to reengineer the ways departments (and neighboring jurisdictions) respond to emergencies, by coordinating the flow of information to dispatch the nearest available help to the scene of an incident. You also can use technology to reengineer the ways people pay for tolls, transit fares, and parking, by consolidating and simplifying the process using smart cards, for example.

ITI technology can also reengineer travel information, by allowing your government to integrate transit, traffic, and tourist information so that people can access it all at once from a touch-tone phone, a kiosk, cable TV, or the Internet.

Reengineering opens new transportation choices to the traveling public in your city or county. By reducing institutional and technological barriers to information-sharing across boundaries, it can bring those choices to an entire region.

fast fact

Transit-management systems

- Show a 45 percent annual return on investment; and
- Reduce fleet sizes by 2 to 5 percent, thanks to more efficient bus use.

—U.S. Department of Transportation

fast fact

New Jersey Transit estimates that its electronic fare-payment system has reduced the annual cost of handling cash fares by $2.7 million. From a similar system, the city of Atlanta, Ga., estimates a savings of $2 million.

—U.S. Department of Transportation

local snapshot

How effective do you think the ITI can be in solving your jurisdiction's problems?

Not effective	18.9%
Somewhat effective	22.8%
Moderately effective	36.8%
Effective	18.2%
Very effective	3.3%

—PTI/ICMA ITS Needs Assessment, Fall 1995

Reengineering and the Role of Technology

Here's what the 50 largest cities and counties have set forth as their objectives for government reengineering in transportation:

1. Establish cross-functional communications and technologies—such as smart cards and emergency-response and incident-management systems—that can improve the delivery of services within and between jurisdictions.
2. Deliver traveler information to the public through automatic vehicle locators, kiosks, the Internet, in-vehicle systems, and other technologies, to improve the movement of goods, services, and people.
3. Develop partnerships with the private sector to implement traveler-information systems.
4. Maximize the use of existing local infrastructure by incorporating new technologies to improve quality of life, public safety, and economic development.
5. Develop seamless systems that minimize institutional barriers and boundaries between different transportation modes: transit, highways, and pedestrians.

—from a resolution adopted by the Urban Consortium of Public Technology, Inc., at a 1995 annual conference in San Diego, Calif.

fast fact

The state of Maryland's Chesapeake Highway Advisories Routing Traffic (CHART) program, which aims to reduce traffic delays by cutting accident-clearance times, is expected to have a 10:1 benefit/cost ratio.

—U.S. Department of Transportation

PART THREE

How Do We Fund and Implement the Intelligent Transportation Infrastructure?

Smart Funding: How to Find Money to Build the ITI

The Intelligent Transportation Infrastructure (ITI) will cost far less to build than new highways and roadways will. Still, the big questions are: Who pays for the ITI? And where will the funds come from?

Intelligent transportation systems not only save taxpayer dollars by reducing gridlock, cleaning the air, and using resources more efficiently, they also generate new revenue for budget-strapped governments. Electronic toll-collection systems like this one can increase vehicle capacity on toll roads by 250 percent, potentially doubling revenue.

While there is no new federal funding initiative for the ITI, federal dollars currently allocated to local transportation systems under the regular aid program can be—and are being—used to build the ITI. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), which introduced flexibility into transportation spending, now allows local governments to use federal funds to pay for most core components of the ITI.

The U.S. Department of Transportation (DOT) is also restructuring the methods by which federal funds are distributed to states, giving states greater leeway in how they use transportation aid, and in how they can be reimbursed. These changes will allow local governments to explore a number of innovative financing mechanisms.

Finally, there is the private-sector option. With the tax dollars available for any transportation project constantly shrinking, DOT is encouraging local governments to pursue financing alternatives that involve the private sector. Some options allow the use of federal funds as "bank" loans for ITI projects that produce revenue, as well as for those that lack revenue potential.

FEDERAL FUNDING OPTIONS

With the passage of ISTEA in 1991, federal funding provisions for our highways and transit systems suddenly became much more flexible. Funds earmarked for highways could, up to a certain percentage, be used for public transit, and vice versa.

With ISTEA, your jurisdiction can build core ITI components and use federal funding to cover 80 percent of the cost. These funds also can reimburse 100 percent of the costs of ITI programs related to traffic control and safety.

Federal funds targeted to reductions in air pollution can, in turn, pay the operational expenses of relevant ITI projects. These funds come from the Congestion Mitigation and Air Quality Improvement (CMAQ) program, which directs federal dollars towards transportation projects in so-called non-attainment areas—those cities and urban areas that have yet to attain minimum federal standards for air quality. CMAQ funds, distributed according to a federal formula, can pay up to 100 percent of the cost of projects that improve transportation-system efficiency, reduce vehicle use or travel, or implement other measures that reduce vehicle emissions.

SMART DEPOSITS: INFRASTRUCTURE BANKS

Besides using funds aimed at cutting air pollution, your government can also "borrow" money to help pay for construction of the ITI.

In November 1995, President Bill Clinton signed into law the National Highway System (NHS) legislation, which gives local governments even more flexibility in meeting the operational expenses of the ITI. NHS includes two key financing mechanisms for local governments: (1) advanced construction, where a company will underwrite needed construction and the regional planning authority will reimburse the costs over time, and (2) state infrastructure banks.

Multi-jurisdictional regions can use up to 10 percent of their highway funds and 10 percent of their transit funds to create a state infrastructure bank that provides loans for ITI projects. In many cases, local governments will use bank loans to fund projects—automated parking-fee-, toll-, and fare-collection systems, for example—that generate revenue,

local snapshot

Has your local government received funding for current or planned ITI services?

Yes	23.5%
No	71.0%
Not sure	5.4%

—PTI/ICMA ITS Needs Assessment, Fall 1995

fast fact

Expansion of the city of Detroit, Mich., freeway-management center would reduce vehicle delays in the Detroit area by 40 percent, cutting fuel consumption by 41.3 million gallons and preventing 122,000 tons of carbon monoxide, 1,400 tons of hydrocarbons, and 1,200 tons of nitrogen oxide from entering the atmosphere.

—U.S. Department of Transportation

fast fact

CMAQ funding is the key to expansion of the Detroit, Mich., freeway-management center, which, when completed, will cut incident-related traffic delays by 40 percent and reduce fuel consumption by 42 percent overall.

—U.S. Department of Transportation

Congestion Pricing: Financing Option or Political Hot Potato?

From a pricing perspective, driving on our highways and roads is a classic case of economic inefficiency. Whether you drive at midnight or during peak rush hour, the price is the same. Without any market incentive to change our driving habits, it's going to be hard to put a dent in the price we really pay for congestion: the loss of billions of hours and dollars each year in time and productivity.

Congestion pricing is an attempt to put market forces to work on the highway. Charge extra for those who drive alone during peak hours, and local governments can generate revenue while inducing individuals to travel in groups, travel less, or use mass transit. Many industries, from air travel and utilities to phone service and resorts, use congestion or peak-period pricing to manage demand.

Cities and counties, however, have been reluctant to implement congestion pricing, primarily because of institutional barriers and concerns over political acceptance. Studies have questioned the fairness of congestion pricing, indicating that those who can least afford it are those who have the least control over their work schedules: the poor and women. Then there's the question of whether drivers will continue to take the same routes once congestion pricing takes effect. Higher tolls on major arterials could direct significant traffic to quiet neighborhood streets, disrupting communities.

But interest in congestion pricing is growing, and technology has made it much easier to implement. Electronic toll-collection systems can charge highway drivers fees that vary according to the time of day. The need for revenues to finance the ITI and other transportation projects makes the quick payback on investments in such systems attractive. And the search for ways to reduce air pollution and energy consumption also favors congestion pricing.

So far, 16 cities have developed proposals for congestion pricing. Seven have actually received funding from the FHWA to conduct studies. These pilot projects test a range of strategies: charging single drivers a fee to drive in high-occupancy-vehicle

which in turn would pay back the loans. NHS provisions, however, also grant local governments the freedom to use federal funds for debt service on outstanding loans, and to make loans to projects that don't have any apparent revenue-generating potential.

NHS also permits local governments to seek private-sector partners—such as financial investors, construction firms, manufacturers, telecommunications companies, and information providers—for ITI projects, and to use those partners' contributions to match federal funds.

MONEY UNDER THE MATTRESS: FUNDING ALTERNATIVES

Because the ITI is a telecommunications-driven initiative, your local government has a potentially strong financing option at its disposal. Public control of certain rights-of-way, such as road medians and utility poles, has barter value when it comes to building the communications network necessary to link and run ITI components.

A growing number of cities and counties are negotiating with private telecommunications companies to exchange access to publicly owned rights-of-way for the communications capacity they need. Other jurisdictions have raised revenue for projects by leasing rights-of-way to private-sector vendors. Both approaches can supply the resources your city or county needs to implement an ITI.

HOW TO GET STARTED

If your jurisdiction is typical, it's likely that you've never received any federal or state funding for the ITI. The PTI/ICMA ITS Needs Assessment, conducted by Public Technology, Inc. (PTI), and the International City/County Management Association (ICMA) in the fall of 1995, revealed that 75 percent of responding jurisdictions were receiving no funding for the ITI at the time. Less than six percent of the respondents had received funding under the federal government's ITI Early Deployment Planning or Operational Test programs. Nearly half of the responding jurisdictions agreed that their actual level of funding for ITI development was far below optimal.

The good news is that funding intended specifically for the ITI is available through the federal government ($223 million

were authorized in fiscal year 1996). While Congress has not appropriated any new funds for ITI development, it has allowed the continuation of ITI funding based on earlier legislation. You can get details on the funds for which you are eligible—CMAQ and others—by calling one of the 19 regional Federal Transit Administration and Federal Highway Administration (FHWA) offices listed at the end of this book.

More important, DOT recognizes that local governments need flexibility in their use of federal funds and in their reimbursement for transportation projects. For the past 40 years, the federal government has dispensed transportation funds through a grant reimbursement program that has chained local governments to a rigid formula, allowing them to begin construction projects only when they had the underwriting funds in hand. Over the years, many critical programs sat on the shelf until the required federal and state funds had accumulated.

Now, with the passage of the NHS legislation, a number of flexible financing mechanisms have restructured these restrictions, or replaced them entirely. Particularly important is the state infrastructure bank. If your state has applied for transportation bank funds, find out how that effort is moving forward and, if you can, tap into its resources by calling your state's DOT representative. If your state hasn't done so, find out why, and what can be done to help your state participate in this flexible financing program. Or find out if your jurisdiction belongs to a regional authority that might be eligible to fund an infrastructure bank.

Talk with your local telecommunications companies and see if they have plans to wire your community for the information superhighway. Chances are you may have some valuable rights-of-way, sitting on top of utility poles or embedded in roadway median strips, that you can barter to acquire some much-needed—and expensive—wiring to operate the ITI.

While the days of fully tax-subsidized transportation projects have come to an end, so too have the rigid and restrictive formulas for funding surface transportation programs. The federal government recognizes both the need for, and the benefits of, a more flexible approach to financing. It also supports the growing role of the private sector as a financial partner in ITI development. Financing options—and ways to find them—abound. Your government must take the initiative to tap the possibilities.

▶ (HOV) lanes during rush hours; charging tolls on privately constructed express lanes with automated toll-collection systems; raising bridge tolls during rush hours; charging drivers emission fees based on the vehicle miles they travel; and selling excess capacity on existing HOV lanes to single- and double-occupancy vehicles.

Smart Planning: Mapping Your Route to a Sound ITI

The Culture of Integration

Integrating technology components has never been easier. In recent years, the software firms that make database management systems have developed solutions that allow different databases to access and share information across computing platforms. If your government already has some components of an ITI in place, integrating those components with newer ones is now quite feasible.

To ensure that the integration of ITI components is as seamless as possible, the U.S. DOT is fostering the development of a standards-based transportation systems architecture. DOT has awarded contracts to the leading standards-development organizations to begin efforts toward that goal.

However, integrating traditionally separate operations, such as traffic-management systems and public-transit computers, is not solely a technology issue. It also demands bridge-building between different cultures and organizations. Studies have shown that the key factors in any successful integration are cooperation and coordination among participating agencies, as well as the use of integrated computer systems.

Integration often transcends jurisdictional boundaries. It's more than likely that your ITI will include components that serve neighboring counties and cities—or wherever your major travel corridors extend.

The success or failure of your ITI depends on planning. Good planning not only ensures federal approval of your funding requests but, more important, lays the groundwork for an ITI that has long-term benefits.

Good planning is also crucial because, unlike traditional transportation projects, which involve just your local transportation department, the ITI involves many stakeholders: from your fire and police departments to the local tourism bureau and economic development council, from neighboring jurisdictions and *their* transportation, police, and fire departments to last, but not least, the public.

A savvy plan will guide the purchase of equipment, training of personnel, and development of software to run various components. It also will set forth a publicity strategy: Get the word out early on the benefits and successes of your ITI, and your public will more easily accept the temporary disruptions and changes in travel needed to implement it.

Before your government embarks on its ITI journey, make sure it has a good map. Outline the planning you need to undertake and determine how these planning processes will help you build a sound ITI.

ISTEA INGREDIENTS: FUNDS AND PLANS

Finding money to start your ITI projects could be as simple as looking up in the air.

Much federal funding is driven by how well you link your overall transportation plans with efforts to improve the quality of your air. The Clean Air Act Amendments of 1990 and ISTEA yoke, for the first time, transportation improvement plans and programs with the attainment of national air-quality standards.

Under Clean Air regulations, local governments' transportation plans must support state efforts to meet federal clean-air standards. Penalties, including the withholding of federal funds, may be imposed if localities do not meet requirements of the Clean Air Act within specific deadlines.

ISTEA, which calls for an economically efficient and environmentally sound national transportation system, not only constrains the building of highways that foster single-occupancy driving (and with it, increasing auto emissions), but also decentralizes the transportation planning process, bolstering the role of metropolitan planning organizations (MPOs). ISTEA vests MPOs with the authority to make decisions concerning the planning and implementation of transportation projects.

For the first time, your local government has a much stronger voice in setting the transportation course that best serves its community. With other local governments, you have both the power to make long-range transportation decisions and the flexibility to use funds for the kinds of transportation your community needs.

Over a six-year span, ISTEA could allow local (and state) governments the flexibility to spend as much as $80 billion on highway and transit projects. Governments could decide how much funding to commit to highway projects, transit projects, and the ITI.

But with that flexibility comes responsibility. ISTEA provisions require your jurisdiction, working through its MPO, to produce two documents on its transportation programs: one on short-term priorities, the other on long-term.

local snapshot

Has your jurisdiction coordinated its planning of the ITI with any of the following?

MPO/council of governments	82.5%
Neighboring local governments	41.7%
Other local governments	27.4%
States	4.0%
Other	16.7%

—PTI/ICMA ITS Needs Assessment, Fall 1995

The short-term proposal is called the transportation improvement program, or TIP, and it includes priority projects slated for construction over a three-year period. The long-term plan covers a 20-year time frame.

Requiring local and state grant recipients to produce these documents is nothing new, but requiring that those documents include only feasible projects—and document those projects' funding sources—is a change from the past. As a result, TIPs and long-range plans are no longer wish lists, but blueprints for projects set for implementation.

ISTEA also requires early public involvement in the planning process for projects receiving federal funds. Such participation ties transportation strategies to broader environmental and quality-of-life goals. The best way to decide how much to invest in an ITI—as well as in ridesharing, HOVs, mass transit, and bicycle paths—is to find out very early what the public's transportation needs are.

Given the many ITI planning commitments your jurisdiction must make and meet to qualify for ISTEA funding, cooperation with your MPO is critical. If your jurisdiction is in a metropolitan area with a population greater than 200,000, ISTEA transfers the lead decision-making role from the state to the MPO. In areas with populations under 200,000, the state's DOT and the MPO will share decision-making authority.

Your MPO provides a neutral forum in which competing community interests can come together to discuss and address the short- and long-term transportation needs of your region. It's a forum that turns the old-fashioned, top-down decision-making process on its head. Now the power to set transportation priorities rests with those most affected by the decisions. That power is precisely what your local government needs to develop the ITI.

local snapshot

Has your jurisdiction developed a strategic plan for the ITI?

Yes	8.3%
No	91.8%

—PTI/ICMA ITS Needs Assessment, Fall 1995

local snapshot

How coordinated are your jurisdiction's ITI efforts across all functional areas?

Not coordinated	33.1%
A little coordinated	17.7%
Somewhat coordinated	33.7%
Coordinated	12.8%
Highly coordinated	2.6%

—PTI/ICMA ITS Needs Assessment, Fall 1995

LEAVING NOTHING TO CHANCE: ITI AND THE PLANNING PROCESS

What should you and your MPO be doing to make sure your region's ITI fits into its overall transportation plans? Remember that the ITI is a solution based on the integration of existing transportation systems with communications and technology. In general, be prepared to consider the ITI at every step of your transportation planning process—including the long- and short-term planning documents required by ISTEA.

Remember, also, that the successful ITI is an integration of services and institutions. Thus ITI planning involves other, non-transportation elements of government, from tourism and economic development to the environment and public safety. Plans, studies, and investment strategies that involve these areas should not leave the ITI out of the picture. For a detailed discussion of short- and long-term ITI planning and for specific guidance and resources on the subject, see the FHWA's *Integrating ITS within the Transportation Planning Process: An Interim Handbook*, available in the fall of 1996.

MAKING STRATEGIC SENSE

The best way to achieve your specific goals for an ITI is to write a strategic plan. A plan can help you define the transportation needs for your area and match these with ITI services or strategies, based on available resources. It also can help you define the systems architecture that best suits your jurisdiction's required services, then establish an action plan for funding, building, and managing the various components of the ITI.

According to the FHWA's *Integrating ITS within the Transportation Planning Process: An Interim Handbook*, your jurisdiction should consider developing an ITI strategic plan to:

- Maximize the use of existing transportation facilities and assets.
- Determine the feasibility of an ITI, and tie its many complex elements together.
- See how the ITI, which cuts across modes of transportation, geographic areas, and institutions, can help you unite these elements for the benefit of all.
- Prioritize the most important elements of your ITI, matching these to the needs of your region. Without such a plan, ITI activities will be uncoordinated and unstructured, paying little attention to overall planning goals and using funds ineffectively.
- Communicate more effectively. The strategic plan is an ongoing communications tool, as well as a reference point that coordinates implementation of the ITI, and keeps it on track.

Lessons Learned from Previous ITI Strategic Plans

1. Assess funding realistically before you develop a strategic plan.
2. Craft the agreements and partnerships that will sustain implementation of the strategic plan.
3. Use subgroups or small committees to maintain engagement and efficiency when involving departments and agencies in a comprehensive ITI strategic plan.
4. Don't over-commit resources to data collection. Save ample resources for addressing solutions.
5. Be sure to connect your strategic plans with other elements and documents of the region's overall transportation planning process.
6. Involve as many interested parties as possible in the ITI plan—from other government departments and elected officials to the private sector, special-interest groups, and the public—even though their involvement may slow down the decision-making process.
7. Relate ITI initiatives to the appropriate department. Remember that institutional concerns over the ITI, such as the change it may bring to traditional department operations, tend to be considerably more significant than concerns about technology.
8. Don't commit to specific technologies too early in the process.
9. Appoint an overall project leader from your lead agency, even though consultants and contractors may perform much of the work.
10. Make the plan result-oriented. Don't just talk about concepts; discuss an actual project with real time frames, costs, and benefits.

—*from* Integrating ITS within the Transportation Planning Process: An Interim Handbook

FINE-TUNING YOUR ITI PLANS FOR SUCCESS

Developing a strategic plan is a multi-step process. The FHWA has produced a basic framework for ITI-related plans in its *ITS Architecture Implementation Plan*. If your city or county lacks experience in public-sector strategic planning, other local governments that have gone through the process are excellent resources and may be able to provide some hands-on assistance, if necessary.

The FHWA's *Integrating ITS within the Transportation Planning Process: An Interim Handbook* defines the general stages of an ITI strategic plan as follows:

- Lay the foundation for consensus on what the ITI should do for your community by identifying your stakeholders. This step is vital to addressing issues related to ITI development. Your stakeholders may include everyone from motorists, transit riders, pedestrians, and tourists to local businesses, trucking firms, local and state government agencies, and MPOs.
- Start consensus-building by organizing a steering committee that includes key transportation officials and the ITI's major stakeholders. Interview focus groups to identify the major problems your community faces.
- Develop an ITI theme or vision that responds to the problems your research has identified, and set your goals and objectives. Your goals may include promoting economic development, reducing congestion, improving the environment, encouraging alternate modes of travel, and enhancing public access to travel and commuting information.
- Identify the user services you want in your area and the ITI components that can deliver them. Match these services and components with the problems you have identified.
- Establish ITI performance criteria.
- Identify the functional requirements of the necessary ITI components and their subsystems, and match those requirements with the components' capabilities.
- Define the system architecture for your ITI. An architecture describes what a computer system does and how it does it, and identifies the functions that the system must perform. Some computer architectures, such as mainframe-based systems, are centralized; others, such as client/server, are decentralized.

- Develop implementation and operation strategies for your ITI. These strategies include program development, cost estimation, project phasing, procurement, funding decisions, attention to legal issues, and ongoing consensus-building.
- Define the deployment plan.
- Monitor and evaluate ITI activities.
- Finally, consider the value of the electronic information your intelligent transportation systems (ITS) will hold, and whether to charge for enhanced access to such data. A very helpful resource for this assessment is Public Technology, Inc.'s *For What It's Worth: A Guide to Valuing and Pricing Local Government Information.*

PUTTING PLANS TO THE TEST

Some local governments have uncovered the keys to ITI success through research and operational tests. A case in point: the city of Louisville, Ky., which undertook a research and planning process before building an incident-management system on the busiest roadway in Kentucky, a 12-mile stretch of Interstate 65 that carries more than 135,000 vehicles each day.

After concluding that adding capacity would be too costly, the city focused on reducing response time to—and traffic delays associated with—vehicle incidents. Acting on recommendations from a private transportation firm, the city set up several committees to address specific concerns.

The specialized committees raised and resolved most of these concerns, leaving a cross-cutting steering committee to deal with just those issues that affected all agencies. The committee gathered data and set overall goals and objectives for the system, as well as methods to measure the system's effectiveness. Once the major issues were settled, Louisville was able to move forward without any significant time- and cost-consuming delays.

Based on another private ITI study, the city of Rochester, N.Y., established a three-phase ITI implementation strategy. The first stage set a goal of achieving quick benefits at minimal cost. One recommendation called for the city to install mileposts, landmark signs, and route and destination signs so that existing incident-response operations could easily identify the locations of incidents. The second stage called for an initial deployment of electronic equipment, such as fiber-optic conduits and electrical pull boxes, while the third and final stage called for full-system deployment.

Success Factors in ITI Deployment

- Hire skilled personnel.
- Be generous with training. Remember, ITI technology is complex.
- Test equipment in stages. Problems found in fully installed systems are harder to correct.
- Purchase equipment from state contracts, if possible. These help you buy the best equipment at the best price.
- Use just-in-time delivery for your equipment orders to reduce your storage costs.
- Use computer-aided software engineering (CASE) tools and object-oriented programming, where possible, to reduce overall software-development costs.
- Use a professional public relations firm to inform system users and benefactors about the need for an ITI and the success of initial ITI projects. Good success stories breed greater acceptance of the overall program.

—from Henry B. Wall, "Success Factors for ITS Deployment"

Smart Partnerships: How Opposites Can Attract

With as much as 80 percent of the investment in the nation's ITI expected to come from non-federal sources, your local government needs to prepare for changes in the way it funds and implements intelligent transportation programs.

While local governments will be responsible for building and maintaining the ITI, the private sector will supply many of the products and services needed to do both. To create an environment within your government that fosters linkages, relationships, and partnerships with the private sector will be a challenge, but the rewards will include more effective products and services, risk-sharing, and lower costs for taxpayers.

Yet those rewards are not the only reasons why partnerships will figure large on the ITI landscape. The technology used to build the ITI, from complex computer systems to telecommunications, will require significant new expertise, much of which your local government will not have. You may have to rely on not one but several technology partners to build and deploy smart ITI solutions.

Moreover, the ITI works best as a regional solution to what has become a regional problem. By its very nature, the ITI demands cooperation. The synergy of government departments, entire jurisdictions, and the public is vital to its success. Partnerships across departmental and jurisdictional boundaries will flourish as you use the ITI to address economic, environmental, and

local snapshot

Has your jurisdiction collaborated with private companies on ITI projects?

Yes	89.4%
No	10.6%

—PTI/ICMA ITS Needs Assessment, Fall 1995

safety issues. As users of the ITI, citizens are also expected to play a major role in shaping the future of transportation.

DANCE LESSONS: FINDING THE RIGHT PARTNER

If partnerships are the foundation on which much of the ITI will be built, then it's vitally important that local governments establish them. Since the final implementation of ITI projects will take place in your community, you, not the state or federal government, need to work directly with private-sector partners to forge strong, equitable, and lasting relationships.

Such relationships help your government benefit directly from any transfer of skills or technology that takes place. By establishing a partnership yourself, you can also ensure that the concerns and needs of citizens' groups are addressed throughout the planning and building process.

If you feel awkward about establishing a partnership with the private sector, you are not alone. To many, serving the public interest and profit-making seem poles apart. But whether out of sheer necessity or because of newly recognized shared interests, attitudes towards such partnerships are changing.

One key reason is the growing complexity of technology. Few, if any, local governments possess the skills necessary to build the components that make up the ITI. Without private-sector help, these systems won't be completed, nor will they meet critical requirements. If too many ITI components fail to perform, we could end up with fewer systems, shrinking the ITI market, which is expected to exceed $200 billion over the next 20 years.

That's bad news not only for government, but also for private industry. The computer and telecommunications industry has a vested interest in seeing that information management in the public sector works.

Another motivation for partnerships is funding. With tight budgets, local governments have little left over to invest in new technology projects. By sharing development costs with the private sector, however, local governments can gain access to new technology they would otherwise be unable to afford. Some private computer firms are willing to shoulder much of the development cost for certain applications because of the valuable research experience they can gain. Others hope to resell the results of their partnership efforts to other public- and private-sector customers.

Keep On Truckin': Commercial Vehicle Operations

Commercial trucking companies hope to gain productivity and profit by adopting intelligent transportation technology. Already a number of firms are using tools such as global positioning systems (GPS) to monitor the location and speed of their vehicles and the number and length of vehicle stops.

Commercial-vehicle operations (CVO) technologies aim to minimize truck stops at weigh stations and ports of entry. Fewer stops reduce travel time, increase productivity, save fuel, and reduce polluting emissions.

The HELP/Crescent Project, a CVO effort launched in 1991, involves states along Interstates 5 and 10, from Canada to Texas. The Crescent system gathers all the truck information needed to comply with participating states' laws and regulations—size and weight, certification of safety inspections, payments of taxes and fees, registrations—and records it on a smart card. As the truck travels its route, the card is electronically read—much as electronic toll cards are read—and its data matched with information in a central computer. Any discrepancies could cause the truck to be stopped and checked.

A similar project, Advantage I-75, runs along the Interstate 75 corridor from Ontario to Florida. One study has concluded that if all weigh-station stops on I-75 could be eliminated, savings would total $260 million each year.

Another north-south truck corridor extends from Duluth, Minn., to Laredo, Tex., along Interstate 35. Businesses there want to set up an electronic system that will allow trucks to clear customs before they hit the border. The plan would allow customs agents to seal truck rigs electronically and, using a GPS transmitter attached to the truck, track the vehicle to make sure it carries goods to the intended destination, with no deviations from a designated route. The trucks would be free to bypass border bottlenecks such as Laredo, where as many as 2,500 trucks arrive daily, creating 24-hour waits to clear cargo across the border.

Partnerships in Action

In Minneapolis-St. Paul, Minn., the Minnesota Department of Transportation (MnDOT), several other government agencies, and more than a dozen private companies have launched Guidestar, a statewide ITS program, as a public-private partnership. Guidestar uses video cameras, loop detectors, ramp meters, and fiber-optic cables to capture, process, and transmit traffic and travel-related information. For 20 to 50 percent of the funding for these projects, MnDOT looks to local governments, other state agencies, or the private sector. One major private-sector partner contributed $1 million to a project that brings travel information into homes and offices via computers, and into public places using touch-screen kiosks.

Atlanta, Ga.'s Traveler Information Showcase also has become a testbed for public-private partnerships, involving federal, state, and local governments as well as private technology and engineering firms. While the government sector is investing $14 million in the project to show how an integrated ITI works, the private sector is contributing labor, specialized expertise, discounted services, and free technologies and software licenses to help develop Atlanta's emerging ITI market.

ASKING THE RIGHT QUESTIONS

So what's considered appropriate in a partnership, and how do you get started? First, be aware that partnership-building is not at all an exact science. Some pitfalls?

1. Local governments often interact with a limited variety and diversity of partners, with many of the same partners involved in different projects.

2. Very few partnerships involve a full range of local government partners (city, county, or special local agency, such as transit or rail authority).

3. Many partnerships seem to exist only for demonstration projects of early operational-test grants, dissolving shortly thereafter.

4. Little documentation exists for objective evaluation of public-private partnerships. The public sector lacks information that might foster more effective future partnerships.

5. It's unknown whether the partnerships local governments form are the most convenient or the most effective.

—from Michael C. Pietrzyk and Raymond A. Yettaw, "Finding the Right IVHS Partnership on a Local Level"

One way to test the partnership waters is to use an unbiased facilitator who understands and can match your intentions and needs with private-sector research, development, and profit-making ambitions. If you decide to proceed on your own, realize that you can follow some basic steps to select a good private-industry partner.

Metro-Dade County, Fla., put approximately 500 hours into the partner-selection process back in 1992, proceeding in three stages. While each stage had as many as a dozen steps, the strategy boiled down to (1) establishing the sources and methods of contact; (2) soliciting and confirming interest among private-sector firms; and (3) formalizing the partnership agreement.

From its experience, Metro-Dade County learned a number of key lessons about soliciting potential partners:

- Understand your needs and the expected benefits from ITI technology before soliciting the help of private industry.
- Investigate all known private-industry listings for related firms.
- Try cold calls. They are the most effective means of solicitation, because they save time, are the most direct form of communication, and assure the widest exposure for the project.

- ▶ Understand that it may take several calls before you reach the most appropriate contact. Be sure to document all calls and contacts, in case a follow-up is needed.
- ▶ Familiarize yourself with the company's current work experience and its future goals.
- ▶ Clearly explain your government's needs and incentives for working with a private-sector partner. Private firms have difficulty recognizing the opportunities that come from participation in public-private partnerships.
- ▶ Don't categorize the partnership as the traditional agency-contractor relationship. Partnerships are based on shared interests, mutual trust, and extensive communication between two groups. Identify and remove institutional and legal barriers, such as indemnification clauses, that might force the partnership to dissolve.
- ▶ Limit private-partner participation to product contribution, installation, marketing, and/or in-kind services in order to avoid the transfer of monies (which can come under close scrutiny and regulation).
- ▶ Use a facilitator to motivate and educate both public- and private-sector partners about their responsibilities in the relationship.
- ▶ Keep the process simple, and document all activities.

—from Michael C. Pietrzyk and Raymond A. Yettaw, "Finding the Right IVHS Partnership on a Local Level"

HAVING THEIR SAY: CITIZEN PARTICIPATION

Inviting citizen participation in the ITI planning process is not only a wise gesture on your part, but a required one, under ISTEA regulations. In fact, the act calls for involving citizens in transportation planning at the grassroots level and at the earliest stage.

Taking a strategic approach to transportation planning, ISTEA calls for the inclusion of community groups and citizens so that those stakeholders can effectively communicate the relevance of their concerns to your region's transportation policy and adoption of an ITI. The purpose is to turn reactionary, "not-in-my-backyard" responses into constructive contributions that shape the growth and character of transportation in your region, based on your community's social, economic, and environmental needs.

The Benefits of Partnership

1. Partnerships allow the public sector to:
   - Gain expertise;
   - Defray deployment costs;
   - Exercise more options in demonstrating and operating ITI components; and
   - Accelerate ITI project deployment.
2. Partnerships allow the private sector to:
   - Gain access to a long-term market;
   - Create an infrastructure that supports a firm's products and technologies;
   - Showcase a firm's products and technologies; and
   - Refine a firm's products and technologies in a real-world environment.

—from Michael C. Pietrzyk and Raymond A. Yettaw, "Finding the Right IVHS Partnership on a Local Level"

There's no question that opening up the ITI planning process to public participation poses some challenges. The ITI requires a certain level of consistency in system architecture, technology integration, and partner involvement, and consistency entails centralized planning. Public participation goes against that grain. The ITI also is complex, and its complexity hinders public understanding and participation. With its many components and reliance on sophisticated computer and telecommunications technologies, the ITI is not easy to grasp and understand. Generally unfamiliar with the ITI and what it can and cannot do, the public can fail to appreciate its full impact on transportation, environmental, and social issues.

Despite these challenges, public cooperation in ITI planning is feasible. Experience from early research and development projects and operational tests yields the following maxims for cooperation:

- Employ tested processes, such as citizen juries and policy consultation committees, that ensure broad stakeholder involvement at the early stages of planning.
- Build coalitions involving key stakeholders in the ITI: transportation policymakers and planners, businesses, and environmental and community interests.
- Spend funds to educate the public about the ITI—what it can do and how it works. Don't try to market the infrastructure to citizens; experience has shown that this approach isn't as informative—or effective—as educational outreach.
- Ensure that the ITI addresses quality-of-life issues, not just the technological issues of improving travel time.
- Integrate the ITI with other ongoing initiatives in your area, such as growth management, economic development, and intermodal planning.
- Encourage linkages between the ITI and ongoing environmental projects, such as alternative fuel programs, "livable city" projects, and even bicycle projects (e.g., rails to trails).

—from David Van Hattum and Lee W. Munnich, Jr., "IVHS and Public Participation: Challenges, Opportunities and New Models for Cooperation"

local snapshot

Are citizens aware of the ITI?

Yes	4.4%
No	81.6%
Not sure	14.1%

—PTI/ICMA ITS Needs Assessment, Fall 1995

Buying Smart

Your jurisdiction has just purchased some high-tech variable-message signs to alert motorists about road conditions and problems along its major traffic corridor. Now you want to share the message-sign information with some existing signs that serve another corridor, as well as with signs owned by your neighboring jurisdictions.

But the new signs were purchased under a low-bid procurement separate from those for the other signs, with different requirements for documentation, training, spare parts, communications protocols, and interfaces. The result? It's too difficult to link everything, and it's costing a small fortune to maintain and manage all the different signs.

Buying smart may sound like a cliché, but, given the prevalence of scenarios like this one, it remains a challenge ITI planners must meet. Rooted in information technology and telecommunications, designed to be flexible and most beneficial when its components are fully integrated, the ITI requires strategic thinking about purchases and investments.

Smart buying means investing in computer and telecommunications technologies that are based on industry standards, so that these technologies can share information with other systems.

Setting Standards for Traffic Management

Traffic management in the United States today is a patchwork of different systems, with cities responsible for arterial and secondary roads, and state departments of transportation managing freeways. The sharing of data between systems is, to put it mildly, weak. Typically, reports of incidents are transmitted by voice over police radios, not by computer.

In the past, automated traffic-management systems (ATMSs) have been built using proprietary technology, making them expensive and out of the reach of all but the largest urban jurisdictions. But under a contract from the FHWA, the Loral Corporation is building a prototype ATMS that uses an open systems computing architecture, which will integrate existing systems with the latest in technology.

The prototype blends off-the-shelf software with standard computer programming and communications languages. It runs on UNIX, a sophisticated computer operating system that is common in traffic management. Through a graphical user interface that displays computer information with easy-to-understand icons and menus, the prototype can accept and tie data from a variety of commercially available database management systems, existing and new.

The prototype ATMS employs advanced technology such as expert systems to predict congestion demands and suggest measures for controlling traffic and incidents. It also boasts mapping features that help traffic controllers visualize traffic patterns and congestion based on real-time data from embedded road sensors known as loops.

Not only does the open systems ATMS prototype cost less to build than a traditional ATMS, but it's also easily upgradeable, capable of incorporating ITI technology advances (such as data from in-board vehicle GPSs, as these become more widely available).

Smart buying also means investing in the best value rather than just the lowest price. Finally, it means taking a flexible approach to procurement, so that specifications don't drive up the cost or unreasonably prolong the time it takes to buy and install ITI components.

OPEN SYSTEMS: LINKING THE OLD WITH THE NEW

If you have been in government for a while, you know that buying computers can be expensive. In the past, the incompatibility of computer systems drove the costs of technology sky-high. The finance department needed one kind of computer, while the public works department needed another, totally different. Buying so many different computers, each based on different standards, meant that sharing resources and information across systems was difficult, if not impossible.

Today, that's changed. Certain technology standards have gained industrywide acceptance, allowing the creation of open systems. So what, exactly, is an open system? When some or all of the connections between the different software programs, networks, and computers in a system are standardized, that system is said to be open. In other words, different brands and models of mainframes, servers, and desktop personal computers—and their software—can share information.

This shift away from single-vendor systems gives you unprecedented freedom to choose the most cost-effective computing solution that fits your jurisdiction's needs. It also means that an existing traffic-management system can be integrated with a brand-new incident- or freeway-management system. As long as you agree to some common standards for computing platforms, operating systems, database systems, and communications protocols, you can design an ITI that shares information.

Once you have defined basic standards, you have the latitude to select from a broad range of hardware and software. Your jurisdiction can tailor its computers to meet the specific needs of a given ITI component, while maintaining data security and integrity across the entire infrastructure.

SERVING YOUR CLIENT

Two types of open systems have taken root in local government today: client/server and the Internet. Both approaches rely on

networks of computers to distribute and process information, and both cost less to implement than traditional mainframe systems, yet each achieves its goals in very different ways.

In ITS, client/server technology enables congestion data from a traffic-management system to be shared with a transit-management system that needs to tweak bus schedules to maintain on-time performance. The transit-management computer takes only the data it needs from the traffic-management database. Client/server technology allows the more efficient use of each computer, improving performance and cost-effectiveness.

Client/server systems are also more flexible than old-fashioned mainframe computers. If your system needs to grow, adding more desktop "clients" or database "servers" is relatively easy—and will not cost your jurisdiction an arm and a leg. Boosting the power of the overall system is as simple as adding new computers to the network.

Mainframe systems, by contrast, are more difficult and costly to expand. When demand outstrips a system's capacity, departments face the dilemma of purchasing an entirely new computer or allowing performance to deteriorate.

Virtually every component of the ITI can operate on a client/server system. GIS, computer-aided dispatch systems, and database management systems—core ITI building blocks—are available in client/server formats with interchangeable hardware and software.

THE INVALUABLE INTERNET

The second type of open system, the Internet, was originally developed by the U.S. Department of Defense with the scientific and academic community as a reliable channel for military communications. The Internet was deliberately constructed as a web of computer networks that use common protocols for exchanging information. That structure persists today. Thus, if one computer in the Internet's web of networks breaks down, information can still reach its destination via alternative routes.

The Internet is a well-known vehicle for distributing information. Already, however, its role is changing. Software developers have produced tools that allow interactive communication to take place on the Internet. In the near future, it will be possible to place orders for products and services, look at dynamic information that's constantly updated by databases, and perform other, to-be-discovered tasks.

The "Softer" Side of Integration

Today's transportation infrastructure isn't the only thing based on integrated components. Software programs increasingly consist of many smaller components integrated to create an entire information system. Take, for example, your common word-processing program. Vendors are rethinking that program's functionality, so that you, the user, will be able to build it in the form that best suits your needs. Don't need some of those high-end features for designing fancy charts and multi-column reports? Take them out. Have a better spell-checker you'd like to use? Simply replace the one that came with the software package with the one you like.

The same trend is surfacing in software used to run government operations. Building one huge software program is costly and time-consuming, and the resulting product is extremely difficult to modify. Recognizing that, developers who once made software that ran everything from payroll to utilities are now designing software in smaller chunks—called "components" or "objects" by the computer industry—that users can combine in customized systems in a relatively short time. Software for imaging systems and GIS, both widely used in local government today, is now being designed in this fashion.

Besides speeding the software-development process, software components promote flexible systems, because they are interchangeable. That's good news for local governments in general, and for those building an ITI in particular. The transportation-management system of a large jurisdiction will differ considerably in size and scope from that of a small or even mid-sized city or county. But the core components will remain the same. By sharing those core components, local governments can acquire proven technology from other jurisdictions while holding down their ITI costs.

Interactive ITI

Up-to-the-minute traffic reports. Instant carpools. The latest information on public-transit fares and schedules. These are just a few of the ITI services that are fast becoming ubiquitous on the Internet's World-Wide Web.

ITI planners have found the Web to be a perfect tool for solving transportation problems with information technology. They have adapted the most dynamic aspects of Web technology and are using them in creative and productive ways.

Take, for example, traffic. Local traffic-monitoring systems can feed real-time information about traffic speeds and suspected incidents into color-coded maps that drivers can view with their Web browsers—before leaving their homes and offices.

For southern California, Caltrans has created a Web site with real-time maps that list construction closures on the Los Angeles and San Diego freeway systems (http://www.scubed.com/caltrans/transnet.html). Drivers in Seattle, Wash., can view up-to-the-minute freeway conditions, including closures and construction projects, on Web-based maps (http://www.wsdot.wa.gov/). For the city of Houston, Tex., there's a Web site with a real-time map and tables that display current freeway speeds and travel times (http://www.herman.tamu.edu/traffic.html). And Montgomery County, Md., is even posting live traffic footage from video cameras in the field on its Web site (http://www.dot.co.montgomery.md.us/): Click on the intersection of your choosing, and up pops an instant snapshot of current roadway conditions, continually refreshed.

In Seattle, the University of Washington is using the Web to promote ridesharing online. In a test that began in July 1996, participants in the Seattle Smart Traveler Instant Ride-Matching System have used a Web site (http://sst.its.washington.edu/sst) to create a profile of their commuting habits and ask the system's computer to search for drivers that match the profile. Profiles can be amended at any time.

Use of the Internet in the ITI is just beginning. While your jurisdiction probably won't use it to operate a freeway-management system, you will very likely use its power to provide information to a wide audience of travelers and commuters. Right now, you can post on your jurisdiction's home page a range of static travel information, covering everything from train schedules to recent road closings.

But with the development of new application software for the World-Wide Web, your jurisdiction can also provide what's known as "real-time" information: up-to-the-minute reports on traffic conditions, the arrival times of buses at neighborhood stops, and commuting times along selected routes. Already, many cities and counties are reworking GISs to run on the Internet. As they do so, commuters will be able to view maps on their computers that show suggested routes and travel times, based on up-to-the-minute information gathered by their region's traffic computer systems.

SMART PROCUREMENT

Want to build a highway? No problem. Use your standard procurement system, which sets exact specifications for road construction. The materials and methods for building a highway have changed little over the decades, so it's really a matter of picking the low-bid winner and making sure that the contractor sticks to its schedule and builds to your strict specifications.

So why can't you do the same with computer systems? First, the cost and performance of hardware and software are constantly changing. Take the microchip, the workhorse of today's computer. Every 18 to 24 months it doubles in power. Today, Intel's Pentium microprocessor has 3.3 million transistors. The Pentium Pro, Intel's next-generation processor, already available in certain markets, has more than six million transistors. By the year 2000, Intel expects to develop a microchip that will contain between 50 and 100 million transistors and will perform two billion instructions per second.

No other industry from which your government purchases goods and services changes as rapidly or as often as the computer industry does. When your procurement department writes exacting specifications for computers, it can't really account for this element of change, especially if a project's timetable—from start to completion—runs 12 to 18 months, as it does with many large-scale projects.

Building computer systems, such as those used in the ITI, is a complex business. The private sector has learned that the best way to build computer systems is to do so in phases. As each phase of a project goes on-line, it can be tested and benchmarked to ensure that the system's integrity and reliability are up to snuff.

Unfortunately, governments can't appropriate funds for technology projects as flexibly as the private sector can. Politics, which change an agency's budget from one year to the next, force your managers to think big when it comes to funding computer systems. That approach contradicts today's computing wisdom.

Another problem with government procurement is its emphasis on low bids. Many prospective vendors say they build computers or write software programs, but few have the experience and expertise to create quality systems and back those systems up with the required support. Computers can easily break down if not built and tested properly.

Talk to your departments, and you will soon hear stories about computers purchased from low-bid contracts that had to be returned by the truckload because they contained faulty parts, or systems built by a small-time contractor, now out of business. When the time comes to fix these poor-quality, non-standard low-bid systems, finding a programmer who can repair someone else's technology can be difficult—and expensive.

SMALL PROCUREMENT CHANGES THAT ADD UP

Obviously, an overhaul of your entire procurement process is unrealistic. Your jurisdiction can, however, adopt some less-drastic solutions to improve its procurement process.

To counter the problems that evolve from low-bid contracts, some local and state governments have turned to "best-value" bids, where they weigh such values as product life cycle (what it costs to own a computer from the start to the end of its life), vendor reliability, and how a proposed system satisfies the government's mission. A best-value approach allows vendors to compete on quality, experience, and reliability, as well as price. Already, several states have adopted this strategy, and a growing number of local governments are exploring it.

Another way to tweak your procurement system, so that it better accommodates ITI and other technology purchases, is to waive some standard clauses. Some agencies have a clause

▶ One of the best sources of information on highway, transit, and rail systems—including conditions, timetables, schedules, and fares—is housed on a Web site maintained by the Intelligent Transportation Systems Program at Princeton University (http://dragon.princeton.edu/~dhb/).

Other Web sites serve as directories to transportation-related sites. You can find one such directory at the Horizon Internet Transit Center (http://www.Transit-Center.com/). This site contains lists of equipment and service providers, product specifications, a library, and a calendar of events of interest to the public-transit community. In the library, you can find copies of ITI-related requests for proposals (RFPs), invitations for bids (IFBs), requests for qualifications (RFQs), and other interesting material.

The Public Technology, Inc. (PTI), Web site (http://pti.nw.dc.us/) can put you in touch with many of these Internet resources. And PTI's *Surfing the 'Net: A Local Government Guide to Internet Connection* is a valuable resource for cities and counties interested in creating their own Web sites—or exploring other avenues for Internet-based service provision.

that requires a prime contractor to perform over 50 percent of the work. When a systems integrator must rely on a variety of vendors to build ITI components based on complex, client/server technology, that requirement can be unrealistic.

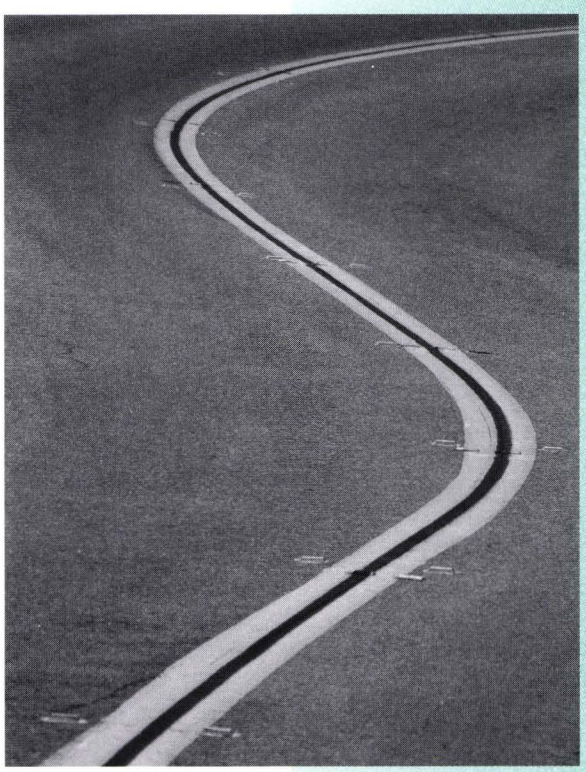
Other standard clauses that don't work well in the technology arena are inflexible requirements for disadvantaged business enterprise (DBE) involvement, as the list of DBEs qualified to work in the highly specialized field of ITI is often shorter than it is for less-complex fields. Also problematic are clauses requiring contractor "capacity," which measures the strength of a company by the scope of its physical assets, such as road graders and backhoes. Few systems integrators—even the big ones with billions of dollars in annual sales—have sizable physical assets, and the lack thereof may unduly disqualify them from bidding on a project despite their high-tech qualifications.

Yet another answer to the special challenges of ITI procurement is to prequalify vendors based on their capabilities as well as their products. With prequalification, your government can be confident that the contractors and integrators it considers have adequate experience in developing and building ITI components, as well as in ITI training and support.

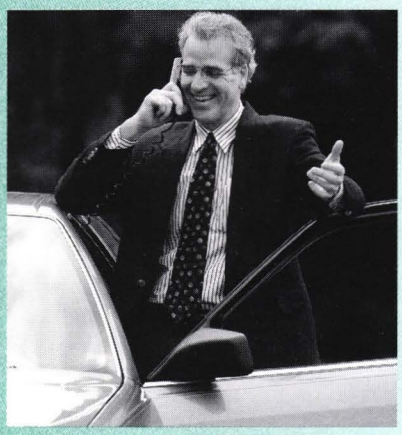
A final way to ensure integration and flexibility in your ITI is to incorporate emerging standards for ITI technology into the design of a component or system. While certain standards already govern information technology in general, the U.S. Department of Transportation has awarded contracts to major national firms to develop standards specific to ITI architecture.

Your jurisdiction may enjoy unusual ITI advantages—existing infrastructure and experienced staff, for example—that make some of this advice seem moot. Nonetheless, the better you understand how open systems can work in your favor and how to adjust your procurement system to fit the brave new world of ITI technology, the better your chances of reaching your goals.

Conclusion



Driving It All Home



A truly intelligent transportation infrastructure will leave travelers less time to worry about the daily commute—and more time to enjoy life.

At first glance, transportation issues often seem more regional than local. But a closer look reveals a different story. Traffic and congestion can affect your community's economy, safety, environment, and overall quality of life.

Despite the tremendous impact transportation improvements can make on the total health of a community, solving transportation problems has always been viewed as a very costly proposition. With tight budgets and other problems to solve, transportation is often low on the priority list.

But the Intelligent Transportation Infrastructure (ITI) changes the status quo. Its flexible, low-cost remedies for transportation ills in urban (and rural) areas allow local governments everywhere to move forward on challenging transportation issues. With practical solutions already tested and developed, your jurisdiction can make concrete changes in the ways people and goods travel in your community, despite limited resources.

With Congress passing, and the President signing, legislation for the National Highway System, construction of the ITI in metropolitan and rural areas is about to speed up. New funding mechanisms, such as state infrastructure banks, are cutting red tape and encouraging private-sector investment in the construction of the ITI. Federal financing can even fund some ITI projects entirely.

These efforts add up to an enormous first step in helping you tackle one of the major problems that communities face today. The ITI is an affordable solution that's already being applied in some of the worst traffic corridors in America. Now it's ready to be built in your community.

Here are three easy steps to help you begin:

1. Start a dialogue with regional business leaders, transportation operators, and commuters about specific needs in your area, and explore how the ITI might address those concerns.
2. Identify the ITI components already in use in your community and in nearby jurisdictions. From transportation and technology vendors, find out what available new technologies you could phase in as components of your ITI.
3. Identify opportunities for public-private partnerships on projects underway or planned.

Most important, talk to other jurisdictions already building ITI components, and learn about their experiences. You can find out more about these innovators from leading national associations involved in ITI research, such as Public Technology, Inc., and ITS America. And don't overlook the Internet. Search the 'Net for World-Wide Web sites that offer information on intelligent transportation. It's amazing what you will find.

Finally, don't wait. All studies show that demand for roads and highways will continue to grow if unchecked. The time to move forward is now. Your community can't afford to ignore an affordable answer to its transportation woes. The Intelligent Transportation Infrastructure is exactly that.

Glossary

Automated Vehicle Identification (AVI) - A system that transmits signals from an on-board tag or transponder to a roadside receiver for the automated identification of vehicles. AVI systems are used in electronic toll collection.

Automated Vehicle Location (AVL) - A computerized system that tracks the current location of vehicles, buses, etc., enabling fleets to function more efficiently.

Commercial Vehicle Operations (CVO) - Intelligent transportation technology used to improve the flow of commercial vehicles over long distances, and minimize truck stops at weigh stations and ports of entry. Fewer stops reduce travel time, increase productivity, save fuel, and reduce emissions.

Congestion Management and Air Quality (CMAQ) - A federal program that funds air-quality improvement projects, some of which include components of the Intelligent Transportation Infrastructure.

Corridors - In a transportation context, roadways identified as highly congested, and, therefore, targeted for federal research and funding.

Fiber (optical fiber) - A medium used to transmit information via light impulses rather than through the movement of electrons. A single strand of optical fiber, the approximate size of a human hair, can carry thousands of digital voice conversations or data transmissions at the same time.

Global Positioning System (GPS) - A system that determines the real-time position of vehicles using communications with a satellite.

High-Occupancy Vehicle (HOV) - Any vehicle containing more than one person, such as buses, carpools, and vanpools.

Intelligent Transportation Infrastructure (ITI) - The computer, communications, and control systems required to support a variety of intelligent transportation system products and services in urban and rural areas.

Intelligent Transportation System (ITS) - The application of advanced technologies to improve the efficiency and safety of transportation systems.

Intelligent Vehicle-Highway System (IVHS) - The former name for the Intelligent Transportation System (ITS).

Intermodal Surface Transportation Efficiency Act (ISTEA) - Legislation, passed in 1991, providing primary federal funding for highway and other surface transportation programs in the United States. ISTEA is unusual in that it allows transportation funds to be spent on nontraditional uses, such as the intelligent transportation systems program.

Internet - A collection of computer networks, all connected using a common set of protocols and rules on sharing and directing messages. The Internet is now the fastest-growing connection of networks known to humanity.

Kiosk - In the transportation context, an interactive computer center for traffic or travel-related information. Usually located in shopping malls, hotels, airports, businesses, and transit terminals, kiosks provide pre-recorded and real-time information using text, sound, graphics, and video clips.

Loop Detectors - Sensors embedded below the surface of roads and highways that monitor the flow of vehicles and help authorities manage traffic and incidents.

Open System - A vendor-independent computer system that is designed to interconnect with a variety of commonly available technology products.

Radio-Frequency Identification (RFID) - An electronic identification method that uses radio-frequency signals to read on-vehicle tags for automated vehicle identification.

Ramp-Metering - Traffic-sensitive regulation of vehicle entry to a freeway, typically via sensor-controlled freeway-ramp stoplights.

Smart Card - Card with a computer chip embedded in its plastic. A smart card works as an ATM card would in reverse. Instead of withdrawing cash from a bank machine, as an ATM-card user does, the smart-card user transfers a cash value from his or her bank account to the card's microchip. The card can then be used to pay subway, bus, or parking fees.

State Infrastructure Bank - Federal financing program that provides loans for Intelligent Transportation Infrastructure (ITI) projects. The bank loans (disbursed by states) can be used to fund ITI projects that generate revenue (automated parking-fee-, toll-, and fare-collection systems, for example), which can be used to pay back the loans. Infrastructure bank loans also can be used to pay debt service on outstanding loans and to pay for some projects that don't have any apparent revenue-generating potential.

Transportation Improvement Plan (TIP) - A program for transportation projects, developed by a metropolitan planning organization, in conjunction with a state, for a three- to seven-year period.

Variable-Message Sign (VMS) - Electronic highway sign that can change the message it displays. Used with traffic-management systems.

World-Wide Web (WWW) - A series of definitions and conventions that allows graphical presentations over the Internet.

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Kimley-Horn and Associates, Inc.

Public Technology, Inc.

Resources

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American Association of State Highway and Transportation Officials

American Planning Association

American Public Transit Association

American Public Works Association

American Trucking Association Foundation

Association of American Railroads

Coalition of Northeastern Governors

Community Transportation Association of America

Friends of ITS

International Bridge, Tunnel, and Turnpike Association

International City/County Management Association

Institute of Transportation Engineers

ITS America

Highway Users Federation

National Association of Counties

National Association of Regional Councils

National Association of Towns and Townships

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National Governors Association

National League of Cities

Public Technology, Inc.

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