

Infrastructure 2007

A GLOBAL PERSPECTIVE



Urban Land
Institute

 ERNST & YOUNG

Infrastructure 2007

A GLOBAL PERSPECTIVE

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COVER: The Millau Viaduct in Millau, France.

PAGES 2–3: A rusting bridge in Middlesex, Vermont. Aging infrastructure is becoming more apparent as bridges and roads reach the end of their life cycles.

PAGES 12–13: The Chicago Skyway was leased to Australia's Macquarie Infrastructure Group and Spain's Cintra Concesiones de Infraestructuras de Transporte S.A. for 99 years. In return, the city received a one-time lump sum payment of \$1.83 billion (courtesy Skyway Concessions Co., LLC).

BACK COVER: The Chicago Skyway (courtesy Skyway Concessions Co., LLC).

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Civilizations are built and sustained by the quality of their infrastructure. Next year, the world marks a major turning point: one out of every two people on the planet will live in cities—the critical role of infrastructure provision, maintenance, and financing rests like never before at the heart of sustainable cities. Infrastructure is the skeleton around which the city is built. Ranging from radial hub-and-spoke systems, new town centers, villages, corridors, and current sprawling patterns, infrastructure dictates how we move and interact with each other. It also can help or detract from the building of community.

Coincident with these trends has been the declining ability of governments at all levels worldwide to fund infrastructure as they have traditionally done, through taxation. Fortunately, the world is awash in investment capital looking for secure assets. Urban infrastructure has begun to emerge as a major investment class promising both income and capital returns.

ULI members at the city and global levels are at the forefront of developing new forms of infrastructure and in the creation of capital markets products to finance them. When Marilyn Taylor became chairman of ULI in 2005, she recognized the importance of infrastructure in this new environment and launched the Infrastructure Initiative. The initiative will create a heightened awareness of public infrastructure and its essential role in communities around the world—and will explore new forms of infrastructure financing.

This report, funded through the generous support of Ernst & Young, is based on wide research and four forums that were held in New York, Los Angeles, Mumbai, and Washington, D.C. These forums, generously funded by James Curtis III, ULI trustee and principal, Bristol Group, brought together experts from the fields of development, design, finance, engineering, and the public sector. The role of infrastructure in the urban form, the current state of infrastructure repair and maintenance, and new financing vehicles were highlighted.

Infrastructure 2007: A Global Perspective examines trends in infrastructure and finance and the nexus between infrastructure and the built environment. Our initial goal is to define the problem, outline solutions, inspire leadership, and provide case studies to demonstrate that these goals are achievable. Of critical importance is an increased understanding of the necessary role that must be played by public finance.

The health and well-being of public infrastructure are a keystone to the Urban Land Institute's mission to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. Infrastructure plays a critical role in every aspect of community building. Done well, it can make an average development good, and a good one great. Done poorly, it can sabotage a great development, if not an entire community.

Richard M. Rosan, President
ULI Worldwide



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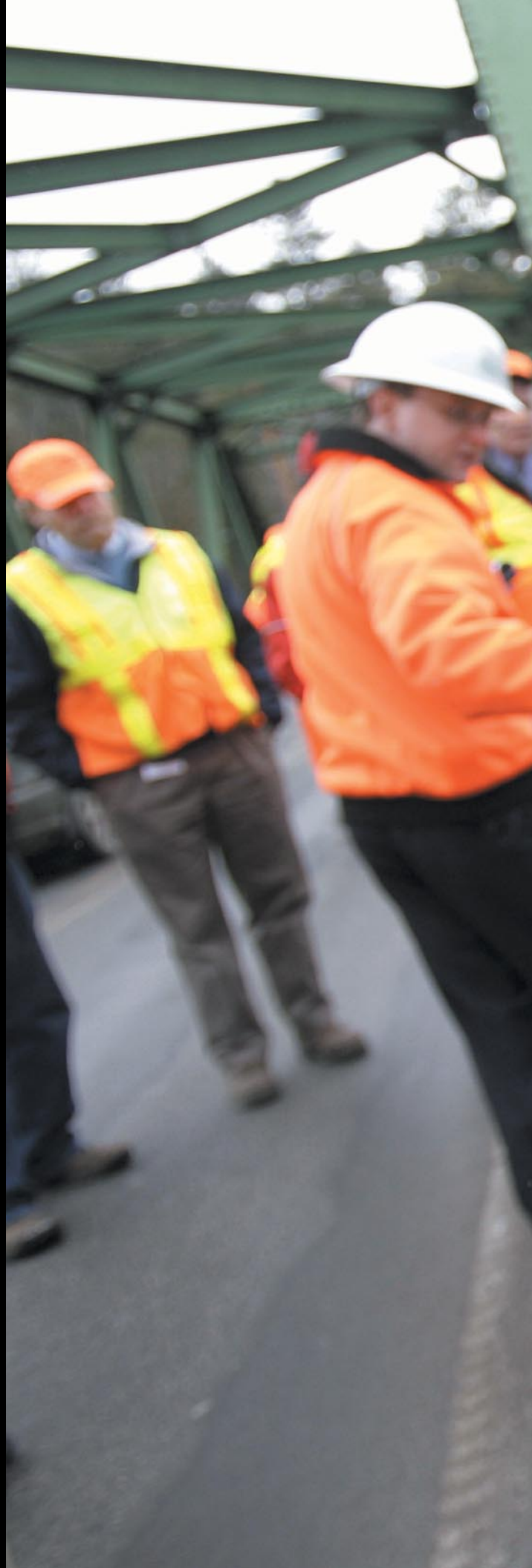
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**Part One
Infrastructure
2007**







Emerging Crisis, Shifting Priorities

We take it all for granted—the networks of interconnected highways branching out from cities over bridges and through tunnels into streets and country roads to neighborhood culs-de-sac; clean water that may travel hundreds of miles in aqueducts and mains before reaching our faucets; electricity that turns on with a flick of a switch from who knows where; the vast lake system and park created by the upriver dam; the airports, the subways, and the rail service; and the fiber optics that somehow make life as we know it today possible.

We grudgingly pay income and property taxes, fuel taxes hidden in the pump price, and, where necessary, tolls and other user fees like transit fares. The monthly electric bills have all that small print about surcharges. And we shell out for the occasional water bill. But who ever thinks about the true costs of the freeway to the city, the sewage pipes and water lines, or the levee? And who wants to pay more taxes or higher bills to maintain and repair them as long as they seem to be working? Can anyone calculate the consequences of putting off repairs or upgrades beyond the stress of roadway congestion and displeasure over rust in the tap water? Most likely, it takes a Hurricane Katrina or a car-falls-through-a-bridge mishap to help us connect the dots.

Sound infrastructure forms the backbone that is critical to maintaining and enhancing regional economic growth, competitiveness, productivity, and quality of life. For businesses, infrastructure has the greatest influence on location after tax rates, the availability of an educated workforce, and low crime. Where time is money, moving people to and from jobs, facilitating deliveries and shipments, freedom from business interruptions like loss of power, and ample telecommunications capacity all enter the equation. Prime access to ports and airports along global pathways becomes more essential for expanding enterprise and profits. Congestion and transport bottlenecks, meanwhile, can threaten regional sustainability.

In countries on every continent, grappling with how to emerge as winners in the rapidly globalizing economy requires coming to terms with vast challenges for building and maintaining roads, mass transit, airports, railways, water treatment plants, electric grids, schools, hospitals, and housing. It all takes vast sums of money and massive investment, which many countries, even the world's richest, can no longer afford to pay without substantial increases in taxes, more borrowing, and new user fees. The bottom line pulls no punches: "Sustainability of facilities does not come cheap."

At budget time, government leaders focus on funding military and defense, social security, health care, and education—all of which are worthy and supported by con-

stituents. Infrastructure increasingly gets put on the back burner and most places fall miserably short when it comes to financing needs. Projected funding gaps for infrastructure are enormous and ominous, especially in the United States: \$1.6 trillion over the next five years. Putting the U.S. dilemma in sharper relief, the World Bank forecasts Asia's infrastructure needs at a relatively modest \$1 trillion over the next five years, led by emerging economic powers China and India. These countries make infrastructure a national priority and are racing to build and expand modern infrastructure in wholesale makeovers to foster growth potential supported in part by their burgeoning economies. The United States, in particular, and most of Europe stumble to repair and retool aging roads, plants, and levees that may no longer serve a changing paradigm for how people will live and work in the future.

Typically, breakdowns—bridges washing out, overpass collapses, dam breaches—must occur before politicians and voters react to need. Dislocation leads to rushed funding on an emergency basis with dramatically heightened costs. Too often, projects focus on restoration rather than rethinking the model and finding possible efficiencies. Indeed, "there is a tendency to invest in the infrastructure we have instead of the infrastructure we will need," warns *A Global Perspective* interviewee.*

"We need to understand that the payoff for infrastructure often is not delivered until many years after it is built," says an interviewee. "The political generation that pays for it is not usually the political generation that benefits from the rewards." Adds another interviewee: "It's an education process that moves too glacially. People need to think 20 to 30 years ahead and take into account the intergenerational benefits" rather than the short-term costs. Too often, infrastructure priorities get caught in shortsighted pork barrel spending, as politicians seek local favor with expenditures on high-cost/low-benefit projects like Alaska's infamous "bridge to nowhere." Absent political will and vision, decisive action is lacking.

For starters, governments—federal, state, provincial, and local—"need to inventory their needs and budgets; establish priorities for expanding, maintaining, and operating more efficiently; and identify the necessary resources for funding improvements. "In the United States [and many other countries], we are falling short on each step."

Ideally, the political resolve must be found to break down silos among local, state, and federal government agencies, and engage in regional master planning. It's a failed model to let highway departments lobby for extra lanes and connector roads while the transit authority independently pushes to extend subway lines without anybody thinking about zoning for housing and commercial devel-

opment around exit interchanges and rail stations. Politicians and planners need to grasp the bigger picture—how integrated networks of roads, mass transit, and sidewalks can bolster mobility between communities and commercial districts as well as facilitate the movement of goods and services in and out of regions. Sound approaches could relieve congestion and manage future growth, all with an eye toward reducing pollution.

Efficiencies can be realized through better regional planning, which integrates infrastructure expenditures with land use and population trends. Federal and state grants to local governments can be structured to encourage integrated regional schemes. Intermodal approaches should be favored over one-off highway projects or transit stops where the only pedestrian walks lead to parking lots. Roads, rail, and mass transit systems should link to walkable neighborhoods and pedestrian-friendly commercial centers. In addition to underwriting costs over time, increased reliance on user fees would help orient behaviors and lifestyles to more efficient location preferences and reduced dependence on cars. If owners had to foot the full bill for far-flung infrastructure enabling their exurban homesteads, would sprawl development seem so attractive and affordable? "When people really understand how much something really costs, they tend to act accordingly."

Of course, this classic paradigm shift faces daunting hurdles: upending established neighborhoods in expensive retrofits; overcoming entrenched bureaucratic and political interest groups, including the patchwork of local governments; changing people's priorities; and reordering lifestyles and habits. "It's human nature—people don't want to change if they don't have to." And forget about it when change means paying a lot now for some future hard-to-grasp reward.

But maybe we must change just to stay competitive and secure our desirable lifestyles!

For now, the excitement or "smoke" hovers around private financing of infrastructure projects and government sales of infrastructure assets to private concessions. The United Kingdom propelled the trend under Prime Minister Margaret Thatcher and other European countries have followed suit. Australia and Canada have latched onto public/private infrastructure partnerships and India views privatization as an answer for funding massive infrastructure needs to support its economic expansion. States and cities in the United States sow interest in the potential for raising capital and funding road projects without incurring more debt or hiking taxes.

Private entities can use equity ownership structures to reduce the cost of capital and assume the risk for project overruns. The assumption is that private management also

We need to understand that the payoff for infrastructure often is not delivered until many years after it is built.

* All quotes in this report are from interviews conducted with industry experts. The list of interviewees can be found on page 61.

can drive efficiencies through incentives that public managers cannot. Pension funds, financial companies, and investment banks pour money into infrastructure investment funds, attracted by predictable, income-oriented returns and the potential for value gains from development projects.

But whether financing derives from public or private sources, the public remains on the hook for infrastructure and expenditures keep rising—construction and repair expenses alone have increased by 50 percent since 1999. Private road concessions will charge drivers tolls to meet return targets at rates considerably higher than customary under government management. In other public/private models, the government and private investors negotiate a long-term payment schedule with the operator taking on development risk and ongoing expenses for maintaining facilities, whether roads, schools, or hospitals. The government still pays the bill from traditional revenue sources—taxes or bonds paid off by taxes. Even investment bankers, who gorge on healthy fees from all these transactions, warn that privatization “will not be a panacea.” Forecasts suggest that only about 10 percent of U.S. roads will attract public/private partnerships and these will focus mostly on new interstate and highway construction using toll concessions. Even in the U.K., where public/private partnerships have been embraced for more than a decade, only about 16 percent of the country’s infrastructure has been ripe for privatization models, including schools, hospitals, and government buildings.

Sorry—there will be no free ride as we begin to tackle a deferred maintenance crisis and the need to ponder out-of-the-mold infrastructure solutions. The time has come suddenly to add infrastructure to that list of costly national priorities The country’s very future depends on it!

ISSUES AND TRENDS

Infrastructure Becomes a Competitive Imperative

- ▶ The global economy pressures countries to upgrade infrastructure in order to remain competitive, gain advantages, or keep from falling further behind.
- ▶ Moving people and goods internally with efficient access to global pathways—ocean ports and international airports—becomes essential.
- ▶ Roads, railways, freight lines, and airports need to integrate and connect with pedestrian-friendly population centers served by mass transit.
- ▶ Car and truck congestion bottlenecks some regions. Planners realize that multimodal solutions are essential for main-

taining traffic flow as populations increase. Car-dependent environments are badly disadvantaged. “Intermodal integration is a necessity.”

- ▶ Mature economies with established but aging infrastructure networks face gargantuan bills for deferred maintenance on roads, water systems, dams, and electric grids. Retooling systems—building rail corridors and incorporating mass transit—will require huge additional capital outlays that many governments are not prepared to pay.
- ▶ Pushed by national pride and centralized power structure, China boldly builds new infrastructure to support its future generations. Spurred by a growing economy, India tries to keep pace and replace third-world transport systems and facilities with state-of-the-art networks and technologies tailored to meet 21st-century demands and paradigms.
- ▶ Australia, the United Kingdom, other countries in western Europe, and Canada track ahead of the United States in confronting needs and using private financing structures to fund improvements. Established railways and mass transit systems, tempered population growth, and moderate sprawl (relative to the United States) help mitigate the urgency for major revamping in western Europe. Eastern Europe, still reeling from communist neglect, requires a major overhaul.
- ▶ Americans only start to recognize a potential crisis and continue to put off the day of reckoning. Caused by two decades of underspending, “a yawning budget gap” swallows initiatives to fund deferred maintenance. Prevalent sprawl, poor planning, and car dependence pose even greater challenges to overcome for meeting future needs.
- ▶ Many U.S. metropolitan areas cope with existing infrastructure designs that cannot readily accommodate projected population growth or support desired economic expansion. Retrofits and changing behaviors may be wrenchingly difficult, not to mention inordinately expensive, for a country already wrestling with pressing health care and social security shortfalls.

Privatization Expands Worldwide

- ▶ Infrastructure emerges as a new asset class for investors, alongside stocks, bonds, and real estate. “Privatization is unstoppable.” Massive needs for infrastructure funding will attract larger pools of private capital.
- ▶ Wall Street involvement will attract “best and brightest” into the sector to cash in on fees and investment participations. Closer attention to management and less on pork barrel spending could lead to smart pricing and new organization models.



- ▶ Various forms of private/public partnerships offer governments the opportunity to retain control, transfer risk of cost overruns, and gain efficiencies from private operators.
- ▶ Compared with the U.K. and Europe, the United States is an emerging market for infrastructure investment, with many more potential opportunities.
- ▶ In Europe, a surfeit of investment players and a dearth of new investments in mature assets set the stage for a secondary market where early-in investment banks sell holdings to longer-term pension fund investors who gain confidence in consistent track records of steady, predictable income-oriented returns.
- ▶ India puts out the red carpet for investors, who will enter the market cautiously over worries about corruption and bureaucratic hurdles. Only China has the luxury of relying on its booming economic engine to fund vast infrastructure development directly.
- ▶ Various forms of public/private partnerships may create efficiencies and reduce some costs for governments, but taxpayers and users must still pay the bills. In the United States, political delay will only increase the costs and force harder choices.

Rates of Return Tighten

- ▶ Increasing capital demand will push down return expectations, but provide greater market liquidity.
- ▶ Investors shoot for returns in the low teens, but mature infrastructure assets will more likely provide high-single-digit performance with attractive low volatility, somewhat akin to core real estate.
- ▶ More opportunistic players—particularly investment banks—bankroll development projects, taking on added risk. Private investor consortiums anticipate selling completed projects to pension funds and other institutional investors looking for stabilized assets or turning investments into public companies.

U.S. Public/Private Partnerships Face Resistance and Early Skepticism

- ▶ Political scrutiny will intensify over appropriate transaction models and terms for private toll road concessions.
- ▶ State and local governments fret that savvy private investors may “take them to the cleaners” and look for political cover from private consultants, who can help guide them through best practices learned in other countries.

Substantial urban growth means that these Indian workers wait for a barge to cross the river as a newly built bridge stands in the background.

- ▶ Public skittishness will persist regarding turning over public franchises to private “for profit” operators, some based offshore, who can raise tolls and fares under concession contracts.
- ▶ As a result, some investors worry about “too many restrictions” and “overregulation.”
- ▶ Critics question the practicality of long concession terms (up to 99 years) in early deals. Who can predict needs and requirements 30 or 40 years from now, let alone in the second half of the century? Will the Jetsons’ space cars become a reality by then? No one knows what to expect despite many contract contingencies.
- ▶ Anticipate transaction models to move away from selling concessions to highest bidders (Chicago Skyway, East-West Tollway) to revenue-sharing arrangements and availability contracts for lowest-cost operators.
- ▶ Eventually, private/public partnerships in the United States will extend from initial forays into toll roads to water supply/treatment, schools, hospitals, public housing, and even lotteries, following the U.K. model.

- ▶ Homeland security issues will hamstring U.S. airport privatizations. The most tested operators have offshore pedigrees, a no-no for security officials.

U.S. Road Funding Burden Shifts to States and Local Governments

- ▶ Reluctance to raise the federal gas tax threatens the viability of the Highway Trust Fund, which could turn insolvent by 2009 and create a “train wreck” for funding interstate improvements.
- ▶ Adjusted for inflation and fuel efficiency, the gas tax has only one-half its purchasing power compared to what it had in 1965, short-circuiting federal contributions to highway construction and repair.
- ▶ States and particularly local governments must become more self-sufficient for funding infrastructure improvements, spurring public/private partnerships and greater reliance on user fees.

Trenton, New Jersey, like many municipalities across the country, is faced with repairing or replacing aging infrastructure.



- ▶ Expect an epidemic of sticker shock as governors and local leaders come to terms with approaching budget shortfalls and receding federal support.
- ▶ Anticipate increases in local sales taxes as well as greater reliance on tax increment financing (TIF).
- ▶ Developer impact fees will pay for most new roads and water/sewer systems. Special tax districts, patterned on California's Mello-Roos districts, will be embraced by towns and counties to fund repairs for local streets and sewers. Property taxes have nowhere to go but up.
- ▶ Disadvantaged areas with declining tax bases will face substantial challenges to improve facilities and roads. Nine-to-five cities, weakened by loss of manufacturing industries, will struggle to fund necessary projects, hastening their declines. Some inner-ring suburbs also suffer. Rural areas may let roads go back to seed without outside help.

Tolls Will Become More Prevalent, Driving Costs Increase

- ▶ Most new U.S. highways will be constructed as toll roads—states will finance through bond issues and private concessions.
- ▶ Elected officials initially will resist morphing existing freeways into toll roads, fearing voter repercussions.
- ▶ But over the longer term, funding shortfalls will dictate greater reliance on tolls for existing roads and transponder technologies will facilitate toll collections.
- ▶ Congestion pricing lanes gain momentum on urban highways, but congestion cordons (like London's) have limited application, except in 24-hour cities with established mass transit alternatives to cars.
- ▶ Emerging technologies—satellite and GPS—will facilitate charging drivers based on miles traveled on specific roads—only 0.08 percent of paved roads in the United States are tolled. But "Big Brother" hang-ups will deter introduction.
- ▶ Trucker lobbies will need to gear up to fight sharply higher rates for moving goods. Politicos eventually will realize that charging tractor-trailer fleets is more voter friendly than sticking constituents with repair bills from trucks' out-sized damage to roads. They're just passing through town.
- ▶ States may consider tolled truck corridors to facilitate movement of goods and expanding freight rail corridors to take pressure off overtaxed roads.
- ▶ Other user fees—parking fares and metering—will become more common. Property owners eventually may get taxed for their parking spaces.

- ▶ Despite current resistance, fuel taxes will increase, too.
- ▶ Bottom line: Drivers will pay more for the privilege.

Local Governments Begin to Face Hard Realities

- ▶ American government officials and taxpayers have blissfully avoided the consequences of laissez-faire suburban development generously enabled by a federally funded, post-World War II interstate highway boom.
- ▶ In particular, high-population-growth metropolitan areas in the Sunbelt have evolved around multiple commercial nodes and low-density subdivision projects, served almost entirely by spiderwebs of roads.
- ▶ Major arterials will soon approach the end of typical 50-year life cycles, needing expensive overhauls. Sewer and water systems are overburdened, too.
- ▶ Congestion, meanwhile, will increasingly overwhelm existing road systems, designed for lower traffic volumes. Without mass transit alternatives and more high-density apartment development in commercial centers, these areas may be unable to sustain projected growth and economic development. Additional lanes and congestion pricing strategies will be part of the mix. "All the transit in the world won't solve the entire problem."
- ▶ But creating efficient hub-and-spoke transit systems may be next to impossible in the absence of pedestrian-friendly commercial hubs. Identifying potential rights-of-way through suburban backyards will prove extraordinarily contentious.
- ▶ Taxes (sales, property, special district) and user fees (tolls, fuel taxes, parking) will increase dramatically, raising the cost of living in places where people and businesses had moved for suburban quiet and convenience on modest budgets.
- ▶ At the suburban fringes, escalating impact fees to fund new streets and sewer lines will discourage greenfield developers and significantly raise new housing costs.
- ▶ Some suburban agglomerations could be severely compromised if they cannot find infrastructure solutions to reduce congestion.

Environmental Issues Could Foster Acceptance of Change

- ▶ Global warming concerns may turn into a passing fancy, but they could also help spur greater acceptance of smart growth principles, which are generally more environmentally friendly.

- ▶ Reducing car pollution and CO₂ emissions comports with raising driving fees and encouraging lifestyle changes, including living in pedestrian-friendly places with nearby mass transit.
- ▶ User fees can exact "pollution" premiums for larger cars and trucks with poor gas mileage.
- ▶ Water quality and availability will become more pressing concerns in many places, and could exact development restrictions. The arid western part of the United States confronts growing demand from expanding populations. Agribusiness interests, meanwhile, compete for supply. Runoff from development and population encroachment in watershed areas threatens water purity in many built-out regions, including the Northeast and Southeast. Rising sea levels could damage aquifers and infiltrate other fresh water sources in vulnerable coastal zones, particularly Florida. Coping with demand and protecting quality will turn into infrastructure priorities. Wind farms and hydropower technologies could present opportunities for private initiatives to source electric power alternatives.

BEST PRACTICES

Planning

GOVERNMENTS NEED TO PROVIDE A BROAD VISION for land use and future infrastructure needs, involving roads, mass transit, airports, and freight corridors as well as water/sewer and power requirements. Integrated, multimodal solutions require centralized, regional oversight. Parochial local planning and zoning regulation must defer. "China has an advantage over the U.S. in this respect."

TO SUSTAIN REGIONS, PLANNERS MUST ANTICIPATE NEEDS over the next half-century, not look for short-term fixes.

TRANSPORT PLANNERS NEED TO FOCUS ON THE WHOLE JOURNEY, not particular stages of trips. Sidewalks and roads from neighborhoods need to link effectively to mass transit and railways that lead to ports, airports, and commercial districts. A "holistic" approach requires understanding how to move people and freight most efficiently across regions using multiple options in order to relieve congestion. One-off road building or a new rail link offers a temporary bandage that may shift traffic, not provide comprehensive solutions.

STATES SHOULD USE THE CARROT OF GRANT MONEY to encourage more uniform, compact transit-oriented development by local governments and discourage more costly infrastructure sprawl models.

ZONING BEHAVIORS CAN BE CHANGED BY LINKING TRANSPORTATION AND HOUSING GRANTS—for sewer, water, roads, transit—to more high-density development along transit corridors. Sprawl-supporting infrastructure should not be subsidized.

IN NEW TRANSIT CORRIDORS, STATION DISTRICTS MUST BE ZONED to encourage apartment-, retail-, and pedestrian-friendly multiuse development, enabling people to walk home or to stores from trains without having to drive. Stations shouldn't be designed as islands surrounded by parking lots and parking decks, the conventional approach that nurtures dependence on cars.

FUNDING NEEDS TO CONCENTRATE ON HIGH-SPEED, INTERCITY RAIL CORRIDORS, supporting regional growth and providing alternatives to car and short-hop air travel. Much of the 21,000-mile (33,796-km) national Amtrak network inefficiently serves low-population areas over long distances. Cross-country railways should focus on increasing freight shipping to regional distribution centers.

Financing

PRIVATIZATION MODELS SHOULD MOVE AWAY from how governments can get the most dollars for a concession to models that secure the lowest bidder for providing the most efficient service as well as revenue sharing in the efficiency gains. Private operators get paid for running the concession better with a stake in the ongoing benefits rather than the government selling an asset for a short-term cash infusion.

THE FRENCH "IMPROVISATION" SYSTEM OFFERS GUIDANCE on navigating public/private contracts. Long-term operating agreements can be renegotiated if underlying conditions change. Special courts rule on modifications, balancing between a reasonable rate of return and the public good.

GOVERNMENTS NEED TO MAKE BIDDING AND DOCUMENTATION PROCESS MORE UNIFORM and less onerous in reviewing privatization proposals from funders and operators. Uniform standards and practices would help speed up the process and reduce costs, improving clarity without necessarily compromising thoroughness.

INCREASED USER FEES ON DRIVERS—tolls, higher fuel taxes, parking fees, congestion pricing—could have huge economic benefits. Fee revenues would provide reserves for infrastructure repair and improvements, while drivers would be charged more directly for the true cost of their road use. Auto insurance rates should correspond to miles traveled in addition to driver history and age. By aligning pricing with use, market incentives will help adjust behaviors to find the most efficient and cost-effective travel as well as inform decisions on where to live and work.

COST BURDENS FOR NEW LOCAL INFRASTRUCTURE—streets and water mains—should continue to shift to developers and owners through impact fees and special tax districts.

THE U.S. FEDERAL GOVERNMENT NEEDS TO DEFINE its policy about funding infrastructure, address approaching highway trust fund insolvency, and decide on possible fuel tax hikes. Until the feds set their course, state and local governments will delay funding decisions, hoping for bailouts.

Changing Behaviors

USER FEES HAVE SIMILAR APPLICABILITY TO ELECTRIC AND OTHER UTILITY RATES. Fixed infrastructure costs for bringing power into homes are higher per capita in sprawling, single-family areas than in compact urban centers. But flat rates that are charged users can distort true costs, subsidizing transmission lines and other infrastructure in suburban areas. Smart metering technology can help electric users understand costs and how to reduce them.

IMPOSE AXLE TAXES ON TRUCKS. Passenger cars actually subsidize trucks on intercity travel since trucks cause disproportionately more damage to roads than lighter vehicles. Many highways and most local streets have not been engineered to withstand wear and tear from heavier, wider, and longer rigs. Weight/distance fees will help pay the bills and assess costs more fairly. Improved rail corridors could provide competitive, lower-cost freight-hauling alternatives—more energy efficient and less polluting, too. The European Union takes regulatory steps to encourage rail freight through member countries.

TRAVEL CONVENIENCE CAN BE ENHANCED WITHOUT POURING SO MUCH CONCRETE. New technologies can provide information to reduce lost time and travel tedium at transfer and interchange points. Among the solutions are the following: improved directional signage, real-time in-

formation on train arrivals at station platforms, up-to-the-minute information on clogged roads, better lighting and security in stations to encourage off-peak travel, improved airport check-in, security clearance, and baggage claim.

CONTROLLING TRAFFIC FLOWS—through improved information and congestion pricing—can speed up road travel without adding lanes. Pricing mechanisms should be convenient for drivers and accurately reflect trip costs. Tolls should reflect peak and off-peak congestion levels in variable pricing schemes and apply to all major thoroughfares. Rates should be as predictable and easy to understand as possible. Avoid frequency discounts—they encourage driving. Provide more choices—transit improvements and bike lanes.

Part Two

U.S. and Global Issues





Infrastructure World Overview

When it comes to infrastructure, America is more of a follower and no longer a world leader. Other countries marshal vanguard strategies and provide the contemporary lessons for developing best practices in public/private finance, intermodal transport, congestion pricing, and high-speed rail. Most governments confront significant budget gaps, but recognize the compelling need to establish infrastructure policies and funding solutions in order to sustain and enhance future prosperity and economic growth. Despite daunting challenges, inevitable policy stumbles, and financing shortfalls, these countries make infrastructure more of a national priority.

"Airports are a litmus test for where America stacks up in the world of infrastructure," says an interviewee who frequently travels internationally. "Airports are your calling card, the first impression when you enter a country. None of the U.S. international airports come close to matching the efficiency or cleanliness of Asia's or Europe's top airports." Not only are they better at speeding passengers to and from gates, but they also offer convenient mass transit connections into local destinations. In Zurich, for example, it takes riders 12 minutes to get from baggage claim to reach the center city on high-speed trains. From Heathrow terminals, nonstop rail runs under 20 minutes into London. On the return, you can check baggage through at the London station. All the primary Asian airports have convenient high-speed rail connections to central business districts. But in New York from JFK, once you drag your bags to the platform, a trip on the monorail and local subway into Manhattan lasts 75 minutes with a "change in Jamaica." In Chicago, the CTA trains make 15 stops during the 45-minute ride between O'Hare and the downtown Loop. Los Angeles International, Dallas-Fort Worth, Miami International, Dulles International, and Denver International, among others, can be reached only by road.

A broad overview of key infrastructure trends in world regions and countries follows.

ASIA

In the rapidly developing Asia Pacific region, China and India leverage their expanding economies and move to construct transport, telecommunications, and power networks to serve their 21st-century aspirations for global economic leadership. Bulging populations and shifts to manufacturing, service-based economies exert pressure on the pace of change and urbanization. Both countries concentrate on greenfield development. Facilitated by central government mandates, China adopts the latest models and technologies to transform backward systems into state-of-the-art sys-

tems. In India, progress comes more in fits and starts after decades of neglect. Like the United States and later Japan in the post–World War II period, they benefit from burgeoning economies, which can propel infrastructure development across underutilized expanses. China spends 9 percent of its gross domestic product (GDP) on infrastructure and India budgets 3.5 percent (\$25.5 billion) while aiming to increase its allocation to 8 percent. By comparison, the United States budgets \$112.9 billion or just 0.93 percent of its GDP, and sidesteps the reality of a ballooning \$1.6 trillion deficit for necessary upgrades over the next five years.

In contrast to fast-developing China and India, Japan, South Korea, and Singapore offer examples of how more mature economies cope with augmenting infrastructure systems. These countries continue to concentrate spending on maintaining and modernizing transport networks and other infrastructure to retain and, where possible, enhance their economic clout.

China

New infrastructure supports the rapid, almost hell-bent, modernization of China. "The whole process, which occurred in the West over the last 200 years, has been telescoped in China into the past 15 years," says an interviewee. The country completed a vast 25,000-mile (40,233-km)

highway system, comparable to the U.S. interstates, in just 12 years and the Beijing subway expands from 70 to 335 miles (114 km to 540 km) in little more than a decade. Thousands of miles of high-speed rail lines are under construction to speed up travel between large cities, while airports are constructed or redesigned to cement the country's place along global pathways. Cash, human capital, and national pride focus on showcasing the Asian juggernaut during the 2008 Olympic Games as a world innovator and economic power. "They are building like crazy," investing approximately \$160 billion annually into new projects.

"China is developing from the inside out," expanding old cities like Beijing and Shanghai and building 30 new "sustainable" metropolitan areas, based on traditional neighborhood models with integrated mass transit systems. The country needs to accommodate vast population movements from rural regions gravitating to exploding numbers of manufacturing and service jobs, which are concentrated in cities.

Two major hallmarks of China's approach to building infrastructure are centralized planning and emphasis on integrating projects with land use. The country also has invested heavily in research and development, sending engineers and government officials overseas to learn from other countries' best practices as well as mistakes. "Many government leaders are engineers, who understand the importance of training, research, and regional planning. They

Airports are your calling card . . . [and] none of the U.S. international airports come close to matching the efficiency or cleanliness of Asia's or Europe's top airports.





Top: This new road to the Beijing airport can be quickly built by the highly centralized Chinese government.

Above: Japan's bullet trains are an efficient method for transporting passengers distances that are too far to commute by car and too short to travel by plane.

understand the importance of investing in research and technology."

China's history of authoritarian rule orients the country to acceptance of central government mandates and policy control. "The dictatorship lays down policy and that is the way." Regional planning links into national policy, and land use is integrated around moving people and goods efficiently. "In the U.S., we talk for years about developing bullet train corridors and it never happens. In China, they just do it." After initial missteps in the early 1990s, Chinese planners have rejected models based on American suburban development—office parks and parking decks separated by roads from cul-de-sac subdivisions. "At first, they copied what they saw in the United States and parts of western Europe—no bike paths and six-lane roads with turning lanes," says an interviewee. "But rising oil costs, dependence on Middle Eastern energy sources, and pollution issues had to be addressed." They realized quickly that "the Irvine, California, concept" would be counterproductive to greater energy independence.

While extensive road construction accommodates ramped-up use of cars, land use policy now emphasizes providing mass transit and rail service, connecting to pedestrian-friendly districts. Beijing plans ten new subway lines and Shanghai quadruples the size of its underground. New cities adopt traditional neighborhood design (TND) principles of concentrating high-density residential projects around mass transit stations and retail. "They want to keep typical walking distance within one-fourth of a mile of stations." Bike lanes are incorporated everywhere.

High-speed trains have also been integrated into China's infrastructure strategy. The country launched the world's first magnetic levitation train in regular service between downtown Pudong and the city's international airport, an eight-minute trip with speeds reaching upwards of 270 miles per hour (434 km per hour). Conventional high-speed rail lines are under construction between Beijing and Shanghai, and Beijing and Tianjin, among other cities.

Looking ahead, the national government has joined forces with regional and municipal authorities to form an expressway development corporation to build, maintain, and expand highways across the country. "It's like the Federal Highway Administration, New Jersey Turnpike Authority, New York Thruway, and various county and municipal road departments rolled into one to form a business." This entity has issued an initial public offering (IPO) to create a public company. "For all our talk in the U.S. about financing and privatizing infrastructure, we are light years behind China."

But offshore infrastructure funds have been discouraged by China, whose laws limit foreign investment in favor of domestic control and homegrown talent. Concerns about

Railways provide the primary option for efficient and convenient high-speed intercity transport in many countries.

- ▶ The Japanese introduced a network of bullet trains in 1964 that travel at speeds of close to 200 miles (321 km) an hour between Tokyo and other major cities.
- ▶ In fast-developing China, rail use is increasing at a 30 percent annual clip—an estimated 156 million people boarded trains during this year's 40-day lunar New Year holiday. Making a major investment in railways, the Chinese government just completed a \$4.2 billion rail line between Beijing and Lhasa in Tibet, which powers through mountain passes and the Gobi Desert over tracks designed to remain stable in permafrost.
- ▶ Taiwan just completed a \$15 billion high-speed line between Taipei and the southern port of Kaohsiung, reducing travel time from four hours to 90 minutes. South Korea also builds bullet train corridors between Seoul and other major cities.
- ▶ Advanced hub-and-spoke rail systems carry passengers in and out of primary European cities where proximity makes for efficient travel. Futuristic TGV electric trains power riders at average speeds of 186 miles (299 km) per hour through France. High-speed center city to center city rail transport between Paris and Lyon has cut into service by airline competition significantly. By year-end 2007, high-speed Chunnel trains are scheduled to begin operations between London and both Paris and Brussels. The Paris trip will take two hours and 15 minutes, and the Brussels route will take under two hours. Expectations are that the new train service will substantially reduce air travel between these European capitals. Germany, Italy, and Spain also spend heavily on high-speed rail.

Low Rail Use

In the United States, rail travel takes a back seat to cars and planes. Amtrak's intercity rail system carried only 25 million passengers during all of 2006, compared to airlines, which served 712 million. Americans, meanwhile, own more than 200 million automobiles. Less than 5 percent of Americans commute to work by forms of mass transit, including trains. Most of those trips concentrate in the handful of 24-hour cities, particularly New York and Chicago. For most people in fast-growing Sunbelt metropolitan areas developed around interstates, cars are the only way to get to their jobs.

Critics point out that Amtrak continues to operate in the red, incurring a \$1 billion deficit in 2006, despite infusions and capital support from the federal government (recently about \$1 billion annually). Every year, Congress seems to battle over proposals to privatize or scuttle the system. Many representatives in far-flung districts inevitably vote to support service, but with major strings attached: unprofitable routes need to remain available to their constituents. As a result, the Amtrak network extends over 21,000 track miles/33,796 track km (half the size of the interstate system) to 500 communities in 46 states including a slew of small cities like Moscow, Idaho; Cheyenne, Wyoming; Burlington, Iowa; and Jackson, Mississippi.

Trailing Behind

While Amtrak extends low-volume passenger service over nationwide routes, the United States has fallen well behind other parts of the world in taking advantage of the potential for bullet train lines linking cities in densely populated regions, covering distances from 50 up to 250 miles (80 up to 402 km). High-speed rail service could prove more efficient and convenient than either air or car travel, and help relieve growing road and airport congestion in corridors like Boston/New York/Washington, D.C., in the Northeast; San Diego/Los Angeles/San Francisco on the West Coast; Miami/Orlando/Tampa in Florida; Houston/Austin/Dallas in Texas; and Chicago/St. Louis/Kansas City in the Midwest.

The lone U.S. version of an aerodynamic TGV-style bullet train, the Acela Express, theoretically can travel up to 150 miles (241 km) per hour on its Northeast route from Washington, D.C., through Baltimore, Philadelphia, and New York and up to Boston. But curving rail beds, conflicts with freight traffic schedules on shared tracks, and various municipal restrictions put the brakes on bullet train-like schedules. Without dedicated, state-of-the-art tracks and freedom from local speed encumbrances, a reasonable three-hour timetable for end-to-end Acela service appears unattainable. Currently, the 210-mile (338-km) trip between New York and Washington actually takes 2.5 hours if everything clicks, while travel time on the comparable New York to Boston leg extends to more than three hours.

Airports and Cars

So if they don't drive, most intercity travelers in the Northeast continue to take the airline shuttles, which can get them door to door in two to 2.5 hours if everything works, but also means taking cabs on often jammed roadways, bridges, and tunnels to get to and from airports. A single

The Bullet Train Alternative

shuttle arrival into LaGuardia Airport can result in 100 to 200 extra car trips flooding onto the Grand Central Parkway, while another 150 cabs and cars may be heading to the terminal for the next outbound flight. Four shuttle flights leave LaGuardia for Boston and Washington each hour while four other planes land. So conservatively, the shuttles can result in approximately 15,000 car trips each day onto New York's swollen highway system.

Trains drop off passengers in central downtown locations, which can facilitate use of mass transit connections or pedestrian routes that don't further tax already crammed streets and highways. Cab rides would presumably cover shorter intracity distances. Bullet trains also use less energy per passenger mile than either cars or planes. Faster train service could buttress intercity regional economies, energizing Baltimore, Philadelphia, New Haven, and Providence as more convenient support centers for the 24-hour economic giants: Washington, New York, and Boston.

Intercity Connections

With the exception of San Francisco, cities in California, Florida, and Texas do not yet have the mass transit networks found in Northeast centers. But bullet train systems could help encourage the evolution of more multifaceted 24-hour downtowns with light-rail links to surrounding districts. Service could slow escalating congestion on major interstates and relieve dependence on cars, at least on the margins.

To make bullet trains work, government regulators need to fashion dedicated rights-of-way without local speed restrictions. Resources must be focused on high-volume corridors where train service can make a difference in relieving congestion and providing convenient and efficient transportation alternatives. But expanding corridors through heavily populated areas presents discomfiting environmental and NIMBY challenges, not to mention extraordinary costs. Experts budget a Sacramento/San Francisco to San Diego rail link at \$60 billion. Refashioning Amtrak, dropping service to low-population areas, and/or bringing in private operators won't make a dent in that bill. Proven rail systems and technologies exist, but the United States has not found the will or a way to take advantage of them.

The pan-Himalayan railroad in Tibet reaches altitudes of over 16,000 feet (4,877 m) above sea level and is indicative of China's commitment to infrastructure.



corruption and opaque laws also contribute to investors' skittishness over higher risk. For now, the government has the considerable luxury of ample resources to pay its own way, using low-cost labor, tapped from the world's most populous nation. "They are willing to do whatever it takes to pave the way for future growth." At some point, funding realities will require at least a modest level of private investment to stoke continued advances.

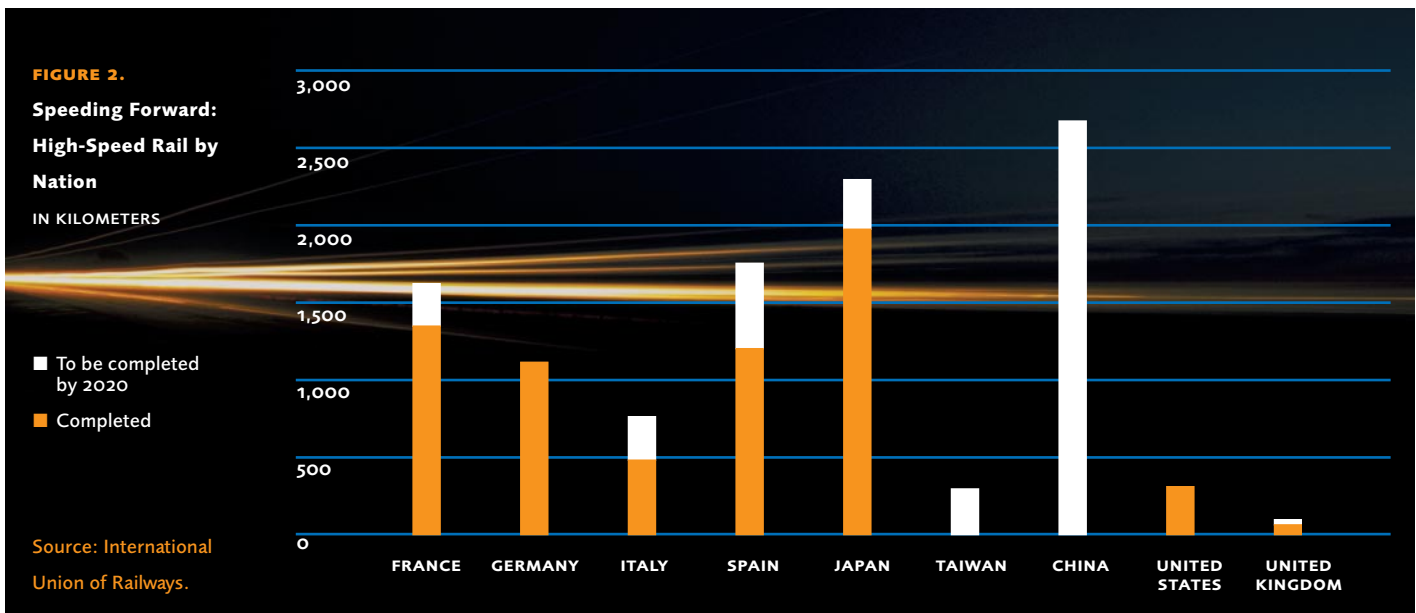
Note (below): The Acela route between Washington, D.C., and Boston is not considered a true high-speed rail because it never reaches speeds near those of other high-speed rail systems.

India

India's headlong transformation from cauldron of third-world dysfunction into global powerhouse will depend on proliferating infrastructure capacity and refurbishing antiquated systems—transport, water, utility, and communica-

tions. Overwhelming poverty, endemic corruption, and fractious politics create significant hurdles. State and local governments can short-circuit plans for rights-of-way, stalling road, transmission line, and railway projects, while adding to costs. But explosive growth in the middle class—now comprising more than 250 million people—fuels mushrooming consumer and capital markets to sustain progress.

Unlike China, India does not have enough cash to self-finance its considerable infrastructure wish list, although the country boasts \$190 billion in foreign exchange reserves to leverage project funding. The finance ministry encourages an increase in savings by domestic households to help fund new infrastructure, underscoring concerns about stymieing economic advances. A proposal under consideration would create tax-free infrastructure savings



bonds as part of retirement savings plan options. Investors would be guaranteed a stable return for helping underwrite essential projects.

The government welcomes (indeed needs) private investment through public/private partnerships, allowing up to 100 percent foreign equity in projects, and hopes for an injection of \$320 billion in private capital during the next five years. But India is somewhat undermined by weakness in regulatory controls and capacity to evaluate and manage public/private partnerships. Bureaucracy and corruption create delays, add costs, and create uncertainties. In addition, questions abound about ongoing ability to meet long-term equity and debt financing for projects. The country also lacks China's internal engineering and planning resources.

Not shy to innovate, the finance ministry examines using collateralized debt obligations (CDOs) to enable banks to spread credit risks across a broad group of bond investors and fund infrastructure products. The country's capitalist environment and English legal traditions provide a solid foundation for growth and give confidence to investors despite the evident impediments. In addition, tax exemptions have been enacted for infrastructure investments. Such financial heavyweights as Citigroup and Blackstone commit to raising capital for a multibillion-dollar infrastructure fund and an array of investment banks investigate potential deals.

Transport infrastructure needs the most immediate attention, if India is to maintain a GDP growth rate of 7 percent or better. The country has fewer than 4,000 miles (6,437 km) of interstate-caliber highways. Many major arterials leading out of cities are rutted, potholed, and chronically jammed. About 50 percent of the country's produce—theoretically enough to feed all of its people—spoils in transit or rots in the fields, because of inefficient and insufficient road and rail systems. Recent initiatives make significant inroads in launching myriad infrastructure projects with setbacks and lessons learned along the way:

- ▶ The government has instituted a sophisticated road privatization system that includes public/private partnerships funded by annuities and revenue sharing. Many new roads will be tolled and privately operated. The prime minister pushes for rural road development, setting benchmarks and deadlines. A \$12 billion national ring road, connecting India's major cities, nears completion. Private toll concessions come into vogue to finance construction. The government enters into "shadow tolling" arrangements, paying private partners based on actual usage.
- ▶ Brimming with freighters and cargo ships, the country's 12 major ports fill to capacity and require expansion. The government pegs \$22 billion for new ports and modernization programs. Port construction has been facilitated by



This traffic jam in New Delhi illustrates the challenges inherent in India's rapid urbanization.

allowing more foreign construction companies into the market. A \$500 million container terminal is under construction in Kochi, a southwestern city.

- ▶ Business travel and tourism growth have been hampered by inadequate airports. A \$430 million privately managed international airport is scheduled for completion in Bangalore next year. Large-scale expansions and facelifts also are underway at the Mumbai (\$515 million), Delhi (\$600 million), and Hyderabad airports, which have been turned over to private operators, while the government retains control of security and air traffic control. As part of the transactions, operators gain valuable development rights around the airports for badly needed new hotels and mixed-use development.
- ▶ Delhi's metro has been successful, but maintenance problems throw monkey wrenches in Mumbai's subway service. Bus rapid transit solutions hit practical obstacles—a lack of roads makes it hard to identify dedicated rights-of-way and car drivers ignore lane restrictions anyway.
- ▶ Railways get short shrift, if only because the system is relatively functional and long established. In fact, India has the world's second-largest rail network. Budget-busting costs deter interest in high-speed trains. Aging and increasingly rickety, the rail system risks further decline, but limited resources are directed elsewhere out of greater necessity, for now.

Despite advances, crime and corruption continue to mire some infrastructure sectors in third-world conditions as demand grows for greater capacity:

▶ Water and sewer systems range from inadequate to nonexistent. Victorian-era mains and pipes suffer chronic leaks in major cities. Theft is rampant and water purity is problematic. Entrepreneurs sell water to city dwellers to ensure uninterrupted supplies.

▶ About 45 percent of Indian households have no power and transmission quality is poor for those connected to service. Peak demand exceeds supply by 15 percent, and growth in consumption outstrips new supply, while demand could double by 2020. Individuals and businesses steal an estimated 55 percent of electric transmissions. Private investors show little appetite for investing in desperately needed power plants and utilities until the government cracks down effectively on the current ongoing larceny.

In India, progress will be choppy, but government and business understand the imperatives for pushing infrastructure initiatives. At least a decade behind China, the country will be hobbled until its transport network becomes more advanced and increases capacity to meet its economy's potential. Basics like electricity and water delivery systems must become more dependable.

Japan

Always a technology leader, Japan benefits from bullet train corridors and new airports with rapid transit connections into major cities. The government has traditionally budgeted more than 10 percent of its spending on infrastructure, generously investing in its transport and utility systems. The country launched bullet train service in 1964 and features one of the most advanced networks of international airports.

Corruption in India has made international financing for infrastructure hard to come by; without it, India's infrastructure will remain stuck in a previous era.



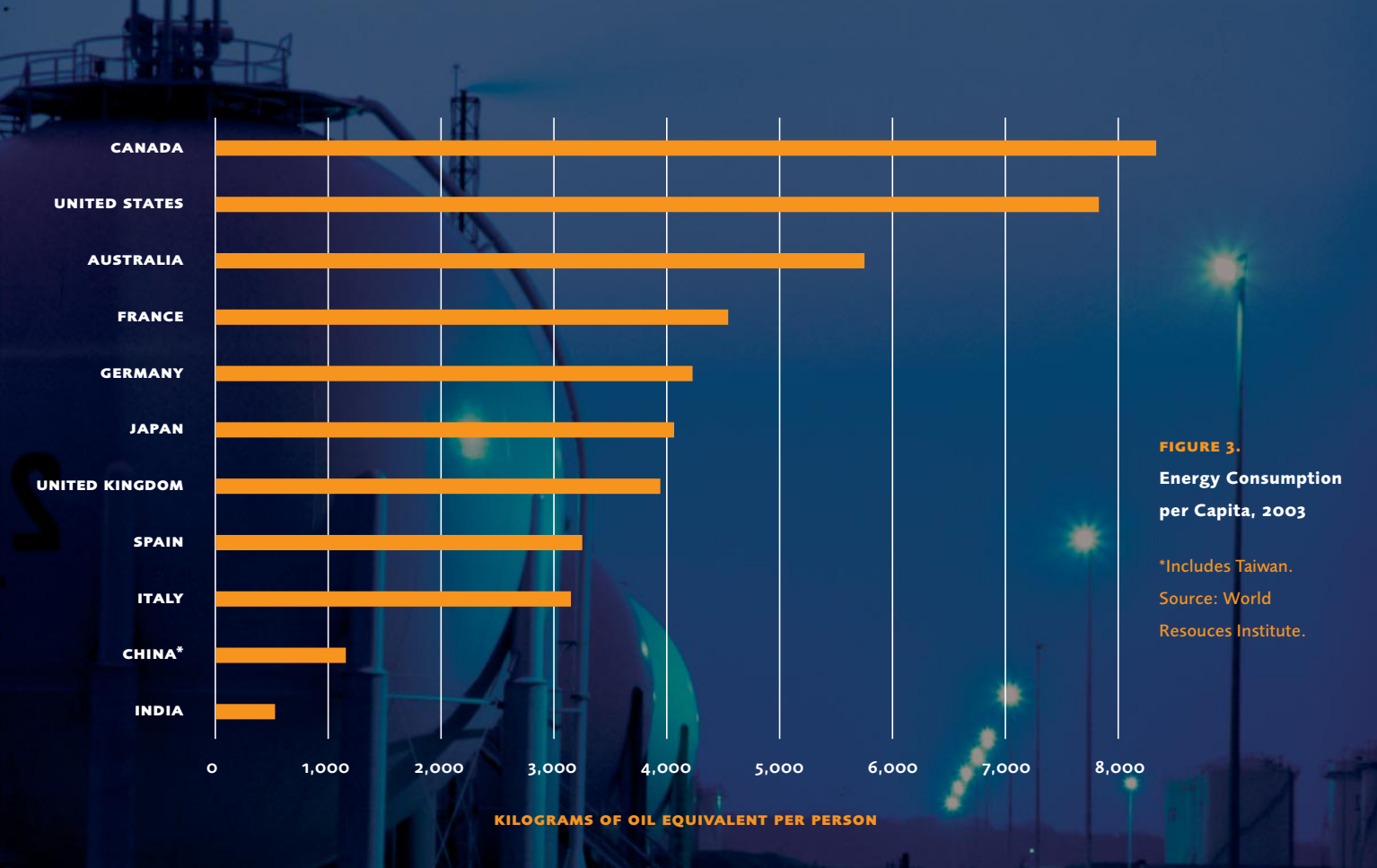


FIGURE 3.
Energy Consumption
per Capita, 2003

*Includes Taiwan.
Source: World
Resources Institute.

Significant expansions and upgrades are underway or have been recently completed at six airports.

Japan's mountainous island landscapes have oriented planners to use land efficiently and concentrate development. "They don't have ten feet of flat land to work with anywhere" and earthquake engineering is a priority. "Everything is built to exacting standards and they use every inch of land to best effect." Declining and aging population trends remove pressure for vastly expanding road networks (the nationwide highway system has yet to be completed), but budgetary deficits for repairs and improvements should become more pronounced as sluggish economic growth and increasing social costs to support large numbers of senior citizens create imbalances. The government's infrastructure budget has been declining as a percentage of overall spending since 2003, a trend expected to continue. The country was an early proponent of public/private financing partnerships in Asia, forming companies to build and operate ports, airports, road systems, and telecommunications networks. Unlike the U.K. financing model, Japanese public/private partnerships limit risk transfer and operate more on trust, an abiding cultural governor. Company cartels, tied into the government, control the bidding process. "The downside is that foreign companies are kept out and lack of competition increases costs. The good news is these companies make a lot of

money and invest heavily in R&D." If budget shortfalls persist, as expected, Japan may open to greater outside investment by private players.

Singapore

China and India can look directly in their backyard for an exemplar of how inspired infrastructure can drive economic growth. Singapore, a tiny city-state with only 4.5 million people, ranks as the world's 22nd-wealthiest country, operating the world's largest port and a primary foreign exchange center. Its airport, rated among the best in the world, serves as the aviation hub between Europe and Australia as well as for southern Asia. More than 1.3 million people a day travel on the country's advanced rail and light-rail systems, and more than 2.8 million use its bus network. Vanguard congestion pricing, meanwhile, helps control traffic in the center city. "This country developed from nothing after World War II," says an interviewee who visits often. "They built prosperity off building some of the world's best transport infrastructure and continuing to maintain and upgrade it." The latest project involves construction of the airport's third terminal.

South Korea

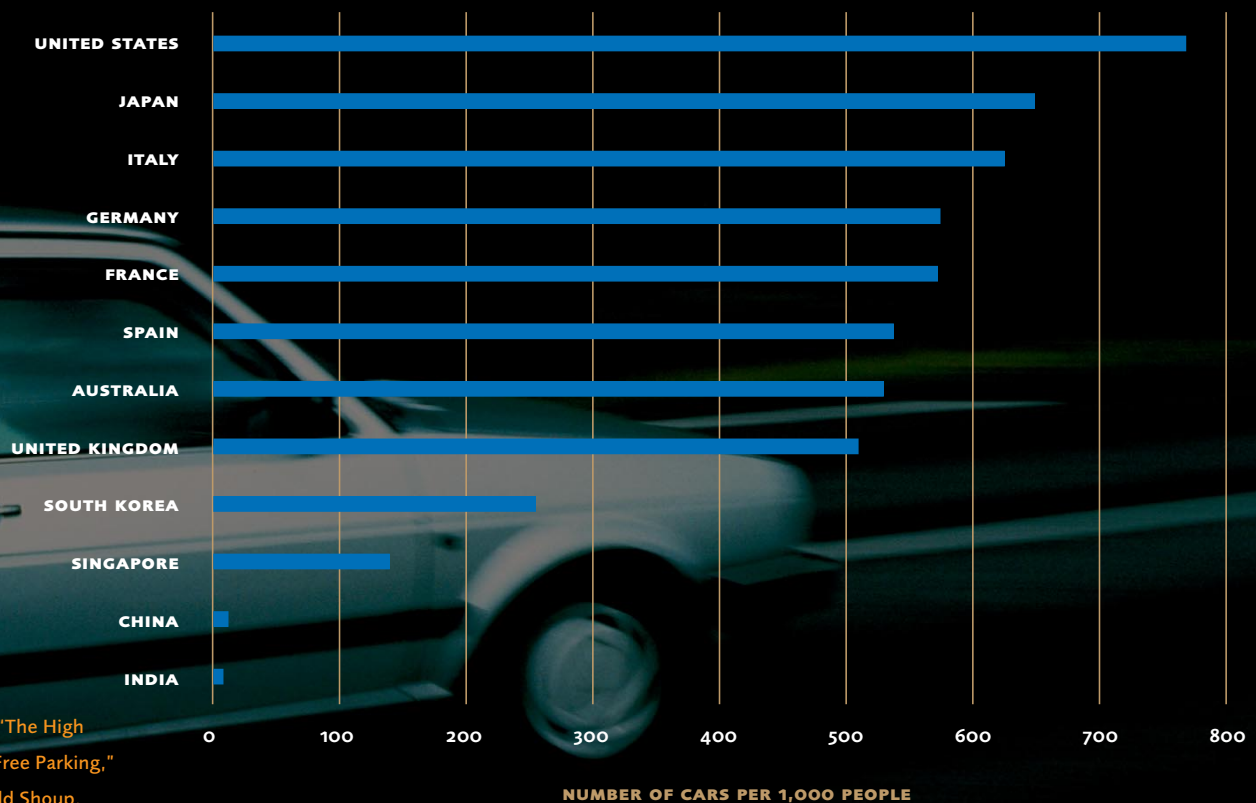
Another Pacific Rim success story, South Korea's economic advances had been propelled by massive government investment in transport infrastructure—roads, railways, subways, and airports. One of Asia's poorest countries at the end of the Korean War in 1954, South Korea ranks today as the world's 11th-largest economy. Despite recent setbacks precipitated by the 1997 Asian financial crisis, the country has engaged a phased expansion of its primary international airport, Incheon, with a goal of positioning the facility as the primary passenger and cargo hub in northeast Asia. Also, a major push is underway to expand the nation's railways, including completion of a high-speed line between Seoul and Mokpo. The country keeps building new roads—ten highway projects are under construction, mostly serving gridlocked Seoul, which concentrates nearly one-fourth of the country's population. On the near horizon, the government plans to build a new, \$50 billion capital city, 90 miles (145 km) southeast of Seoul, to help relieve congestion around the current capital. South Korea actively encourages private investment, especially in greenfield toll road

projects, schools, and hospitals; but like Japan, it favors participation by domestic players over foreign companies.

EUROPE

Western Europeans were forced to confront the consequences of aging infrastructure sooner than the United States as their mature economies lagged in the 1970s and 1980s and competitive pressures increased. France and Spain needed to revamp road networks and the United Kingdom started facing up to overtaxed road and rail systems as well as crumbling hospitals and schools. Other western European countries followed suit with a spur from formation of the European Union, which seeks to compete economically against the United States. These nations have drawn up extensive infrastructure plans, assessing needs and seeking funding. The European Conference of Ministers of Transport also has been at the forefront for exploring solutions. Many countries encourage partnerships with private operators to finance and manage infrastructure facilities, looking to achieve greater efficiencies and transferring risk of cost overruns from governments. In particular,

FIGURE 4. Car Ownership by Nation, 2000



Source: "The High Cost of Free Parking," by Donald Shoup.

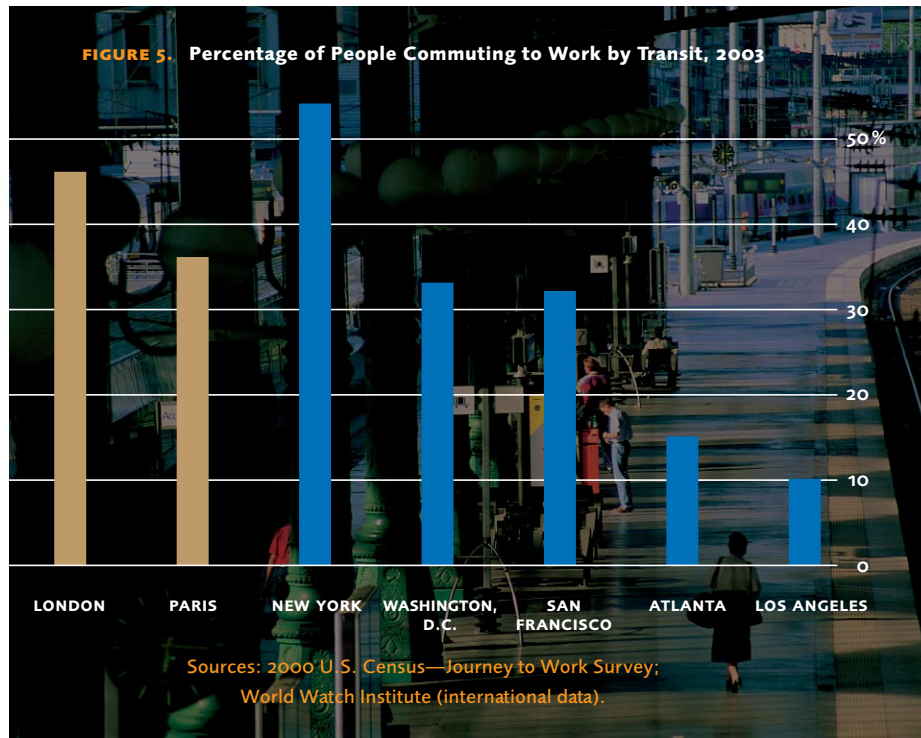
many airports have been turned over to private managers. "We have huge needs for rehabilitation and maintaining existing facilities," says one European transport expert. "But generally we don't need huge new projects."

Europe benefits from a tradition of core-centric cities, towns, and villages and greater reliance on rail and mass transit alternatives to the car. Biking, motorbiking, and walking are more accepted there than they are in the United States for running errands and traveling short distances. Countries sympathize with global warming concerns, boosting the cause of rail freight over trucks and embracing carbon caps. While driving remains overwhelmingly preferred and desirable for flexibility and mobility, limits placed on car culture are more common and accepted. Still, growing suburban areas around major cities have not been immune to increasing congestion and other side effects of traditional sprawl.

In Europe, car ownership costs more, helping to moderate auto-buying appetites. Some countries like the U.K. even tax car ownership and fuel taxes are significantly higher than in the United States. The number of toll roads increases across many countries—"there's a strong movement in Europe of not leaving drivers the free option." At the extreme, Italy's motorway system is composed of mostly private toll roads. New motorway construction in the U.K., France, Portugal, and Spain, among other countries, will be funded mostly through privately operated toll road concessions. Even Germany, home of the high-speed Autobahn, jumps on the bandwagon.

As a result of higher driving-related expenses, car ownership per-capita ratios are lower and rails are somewhat more favored (as well as heavily subsidized). France, for example, spends 20 times more per capita on railways than the United States does. Nevertheless, rail use has declined steadily among passengers and freight haulers in European Union countries since 1970. Railways carry only about a 6 percent market share of passenger traffic, down from 10 percent in 1970; freight transport captures a 13 percent market share, down from 30 percent. But overall, Eurozone countries want to reverse these trends. They increase budgets to expand railways and political momentum builds for revitalizing rail use. In 2007, the European Union has moved to deregulate rail freight and open markets to cross-border competition with uniform practices. Privatization advocates suggest that breaking national railway monopolies in countries like France and Italy will stimulate innovation and enable "interoperability" across rail systems throughout the continent, facilitating transport and reducing costs. They push for deregulation of passenger trains, too.

In most EU countries, infrastructure decision-making and land planning tend to be centralized and top down, re-



sulting in more integrated national transport systems and better-contained suburban growth. "We consciously try to avoid investments that lead to sprawl, and concentrate on infill like success stories in the Docklands [London] and Manchester," says an interviewee. "Reinvesting in public transport for central cities is a common strategy. Paris and other French cities as well as Dublin invest in tramways." Light rail has been embraced in many countries. Germany has the most systems—every large to mid-sized city uses light rail. Eleven cities in France, including Paris, now have light rail, and six Italian cities have constructed or are planning light-rail systems. Dublin, Edinburgh, and Barcelona also have built systems.

Demographic trends, meanwhile, anticipate slow-growing, graying populations in most countries, with declines forecast in Italy, Germany, and some central European states. This outlook suggests slackened new demand on strained infrastructure systems. The region's enduring emphasis on mass transit will help serve less mobile aging populations in urban centers. But government budgets will be stressed in supporting increased numbers of older citizens with greater needs and by lower percentages of younger, working cohorts able to generate tax revenues. As a result, the privatization wave in Europe will get a further boost as leaders seek to fill funding gaps.

United Kingdom

Budget constraints have coaxed the U.K. into becoming the world leader in implementing public/private partnerships to make up funding deficits. Nearly 800 so-called private finance initiative (PFI) projects, totaling \$55 billion, are either underway or operational, involving mostly hospitals, schools, police stations, and government office buildings. About 16 percent of U.K. infrastructure outlays involve public/private partnerships, including all major airports and railways. Most water systems have also been privatized as well as the gas and electricity industries. The breadth of privatization activities is leading to development of a secondary market where original investor/operators sell assets to investment funds. The country has never embraced toll roads, other than for a handful of bridges and tunnels, but user fees begin to come into vogue, starting with the London congestion pricing scheme. New road projects, following the example of the M6 highway in Birmingham (opened in 2005), will likely be tolled and operated privately. Existing motorways may be turned into toll roads eventually too, if political opposition tempers. For Brits, driving gets even more expensive . . . Extensive U.K. rail networks have been privatized with decidedly mixed results. Prices have skyrocketed—a first-class ticket on the London/Manchester route costs £250! But trains have better on-time records. “Tube” fares in London also rise. The public gnashes its teeth and gets a dose of reality—transport and congestion costs begin to align more directly with user fees. That’s what happens when a government no longer chooses to provide all the necessary funds to build and maintain infrastructure projects.

Spain

Since 2000, Spain has budgeted more than \$120 billion for an extensive infrastructure and public works makeover plan, focused on increasing road, rail, port, and airport capacity throughout the country. An additional \$200 billion has been earmarked through 2020. The country evidences long-term focus on infrastructure needs and planning to serve future growth. High-speed rail lines are under construction to link all provincial capitals to Madrid by train within three hours. About \$4.4 billion has been allocated to modernize and expand the nation’s ports and an additional \$7 billion has been targeted to upgrade airports, including large-scale expansions for major international hubs in Madrid and Barcelona.

The Spanish rank as world leaders in building privately managed toll roads. After years of neglect during the post-war Franco era, officials finally determined in the 1960s that

upgrading the country’s deficient road networks would be essential to boost tourism and help jump-start an ailing economy. With limited public financing sources, the cash-strapped government offered toll concessions to private builder operators, backed by government guarantees to attract foreign loans. Over the next two decades, private companies constructed thousands of miles of new roads crisscrossing the country, and developed successful financial models for calculating tolling rates, based on usage and improvement costs. Spanish companies have turned their experience into a major industry, exporting their toll road expertise for billion-dollar projects across Europe and Latin America as well as to Canada and most recently the United States.

France

The French boast the most advanced high-speed rail network in Europe and benefit from one of the world’s most modern motorway systems after playing catch-up in road building for most of the post–World War II period. France’s nearly 20,000 miles (32,187 km) of railways, the most extensive in Europe after Germany, efficiently move passengers and freight. Its renowned TGV trains have set speed records, most recently at 357 miles (574 km) per hour, and link Paris to key French cities like Lyon as well as to destinations in Great Britain, Belgium, the Netherlands, and other bordering countries.

About three-fourths of France’s 7,400-mile (11,909-km) motorway system is tolled and managed by various private and semiprivate companies to which the government has sold concessions through 2032. The government continues to hold freehold interest in the roads themselves. Beginning in the 1960s, the privatization process jump-started funding for needed highway construction, which the government could not finance directly. During the 1980s, France’s then-socialist government attempted to roll back tolls in an egalitarian gesture, but backed off when it became evident that the cost to build and maintain roads would become exceedingly prohibitive. Today, the country moves toward public/private partnership models to fund new projects with less state control. France trails only Spain and Italy in planned infrastructure constructions on the continent. Among the major projects is a new Paris metro line. Like other global urban centers, Paris suffers from an inordinate amount of congestion, but superior metro and rail service alleviates some of the pain for commuters.

Italy

Infrastructure suddenly has become a major priority for Italy after more than two decades of neglect and severe underfunding. The government got religion when traffic bottlenecks around Rome forced some trucks to sit in lines for five hours or more before finally inching their way into the capital city. The country budgets for more than 100 needed projects ranging from rail and roads to water management, electricity grids, and ports. An early proponent of high-speed rail in the 1970s, Italy fell asleep at the switch after introduction of a Rome to Florence line, and now makes up for lost time. About €7 billion has been spent or budgeted on expanding bullet train lines and freight transport capacity. New high-speed routes have been recently completed between Turin and Milan, Milan and Bologna, Bologna and Florence, and Rome and Naples. Italians accept the toll road concept—they pay their way on most motorways, which are operated by private or semiprivate operators. New road construction will also be tolled and likely financed through public/private partnerships.

Germany

Germans love their cars almost as much as Americans do (maybe more)—zipping about on Autobahns free of speed limits and tolls. But a day of reckoning approaches. Built during the Nazi era to facilitate military transport, many of these roads have reached the end of their life cycles when extensive repairs and makeovers are required. Increasing truck traffic—fivefold since 1970—tears up the motorways, exacting significant damage and congestion. Germany has become a European Union crossroads for increasing commerce transported between western Europe and the newly integrated states to the east. The government, meanwhile, faces a traumatic future marked by declining population, growing percentages of older Germans, and shrinking revenue sources. In order to fund repairs and improvements, a shift to user fees is inevitable.

The country has successfully implemented an electronic tolling system for trucks, many of which are based abroad and just pass through. But politicians have been reluctant to impose user fees on individuals, fearing extreme voter antipathy. Advocates argue that the public needs to understand tolls are a quid pro quo for improved traffic flows, up-

Even the notoriously speedy German Autobahn is not immune to congestion.





Central Europe and eastern Europe are slowly improving the decrepit infrastructure they inherited from the Soviet Union as this nearly completed bridge in Hungary illustrates.

graded roads, and sustained economic benefits. High fuel taxes are not the only answer. Proponents contend that the experience of Spain, Italy, and France points to the eventual acceptance and rationality of tolling roadways. When instituted, tolling will open the door to various privatization schemes, modeled on French, Spanish, or Italian systems. The government will be eager to gain efficiencies and realize capital or income from road concession agreements.

Demographic shifts—a 10 percent decline in population and doubling of seniors by 2050—portend lowering demand for schools and reduced requirements for water/sewage treatment capacity. Individual car usage is expected to flatten, but truck traffic and air cargo capacity will increase substantially. The country's focus will need to shift from new-build projects to maintenance. Increasing cargo traffic along the country's vast rail network will also be desirable, taking pressure off roads.

And speed limits may be coming to the Autobahns, if European Union rules are imposed.

Eastern Europe/Russia

Russia and eastern Europe must contend with a legacy of systems built below industry standards and post-communist era decline and inattention. These countries' economies, while expanding, don't yet provide the firepower to underwrite a needed wholesale infrastructure revamping. In these formerly socialist states, energy-related supplies were regarded as entitlements and priced artificially low. Gasoline taxes and tolls were nonexistent. Now, these nations struggle to find resources to rehabilitate their existing road systems to serve more market-based economies. Poland, for example, has established a national road fund to modernize its highway networks with revenues raised from fuel surcharges. Car ownership had been unaffordable for many people, who still rely on railways as a primary travel alternative. But in Russia, car ownership rapidly expands and traffic around major cities like Moscow can be gridlocked. Increasing truck traffic from trade with western Europe takes a toll on roads, increasing damage and creating further setbacks in countries' ability to keep up with repairs. During the days of communist rule, most freight had been delivered by rail. Airports are dated and outmoded. Private investments have overwhelmingly concentrated in telecommunications and energy, with only limited participation in transport. Investors will increasingly explore opportunities mindful of concerns about corruption and lack of transparency in laws and regulations.

Australia and Canada

Australia and Canada are both small-population countries situated on relatively large, but mostly uninhabited land masses with populations concentrated in a handful of major urban centers. Both countries have relatively mature, highly developed infrastructure and are following the U.K. model for financing repairs and funding new projects. They look to private/public partnerships to help propel new initiatives, take on risk, and fill voids in direct public funding from cash-strapped governments that want to temper tax burdens. Australia, for example, has halved infrastructure spending from 7.2 percent of GDP in 1970 to 3.6 percent today. Federal, state, and local governments in Australia collectively forecast a need for A\$100 billion in new infrastructure investments over the next ten years. In Canada, the infrastructure deficit is pegged at CAN\$300 billion through 2025. Australia, in particular, has been a leader in developing privatized procurement models, especially for roads, railways, and airports as well as social infrastructure for hospitals and schools. More than A\$30 billion of Australian infrastructure assets are held in publicly traded investment funds or entities.

Canada's early public/private partnerships (P3) vary from province to province, but tend to concentrate on smaller projects like hospitals, health centers, and water treatment facilities. A handful of highways, bridge improvements, and sports centers have also attracted P3 ventures. Both countries need to provide a more consistent deal flow pipeline so that private companies gain the incentive to staff up and attract the necessary expertise to bid and deliver on projects. The high cost of providing detailed bids and lack of uniformity in bidding/document processes across jurisdictions deter private players from entering some markets.



The State of U.S. Infrastructure

Lane closures and road repairs create constant traffic backups, and streets are more potholed. It's taking longer to get to work under any circumstances. Even on the weekends, highways seem more congested. You hear stories about water main breaks, sewage problems, and sinkholes swallowing cars. Katrina flooded New Orleans and brownouts have been more frequent in the hot summer months. Local property taxes go up and you hear chatter about higher tolls. Airports have become a real pain—sometimes getting to the plane takes longer than the flight time. And except in a few metropolitan areas, trains are quaint memories, not travel options.

Government leaders steer clear of addressing the problems. No one wants to confront the realities or future needs. It means raising taxes or finding new revenue sources, and the politicians have enough problems closing budget gaps for health care, police, and schools, while trying not to get thrown out of office.

In fact, when has a government leader had the inspiration to talk about infrastructure and land use? Has any presidential candidate delivered a policy plank on revamping and modernizing the country's roads, rails, airports, and power grids? Have you heard a bold address lately by a national leader about securing our economic future and maintaining our standard of living, based on a grand new vision for the nation's infrastructure in the 21st century? Unfortunately, for many congressmen, congresswomen, and senators, infrastructure policy amounts to securing an earmark, a few million dollars here and a few million there, for a new government building or road project back in their home districts. Recognition of mounting distress, let alone forthright initiative for future action, is sorely lacking.

Looming Crisis

"We're suffering death by a thousand cuts, and no one is willing to face up to it," says an interviewee. "If a crisis isn't created, then there is no need for an immediate response."

So what does it take for a crisis? Another Katrina or 2003 power blackout redux, the pending insolvency of the Federal Highway Trust Fund in 2009 or the already existing \$1.6 trillion deficit in needed infrastructure spending through 2010 just for repairs and maintenance? Or must the American Society of Engineers issue another startling report card that grades the condition of most U.S. infrastructure segments as "poor." (See Figure 6.)

China, our looming global competitor, makes infrastructure a priority. Other countries in Europe and Asia plan and implement long-term policies to cope with future

needs. "But in the U.S., Rome is burning and we fiddle. I'm despondent," says an interviewee.

Among *Global Perspective* interviewees, a broad consensus exists: the United States is on the cusp of a crisis and if we don't face up to our future infrastructure requirements, our economy and way of life could be affected, maybe severely. "Without a doubt, the condition of our infrastructure results in loss productivity and quality of life." "We are living on borrowed time." "Driving the necessary changes could cost trillions of dollars" and we must plan to accommodate an additional 140 million in population over the next 50 years, compared with an increase of 130 million since the 1950s when interstate construction and suburbanization began in earnest.

Deterioration, Congestion, Unreliability

The obvious signals of infrastructure neglect—deterioration, congestion, and reduced reliability—appear across all sectors.

ROADS. The average metropolitan-area driver spends 46 hours a year stuck in traffic, and for daily rush-hour commuters in large cities time lost in jam-ups doubles. Gridlock results in significant productivity losses and idling cars spew more exhaust and create more smog. What used to be a big-city problem has spread to medium-sized cities and many suburban areas. Poor road conditions also lead directly to \$54 billion in needed car repairs annually—oh, those potholes! Major ports and shipping hubs become bottlenecks for high volumes of container trucks, and increased truck traffic inflicts substantial road damage. Total road spending is about two-thirds of what is needed to fund necessary improvements.

TRANSIT. Use increases on a percentage basis ahead of other transport modes since the mid-1990s, but only to miniscule levels, with ridership confined largely to a handful of metropolitan areas. Most places offer only vestigial mass transit services—some bus lines and possibly light rail. Americans basically depend on cars to travel anywhere. Higher bus and subway fares and service cutbacks can't make up for funding shortfalls to maintain tracks and trains. Intimidating construction costs discourage new projects and major improvements. Chicago alone needs \$6 billion to bring its subways into "a state of good repair."

AIRPORTS. Airlines struggle to shoehorn flights and delays increase. Airports look more like bus stations. Bad weather can throw off schedules for days, stranding passengers across time zones. Huge new jumbo jets and increased air cargo need to be accommodated on reengi-

neered runways. Rail and mass transit links are lacking, strangling road access at peak travel times. Increasing global business travel expands traffic at primary international airports, which will struggle to handle anticipated future volumes and demand for connecting flights to secondary locations. Congress estimates that airports require \$14 billion in annual capital infusions to keep pace with needed improvements and expansions.

RAILWAYS. Experts agree that rail freight must increase to take pressure off roads and high-population regional corridors need passenger trains, preferably high-speed rail, to provide efficient intercity transport. But derailments make frequent headlines—often the result of poorly maintained tracks—and intersecting freight and passenger networks already create choke points in many rail hubs, slowing service. Mired decades behind Europe and Asia in rail service quality, the United States will need to spend at least \$250 billion over the next 20 years in attempts to catch up.

DAMS. Engineers have identified 3,500 unsafe dams in the United States. Despite all the talk, New Orleans levees haven't been properly reengineered and a recent California bond issue will only put bandages on vulnerable levee systems around Sacramento. Failures risk significant loss of life and substantial property damage. In the wake of dam construction years ago, many new communities across the country have been developed obliviously in downriver flood plains, assuming breaches were not a threat.

DRINKING/WASTEWATER. In order to comply with safe drinking water regulations, the country needs to spend ten times its current budget for replacing aging systems—all those pipes and mains installed decades ago rust under street grids. The Environmental Protection Agency and other experts estimate a funding gap exists, ranging from \$300 billion to \$500 billion, for maintaining and improving wastewater infrastructure nationwide over the next two decades. If not fixed, deteriorating plants, unable to process increasing effluent, will start to suffer more accidents, spilling untreated sewage into rivers, streams, bays, and oceans.

POWER GRIDS. Who wants a transmission tower running through their backyard? Well, nobody. But the country desperately needs more power plants and state-of-the-art transmission networks to meet increased demands for electricity. Maintenance expenditures on power networks actually have decreased annually since the early 1990s. Environmental issues, nuclear power, and global warming enter the calculation, which may lead to mandated conservation measures and higher energy bills. The patchwork of regional

The costs are just hard to get your arms around.

FIGURE 6.
America's Infrastructure Report Card

Roads	D
Bridges	C
Transit	D+
Rail	C-
Aviation	D+
Power grid	D
Drinking water	D-
Wastewater	D-
Dams	D

A = Exceptional
B = Good C = Mediocre
D = Poor F = Failing

Source: 2005
American Society of
Civil Engineers.

A busy Port of Los Angeles depicts just how many goods the U.S. freight infrastructure must accommodate.



electric grids, controlled and managed by various power authorities and utilities, broke down in summer 2003 when the blackout hit, and still operates today without significant modification. The risk rises for costly service interruptions to increasingly power-dependent businesses and homes.

Approaching Train Wreck

Infrastructure 2007: A Global Perspective's survey of U.S. state transport officials reinforces a sobering outlook. Fifty percent of respondents said their surface transportation infrastructure currently meets only "some needs" versus 44 percent meeting "most needs." (See Figure 7.) But nearly 80 percent indicated their ten-year plans will "not meet needs" for future transport networks. (See Figure 8.) The respondents warned that 97 percent of roads, bridges, and tunnels and 88 percent of transit/rail systems will require "much" or "moderate" improvement in coming years. (See Figure 9.)

State and local officials come to grips with some harsh budget realities. Back in the anomalous interstate highway boom era (circa 1956–1980), the federal government underwrote much of the nation's highway road construction, using the Highway Trust Fund fuel tax. In addition, states issued bonds supported by various general revenues or, in some cases, tolls. Once completed, interstates were turned over to the states to maintain with some ongoing support from federal fuel tax revenues. That was fine back then, when roads were brand-spanking-new with blacktop sheens and needed minimal yearly upkeep. "The states and localities had no concept of future capital costs and there were no easy answers for how to value assets."

Decades later, interstates begin reaching the end of their typical 50-year life cycles when they require expensive rebuilding or revamping. For example, engineers have concluded that the Tappan Zee Bridge, completed in 1955 as part of I-90 north of New York City, needs substantial reconstructing or even replacing. Six alternatives under consideration focus on rehabilitation or replacement ranging in cost from a few billion dollars to as much as \$14.5 billion if a mass transit link is included. New York State doesn't have the money in any contingency kitty and the federal trust fund hurtles toward insolvency in two years. Congress hasn't raised the fuel tax since 1993, enacting a meager 4.3 cents per gallon hike back then. Afraid of voter ire, officeholders view increasing the tax as a nonstarter for their political futures. Today, the gas tax is less than one-half of 1960 levels, adjusted for inflation. That doesn't stop some congressmen from trying to score political points by proposing the suspension of the tax whenever gas prices approach \$3 a gallon. Between inflation and improved fuel efficiency, the tax effectively will sunset, unless Congress and the president support an increase. "It's an approaching train wreck." (See Figure 10 on page 33.) "Federal dollars have disappeared."

The Tappan Zee dilemma extends to other forms of aging infrastructure, especially in older cities, where water, sewer, and mass transit systems were built early in the last century or before. New York City budgets the cost for replacing a single 100-year-old drawbridge across the Harlem River at more than \$600 million. More deferred maintenance leads to greater capital costs with the burden placed increasingly on local governments. The federal government just won't pitch in anymore—"no new taxes."

FIGURE 8.
Is Our Transportation Infrastructure Capable of Meeting Our Needs Over the Next Ten Years?

Yes	17%
No	83%

Source: ULI survey of U.S. directors of planning for state departments of transportation.

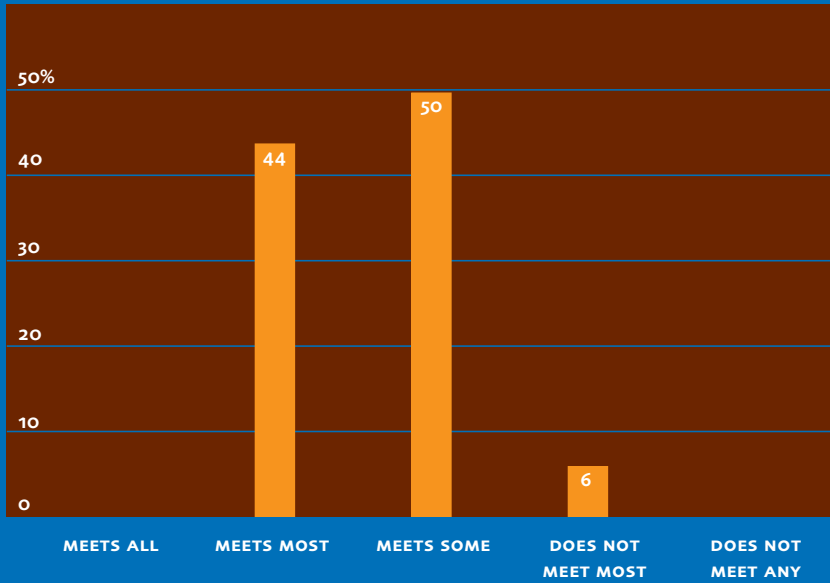


FIGURE 7.
Does Transportation Infrastructure Meet Our Current Needs?

PERCENTAGE OF RESPONDENTS

Source: ULI survey of directors of planning for state departments of transportation.

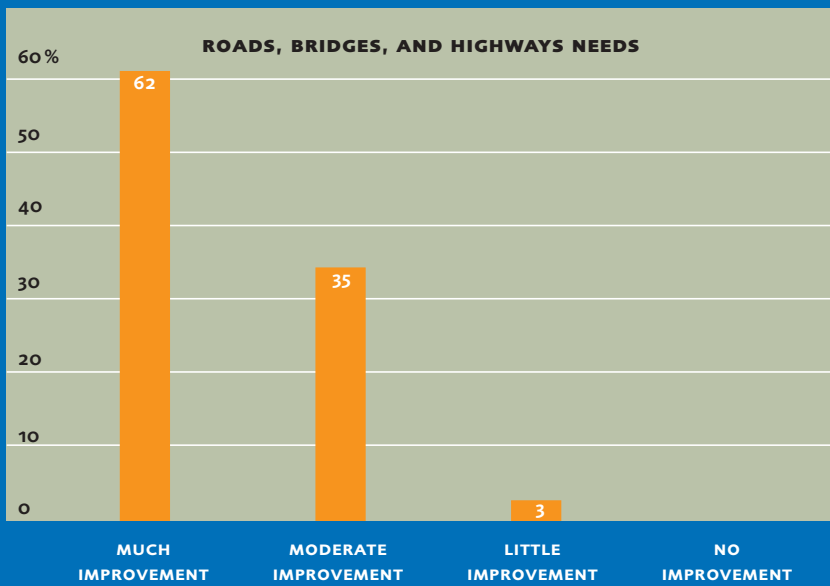
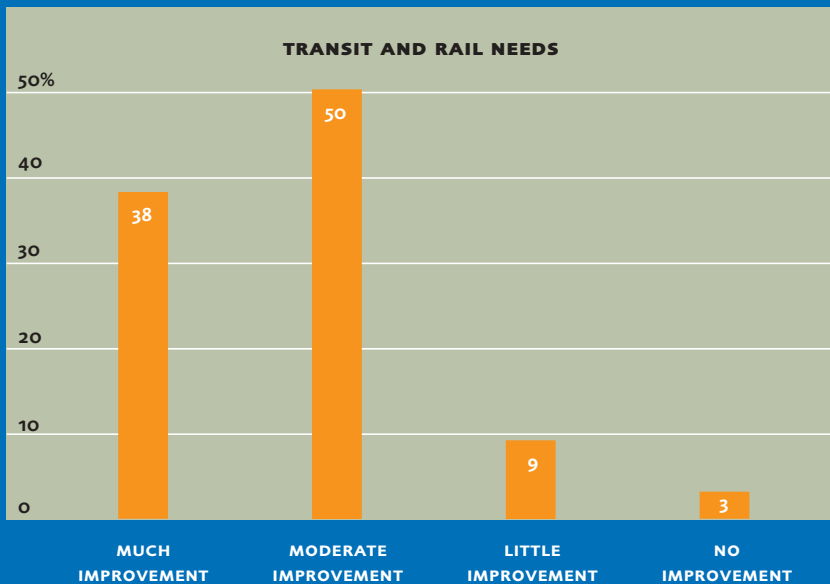


FIGURE 9.
Impending Crisis for States? Road and Transit Improvement Needs

PERCENTAGE OF RESPONDENTS



Source: ULI survey of directors of planning for state departments of transportation.

Was Hurricane Katrina a once-in-a-lifetime cataclysm or a harbinger of future crises that could befall under-maintained and obsolescent infrastructure throughout the United States? Pollyannas can argue that New Orleans is a special case—a below-sea-level city in a hurricane zone, which has always been extremely vulnerable to a monster storm no matter the manmade protections. But is it?

Katrina's Lessons: Pollyanna v. Cassandra

When Katrina hit the Louisiana coastline in August 2005, it became a Category 3 storm, substantial in fury, but not the worst-case maelstrom. Even so, levees built and patched over the past 150 years breached and overflowed. Outmoded flood control systems failed. For decades, officials knew that levees had been slowly sinking and realized protective barrier islands and wetlands along the coast had been destroyed by reengineering the flow of the Mississippi River. Tests had predicted system failures in the event of a big storm. A patchwork of local levee districts and the Army Corps of Engineers undertook ad hoc repairs, but political initiative was lacking to initiate the expensive steps to shore up the entire flood protection system and fend off potential catastrophe. Every layer of

government—federal, state, and municipal—balked at such a multibillion-dollar proposition. The price tag for taxpayers was too high, but a fraction of the \$110 billion in federal aid committed in the storm's wake. And the future of New Orleans remains in doubt, clouded in a fiscal morass and the enduring dilemma of its exposed location.

More Red Flags

Experts point to the fast-growing Sacramento/San Joaquin River Delta in California as the next disaster waiting to happen. Katrina helped energize state voters to enact a \$9.5 billion bond issue to upgrade sinking, undermined levees around the low-lying capital district that leave hundreds of thousands of people at risk and threaten the viability of the state's drinking water system. Despite obvious erosion and seepage throughout the extensive and aging 1,000-mile (1,609-km) levee network as well as the occasional breach (Stockton suffered \$90 million in flood damage in 2004), government officials in recent decades not only sidestepped necessary upgrade expenditures, but also encouraged widespread tract suburban development on farmland and other flood plains directly in the bull's eye of disaster scenarios. Engineers warn that planned enhancements from the recent bond issue will not shore up levees enough to sustain damage from predicted 6.5 earthquakes or worse that could strike the region at any time. Suburban development, meanwhile, continues to mushroom as people leave expensive communities near the

California coast for more affordable areas inland. If the Cassandra warnings ever come true, \$9.5 billion will seem like a drop in the bucket compared to possible damage.

Unfortunately, New Orleans and Sacramento may represent the tip of the iceberg when it comes to vulnerable flood control infrastructure in the United States. Dam and levee systems around Lake Okeechobee in Florida are ripe for disaster in the event of a major hurricane. Katrina-like breaches could flood once-agricultural areas, more recently converted into swaths of suburban subdivisions. In early 2007, the Army Corps of Engineers identified 120 levees around the country that could fail in a major flood. Most of these endangered levees were built generations ago in underpopulated areas without the benefit of today's more state-of-the-art engineering. They are located in and around major metropolitan areas like Washington, D.C., Seattle, Portland (Oregon), Honolulu, Jacksonville, and Albuquerque. In one example, the "high risk" Wolf Creek Dam in Kentucky, which secures a \$150 million local tourist industry, potentially puts Nashville at risk to major downriver flooding. The Army Corps estimates that the dam will need more than \$300 million in buttressing repairs. Separately, the American Society of Civil Engineers has identified 3,500 unsafe dams nationwide and more than \$10 billion in repairs over the next decade necessary to address critical, life-threatening situations. The dangers will escalate as more development occurs downstream from noncompliant structures and other dams will continue to deteriorate without proper maintenance. The total investment needed to bring all 79,000 dams nationwide into safety compliance totals \$30 billion, while the federal government provides less than \$10 million annually to the states for such programs. Most cash-strapped states do not give dams and levees high priority either.

A combination of underfunding, unchecked development, and a blind eye to obvious dangers suggests taxpayers face a choice of paying more today or multiples tomorrow for a potential cascade of predictable, tragic Katrina-like outcomes.

Hurricane Katrina in 2005 exposed the degree to which some of the nation's dams and levees had deteriorated.





Searching for Answers

So what is happening to the Tappan Zee? Sections are rusting badly, small concrete slabs fall from road beds exposing see-through views of the Hudson River below, as 135,000 cars travel this key suburban route every day. Something has to be done soon: "We're studying options," says a state Thruway official, who adds the next step is figuring out how to pay for whatever plan is chosen. Nationwide, countless other roads, bridges, and tunnels will need extensive reclamation in coming years, too. An estimated \$185 billion in additional funding will be required for road systems over the next five years alone. "The state of the deferred maintenance is so gargantuan nobody knows where to begin." "The gap is so big, people are overwhelmed." Meanwhile, annual construction costs ratchet up as China and other countries compete to buy raw materials for their ongoing projects.

As the federal government pushes the infrastructure burden down, states, counties, and cities search for answers. Until now, procrastination has been the favored stratagem. "States have been putting off these issues to fund other needs. It's not the same economic consequences as when a landlord puts off building upgrades and tenants won't rent. People will still use the roads until they can't be used, and as long as the roads work they can put it off." If that sounds like the Katrina principle, maybe it is. But the bridge doesn't need to collapse for insidious consequences to hit home. Rough roads and lane closures stall traffic and create delays—productivity declines hurt businesses and increase costs in lost time, gasoline bills mount, and vehicles suffer more wear and tear. When neighborhood streets

crumble and sidewalks crack, property values eventually take a hit. Places already struggling to hold their tax base—particularly inner-ring suburbs and many urban districts—won't be able to keep up with repairs and their downward spiral escalates. Many rural roads just go to seed. "That's when the public may wake up and something hits the fan."

States and localities take baby steps in confronting funding shortfalls. They patch asphalt to buy time, hike property taxes, set up special tax districts, impose tax increment financing schemes, and force developers to pay impact fees for new roads and sewers. Governors uneasily float ideas like raising tolls or sales taxes. Bond issues for projects remain popular by putting off today's bills until tomorrow, but

The Tappan Zee Bridge in New York, here battered by a frozen Hudson River, is in dire need of repair or replacement.



they can create current problems by lowering state credit ratings and raising overall borrowing costs, which taxpayers eventually pay. Departments of transportation create high-occupancy vehicle (HOV) lanes, and some even ponder the idea of congestion lane pricing.

An Outmoded Model

But money—or the lack of it—is just part of the enormous problem. Even if you could repair all existing infrastructure and make it safe, the transport and land use models developed for suburbanizing America in the late 20th century already may no longer work for the future. Unfortunately, disconnection and lack of integration characterize the evolution of recent American land use and infrastructure schemes. Most of the nation's fastest-growing areas are diffuse suburban agglomerations built around interstate hubs with multiple commercial cores held together by serpentine road and street networks. Neighborhoods end in culs-de-sac. Retail strips separate from office parks. Parking decks and lots surround office buildings and malls. Totally car dependent, people need to drive to get anywhere or do anything except maybe visit their neighbor across the street. Sidewalks usually are an afterthought and, where they exist, end at subdivision property lines. Even in metropolitan areas with new light-rail or subway service, most people need cars to reach mass transit from home. The average commuter drives 39

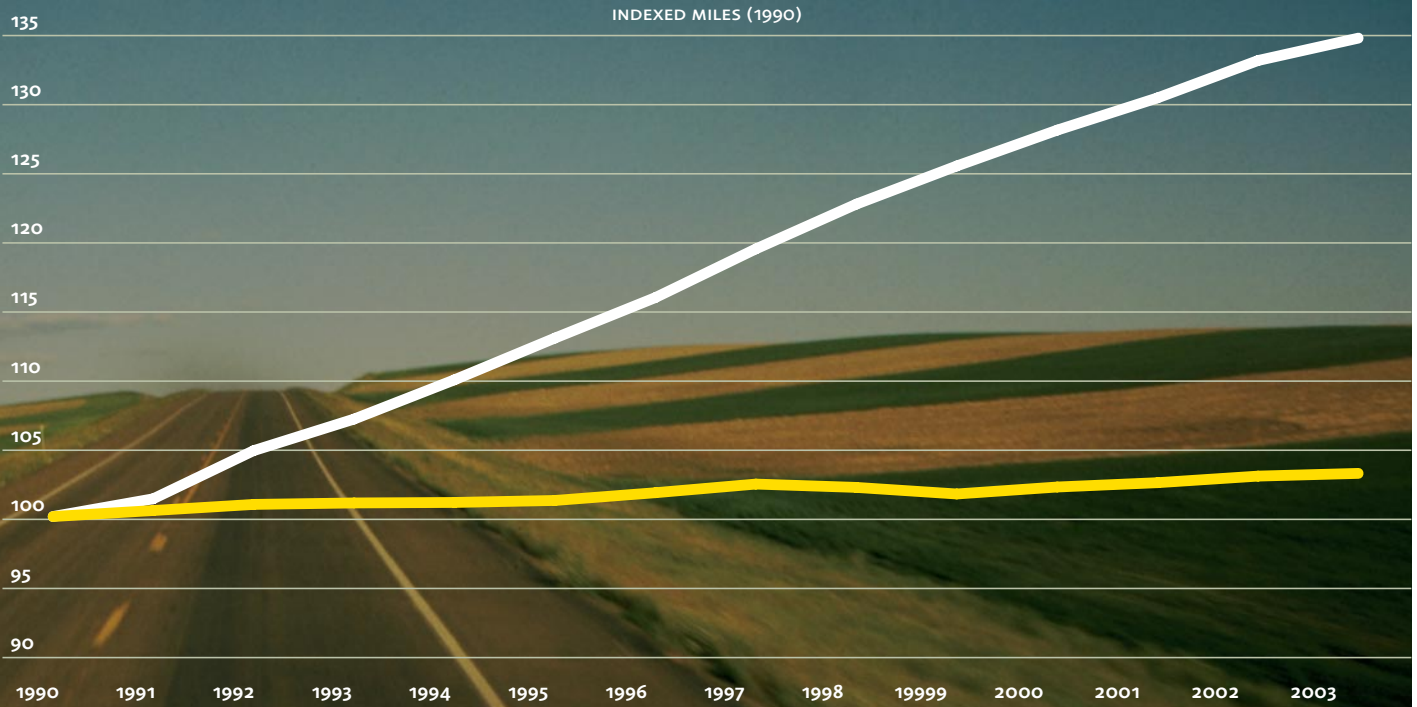
miles (62.7 km) in Houston and 31 miles (49.8 km) in Atlanta, compared with 17 miles (27.3 km) in the New York area. Poorly conceived without any regional planning, these disjointed areas become even more inefficient and costly as they struggle to accommodate growth.

Rising Driving Costs

Following the experience of southern California, traffic congestion and car pollution levels begin to throttle popular Sunbelt agglomerations like Atlanta, Dallas, Houston, and Phoenix. Traffic along the I-95 corridor in south Florida and around the northern Virginia suburbs near Washington, D.C., can turn nightmarish, too. (See Figure 13.) In these high-growth places, everybody of driving age needs a car for mobility, and because jobs, homes, and stores are dispersed throughout the region, everyone heads in different directions to get around. More family cars translate into more car loan payments and insurance premiums. Fuel costs increase and higher user fees (tolls, congestion pricing schemes) are inevitable. These metropolitan areas, meanwhile, could double in size over the next generation. Forecasters predict that current rush-hour trips in Atlanta could take 70 to 80 percent longer by 2030. Driving becomes steadily more expensive and consumes more time, offsetting more affordable housing prices and affecting quality of life.

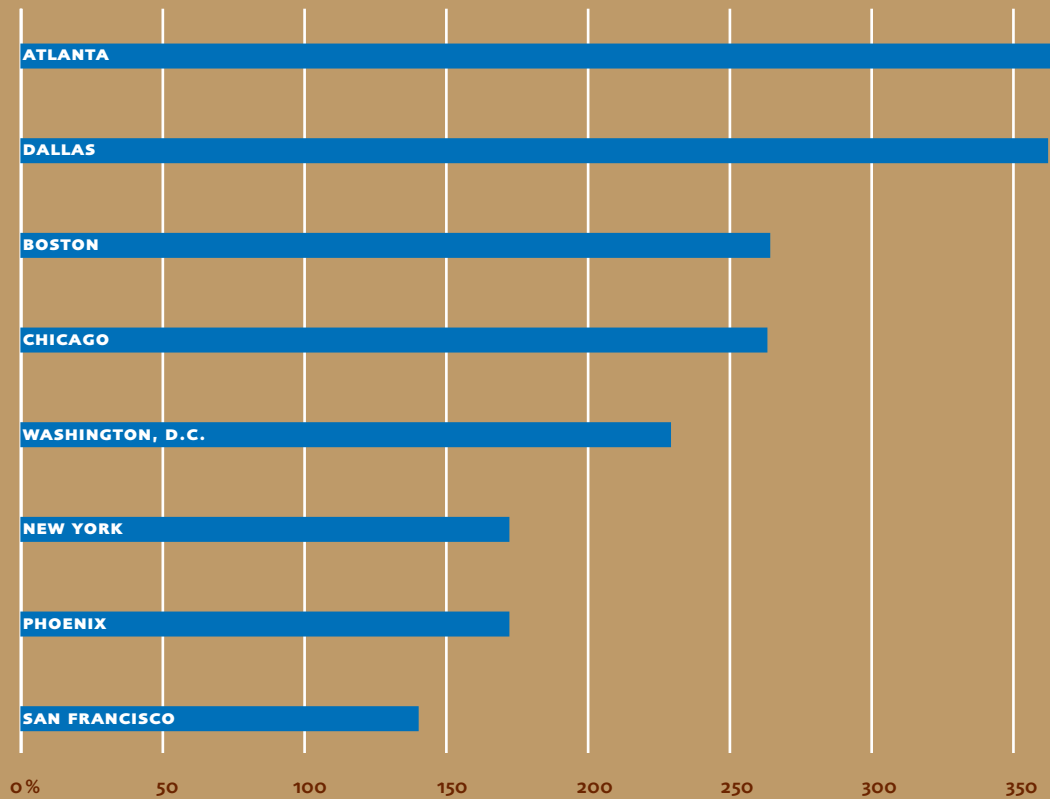


FIGURE 12. While the Distances Traveled by Car Have Increased, the Amount of Roadway Has Remained Static.



Source: BTS (vehicle miles traveled) FHWA (roadway lane miles).

FIGURE 13. Congestion Is Spreading: Percentage Increases in Travel Delay, 1982–2003



Source: Texas Transportation Institute, 2005 *Urban Mobility Report*.

Always in the vanguard, California faces up to the costly realities of renewing aging infrastructure by trying to preserve its freeway lifestyle without raising taxes and resorting to unpopular user fees. Passed in November 2006, a record \$37 billion state public works bond issue takes a stab at averting a future crisis—Governor Arnold Schwarzenegger had wanted \$68 billion and many observers believe the approved funding will be inadequate to meet future needs. But unlike many states, California has made some headway and taken action.

California's Bond Issue

California's dance over infrastructure budgets informs political calculations across the United States. For all the red flags about deteriorating roads, bridges, and dams, voters and their elected representatives are not willing yet to address the true costs of necessary improvements and don't want to impose on themselves the higher expenses to pay for them. Somehow, "no new taxes" means you can still have all the goodies that the government is supposed to provide like uncongested highways, extra lanes of freshly paved blacktop, new schools, sewage treatment, and levees that won't breach. Lifestyles dependent on cars become less attractive and more expensive when user fees are imposed. And most Americans today live in suburban places where cars are their lifelines. Southern California has been the model for road-based horizontal development, which has spread across the rapidly expanding Sunbelt. Significant population growth in these areas will stress current overloaded facilities even more.

Looming Problems

While newer vintage ring roads and interstate connectors snake around Atlanta, Dallas, and Phoenix, many of California's fabled highways—including 4,700 freeway miles (7,564 km)—approach old age. Without constant maintenance, these roads will deteriorate more quickly and many experts agree a decline in road quality could lead to greater congestion, business interruptions, declining employment growth, and impaired property values. In fact, the truck bottlenecks coming out of Los Angeles/Long Beach ports have many shippers looking for alternative harbor destinations. San Francisco offers superior mass transit, but southern California struggles to find multi-modal solutions in heavily built-out suburbs to temper the car culture.

Every mile of new subway in Los Angeles is a multibillion-dollar proposition.

The state's record public works bond measure earmarks \$20 billion for transport, \$10 billion for school construction, \$4 billion for levees, and \$3 billion for affordable housing built near mass transit. As a result, about 6 percent of the state's general fund tax revenues will be needed to pay debt service. California's relatively high level of borrowing has decreased the state's credit ratings and increased the interest premiums paid on its bonds. One way or another, additional costs are pushed onto taxpayers.

Avoiding Gas Taxes and Tolls

In going the bond issue route, the governor and legislature rejected increasing gas taxes and embracing additional toll roads, which charge users more directly. Only 82 miles (132 km) of California roads are tolled, testament to public anathema for user fees. If other states follow the California lead, they will push expenses and projects off to the future, add on debt loads, and rely on familiar formulas that subsidize driving, which, in turn, encourages greater car use, undesirable congestion, and more rapid road wear and tear. In its defense, the political consensus fears that higher driving fees will make the state too costly, forcing out business and workers, and unacceptably reducing the tax base. Gestures at more transit-oriented development should be celebrated, but resignation to car dependence has produced an uncomfortable Hobson's choice over funding infrastructure improvements. Indeed, other states wrestle with California's conundrum, too:

- ▶ In New Jersey, state officials wrestle with plugging budget shortfalls by raising turnpike tolls. Higher gas taxes and user fees generally get short shrift. In addition to contemplating selling the turnpike concession to a private operator, the state also considers orchestrating a takeover by its public pension fund. Selling to the pension fund could still extend politicians some political distance from responsibility for distasteful toll increases, and proponents suggest the pension fund wouldn't be inclined to hike the tolls as much as private concessions. The pension fund solution also retains some measure of public control over the state's most important road asset and addresses public concerns about private companies taking advantage of the state in complex agreements at drivers' expense.
- ▶ Pennsylvania rejected a 12.5-cent gas tax increase to fund road and transit improvements. Officials couldn't swallow what amounted to a 25 percent increase, fearing voter wrath. The additional tax would have amounted to about a 5 percent hike on the overall pump price. The

governor, meanwhile, pushes selling a turnpike toll concession to a private operator, who would be expected to raise tolls.

- ▶ Reflecting the sharp divergence between its traffic-choked northern counties around Washington, D.C., and rural southern sections, Virginia's legislature rebuffed proposals for statewide taxes and user fees, but adopted laws allowing localities to levy sales taxes for infrastructure improvements.
- ▶ Texas may break the mold, planning an ambitious 4,000-mile (6,437-km) corridor of tolled road lanes and tracks to shepherd cars, trucks, and trains through the state to the Mexican border. The Dallas region also will bank on tolls to fund new suburban roads. But the state has rejected indexing the motor fuel tax to raise infrastructure monies.

Without traditional hub-and-spoke configurations of enduring 24-hour cities (New York, Chicago, San Francisco, Boston), suburban agglomerations cannot easily accommodate mass transit systems. Unlike cities in Europe and Japan, the new American metropolitan areas do not have the infrastructure bones in place to offer alternatives to car transport. The typical European or Asian gateway links airports to rail and subway service with rapid transport to downtown commercial and hotel districts. Intercity bullet trains speed to interior locations. Roads are only part of the equation. In the United States, roads are more typically the only solution. "Even if you were able to double current mass transit ridership share in the country from the current 3 percent to 6 percent, the overwhelming population will remain car dependent."

Confronting the Reality

Without multimodal transport backbones, suburban agglomerations will confront staggering costs to retrofit. In Atlanta, a government task force recommends an \$18 billion long-range plan for more road capacity and a significant infusion for expanded mass transit. Critics argue that more road funding is necessary and new subway lines won't make a dent in traffic congestion. Other planners counter with a \$25 billion road scheme including new connectors, double-decked tunnels, truck corridors, and variably priced toll lanes on the entire regional highway system. Whatever the approach, state and local leaders will need to increase local fuel, property, income, or sales taxes, and maybe all of the above. "They're dreaming if they think the feds will bail them out." Even after spending tens of billions of dollars, Atlanta will not solve its overarching issue of disengaged land use and car dependence. "Double-decked highways will still exit into the same bottlenecked local roads." And the \$10 billion mass transit proposal won't help much if people cannot walk to a station from home or work.

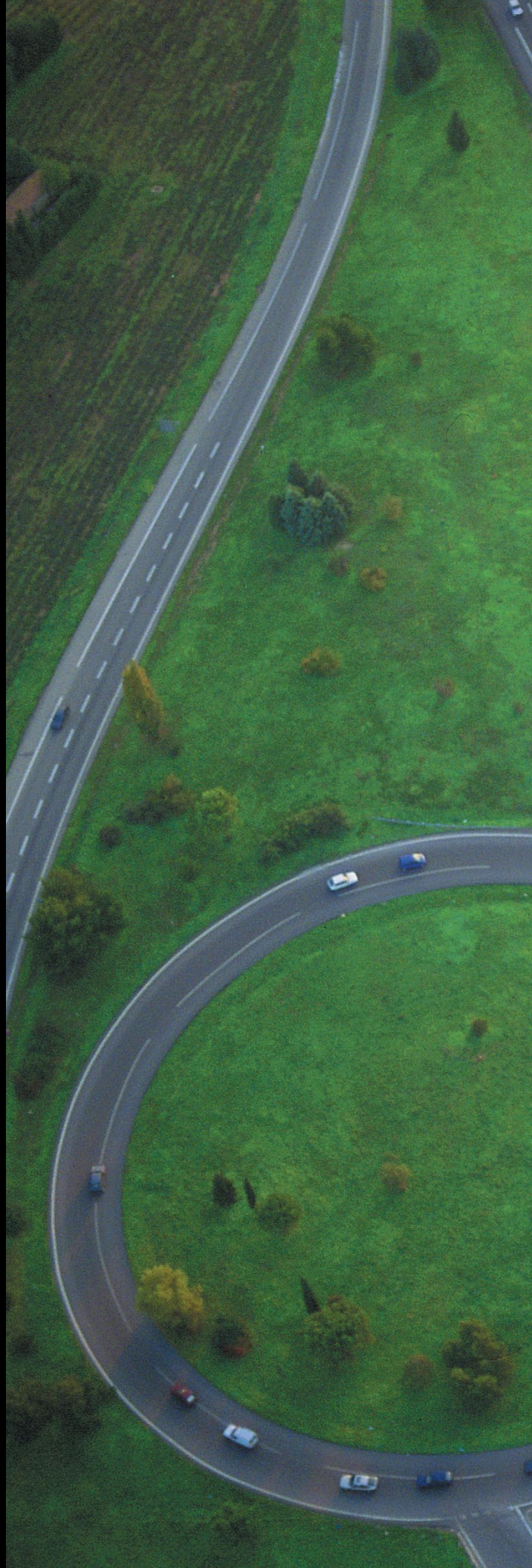
Government leaders and planners begin to turn away from fixing failing models with more roads in favor of examining new approaches that also involve infill housing, mass transit, parks, and mixed-use development. "I'm advising the governor and local officials in a [large suburban agglomeration], and they are scared to death of what will be needed to deal with making over their infrastructure," says an interviewee. "There are no ready solutions and all of them are excessively costly. But at least these leaders are confronting the issues and trying to understand them."

Global Warming Impetus

Oil dependence, global warming, and reduced carbon emissions also weigh in on the current state of U.S. infrastructure and the nation's car dependence. The roiled Middle East forces up pump prices. Drivers reconcile themselves to higher gasoline costs, while fuel tax proponents buttress arguments by raising national security imperatives—"we need to wean ourselves from oil." If the country reacts to global warming red flags and tamps down on carbon emissions, higher taxes on fuel or cars and trucks would change the economics of driving and cause people to rethink where they live and work. Rail and mass transit solutions could gain support. Infill areas closer to transit and pedestrian-friendly areas near stores and services would look more attractive. People might start to reevaluate the relative benefits of tolls and user fees for funding new infrastructure, and politicians working with planners might find voice for undertaking significant changes.

All of these complex issues are interlinked.

Part Three
A Road to the
Future







Finding a New Model

In 2007, the United States reaches “an inflection point.” Money for funding basic infrastructure needs has run out and systems require substantial repairs. Already clogged road-based transport networks cannot sustain future growth. America desperately needs to find the political will for a new, long-term action plan to cope with gathering fallout—establishing priorities, identifying revenue sources, changing behaviors, and adopting more economically efficient models. Change is never easy, but the time has come by necessity to alter process and strategy:

► For starters, the country could do with a reality check. “The current level of infrastructure investments cannot sustain current economic activity, let alone allow for growth.” The United States must find trillions of dollars in coming years to fix its infrastructure problems. In the end, people must pay. But if infrastructure expenditures are comprehensively planned and integrated with regional land use, the lasting economic benefits can be enormous, propelling the nation’s growth for generations. “The government needs to tie together economic development, land use, and efficient infrastructure planning.”

► The federal government, working with regions and states, will need to develop a clear vision for policy and integrate programs that link costs to use and drive efficiencies. Silos must be broken down between multiple layers of state and local road departments, transit agencies, planning boards, and housing authorities. “Stove-piping does not work anymore,” says an interviewee. “You can’t have everybody doing their own thing. That’s the height of inefficiency, waste, and poor planning.” Cities, counties, and towns must stop competing against each other for infrastructure projects and funds and begin formulating comprehensive plans that will give them the opportunity to help the country compete globally.

► Users—government, businesses, individuals—“need to understand the full-cost price of infrastructure—not just the building, but also the maintenance and repair.” “Costs need to align with use,” and users need to pay for the privilege. In the world’s most market-driven economy, people have no idea how much infrastructure costs them, “masking any rational decision making” about where they should live and work.

► Suburban sprawl has been subsidized heavily by infrastructure spending on roads as well as water, sewer, and power lines not factored into land costs at the fringe. More economic, compact development supported by multiple transportation options has been sacrificed for horizontal, car-dependent models. When the fully loaded costs of sprawl development are brought to bear on homeowners and businesses by user fees and higher car-related ex-

penses, behaviors will adjust to seeking greater convenience in transit-oriented communities and infill areas. "All that cheap land in Sunbelt areas and the exurbs is not so cheap when infrastructure costs are properly factored." In fact, combined housing and transportation costs are about equal in high-growth, car-dependent sprawl areas and less car-dependent, high-density metropolitan areas.

► It's no coincidence that today's dominant cities, prospering along global economic pathways, feature sophisticated and integrated infrastructure with multiple modes of transit to accommodate high volumes of activity and concentrated populations. "Their infrastructure creates a competitive advantage." It also leads to higher land values. Over time, Manhattan and San Francisco property values skyrocket, while housing prices in car towns like Atlanta and Dallas only edge forward comparatively.

► Issues of sprawl-related congestion, overreliance on cars, and outmoded infrastructure merge with heightened concerns about fuel costs, dependence on Middle East oil, and global warming. Dangerous overseas conflicts risk compromising energy supplies, while greenhouse gases threaten future generations. More Americans ponder the viability of lifestyles where 5 percent of the world's population uses 25 percent of global energy stocks. If Iraq quiets down and pump prices edge lower, public apprehensions may alleviate. For now, the weight of unease influences changing attitudes and possibly reduces impediments for considering revised approaches to infrastructure and land use.

► Integrated land use and infrastructure planning should incorporate the successful models of the world's enduring 24-hour metropolitan centers, which feature multifaceted cores, served by interconnected transport and infrastructure systems. Transit can be only part of the solution. Increased infill development in suburban areas must provide more walkable commercial centers, better-planned street grids, and especially secondary routes to get people to stores and schools without using main roads.

Absent Political Will

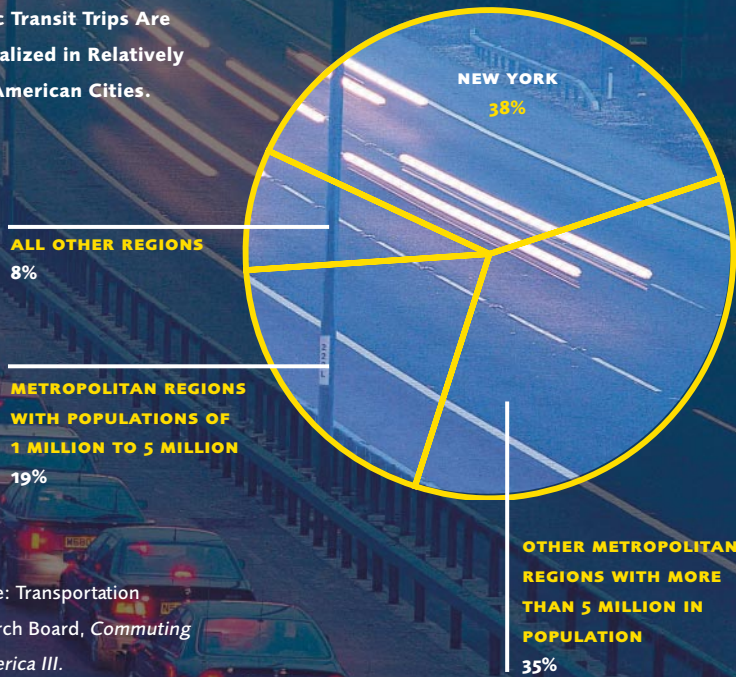
Freeways are aptly named. We drive them and assume they are free. It's the same for all the streets and roads in our neighborhoods. Well, the cost is covered somewhere in the taxes we pay, but who has any idea how much that really is. Most people don't think about the fuel taxes built into the pump price and the few toll roads are made to be avoided, if possible. Roads like tap water are a given, a necessity, a right. And don't raise my taxes.

The country needs a new model for how it plans and pays for infrastructure, including how it plans its communities.



U.S. wastewater plants nationwide are in need of repair.

FIGURE 15.
The Vast Majority of
Public Transit Trips Are
Centralized in Relatively
Few American Cities.



Source: Transportation
Research Board, *Commuting
in America III*.

Interviewees bemoan the “lack of political will any-where.” Conservatives, liberals, Republicans, and Democrats “all observe the Holy Grail” (really, the holy trinity): don’t raise fuel taxes, don’t impose new tolls, and avoid increasing existing tolls. But can you blame them—we’ll vote them out of office if they do. “We keep fuel taxes low, provide free parking everywhere. Not only are we not pricing auto use to support road infrastructure, we encourage greater auto use and then spend dollars on alternatives in inefficient ways” like extending mass transit to low-density areas or insisting that Amtrak run to Duluth.

Overcoming Bureaucratic Myopia

Funding policy suffers from fragmented interests and pork barrel initiatives. “Nobody takes the long view. Federal politicians actually distribute a fair bit of money, but have no collective strategy. Monies are divided by topic or type category of transportation—highways, local roads, subways, buses, or new stations. But nobody thinks about all options and tries to tie it all together.”

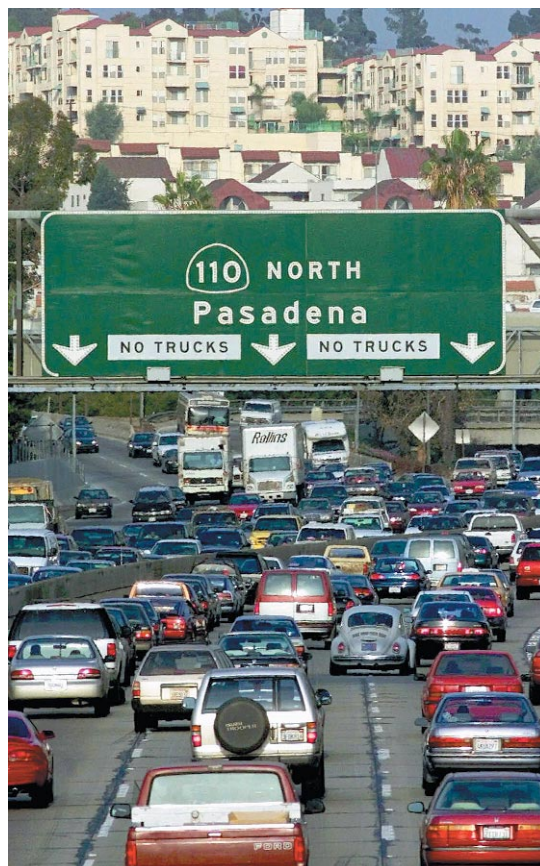
Fragmentation carries down to the state level. “Multiple turnpike authorities don’t coordinate with each other,” let alone consider mass transit or housing-related issues. It’s not their mandate or vested interest.” Expertise and best practices tend to diminish the further down the food chain. “What drives me crazy,” says an investment manager, “are all the unsolicited proposals I receive from state DOTs. They basically don’t know what to do.”

At a local level, “[land use] decisions come from all over the map.” Mayors make housing policy while school boards choose school locations. Counties plan new roads and transit authorities consider new lines. Developers scope out subdivisions. Nobody is thinking through the multidisciplinary aspects and the comprehensive impacts.”

More Centralized Control

The United States has always functioned off government based on a federation of states with localities controlling land use. But this balkanized approach has reached diminishing returns when it comes to infrastructure and related land use planning. The myriad zoning and planning boards; overlapping agencies; and layers of village, town, city, and county governments jostle for state and federal funding and collectively fashion a patchwork of often ill-conceived land use on the suburban agglomeration/sprawl archetype. Parochial interests run counter to forming policy that serves the greater good. “All thoughts about smart growth melt away when a local government has a chance to bring Costco to town.” Ultimately, “localities want the tax revenue from

The notorious Los Angeles traffic could be alleviated by an expanded subway network and better downtown housing.





Sprawl requires laying miles of sewer pipes; more compact development is more efficient in both construction and maintenance.

commercial development” to offset property tax burdens on voters, and “don’t care about the bigger picture,” including their neighboring communities and the region at large.

Interviewees suggest that more centralized control and planning will be prerequisites for tackling America’s future infrastructure needs and its ability to compete globally. Regions must be empowered within a national framework to marshal expertise and impose policy over local control. At a centralized level, the appropriate research, technology, and knowledge can be accessed and appropriated to achieve better, more integrated, interdisciplinary results. “When it comes to infrastructure, the nation-state model is instructive—look at Singapore, Hong Kong, and Europe, which are all doing a much better job.” “China can teach us about best practices, training people, and using research and development to develop sound strategy.”

Master Regional Plans

Robert Moses, New York’s infrastructure czar, left a checkered legacy in muscling through his regional blueprint for road building, parks, and housing over 50 years of nearly autocratic rule. He destroyed healthy neighborhoods and gave scant attention to subways or rails. But thanks in part to Moses’s interdisciplinary approach as well as the city’s preexisting mass transit networks, New York boasts the nation’s most effective and enduring urban transport model that incorporates public space and housing.

A Moses-style regional powerbroker would face intractable obstacles to refashioning today’s sprawldoms. In the short term, improvements can “only occur in greenfield and transitional communities.” Change can’t be imposed im-

mediately on existing suburban communities—“the public won’t stand for it.” But federal and state governments can influence local policies by incentivizing smarter growth behaviors and forcing regions to adopt long-range master intermodal transport plans as quid pro quos for funding not only local roads and transit, but also housing, parks, water, sewer, and schools.

States shouldn’t get federal grants for one-off connector roads before developing master plans showing how projects will integrate with regional mass transit, infill housing, and local parks and recreation, anticipating future growth. Particular attention needs to be focused on urbanizing commercial districts of suburban agglomerations, bereft of traditional urban infrastructure to handle increased populations. “At some point, the quality of life becomes seriously affected when everyone is riding around just to get a quart of milk.” Deteriorating inner-ring suburbs need to be reexamined and replanned. Local governments must be encouraged to come together to chart their collective futures rather than left to compete to the death in shortsighted battles over tax base. No plans, no cooperation, no integration should mean no funding from state and federal sources.

Understanding Costs

Master regional planning must relate intelligently to a rational understanding of the true expense of infrastructure—not only building, but also maintenance and future repair. If costs are aligned with use through user fees and appropriate taxes, then people will be able to adjust their lifestyle behaviors to economics that support more efficient infrastructure and help ameliorate congestion. “Our system cur-

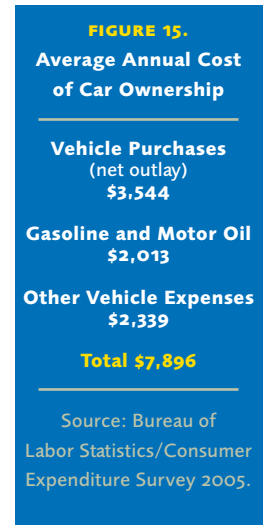
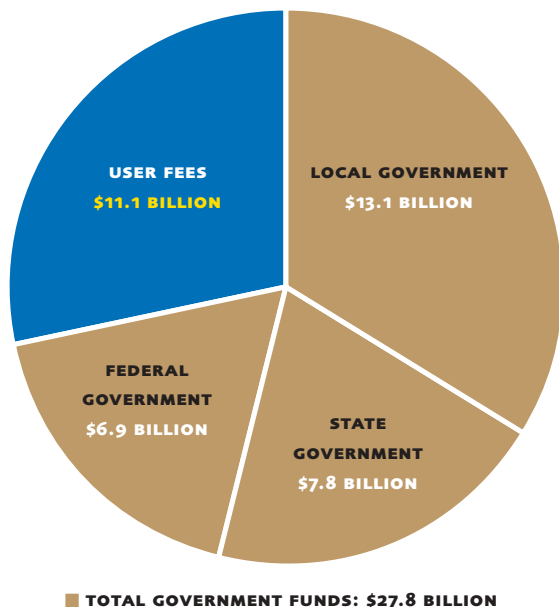


FIGURE 16.
Transit's Helping Hand:
2004 Transit Revenue
Sources



Source: Federal Highway Administration, 2006 Conditions and Performance Report.

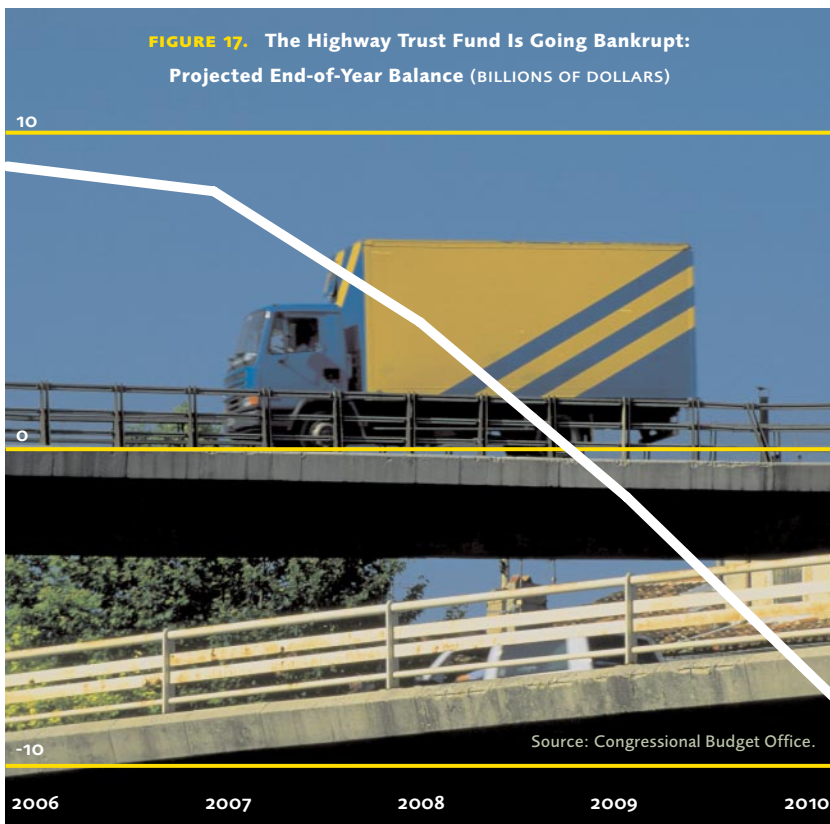
rently finds ways to hide infrastructure costs, so the consumer/taxpayer fails to understand the true cost benefit." Even for government planners and leaders, the "cost of infrastructure is completely opaque" and distorts rational decision making. "If you know how much a shirt costs, it will determine how many you buy. But we've never figured out how much roads cost to build and maintain, but we keep building them." "The freeway system is like a restaurant that attracts customers with low prices, but then doesn't make enough money to buy food now that customers are lined up outside the door." "Demand is not inelastic and behaviors can be modified. We need instruments like tolls and higher fuel taxes in place to help modify behaviors." For their part, electric companies will start to install smart meters in homes and businesses so people will be able to track their electric usage and monitor cost on a real-time basis. Over time, a more educated consumer should begin to adjust attitudes and practices in line with pocketbook realities.

Funding shortfalls will lead to greater reliance on tolls and user fees, including higher fuel taxes. Federal and state governments ultimately won't have a choice. Either they raise funds or watch roads decay into disuse. Potential Highway Trust Fund insolvency in 2009 will be the first test—either the gas tax increases dramatically or federal grants for road repairs and improvements disappear. "Higher gas taxes and fuel taxes will first [affect] car buying oriented to more fuel-efficient cars and eventually [affect] locational behaviors." The inevitability of more toll roads, higher tolls, and congestion pricing lanes will all start to bite on where people choose to live and work.

All these car-related costs will begin to add up more clearly than potential sticker shock on a dealer's lot. Many people don't realize that transportation already has become the biggest household expense after housing. "The cost just to maintain each family car [about \$8,000 annually] easily surpasses the debt service on a \$100,000 home mortgage. Right now, it may cost less to buy a home in certain exurbs. But when you factor in car expenses [loans, repairs, insurance] and then add in fuel taxes and tolls, you may figure you can live with fewer cars and get more value moving to an infill area where housing is more expensive." Greater convenience could translate into obvious cost savings, beyond time lost in traffic delays and long commutes.

The Outsized Cost of Trucks

Freight trucking is the very lifeblood of just-in-time technologies, which move trillions of tons of goods cross-country from ports and factories directly to local stores, meeting real-time customer demand. But truck efficiency and flexibility come with considerable hidden costs in outsized road



Congestion Pricing

In February 2007, London doubled the size of its controversial congestion-charge zone in the central city to 15 square miles (38.8 sq km) after the initial four-year program cut traffic by 10 to 15 percent, reduced vehicle delays by 20 to 30 percent, and tempered pollution levels. The expanded zone is expected to reduce traffic by upwards of 15 percent and collect additional revenues. Camera and transponder technologies track license plate numbers and electronically charge for entry into the cordoned districts during peak workday congestion periods without cars going through tolls or checkpoint delays. Drivers incur hefty fines if they don't pay up through credit card plans or kiosks set up around the city.

Singapore inaugurated the concept of congestion zone pricing back in 1975. So far, only Oslo and Stockholm have followed London's lead in Europe, and most American cities have avoided serious consideration of the option. A proposal for implementation in New York City, which had dropped its commuter tax under political pressure from surrounding suburbs, faces tough political sledding.

Coming Attractions

Despite the general lack of enthusiasm at present, various forms of congestion pricing are touted as the "Holy Grail" by many transportation engineers and economists and emerging wireless, satellite, and computer technologies pave the way for implementation. In fact, these systems may be coming attractions for many choking urban areas, confounded by gridlock, declines in productivity and economic competitiveness, and deterioration in quality of life. People never want to pay for what has been free, but at some point saving time and avoiding frustrating delays has obvious value. As populations grow and suburban areas become denser, car congestion will only worsen. Global warming concerns, meanwhile, have raised more direct connections between the impacts of idling cars and tailpipe emissions with undesirable climate change as well as unhealthy smog.

Road systems and mass transit have never come free. One way or another, taxpayers have paid for their construction and maintenance. Various congestion pricing models place more of the economic burden on users and can help influence efficient behaviors by putting a more direct cost on how people choose to get around as well as where they live and work. Politicians tend to recoil at congestion pricing schemes, characterizing them as regressive forms of taxation that unfairly burden the poor and middle class. But in many places, government coffers are empty, transport systems need capital infusions, and street networks are jammed. Car de-

pendence is becoming a more expensive proposition and the rubber is hitting the (crumbling, jam-packed) road.

Limited Application

Realistically, the London cordon pricing scheme has limited application to pedestrian-oriented central business districts with efficient mass transit alternatives to cars. In the United States, only the familiar 24 hour cities—New York, Boston, Washington, D.C., Chicago, and San Francisco—as well as Philadelphia fit this profile, having rail, subway, bus, and ferry options to make zone pricing conceptually practical. Charges would be counterproductive in the business nodes of diffuse, car-dependent suburban agglomerations. People would stay away from cordoned congestion zones to avoid the added direct cost with no alternative for access, hurting commercial enterprises and eventually the tax base; or they keep coming out of necessity in their cars, leaving roads perpetually clogged without relief.

In car-dependent areas, congestion pricing models will focus on ramping up facility pricing (tolls for specific high-speed lanes, roads, bridges, tunnels) and regional networks (where all major thoroughfares are tolled). Some facilities will be operated by increasing numbers of privately owned concessions. New electronic tolling technologies can be calibrated to charge different prices depending on the time of day or real-time congestion patterns to help adjust traffic flows and orient behaviors to reduce delays, but for a price. "You can buy your way out of congestion on a Lexus lane."

Charging by the Mile

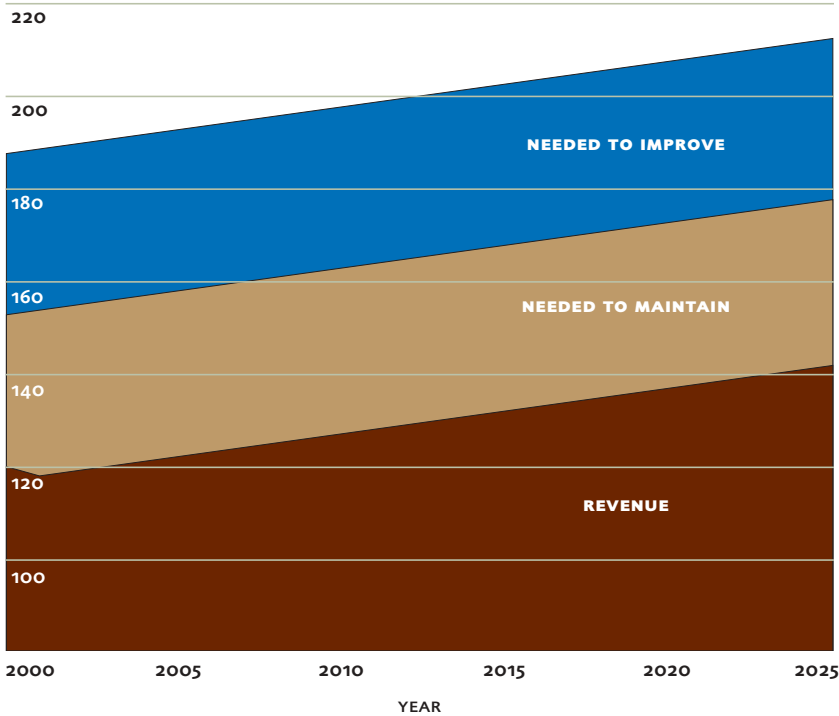
Studies are underway to assess the viability of utilizing GPS technologies and electronic tolling systems to charge drivers simply based on mileage traveled. Distance-based tolling could replace or augment the gas tax and more directly assign the burden of road costs and congestion to users. These high-tech mileage tracking systems could be programmed to adjust charges based on congestion delays, damage to roadways (based on vehicle weight), and vehicle emissions. The further you travel, the heavier your vehicle, and the higher your emissions—the more you pay. Through a clearinghouse, revenues theoretically can be directed to municipalities, counties, and states linked to actual use of their roads, providing a new funding source for maintenance, capital improvements, and mass transit alternatives. Critics raise alarms that these satellite information collecting systems are fraught with "Big Brother" privacy concerns where drivers' every move can be followed. Proponents counter that these systems could be designed not to track motorists.

Insurance premiums could also be priced more directly on the basis of actual miles traveled, calculated in a formula with a driver's safety record and other actuarial assumptions. Intuitively, it makes sense—the more miles you drive each year, the greater the risk of accidents and the more you should pay in premiums. More metered parking and higher parking rates would also help align cost to actual use.

Congestion pricing and distance-based tolling could help align infrastructure cost with vehicle use. Then, politicians, planners, businesses, and the public at large would be able to gauge a more accurate cost of using cars and trucks. It would let everyone make choices based more on economic realities—do you use alternative transportation, relocate to drive less, make fewer trips, or stay the course? "You need to make users pay and only then will you influence behaviors," says an interviewee. But implementation of these systems and changed behaviors will not likely occur until the public cries uncle—either when congestion becomes unbearable or funding essential infrastructure improvements through sharply higher property or income taxes becomes unpalatable. Something has to give, maybe sooner than later in many places. It happened in London.

FIGURE 18.

Additional Funds Are Needed to Maintain and Improve the U.S. Highway System
(BILLIONS OF US\$)



Source: Cambridge Systematics, *Initial Assessment of Freight Bottlenecks on Highways* (October, 2005).



damage, fuel inefficiency, and pollution. As a result, the United States will be forced to adopt more intermodal freight solutions to reduce reliance on trucks as shipping needs continue to expand.

At times during the day, trucks can make up 50 percent of road traffic in some key transport corridors—Los Angeles/Long Beach, northern New Jersey, and Washington, D.C. Rigs, meanwhile, become longer and heavier. While flexible and efficient in transporting from point to point, trucks inflict the lion's share of damage not only to interstates, but also to local roads, which can't withstand the constant pounding of heavy loads. "The cost of damage to interstates by 18-wheeler semitrailers is six times what they pay in fees, and they effectively pay no costs for damage to local streets." "Taxpayers don't know it, but they have been subsidizing truckers." On a fuel-efficiency basis, trucks also trail rail and boat alternatives and they contribute more pollution than other transport options.

Higher user fees and tolls will begin to affect trucking-related expenses as states look to fund road repairs, and those costs may result in higher retail prices for various goods. Many states and regions will establish tolled truck

corridors to help reduce congestion. But the country will need more dedicated freight rail lines for goods movement and better connections at shipping origins and destinations—ports, airports, and border crossings. Truck routes and rail lines must feed out of shipping hubs without impinging on local roads and passenger lines, and greater reliance will be placed on regional rail centers for offloading shipments to trucks for more localized deliveries. Congestion pricing schemes will encourage schedules to move goods through familiar road chokepoints at off hours. Just-in-time will get ever more sophisticated. "Goods movement is key to sustaining competitive environments."

Different Challenges/Modernizing Aging System

Understanding and addressing infrastructure costs set the stage for reordering land use priorities and lifestyle choices. Market forces can begin to take over and help focus political action for seeking regional solutions to accommodate funding realities and growth aspirations.

The nation's established 24-hour cities face challenges



different from those faced by faster-growing suburban agglomerations. Cities like New York, Chicago, Boston, Washington, D.C., and San Francisco benefit from multifaceted transport backbones and efficient infrastructure schemes derived from traditional European models. Their primary challenge is to repair, maintain, and, where possible, modernize aging systems. Water mains, bridges, tunnels, and elevated tracks approach their centenaries and beyond in some older cities.

- ▶ New York looks to add a downtown mass transit hub near the Ground Zero site, enhancing the financial district's accessibility and buoying residential development. A new water tunnel nears completion and additional subway lines are planned.
- ▶ Boston's "Big Dig" led to egregious cost overruns, but has improved access to residential and business areas, reduced congestion, and created more attractive public space.
- ▶ The removal of earthquake-damaged road overpasses has reinvigorated neighborhoods along San Francisco's Embarcadero, and the Bay Area Rapid Transit (BART) system continues to expand area subway service.

Reconfiguring Failing Environments

Sunbelt agglomerations confront steeper long-range hurdles—they need to convert urbanizing sprawldoms into regions with viable 24-hour environments, including multifaceted commercial cores served by mass transit. "It's dawning in the Sunbelt what a terrible state of infrastructure and congestion exists. These places can't keep up with the costs."

- ▶ Denver makes progress, creating a light-rail hub in its downtown LoDo district and infusing the neighborhood with sports, entertainment, retail, and new residential space. Light-rail lines link and expand to surrounding suburban districts.
- ▶ Atlanta's emerging core begins to form around its Midtown and Buckhead districts, which are both served by the MARTA subway system. High-rise housing springs up around subway stops and businesses cluster near MARTA stations.

Los Angeles struggles to move freight from the Port of Long Beach without further disrupting commuter traffic.

- ▶ Los Angeles slowly expands its subway and builds more residences in its downtown, which was once lifeless after dark.
- ▶ Houston begins to link commercial districts with light rail and encourages downtown residential.

"Local leaders have come to realize that without mass transit systems, you're in trouble." While finding rights-of-way among the developed mazes of subdivisions and commercial strips can be discouraging, replanning areas around designated stations for pedestrian-friendly mixed-use environments can border on hopeless. The puzzle is this: how do people get to stores and stations without driving when they live miles away in single-family homes? At the same time, most car-dependent metropolitan areas have sacrificed large public recreation areas for suburban backyards and private golf courses. As these suburban places turn more vertical and dense, they must find places for parks or risk becoming insufferably claustrophobic, the antithesis of their original intention. Various communities and their leaders will battle over which get the spoils of convenience and which sacrifice for the greater good, as governors and regional planning authorities wrestle over sensible long-range visions. Congestion, higher driving costs, and economic realities will help form broader consensus for solutions. Failing neighborhoods and malls may offer the best

opportunities for conversion to palatable schemes. Districts around well-planned transit hubs ultimately will become more attractive and valuable because of the convenience they offer. Costs and the market will shape the future and dictate the course of renewal.

Visioning Exercises

Some communities use vision exercises to help tackle long-range planning and overcome seeming intractable congestion issues. In Los Angeles, 1,300 participants attended a "growth vision workshop" sponsored by the California Association of Governments. The planners estimated that 98 percent of the region's land could be spared the negative impacts of uncontrolled growth by concentrating new development in the remaining 2 percent. The vision emphasized infill redevelopment, mixed-use development, and transit-oriented development in centers and corridors with existing infrastructure. Although anticipated congestion would increase as a result of expected population growth, the plan forecasts 5 percent less driving per capita and a 12 percent reduction in forecast traffic levels. This so-called 2 percent strategy would reduce congestion more than expected improvements from substantial growth in the area's freeway system.

Boston's Big Dig is the nation's largest transportation infrastructure improvement project.



Knowledge is power. But most consumers don't have a clue about how much it costs them to run their air conditioner or washing machine. They have no idea how much they might save on their electric bills if they used some appliances less often or turned the lights off when they leave a room. Most electric utilities are in the dark, too. Since their meters don't monitor time of usage, just kilowatts used, utilities still must charge residential customers the same flat rate even though their energy costs may be ten times higher at peak usage, such as on unbearably hot July afternoons. "Consumers are treated like morons with this kind of billing," says an interviewee.

Increasing power demand, meanwhile, threatens to outstrip supply as utilities grapple with costs to build controversial new power plants and add transmission lines in the face of pollution, global warming, and other environmental concerns. What community wants a coal-burning power plant or nuclear reactor in their backyard? Transmission lines raise hackles as they scar endless miles of countrysides and rural areas. Without some relief, already stressed power grids may short-circuit more easily into brownouts and blackouts. Either users conserve or costs will escalate and the necessity for more power infrastructure will become increasingly obvious.

Reducing Consumption

Finding ways to improve energy efficiency and discourage waste has become an international priority. In many countries with market-driven pricing, power companies, prodded by regulators, are turning to smart meter technology as a way to measure electric consumption in real time, offering opportunities to control usage and modify consumers' sometimes profligate behavior. Most experts estimate that consumption can be reduced by 5 to 10 percent through use of the meters, which use wireless technologies to monitor consumption, calculate current billing, and register real-time changes in pricing depending on systemwide demand and generation costs.

Instead of dials with indecipherable readings on boxes located in closet corners or basement nooks, smart meters can provide consumers with meaningful readouts that appear on kitchen monitors or can be called up through Internet connections. Utilities can warn residential consumers of peak usage demands and alert them to curtail use to save costs and avert outages. Computer chip technologies also will be available for utilities to turn off appliances or adjust thermostats remotely at peak loads. Besides reducing electric use, many experts believe these "intelligent" systems will help condition people to restrain bad habits—like cooling empty

homes throughout the day or running appliances at peak load times—by providing tools for understanding how to cut their bills. The technology will also have application for natural gas and water meters.

Europe Leads

With more than 27 million devices installed, Italy is the world's leading proponent of smart meter technology. Spain and Sweden also have mandated smart meter applications and pilot programs are underway in the United Kingdom. In Canada, Ontario has committed to installing smart meters in 800,000 homes by the end of 2007 and throughout the province by 2010.

Smart metering is also catching on in the United States, boosted by the federal Energy Policy Act of 2005, which ordered states to investigate implementation of demand response programs. In California, where high costs and rolling brownouts have infuriated consumers, utilities are undertaking systemwide smart meter installations. Many states have instigated pilot programs with their power companies.

Still, electric utilities make more money if people use more power, which creates less incentive for power companies to encourage conservation among customers, who may balk at the initial \$100-plus cost for meter installation. "The utility culture is building a franchise around selling more electricity, not less." Some regulators examine ways of decoupling revenues from sales, providing market incentives to companies that help their customers become more efficient and less wasteful. "Smart metering is a step in the right direction."

Smart Meters

An aerial photograph showing a large, multi-decked ship, possibly a ferry or cargo vessel, navigating a narrow waterway. The water is a deep blue. To the right of the ship is a tall, narrow, light-colored structure, possibly a bridge or a pier, with a circular opening at its base. The sky is a clear, bright blue. The overall scene is a high-angle view of maritime infrastructure.

Infrastructure: Paying the Way

Let's accept as a given that funding U.S. infrastructure will cost big bucks—money for which federal, state, and local governments have not yet adequately planned or budgeted. So where will governments find it? The following is a list of familiar revenue sources: income, sales, and property taxes; user fees such as tolls, subway fares, and water bills; developer impact fees; bond issues funded by user fees and general tax revenues; and various forms of public/private partnerships financed by all of the above. But no matter the structure or method, taxpayers, users, and businesses will pay the way and assessments will increase, in some cases substantially. The payback should devolve to future generations, including improved economic productivity and enhanced lifestyles as the country accommodates tens of millions of new residents.

Sound vision and integrated planning will be necessary to help find efficiencies and solutions. Increasingly, economists, academics, and planners argue that users should pay for the infrastructure from which they benefit to help orient behaviors to the most cost-effective and sound lifestyle and business practices. Bond issues remain politically palatable since costs get pushed into the future, arguably paid for over time by people who are getting the benefits. General revenue taxes hold some favor among politicians looking to spread the pain and limit fallout from large segments of aggrieved users, but that may mean cutbacks in favored categories like schools and police as well as some other tough policy calculations.

Privatization Wave

Gaining recent traction, U.S. state and local governments examine using private investors to build, manage, and/or operate infrastructure assets, particularly toll roads, bridges, and tunnels. "Privatization models can strengthen city or state balance sheets in the short run, redeploy equity locked in assets, access private sector skill sets, and often better management practices." Depending on transaction structures and stipulations, governments gain cash infusions and/or share in future revenues. In addition, they can transfer project and operating risks over to private entities, which are incentivized to manage facilities cost effectively within strictures designed for meeting the public good. If cost overruns hit the tunnel project or new school construction, the private companies and or investors—rather than taxpayers—pick up the tab. They also must maintain the facility to a certain standard over the life of the contract. "The major benefit for governments is risk transfer and that can be huge."

Private concession operators also tout their incentives to improve service and increase public use, thereby driving

up their returns—these efficiencies save money for everyone. “We’re in the service business,” says a toll road investment manager. “We are in the business of saving time and making roads run better so more people will use them and benefit. The public sector is shackled—workers get no upside bonuses for changing practices, they stick with the status quo, and so the public doesn’t gain improvements.”

Privatizing infrastructure in the United States is nothing new—railroads, mass transit, telecommunications, and power systems traditionally have been developed and operated by publicly regulated private companies. Over the past two decades, a handful of toll roads have also been privatized, with about \$25 billion worth of projects proposed or under development. More recently, a small group of airports has entered into retail management contracts with private operators, and increasing numbers of publicly owned water and wastewater systems are contracting with private providers for system operations and maintenance. But the United States trails other regions, especially in transport-related privatization. In Europe, public/private partnerships have been building and operating toll roads since the 1970s. More recently, private companies have taken over airports and ports as well as school and hospital management. Public/private infrastructure transactions have been adopted widely in Australia, Canada, India, Asia, and South America.

Investment Funds Proliferate

New to the game are a raft of investment funds, sponsored by global investment banks, private equity firms, and institutional money managers, looking to place money from pension funds, insurance company general accounts, and high-net-worth clients into infrastructure investments. During the mid-1990s, Australian investment firms established the first of these funds, looking for new assets to invest in after tapping out on local real estate, stocks, and bonds. The rise of private infrastructure investing in Australia notably coincided with reduced government spending (from 7.2 percent of GDP in 1970 to about 3.6 percent in 2006). In 2007, more than \$30 billion of Australian infrastructure assets are held in publicly traded or listed entities. Various new global infrastructure funds have raised about \$100 billion to invest in infrastructure assets with an initial focus on Europe, where public/private partnerships have been well established in many countries whose governments have sought alternative financing sources.

Fund marketers tout infrastructure as a “new asset class” offering secure, long-term cash flows, inflation protection, and opportunities for reducing overall portfolio volatility and risk. Funds tend to be highly diversified—“a broad basket of things” investing in economic infrastructure like toll

Sound vision and integrated planning will be necessary to help find efficiencies and solutions.



The world’s tallest bridge, the Millau Viaduct in France, was privately financed and constructed by the Eiffage Group in exchange for 75 years of toll concessions.

Breakdown of All Transportation Infrastructure Deals Involving PPPs, January 2005–February 2007

FIGURE 19.
Types of Transactions
IN MILLIONS US\$

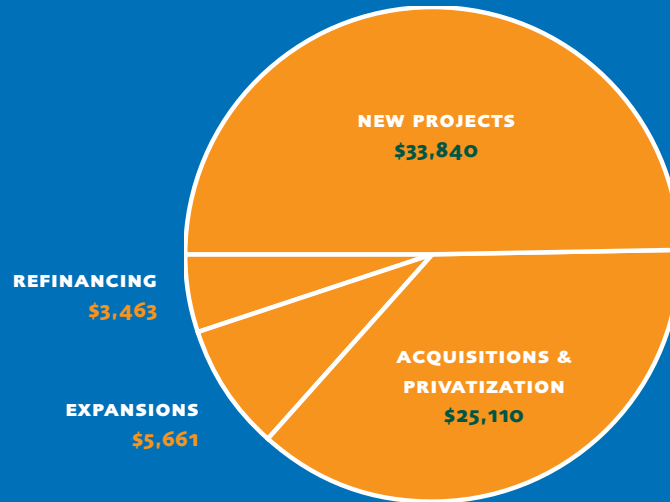
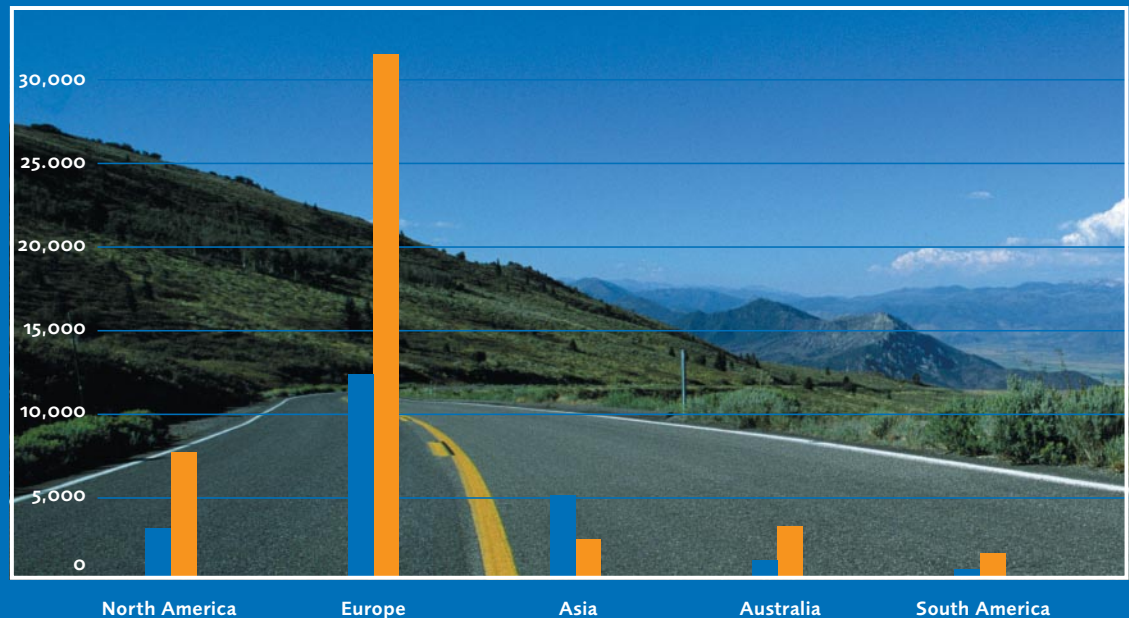


FIGURE 20.
Ten Largest Transactions

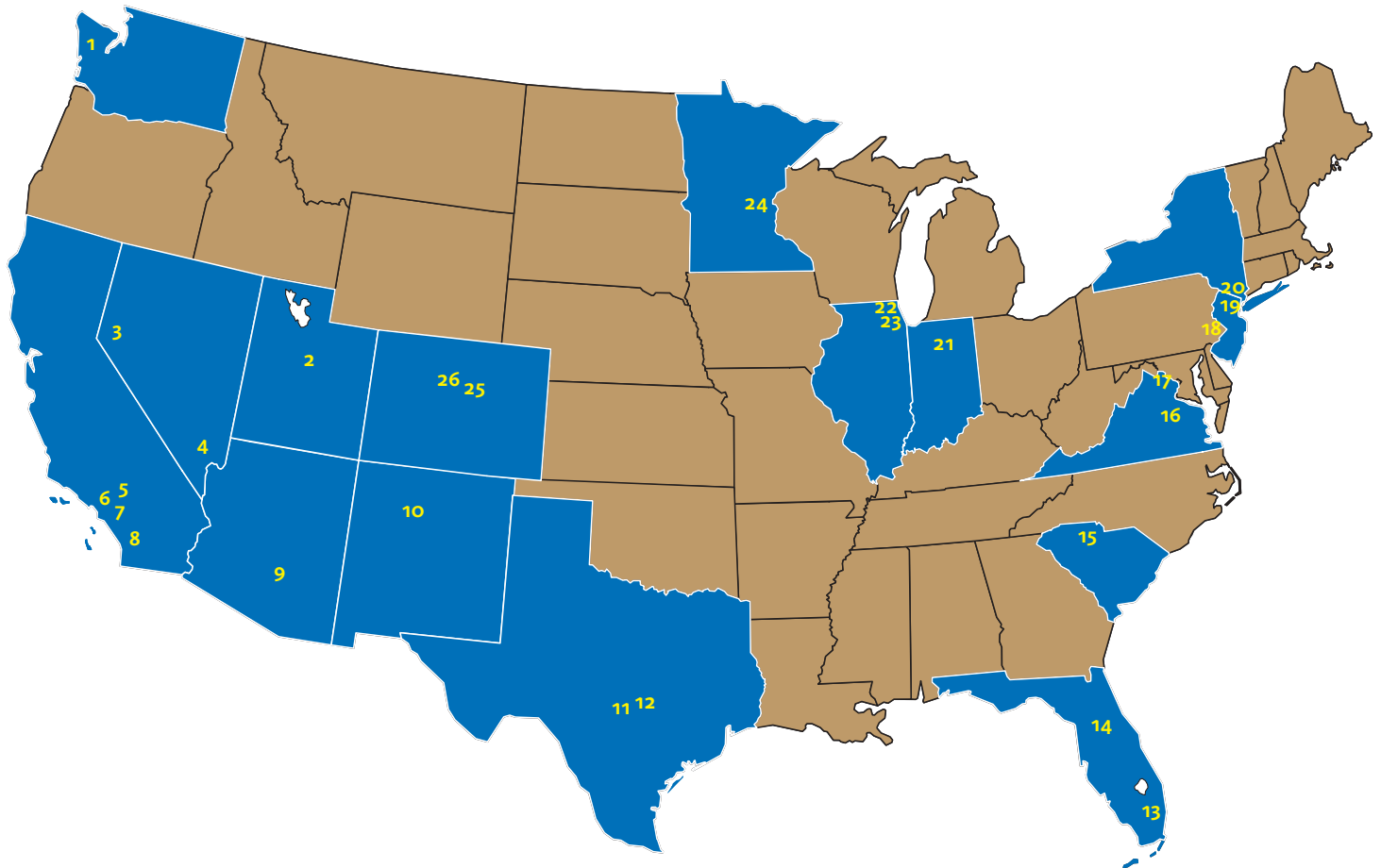
PROJECT NAME	PROJECTED VALUE (US\$M)	COUNTRY
Abertis Acquisition of SANEF	10,000	France
APRR (Autoroutes Paris-Rhine-Rhone) Privatization	9,130	France
Indiana Toll Road	4,823	United States
Madrid Calle 30 PFI	3,709	Spain
Gautrain Rapid Rail Link	3,300	South Africa
Reliance Rail PPP	2,839	Australia
Budapest Airport Privatization	2,133	Hungary
Richmond Airport Vancouver Rapid Transit Project	1,660	Canada
South Korean Incheon Grand Bridge	1,600	South Korea
Bundang Railroad Project PFI	1,580	South Korea
Metro de Madrid PPP	1,470	Spain
Total	42,244	

FIGURE 21.
Projected Value of All
Transactions in 2005
and 2006
IN MILLIONS US\$

■ 2005
■ 2006



Source: Infrastructure
Journal Database.



- 1 Tacoma Narrows Bridge
- 2 I-15 Reconstruction
- 3 Reno Rail Corridor
- 4 Las Vegas Monorail
- 5 Alameda Corridor
- 6 Foothill Eastern Toll Road
- 7 San Joaquin Hills Toll Road

- 8 SR 125 Toll Road
- 9 AZ-17
- 10 NM-44 (US 550)
- 11 Trans Texas Corridor
- 12 Central Texas Turnpike
- 13 Miami Intermodal Center
- 14 Osceola Parkway
- 15 Southern Connector

- 16 Pocahontas Parkway
- 17 Dulles Greenway
- 18 Camden-Trenton Light Rail Line
- 19 Hudson-Bergen Light Rail Line
- 20 Jamaica JFK Airtrain
- 21 Indiana Toll Road Asset Sale

- 22 Chicago Skyway Asset Sale
- 23 CREATE
- 24 Hiawatha Light Rail Line
- 25 Denver E-470
- 26 Northwest Parkway

FIGURE 22.
Recent Public/Private Partnerships
 ■ States Using PPPs to Help Address Transportation

Source: Cambridge Systematics, July 2006.

roads, parking lots, power plants, water treatment facilities, and airports as well as social infrastructure, including hospitals, schools, and affordable housing. Portfolio managers may balance the known and predictable cash flows of existing infrastructure investments with investments in higher-risk/higher-return greenfield construction projects.

Attractive Returns

Mature infrastructure assets compare to core real estate, offering mid- to high-single-digit annualized returns, often from government-backed income on existing facilities. Pension funds and insurance companies gravitate to core-friendly, long-term lease terms with stable returns from toll

roads or government contracts for managing schools and hospitals. These income flows can match up well to actuarial liabilities for retirees and life policies. Core-oriented portfolio managers have felt more comfortable operating in western Europe, Canada, and Australia, where political stability, transparent regulatory environments, and rule of law are entrenched. But many of these markets "have been picked over," says a consultant. "It's hard to find deals for mature, core assets in Europe" and all the competition "has brought returns down."

Greenfield investments, meanwhile, match opportunistic real estate on the risk/return spectrum, potentially throwing off annualized gains in the high teens or above from redevelopment or development-style transactions. Invest-

ment banks tend to dominate the greenfield arena. Their typical game plans follow a private equity/IPO model: leverage up equity investments, refinance the assets through bond issues or securitizations, and either sell stabilized assets as soon as possible to core funds and other investors or take the entities public. Transaction fees, leverage, and early sales can translate into big internal rates of return, if projects work out, and refinancing strategies can reduce risk for equity investors, if deals sour. China, India, Russia, and other parts of eastern Europe start to draw more opportunistic players, who chance problematic political and regulatory landscapes with histories of corruption. But new highway construction in North America fits squarely in greenfield parameters.

Sandwiched between core and opportunistic categories, core-plus investments favor existing assets, which can be enhanced through operation improvements to produce more income—adding new toll lanes, reconfiguring airport concessions. Private equity firms actively engage in these investments, looking to provide a value-add through active management, and sharing in investment gains with investor and government partners.

Capturing U.S. Opportunities

Now, the global investment pipeline, flush with cash, eagerly and hopefully shifts some flows to the United States as Americans begin to realize the scope of future infrastructure requirements and size of funding shortfalls. "The best opportunities for mature assets are in North America" and "the U.S. has to do something—they have a need and there is capital demand." U.S. legal transparency and political stability also attract portfolio managers and investors. In fact, U.S. markets seem receptive—28 of the 50 states have passed legislation enabling private market investment in infrastructure, but the floodgates have not opened yet. "There's more dialogue with states and governments," says an investment banker looking to score deals. "You see some vibrancy in the market, lots of smoke, needs are great, but few bold strokes of action. So far there have been just five or six recent transport deals in the whole country and it's a big country." Grouses a frustrated investor: "There have been more deals done in Greece in the past five years than the U.S."

Proponents and Critics

Two recent highway concession transactions on existing toll roads—the sale of long-term leases for the Chicago Skyway and Indiana East-West Tollway—have attracted attention and elicited mixed reactions. Both deals scored large one-

time payments to governments, raising questions about judicious appropriation of the proceeds. "The only reason to do PPP stuff should be to improve road quality and lower the cost of operations, not to get a pile of money. Done well, it could be a boon." (See sidebar on next page.) Critics express discomfort over private entities having a monopoly on public thoroughfares with the right to raise tolls outside traditional public regulatory channels during lengthy lease terms (75 to 99 years). "Our studies show that the public is generally more comfortable with government controlling infrastructure assets," admits a fund manager.

Governors in Pennsylvania and New Jersey dither over whether to sell outright turnpike concessions to private operators given conflicted reactions to the Chicago and Indiana models. But observers expect that most new highway construction in many states will be funded by private managers gaining long-term toll concessions. To temper opposition, contracts will be structured to give states greater control over toll increases and allow revenue sharing in the event of windfall gains. States look at compensating private concessionaires through "availability payments" based on performance standards, including traffic volumes. "Part of the education process with the public will be to show that the government still has control to ensure that the asset is operated for the public good" and, most important, has retained some discretion over toll rates.

Sharks v. Bureaucrats

Political adversaries also raise fears over Wall Street hotshots taking government bureaucrats to the cleaners in structuring public/private partnerships. "Wall Street's best and brightest make deals happen and collect huge fees, but who can go toe to toe to protect the public's interest?" Counters an investment manager: "Governments can call on outside advisers and consultants to deal with financial structuring and best practices."

Both sides struggle with how to structure deals. The early-on Dulles Greenway (in suburban northern Virginia) toll road transaction, completed in 1995, did not protect the concession operator from new road competition. When alternative free roads were constructed, toll road traffic volumes slowed well below operator profit targets. "You need to protect against competition in concession contracts," says a portfolio manager. But such covenants could preclude integrated regional transport strategies. Private operators have trouble anticipating traffic volumes on new roads without track records. Some deals can sour quickly if debt service targets aren't met. Valuing assets and future cash flows can be problematic, and crystal balls cloud up when anticipating technological changes that could make concessions

Was it a great financial coup for the city of Chicago or a red-handed "Skyway robbery" by investors? We may not know for decades who comes out ahead in the city's \$1.83 billion sale of the Chicago Skyway toll concession for 99 years to a private consortium composed of two international infrastructure market giants—Macquarie (Australia) and Cintra (Spain). In early 2006, just months after completing the Skyway deal, a separate Macquarie-Cintra venture acquired similar concession rights over 75 years to Indiana's 153-mile (246-km) East-West Toll Road, which connects at the Illinois state line to the 7.8-mile (12.5-km) Skyway. The consortium paid \$3.85 billion for the privilege to increase tolls and maintain the state's section of I-90, also known as the "Main Street to the Midwest." These roadway privatizations, the first in the United States, promise to be the vanguard of a mushrooming trend as state and local governments look to cash in on their existing infrastructure assets out of sheer necessity.

The short-term transaction benefits of these public/private partnerships (PPPs) for the city and state governments seem clear. With a huge one-time cash infusion, Chicago's Mayor Richard M. Daley paid off existing Skyway debt, boosted the city's lagging credit rating, created a rainy-day fund for general city services, and avoided the politically unpalatable necessity of raising taxes in the face of a potential budget crisis. Indiana Governor Mitch Daniels filled an uncomfortable void for an infrastructure fund to finance new highways and upgrade the state's deteriorating transportation system. He sidestepped the less palatable options of higher gas taxes, new bond issues, or doing nothing. Both politicians also skirted the voter wrath that typically accompanies decisions by government to boost tolls.

Political Cover

The new private concession owners, insulated from political consequences, are free to raise tolls capped to fixed percentages above the higher of growth in gross domestic product or the Consumer Price Index (CPI). A Federal Reserve study shows Chicago-area drivers would be paying five times the current rates had tolls been indexed previously to the CPI. By 2017, motorists could be charged \$5 for a Skyway trip, up from \$2, the rate in effect for more than 12 years before the sale. Indiana Toll Road users confront similar hikes after having paid the same "bargain" toll rates for almost a quarter-century.

Critics claim the city has given up substantial future revenues from toll collections to plug gaps in current operating budgets. Indiana's strategy appears to have longer-term benefits and wins more plaudits, funding statewide im-

provements in future infrastructure projects from the newly created trust fund. But voters registered displeasure with toll hikes and the idea of more toll roads, voting out some concession supporters in recent elections.

Risks and Rewards

The investment consortiums, meanwhile, have paid substantial upfront costs to lock in steady and predictably increasing, long-term income flows that could provide extremely attractive returns, translating into low-double-digit annualized gains over the life of the investments. In the process, they have paid themselves handsome transaction fees for securing and financing the acquisitions and offloaded most of their equity risk into funds for pensions and insurance companies (more fees), while retaining asset management (ongoing fees). The private managers are incentivized to maintain these roads to attract higher volumes of motorists and are responsible for expensive capital projects during their holding periods. Over the lease term, the now 50-year-old Skyway bridge could need extensive renovations, even possible replacement. If the concessionaires don't maintain standards and traffic volumes, the governments can take the franchises back. The Skyway consortium already claims to have reduced travel times for motorists through installing electronic toll-scanning technology and by reversing lane flows at peak travel times. If time is money, drivers already get a value-add for the higher user fees.

But how will the investment equation turn if within the next 20 or 30 years some technology or new competing transport solution makes these road systems as obsolete as the Erie Canal? The fund investors will be on the hook, but may have made enough in the meantime to gracefully exit without a loss. The tougher case arises if mounting capital costs force fund managers to make a fiduciary call—do they pony up on repairs or walk away, leaving the taxpayers holding the bag? The investors would argue the concession is a dud no matter what their involvement and the government got the benefit of their full upfront payment. In all likelihood, Mayor Daley, Governor Daniels, and the financial wizards who engineered these seminal privatizations will have long obtained their rewards—the windfalls, fees, and bonuses happily spent. "It's really anyone's guess what will happen," says an interviewee.

Caveat Emptor

Buyers beware—infrastructure development deals can sour quickly when drivers have alternatives and balk at high toll concessions and when private owners overleverage and misjudge traffic volumes. The Cross City Tunnel in Sydney,

Privatizing Tollways

Australia, was completed in 2005, costing A\$900 million. In late 2006, the tunnel concession collapsed into receivership with debts of A\$560 million. Despite schemes to funnel motorists by closing some nearby roads, traffic flow through the tunnel is a third of original estimates—high tolls (up to A\$5-plus per trip each way, with increases quarterly indexed to the CPI) discouraged drivers, who still can take traditional lower-cost routes. Various tunnel equity investors and superannuation funds stand to lose more than A\$100 million and bank lenders considerably more in the "bloody" Cross City debacle . . . Private management involved in toll road construction doesn't guarantee on budget results either. A private toll road project scheduled to open in San Diego in summer 2007 has been beset by legal wrangling and cost overruns. Its cost, nearly \$700 million, is 70 percent above forecast . . . Privatized new-launch rail systems can founder off overly optimistic forecasts, too—only three years into operation, the Las Vegas Monorail Company had its bond rating dropped to junk status after daily ridership between various casinos fell to less than half of projections.

Tax Incremental Financing Paying for Local Infrastructure

Tax increment financing (TIF) started in California back in 1952. The idea was to provide an innovative tool for local governments to self-finance improvements in blighted areas that wouldn't otherwise attract private investment. The increased amount of property taxes generated by a TIF district is used to pay off bonds sold in municipal securities markets. When the bonds are paid off, the TIF revenues go directly into local treasuries.

Today, every U.S. state except Arizona allows TIF with varied (some rather liberal) "but for" qualification tests for whether projects would occur without such public financing support. Many localities use TIF bond proceeds as a primary source to pay for new infrastructure to attract developers and commercial enterprise. TIF bonds may help fund a new school building or power plant, or capitalize local road and sewer improvements around a Wal-Mart Super Center or regional mall.

Proponents tout TIF as a lifeline for local governments reluctant to raise property and sales taxes in the face of substantial declines in federal grants and subsidies. They point to studies that show how local governments can gain greater access to bond markets, which in turn allows them to leverage greater amounts of private investment to spur economic growth and strengthen the tax base.

Impact Fees

Not surprisingly, developers typically favor TIF over impact fees, which local governments increasingly require them to pay out of their own pockets for infrastructure extensions and improvements into non-TIF projects, especially greenfield developments. Builders must ratchet up sales prices to cover impact fee outlays and are on the hook if projects don't sell. With TIF in place, owners of properties who benefit directly from infrastructure improvements pay for them over time in higher tax assessments. Bond holders, meanwhile, carry the risk that tax assessments don't cover debt service, and local governments need to be concerned about the impact of potential defaults on their overall credit ratings.

Neither tax increment financing nor impact fees touch truckers and other drivers—they pay nothing to use the new roads running through these districts. And neither finance structure pays for maintenance or repairs of infrastructure systems after they are built. Those increasingly imposing, ongoing costs typically must be covered by property and sales tax revenues raised by the county or municipality, which ever takes responsibility for the road. In California, so-called Mello-Roos districts can assess local taxpayers directly for infrastructure maintenance.

Critics of TIF argue that surrounding non-TIF areas suffer in comparison—subsidizing a store or project in one district often can reduce demand and property values in neighboring areas. At the extreme, these programs can work against more efficient regional land use planning, foster destructive competition between municipalities, and enable sprawl. Tax increment financing, detractors argue, facilitates balkanized infrastructure development, representative of America's bottom-up, highly decentralized approach to managing land use.

Paying for Repairs

For the immediate future, TIF and developer impact fees will become more popular and necessary infrastructure funding sources for local governments, deprived of handouts from Washington and state capitals. A more ominous problem will be how these communities pay for resuscitating aging networks of potholed local roads and rusting underground sewer and water mains. Higher taxes of all stripes will be necessary, including the formation of special assessment districts. In particular, some older suburban areas may be hard hit as tax bills come due for revamping inefficient infrastructure layouts, symptomatic of sprawl. Once built with hefty contributions from federal programs, snaking roads, elongated water district systems, old dams, and overburdened wastewater plants now are the responsibility of villages, towns, and counties. Living in these suburbs promises to become more expensive. Some rural areas—with low populations and tax bases—face an even greater bind.

obsolete. Toll road operators roll the dice over the potential introduction of Jetsons-style space cars over the course of 75-year lease terms. "Gas prices could go to the moon, too." You never know.

Governments, on the other hand, may undersell assets or make mistakes in concession agreements that saddle future administrations with losses. "But that happens all the time with public oversight—what about the Big Dig?" In the U.K. PFI process, the private sector "got knock-down prices in early transactions, but the public sector became more savvy and learned, negotiating clawback provisions and revenue sharing." France has courts to reopen contracts and modify terms, based on changed circumstances.

Need for Standards

Negotiating procurement and concession agreements can result in a tortured process. Private bidders complain about the lack of standardized forms and procedures across jurisdictions, which escalates costs in filing proposals and create delays. In the U.K., the average tendering period for a PFI project is almost three years. According to a National Audit Office (U.K.) audit, government departments underestimate the costs for legal and consultant services by an average of 75 percent. "Negotiating transactions is a work in progress. Everyone is learning lessons. The technology and practices are improving, but it's not perfect."

No Magic Solution

Investors emphasize that privatization "is not a panacea to the infrastructure crisis," rather "it's a financing tool." In reality, the nut of the road privatization discussion comes down to the need for increased user fees to pay infrastructure costs. Privatization doesn't create free money—the public still ends up with the bill. Sums up an investment manager: "The public needs new infrastructure for economic sustainability, the feds won't pay, locals don't want to raise taxes, bond issues are not as attractive, so the best alternative is toll roads and shifting risk by privatizing."

For politicians, privatizing roads provides some cover for instituting tolls or raising them. "They transfer the dirty work." Most tolls run by public authorities are "low-balled" for fear of voter retribution, and private operators can take the heat better for increases. "Private concessions seek to find the maximizing point" for expanded volumes at the highest possible tolls, figuring in congestion pricing mechanisms. "The dumbest thing you can do is raise tolls too high, become a political piñata, and lose volumes." Most concession agreements place caps on increases, but private operators want significant latitude to increase tolls beyond

the typical comfort levels of governors and legislators. "The price of our inability to raise taxes or user fees for new infrastructure is turning responsibility over to the private sector." The good news is the pricing system will provide "truer costs for infrastructure" with prices "the market will bear, not at prices where politicians think will help them win votes."

Blind Eye to the Big Picture

Not surprisingly, the wave of infrastructure fund managers and investment bankers focuses on finding and negotiating their next deals, working through encyclopedic agreements with their government counterparts. Integrated transport and land use policy remains safely off their radar screens, unless something might effect a noncompete clause. Some interviewees from the investment side react quizzically to the topic of intermodal planning and regional infrastructure master plans. "Government must remain in the driver's seat setting policy—that's not our job." But government leaders do not necessarily connect privatization to broader infrastructure planning either, seeking money instead for one-off projects or to fill budget gaps. "It's discouraging to see dollars pushed around Wall Street, handing out highway assets to private companies without looking at how these roads integrate with mass transit and future needs, re-designing development around interchanges, and building more high-rise, pedestrian-friendly communities," says a planning consultant.

"The privatization process should be wrapped up in smart growth initiatives. To make it work for more responsible land use, funds should be allocated to various integrated transportation projects. Otherwise, privatization just means more money for more roads for more cars." "The jury is out on privatization benefits. Clearly, private owners are interested in increasing volumes and profits from their assets—they are not focused on integrated solutions or land use issues." Government must fill that gap intelligently, devoting resources to extensive regional, multimodal planning incorporating land use and housing.

Narrowed Scope

Public/private partnerships may also have limited application in helping finance overall infrastructure needs. "In Europe, governments have had naïve expectations about what can be privatized successfully. Railways, waterways, and urban transport lines have less success in finding private partners" than airports, motorways, hospitals, schools, and ports. Private operators want to "cherry pick" the prime high-trafficked intercity turnpikes and city-suburban con-

nectors. Secondary and suburban roads fall off wish lists. They obviously don't want to manage vast sections of lightly traveled rural highways either—"better a New York tunnel than a prairie road." "Private investors look for assets with proven demand and relative monopoly positions that are capacity constrained and where raising tolls will have limited impact on volumes." In the United States, "privatization will amount to a small piece, a maximum 5 percent of roads." Another expert suggests "10 percent."

More Tolls

Whether managed by private operators or public authorities, the long-term finance trends seem clear for major highway arterials, especially around most gridlocked metropolitan areas. Governments eventually will impose tolls on increasing numbers of these roads to raise money for improvements and maintenance as well as control traffic flows through congestion pricing schemes. They may start with new congesting pricing lanes, but will expand from there. Entire regional road systems ultimately will collect tolls through transponder technologies, calibrated to traffic flows and rush-hour conditions. Despite initial public distress and outrage, drivers will swallow electronic tolling and get used to monthly bills in return for functioning highways. New private toll concessions will ease the initiation process, helping "depoliticize tolling and move rates closer to real costs." Reality sets in—there won't be any other viable way to pay for these roads. "Every urban interstate could make a case for two additional lanes and each could be tolled."

Separately tolled, truck-only lanes and corridors will become more common to relieve congestion for commuters and help move freight traffic. But truck corridors will require significant construction funding and impose engineering challenges, especially related to adding lanes in built-out suburban areas and through urban environments. Some 24-hour cities may choose to impose congestion pricing cordons like London's (see sidebar on page 43).

Higher Taxes

Washington, D.C., will run slam-bang into whether to increase the federal gas tax (currently 18.4 cents per gallon) in order to maintain solvency of the Highway Trust Fund. Like the federal government, states will swallow hard before raising fuel taxes. But when push comes to shove, the feds and states may have no choice: \$50 billion is needed immediately to fill the gap for basic maintenance of roads and transit systems, with an additional \$50 billion required for necessary improvements. People gradually will come to

grips with the reality of higher driving costs to pay for infrastructure, including tolls and higher fuel taxes.

Global positioning technologies eventually could supersede pump-exacted fuel taxes and tolling by charging fees based on vehicle miles traveled over specific road networks. These tracking systems also could impose surcharges for congestion pricing, car weight, and vehicle emissions—all designed to help traffic flows and orient behaviors around efficient vehicle use. In addition, parking fees and assessments will become more common not only in cities, but also in many suburban areas. Transit fares will steadily climb, too.

Other primary infrastructure funding sources will continue to derive from state income and sales taxes and local property taxes, including special tax districts for improvements and upkeep of community streets and water/sewer systems (see sidebar page on 55). Six large states (California, New York, Pennsylvania, Virginia, Massachusetts, and Indiana) dedicate a portion of sales taxes to transit and other states earmark sales taxes for highway expenditures. Nearly 30 states have enacted legislation allowing impact fees charged to developers for funding streets and water/sewer infrastructure associated with projects. These costs ultimately get passed on to tenants and buyers through higher rents and sales prices.

States and cities will continue to use bonding authority to raise funding through securitizations, which can offer investors attractive tax-free returns.

Equitable Cost Burdens

Regions may need to rethink how to pay for the benefits of their established 24-hour cores and integrated infrastructures, which make surrounding suburbs more viable and cheaper. "Many people have moved out of the center city, because of high taxes and living costs, but still work there because of opportunities. Commuters get bargains—they use the urban core, the transit, the sewers, the sidewalks, but don't pay the full costs, which falls on city taxpayers." Various forms of commuter taxes would make the costs and benefits more equitable for taxpayers across regions and help "avoid a free lunch for discounted use of infrastructure." New York State recently forced New York City to drop its commuter tax in a gesture to suburban residents. But the infrastructure discussion and higher driving-related costs may force changes in how people value housing, location, roads, and transit . . . eventually.

PRIVATIZATION

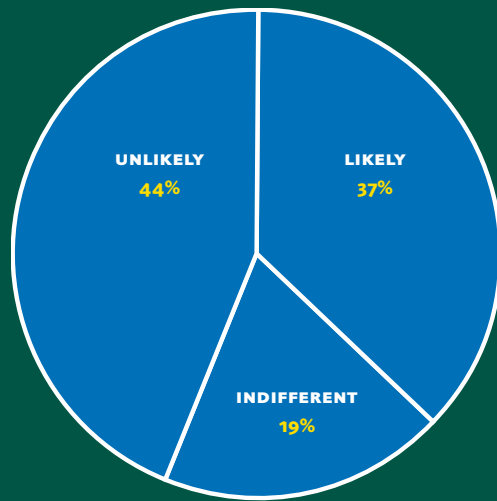
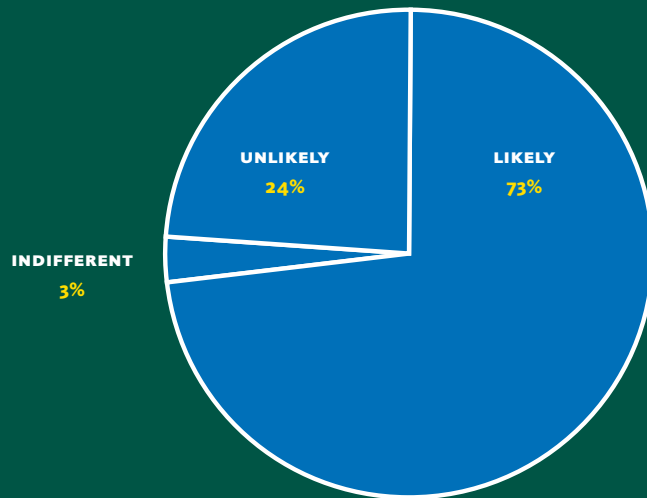


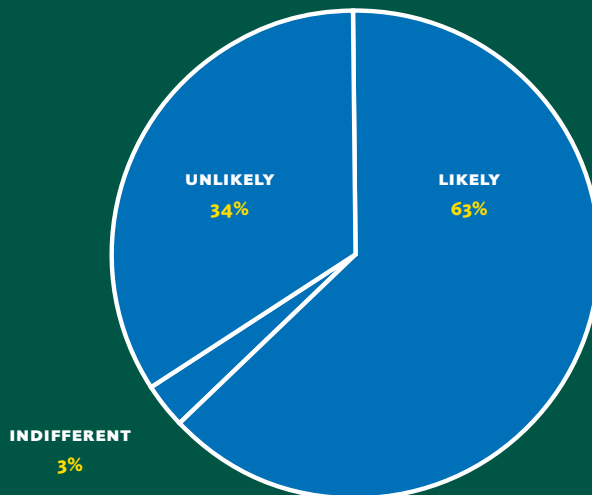
FIGURE 23.
Where Will the Money
Come From?
State Departments of
Transportation Rated the
Likelihood of Raising
Funds from Various
Sources

Source: ULI survey of direc-
tors of planning for state de-
partments of transportation.

**INCREASING
USER FEES**



INCREASING TAXES



The Urban Land Institute conducted a survey of directors of planning for state departments of transportation in February and March of 2007. The goal of the study was to ascertain how administrators directly involved with transportation viewed their current situation and their future challenges. Below is a list of states that responded to the survey:

Alabama
 Alaska
 Arizona
 Arkansas
 California
 Colorado
 Connecticut
 Delaware
 District of Columbia
 Idaho
 Illinois
 Iowa
 Kansas
 Maine
 Minnesota
 Mississippi
 Missouri
 Nevada
 New Hampshire
 New Jersey
 New Mexico
 Ohio
 Oklahoma
 Oregon
 Pennsylvania
 Rhode Island
 South Carolina
 Washington
 Wisconsin
 Wyoming

*All charts and graphs in this report were compiled and completed in March 2007 (unless otherwise noted) and the data reflect the most current available at that time.

Interviewees

Thomas Bradshaw, Jr.
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 The Carlyle Group

Mark Florian
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Douglas Foy
 DIF Enterprises

Kevin Honey
 Partner
 Ernst & Young United Kingdom

Gregory Hummel
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 Bell, Boyd & Lloyd, LLC

Max Johnson
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Eva Lerner-Lam
 Palisades Consulting Group

John Miller
 Patton Boggs, LLP

James Neal
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 Ernst & Young

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Dale Anne Reiss
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Forum Participants

New York City: June 13–14, 2006
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2006
Mumbai, India: February 28, 2007

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Mark Florian
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Goldman, Sachs & Co.

Douglas Foy
DIF Enterprises

Merrie Frankel
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Moody's Investors Service

Felicity Gates
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RREEF Infrastructure

Kumar Gera
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Gera Developments

Arthur Guzzetti
Director of Policy and Advocacy
American Public Transportation
Association

Gregory Hummel
Member
Bell, Boyd & Lloyd, llc

Kenneth Jackson
Professor
Columbia University

Roopesh Kaul
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Center for Quality Growth and
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