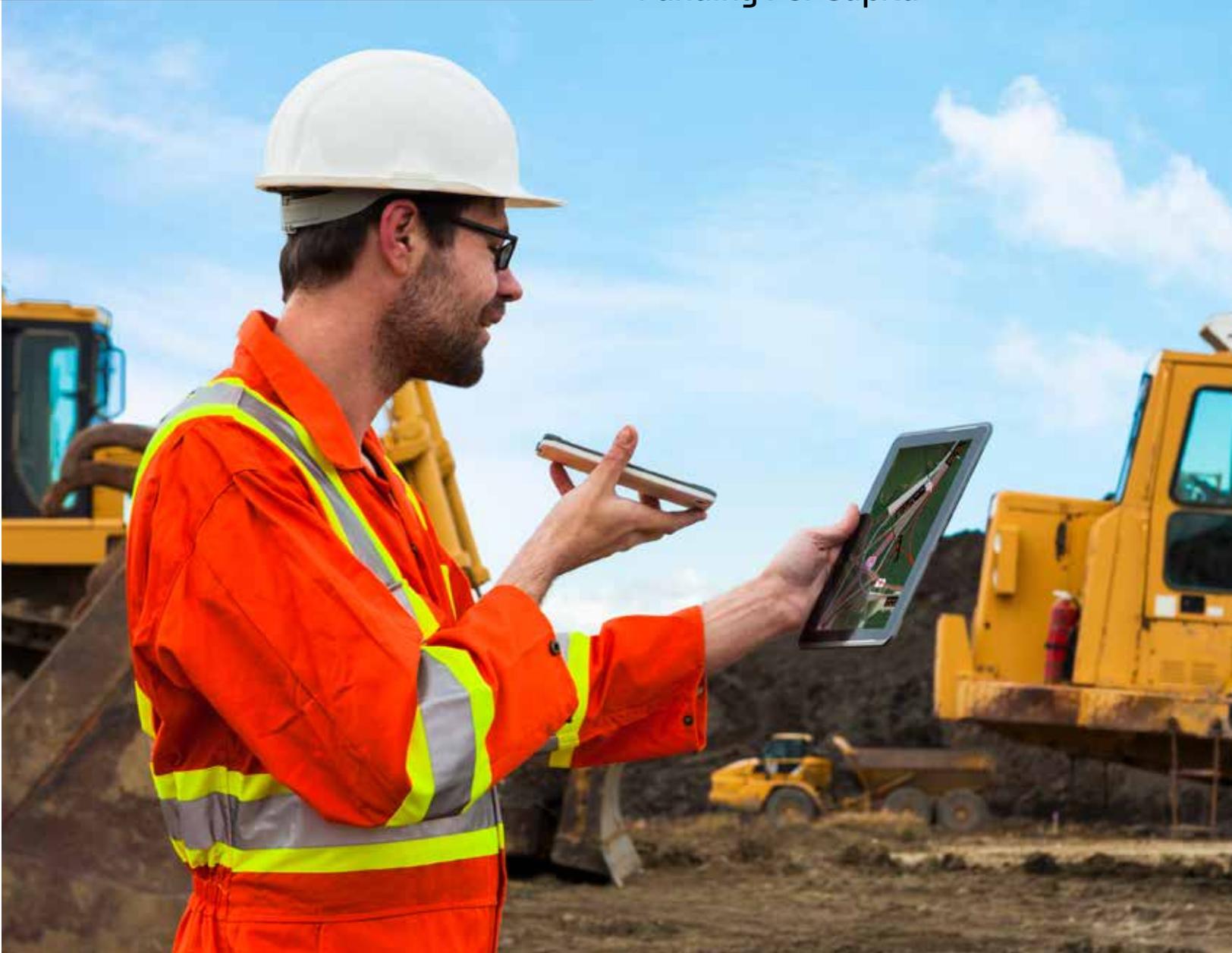


# Civil Quarterly

Q3 2021 Business Conditions, Including Supply Chain Challenges  
Cybersecurity: New Data and Information on How Civil Contractors Can Manage This Risk  
New Data on Reality Capture  
Top States for Infrastructure Funding Per Capita



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## Message From the Publisher

Welcome to the latest edition of the *Civil Quarterly*, Dodge's unique periodic research report focused solely on heavy/civil/infrastructure design and construction.

We are continuing to track the state of civil construction from the perspective of contractors and engineers, and we are still seeing headwinds and tailwinds.

- On the one hand, civil contractors are highly optimistic about the ability of the market to supply new business for them in the near future. And their optimism seems to be well founded: currently civil engineers are reporting excellent backlog, suggesting plenty of work is coming.

- On the other hand, supply chain challenges dramatically worsened over the past year.

The data this quarter also explores new opportunities and challenges by looking at how contractors, engineers and owners are responding to the increasing need for cybersecurity, and how the emerging use of reality capture is improving projects and business outcomes.

We also examine these concepts in greater detail in this quarter's special features, which take an expansive look at cybersecurity and digital project delivery.

As always, we thank our funding and research partners, and we look forward to providing everyone associated with the industry a better understanding about the business of civil construction as it continues to evolve and adapt to a rapidly changing world.

**Stephen Jones**

Senior Director, Industry Insights Research  
Dodge Data & Analytics

## Message From the Founding Partner

When we talk about the critical and central role of data to the construction industry, cybersecurity is implied as an essential. Still, despite a \$217B market dedicated to protecting our data and securing our technical infrastructure, breaches occur. Events like the Colonial Pipeline cyberattack only further underscore the importance of protecting our physical infrastructure through robust and comprehensive cybersecurity measures. As this report indicates, those who don't expect a cyberattack to some degree are in a small minority.

At Infotech, we've always operated on a policy of what can happen, will happen when it comes to cybersecurity. Data protection is an imperative—a responsibility to our clients and customers with sensitive information stored and encrypted throughout our systems. We share many of the same best practices as the engineers and contractors in this report, from daily backups to filters and firewalls. Still, despite many positive signs of an industry that's embracing cybersecurity, there are several areas of concern in the report.

While a large portion of engineers and contractors surveyed are using some mix of firewall, anti-malware software, and email security software to protect their data, these numbers dip when looking at other essential practices. Documented policies, regular training and multi-factor identification all come in at lower thresholds that indicate there is still growth to be had.

So, what's in your cybersecurity incident response plan? Are you prepared for the when, not the if? We hope the insights in this report provide a window into the ever present threat of cyber attacks—and how the industry is responding.

**Will McClave**

President of Systems  
Infotech



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### We Want Your Feedback!

What do you think about the findings and perspectives you see in this edition of the **Civil Quarterly**? What are your thoughts/hopes/concerns about the business of heavy civil construction? Do you have suggestions for what you'd like to see explored in future editions? We'd love to hear from you and will be

featuring reader comments and responses in future issues. Please send all comments to [TCQ@construction.com](mailto:TCQ@construction.com).

We read all feedback carefully, but may not be able to respond to each submission individually. If you provide your email address, you agree that we may contact you to better understand the comments you submitted.

# BUSINESS CONDITIONS

Each *Civil Quarterly* survey takes the pulse of civil contractors about a variety of business conditions they are experiencing, from backlog, revenue and profit margins to project performance, costs and planned investments. This quarter includes data on the supply chain.

## Current Backlog

Civil contractors were asked how many months of backlog they currently have compared with their ideal amount. The ratio between those two figures for the last four quarters is shown in the chart at right. After a strong leap in the ratio between Q1 and Q2 2021, Q3 saw a notable decline, but the ratio is still higher in Q3 than it was six to nine months ago.

Contractors were also asked whether their backlog has increased, stayed about the same or decreased in the last six months, with the findings shown in the chart at bottom right. Here, Q3 sustains the growth seen in Q2 over the previous two quarters.

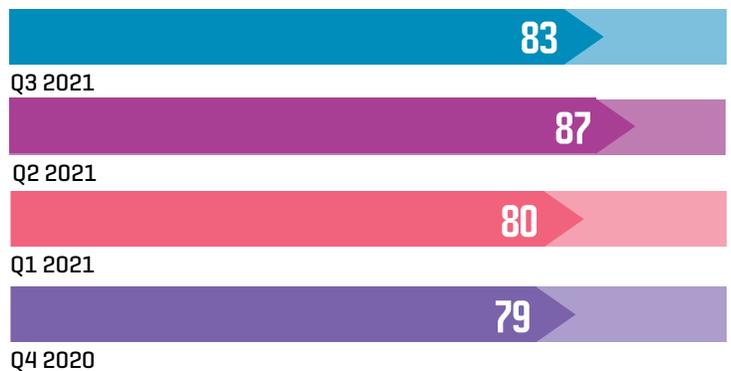
These findings suggest that the civil construction market is recovering from any pandemic-related slowdowns, but that the rebound may have already peaked for the time being.

### VARIATION BY SIZE

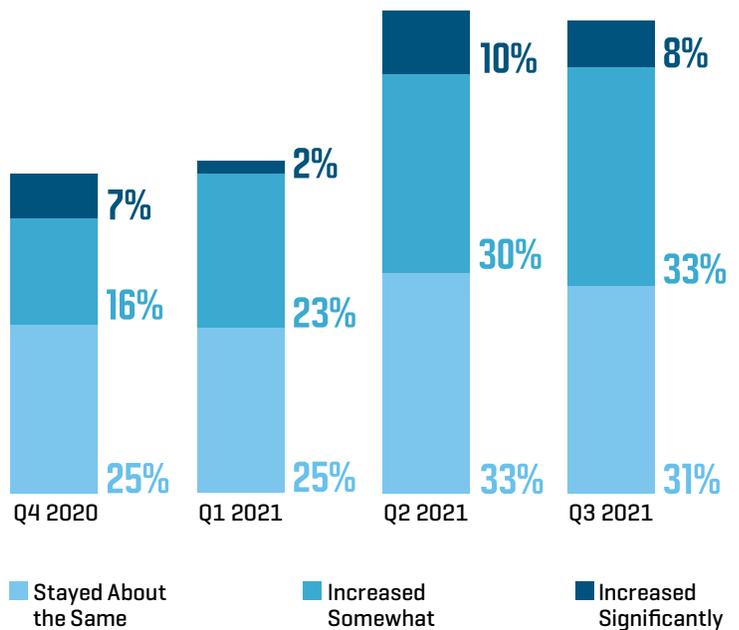
Larger firms have a higher average ratio than smaller companies:

- Large Companies (Revenues \$50M and More): Ratio of 85
- Midsize Companies (Revenues \$10M to \$49M): Ratio of 83
- Small Companies (Revenues Less Than \$10M): Ratio of 77

## Ratio of Current to Ideal Backlog



## Change in Backlog in Last 6 Months



## New Business Confidence

Every quarter, civil contractors are asked to rate their confidence in the market’s ability to supply them with new business in the next 12 and 24 months on a 10-point scale. The chart at right compares their levels of confidence in the third quarter of 2021 with the second quarter.

- Those in Q3 who are highly confident in the market grew by three percentage points from the previous quarter to this one, and by six points compared with Q1.
- There was also a dip of six points in those with little to no confidence from last quarter, and an 11-point decline from Q1.

The biggest change in the 24-month outlook quarter over quarter is a notable decline in those with little or no confidence, from 12% down to 4%. It is likely that the discussion around a possible infrastructure bill during the survey period is fueling optimism in a longer-range outlook.

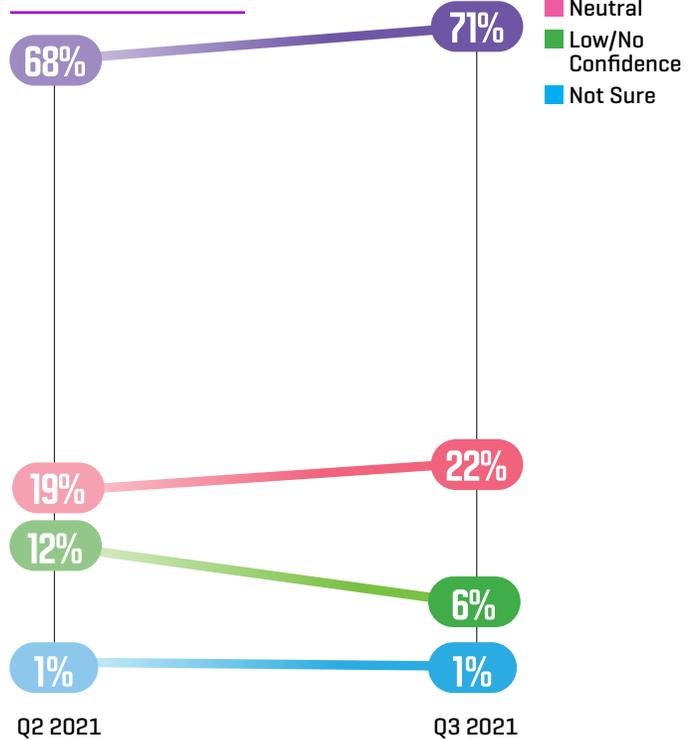
### VARIATION BY SIZE

Large companies [revenues \$50M or more] continue to be the most confident, with 76% reporting a high level of confidence in their 12-month business outlook and 73% in the 24-month outlook.

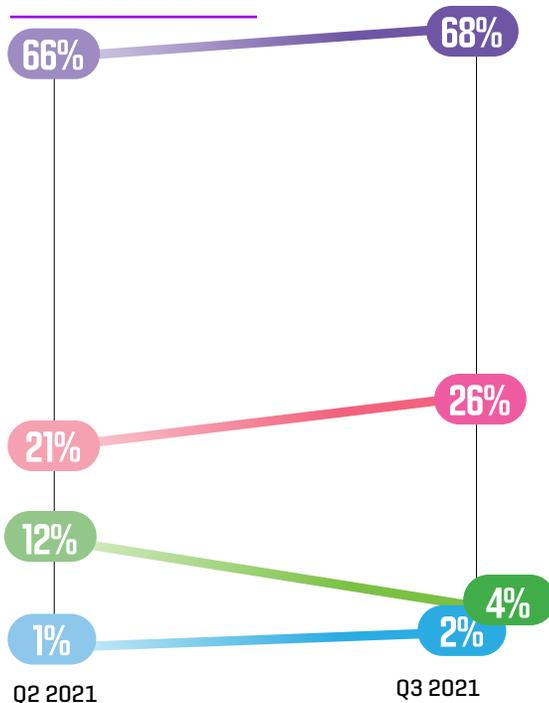
In contrast, only 57% of small companies [revenues under \$10M] are highly confident in their outlook for the next 12 months, but 63% report that they are highly confident about the market in the next 24 months.

## New Business Confidence

### NEXT 12 MONTHS



### NEXT 24 MONTHS

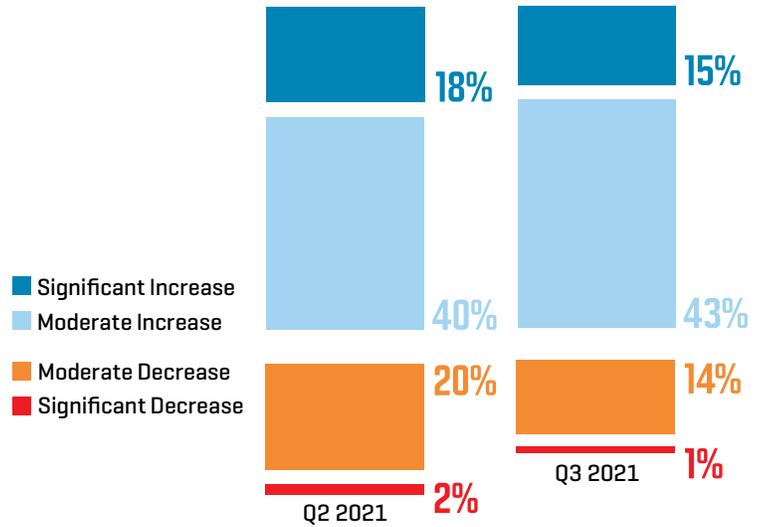


## Revenue Change

Civil contractors were asked to describe the change in revenue they expect in the next 12 months. The chart at right shows those expecting increases or decreases in revenue. It demonstrates that contractors remain far more optimistic than pessimistic about revenue over the next 12 months, with over half expecting it to increase, similar to last quarter, and only 15% expecting a decrease, fewer than those expecting a decrease in Q2.

Notably, there are no significant differences by size of contractors on revenue expectations for the next 12 months.

### Expected Change in Revenue in 12 Months

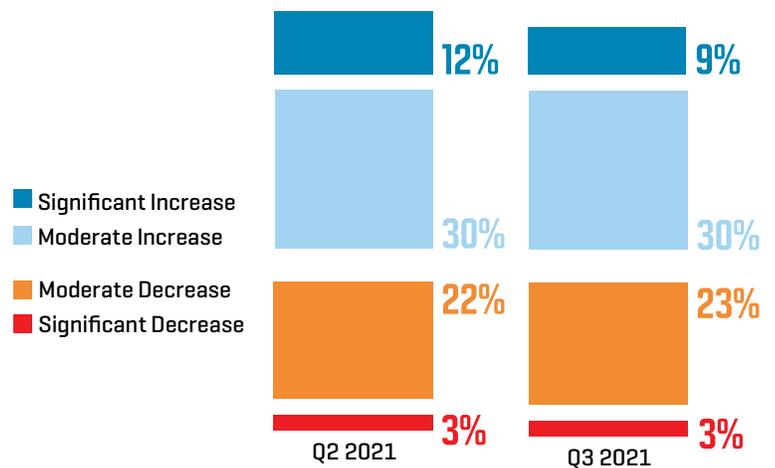


## Profit Margin Change

Civil contractors were asked a similar question about the expected change in profit margin. Their responses are notably similar to last quarter. Far more still expect increases versus decreases, as they did in Q2. And again, many (35%) do not expect their profit margins to change.

The share expecting their profit margins to increase still remains below those who are expecting their revenues to increase. This is not surprising, given the supply chain (see pages 7 to 9) and skilled worker challenges, which may be driving up costs for many on their projects.

### Expected Change in Profit Margin in 12 Months



## Reasons for Reductions

Contractors who expect reductions in either revenue or profit margin were asked why they believe those reductions will occur. The list of options they could select are in the chart at right, which shows the contrast between the Q3 and Q2 2021 responses.

The highest share of those expecting a decrease believe that an increased number of competitors bidding projects will push down pricing, similar to last quarter. Notably, this is a particularly strong concern among respondents from large [\$50M revenue or more] companies, selected by 83%.

In Q3, though, concerns are growing about the possibility of an economic downturn compared with the previous quarter. This may be due to the return of pandemic restrictions dampening the economic growth seen in the spring.

On the other hand, far fewer are concerned about delays in new projects due to reduced public revenues than were in Q2, perhaps due to encouraging news reports on the possibility of an infrastructure bill offering additional funding for their sector.

### Reasons for Reductions

According to Those Anticipating Reduced Revenue or Profit Margins



■ Q3 2021  
■ Q2 2021

## Reasons for Expected Increases in Revenue and/or Profit Margin

Contractors who expect increases in revenue and/or profit margin were asked why they believe those increases will occur. They could select all options that applied that are listed in the chart at right.

There is little change between Q2 and Q3 about why contractors are optimistic. The top factor continues to be the expectation of more work, followed even more strongly this quarter by expectation of increased public funding for infrastructure.

In addition, nearly half believe that they will be able to target more profitable work, similar to last quarter.

Notably, there are also no significant differences by company size in terms of what they think will drive growth in their revenue or profit margins.

### Reasons for Expected Increase

According to Those Expecting an Increase in Revenue and/or Profit Margins



Expectation of More Work



Expectation of Increased Public Funding for Infrastructure



Targeting More Profitable Work



More Efficient Workforce



Expectation of Fewer Competitors Bidding Projects

■ Q3 2021  
■ Q2 2021

## Impact of the Fluctuation of Construction Materials' Costs

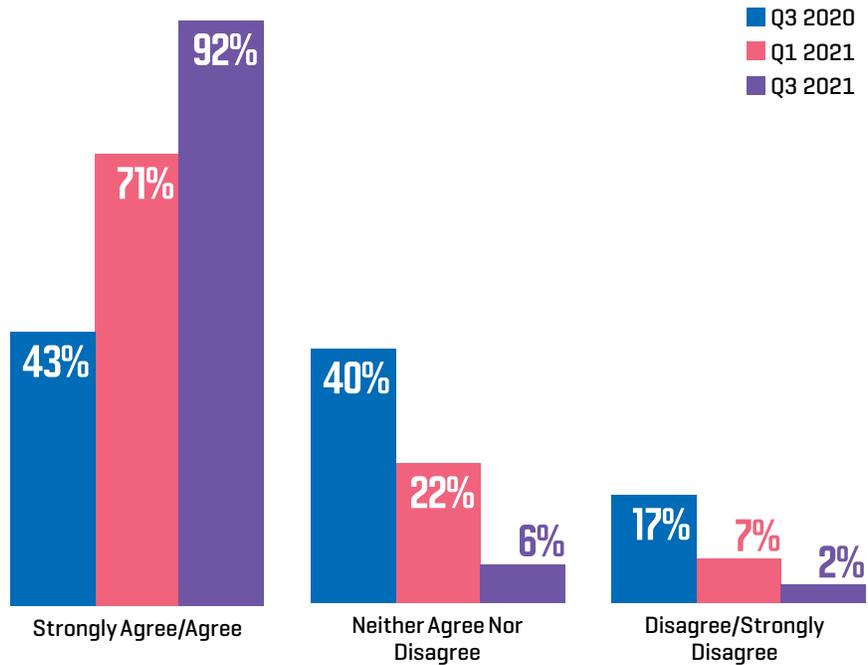
This quarter, civil contractors were asked about the impact of supply chain issues on their projects and businesses.

The chart at upper right shows the degree to which they agreed or disagreed that their projects have been impacted by fluctuations in the cost of construction materials in the last six months, and compares those responses to the impacts reported in Q1 2021 and Q3 2020. Notably, nearly all civil contractors [92%] are experiencing project impacts from those cost fluctuations, a dramatic increase from one year ago.

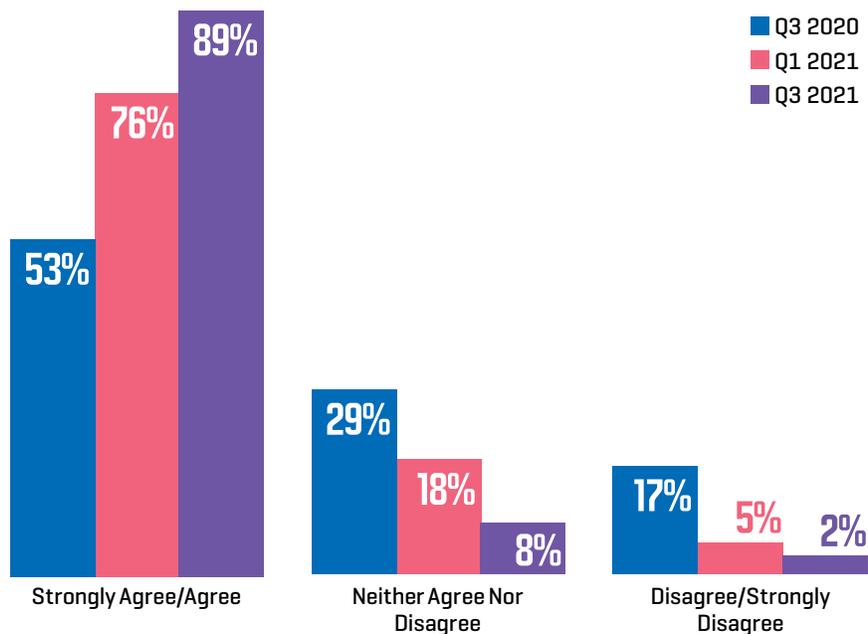
They were also asked about their concerns about additional cost increases in the next six months, and nearly as many [89%] report that they are highly concerned.

Clearly, civil contractors are experiencing the same supply chain challenges as the rest of the construction industry, and very few expect them to abate in the near term.

### Projects Have Been Impacted by Fluctuations in the Cost of Construction Materials in the Past 6 Months



### Our Company Is Concerned About Cost Increases for Construction Materials in the Next 6 Months



## Materials of Greatest Concern

Civil contractors who are concerned about material cost increases in the next six months were asked which materials they were most concerned about. The list of options offered to them was expanded this quarter because of the many different options volunteered by contractors to this question in Q1, when

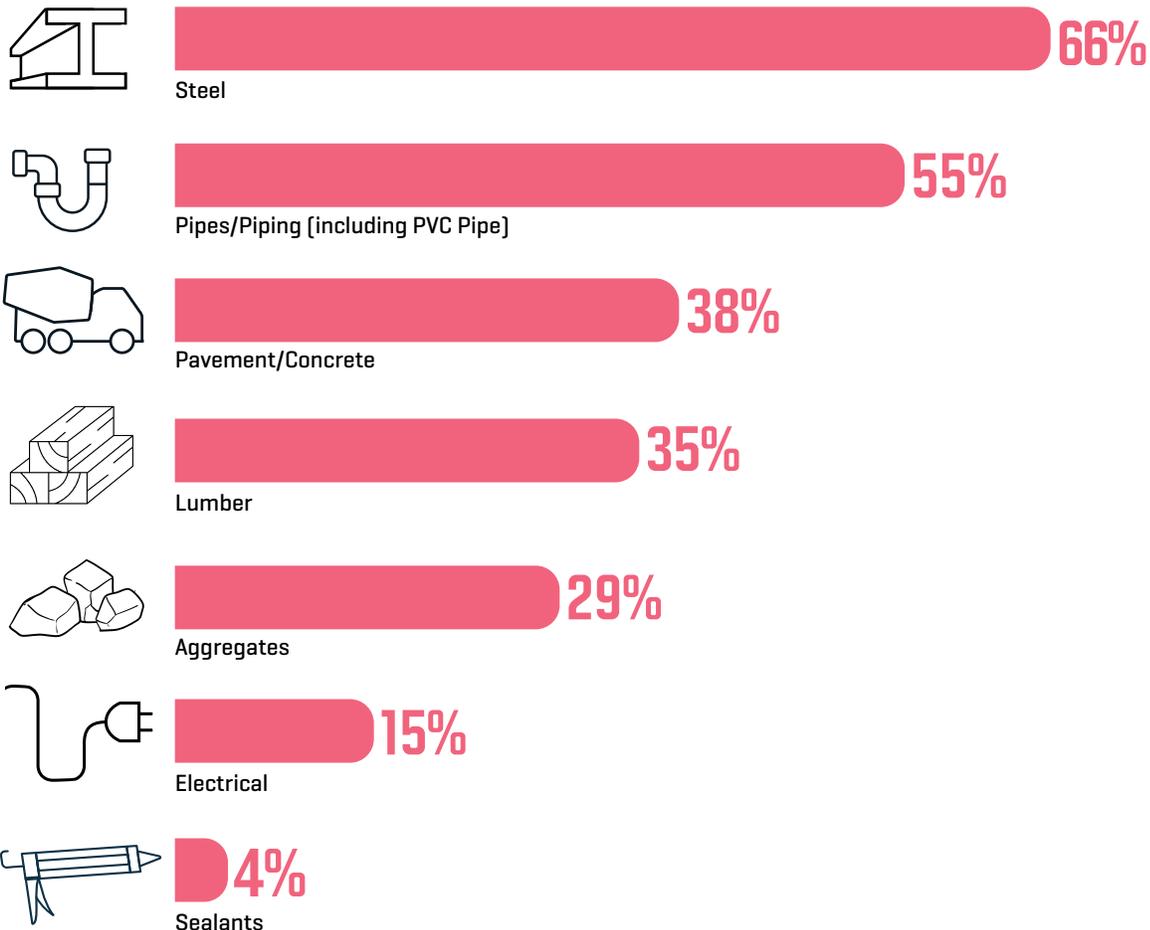
the survey first captured elevated levels of concerns about materials.

The top seven options are shown in the chart below, with the majority indicating concerns about steel and piping prices. While piping is a new addition to the survey, the share expressing concern about steel prices is

roughly equivalently to Q1.

About one third also report concerns about pavement, lumber and aggregates. Pavement and aggregates were included in the study in Q1, and in this case, the share selecting them has declined by around 10 points, perhaps suggesting some relief in these two types of materials.

### Materials About Which Contractors Are Most Concerned About Price Increases



## Construction Equipment Concerns

Civil contractors were also asked whether they agree with a set of questions about challenges related to equipment. The findings for each question are shown in the chart below for the Q3 and Q1 2021 and Q3 2020.

While the total share who express concerns about equipment availability and cost is less than those impacted by the cost of construction materials,

there is nonetheless dramatic growth since 2020 in the share concerned about construction equipment.

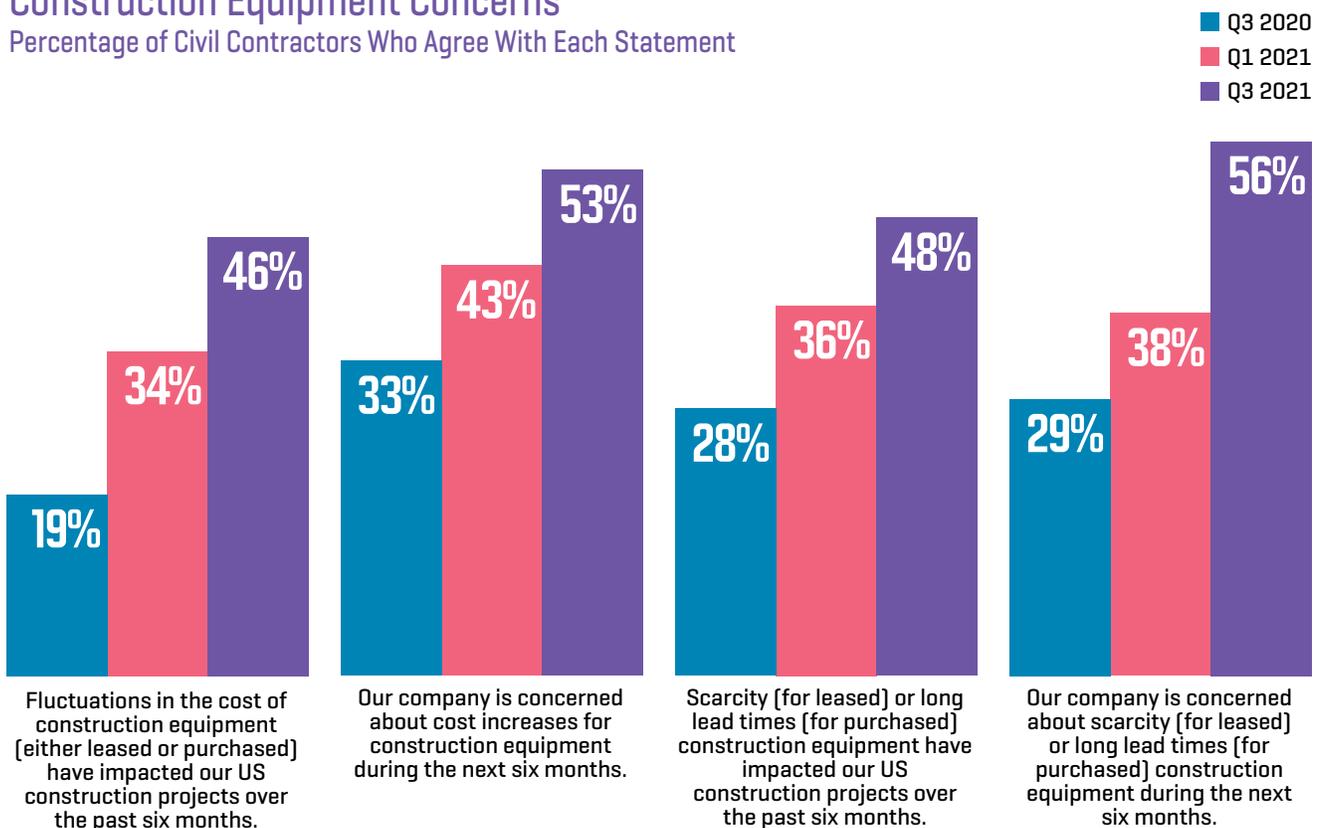
- The highest share overall are those who are concerned about the scarcity of construction equipment in the next six months.
- That factor is also one of the top two with the steepest

increases in those concerned since 2020, matched by the growth in those who report that cost fluctuations for equipment have impacted their projects over the last six months.

- Notably, there are no significant differences by size of company, suggesting that this is a growing concern industrywide.

### Construction Equipment Concerns

Percentage of Civil Contractors Who Agree With Each Statement



# IN THE PIPELINE

The amount of work in planning provides a glimpse into the volume of work contractors can expect to be released for bidding. Therefore, every quarter, civil engineers are asked about their backlog of projects as well as their confidence in the market to supply them with new work.

## Backlog

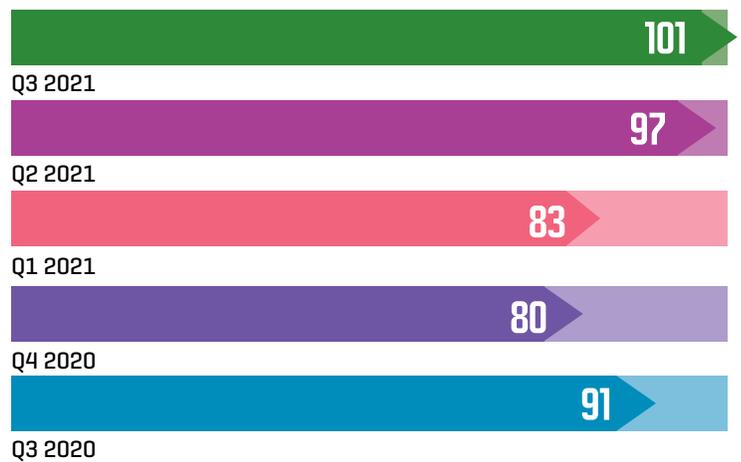
Civil engineers were asked about their current and ideal levels of backlog. The average ratios for the last five quarters are shown in the chart at upper right.

This quarter, civil engineers on average actually report a higher level of backlog than they consider ideal. While likely creating challenges for the engineering firms, this glut of work bodes well for the volume of bidding opportunities that civil contractors can expect, and it suggests that a rigorous recovery from the pandemic doldrums is already well underway.

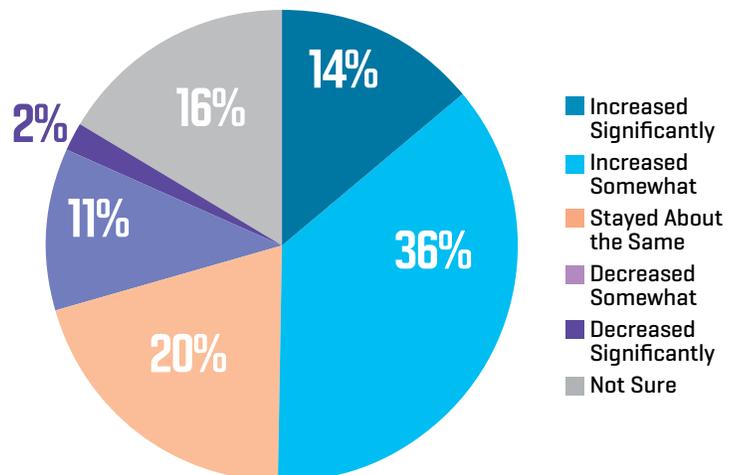
Civil engineers were also asked about how their backlog has changed over the last six months, with the results shown in the pie chart at right.

- Half (50%) have seen their backlogs grow in that period, a nine-point increase from last quarter.
- Only 13% report decreases, fewer even than the share who report that they are not sure how their backlog levels have changed.

## Ratio of Current to Ideal Backlog for Civil Engineers



## Change in Civil Engineers' Backlog Over the Last 6 Months



## New Business Confidence

Civil engineers were asked to rate their confidence in the ability of the market to provide them with new business opportunities in the next 12 and 24 months.

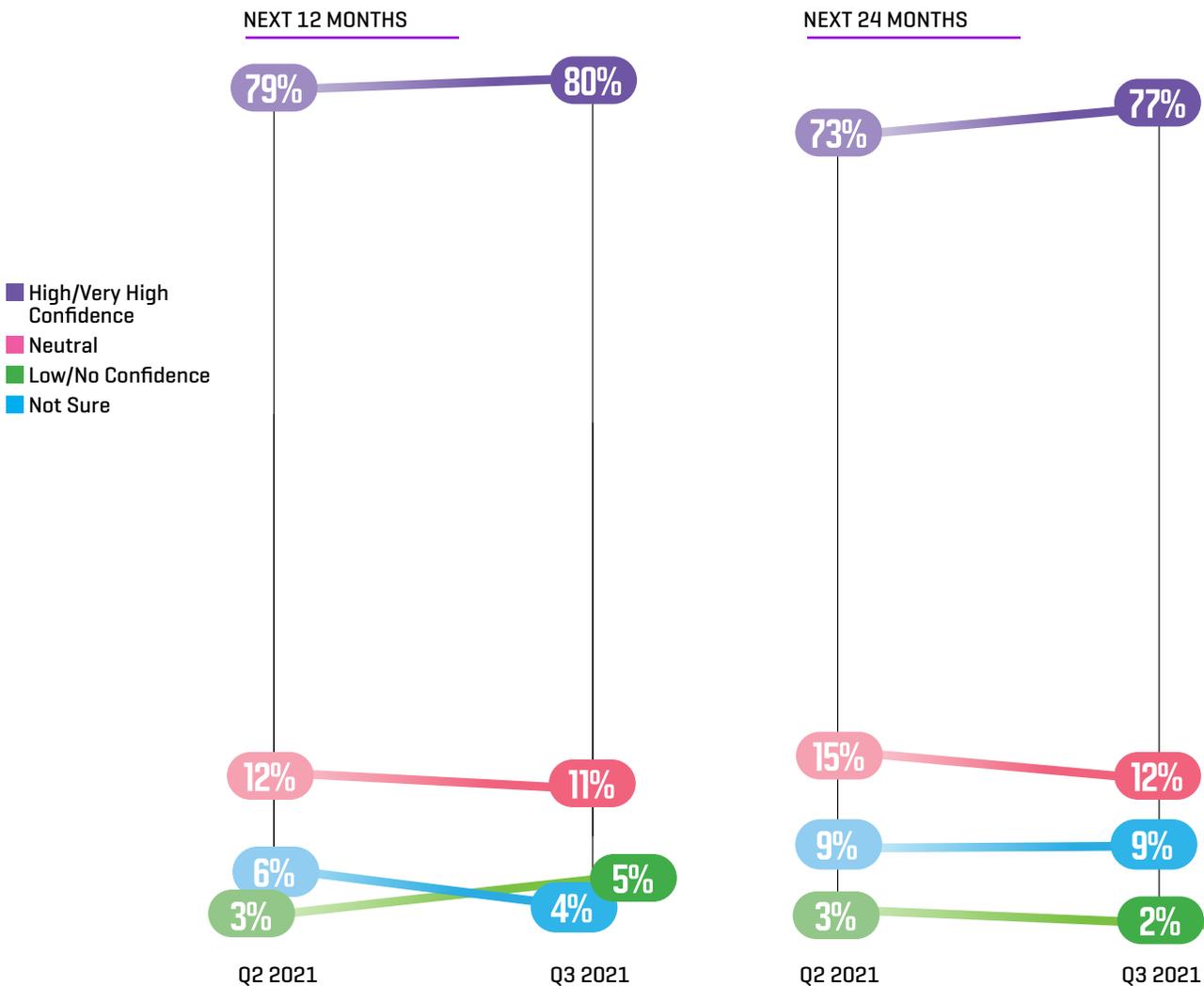
- Given the high levels of backlog the firms are experiencing, it is not surprising that most of the

engineers [80%] report a high degree of confidence in the market for the next 12 months.

- Nearly as many [77%] are as confident about the 24-month outlook as the 12-month one. This is an improvement of four points over last quarter.

The increase in longer-term confidence over last quarter is no doubt related to their very high levels of backlog and suggests that contractors can expect the pipeline of projects to remain quite high for the next few years.

## New Business Confidence According to Civil Engineers



# Cybersecurity

## Introduction

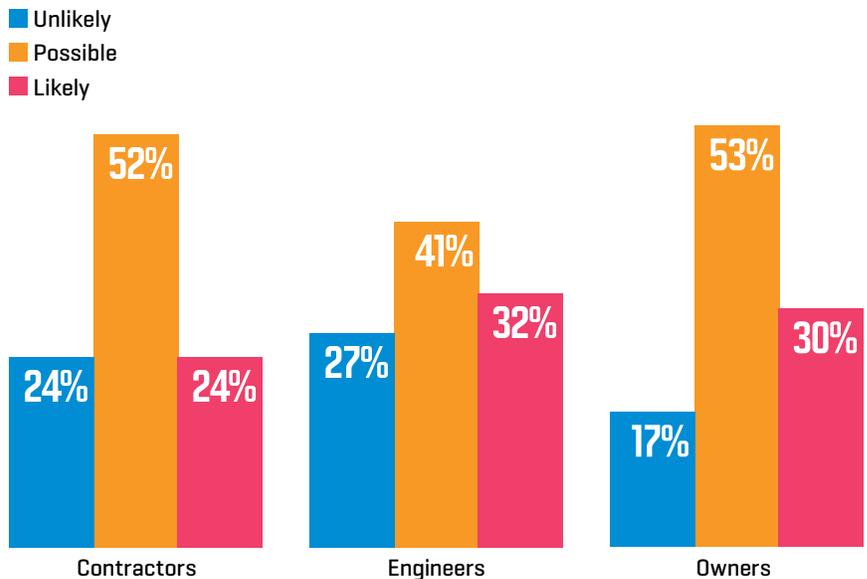
As with many other industries, the construction industry is vulnerable to cyber attacks, especially as the nature of those attacks have changed, with small to midsize businesses now targets for this activity. This quarter, the study examines how civil contractors, engineers and owners are responding to the risk of a cyber attack.

## Likelihood of a Cyberattack

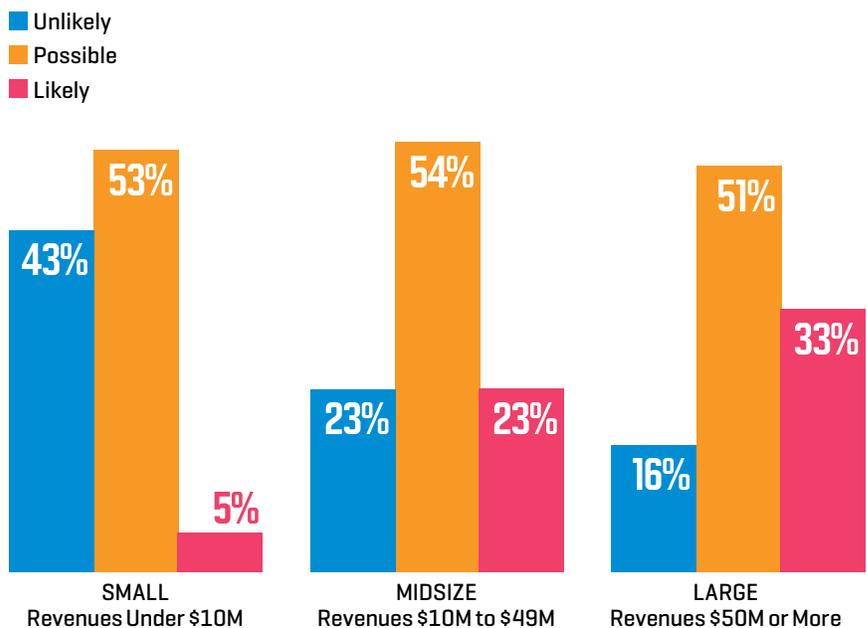
The two charts at right show the respondents' responses about the likelihood that their company will be a victim of a cyberattack. The chart at upper right shows the responses by player, and the lower one shows the civil contractor responses by size of company. A few key patterns emerge from these:

- Less than one third of all respondents believe their company is likely to be a victim.
- Nearly half (43%) of small civil contractors think they are unlikely to be victims of an attack.

### Expected Likelihood of Being a Victim of a Cyberattack According to Contractors, Engineers and Owners



### Expected Likelihood of Being a Victim of a Cyberattack According to Contractors, by Size



# Cybersecurity

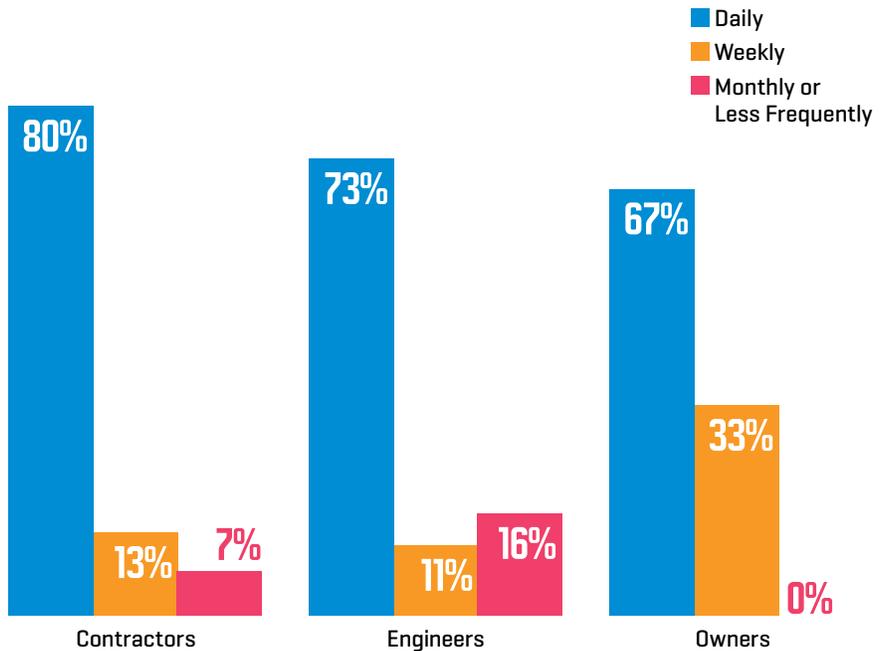
## Data Backup

One strategy for helping to deal with cyberattacks is frequently backing up data from your company. While not a foolproof strategy, having a backup that can be restored can help avoid crippling losses of weeks of time by companies seeking to recover from a cyberattack.

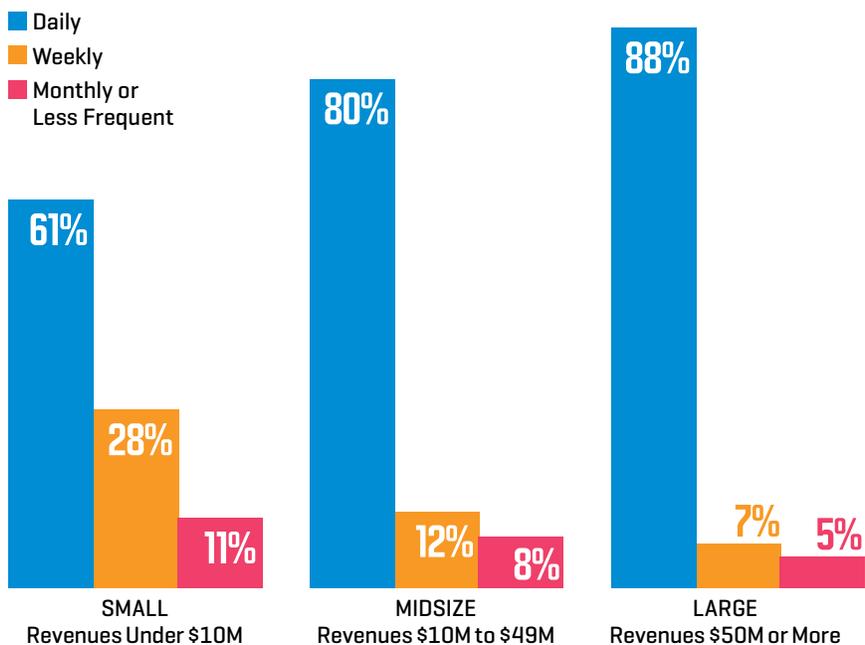
Therefore, civil contractors, engineers and owners were asked about how frequently they back up their data. The charts at right show the responses of all three players and the responses by size of company.

- Generally, civil contractors are most frequently backing up their data on a daily basis, with the vast majority (80%) reporting that they do so. Daily backups are also common among engineers, but only two thirds of owners engage in this practice.
- The larger a contractor is, the more frequently they report backing up data on a daily basis, with 88% of large companies reporting that they do so, compared with 61% of small companies.

### Frequency of Data Backup by Type of Organization



### Frequency of Data Backup for Contractors, by Size



# Cybersecurity

## Cybersecurity Measures Employed by Contractors

There are many important tools that companies can use to protect themselves from cyber-attacks. Civil contractors were asked to identify the ones they employ from a list of 11 options. The charts at right and on the following page show the percentage who report using each by the size of the company.

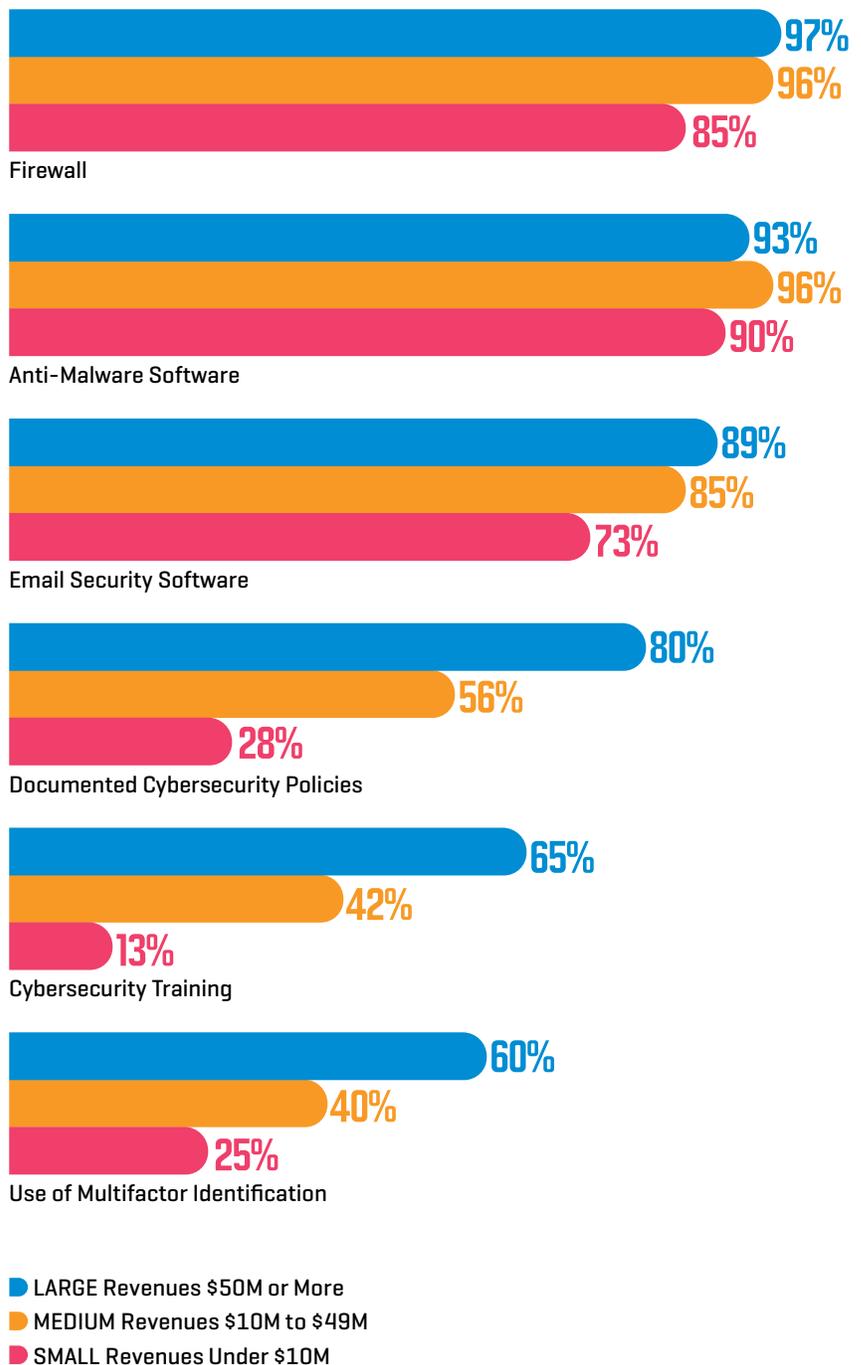
### WIDELY USED OPTIONS

Three common means of defending against cyber attacks are widely used by companies regardless of their size: firewalls, anti-malware software and email security software. Each of these are long-standing measures that have been around for decades and are in common use outside of construction as well. It is not unusual for cyber criminals to have means to circumvent these measures.

### WIDELY USED OPTIONS BY LARGE COMPANIES

The remaining three measures listed in the chart at right are used by 60% or more of large companies, but are far less widely used by midsize or small companies.

## Most Common Security Measures for Civil Contractors, By Size



# Cybersecurity

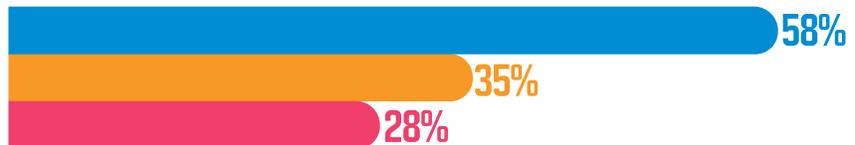
The people who work for a company are often one of the biggest points of vulnerability for cyberattacks. Having documented cybersecurity policies and offering training to employees on cyber risks are two critical ways to mitigate that threat. While common activities among large companies, these are only used by about half of midsize and a quarter of small ones.

## LESS COMMONLY USED MEASURES

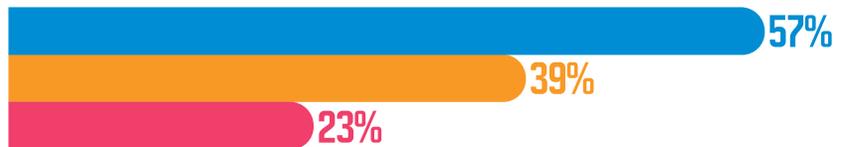
The responses to the rest clearly demonstrate that small companies, which regard cyberattacks as less likely, are also far less likely to invest in resources to protect against them. This includes:

- More rigorous security measures like multifactor identification and enterprise password managers
- Additional security around devices that allow access into their systems, by using a mobile device action plan or protected IoT devices
- Investing in cybersecurity insurance, which can help companies recover after losing operations after an attack

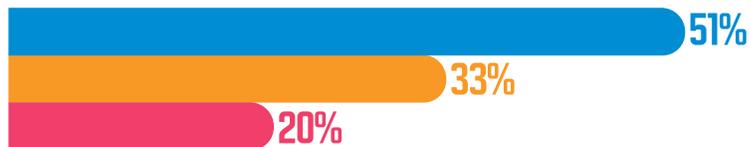
## Less Common Security Measures Employed by Contractors



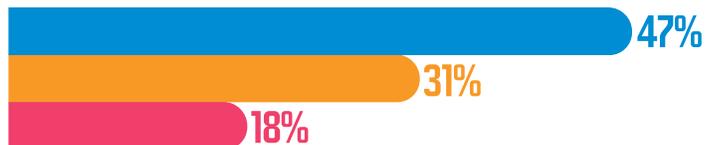
Insurance Policies Covering Cybersecurity



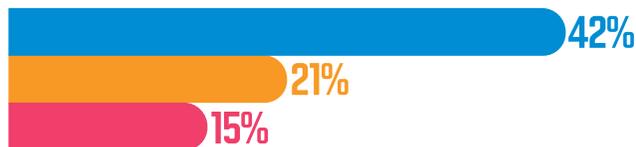
Enterprise Password Manager



Mobile Device Action Plan



Protected IoT Devices



Create Incident Response Playbook

- LARGE Revenues \$50M or More
- MEDIUM Revenues \$10M to \$49M
- SMALL Revenues Under \$10M

# Cybersecurity

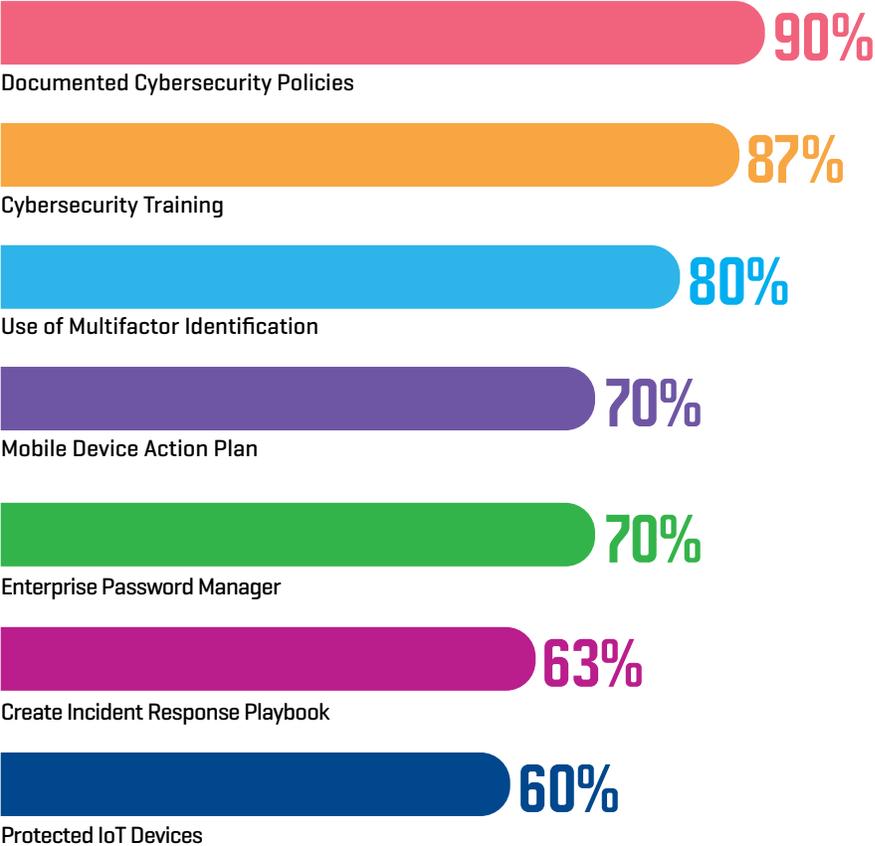
## Cybersecurity Measures in Use by Owners and Engineers

Engineers and owners were also asked about the cybersecurity measures they use. Engineer use largely parallels contractor use, but owners are generally more invested in cybersecurity measures than contractors are on average. The chart at right shows the measures they implement at significantly different levels than contractors.

- Owners more frequently implement measures that reduce the risk created by actions of their employees, with cybersecurity policies and training quite common among them.
- They are also more likely to use more rigorous means of defense against attacks like multifactor identification, and enterprise password management.
- They also try to minimize the threat of mobile and IoT devices to their systems.

Owners are the most likely to consider a cyberattack possible or likely and therefore invest in preventing them.

### Share of Owners Currently Using Cybersecurity Measures Where Significantly Different From Contractors' Use



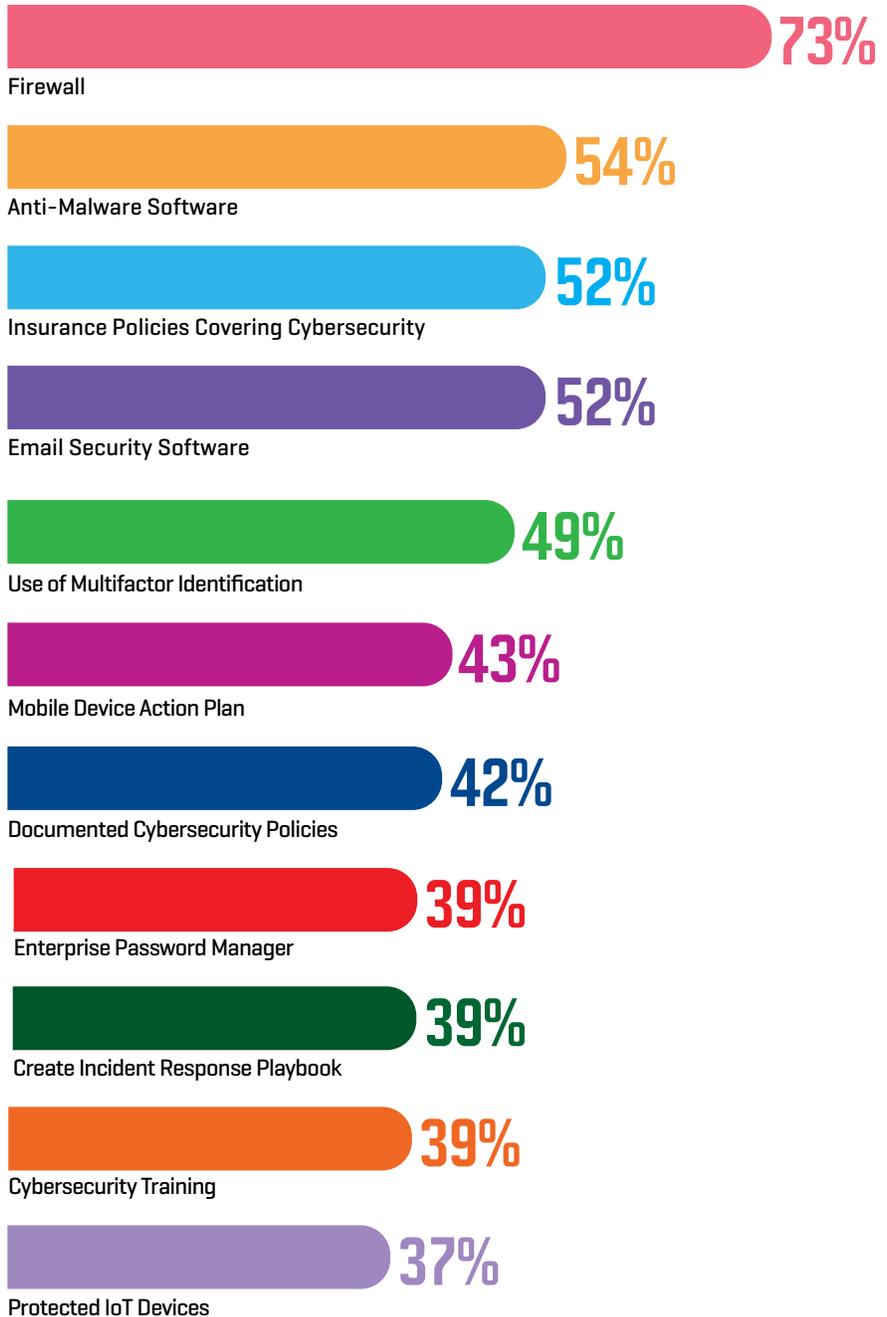
# Cybersecurity

## Contractors Not Currently Using Cybersecurity Measures Who Plan to Invest in Them

To better understand how likely civil contractors are to increase their defenses against cyberattacks, those not currently using various measures now were asked whether they plan to do so in the next few years. The chart at right shows the share of nonusers who say they will adopt these measures.

- Around half of those not using the most common measures—firewalls, anti-malware software and email security software—plan to do so in the near future.
- Over half of nonusers are considering getting cybersecurity insurance policies.
- Almost half are considering adopting multifactor identification, and 39% are looking into enterprise password managers.
- There is also growth likely in those addressing the human vulnerabilities in their organizations with 42% planning to have documented cybersecurity policies and 39% to invest in training.

## Share of Contractor Nonusers Who Are Considering Use in the Next Two Years



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# Cybersecurity

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## Drivers for Investment

Civil contractors were asked about the factors that would encourage them to increase their investments in cybersecurity.

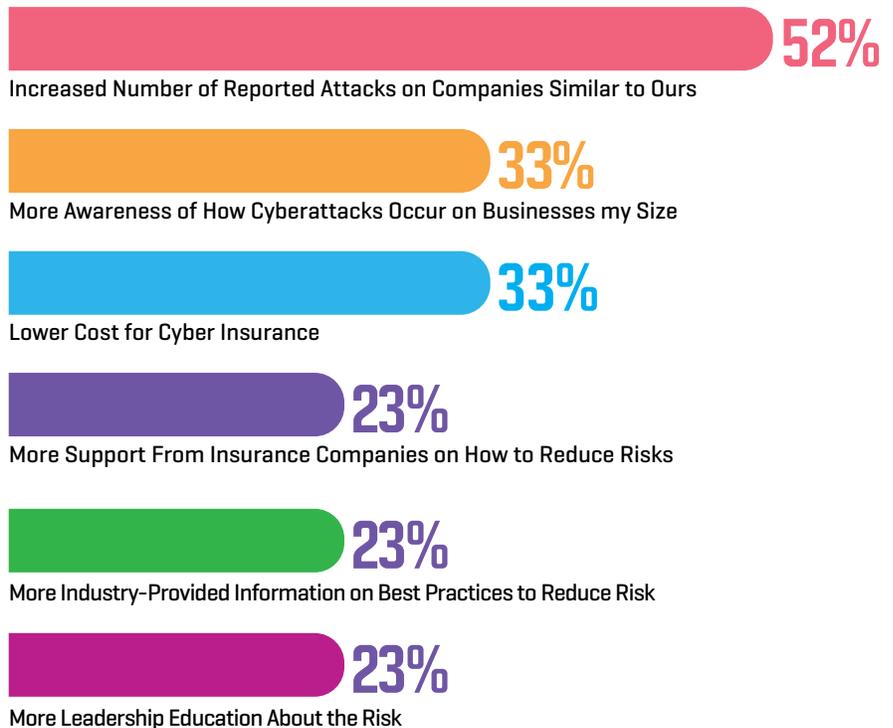
The top factor by far is an increased number of reported attacks on companies similar to their own. Currently, many businesses do not make it public knowledge when their companies are attacked. The extent of cybercrime in the US is therefore largely invisible to most companies, and many do not realize the degree to which they are vulnerable because they don't hear about attacks on companies like their own.

Another top factor is knowing how companies similar to theirs were attacked. It is challenging to protect your company against attacks if you do not have enough knowledge about how these attacks occur.

Also among the top factors is lower cost for cyber insurance, which is a challenge for insurance companies as the number and severity of cyberattacks increases.

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## Top Drivers for Civil Contractors to Invest More in Cyber Security



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# Cybersecurity

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## Obstacles to Wider Investment by Contractors in Cybersecurity

Contractors were asked what the biggest obstacles are to wider investment in cybersecurity by their company.

Awareness of the risk is again the biggest factor, just like it was with the drivers, with by far the largest percentage [44%] stating that a top obstacle for wider investment by their company is that they do not think the level of risk they face warrants further investment. Clearly, understanding the threat itself is the most critical factor to overcome resistance and encourage wider investment.

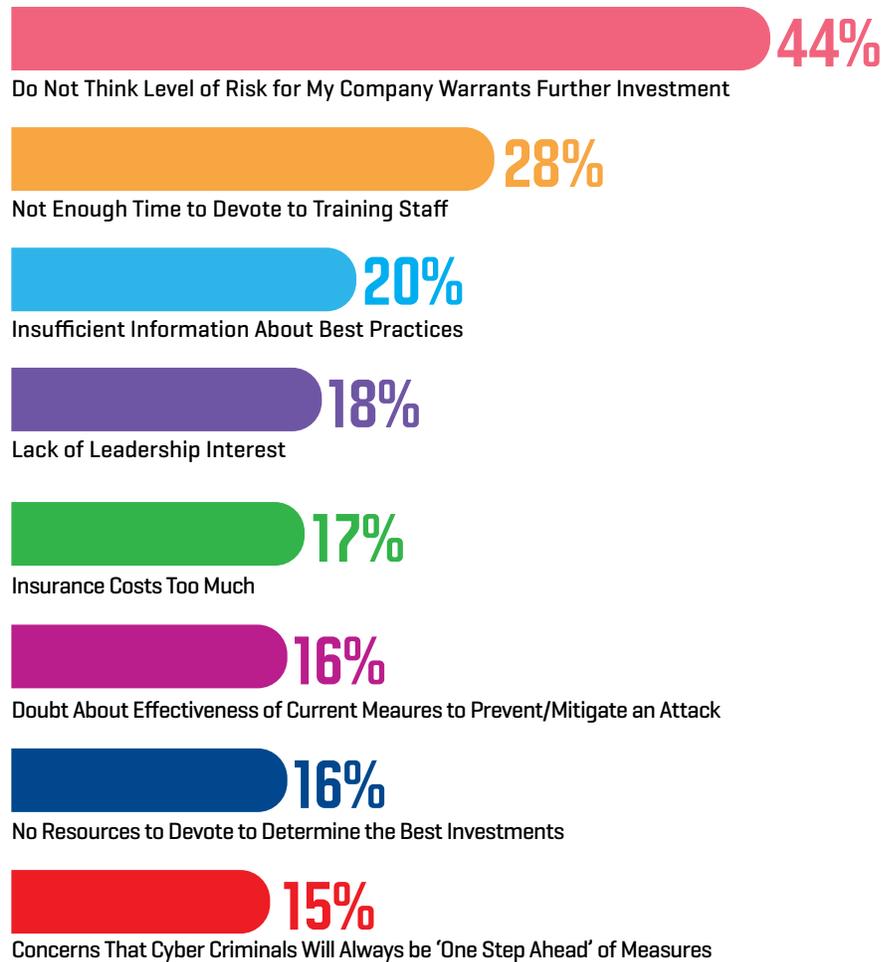
Contractors are also faced with many critical issues that require training, so it is not surprising that many also note that training time for staff is also an obstacle.

Lack of information about best practices is considered a serious obstacle by one in five contractors. Being convinced of the need is not enough: knowing what to do about it is also critical.

The remaining obstacles are cited by a small but notable share, demonstrating the breadth of challenges to industry advancement on this issue.

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## Obstacles for Contractors to Wider Investment in Cybersecurity



# Reality Capture

## Introduction

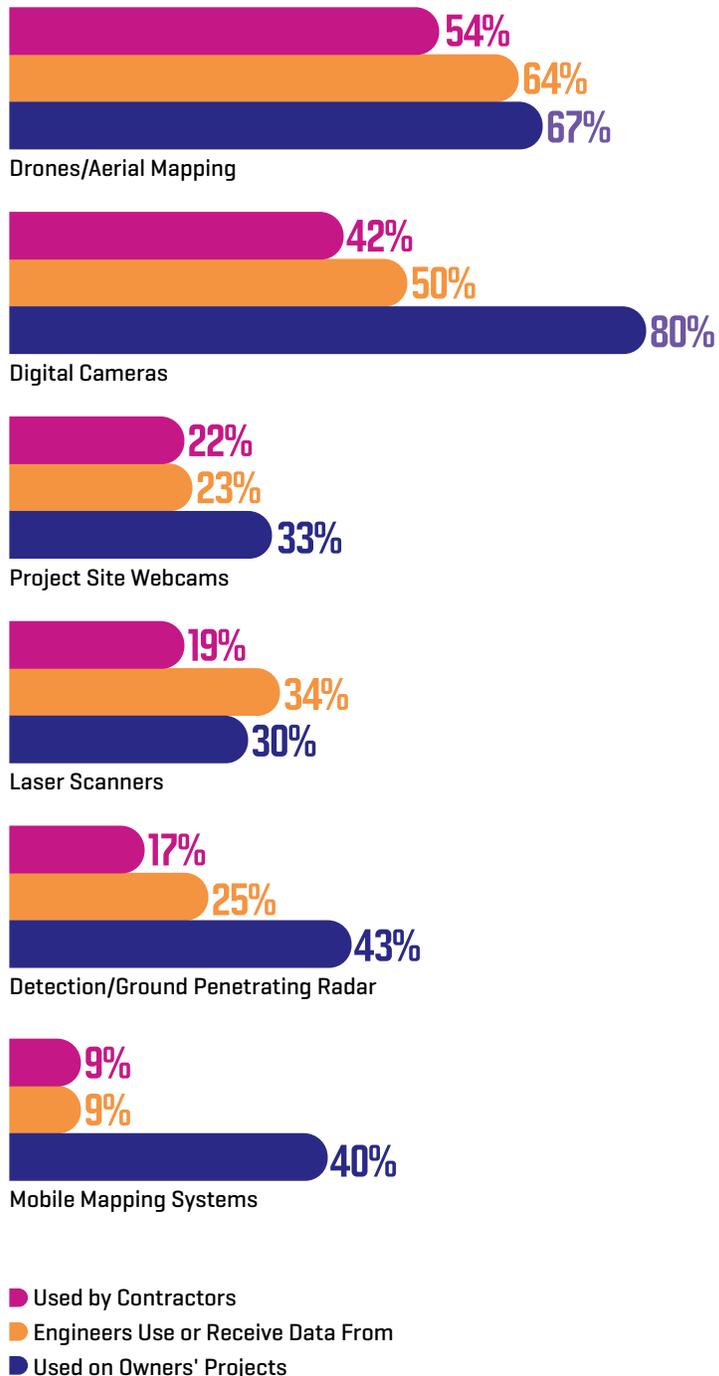
Reality capture technology has the potential to provide contractors with new ways to improve safety, track progress on their projects, gather data for analysis and track trends across projects for continual improvement. Smart phones are the most basic tool, but since they are nearly ubiquitous for contractors, engineers and owners, the findings analyzed here, especially for contractors, focus on those using other reality capture technologies, although smartphones were included in the survey.

## Devices in Use

The top types of reality technology in use, other than smart phones, are shown in the two bar charts on this and the following page: one chart showing the top technologies in use by contractors, engineers and owners, and the other showing the technologies with significant differences in use between small, midsize and large contractors.

- The only reality capture tech other than smartphones that is used by over half [54%] of civil contractors is drones/aerial mapping. Owners and engineers more frequently

## Reality Capture Technology With Differences in Share Reporting Use, by Organization Type

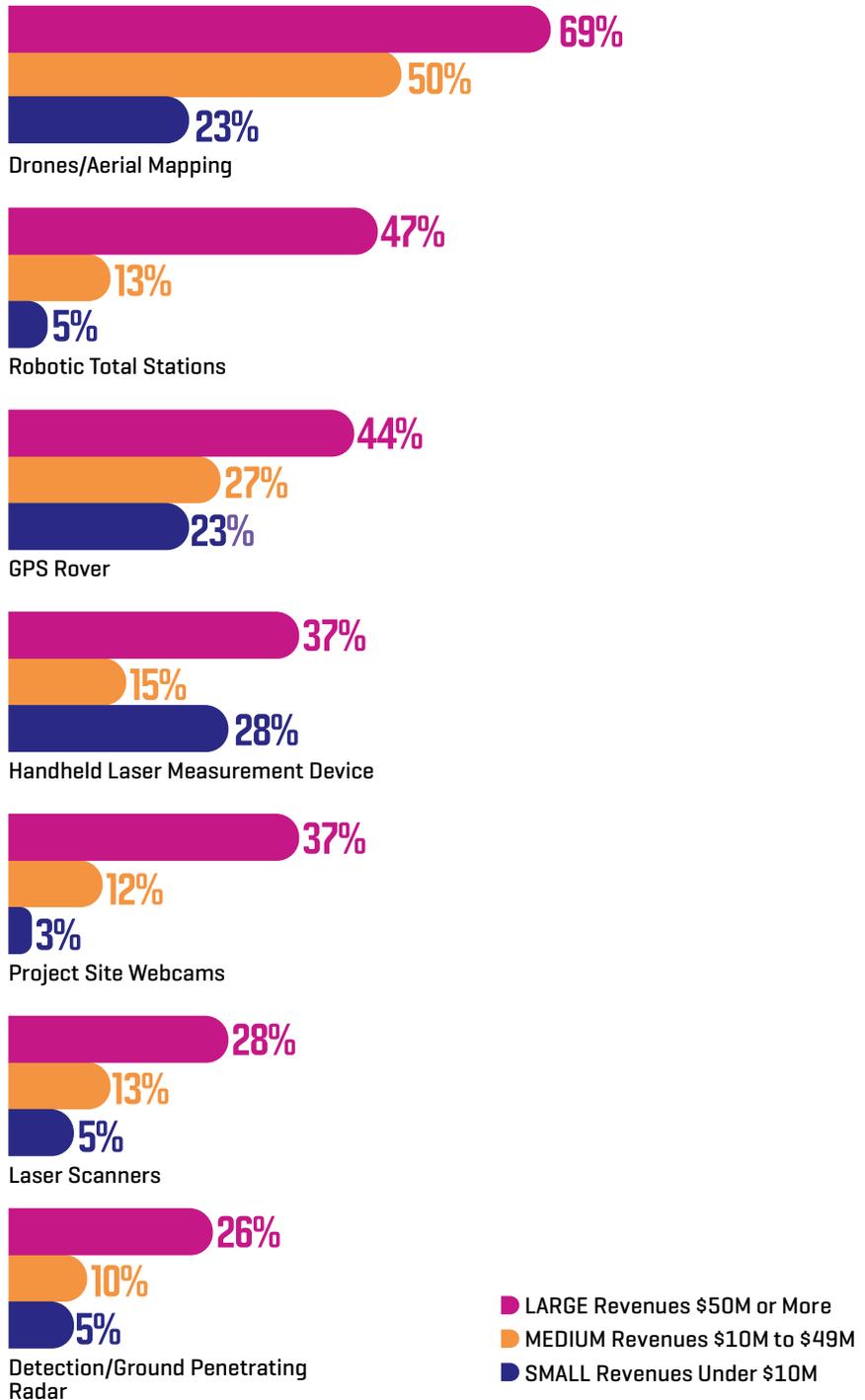


# Reality Capture

report use of this technology than do contractors.

- Far more owners report the use of digital cameras, detection/ground penetrating radar and mobile mapping systems than do civil contractors or engineers. In fact, for owners, the use of digital cameras on civil projects is widespread, with 80% reporting their use.
- Civil engineers more frequently get data from drones and digital cameras on civil projects than from any other technology, other than smartphones. Clearly there is a notable opportunity for them to benefit from other forms of data currently being captured onsite.
- Use of most of the reality capture technologies by civil contractors is driven by large companies, but even among them, most of the tech is used by less than half. Clearly there is broad opportunity for wider adoption on civil project sites.

## Reality Capture Devices Used More by Large Contractors Than by Small/Midsize Ones



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# Reality Capture

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## Use of Reality Capture Data by Contractors

All the contractors who use more reality capture technologies were asked what applications they use to work with the information it provides.

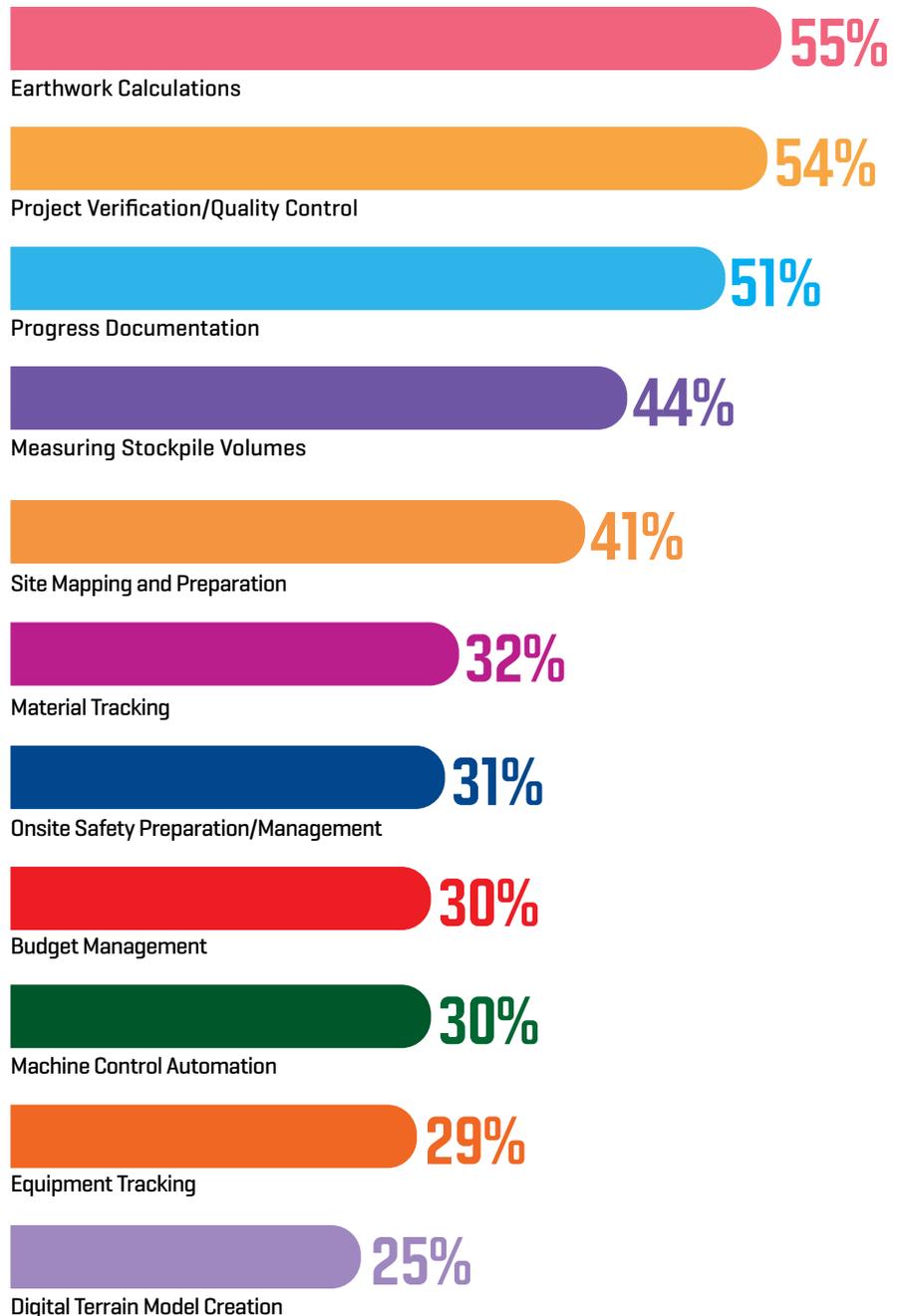
The chart at right shows the most common applications in which contractors who use more than just smart phones are analyzing the data they gather from their reality capture technologies.

The list demonstrates that many contractors are already managing the site better through earthwork calculations, improving their project quality through project verification/quality control and improving schedule tracking through progress documentation.

This practical application of data demonstrates the potential for project improvement from wider adoption of a variety of these tools.

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## Applications of Reality Capture Data Used by More Than One Quarter of Contractors



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# Reality Capture

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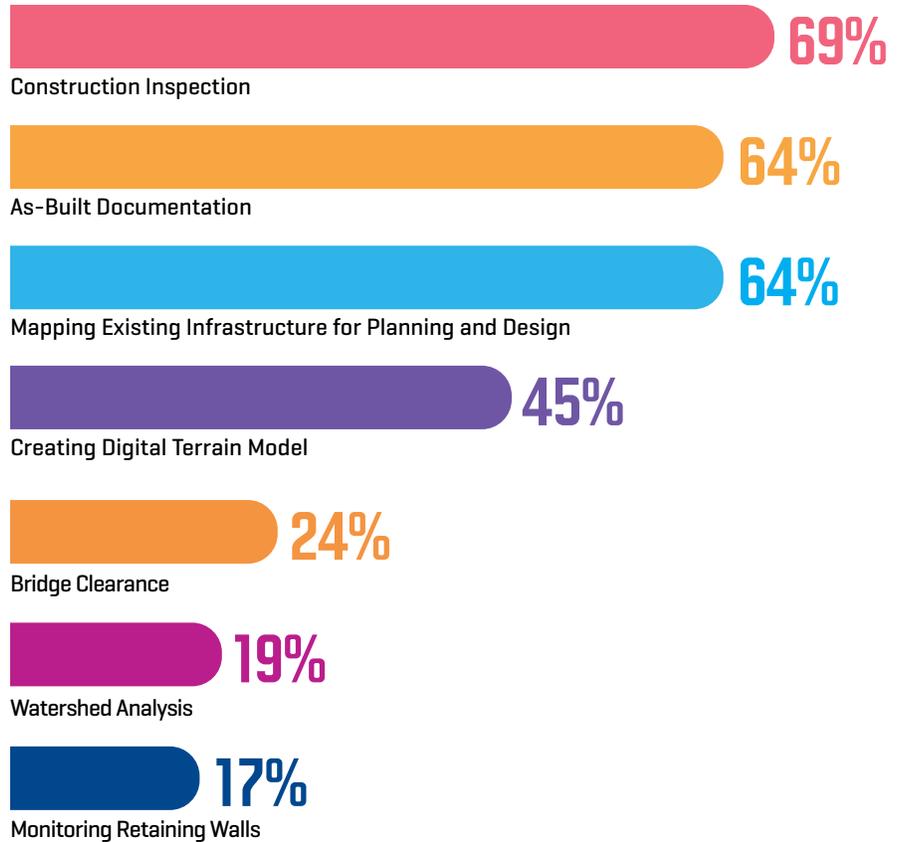
## Use of Reality Capture Solutions by Engineers

Despite relatively low rates of engineers getting data from most of the reality capture technologies other than smartphones, the majority who do so put that data to use in three ways: construction inspection, as-built documentation and mapping existing infrastructure for planning and design.

The chart also reveals opportunities for wider use of the data, with 45% using it to create a digital terrain model and less than one quarter doing so for bridge clearance, watershed analysis and monitoring retaining walls.

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## Applications for Which More Than 10% of Engineers Use Reality Capture Solutions



# Reality Capture

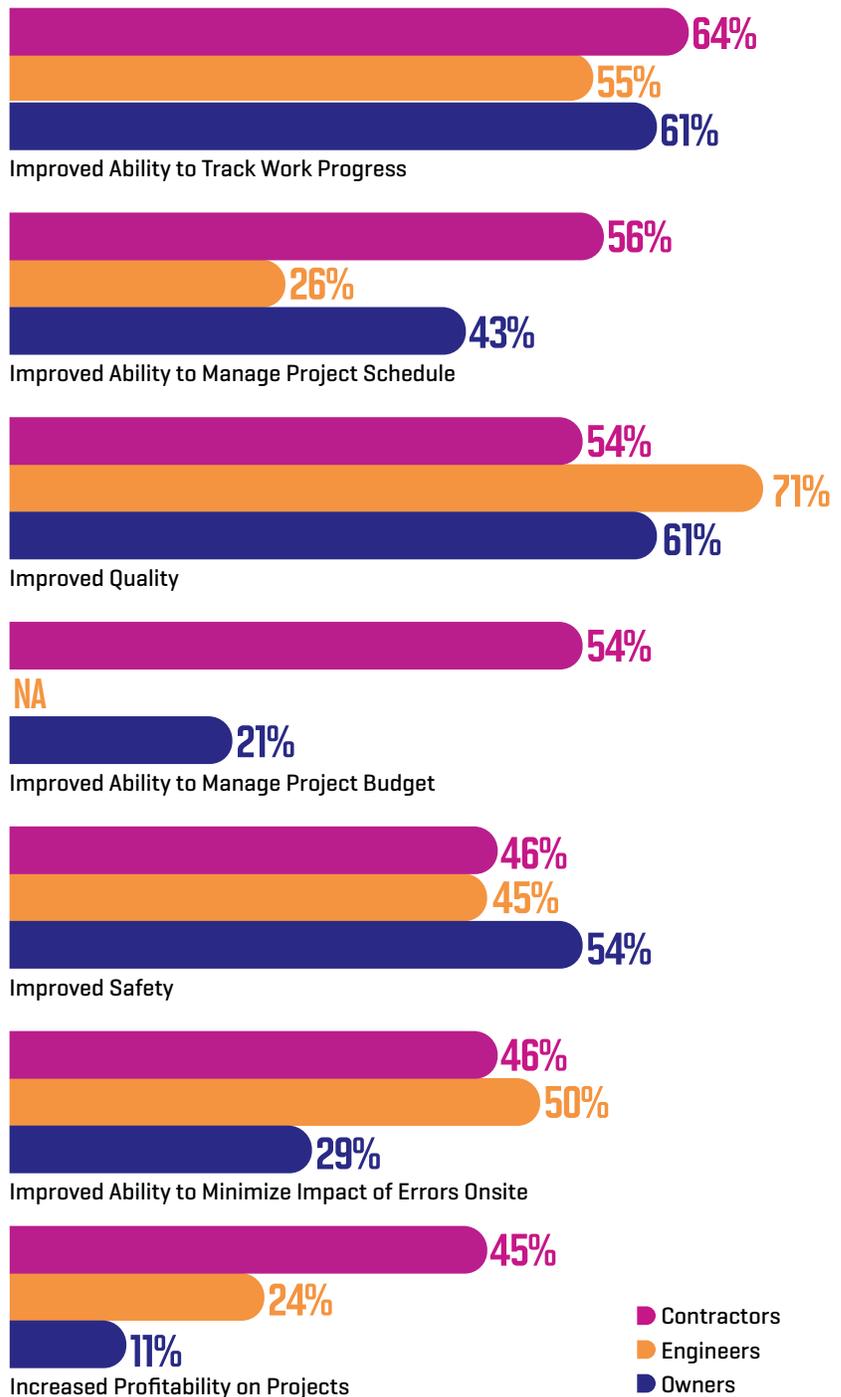
## Project Benefits From the Use of Reality Capture

Civil contractors, engineers and owners were asked about the project benefits they experience from using reality capture tools. The chart at right shows the share who report experiencing each of the benefits.

- Improving their ability to track work progress is the top benefit for contractors, and among the top for engineers and owners.
- Civil contractors are enthusiastic about most of the benefits, with about half reporting positive impacts on managing schedule and budget, quality and safety from the use of reality capture.
- The top benefit by far for engineers is improved quality, and around half also report improved ability to minimize the impact of errors onsite and improved safety.
- Improved quality and safety are among the top benefits for owners.

The findings show the benefits across the project team due to use of reality capture, and suggest that the industry will benefit even more from wider use.

## Project Benefits From Use of Reality Capture Tools



# Reality Capture

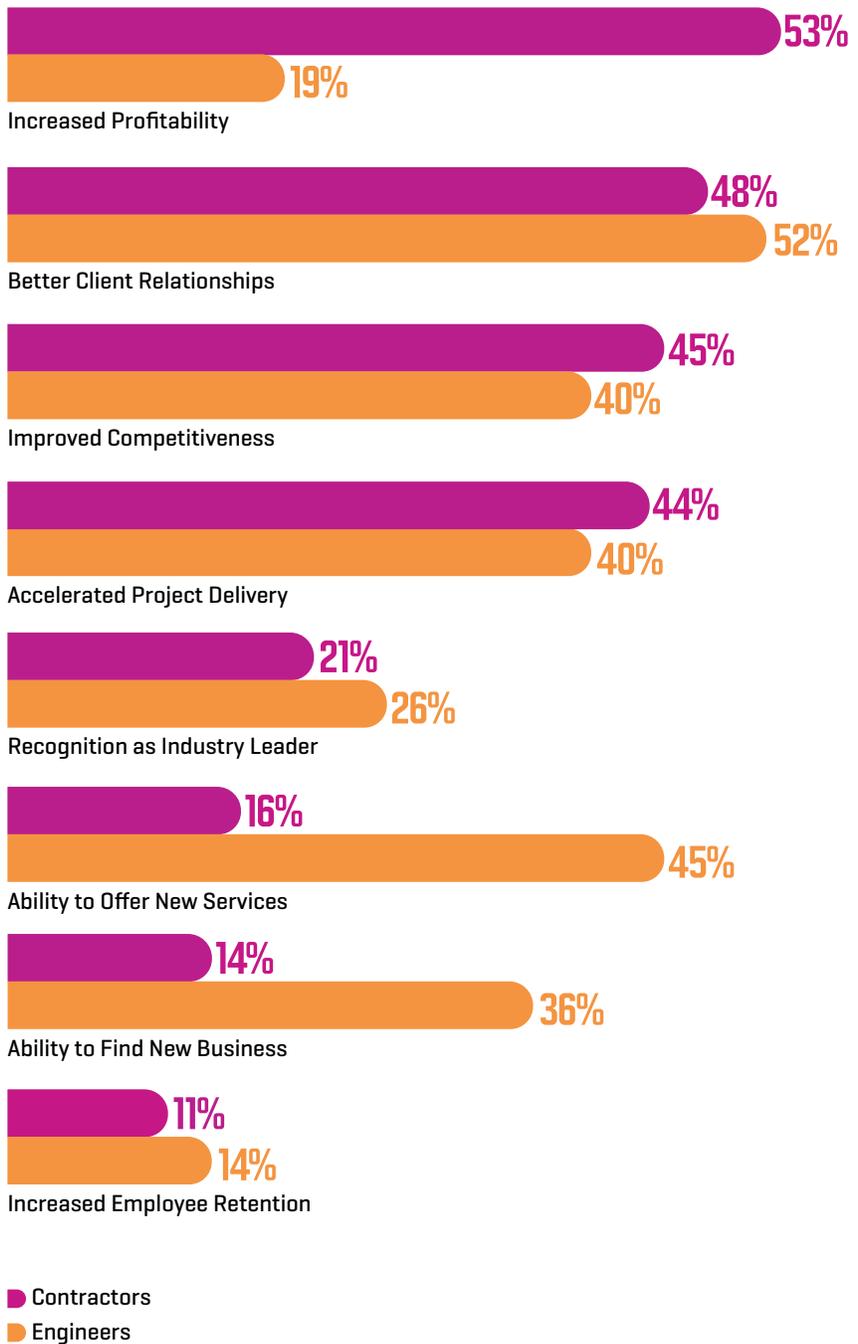
## Business Benefits of Reality Capture

Civil contractors and engineers were also asked whether their use of reality capture has helped them achieve several business benefits. The top benefits they experience are shown in the chart at right.

In addition to numerous project benefits, these findings demonstrate that significant business benefits also accrue from the use of reality capture.

- The top four benefits are reported by about half of contractors, suggesting that they are widely achievable.
- A similar share of civil engineers report better client relationships, improved competitiveness and accelerated project delivery, compared with the contractors. In addition, while fewer engineers than contractors experience increased profitability, far more report that data from reality capture technologies increases their ability to offer new services and to find new business. These findings suggest that wider access to reality capture data would benefit engineers.

## Business Benefits of Using Reality Capture



# Reality Capture

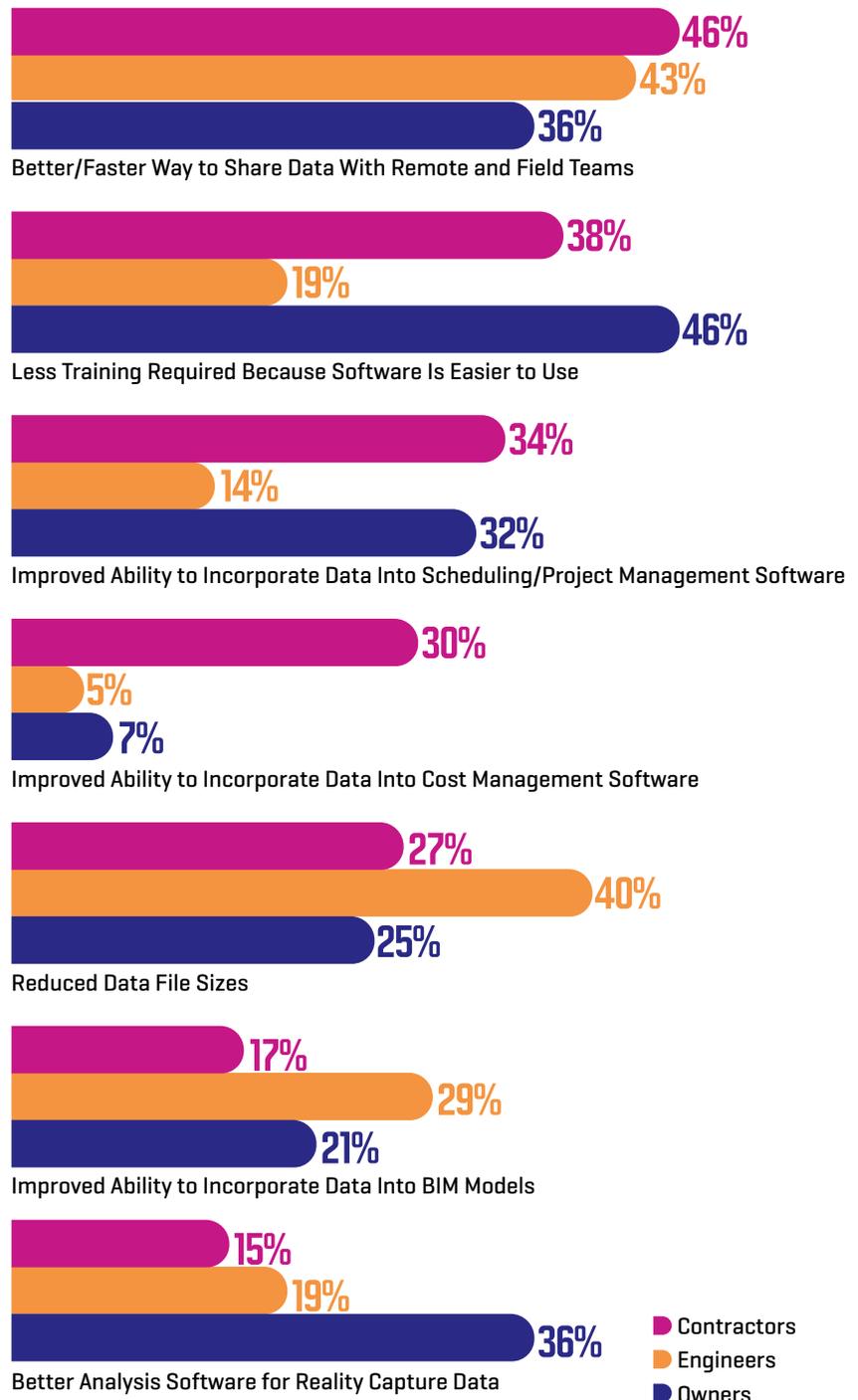
## Means to Increase the Usefulness of Reality Capture

Civil contractors, engineers and owners were asked about the top ways to increase the usefulness of reality capture.

All three agree that having a better/faster way to share data is one of the top ways to improve its usefulness. Clearly information mobility is an issue that needs to be addressed to help increase the use of reality capture tools.

- For contractors, another top priority is ease of use, which requires less training. Ease of use is often a top factor for contractors when it comes to technology.
- Reduced data file sizes are particularly important to engineers. With engineers far less likely to have access to this data than other players (see pages 20-21), anything that makes the data easier to obtain may be important.
- Owners are about evenly split between ease of use, ability to use with scheduling software and better analysis software.

## Top Ways to Increase Usefulness of Reality Capture



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# A Closer Look

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## Construction Companies Need to Address Their Cyber Risks

The construction industry has undergone transformative change over the past decade, as firms adopt new technologies that help teams stay better connected on everything from daily operations to multi-firm project collaboration. But along with these new means of connectivity, threat actors are increasingly looking at ways to exploit the industry's cyber vulnerabilities.

"The construction industry has the hallmarks for being prime targets [for cyberattacks]," says Dave Shluger, vice president of cyber risk engineering at Zurich North America. "Companies have both sensitive and confidential information, which can be valuable if exfiltrated. And they also have a business that is increasingly reliant on technology. Businesses can be disrupted, shut-down or stopped, if that technology is unavailable or corrupted or destroyed. Those angles are what threat actors look for."

### Cyberattacks in the Construction Industry

Some high-profile cyberattacks have already hit the industry. Bird Construction, a \$1.3 billion Canadian construction firm, told the CBC that it was the target of a ransomware attack in December 2019. Threat actors reportedly encrypted 60GB of data and demanded \$9 million in ransom.

A month later, \$40 billion French firm Bouygues announced in a press release that it had fallen victim to a ransomware attack. The firm, which is the parent company of Bouygues Construction, said construction operations were not affected by the incident.



**"You're not immune. Assume it will happen someday and prepare for it now."**

—Dave Shluger  
ZURICH NORTH AMERICA

### Level of Preparedness for Cyberattacks

These incidents come as much of the industry is just beginning to address the threat of cyberattacks. AON rated the construction industry's cybersecurity maturity as "basic" in its *2021 Cyber Security Risk Report*. The report noted that more than half of survey respondents stated that they do not undertake any form of penetration testing to help identify potential vulnerabilities.

Most construction firms also are not prepared for the aftermath of an attack. Among the survey respondents, 59% said they did not have a

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## A Closer Look

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**“Do you even know who you will call if you have a cyber incident? Is that in your phone or written down somewhere? Because you may not have access to your computer.”**

**—Dave Shluger**  
ZURICH NORTH AMERICA

formalized business continuity management process in place and 69% report that they do not have a formalized incident response process.

### **Risk of a Cyberattack**

After years of seeing few cyber incidents—in part due to the limited personal information kept by firms—the “construction industry is one of the leading industries impacted by data security incidents,” according to the white paper “Why the Construction Industry is Being Impacted by Cyberattacks, and What to Do About It.” The paper, which was authored by representatives of law firm Beckage and presented during AGC’s 2021 Surety Bonding and Construction Risk

Management Conference, notes that the construction industry lags other industries in data security and privacy initiatives. This is in part due to a lack of significant regulation in data security and privacy laws, according to the paper.

Adding to the concern is the rapid rise of ransomware attacks. In September, cybersecurity firm Positive Technologies reported that in the second quarter of 2021, ransomware accounted for 69% of malware attacks. While sophisticated attacks aimed at data exfiltration still occur, many threat actors are favoring ransomware, which Shluger says can be a less intensive approach with a high potential for causing disruption.

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## A Closer Look

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“It is middle market firms like that [that rely on older systems] that need to be worried.”

—Daniel Parziale  
BECKAGE



“It’s a numbers game, where they are reaching out to lots of individuals and organizations,” he says. “I don’t want to call ransomware attacks unsophisticated, but they are low-hanging fruit. [Threat actors] looking for the most vulnerable companies and then disrupting them.”

### Vulnerability by Size of Company

Although large firms that have fallen victim to cyberattacks have made headlines, firms of all sizes are at risk. Shluger says large firms with sophisticated defenses may be specifically targeted with advanced persistent threats, while smaller firms may get caught in the numbers game, where threat actors cast a wide net to thousands of individuals. “If someone clicks on a bad link, the threat actor may not even know what organization that person represents because they sent it out to everyone on their list,” he adds.

Daniel Parziale, an attorney at Beckage and co-author of the AGC paper, says many threat actors are looking for the “sweet spot,” where they expect to see the greatest return on the time invested in an attack. While large firms could be a high-dollar target, their defenses are likely to be more difficult

to compromise. Small firms may be easier targets, but they are likely to be less profitable.

Parziale says middle market firms are often ideal targets for threat actors, as they may not have the levels of defense of larger firms, yet they could face large losses from business disruptions caused by a cyberattack. “If I’m the biggest electrical company in my state—but not necessarily the largest nationwide—I pull down a decent amount in revenue,” he explains. “My firm has been in business since 1908 and we’re using systems that we put in a while ago. It is middle market firms like that, that need to be worried.”

### Supply Chain Attacks

The construction industry is also particularly vulnerable to supply chain attacks. A high-profile cyberattack on IT firm SolarWinds made headlines last spring, when threat actors used its attack on SolarWinds to penetrate the defenses of its customers, including the United States Treasury Department.

Most construction companies are heavily reliant on a wide swath of vendors, subcontractors

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## A Closer Look

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and service providers. In many cases, contracts with project owners dictate that construction companies must offer a percentage of work to small firms, which may be less protected against attacks. Parziale says this is of particular concern as many project teams use collaborative delivery methods, where subcontractors and vendors may be granted access to a general contractor's systems. "The problem is, if [the subcontractor] gets compromised and they have access to the general contractor, the threat actor will use that to get into a larger system," he says. "They go after the small fish, but eventually follow that to a big fish."

### Reducing the Risk of Cyberattacks

While every company has its own unique vulnerabilities, there are some basic steps that firms can follow to help reduce their risk. Email remains a primary means of entry for threat actors, so Parziale says simply using multifactor authentication on email accounts can help reduce that risk. Companies should also regularly train employees on how to identify and avoid phishing attacks.

Vulnerabilities in software also represent a serious risk, so Parziale says companies need to make sure they get continuous security updates. Likewise, companies should transition away from any "end-of-life" software, where security updates are no longer available.

Although not all firms can afford to have in-house IT capabilities, Parziale says firms should consider bringing in a third-party managed security service provider to manage and monitor cyber vulnerabilities.

Having a robust incident response plan and backup procedures in place could help significantly

**"[Threat actors are] looking for the most vulnerable companies and then disrupting them."**

—Dave Shluger  
ZURICH NORTH AMERICA

decrease the damage, if an incident does occur, Shluger says. "Conduct regular exercises and know what you'll do in an incident," he says. "Do you even know who you will call if you have a cyber incident? Is that in your phone or written down somewhere? Because you may not have access to your computer."

### Deciding Whether to Pay a Ransom

If you're a victim of a ransomware attack, Parziale says that in some cases, a firm may end up having to pay the ransom. But before pursuing that option, he says firms need to bring in experts to help with the process. "In those cases, we will engage with the threat actor and negotiate with them to get information from the threat actor," he says. "Sometimes the attack ends right then, and nothing gets paid."

If a firm does pay, they need to be aware of several risks. For example, Parziale says a firm could be fined if it pays someone on the no-fly list or someone associated with the North Korean government. Firms could also face notification obligations after an attack. "People often think they'll just pay the guy and we'll be done," he says. "Wrong. If [the victim] had W-2s and we find that [the threat actor] took that data, now they have the Social Security numbers from those W-2s and you have to notify [the people on those W2s]. If you don't, you could face big fines."

While these cyberattacks are still an emerging threat, Shluger says firms of all sizes need to prepare now. "You're not immune," he says. "Assume it will happen someday and prepare for it now."

CQ

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# A Closer Look

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## Digital Project Delivery in Civil Construction

The reality capture technology featured in the data in this Civil Quarterly is just one element of a shift toward digital project delivery in civil construction. Dodge Data & Analytics, in partnership with Bentley, recently released a study of civil contractors, *Going Digital: Modeling Scheduling and Field/Project Management for Civil Construction SmartMarket Brief*, that examined two critical technologies that support digital project delivery: model-based technology, and field and project management software. The findings reveal that the industry is still in the process of shifting to these digital tools, but that the benefits being achieved from them should help drive further adoption.

### Model-Based Technology

Civil construction lags behind vertical building in the adoption of model-based technology. Only about one third [34%] of civil contractors currently use these tools, while over half [57%] of those in the vertical sector are employing them.

However, those who do employ them are using them for a variety of workflows, although even among users, there is only one that is adopted by over half: model-based quantity take-off for estimating. Other workflows are used by over one third of civil

contractors, including using the model as the as-built handover at the end of a project [40%], conducting model-based scheduling and simulation to optimize project plans [38%] and using these tools for machine automation/control. These findings reveal that model-based tools are providing useful ways to improve project delivery to their users, but they also suggest that use is still emerging in the industry, with many opportunities for wider adoption. One finding in particular that supports the idea that adoption is early and likely to become more widespread for most of these workflows is that the vast majority—over 80%—of those using these model-based tools report that they are highly valuable for their projects.

Civil contractors using model-based technology also report several key benefits from its use. The ones ranked the highest by the contractors include reducing rework, improving project schedule, improving stakeholder understanding of the project and improved profitability. In addition, in response to a separate question solely about the impact on schedule delays, 83% of civil contractors using these tools report that they have a medium or higher impact in keeping projects on



**Model-based quantity take-off for estimating is the top model-based workflow for civil contractors, and the only one employed by a majority of them**

# 34%

**Percentage of civil contractors who use model-based technology**



**Top project outcome improvement is reduced rework, and 83% also report reducing schedule delays**

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## A Closer Look

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schedule. This is a critical, fundamental benefit that helps contribute directly to the success of the project and to their ability to balance their workloads.

These findings make clear that the civil construction industry would benefit from wider use of these tools. To better understand the degree to which the industry is shifting toward these tools, the contractors who currently do not use them were asked about their level of interest in doing so. Over one third [36%] are considering their use currently, suggesting the potential of a slow but steady shift toward wider implementation. And, as the schedule, productivity and profitability benefits become more widely known in the industry, it is likely that the pace of adoption will accelerate.

### Field and Project Management Software

The use of field and project management software is better established among civil contractors than the use of modeling tools, with 61% now using this software. However, over one third are still not using it, although its clear benefits are evident in the study.

Users of these tools are nearly unanimous in their belief that they help to get the most value out of project data, with 97% reporting a medium or higher benefit in this area. The top ways in which contractors find that

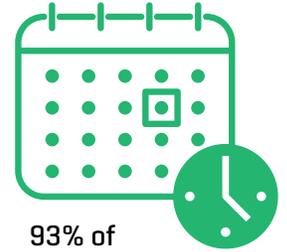
these tools help them get more value out of project data include improved schedule performance, reduced costs, improved labor productivity and improved cost predictability. And when asked separately about their impact on schedule, 93% reported a medium or higher impact on reducing delays.

In addition, half [50%] or more report that use of these tools likely decreases the risks of cost overruns, rework due to construction errors and inaccurate estimating.

Given these benefits, it is not surprising that nearly two thirds [63%] of those who do not currently use these tools are considering doing so. In fact, the drivers that the nonusers are looking for, such as improved profitability, reduced costs, improved labor productivity and improved schedule performance align closely with the top benefits reported by users. Thus, the study suggests that use of these tools is likely to become standard practice in the industry within the next few years.

### Conclusion

Digital project delivery encompasses a broad range of tools, but modeling tools and field/project management software are core components of any digitally driven approach. The study suggests that civil construction is becoming increasingly digital, driven by the benefits associated with the use of these tools. 



**93% of users report that these tools help reduce schedule delays**

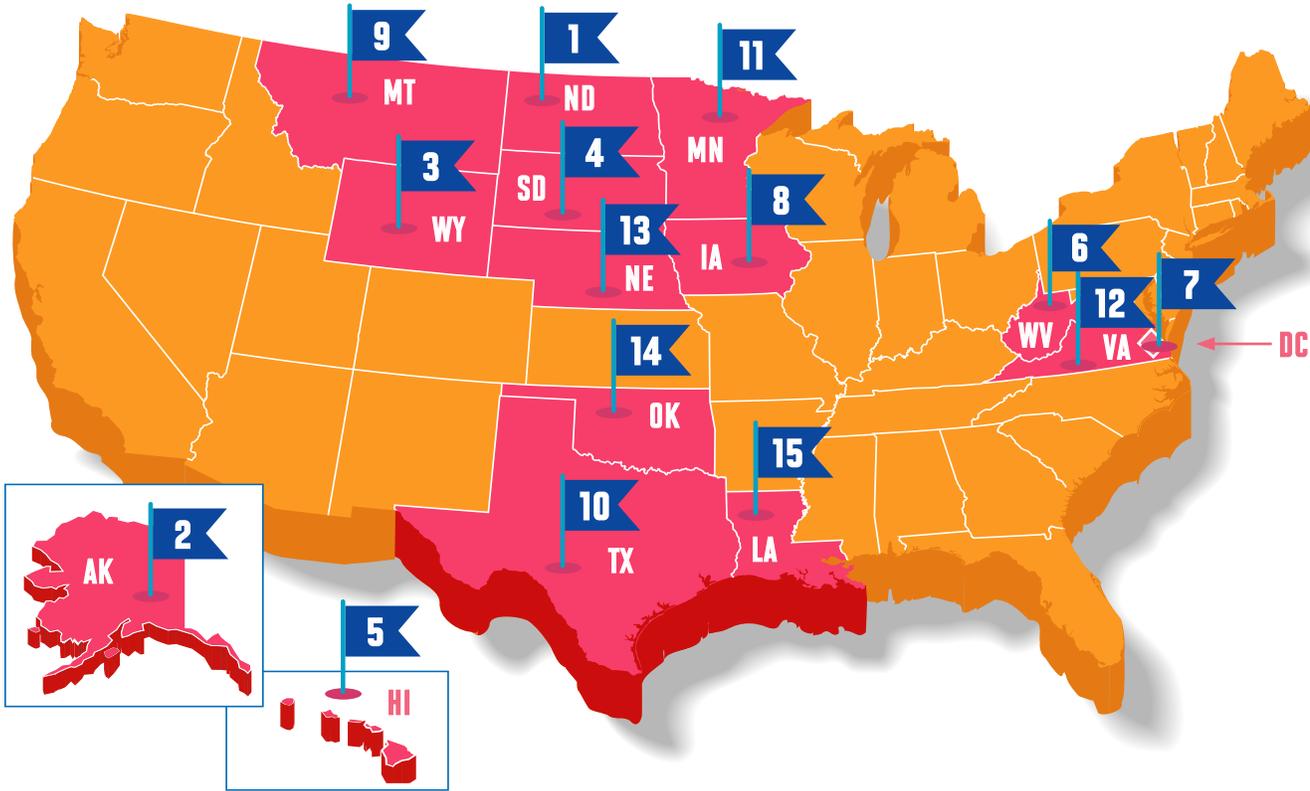
**61%**

**Percentage of civil contractors using field/project management software**



**Users get more value from their project data by using this software due to improved schedule performance, reduced costs and improved labor productivity, cost predictability and profitability**

# Dodge Economic Insight



## Top Per Capita Infrastructure Spending by State

The map above and table at right show the 15 states with the highest infrastructure spending per capita. The data is drawn from the Dodge Data & Analytics database of projects in Start from 2015 to 2020.

- The top three states from 2020—ND, AK, WY—are the top three states again in 2021.
- DC slipped in the rankings from fourth to seventh.
- VA, NE and LA made the top 15 list in 2021, and NV, ID and NM all dropped below that level in their funding per capita.

	STATE	TOTAL SPENDING	PER CAPITA SPENDING
1	ND	\$5 B	\$6.6K
2	AK	\$3 B	\$4.6 K
3	WY	\$2 B	\$3.8K
4	SD	\$3 B	\$3.5 K
5	HI	\$5 B	\$3.2 K
6	WV	\$5 B	\$2.8 K
7	DC	\$2 B	\$2.8 K
8	IA	\$9 B	\$2.8 K
9	MT	\$3 B	\$2.8 K
10	TX	\$70 B	\$2.4 K
11	MN	\$13 B	\$2.4 K
12	VA	\$20 B	\$2.4 K
13	NE	\$4 B	\$2.3 K
14	OK	\$9 B	\$2.2 K
15	LA	\$10 B	\$2.1 K

# Dodge Economic Insight

## Top 25 Infrastructure Projects in Planning

The projects listed in the table below are the top projects by value still in the planning stages published in Dodge Construction Central from Jun. 1 to Sept. 15, 2021. Tunnels in the NY area continue

to dominate the top five projects, with highway and pipeline projects also representing most of the remaining top 10 projects.

Data on the top projects in planning reported in Dodge for the previous three months will be an ongoing feature in the *Civil Quarterly*.

	STATE	DOLLAR VALUE	PROJECT NAME	CITY
1	NY	\$11.6 B	Northeast Corridor Gateway Tunnel Project	New York
2	MD	\$10.0 B	MD/DOT I-495 & I-270 P3 Program Improvements P3	Bethesda
3	NJ	\$9.5 B	Hudson River Rail Tunnel (Gateway Tunnel)	Secaucus
4	NY	\$7.0 B	Cross Harbor Freight Tunnel and Rail Improvements	Brooklyn
5	GA	\$3.5 B	GA/DOT: I-75 Truck Lanes Improvements	Bolingbroke
6	TX	\$2.8 B	TX/DOT: North Houston Highway Segment 3	Houston
7	TX	\$2.8 B	TX/DOT: North Houston Highway Segment 2	Houston
8	IA	\$2.4 B	Navigator CO2 CCS Pipeline	Des Moines
9	TX	\$2.2 B	Rio Bravo Natural Gas Pipeline	Brownsville
10	NY	\$1.6 B	RFP/DB: Metro-North New Haven Line Run to Penn Station	Hunts Point
11	LA	\$1.4 B	Mid-Barataria Sediment Diversion	
12	TX	\$1.2 B	TX/DOT: IH 45 Interchange Improvements	Houston
13	TX	\$1.1 B	TX/DOT: IH 45 Interchange Reconstruction	Houston
14	IN	\$975 M	IN/DOT: I-69 Ohio River Crossing ORX Section 2	Evansville
15	PA	\$900 M	Mon/Fayette Expressway Rte 51 to I-376 Sec 53A	Pittsburgh
16	NC	\$800 M	Wilmington Rail (Realignment) & Bridge	Wilmington
17	TX	\$751 M	TX/DOT: I-10 Segment 2 Paving	El Paso
18	FL	\$741 M	Loxahatchee River Watershed Restoration	
19	MA	\$676 M	MA/DOT: (Boston) Bridge Deck/Rail Station West Station	Boston
20	AL	\$670 M	AL/DOT: I-10 Grade Drain and Paving Improvements	Mobile
21	CA	\$650 M	Poseidon HB Seawater Desalination Facility	Huntington Beach
22	CA	\$616 M	Anderson Dam Seismic Retrofit Project (Phase 1B)	
23	AZ	\$616 M	AZ/DOT: I-10 Broadway Curve—I-17 Split to SR 202L (Santan)	Tempe
24	TX	\$610 M	TX/DOT: IH 35 Lane Widening	Laredo
25	OR	\$600 M	Bull Run Filtration Facility	Portland
25	TX	\$600 M	TX/DOT: I-35E Reconstruction and Widening Phase 2 D/B	Dallas

# Dodge Economic Insight

## Top 25 Infrastructure Projects in Start

The projects listed in the table below are the top 25 projects by value reported in Start in Dodge Construction Central from June 1 to Sept. 15,

2021. There is a wide mix of geographies and project types among the biggest projects that started in the last quarter.

Data on the top projects reported in the start phase in Dodge for the previous three months will be an ongoing feature in the *Civil Quarterly*.

	STATE	DOLLAR VALUE	PROJECT NAME	CITY
1	IN	\$728 M	I-69 Sec 6 Cont 5 DBBV-State Road/Bridge	Indianapolis
2	TX	\$640 M	TX/DOT: IH 35E Corridor Phase 2	Dallas
3	TX	\$500 M	Whale Offshore Oil Field Pipeline	Houston
4	RI	\$453 M	Combined Sewer Overflow (CSO) Phase III DESIGN/BUILD	Pawtucket
5	NC	\$450 M	Waterfront Repairs	Beaufort
6	NC	\$264 M	NC/DOT: US 70 (Expansion) DESIGN/BUILD	New Bern
7	CA	\$255 M	NCWRP Expansion & Influent Pump Station/Pipeline	San Diego
8	MO	\$240 M	MO/DOT RFP/DB: I-70 Rocheport Bridge Project	Boonville
9	MO	\$220 M	MO/DOT: Buck O'Neil Bridge Replacement	Lees Summit
10	DE	\$205 M	I-95 Bridge Rehabilitation	Wilmington
11	OH	\$202 M	Shoreline Storage Tunnel (SST)	Cleveland
12	OR	\$200 M	MAX Red Line Extension & Reliability Improvements	Portland
13	TN	\$199 M	TN/DOT: I-65 Drainage Improvements (CO 027)	
14	TN	\$192 M	TN/DOT: I-75 at I-24 Interchange Modification	Chattanooga
15	VA	\$179 M	VA/DOT: I-81 Widening MM 136.6 to MM 141.8	Salem
16	NM	\$163 M	Waste Isolation Pilot Plant (WIPP) Air System Rebuild	
17	HI	\$160 M	Honouliuli WWTP Env Support Facilities	Ewa Beach
18	NJ	\$152 M	NJ/DOT: Route 70 Paving & Drainage Improvements	Cherry Hill
19	TX	\$152 M	Corpus Christi Ship Channel Improvement	Corpus Christi
20	TX	\$136 M	TX/DOT: US 380 Lane Improvement REBID	Denton
21	AK	\$133 M	Joint Base Elmendorf-Richardson Paving IDIQ	Elmendorf Afb
22	CA	\$130 M	South San Francisco Bay Shoreline Reach 1-3	Alviso
23	MN	\$127 M	MN/DOT: Interstate 94 Improvements	
24	IL	\$126 M	IL/DOT: I-57 Interchange Improvements (CO 221)	
25	MI	\$121 M	MI/DOT: I-94 and US-127 M-50/ West Ave Interchange	

# METHODOLOGY

Dodge Data & Analytics (DD&A) conducted an online survey between Aug. 2nd and 25th, 2021, of contractors, engineers and owners active in civil projects. They were drawn from several sources:

- The DD&A Contractor Panel (over 2,700 decision-makers that include general contractors, construction managers, design-builders and trade contractors)
- The DD&A database of contractors and engineers
- Outreach by Infotech, Hexagon, Command Alkon, DCW, Iowa State University, University of Florida, *Civil + Structural Engineer*, and the Design-Build Institute of America

185 contractors, 44 engineers and 30 owners who are involved with heavy civil infrastructure projects responded to the survey.

## Location of Contractors

99% do most of their construction work in one of the four census regions:

- 38% in the South
- 21% in the Midwest
- 25% in the West
- 15% in the Northeast

## Type of Contractor

- 65% general contractors, construction managers, design-builders
- 17% non-building contractors
- 18% trade contractors

## Contractor Job Functions

- 36% of contractors identify themselves as executives (CEO/Owner/Partner/President/Principal/Other C-Level)
- 31% identify themselves as project leadership (Project Manager/Project Engineer, Project Executive/Construction Manager)
- 22% identify as estimators, and 11% as other

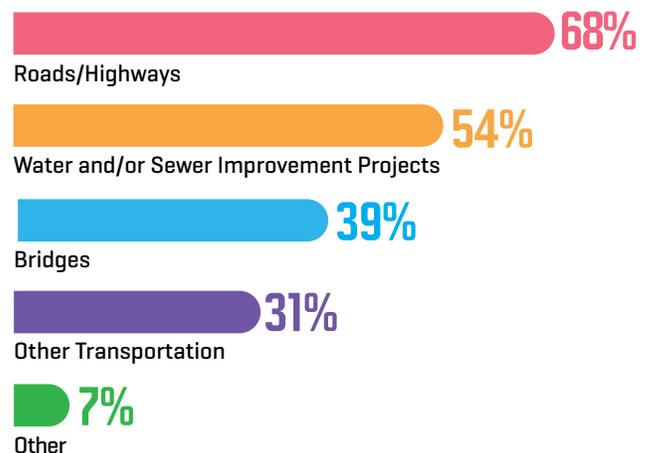
## Contractor Size by Annual Revenue

- 22% small contractors (revenues less than \$10M)
- 28% midsize contractors (revenues from \$10M to less than \$50M)
- 50% large contractors (revenues \$50M or more)

## Civil Engineers and Owners

Civil engineers were asked similar questions to those asked of contractors about their backlog and market expectations, and civil engineers and owners were asked about cybersecurity and reality capture on their projects.

## Project Types (Contractors)



# RESOURCES

## Additional Resources on the Heavy Civil Construction Industry

### FOUNDING PARTNER

**Infotech** [www.infotechinc.com](http://www.infotechinc.com)

### PLATINUM PARTNER

**Hexagon** <https://www.hexagon.com>

### GOLD PARTNERS

**Command Alkon** <https://commandalkon.com>

**Digital Construction Works** [www.digitalconstructionworks.com](http://www.digitalconstructionworks.com)

### RESEARCH PARTNERS

**Civil+Structural Engineer** <https://cseengineermag.com>

**Design-Build Institute of America** <https://dbia.org>

**Iowa State University Civil, Construction and Environmental Engineering**  
<https://www.ccee.iastate.edu>

**The University of Florida M.E. Rinker, Sr. School of Construction Management**  
<https://dcp.ufl.edu/rinker>

### OTHER RESOURCES

**FHWA Resource Center** <https://www.fhwa.dot.gov/resourcecenter>

## Acknowledgements

We would like to thank our founding partner, Infotech, for their vision in joining us in this effort. We would also like to thank our platinum partner, Hexagon, and gold partners, Command Alkon and Digital Construction Works.

We appreciate the efforts of our research partners, Civil+Structural Engineer, the Design-Build Institute of America, Iowa State University and the University of Florida.

We thank all those who participated in our feature articles for sharing their insights and experience with us on critical topics impacting heavy civil construction.

## We Need Your Feedback!

What would you like to see in our next report? What trends would you like to know more about? Let us know at [TCQ@construction.com](mailto:TCQ@construction.com).

# DODGE

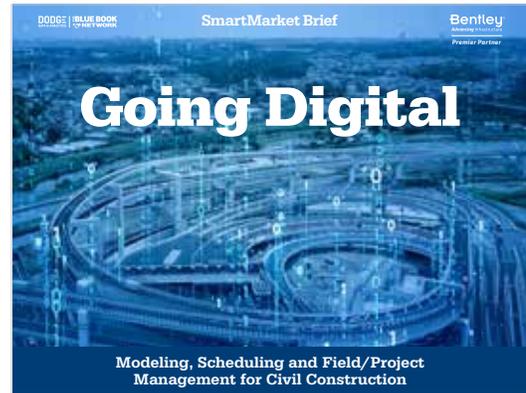
## DATA & ANALYTICS

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