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Intelligent transport

How cities can improve mobility

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Intelligent transport

How cities can improve mobility

By Jamie Houghton, John Reiners and Colin Lim

Cities face urgent transport challenges. Many are starting to tackle them by implementing new intelligent transport systems, and some have achieved impressive benefits. However, many cities are at the “early adopter” stage. How can they move forward? We believe five recommendations can assist cities in using new technologies to achieve optimized, integrated transport services.

The world is urbanizing rapidly, and population densities are increasing. A United Nations report estimates approximately 70 percent of the world's population will live in cities by 2050.¹ This growth is expanding demands on urban infrastructures of all kinds, including transport.

IBM research in over 50 developed and developing world cities reveals that although cities face unique transportation challenges, their leaders share a number of common ambitions.² Most strive for cleaner, less congested cities and improved traffic flow, primarily through increased use of enhanced public mass transit systems and other alternatives to private vehicles. In terms of transport systems, most leaders agree that infrastructure invest-

ments are necessary. However, the constraints of tight capital budgets are driving an increased focus on the need to better manage transport demand and supply through deploying intelligent transport systems (ITS).

The majority of cities are at an early stage in understanding and realizing the full potential of ITS. Our research identifies significant gaps between the progress of the typical city and the global leading practice. To understand what the leaders are doing, we talked in depth to transport officials and experts responsible for transport policies, programs and service operations in selected cities about their transport visions out to 2020 and the role of ITS in meeting their objectives.³ Specifically, we discussed their strategies and plans for implementing ITS, their progress and any practical

issues faced during implementation. After collating their experiences, we summarized a series of recommendations to assist cities as they progress toward solving transport challenges:

- Develop and implement comprehensive ITS strategies that are long term, flexible and integrated with the city's transport vision.
- Adopt customer-centered approaches to improve services, understand customers and influence customer behavior patterns.
- Integrate service delivery across transport modes.
- Secure funding and apply innovative business models.
- Effectively manage implementation by addressing the complexity of ITS projects.

Some cities have already made significant strides in these areas through implementing ITS (for example, multimodal fare card ticketing). As technologies mature and cities become more experienced in optimizing their value, we believe more and more cities will adopt global leading practices. In addition, virtually all cities can learn from others' experiences and accelerate their own programs. Ultimately, success will be determined by the leadership qualities of those with responsibility for developing and executing their city-wide transport strategies.

Intelligent transport

How cities can improve mobility

As part of their transport strategies, many cities have deployed ITS, and many others have plans to do so.

The smart city

The twenty-first century has been described as “the century of the city” due to increased urban populations and the expectation that this trend will continue.⁴ Urban growth is driven by the developing world, and there are increasing numbers of megacities – those with ten million or more people.⁵ Along with population growth, there is an increase in car ownership and demand for transport journeys across all regions (see Figures 1 and 2).

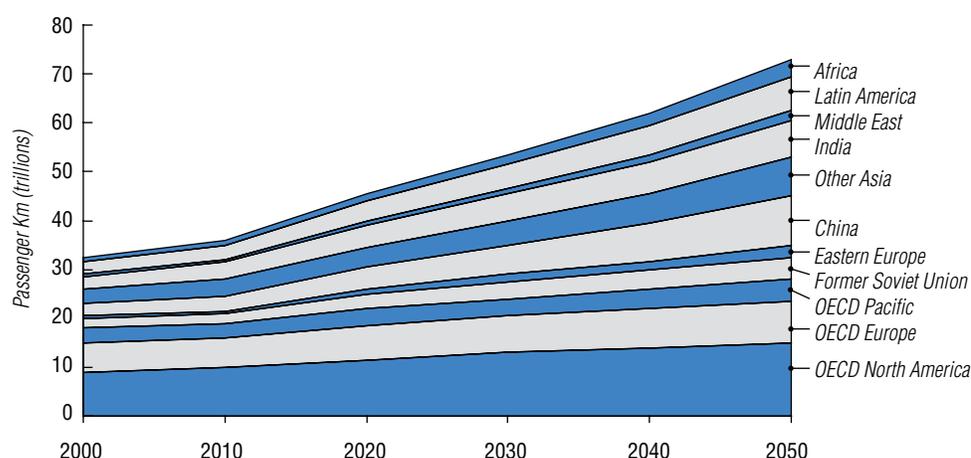
In the developed world, cities are increasingly becoming driving forces of their national economies (e.g., Tokyo, Paris, Zurich, Prague and Oslo all produce about a third of their countries’ gross domestic products, or GDPs).⁶ As cities grow in economic importance in the global economy, they often compete to attract commerce and employment opportunities. The effectiveness of a city’s transport system has a

significant impact on a city’s attractiveness to both prospective investors and employees.

The growth of the city presents city leaders with significant challenges and opportunities. A common emerging theme is the potential for cities to become “smarter” – to apply advanced technologies to collect more and better data, analyze it more intelligently and connect it through more effective networks. The end result is more efficient, effective and targeted services for citizens.

Cities are starting to use smarter solutions in the areas of water, wastewater, electricity supply and public safety. However, the adoption of smart solutions is perhaps most advanced in the area of transport, with many cities having deployed intelligent transport systems and many others planning them as part of their transport strategies.

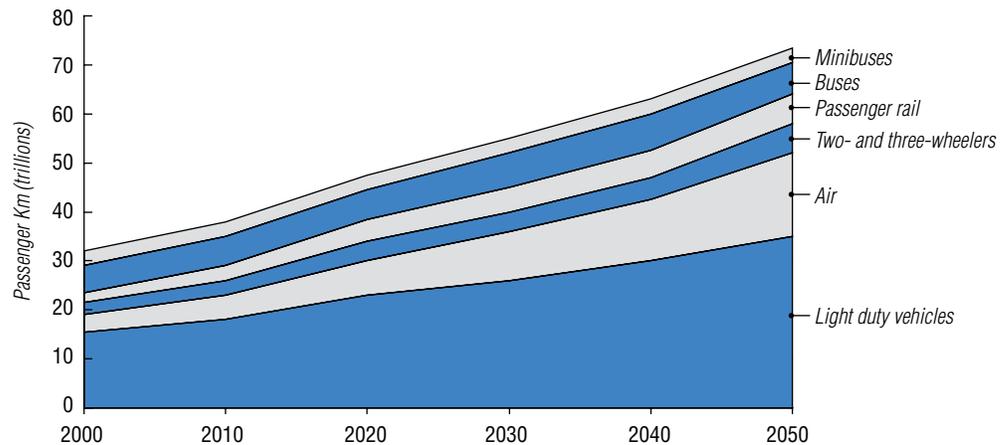
FIGURE 1.
Personal transport activity by region.



Note: OECD = Organisation for Economic Co-operation and Development.

Source: “Mobility 2030: Meeting the challenges to sustainability.” The Sustainable Mobility Project. World Business Council for Sustainable Development. December 2004.

FIGURE 2.
Personal transport activity by mode.



Source: "Mobility 2030: Meeting the challenges to sustainability." The Sustainable Mobility Project. World Business Council for Sustainable Development. December 2004.

Today's transport challenges

Transport is perhaps one of the most urgent issues facing most cities today. A 2006 study, "Megacity Challenges, A stakeholder perspective," found that transport was the single biggest infrastructure challenge for cities at all stages of development.⁷ Effective transport is central to a city's economic competitiveness, and severe congestion is known to have an equally severe economic cost, estimated as high as between 1 and 3 percent of GDP in developed and developing countries.⁸ Equally important, transport is an experience shared by almost all of a city's inhabitants and directly affects their well being. Transport is also responsible for a large share of emissions, which authorities increasingly want to control.

Our research reveals a common set of transport challenges. The most severe challenges reported include increasing congestion on all modes of transport, customer safety, a decaying transport infrastructure, under funding, growing negative environmental

impacts and the pressure to improve a city's economic competitiveness.

While there are similarities, the exact nature of the challenges and planned solutions vary for each individual city based on a number of factors, including the city's stage of development, physical characteristics, existing levels of transport infrastructure and citizen preferences (see Figure 3). For example, Amsterdam and Chicago are both mature cities but have very different characteristics that will shape their transport ambitions: in Amsterdam, over 50 percent of daily trips are on foot or on bicycle, whereas in Chicago, just under 90 percent are by private car.⁹

"Total mobility is the most compelling driver. The emphasis must be on achieving traffic outcomes that benefit the city and its people – be they permanent or visiting."

Phil Mumford, CEO, Queensland Motorways Ltd.

Effective transport is central to a city's economic competitiveness.

FIGURE 3. Regional transport challenges, priorities and solutions.



Source: IBM Institute for Business Value interviews and analysis of publicly available information.

Virtually all cities are developing visions and strategies to address their particular challenges and improve mobility, usually by changing modal shares and delivering improved transport services. In addition, nearly all of the city leaders interviewed highlight the importance of ITS in tackling their transport challenges.

“Allowing congestion to grind cities, suburbs and supply chains to a halt every morning and afternoon is unacceptable when we have innovative tools, technologies and strategies available to manage our transportation systems and utilize our infrastructure more effectively,” states Scott Belcher, president and chief executive officer (CEO) of ITS America.

Intelligent transport systems

Intelligent transport systems have been around for many years, but more recently, global cities have been implementing a new generation of ITS. Some examples include:

- Integrated fare management
- Enhanced transit/customer relationship management
- Traffic prediction
- Improved transport and traffic management
- Traveler information and advisory services
- Road user charging
- Variable parking pricing.

ITS technologies also create the potential for new information-based services like pre-trip and on-trip journey planning and traffic alerts, as well as different pricing and business models, such as variable pricing based on usage, emissions or peak times.

As part of its research, IBM has studied a number of cities over several years as they implement ITS. Our findings suggest that intelligent transport systems are about much more than discrete software solutions. Leading cities are implementing broader strategies to help them move from single mode operation to more sophisticated multimodal transport services and integrated transport delivery. Their strategies address three main areas: governance, transport network optimization and integrated transport services. Typically,

they progress through different levels of sophistication in each of these three areas, which we have documented in the IBM Intelligent Transport Maturity Model (see Figure 4).

Implementing ITS

As cities address these three areas and progress to more integrated and optimized modes of transportation, many will face implementation hurdles. Intelligent transport systems are relatively new and, although proven technically, still present challenges, especially around matching strategic objectives with assured delivery. Many cities freely admit they have not yet gained all of the anticipated benefits from their ITS investments, and some look forward to further evolution of their intelligent trans-

FIGURE 4.
IBM Intelligent Transport Maturity Model (summary version).

	Level 1 Single mode	Level 2 Coordinated modes	Level 3 Partially integrated	Level 4 Multimodal integration	Level 5 Multimodal optimized
Governance <ul style="list-style-type: none"> Strategic planning Performance management Demand management 	Single mode planning with little coordination between various transport providers.	A transport vision is articulated. Single overarching regulator but with limited planning and management powers.	Integrated multimodal transport authority. Coordinated demand management measures.	Integrated corridor-based multimodal planning. Dynamic demand management schemes.	Integrated regional multimodal planning. Continuous system-wide performance measures with dynamic pricing.
Transport network optimization <ul style="list-style-type: none"> Data collection, integration and analysis Network operational responsiveness Incident management 	Limited data collection and integration. Ad hoc analysis and incident response. Manual incident response by individual modes.	Data collection for major routes. Periodic data collection and analysis. Network and incident response mostly by individual modes.	Realtime collection of multiple data source with high-level analysis. Automated network and incident response systems.	Realtime multimodal coverage for most corridors. Detailed realtime data analysis. Automated pre-planned multimodal incident response.	System-wide realtime multimodal data collection, integration and analysis. Dynamic network optimization and incident response.
Integrated transport services <ul style="list-style-type: none"> Customer management Payment systems Traveler information 	Minimal; mostly cash collection. Limited and static traveler information.	Customer accounts by mode. Mostly cash collection. Static trip planning with limited realtime alerts.	Electronic payments. Multichannel trip planning and account-based alert subscription.	Multimodal integrated transport card. On journey, multimodal information services.	Single customer transport account. Location-based multimodal proactive trip advisory.

Source: IBM Global Business Services analysis.

Many cities admit they have not yet gained all of the anticipated benefits from their ITS investments.

port systems. Other cities are considering ITS investments but are discouraged by perceived public resistance or funding challenges.

The IBM Intelligent Transport Maturity Model can be used to assess a city's progress compared with the global leading practice. As part of our research, we used a more detailed

version of the maturity model to assess the current positions of a number of cities and the current state of global leading practice, which comprises the outstanding features of many individual cities (see Figure 5). This benchmark is itself shifting to the right over time, as technologies improve and cities get better at exploiting them.

FIGURE 5.
Progress profile for a typical city versus global leading practice.

		Level 1 Single mode	Level 2 Coordinated modes	Level 3 Partially integrated	Level 4 Multimodal integration	Level 5 Multimodal optimized
Governance	Strategic planning	Functional area planning (single mode)	Project-based planning (single mode)	Integrated agency-wide planning (single mode)	Integrated corridor-based multimodal planning	Integrated regional multimodal planning
	Performance measurement	Minimal	Defined metrics by mode	Limited integration across organizational silos	Shared multimodal system-wide metrics	Continuous system-wide performance measurement
	Demand management	Individual static measure	Individual measures, with long-term variability	Coordinated measures, with short-term variability	Dynamic pricing	Multimodal dynamic pricing
Transport network optimization	Data collection	Limited or manual input	Near realtime for major routes	Realtime for major routes using multiple inputs	Realtime coverage for major corridors, all significant modes	System-wide realtime data collection across all modes
	Data integration and analytics	Limited with ad hoc analysis	Networked but periodic analysis	Common user interface with high-level analysis	Two-way system integration and analysis in realtime	Extended integration with multimodal analysis in realtime
	Network operations response	Ad hoc, single mode	Centralized single mode	Automated, single mode	Automated, multimodal	Multimodal realtime optimized
	Incident management	Manual detection, response and recovery	Manual detection, coordinated response, manual recover	Automated detection, coordinated response, manual recover	Automated pre-planned multimodal recovery plans	Dynamic multimodal recovery plans based on realtime data
Integrated transport services	Customer relationships	Minimal capability, no customer accounts	Customer accounts managed separately for each system/ mode	Multichannel account interaction by mode	Unified customer account across multiple modes	Integrated multimodal incentives to optimize multimodal use
	Payment systems	Manual cash collection	Automatic cash machines	Electronic payments	Multimodal integrated fare card	Multimodal, multichannel (fare cards, cell phones, etc.)
	Traveler information	Static information	Static trip planning with limited realtime alerts	Multichannel trip planning and account-based alert subscription	Location-based, on-journey multimodal information	Location-based, multimodal proactive rerouting

Source: IBM Global Business Services analysis.

Typical city Global leading practice

Our analysis led to several conclusions:

- Different cities prioritize the model's initiative areas in different ways – there is not one solution that fits all.
- There is a material gap between the typical city and the global leading practice.
- There are particularly large gaps in data collection, data integration and analytics, and customer relationships.
- The typical city is having difficulty making progress with data integration and analytics, especially across modes.
- The more sophisticated services, including demand management, incident management and traveler information, are relatively undeveloped even among leading cities.
- All cities have bold ambitions – regardless of current stage of development or current level of transport infrastructure – though their priorities differ.
- Each city will have a different implementation path based on its unique starting position and the priorities it sets out in its transport strategy.

Cities can map their ITS strategies on this maturity model to measure their current progress and compare it to global leading practices. This can then be used both to validate their strategies against the global benchmarks and to develop an ITS implementation roadmap.

Enhancing ITS

Regardless of a city's current state of ITS maturity, there is typically room for improvement and continued development. Therefore, based on our research and detailed discussions with city officials, we have identified five key recommendations to help all cities as they implement ITS.

1. Develop and implement comprehensive ITS strategies

A leading practice demonstrated by several cities is to develop effective ITS strategies that are long term and integrated with wider strategies and plans for transport, the city and even the wider economy. Our research found that many ITS projects are developed independently and are not part of a wider strategic ITS or multimodal transport plan. This can lead to difficulties later in gaining the potential network benefits across all modes that ITS can offer.

“We shouldn't lose sight of 2020 when addressing the challenges of 2010.”

Julie O'Neil, Secretary General, Department of Transport, Dublin

An ITS strategy should be long term to anticipate customer demands for new services across transport modes and the growing capabilities of emerging technologies, such as next-generation global positioning system technologies and the rapid deployment of personal digital assistants (PDAs) for realtime information. Also, ITS services are expected

ITS strategies should be long term and part of an overall transport plan.

to expand in scope, linking cities with other cities, regions and government agencies. They also may need to work effectively with a large number of commercial providers, as many cities view ITS as a platform to deliver a range of services to customers.

To move toward multimodal and integrated transport services that benefit customers, the city and the wider economy, ITS projects and plans need to be joined up at various levels to show how individual projects contribute to the delivery of a broad ITS strategy (addressing a broad set of dimensions listed in the maturity model). The strategies for a city's different transport modes also should be integrated as part of a coherent city transport strategy and need to be consistent with strategies in other areas of municipal government (for example, land use planning). In addition, they should be coordinated with strategies in other levels of government, including national, regional and district.

Cities with an integrated transport authority will find it easier to develop and implement a holistic ITS strategy across all transport modes. For example, Transport for London, which has responsibility for all public transport modes within the London metropolitan area and reports to the Mayor of London, developed a comprehensive and integrated 20-year strategy for transport, which details how specific initiatives will contribute to achieving a wide range of city and even national objectives.¹⁰ Where formal organization dependencies do not exist, cities need to collaborate effectively with partner organizations. A number of cities in our research mention the importance of political support and active sponsorship in establishing and later implementing coherent ITS plans.

In response to the need for integrated transport initiatives and the uncertainties involved in long-term planning, national and international transport authorities are increasingly playing a role in framing cities' transport strategies and promoting technical standards.

“There is a need for a single transport vision and plan for Egypt and a central governance and ownership.”

Omar El Bakary, Deputy Minister, Ministry of Transport, Egypt

The European Union (EU) is progressing plans to encourage the adoption of ITS across Europe based on common frameworks and standards, stating that “it is not acceptable anymore to see Member States of the EU implementing new proprietary road charging systems. Drivers should have only one system for the whole Europe and not one per Member State.”¹¹

Stockholm increases services, decreases congestion

The Swedish city of Stockholm has implemented several global leading practices. Stockholm aims to be the world's most accessible capital and views its transportation system as an important part of reaching this goal. Stockholm is well known for its congestion tax, which resulted in a 25 percent reduction in car use and 14 percent reduction in emissions from road traffic.¹²

However, it is important to note that Stockholm implemented the tax as part of a holistic transport plan that also increased bus services and park-and-ride facilities.¹³ In addition, Stockholm has an integrated ticketing system that links the major modes of transport.¹⁴

2. Adopt customer-centered approaches

Customer expectations of transport services are increasing, and transport authorities can use ITS to deliver both new and improved services. Many transport users have ingrained behavior patterns based on their perceptions of the convenience, reliability and cost of alternative transport modes. To optimize the transport network and encourage modal shift, cities need to alter customer attitudes about the cost, value and use of transport systems.

“Londoners should not have to hunt for transport information. It should be everywhere and easily accessible.”

Kulver Ranger, Director of Transport Policy to the Mayor of London

For many cities, improving the customer transport experience is the primary objective of ITS projects, whether by increasing overall customer satisfaction or encouraging greater use of public transport services. According to Elio Catania, CEO of Milan’s transport authority, “The key issue is to significantly improve public transport – efficiency, cost, punctuality, high quality infrastructure / rolling stock, personal safety, accessibility, etc. – to ensure that public transport becomes a superior alternative to the car.”

One way to improve the transport experience is through Web-based journey planning services, which can help customers optimize their travel across modes, increasing efficiency. These services can be delivered via mobile phones and other mobile devices such as PDAs. Location-based services can also be added, such as tourist information. Some cities

offer increased convenience for customers through integrated public transport smart cards, which can be used not only for transport-related services, but also as electronic purses for small purchases.

Understanding patterns of customer demand and use is very useful in developing customer-centered transport strategies. Leading cities are using demand and usage data to segment customer groups so they can provide optimized scheduling services as well as transparent and targeted communication to specific groups (e.g., text alerts of traffic problems and advice about alternative routes to daily commuters). As Peter Martin, general manager of tolling for Sydney’s Roads and Traffic Authority, remarks, “The travelling public in 2020 will be defined as a number of market segments... We will see offerings to travelers that give them a better value proposition but also offer the city a better proposition.”

To fully utilize the breadth of such capabilities, transport officials need to get much closer to their customers. Increasingly, transport will embrace techniques used in retail, such as customer relationship management (CRM) systems to support and enhance customer relationships and analyze customer data. Data will be collected on customer journeys, preferences and purchasing patterns just as retail does now. According to Phil Mumford, CEO of Queensland Motorways, “Supermarkets know exactly when, where, what and why I buy what I do. We will be like them around every aspect of a journey.”

Once they better understand their customers’ travel patterns, city officials can more effectively influence behavior patterns through incentives (such as improving the quality and

ITS solutions can be used to help improve the customer's transport experience and integrate modes of transport.

reliability of preferred transport modes) and pricing mechanisms (ticket pricing, higher city-center parking charges, emissions-based charging, road user charging, etc.). In most cases, a combination of service improvements and price incentives will be needed to change customer behavior patterns.

“A key priority is changing behavior – encouraging a shift to public transport usage by adjusting the mindset of the commuter.”

Lew Yü Der, Group Director, Policy and Planning, Singapore LTA

London boosts bus popularity 40 percent

London has been very successful in changing customer tendencies to make more use of buses, with a patronage increase of 40 percent since 1999, and 4 percent modal shift from private vehicles. This was achieved through targeted initiatives, including expanded services, better scheduling and connectivity, investment in new buses, a simpler fare structure and payment solution, regular travel updates and marketing campaigns. Shifts have been highest in central London, assisted by congestion charging and bus priority measures.¹⁵

3. Integrate service delivery

Almost all cities report that transport service integration across modes is essential. According to Dr. Ashwin Mahesh of Bangalore's Indian Institute of Management, “Integration of modes is the only way to address the problems of congestion and mobility.”

The objective is to allow the consumer to plan an optimal journey, irrespective of transport mode, and to carry out that journey effectively (e.g., with connections between modes and without having to buy separate tickets). Service integration also helps transport authorities deliver a more efficient service. By sharing information from different sources, they can construct a holistic view of transport demand and supply and make decisions to optimize the transport network. However, the reality is that most cities' transport services are still delivered by individual modes.

“Within the city, the integration of all modes, including the bicycle, is important.”

Rene Meijer, Vice Director, Infrastructure, Traffic and Transport, Amsterdam

Service integration is difficult and, while many have made progress, only a few of the cities in our research have achieved it to their satisfaction. Integration is required at many different levels, as transport services are typically delivered by many different organizations operating in different ways on a wide range of different systems. Joining all of these to deliver an integrated service to the consumer and provide integrated information to the transport authority and consumer is a daunting political, organizational, procedural and technical challenge.

From an organizational perspective, the preferred approach is an integrated transport authority, which a number of cities have established and others hope to achieve. Regardless of organizational structure, it is important that all who work toward planning and delivering

the city's transport are able to work collaboratively with effective political support and sponsorship. At a policy level, this involves coordination between city, regional and national transport authorities and agencies, as well as other interested parties, such as city planners and transport service providers. Collaboration among these multiple entities is essential to develop coherent strategies, consistent policies and technical standards (as described under our first recommendation), as well as to help ensure plans are executed in a coordinated way.

At the operational level, much work is required to integrate processes, policies and procedures. Employees from different organizations need to collaborate to deliver an integrated service to consumers. Scheduling, ticketing and pricing have to be coordinated across transport providers, and this has further implications on integration of back-office functions, such as the need for common transit customer accounts and clearing-house functions.

Integration challenges also occur at the technical level in integrating information using incompatible standards and connecting multiple systems. This challenge is compounded by the complexity and volume of information flows involved. Cities need to make more progress in this area, and the need for effective systems integration is likely to increase as demands for interoperability of transport systems rise.

The long-term answer involves implementing open information technology architectures and working with standards-setting bodies to adopt widely used common or open standards in ITS applications. For example, the Santiago transport authority made the decision to use open

architectures on all ITS projects, is promoting the development of a national architecture and is encouraging the use of service-oriented architecture (SOA) and open standards to help systems integration.¹⁶

“Our greatest technical challenges involve integrating systems with those of other provinces and changing legacy systems according to the standards.”

Soojin Lee, City Transportation Headquarters, Seoul

In Singapore, ITS enables mobility – and shopping

A good example of integrated service delivery is Singapore's next-generation multimodal e-payment system dubbed Symphony for e-Payment.¹⁷ Based on Contactless E-Purse Application Standard (CEPAS), an open national transport card standard, the system allows multi-purpose stored value (MPSV) cards to be used for transit (bus, rail, vehicle congestion charging, etc.), as well as nontransit purposes, such as micropayments for retail purchases. In addition, it provides support for multiple (CEPAS compliant) card issuers, increasing choice and convenience for the public commuter.¹⁸

4. Secure funding, apply new business models

Several city officials describe difficulty in securing funding as a significant barrier to achieving their transport visions. Officials compete for funding both with counterparts from different modes of transportation and more traditional infrastructure projects. A further challenge is gaining public support for ITS projects, particularly if citizens are asked to contribute to costs through increased fares.

Ideally, cities need business models that both exploit new revenue opportunities and price transport to support their transport objectives.

“New infrastructure projects get too much attention at public planning. We need new priorities to focus on smart solutions.”

Professor Jonas Eliasson, Royal Institute of Technology, Stockholm

ITS proposals need to be accompanied by convincing business cases and supported by evidence that benefits are being delivered. According to a senior transport official of a large Chinese city, “Funding is the greatest challenge in implementation, but funds will follow if ITS projects prove their value following evaluation.”

Evaluations should measure a range of benefits beyond financial payback – for example, improvements in numbers of accidents (and traffic related deaths), reduced emissions and the customer benefits derived from an enhanced traffic network.

Most cities expect transport investments to be funded primarily via general taxation since the public benefits from reduced congestion and fewer emissions. Some national transport authorities (e.g., those in the United States, the United Kingdom and Singapore) are trying to encourage ITS adoption by creating national funds to support regional and local innovative transport initiatives.¹⁹ Some countries also look to the private sector for funding. Public-private partnerships have been used for some time in a number of countries, including the United States, the United Kingdom, Australia and South Korea, particularly for infrastructure projects.²⁰

Intelligent transport systems themselves can provide new ways of raising funds, for example, usage-based charging that varies by vehicle type, volume of usage or time of day. In addition, traffic information collected via ITS can be sold to consumers in the form of traffic updates or to private corporations for fleet management.

In addition to raising valuable revenue, the pricing of transport services can impact customer behavior patterns. Cities should be cautious that price increases and new charges do not lead to public opposition. It is notable that both London and Stockholm promoted their road user charging plans not only by stating the benefits of reduced congestion and lower emissions, but also by emphasizing that fee revenue would be reinvested in the transport network.²¹ Ideally, cities need an effective overall business model that exploits new opportunities for revenue and, at the same time, prices transport in a way that supports the city’s transport objectives.

Oregon taxes miles instead of gas

The U.S. state of Oregon is testing a mileage tax, based on the number of miles a vehicle is driven, as a replacement for the state gas tax. Responding to declining gas tax revenues due to greater fuel efficiency in cars, the state sees this as a more equitable way to fund road improvements.²²

5. Effectively manage implementation

While almost all cities see the use of intelligent transport systems as central to the delivery of their transport visions, many express concerns about their capability to implement them.

There are difficulties involved in implementing large and complex intelligent transport projects, as well as a natural concern that failure would be highly visible to the public.

With some ITS projects, the implementation spans different transport modes, which often are the responsibility of different organizations, resulting in increased complexity. In these cases, setting up effective governance structures and sponsorships are important.

Other implementation concerns include the need for effective change management and anticipation of potential resistance from staff and consumers. For example, some cities in our research highlight the need to respond to consumers' resistance to privacy-threatening technologies, such as vehicle plate recognition.

Much can be learned from those who have succeeded in implementing complex information systems, whether in transportation or other industries. Several cities emphasize the importance of effective project teams with the right balance of technical and project management skills. For example, Akio Shiibashi, the deputy director of IT-Suica business development in Tokyo, reports that the technology behind the integrated Suica rail smartcard was relatively straightforward. "The key to the successful implementation was the commitment of the project team to make it happen," he says.

Other industries, such as healthcare, financial services and retail, have deployed innovative approaches, such as offering incentives to customers and deploying privacy-enhancing technologies (PETs), to overcome customer resistance to the introduction of technologies that some perceived threatened personal privacy.²³ Pilot implementations also can help build confidence for delivery authorities and test the acceptance of users.

Part of managing implementation involves cities effectively measuring progress against their transport strategies by using well-defined metrics. Sharing more traffic-related information in a transparent way and communicating the objectives and progress of transport initiatives can also be effective in building public support. Cities are increasingly sharing their progress with the public using Web sites and other channels. The performance indicators are changing as well. In addition to traditional transport metrics of modal share, journey times, etc., many cities now are measuring customer-centric measures, in particular customer satisfaction.

“Our transport indicators are all public. People can get the information on the official Web site.”

Jeffrey Liu, Planning Section Chief, Department of Transportation, Taipei

City officials can look to global leading practices – and our five recommendations – for guidance as they implement integrated ITS solutions.

Conclusions

Cities around the world face common transport challenges – from increasing congestion, safety concerns and aging infrastructure to a lack of funding and increasing environmental impacts. Like their colleagues in city administration and government, transport officials are starting to implement “smart solutions” to address these challenges and provide improved mobility in their cities, better services for citizens and a more cost-effective transport network.

Intelligent transport is about more than implementing discrete technologies. Leading cities are using these technologies to evolve their transport systems from single modes to integrated ones, improve transport services and provide an improved value proposition to customers. City transport officials can look to global leading practices – and our five recommendations – for guidance as they implement integrated ITS strategies.

Our research suggests that innovative city officials exhibit a common set of attributes. They:

- Provide leadership and vision in transforming their network of modes of transportation through crossmodal collaboration. They look far into the future to develop broad strategies, yet also provide leadership to help ensure short- and medium-term plans are executed.

- Treat transport as an integrated service, moving from just managing infrastructures to providing integrated services, making this style of management a team sport that involves collaboration among customers, suppliers and all levels of government.
- Adopt a customer-centric approach to transport strategy and execution. They understand and influence consumer perceptions and behavior patterns, share information in a transparent way and are committed to delivering improved customer satisfaction.

As cities move toward more integrated systems and sharing more information with their customers and stakeholders, consumers enjoy faster and better services, cleaner air, greater alignment and collaboration among transport stakeholders, and pride in knowing that their cities are becoming more economically competitive than before.

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