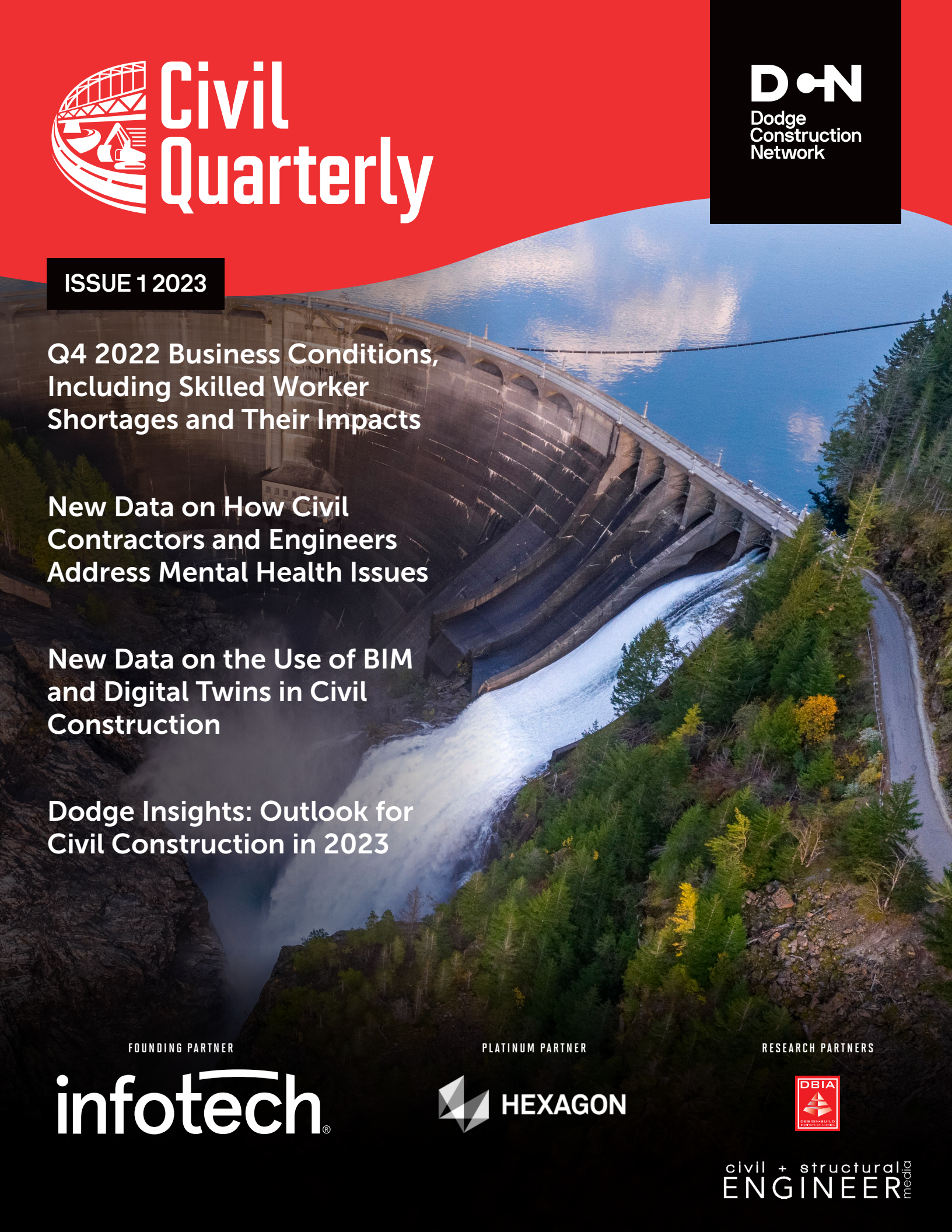
Civil Quarterly

Dodge Construction Network

ISSUE 1 2023



Q4 2022 Business Conditions, Including Skilled Worker Shortages and Their Impacts

New Data on How Civil Contractors and Engineers Address Mental Health Issues

New Data on the Use of BIM and Digital Twins in Civil Construction

Dodge Insights: Outlook for Civil Construction in 2023

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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.

This edition examines mental health in civil construction. It features survey data from civil contractors and engineers that demonstrates what progress has been made so far in addressing mental health challenges and reveals opportunities to do more. In addition, we provide an in-depth interview on the topics of mental health, suicide and opioid misuse with Dr. John Gaal, an expert in this area with over 40 years of engagement in the industry. He delineates the specific issues that create greater challenges in the construction industry for mental health, including higher suicide rates, and provides actionable insights and resources for those seeking to improve.

We also have new information on the civil industry's engagement with BIM and digital twins, by updating the study first conducted in 2020 and capturing the perspective of technology providers on the current use and future potential for digital twins.

Our first edition of the year also includes the 2023 Outlook for civil construction from the Dodge Economic Forecasting team to help our readers with a summary of the major influences on the markets and Dodge's expectations for how they will impact the year ahead.

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

No one knows exactly when "the future" arrives—it sneaks up on you. One minute you're sending faxes and checking the voicemail on your landline, the next thing you know, you are FaceTiming in a self-driving car. In some ways, that's how I feel about the findings in this report.

It wasn't that long ago that construction teams were working from and contributing to completely disconnected datasets—some still are. It wasn't that long ago that even the most expensive and elaborate projects were managed on some mix of paper forms and spreadsheets—and yes, some still are.

But for all but the smallest civil contractors, this report reveals a double digit jump in the usage of Building Information Modeling (BIM) on projects since 2020. To me, that's the clearest sign that if the future isn't here already, it's right around the corner.

The way we manage projects and handle data is changing. Many may still be a while away from a true digital twin—a virtual representation of a physical asset, like something truly out of science fiction—but we've begun building the data environment to get us there.

As more civil contractors and engineers see the benefits in collaboration, coordination and risk-avoidance that comes from BIM, those of us on the technical side of the industry need to ensure our solutions can handle the necessary data types.

At Infotech, we've made an active commitment to adopting IFC standards to support open digital information exchange between our products and others. As BIM usage grows industry-wide, we hope you'll join us in building a better blueprint—because the future is well on its way.

Will McClave
President of Systems
Infotech

Civil Quarterly

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Diablo Dam Digital Twin Modeling, Courtesy of Bentley Systems

We Want Your Feedback!

What do you think about the findings and perspectives 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**.

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 skilled worker shortages.

Current Backlog

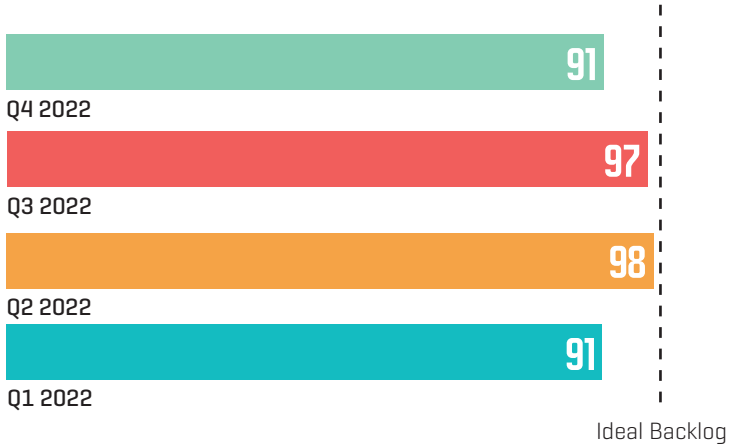
Civil contractors were asked how many months of backlog they currently have compared with their ideal amount. The ratio between those two figures for the last four quarters is shown in the chart at right. As it reveals, backlog volume peaked in Q2 this year. However, the Q4 ratio of 91, the same as the ratio in Q1 2022, reveals that backlog levels are still very high, much higher than in 2021, when the ratios ranged from 80 to 87.

When asked about the changes in backlog they have experienced in the last six months, though, most civil contractors (73%) report that their backlog levels either stayed the same or increased. Notably, a much higher percentage this quarter (19%) than last quarter (11%) felt that their backlog has increased significantly. This certainly suggests that the high levels of backlog are likely to be sustained for the near future.

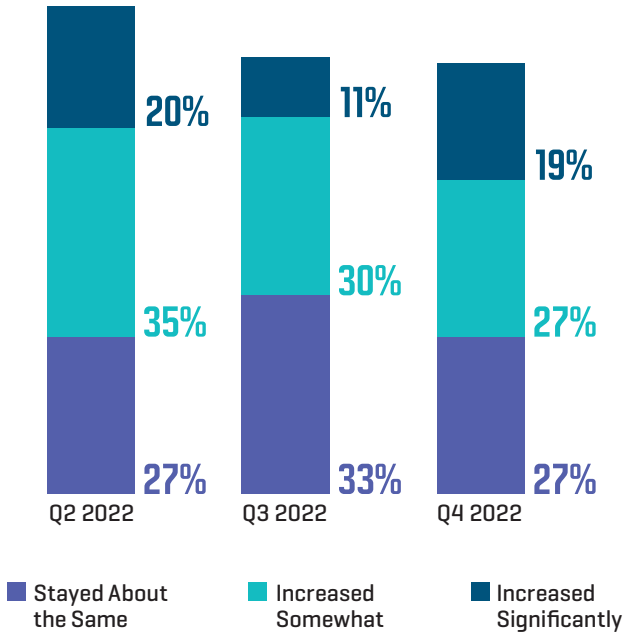
VARIATION BY SIZE

Large civil contractors ($50M in revenue or more) are closer to being at capacity for new work than midsize or small companies, with a backlog ratio of 97, compared with 87 for midsize companies and 88 for small ones.

Ratio of Current to Ideal Backlog



Change in Backlog in Last 6 Months



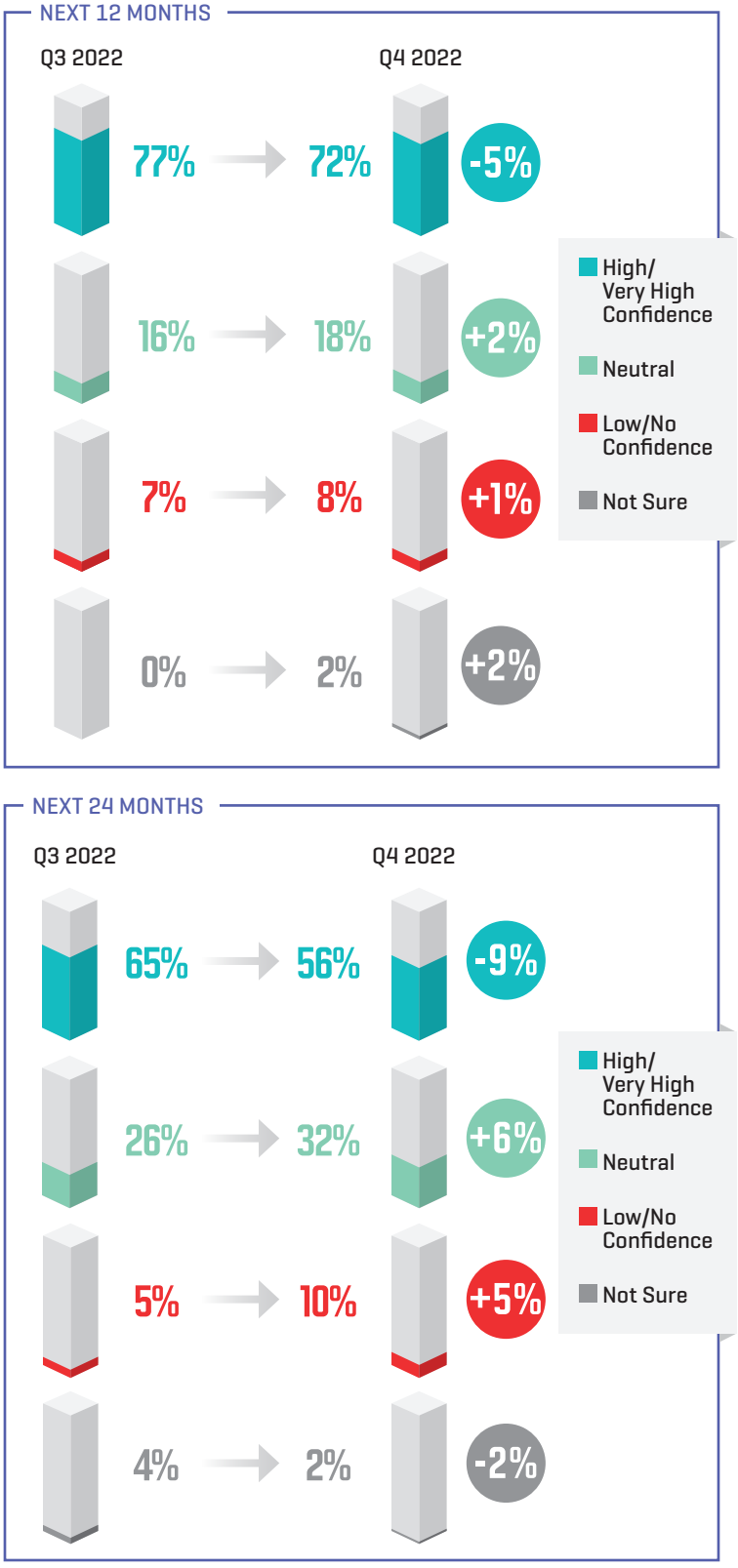
New Business Confidence

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 and fourth quarters of 2022.

- Those highly confident in the outlook for the next 12 months declined by five points from last quarter and is the lowest share in 2022. Despite this, at 72%, most report high optimism about the next year.
- The share who are optimistic about the 24-month outlook, though, declined more notably, with only 56% now reporting high confidence for that time frame. This is well below any other quarter in 2022, which all remained above 60%. Since the distribution of the federal funds from the Infrastructure Investment and Jobs Act has been slower than anticipated (see pages 45–46 for more information), it is likely that work levels will remain high for at least two years. Therefore, this dip in confidence may reflect concerns about the economy, ongoing supply chain challenges and possibly even the results of the recent midterm elections, more than any likelihood of a general slowdown in the infrastructure sector.
- The share with little to no confidence in both their 12- and 24-month outlook continues to remain very low.

Notably, there are no significant differences by size of contractor for their 12- and 24-month outlooks, consistent with last quarter.

New Business Confidence



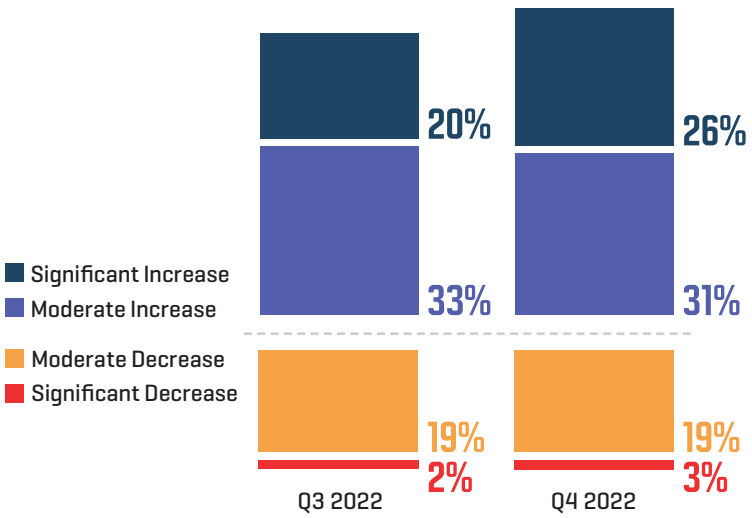
Revenue Change

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.

There is a notable uptick in Q4 in the share who are expecting a significant increase in revenue. This increase makes this quarter more consistent with the findings earlier this year (26% in Q1 and 30% in Q2).

The share who expect a moderate decrease has also increased in the latter half of 2022, from 13% in Q1 to 19% in Q3 and Q4.

Expected Change in Revenue in 12 Months

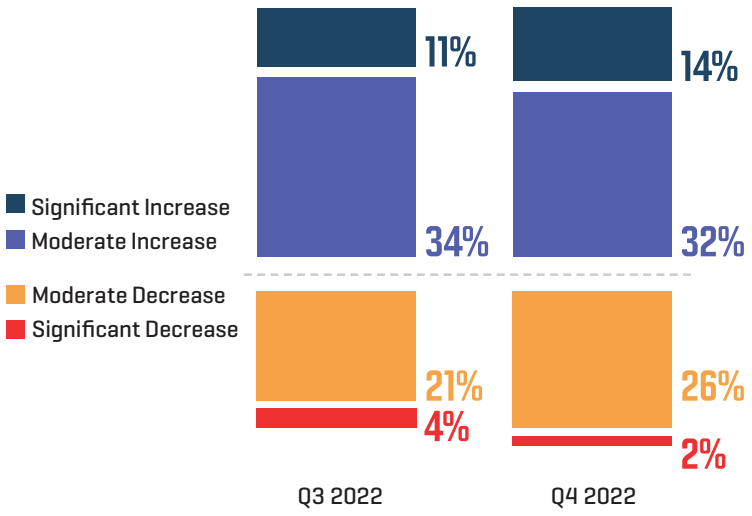


Profit Margin Change

Civil contractors were asked a similar question about the expected change in profit margin. The findings this quarter are very consistent with those in Q3, with nearly half (46%) expecting an increase in their profit margins, but a notable percentage (28%) expecting a decrease.

Civil contractors are slightly less optimistic about their profit margins than they were in early 2022, with over half in the first and second quarters expecting their profit margins to increase. This is likely due to the wider expectation in early 2022 that supply chain pressures would soon decrease; the staying power of those challenges is likely a factor in the contractors' lower expectations.

Expected Change in Profit Margin in 12 Months

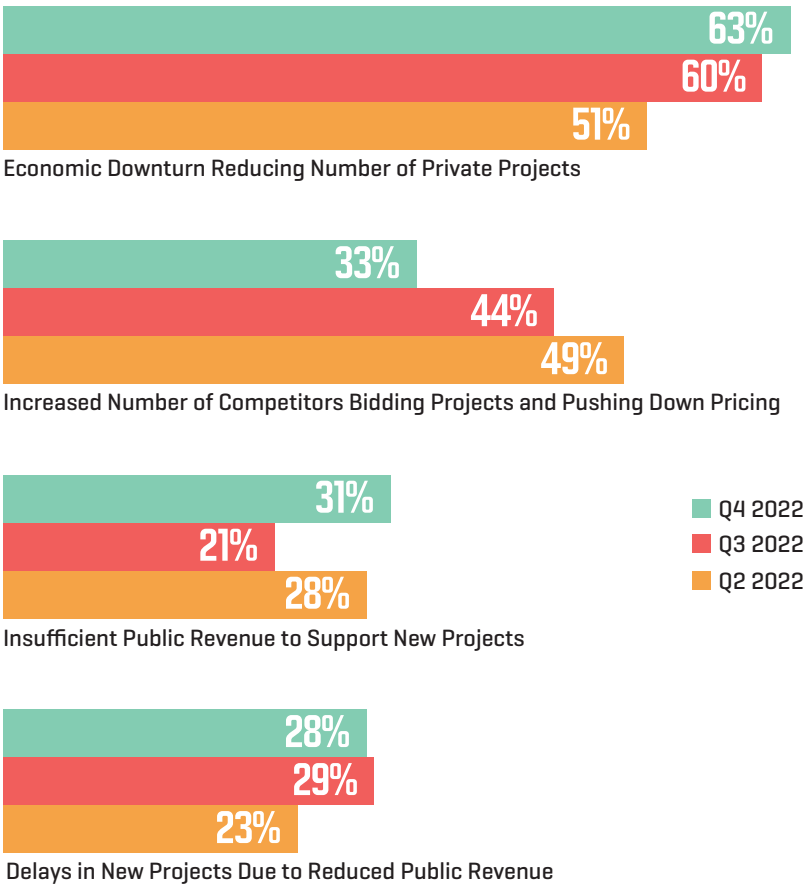


Reasons for Reductions

There are still a small share of civil contractors who anticipate reductions in either their revenues or profit margins in the next year, and they 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 responses in the last three quarters.

Among those who expect a decrease, concerns about an economic downturn continue to grow, up 12 points from Q2. The slower distribution than expected of federal infrastructure funding, combined with concerns about recessionary impacts on state and local funding, are likely contributing to the increase in concerns about delays in new projects due to reduced public revenue since Q2.

In contrast, concerns about an increased number of competitors bidding projects have significantly reduced, from nearly half (49%) in Q2, to just one third in the current quarter.



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 apply from those listed in the chart at right.

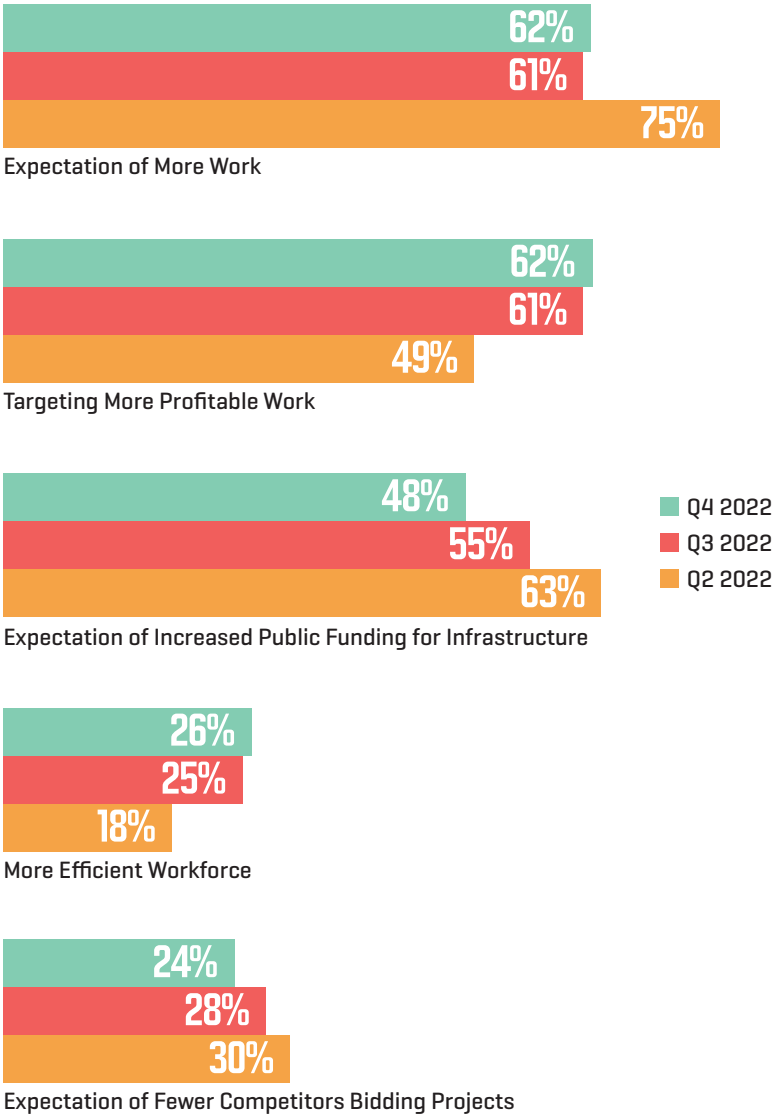
Two factors have emerged as the top reasons that contractors expect increases in the latter half of 2022, with nearly two thirds who expect more work and plan to target more profitable work in the next 12 months. This is in contrast to earlier in 2022, when far fewer believed that they could target more profitable work and far more expected the volume of work to increase.

There has been a consistent decline since Q2 in those who expect increased public funding for infrastructure. The slow distribution of the infrastructure act funding is likely contributing to this supposition.

Promisingly, the share who report having a more efficient workforce continues to grow, up eight points from the second quarter of 2022.

Reasons for Expected Increase

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



Need to Hire and Availability of Skilled Workers

This quarter, civil contractors were asked about the challenges they face finding skilled workers.

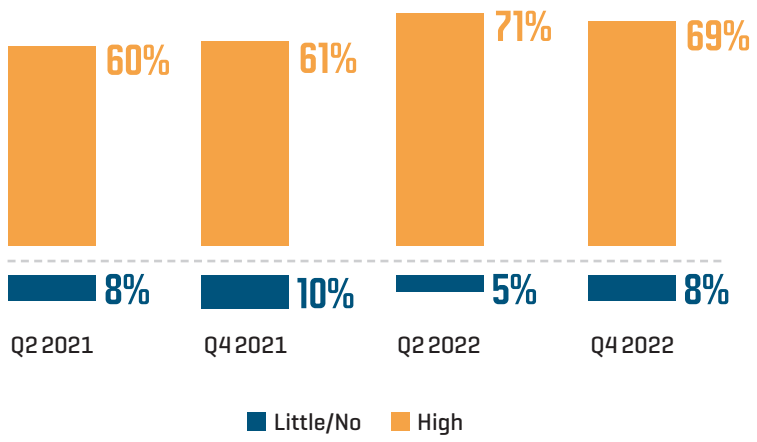
First, they were asked to rate their expectations for their need to hire skilled workers in the next three months, from none to very high. As the chart at right reveals, the demand for skilled workers has increased in the civil sector in 2022, making labor shortages that much more acute.

Next, they were asked to rate the difficulty they experience in finding skilled workers on the same scale. The challenge has remained consistently high since mid 2021, with little variation. This is not surprising, since the industry has struggled with skilled worker shortages for many years.

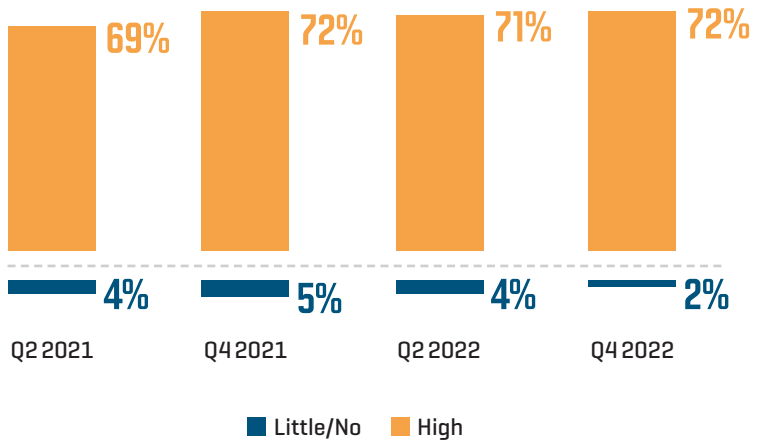
Notably, there is no variation by size of company in these findings.

A large percentage (77%) of respondents from the West (AK, AZ, CA, CO, HI, ID, MO, NV, NM, OR, UT, WA and WY) report that they expect a high/very high need to hire workers in the next three months.

Degree of Need to Hire Skilled Workers



Degree of Difficulty in Hiring Skilled Workers



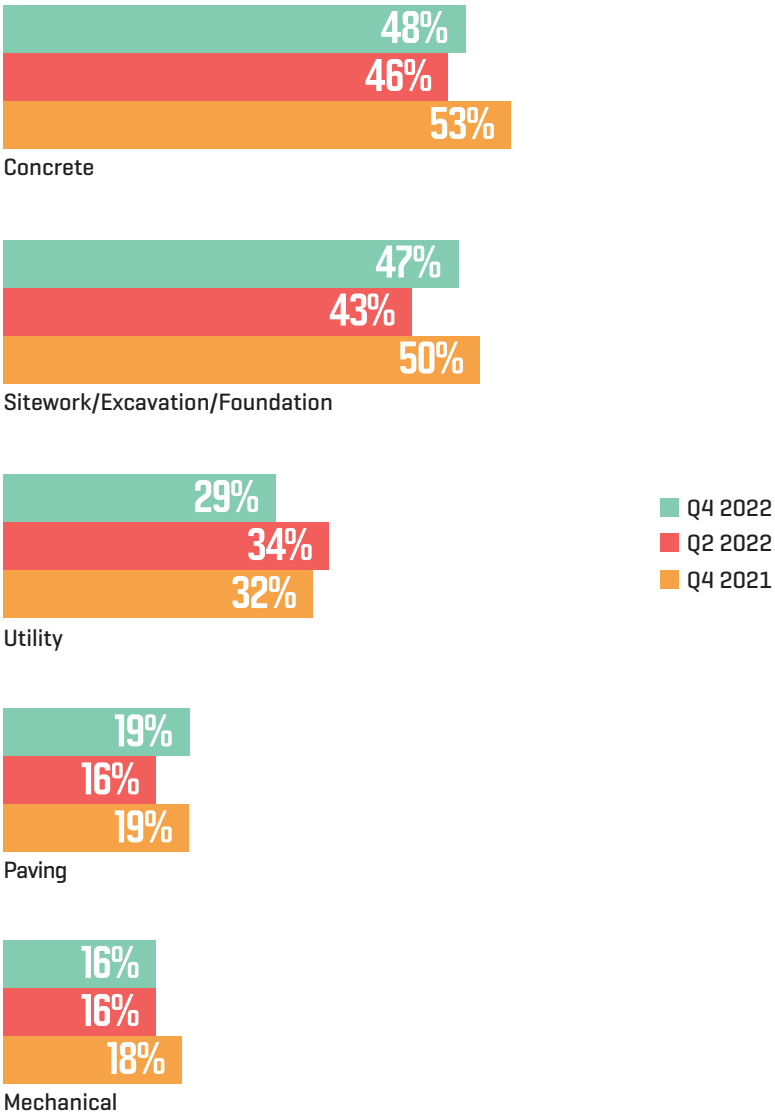
Types of Skilled Workers Most Difficult to Find

Civil contractors who report challenges in finding skilled workers were asked which trades are the most difficult to find. The chart at right compares their responses with those from the previous 12 months.

The most notable aspect of the findings is the degree to which there are only minor variations every six months. Respondents consistently report that workers doing concrete and sitework/excavation/foundation are the most difficult to find, with many also experiencing issues finding utility workers.

The consistency of these findings clearly shows that this is an ongoing problem in the industry, which the increased volume of work has exacerbated but not created.

Types of Skilled Workers That Are Currently the Most Difficult to Find



Effects of Skilled Worker Shortages

Civil contractors who are experiencing skilled worker shortages were asked about the impacts those shortages have on their businesses. The top impacts are shown below.

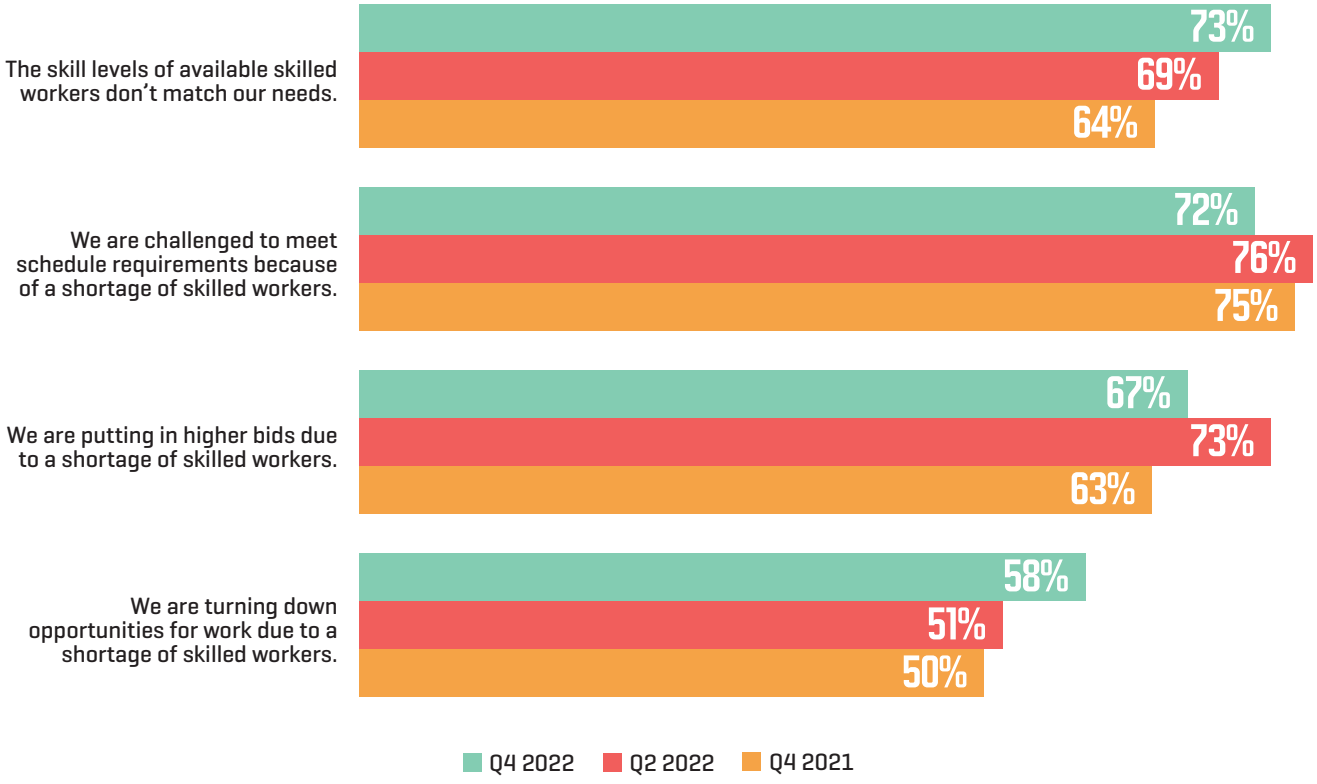
The top two impacts currently are that workers do not have skill levels that match their needs and that they are experiencing schedule impacts on their projects due to worker shortages.

- In previous quarters, schedule impacts were the most frequently selected, and the current share of those selecting them has only dipped slightly.
- Conversely, the share who find that skill levels do not match their needs has been growing consistently since Q4 2021.

There has also been a notable increase in the share who report that they turn down work due to the shortage of skilled workers. With the large volumes of work currently in the pipeline (see page 12), this may ultimately impact the degree to which the US can fully capitalize on the extra infrastructure funding that has been allotted.

Notably, there is no significant variation by size of company for any of these challenges, revealing how universal the impacts are across the industry.

Effects of Skilled Worker Shortages



Expected Changes in Skill Levels and Cost of Skilled Workers

Civil contractors were asked about their expectations that either the skill levels of available workers or the cost of those workers would change in the next six months.

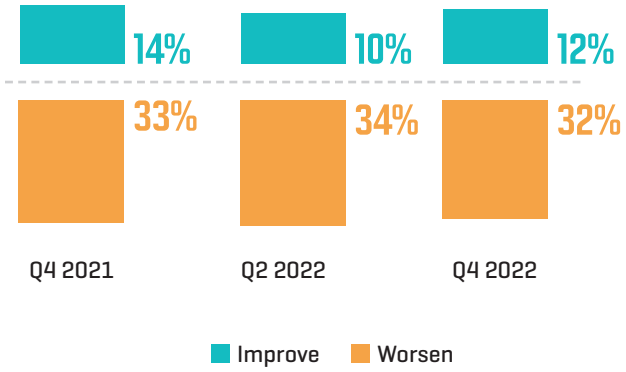
As the chart at upper right reveals, contractors have remained relatively consistent in their expectations about the skill levels of their workers, with one third expecting skill levels to worsen in the next six months.

The civil contractors are even more concerned about the cost of skilled workers, with 79% expecting that to worsen by mid 2023. However, that number reflects a decline from the previous quarters, where concern over the cost of workers increasing was even more widespread.

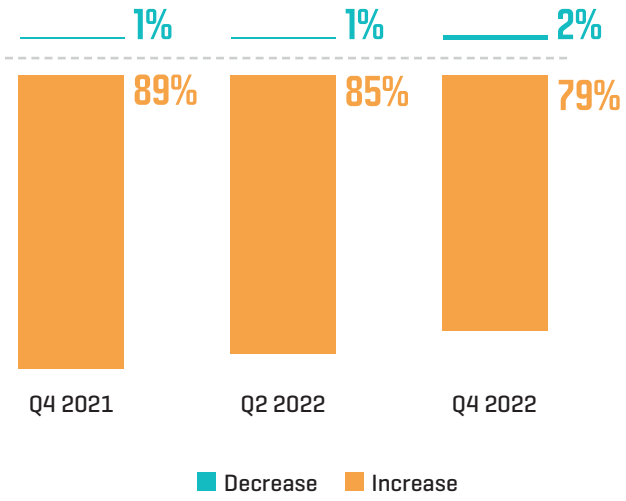
These high levels of concern about labor costs, though, are not yet having a significant dampening effect on profit expectations (see page 4), which suggests that many contractors are building these expectations into their bids.

The largest share are concerned about cost increases for two types of workers: those doing grading, drainage structures and aggregate construction, and those doing sewers and water mains, consistent with the previous quarter.

Expected Change in Skill Levels of Skilled Workers in the Next 6 Months



Expected Change in Cost of Skilled Workers in the Next 6 Months



Effects of Higher Costs for Skilled Labor

Civil contractors who expect increases in the cost of skilled labor were asked about how the additional costs would affect their businesses.

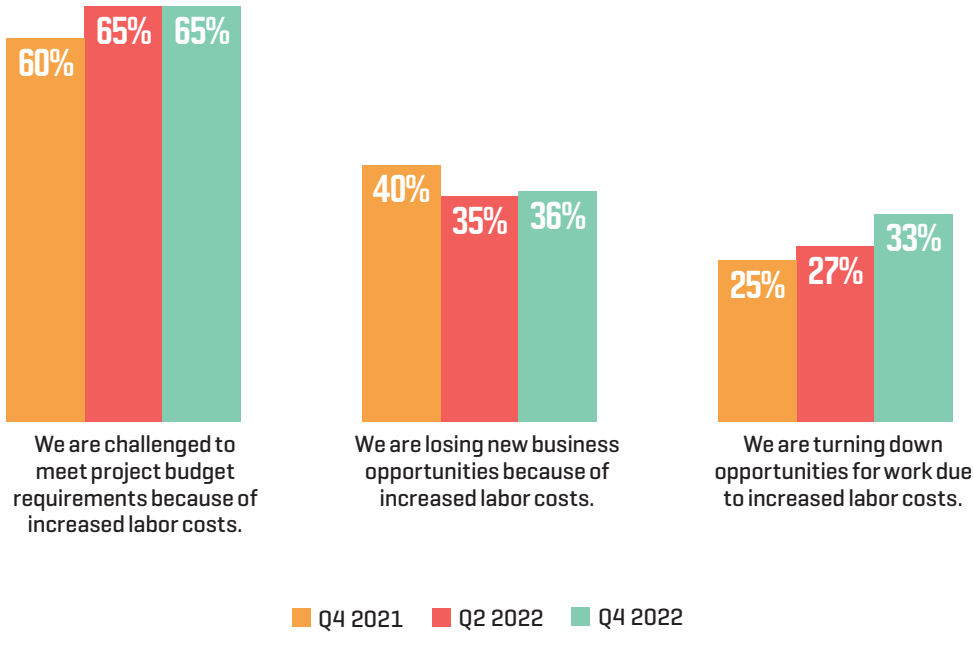
Meeting budget requirements on their projects continues to be the top impact of higher costs for skilled labor, with this impact expected by nearly two thirds (65%). Notably, this expectation is more common among large companies (annual revenues of $50M or more) than smaller ones, with 74% of large companies reporting this expectation, compared with 59% of midsize and small ones.

About one third also report that they believe they will lose new business opportunities due to these labor costs.

While less frequently selected, turning down new bid opportunities due to labor cost is on the rise. Only one quarter reported doing so last year, but now, one third are stepping away from work due to rising labor costs. With infrastructure commonly being competitively bid, civil contractors may feel pressure not to include the additional cost of labor, which could make some jobs less appealing or less likely to be won. They may feel more inclined to focus on a few projects and achieve a better margin than spread themselves too thin. This will result in less competition and likely ultimately raise the cost of work to be completed, while also perhaps causing delays in getting projects awarded due to concerns about too few bidders.

Effect of Higher Cost of Skilled Labor

According to Contractors Who Think Costs Will Increase



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

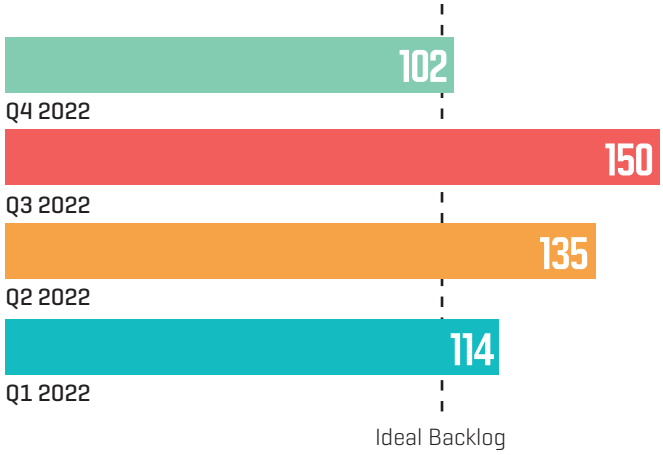
Civil engineers were asked about their current and ideal levels of backlog. The average ratios for the last four quarters are shown in the chart at upper right.

Throughout 2022, the average number of civil engineers' backlog projects have exceeded their ideal number, with the peak reached last quarter. The current ratio drops substantially from that high point, but still reveals that high volumes of civil projects are in the pipeline.

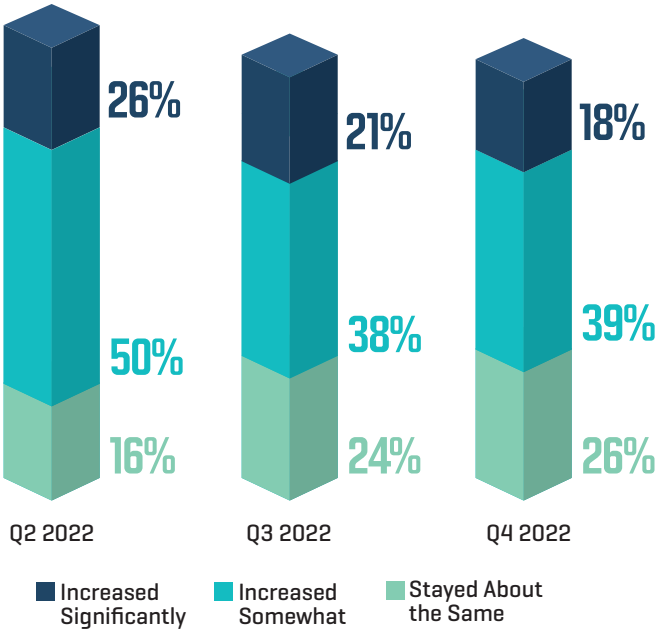
Civil engineers were also asked about how their backlog has changed over the last six months, with the results shown in the chart at lower right.

The findings this quarter are very similar to last quarter's findings. However, this does not mean that the volume of work should be expected to remain steady, with 57% of civil engineers reporting that their backlog increased in the last six months. These increases on top of the already high volumes of projects suggest that civil contractors can expect a great deal of work to be released over the next couple of years.

Ratio of Current to Ideal Backlog for Civil Engineers



Change in Civil Engineers' Backlog Over the Last 6 Months



New Business Confidence

Every quarter, civil engineers 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.

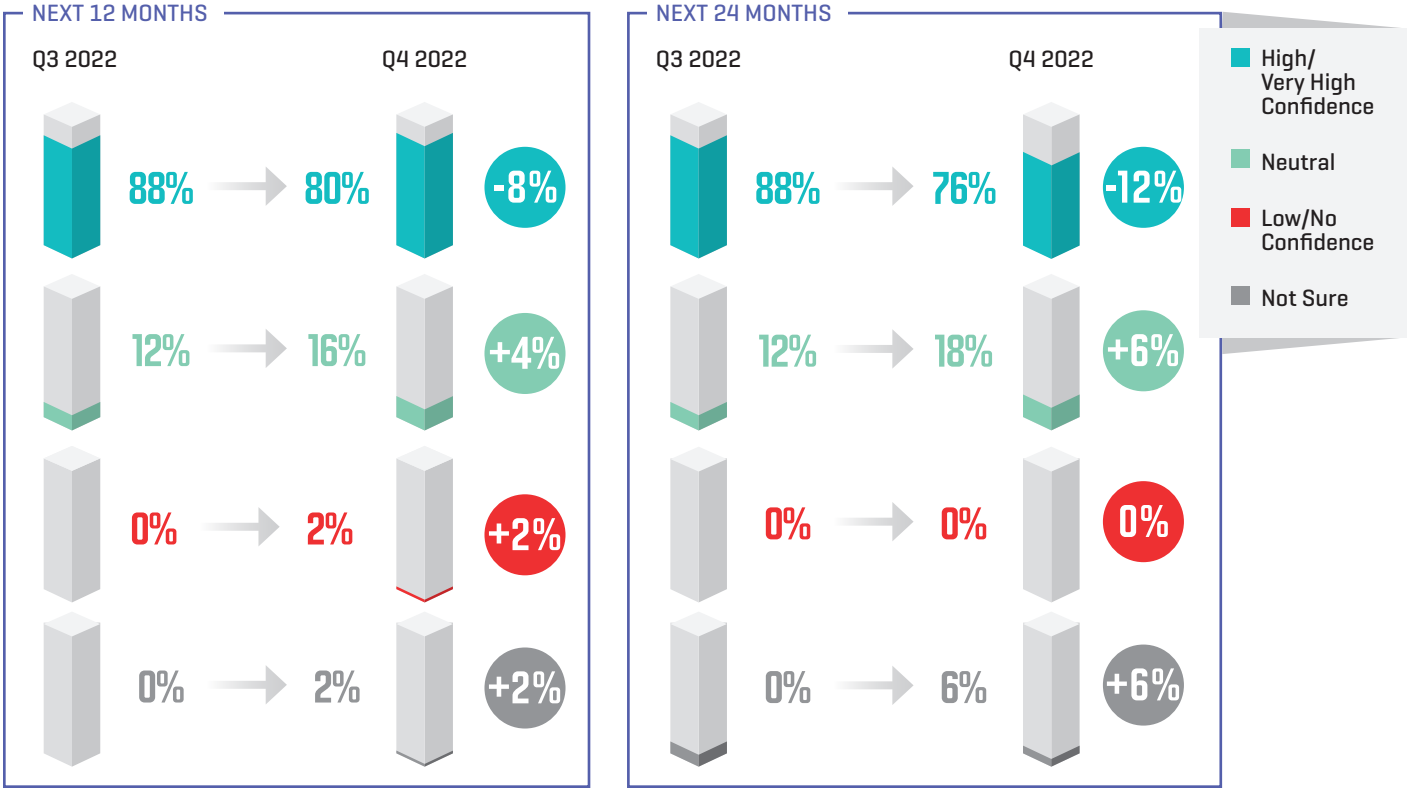
As they have for many quarters, the findings show a high degree of confidence among engineers in the market's ability to provide new work. However, they also reveal that the engineers' confidence has slightly eroded from its height in the previous quarter. This is especially true in the 24-month outlook, which declined by 12 points.

The decline for the longer-term outlook for engineers is a little surprising, given the measured way in which the funds from the Infrastructure Investment and Jobs Act are being disbursed (see pages 45–46 for more information). Certainly, it suggests some engineers expect to see their work peak in 2023. It is notable, though, that none of the engineers report little/no confidence in the market in 2024. Instead, they are either neutral about their expectations or unsure of what to expect. So these findings largely reflect an increase in uncertainty rather than a true decline in confidence.

Thus, these findings suggest overall a robust pipeline of work for civil contractors, which is likely to continue well into 2024.

New Business Confidence

According to Civil Engineers



MENTAL HEALTH

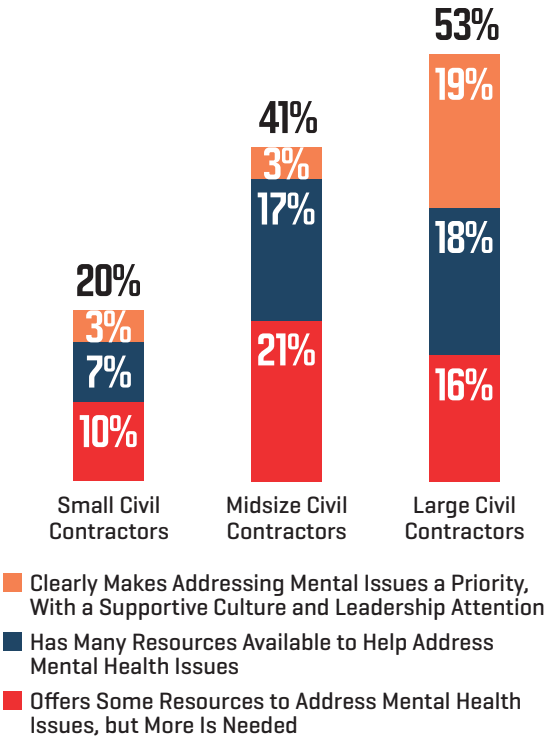
Providing Resources to Address Mental Health

This section's data explores the increasing focus in the construction industry on the mental health of its workers.

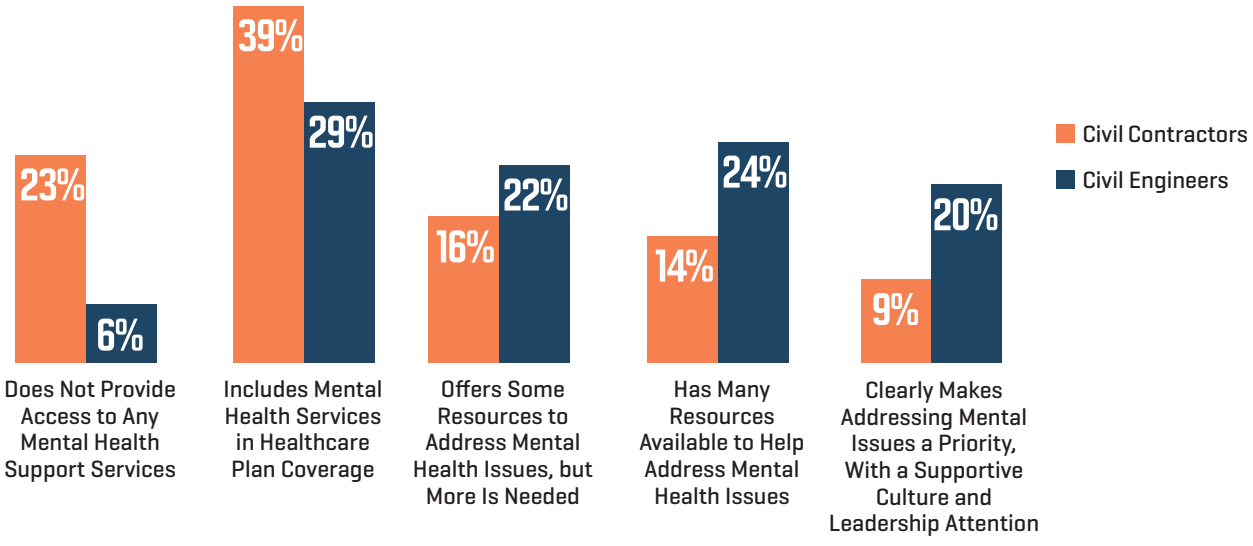
Civil contractors and engineers were asked to select the option that corresponds best to their company's approach to supporting the mental health of its employees from the five options shown in the chart below. It reveals that that many contractors (39%) offer some mental health resources, but that overall, the majority do not.

The chart at right shows the distribution of those who offer some resources by size of contractor, and it demonstrates that larger civil contractor companies are far more likely to address these issues than are smaller ones.

Share of Civil Contractors That Provide Resources to Address Mental Health Issues By Size of Contractor



Organization's Approach to Supporting the Mental Health of Its Employees



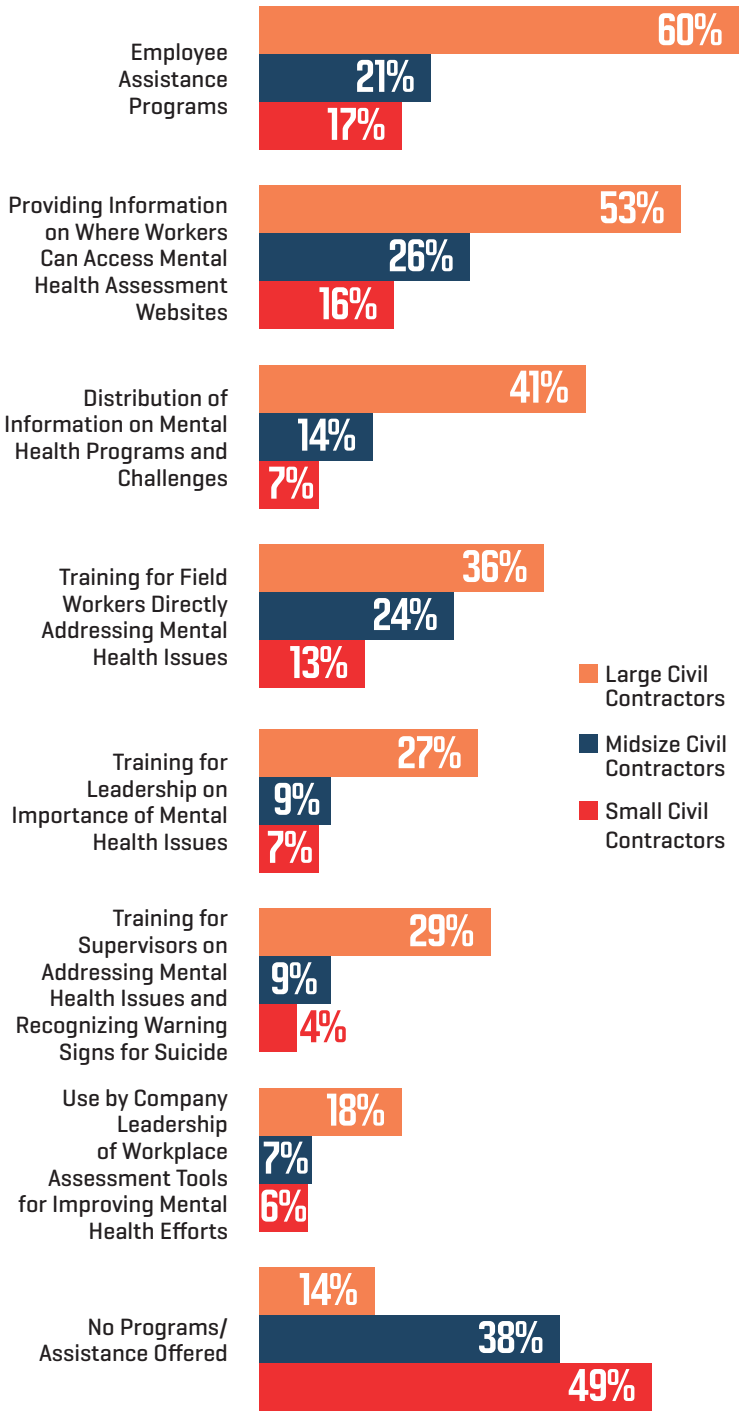
Mental Health Programs/Assistance Offered by Civil Contractors

As the findings on the previous page reveal, large civil contractors tend to generally provide more resources to employees with mental health concerns. The findings of this page demonstrate that this general pattern holds true for all of the top types of programs/assistance offered by civil contractors to their workers.

- Over half of large civil contractors [revenues of $50M and more] offer employee assistance programs and provide information on where workers can access mental health assessment websites. However, these are infrequently offered by smaller companies.
- Midsize [revenues of $10M to $49M] and small companies [revenues less than $10M] offer training for field workers that addresses mental health issues nearly as frequently as they offer the top two options, suggesting that when they do address mental health issues, they prioritize field workers. However, training for field workers ranks a distant fourth for large contractors.
- Many companies offer at least some assistance, regardless of size. Even among small companies, over half offer at least one option.

Programs/Assistance Offered by Civil Contractors

by Size of Contractor



Most Effective Means to Promote Improved Mental Health

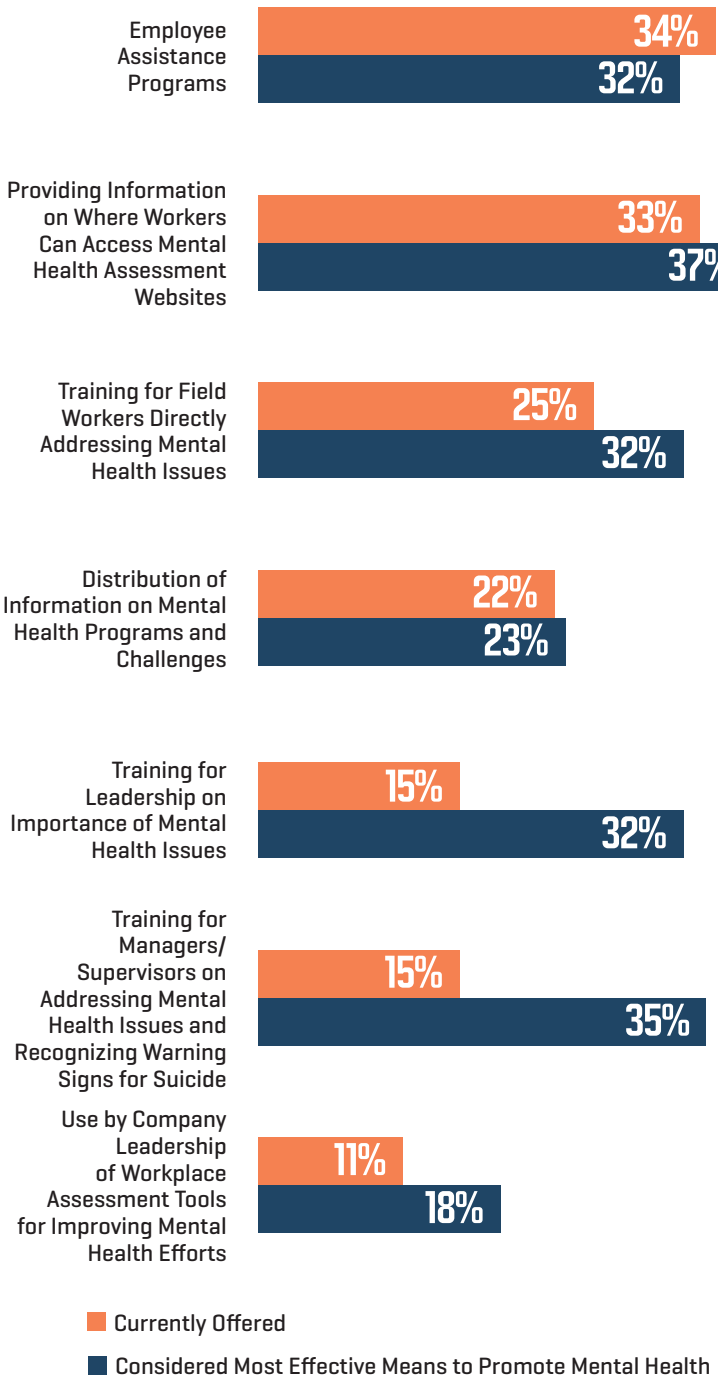
Civil contractors were asked to select the most effective means companies can use to promote improved mental health. They were allowed to select items regardless of whether their company currently uses them.

The chart at right shows both the overall share who use them and those who consider them effective. As the blue bars on the chart reveal, the methods considered most effective are not always those in widest use.

- The largest share of civil contractors believe that providing information on where workers can access mental health assessment websites is an effective way of helping to address mental health issues. Fortunately, this is among the most widely used as well.
- Training is currently underutilized, especially for managers/supervisors and for company leadership. Far more believe this type of training would be helpful than report that it occurs at their companies.

Programs/Assistance Offered by Civil Contractors

Reported Used by Their Companies and Selected as One of the Most Effective Means to Promote Improved Mental Health



Specific Programs/Assistance Used by Civil Engineers to Improve Mental Health

Civil engineers were asked the same questions about the use of specific programs/assistance at their companies and the types of programs or assistance that they think would be the most effective to promote mental health.

Use

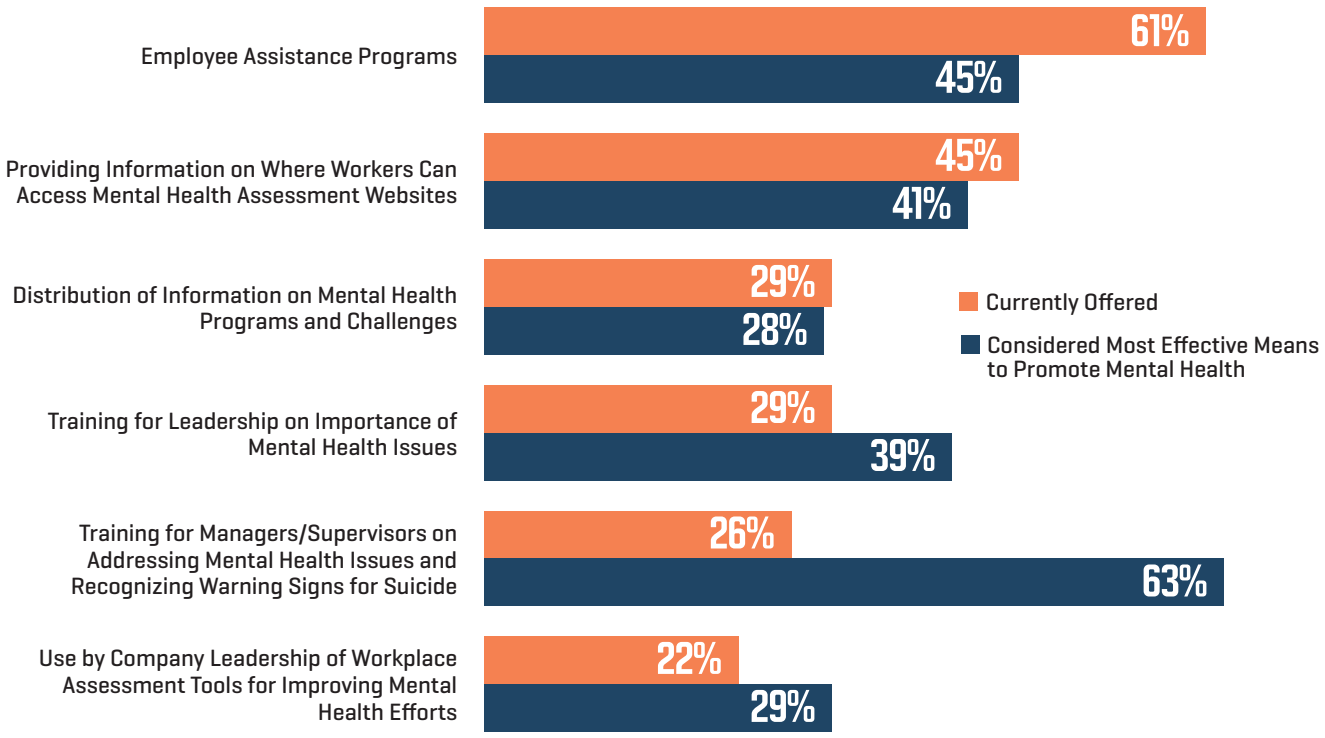
The top programs/assistance in use at civil engineering firms are generally the same as those at contractors, although a larger share of engineers report use of them by their companies than do contractors.

Effectiveness

Training for managers/supervisors is also under-deployed at civil engineering firms, similar to contractors, with a clear preference by engineers for this type of program to promote mental health. However, engineers more frequently consider the top two types of programs/assistance in use—employee assistance programs and providing information on where workers can access mental health assessment websites—to be effective than do contractors.

Programs/Assistance Offered by Civil Engineering Firms

Reported Used by Their Firms and Considered One of the Most Effective to Promote Mental Health



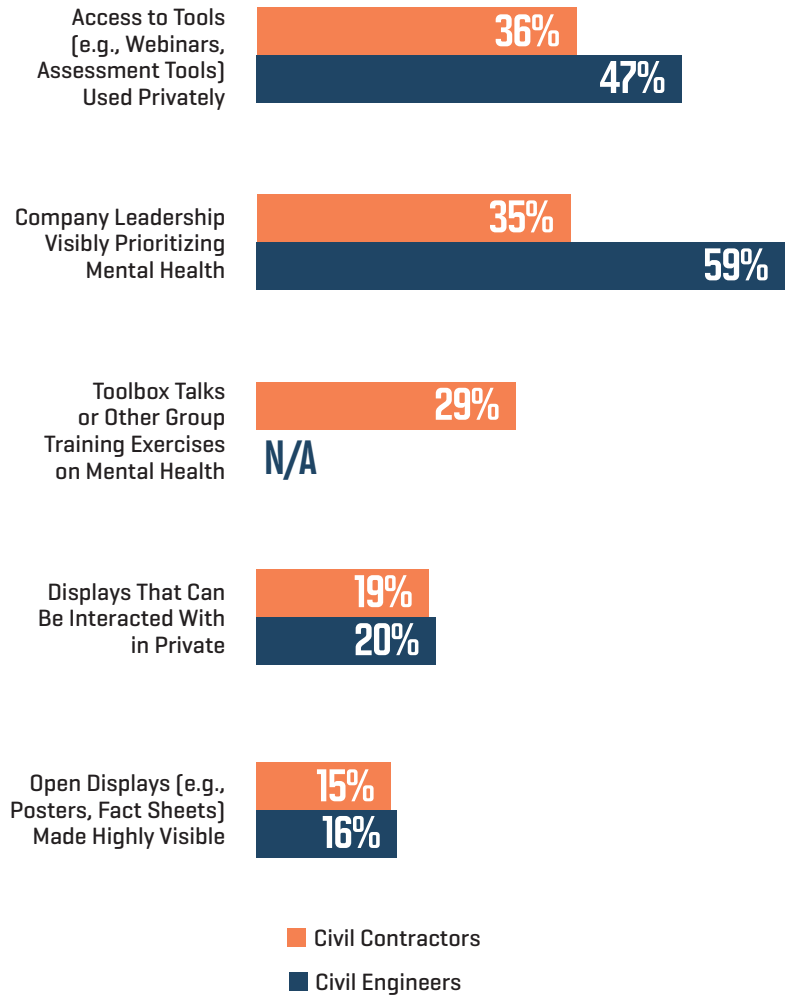
Strategies for Removing the Stigma of Seeking Mental Health Support

Civil contractors and engineers were asked to rate the effectiveness of several strategies for removing the stigma of seeking mental health support. The chart at right shows the share who rated each strategy as effective.

- Few civil contractors consider any of these strategies effective, with the most popular one selected by only 36%. These findings suggest that removing the stigma of seeking mental health support may be particularly challenging at these companies.
- More than half of civil engineers (59%) believe that company leadership visibly prioritizing mental health would be an effective means of reducing the stigma of seeking help within their profession.
- Nearly half of engineers (47%) also rate access to tools that can be used privately to be a good means to allow workers to seek help without facing the stigma of doing so. This was also the top option of contractors.

Strategies for Removing the Stigma of Seeking Mental Health Support

Share Who Consider Each Strategy Effective



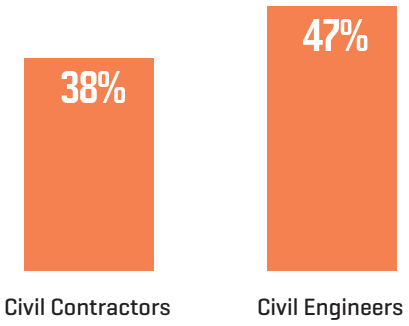
Accommodating Employees With Disabilities

Fewer than half of the civil contractors or engineers report that they provide accommodations to employees with mental illness or other disabilities, such as cognitive/intellectual disabilities, physical disabilities or substance abuse. Among contractors, this varies by size, with nearly half (45%) of large and midsize civil contractors offering them versus only 25% of small companies.

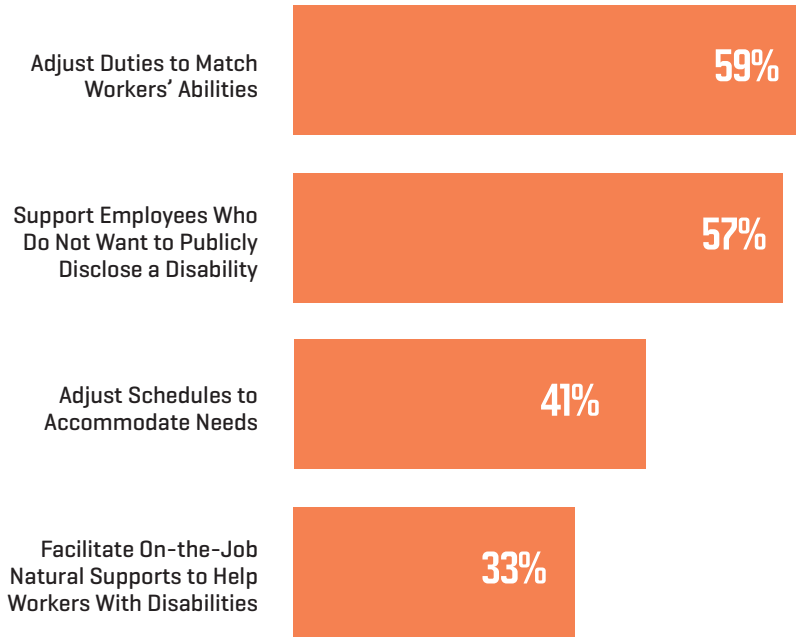
The four accommodations most commonly offered by civil contractors are shown in the chart at right. Promisingly, more than half who offer any report that they adjust duties to match workers' abilities and support employees who do not want to publicly disclose their disabilities.

Most civil engineers offering accomodations (over 70%) report that their companies adjust schedules to accommodate needs and help employees avoid public disclosure if desired, and nearly half adjust duties to match workers' abilities and have employee resource groups addressing company policies.

Provides Accommodations to Employees With Mental Health Illness or Other Disabilities



Most Common Accommodations Provided by Civil Contractors for Those With Disabilities



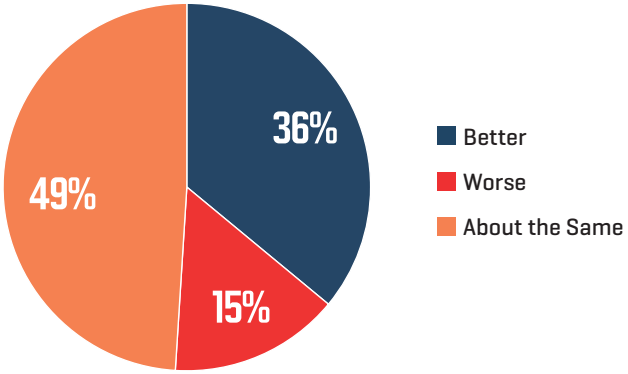
Current State of Mind/State of Mental Health in the Civil Construction Industry Compared With Five Years Ago

When asked how the state of mind/state of mental health at their organization has changed in the last five years, the most common answer from civil contractors and engineers is that it has stayed about the same. However, among those who have seen a difference, over twice as many (36%) say that it has improved than those who say that it has worsened (15%). There are no significant differences between civil contractors and engineers in their responses, nor are there significant differences by size of company.

This finding may be surprising, in the aftermath of the pandemic and amidst concerns about an economic recession. However, as the findings in this report reveal (see pages 2, 3 and 7), workers have notable job security and more attention has been paid to mental health in the industry since 2020, which may also be a positive factor.

State of Mind/Mental Health at Organization Currently Compared With Five Years Ago

According to Civil Contractors and Engineers



BIM AND DIGITAL TWINS

Use of BIM on Civil Projects

Civil contractors and engineers were asked to what degree they use BIM: not at all, to analyze models created by others, to author models themselves or to both author their own models and work with models created by others. This same question was asked two years ago in a previous *Civil Quarterly* survey.

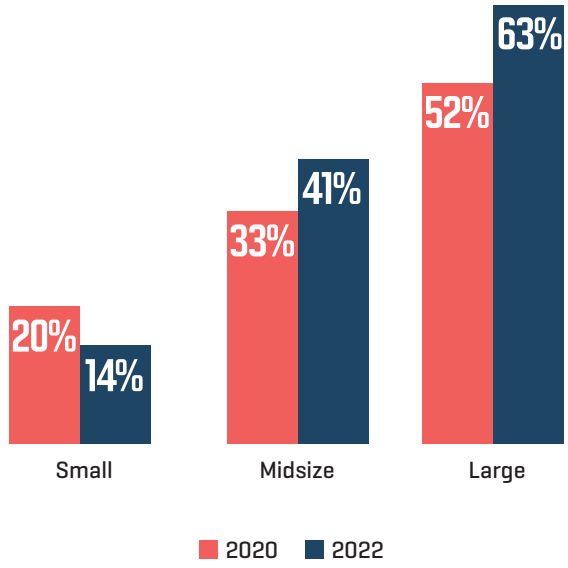
Civil Contractors

The chart below shows the responses to this question by civil contractors.

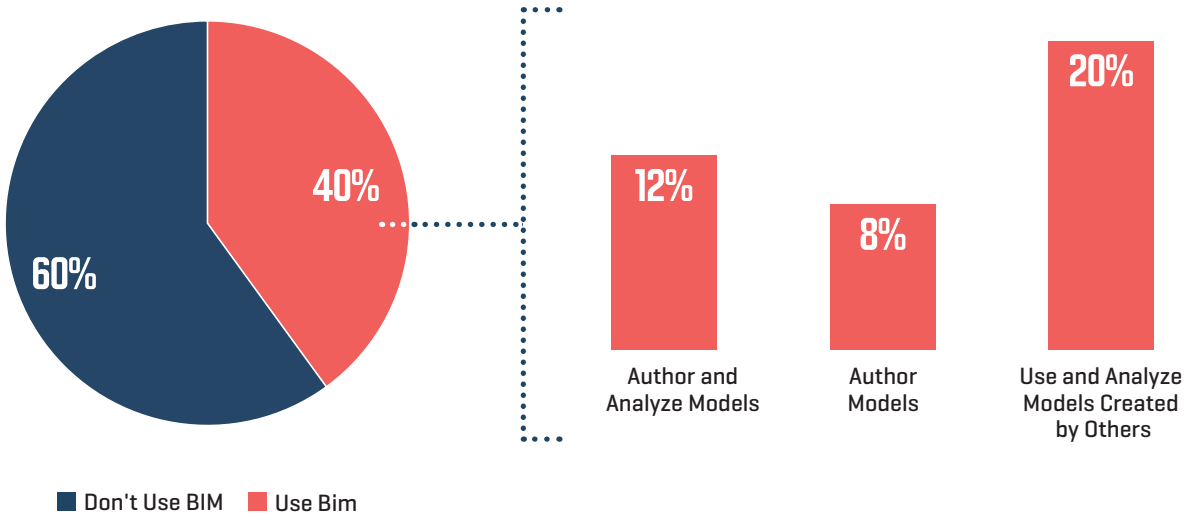
Notably, the majority of civil contractors report that they do not use BIM at all. Surprisingly, this is roughly the same share who did not report using BIM in 2020. As the chart at right reveals, though, the use of BIM by midsize [CONTINUED]

Civil Contractors Using BIM

by Size of Contractor



Contractors' Use of BIM



(revenues between $10M and $49M)and large (revenues 50M or more) companies has increased considerably. This increased use of BIM is not surprising as many contractors and owners of civil projects continue to advance the digital transformation of their organizations.

However, the same is not true of small civil contractors (revenues less than $10M). Their use of BIM actually slipped back from previous studies.

Even among the civil contractors who use BIM, only half author models, with half reporting that they only use and analyze models created by others. In addition, only about one third (34%) of those who use BIM report that they do so on half of their projects or more.

These findings clearly demonstrate that BIM use, while generally growing, is still not common practice on infrastructure projects.

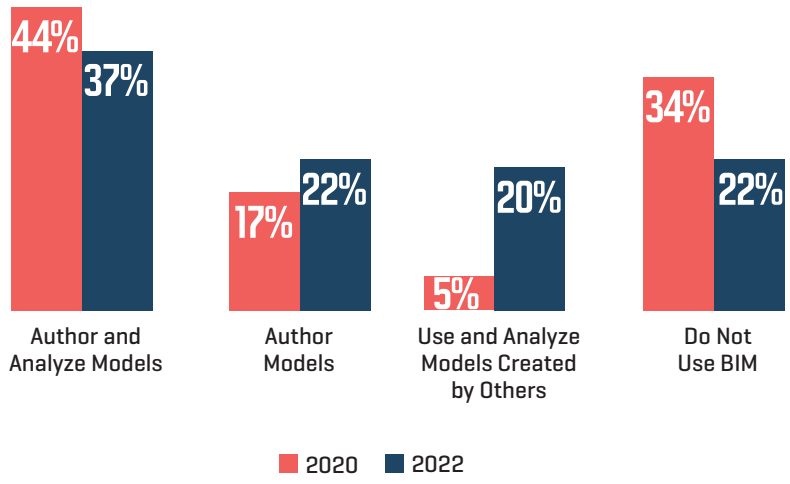
Civil Engineers

In contrast, BIM use is common among civil engineers. Over three quarters (78%) report using BIM. That share is up significantly from 2020, when two thirds (66%) said that they use BIM.

In addition, nearly three times as many also report that they author models (59%) compared with those that simply use and analyze models created by others (20%).

Interestingly, though, most of the growth in BIM use among engineers appears to have come from those using and analyzing models created by others. This suggests that even among these more advanced users, BIM utilization in the civil sector increases incrementally.

Civil Engineers' Use of BIM



BIM Users: Common Uses of BIM by Civil Contractors

Civil contractors were asked to select the three most common uses of BIM models and data from the list of seven options shown in the chart below.

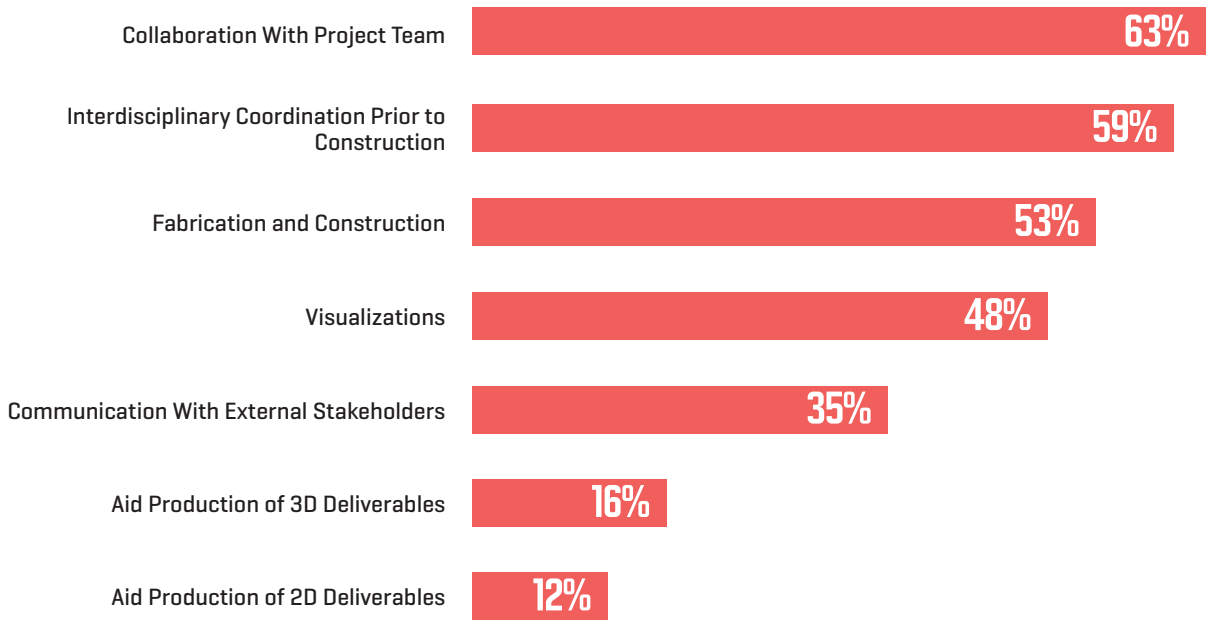
The two most common uses both involve contractors working with other team members: collaboration and interdisciplinary coordination prior to construction. This finding is no doubt influenced by the fact that about half of the BIM users are working with models created by others, and it suggests the importance of BIM as a means of enhancing collaboration in civil construction.

The next two most common uses involve approaches that aid directly in the process of construction, including using BIM to support fabrication processes and better visualization of what is to be built.

Notably, very few civil contractors currently find that digital deliverables are among the top three ways they use BIM. As owners of infrastructure assets become more digitally sophisticated, they are likely to expect digital deliverables that can support their own efforts in this area.

Most Frequent Uses of BIM Models and Data by Civil Contractors

Selected in Top Three



BIM Users: Common Uses of BIM by Civil Engineers

Civil engineers were also asked about their most common uses of BIM models and data. The options that they were provided are shown in the chart below, including most of the ones provided to the civil contractors, with a few exceptions.

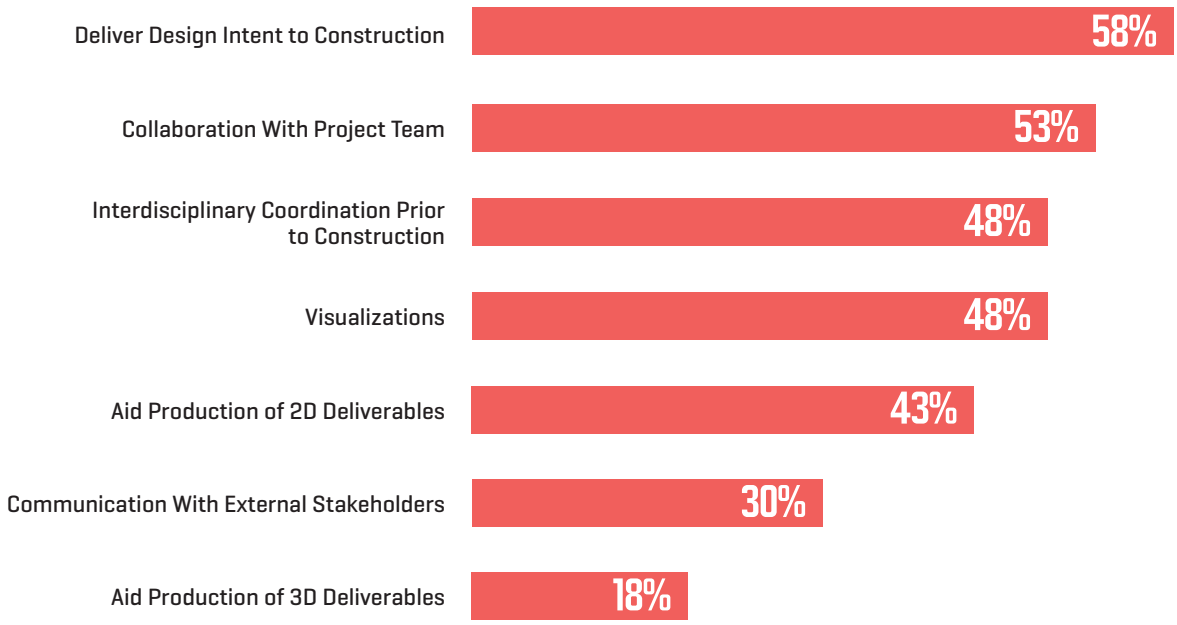
Again, communication across the project team plays an important role in the top ways they utilize models, similar to the contractors. However, the most frequently selected option for engineers is to deliver design intent to construction. The ability of BIM to aid in visualization and provide more information can help better convey their intentions to the contractors building their projects.

Collaborating through BIM is also a top function for them, similar to the civil contractors. This again demonstrates the effectiveness of collaborating through BIM. The frequency with which they select interdisciplinary coordination prior to construction and visualizations among their top three uses also shows the role that BIM plays as an aid for collaboration for engineers.

Notably, many engineers are still using BIM to produce 2D deliverables. This is no doubt due in part to the number of civil contractors not yet using these tools, who still rely on 2D deliverables.

Most Frequent Uses of BIM Models and Data by Civil Engineers

Selected in Top Three



BIM Users: Benefits Civil Contractors Experience From BIM Use

Civil contractors who use BIM were presented with a list of a dozen potential benefits and asked to select all that they experience from their use of it. The most frequently selected ones are shown in the chart below.

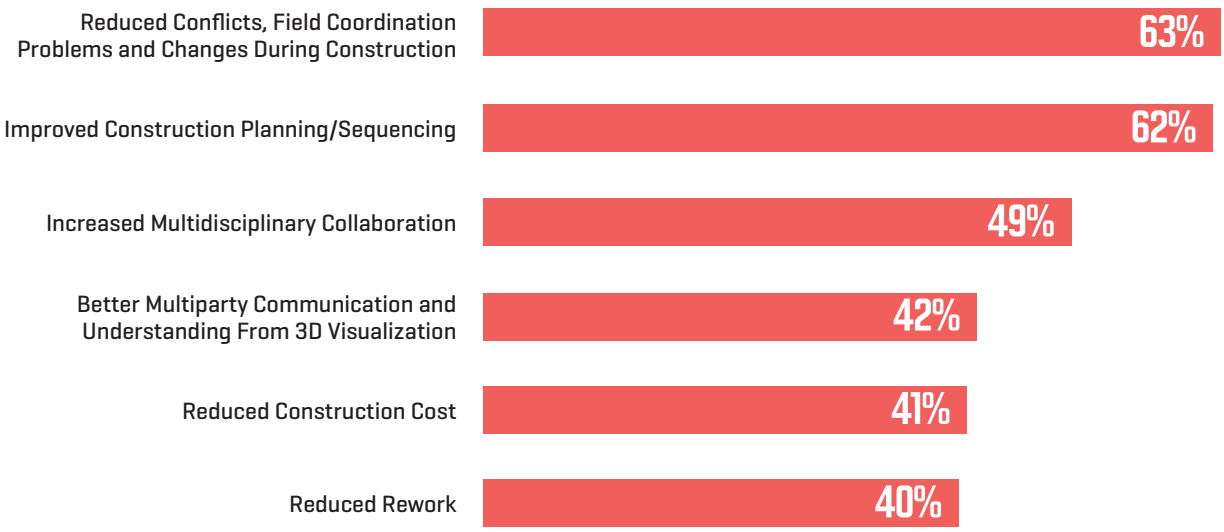
Encouragingly, the top two benefits directly improve the process of construction and are widely experienced by BIM users: reduced conflicts, field coordination problems and changes during construction, and improved construction planning/sequencing. Both of these benefits directly impact project schedule and budget, two of the key indicators of project success for contractors.

Collaboration is also improved, a critical benefit of BIM. The findings on this benefit echo the top functions that many derive from BIM, including those who find they have increased multidisciplinary collaboration and better multiparty communication and understanding from 3D visualization.

Over 40% also report that they see reduced construction costs. Whether this goes directly to their bottom lines or allows them to win more competitive bids, it is a significant business advantage, especially when so many civil contractors still are not using BIM.

In addition, 40% find that they are able to reduce rework on their projects, which has significant implications for productivity, schedule and budget.

Benefits of Using BIM Most Frequently Experienced by Civil Contractors



BIM Users: Benefits Civil Engineers Experience From BIM Use

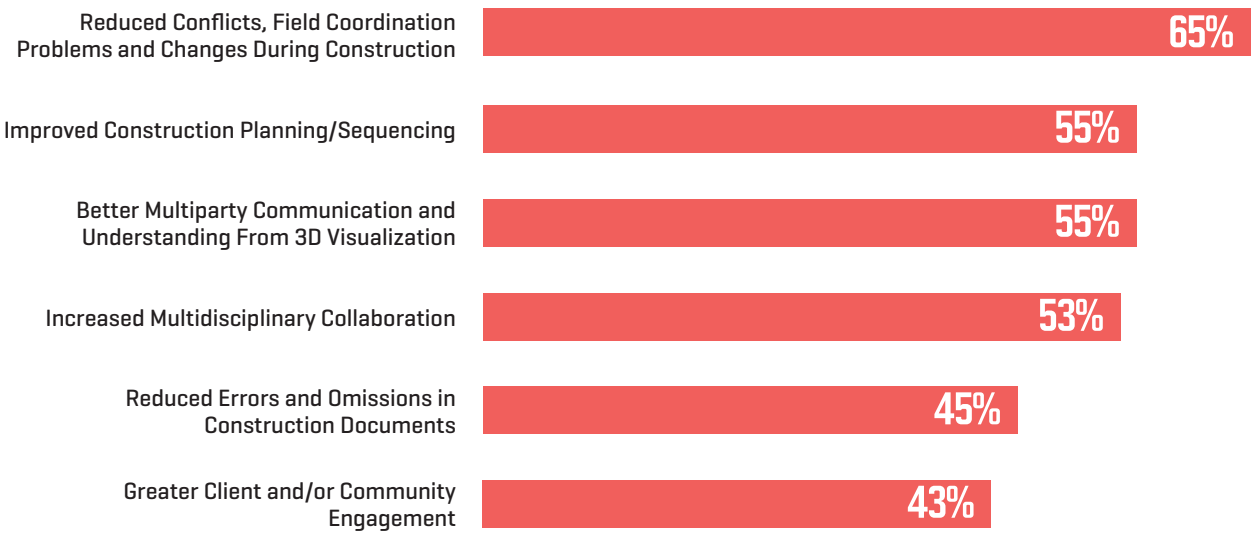
Civil engineers who use BIM were also presented with a list of over a dozen potential benefits and asked to select all that they experience from their use of BIM. The benefits they select most frequently are shown in the chart below.

Notably, their top four benefits mirror those of the civil contractors. This demonstrates wide recognition of the value of BIM to improve construction processes and to support collaboration across the project team. The engineer findings affirm those of the contractors of the key value that BIM is currently bringing to civil projects.

Over 40% of engineers also note two benefits that apply more directly to their work. Many find that they see reduced errors and omissions in construction documents. This benefit is likely influential in the reduced rework and improved construction planning and sequencing that comes from having more accurate and complete plans at the start of a project.

In addition, over 40% also note that they have greater client and/or community engagement. BIM allows for the creation of compelling visual experiences that allow stakeholders to better understand what the completed asset will offer. Engineers directly benefit from this in multiple ways, including better client input and helping to encourage community support for their projects.

Benefits of Using BIM Most Frequently Experienced by Civil Engineers



BIM Users: Owners Requesting/ Requiring BIM Models at Handover

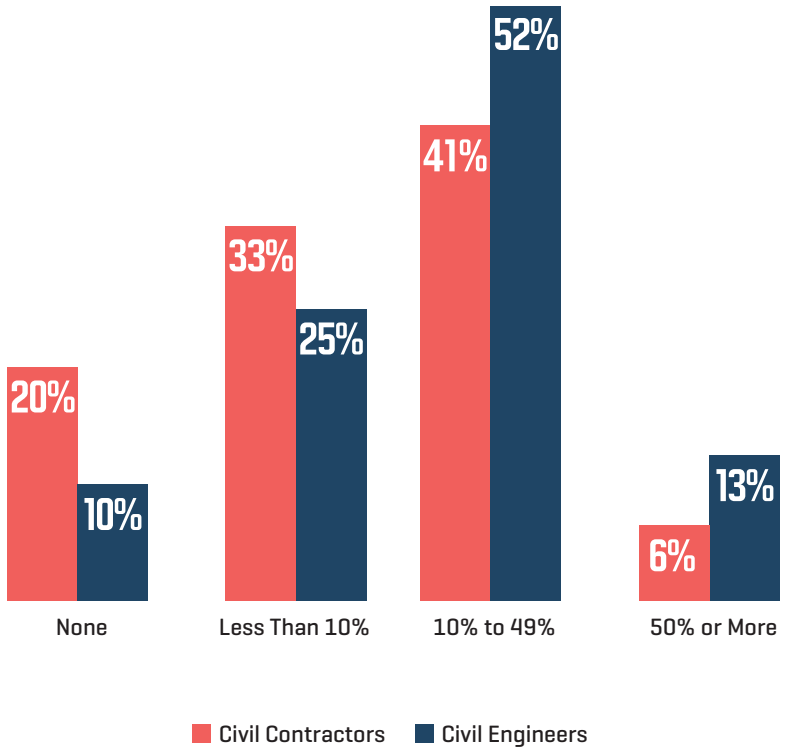
Owners can be a critical driver for the adoption of technology in construction. Therefore, civil contractors and engineers were asked about the percentage of owners who request/require BIM models as part of their project handover.

As the chart at right makes clear, most civil contractors and engineers have had BIM models requested by owners. However, for most, it is also not a common experience, with only 6% of contractors and 13% of engineers reporting that this occurs on more than half their projects. The largest share find that it occurs on between 10% and 49% of their projects.

Other research by Dodge, however, suggests that owners in the civil sector are becoming more engaged in digital delivery and asset management of their projects. BIM is likely to play a larger role in this over time.

Percentage of Owners Who Request/Require BIM Models as Part of the Project Handover

According to Civil Contractors and Engineers Using BIM



BIM Users: BIM Standards

Widespread adoption of BIM standards will increase the value of BIM by creating clear guidelines for data that would make the data across projects more uniform, benefiting all those who work with multiple partners on different projects

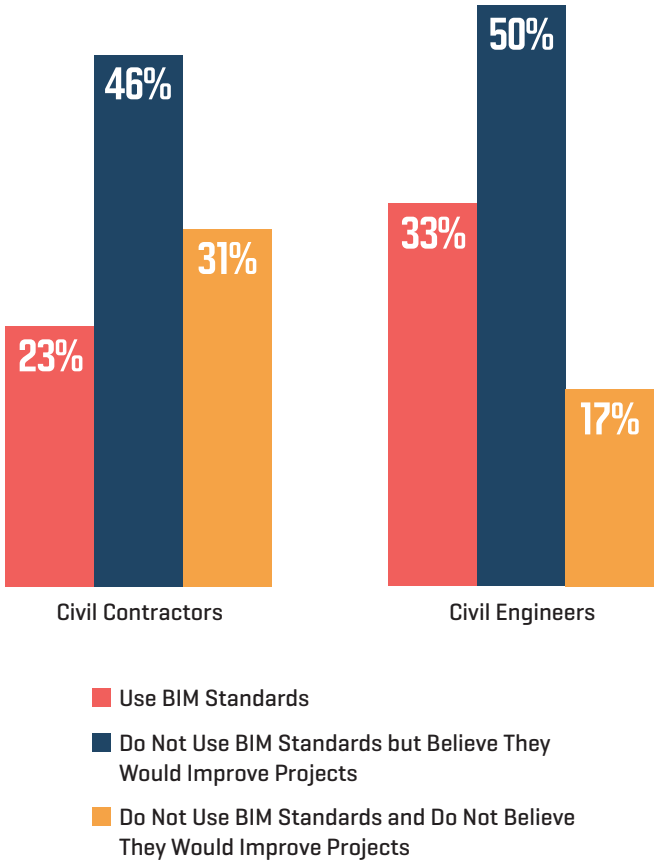
Civil contractors and engineers were asked to indicate whether they use BIM standards, do not do so but believe in their value or do not do so and consider them to have no value for their projects. Their responses are shown in the chart at right.

Civil contractors largely see the value of using BIM standards, with nearly one quarter doing so currently, and the majority of those who do not use them saying that they believe they would improve projects.

Engineers are even more enthusiastic about BIM standards, with one third utilizing them now, and most of the rest reporting that they are likely to improve projects if used more widely.

Use and Expected Impact of BIM Standards

According to Civil Contractors and Engineers Using BIM



Civil Contractors Not Using BIM

The nonuser analysis is focused on civil contractors because too few civil engineers in the study are nonusers to allow for a good analysis.

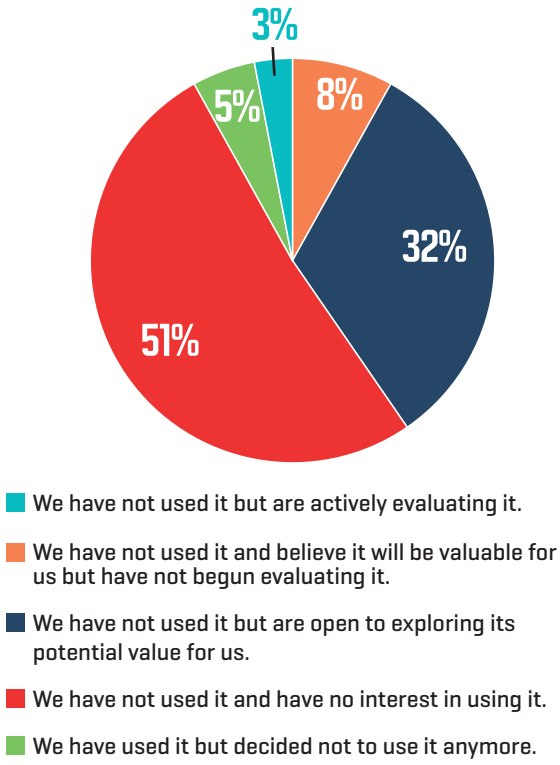
Many of the civil contractors, though, report that they do not use BIM. To better understand the likelihood that they will begin to use it in the near future, these nonusers were asked which of the options shown in the legend of the chart at right best describes their current stance in regard to BIM.

About half (56%) say that they are not interested in using BIM. Notably, there are no significant differences by size among this group. This reveals that the value of BIM still needs to be demonstrated to all types of contractors who work in civil construction.

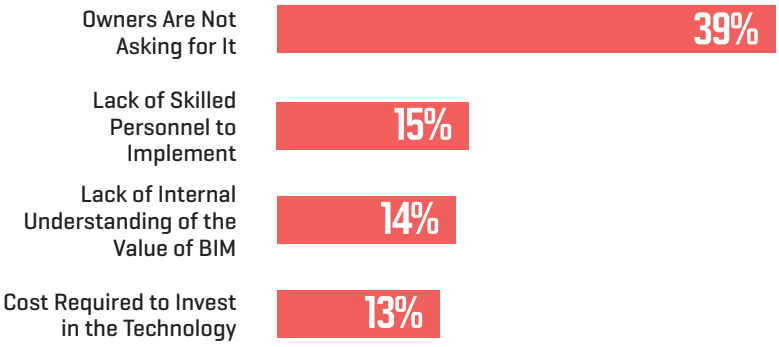
Factors Impacting Lack of Use

Civil contractor nonusers were asked which factors had the biggest impact on their decision not to use BIM, and one factor clearly dominates: Owners are not asking for it. [CONTINUED]

Civil Contractor Nonuser Attitudes About BIM



Top Factors Impacting Why Contractors Are Not Using BIM



This again shows that many do not recognize compelling benefits for their company. It also shows the influence owners have on encouraging digital transformation.

Factors That Would Influence Adoption Among Contractor Nonusers

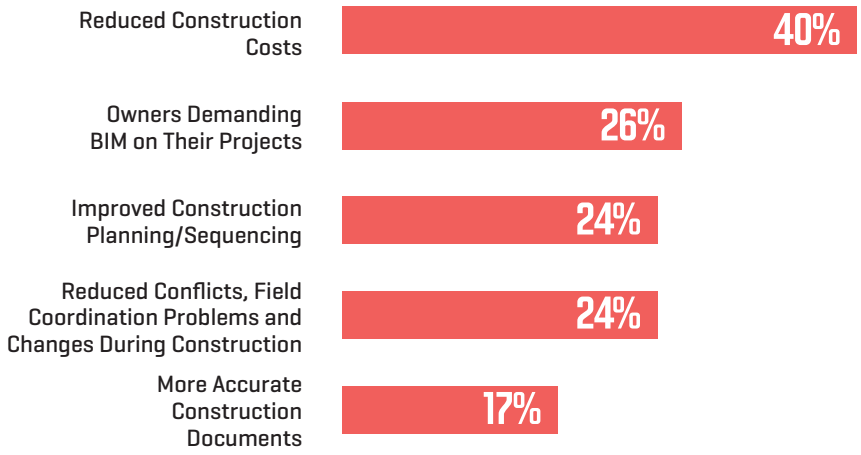
The civil contractor nonusers were asked to select the top three factors that, if they can be demonstrated to be achieved by BIM use, would encourage them to consider BIM.

By far, the most influential is reduced construction cost. Promisingly, this benefit is also experienced by 40% of those using BIM. In addition, it may be an added result of other benefits that are more widely reported by users, including the top one—reducing conflicts and changes during construction.

The responses additionally reinforce the importance of owners and of the ways that BIM can improve construction processes.

Top Benefits That Would Influence Civil Contractors to Consider Using BIM in the Future

Selected in the Top Three by Nonusers

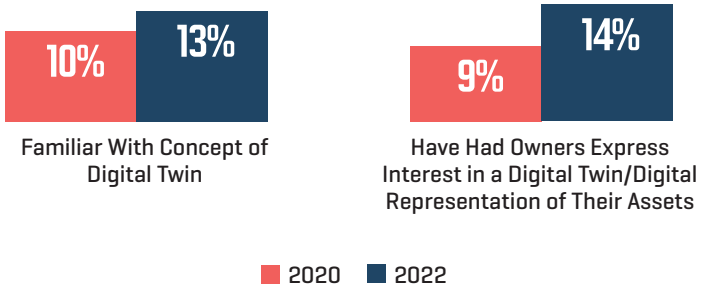


Familiarity With Digital Twins

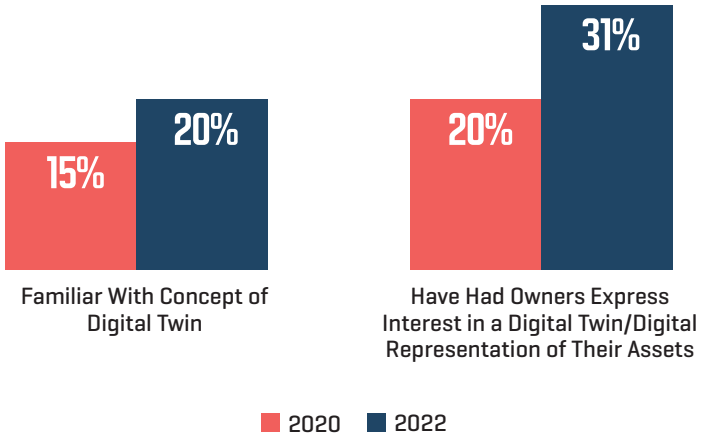
Digital twins have become something of a buzzword in the industry, but are often defined differently by different people. Before asking civil contractors and engineers about digital twins, therefore, they were provided with the following definition: A digital twin is a virtual representation of a physical asset, process or system. The digital representation is continually updated with data federated from a variety of sources (often including sensors) so that it is always a representation of the asset, process or system as it evolves through time. It can be used to support virtual design and construction processes as well as used by owners to optimize operations and maintenance.

As the charts at right demonstrate, familiarity with digital twins by that definition has grown since 2020, and owners have expressed interest in them more frequently. While only a small share of contractors report owner interest, nearly one third of engineers do, suggesting that contractors and engineers may need to consider how they can support digital twins in the future.

Civil Contractors Familiar With and Experiencing Owner Interest in Digital Twins



Civil Engineers Familiar With and Experiencing Owner Interest in Digital Twins



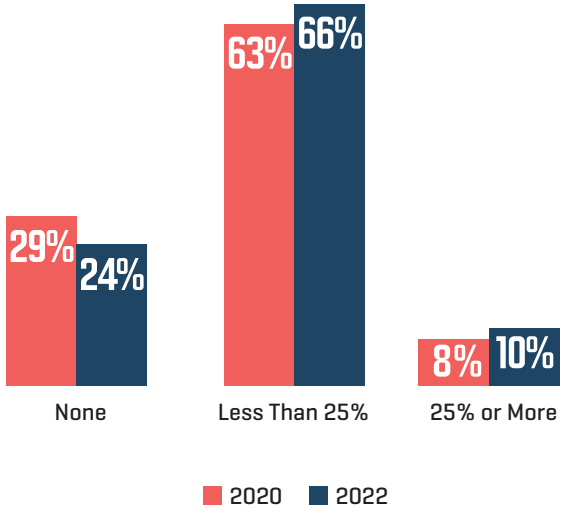
Expected Interest Among Owners in the Next Five Years in Digital Handover Materials

Civil contractors and engineers were also asked about their expectations for the share of owners that will be seeking handover materials in the next five years that support the creation of a digital twin, based on the definition provided.

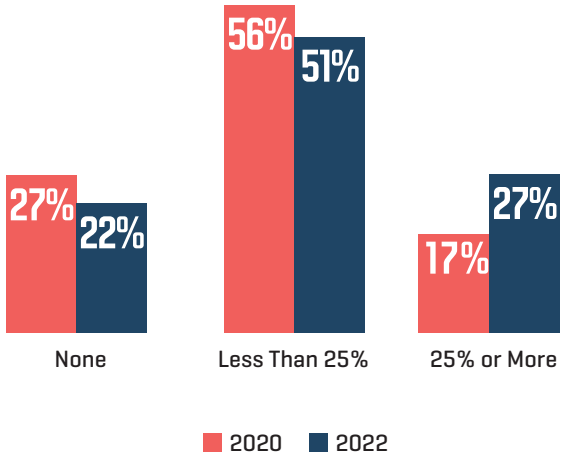
Over 75% of civil contractors and engineers expect that at least some of the owners they work with will want these handover materials in the next five years, up slightly from the share who had those expectations in 2020. The majority of them think that it will be less than one quarter of the owners that they work with, but there is a clear expectation among both engineers and contractors that some owners will want to pursue digital twins and expect their project teams to support them in that effort.

Certainly, contractors who are already working in BIM will have an advantage with these owners.

Share of Owners That Civil Contractors Believe Will Be Seeking Handover Materials That Support the Creation of a Digital Twin



Share of Owners That Civil Engineers Believe Will Be Seeking Handover Materials That Support the Creation of a Digital Twin



Action Needed to Prepare for Owner Shift to Digital Twins

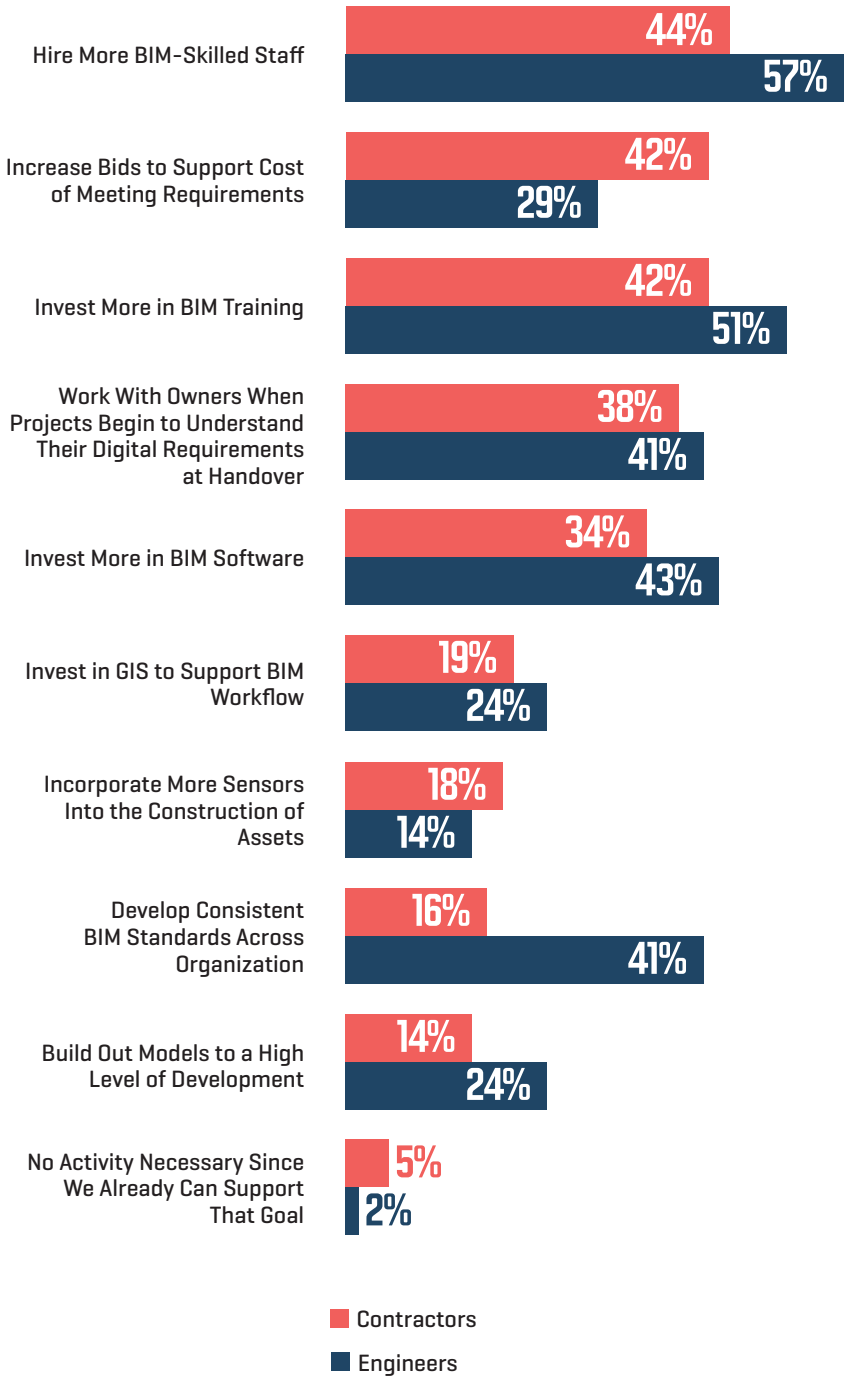
Civil contractors and engineers were asked to select the actions their company should undertake if it wants to prepare to support owners' creation of digital twins of their assets. The chart at right shows some of their most common responses.

Notably, nearly all contractors (95%) and engineers (98%) believe that they need to do more if they are going to support owners' efforts in this area.

The items most important to contractors fall into two tiers. The first tier demonstrates that investing in BIM skills is a top priority, and also proposes that they will need to increase prices to prepare. The second tier includes understanding owner requirements and making direct investments in BIM software.

Engineers' responses are largely consistent with the GC ones, although they also see BIM standards as a key priority for preparing to support owners in their pursuit of digital twins. Fewer, though, see increased bids as a means that can help support the necessary investments.

Actions Needed by Civil Contractors and Engineers if Owners Want to Pursue Digital Twins of Assets



A CLOSER LOOK

Entering the Age of the Digital Twin

Donna Laquidara-Carr, PhD, LEED AP

One of the most exciting aspects of digital transformation in civil construction is the potential it has to support the engagement of those involved in the planning, design, construction and operation of a built asset through a digital representation of that asset throughout all these stages of its lifecycle. Digital twins are one key element to achieve this inclusive approach. A digital representation of a physical asset that can be utilized across the asset's lifecycle offers the ability to connect all of the different stakeholders involved in that asset in a meaningful way.

Diablo Dam digital twin modeling. Image courtesy of Bentley.

The perspectives of those who help develop and implement digital twins provide unique insights into their potential for transformation of the design, construction and management of infrastructure assets, the successes that have already been achieved from their deployment thus far, and what the next steps are for the industry to utilize them more broadly. Two such perspectives are highlighted here:

- Ivan Panushev is the principal partner solutions architect at Amazon Web Services, which supports developers creating digital twins of real-world systems such as buildings, factories, industrial equipment and production lines. He describes himself as "the technology lead for all technical questions at AWS related to partners who are typically independent software vendors or global systems integrators ... that are developing solutions in the engineering construction domain."
- Dustin Parkman is the vice president of mobility industry solutions at Bentley, who "for the past five years had been in the throes of developing some of [Bentley's] key digital twin technology and products."

What Is a Digital Twin?

One of the biggest challenges currently is that, while there is general agreement about a digital twin being a digital representation of a physical asset, the exact definition of what does and does not constitute a digital twin is still in flux. Panushev and Parkman offer overlapping but different definitions of what a digital twin is. Panushev describes a digital twin as "a living

representation of a physical system that is dynamically updated to mimic the structure, state and behavior of the physical system in order to drive business outcomes." For him, the question of the business outcomes that customers are seeking to drive is a fundamental part of the digital twin, as important to what it is as the rest of the definition.

Parkman takes a different perspective. "The most basic definition is that it is a digital replica of a physical thing … What we are looking at [for the civil sector] is creating a digital replica of infrastructure, roads, water networks, railway systems, energy grids, civil infrastructure that are serving communities and the public. When you think about that, it could be a lot of different things … because there are lots of digital artifacts, some new, that embrace a lot of new technology, some old and historical. We have been focusing on leveraging some of the new technology to connect with the old."

He offers the example of an existing bridge, which can be turned into a digital 3D representation through current technologies utilizing drones and scanners. Then that could be layered with digital documents and data about the bridge, such as survey data, data from rehabilitation information, sensor data and other helpful forms of data. He also states that the real value for asset owners comes when that digital bridge is part of a network. And the most immediately useful function of creating this layered digital representation is the way in which it enables people to access information about all the assets in the network.
He states, "At the end of the day, it is about getting the right information quickly to make decisions, to create work orders, to create action."

Readiness of Infrastructure Sector for Digital Twins

One area of agreement between both Panushev and Parkman is that the infrastructure sector is widely varied. Both have seen successful digital twins already deployed in this sector, but they also recognize that the digital sophistication across the sector is uneven. Panushev says,"The readiness of [public sector owners, public and private utilities, and others in the infrastructure sector to use digital twins] is dependent on their level of digitization." He explains that he sees "pockets of excellence, and places where strong leadership has driven strong results," but he recognizes that currently the range of digital engagement is the most significant factor in determining their readiness to utilize a digital twin.

Parkman acknowledges that most owners in the civil sector would not regard themselves as having sufficient digital sophistication to be ready to use a digital twin, but his definition of a digital twin as a repository of existing forms of digital data does allow for the participation of owners who may not regard themselves as digital leaders. He states, "I think the market is ready for digital twins, not because of digital twin technology, but because they have problems they need to solve … and a digital twin solves a lot of key problems that US infrastructure owners have."

A CLOSER LOOK: Entering the Age of the Digital Twin

Panushev and Parkman both agree that their conversations with infrastructure owners don't begin with the technology. They begin with the problems they are trying to solve. This is clear in the examples they provide of digital twins that they have seen owners successfully deploy.

Examples of Existing Digital Twins

Not surprisingly, California appears to be a leader in digital twin use, since both Panushev and Parkman provided examples of digital twins in California. Panushev described the deployment of a digital twin by the Yorba Linda water district in California. He explains that the digital twin helps them to manage ground water delivery and drainage, which is particularly important in drought-stricken Southern California. He says, "They set up multiple pump stations, then through monitoring the performance of these pump stations based on real-time data, they are able to better adjust the performance of the individual pumps and the stations as a whole. With predictability analysis, they are able to tie the demand with the supply of water, so that they can reduce water usage … They were able to reduce total water consumption by 30%, just because they realize what the usage is and could reuse groundwater as opposed to imported water."

Parkman was able to cite several examples that were recent finalists or winners of Bentley's Going Digital Award, presented at their annual Year in Infrastructure conferences, including the creation of a digital twin to help assess a dam lcoated in California. Parkman explains that the dam had been flagged as a high-risk structure.The asset owners made the decision to use IoT devices to better understand its condition. Parkman describes how they are now gathering data on "water samples, structural deflection, movement, anything that would have been a high-risk scenario." Ultimately, he explains, "instrumenting the dam with IoT devices help to understand the behavior of the dam and isolate risk generalization into specific risks that you may have to take action on for rehabilitation. Rather than having to replace the dam, they are able to optimize it, it's like having an EKG machine for your infrastructure."

Another US example of a digital twin in use demonstrates that even smaller communities can benefit from these applications. Parkman describes how the city of Perry, Iowa, population 7,929, hired Foth Infrastructure & Environment LLC originally to use Lidar scanning in order to evaluate their streets and sidewalks, but the project evolved into a digital twin of the entire city. Parkman describes its broad range of applications: "They are using the digital twin for all of their planning activities, reconstruction and permitting. [They use it to consider] new zoning aspects for their town. And now they are starting to connect the digital information they have about the town to be spatially located on a 3D model." He felt this project was particularly noteworthy as an example of how the use of this technology can be scaled up in the US. "This is not the typical example you hear about," he says. "Usually it is the Cadillac projects costing hundreds of millions of dollars. This is a digital twin that was probably created for less than a couple of hundred grand."

New-built projects were also described. Parkman shares how a virtual test environment for autonomous trucks carrying heavy loads was created to help simulate challenging conditions that an autonomous vehicle would experience before constructing a physical track. He explains, "They designed a fake road network, with some

A CLOSER LOOK: Entering the Age of the Digital Twin

Drone inspections minimize safety risks, capture data faster with fewer people and lower inspection costs. Image courtesy of HDR.

of the worst roadway you would ever encounter to train their physical trucks .... They first designed it digitally and ran all their permutations to see if it was going to be a hard terrain to navigate. Then they built the actual test track."

This is just one example of a new-built asset utilizing this technology. As Parkman points out, "For new major capital projects, it makes sense to [create the digital twin] during the design and build process, so you end up with a digital-as-built in the end as an outcome of the project, as opposed to just surveying it after the fact. But the reality is, 85% of the stuff is already built, so you have to have both."

Challenges and Opportunities in Creating Digital Twins for Civil Infrastructure

Civil infrastructure poses specific challenges for the creation of a digital twin. Parkman identifies the scale of many infrastructure projects as the biggest challenge. "They are big, they are long, and they cover a massive area, so the sheer amount of data [to capture on an existing asset] is on an order of magnitude more than vertical infrastructure ... more photos, more Lidar, more design drawings and more 3D models." He also notes that infrastructure is a continuous system of assets, and defining exactly what the asset is can be challenging. He comments, "If I showed you three miles of pavement, what would you say the asset is? Is it the pavement? Is it the section of roadway? Is it the aggregates ... How you have to break the [components] up and componentize them is very different. You have to do it based on things with linear algorithms like mile markers ... A faucet in a bathroom has a manufacturer and a model number. With linear infrastructure, you don't have that."

He also notes that capturing what is underground can also be very valuable, but it presents its own challenges. He discusses a road project in Minnesota in which they were able to reduce a significant amount of risk because they had access to the existing subsurface data in the model.

However, there are also aspects of infrastructure that make it better suited to the use of a digital twin than vertical building assets. Panushev believes that among the biggest challenges to creating digital twins in general is the digitalization of the physical asset and the ability to get real-time data. Therefore, he argues that "in some cases, we see that it is easier to capture data for horizontal infrastructure projects, such as utility grids or waterways, than it is for vertical construction because the assets are built with the intention to be monitored, and with vertical construction the telemetry is not [often] designed into the assets."

A CLOSER LOOK: Entering the Age of the Digital Twin

Recommendations for Civil Contractors

As digital twins become more common for infrastructure assets, contractors need to be prepared to be more proactive with the owners on their projects, according to both Panushev and Parkman. Panushev recommends that contractors need to ask owners seeking the basis for digital twins about the business outcomes they expect. He explains, "Without really clear definitions of business outcomes, it is hard to deliver a digital twin that can provide sustaining value." He also provides a specific example from a system they support that allows contractors "to extend the value of information they have collected during the design and construction process into operations, and then tie this data to real-time data coming from sensors." But you can only capture the right data if you know what the owner wants to accomplish.

Parkman believes that contractors should be more vocal about owners requiring 3D-based delivery, which he describes as "providing the contractors with a lot more information during the design process so that they can optimize the construction. They can simulate construction and do performance-based construction digitally before they break ground, which allows them to significantly reduce risk and optimize performance." He sees an increasing number of owners providing this type of information, but it is still not a common industry practice and tends to occur more on complex projects than typical projects, such as road widening or replacing drainage pipes. He believes that enough empirical data on the benefits of providing contractors with this data exists, and that all stakeholders would benefit from contractors asking for this data more frequently, even on the simpler projects.

In fact, Parkman considers requirements for 3D deliverables one of the top three means of seeing increased use of digital twins in the future in civil construction.

Factors That Will Encourage Wider Use of Digital Twins for Infrastructure

Panushev and Parkman both agree that for digital twins to advance, strategies about how to ready the industry for them need to be carefully considered. On Panushev's part, that consideration is on the part of those building digital twins, who need to establish clear goals for what they want to accomplish and share those goals with those developing the digital twins. Understanding those goals would support the creation of compelling applications that could deliver the most value to their end customers.

He also recommends that owners need to capture more digital information on their assets, whether through Lidar, reality capture data or BIM. Parkman also cites this final point, noting that owners may need to reconsider their traditional asset management strategies to fully take advantage of this information.

In fact, for Parkman, the planning and preparation that is required falls more squarely on the owners. In addition to the 3D deliverables mentioned above, he also believes owners need to develop good cloud governance strategies. These include accounting for security risks and what is needed for compliance.

Both make it clear that they believe that technology itself is not a hurdle, even for smaller owners. They both see the potential for development and the need for access to additional data as more owners embrace these tools. CQ

VOICES OF THE INDUSTRY

Dr. John S. Gaal,
CWP, CPS, CHW

Director of the Worker Wellness Program MO AFL-CIO's Missouri Works Initiative

Dr. Gaal started his current position in 2021, after 40 years of service with the St. Louis-Kansas City Carpenters Regional Council, most recently as the director of training and workforce development. As a labor representative, he continues to serve on the St. Louis County Workforce Development Board, International Vocational Education and Training Association's Board of Directors (past-president), and International Foundation of Employee Benefit Plans' Health Care Management Committee.

How did you get engaged in helping to reduce the incidence of suicide in the US?

John Gaal: In the early 2000s, researchers from Washington University School of Medicine in St. Louis approached me about how they could help the St. Louis Carpenters Union, specifically their apprentices, via research regarding safety on the jobsite. Their goal was to ensure that workers came home safe at the end of the day.

Early on, their work focused on the physical aspects of safety, things like slips, trips and falls. That led to other studies [that] got into issues of nail guns and musculoskeletal disorders, [and this led them] to realize there was a pain connection.

At about the same time, 2007 or 2008, the Great Recession hit us, and, as a director of the training program for the carpenters, I could see how job insecurity issues were starting to negatively impact our apprentices. [Talking with them] season upon season, you could see that things were starting to go downhill, and a lot of it was related to [their] finances. [For example,] I would ask, "How is it going?' and they would reply, "Not too good. I'm not working the hours I used to, and bills are getting tight." Then I would see them a couple of months later and ask, "Are things going better?" and they might reply, "No, I just lost my truck." Three months later, things would be worse: "I just lost my house." It kept rolling downhill like that.

At that point, I contacted the Washington University researchers with my concerns about addressing the mental health aspects in their work, and they mentioned to me that their research partners at the University of Iowa had a name for this approach: Total Worker Health, [which involved] bringing the mental and physical aspects of safety together.

We began by creating a financial literacy course, and it was well received. In fact, it was intended for apprentices, but we received compliments from our journey-level workers, who asked for more of this type of training. One of the reasons we focused on financial literacy is because we kept hearing that money was the underlying issue.

Not long thereafter, we started to see the effects of the opioid crisis on our workers. And then sadly, that was quickly followed by the suicide crisis.

On a personal note, in March of 2016, a friend of mine, Don Willey, who was a local labor leader at the time, lost his 36-year-old son to a heroin overdose. And one year later, in March 2017, I had lost my 24-year-old son to suicide. Within months, we both realized that our personal lives were touched by major tragedies that were impacting our professional lives, as well as our industry and communities. As construction workers, he and I are both fixers, and so as a team, we set out to heal a nation, not just our industry. We made it our mantra to start knocking down some of these barriers.

How big of a problem is this issue, and why is the construction industry particularly vulnerable to mental health challenges, substance misuse and suicide?

Gaal: CDC [The Center for Disease Control and Prevention] data reveals that as an industrial sector, the construction industry ranks number one when it comes to opioid misuse, and number two when it comes to suicide. I think the industry structure exacerbates the workforce shortage and mental health crisis it now faces. Things like job insecurity, long hours, fast track schedules, no work, no pay. Not to mention the mistreatment of apprentices, especially women and people of color. These all play a part in the anxiety and depression workers confront. They often do this alone, mostly in silence, and sadly, they end up being marginalized for being weak if they speak up.

Are there risk factors that are particularly associated with heavy civil construction?

Gaal: Heavy and highway workers are constantly exposed to working in and around dangerous environments. Fast moving traffic is just feet away. I recently spoke to a supervisor who worked in this sector years ago, and he still has flashbacks to the sight of fellow workers who were injured or killed on the roadway while performing their duties. This guy hasn't worked in that sector for at least five years, and the trauma still lingers long after the events. As such, I think it would behoove contractors to enlist the support of grief counselors as part of their crisis intervention teams.

Have you seen any changes in the last few years in the construction industry that you think can help address the issues of improved mental health, addressing substance misuse and suicide?

Gaal: Definitely. The AGC of Missouri took a big step in the right direction in 2018 when they started their suicide prevention task force to address this challenge. Their VP of safety brought an array of interested parties to the table: contractors, safety professionals, labor reps, academic researchers, mental health advocates. Their chapter quickly created a page on their website that is now the envy of the industry. Before September of each year, which is National Suicide Prevention Month, they enlist various contractors, owners and unions to support jobsite stand-downs, where the job shuts down for close to an hour and the workers participate in expert-led activities to encourage workers to break their silence and stop the stigma.

I firmly believe that the impact of COVID has provided a safer environment to discuss these difficult topics such as suicide and opioid misuse and mental health issues. We've come a long way, and COVID has helped us get there. I don't know of a family that hasn't had some mental health issue, and it's made it safer to talk about it now compared with pre-COVID.

It would also be remiss on my part not to mention the role

that's been taken recently by OSHA. In fact, I would call their August 21 video by Acting Secretary Jim Frederick the mental health moonshot. I can't tell you how many times I went to my area director for OSHA to try to get him to embrace suicide prevention and [to address] opioids that are being used on the jobsite, and all that kind of stuff. He'd reply, "John, I do locally, but I can't take a stand because national hasn't done anything about it." In late August 2021, they finally did something about it. We posted a four-minute video [of it, which] was fantastic. Mental health professionals working in the construction industry, including myself, were grateful to see the federal government take an official stand on how mental health issues, including opioid misuse and suicide deaths, were now considered top workplace safety issues.

What are the biggest challenges to making advancements in reducing suicide rates, and what can you recommend for addressing them?

Gaal: Silence and stigma are huge challenges. A report came out a couple months ago indicating that US construction industry is still about 92% male dominated. This equates to a macho culture, which wreaks havoc across the industry. Not unlike in the military or law enforcement, expressing one's concern about mental health on the jobsite is often used as a sign of weakness and can result in destroying one's career progression.

[To help address this, I recommend that people] look at the CIASP [Construction Industry Alliance for Suicide Prevention] website. It offers a 90-minute online interactive training tutorial on suicide in the workplace called Living Works. In my opinion, it's probably the best situations-based tutorial I have seen to date. Last I checked, it's still free. The only thing I would caution is that it takes 60 to 90 minutes to do it. If you're sitting on the fence on this issue of suicide, I'd say, take a look at this video, because it allows one to approach a very difficult topic in the privacy of their own home, away from the office or jobsite distractions.

Do you think this challenge is best addressed from the top down or the bottom up?

Gaal: We need to act concurrently from the top down and bottom up. The research we've done over the years with Washington University indicates that not only do you need support at the top but willingness in the ranks. Early on, the research we did was on keeping apprentices safe, but we quickly found that what they'd learned in school was not always easily accepted or applied on the jobsite. It became incumbent upon us to not merely educate the new workers on the safer methods, but the seasoned employees, including field supervisors. Make no mistake, this could not have been accomplished without the support of the C-suite. Again, it's got to be bidirectional.

What are the top changes to the industry as a whole that you would like to see to help address these challenges?

Gaal: First and foremost, making mental health a priority, not unlike what we did 20-plus years ago with OSHA 10 [and safety]. Use that model to get the work done that still needs to be addressed. First, develop an industrywide one-hour training module addressing mental health in the construction industry. For instance, NABTU has a six week, pre-apprenticeship curriculum called MC3. It would be wonderful to start the process with pre-apprenticeships, so that it becomes second nature,

not unlike OSHA 10. When OSHA 10 was implemented, the contractors and the unions, they [complained about it] for three or four years, and by year five, everybody did it, because they knew it was the cost of doing business. Eventually they realized how good it was, and that the outcome was that we have a safer workforce. I would also ensure that all workers on the jobsite are exposed to the above-mentioned module within the next 12 months.

Then I think the US Department of Labor's Office of Apprenticeship needs to review and audit apprenticeship curriculum to include mental health trainings throughout the program versus [just having the training during] pre-apprenticeship and never doing it again. That is one thing we learned 20 years ago about OSHA 10 training. In those first couple of years, everybody was doing it upfront and checking a box, and then the more progressive companies said, "Wait a minute, when I teach roof framing, this aspect of OSHA 10 fits there. When I teach concrete forms, this aspect of OSHA 10 fits there. They started building safety into their training programs across the board. I think we could do the same thing with mental health. I think where we were 20 years ago with OSHA 10, we are right now with mental health.

The next point is a request that OSHA expand their focus four to focus five, so that mental health is a mandatory training topic in all OSHA 10 courses.

Next, recruit a corps of qualified workers with lived experience to serve as peer support navigators. What we find in the research is that when a person who is in trouble talks to a peer with like experience, that outcome is more positive than that of a peer-to-professional relationship. We need to find people within our ranks with lived experience who are willing to share with and train others. We need to develop a training program for those who seek to serve as those navigators.

Finally, this industry has been experiencing worker shortages for two-plus decades now. Contractors and unions across the US have invested millions of dollars trying to recruit the next generation of electricians, plumbers, millwrights, etc. To do so, many have focused their marketing campaigns on two major target audiences, former military service members, and ex-high school college football athletes. [But the] one negative [aspect of that recruitment strategy] is traumatic brain injuries [TBIs]. People who have served on the battlefield or on the field of play have experienced repetitive head impacts. This is often referred to in the military as the invisible wounds of war. As an industry, we need to understand what TBIs are, and how to care for them, especially since TBIs make up approximately 25% of construction fatalities.

What are the top recommendations you have for civil contractors in particular to address the issues we've discussed?

Gaal: I have three points I want to make here. Get educated, that's number one. There are plenty of resources at the local, regional and national levels at your fingertips to get a jumpstart on the most vital matter of our times. Reach out to organizations with decades of experience such as NAMI [National Alliance on Mental Illness] or the AFSP [American Foundation for Suicide Prevention]. They've got more information on these topics. Check with your affiliated management associations, as well as your nearby universities. If you have a United Way chapter

nearby, I highly suggest that you meet with them to discuss what their 211 program entails.

And let's not forget, this past July, Congress made provisions to move the National Suicide Prevention Lifeline from a 1-800 number to a three-digit 988 National Suicide and Crisis Prevention Lifeline. So, not only did it change to a three-digit number, which is easier to remember, but it's also not just about suicide prevention anymore, it's about all mental health crises.

Number two is more direct. A few high-profile projects in the Midwest are requiring that the general contractors provide a mental health professional on the jobsite, no less than two days per week, at least six hours each day in a designated office space. That's a pretty new twist, and I'm waiting to see how this plays out with some research.

Number three: If you already supply a first aid kit on your jobsite, my question is, do you also have Narcan available?

What would you recommend specifically to a small to midsize contractor that may not have the resources of a larger company as the best steps they can take to address these issues?

Gaal: I have three more recommendations. Number one, use what is already available to union and non-union contractors. For example, CPWR is the research arm of the North American Building Trades Unions. They have research, they have data bulletins, and much more available, addressing mental health, opioid misuse and suicide prevention in the construction industry on their website. It's free, whether you are union or non-union.

Number two, get to know the Healthier Workforce Center of the Midwest, which is housed at the University of Iowa. They offer a whole array of toolbox talks and industry guidelines, covering many of the above-mentioned topics, including suicide prevention and bringing people safely back onto the jobsite who are in recovery from opioid misuse.

This leads to my third point. I highly recommend that they get familiar with their own state's efforts to develop what we now call recovery-friendly workplaces. For example, in Missouri, we have approximately 29,000 workers who are in medication-assisted treatment for opioid use disorder [MAT OUD], of which 3,800 of those are construction workers. In light of the worker shortage, we need to work collaboratively to find safe ways to bring people who are in MAT OUD recovery safely back onto jobsites.

What are the next steps?

Gaal: Number one, we need to develop a pilot study for suicide prevention in the construction industry, like the Mates in Construction project in Australia. We need to test that and see if that works in our market.

Number two, we need to expand substance and opioid use disorder programs, like the Lean program that is serving laborers in Massachusetts.

Number three, we need to keep an eye on the organic nature of the Los Angeles/Las Vegas region carpenters' union's peer support program called BOSS.

Number four, we need to learn from others who are beyond our borders. [For example, in Zimbabwe, they are] confronting the issue of mental health in a country that may have one psychiatrist

for every quarter of a million people. They've created a very constructive and innovative way [to address that need] via a peer support model called the Friendship Bench. It's so popular that it has spread into New York City now.

Number five, we are in a time of crisis, so we don't have time to reinvent the wheel. For example, there is a Labor Assistance Professional program that has been around since the early 1990s. They basically created their own certified peer support network for industries like car plants, police and fire, the airline industry, whether it's the flight attendants or the baggage handlers or the UAW. I think they have a great model, and we ought to at least take a look at it.

I am really pushing hard on this issue of peer support because the federal government has thrown lots of money at the community colleges to build up the community health workers in each community. If you take that community health worker program and tailor it to mental health, I could see this as being a great training ground for our construction workers who want to serve as those peer navigators. There are programs out there, though many are only eight to 30 hours long. I am concerned about that because it might be just enough to get somebody in trouble. Community health worker programs [are more comprehensive]; I went through a program two years ago that had 120 hours of seated coursework, and 60 hours of internship. That allowed me to sit for my state credentialing … I see that [type of coursework] as a gateway into connecting with our blue- and white-collar workers out on the jobsite. [The credentials help address naysayers who doubt the knowledge of peer navigators.] It doesn't make you a counselor, but when you hear somebody out, it helps you move them toward a plan that they create. [You can] point them in the right direction. CQ

DODGE ECONOMIC INSIGHT

Infrastructure Funds Provide Boost to Construction Starts

By Dodge Construction Network Economics Team

- *In 2022, nonbuilding construction starts will advance 19% to $243.1 billion after a 6% gain in 2021. Within nonbuilding construction, public works will increase 16% to $191 billion, while power/utilities will climb 27% to $52 billion. The early influence of the Infrastructure Investment and Jobs Act (IIJA) has boosted levels of activity as funding begins to flow to state and local areas in earnest.*
- *In 2023, nonbuilding construction starts are expected to grow 16% to $281.1 billion as more IIJA funds flow to state and local entities. While funding provided by the IIJA and IRA will lift the entire nonbuilding sector in 2023, there is one major risk. As of this writing the appropriations packages for FY2023 have not been approved by Congress. Further delays in approving this spending could work to undermine the 2023 starts forecast.*

Streets and Bridges

All nonbuilding construction, including streets and bridges, is a mix of public and quasi-public projects, which are driven more by legislative and regulatory initiatives than by economic trends. In fact, several recent pieces of legislation will have a huge collective impact on streets and bridges over the course of the five-year forecast. At the end of 2021, the $1.2 trillion bipartisan infrastructure package, the Infrastructure Investment and Jobs Act (IIJA), became law. This legislation provided stimulus to help the economy following the COVID-19 recession but also included language authorizing the use of federal funds for streets and bridges, replacing the FAST Act. The funding that came with this new legislation quickly eliminated much of the uncertainty that had plagued the industry since the expiration of the FAST Act. In addition to significantly higher levels of funding in the authorizing legislation, IIJA provided another $110 billion for roads and bridges over a 10-year period. As such, this funding will provide a strong positive force for street and bridge construction over the course of the next several years.

While Dodge predicted that it would take time for funding to reach construction sites, the annual appropriations process proved to be an additional, unanticipated hurdle. Despite passage of the authorizing legislation, funds made available by the IIJA were held back until Congress passed the omnibus budget resolution in March 2022 (five months after the fiscal year began). Despite the delay, street and bridge starts have been particularly strong, rising 20% on a year-to-date basis through nine months; street starts are up 20%, while bridges have risen 18%. The bounty in funding has been more-or-less a positive influence across the country with only 13 states and D.C. posting year-to-date declines. In the first nine months of 2022, the five states showing top growth rates for street and bridge starts are: North Carolina (+82%), Texas (+40%), Florida (+11%), Illinois (+11%) and California (+1%). In terms of total

share, however, Texas takes the top spot with 12% of all street and bridge projects started.

Several notable projects have gotten underway through the first nine months of 2022, including the $1.6 billion Amtrak Gateway Portal Bridge Capacity Enhancement in New York and New Jersey; a $739 million repaving project in Honolulu, Texas DOT's $522 million improvements along the IH 35E corridor and Louisiana DOT's $464 million second phase of asphalt and concrete pavement improvements along LA 1 and LA 3235.

With federal funding now in place, starts in the final quarter of 2022 will remain fairly stable. For the year, street and bridge starts will increase 23% to a combined $101 billion; bridge starts will climb 25%; and street starts will increase 23%.

According to a report released by the White House in July 2022, only 19% of all street and bridge funds provided by the IIJA have been allocated to state and local communities, meaning the bulk of funding is yet to come.

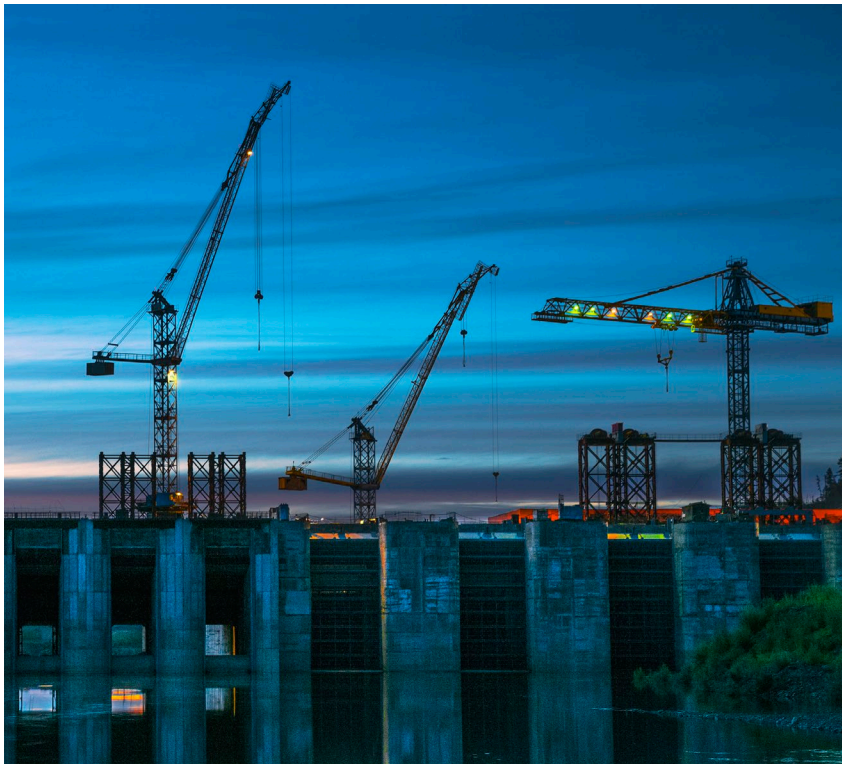
Federal funding for FY2023, which began on October 1, has yet to clear Congress. However, the government is funding transportation programs at FY2022 levels through a continuing resolution that expires on December 16. At present, Dodge anticipates the lame-duck Congress will wrap up spending bills in short order, but it is entirely possible that key funding decisions will be pushed off until the new Congress convenes in January. That would undercut Dodge's current 2023 streets and bridges forecast but result in a higher forecast for 2024 and beyond.

Environmental Public Works

Environmental public works construction is strongly tied to changes in federal, state and local legislation, regulations and funding levels for the development of drinking water systems, storm sewers, water resources (such as dams, levees and harbor development) and remediation of hazardous waste. After years of scarce appropriations, federal funding has been steadily increasing for environmental construction alongside rising numbers of environmental disasters.

Historically, these categories of construction have benefited from broad bipartisan and bicameral support in Congress, which has served as a significant stabilizing force for the sector. Growing partisanship in Washington, though, has led to increasing delays in having funds for the Environmental Protection Agency (EPA) and the Army Corps of Engineers approved. This year has been no exception.

DODGE ECONOMIC INSIGHT



After a slow start to the year, environmental public works construction steadily rose after FY2022 spending packages were approved. On a year-to-date basis through September, total environmental public works construction was 13% higher than the same time period in 2021. Starts for dam and flood control projects were up 16%, sewer projects were 12% higher, and water projects had increased 11% on a year-to-date basis through nine months.

The largest project to get underway through the first three quarters of 2022 was the $1.9 billion third phase of the Soo Lock Chamber in Sault Ste. Marie, Michigan. Also notable was the $531 million expansion of the Gross Reservoir in Golden, Colorado, and the $460 million first phase of the Sand Island wastewater treatment plant in Honolulu.

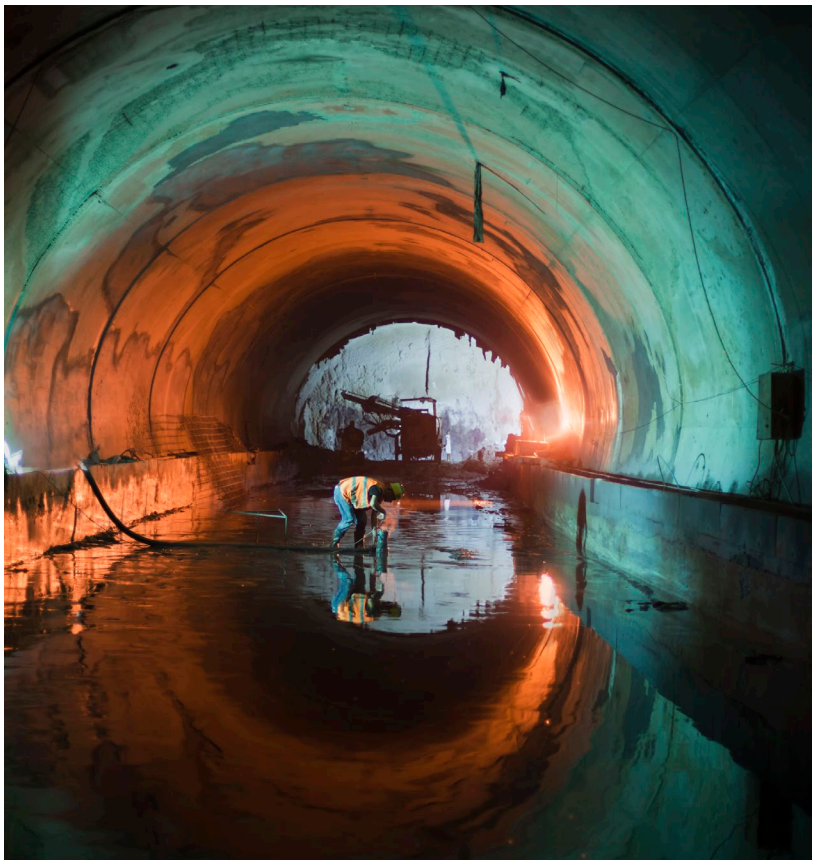
Environmental public works starts should remain brisk in late 2022, resulting in an 11% gain from 2021 to $60.1 billion. Dam and flood control projects are expected to rise 8%, water projects will gain 11%, and sewer projects will move 15% higher for the year.

As with the streets and bridges category, the main driver of activity in 2023 will be funds provided under the IIJA. The infrastructure package allocated $55 billion for water supply, $50 billion for storm resilience and $23 billion for environmental remediation. Now that these allocations have become accessible, it will still take time for funding to reach its intended targets. As of July 2022, 17% of IIJA water funds had been allocated to states.

Potential further delays in federal appropriations could undercut the short-term forecast but would lead to higher levels in the out years. The risk of a U.S. macroeconomic recession in 2023 (or not) should not be an impeding factor in this sector's growth trajectory.

Another relevant factor to future growth in water and sewer construction is the residential sector, particularly the single family market. In general, home construction typically leads to more water and sewer construction. However, the single family market is currently in cyclical decline, and Dodge's current forecast calls for further declines to housing starts in 2023. Multifamily starts are also slated to decline next year, pushing the entire residential sector into a recession-like year.

Other Nonbuilding



Other nonbuilding construction contains a diverse set of construction activity, including sitework, pipelines, rail lines and large sports venues without roofs (venues with roofs are included in the recreation category within institutional construction). In 2020, other nonbuilding starts fell 24% to $31.5 billion. Most subcategories lost ground in 2020, including a 42% decline in railroad activity and a 45% drop in oil and natural gas pipelines. There were some resilient categories, however, as military facilities, space facilities, and airport runway and taxiway starts enjoyed strong gains, increasing 262%, 16% and 29%, respectively.

Overall weakness in other nonbuilding construction starts continued into 2021. Starts dipped a further 12%, settling at $27.7 billion. Of the various subcategories, only petroleum/natural gas pipelines and military facilities grew from the previous year. Construction projects on the larger end of the spectrum were relatively rare that year. The most notable included the $2.1 billion Line 3 Replacement Program in Minnesota (a 337-mile oil pipeline in the northern portion of the state), the $1.2 billion Foothill Gold Line Alignment Light Rail System in California, the $530 million Leidy South Marcellus and Utica Takeaway pipeline in Pennsylvania and the $500 million Whale Offshore Oil Field Pipeline in Texas.

Construction starts in the other nonbuilding category are expected to improve in 2022, increasing 8% to $29.7 billion. While the sector's diversity can lead to difficulty navigating the headwinds and tailwinds, there is a smattering of large projects breaking ground this year or waiting in the pipeline, which should boost the category. One project that has the potential to drive activity moving forward is the nearly $30 billion Dallas-to-Houston high-speed rail project. This project will be broken into multiple phases and is expected to take several years to complete, which is reflected over much of the Dodge five-year forecast. Another project of note is the Tellurian Driftwood LNG Processing and Export Terminal project. Phase 1 of the terminal project broke ground in July, with value splitting between the power and utilities sector and other nonbuilding. Soaring global demand for natural gas adds urgency to the project's construction timeline; Tellurian hopes to complete

the project by 2026. The $2.2 billion Rio Bravo Natural Gas Pipeline in Texas and the nearly $2 billion East San Fernando Valley Light Rail Transit project in California should also shore up growth opportunities over coming months.

Passage of the $1.2 trillion federal infrastructure bill last year will have a limited positive impact on this sector in 2022, though there is potential for the legislation to have more significant impacts in later years.

The main benefits will come through additional funding for traditional and high-speed rail projects as well as dollars allocated to airports that may lead to additional runway and taxiway projects as part of larger airport expansions. While the other nonbuilding sector does not benefit from the IIJA in the same ways that other nonbuilding sectors do, increased pressure on domestic energy production (both oil and LNG) in the wake of Russia's war with Ukraine should provide some downside protection to the sector over the duration of the forecast.

Power & Utilities

The power and utilities category encompasses all types of energy-related construction, ranging from hydroelectric and nuclear power plants to wind, solar and natural gas-fired power generation. Due to the unusually large projects that dominate the energy industry, the power category is frequently subject to large year-over-year swings in activity. This year's starts are expected to surge 27% to $52.5 billion (after last year's 15% upswing). Starts will then continue to increase in 2023, reaching $56.4 billion before pulling back in 2024 to $54.5 billion. Through the remainder of the forecast, starts will increase steadily, reaching $60.5 billion in 2027.

In the first nine months of 2022, the energy sector broke ground on $39.8 billion in starts, 62% above the same period in 2021. This significant increase is mostly owed to two of the subcategories within power and utilities. The solar and wind subcategory (the largest within power and utilities) broke ground on $15.5 billion in starts during the first half of the year thanks to large projects such as the $1.28 billion Gemini solar project in Las Vegas and a $625 million Oberon solar facility in Desert Center, California. Despite these starts, a smaller number of projects overall in the first nine months of the year has resulted in a 20% decrease for solar and wind overall.

The natural gas plants subcategory should also be credited for the significant rise in power projects during the first nine months of 2022 with $15.9 billion breaking ground so far this year—the $8.5 billion Driftwood LNG Production Terminal Phase I in Lake Charles, Louisiana, and the $7 billion Cheniere Corpus Christi LNG Stage 3 in Gregory, Texas.

The solar/wind and natural gas-fired power generation subcategories alone have made up 79% of total energy/utilities projects in the first nine months of 2022. The power lines subcategory has also posted substantive gains (up 36%) in the first nine months of 2022 thanks to starts on several large projects, including the $1.78 billion Segment F of PacifiCorp, which consists of roughly 400 miles of power lines stretching from Wyoming to Utah.

Continued strength in electric power-related starts is largely thanks to initiatives from the federal government. The first is an important new piece of legislation, the Inflation Reduction Act (IRA), which Congress passed and President Biden signed in August. The IRA is a major new initiative to mitigate climate change and will provide roughly $400 billion over 10 years to encourage purchases of electric cars and nudge electric utilities toward more renewable energy sources. Specific components of the bill include $30 billion in tax incentives to speed up production of solar panels, wind turbines and electric vehicle batteries. An additional $10 billion is budgeted for new construction of needed production facilities.

The IRA also includes a clause that extends the production tax credit (PTC) and investment tax credit (ITC), two significant tax incentives that have contributed significantly to growth in the renewable energy industry. These tax extensions come as a great relief to the sector that has been plagued with many supply chain delays, giving renewable energy a strong chance to flourish in the power sector going forward.

Another significant factor for energy sector construction lies with recent commitments from the U.S. government to supply the European Union (EU) with natural gas as it attempts to wean itself off Russian supplies after Russia's invasion of Ukraine. Russia supplied almost 50% of the EU's gas imports in 2021, but the EU is now looking for alternative suppliers, particularly after the August 2021 announcement that the Nord Stream pipeline (one of Western Europe's primary fuel conduits connecting Russian natural gas to energy users) would be shut down for three days. The White House in March pledged to increase liquefied natural gas exports to Europe to help reduce the EU's reliance on Russian fossil fuels. According to the U.S. Energy Information Administration (EIA), 60% of all U.S. LNG exports in the first nine months of this year went to Europe, a massive leap from a 29% annual average in 2021.

The need for more capacity to support new European demand is becoming very clear to energy producers in the U.S. Moreover, the EIA notes that this past summer's extremely warm weather has boosted domestic retail electricity sales, another key driver in power and utilities construction. The EIA estimates that electric power sales will increase 2.5% this year to a record 3.9 billion megawatt hours (MWh) and notes also that wholesale power costs increased across most of the country, further fueling inflationary trends. Both to accommodate EU demand and to ease prices in the U.S., producers have accelerated plans to expand capacity. These elements boost the significance of LNG projects that have started this year and those still yet to come, such as the $9.6 billion Rio Grande export Terminal in Brownsville Texas, which is set to start construction at the beginning of 2023. CQ

Top 25 Infrastructure Projects in Planning

The projects listed in the table below are the top 25 projects by value still in the planning stages published in Dodge Construction Central from Oct. 1 to Dec. 7, 2022. 18 of the top 25 projects are currently estimated at over $1B, with a major water supply transmission and hydropower project in CO estimated at $24B topping the list.

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	CO	$24 B	Water Supply Transmission/Storage/Infrastructure/Hydropower	Wellington
2	GA	$5.5 B	GA/DOT: I-285 Top End Express Lanes (DESIGN/BUILD)	
3	LA	$4 B	Commonwealth LNG Liquefaction & Export Facility (Cameron)	Hackberry
4	CA	$3.9 B	Sites Reservoir Project - Phase 1	Colusa
5	IA	$3.2 B	Heartland Greenway CCS Pipeline	Des Moines
6	NV	$3.2 B	Brightline West Cajon Pass High-Speed Rail Victor Valley to	Las Vegas
7	TX	$2.6 B	Matterhorn Express Pipeline	Coyanosa
8	TX	$2.4 B	TX/DOT: North Houston Highway Segment 3	Houston
9	TX	$2.4 B	Orange County Coastal Storm Risk Management HARVEY	
10	CO	$2.3 B	Ph I Water Pipeline/Reservoir/Hydropower	Wellington
11	TX	$1.5 B	TX/DOT: I-35 Northeast Expressway NEX South	San Antonio
12	LA	$1.4 B	Mid Barataria Diversion BA-0153	Port Sulphur
13	GA	$1.3 B	RFQ/DB: GA/DOT: SR 400 Express Lanes (DESIGN/BUILD) REBID	Sandy Springs
14	TX	$1.2 B	TX/DOT: North Houston Highway Segment 2	Houston
15	PA	$1.2 B	Norristown High Speed Line to King of Prussia	King of Prussia
16	CA	$1.2 B	Sacramento River West North Levee Phase I Extension	West Sacramento
17	TX	$1.2 B	TX/DOT: IH 45 Interchange Reconstruction	Baytown
18	OH	$1.1 B	Park Overlook Waterline Replacement	Columbus
19	TX	$913 M	Port Arthur LNG - Natural Gas Pipelines	Port Arthur
20	NC	$800 M	Wilmington Rail Realignment and Bridge	Wilmington
21	AR	$800 M	AR/DOT: Interstate 49 Extension	Barling
22	TX	$714 M	Walnut Creek Wastewater Treatment Plant Expansion	Austin
23	CO	$700 M	CO/DOT: I-70 Floyd Hill to Veterans Memorial Tunnels	Georgetown
24	WA	$700 M	West Seattle and Ballard Link Extensions	Seattle
25	TX	$654 M	TX/DOT: IH 35 Road Widening	San Antonio

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 Oct. 1 to Dec. 7, 2022. The list as a whole consists nearly entirely of road and water treatment/ reclamation projects. Not surprisingly, most of the work is also concentrated in the warmer climates of the South and West.

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	TX	$548 M	TX/DOT: IH 35 Road Widening REBID	Austin
2	HI	$496 M	City Center Utilities Relocation Phase IV	Honolulu
3	TX	$313 M	TX/DOT: IH 30 Road Widening	Rockwall
4	CA	$278 M	Secondary Treatment and Dewatering Project	Sunnyvale
5	MS	$213 M	MS/DOT: Paving Improvements (CO 001)	Vancleave
6	WI	$201 M	WI/DOT: IH 043 Road Improvements (CO 003)	River Hills
7	NC	$200 M	Stowe Reg Water Resource Recovery Facility	Charlotte
8	FL	$182 M	FPL Turkey Point Clean Water Recovery Center PPP	Homestead
9	GA	$182 M	Walnut Creek Water Reclamation Facility Expansion	Mcdonough
10	RI	$167 M	RI/DOT: Route 146 Reconstruction	Providence
11	VA	$163 M	RFQ/DB: VA/DOT: I-64 Hampton Roads Express Lanes Segment 1A	Norfolk
12	OK	$158 M	OK/DOT: Interchange Improvements (CO 790)	Oklahoma City
13	NC	$150 M	Sams Branch Water Reclamation Facility	Clayton
14	TX	$146 M	Pflugerville Water Treatment Plant Expansion PH 1	Pflugerville
15	KS	$141 M	KS/DOT: I-235 Grade & Bridge Improvements (CO 253)	Wichita
16	HI	$138 M	HI/DOT: Farrington Highway Widening Improvement	Waianae
17	TX	$128 M	TX/DOT: IH 30 Interchange Improvement	Greenville
18	SC	$127 M	SC/DOT: Carolina Crossroads (Broad River Rd) PHASE 2	Irmo
19	TX	$129 M	S. Mesquite Regional WWTP Peak Flow Management & Exp	Mesquite
20	TX	$117 M	South Austin Regional WWTP Trains A & B Improvements	Del Valle
21	MA	$112 M	FSB Tri-Town Regional Water Treatment Plant	Braintree
22	TX	$107 M	TX:DOT: SH 105 Road Lanes Widen	
23	FL	$103 M	FL/DOT: Pavement Improvements (CO 001)	Lecanto
24	LA	$101 M	LA/DOT: Asphalt Concrete Pavement Improvements REBID	Lake Charles
25	MA	$96 M	RFP/DB: MA/DOT: (Charlton) Safety Improvements	Charlton

METHODOLOGY

Dodge Data & Analytics conducted an online survey from Oct. 17 to Nov. 21, 2022 of contractors and engineers active in civil projects. They were drawn from several sources:

- The DD&A Contractor Panel (over 2,700 decision-makers that includes general contractors, construction managers, design-builders and trade contractors)
- The DD&A database of contractors and engineers
- Outreach by *Civil + Structural Engineer* and the Design-Build Institute of America

200 contractors and 51 engineers who work on heavy civil infrastructure projects responded to the survey.

Location of Contractors

97% do most of their construction work in one of the four census regions:

- 28% in the West
- 28% in the South
- 26% in the Midwest
- 15% in the Northeast

Types of Contractors

- 68% general contractors, construction managers, design-builders
- 13% nonbuilding contractors
- 19% trade contractors

Contractor Job Functions

- 28% of contractors identify themselves as executives (CEO/Owner/Partner/President/Principal/Other C-Level)
- 36% identify themselves as project leadership (Project Manager/Project Engineer/Project Executive/Construction Manager)
- 25% identify as Estimators, and 11% as Other

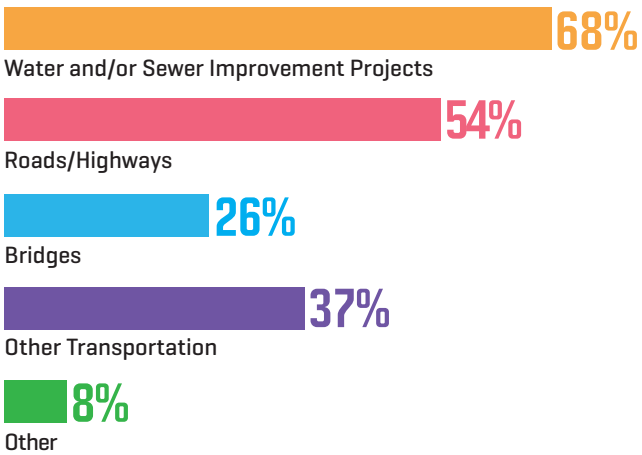
Contractor Size by Annual Revenue

- 34% small contractors (revenues less than $10M)
- 29% midsize contractors (revenues from $10M to less than $50M)
- 37% large contractors (revenues $50M and more)

Civil Engineers

Civil engineers were asked similar questions to those asked of contractors about their backlog and market expectations. Their responses are featured in the Pipeline and Special Topic sections.

Project Types (Contractors)



RESOURCES

Additional Resources on the Heavy Civil Construction Industry

FOUNDING PARTNER

Infotech www.infotechinc.com

PLATINUM PARTNER

Hexagon https://heavyconstruction.hexagon.com/

RESEARCH PARTNERS

Civil+Structural Engineer https://csengineermag.com

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

OTHER RESOURCES

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

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

We thank all those who participated in our feature article and industry interviews 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**.

Dodge Construction Network

About Dodge Data & Analytics

Dodge Data & Analytics is North America's leading provider of analytics and software-based workflow integration solutions for the construction industry. Building product manufacturers, architects, engineers, contractors, and service providers leverage Dodge to identify and pursue unseen growth opportunities and execute on those opportunities for enhanced business performance. Whether it's on a local, regional or national level, Dodge makes the hidden obvious, empowering its clients to better understand their markets, uncover key relationships, size growth opportunities and pursue those opportunities with success.

The company's construction project information is the most comprehensive and verified in the industry. Dodge is leveraging its 100-year-old legacy of continuous innovation to help the industry meet the building challenges of the future. To learn more, visit www.construction.com.

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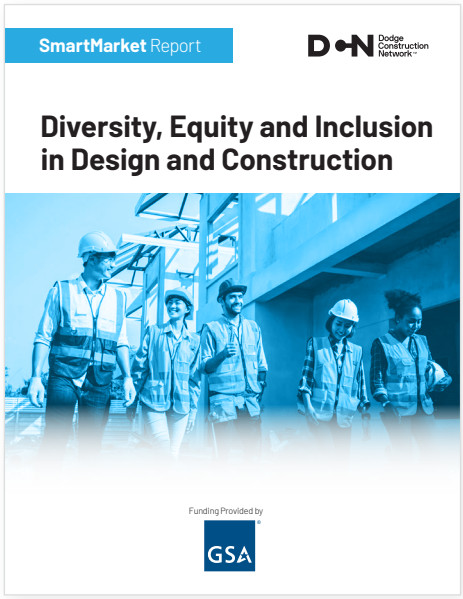

Industry Insights

Research on trends impacting the construction industry is featured in reports available for free at www.construction.com/toolkit/reports.