

How Tech is Remaking the Construction Industry

Speakers:

Michael Marks, Katerra

Lincoln Wood, Turner Construction Company

Tracy Young, PlanGrid

Moderator:

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(Transcription by [RA Fisher Ink](#))

Ross: Why construction? It is a highly, highly inefficient industry. It's wasteful. It's a \$10 trillion dollar industry where pretty much most projects go over budget, over time, pretty much all the time. I've got three great panelists here today.

We're going to start with Michael Marks who is the co-founder of Katerra. You might know him from his previous life as CEO of Flextronics. So, Katerra, you're not a construction company—that's what you told me on the phone—you're not a tech company; you're a design build company. What exactly is that?

Marks: Well, we are both a technology company and a construction company. But, what we mean by that is we take complete responsibility for a whole project. We design it and we build it. So, we have architects, we have engineers, we're the general contractor, we're the subcontractor, and we're the material supplier. We just do an end-to-end, fully integrated offering to the developers, much like we did the electronics industry—we just had different customers.

Ross: So, you're kind of like a one-stop shop for the developers?

Marks: We are.

Ross: Okay. Got it. You're basically doing, and I might be oversimplifying this, but you're basically doing prefab housing to some degree?

Marks: Well, I don't really know quite what that is. We get a lot of people go like, "you're modular, or prefab, or whatever it is." We make—

Ross: What's the difference between the two?

Marks: We make building components of all kinds and we make them in factories and then we deliver them and build them. But, we don't build boxes in the factory, which is what a lot of the prefab guys are. We just dissect a project into a bunch of parts and we make the parts and we bring them on a truck and we assemble them on site.

Wood: And you're doing them digitally too?

Marks: And we're doing them digitally too.

Ross: And it's not just sort of the windows and the walls—it's the electric, it's plumbing, it's everything?

Marks: We make walls, for example, and our walls come with windows and doors, and sheathing and insulation, electricity, plumbing, drywall. Just think of it as a part—a part number. It's different from prefab, the way a lot of people thought about it, that wall can be any kind of wall. And we have lots of different walls. They're just parts and then we assemble them on site.

Ross: I read somewhere that you can build a 24-unit apartment building every two weeks from your factory in Arizona. Is that correct?

Marks: Yes, but that's probably not the most valuable metric. The more important metric is how long it takes to build, let's say, a 24-unit apartment. And today we do that in about 60 days and by next summer, we'll be at 30 days.

Ross: Right. So the two weeks for you is more about the components at the factory and then you have to go to the site—

Marks: We do that just in time and we don't store a bunch of inventory. We do it as it's needed for the sites.

Ross: So, you basically brought to construction what you sort of did with electronics and manufacturing. I know what you're going to say to this because I've asked you this on the phone, but to me, building buildings seems to be like it would be a lot more complicated, so is it really as simple as you say it is to do this?

Marks: It's breathtakingly simple at the factory level, compared to what I used to do. When you make a cell phone, we might have, in a factory, an electronics manufacturing factory, it costs, maybe \$300 million dollars into a factory and that may be 2,500 suppliers—maybe 5,000 different suppliers—you're responsible for. You know, a factory, to build walls is \$15 million dollars and the inputs of are, kind of, wood and nails. I mean, it's just much, much, much

simpler. That doesn't mean the whole thing is simpler—you know, design is complicated and customers are complicated and there's a lot of different trades involved, so there's a lot to do. But, from a factory standpoint, this is a piece of cake compared to my past.

Wood: The ability for your guys to manage a supply chain is critical.

Marks: Right.

Wood: Right? You're not just the subcontractor, you're delivering the whole product—which is an advantage. It takes a huge investment to do that. That's why it's been a discussion for the last 15 years—

Marks: It's really why people haven't done it. Because being a real global supply chain company is complicated.

Ross: Lincoln is with Turner Construction, which is one of the largest construction management companies in the U.S. You're sort of like the innovation guy there, is that correct?

Wood: Yes, it's my title now, officially. Innovation is kind of a nebulous word, of course. For us, it's been—for me personally, it's been kind of a position that's grown out of design, technology—kind of grass-roots piloting of new tech that's coming out, when you'll hear about Tracy's company. That was one of our earlier companies we used several years ago to start.

But, what I'm doing now is more working with just teams around problem-solving and kind of trying to look at what does our business need. What are our core business needs in trying in trying to bring in tech strategically, and kind of drive this argument—is technology really just getting it out on our job sites and having VR and AR, or is it truly something that we can leverage for our business and kind of have our executive management understand the value of it.

Ross: So, what are you seeing that is sort of really helping right now? Do your guys sort of roll their eyes when they hear the phrase "Silicon Valley is going to disrupt building or construction."

Wood: The disruption part, maybe a little bit but, the Silicon Valley [part] definitely not. Half of my week is spent talking to startups—some are in stealth. My network with early growth companies is absolutely paramount to our competitive advantage in how we're bringing in the technology. So, I'll be meeting with those companies far in advance—we'll never actually use them on a pilot; it's just more or less to learn who's out there—vet them. I work closely with venture capital companies because we share similar kind of interests around understanding. How do we look at technology strategically? They'll obviously look at it from the investment standpoint. We're looking at it from a client's perspective—who would we want to partner with?

Ross: So, Tracy. Tracy is the CEO of PlanGrid. Tracy actually spoke at our New York conference—it was about six months ago. Kind of like what Michael's doing—you guys are also

about cutting, making things more efficient, using data. You had some stats on like, project overruns on megaprojects—can you remember what those were?

Young: Yes. So, megaprojects are billion dollar plus projects. If you're from the Bay Area, basically, every new tech campus that's going up, every new hospital in this region, is over a billion dollars. I mean, it's really sad, the statistics for megaprojects, 98 percent of megaprojects see overruns. Overruns means it's going to be delayed in schedule, it's going to be way above its original project budget, and on average, the overruns in schedule is 20 months. So, that's a long time—you could have like, three babies in there. And then the average cost increase was [about] 75 percent over its initial budget.

Ross: I think you said 80 percent, but that's—

Young: It's 80 percent, thank you.

Ross: So, talk about how your product helps with this.

Young: Yes. So, in a lot of ways, we're all just trying to solve the productivity problem. Obviously, Katerra is solving it a much different way. The construction industry is incredibly fragmented. What I mean by that is, you've got your building owner; they'll hire an architect, maybe. The architect will hire a dozen engineers; they subcontract off the designs. They'll hire plumbing engineers, electrical engineers, structural engineers. And the building owner will also hire a contractor—someone like Turner Construction—and then the general contractor will hire 50 subcontractors. And working for those 50 subcontractors are another, let's say, 2,000 vendors.

So, Katerra is saying, "Look. There's obviously a communication problem at every single step. We'll just take the whole thing—because we're crazy and we're experts at manufacturing—and we're just going to do it all."

For PlanGrid, we recognize that there are 10 million people in the U.S. alone that works in this ecosystem. And so, we're building software to help people communicate better so that there's no arguments, because, a lot of the time in construction projects—and Lincoln, you know this—we're just constantly pointing fingers at each other because we're seeing these massive overruns, but we don't understand who screwed up. But, you should be able to see that in the data.

Ross: So, {Michael} with your stuff, if there's a screw up, it's on you guys, right? Because you own everything—

Marks: No argument. We save a lot of time there—it's ours. It's us! I have to add to something Tracy said. It's a little off script, but this is a fantastic statistic that I got just recently. There are 730,000 companies in the United States that are somehow involved in the construction industry.

Ross: How many?

Marks: 730,000 companies. The average number of employees—10. There's no industry that looks like that. It's nuts that there hasn't been a consolidation.

Young: Yes. The top firms like Turner Construction only employ 5 percent of the workforce in construction. That's unbelievable. Every other industry the top firms employ, I want to say, like—okay, I'm not an expert here—but maybe 25 percent to 50 percent of the workforce in that industry.

And so, what you see is these terrible margins in construction general contractors. I mean, on a good year, maybe 4 percent margins. Talk about restaurants having like the worst margins. No, it's construction!

Ross: It's construction.

Wood: Yes, I mean, I'll interject for a second. It's definitely an industry that's looking to improve. I think, as everyone is full well aware, McKinsey everything, capex is the same ag, I think we're at the bottom. So, it's interesting to see where we can be strategic as we digitize. Other industries, obviously, have looked at this strategically, maybe even in advance of construction. But, where we're at right now is exciting. My role is an opportunity to solve a big problem.

It's going to take multiple stakeholders—some are going to be outside our company—and that's a culture that's going to have to, you know, something people are going to have to understand.

Ross: So, I know you are with PlanGrid. Are you guys frenemies?

Marks: Let's do it! We just started talking about it today.

Wood: So, you know, digital fabrication, using robotics—it's something that even our competitors are looking at. You know, it's something that Turner strategically works with subcontractors who are doing those things. So, we should be talking.

Ross: Talk a little bit about the types of buildings that you guys build, or produce, or design.

Marks: We're primarily serving the five segments of residential. And so, that's, you know, multifamily, senior living, hotels, hospitality business, dormitories, and single family. And we're, unlike Turner, we're 12 stories and down. So, we don't do type one high rise construction.

Ross: So, is there a limit to what is, sort of customizable within that?

Marks: No. No limit at all.

Ross: No? And yet, so you can basically design something that could be plonked down on any plot of land?

Marks: Yes. We just started building high-end homes in a resort community in Idaho. We took the designs from the resort owner and converted them digitally and turned them into walls and we're building the things in four months—and they're used to it taking 18 months.

Ross: Wow.

Marks: It can be anything.

Ross: So, Tracy, when we chatted, one of the things that you told me was about the huge shortage of qualified construction workers in the U.S. I think you were talking about it. So, let's talk about that a little bit, because you're starting to see—what will construction workers need—what skills do they need in five years that they don't have now, and give the amount of construction that's happening, how do we actually keep up with all of this?

Young: Yes. I think there's a few reasons why we have this massive labor shortage in construction. We obviously went through, in 2008, one of the worst years, actually several years, for construction unemployment. I graduated from university in 2007—worst time to come out with a construction engineering degree—but I was lucky enough to work on this hospital project, so I stayed employed. And so, we went from like, 10 million people who worked in construction—in let's say 2006, 2007—and unemployment was like, up to 25 percent in the construction industry.

And so, people were just so jaded because that had given like, 20 years to the industry and they were just fired one day, right? And so, the work force is aging—that's another problem—and it's just like this really not sexy industry, which is really disappointing as a construction engineer, because it's so rewarding—

Wood: Speak for yourself, Tracy.

Ross: You guys are going to make construction sexy.

Young: —so rewarding! I mean, I've always wanted to be a builder and that was what I went into. And so, they're just not attracting this new generation of builders. The universities are stepping up. The unions are stepping up. I mean, if you look at the industry, it's 91 percent male.

And like, I'm telling you, females can work just as hard and good in the construction industry. In fact, one of my best friends is a superintendent and he's like, texting me. He's like, "We're seeing a lot of female carpenters coming out into the field and they're good." And I was like, "What the hell did you expect?" And so, like—

[LAUGHTER]

We're missing out on like, half of the world right now. And so, we work really closely with trade unions and what we're seeing now—like even the international carpenters' union of the brotherhood of carpenters—is posters of the sisterhood plastered everywhere. Because we

know that if we could recruit the women into this field, we wouldn't have this problem. Five years from now, to answer this question, I do think that PlanGrid is not planning to go anywhere—and there's all these new startups that are coming into the space. I do think that there are basic tools that other industries have leveraged that would totally benefit the construction industry. So, I don't think it changes building—

Wood: I think it goes back to what I was saying: How can we work together as our business changes and evolves. I'd like to think that we can make it an attractive environment for the best and the brightest. And that's kind of what I'm working on right now is trying to create an environment where people can take an idea and run it up through the company and build it, test it, integrate it up, and scale it through the organization. And so, that is something that—the lights are turning on—people are realizing that lean manufacturing doesn't always equate with innovation, and it has arrived. Technology has arrived. How do we strategically integrate it into our business to allow our younger generation to get excited, have the entrepreneurial bug, but also drive our business? I'm very passionate about that.

Ross: So, Michael, you told me you guys are growing pretty quickly it seems. You've got a lot of demand for what you do. So, what types of people are you hiring?

Marks: Well, I'll start with, Tracy, we have 34 percent women in our company.

Young: Good job.

Marks: And your number is exactly the number we use—9 percent women in the construction industry. So, we believe in gender diversity and ethnic diversity. Where we live here, you get ethnic diversity for free. You don't get gender diversity for free.

We're hiring—we're trying to hire as many young people as we can. Tracy pointed out exactly what the issues are. It's a very aged population, the construction industry. And you know, the weakening of the unions has had the negative effect here—is that unions were where most people got training. The apprenticeship programs—there are not as much of that today. We're hiring a lot of people out of school. We go to a dozen universities and out to recruit, and it's—you know, architects, engineers, you know—for them to do a lot of training though.

Ross: But mostly they work for you in the factories, or do they on the side—

Marks: In the factories, on the field, we build this stuff. We have people in the field, we have people in the factory. We have a hundred data scientists and software engineers doing various kinds of technology developments.

We're doing developing energy systems and so on. It's like a regular company in that—think of it as a manufacturing company and we have all the different disciplines and we're hiring young where we can—and the main reason we're doing that is because people from the industry, in general—don't take any offense—are pretty old-fashioned in the way they think about this, and it's sometimes hard to change their mind. So, we're trying to start as young as we can.

Ross: And your co-founder is actually a construction guy, right?

Marks: Multifamily developer.

Ross: Good. Okay. I'm going to go to questions soon, so if anyone has, put your hands up so the mike handlers can come. I think there's one over there lurking towards the stage.

Apple: Marty Apple. One simple question. How much have you cut carbon emission in the whole processes of developing construction over the last decade and how much more do you think you'll cut it over the next decade?

Marks: I'll take one part of that. One of the things we have as a mantra is to get rid of, as much as possible, concrete, which is responsible for 5 percent of the world's CO₂. And there are many ways to do that, so that's a big hitter on CO₂ emissions.

Ross: You guys all actually talk about that a little bit in terms of the social responsibility. When we spoke on the phone, you said that's actually helping—you basically said you guys concrete the world. So, it's something that you really have to start thinking about—

Wood: Just our footprint, right? It's that we work in 60 countries, you know, \$14 billion dollars in revenue a year—so I'd like to think that, you know, if we can tweak the dial or we can move the needle somehow, incrementally—whatever—you know, that will be impacted. And that's—I find there's a social responsibility in that for us a company.

Young: And quick funny story—since we're talking about concrete—I remember having an argument with my superintendent ages ago, about some technical thing.

Ross: What is a superintendent in the construction world?

Young: Superintendent is like, the king of the job site. This is the person that runs like, a 500 person crew in the field.

Ross: So not like my super in New York who takes out the trash.

Young: The most experienced person on the crew running the job site. Anyways, quick story. He then said to me, because we were arguing about something; he said, "I have poured more concrete than you have walked on and this is a measurement of your experience in construction!" That was funny, guys!

[LAUGHTER]

Wood: See, it's not sexy.

Young: But emissions is a massive problem, right? So, 30 percent of the world's greenhouse gas emissions is attributed to our structures, our buildings, construction—and that's like, awful. It's going to take everyone to step up to do something about it. Concrete is a good place to

start because it's 5 percent of it. But it comes down to the materials we use, how we design our buildings, how we build our buildings, etcetera.

Wood: Right. And I think sustainability has obviously been a major focus of the industry for the last 15 years. I mean, Turner—we helped build that council around LEED, but what could we do more than that, right? And how can we actually be, you know, working with technologists or, you know, thinking more creatively about what we need to do for the next several decades.

Ross: One of the things we talked about is, for you—you said that, one of the drivers for you—which I thought was sort of unusual in this—is that, you actually view what you're doing as helping improve things for the humans in the industry.

Young: Yes.

Ross: Talk about that.

Young: Well, as construction people, we just don't have the luxury of working close to our job sites. So, everyone in the construction industry, unless you're in manufacturing buildings, you have this awful commute. We're talking like, two hours each way, if you're lucky.

And there's also this massive re-work problem which means that we're constantly building off of the wrong information—which means, we're stuck behind the job site re-doing our work and not getting paid for it. And so, everyone has to work overtime. We spend so little time as construction people at our own homes. And this is like, peoples' livelihoods. So, if we could just make people 1 percent more productive, given that this industry revolves around like, \$10 trillion dollars—\$10 trillion dollars per year and however many millions of people—if we could just make them a little bit more productive and save them a few minutes each day, we're saving humanity hours, years.

Ross: Question over there I think, Michael?

Michael: You were just telling us the topic of productivity—the construction industry obviously has had lousy productivity numbers for a long time; it hasn't really improved in many years. How optimistic are you that the new techniques that you guys are talking about here are going to move the needle, in say, the next five years? How big of a gain in productivity would you expect?

Wood: I'll take that. I've heard a lot of people say they're optimists. I am an optimist too, at heart, but being in this role and seeing things get tested and technology coming in—it's a little bit slower than I think people think. And I think it goes back to contracts and the way we build partnerships across, you know, from the owner down to the subcontractor. How can we kind of redesign some of those partnerships—because there's a lot of restrictions and regulations around how we have to work together due to those contract structures.

But, all of that is kind of being developed. Certain regions of the country do things a little differently—a little bit more aggressive with different types of contracts. But, I think technology definitely plays a role. It's just, I go back to the same thing. How can folks like Turner be working strategically with folks that are outside of Turner—and inside—but, how can we team up? I think that's going to really drive this.

Young: Another way PlanGrid looks at it is, how did the rest of the world become more productive? So, by and large, everyone has seen a massive increase in labor productivity over the last 60 years and certainly in the last 20 years. But construction has steadily declined; we are less productive today than we were 60 years ago. This is unbelievable!

When we look at other industries, there's a lot of economists that have detailed research on what has driven productivity in these other industries and they boiled it down to four things.

It's increase use of information technology, so they started using software. Two, digitization of data because paper sucks. Three, increased competition through globalization. And then four, something as simple as just process and organization change, which I think is what you're tackling.

PlanGrid is tackling the first two. Let's use software in construction and really—the first time you can use software in the construction industry was when Steve Jobs announced the first-generation iPad. And then, digitizing all this paper on the job site. So that's what we're tackling.

Wood: Tracy is a technology person now and used to have the construction background. Like, what is next?

Young: What is next?

Wood: Yes. Your company is obviously built on, you know, PDFs and the iPad—

Young: Yes, yes. We're crazy. We've got this big conference coming up in June; I hope you attend. We're going to be unveiling a buttload of new products. Lots of stuff. Come over to my office; I'll show you.

Wood: Okay.

Ross: What is this big conference?

Young: PlanGrid conference.

Ross: You do a PlanGrid conference?

Young: Yes.

Ross: Oh, my. Why would anyone want to organize a conference? More questions.

[LAUGHTER]

Jeffers: Hi. Cindy Jeffers. I was wondering, what are the most disruptive technologies that are coming to construction?

Young: You look at technology all day.

Wood: I know. We kind of look at three different horizons. Some of the stuff is kind of out there, emerging tech that we want to be aware of. Some of that we're looking at in autonomous rovers, things that can track our job sites, visually document our projects autonomously, given that the fact that most people, like you were saying, have no time to do any of this kind of work. So, how can we take away some of the work that, ultimately, either isn't getting done, or is just painful for the worker to have to do.

And then, you know, we look at stuff that is incremental—stuff that actually helps my leadership team understand—how does innovation work with our business and the current next few years. So, we look at things like digital time keeping, putting out Wi-Fi access points out to our job sites that are, you know, connected through Bluetooth so they can kind of, light up our jobs for connection. Things that maybe don't sound groundbreaking, but in the end of the day like, to a lot of our teams, are highly, highly instrumental.

Ross: So, I'm curious—any one of you can take this—do we actually get to a point where you don't need manual labor anymore to build buildings and things?

Marks: Yes.

Ross: Really?

Marks: I'm having a very different answer on the productivity thing. I think for the productivity question, we get 50 percent productivity in the next 24 months. But, understand—I don't build concrete steel high-rises in downtown urban areas. But, the answer is, we're using automated processes in factories, we're taking a huge 70 percent of the labor off the job because we just assemble these buildings instead of constructing one piece at a time.

I mean, of course. You're never getting rid of people—we're not trying to get rid of people altogether, but we're trying to automate everything that can be automated.

Ross: So, your job site would be different to the average job site in that less people—

Marks: Every time you drive your car down a street—you see a guy taking a 2x4 out of a truck and getting a tape measurer out—that is going away. Turner doesn't have that kind of work. I mean, this is basically three stories or five stories and down, [and] wood construction and that is very different. But, you know, if you go to Germany or Japan today, there is no stick build. This isn't rocket science.

Ross: There's no what build?

Marks: No stick build. That's what they call it, where you go get a 2x4 and you nail it in place and cut it to size and you go get another one. That's called stick build. There is none in Germany or Japan, but it's everywhere in the United States.

Wood: Yes. It's interesting because sometimes the discussions I have with these companies, you know, the people in our industry don't go to the machine or robot. Essentially, if we're going to automate, right now, they have to come to the worker. So, it's this idea of augmenting or helping them in their tasks. And so, we're working with some companies that are looking at different phases of construction—they won't take the whole phase of work. They'll look at the drywall, for instance, or scaffolding and try to kind of, automate that, but out in the field.

Young: I think you guys can totally count on the commercial space if you wanted to. If you look at high-rise condominiums, for example, the space that you just said you don't do—I mean, you look at the common rooms. There's like, a hundred bathrooms and they're exactly the same and perfect. You can build them and just drop them in. Or, let's say exam rooms in hospitals.

Wood: That's really tricky though, just when you brought that up because as we implemented prefab out on our projects, like when you have different tolerances—some are, you know, the site build construction tolerances—there's so much more wiggle room than when you get in the prefab because it's so exact. So, I really like the model you guys have because you're owning everything. When you try to hybrid it, it's really tough. It's really, really tough. Because all those connection points on the project—physical environment—you leave that to the hands of, you know, a team to install it, and they're like, "Well, why aren't these bolts lining up perfectly?" It's just, not how it would work.

Ross: So, I think things that people, sort of, might not know about—underestimate—is that on a job site, you can bring all this stuff in and things actually don't fit together because of the heat or the humidity, or the damp or rain or whatever else—

Wood: That's why most companies need to have industry experts. In our industry, I feel that as far as construction is concerned, I know you guys have hired great talent. So, that's going to help you.

Young: Right.

Ross: So, what will a job site look like, from your perspective, in five years' time?

Wood: I hate this question. Sorry. You know, I think you're going to see more and more sensors out on your job site. You're going to see more collection of high-frequency data that's being generated every day. Because we have trailers which were our offices out on-site, and they called that the field, but in reality, it's computers and a nice little trailer not physically on the project. So the information from those trailers out to the job site—there's just a lot of lag.

Ross: All about IoT then.

Wood: So, yes. I don't want to—yes. Potentially.

Ross: Sadly, we are out of time. Thank you guys so much and thanks a lot!

[APPLAUSE]