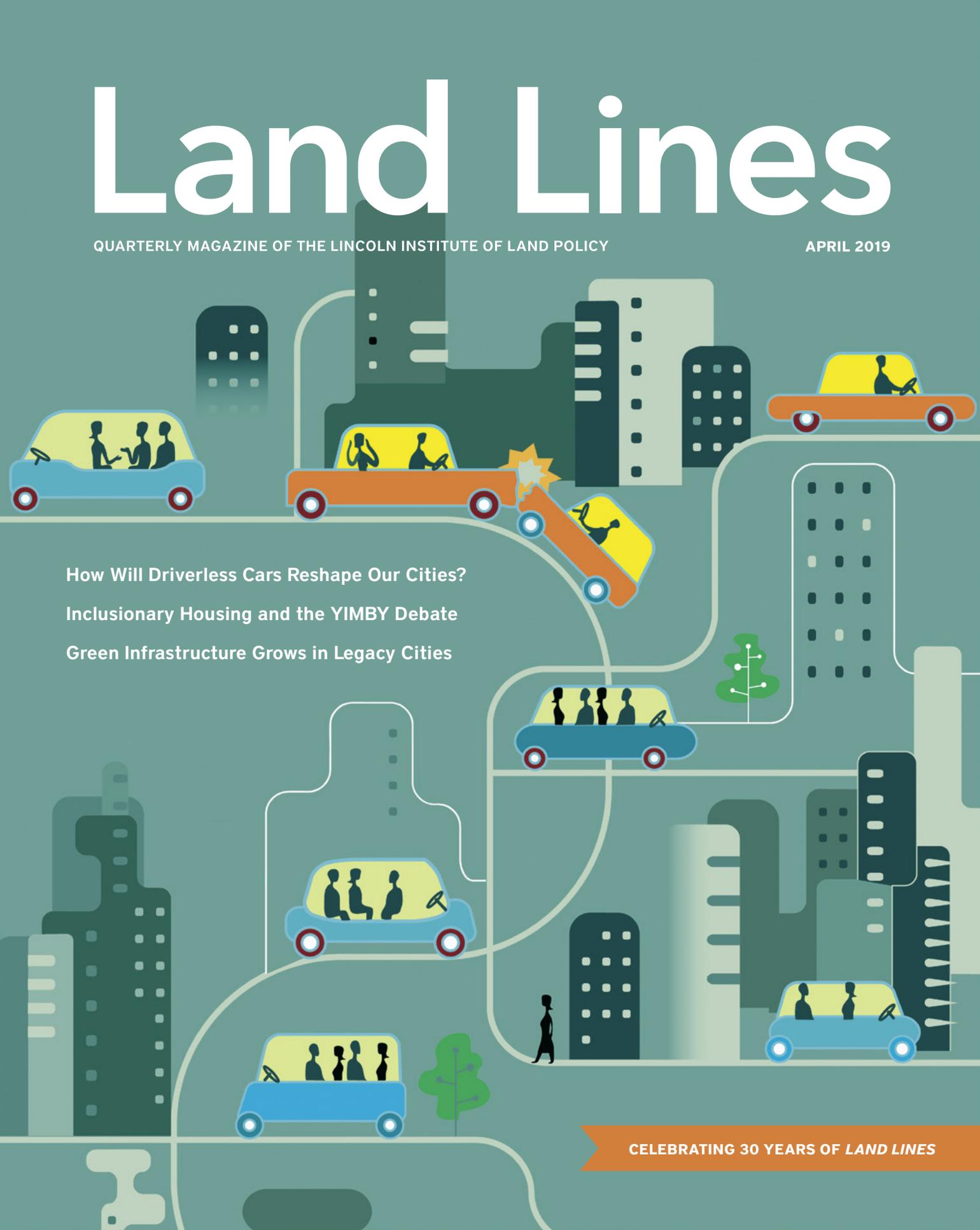


Land Lines

QUARTERLY MAGAZINE OF THE LINCOLN INSTITUTE OF LAND POLICY

APRIL 2019

A stylized illustration of a cityscape in shades of teal and grey. Buildings of various heights and shapes are scattered across the background. In the foreground, several cars are depicted on a winding road. The cars are in shades of blue and orange. Some cars contain silhouettes of people, while others are empty. One orange car is shown crashing into a yellow car, with a starburst effect indicating the impact. A person is shown falling out of the yellow car. The overall style is flat and modern.

How Will Driverless Cars Reshape Our Cities?
Inclusionary Housing and the YIMBY Debate
Green Infrastructure Grows in Legacy Cities

CELEBRATING 30 YEARS OF *LAND LINES*

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Land Lines is published as a digital monthly and print quarterly magazine to report on Institute-sponsored programs and related subjects.

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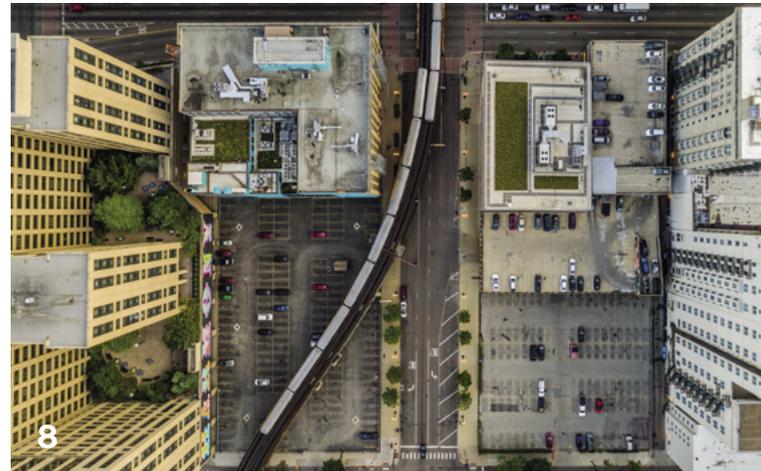
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Contents

FEATURES



8 Backyard Brouhaha

Could Inclusionary Housing Break the YIMBY Deadlock?

The movement known as YIMBY, or Yes in My Backyard, argues for removing barriers to development, but critics have raised concerns about the equity and impact of this approach. Now some communities are finding a compromise in the form of affordable housing requirements.

By Anthony Flint

20 Driverless Ed

Urban Planners Shift Gears as Autonomous Vehicles Hit the Streets

No longer a futuristic fantasy, autonomous vehicles are operating on city streets around the United States. Find out how planning and transportation officials are responding to the rapid evolution of mobility technology.

By Kathleen McCormick

32 Great Adaptations

How Two Smaller Legacy Cities Are Embracing Green Infrastructure

Connected by the Blackstone River and by a history of hard times, Worcester, Massachusetts, and Providence, Rhode Island, are demonstrating how green infrastructure projects can help forge a new urban future in the era of climate change.

By Cyrus Moulton

DEPARTMENTS

2 President's Message

Building the Cities We Need

By George W. McCarthy

5 City Tech

The Road to Smarter Transit Is Paved with Data

By Rob Walker

41 Mayor's Desk

Santa Monica Goes All-In on Sustainability

By Anthony Flint

45 Policy Brief

Scenario Planning

By Robert Goodspeed

49 Place Database

Brownfields and Flooding in Providence, RI

By Jenna DeAngelo



Utopia, dystopia, or something in between? The urban impact of autonomous vehicles remains to be seen. Credit: Ikon Images via AP Images



Building the Cities We Need

BY 2050, THE PLANET WILL be 70 percent urban, as we add some two billion residents to the world's cities. As we consider the history and future of these areas, our biggest challenge may be redeveloping land that is already used or occupied. Maintaining, managing, and growing a city where buildings and people already are rooted is much harder than creating one from scratch. Where and how we accommodate new populations will set the stage for human habitation for the rest of this millennium. In this century of the city, we must find ways to build the cities we need.

Future urban growth will not take place in megacities. All indications suggest that population growth is plateauing in the 30 or so places with more than 10 million residents. The fastest-growing cities are the ones with current populations between 100,000 and one million. These cities do not and will not have the capacity to manage growth. How will they pay for the infrastructure—highways, bridges, gas lines, and the like—to double or treble their size? Will they be choked with unplanned development, adding to the one billion people already living without public services?

Beyond the logistical and financial challenges, a separate concern relates to the identity of cities. How much do we care about the relationship between people and their places? Are we prepared to protect the integrity of cities and the people who live in them by preserving their “character”? Will we have the luxury of forgoing expedience for individuality? If we accept that most of the world's cities do not have the resources to plan and manage their own future growth, then we concede the design and form of future cities to market forces. This portends a

future of urban sameness, a dystopia straight from Le Corbusier: all cities looking like forests of “towers in the park,” expedient and soulless.

If recent and historic efforts to redevelop urban neighborhoods are any indication, urban residents might not be so quick to accept expedient solutions. In Dharavi, a Mumbai neighborhood made famous in the movie *Slumdog Millionaire*, 700,000 people live on less than one square mile of land. In 2006, an advocacy group decided to “improve” the living conditions of thousands of people who lived in the slum by building high-rises and trying to persuade people to move. Despite offering indoor plumbing, secure roofs, and the like, this group was stunned to have few takers. They were mystified that no one wanted to leave for modern accommodations. But they hadn't done their homework: Dharavi produces an estimated 25 percent of the gross domestic product of Mumbai. The residents didn't just live there, they worked there. They weren't willing to trade their livelihoods and shelter for better shelter, no matter how much better.

Plans are still afoot to develop Dharavi, which sits on the most valuable real estate in Mumbai. It will be difficult for its poor residents to protect themselves from the inexorable power of the market. But if we were committed to defending the rights and interests of the residents, could we imagine a future centered not on high-rises, but on more creative land use providing shelter and promoting livelihoods? What would that take? Where can we look for good examples of responsive redevelopment?

In the United States, our history is not replete with successful examples of urban redevelopment. Early attempts at slum clearance through the construction of public housing are eerily

similar to the efforts in Mumbai. Ironically, building public housing was not a housing strategy. Congress passed it as a livelihood strategy, designed to reemploy idle construction labor during the Great Depression.

In the postwar era, the federal government devolved redevelopment to local authorities through Urban Renewal. A famous case involved the redevelopment of Boston's West End in the mid-1950s. Using (or misusing) eminent domain, the city obtained hundreds of homes that were owned by middle-class white families, citing their poor condition and the need for “higher and better use.” Neighborhood residents tried to stop the process through local organizing, protest, and the courts. They failed. The neighborhood was replaced by market-driven development. By 1964, more than 18,000 historic buildings in the United States were lost to urban renewal, says the Trust for Historic Preservation.

Informed by the Boston experience and the demolition of New York's original Penn Station, an “improvement” against which she had protested, activist and author Jane Jacobs organized others to prevent the wholesale destruction of the urban fabric of New York City when developer Robert Moses proposed a crosstown highway through Greenwich Village. Jacobs ushered in a multipronged approach to oppose abusive, top-down, centralized planning.

In Dharavi, a one-square-mile neighborhood in Mumbai, India, that's home to 700,000 people, tensions have existed between externally designed “improvements” and the actual needs of residents. Credit: Urbz/Flickr CC BY-NC 2.0



Organized resistance was the first prong; coalition-building was the second; but it was land use policy that created the framework for hundreds of others to defend their cities.

Jacobs' coalitions enlisted New York housewives and powerful allies such as Eleanor Roosevelt and Lady Bird Johnson, who not only found the human toll of urban renewal intolerable, but also mourned the loss of culture and history. Mobilizing others can help us protect urban history and culture. Including powerful allies helps even more. But to scale up one's efforts requires more powerful tools—policies that prevent what one wants to prevent and promote what one wants to promote. It requires carrots and sticks.

The National Historic Preservation Act (NHPA), signed into law by President Johnson in 1966, was the stick, requiring review of historic structures before demolishing them to redevelop neighborhoods. The Historic Tax Credit, enacted in 1978, provided the carrot. Because it might be costlier to redevelop historic buildings and adapt them for new uses, the tax credit sweetened the pot—paying for the public good that was preserved in the historic structures and making redevelopment financially feasible. Thirty-five states have followed suit with their own historic tax credit programs to supplement federal funding. Thus began the rebound of American cities. More than \$120 billion was invested in adaptive reuse of buildings from 1981 to 2015, says the Trust for Historic Preservation.

What are the challenges of urban redevelopment today? One is the persistence of “highest and best use” planning. In a talk I gave last year in Guangzhou, China, planners could not conceive of why Jacobs' prevention of a highway across lower Manhattan was considered a success. They argued that achieving highest and best use was the planner's job. Keeping old buildings and neighborhoods intact was not. Top-down planning predicated on narrow objectives is almost guaranteed to reproduce the results of urban renewal, at the expense of culture and history.

Urban activist and author Jane Jacobs in New York City in the 1960s. Credit: Bob Gomel/The LIFE Images Collection via Getty Images



Urban communities everywhere are at risk of displacement from a second, bigger challenge and a faceless new villain: global capital capturing real estate in cities across the globe, making them less livable and less affordable. In spite of the global financial crisis of 2008, urban real estate is considered a safe harbor for capital, especially in places with stable currencies like the United States. In the 12-month period ending in March 2017, foreign investors purchased 284,455 U.S. homes, spending more than \$150 billion, according to CNBC. According to Statistica, 52 percent of foreign real estate purchases are in the suburbs, while 27 percent are in central cities. In some cities, more than 20 percent of all real estate investment comes from outside the country. Global investment includes domestic capital as well, and it flows not only to U.S. destinations, but also to growing cities around the world. This capital distorts housing markets and makes urban areas, from California to China, unaffordable for the people who live there. It also distorts supply markets, dictating what will be built based on the tastes of part-time residents and speculators.

What can be done? What would Jacobs do? I am sure she would mobilize local residents to reclaim power over land control and teach about the consequences of treating housing as a tradable commodity. Part of mobilizing is to get more stakeholders to the table. She would no doubt use new tools to engage citizens in urban planning, like the tools that helped build the Detroit Future City plan. By using everything from online games to data visualizations, Detroit planners secured input from more than 100,000 residents.

To scale this effort, she would need new land policy tools, sticks and carrots, to motivate developers to build the cities residents need, not the real estate investors want. Sticks might include surcharges on outside investment, like those recently enacted in Vancouver and Toronto. They might include significantly higher property tax rates combined with very high homestead exemptions to increase holding costs for properties owned by nonresidents. Buildings might be protected from speculation using devices like community land trusts. Carrots might include approval for additional development through density bonuses for developments that preserve urban character, offering residents the opportunity to live and work in closer proximity. And the carrots should also include subsidies to motivate developers to build the right developments—those that preserve the character of the city by supporting residents and their livelihoods.

As a society, we have made, and continue to make, lots of mistakes. But those of us who want to help create more sustainable and equitable cities must do two things: find more effective ways to engage and mobilize people and find the policies to work at scale. This is a time to ask, “What would Jane Jacobs do?” While she did not get it all just right every time, she did compel us to find creative ways to make cities work while preserving their culture and history. Cities that were more welcoming, that could provide both shelter and work. Cities that facilitated social interaction, not just commerce. That is a tall agenda, but it’s one that we should aspire to achieve. It is critical if we are going to survive beyond this century of the city. □

The Road to Smarter Transit Is Paved with Data



“WHAT GETS MEASURED, gets managed,” goes the business truism. For better or worse, the idea applies to the design of cities and infrastructure, too.

And the emergence of big data—massive sets of raw information made possible by new collection and storage technologies—is making possible new measurements that can inform how state transportation agencies plan and manage their projects.

Consider the work being done by the State Smart Transportation Initiative (SSTI). Founded in 2010 at the University of Wisconsin, SSTI uses new data troves to guide real-world land use and planning decisions. By combining and analyzing data on questions ranging from how people access transit stations to how easy it is for them to get to work or the grocery store, SSTI is shedding light on patterns that can inform future decision making.

New data analysis is shedding light on questions ranging from how people access transit stations to how easy it is for them to get to work. Credit: Judy van der Velden/Flickr CC BY-NC 2.0

In 2018, SSTI began operating in partnership with the nonprofit Smart Growth America, whose programs include serving as a resource for state departments of transportation and collaborating with SSTI on multiple editions of *The Innovative DOT: A Handbook of Policy and Practice*, a guide “for DOTs committed to innovative excellence.” The partnership now works with more than a dozen transportation agencies, functioning as a kind of policy knowledge base and providing direct technical assistance.

One key to making the most of big data is finding the right framing. “Accessibility means looking at ‘how accessible is this place?’ as opposed to ‘how fast are the cars going on a certain part of road?’” explains SSTI Director

“Accessibility means looking at ‘how accessible is this place?’ as opposed to ‘how fast are the cars going on a certain part of road?’”

Eric Sundquist. This more holistic approach is not a new idea, but it’s one that’s gaining momentum, partly because of richer data and more sophisticated tools for sorting it. In recent research, SSTI defined accessibility as “the ease with which people may reach opportunities such as jobs, stores, parks, schools, and other destinations. ‘Ease’ is measured in terms of travel time, with some adjustments to account for how travelers use the system.”

Among other projects, SSTI has been working with the Virginia Department of Transportation, whose Smart Scale program draws on big data to “score” transportation proposals submitted by counties and municipalities on their likely ability to improve accessibility to jobs. The most recent round also incorporates access to nonwork destinations such as shopping and parks.

As an example, an SSTI planning exercise focused on improving nonwork-destination access in Vienna, Virginia. One track of analysis explored how beefing up a walking network and bike path could better connect the town’s main street to other neighborhoods. But another track considered a scenario that involved a shift in land use: encouraging the commercial development of an underused area on the southern edge of town. The latter actually led to higher-scoring accessibility improvements than the hypothetical transportation projects.

This scoring scheme draws on population, employment, and land use data; auto data; transit service data that’s now largely reported in a consistent format thanks to Google Maps; and bike and pedestrian data. Depending on the project, more data can be added, like job categories and neighborhood income. This opens up broader thinking about how “accessibility” can be improved, measuring whether the best

option is building new pedestrian infrastructure or working to place a grocery store in a food desert.

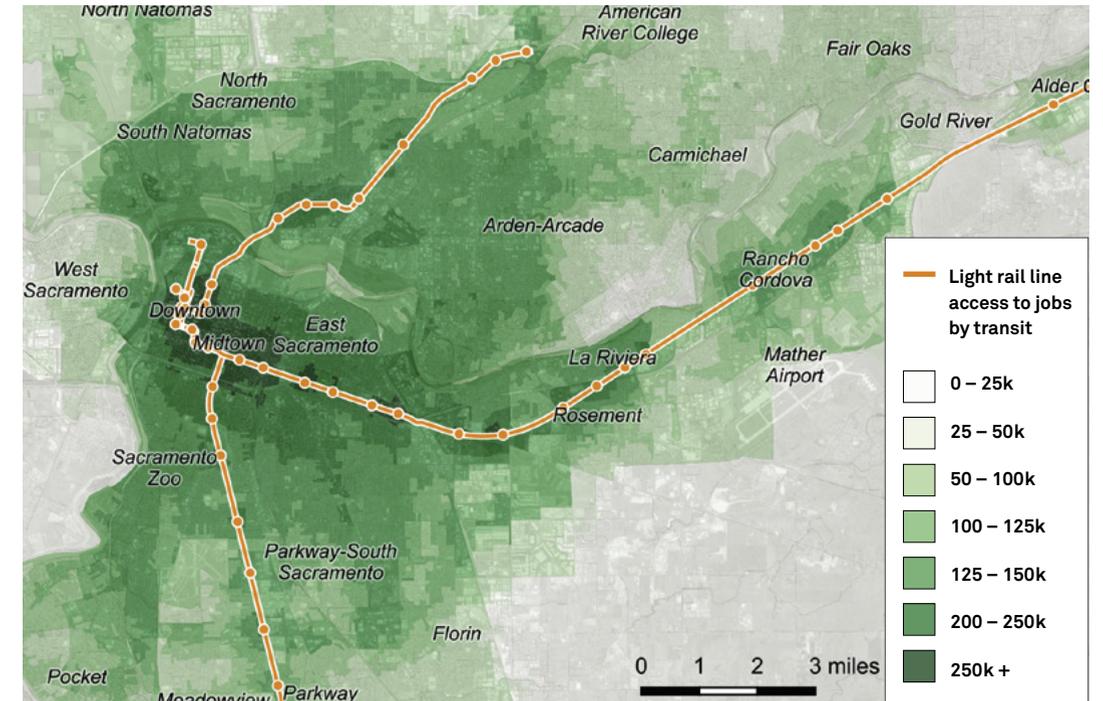
“We’ve made people aware of this in our community of practice,” Sundquist adds, so that other DOTs can build on the same ideas. And indeed, transportation officials from Hawaii recently worked with SSTI to try to take the scoring process “a step further,” he continues. “We scored all their projects on a weighted accessibility basis. So if a project provides more access by transit in relation to auto, it will suggest how modes might shift.” The state is evaluating SSTI’s results now.

Such data represent both improvements on existing information gathering methods and measurements that are altogether new, observes Amy Cotter, associate director of Urban Programs at the Lincoln Institute.

For example, she says, planning decisions have often relied heavily on transit survey results, which are “expensive to collect and sometimes questionable.” So the emergent technologies SSTI is harnessing—including “trip-making data” culled from services that aggregate information from GPS-enabled vehicles, navigation devices, and even smartphone apps—are an enticing alternative. “These new data are providing better information at lower cost to prepare agencies, planners, and state DOTs to make better decisions,” Cotter says.

The Lincoln Institute partnered with SSTI in a 2017 project, “Connecting Sacramento,” along with a variety of public and private entities and stakeholders. The resulting study, which catalyzed much of SSTI’s more recent work, sought to assess how these new data sources, and new tools for understanding data, could help improve transportation policy.

The Sacramento research included a case study on walking trips to and from a particular transit station. SSTI worked with traffic analytics start-up StreetLight Data, which has devised methods for assessing GPS signals with machine learning to distinguish walking and biking behaviors. Walking and biking have at times “gotten short shrift” in planning efforts, says Sundquist, precisely “because they’re so hard to measure.” So adding this new information to other



One of the maps from “Connecting Sacramento,” a project conducted by the State Smart Transportation Initiative with partners including the Lincoln Institute. The study assessed how new tools and data could help improve transportation policy. Credit: State Smart Transportation Initiative

transportation and land use data sets can lead to new discoveries. In this case, the data pointed out an unexpectedly high percentage of foot trips between the transit station and a particular cluster of office buildings. This was surprising, given that the buildings not only had ample parking, but also were accessible on foot only by way of a single route—across a freeway. The study argued that, in light of this finding, improved or additional access points would improve conditions for current commuters and encourage more to join in.

Such analysis, of course, can often be miles ahead of the realities facing a state department of transportation. But programs like Virginia’s Smart Scale rating system suggest what big data analysis might lead to. Continuing advances in data collection and analysis should mean we will be better able to evaluate the impact of any given

project, and better able to compare that to what was predicted—and adjust for the future.

The “what gets measured gets managed” cliché is sometimes used, inappropriately, to argue that what isn’t (or can’t be) measured also can’t—or even needn’t—be managed. But as Sundquist argues, these new forms of transportation data and analysis can be considered as an opportunity. They can reveal practical, actionable information. And they can also help planners, transportation managers, and others think creatively about what they wish they could measure next. □

Rob Walker (robwalker.net) is a journalist covering design, technology, and other subjects. His book *The Art of Noticing* will be published in May 2019.



BACKYARD BROUHAHA

Could Inclusionary Housing Break the YIMBY Deadlock?

By Anthony Flint

IN THE FEW YEARS since the Yes in My Backyard movement splashed on the scene in cities across the United States, the YIMBY mantra has been persistent: Clear away the regulatory barriers and let developers build more housing. The laws of supply and demand will take over, this argument goes, and ultimately prices will go down. But the backlash against the YIMBY movement has been strong, as community activists have warned that increased development actually makes things worse. They worry, with some evidence, that the zoning changes YIMBYs are advocating for only accelerate gentrification and displacement—disproportionally harming low-income families and communities of color.

Those concerns were enough to derail YIMBY-sponsored legislation in California last year that would have fast-tracked multifamily housing production around transit stations. Coalitions of low-income families and social justice advocates, in increasingly harsh terms, denounced the pro-growth approach and proclaimed that in some transitioning neighborhoods, it might be better to halt new building altogether.

The controversy roiled further as critics of the YIMBY movement asserted that it skews too young and white to effectively understand or address the housing-related realities faced by residents of neighborhoods in transition. Meanwhile, research has cast doubts on the very premise that the market can solve the affordability challenge.

Research on zoning reforms in Chicago and other cities confirms that the relationship between supply and affordability is far from simple. Credit: Razvan Sera/EyeEm/Getty Images

In the midst of this messy situation, a potential compromise has begun to emerge thanks to forward-looking policy makers: Increasingly, cities are formalizing the requirement that new residential development include a percentage of affordable homes, the policy known as inclusionary housing. The principles of land value capture form the foundation of such mandates for affordability, which allow the public to recover some of the increased property value enjoyed by landowners as the result of government actions like rezoning.

“[Upzoning] generates a lot of value. There’s widespread agreement on that,” said Rick Jacobus, principal at Street Level Advisors in Oakland, California, who wrote *Inclusionary Housing: Creating and Maintaining Equitable Communities* for the Lincoln Institute (Jacobus 2015). With affordability requirements, he says, communities “can recover that value and put it to work for the public, and benefit the people who would not otherwise be the beneficiaries of real estate development—and indeed have suffered from it in the past.”

The mantra of the Yes in My Backyard movement has been persistent: Clear away the regulatory barriers and let developers build more housing. The laws of supply and demand will take over, this argument goes, and prices will go down. But the backlash against the movement has been strong.

This reframing of the urban development paradigm—the notion that when government clears the way for more building, the public can expect something in return—has become the basis for fledgling coalitions from Seattle to Minneapolis and beyond. Some in the YIMBY movement still view inclusionary housing requirements as another barrier that gets in the way of increased housing supply. But others say this new way of looking at the relationship among builders, government, and neighborhoods may be the key to breaking the deadlock—and that it could be one more step toward building cities that are livable for all.



YIMBY advocates turned out for a rally in San Francisco to support SB 827 in 2018. The proposed legislation would have fast-tracked multifamily housing production around transit stations. Credit: Jef Poskanzer/Flickr CC BY-NC 2.0

Born of Backlash

In high-cost cities from Seattle to Boston, the housing affordability crisis is extending its reach to the point where even middle- and higher-income people are getting priced out. As a result, political energy is spreading beyond long-standing advocates for affordable housing to include new stakeholders, many of whom are focused on zoning and other regulatory barriers to development. These are the people who have organized under the banner of Yes in My Backyard, or YIMBY. It's a counterforce to those who oppose development in their neighborhoods—a mindset, if not quite an organized movement, long known as Not in My Backyard, or NIMBY.

The YIMBY movement has roots in Europe and Canada, and arguably first gained momentum in the United States in San Francisco, as millennials and those in the burgeoning tech industry became frustrated with the lack of new housing supply. (See Figure 1, page 17.) The YIMBYs received national attention last year with a bill—written by a California YIMBY group and

backed by Silicon Valley money—that would have required cities to allow denser development near transit, regardless of local zoning.

Though now facing pushback, the YIMBY movement was itself born of backlash. Ever since cities across the country started making a comeback in the 1980s, infill redevelopment in established urban neighborhoods has been stymied by outdated zoning and codes, Byzantine regulations, onerous requirements such as extensive off-street parking, and so-called exclusionary zoning that favors large lots and discourages multifamily housing. YIMBYism arose in large part out of frustration with neighborhoods saying no to new housing supply.

Established residents of every political persuasion have often been stubbornly resistant to change in their midst, embracing the regulatory barriers—all the hoops developers had to jump through—as much-needed protection. “They’re worried about their views, traffic, parking, and a new demographic coming into their community,” said Mary Lydon, a housing consultant in San Diego, where Mayor Kevin Faulconer recently announced he wants to be the first YIMBY mayor. At the mere proposal of increased density along transit corridors, she said, people “become unglued.”

Economists and land policy scholars have thoroughly documented the NIMBY dynamic.

William Fischel at Dartmouth College, author of *The Homevoter Hypothesis* (Fischel 2001) and *Zoning Rules!* (Fischel 2015), showed that concern about individual property values was driving much of the resistance to further growth. In *Triumph of the City* and numerous papers, Harvard University professor Edward Glaeser illustrates how land use regulations, exclusionary zoning, and even historic preservation are hobbling urban economies because there isn’t enough housing available for workers (Glaeser 2011).

Research on four booming cities in Texas—Dallas, Houston, San Antonio, and Austin—indicates that Austin’s housing got more expensive more quickly than in the other metro areas. The distinguishing factor was that Austin, by comparison, had more extensive regulations and permitting requirements that either discouraged density or led to long construction delays (Shannon 2015).

Add more housing, the YIMBY advocates claimed, and the demand for that product will get absorbed, leading prices to drop—a basic rule of economics. Even new luxury housing

could have a salutary effect, they argued, in a process known as “filtering”: wealthier residents moving into a new penthouse downtown free up the aging town house in outlying neighborhoods, which in turn liberates a triple-decker down the street that will command lower rents.

The mantra to build, build, build has also been buttressed by an environmental argument: that cities have an obligation to cluster height and density at transit stations, to cut down on carbon emissions. The combination of climate change and the affordability crisis amounts to a national emergency, said Dan Bertolet, senior researcher at the Sightline Institute in Seattle, a research organization promoting environment and equity in the Pacific Northwest.

“We need to focus on the big picture: cities like Seattle need to add as much housing as [they can] as fast as possible. People seem to get hung up somehow on the fairness of that . . . that landowners and developers are bathing in gold coins,” he said. The wave of tech jobs in such cities should be seen as a “gift,” he said, that will ultimately boost the entire city.

Land value capture is a policy approach that enables communities to recover and reinvest land value increases that result from public investment and other government actions. It’s rooted in the notion that public action should generate public benefit.



New residential construction in cities like Seattle increasingly comes with requirements that developers reserve a portion of the project for affordable housing. Credit: Ajay Suresh/Flickr CC BY-NC 2.0

“Developers build, supply increases, prices start to roll off—they are right now in Seattle, rents are down—and then developers stop because they can’t make money anymore. City governments should lower all the regulatory costs and all the things they can control, so developers will keep going, and lower the baseline rent as much as possible, before they stop,” Bertolet said.

“People say building all this supply won’t solve the [affordability] problem, and that’s true,” he said, noting that low-income families will still need subsidies and forms of public housing. “But if you build as much as you can, you make the leftover subsidy problem smaller. Who wouldn’t want to do that? We all know public housing is hugely expensive to build.”

The California Experiment

For all its apparent logic, the YIMBY movement was dealt a serious setback last year, when the California legislation fast-tracking density at transit stations, SB827 by San Francisco State Senator Scott Wiener, died in committee. Traditional housing affordability advocates concerned about gentrification and displacement formally parted ways with the cause for increasing supply. YIMBY advocates were accused of not understanding real estate realities on the ground, particularly in communities of color.

The basic problem was that the legislation did nothing to counteract historical patterns of racialized displacement and dispossession by real estate investment capital, University of Southern California urban studies Professor Lisa Schweitzer wrote on her blog during the fractious debate. The growing perception was that the California measure gave the green light to developers without addressing equity concerns. The San Francisco Planning Department noted drily that SB827 would provide “huge additional value to property owners throughout the state, without concurrent value capture.” On the



A coalition of neighborhood groups on the front lines of Boston's displacement crisis protested at the national YIMBYtown conference held in the city in 2018. Credit: Lauren Miller

Crenshaw Subway Coalition's website, Damien Goodman was more forthright, describing the legislation as “a declaration of war on South LA.”

The political disintegration in California augured much more acrimony to come. A flier in Oakland called for “autonomous action/creative intervention/sabotage” against a scheduled gathering of the “pro-gentrification YIMBY party” descending on the community “to plot our total destruction.” In the fall of last year, when YIMBY organizers chose the Roxbury section of Boston—a neighborhood facing intense gentrification pressure and rising prices—as the site for their national conference, called YIMBYtown, a coalition of local social justice groups organized a protest under the banner Homes for All. Bearing spools of caution tape imprinted with the words “No Displacement Zone,” they interrupted the closing plenary, which featured a speaker from the National Low Income Housing Coalition.

“We believe the people closest to the pain are people who have the answers,” said Armani White, a Roxbury resident working with a group called Reclaim Roxbury.

Hallah Elbeledy, policy analyst of Urban Programs at the Lincoln Institute, helped organize the YIMBYtown conference as a volunteer and focused on offering a program that featured critical and different viewpoints. The protest led to some soul-searching within local YIMBY and YIMBY-aligned organizations, she said, but didn’t necessarily lead to meaningful

“We believe the people closest to the pain are people who have the answers.”

change. “Those they declare to want as neighbors aren’t represented in their organizations in a meaningful way, nor in the neighborhoods in which they reside,” says Elbeledy. “While there are some uncontrollable factors at play, YIMBY advocates must examine and respond to how far from these individuals they really are, and not just spatially.”

Reflecting on the experience of being the subject of protests and the discomfort these very necessary conversations can bring, Elbeledy penned an essay titled “Getting Comfortable with Being Uncomfortable” in *Planning* magazine (Elbeledy 2019). In the piece, she urges greater collaboration among housing advocates: “We cannot accept a siloed approach to a problem fundamentally relevant to every individual.”

Examining the Premise

One of the most potent arguments in the backlash against the YIMBY movement is that its basic premise is all wrong. “We’re challenging YIMBYs to stop promoting the myth that the market can solve the affordability and displacement crisis,” said Lori Hurlebaus of Dorchester Not for Sale, during the Roxbury protest.

Well-established research shows that excessive regulations, exclusionary zoning, and NIMBYism can lead to higher prices. But there is little definitive evidence in the current literature that removing barriers and adopting upzoning brings prices down.

Some studies use econometric modeling and survey data that shore up the YIMBY argument. In *The Long-Term Dynamics of Affordable Rental Housing*, researchers at the Hudson Institute and Econometrica Inc. found that from 1985 to 2013, nearly half of rentals affordable to low-income families existed previously as homes owned or rented by higher-income residents (Weicher 2017). Stuart Rosenthal at Syracuse University estimated that this filtering occurred over roughly the same time period at a steady rate of 2.5 percent per year (Rosenthal 2014).

Well-established research shows that excessive regulations, exclusionary zoning, and NIMBYism can lead to higher prices. But there is little definitive evidence in the current literature that removing barriers and adopting upzoning brings prices down.

If new housing isn’t built, wealthy newcomers have no choice but to bid on existing homes, driving up prices and derailing the filtering process, said New York University Professor Roderick M. Hills, Jr. In this view, it would defy the laws of economic gravity to assert that building more supply somehow exacerbates affordability problems. “Attributing rent increases to new market-rate housing is like attributing rainstorms to umbrellas,” Hills wrote in *The Washington Post* (Hills 2018).

Other studies, however, suggest that what’s actually happening on the ground is far more complicated. An extensive review by New York University’s Furman Center found that, “from both theory and empirical evidence . . . adding new homes moderates price increases and therefore makes housing more affordable to low- and moderate-income families.” But the study also quickly emphasized that “new market-rate housing is necessary but not sufficient, and that government intervention is critical to ensure that supply is added at prices affordable to a range of incomes” (Been 2018).

A 2018 Federal Reserve paper by Elliot Anenberg and Edward Kung confirmed that housing demand has low elasticity—meaning essentially that consumers continue to pay higher prices despite increases in supply—and that rents may be more determined by the amenities in desirable or transitioning neighborhoods (Anenberg 2018). The implication is that even if a city were able to ease some supply constraints to achieve a marginal increase in its housing stock, that city would not experience a meaningful reduction in rental burdens.

In some cases, neighborhoods that are targeted for zoning reforms allowing greater



More than 25 percent of the units at Green on Fourth, a new apartment complex in Minneapolis, will be designated as affordable housing. Credit: Timberland Partners



With a new rail line in Honolulu increasing property values along the route, affordability requirements will help ensure that the community sees benefits. Credit: Van Meter Williams Pollack

height and density see prices rise very quickly—before a single foundation is poured. That was the conclusion of an MIT study published in January 2019 in *Urban Affairs Review*, looking at land parcels and condominiums in catchment areas around transit stations in Chicago that had been rezoned for taller and denser buildings (Freemark 2019). An important caveat was that there was a lag in permitting and construction of new projects, so supply wasn't actually increased. But because the city signaled that density would increase, the research concluded that the "short-term, local-level impacts of upzoning are higher property prices."

Even if the massive introduction of supply eventually has a moderating effect, the urgency of the housing crisis is that there's no tomorrow. "Unfortunately, those facing pressures from increasing prices don't have the luxury of time—they can't pay the difference and wait for a better deal down the line," said Elbeleidy.

Cities Move Forward

While this battle plays out, policy makers and housing advocates are making adjustments on the ground. Many are tying upzoning to affordability requirements such as inclusionary housing, where new residential development must include a percentage of affordable

homes—typically 10 to 15 percent as a baseline—or funding so that the same amount of affordable homes can be built elsewhere in the community. (See Figure 2, page 18 for a map of local and statewide inclusionary housing policies.) Many cities are changing this policy from voluntary to mandatory. In California, lawmakers have worked with critics to redraft the density bill with statewide affordability requirements, as well as other protections for renters. The legislation also delays implementation for five years in neighborhoods most threatened by displacement.

In Minneapolis, the scene of extensive policy innovations around housing, the city laid the groundwork for increasing supply by easing restrictions in the downtown area, legalizing accessory dwelling units, and banning single-family-only zoning, to encourage more multifamily development. All of that was swiftly followed by a minimum inclusionary requirement of 10 percent for any project that gets increased allowable size, measured as floor-area ratio.

"This city council isn't going to upzone without that policy," said Minneapolis City Council President Lisa Bender. Even if it's not discussed on a daily basis, the concept of value capture provided a critical rationale for that reciprocity, she said. "We have made it easier to develop. We have given lots of benefits to developers—we've eliminated parking requirements, we have an amazing park system, streets, transit—all kinds

of investments that are creating a private benefit. And affordable housing isn't the only way we ask for some of that benefit back. We have a fee to help pay for the park system." That message—that taxpayers are constantly providing things that increase value for private landowners and developers—is hugely important, she said.

While expectations have permanently shifted, the city is constantly monitoring projects to make sure developers don't end up with undue burdens. One additional measure being studied is allowing the use of tax increment financing as a supplement to the inclusionary requirement—additional funding that could potentially double the number of affordable units from 10 to 20 percent.

"I think we're at a point in Minneapolis where we have a pro-growth, pro-equity

political coalition," Bender said. "Increasing supply is a necessary part of housing stability, but we insist that growth should help close our race and equity gaps, which are among the worst in the country."

Inclusionary housing requirements are either in place or on the way in other cities as well. Seattle's Housing Affordability and Livability program, for example, essentially now establishes a formula: if certain parts of town are upzoned, or projects get to be denser, larger, and taller, the obligation to supply affordable housing increases concomitantly. A few other examples:

- In **Honolulu**, a new rail line will boost private land values along its route. As such, the affordability requirements in Hawaii are seen as neither a gift by developers nor an extra charge—but rather, the recovery of a portion of the taxpayer-funded infrastructure project

Many cities are tying upzoning to affordability requirements such as inclusionary housing, where new residential development must include a percentage of affordable homes—or funding so that the same amount of affordable homes can be built elsewhere in the community.



San Diego Mayor Kevin Faulconer has embraced the YIMBY approach, vowing to increase density along transit corridors. Credit: Mid-Coast Corridor Transit Project



Vancouver, B.C., mandates developer contributions that fund affordable housing, bikeways, parks, childcare sites, and other amenities. Credit: Rick Schwartz/Flickr CC BY-NC 2.0

that is creating large increases in value for the private sector. “The public has invested billions of dollars into rail. That is increasing the property values around rail stations, and allowing people to build higher and more densely. That is all worth a lot and we need to get back some of our public investment by building more affordable housing,” said Gavin Thornton, co-executive director of the Hawaii Appleseed Center for Law and Economic Justice.

- In **San Diego**, the multipronged approach includes removing height restrictions and minimum parking requirements, an unlimited density bonus for any project that includes affordable housing, a 10 percent inclusionary standard, and by-right zoning approval for affordable housing and housing for the homeless. A plan to vastly increase allowable height and density along a new transit corridor is set to be accompanied by the provision of land near stations owned by the regional transit agency.
- **Vancouver**, B.C., is divided up into six districts that determine contributions by developers, known as Community Amenity Contributions and Development Cost Levies, based on the rezoning in each area. A measure to allow more duplexes, for example, triggers a calibrated affordability requirement. The system was designed to improve transparency, and it also has the effect of taking the mystery out of what developers can or can't afford.

“There is understandable distrust of developers—those who have benefitted from the housing crisis. Well-designed land value capture policies serve to counter some of those fears,” said Vancouver City Councilor Christine Boyle. In what is increasingly becoming a common refrain, Boyle said she would prefer a citywide land value tax, which would fully match the realities of how landowners and developers are currently making profits. Boyle, a United Church minister, pitched the idea during her campaign, and gave it a catchy label: Windfall Power.

A New Framework

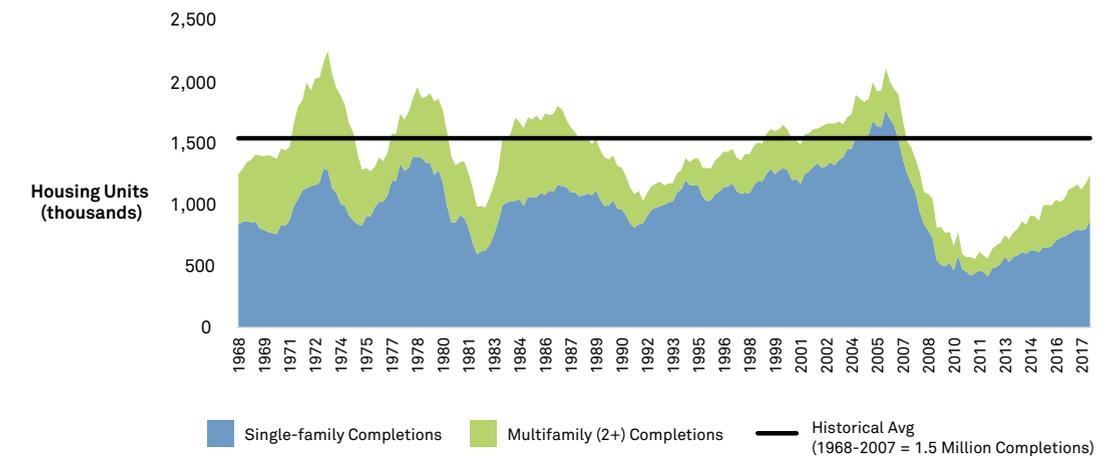
Despite this embrace of inclusionary requirements, complaints persist that they are never enough—that if cities require 15 percent of new residential development, the number of affordable homes will never catch up to the number of market-rate homes.

“Everybody recognizes it's not enough, and it should never be the only thing, but inclusionary housing is an important source of affordable housing,” said Jacobus of Street Level Advisors. There is no question, he said, that the details of implementation are reliably complicated, and that changing the required percentage of affordable homes can be at odds with making the policy predictable.

But once landowners, in particular, realize that inclusionary requirements will be part of the equation from the start, the policy becomes

“There is understandable distrust of developers—those who have benefitted from the housing crisis. Well-designed land value capture policies serve to counter some of those fears.”

Figure 1
Shortage of Total Housing Completions



Source: U.S. Census Bureau, Moody's Analytics, Freddie Mac. Credit: Freddie Mac, *Multifamily 2018 Mid-Year Outlook*

an accepted and standard component of the urban development process, he said. With that as a basic foundation, policy makers can turn to other measures and initiatives, in a bundling of actions for affordability—strengthened tenant protections, co-housing and shared equity housing, tax increment financing for affordable housing, and reforms to allow accessory dwelling units, tiny houses, and single-room occupancy or rooming houses, just to name a few.

Given the high price of urban land, which makes housing so expensive, many cities are supplementing inclusionary requirements with direct actions such as providing government-owned land for affordable housing. Sound Transit, the Seattle area's regional transportation authority, has made it a policy to do just that, handing over parking lots and construction staging areas next to existing and new light rail stations.

A mix of carrots and sticks is increasingly part of the effort to push cities and towns to plan for adequate housing. Courts in New Jersey have for decades enforced the state's "fair share" housing laws, stemming from the landmark Mount Laurel decisions. In Massachusetts, under Chapter 40-B, housing gets fast-tracked if municipalities fail to

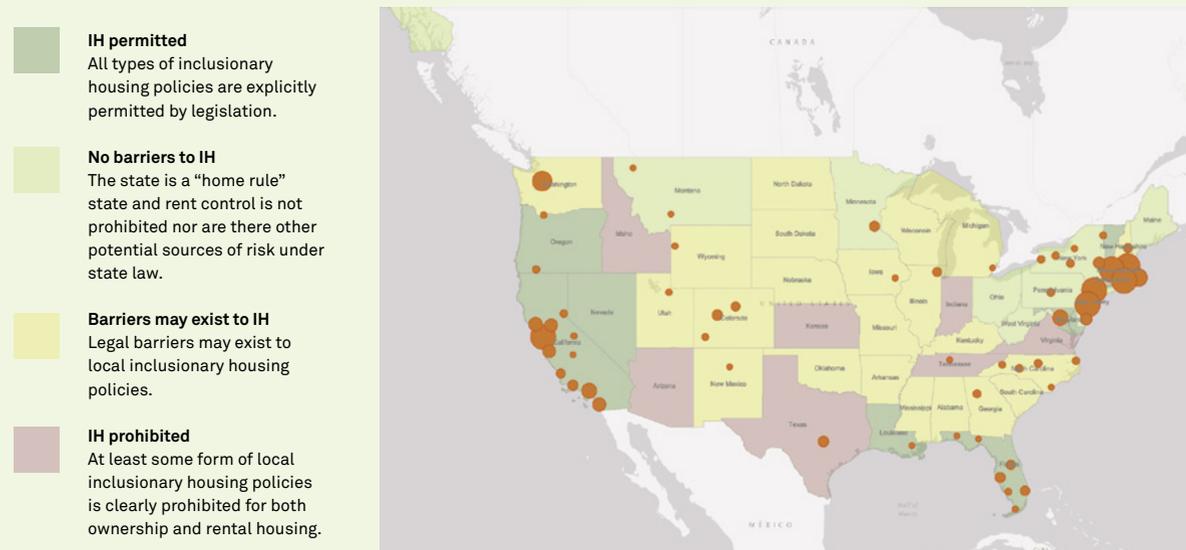
maintain at least 10 percent of their housing stock as affordable to those earning 80 percent of median area income.

And some politicians are getting tougher. Mayor Martin Walsh has endorsed a special tax on the penthouses and other luxury homes that are increasingly dominating the landscape in Boston. California Governor Gavin Newsom, formerly the mayor of San Francisco, coupled \$2 billion in new funding for housing and homelessness initiatives with a proposal to punish communities that block home building by withholding other state funding.

Randy Shaw, a leader of the YIMBY cause and author of *Generation Priced Out: Who Gets to Live in the New Urban America* (Shaw 2018), said he would take such tough measures a step further—by charging residents who block multifamily housing for the value they are accruing by maintaining the status quo.

“Homeowners increasing their own values are profiting by artificially restricting development,” said Shaw, who is director of the Tenderloin Housing Clinic, a pro-tenants group. “We act as if there's no economic impact of anti-apartment policies. They increase the price for everybody else, and in terms of equity, it's a staggering

Figure 2
State and Local Inclusionary Housing Policies in the United States



Inclusionary housing programs have gained momentum across the United States, as indicated by the orange circles on this inclusionary housing database map (beta version), which represent clusters of programs. This interactive map can be accessed and more fully explored at <https://inclusionaryhousing.org>. Credit: Grounded Solutions Network

amount of money that homeowners are gaining.” In contrast, linking upzoning to affordability requirements stands to be a more feasible and politically acceptable step, as a theoretical basis for the YIMBY movement. Changing the framework for urban development across the country can also smooth out highly charged neighborhood politics.

“I think the world is a better place for them being around,” said Jacobus of YIMBY advocates. “I just want them to be more concerned about what these communities are concerned about.”

Clashes like the protest of YIMBYtown in Roxbury are “totally avoidable,” he said. “Both sides are fighting an uphill battle, and there’s no good reason to be on opposite sides. It’s not going to be right to not build at all.”

If nothing else, YIMBYs might embrace affordability requirements as part of a better communications campaign. “It changes the way voters respond to a new development, even though everybody recognizes it’s not enough,” Jacobus said. “Lecturing people about supply and demand doesn’t work. What would it take to make people think they’re part of the solution? If we’re all going to row in the same direction, we have to all think there’s something in it for everyone.” □

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Urban Planners Shift Gears as Autonomous Vehicles Hit the Streets

DRIVERLESS ED



Look ma no driver! Navya's autonomous shuttle in Las Vegas. Credit: John Locher, Associated Press

By Kathleen McCormick

LAST FALL, LAS VEGAS completed a yearlong pilot of the nation's first public self-driving shuttle. Over the course of the experiment, more than 32,000 people hopped aboard a blue electric minibus bearing the slogans, "The future is here" and "Look ma no driver." Designed and built by French start-up Navya and operated by Keolis North America, the eight-passenger shuttle traveled on a 0.6-mile loop through the downtown area. A human operator rode along, poised to override vehicle functions in an emergency using a converted Xbox controller.

The city partnered with the regional transit agency and AAA to run the pilot, which was deemed a success. Now accelerating their commitment to autonomous vehicles (AVs), city officials are planning for a second shuttle route and a "robotaxi" service by Keolis and Navya. And in December, the city and transit agency won a \$5.3 million grant from the U.S. Department of Transportation for a project called GoMed. Slated to begin in late 2019, GoMed will provide four autonomous electric shuttles on a four-mile route between the Las Vegas Medical District and a downtown transit center. The medical district includes four hospitals and the University of Nevada at Las Vegas School of Medicine campus, which serve 200,000 patients annually and will employ 6,000 people by 2020. GoMed will feature pedestrian safety devices and 23 smart transit shelters with Wi-Fi, information on shuttle arrival times and occupancy, and wayfinding kiosks.

When it comes to AVs, Las Vegas appears to be all-in—but planning for the impacts of rapidly emerging technology can be complicated. In a Big City Planning Directors Institute session on AVs hosted last fall by the Lincoln Institute of Land Policy, the American Planning Association, and the Harvard Graduate School of Design, Las Vegas Planning Director Robert

Summerfield acknowledged that it is challenging to regulate new mobilities and incorporate them into the urban fabric. This is especially true now, he says, when city leaders are juggling citywide master planning, form-based code regulations, thoroughfare standards, transit system changes, and downtown capital projects—all of which could need adjustments as new mobility options become more popular.

It's an era of contrasts: Public transit is enjoying a surge in metro areas, with expanding light-rail systems in Denver, Los Angeles, and other places, and demand for walkable and bikeable urban spaces is at an all-time high. At the same time, ride-hailing services like Uber and Lyft (which are also known as transportation network companies, or TNCs) have actually increased traffic congestion and vehicle miles traveled (VMT). So how do AVs fit into the picture, and what will they mean for cities? How are planning, transportation, and public works departments adjusting to this rapidly changing mobility landscape, and how can they ensure that the built environment will accommodate changes that haven't yet happened?

At the Planning Directors Institute, Andres Sevtsuk, assistant professor of urban planning and director of the City Form Lab at the Harvard Graduate School of Design (GSD), illustrated the "totally transformative" nature of AVs with an example from the past: When the Model T was introduced, he said, no one could have predicted that we would have 41,000 miles of paved highways across the United States 20 years later. It's just as difficult to predict the impact of AVs.

With so much buzz and uncertainty, the art appears to lie, at this point, not in finessing the AV future, but in managing the next few years of transition. Cars notoriously reshaped our cities in the twentieth century—the question is how AVs will reshape them in the twenty-first.

Transformative Technology

“We know from our work with big city planning directors across the country that autonomous vehicles are seen as a disruptive technology that will require preparing for a range of impacts—both positive and negative—related to transportation systems and travel modes, land use and urban design, and access for low-income and underserved communities,” says Armando Carbonell, chair of Planning and Urban Form at the Lincoln Institute. Carbonell notes that these topics will be featured in a panel at APA’s 2019 National Planning Conference in San Francisco, with speakers including Los Angeles Planning Director Vince Bertoni and New York City Planning Director Anita Laremont, as well as experts from the fall Planning Directors Institute.

Many other organizations are thinking through the impacts of AVs, including Bloomberg Philanthropies and The Aspen Institute, which issued a joint report on the topic. “Automation is changing the automobile, mostly in ways that will help cities,” notes the report (Bloomberg 2017). “Cities have long struggled with the car’s demands for space. But AVs can be designed for many more forms and functions, creating new opportunities to right-size vehicles for urban use.”

Most AV pilots in the last decade focused on high-speed highways, “but the AV’s future is in cities, where its biggest market demographics are concentrated,” the report suggests.

This shift seems to align with the values of urban dwellers, especially younger generations; in a recent consumer survey by Arity, a data start-up launched by Allstate, 59 percent of

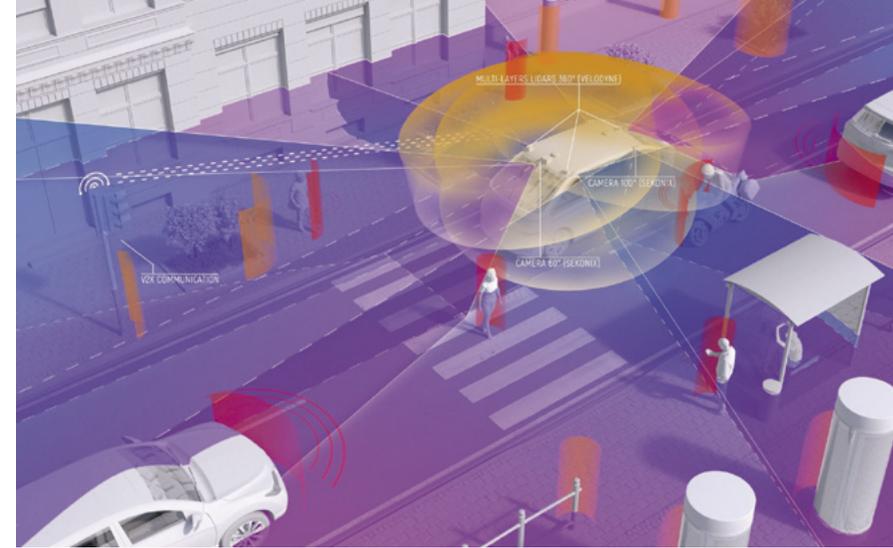
respondents between 22 and 37 years old say they’d rather spend time doing more productive tasks than driving, 51 percent don’t think owning a car is worth the investment, and 45 percent regularly use ride-hailing services (Arity 2018).

“AVs are coming just as our demographics and economy are very pro-urban for the next 20 years,” says David Dixon, who leads urban planning and design efforts at the global design and engineering firm Stantec and also presented at the Planning Directors Institute. “Change will come much faster in urban centers than in suburbs or rural areas because of a critical mass that allows for shared vehicles.”

That change is beginning to occur. After a decade of research and development, tech companies and car manufacturers (also known as OEMs, or original equipment manufacturers) are readying self-driving vehicles for market at a remarkable pace, with fully autonomous vehicles scheduled to roll out this year in pilot programs across the United States. Small, self-driving shuttle buses like the one in Las Vegas have appeared or will soon appear in cities across the United States, from Providence, Rhode Island, to Lincoln, Nebraska, and single-occupant AVs have been tested in cities from Boston to San Jose. Half of the country’s



Passengers board a driverless shuttle in Las Vegas during the city’s yearlong pilot program. Credit: AAA



Fully autonomous vehicles use a combination of sensors, cameras, radar, and artificial intelligence to travel between destinations without a human operator. Credit: Navya

How are planning, transportation, and public works departments adjusting to this rapidly changing mobility landscape, and how can they ensure that the built environment will accommodate changes that haven’t yet happened?

largest cities are preparing for self-driving vehicles in their long-range transportation plans, according to a National League of Cities report on autonomous vehicle pilots, which notes that 28 states were introducing legislation to support such pilots (Perkins 2018).

More comprehensive testing programs are also underway in cities including Austin, Texas, and Phoenix, Arizona. Last fall, Austin—which was the site of the first passenger ride on public roads in an autonomous car without a driver in 2015—began a pilot program with a free, 15-seat electric AV minibus deployed as a circulator in the downtown area.

In another pilot, the Austin Transportation Department is testing technology at five intersections that will allow the city’s traffic system to communicate with self-driving cars. Installed over the streets on traffic-light equipment, the technology can inform AVs about when the light is about to turn, if a driver has run a red light, or if pedestrians are present.

The Phoenix metro area also has evolved as an AV-testing hub for tech companies and OEMs thanks to its road infrastructure, weather, cross-border supply chain, favorable business climate, and access to tech talent. The area boasts 15 companies that are developing and testing driverless vehicles and related technology, according to the Greater Phoenix Economic Council, which says the AV industry will bring Arizona 2,000-plus jobs and \$700 million in capital investment by 2020.

One of those companies is Waymo, launched by Google, which has tested vehicles in auto-

mous mode for over 10 million miles on public roads across the country, from sunny California to snowy Michigan. A test group of 400 “early rider” volunteers has been riding Waymo’s Chrysler Pacifica minivans, modified and equipped with safety drivers, for more than a year in the Phoenix suburbs of Chandler, Gilbert, Mesa, and Tempe. (In 2018, Tempe was the site of the first pedestrian fatality caused by an AV. Uber, which had been testing the vehicle, temporarily suspended its AV operations in Phoenix and elsewhere as a result.)

In October 2018, Arizona Governor Doug Ducey announced the creation of a public-private enterprise to pave the way for self-driving vehicles. The state has pledged \$1.5 million for the project, the Institute for Automated Mobility, a consortium including Intel, researchers from Arizona State University, University of Arizona, and Northern Arizona University, and state transportation, safety, and commerce agencies. The institute will prepare for the expansion of AV technology nationwide, with a focus on liability, regulatory, and safety implications.

At least three dozen companies besides Intel, Uber, and Waymo are involved in developing or testing AVs, including Audi, BMW, Chrysler, Ford, General Motors, Jaguar, Lyft, Tesla, Volkswagen, and Volvo. While no fully autonomous vehicles are available to consumers yet, the current cost of a personal AV “hardware and software package” would add \$70,000 to \$200,000 to the base price of a vehicle, according to various estimates; those figures are expected to come down dramatically, to closer to \$5,000 to \$15,000, as the technology evolves and is adopted more widely.

Planning for the Unplannable

What will this mean for cities? That's a source of much debate. The "utopian" perspective holds that AVs will usher in a seamless, door-to-door new-mobility system. Their potential benefits include increased roadway safety—the National Highway Traffic Safety Administration estimates that 94 percent of serious crashes are due to driver error—as well as impacts on urban planning and mobility:

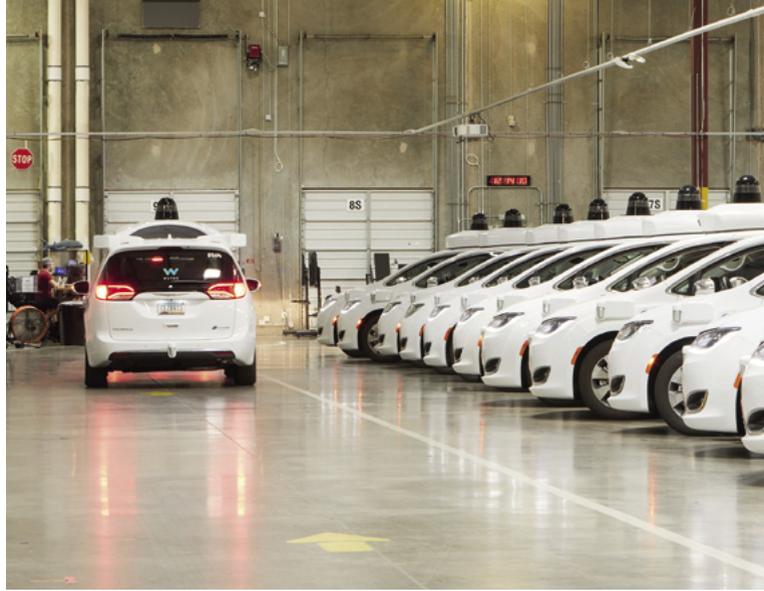
Roadway efficiency. Because of their tracking features and the elimination of driver error, AVs could improve transportation efficiency by enabling vehicles to travel closer together. This could allow road diets—modifications that create fewer or narrower lanes—that free up roadway strips for fast transit, alternative modes like protected bike lanes, or green infrastructure.

Improved traffic flow. With sensing technology and artificial intelligence fed by route data, AVs could reduce congestion and improve traffic flow through intersections, reducing travel time.

Decreased travel costs. AVs could supplant ride-hailing services and eliminate the need for and cost of private vehicles and drivers. Depending on local policies, they could also be deployed for greater transportation equity, to serve underserved populations including those who are elderly, disabled, poor, or live far from public transit (see sidebar, page 29).

Sustainability. If all AVs were electric, and powered by renewable sources, they could help cities shift away from fossil fuels, reducing urban pollution and carbon footprints.

On the "dystopian" downside, critics say, tightly spaced and continuously cruising AVs could have negative consequences for bicyclists and pedestrians. If they didn't have to sit behind the wheel, more commuters might opt for a longer commute to a larger house and yard, expanding sprawl, creating more low-density development, increasing municipalities' costs for providing public services, and inflating land and housing costs in the outer reaches. If AVs were predominantly privately owned passenger vehicles rather than shared shuttles, they would



A fleet of driverless cars, ready to be deployed on the streets of the Phoenix metro area. Credit: Waymo

increase congestion. Negative environmental impacts could be compounded by vehicles that were not renewably powered and by the high level of toxicity in manufacturing and disposal of electric batteries. Privately owned AVs could widen the divide between the transportation haves and have-nots.

Utopian, dystopian, or somewhere in between, one thing is certain: The AV future will require adjustments in the way urban planners think. "Because of the significant anticipated impacts of AVs on public infrastructure, land use, and public finance, it is vital that planners actively prepare now for their widespread arrival on city streets," says Carbonell.

As to how to do that, "most preparation for autonomous vehicles involves good-sense common planning principles," says David Rouse, research director for the APA. "Cities should start with visioning and goal setting, and look at development codes, street regulations, public investment, capital improvements," and other areas to guide planning. A key question, he suggests, is how do AVs serve those futures?

"The danger now is that the private sector and car manufacturers will drive how this rolls out," says Rouse. Cities will need help from new types of collaborations and public-private partnerships, he says. "OEMs also need to be brought to the table with cities and the public sector as we figure out how to introduce this technology."

Rouse suggests planners create a site plan review checklist for AVs and consider ideas contained in *Planning for Autonomous Mobility*, a 2018 APA report that aims to provide direction for planners as they update their communities' long-range plans (Crute 2018).

Nico Larco, an architecture professor and director of the Urbanism Next Center at the University of Oregon who presented at the Planning Directors Institute, says cities need to take control of how AVs are introduced and managed before they just appear on the streets, as happened with electric scooters.

Larco advises several steps to ensure control of new mobilities: First, identify and document city priorities. He pointed to Seattle's *New Mobility Playbook*, which identifies outcomes, values, and priorities for equity, economic opportunity, and environmental sustainability (SDOT 2017).

Second, "figure out how best to leverage the new technologies to get to the outcomes you want," he says. "High-density, mixed-use, built on transit are key pieces we need to focus on, and the new mobility gives us that ability. Make sure we frame it as, 'These are the outcomes we want,' and use new mobility to achieve that."

Third, define how data will be collected, owned, and shared. "Data is critical to regulating and evaluating mobilities to see whether they are doing what they said they'd do, and the city is getting the outcomes it wants," he says.

As the mobility landscape changes, San Francisco and other cities have ended or reduced minimum parking requirements for new development projects. Credit: stelianpopa/iStock



Because of their tracking features and the elimination of driver error, AVs could improve transportation efficiency by enabling vehicles to travel closer together. This could allow [more room for] fast transit, alternative modes like protected bike lanes, or green infrastructure.

Parking Requirements

Parking is emerging as a critical issue as cities begin to look in-depth at the on-the-ground challenges of AVs. In 2018, Chandler, Arizona—one of the four Phoenix metro cities piloting Waymo shuttles—became the first U.S. city to change its zoning code in anticipation of AVs. The zoning amendments, which went into effect last June, allow for minimum parking requirements for new developments to be reduced by up to 40 percent in exchange for the inclusion of passenger loading zones for shared AVs. One passenger loading zone could achieve a 10 percent reduction in parking, with a cap at 40 percent, depending on the number of zones, land use, and building square footage. Planning staff had two primary objectives: to allow for more flexibility in parking minimums as demand for parking changes, and to promote the creation of passenger loading zones for shared rather than single-passenger vehicles.

"In the future, if AV usage picks up, we see the need for parking to be reduced drastically, and we need to be flexible now," says David de la Torre, Chandler planning manager and principal planner for the ordinance project. Reduced parking "presents a lot of opportunity for the city to redesign itself to be a better city for residents and businesses," he says. De la Torre adds that the zoning change is garnering support: at least five developers of multifamily and commercial mixed-use projects are interested in creating TNC-AV passenger zones.

With an estimated 1 billion to 2 billion parking spaces across the country, most cities are significantly overparked, says Larco. Seattle, for example, has about 29 parking spaces per acre, more than five times its residential density of 5.7 households per acre, according to a study of parking in five cities by the Research Institute for Housing America (Scharnhorst 2018). Cities including San Francisco and Hartford, Connecticut, have eliminated minimum parking requirements citywide to help speed up development projects and reduce the number of cars on city streets, and other cities have relaxed parking minimums or removed them in transit corridors.

When the nation shifts to AVs—and most experts agree that the question is indeed *when*, not *if*—cities will see “tremendous opportunities because we’ll need less parking,” says Larco. He estimates that AV shuttles could be in service half of the time, depending on their manufacturing and maintenance costs. Others say AV shuttles could run almost continuously except for brief recharging stops. When they’re not chauffeuring riders, AV fleets will still need a place to park at least temporarily—ideally on less expensive land near arterials or freeways with access to a substation to recharge.

AVs also could reduce the cost of urban development. The median cost of building parking in the United States is \$20,450 per space, according to WGI, a nationwide transportation and civil engineering firm. But that can vary greatly, depending on site factors and regional construc-

tion costs. In Denver, underground parking can cost \$40,000 per space and aboveground \$25,000. In Seattle, structured parking can cost over \$100,000 per space. These parking costs, which can amount to 20 percent of a project’s total development costs, could be used to build more affordable housing or public amenities, or to underwrite additional costs for sustainable buildings. According to the Lincoln Institute’s Carbonell, “One of the greatest potential benefits of the shift away from personal cars could be the freeing up of urban land currently used for parking for redevelopment at greater densities, with more affordable housing and a more livable public realm.”

Goodbye to Garages?

Meanwhile, how do you decide whether to build that new municipal parking garage? Obtaining a parking construction bond now for 30 years could mean losing money. If you still need to build it, how should it differ from the parking garages of past decades?

Some cities and private developers are building parking garages with flexible design that allows for conversion to other uses later, like office space or housing. Two parking garages for the medical center that are under construction in downtown Las Vegas, for example, “are designed to be future-proof” and adaptable for other uses, says Summerfield.

Global design firm Gensler is helping clients develop AV-compatible buildings like the three flexible garage floors in its 84.51° Centre project, an eight-story, mixed-use building in Cincinnati. Gensler is also designing Giambrocco, a mixed-use project in Denver’s River North (RiNo) district that includes a five-story office building on top of three floors of flexible garage space.

Gensler and the Giambrocco developer, Tributary Real Estate, compared the cost of building a standard parking garage with slanted floor plates and ramp parking against a flex design with flat floor plates, 14-foot ceiling heights to accommodate office space, and external speed ramps that can be removed when the space is converted. They determined that the flexible garage design would cost 25 percent more for the same 375 parking spaces, a \$2.3 million difference on the \$80 million project, mostly because of higher construction costs, says Brent Mather, principal and design director for Gensler’s Denver office. The developer determined that it made financial sense to build the flex plan, he says, because “ultimately when the demand for parking is reduced in 10 to 15 years, converting it to office space will provide bigger returns on investment.”

Cities have compelling reasons to build flexible municipal parking garages “because they’re long-term holders of the properties and have public money invested,” says Mather. For maximum adaptability in buildings, he advises, cities should develop only aboveground, flexible parking, as underground parking has limited reuse potential beyond concepts such as data centers, gyms, or drop-off areas for buildings serving thousands of people. Airports will have to determine what to do with their massive and revenue-rich parking areas and how to provide more efficient drop-off and pick-up areas, he says, “as part of this paradigm shift.”

“We’re at peak parking in the next year or two,” says Stantec’s Dixon. “Any project being planned and permitted today should demonstrate it can increase density for the kinds of projects that will be at the forefront of the AV shift—new urban districts and large mixed-use developments. Any parking we build or that exists today



One of the potential benefits of autonomous vehicles is that they require less room, which could free up roadway space for bike lanes, green infrastructure, and other uses. Credit: Paul Krueger/Flickr CC BY-NC 2.0

should be able to support 50 to 100 percent more development in 10 years. That’s an unprecedented opportunity to double our density in urban cores.”

Dixon and other AV advocates advise that urban planners and municipalities should look at every possible alternative to building structured parking, and consider surface parking only as a placeholder for a site. They also suggest requiring district parking for large development areas and shared parking for mixed-use residential development, which can reduce by a third the number of parking spaces needed by residents and office or retail spaces.

Rethinking Roads

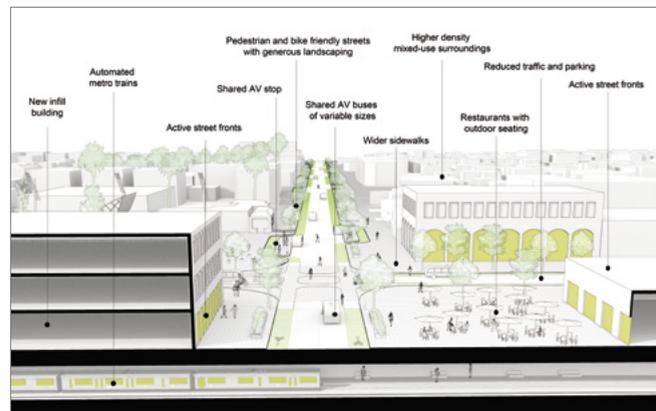
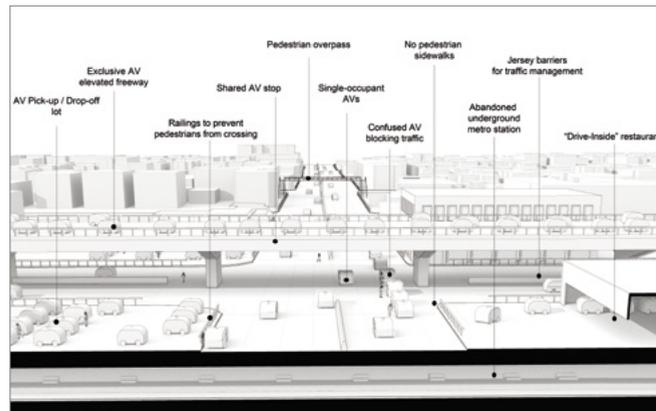
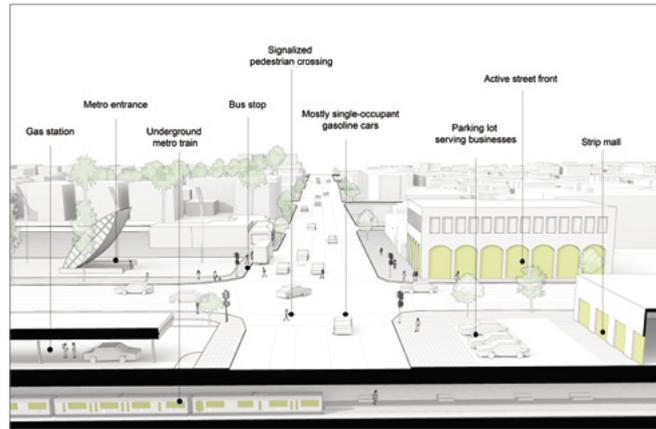
“The million-dollar question is, ‘What’s the minimum we have to do to redesign streets?’” says Larco. “None of us are building for this new technology, and most of us want to make as few changes as possible.”

AVs will require rethinking roadway and street design for elements such as separation of lanes by speed, lane width, and prioritization, locating pick-up/drop-off zones, and paying more attention to how buildings meet sidewalks and streets. During the transition to a fully automated AV fleet, narrower lanes could be designated and striped like HOV lanes are now. But as AVs are adopted more widely, roadways might be designed with narrower lanes, which would leave more public-realm space for active streetscapes, pedestrian and bike infrastructure, open space, and green infrastructure.

Giambrocco, a mixed-use project in Denver, includes three floors of flexible garage space that can be converted into office space. Credit: Gensler



A series of images produced by Harvard's Future of Streets project shows a current depiction of the intersection of Vermont Avenue and Santa Monica Boulevard in Los Angeles, then "hell" and "heaven" scenarios for how it might evolve with the advent of new mobilities. Credit: City Form Lab at the Harvard Graduate School of Design



Harvard GSD's Future of Streets project, led by Andres Sevtsuk, created 24 scenarios for how cities might adapt streets to emerging transportation technology—ride-hailing, as well as electric and autonomous vehicles—in ways that ideally would maximize multimodal, socially inclusive, and environmentally sustainable outcomes. The research project is partnering with the Los Angeles and Boston planning and transportation departments.

At key intersections in each city, Sevtsuk explained at the Planning Directors Institute, his team assessed the current scenario, then outlined "heaven" and "hell" alternatives. At LA's busy downtown Vermont/Santa Monica intersection, site of a new Red Line rail station, the "heaven" scenario for shared electric AVs included improved public transport systems, shared AV pick-up and drop-off zones, continuous bike lanes, active retail facades, and street trees and landscaping. The potential "hell" scenario for the same intersection included an AV-exclusive freeway prone to being blocked by disabled vehicles, an elevated highway for private AVs, drive-in restaurants, and railings and barriers that prevented pedestrian crossings. More than two-thirds of the AV scenarios created as part of the project's research pointed to more congestion.

Sevtsuk advises cities to begin making urban design and infrastructure changes that can help manage TNCs and the transition to AVs, beginning with passenger pick-up and drop-off areas. "Hong Kong and Singapore, very dense cities, have highly regulated pick-up/drop-off zones on every city block," he says, adding that the lack of such zones in U.S. cities is causing major traffic and public safety issues. The Future of Streets project is also exploring the use of HOV lanes for multi-passenger AVs, as well as for bus rapid transit, as an incentive for using shared mobility. This promotes the idea that "if you share your rides, you'll get through cities much faster," says Sevtsuk.

In some cities, these changes are starting to appear. Las Vegas is working on a change to its zoning code to allow for downtown ride-share lots that would eventually also serve as AV

passenger zones, says Summerfield. Local companies Lyft and Zappos partnered on creating a downtown art park and pick-up/drop-off area on a privately owned parking lot. The city approved the pilot last year as a special event project, a one-off to prove the concept could work. The city then entitled the project through the normal process as a plaza/parking facility, and is trying to replicate it with other private landowners and city properties as a public amenity that can help reduce traffic congestion.

Preparing for Change

The shifts caused by AVs will affect municipal budgets. In fiscal year 2016, the 25 largest U.S. cities netted nearly \$5 billion from parking-related activities, camera and traffic citations, gas taxes, towing, and vehicle registration and licensing fees (Governing 2017). But gas tax revenues will shrink if most AVs are electric. There could be fewer vehicle registration fees as car ownership dwindles. Parking tickets could become a thing of the past. The list goes on.

"The change will be stepped, and not gradual," says Larco. He advises cities to consider VMT fees, congestion pricing, and new municipal revenue generators, such as taxes or fees for empty seats, charging stations, use of curb access, fees for fleet parking, GPS, data, advertisements, mobile business, and retail, as well as tax credits for vehicles full of passengers.

So far, cities have approached companies like Uber and Lyft with mostly "stick" dissuaders of fees and taxes for their impacts, notes Sevtsuk. Some U.S. cities are considering a congestion toll, such as those levied in European cities like Stockholm. But congestion charges are hard to implement, he says, and have to be approved at the state level. He says a combination of carrots and sticks, with more progressive ways to welcome this new technology on the streets, is more likely to gain public approval.

As the AV industry gains speed, cities will also have to factor in many other considerations, ranging from the location of electric charging stations to the redesign of traffic signals, from

NEW MOBILITY OPTIONS AND EQUITY

In cities and suburbs alike, many people who are elderly or disabled, who live too far from public transit stations, or who can't afford transit fare are left without convenient mobility options. How do cities equitably share the benefits of new mobility options for all their residents?

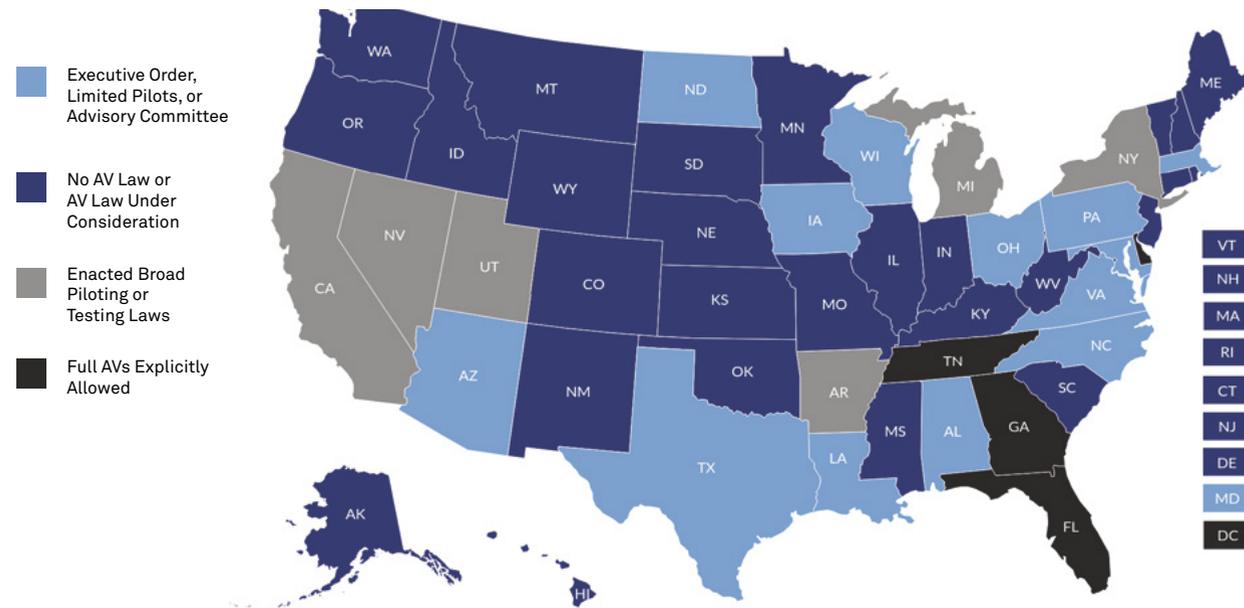
Some cities are making it a priority. In Washington, DC, Ford is piloting a citywide AV project in both wealthy and low-income neighborhoods. The city's interagency AV Working Group, composed of transportation, disability rights, environmental, and public safety officials, is focused on ensuring that AVs will benefit all eight wards of the city. Last October, Ford Autonomous Vehicles announced a job training program in conjunction with the AV project, in partnership with the DC Infrastructure Academy and Argo AI, an artificial intelligency company.

In other cities, AVs are playing a role in on-demand transit programs. In what may be the first-of-its-kind partnership between an AV tech company and a public transit system outside of a controlled environment, Waymo and the Phoenix area's Valley Metro Regional Public Transportation Authority (Valley Metro) have been using Waymo's self-driving vehicles as robotaxis to help fill some mobility gaps across the metro area.

"Think of it as the start of mobility on demand or mobility as a service," says Scott Smith, CEO of Valley Metro, which provides regional bus service and a 26-mile light-rail system slated to expand to 66 miles by 2034. Bloomberg reports the first wave of paying Waymo customers likely will draw from the Early Rider Program for trips such as first- and last-mile transportation to transit stations, but the partnership also holds promise for addressing transportation inequities.

In California, a \$12 million pilot program launched last fall by the City of Sacramento and Sacramento Regional Transit is providing low-cost rides in electric shuttles to connect people in the lower-income neighborhoods of disinvested South Sacramento with jobs and services as part of a larger effort to provide greater social and economic equity around transit. The shuttles cost less than ride-hailing services, and rides are free for groups of five or more. So far they are traditionally operated vehicles, but in a city that prides itself on being, in the words of Mayor Darrell Steinberg, "a center of innovation in new transportation technologies," that could soon change. -KM

Figure 1
Status of State Policies Related to Automated Driving



Source: National Conference of State Legislatures and individual state legislation. Created by Ann Henebery/Eno Center for Transportation

redevelopment opportunities to workforce impacts. And they don't have much time to do it.

By some estimations, 2030 will be the tipping point for tech companies and OEMs to produce AVs exclusively and for the public to adopt AVs on a massive scale, with the potential for a completely autonomous fleet by 2050. Some states are already preparing for an AV future (see Figure 1): The Colorado Department of Transportation is planning for communications between vehicles and the highway along the I-70 corridor that traverses the state from east to west through the Rocky Mountains.

But AVs also might not dominate the landscape as soon as some tech companies and OEMs hope. In a recent consumer survey, 50 percent of survey respondents from the United States indicated they do not believe AVs will be safe, and 56 percent were not interested in ridesharing services. Nearly two-thirds of respondents were concerned about biometric data being captured via a connected vehicle and shared with external parties (Deloitte 2019).

Regardless of how quickly AVs will be adopted, says Larco, "they will have impacts on all sorts of things in cities, and we need to prepare." He advises urban planners, municipal officials, economic development directors, environment and equity advocates, and others to be proactive about making policy and infrastructure changes. Cities historically have had trouble with change, he says, and the pace of change is much faster now. When it comes to evolving mobility options, cities will need to "be nimble in their approach, create responsive regulations, and change the culture of risk with stakeholders and constituents by letting them know, 'We're going to try things out.'" □

Kathleen McCormick, principal of Fountainhead Communications, LLC, lives and works in Boulder, Colorado, and writes frequently about sustainable, healthy, and resilient communities.



As the AV industry gains speed, cities will have to factor in many other considerations, ranging from the location of electric charging stations to the redesign of traffic signals, from redevelopment opportunities to workforce impacts. And they don't have much time.

A driverless shuttle at the University of Michigan in Ann Arbor, where researchers are studying consumer acceptance of autonomous vehicles. Credit: Levi Hutmacher, University of Michigan

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GREAT ADAPTATIONS

How Two Smaller Legacy Cities Are Embracing Green Infrastructure

By Cyrus Moulton

AS RAIN SHEETED across the 150,000-square-foot roof of a transit facility in one of the most flood-prone neighborhoods in Worcester, Massachusetts, things looked ominous. But instead of posing a threat, that stormwater slithered into a jumble of purple coneflower, Joe Pye weed, Russian sage, and other flood- and drought-tolerant plants growing between the complex and nearby Quinsigamond Avenue.

The transit facility, built on a remediated brownfield, represents a \$90 million investment for this small city. Green infrastructure elements like that rain-absorbing bioswale were considered a must, according to William Lehtola, chair of the Worcester Regional Transit Authority Advisory Board: “We want to provide the best possible environment for the city and our customers and employees,” he said. “Not just in our buses, but in our facilities too.”

As smaller legacy cities like Worcester and nearby Providence, Rhode Island, continue the grueling work of rebounding from the severe economic and population losses suffered since their manufacturing heydays, the green approach is gaining traction. Despite challenges ranging from financial constraints to deteriorating infrastructure, many legacy cities have realized that investing in—and, in some cases, mandating—green infrastructure yields multiple

benefits. Projects such as rain gardens, bioswales, urban farming, and tree planting, whether introduced on a small scale or implemented citywide, are an effective way to revitalize public spaces, manage stormwater, improve public health, and deal with the impacts of climate change, from increased heat to floods.

“Green infrastructure can address multiple challenges, and provide amenities as well,” says Professor Robert Ryan, chair of the Landscape Architecture and Regional Planning Department at the University of Massachusetts, Amherst. Ryan has led courses on greening legacy cities including Worcester. “Cities like Worcester and Providence are the ideal place for this approach.”

Cultivating this shift isn’t always simple. While new environmental codes, regulations, and awareness have increased the frequency of green infrastructure projects, they still often coexist with structures and streetscapes from an earlier era, when nearby waterways were de facto sewers, and pavement was the go-to choice for urban improvements.

As legacy cities across the country implement green infrastructure projects and strategies, they are coping with an important reality: They cannot just create themselves anew. They can, however, adapt and evolve.

Once buried under parking lots and railway lines, the Providence River now defines the city of Providence, RI. Credit: aimintang/iStock



Green infrastructure can be an effective way to revitalize public spaces, manage stormwater, improve public health, and deal with the impacts of climate change . . . Cultivating this shift isn't always simple.

A New Lease on Life in New England

Located in a hilly area of central Massachusetts, Worcester is home to an estimated 185,000 people. Its population peaked at 203,486 in 1950 and dipped to about 161,000 by 1980.

Worcester was always the economic hub for surrounding Worcester County. But it earned the moniker “Heart of the Commonwealth” thanks to connections with Boston (via railroad in 1835) and with Providence (via the Blackstone Canal in 1828 and the Providence & Worcester Railroad in the late 1840s), which made it an increasingly important industrial and transportation hub. It became known for its machine tools, wire products, and power looms.

Providence, perched on the banks of the Providence River at the head of Narragansett Bay, has followed a similar path, albeit in a different setting. The coastal city is home to approximately 180,000 people. That's up from a twentieth-century low of 156,000 in 1980, but far smaller than the peak of more than 253,000 in 1940. The state capital, Providence became a manufacturing powerhouse after the Revolutionary War, with factories churning out goods such as jewelry, textiles, silverware, and machin-

ery, and shipping them from its port. At one point, it was one of the wealthiest cities in the country.

In both cities, the industrial activity and the population eventually declined and, coupled with suburbanization, left hollowed-out sections of formerly vibrant urban cores (see Figure 1). But, as is the case with many legacy cities, people have slowly rediscovered the assets these communities offer. As Alan Mallach and Lavea Brachman explain in the Lincoln Institute report *Regenerating America's Legacy Cities*, these assets include downtown employment bases, stable neighborhoods, multimodal transportation networks, colleges and universities, local businesses, historic buildings and areas, and facilities for arts, culture, and entertainment (Mallach 2013).

Providence, for instance, is home to Brown University, the Rhode Island School of Design, the University of Rhode Island, and Johnson & Wales. Worcester is home to more than a dozen institutions of higher learning including Clark University, College of the Holy Cross, Worcester Polytechnic Institute, and University of Massachusetts Medical School. Both cities have major hospitals and performance venues. And both cities have revitalized their downtowns with signature projects.

Figure 1

Providence and Worcester Population Trends, Key Industries, and Land and Water Area

	Current population	Population 1900	Peak population	Population 1980	Key Industries	Land Area	Water Area
Providence	180,000	175,597	253,000 (1940)	156,000	jewelry, textiles, silverware, machinery	18.45 sq. mi.	2.17 sq. mi.
Worcester	185,000	118,421	203,486 (1950)	161,000	machine tools, wire products, power looms	37.36 sq. mi.	1.09 sq. m.

Source: World Population Review

Providence successfully rebranded itself as an arts and cultural hub beginning in the 1990s. In a massive green infrastructure effort, the city unearthed the Providence River, formed by the confluence of the Woonasquatucket and Moshassuck rivers, which had long been buried under parking lots and railroad tracks, and lined the banks with parks and pedestrian-only walkways. (“The river has to be an integral part of the city,” said then-Mayor Vincent “Buddy” Cianci Jr. “Don’t cover it, don’t block it, don’t pollute it. Celebrate it and use it.”) The massive effort changed the character of the downtown, which soon began to draw new development projects—including ambitious renovations of vacant mill buildings—as well as new residents and businesses.

Worcester is replacing its failing downtown mall with the \$565 million, mixed-use CitySquare redevelopment, reconnecting the central business district with other burgeoning parts of the city such as Washington Square—the home of the renovated Union Station—the restaurants of Shrewsbury Street, and the hip Canal District. In fact, Worcester was deemed “high performing” among cities of its size in the Lincoln Institute report *Revitalizing America's Smaller Legacy Cities* (Hollingsworth 2017). Factors cited in this designation included its proximity to Boston and

easy access via commuter rail; leaders who have the energy and skills to revitalize the city; and the CitySquare project. Providence was not included in either Lincoln Institute report, but its revitalization efforts have been heralded by organizations from the American Planning Association to *The New York Times*.

Although this momentum is promising, climate change complicates everything. In the Northeast, climate change is associated with more frequent extreme weather events including heavy rainfall and flooding, droughts, warmer air and water temperatures, changing circulation patterns in the ocean (and related impacts on weather and fisheries), and sea-level rise. Providence is positioned to see flooding and damage from more intense Nor'easters and hurricanes that slam into its shores; a climate report prepared in Worcester nods to predicted impacts including “increased temperatures, more extreme heat days, and changing precipitation patterns.”

“Some degree of climate change is inevitable—there's literally nothing we can do about it now,” said Edward R. Carr, professor of international development, community, and environment at Clark University in Worcester. “The question is, how much can we deal with it, and what is that going to look like.”



Cars navigate heavy flooding under an aging Providence & Worcester Railroad bridge in Worcester in July 2018. Credit: Matthew Healey

Where Revitalization and Preparedness Meet

“The most fundamental rationale for thinking about green infrastructure is to come up with uses for a massive accumulation of vacant lots, so it will not be a blight and hopefully will [have] a positive effect on the neighborhood,” said Alan Mallach. “Historically, a lot of people had the theory that a vacant lot was worthless unless you built something on it. But that’s changing. There are a number of ways you can take a vacant lot and make it valuable to the community, whether for recreation, to produce fresh food, address sewer overflow. There are ways to address vacant lots that don’t require building new housing or office buildings.”

As legacy cities assess such land use opportunities, they sometimes lack the political or economic power to engineer effective solutions. But there’s one area in which legacy cities have an advantage: They are seeking to reinvent themselves as healthier, more appealing places to live, so they are often more willing to embrace novel and creative projects. This will be helpful in the era of climate change, says Amy Cotter, associate director of Urban Programs at the Lincoln Institute.

“If you think about ways we could prepare legacy cities to play key roles in a future where climate change is affecting large population centers, green infrastructure could be both a revitalization strategy and a climate preparedness strategy,” said Cotter. “It can also help places revitalize and deal with what otherwise would be the blight of vacant property.”

Larger legacy cities across the country have embraced a suite of options with these goals in mind. In Detroit, a comprehensive green infrastructure effort has led to a citywide sprouting of green roofs, rain gardens, and a “green alley” program in which native plants and permeable pavers replace urban debris and concrete in previously neglected alleyways. In Cleveland, the regional sewer district manages a green infrastructure grants program, and ambitious plans are coming together for a park that will occupy



An aerial view of Worcester, Massachusetts. Credit: Jacob Boomsma/Shutterstock

20 acres of formerly industrial waterfront along the Cuyahoga River. Philadelphia is investing approximately \$2.4 billion in public funds over 25 years to do everything from provide rain barrels to create urban wetlands in order to reduce combined sewer overflow.

Smaller legacy cities with populations under 200,000 don’t always garner headlines, or have the resources and capacity to undertake such large projects, but many are making similar efforts. Worcester and Providence demonstrate how smaller legacy cities—one coastal, one inland—are relying on green infrastructure to help them rebound from the challenges of the last century and prepare for the uncertainties of the decades ahead.

“Not only does green infrastructure act as an environmentally friendly alternative to traditional stormwater systems, it can help protect us from climate impacts like urban heat island and coastal erosion, and be used in streetscape design to make our roads safer for cyclists and pedestrians,” said Leah Bamberger, the city of Providence’s director of sustainability. “Providence is a forward-thinking city, and green infrastructure is an opportunity to invest in green jobs while building a healthier, thriving community.”

Finding Stormwater Solutions

In the last 80 years, Rhode Island and southern New England have experienced a doubling of flood frequency and an increase in the magnitude of flood events, according to the report *Resilient Rhody: An Actionable Vision for Addressing the Impacts of Climate Change in Rhode Island* (State of Rhode Island 2018). Unfortunately, the region’s infrastructure isn’t up to the challenge.

“Much of the state’s stormwater infrastructure was built at least 75 years ago and was designed for less intense storms,” the *Resilient Rhody* report says. “Climate change further challenges the capacity and performance of these drainage systems.”

Carr says the same is true of the Worcester area, noting that the “infrastructure here is simply not built to handle . . . what is becoming normal.”

“Climate adaptation is very specific to place,” says Ryan of the University of Massachusetts, who coedited *Planning for Climate Change: A Reader in Green Infrastructure and Sustainable Design for Resilient Cities*, published by Routledge. “For these particular cities, and for any legacy city, the question is how do they accommodate the extra water that comes with sea-level rise and increased precipitation.” Pointing out that neighborhood development patterns have tended to stem from the historic location of worker housing near riverside mills and factories, Ryan says flooding raises equity issues too: “How do cities protect the vulnerable populations in those low-lying areas?”

With this array of concerns in mind, public and private entities are taking action. The Green Infrastructure Coalition in Rhode Island—made up of more than 40 nonprofit organizations, city planners, architects, elected officials, and others—works to promote green infrastructure projects as one way to reduce stormwater problems such as flooding and pollution.

The coalition hires local crews to install green infrastructure projects, such as a bioswale in a local park, a green roof, or a rain garden, and trains public works employees and

other involved parties on maintenance. “It’s small projects right now, but it seems that the need and appetite for this is growing,” said John Berard, Rhode Island state director of Clean Water Action, which acts as the project organizer for the coalition. “We’re seeing it get more and more prevalent as storms get worse, and cities are realizing that stormwater is a really important piece for managing a city effectively.”

Meanwhile, the city of Worcester has put policies in place that help ensure sound stormwater management. The city regulates runoff near wetlands and catch basins that drain directly to wetlands or water resource areas. Additionally, all development and redevelopment must have no net increase in runoff rates, often leading to on-site stormwater management systems for large developments.

The city also aggressively protects land within its watershed to improve the quality of its drinking water and offset some of the land lost to development, according to Phil Guerin, director of water and sewer operations for the city.

But Guerin noted that the built-up nature of Worcester, as well as the geology of the city, makes it difficult to decrease the amount of impervious surfaces. “There are lots of areas with shallow bedrock, a shallow water table, and it’s a pretty built-up city,” Guerin said.

At a Green Infrastructure Coalition project in Providence, bilingual signs explain how green roofs reduce flooding. Credit: Dot Campbell, Woonasquatucket River Watershed Council



Combating the Urban Heat Island Effect

A few years ago, scientists from NASA set out to understand the difference between surface temperatures in the cities of the Northeast and surrounding rural areas. Their research revealed that surface temperatures in the cities were an average of 13 to 16 degrees hotter than surrounding areas over a three-year period. In Providence, surface temperatures are about 21.9 degrees warmer than the surrounding countryside (NASA 2010). The compact size of Providence contributed to this heat island effect, which is caused by buildings retaining heat and urban infrastructure such as pavement.

When it comes to combating the heat island effect, the answer is clear, says Carr of Clark University: “Trees, trees, trees. There are tons of studies that urban tree cover makes a tremendous difference in lowering temperatures, improving air quality, and—to some extent—helping with flooding.”

According to the U.S. Department of Agriculture, a healthy, 100-foot-tall tree can take 11,000

gallons of water from the soil and release it into the air again in a single growing season.

In 1907, the city of Providence recorded approximately 50,000 street trees, according to the local nonprofit Providence Neighborhood Planting Program (PNPP). The city currently has just half that amount—approximately 25,500 street trees—according to the sustainability dashboard on the City of Providence Sustainability website. A citywide tree inventory is underway.

In its Trees 2020 plan, Providence aims to increase the tree canopy 30 percent by 2020 and plant 200 trees annually. The city has partnered with PNPP, offering grants for tree planting and providing the curb cuts, tree pit, and trees for free. In addition, PNPP and the city offer the Providence Citizen Foresters program, which provides technical training focused on the care of young urban trees. PNPP has cofunded the planting of more than 13,000 street trees with more than 620 neighborhood groups since 1989.

“If people are engaged and want the tree, they’re more likely to care for it and nurture it,” said Bamberger. “You can plant the trees all day long, but if there’s no one there to care for them and nurture them, they’re not going to last long.”



A project in Providence’s Olneyville neighborhood will transform a paved bank parking lot, adding plantings to help absorb stormwater and incorporating a path to a nearby bikeway. Credit: Fuss & O’Neill for RIDOT, courtesy of Woonasquatucket River Watershed Council

Ryan echoes that sentiment, drawing from research he has been involved with on community gardens in Boston and Providence. “You often have outside groups come to cities and neighborhoods saying how wonderful green infrastructure is, but unless a community wants it—and wants to maintain it—it doesn’t sustain itself so well over time,” he says. “Green infrastructure needs to be both top-down and bottom-up. A bottom-up approach seems to have longer-term impact in terms of stewardship and making projects work.”

In Worcester, a robust tree-planting effort grew into a statewide success story. In 2008, the discovery of the invasive Asian longhorned beetle (ALB) in Worcester led to a massive eradication effort that would fell 35,000 trees in a 110-square-mile quarantine area in the city and adjacent towns. (Four years later, students at Clark University began studying the impact of the tree loss, noting that the heat island effect had increased in a neighborhood that had lost its trees, as did heating and air conditioning bills.)

An ambitious replanting effort known as the Worcester Tree Initiative kicked off in 2009, with the city and state Department of Conservation and Recreation (DCR) partnering to plant 30,000 trees in just five years in private yards, in parks, and along streets. The program recruits neighborhood tree stewards to care for and monitor the trees, and runs a Young Adult Forester program in the summer for at-risk youth.

The partnership has been so successful that the DCR has expanded it to other cities in

Massachusetts through its Greening the Gateway Cities Initiative. This program is concentrated in areas within cities with lower tree canopy, older housing, and a larger renter population. DCR works with local nonprofits and hires local crews to plant trees for environmental benefits and energy efficiency. The program is currently active in Brockton, Chelsea, Chicopee, Fall River, Haverhill, Holyoke, Lawrence, Leominster, Lynn, New Bedford, Pittsfield, Quincy, Revere, and Springfield.

“The model was established in ALB areas and is now a successful model across the state,” said Ken Gooch, director of the DCR’s Forest Health Program. “We’ve planted thousands and thousands of trees.”

Facing Challenges

The city of Worcester’s zoning ordinance requires that trees be planted around the perimeter of parking areas abutting a street, park, or residential property and serving more than three residential dwellings. Additionally, interior tree plantings are required in surface lots with more than 16 spaces and the state’s Complete Streets Policy, enacted in March 2018, specifically calls out trees as an important part of the public street, noted Stephen Rolle, assistant chief development officer for the city.

But some neighborhoods are less amenable to trees, as utilities, power lines, and sidewalks on narrow streets compete for space. There are



Volunteers helped the Worcester Department of Public Works and Parks install a rain garden along a busy road in the northeast section of the city. Credit: Worcester DPW

simply fewer places to plant trees in built-up cities, particularly the large shade trees providing the most environmental benefits. Urban rain gardens or bioswales often have to compete for space with utilities and parking areas too.

"There is valuable paved space downtown, and people are hesitant to let that parking space go to put in bioswales or street trees," said Berard of the Green Infrastructure Coalition.

Rolle notes another challenge: low-intensity development is sometimes perceived as more expensive, because of installation costs or maintenance requirements. But "there's quite a bit of evidence suggesting that the benefits of such improvements overall outweigh the costs," he says. "It can be cheaper to pave it, but that doesn't make it the right choice."

Part of the Green Infrastructure Coalition's advocacy includes support for a stormwater enterprise fund with a utility fee. Property owners pay into this fund based on the amount of impervious surface on their land, with the funds dedicated to projects including green infrastructure. But Berard admitted it's a tough sell. "As a policy solution, it's pretty much accepted to be the best way to fund programs," he said. "But it's politically unpalatable."

As the two cities look ahead, more plans are taking shape. Worcester is engaged in a citywide master plan process that will consider adaptations to climate change. The city also received a \$100,000 grant in 2018 to prepare a citywide climate change vulnerability assessment.

The Water and Sewer department is also developing a long-term plan to prioritize investments in water, wastewater, and stormwater infrastructure over the next 50 years, giving the department an opportunity to look at increasing stormwater capability through green infrastructure.

Meanwhile, the city of Providence has been updating its Hazard Mitigation Plan, with a major focus on climate preparedness, said Bamberger. As climate change bears down, she says, thinking ahead and planting the seeds for a greener city will be the key to vitality.

"If you only have a day to prepare, you have [fewer] options . . . You may only get to batten down the hatches," Bamberger said. "We do have some time to think strategically as to how we need to respond to these impacts. Integrating nature into urban design and supporting the natural systems we depend on is critical to creating a climate-resilient city." □

Cyrus Moulton is a reporter for the *Worcester Telegram & Gazette*, where he covers urban and environmental issues, health, utilities, and transportation.

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Santa Monica Mayor Gleam Davis. Credit: Kristina Sado

Santa Monica conjures images of sunshine and surfing, but the southern California city should rightly be known for sustainability, too. The City Council adopted the Santa Monica Sustainable City Program in 1994; twenty-five years later, the city has implemented projects ranging from building retrofits to renewable energy programs, with a new mayor every one to two years ensuring fresh perspectives. **Gleam Davis** was sworn in as mayor in December 2018, having served on the council since 2009. Active in the community since moving there in 1986, she has been involved with organizations including the Santa Monica Planning Commission, WISE Senior Services, and Santa Monicans for Renters' Rights. As corporate counsel for AT&T, she has worked with Kids in Need of Defense, which represents unaccompanied minors in immigration courts. Before joining AT&T, Davis prosecuted civil rights violations as a trial attorney at the U.S. Department of Justice and was a partner at the law firm of Mitchell, Silberberg & Knupp. A native of California, she holds degrees from Harvard Law School and USC. Davis and her husband, John Prindle, have one son. She spoke with Lincoln Institute Senior Fellow Anthony Flint for this issue of *Land Lines*.

Santa Monica Goes All-In on Sustainability

ANTHONY FLINT: Does Santa Monica's system of having a mayor for two years present a challenge for sustainability efforts, which often are slow to get going—and to pay off? What are the projects that can have the greatest impact through your upcoming term?

GLEAM DAVIS: I don't think it creates much of an impediment to the sustainability agenda. The mayor and the mayor pro tem are members of the entire city council. The city council sets the policy, adopts the budget, and drives the city's policies. Then it's the city manager who does the implementation. Whatever policy direction is given to the city manager is from a vote of the full city council.

On the sustainability front, the big news is we are now part of a group called the Clean Power Alliance, where the default provision for customers is power that is 100 percent sourced from renewables. This is helping us take a big leap toward energy self-sufficiency. People can choose to shift into lower tiers, such as 50 percent renewable, or they can opt out entirely. There are also discount options for low-income families. So far the opt-out rate is very low.

Another continuing thread is providing mobility choices. We live in a compact city, less than nine square miles, and we have the ability to provide transport options to our residents. We have light rail with three stations, so you can take transit to downtown Santa Monica or downtown LA. For our Big Blue Bus [which runs on natural gas and is moving toward an all-electric fleet by 2030], we have a policy of 'any ride, any time,' so

students can get on a bus, show an ID card from any college—a lot of UCLA students ride those lines, and of course [students from] Santa Monica College—and it's free.

AF: The city's overall greening strategy has included a first-of-its-kind zero net energy ordinance for new single-family construction and a commitment that all municipal power needs be met by renewables. But the new \$75 million municipal building project has been criticized as too expensive. How can being green be cost-effective?

GD: What's important to know is, we're leasing a fair amount of private property for government offices, at a cost of roughly \$10 million a year. We needed to bring employees into a central location, which will save money on

leases, and will encourage face-to-face and 'accidental' meetings that can be so important to communication. It just made business sense to have everybody under one roof. We'll end up saving money over time, and ultimately the building will pay for itself just on that basis. There will be additional savings over time if the building is energy neutral and has reduced water intake—we won't be consuming resources outside the building.

One of the things we've done is require developers to meet pretty stringent sustainability requirements. If we're going to do that, we need to walk the walk. That's one of the things this building shows—it's possible to build an aggressively sustainable building that will ultimately bring savings. We're trying to be a model, to show that with a little up-front investment, you can have a big impact over time.

Santa Monica's new City Services Building will consolidate municipal operations while aspiring to be one of the greenest buildings in the world. Credit: Frederick Fisher and Partners



AF: How does the Wellbeing Project, which won an award from Bloomberg Philanthropies for its ongoing assessment of constituents' needs, connect to your sustainability efforts? What has it revealed?

GD: We declared ourselves a sustainable city of wellbeing. How are the people in the community faring—are they thriving, or are there issues? The Wellbeing Project began as an assessment of youth and how they were doing, and what can we as a city do to try to help. It's really about changing the relationship between local government and people. It's not really a new concept—it goes back, not to be corny, to the Declaration of Independence: life, liberty, and the pursuit of happiness. That doesn't mean people going out and having a good time, but the ability of people to thrive. A sense of community can get frayed, whether due to technology or culture. One of the things we do is make sure children enter kindergarten ready to learn. For our older citizens, [we ask] are they feeling isolated in their apartments? It's a global movement we're thrilled to be a part of.

In our Wellbeing Microgrant program, if people come up with something to build community, we will fund it, up to \$500. One example was going out and writing down the histories and memories of Spanish-speaking residents in the many parts of the community where English is a second language. Another was a dinner to bring together our Ethiopian and Latino communities. One individual took a vacant lot and created a pop-up play area and space for art. It's about community connectedness.

AF: Another innovative strategy is to impose charges on excess water use to fund energy-efficiency programs in low-income homes. In terms of water, what's your long-term view on managing that resource in what looks to be perilous times ahead?

GD: The other thing we've done, which will percolate throughout my term and next, is to work on becoming water self-sufficient. We

control a number of wells in the region, but we had contamination [in the 1990s], and ultimately reached a multi-million-dollar settlement [with the oil companies responsible]. We had been getting 80 percent of our water from the Metropolitan Water District [after the contamination was discovered]—if you saw *Chinatown*, that's [the system that] sucks water out of the Colorado River and brings it to LA—and now we've totally flipped that, and we're getting 80 percent of our water from our own (restored) wells again. This makes us more resilient in case of an earthquake affecting the aqueducts or other disruptive events to water infrastructure, like broken water mains. Pumping water over mountains [from the Colorado River] also takes a lot of energy. We are making sure our water infrastructure is sound. We're not trying to isolate ourselves. But by getting water from our own wells, we will have good clean water for the foreseeable future.

AF: What policies would you like to see that might limit the devastation so sadly seen in the recent wildfires in California?

GD: Luckily Santa Monica was not directly affected by the Woolsey Fire. Our neighbor Malibu was—their emergency operations center was right in the path of the fire, so they came and used ours, for fighting the fire, rescuing people, and cleaning up. We had Santa Monica firefighters on the ground throughout the state under mutual aid. We hosted meetings with FEMA on displacement and recovery. We have a chief resiliency officer, and she is a steady drumbeat, reminding people [that a major natural disaster] could happen here. We have promoted the Seven Days Plan—does everyone have seven days of water, food, and an emergency radio that doesn't require electricity? We also passed aggressive earthquake requirements, evaluated properties that are most vulnerable, and are now moving to seismically retrofit them.

These things we do in Santa Monica may seem a little aggressive, and cost money, but it's not just about winning awards or patting ourselves on the back for being environmentally



Santa Monica's Big Blue Bus, which runs on natural gas and is expected to be all-electric by 2030, is part of the city's commitment to providing mobility options for all. Credit: City of Santa Monica

progressive, it's so that we'll be able to weather things like fires. People say you're spending money, raising water rates, and it costs more for energy ... we want to do it to address the impacts of climate change. But it also means that when there's a natural disaster, we are more resilient.

AF: The city's experience with electric scooters—I'm referring to the company that deployed a fleet without asking permission—seemed to show that the transition to a sharing economy coupled with technological innovation can be messy. Is it possible to welcome disruption and maintain order?

GD: We were sort of ground zero for scooters. It was disruptive at first, and we had to make a lot of adjustments. Their philosophy was that it was easier to ask forgiveness than permission. There was some panic, and some people were also using them in a horrible manner. Now we're in a 16-month pilot program, where we selected four dockless mobility operators: Bird, Lime, Jump, which is part of Uber, and Lyft. We created a dynamic cap on the number of devices on the street, so they can't put out as many as they want. We have some policies to address

conflicts and safety, and we have issued tickets when necessary.

This is all part of giving our residents lots of mobility options. It's all designed to give people the option to get out of their car, whether it's going to downtown LA or walking two blocks to a neighborhood restaurant. We wanted to make sure our more economically diverse communities had access, so it's not just downtown. If you can replace a car with alternative means that include scooters or electric bikes for that first or last mile, that's a big cost savings. We had about 150,000 rides on shared mobility [in November 2018]. That's pretty amazing for a place with 93,000 people. At the end of the pilot, we'll evaluate everything and figure out where we go from there.

A number of neighboring cities banned scooters outright, but that's not how Santa Monica deals with technology. We're figuring out the best way to manage the disruptive technology. Disruption isn't a four-letter word. □

Anthony Flint is a senior fellow at the Lincoln Institute of Land Policy.

POLICY BRIEF

Scenario Planning: Embracing Uncertainty to Make Better Decisions

By Robert Goodspeed

AMERICAN CITIES AND regions face an unprecedented array of challenges and uncertainties. When it comes to planning for the future, some communities seek transformative spatial changes, such as stopping urban sprawl and pursuing greater sustainability. Others seek resilience in the face of extreme weather, flooding, and droughts intensified by climate change. In response, many leaders are turning to scenario planning—a procedural tool that enables planners to make better decisions about the future by incorporating diverse stakeholder input and other relevant data more thoughtfully and deliberately. Scenario planning improves inclusive decision making and yields plans more likely to be implemented.

Originally developed as a tool for military and corporate strategic planning, scenario planning enables communities to create and analyze multiple plausible versions of the future. Unlike traditional approaches that begin with forecasting, scenario planning starts with a different mindset: *We can't predict the future, but we can better prepare for it.* In recent years, it has

been adapted by urban planners and combined with traditional planning methods like visioning and consensus building for use in city and regional plans.¹

At its core, scenario planning guides planners, community members, and other stakeholders to consider the various futures they may face—good, bad, and unexpected. Typically, normative processes consider how to plan and implement a specific, desired scenario, whereas exploratory processes build several scenarios to help plan for different futures, resulting in adaptable, effective plans. Projects may also use scenarios to analyze emerging trends or overlooked issues.

Scenario planning does not require complex software or expensive tools, although both may be helpful. Regardless of whether flip charts or computer models are used, scenario planning engages with uncertainty, encourages careful thinking, and fosters diverse perspectives. The results produce more effective, deeply considered plans that better support tough decision making—and that are more likely to be implemented.

We can't predict the future, but we can better prepare for it.

Through the Austin Sustainable Places Project, elected officials, property owners, local residents, and other stakeholders in Dripping Springs, Texas, use colored stickers to represent different place types—such as residential neighborhoods or mixed-use developments—as part of the process to create a normative land use scenario. Following this workshop, planners refined participants' ideas to consider different ways their community could grow. Credit: Robert Goodspeed



Scenario Planning in Practice

Scenario planning begins with a careful analysis of what is certain and uncertain about the future. The planning field has largely ignored uncertainty for too long, resulting in fundamentally flawed plans that are poorly suited for implementation. Indeed, inflexible plans have seen homes flooded because they were built in areas that were thought to be safe from storms, public funds wasted on infrastructure to accommodate overestimated growth, or expensive mismatches between affordable housing types and residents' needs. Furthermore, planning that ignores uncertainty tends to perpetuate the status quo, rather than prepare residents for the future.

By contrast, scenario planning puts looming uncertainties at the heart of the process by prompting practitioners to identify, prioritize, and analyze the more important variables facing their cities and regions—like changing climate and weather patterns, uncertain growth trends, and shifting housing preferences. When this analysis focuses on forces within the city itself, planners can explore not only what *may* change but also what *could* change to advance community goals—or as the result of other interventions. When participants focus on external uncertainties, they can better prepare for changes in the broader environment, improving resilience to uncertain but foreseeable events. Taken together, these investigations are how scenario planning helps cities to pursue practical transformation.

Depending on a community's goals, planners can use several different types of scenarios, exploring what *may* happen given certain assumptions or what *can* happen subsequent to certain events.² Scenarios are then combined in different types of projects, which can be implemented at different spatial scales (see Table 1):

Normative processes create several scenarios and identify one that describes a community's desired future as the basis for a plan. The most developed type of scenario planning, normative processes are used primarily for plans concerning land use, transportation, or both.³ Such projects encourage a synthesis of quantitative analysis and discussion of community values, resulting in detailed scenarios and plans that enjoy stakeholder buy-in. Normative scenario planning processes can also incorporate scenarios that focus on uncertainties beyond the immediate control of city leaders—such as the amount of economic or population growth—to build a plan that describes how the city should respond under these different conditions.

Exploratory processes are generally qualitative and thus best used to build a shared understanding of complex, new trends among diverse stakeholders. These projects create multiple hypothetical future scenarios, based on both changing trends and potential decision making, allowing planners to analyze uncertainties beyond city or regional control. These projects improve understanding of key trends, recognition of uncertainties, and insights about existing plans.

The Scenario Planning Toolbox

A clearly organized process is essential to coordinate the collaboration that drives scenario creation and analysis. Many projects also incorporate certain digital tools to model and analyze specific scenarios. These two elements are often closely intertwined, as participants provide key inputs and scrutinize results. Regardless of the specific tools chosen, responsible practitioners ensure close collaboration between the experts who design and implement the tools and other stakeholders—especially as experts often bring assumptions that particular scenario projects may want to challenge.

PROCESS TOOLS

Scenario projects draw on various methods of collaboration and participation in order to achieve their goals. Although some engage only small groups of stakeholders while others feature broad public participation, effective scenario planning at any scale requires including a diverse array of participants. Various templates exist, but most share several key stages, each of which can involve participatory or collaborative workshops (see Figure 1).⁷

DIGITAL TOOLS

Whether or how scenario projects use digital tools depends on the nature of the scenarios being created, the types of analysis needed, and the resources at hand—but certain types of software can be powerful, informative additions to the process when available:

- **Systems Modeling:** Models of urban systems like stormwater infrastructure or transit networks can be an extremely useful way to create and test alternate scenarios. Planners often use these tools in close collaboration with modeling experts, including engineers and university-based researchers. More complex models require additional expertise to operate, but they too are powerful; for instance, cellular automata-based models can predict urbanization patterns, and econometric models like UrbanSim link transportation infrastructure to land development patterns.

Figure 1
Typical Steps in a Scenario Planning Project

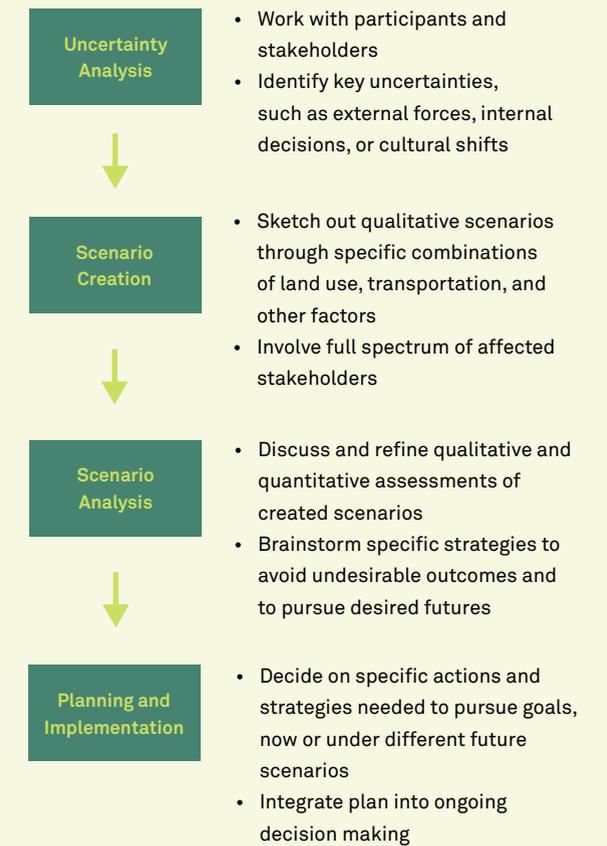


Table 1
Examples of Urban Scenario Planning Projects

EXAMPLE	PROJECT TYPE	SCALE	CASE OUTCOMES
Envision Utah (1999)⁴	Normative project (focus on transformation)	Metropolitan Region	Shared vision to slow sprawl and invest in transit
Gwinnett County (GA) 2030 Unified Plan (2009)⁵	Normative project (focus on external uncertainties)	County	Detailed scenarios with recommendations for different levels of economic growth
Sahuarita (AZ) Exploratory Scenario Project (2014)⁶	Exploratory project	Municipality	Direction on regional collaborations and the need to form a municipal water utility

- **Demographic and Economic Modeling:** Communities can use a variety of well-known demographic and economic models to create detailed population scenarios. For example, they can use demographic projections to describe a city's future population under various migration scenarios.
- **Place-Type Development and Analysis:** These tools allow planners to sketch different land uses and calculate a complex suite of indicators that describe the different patterns. Because they require less customization than other forms of models and speak directly to widespread land use planning questions, such programs are among the most popular and useful ways to create scenarios (see box on next page).

Recommendations for Practice

USE SCENARIO PLANNING FOR VIABLE LONG-RANGE STRATEGIC PLANS

Although planning approaches based on accommodating predicted growth worked for many 20th-century communities, writing plans this way today leaves many vulnerable to economic, technological, and climate-related uncertainties. All long-term strategic plans, prepared at all levels of government, could benefit from scenarios and the voices and inputs of more diverse stakeholders. Scenario planning empowers communities to grapple with broader trends, educate the public, and catalyze collaboration, consensus-building, and action.

CREATE SCENARIOS WITH AND WITHOUT HIGH-TECH TOOLS

There is a common myth that scenario projects require big budgets and complex computer models. While models can provide useful insights and analysis, these tools do not define the scenario planning process:

Even model-intensive projects require extensive qualitative discussions and analyses to ensure that participants understand them thoroughly and leverage them appropriately and effectively. Practitioners should therefore use modeling software if appropriate and when possible, but they should not neglect well-proven qualitative scenario methods, which can generate useful insights, understanding, and creativity with little more than paper and a pencil.

TEACH SCENARIO PLANNING METHODS TO THE NEXT GENERATION

Given its growing popularity and relevance to urban planning challenges, scenario planning should be taught as part of professional degree programs in urban planning and related fields. The current standards used by the Planning Accreditation Board, which accredits urban planning programs in North America, specifies that degree curricula must include discussions of the future—specifically “relationships between past, present, and future in planning domains, as well as the potential for methods of design, analysis, and intervention to influence the future.”⁸ Scenario planning clearly addresses this issue and ought to be more explicitly acknowledged in future standards. □

CommunityViz communityviz.city-explained.com

An ArcGIS extension that functions as a planning toolbox used to create and analyze place types, among many other functionalities

Envision Tomorrow envisiontomorrow.org

An ArcGIS extension that links with a set of spreadsheets to allow planners to sketch and analyze land use patterns with flexibility

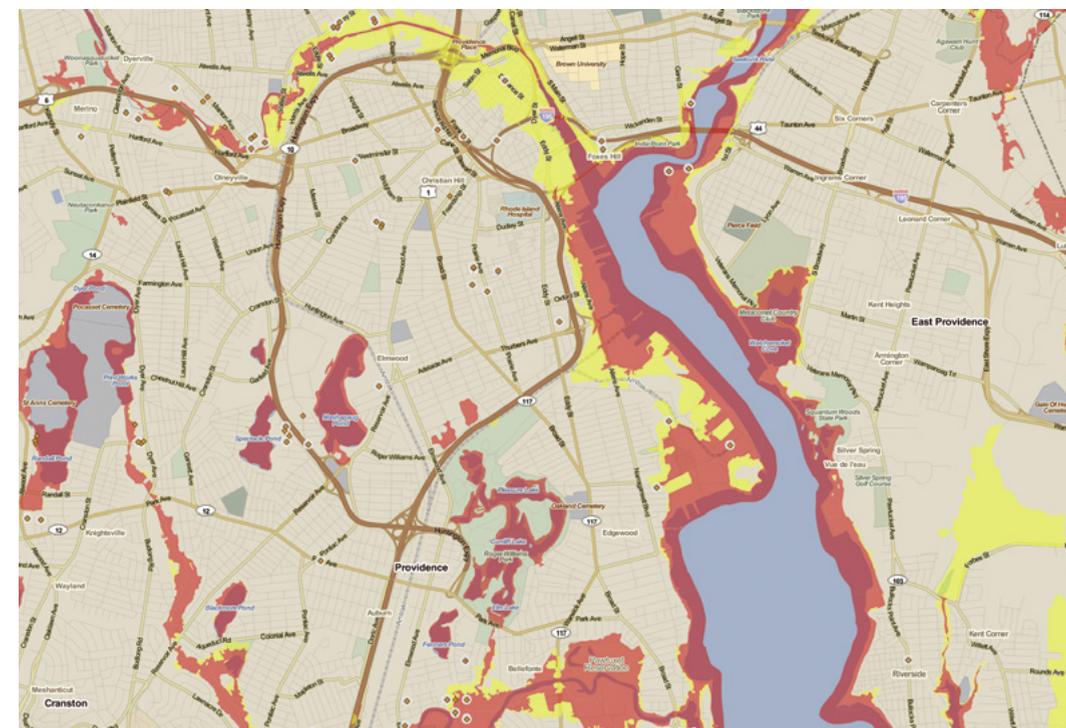
UrbanFootprint urbanfootprint.com

A web-based planning tool similar to Envision Tomorrow that also facilitates analysis of additional topics, such as health impacts or risk for flooding, sea-level rise, and fire

This policy brief is based on the forthcoming book by Robert Goodspeed, *Shaping Places with Scenarios: A New Approach to Urban and Regional Planning* (Cambridge, MA: Lincoln Institute of Land Policy).

- ¹ For discussions about the use of scenario planning in urban planning, see Arnab Chakraborty and Andrew McMillan, “Scenario Planning for Urban Planners: Toward a Practitioner’s Guide,” *Journal of the American Planning Association* 81, no. 1 (Winter 2015): 18–29; and Lewis D. Hopkins and Marisa Zapata, eds., *Engaging the Future: Forecasts, Scenarios, Plans, and Projects* (Cambridge, MA: Lincoln Institute of Land Policy, 2007).
- ² Lena Börjeson, Mattias Höjer, Karl-Henrik Dreborg, Tomas Ekvall, and Göran Finnveden, “Scenario Types and Techniques: Towards a User’s Guide,” *Futures* 38, no. 7 (September 2006): 723–739.
- ³ For more on normative scenarios, see Federal Highway Administration, *Scenario Planning Guidebook*, 2011; Oregon Department of Transportation, *Oregon Scenario Planning Guidelines*, 2013; and Keith Bartholomew, “Land Use-Transportation Scenario Planning: Promise and Reality,” *Transportation* 34, no. 4 (July 2007): 397–412.
- ⁴ Brenda Scheer, *The Utah Model: Lessons for Regional Planning* (Las Vegas, NV: Brookings Mountain West, 2012), 1–27.
- ⁵ Gwinnett County, *2030 Unified Plan*, February 2009, <https://www.gwinnettcountry.com/web/gwinnett/departments/planninganddevelopment/gwinnett2030unifiedplan>.
- ⁶ Joe Marlow, Hannah Oliver, Ray Quay, and Ralph Marra, “Integrating Exploratory Scenario Planning into a Municipal General Plan Update” (working paper, Cambridge, MA: Lincoln Institute of Land Policy, December 2015).
- ⁷ For a useful discussion of how to organize scenario workshops, see Bill Ralston and Ian Wilson, *The Scenario-Planning Handbook: A Practitioner’s Guide to Developing and Using Scenarios to Direct Strategy in Today’s Uncertain Times* (Mason, OH: Thomson/South-Western, 2006).
- ⁸ Planning Accreditation Board, “PAB Accreditation Standards and Criteria Approved March 3, 2017,” www.planningaccreditationboard.org/index.php?s=file_download&id=500.

Brownfields in High and Moderate Flood Risk Areas in Providence, RI



Map Boundaries (As of 2018)

- High Flood Risk
- Moderate Flood Risk
- ◆ Brownfield

Though frequently seen as an urban liability, brownfields can be an asset. The cost to remediate these formerly developed properties is often high, but they present valuable opportunities for revitalization and redevelopment. According to the EPA, waterfront brownfields “can play an important role in bolstering local resilience to increased flooding, storm surge, or temperatures from a changing climate.” In Providence, brownfields are a top priority in the ongoing effort to revitalize river corridors and riverfront areas.

Sources: Brownfield Revitalization in Climate-Vulnerable Areas, U.S. EPA, 2016; Woonasquatucket Vision Plan, City of Providence, 2018.

Credit: The Place Database. www.lincollnst.edu/research-data/data/place-database

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