FUTURESTRUCTURE
A Different Approach

TRANSPORTATION INNOVATED
Thinking Differently, Thinking Better

INTELLIGENT TRANSPORTATION
Optimizing Our Systems

BUILDING BETTER
Transforming the Built Environment

FutureStructure

A PUBLICATION FROM THE GOVERNING INSTITUTE AND THE CENTER FOR DIGITAL GOVERNMENT

November 2013

What is Soft Infrastructure?

HOW IDEAS DRIVE WHAT WE BUILD.

A SUPPLEMENT TO GOVERNING

CH2M HILL: PROVIDING FORWARD-THINKING SOLUTIONS TO FUND FUTURE TRANSPORTATION INFRASTRUCTURE

In light of decreasing gas tax revenues — the result (in part) of increasing vehicle fuel economy — finding a way to generate sustainable revenues that will maintain and operate the transportation system is a topic of great interest to nearly every transportation agency.

At a time when public agencies are looking for fuel tax alternatives that will generate sustainable revenue, CH2M HILL brings deep expertise in transportation policy, legislation, advanced technology systems, and public information strategies to deftly guide those agencies.

Helping public agencies think outside the box

When the Oregon Department of Transportation (ODOT) decided to examine alternate funding approaches, it selected CH2M HILL to develop a program that explored charging drivers based on the actual miles they drove, with a refund of state fuel taxes paid.

Officials wanted to gauge the feasibility of using advanced, non-invasive technology to accurately report miles driven by those vehicles, while protecting users' privacy. They needed to understand the key to public acceptance for such a program, and whether related implementation, operations, monitoring, and maintenance could be cost effective.

Addressing privacy, ease of use, and implementation concerns

Working with ODOT, the CH2M HILL team designed and implemented the program from the ground up — preparing everything from a new road user charging concept to a working pilot system. The overall program included policy development, governance, technology research, systems engineering, and public outreach. In the process, Oregon legislators and transportation officials learned the keys to gaining public acceptance by providing road users with:

- **Data privacy**
- **Flexibility, with choice of several payment methodologies and technology options**
- **Technology that is reliable, adaptable, easy to use, and open source**
- **Easy and cost-effective program administration and compliance**

In the end, the pilot system demonstrated that a road usage charging program can be a viable, practical, sustainable, and equitable alternative for a state's gasoline tax.

To learn more about these forward-thinking solutions, contact CH2M HILL's Highways and Bridges Director **Susan Martinovich** (susan.martinovich@ch2m.com) and CH2M HILL's Chief Technologist for Transportation Operations **Dan Baxter** (daniel.baxter@ch2m.com).

CH2MHILL®

November
2013

FutureStructure
How Ideas Drive What We Build

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FutureStructure is a joint initiative from the Governing Institute and Center for Digital Government. FutureStructure is a framework for thinking through and solving challenges faced in building economically, environmentally and socially robust communities. Learn more in the pages of this special publication and at **FutureStructure.com**

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On the cover: The new East Span of the San Francisco-Oakland Bay Bridge, opened to traffic in 2013.

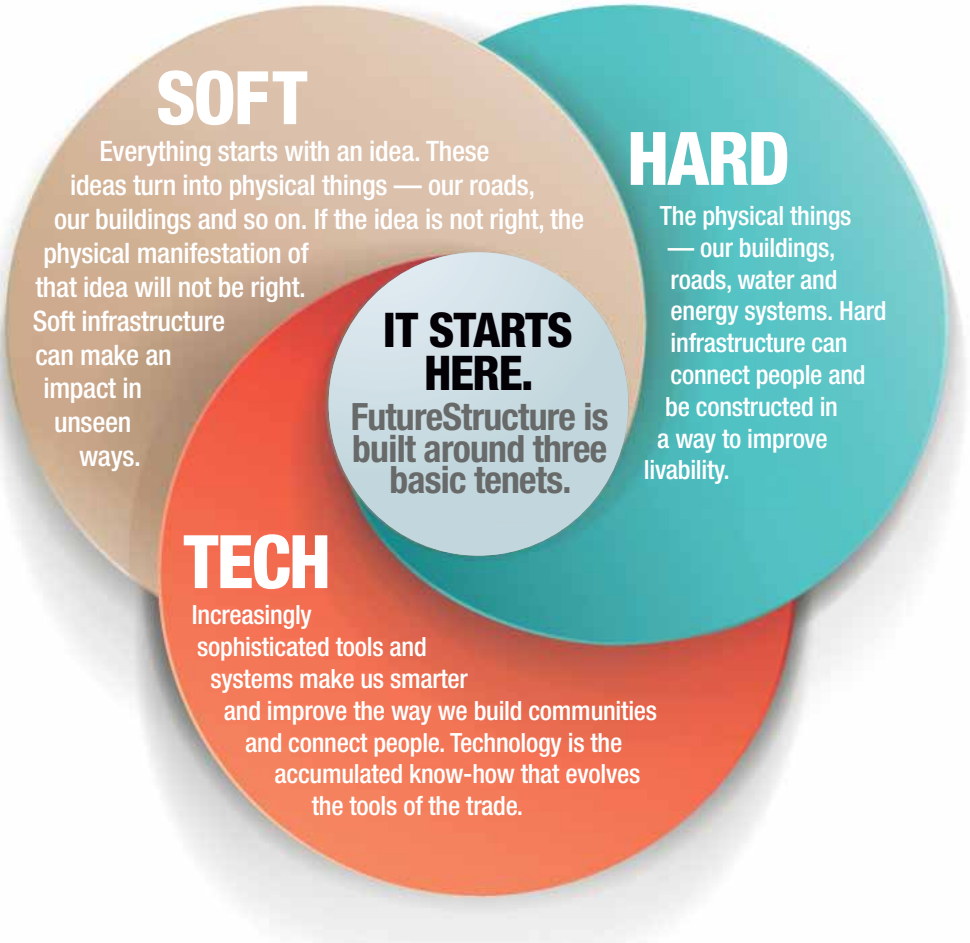
COVER IMAGE BY JOE ERCOLI - ANVILIMAGE.COM

FUTURESTRUCTURE: A DIFFERENT APPROACH TO THE USUAL PROBLEMS

BY JOHN MIRI

Human beings are not meant to be isolated. We're terrible at it. Even the basic blueprint of our lives, our DNA, is composed of a complex and interwoven tapestry of individual strands. Left on their own, these building blocks would be lifeless, inert and useless. But knit together in this powerful yet peculiar way, DNA base pairs somehow quicken with the spark of something infinite and wonderful.

Shouldn't our communities — our cities, states, provinces and countries — be the same?



FutureStructure is the idea that the same pattern that defines us as individuals also connects us to each other in living, breathing communities of people. Strictly speaking, FutureStructure is a framework for thinking through and solving the challenges in building socially and economically robust communities. The enthusiastic reception that greeted our first special publication on FutureStructure, in which we introduced this concept, likely stems from a reaction to the over-specialization that has plagued modern public policy and obscured this foundational operating principle.

Don't get us wrong: Specialization is a good and healthy thing for public policy and for communities writ large. It makes no sense for one person to do each and every job. The very essence of a community is that it brings the different together, whether that means different skills, different people or different infrastructure components. But in our quest to squeeze every last post-industrial-era bead of sweat out of our already optimized business processes, we've let our focus become too narrow. We're solving small, specific problems without a regard for the coherent, expansive whole.

The reason why this matters — and matters more than ever — is clear when scanning the day's news on our favorite online media. Our fascination with the unfolding drama in Egypt, for example, as successive governments and perpetual revolution appear to set in, goes beyond a simple concern for American interests or foreign policy. As a nation, we are transfixed when we hear stories of how Médecins Sans Frontières, a.k.a. Doctors without Borders, was forced to evacuate from a failed state like Somalia or when we read about how a banking crisis nearly destabilized the civilian government in Iceland. The reason we can't tear ourselves away from these stories is a deep and abiding fear that the structure of our own first-world communities is more fragile, more complex and more at risk than we would like to admit to ourselves. And we're right.

FutureStructure involves doing something about it. It's about connecting people and ideas, and putting the systems and infrastructure in place that provide people with the opportunity to lead better lives. The bottom line of FutureStructure is the bottom line for our communities: We need true, long-term livability along with sustainable community growth. We need more and better citizen engagement. We need infrastructure that brings diverse neighborhoods together — like the metro subway, or "T," did for Boston's blue bloods, Italian immigrants and south-side Irish. This effort is not just about sustainability, although sustainability has much to do with it. It's about resiliency, and, ultimately, humanity.

To recap, and to introduce those new to the movement, FutureStructure has three basic tenets. Many different instances of each of these things form the DNA base pairs of our community. The art and science of FutureStructure is about thinking boldly and decisively about how to best combine them. They are: soft infrastructure, hard infrastructure and technology infrastructure (see graphic above).

> **IN OUR QUEST TO SQUEEZE EVERY LAST POST-INDUSTRIAL-ERA BEAD OF SWEAT OUT OF OUR ALREADY OPTIMIZED BUSINESS PROCESSES, WE'VE LET OUR FOCUS BECOME TOO NARROW. WE'RE SOLVING SMALL, SPECIFIC PROBLEMS WITHOUT A REGARD FOR THE COHERENT, EXPANSIVE WHOLE.**

If we are to initiate positive change in our communities, then we cannot content ourselves with merely establishing or articulating these core principles. The vision of FutureStructure only comes alive when it is put into practice. The value of a tool or concept is found in its application, not in itself. The pages of this issue — and the collected wisdom of some of the nation's leading thinkers, strategists, activists and practitioners — will

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Courtesy Gill Engineering

Accelerated Bridge Construction: Fixing 14 Bridges in Just 10 Weekends

ASCE RAISING THE GRADES SUCCESS STORY

In 2011, the Massachusetts Department of Transportation began the **I-93 Fast 14 Project**, an effort to replace 14 deteriorated bridges in only 10 weekends. Using traditional construction methods, this could have taken over 4 years — MassDOT replaced each bridge in under 55 hours. The projects used accelerated bridge construction techniques and materials to complete the work ahead of schedule and without impacting rush-hour traffic.

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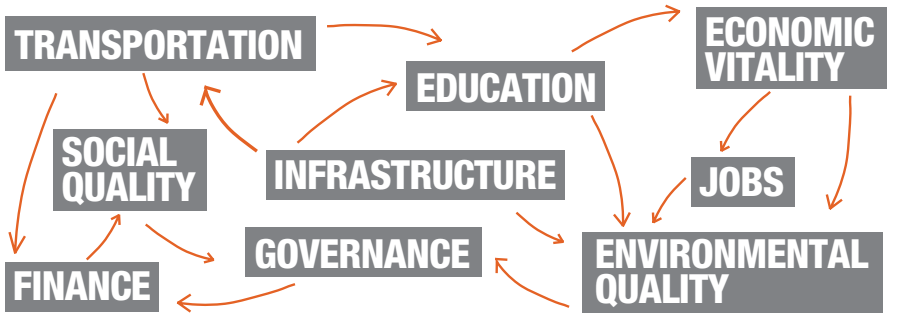
Visit **www.infrastructurereportcard.org** to see examples from every state.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

SYSTEM DESIGN

A community is best envisioned as a large system made up of interdependent smaller systems. Everything is connected.



apply FutureStructure to the challenges of transportation and the built environment.

By "transportation," we mean something very large: all of the means, public and private, by which people and goods move from source to destination. And by the "built environment," we refer to those physical artifacts wrought on the landscape by the efforts of human beings and the use of capital — buildings, roads, power plants, parks, reservoirs, airports and even the humble hike-and-bike trail.

One leading thinker contributing ideas to FutureStructure is Stephanie Pincetl, Ph.D., an institute director and professor-in-residence at the University of California, Los Angeles (UCLA). Pincetl goes beyond past work in urban dynamics to consider a new urban metabolism: a method for understanding an urban community along much the same lines as one would study a living organism. To her, urban metabolism "allows a comprehensive accounting for the energy and materials inputs and outputs of different community systems within a comparative framework."[1] Pincetl's research dovetails nicely with the concept of the city as a system that we described in our first publication on FutureStructure.

"I really started my career interested in why we use land the way we do," Pincetl says. In her view, "Contemporary society is very resource extractive, and we don't have a good understanding of the relationship between how we live, what we build and what we consume." Pincetl advocates looking at resource flows and infrastructure lifecycle of a city as a system, using deep and meaningful "cradle to grave" analysis. The analytical framework of urban metabolism details "how energy flows in, how it is used and how it flows out," providing, "a very powerful way to understand that linkage, that supply-chain-type of linkage, between us and, say, the Congo's rare mineral deposits," says Pincetl.[2]

> **CONTEMPORARY SOCIETY IS VERY RESOURCE EXTRACTIVE, AND WE DON'T HAVE A GOOD UNDERSTANDING OF THE RELATIONSHIP BETWEEN HOW WE LIVE, WHAT WE BUILD AND WHAT WE CONSUME.**
>
> — STEPHANIE PINCETL, PH.D., INSTITUTE DIRECTOR AND PROFESSOR, UCLA

To envision her community as a system, Pincetl was funded to develop an urban metabolism map of Los Angeles County. The goal was to take the abstract concept and make it much more granular. After her team's analysis, Los Angeles County could visualize resource flows of energy, water and more over its landscape, including its linkages to embedded infrastructure.

"The age of the building, the size of the building, the shell of the building, the road infrastructure — all of these things have embedded energy and resources," says Pincetl. "That infrastructure itself leads to what my colleague Mike Chester calls 'emergent behavior.'" Emergent behavior is the collected decisions of community members that arise from infrastructure choices, or are at least heavily influenced by them. The urban metabolism map provided for Los Angeles County will help enhance policy and improve land-use decisions with real, tangible data. This is especially exciting, since the stakes are so high. As Pincetl notes, "Once you transform land, you can't take it back ... that is very, very difficult."

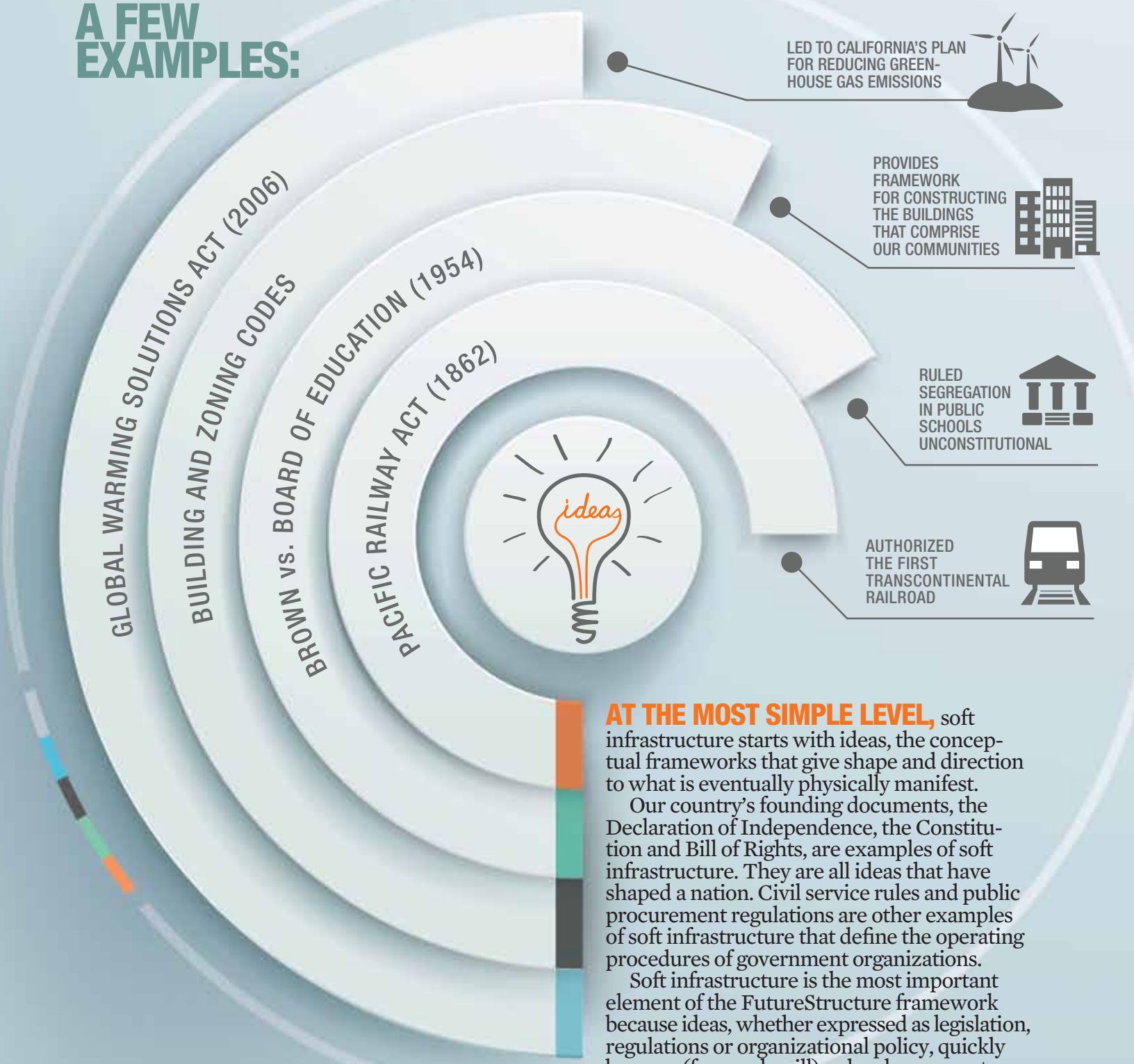
While we take full advantage of the hard-data, number-crunching predilections of the planet's brightest think tanks, research institutions and journalists to make the case for FutureStructure, the best summation of this idea might come from popular culture. The dreams, aspirations and fears of a generation are perhaps most evident in its pop culture, specifically in how people envision the future.

Back in the 1950s, we envisioned the future as a world of brushed stainless steel, atomic power, clean architecture and form altogether following function. But now, in the 2010s, we are the actual people who live in that world. As we — the people of yesterday's future — look ahead, what do we see? Is it simply more of the same?

The biggest difference in our present conceptualization of the future is that it is altogether more human, and more of a living community. The futurists of today envision a world where technology is viewed less like a weapon and given a more human face. We want our car's GPS and our smartphones to talk to us in a lifelike voice. Many of us bristle at wearable computers that make our faces look creepily robotic. The future of our imagination is different from that of our predecessors. It's more human. And that's why we need FutureStructure. FS

WHAT IS SOFT INFRASTRUCTURE?

A FEW EXAMPLES:



AT THE MOST SIMPLE LEVEL, soft infrastructure starts with ideas, the conceptual frameworks that give shape and direction to what is eventually physically manifest.

Our country's founding documents, the Declaration of Independence, the Constitution and Bill of Rights, are examples of soft infrastructure. They are all ideas that have shaped a nation. Civil service rules and public procurement regulations are other examples of soft infrastructure that define the operating procedures of government organizations.

Soft infrastructure is the most important element of the FutureStructure framework because ideas, whether expressed as legislation, regulations or organizational policy, quickly become (for good or ill) as hard as concrete.

It will likely turn out that our most productive path to innovation starts with rebuilding the "soft infrastructure" of our thinking.

TRANSBAYCENTER.ORG

THINKING DIFFERENTLY ABOUT TRANSPORTATION:

HOW IDEAS DRIVE WHAT WE BUILD.

BY ALEX MARSHALL

THROUGHOUT HISTORY, many of the big transportation innovations that have helped people to live better have not involved high technology or even hard infrastructure, at least in a primary role. They have involved thinking better, thinking differently, to paraphrase Steve Jobs, and in ways that don't require an advanced computer science degree.

P12 When a Bus Becomes a Subway

P12 Bicycle Sharing

P15 Complete Streets, Shared Spaces and Public Plazas

P17 A New Way to Pay for Roads

P18 The Chinatown Bus

P19 Thinking Better

↗ **The Transbay Transit Center** is a visionary project that transforms downtown San Francisco and the regional transportation system by creating a modern regional transit hub connecting 8 Bay Area counties and 11 transit systems.

TRANSBAY TRANSIT CENTER

It's this thinking differently that defines what we call soft infrastructure, a necessary step before creating hard infrastructure. It involves looking at the lines on the mental maps in our heads, and sometimes rearranging them. When that happens, old things can be used in new ways that are transformative.

Some of the most significant developments in how we get around have come from simply rethinking how familiar things can be used, or how their support systems can be structured. They include the development of what has come to be known as bus rapid transit, public bike sharing, low-cost inter-city bus service, pay-per-mile road pricing and public plazas in streets. The public sector has taken the lead in most of these initiatives, but private companies have been involved as well. What they have in common is a certain nimbleness, a readiness to rethink the usual game plans. Advanced technology and government money are often used, but neither has been crucial. What comes first is better conceptual thinking.

↗ WHEN A BUS BECOMES A SUBWAY

IN THE 1970s, Jaime Lerner, the mayor of the medium-sized city of Curitiba in Brazil, and an architect and planner by training, envied the benefits a subway could provide a city. The heavy-rail trains in tunnels underground could carry people quickly from one place to another, without interference from traffic, and with rapid boarding and exiting. But his city could not afford a subway.

Jaime Lerner

Then Lerner had a thought: Why not have a subway above ground, on the street, with tires on a road rather than wheels on rails? Why not have a high-speed bus? Thus was born what came to be called bus rapid transit or BRT, which approaches the benefits of a subway at a fraction of the price. Buses with multiple doors run on special lanes cleared of traffic, and pick up passengers at pre-loaded, pre-paid "tubes," so they can board quickly. Since its inception in Curitiba in the mid 1970s, it has been refined, improved and continues to this day.

From Curitiba, it has spread all over the world. Istanbul has a significant BRT program. In the United States, New York, Los Angeles, Cleveland, Las Vegas, Eugene, Boston, Chicago, Nashville and Pittsburgh either have a program or are working to establish one. It's easy to accomplish in theory. What's hard are the politics of who wins and loses. True BRT means clearing a lane completely of private cars and building permanent station stops. But if done, it can deliver quick service cheaply.

FLICKR/WHL.TRAVEL

↗ **The first bus rapid transit system** was developed in Curitiba, Brazil, and is now an internationally recognized model for public transportation.

↗ BICYCLE SHARING

THE MODERN BICYCLE, two wheels powered by thighs connected to pedals and a chain, has been around 125 years. But in the past decade, cities have found a new way to use it: public bike sharing plans.

While various cities had experimented with public bicycles, including La Rochelle in France in the 1970s, it was Paris that catapulted public bike sharing into the growing popularity it enjoys today. Mayor Bertrand Delanoë launched Paris' Vélib' plan for public bike sharing in 2007, which established many of the accepted components of bicycle sharing plans. It has stations where bikes are available, a limited free checkout period and private operation of the program — with support gained through advertising. A private company does the actual work of providing, storing and repairing bicycles, repaid in large part through advertising revenues.

Currently, more than 100,000 Parisians and tourists ride one of the more than 20,000 beige bicycles each day. It has transformed the city. It's common to see French men and women promenading in their best clothes on the bikes. Fashion writers have noted that riding the free bicycles has become another way to engage in the French mode of displaying oneself and one's style. By transforming life so thoroughly in a world city, and by the clear acceptance the plan gained, public bicycle sharing earned credibility.

FLICKR/AUSTINEVAN

↗ **More than 100,000** Parisians and visitors ride the bikes that are part of Paris' Vélib' bike sharing program each day.

WHEN ARCHITECTS ARE NOT Designing

The U.S. ECONOMY SUFFERS

CONSTRUCTION	ENGINEERING	MANUFACTURING	RETAIL SALES	INDUSTRIES THAT **DEPEND** ON ARCHITECTS DESIGNING
OF DESIGNED BUILDINGS	OF DESIGNED BUILDINGS	OF BUILDING SUPPLIES	OF HOME GOODS & OFFICE GOODS	
$885 BILLION	$559 BILLION	$1.26 TRILLION	$123 BILLION	ANNUAL U.S. REVENUE
5.9%	3.73%	8.42%	.82%	PERCENT OF U.S. GDP
55.2 MILLION	12.7 MILLION	8.2 MILLION	2.1 MILLION	NUMBER OF U.S. JOBS IN RELATED FIELDS

THIS MAKES UP OVER 75 Million U.S. JOBS

THE TRICKLE DOWN EFFECT WHEN ARCHITECTS ARE NOT DESIGNING

HEALTH CARE FACILITIES	EDUCATION FACILITIES	TOURISM	PUBLIC SAFETY & CIVIL INTERESTS	RESIDENTIAL & HOUSING	COMMERCIAL & OFFICE
$40.9 BILLION	$82.2 BILLION	$26.6 BILLION	$160.7 BILLION	$303.5 BILLION	$85.4 BILLION

ARCHITECTS GROW the AMERICAN ECONOMY

Architects generate **OVER 18% OF THE U.S. GDP AND OVER 20% OF ALL AMERICAN JOBS.** If architects aren't designing, then engineers aren't engineering, and construction firms aren't building - all **CAUSING A TRICKLE DOWN EFFECT** that is tremendously damaging to our economy and the mission of job creation. This is something we cannot allow to happen as we continue to rebuild our economy and strive to keep innovation in America.

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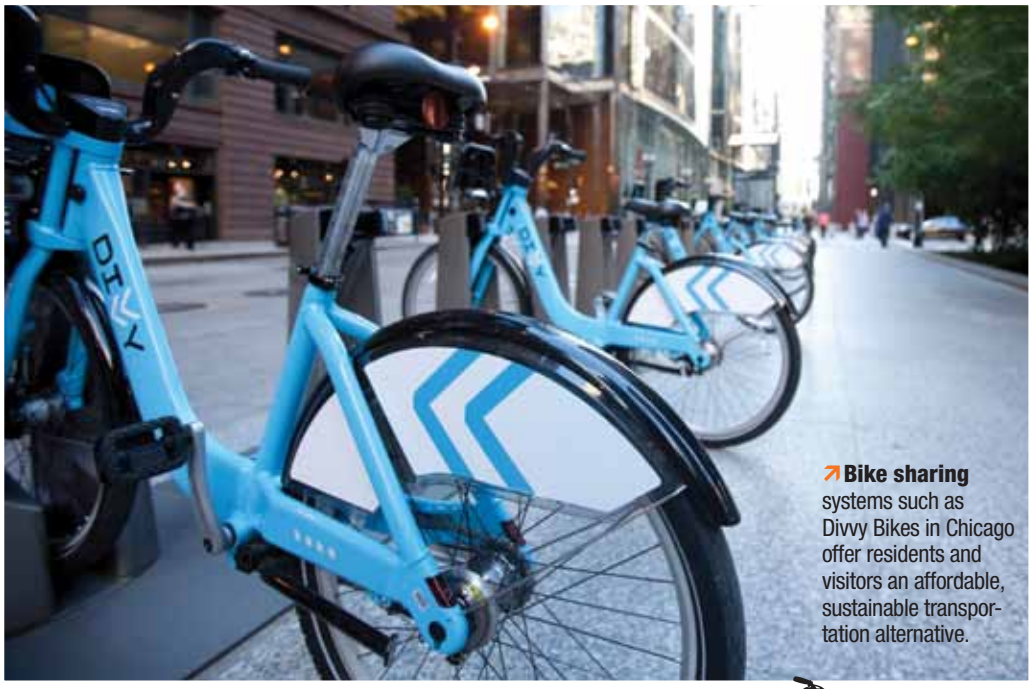
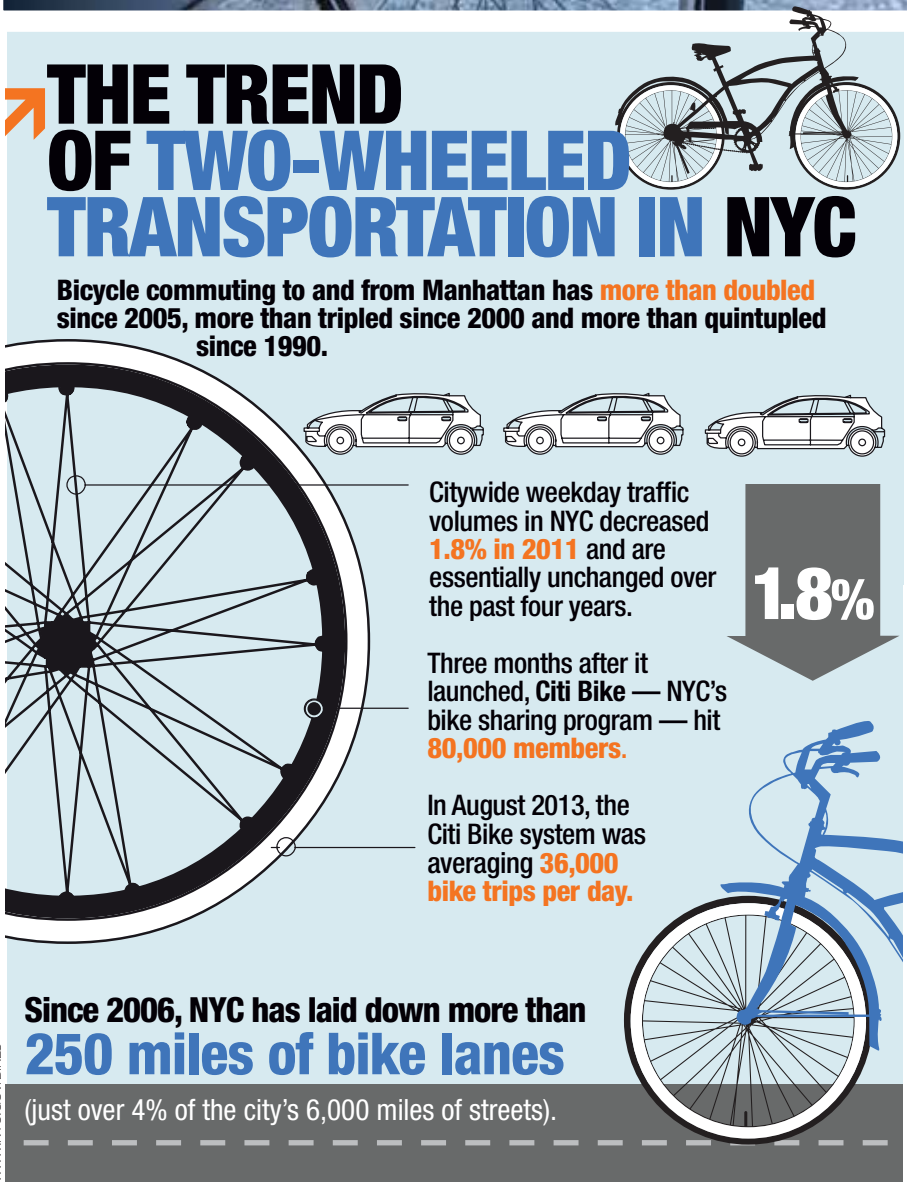


DAVID KIDD

Bike sharing systems such as Divvy Bikes in Chicago offer residents and visitors an affordable, sustainable transportation alternative.

FLICKR/ NEW YORK CITY DEPARTMENT OF TRANSPORTATION

New York City Mayor Michael R. Bloomberg and Department of Transportation Commissioner **Janette Sadik-Khan** launched Citi Bike, the nation's largest bike sharing system, with 6,000 bikes available at more than 300 stations on May 27, 2013.



Like many examples of thinking differently, Delanoë began with a unique philosophy. He had the controversial idea that a city could succeed economically by making itself a nicer place to live, with less attention to things like tax breaks for companies or conventional economic development. Delanoë did innovative things like turn freeways into beaches in the summer months — another example of soft infrastructure.

Since its success in Paris, bicycle sharing has spread to scores of cities large and small, including London, Barcelona, Montreal, Denver, Chicago and most recently New York City. It is becoming an accepted part of city life. And it began not with a new technology or big investment of

capital, but with thinking differently. It is transforming how cities are used, and how people relate to the street.

Roberta Gratz, author of *The Living City* and *The Battle for Gotham*, says that there has been a general trend in recent years by young people toward less car-oriented lifestyles. They are gravitating toward walking, bicycling and another old-fashioned technology: streetcars.

"Piece by small piece, cities are recreating the streetcar systems they were once built around, including Los Angeles, but traded in for the deceptive hope of the car," says Gratz. "The recent and rapidly growing bicycle culture is accelerating this trend as more and more city dwellers, often escapees from auto dependency, advocate for alternatives to car dependency."[3]

↗ COMPLETE STREETS, SHARED SPACES AND PUBLIC PLAZAS

IN NEW YORK CITY, cyclists can stop and sit in plazas with tables and chairs that have sprouted in what were once city streets. In an urban setting where streets are contested ground, and where the pace of change can be glacier, these enhancements have come quickly, essentially in the last five and half years.

It is no coincidence that this happened at the same time in 2007 when Mayor Michael Bloomberg appointed Janette Sadik-Khan to be the transportation commissioner in his second term. Sadik-Khan, a lawyer and an experienced transportation administrator in both the public and private sector (Federal Transit Administration and Parsons Brinckerhoff), moved quickly, showing a nimbleness not only in her conceptual plans, but even more importantly in navigating the city and state's treacherous political waters. Sadik-Khan and her staff utilized the Department of Transportation's (DOT) power to determine what happens on city streets. To not get bogged down in endless public debate, her teams launched themselves, commando style, and over a few days and nights painted new bicycle lanes and turned streets into plazas with café seating.

Underutilized streets and other areas in NYC were revamped into public plazas where people can relax and socialize.

DAVID KIDD

"We changed a parking lot over a weekend, from an underutilized area for parked cars to a plaza," says Sadik-Khan in an interview with *Fast Company* about one of the first projects in the DUMBO (Down Under the Manhattan Bridge Overpass) section of Brooklyn.[4] "And we literally just painted it, painted it green, painted the curbs. Added tables and chairs and planters. Three years later, the sales tax receipts are 172 percent higher than before in the adjacent areas. It worked."

If it hadn't, then the action could have been easily reversed. "One of the benefits of being able to try things out quickly is, if it doesn't work, fine, put it back," Sadik-Khan says in the same interview. "No harm, no foul. And that gave us the confidence to move forward with something like a Times Square [pedestrian plaza]."

This has resulted in the biggest change to how New York City streets are used in the last 75 years since cars began to dominate them — and for the better. Cyclists use the new bike lanes, and thousands of locals and tourists sit in Times Square and other lesser-known areas. And all this was done for a relatively small cost. The changes are now one of the most visible aspects of the city.

"WE CHANGED A PARKING LOT OVER A WEEKEND, FROM AN UNDERUTILIZED AREA FOR PARKED CARS TO A PLAZA. THREE YEARS LATER, THE SALES TAX RECEIPTS ARE 172 PERCENT HIGHER THAN BEFORE IN THE ADJACENT AREAS."

Janette Sadik-Khan, Commissioner, NYC Department of Transportation

On a sunny weekday afternoon, Andre from Rome sat with his spouse at a café table in what used to be one lane where Broadway and Fifth Avenue intersect by Madison Square Park. In accented English, Andre noted the small but significant ways it was different and better than the famous pedestrian plazas in Rome, where thousands gather. "The tables move. That's important. We don't have that in Rome," he said.

Nearby, a group of burly guys from Queens expressed their approval: "We're sitting here aren't we? We like it."

During the same time period in 2007 and 2008, Bloomberg spent millions in money and political capital in a sweeping campaign attempting to get permission from the state legislature to set up a congestion pricing system, where drivers are charged to enter the city at peak times. After a year and a half of work, the state legislature did not even vote on the bill and New York City lost $350 million in promised federal funding. The point of this example isn't to blame Bloomberg for his valiant attempt, but to point out that change can happen quickly if the right levers are used. Looking more broadly, the bicycle lanes and public plazas in New York and now many other cities fit into several related movements that are based on rethinking how and what streets are used for. They include the Complete Streets movement (www.smartgrowthamerica.org/complete-streets), and "Shared Space," where traffic signs are removed and children encouraged to play in the streets, with the paradoxical results that streets are made safer. These are all examples of soft infrastructure.

↗ A NEW WAY TO PAY FOR ROADS

THINKING DIFFERENTLY can happen at any level, whether local, state or federal.

Oregon has been a national leader in transportation and land use since the state passed the statewide growth control act, Senate Bill 100, in 1973, and in 1974 tore down the four-lane freeway Harbor Drive to create a waterfront park. Since then, both the state and the city of Portland are renowned for developing a cleaner and less car-centered form of life.

In recent years, the state DOT has continued its record of innovation by experimenting with a controversial but also much sought after innovation: paying for roads by charging drivers for how much they use the road, rather than for how much gas they consume. The Office of Innovative Partnership and Alternative Funding, part of Oregon DOT, experiments with different ways of funding highways and transportation. The same office has been experimenting with building solar panels into highways.[5]

Among urban planners, there has been a growing concern that the gas tax can no longer be relied on as heavily, because as fuel economy and the production of electric cars increases, revenue from gas taxes decreases. Approved by the legislature in 2011, the Road Usage Charge Pilot Program equipped cars with several types of transponders, sold by private companies, that measured how many miles were driven and where, and charged them accordingly. Users, who were volunteers, received a bill in the mail for their road use. Their gas taxes were then refunded.

"The basic system worked like a dream," says Jim Whitty, manager of the Office of Innovative Partnership and Alternative Funding that set up and ran the program.[6] The information on miles driven was transmitted easily through a variety of devices to servers, which calculated information so bills could be sent out to the participants in the program. "It has taken us into a new world. It allows total scalability and flexibility," he says.

After the success of the first pilot program, the Oregon legislature approved Senate Bill 810 in 2013 which sets up a

"THE OREGON TRAIL WAS A LONG ONE. IT TOOK SIX MONTHS TO GET HERE, AND SIX MONTHS TO GET BACK. WE ARE USED TO THINKING ON OUR OWN."

Jim Whitty, Manager, Oregon Office of Innovative Partnership and Alternative Funding

↗ **Before and after images** depicting the previous four-lane freeway Harbor Drive in Oregon, now transformed into a waterfront park.

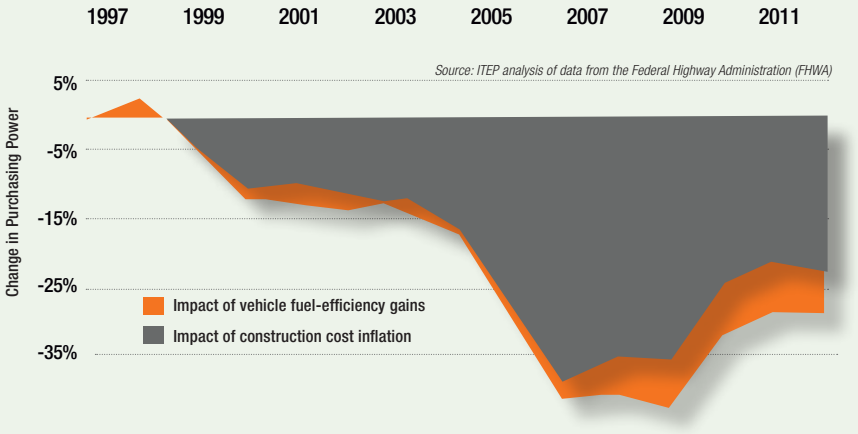
TOP: CITY OF PORTLAND ARCHIVES, OREGON, AERIAL VIEW OF HARBOR DRIVE. A2012-005, 1974. BOTTOM: FLICKR/GREG_E

THE GAS TAX: MORE MILES PER GALLON, FEWER DOLLARS FOR ROADS

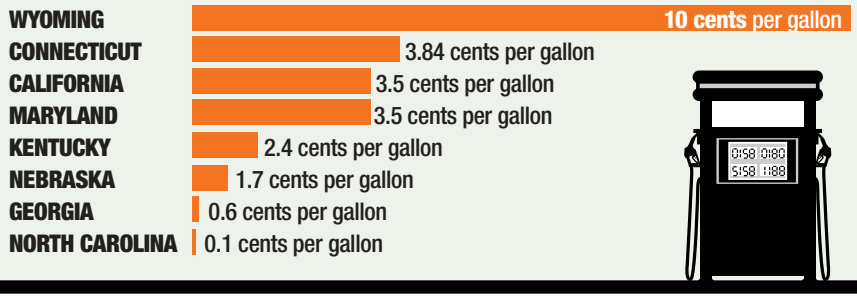
While the federal gas tax – which is used to fund transportation infrastructure improvements through the Highway Trust Fund – has remain unchanged for 20 years, cars have not. The graphic below shows how rising construction costs and increasingly fuel-efficient vehicles have been detrimental to the solvency of the Highway Trust Fund.

PURCHASING POWER OF THE GAS TAX HAS DROPPED 28 PERCENT SINCE 1997

Decline is Due Mostly to Construction Cost Inflation



Several states are increasing their gas tax as a way to acquire funding for infrastructure improvements. Eight states increased their gas tax in July 2013.



GOVERNING

larger pilot program that will put the necessary institutional infrastructure in place to make the program permanent, if desired. Oregon is on the way to being the first state to gradually replace the gas tax with what before had been a dream among planners, charging road use by the mile driven. The system being set up would also allow, if approved by the legislature, to have a type of congestion pricing where roadways that are in high demand are priced more highly than those that are not in high demand.

Whitty envisions a day where all newer electric or other low-mileage cars will use this technology routinely. The technology is such that car manufacturers could easily build these devices into their cars for their customers. Programs like "OnStar" already use this information.

Whitty speculated on why Oregon has been such a leader in innovative and new policy on a variety of fronts.

"The Oregon trail was a long one," Whitty says, noting the state's pioneer history. "It took six months to get here, and six months to get back. We are used to thinking on our own. It's built into the culture."

THE CHINATOWN BUS

IT'S NOT JUST the public sector that manages to think differently.

While BRT gains adherents, until recently the old style inter-city bus travel, where one travels from city to city in a bus, had been steadily declining, year after year. The top companies, Trailways and Greyhound, had declared bankruptcy multiple times and were burdened by their expensive network of bus stations. Few people took an inter-city bus unless it was a necessity.

Then, on a somewhat shabby corner of a street in Lower Manhattan, another revolution was born. Ethnic Chinese began offering bus service to Boston at a ridiculously low price, often $10 one way. These buses had no stations. While perfectly respectable buses, they picked up people on the street. Gradually, non-Chinese began hearing about the $10 bus service to Boston, and taking it. It was a lot cheaper than the Amtrak train or driving yourself. At first, just a few daring urban adventurers took what people began calling the Chinatown bus, but others followed. Soon a lot of people were.

↗ **The Chinatown bus** revolutionized inter-city buses by charging much lower rates and operating without bus stations.

Flash forward a few years, and dozens of companies are offering such service; big international companies such as Megabus from England are investing in service; and bus service itself is being revived all over the country. Even established companies like Greyhound are benefiting. How big this service can grow is debatable. Sidewalks can only accommodate so many people, and some cities, like Boston, are requiring companies to use centralized stations. But it's clear that inter-city bus service has been revived, and it all began when, out of necessity, some people began thinking differently.

↗ THINKING BETTER

WHAT ALL OF THESE examples have in common is that none of them work by simply adding more of what's already there, which until recently has been this country's usual mode of operation, particularly with roadways. That's changing.

For instance, Colorado is expanding a highway between Boulder and Denver that attempts to change the usual dynamic on high-traffic roadways, where more lanes are added in response to more traffic. Rather than simply add more lanes, the Colorado DOT, with support from the federal government, is adding a BRT lane, a high-occupancy vehicle lane, a "hot lane" where people pay for less traffic and a bike lane. It's a lot to squeeze into an existing roadway, but the hope is that these will change the game from the usual one, where another lane is built which quickly fills up again. The idea is to alter the dynamics of development not only on the highway but off of it.

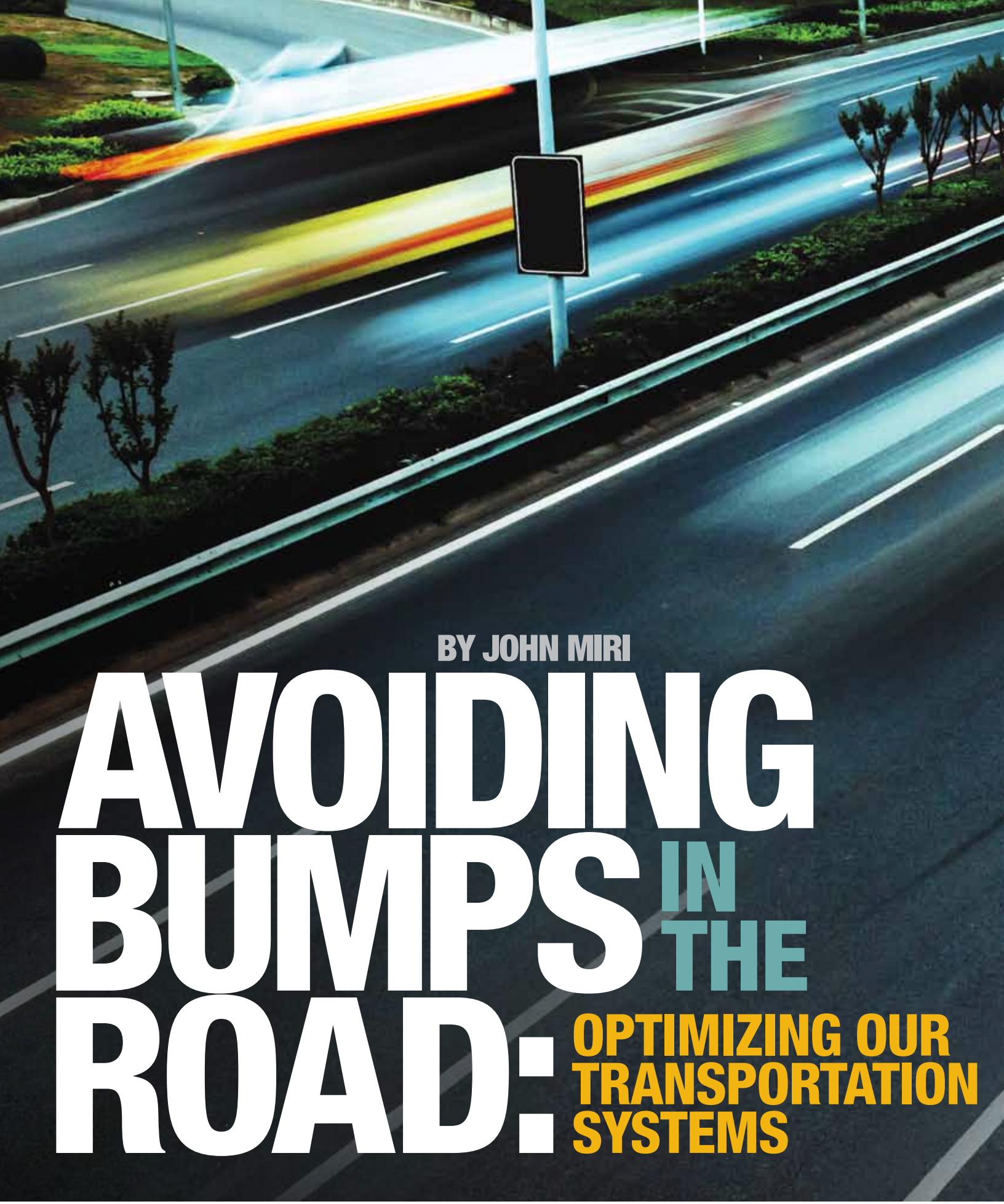
Emily Fishkin, director of infrastructure initiatives with the American Society of Civil Engineers (ASCE), says policymakers were being pushed by circumstances to explore new ways of doing things.

"You can't have 22-lane highways," Fishkin says.[7] "You can't just keep adding lanes. So you have to do something different."

What's undeniable is that there has been a general trend over the last decade to build things smarter, lighter and more carefully, not only in transportation but for all types of infrastructure. Space is dearer, and infrastructure must be constructed more carefully. In this type of environment, the soft infrastructure becomes much more important. One can't simply build indiscriminately, or throw money at a problem. In transportation, it means looking at alternatives to simply pouring asphalt. It means evaluating how people live, and considering what the objectives are, and whether there are other, better means to get there. FS

"YOU CAN'T HAVE 22-LANE HIGHWAYS. YOU CAN'T JUST KEEP ADDING LANES. SO YOU HAVE TO DO SOMETHING DIFFERENT."

Emily Fishkin, Director of Infrastructure Initiatives, ASCE



BY JOHN MIRI

AVOIDING BUMPS IN THE ROAD: OPTIMIZING OUR TRANSPORTATION SYSTEMS

SHUTTERSTOCK.COM

ALL OF THE WISDOM IN BETTER MANAGEMENT of soft infrastructure will be lost if it isn't integrated tightly with its companion elements of hard infrastructure (bridges, roads and buildings) and technology (intelligent transportation systems and information technology). FutureStructure requires a tight coupling of all three domains — soft, hard and tech — to deliver real benefits for communities.

Transportation is Energy in Motion

Williamson County, Texas, racked up a 69 percent increase in its number of jobs between 2000 and 2012. That is extremely fast growth, even by Texas standards. With a boost in overall population to match the job growth,[8] civic leaders were faced with a major challenge: The county needed a significant amount of new hard infrastructure, including roads, power, water and schools.

Tony Dale served as mayor pro tem of the city of Cedar Park — one of the fastest-growing municipalities within Williamson County — and on several transportation-related boards at the county level. Dale recently completed his first term representing the area in the Texas House of Representatives.

"The Texas State Demographer estimates that the state is currently adding about 1,100 new residents per day," says Rep. Dale.[9] "That is creating tremendous pressure on all types of infrastructure to include transportation as well as water and schools ... in addition to other basic services."

Dale notes that while the transportation infrastructure is certainly vital to the movement of people around the state, it also supports key industries and job creation. As such, he sees transportation and the built environment as inextricably linked to all other aspects of the system of civic life. For example, Texas may lead the nation in innovative and unconventional oil and gas exploration, but growth in the energy sector isn't possible without a sustainable transportation system.

"Exploitation of shale oil and gas assets requires a high volume of heavy truck and equipment traffic, typically on rural roads designed and built to handle farm and ranch traffic. The wear and tear on these roads has made them less safe and put a strain on the counties typically responsible for the maintenance," says Dale. To power future growth, Dale and other transportation-minded state officials are looking to innovate hard infrastructure in ways that go beyond simply building more roads.

"As it relates to congestion on highways, it is my opinion that computer-assisted driving could reduce accidents and increase travel speeds leading to multiple benefits for commuters. It may even be possible to achieve higher, safer speeds without increasing road capacity," says Dale. In his estimation, pipelines are also a key part of the state's transportation infrastructure. "Pipelines are the safest mode of transportation for any product and specifically for the hydrocarbons produced in Texas," he says. "Expedited construction of pipelines will mitigate heavy truck traffic, as well as have positive environmental impact by reducing the flaring, or burning of oil and gas, that sometimes occurs when wells come in and pipelines are not in place."

Texas is even negotiating with a private sector partner to provide a concession for a monorail-style system that would move truck trailers in an automated fashion from the Mexican Border to Dallas.

"If this innovative project comes to fruition it will reduce traffic on the heavily congested I-35 corridor, decrease road maintenance costs and increase safety," says Dale. "The bottom line is that government must not fear innovation and must establish a framework where the private sector can help solve these problems. There will never be enough tax money and you can't pave everything."

"THE BOTTOM LINE IS THAT GOVERNMENT MUST NOT FEAR INNOVATION AND MUST ESTABLISH A FRAMEWORK WHERE THE PRIVATE SECTOR CAN HELP SOLVE THESE PROBLEMS. THERE WILL NEVER BE ENOUGH TAX MONEY AND YOU CAN'T PAVE EVERYTHING."

Tony Dale, Member of the Texas House of Representatives

Technology Makes Hard Infrastructure Smarter

Of course, information technology is playing a large role in modernizing transportation. Everything seems to be going back to school these days to become "smart" — smart roads, smart grids, smart traffic systems and even entire smart cities. Technology continues to be critical to the long-range planning of future projects through GIS mapping, sophisticated data mining and statistical analysis. But those high-powered tools are increasingly leaving the engineer's or the planner's office and heading out to the highways and byways themselves.

For example, everyone knows that the traffic around the U.S. capital region

DAVID KIDD

↗ Los Angeles' Automated Traffic Surveillance and Control System alerts traffic engineers whenever there are unusual levels of congestion in the city.

Computer programs keep traffic flowing along major corridors in L.A.

DAVID KIDD

is challenging to say the least. A new project under the Commonwealth of Virginia "GEC Megaprojects Program" will add an additional 14 miles of two new lanes in each direction on I-495. These aren't ordinary lanes, however. The high-occupancy toll (HOT) lanes will be free for vehicles that carry three or more people, and tolled for those that don't. Using a novel intelligent transportation system (ITS), the tolls on the lanes can be changed based on traffic conditions to regulate demand. Higher tolls can be charged during busy times and lower tolls on off hours. The result is smarter management of traffic on the roads.[10]

The outcome of the I-495 improvements isn't just convenience for drivers — it's also positive for the environment as well. Researchers estimate that stop-and-go traffic decreases gas mileage by 40 percent. The ITS will enable lane-specific speeds and active speed management. When commuters maintain a steady rate of speed, their pocketbooks and carbon emissions will benefit. The project is also innovative in its structure as a public-private partnership.[11]

Within and between communities, other forms of transit are also gaining ground. Los Angeles recently topped New York City at providing access to public transportation to households without vehicles. According to a Brookings Institution study, 99.1 percent of L.A. residents in no-car homes had ready access to public transit. The high percentage is especially good news for low-income households, which rely on the mass transit system.[12]

This accomplishment came, in part, as a result of "Measure R," a 2008 ballot initiative that instituted a half-cent sales tax that would be used to address the county's transportation needs. Over its 30-year lifespan, the tax will raise $40 billion for innovative solutions that will ease congestion. Funds already raised by the measure are going towards new public transportation infrastructure, including rail and bus lines.[13]

"We really had maxed out what could be done with asphalt," says Denny Zane, executive director of Move LA. Zane's organization is focused on improving public transportation in L.A. County. "I think there was a broad appreciation that building more freeways was a source of the problem, not an opportunity for a solution."[14]

The improvements in Los Angeles transportation — and the vision that inspired them — are significant in their scope but integrated in a way that demonstrates the principle of FutureStructure. Los Angeles has combined what were formally separate projects — like a 30-year, 1,680-mile bicycle master plan, a public-private bike share program, HOT lanes, congestion pricing and a network of 4,398 high-tech networked traffic signals — into an integrated, well-planned and networked whole in which component parts work together.[15]

When the Bill Comes Due

Of course, any grand transportation vision has to be paid for somehow. Julia Burrows, president and executive director of the Greenwise Joint Venture in Sacramento, Calif., (a nonprofit organization dedicated to transforming Sacramento into the greenest region in the country) sees financing as an inseparable part of the overall task of building prosperous and sustainable communities. In fact, finance is one of the most critical considerations of all civic planning.

"The cities that have been successful have not only integrated the different departments that are in charge of transportation, planning, building and utilities, but they have also integrated financing," says Burrows.[16] Her own experience as the deputy city manager for Roseville, Calif., bears this out: "With the city of Roseville ... when we looked at a 1,000-acre development and considered where everything should go, we ran the financing model at the same time."

↗ Los Angeles has combined what were formerly separate projects — like a 30-year, 1,680-mile bicycle master plan, a public-private bike share program, HOT lanes, congestion pricing and a network of 4,398 high-tech networked traffic signals — into an integrated, well-planned and networked whole in which component parts work together.

States have a particularly vexing funding challenge when it comes to the gas tax. The U.S. federal gas tax hasn't been raised since 1993, and it is assessed on a per-gallon basis. As gas mileage has climbed, that means vehicles are driving more miles for each gallon of gas they purchase. More miles driven means more wear and tear on the roads, and a growing budget gap between revenues and costs.

To help overcome the transportation funding gap, states have taken matters into their own hands — which is why eight of them recently raised their state gas tax, effective July 1 of this year (see infographic on page 18). Wyoming added the most at 10 cents per gallon, while Connecticut, California, Maryland, Kentucky, Nebraska, Georgia and North Carolina imposed gas tax increases as well, all to help fund their transportation budgets.[17] Maryland added an extra 3.5 cents per gallon to pay for transportation projects, taking its total rate to 27 cents per gallon.[18]

"WE REALLY HAD MAXED OUT WHAT COULD BE DONE WITH ASPHALT. I THINK THERE WAS A BROAD APPRECIATION THAT BUILDING MORE FREEWAYS WAS A SOURCE OF THE PROBLEM, NOT AN OPPORTUNITY FOR A SOLUTION."

DENNY ZANE, EXECUTIVE DIRECTOR, MOVE LA

Even though state gas taxes are seen as more palatable than federal gas taxes, in general gas taxes are not looked upon fondly by taxpayers or policymakers. The commonwealth of Virginia actually took a new approach when it dropped its 17.5 cent-per-gallon tax on fuel in favor of a new 3.5 percent wholesale tax. While the change is not revenue neutral — motorists are expected to pay an average of $15 more per month — the new structure will automatically take account of inflation. That's something that the old gas tax never did, remaining fixed all of the last 26 years.[19]

As mentioned previously, the state of Oregon recently passed a bill that would charge drivers a vehicle mileage tax (VMT) instead of the traditional gas tax. The change would both eliminate the unpopular gas tax that is viewed as increasingly unsustainable for transportation financing needs and it would encourage purchasing cars with better MPG, lowering fuel emissions. This approach is one way that states are looking to close the increasing imbalance caused by higher-mileage vehicles.[20]

As an additional option, transportation financing can come from trust funds that tax certain purchases specific to a particular industry. For example, people flying commercial planes pay a tax on their airline ticket that goes into the Aviation Trust Fund, which provides grants to airports to cover some of their capital and operating costs, including that of the air traffic control system.[21] Some states may be considering tapping the energy sector for a similar infrastructure fund approach to meet growing transportation needs.

Another way policymakers can fund transportation projects and upkeep is through the use of public-private partnerships. In Boston, the Massachusetts Highway Department (MassHighway) and the Massachusetts Executive Office of Transportation partnered with a private company to perform improvements and additions to the Route 3 North highway. The involvement of the private sector reduced the project's delivery time from an expected nine years to less than four. The agreement required the private sector partner to operate and maintain the road for a 30-year period before transferring it over to MassHighway — providing an incentive for higher quality and containment of maintenance costs.[22] Whatever the funding strategy, creating funds for transportation innovations and maintenance is an ongoing struggle and an increasing problem as our nation's growth rapidly rises — but as evidenced, innovative financing models do exist. FS

↗ **After an energy retrofit,** the California DMV now exceeds the 2005 Title 24 energy code by 12.5% and realizes annual energy cost savings of $126,000.

BUILDING BETTER

BY JACK McGOWAN & BOB GRAVES

CONNECTING OUR COMMUNITIES AND CREATING OUR FUTURE WITH A BETTER BUILT ENVIRONMENT

IN THE CITY PLANNING and urban simulation video game SimCity, players are tasked with founding and building communities while ensuring citizens are happy and budgets are kept in check. Releases of the game throughout the years have increased complexity of decision-making while making the depth of the simulation more "real" for the player.

While the extremely popular game has sparked the interest of many future urban planners, it has also likely left many shaking their heads once they meet the reality of city planning, urban design and infrastructure improvements. If only decisions could be made regarding the re-routing of an interstate or the construction of a community arena with ease and planners could see the immediate impact of that decision and how it affects the city overall. But it's simply not that easy.

Throughout history, cities have served as hubs of civilization. They have grown, expanded and evolved to fit the needs of their citizens. But the problem has been that different parts of the city have different needs, oftentimes leaving the overall whole overlooked. Siloed thinking and overspecialization can lead to mismatched parts — a Frankenstein-type conglomeration of well-intentioned projects that simply don't work together. Short-term needs have often come before long-term sustainability and resiliency. And the need for infrastructure has traditionally outpaced the ability to finance it.

In our first FutureStructure publication, we introduced the importance of viewing the city as a system and as a living thing that incorporates and organizes non-living components in service of its ends. In this issue, we take that farther and focus on two of the most important parts of any city system — transportation and the built environment. In the previous two articles in this issue, we focused on the soft, hard and technological components of optimizing our transportation systems. Now it's time to focus on the built environment.

When we talk about the built environment, we mean the man-made things you see when you walk out of your front door. It's all of the artifacts we humans have constructed over time and continue to update — our buildings, roads, power plants, parks, reservoirs, airports and more. It's the places we go and the things

MITHUN

we use to get there. It's the critical infrastructure that our communities need in place to attract industry and citizens and position the city to thrive economically and socially for years to come.

The Big Picture: Thinking Differently About Building

The urbanization of the world is rapidly increasing. One hundred years ago, 2 out of every 10 people lived in a city, but by 2010 this number had increased to 5 in 10. It is projected that by 2030, 6 out of 10 people will live in a city. Sixty million people become urban residents every year.[23] This type of growth requires innovative thinking to promote resilient, thriving communities that are economically sound — in short, good places to live for the people who live there.

The built environment has an enormous impact on a city's ability to succeed or fail — and what once "worked" is often no longer an attractive asset. No city knows this better than Houston. Thought of as a city of sprawl, the Houston metropolitan area is spread out and requires an automobile to navigate. The city, however, is straying from its roots and making moves to become more compact, with options for public transportation and communities made for walking and biking. Mixed-use areas, part development, part residential, with shops and restaurants, are taking the place of traditional suburban communities dotted with homes and nothing else.

El Paso, too, is taking a cue from trendy cities like Portland and Austin. Drawing on principles of new urbanism, city officials wanted to create more livable communities. The city had been impacted by sprawl and infrastructure had traditionally been designed in mind for transportation of the four-wheeled variety. Every commercial building was surrounded by parking lots and kept firmly separate from residential areas — the two linked only by roads and highways. Now, design quality has become the focus for not just better designed corner street stores, but also for a number of large-scale projects the city is funding, including a new museum, arena, ballpark, cultural center and parks.[24]

FACEBOOK/PHX RENEWS

↗ **Phoenix** is a leader in exemplary municipal energy management and is recognized for best practices in setting goals for reducing energy use in local government operations. One of the city's sustainability projects, "PHX Renews," transformed 15 acres of vacant land into sustainable public space for community gardens, outdoor classrooms and public art.

In Denver, the Auraria West Redevelopment is a project designed to revitalize the downtown area. Through a public-private partnership, the Community College of Denver, Metropolitan State College of Denver and the University of Colorado at Denver will share facilities, including a student center, classrooms, faculty and student housing, and a large underground parking garage. Also included are retail developments and a transfer station for the RTD light rail system that could accommodate a streetcar connecting Auraria to the city's urban core. With work already well underway, the latest version of the Auraria Higher Education Center's master plan calls for "strong physical and programmatic connections from the campus to Denver's core." The overall idea is to move away from the suburban office-park model of the original campus design to a "highly urban environment inspired by the nearby urban neighborhoods of Lower Downtown."[25]

Too often city planning has occurred in a vacuum, without taking advantage of local resource strengths. Building took place one project at a time. But once hard infrastructure is set in place it dictates how residents connect, or, conversely, are disconnected from each other. Building for the future requires a systemic view of the entire built environment and how one project will affect the whole. Thinking differently requires building for what the populace might need 30 years from now — not only what they need today.

For its part, the Metropolitan Washington Council of Governments is using a tool called State of Place to guide its efforts to improve the region's walkability and economic performance.[26] Developed by Mariela Alfonzo, Ph.D., research fellow at NYU-Poly, it is a place rating and walkability diagnostic tool that informs economic

↗ The Auraria West Redevelopment is a project designed to revitalize downtown Denver by having the Community College of Denver, Metropolitan State College of Denver and the University of Colorado at Denver share facilities that include retail developments and a transfer station for the RTD light rail system.

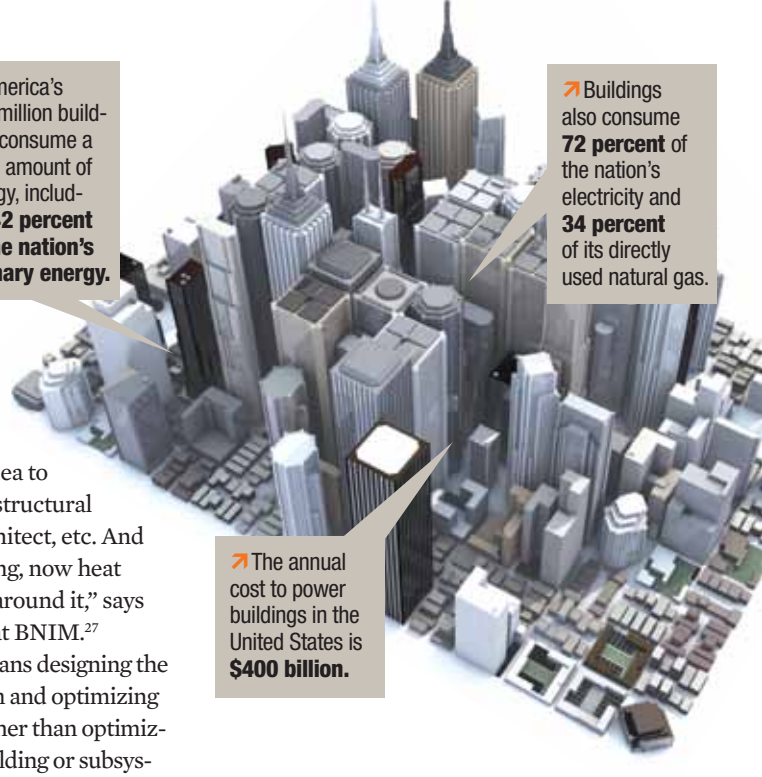
AIA

development, guides investment, aids place branding and enhances communities. Community members and planners in over 95 neighborhoods are making block-by-block assessments of some 250 features within 10 different urban design dimensions. The tool pulls existing data together and gives a profile of what's working and what makes the most sense to change.

Drilling Deeper: Integrative Design of Buildings

Important too is the people at the table when planning takes place. Gone are the days where a master builder strategized, planned and executed a building, a project or even an entire city. In our first Future-Structure publication, we noted the "problem of specialists." Not that specialists and specific jobs aren't needed, but that their creation has led to a silo of information and the lack of a holistic view. The Rocky Mountain Institute, an organization dedicated to sustainability — particularly in the areas of energy and resource efficiency — advocates for integrative design for the built environment. Integrative design starts with getting input earlier in the building process — including input from people that would not normally be involved until later in a project. The ultimate goal is to design the building as a whole system.

Integrative design was used when implementing the energy efficient retrofit measures for the Empire State Building, which resulted in a 38 percent energy use reduction with an annual cost savings of $4.4 million.



America's 120 million buildings consume a huge amount of energy, including **42 percent of the nation's primary energy.**

Buildings also consume **72 percent** of the nation's electricity and **34 percent** of its directly used natural gas.

The annual cost to power buildings in the United States is **$400 billion.**

"Traditionally, buildings have been created by an architect with an idea who then gives that three-dimensional idea to a mechanical engineer, a structural engineer, a landscape architect, etc. And they say, here's the building, now heat it, cool it, put a structure around it," says Bob Berkebile, principal at BNIM.[27]

"Integrative design means designing the building as a whole system and optimizing it for multiple benefits rather than optimizing components of the building or subsystems of the building for single benefits," says Amory B. Lovins, chairman and chief scientist of the Rocky Mountain Institute.[28]

Integrative design has been used in multiple successful institute projects, including the energy efficient retrofit measures for the Empire State Building, which resulted in a 38 percent energy use reduction with an annual cost savings of $4.4 million, and the retrofit of the City and County Building for the city of Indianapolis. There, a diverse group of building industry experts identified opportunities, barriers and solutions to achieving significant energy savings. The research revealed that the since 1959, the city had pumped over 200 gal/min of groundwater from the lower parking deck due to a high water table, which could be used to heat and cool the building. The city and county recently signed an Energy Savings Performance Contract (ESPC) for 57 percent energy savings.[29]

Resources are also coming available to help community leaders make decisions about their important public assets. One such tool, developed by the Institute for Sustainable Infrastructure, is its new rating system called Envision that serves to guide public decisions on what should be built. Envision is designed to cover all civil infrastructure from roads, bridges and railways to solid waste landfills, water supplies, wastewater treatment plants, power transmission lines and the public spaces in our cities, towns and local communities. William Bertera, ISI's executive director, explains it this way, "We now have a way to help government prioritize needs and allocate resources for the physical infrastructure upon which everything else depends."[30]

Energy Efficiency

According to the Rocky Mountain Institute, America's 120 million buildings consume a huge amount of energy — 42 percent of the nation's primary energy, 72 percent of its electricity and 34 percent of its directly used natural gas. If America's buildings were a separate country, they would be the third biggest energy user behind China and the U.S. The annual cost to power buildings in the United States is $400 billion — as much as we spent on Medicare in 2009 — and much of that is wasted.[31]

Traditionally, energy use in our existing buildings has been tremendously wasteful, but new equipment technology and building materials, as well as better designs, improve energy efficiency and offer huge opportunities to save money, reduce impact on the environment and drive job creation in virtually every community across the country.

Phoenix is a leader with exemplary municipal energy management and is recognized for best practices in setting goals for reducing energy use in local government operations. The city closely monitors energy use and broadly communicates energy savings results. Mayor Greg Stanton says, "It is the leadership and commitment to sustainability

— coupled with great implementation — that drives great cities forward."[32]

After realizing that energy costs are the largest budget item after payroll, the city evaluated 300 buildings and identified and deployed efficiency projects that saved it $22.8 million. Phoenix also developed an energy savings reinvestment program, completing $4.4 million in efficiency improvements with reinvested energy savings. Additionally, Mayor Stanton's signature sustainability project, "PHX Renews," was launched in 2012. The initiative promises to transform 15 acres of vacant land into sustainable public space for community gardens, outdoor classrooms and public art.

Also a leader in energy efficiency, Hartnell Community College in California has been recognized for its high performance buildings and use of renewable energy sources. It serves as a model of infrastructure design and integration. The college's most recent solar project is expected to reduce electricity use at its Alisal Campus by more than 90 percent. "This project will help Hartnell College advance a number of our goals, including achieving improved sustainability at all three campuses and setting an example we hope will resonate across the state," says College President Willard Clark Lewallen.[33] "With many of our students looking to pursue careers in the emerging green economy, this project also serves as an extraordinary learning opportunity to perform project-based research."

Paying for Our Building

A significant hurdle to overcome is the upfront costs to upgrade building efficiency. City leaders are looking for innovative ways to encourage and incentivize owners to make changes to their properties. In this vein, a new private sector financing tool is rapidly coming into use called Property Assessed Clean Energy (PACE).

Cisco DeVries, president and CEO of Renewable Funding, initiated the first PACE district in 2008 while chief of staff for the mayor of Berkeley, Calif. "Financing doesn't motivate people to do something," DeVries adds, "but it's a way to get property owners to engage in their own interests and improve the community in the process."[34] California passed the first PACE legislation in 2008. Since then, 30 other states and the District of Columbia have passed similar enabling laws.

PACE allows property owners to defer the upfront costs of their improvements (which can include HVAC, insulation, solar, water conservation, etc.) and pay them back on their property tax bills over a period of up to 20 years. The loan is attached to the property, rather than tied to the homeowner. If the property is sold the debt continues on the tax rolls to be paid by the subsequent owners. To date, 180 PACE projects have been completed (43 of these being government buildings) totaling over $37 million in funded projects.[35]

↗ **Sacramento** Mayor Kevin Johnson launches the PACE-backed Clean Energy Sacramento project that is expected to create 1,500 jobs, $250 million in economic activity and $25 million in tax revenue for every $100 million invested.

FORBES

Sacramento Mayor Kevin Johnson has been a leading proponent of PACE as a tool to spur economic development and job creation. In January 2013, in partnership with Ygrene Energy, he opened the Sacramento Clean Energy Center. "Launching Clean Energy Sacramento is a major milestone in establishing this city as a national leader in the green economy," says Johnson.[36] "Not only are we making Sacramento a cleaner and healthier place to live, we're also putting Sacramento's hard-hit construction business back to work and revitalizing our economy at zero cost to taxpayers."

Clean Energy Sacramento launched with $22 million of prequalified projects in the pipeline, with more than 150 trained local contractors ready to begin work across the city. According to independent research conducted by ECONorthwest, every $100 million invested via Clean Energy Sacramento is projected to create 1,500 jobs, $250 million in economic activity and $25 million in tax revenue.

PACE monetizes the upgrade process by mining trapped value in buildings. Savings, generated by increased efficiencies, can be used to upgrade building components without need for public subsidy and provides a ready avenue to improve a community's commercial and residential building stock. Deeper energy retrofits that involve redesigning major systems from heating and cooling to the building envelope open up opportunities to modernize a building's appearance while simultaneously reaping significant energy savings.

Of course, PACE is not the only such financing tool available. But its rapid spread across the country shows the strength of interest by state and local governments to access new approaches. Other financing options include: energy savings performance contracting, mortgage-back financing, sustainable energy utilities, state and municipal loan programs, and utility-backed on-bill financing. FS

ENERGY, INNOVATED

Capitalizing on the Public Sector's 'Hidden' Resources

In this period of economic concern and uncertainty, governments fulfill a role of increasingly critical import. However, the cost of providing public services and carrying out the functions of government continue to increase while resources available to fulfill governmental mandates and missions can be scarce.

This dilemma's resolution may be in finding 'hidden' resources and using them wisely, as cities, counties and other public institutions around the country have already done, by partnering with Chevron Energy Solutions on hundreds of projects.

Numerous governments — including Kings County, Calif., Lemoore, Calif., and Brea, Calif. — have undertaken a wide range of solar, lighting and energy efficiency projects, which are expected to produce significant returns on investment. For example, Kings County is expected to save $12 million, Lemoore will reduce costs by $45 million and the City of Brea is expected to reduce its electricity expenses by 65 percent.

"The City of Brea's work with Chevron Energy Solutions will save millions of taxpayer dollars by cutting our energy consumption," said then-Mayor Roy Moore of the project. "[Our project also] positions Brea as an environmental leader in the county, and demonstrates fiscal responsibility by investing in long-term, sustainable projects that will benefit our community for decades to come."

Local economies benefit from these savings and the "multiplier effect" helps increase tax bases that further benefit city and county revenues. Renewable energy projects also provide significant environmental and educational benefits by connecting students with hands-on demonstration of science and math skills.

In an era of increasing costs and declining budgets, real solutions are being developed and implemented by cities and counties across the country.

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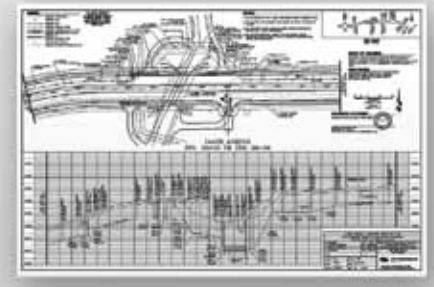

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