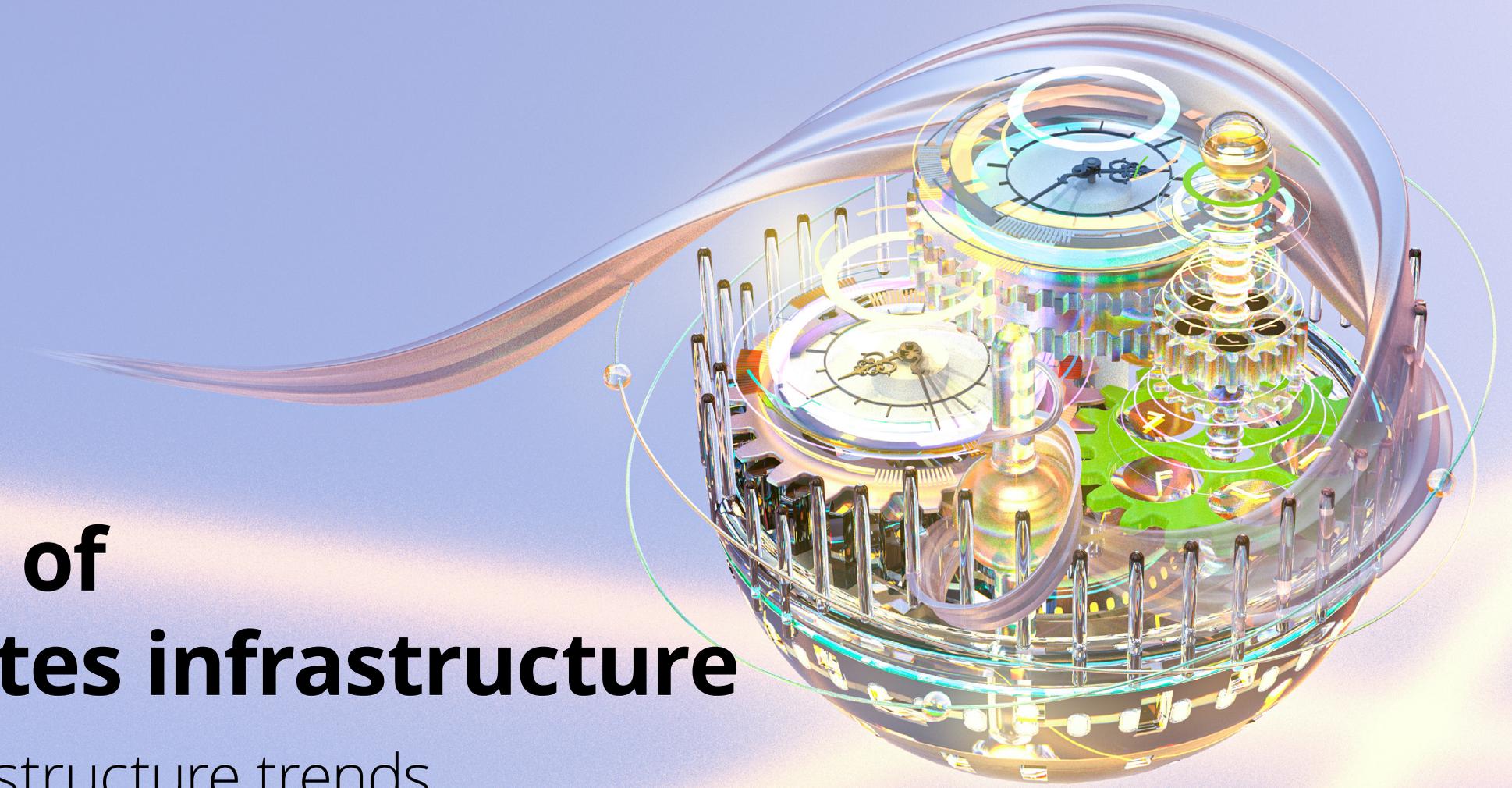


The future of United States infrastructure

A survey of infrastructure trends



About the authors

John O’Leary | jpoleary@deloitte.com

John O’Leary is a senior manager with Deloitte Services LP and is the state and local government research leader for the Deloitte Center for Government Insights. Prior to joining Deloitte, he served as the vice president of communications and executive reporting with State Street Bank. O’Leary previously served in multiple senior leadership roles for the Commonwealth of Massachusetts and was a distinguished research fellow at the Kennedy School of Government at Harvard University. He is the coauthor of the 2009 *Washington Post* bestseller *If We Can Put a Man on the Moon*.

Avi Schwartz | avschwartz@deloitte.com

Avi Schwartz is a Risk & Financial Advisory principal in Deloitte Transactions and Business Analytics LLP and leads the Infrastructure and Capital Projects practice for Government & Public Services. He has more than 20 years of experience working in the construction industry and advising owners of major capital construction projects. He routinely conducts management and financial controls assessments of significant capital projects with a goal of improving performance and mitigating strategic and operational risks. While his clients have included a range of Fortune 500 companies, Schwartz maintains a special focus on large-scale public sector construction and infrastructure projects, integrating leading practices from public, private, and global entities so that public sector projects can be built better.

Steven Hamilton | shamilton@deloitte.com

Steven Hamilton is a senior manager with Deloitte Transactions and Business Analytics LLP. He provides market/economic assessment, strategic planning, and transactions (P3) support for large-scale economic development and infrastructure projects worldwide for national and city clients. Hamilton is helping drive Deloitte’s urban development and SMART cities market focus and solutions, including developing and deploying new evidence-based approaches that support informed decision-making by city leaders, citizens, and stakeholders. His other areas of technical focus include Special Economic Zones (SEZs), industrial zones (IZs), ports, and airport cities. He has experience in developing key performance indicators for infrastructure investment and identifying business reforms to enhance countries’ investment climates.

Sushumna Agarwal | sushagarwal@deloitte.com

Sushumna Agarwal is an assistant manager with the Deloitte Center for Government Insights, Deloitte Services LP. She researches workforce issues at the federal, state, and local government level. Her primary focus is on applying quantitative techniques to enable data-driven research insights.

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The year 2022 marks a new beginning for infrastructure in the United States

THE CURRENT MOMENT represents an opportunity of renewal, for several reasons. The United States plans to invest US\$1.2 trillion in infrastructure projects.¹ This includes the passage of the Infrastructure Investment and Jobs Act (IIJA) in November 2021 which will bring US\$550 billion in new infrastructure spending over the next five years—a massive federal infusion of funds (figure 1). In addition, there are several larger trends now reshaping infrastructure:

Economic stimulus for a postpandemic rebuild: The pandemic acted like a time-machine into the future, delivering massive changes faster than imaginable. Governments are investing in this new economy, which will require new—and different—infrastructure.

Focus on environmental sustainability: While green infrastructure has been on the radar for a while, the IIJA significantly increased the federal commitment to environmental projects.

Emphasis on greater social equity: There is a strong focus on ensuring that new infrastructure meets the needs of all people, with a specific emphasis on disparately impacted communities.

Technology: The pandemic demonstrated the ever-increasing importance of technology. From increased broadband access to smart infrastructure, technology is transforming infrastructure priorities—and raising cybersecurity concerns.

New funds will go to a wide array of traditional and innovative infrastructure.

FIGURE 1

IIJA has committed US\$550 billion in new infrastructure

US\$ billions

\$100 Roads and bridges	\$65 Broadband internet	\$62 Water infrastructure, water storage, and wastewater systems*		\$46 Infrastructure resiliency	
	\$66 Passenger and freight rail	\$65 Power infrastructure	\$39 Public transit	\$25 Airports	
\$17 Ports and waterways				\$15 Electric vehicles and infrastructure	\$11 Safety and research

Note: The \$8.3 billion for western water infrastructure is included in the “Water infrastructure, water storage, and wastewater systems” category.
Source: Deloitte analysis of IIJA.

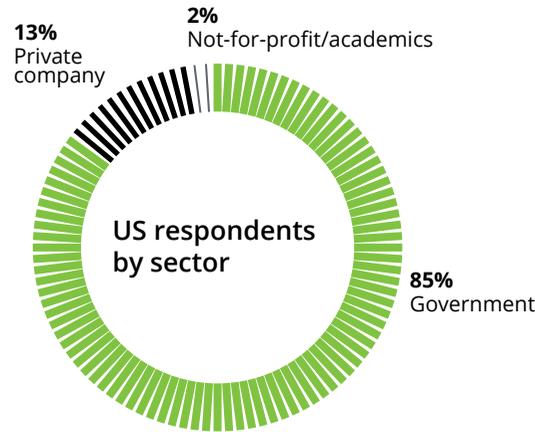
What does the future hold for infrastructure in the United States? We asked the specialists.

TO FIND OUT what's ahead, in September 2021 we surveyed 300 public officials and infrastructure executives in the United States. These were senior officials in the area of infrastructure, representing governments, private companies, and nonprofits including academics (figure 2). We surveyed public officials from federal (9%), state (29%), and local (61%) governments, with a greater weighting on state and local governments since they are more responsible for the actual execution of infrastructure projects. Deloitte engaged an outside survey firm to conduct a "double blind" survey to promote unbiased participation. (For more information on the survey methodology, see appendix).

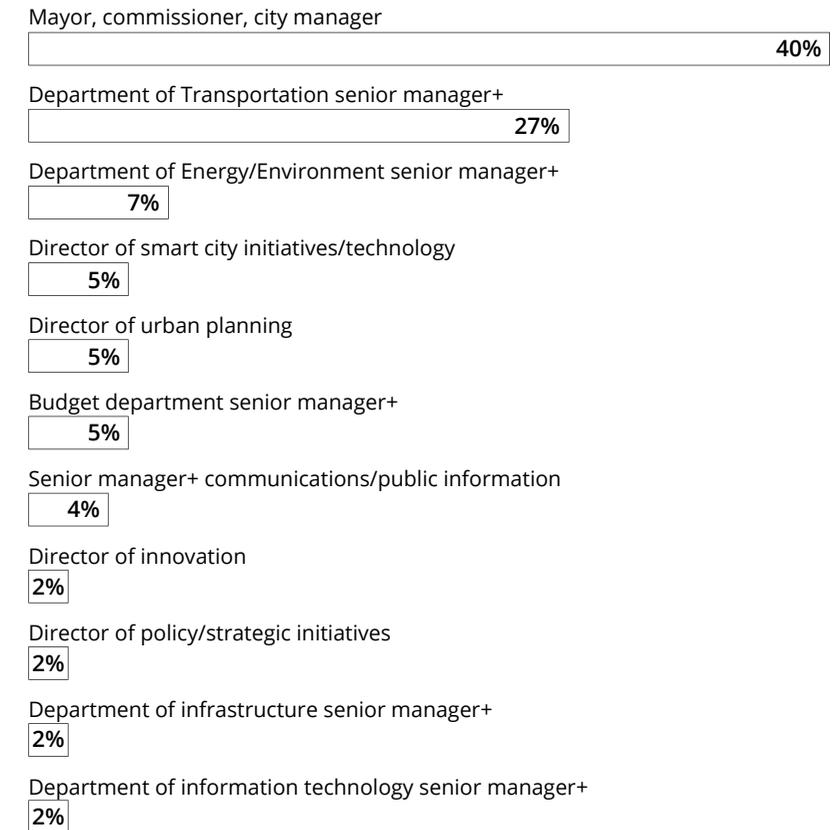
Our survey respondents also shared their comments and insights with us, and some of their quotes will be shared throughout the report.

FIGURE 2

Survey respondents represent governments, private companies, and not-for-profits



US public sector respondents by title



Note: The "+" symbol denotes senior-level designations (including commissioner, director, and senior manager).

Source: Deloitte analysis.

Ninety-seven percent of respondents told us they expect that there will be significant, lasting impacts from the pandemic. But what might these lasting changes be?

THE PANDEMIC DISRUPTED everything. What remains to be seen is which changes will be transient and which ones will be more enduring.

Importantly, an overwhelming majority of our survey respondents (97%) agree that the pandemic will have significant, lasting impact on infrastructure. However, there was disagreement about what that impact will be.

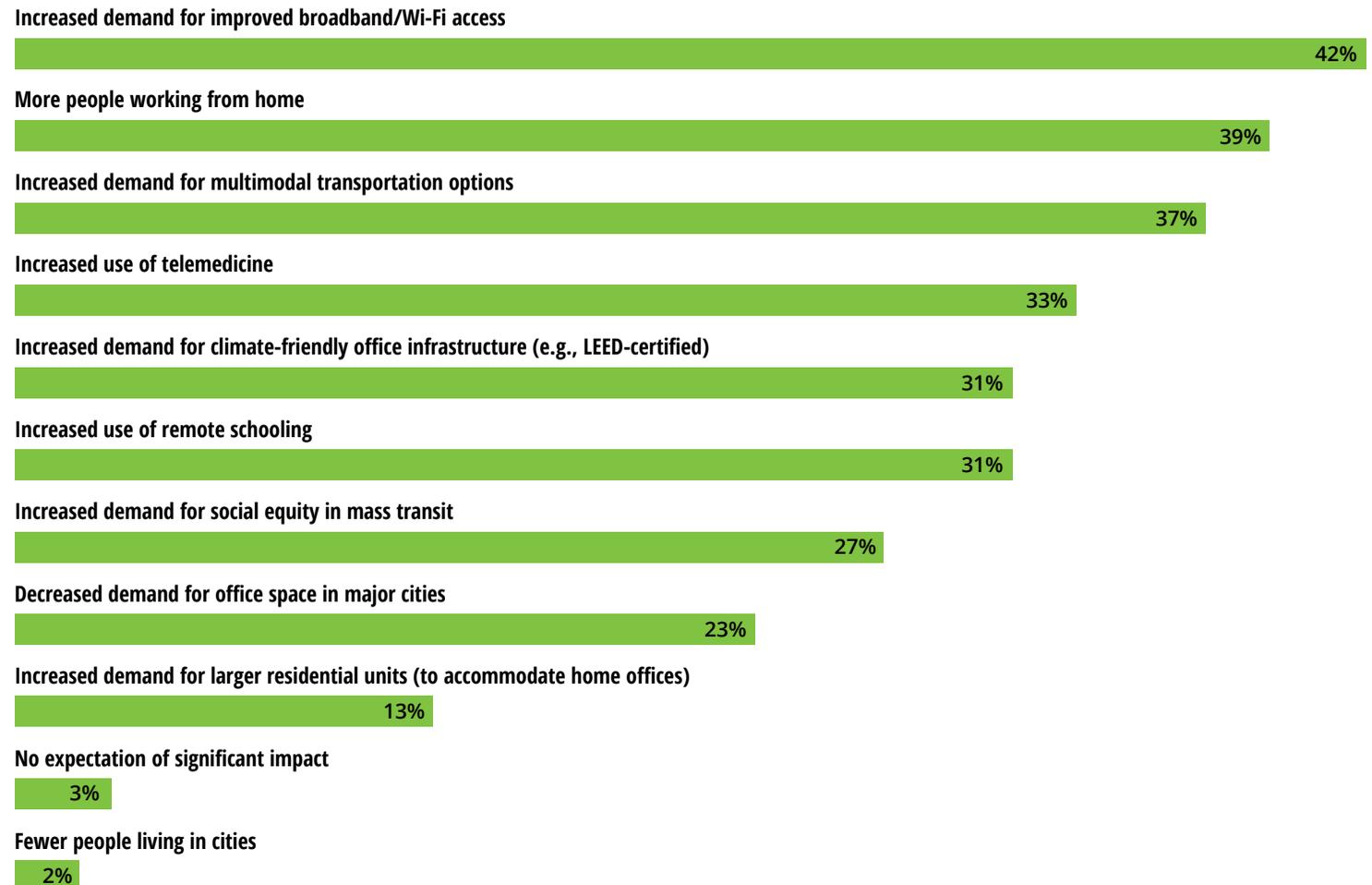
The biggest impacts expected by those surveyed are higher demand for broadband and multimodal transportation (figure 3). More than one-third of respondents also believe that there will be more people working from home and greater use of telemedicine. Interestingly, greater use of online modes of working or accessing services are not expected to translate to where and how people live. **Only 2% of respondents believe that there will be fewer people living in cities** and only 13% believe that there will be more demand for larger residential units. While some real estate observers point to recent trends toward larger residential units,² the government and private sector infrastructure leaders we surveyed, didn't see this as a significant trend.

Respondents do not expect people to flee cities. But they do believe demand for multimodal transportation will increase.

FIGURE 3

Higher demand for multimodal transportation and broadband lead the list of the lasting impacts of the pandemic

Which of the following possible postpandemic shifts do you believe will have a significant impact on infrastructure over the next three years? (Select all that apply)



Source: Deloitte analysis.

Respondents expect infrastructure to become more digital, more ecofriendly, and more focused on limiting cybercrime

HOW WILL INFRASTRUCTURE investment look different in the postpandemic era? Our respondents sent several strong signals:

Focus on cybersecurity: More digital activity brings more cybercrime. More than two-thirds of respondents expected greater focus on data security over the next three years. Today, even “hard” infrastructure increasingly entails a digital component, as shown by the Colonial

Pipeline shutdown.³ As autonomous vehicles become more common, they will likely require compatibility with vehicle-to-vehicle (VTV), vehicle-to-grid (VTG), and Internet of Things (IoT) requirements, all of which come with cyber risks.

A big commitment to digital: This survey, which was conducted prior to the passage of the IIJA, foresaw a steep increase in digital infrastructure investments. Almost two-thirds of respondents expect governments to focus

heavily on digital infrastructure investments—a commitment embodied in the US\$65 billion allocation for broadband in the IIJA (for more see “Closing the digital divide”).

Climate-friendly infrastructure: The environmental step respondents most expect is providing incentives for renewable energy, which 59% say will grow, and more than a third say will grow significantly.

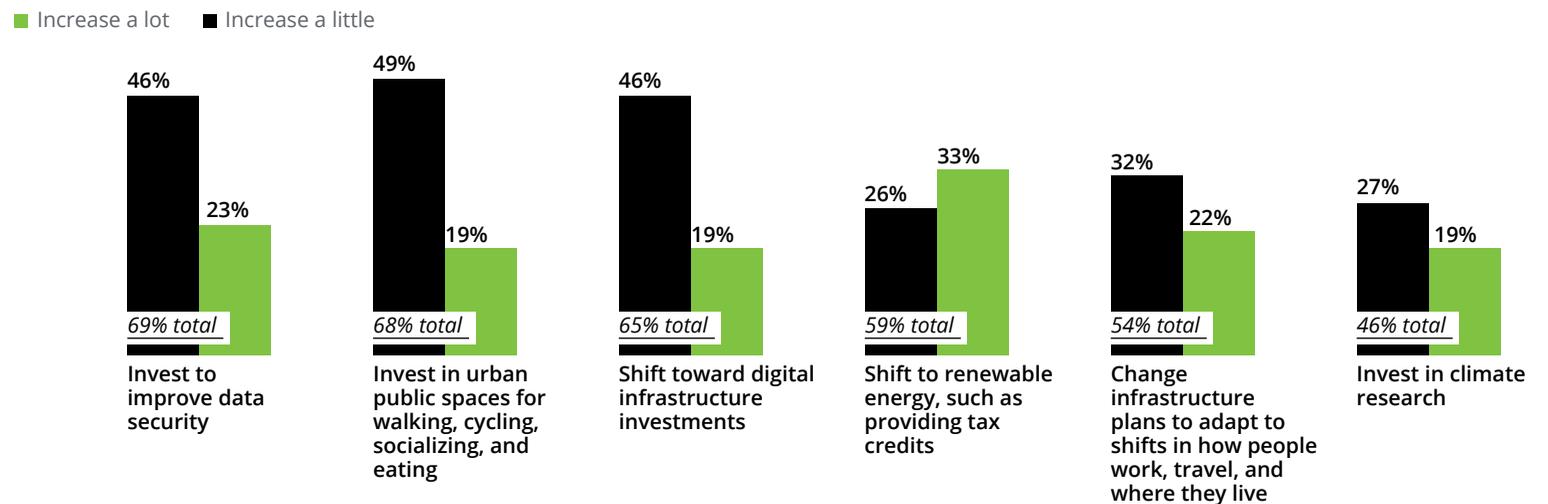
“We will invest in IoT and cloud products and services to reduce cyberthreats and deliver digital workplaces to remote city workers.”

— Director of smart city initiatives, California city

FIGURE 4

Most respondents expect the government to focus more on data security, digital infrastructure, and climate-friendly initiatives

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?



Source: Deloitte analysis.

Is our infrastructure adequately protected from cyberattacks? One in four state and local respondents say, “No.”

CYBERATTACKS ON CRITICAL infrastructure can be dangerous and costly. From New York’s Bowman Avenue Dam in 2013⁴ to San Francisco’s MUNI light rail system in 2016,⁵ to the shutdown of the Colonial Pipeline in 2021,⁶ attacks on essential infrastructure are a big concern for many public officials.

The challenge is especially acute for state and local governments. While federal agencies often spend 5% to 20% of IT budgets on cybersecurity, most states spend only 1% to 2% specifically on security.⁷ For local governments with smaller IT budgets, even paying the average salary (more than US\$100,000) of one cybersecurity professional can be a daunting task.⁸ The result is that state and local governments that provide some of the most critical services can also be some of the most vulnerable to attacks.

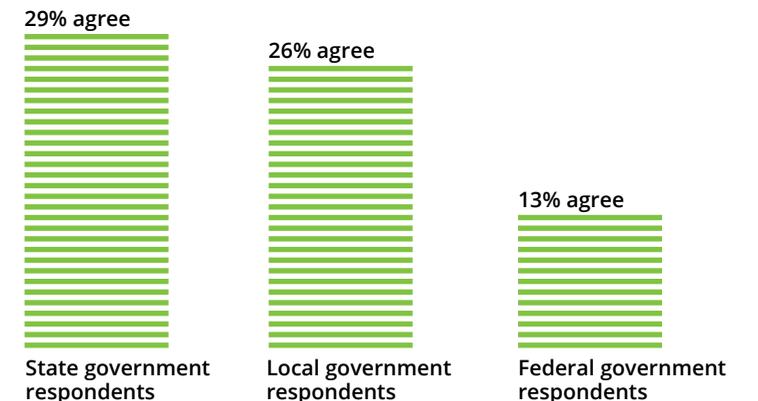
Our survey found that federal officials were much more confident about cybersecurity than their state and local counterparts (figure 5). More than one in four state and local officials told us that infrastructure is vulnerable to cyberattacks, compared to federal officials surveyed.

The NASCIO survey of state CIOs found the number one priority for 2021 to be cybersecurity and risk management.⁹

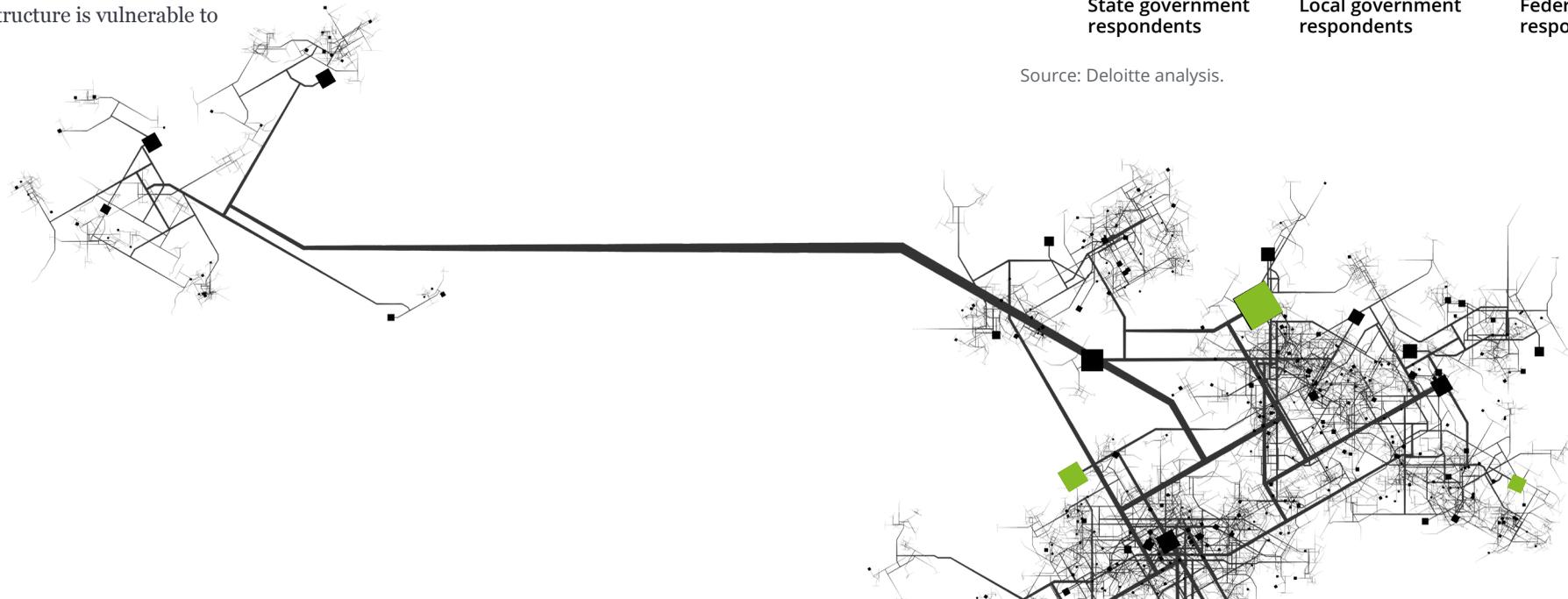
FIGURE 5

State and local government infrastructures are deemed more vulnerable to cyberattacks compared to federal as per respondents

Do you agree with the following statement? Our infrastructure is not adequately protected from cyberattacks.



Source: Deloitte analysis.

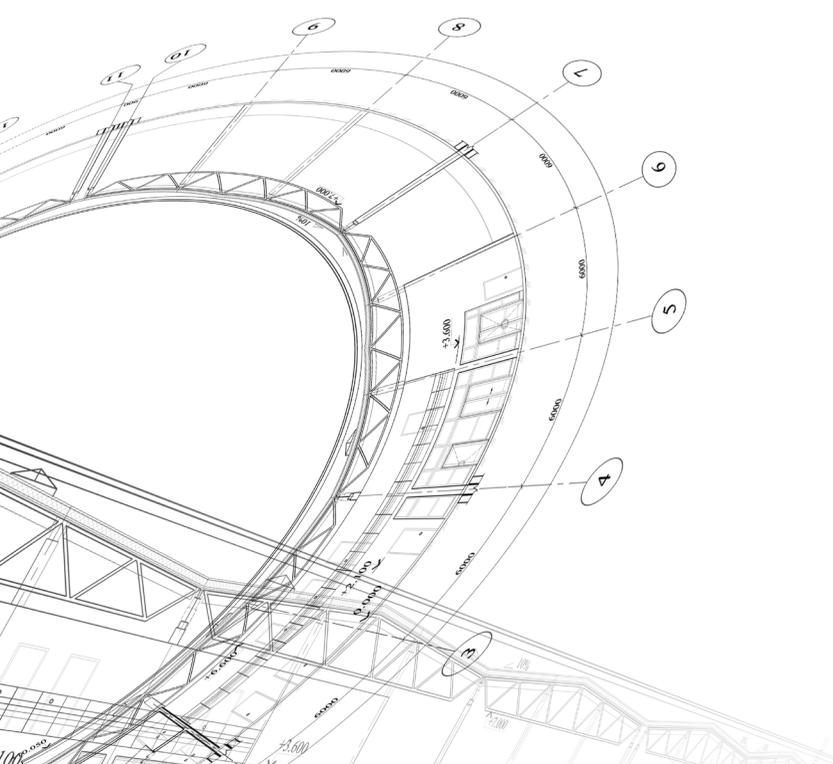


What do respondents say isn't going to change? The (sometimes burdensome) process of building infrastructure

OUR RESPONDENTS OVERWHELMINGLY told us that they don't expect the way governments oversee the building of infrastructure to change much— meaning some of the execution challenges around infrastructure projects are likely to continue.

Complex regulations and associated court challenges can significantly increase the costs and create long delays in the execution of infrastructure projects. Yet only 3% said they expect regulations to be loosened to make it easier to execute on projects.

Similarly, few respondents expect significant changes to contracting methods or an increase in the involvement of the public in infrastructure decisions.



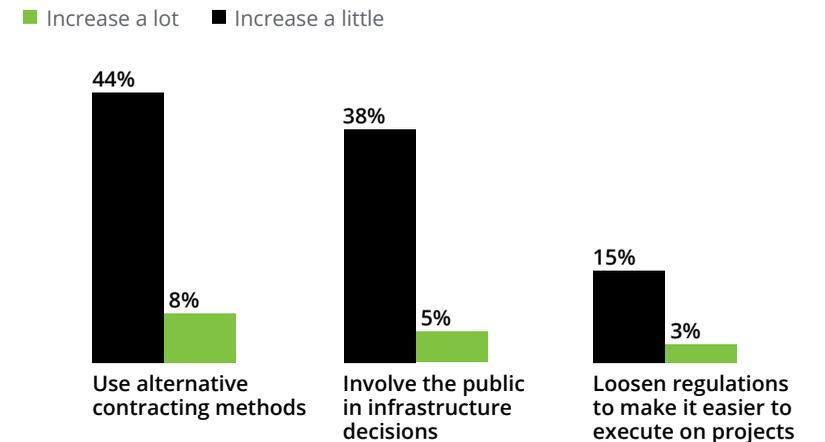
The federal government has recognized the challenge of having a lengthy permitting process. In December of 2015, Congress established the Permitting Council, an agency comprising 13 different federal agencies, with the goal of improving reviews and streamlining decisions for certain large infrastructure projects.

In 2021, the IJA legislation made the Permitting Council permanent.¹⁰

FIGURE 6

Respondents don't expect big changes in infrastructure execution

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?



Source: Deloitte analysis.

Talent shortages were cited as the biggest obstacle to infrastructure over the next three years

OUR SURVEY REVEALED an interesting finding: Respondents told us that a shortage of talent would be the biggest obstacle to implementing infrastructure projects—more than budget constraints or regulatory challenges. When thinking of infrastructure talent, it is easy to think of construction workers. But today’s infrastructure encompasses many more elements such as renewables, internet services, data management centers, and data analytics, which require a far more diverse range of skills.

Data privacy and security risks were cited as the number two challenge to implementing infrastructure projects, according to the survey respondents. Recent events such as the Colonial Pipeline hack have highlighted security vulnerabilities of US infrastructure.

Another shortage that might impact infrastructure construction? Supplies. Availability of materials (33%) and supply chain costs (33%) were both cited as significant potential obstacles.

“Certified cybersecurity professionals should be trained to meet the shortage of cybersecurity advisers.”

— *CEO, New York-based telecoms company*

FIGURE 7

Respondents cited talent shortage, and data privacy and security risks as the biggest expected obstacles in implementing infrastructure projects

Over the next three years, what do you expect to be the greatest obstacles in implementing the infrastructure projects that you are involved in? (Select up to five).

Obstacles to infrastructure projects over the next three years	US respondents
Shortage of talent and expertise	46%
Data privacy and security risks	37%
Unclear implementation road map and ROI	35%
Budget constraints	34%
Availability of materials	33%
Increasing supply chain costs	33%
Difficulty coordinating across departments	31%
Complex regulations	29%
Difficulty obtaining environment clearance	28%
Lack of technological skills	26%
Complex procurement process	26%
Lack of citizen support	18%
Lack of political will	14%
Investments seen as helping the rich, not the poor	5%

Source: Deloitte analysis.

Incremental steps to meet equity goals are expected on the ground

MORE THAN HALF of respondents (52%) expect at least some increases in social impact assessments for future infrastructure projects, and a similar number (54%) expect increased efforts to improve equitable access for mass transit in underserved areas. (It should be noted that this survey was conducted before the passage of the IIJA, which includes significant funding for equitable infrastructure initiatives. If the survey had been conducted after passage of the IIJA, some of these responses may have been even higher.)

Our survey respondents did not reveal a strong consensus that major steps will be taken to meet various equity goals, however. Only 15% of US respondents said social impact assessments will increase a lot. Similarly, only 17% expect efforts to provide equitable access to mass transit to increase a lot (figure 8).

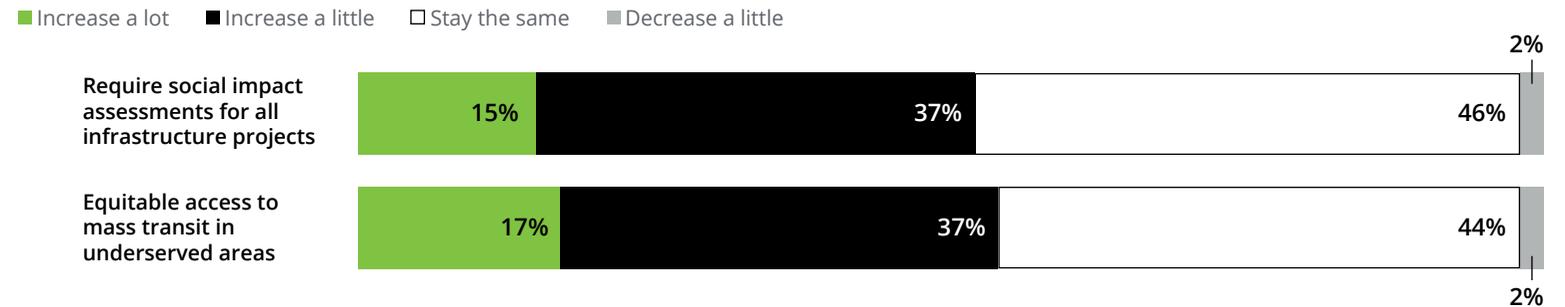
Fifty-two percent of respondents expected social impact assessments for infrastructure projects to increase—before the passage of the IIJA.

Fifty-four percent of respondents expected more equitable access to mass transit—before the passage of the IIJA.

FIGURE 8

Most respondents expect some increase in social impact assessment and changes to equitable mass transit

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?



Source: Deloitte analysis.

Eco-infrastructure: Respondents anticipate uptick in tax credits for renewables

THE SURVEY FOUND that a high percentage of respondents are expecting sizable increases in incentives for renewables, with 33% expecting that area to increase a lot and another 26% expecting it to increase a little.

As climate incentives increase, state and local governments should learn how to access them and integrate them into project management of infrastructure.

However, our survey indicates that other actions are deemed less likely.

For example, although respondents expect *demand* for multimodal transportation to increase (see figure 3), they expect a limited response from government in this area. Just 13% expect a significant shift ahead in terms of

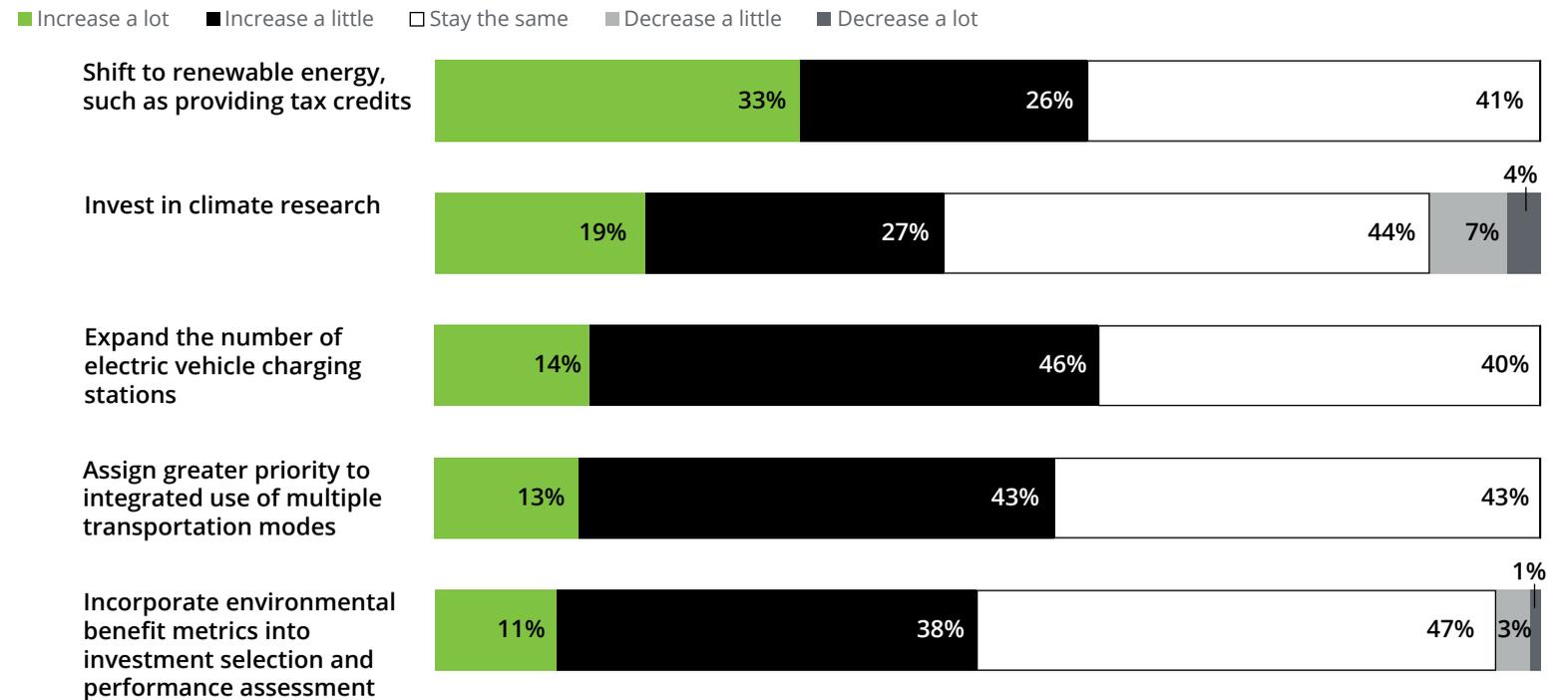
prioritizing mixed transportation modes (such as train to bus to bike) while 86% expect it would either stay the same or increase by just a small amount.

Just 11% expect efforts to incorporate environmental benefit metrics into investment selection to increase a lot.

FIGURE 9

Respondents largely expect governments to increase incentives for renewables

Governments are expected to take various steps over the next three years to achieve their postpandemic social, environmental, and economic infrastructure agendas. For each step below, do you expect the government to increase its efforts a lot, increase a little, stay about the same, decrease a little, or decrease a lot?



Source: Deloitte analysis.

Environmental justice: Top of mind for the federal government, less so for state and local

THE FEDERAL OFFICIALS we surveyed had a much higher expectation than state officials that the government will be promoting environmental justice by helping disparately impacted communities—about 58% federal government officials agreed versus just 32% state officials.

Environmental justice is a focus of the federal government as evidenced by the January 2021 executive order to “secure environmental justice and equitable economic opportunity.” This order established a new Interagency Working Group on the Social Cost of Greenhouse Gases and directs federal agencies “to immediately commence work to confront the climate crisis.”¹¹ The White House also launched the “Justice40” effort to ensure that at least 40% of all benefits from federal investments in climate and green energy goes to disadvantaged communities.¹²

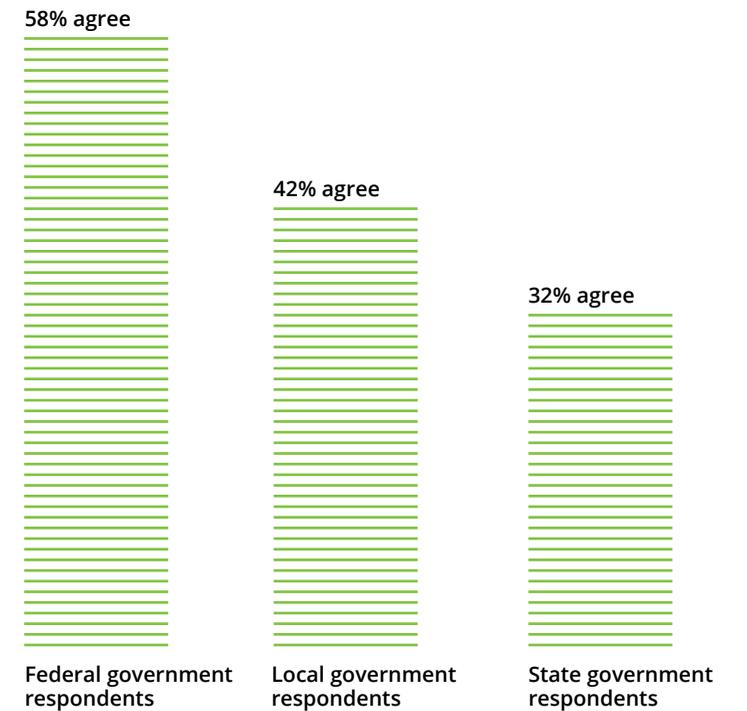
Our survey showed a significant difference in response rate from state and local infrastructure leaders.

Federal respondents expect environmental justice at a much higher rate than state governments—will states be ready to execute on this priority?

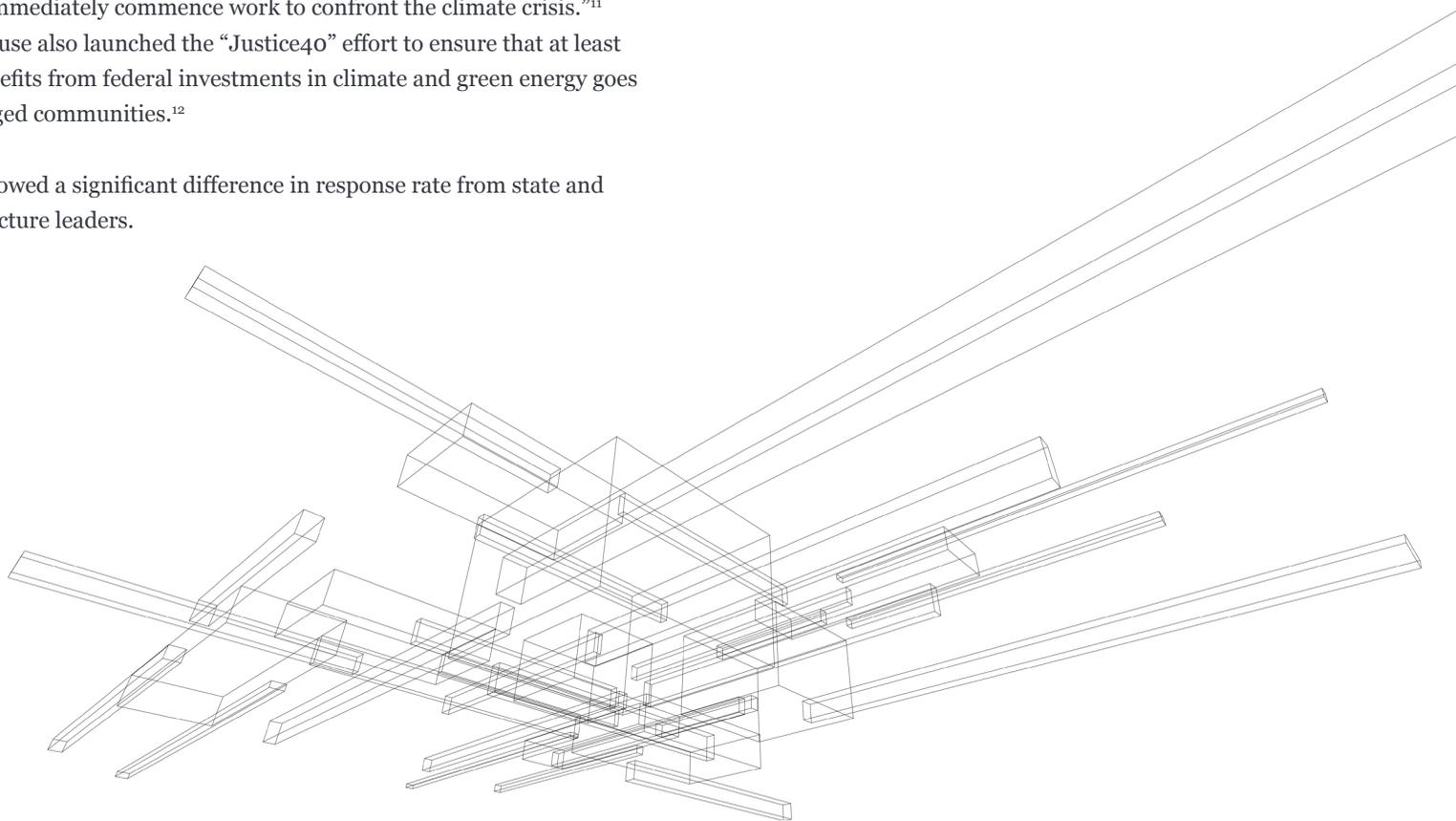
FIGURE 10

Federal government officials surveyed were more optimistic about government promoting environmental justice compared to surveyed state and local officials

Do you agree with the following statement? Governments will promote environmental justice by helping disadvantaged communities.



Source: Deloitte analysis.



Which technologies will reshape infrastructure over the next three years?

INFRASTRUCTURE OFFICIALS IN our survey were clear about their top technology picks expected to reshape infrastructure—**artificial intelligence (AI), cloud computing, and cybersecurity** (figure 11). These technology choices highlight the shift from purely physical infrastructure to a hybrid of physical and digital. From power grids to roads, infrastructure is getting “smarter.” This also means that it will hold more personal data and be more vulnerable to cybercrime.

The increasing use of AI, cloud, and digital technologies means public officials should strengthen their privacy and ethical use of data protocols. At least eight states have appointed chief privacy officers.¹³ In 2021, Georgia became the first state to name a chief cloud officer.¹⁴

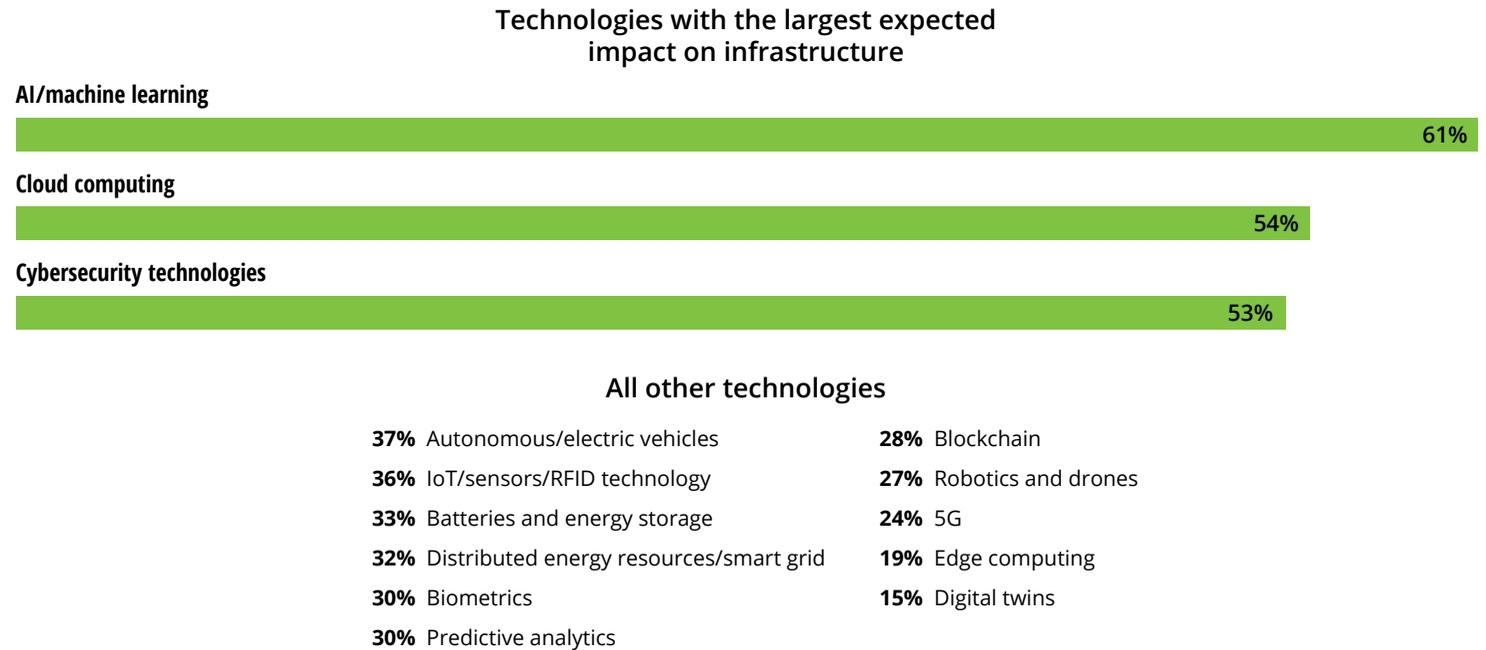
Governments expect to make use of many emerging technologies (highlighted in figure 11) in the next three years. But as noted earlier, respondents view a shortage of skilled talent as the biggest obstacle to infrastructure projects. To be successful, governments should consider bolstering their tech-savvy workforce, including data scientists and cyber professionals.

Georgia became the first state to appoint a chief cloud officer in 2021 and others are expected to follow suit.¹⁵

FIGURE 11

AI, cloud computing, and cybersecurity technologies are expected to have the most impact on infrastructure projects, according to respondents

From your perspective, which of the following technologies will have the largest impact on infrastructure plans over the next three years? (Select up to five)



Note: 3D printing, big data, and clean/green energy all had 0%.

Source: Deloitte analysis.

Infrastructure funding methods in the United States consistent with global trends

HOW WILL INFRASTRUCTURE be funded going forward? The short answer, both in the United States and elsewhere, seems to be “More of everything!”

In the United States, public funding for infrastructure was highly anticipated by respondents, and that has been borne out in the passage of the IIJA, which provides significant new federal funds to infrastructure.

But the approach that respondents most expected to increase, both in the United States and across the globe, was privatization of assets.

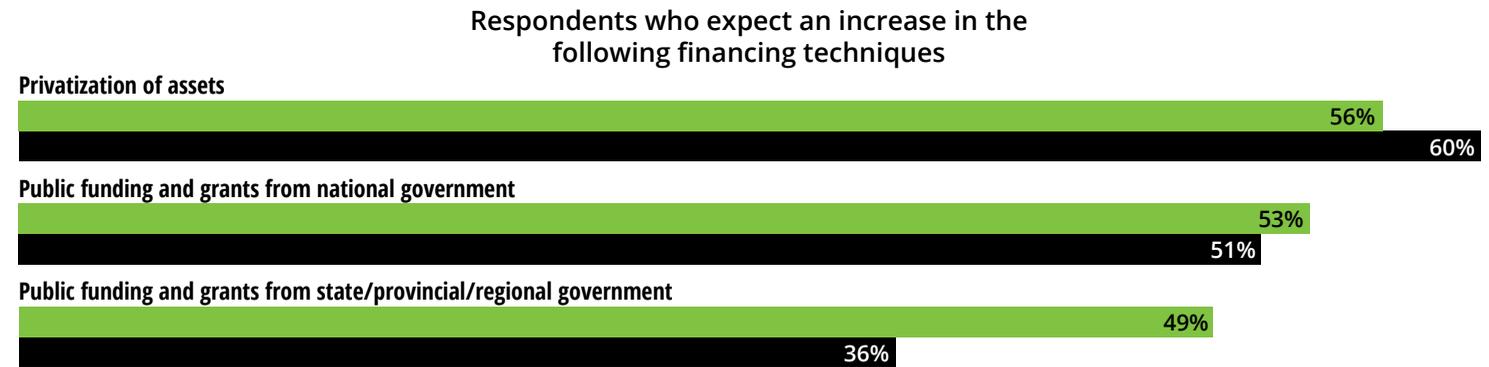
Other financing techniques expected to rise include performance-based contracting, user fees, and multilateral and development funding.

FIGURE 12

Most respondents expect more infrastructure funding through privatization of assets and national government funds

For infrastructure projects you are involved with, do you think the following financing techniques will increase, decrease, or stay about the same over the next three years?

■ United States ■ Other regions (Middle East/Africa, Latin America, Europe, and Asia/Pacific)



All other financing techniques	United States	Other regions
Performance-based contracting	47%	54%
Public funding and grants from local government	46%	38%
Funding through user fees/taxes	43%	47%
Multilateral and development funding	40%	51%
Equity investment from the private sector	39%	44%
Government-based borrowing	36%	42%
Private sector financing	36%	47%
Crowdfunding from public	35%	40%
Vendor financing and business models	34%	39%
Philanthropic support	26%	25%

Note: Apart from the United States, we also surveyed more than 300 infrastructure officials from Middle East/Africa, Latin America, Europe, and Asia/Pacific. To view global survey responses, please see our global report.

Source: Deloitte analysis.

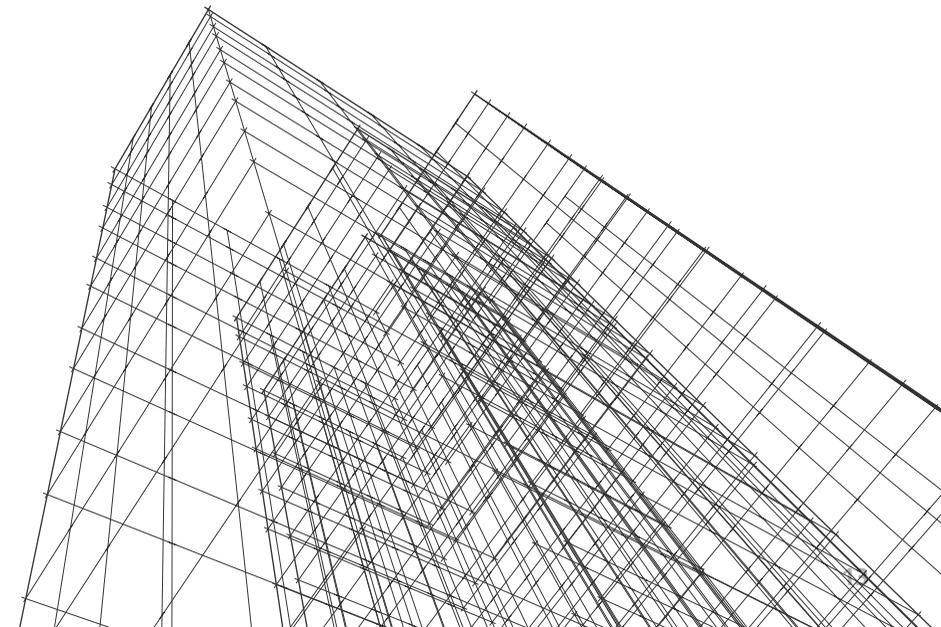
The IIJA provides funds, but an implementation challenge lies ahead for state and local officials: Making the most of federal dollars, complying with federal rules

STATE AND LOCAL officials will soon receive unprecedented levels of infrastructure funding. But these funds will come from an alphabet soup of federal agencies, with significant reporting and compliance requirements. In addition, coordinating with local officials, as well as regional entities such as transit authorities, could stretch execution capabilities. To be successful, public officials should:

- Select the projects with the largest impact;
- Successfully work with federal officials;
- Fulfill compliance and reporting capabilities;
- Partner with infrastructure builders and finance providers; and
- Access a capable pool of talent to oversee projects.

“The compartmentalization of federal programs makes the blending of public resources, let alone the leveraging of private and civic capital, inordinately complex ... The end result is a Rubik’s Cube of government programming and investment which requires dozens of different, often conflicting, funding sources in the same transaction.”¹⁶

— Bruce Katz, *The New Localism*



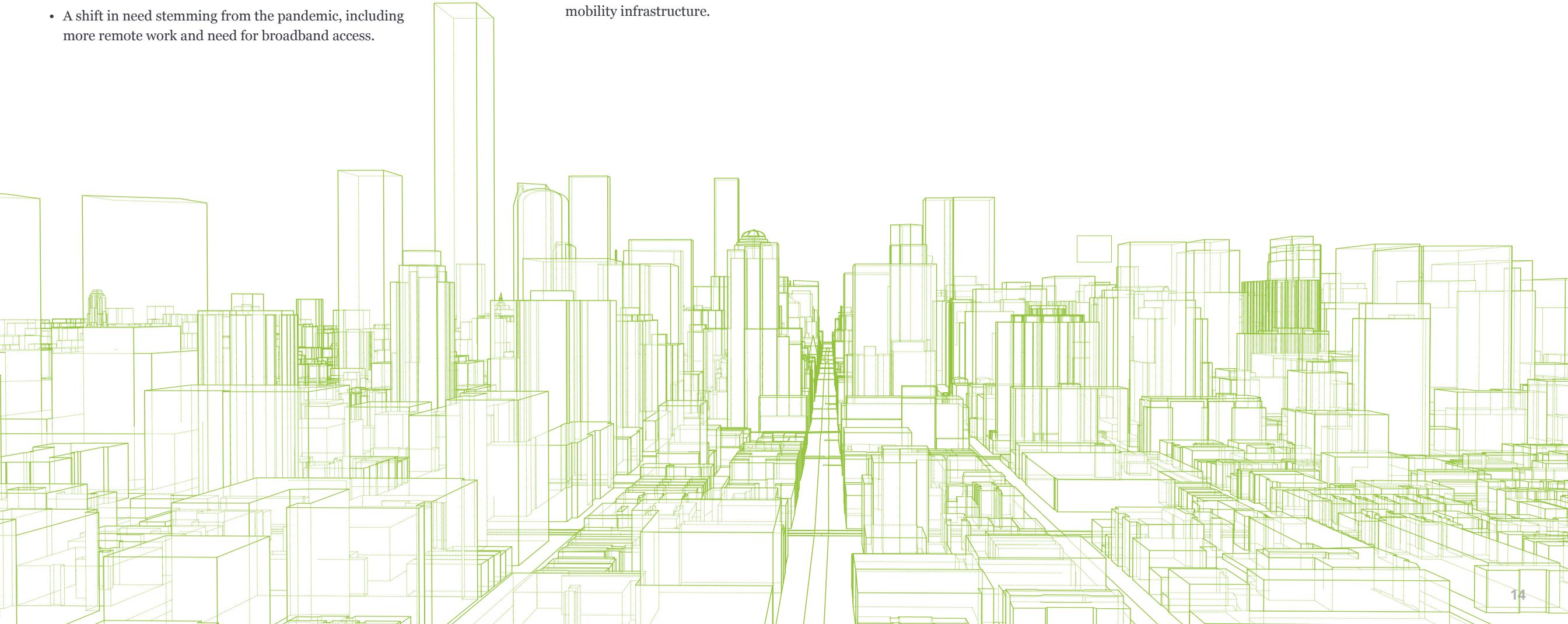
The future for infrastructure is now

THE UNITED STATES is clearly embarking on a new era of infrastructure. A number of forces are pointing toward important shifts in infrastructure in 2022 and beyond:

- A large influx of federal funding with a commensurate increase in compliance.
- A shift in need stemming from the pandemic, including more remote work and need for broadband access.

- Greater emphasis on inclusive accessibility of infrastructure.
- Greater emphasis on environmental sustainability.
- As even physical infrastructure takes on digital features, greater need for cybersecurity measures.
- Shifts in commuting, leisure travel, and tourism are also reshaping mobility infrastructure.

Infrastructure will never be the same again. Every part of the infrastructure ecosystem—the federal, state, and local governments, as well as private partners—will need to adjust.



Appendix on survey methodology

TO HELP ILLUMINATE the future of infrastructure, in September 2021, Deloitte conducted a survey of 660 respondents from 18 countries across five regions, with the largest sample, 300, from the United States (figure 13). These 660 total respondents included government officials and infrastructure executives, as well as a small sample of nonprofits including academic representatives (see figure 14 for US respondents by region).

Qualifying responses came from respondents who indicated that they are “very knowledgeable” or “knowledgeable” about infrastructure plans and investments in their geographic area. The respondents were focused on three broad areas—mobility and transportation; energy, water, and utilities; and digital infrastructure (figure 15).

FIGURE 13

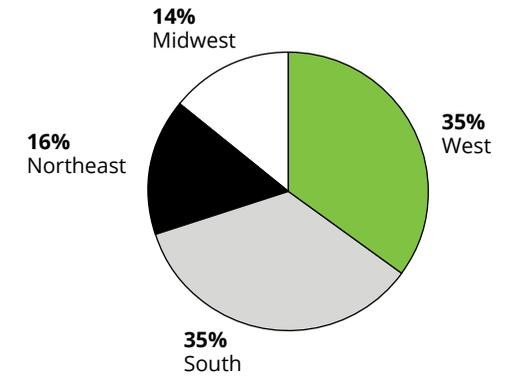
Countries surveyed

North America	3% Canada 45% United States	48%
Europe	7% Germany 13% United Kingdom	20%
Asia/Pacific	2% Australia 2% India 2% Indonesia 2% Japan 2% Singapore	11%
Middle East/Africa	3% Kenya 2% Saudi Arabia 2% Qatar 2% UAE 2% Uganda	11%
Latin America	2% Brazil 2% Colombia 2% Chile 2% Mexico	9%

Source: Deloitte analysis.

FIGURE 14

US respondents by region



Source: Deloitte analysis.

FIGURE 15

US respondents by infrastructure focus

Mobility and transportation	62%
Energy, water, and utilities	40%
Digital infrastructure	22%
Multiple/overall policy	5%

Source: Deloitte analysis.

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Avi Schwartz

Principal | Deloitte Transactions and Business Analytics LLP
+1 571 858 1359 | avschwartz@deloitte.com

Avi Schwartz is a Risk & Financial Advisory principal in Deloitte Transactions and Business Analytics LLP and leads the Infrastructure and Capital Projects practice for Government & Public Services.

Steven Hamilton

Senior manager | Deloitte Transactions and Business Analytics LLP
+1 617 437 3359 | shamilton@deloitte.com

Steven Hamilton is a senior manager with Deloitte Transactions and Business Analytics LLP. He provides market/economic assessment, strategic planning, and transactions (P3) support for large-scale economic development and infrastructure projects worldwide for national and city clients.

Deloitte Center for Government Insights

William Eggers

Center director | Deloitte Services LP
+1 571 882 6585 | weggers@deloitte.com

William Eggers is the executive director of Deloitte's Center for Government Insights, where he is responsible for the firm's public sector thought leadership. His most recent book is *Delivering on Digital: The Innovators and Technologies that Are Transforming Government*.

John O'Leary

Senior manager | State and local research | Deloitte Center for Government Insights
+1 617 437 3576 | jpoleary@deloitte.com

John O'Leary is a senior manager with Deloitte Services LP and is the state and local government research leader for the Deloitte Center for Government Insights.

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Editorial: Abrar Khan, Aparna Prusty, Rupesh Bhat, Arpan Kumar Saha, and Dilip Poddar

Creative: Sonya Vasilieff, Molly Woodworth, Steffanie Lorig, and Govindh Raj

Audience development: Hannah Rapp and Nikita Garia

Cover artwork: Lisa Sheehan

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