

Transportation Planning and Infrastructure Delivery in Major Cities and Megacities

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The number of major cities and megacities is increasing globally. How the distinctive opportunities and risks of major cities and megacities are managed will either erode or enhance the quality of life for their communities. Whereas only one megacity existed in 1950, more than 20 megacities currently exist—and ongoing urbanization inevitably will ensure that several major cities achieve megacity status. The megaregion is increasingly important in infrastructure development that not only solves existing metropolitan problems in a transient manner but proactively recognizes and capitalizes on supraregional opportunities to create sustainable alternatives. Transportation planning and infrastructure delivery are recast in this context, with recognition of the specific changes necessary to support the emerging urban form of megacities and megaregions. Specifically, the scope of the long-range transportation planning framework, infrastructure performance reporting practices, and public–private partnerships (PPPs) is examined in relation to providing adequate transportation infrastructure for megacities. For supraregional planning that involves multiple states and a cohesive vision and standards for the national transportation system, findings indicate that sustainable solutions may involve extending geographic and temporal frames of reference for long-range planning and expanding performance measures to capture appropriate planning inputs that evaluate planning effectiveness according to desired outcomes, a public-sector commitment to involve the private sector in infrastructure delivery, and federal and state leadership to pass laws that create a PPP-enabling environment.

Megacities are larger than most nations. The world population, currently about 6.5 billion, is increasingly concentrated in urban areas. Thus urban areas are growing rapidly, and projections anticipate increased urbanization worldwide—particularly in countries with less developed and developing economies but also in developed regions. It is expected that by 2030, for the first time in history, two out of three people will live in an urban area (1).

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INTRODUCTION

Background

“Megacities” are currently defined by the United Nations (UN) as cities with more than 10 million people. They are products of rapid urbanization. A historical look at megacities shows that their definition is somewhat arbitrary and that their numbers have increased over recent decades—and most likely will continue to increase, given the growing rates of urbanization.

The United Nations coined the term megacities to differentiate the areas of highest population from other urban areas. The more than 23 megacities in the world today are located in North and South America, Asia, and Africa. The most populous cities are Tokyo (26.4 million); Mexico City, Mexico (18 million); São Paulo, Brazil (18 million); New York (16.7 million); and Mumbai, India (16 million). From 1975 to 2015, the number of megacities is projected to increase from 5 (3 in the developing world) to 26 (all but 4 in the developing world) (2, 3). Several sources depicting current and emerging megacities indicate that the phenomenon is global; the number of major cities and megacities is growing on most continents (4).

The megaregion concept is a direct product of the recent changes in urban form. A “megaregion” is a contiguous area that comprises multiple major cities or megacities. Sustainable infrastructure planning for regions with major cities and megacities as well as (emerging) megaregions may need broader physical and temporal scopes of planning to address the needs of multiple megacities that transcend state boundaries. This approach may call for a hierarchy of plans to address transportation and other infrastructure needs at metropolitan, state, and multistate levels. Although focused on transportation, this paper presents ideas that are applicable to the broad range of infrastructure systems that support modern societies.

Motivation

For several years, various discussions about infrastructure adequacy for major cities have revealed that several metropolitan areas are playing catch-up with the growing demands of their communities (e.g., 5, 6). Major cities in more developed regions typically face the challenge of managing urban growth to preserve or improve the quality-of-life gains attained over several decades. Megacities are expected to face even more severe pressures (4). Whereas megacities in less developed and developing countries (e.g., Lagos, Nigeria; Mexico City; and São Paulo) are dealing with basic issues of survival, such as access to sanitation and clean drinking water, megacities in developed countries (e.g., Los Angeles, California;

New York; and Tokyo) must manage growth to continue advancing the quality of life in their communities.

Megacities in developed countries are sometimes called “world cities” or “global cities” to distinguish them from their counterparts in less developed and developing countries (3). Depending on how they are managed, these modern cities will continue to consolidate their gains as cradles of civilization’s creativity and ambition, or they will gradually erode the quality-of-life gains that have accrued over several decades. In the transportation context, indicators such as improved accessibility to basic economic, social, and emergency services (passenger); increased mobility (passenger and freight); debilitating congestion; poor air quality and its effects on public health; and growing disparities between the rich and poor (that threaten the long-term stability of cities) all determine how transportation decisions affect the quality of life for the communities that use the resulting transportation system.

The daily challenges of keeping up with urban growth seem common, perhaps even standard, in major metropolitan areas. From a broader perspective, however, the issues associated with infrastructure inadequacy may be symptomatic of a gradual erosion of the capacity of present planning and delivery systems to adequately provide for growing communities in the emergent urban form. After all, even though standard planning approaches have been incrementally refined over several years, they were developed when few (if any) megacities or megaregions existed. Fine-tuning various aspects of the planning process may be effective for a while; however, significant changes (e.g., what may be needed with the emergence of megacities and megaregions) may call for nothing short of a paradigm shift in traditional infrastructure planning and procurement methods.

In several of the fastest-growing metropolitan areas, what were intended to be long-term improvements have ended up being piecemeal improvements to existing systems because of high growth and demand on the system. Thus, in megacities and some major cities where growth rates are the highest, the capacity of current infrastructure planning and procurement approaches to preserve quality-of-life gains—even if applied steadfastly and seriously—may be eroding. The emergence of megacities and megaregions may call for a broader vision and planning framework.

Objectives

In this paper, three important aspects of the transportation planning and infrastructure delivery process are examined in light of the emergent megacity and megaregion urban landform:

- Scope (physical and temporal) of long-range transportation planning,
- Approaches used for reporting on infrastructure quality, and
- Public–private partnerships (PPPs) and their legal obstacles in moving toward a megacity or megaregional paradigm for infrastructure planning and delivery.

Transportation opportunities and challenges in major cities and megacities are outlined, and the limitations of the present framework for long-range planning to address those needs are assessed. Formal approaches for reporting on the quality of infrastructure relative to the emerging needs of megacities are reviewed. PPPs for financing transportation infrastructure are examined relative to urban growth projections for major cities and megacities. The intent of the paper is to articulate some of the major pressure points that can be expected with the emergence and growth of major cities and megacities, the need for innovations in planning and finance, and some of the important questions that these issues spawn.

NEED FOR SUPRAREGIONAL PLANNING

Urban Growth

Estimates from the 2004 U.S. Census indicate that the United States has at least two megacities and several major cities. Although named for the predominant city, a megacity refers to a metropolitan area with more than 10 million people. Thus, for example, a megacity such as New York City (with a population of 18 million) actually refers to the New York–New Jersey–Pennsylvania tristate metropolitan region, and the Los Angeles megacity (with a population of more than 12 million) comprises the Los Angeles–Long Beach–Santa Ana area of California. Chicago (which is approaching megacity status with a population of more than 9 million) comprises the Chicago–Naperville–Joliet area of Illinois.

With current rates of urbanization, several major U.S. cities are on their way to megacity status: Philadelphia, Pennsylvania (Philadelphia–Camden, New Jersey–Wilmington, Delaware), at 5.8 million; Dallas, Texas (Dallas–Fort Worth–Arlington), at 5.7 million; Miami, Florida (Miami–Fort Lauderdale–Miami Beach), at 5.4 million; Houston, Texas (Houston–Sugar Land–Baytown), at 5.2 million; Washington, D.C. (Washington, D.C.–Arlington, Virginia–Alexandria, Virginia), at 5.2 million; Atlanta, Georgia (Atlanta–Sandy Springs–Marietta), at 4.7 million; and Detroit, Michigan (Detroit–Warren–Livonia), at 4.5 million (7).

With the kind of growth that has occurred in recent decades and is expected over the next 50 years, transportation (and other infrastructure) systems either will continue to be heavily burdened while piecemeal improvements try to keep up with the rapid growth or will undergo some basic transformations that move them significantly ahead of current and anticipated demands for a sustained period. Several practitioners and researchers have articulated this thought in various forums. For example, in discussing PPP models for road pricing and bus rapid transit (BRT) initiatives, DeCorla-Souza and Barker observe that “transportation agencies in major, highly congested metropolitan areas will need to fundamentally rethink the kinds of solutions that make sense” (8).

For multistate regions with many megacities, the importance of intercity networks may necessitate planning efforts that cross state boundaries.

Quality of Life

The quality-of-life impacts of transportation can be assessed by measures of effectiveness such as a community’s general accessibility to basic social, economic, and emergency services (less readily measured); passenger and freight mobility; air quality and public health impacts of transportation; safety; and the disparity between good and poor accessibility for metropolitan communities. To be more effective, however, these measures also must include inputs and outputs of land use decisions that affect transportation needs and planning outcomes.

Several metropolitan areas are making notable efforts to manage chronic congestion and reduce the negative impacts on air quality of automobile-based transportation systems, with various degrees of success. A range of indicators has been used to depict the current picture. For example, the Texas Transportation Institute’s *2005 Urban Mobility Report* estimated that congestion cost Americans in the 13 largest metropolitan areas (e.g., Los Angeles, New York, Chicago, and Atlanta) an average of \$325 million in 2003 (5). The Centers for Disease Control and Prevention have well documented the effects of air quality on public health, particularly the respiratory health of the elderly and children. For example, 25% of American children live in areas that regularly exceed the U.S. Environmental

Protection Agency's limits for ozone, more than one-quarter of which comes from automobile emissions (9).

These effects of growth also extend to other infrastructure services (some considered more basic than transportation) that compete with transportation for finite resources. For example, the continued availability of freshwater supplies in growing metropolitan areas gives rise to conflicts such as the long-standing Tri-State (Alabama, Florida, and Georgia) Water Wars. This conflict over water from the Apalachicola–Chattahoochee–Flint river system has continued since 1990. Florida and Alabama recently charged that the 500 million to 700 million extra gallons a day that ever-expanding metro Atlanta will need over the next three decades could leave too little water for economic development in Alabama and Florida (10).

These examples exemplify the infrastructure challenges that might appear or intensify with megacity growth. Such challenges also may call for supraregional efforts in search of adequate (i.e., farther-reaching or more sustained) solutions that not only preserve but also enhance the quality of life of growing urban communities.

Supraregional Planning

Evolution of Transportation Planning

The current framework for long-range transportation planning, based on the metropolitan region and a 20-year planning period, may have been structured well to address the predominant transportation needs of the 1960s, 1970s, and 1980s. However, as several metropolitan areas achieve megacity status and some morph into megalopolises, the planning period and area may have to expand accordingly. Menendez and Cook describe how the evolution of long-range transportation planning has been a function of the changing institutional context (11).

For example, in the 1950s and 1960s, classical transportation planning focused on comprehensive highway studies for metropolitan areas largely to determine the best highway alignments to serve metropolitan areas. In the early 1970s, neoclassical or open transportation planning emerged in response to changes in the planning environment. Certain groups that felt that their interests were not being protected by individuals involved in the planning process generally mistrusted government planning, and the emphasis on the land use element of transportation planning declined during the same period.

The ensuing period from 1975 to the 1980s was an era of fragmented transportation planning, when planning focused on small-area improvements, primarily within existing transportation rights-of-way. FHWA sponsored studies to enhance the performance of existing transportation infrastructure in terms of efficiency, capacity, and safety; this new focus was the beginning of transportation demand management. The mid-1980s onward have marked a movement toward consolidated transportation planning, concurrent with a rising concern about increasing congestion on metropolitan and intercity transportation networks.

Over these four eras, the emphasis in regional transportation planning also has shifted from the development of a comprehensive highway plan to the development of a comprehensive transportation plan that includes public transit systems (11). The 1990s and the beginning of the 21st century have increasingly focused on reducing congestion and improving the quality of life for metropolitan communities through integrated planning and decision making for transportation and land use (e.g., 12, 13).

This brief history of the evolution of transportation planning supports the idea that planning approaches must evolve over time to meet changing needs. Although it may be incremental for the most part, evolution may involve paradigm shifts when circumstances are more

extreme than usual. In January 2006, the Transportation Research Board issued a report that identified several critical quality-of-life issues in transportation: congestion (i.e., increasingly congested facilities across all modes), safety (i.e., loss of leadership in safety), emergencies (i.e., vulnerability to manmade and natural disasters), energy and the environment, and equity (i.e., burdens on the disadvantaged) (14). The report also emphasizes the need for adequate revenues (finance), infrastructure renewal, and human and intellectual capital (i.e., adequate investment in innovative solutions). Against the backdrop of continuing urban growth, the quality-of-life issues widely experienced in metropolitan areas arguably call for innovation in transportation planning as it is known today.

Scenario Methods

One example of an arguably incremental innovation in transportation planning is the application of scenario planning methods, which are gaining use in long-range transportation planning. Although uncertainty always has been a part of demand forecasting in the four-step planning process, unprecedented growth in metropolitan areas in the past two decades has exacerbated this uncertainty and perhaps eroded forecasting effectiveness.

Transportation agencies such as Portland Metro in Oregon and the Cape Cod Regional Planning Commission in Massachusetts have counteracted this problem by adopting scenario-based methods to develop plausible scenarios and plan for robust outcomes independent of which future scenarios actually materialize. Scenario planning methods are increasingly useful in the emerging context for transportation planning (15, 16). As documented in *NCHRP Report 541*, several states and metropolitan planning organizations (MPOs) are undertaking incremental innovations to visioning, setting goals and objectives, measuring performance, applying emergent analysis tools (including integrated land use and transportation modeling, risk analysis), and developing formal and informal partnerships (16). These innovations are expected to influence decisions in separate institutional domains that affect transportation (e.g., land use) to improve their capacities for effectively addressing evolving planning needs.

Longer Time Frames and Broader Geographic Scopes

The development of regional plans may still be adequate for some metropolitan areas. However, in what may arguably be called a paradigm shift, planning officials may be required to take leadership roles in recognizing when a supraregional effort in planning is necessary for sustained system improvements as urban areas continue to grow and expand and megaregions emerge. Such planning efforts probably would move beyond the metropolitan region to recognize critical opportunities to partner with other regions and develop broader-reaching visions and solutions that address not only metropolitan but also multi-metropolitan needs.

Even though they typically would require longer planning horizons, such planning activities would not necessarily eliminate the need for regional efforts, and a tiered planning process may emerge. The organizing committee for the first conference to integrate sustainability into the transportation planning process suggests a planning horizon of at least 40 years for sustainability-oriented planning (12).

A few such initiatives are beginning to emerge around the country. For example, the proposed 6,400-km (4,000-mi) Trans-Texas Corridor conceptually addresses supraregional transportation needs and is one long-range, broad-reaching effort to address the growth in passenger and freight demand for transportation. Estimated to cost at least \$145 billion, this megaproject is a PPP that would take 50 years

to develop. It is Texas' most ambitious transportation project to date and comprises a network of transportation corridors for multiple modes to move freight and people. The impacts of the Trans-Texas Corridor will be significant; most U.S. imports from and exports to Mexico and South America travel through Texas. In essence, 79% of United States–Mexico trade passes through Texas ports of entry, and trade flows are expected to increase as a result of the North American Free Trade Agreement (17). Even though it has its advocates and detractors and one model is not necessarily applicable to all contexts, the Trans-Texas Corridor notably attempts to address passenger and freight needs, opportunities for multiple metropolitan areas, and intercity as well as international transportation.

Where megacities occur in relatively close proximity across state lines, collaborative planning between or among multiple states may become increasingly necessary to address transportation needs and opportunities comprehensively.

Assessing and Reporting on Infrastructure Quality

Common Infrastructure Reporting Initiatives

Several formal approaches exist for assessing and reporting on the quality of civil infrastructure. For example, the American Society of Civil Engineers (ASCE) Infrastructure Report Card, released every 2 or 3 years, is an aggregate measure of the physical condition, operational capacity, and funding status of the nation's infrastructure. Multiple infrastructure categories are evaluated: aviation, bridges, dams, drinking water, energy, hazardous waste, navigable waterways, public parks and recreation, rail, roads, schools, security, solid waste, transit, and wastewater. The ASCE Infrastructure Report Card is one of several initiatives for assessing and reporting on the quality of infrastructure to the general public, political decision makers, and other stakeholders.

Other examples are the Government Performance Project (GPP), the U.S. Department of Transportation's Condition and Performance Report series, and the Government Accounting Standards Board Infrastructure Reports. Several other performance reporting initiatives exist, particularly at the state, metropolitan, and local levels.

Although reporting systems with multiple infrastructure categories (e.g., ASCE Report Card, GPP) are referenced, this discussion also would apply to metropolitan- and state-level unimodal reporting systems. Such reports generally attempt to characterize the condition and performance of infrastructure relative to some desired status (or the quality of the practices used to procure and manage the infrastructure) for various audiences (e.g., federal policy makers and executive-level decision makers in state and local agencies). For example, on a scale of A to F, the 2005 ASCE Infrastructure Report Card assigned an overall grade of D to the nation's infrastructure and estimated that approximately \$1.6 trillion would be needed over the next 5 years to bring the infrastructure up to acceptable levels of service (6). The previous report card issued in 2001 assigned an overall grade of D+ to the nation's infrastructure, with an estimated need for \$1.3 trillion over the next 5 years.

Incorporating Planning Elements into Infrastructure Evaluation

A closer examination of these infrastructure evaluation and reporting efforts indicates that the grades capture both planning inputs and outcomes. For example, in addition to rating the condition and capacity of the systems, the ASCE Infrastructure Report Card considers the

amount of funding programmed or available relative to the projected infrastructure needs. The GPP actually rates the management practices of state and local infrastructure agencies, rather than the outcomes or effects of these practices on the infrastructure systems (18).

In an era of rapid change, performance measurement systems must include input- and output-based (or outcome-based) indicators and measures. Efforts to include planning inputs in the rating of infrastructure quality are important with respect to benchmarking best practices and ensuring that infrastructure continues to meet the evolving needs of communities over time. For example, an infrastructure reporting system that captures the planning needs for megacities or megaregions must include the range of inputs that are considered critical to achieve the system's intended goals as it develops through the decision process. Aligning infrastructure reporting practices with the changing planning needs of communities thus will continue to be important in encouraging the rating of planning and delivery approaches on their progressive abilities to address prevailing and anticipated needs rather than past needs.

If one agrees that urban landforms have changed significantly (i.e., enough to significantly affect the performance of metropolitan transportation systems) over the past two decades or so, is it reasonable to expect performance evaluation systems to be refined accordingly to capture these changes? In particular, what changes in the planning inputs would result in the desired outcomes for the system in a desired time frame (i.e., in the context of megacity development, what planning inputs and outcomes are necessary to provide sustained solutions for the transportation needs of megacities and megaregions)? and When would a metropolitan area need to engage in supraregional planning activities to achieve the intended transportation system outcomes? The answers to these questions could help refine existing reporting systems to support the emerging urban forms of megacities or megaregions. The ability of reporting systems to capture planning inputs that reliably affect intended system outcomes arguably would reflect how well those systems are evolving to meet urban needs.

Addressing congestion may be an urgent need evident in most metropolitan areas. However, recognizing that rapid urban growth will continue to occur into the foreseeable future and that improvements intended to last for longer periods may end up being piecemeal and transient in practice, congestion itself is perhaps more symptomatic of an underlying need to plan differently. In this era, then, one could argue that efforts to provide separate categories in infrastructure reports that address not only the symptoms but the dominant causes or influences of infrastructure performance should help to create incentives for planners to critically examine their planning activities relative to their desired outcomes. In addition, research and practitioner efforts to identify and standardize (to the extent reasonable) the planning goals attainable through regional versus supraregional efforts—as well as the obstacles to be overcome in conducting supraregional planning activities—would contribute to the current discourse on planning and infrastructure development and management for major cities, megacities, and megaregions.

INFRASTRUCTURE FINANCE

Funding Constraints and Demographic Trends

The U.S. civil infrastructure typically has been funded by a combination of taxes and user fees. If the existing infrastructure reports are considered to be fairly accurate indicators of trends in infrastructure quality and needs, then they generally communicate the need for more funds than are available for infrastructure renewal and capacity expansion.

A 2005 *Scientific American* special issue on sustainability highlights the effect of the aging U.S. population on the society's eroding capacity to generate taxes, the main source of funds for infrastructure provision and other public services (1). Cohen describes 2000 as the transition point for old–young demographics: “Before 2000, young people always outnumbered old people; from 2000 forward, old people will outnumber young people” (1). Although this point is good news in terms of a slowing national rate of population growth—even though urban populations will continue to grow over the next 50 years—it also reduces the tax base as the older population transitions out of the workforce and increases pressure on the public funds available for providing infrastructure and other public services for cities. Recent activity shows that, with these pressures, the private sector is increasingly being viewed favorably by several governments as a potential partner for infrastructure procurement and asset management.

PPPs are thus becoming more common for financing or otherwise procuring infrastructure facilities. The Chicago Skyway, Orange County SR-21 (California), Virginia Interstate Routes for Asset Management, and the Atlanta I-75 HOT expansion are examples of multimillion-dollar projects with substantial private-sector involvement. PPPs likely will become fairly standard tools in the quest to adequately fund infrastructure development and management in the United States and abroad.

U.S. PPP Experiences and Infrastructure Renewal Opportunities

At their core, PPPs involve long-term relationships between the public and private sectors to accomplish explicit objectives. PPPs have performed traditional government functions, such as setting rules and standards, implementing rules, and providing services (19). The U.S. Department of Transportation *Report to Congress on Public–Private Partnerships* defines a PPP as a contractual agreement formed between public- and private-sector partners that allows for more private-sector participation than traditional (20). PPPs are becoming more common in the United States for infrastructure procurement and asset management. The PPP examples listed in Figure 1 reflect the growing and varied use of private capital for public infrastructure development and asset management.

In several major cities and megacities around the world, a sizable portion of the existing civil infrastructure inventory is reaching the end of its useful life. In the United States, large facilities that are indispensable to the general daily operation of cities and their economies cannot be conveniently shut down for renewal and must be reconstructed while providing for the basic social, economic, and emergency service requirements. This constraint creates several opportunities for innovation—both technical and environmental. For

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| <p>Atlanta I-575/I-75 project</p> <p>Georgia's Public Private Initiative (PPI) law, passed in OCGA 32-2-78, updated in May 2005, makes provisions for Georgia DOT (GDOT) to solicit and receive proposals for PPPs; potential private partners have 135 days to respond to an unsolicited proposal. In May 2006, a contract was signed between GDOT and Georgia Transportation Partners (a group of private companies) on the state's first project under the PPI law. The project will use tolls and private investment to finance expansion of the I-575 and I-75 with the addition of high occupancy toll (HOT) lanes in Cobb and Cherokee Counties, where people can choose to pay to get out of congestion. It could also involve truck-only toll (TOT) lanes on I-75. The GDOT's Board views such projects as the only way to fund massive road expansion that are desperately needed for metro Atlanta's booming population. Of megaproject status, 2004 estimates placed the total project cost at \$1.8 billion. Some of the debt will be repaid by toll receipts from those lanes (21).</p> |
| <p>Chicago Skyway</p> <p>The Chicago Skyway is a 7.8-mi toll road built in 1958 to connect the Dan Ryan Expressway to the Indiana Tollway. It has been operated and maintained by the City of Chicago (Department of Streets and Sanitation) for almost 50 years. It is the only toll highway in Illinois that is not operated by the Illinois Toll Highway Authority. The Skyway's annual revenues amount to several millions of dollars. In 2002, for example, the Skyway attracted a record 18.7 million motorists with tolls amounting to \$43 million in revenue. A \$250 million road reconstruction project began in 2001 and ended in 2004. Following the reconstruction, the city of Chicago formed a PPP with the Skyway Concession Company, LLC (SCC), with SCC assuming operations on the Skyway on a 99-year operating lease. The City of Chicago received \$1.83 billion in this transaction. SCC will be responsible for all operating and maintenance costs but has the right to all toll and concession revenue. A transaction of megaproject proportions, this agreement between the SCC and the City of Chicago is the first privatization of an existing toll road anywhere in the United States (22).</p> |
| <p>Virginia asset management contract</p> <p>In 1996, in an effort to preserve and maintain roads while faced with fiscal constraints, Virginia became the first state to use a private company to manage its highways. In 1995, Virginia passed the first law in the country authorizing PPPs. The Public–Private Transportation Act of 1995 was recently updated. Virginia Code Annotated 56-556 contains guidelines to assist parties interested in PPPs. Virginia Department of Transportation entered into an asset management contract with VMS, Inc., a Richmond-based company that specializes in highway asset management. Under the 5.5-year contract with VMS, Inc., all aspects of 20% of Virginia's Interstate highway system were guaranteed to be maintained at specific standards throughout the duration of the fixed-price, lump-sum agreement. Since Virginia's pioneering effort, several other states and municipalities have begun using highway asset management to address their transportation needs, including Washington, D.C., Alaska, Florida, Oklahoma, and Texas (23).</p> |
| <p>Trans-Texas Corridor</p> <p>Texas Transportation Code Annotated, chapters 227, 361, and 370, allows the Texas Turnpike Authority and other regional authorities to engage in PPPs. The Trans-Texas Corridor is a 6,400-km (4,000-mi) multiuse transportation system, projected to take 50 years to develop. The proposed system will be a network of transportation routes incorporating separate lanes for passenger vehicles and trucks, rail lines for high-speed passenger and freight rail, and a dedicated utility zone. Transportation officials expect the project to improve both the freight and passenger flows in the existing transportation network in the state's busy metropolitan areas. The Texas Department of Transportation plans to use PPPs to finance much of the development of the corridor with an estimated price tag of \$145 billion to \$183 billion. The impacts of the Trans-Texas Corridor will be significant: most U.S. imports from Mexico and South America travel through Texas, as do most exports to Mexico and South America. In essence, 79% of U.S.–Mexico trade passes through Texas ports of entry, and trade flows are expected to increase as a result of the North American Free Trade Agreement (17).</p> |

FIGURE 1 Examples of transportation PPPs in the United States (17, 21–23).

example, during reconstruction of the Boston Central–Artery Tunnel in Massachusetts, one of the largest construction projects in U.S. history, the facility has been required to continue to carry almost 200,000 vehicles daily (24). With notable technical innovations, the new facility was planned to be constructed underground to free up several acres of open space for public parks; relink the east and west portions of the city (separated by the construction of the original highway in the 1950s); revitalize the downtown economy; and transform the city into a more vibrant, livable, walkable, and healthy environment.

Such projects are not without their share of significant risks, however. Projects have routinely experienced financial risks as projected capital costs have escalated, calling into question long-term economic sustainability. Lessons learned from completed megaprojects and the growing willingness of the private sector to participate in infrastructure procurement remain positive factors in thinking about fundamentally new ways to address the transportation needs of major cities and megacities.

Several useful lessons also may be learned from international PPP experiences, because many countries have undertaken PPPs for large-scale infrastructure development and management [e.g., the World Bank maintains a growing stock of knowledge on PPPs (25)]. Studying the emerging U.S. PPPs is also worthwhile to understand useful lessons as they are learned and what works in different institutional contexts (26, 27).

Overcoming Legal Obstacles to PPPs

Although PPPs are not new, they are increasingly being used for transportation and other infrastructure provision in the United States. Although legal barriers to PPPs have existed for several decades, recent changes in state laws indicate that PPPs will play a significant role in U.S. infrastructure development and management into the foreseeable future. Even though most state laws are still silent regarding the use of PPPs in transportation initiatives, a growing number of states have enacted or are in the process of enacting legislation supporting PPPs.

Across states with express legislation, regulations differ slightly. Several states (Alabama, Colorado, Delaware, Florida, Georgia, Minnesota, Montana, Oregon, South Carolina, Texas, Utah, Virginia, and Washington) and Puerto Rico have enacted legislation that allows for PPPs without restriction. States with written legislation pending include Arkansas, Arizona, California, and Louisiana. Maryland has no express authorization for highway PPPs, but the state attorney general has allowed the construction of toll roads using certain formulations of public–private associations. Indiana severely restricts PPPs for roads other than I-69, except if approved by the legislature; and North Carolina limits PPP toll facilities to a maximum of nine projects. Nevada PPPs are authorized, but toll bridge and toll road projects are prohibited (26).

One way to organize the many laws that discourage PPPs is to divide them into two main categories: fundamental laws reflect the federal republic system of U.S. government, and risk allocation–type laws reflect how infrastructure projects have evolved over time. Carefully crafted PPP-enabling legislation should address both categories, but legislation alone will not guarantee total acceptance of PPP projects.

In the first category, fundamental laws regulate the delegation of a state’s power. Certain powers are reserved for government to ensure unbiased operation. For PPPs to operate, the state must delegate some of these government powers (which include police, eminent domain, and credit lending) to PPPs, which involve private entities by definition. Using a strategy that grants state powers to private entities that will eventually produce profits for private partners

can be controversial. It can be argued that in the case of a PPP, state power has directly enriched specific private citizens.

In the second category, risk allocation–type laws can be subdivided into regulations that affect the risks of the government and private partners separately. Such regulations include traditional compliance with environmental regulations, tort liability of private partners, construction procurement issues, and other risk-allocation strategies.

In the context of growing pressures to provide alternative financing sources for infrastructure procurement, the changing PPP legal framework (i.e., the growth of PPP legislation) can be viewed as a reflection of a growing general willingness to create legal environments that support PPPs, recognizing that PPPs likely will play an indispensable role in infrastructure procurement in the future. Similarly, if supraregional planning involving multiple states is critical to support the transportation needs of the 21st century, then a federal-level legal framework is necessary to create an environment that supports such planning activities.

ADAPTING TO CHANGE

The preceding discussion indicates that as megacities and megaregions emerge, various criteria may be important to assess the relative preparedness and effectiveness of transportation officials and political decision makers to address the associated transportation needs and challenges. These criteria include

- The current transportation-related quality of life of the major city or megacity community, as captured by measures and indicators (e.g., congestion indices, air quality, safety, relocation desirability for businesses, and quality of public health), some of which are found in the performance measurement systems of various MPOs and state departments of transportation;
- The willingness of planning officials to take leadership in developing formal or informal measures or partnerships to explicitly integrate transportation and land use decision making;
- The extent to which the current performance measures used in evaluating the system capture appropriate planning inputs that create the desired and sustained system outcomes (e.g., the ability of system measures to differentiate planning activities that will result in piecemeal and transient improvements from broad-reaching, long-term improvements and hence encourage innovative planning activities to address heavy growth scenarios);
- The proactive leadership taken by executive-level transportation officials and political decision makers to generate adequate funding or financing for projected transportation needs besides the traditional gas tax and vehicle user fees, which may include the development of a PPP-supportive legal framework (i.e., the passage of PPP laws to encourage private-sector involvement in infrastructure finance and procurement), supraregional planning that may involve multiple (state and local) jurisdictions, and a willingness on the part of public officials to proactively engage the private sector in infrastructure development activities through attractive shared-risk regimes and other incentives for private involvement;
- The current and expected growth rates of the metropolitan areas (because areas with the highest growth rates could pose the most significant risks for the erosion of quality-of-life gains, particularly where transportation officials and political decision makers take no explicit steps to change the status quo for planning and funding infrastructure, despite measures indicating that the metropolitan area is struggling to keep up with growth); and
- The initiative of planning leaders and political decision makers to identify supraregional opportunities—which may involve collabo-

ration among multiple metropolitan areas and states—to jump significantly ahead of metropolitan needs by creating a sustained capacity to preserve or enhance quality-of-life gains in metro areas while capitalizing on supraregional economic development opportunities.

The federal role may be broader regarding the establishment of a new vision for the nation's transportation system that recognizes the efforts of different regions while providing the appropriate guidance and standards to integrate such efforts to support a cohesive vision with standards for that system. For example, whose role is it to ensure that the capacity to be provided by major projects such as the Trans-Texas Corridor does not end at the Texas borders and cause severe bottlenecks in adjoining corridors? It may be time to develop a renewed vision for a national multimodal transportation system—similar to the 1950s vision for a national highway system—which clearly would necessitate federal involvement. Such a vision cannot be focused exclusively on transportation and ignore land use in the emergent urban landform.

SUMMARY AND CONCLUSIONS

Current and predicted trends in urban demography suggest that, unless fundamentally new ways of infrastructure planning and finance are adopted and implemented, infrastructure demands will continue to outpace the ability of the traditional long-range transportation planning and finance systems to deliver long-lasting solutions in the foreseeable future. The results of this review of emerging urban demography and landform suggest that megacities or megaregions are emerging as an appropriate frame of reference, geographically and temporally, to plan more effectively for transportation and other infrastructure systems.

For some of the most rapidly growing metropolitan areas, an inability to move beyond piecemeal and transient improvements to address congestion—despite serious and steadfast efforts by planning officials and political decision makers—may indicate the encroaching obsolescence of the underlying planning and financing methods faced with population growth of megacity proportions. Effective solutions would require not only broader geographic and temporal frames of reference for planning but also a broader range of performance measures and indicators that capture planning inputs when assessing and reporting on infrastructure quality, a clear public-sector commitment to involving the private sector in infrastructure procurement, federal and state leadership to pass laws that create PPP-supportive environments, the removal of obstacles to supra-regional planning that involves multiple (state and local) jurisdictions, and ensuring that the national transportation system continues to evolve with cohesive vision and standards.

Failure to recognize the demands and opportunities associated with the emerging megacity–megaregion complex or develop proactive approaches to address and explore them will leave communities with a growing risk of an eroding quality of life; the best planning efforts have unintended piecemeal outcomes, the gap between infrastructure funding and supply continues to grow, and opportunities to advance supraregions lie dormant and unexplored. One could argue that much of the competitive advantage of world megaregions lies in recognizing their inherent potential value and being willing to develop new institutional structures and planning methods that will capitalize on the synergies, economies of scale, and other kinds of dormant value currently held within the emerging megacity–megaregion complex.

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