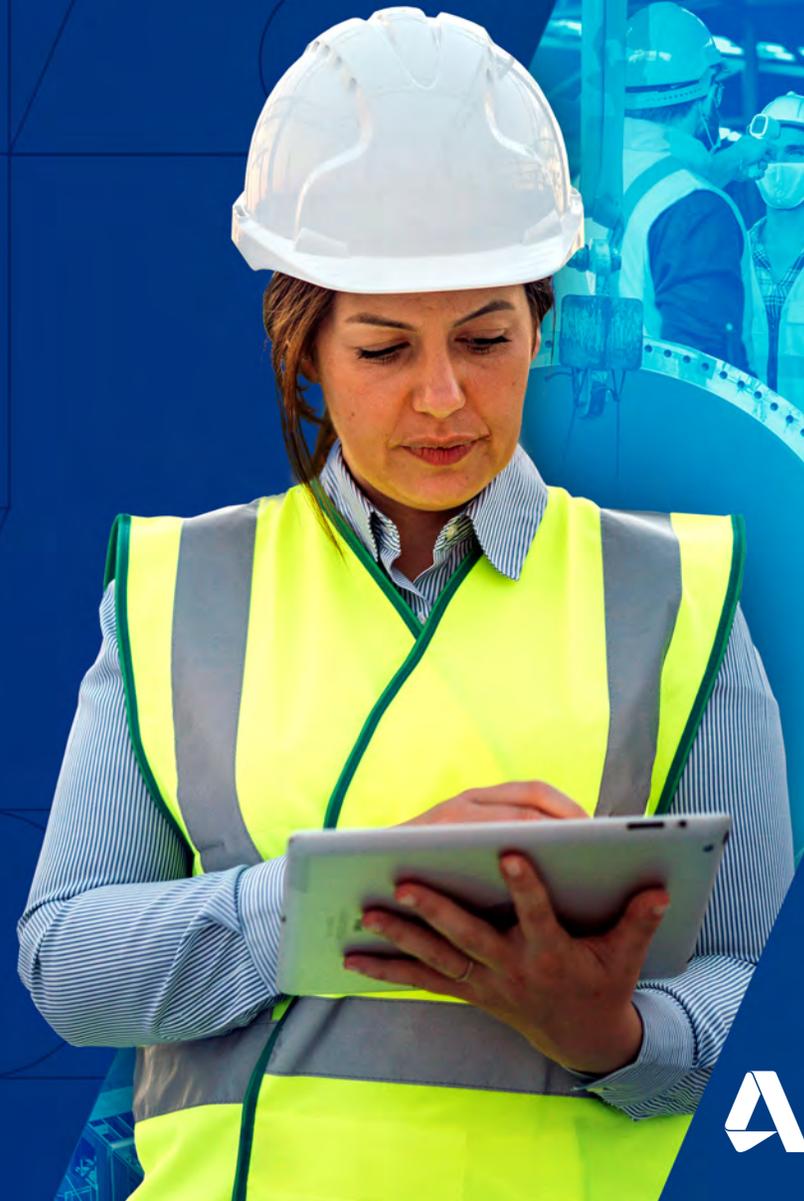




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2021 Autodesk Construction Outlook: Owners



Produced in partnership between the BuildingConnected analytics team and Edward R. Zarenski, [Construction Analytics](#)



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Introduction

It's safe to say that 2020 was a year no one expected.

The construction industry is navigating a new world and more than ever, we want to arm our customers with the insights and analysis they need to make the best possible business decisions.

To help achieve this goal, our BuildingConnected analytics team worked with Edward R. Zarenski from Construction Analytics to develop the **2021 Autodesk Construction Outlook**¹. The Construction Outlook for Owners is a distillation of the larger Autodesk Construction Risk Outlook tailored specifically for owners. This report combines external economic data with Autodesk's own aggregated, anonymized BuildingConnected product data to uncover the evolving state of the industry. For instance, what does the bidding activity from Autodesk's Builders Network of over 1 million construction professionals say about subcontractor backlog? How does the volume of RFIs and change orders on a project affect its success?

We hope that the insights contained in this report will help you stay resilient in 2021. Even more, we hope they will help you uncover new areas of opportunity for your business. Construction is known for developing creative solutions to difficult problems, and we believe the challenges we are currently up against are no different. You can continue to turn to Autodesk as you tackle those challenges head-on.

Will 2021 look like years past? Certainly not. The construction industry has been forever changed, and many of those changes will help us become more nimble, more efficient, and more connected than before. Together – armed with the right tools and insights – we can imagine a new possible.

Best,
Jim Lynch
Senior Vice President & General Manager,
Autodesk Construction Solutions

Executive Summary

Economic data shows that construction firms will continue to experience the long-term impacts of the COVID-19 pandemic over the next two to three years. However, bidding activity from Autodesk's Builders Network shows that the industry might be climbing out of the initial trough faster than expected, which has meaningful implications for owners looking to build in the year ahead.

In fact, in 2021, the bidding landscape will be more competitive than in years past. Over the past twelve months:

- Total bidding activity was up 15 percent in November and 36 percent in January, compared to a three-month pre-pandemic average, with January volume representing an all-time high on the BuildingConnected platform.
- The volume of projects added to BuildingConnected and the volume of bid invitations has increased. This surge in bidding activity may be due to restarts of delayed or rescheduled projects.

Construction starts dropped significantly in 2020, causing 2021 spending to decrease. In 2021 construction starts are beginning to rebound:

- New starts in 2021 are forecast to increase six percent, with a four percent increase in nonresidential projects and a 10 percent increase in non-building infrastructure projects.
- 2022 total starting backlog is projected to decrease five percent, while growth is expected in commercial, healthcare, and transportation sector starting backlogs.
- By October 2021, nonresidential building spending is projected to decrease 15 percent from February 2020, with projected drops of two to three percent each quarter. In total, nonresidential spending is forecast to hit \$410 billion in 2021.

With this shift in the landscape in 2021, what does it mean for owners who have new construction starts on the table in the year ahead? Or even owners who are potentially picking back up projects that were placed on hold during the pandemic?

Owners will have four key areas to navigate:

- Costs
- Material Costs
- Schedule
- Design



About the Report

The **2021 Autodesk Construction Outlook** was created from our own internal, aggregated, anonymized, BuildingConnected product data as well as data pulled from external sources such as [Dodge Data & Analytics](#). The analysis was conducted by construction economist Ed Zarenski.

Ed Zarenski retired in 2014 from a 42-year career in construction, during which he spent 30 years as a building project cost estimator and construction economics analyst. He now spends his time as a construction economics analyst, author, educator, and presenter. Upon retirement, he focused on two goals: teaching – which he was fortunate to do at Worcester Polytechnic Institute – and supplying unique construction economics reporting. He created the blog [Construction Analytics](#) as a place where his readers can find in-depth, behind-the-headlines commentary related to the economics of building construction.

Data Analyzed

- Forecast includes U.S. Census December 2020 year-to-date spending as of February 1, 2021
- Forecast includes Dodge Outlook 2021 and December construction starts as of January 19, 2021

Purpose and Method of Analysis

This report presents the results of analysis using currently available actual and predicted national construction data to determine the impact of recent construction market activity and cost inflation and to forecast future construction activity, jobs, and inflation. The analysis uses a unique model to factor construction starts and cash flow data to predict construction market activity. Forecast market activity is viewed in relation to job growth and availability to predict market inflationary response.

[Learn more here.](#)

This analysis uses [Dodge Data & Analytics](#) construction starts data to generate spending cash flows to then determine how spending may affect future construction activity. This analysis is based upon U.S. national-level data.

All adjusted starts, backlog, cash flow and spending reported in the tables in this report are directly forecast from the construction starts data provided by Dodge Data & Analytics. The input data is new and forecast construction starts.

Survey market share factors and cash flow curves applied are developed by Construction Analytics from historical actual data. Actual spending data is reported by the U.S. Census. Inflation indices are developed by Construction Analytics and inputs are from various named sources.

Residential inflation indices are primarily single-family homes but would also be relevant for low-rise two to three story building types. High-rise residential work is more closely related to nonresidential building cost indices.

A nonresidential buildings index would be representative of commercial construction or high-rise residential construction, since high-rise residential is quite similar to commercial construction, and in fact substantial portions of the building are constructed by firms classified as commercial contractors.

The following guide will explore these four key areas, projecting an outlook for 2021 and breaking down what this outlook means for owners with practical insights for handling each potential challenge.

Part 1: Costs



The Outlook

Cost is always a concern for owners. Projects need to be within a specific budget and there needs to be predictability to the project costs throughout the entirety of the build.

Going into 2021, owners should first take note of their outlook in spending, backlog, and bidding, which will all greatly impact the total cost of projects in the years ahead.



Spending

When spending increases, demand for all sorts of products and labor also increases. Owners should be aware of the upcoming market conditions to control their costs. If spending is up 10%, there is greater demand for products and costs will generally rise. Some of those increases can be controlled by early buyouts. Estimators on any project need to be aware of what cost to carry in the budget for products that won't be purchased until six months or a year from now.

Backlog

Starting backlog is the estimate to complete (in this analysis taken on January 1, 2021) all projects currently under contract.

Backlog leading into 2020 was at an all-time high, up 30% in the last 4 years. Prior to the pandemic, the 2020 starting backlog was forecast up +5.5%. Due to delays and cancellations, that has been reduced to +1.8%, still an all-time high. Starting backlog, from 2011-2019, increased at an average rate of 7% per year.

Impact of the Pandemic on Backlog

Some of the projects that were delayed or canceled due to COVID-19 started before January 2020. When projects are delayed, the part of the project that was delayed shifted to the future backlog. When one of those projects was canceled, the part of the project not yet put in place was removed from 2020 and future backlog.

Not only does that reduce the future backlog, but it also retroactively reduces the backlog that was on record at the start of 2020. Therefore, the 2020 backlog is reduced by cancellations while the future backlog is increased by delays, but also reduced by cancellations and a loss of new construction starts.

Backlog Forecast

If new construction starts are greater than construction spending in the year, then starting backlog increases for the following year. When new starts are lower than the amount of spending in the year, the backlog declines.

This year the total starting backlog is down -10% for 2021 and -5% for 2022. The 2021 starting backlog is back to the level it was in 2018.

The total starting backlog is expected to show signs of recovery by the start of 2022, down only five percent, compared to the -10% decline in 2021. Due to new starts declining by -24% in 2020, nonresidential buildings backlog dropped -19% for 2021 and is projected to slow to -8.7% for 2022. For non-building infrastructure, a drop of -13% in 2020 starts resulted in a drop of -8.5% in 2021 starting backlog, also slowing to -4.6% by 2022. The biggest changes to 2021 starting backlog were lodging (-42%), amusement/recreation (-40%), manufacturing (-26%), and power (-20%). Based on the projected growth in new starts for 2021, starting backlog for 2022 should improve marginally.

Office buildings, lodging, and amusement/recreation – some of the hardest-hit areas – still see declines in backlog in 2022 but on a smaller scale. Commercial, healthcare, and transportation are expected to see growth in starting backlog by 2022.

Currently, 80% of all nonresidential building spending in any given year comes from backlog, on projects started last year or even 3-4 years ago. Residential spending is far more dependent on new starts than backlog. About 30% of residential spending comes from the backlog and 70% from new starts.

Forecast Starting Backlog

Delays, Cancels, Starts | Adjusted for SHARE | \$ in millions 000,000s

	2018	CHANGE	2019	CHANGE	2020	CHANGE	2021	CHANGE	2022	CHANGE
Total all markets	1,187,026	8.2%	1,247,607	5.1%	1,270,527	1.8%	1,148,333	-9.6%	1,086,151	-5.4%
Residential bldgs	180,346	4.6%	180,801	0.3%	194,878	7.8%	218,605	12.2%	217,174	-0.7%
Manufacturing bldgs	113,710	4.3%	114,803	1.0%	110,717	-3.6%	74,499	-32.7%	49,616	-33.4%
Office bldgs	96,181	21.4%	112,995	17.5%	119,187	5.5%	98,864	-17.1%	88,687	-10.3%
Commercial bldgs	83,141	-2.0%	77,127	-7.2%	64,859	-15.9%	54,989	-15.2%	59,622	8.4%
Educational bldgs	110,881	6.9%	114,278	3.1%	117,642	2.9%	108,332	-7.9%	104,151	-3.9%
Lodging bldgs	26,495	20.5%	26,803	1.2%	24,485	-8.6%	13,930	-43.1%	11,771	-15.5%
Healthcare bldgs	45,592	5.7%	49,422	8.4%	54,064	9.4%	50,839	-6.0%	53,475	5.2%
Amusement/Recreation bldgs	31,774	16.2%	34,810	9.6%	30,978	-11.0%	17,743	-42.7%	13,306	-25.0%
Total nonres bldgs	519,777	8.1%	541,443	4.2%	528,671	-2.4%	429,205	-18.8%	391,723	-8.7%
Power infra	206,205	9.6%	213,781	3.7%	206,831	-3.3%	162,154	-21.6%	141,255	-12.9%
Highway/street/bridge infra	141,736	4.0%	150,100	5.9%	159,159	6.0%	167,520	5.3%	167,078	-0.3%
Transportation infra	65,120	24.8%	81,586	25.3%	97,373	19.4%	91,450	-6.1%	92,672	1.3%
Environmental public works infra	51,321	11.8%	57,789	12.6%	61,969	7.2%	58,908	-4.9%	56,148	-4.7%
Communication infra	22,521	4.6%	22,106	-1.8%	21,647	-2.1%	20,492	-5.3%	20,102	-1.9%
Total nonbldg infra	486,903	9.6%	525,362	7.9%	546,979	4.1%	500,524	-8.5%	477,254	-4.6%

Source: [2021 Construction Economic Forecast](#), [Construction Analytics](#)



What This Means for Owners

From the outlook above, there are a few notable takeaways for owners.

First, spending is up which means owners need to be aware of the upcoming market conditions to control costs. Additionally, owners need to partner with a team that includes an estimator who will be hyper-aware of future costs for products purchased later in the life of a project. Accurate estimates will be critical for staying on budget, and will ensure owners see the full picture during the initial budget forecasting.

Secondly, the backlog for 2021 shows some mixed implications for owners building in different industries. In some sectors such as healthcare, owners will have to be aware that the high volume of projects out to bid may result in few qualified bids for their project.

This can translate to higher prices, which makes it critical for owners to look at the quality of bids and the track record from the firm chosen. It is more important than ever to ensure teams show a high level of predictability and reliability.

In sectors where there are fewer projects out to bid, such as amusement and recreation, it will be an owner's market, with better pricing by qualified bidders.

In relation to both spending and backlog, the outlook also demonstrates that the rebound has only begun. As new starts catch back up and previously paused jobs restart, the backlog and spending are only going to increase over the years ahead.

It is critical for owners to look at the quality of bids and track the record from the firm chosen. It is more important than ever to ensure teams show a high level of predictability and reliability.

Part 2: Material Costs



The Outlook

Projections around material costs will also impact owners in the year ahead. Owners should be aware of how material costs may affect total project costs.



Construction Costs

Typically, when work volume decreases, the bidding environment gets more competitive and prices go down. However, if materials shortages develop, prices may increase in response to short supply. It's hard to say which of the two effects will be more impactful, and how prices will change as a result. There are reports that many imported products are not available or in short supply.

The [American Iron and Steel Institute \(AISI\)](#)² reports domestic U.S. steel mill shipments year-to-date through October are down 16.5% from 2019. Imports are down 22%. Firms that manufacture goods used in construction were closed temporarily, so their production was disrupted. Many projects have been halted, and many more have experienced disruption.

Delays may add several weeks or longer to the overall schedule, causing management costs to go up. In this case, the material availability issues and schedule delays could outweigh any decline in work available for bid.

Residential Building Material Inputs costs were up +8% YTD through October 2020. Increases for lumber and ready-mix concrete are noted. Over the last five months, the PPI (Producer Price Index) for softwood lumber is up **+90%, adding more than \$17,000 to the price of an average new single-family home since mid-April.**

Nonresidential building construction inputs were up YTD +2.0% through October. PPI Index YTD for some materials:

- Ready mix concrete +3%
- Fabricated structural metal -0.9%
- Flat glass +1.2%
- Lumber and plywood +45%
- Concrete brick and block +3.1%

Expect nonresidential buildings inflation near 4% for 2020 and 2021, perhaps 5% to 6% for residential work.

Managing supply chain in 2021

The construction industry has responded to the pandemic disruption by paying much closer attention to their supply base. Many Autodesk customers report that they've increased communication with existing suppliers while working to qualify alternate suppliers.

What This Means for Owners

While there isn't much that owners can do to change the outlook, practical approaches can be taken to mitigate the impacts.

Efforts to manage supply chains will be largely owned by the contractor that wins the bid, which is why it is critical for owners to be extremely thorough in vetting bids.

Owners should consider asking about all of the following tactics when reviewing submitted bids.

Who will be in charge of managing the supply chain on this project?

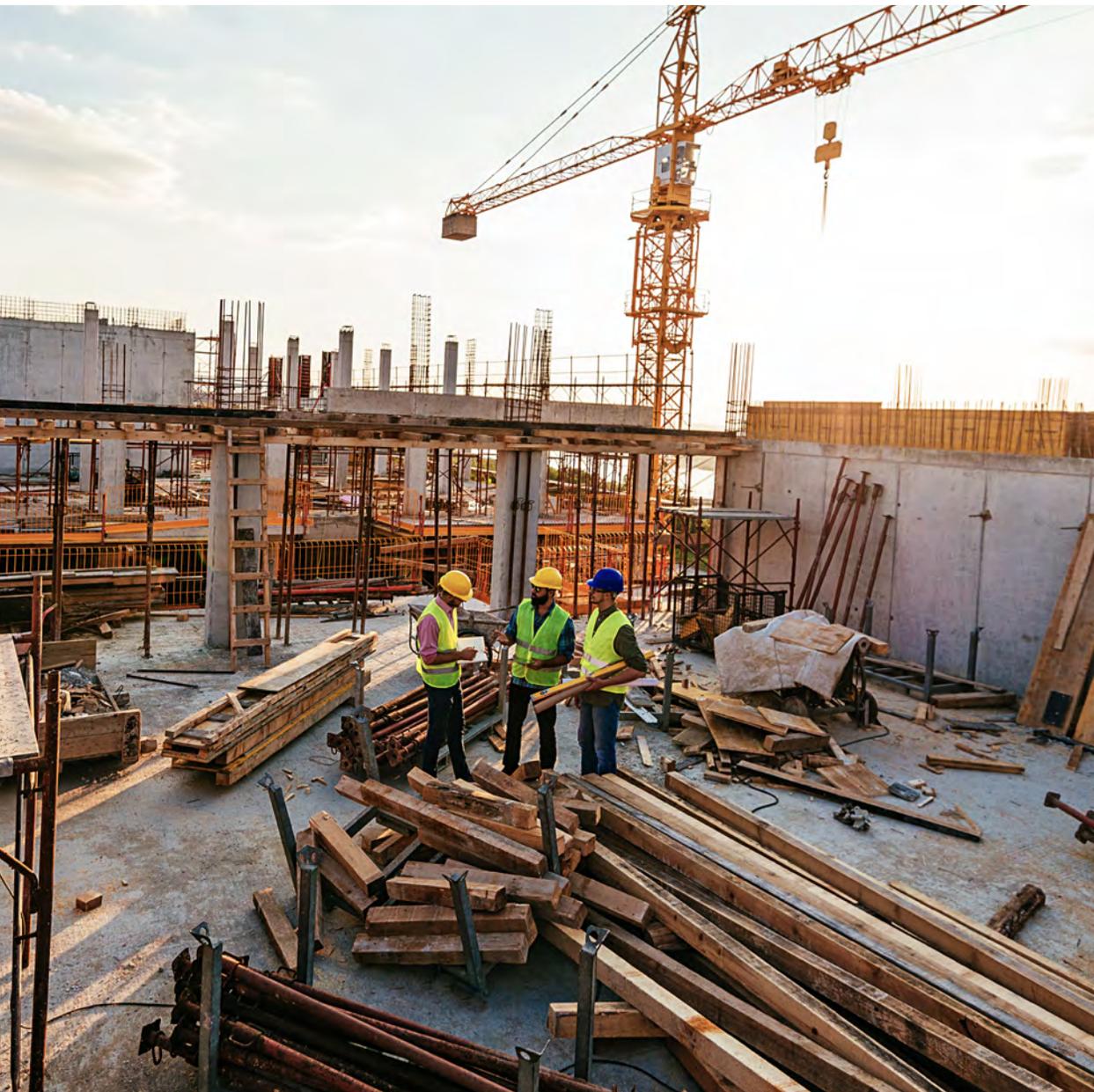
This may be an individual or a committee. The supply chain is a complex subject, and someone needs to own it to achieve success. The primary function of the role should be to break down silos and talk about supply chain risk on an enterprise basis.

Will a supply chain audit be performed for this project?

Contractors should understand which materials are truly single source or specialized and what alternates may exist, and which subcontractors or suppliers are particularly financially fragile or on a critical path.

They should implement a material monitoring and management plan for all at-risk materials. Then, they should track these materials from their point of origin to the worksite with documentation along the way. Once on site, these materials should be checked in against submittals to ensure the correct and sufficient materials were received.





How will material costs and supply chain management be documented?

Project schedules and cost reports should be baselined so that they accurately reflect the conditions on-site at the time the impact arose. This documentation should be a clear snapshot in time of conditions before the impacts hit and will frame and form the basis of any request for time or cost. This documentation must be clear, accurate, and in agreement with other project documents. This will provide a measurement tool for the impacts that may be experienced.

Material constraints/delays should be incorporated into the project schedule as they are known, so that it always accurately reflects the actual activities on site.

Part 3: Schedule



The Outlook

In 2021, an increasingly difficult labor situation is expected. According to the results of a workforce survey conducted by the Associated General Contractors of America and Autodesk, the pandemic has had little impact on labor demand in recent months. Despite obvious interruptions caused by the pandemic, firms still have a tough time filling craft and salaried positions.



Labor Availability

Labor shortages put demands on project schedules. If there is insufficient labor to work normal hours and complete the project on time, owners are left with few avenues to change the situation. If there are no more workers to hire, either the current workers need to work longer hours, or the schedule will slip.

In many cases, an owner's schedule cannot be allowed to slip. In this case, the project may be forced into overtime, which has some complex lost productivity issues to assess. Longer hours per week, higher cost per hour, and lost productivity all come into play, and the total cost to the project suffers. If the owner's project completion date moves out, the owner is at risk of losing revenues from the lost time the project building is not in operation.

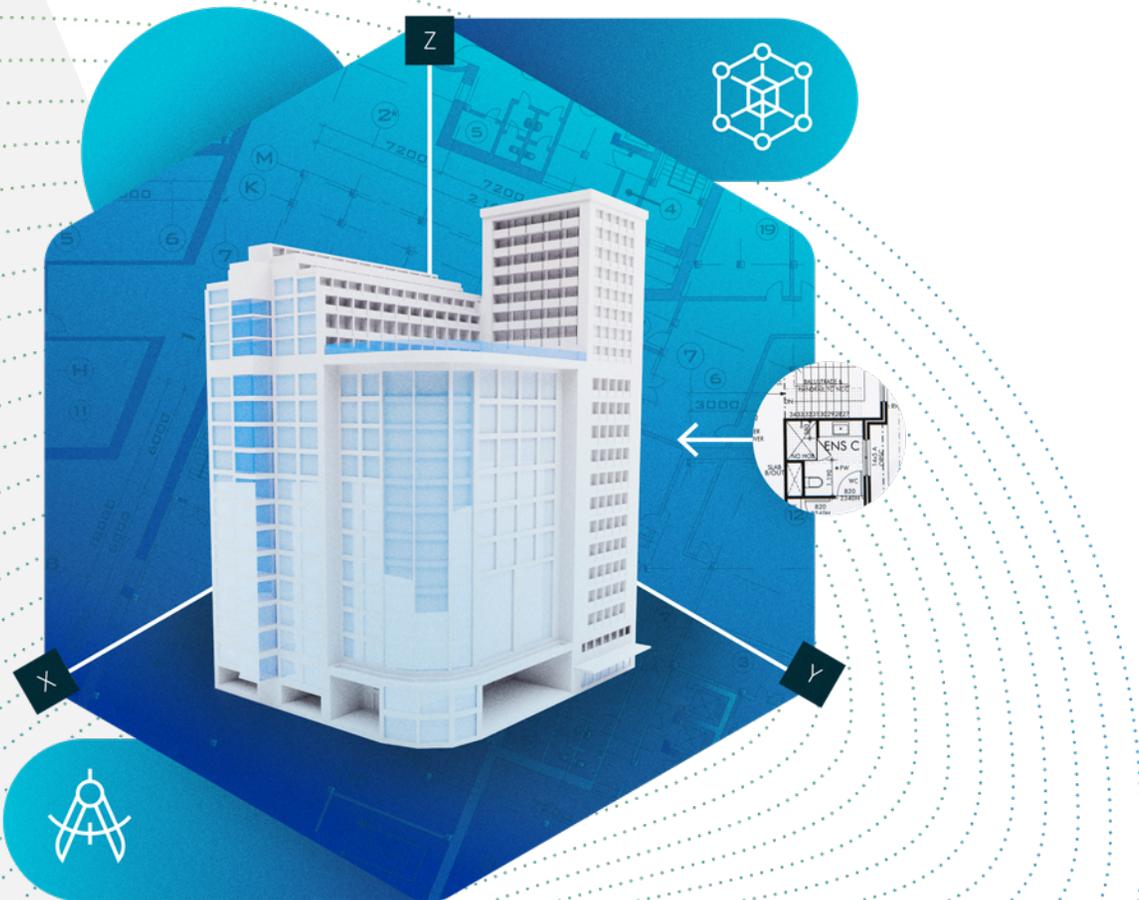
What That Means for Owners

The labor shortage has a two-pronged effect on owners. First, owners will need to consider the flexibility or rigidity of their schedule. If the schedule is tight, they will need to factor in potentially higher costs due to labor shortages.

Secondly, if the bid environment is saturated in an owner's particular sector, subcontractors could potentially be bidding on and perhaps successfully winning more projects than they can handle. For this reason, it is in the owners' best interest to vet subcontractors before awarding a contract to a subcontractor who may not have the resources to take on any more additional work.

Labour shortages put demands on project schedules.

Part 4: Design



The Outlook

Owners should be aware that design risk has been on the rise for several years due to the increasing complexity of project plans.

A team of data scientists at Autodesk recently found that projects with more than 6% of construction value in change orders showed margin erosion. To be clear: change orders in construction are not necessarily a bad thing – they're an expected part of a job. It's when a project hits the tipping point of having too many change orders that represent too high a value of total project value that this pattern of losses can emerge.

“I think the takeaway here is that you need to expect some change, but you also need to invest more time and resources into the earlier phases of project planning to keep that change in the right zone,” said Pat Keaney, Director of Product Management for Autodesk Construction Cloud Intelligence Products. “So, the next question we asked is: what led to those changes? We worked backward to RFIs, which are sometimes early warnings of change.”



RFI Prioritization Is Critical to Success

In analyzing several teams' RFI behaviors across five different software systems, data experts at Autodesk found that projects that prioritized closing more critical RFIs faster were more successful. The devil is in the details. The most successful teams were not closing out all RFIs faster; they were closing out critical RFIs faster.

"This made a lot of sense: the best managers intuitively know which RFIs are the most important, and they prioritized those," Keaney said. "They knew which RFIs had dependencies or could cause schedule delays, and they got those resolved faster."

The nuance this data reveals is that prioritization matters. Many firms collect data that can't necessarily predict project results. What's worse, measuring this data could drive the wrong behavior. But when it comes to prioritization, how do firms know which RFIs matter most? This leads to the next insight that owners should take note of – coordination problems.

Coordination Problems Are a Common Root Cause of Unsuccessful Projects

When the same team of data scientists examined the common root causes of a group of unsuccessful projects*, they found these projects had 50% more RFIs due to coordination problems than the successful projects studied.

Specifically, it is now apparent that poor coordination erodes project margins. If the industry can focus more on improving and standardizing their coordination processes, it will lead to more project success in the future.

*In this case, unsuccessful projects are classified by profit margins.

What That Means for Owners

Technology can greatly reduce design risk for owners. Additionally, owners should require certain design practices, including design review.

Design Review is Often the Answer

According to the data, more than 70% of RFIs could have been resolved in design review.

"I'm sure both GCs and design professionals would agree with this," said Manu Venugopal, who oversees Construction Data and Analytics for Autodesk Construction Cloud. "Our industry is on a mission to figure out how to minimize cost overruns. What we are realizing is that one way to head off unexpected changes is to have a robust design review process. Today, many GCs that I talk to have teams devoted to reviewing design documents and drawings and identifying potential problems and solutions in a more collaborative environment."

To reach this insight, Venugopal's team decided to measure the impact of the design review process with machine learning models that would automatically tag RFIs with root causes. The findings showed that roughly 70% of RFIs stem from design and documentation errors and omissions.

"A more robust design review gives you the opportunity to identify and mitigate a majority of these problems early and make sure they don't reach the field," Venugopal added. "I think the biggest theme we saw come out of all of this, which is something we hear all the time, is the earlier you catch the potential problem, the cheaper it is to fix."

In a world where projects are becoming increasingly complex, design risk is on the rise. For owners, this means requiring that the team they hire is adhering to strict design practices and reviews, utilizing collaborative technology that allows for full transparency in the process.

Conclusion

While it's not a sign that the construction industry is completely out of the woods, the aggregated, anonymized bidding data seen from Autodesk's builders Network points to the fact that projects delayed by the COVID-19 pandemic are beginning to come back online. Not only has bidding returned to pre-pandemic levels, but in some cases surpassed those pre-pandemic levels.

That said, being able to predict recovery has become increasingly nuanced, especially while navigating this uncharted territory. More than ever, owners need to require thorough preconstruction planning to reduce costly rework and generate critical data that can be carried through the entire project lifecycle.

In conclusion, the following are the top four recommendations for owners to help mitigate risk and protect their profits in 2021 based on the four components explored above:

- **Costs:** To reduce project costs, owners should pay attention to the quality of bids presented. Subcontractors should be carefully vetted, looking for a track record of predictability.
- **Material Costs:** With the supply chain being affected by the pandemic, owners will need to look for construction firms that have a quality plan in place to mitigate the potential for higher costs throughout the project lifecycle. Owners should ask about this strategy upfront, opting for a team that will provide clear documentation around their supply chain management.
- **Schedule:** Owners will need to be aware of the potential schedule slippage in the year ahead. For owners with strict deadlines, mitigation will need to be in place as labor shortages continue to occur.
- **Design:** Design risks are on the rise as project complexity increases. Savvy owners will ask about design practices and require a rigorous strategy around design reviews.

In each area, owners need to be extra diligent in vetting bids in the year ahead. The good news is that as technology options improve, owners can now require greater transparency from preconstruction to the final project sign off. Looking for teams that implement a collaborative technology solution can ensure that owners are getting the best price point for the highest quality project completion possible. This can also reduce the number of unknowns throughout the project lifecycle and ensure real-time data is always accessible.

In this way, 2021 can be a successful year for owners looking to start a new project or potentially restart a project that was previously placed on hold.

Endnotes

- [1] [Construction Risk Outlook](#), Autodesk, March 2020
- [2] [October Steel Shipments Down 14.7% from October 2019](#), American Iron and Steel Institute, December 2020



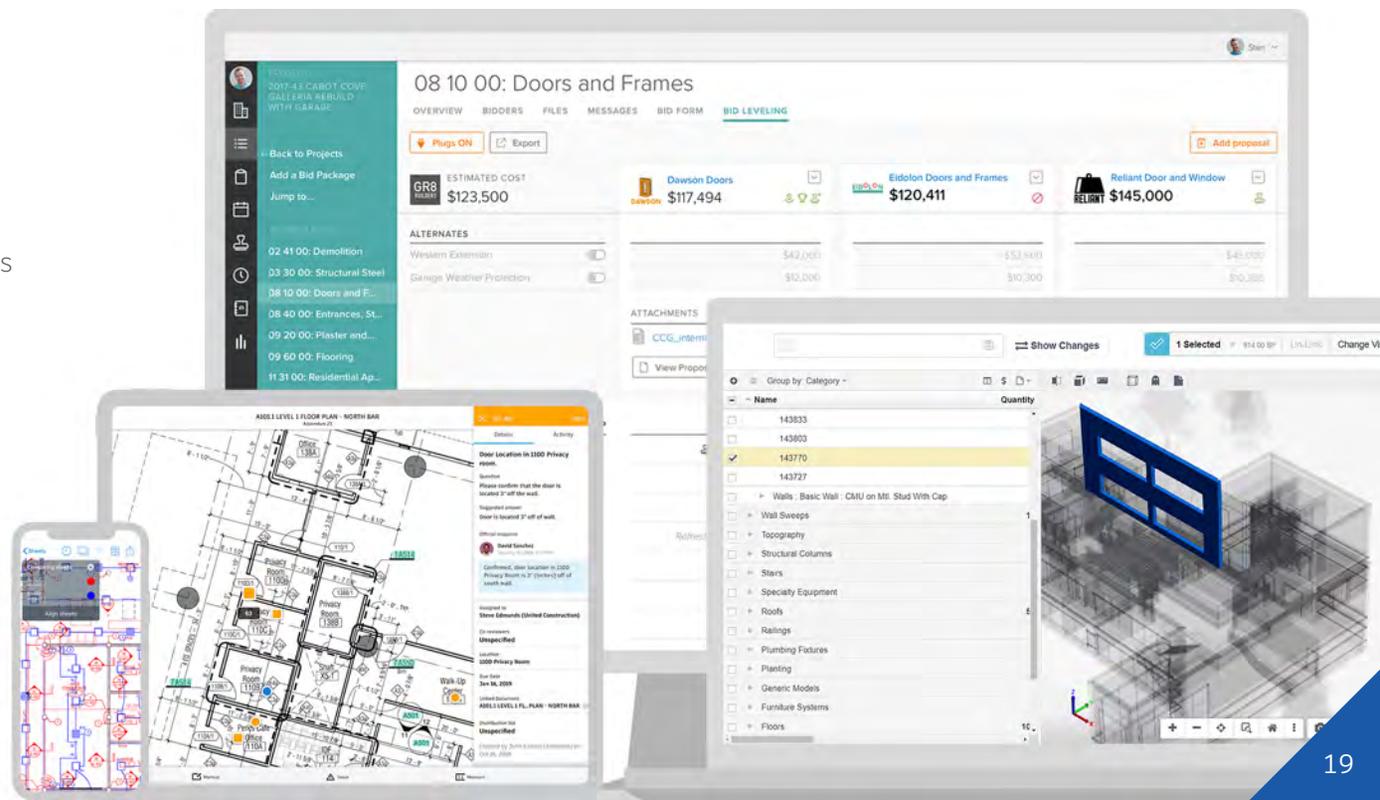
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Our industry requires solutions that connect their information, teams, and technology –breaking down data silos and disconnected processes that hinder true transformation. As we navigate the ever-present push to do more with less, we need to uncover new ways of working, enhance connected digital workflows, and incorporate advanced analytics. To support us on this journey of transformation, we must lean into tools that connect construction – from design to plan, build, handover, and operations.

Built on a unified platform and common data environment, Autodesk Construction Cloud is a powerful and complete portfolio of construction management products that empowers general contractors, specialty trades, designers and owners to drive better business outcomes. Autodesk Construction Cloud combines advanced technology, a unique builders network and predictive insights to connect teams, workflows and data across the entire building lifecycle.

While the industry experiences unprecedented transformation, our mission remains the same: to help construction teams meet the world's rapidly expanding building and infrastructure needs while making construction more predictable, safe, and sustainable. And we've remained steadfast in our promise to deliver the industry's most compelling solutions, connecting data, teams and workflows from the field. This is our commitment to connected construction.





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