

## Digital Twin Seminar | Bentley, November 11, 2021

Connie:

Thank you for joining the call today. Which is for J.P. Morgan equity high touch clients of research advisory or MiFID out-of-scope clients. The call is for institutional investors only. Therefore, if you are a corporate client or a member of the press, please kindly disconnect from the call. For those of you who might wish to share this presentation with other colleagues, we want to let you know that this session is being recorded and Bentley will make it available for subsequent viewing on Bentley's investor relations website, [investors.bentley.com](https://investors.bentley.com). I will now pass you over to the J.P. Morgan host for this event, Jackson Ader.

Jackson Ader:

Wonderful. Thank you very much, Connie. Good morning everybody. As she mentioned, my name is Jackson Ader. I'm a software analyst here at J.P. Morgan. We are thrilled to welcome everyone to another session on our digital twin seminar. We have Greg Bentley, founder, chairman, president, CEO, a number of different titles Bentley Systems and Nicholas Cumins, chief product officer. Just a quick reminder, if you'd like to ask Greg or Nicholas any questions all Q&A are going to be through email. My email's on the screen [jackson.e.ader@jpmorgan.com](mailto:jackson.e.ader@jpmorgan.com). But I'm just going to hand it over to Greg and Nicholas. They have prepared a presentation that will last about a half-hour, and then we'll jump you more of a fireside chat after that. But Greg Nicholas, please take it away.

Greg Bentley:

Thank you very much for your interest, in particular, infrastructure digital twins. And of course, that's our interest. We consider ourselves a Bentley Systems for those less familiar to be the infrastructure engineering software company. Because that's what we've worked on since founding, in fact, by five Bentley brothers. And we have just surpassed a billion dollars in annual revenues and those revenues are broken down this way among the world's infrastructure classes. And we consider that we're the market leader in those segments in green and in public works utilities overall. All of which, are great opportunities for infrastructure digital twins. We consider the leader in structural and geotechnical disciplines that underlie all of those infrastructure assets and the potential for infrastructure digital twins. So another way to look at, in fact, our own history as a company is we began with infrastructure modeling applications.

Greg Bentley:

There was one and now many that are based on a platform and then the simulation applications here came later. Then we focused on collaboration for infrastructure, project delivery and then asset performance and have become the most comprehensive for the infrastructure life cycle. But there's an additional opportunity because the applications for modeling and simulation especially tend to be used once during the life cycle of an infrastructure asset. They're used for a certain deliverable and ever after they're immutable blobs that are not open to being reused for the continued resilience and adaptation of the infrastructure asset over its life cycle. So that's the opportunity for an infrastructure digital twin. Across this life cycle, a cloud service that can be added incrementally to reflect up the data and functionality from all of these modeling and simulation to add intelligence over the life cycle of the infrastructure asset.

Greg Bentley:

So that is the infrastructure digital twin opportunity. And our approach to it can be incrementally added to wherever our users begin. So another institutional way of looking at that beginning is we started with computerized design and then GIS geographic information systems, arguably went from 2D to 2.5D. We added the collaboration by way of ProjectWise and AssetWise and the 3D BIM applications, of course, which continue to advance and will always advance. But then when we introduced our cloud service for the purpose in 2015, I actually didn't use the word digital twin. I wouldn't let us use that term until it turned out a new innovation called reality modeling was introduced. And I will explain that further, that enables us to move now to 4D digital twins for the life cycle span of this opportunity.

Greg Bentley:

So especially what is reality modeling and why do I think that infrastructure digital twins are qualitatively different than product digital twins? A product digital twin could correspond to a notional abstraction a product design at a point in time. But infrastructure consists of assets that are particular instances and are constantly changing. So we say that an infrastructure digital twin needs to capture its digital context. Of course, it's 3D. So it's not a twin if it's not 3D on the digital side, but they don't happen to exist 3D models produced by our applications for most infrastructure assets. Most are ground fields. But with reality modeling available since 2016, from overlapping imagery from photographs or laser scans where needed, one can process through our context capture software the overlapping imagery into a reality mesh which is a 3D engineering ready model that captures the digital context.

Greg Bentley:

So you can have an as-operated 3D model for any infrastructure asset. And then the veracity of a digital twin, that's not enough for a digital twin that's necessary but not sufficient, comes from the digital components, the engineering applications, which need to be semantically aligned. Whether there are applications or any other applications. We synchronize from those semantically and spatially aligning and using machine learning to recognize the components in the reality meshes to correspond to that engineering data. And then the last thing needed after digital context and digital components is digital chronology over the life cycle because the ledger of changes and the pattern of changes is what's valuable in the infrastructure digital twin to provide all of these advantages. And especially, I'll talk about the convergence of the IT, OT, and ET for this purpose. But here's an example. I'm using the example of communication towers because all the communication tower codes are demanding digital twins now because they have the opportunity to add 5G capacity to their towers.

Greg Bentley:

Every time they do that, they have to reanalyze for structural loading and wind and so forth. This is the process of using drone surveying to create the reality model, digital twin, which as you see, can even be to millimeter accuracy depending on how many overlapping photographs are processed with our software. And then machine learning is used to recognize in this case, the antenna equipment and then applications to determine what the structural and wind and electro magnetic force interference is and so forth. So that they know what capacity they have to safely operate their towers. So you could say for a communication tower, digital twin, just as an instance of an infrastructure digital twin, it starts with the operational context captured by UAV's. It could even be, by the way, from cell phones to produce overlapping photographs. We have an app for that. For inspections in the field to create these reality measures.

Greg Bentley:

And that would be the nervous system for this digital twin. And then the engineering logic, the engineering models that exist for the tower and the equipment and machine learning to recognize and classify and correspond that is the brain power for the digital twin. And then the heart of it is the change ledger in the cloud service, which supports the immersive visualization and the analytics. And then a final step we could say is to add IoT devices. I think when you look at it this way, I know some of you as investors will have gone through perhaps the trough of this illusion with industrial IoT, where streams and you can drown in lakes of data. We won't have that problem with infrastructure digital twins because there exists the ET and the IT to make sense of it.

Greg Bentley:

The frame of reference to know what's actionable and provide the insights from that. From those IoT sensors, for instance, on the communication tower that would measure wind and seismic threats, electromagnetic phenomenon, and so forth. So making the infrastructure digital twin a living digital twin with the introduction of infrastructure IoT. Another example there would be going the right direction here, a roadway or a bridge digital twin. And this is a project from Korea where they set about to find out for \$10,000, could they sufficiently instrument a roadway bridge? And you can spend orders of magnitude more than that adding sensors. But it turns out if you take advantage of the structural models that exist for the bridge, then you can use video for instance, as very inexpensive sensor. And they found that they could have infrastructure digital twins for their bridges to maintain their safety and resilience, very affordably.

Greg Bentley:

So another living aspect potentially for infrastructure digital twins is below the surface. Earlier this year, we acquired Seequent to become the leader by far. It's about 10% of our company now. It's for subsurface digital twins, including especially environmental factors, and water seepage, and flood resilience and so forth, depend on subsurface conditions. And so one could have, for instance, digital twins now for earth and dams that connect all of this up and are priceless in what they can do. So we say that this notion where the digital twin can be added wherever you start. Let's say there's a project digital twin. So this example is a rare infrastructure project that made it on the front page of the wall street journal for a success story. Two years after the tragic collapse of the bridge in general, the replacement bridge. We can't take any the credit for the rainbow in the wall street journal picture here, but the bridge project succeeded in two years with an architect design bridge in Italy. Multimodal and ready for lifecycle use of the models by virtue of a project digital twin approach using our software.

Greg Bentley:

Construction is always about the occupancy of space and time. So a 4D digital twin is the natural solution for infrastructure projects in that respect. And then an asset performance digital twin, in this example, this is the center for digital built Britain in Cambridge where they have a national digital twin day and shows the reality model capture. Including, in this case, in their engine room where the asset reliability environment with our software is connected up to for an asset from performance life cycle digital twin. So to describe our platform approach to this, may I introduce our chief product officer Nicholas Cumins.

Nicholas Cumins:

Thank you, Greg. Hello everyone. So we believe digital twins are a paradigm shift for the infrastructure industry. They're also fundamental to the evolution of the company. Now we don't see ourselves as the infrastructure digital twin company. We see ourselves as the digital twin platform company. So I need to explain a bit. When I joined Bentley about 14 months ago, what I saw is that the company had built a great platform made of cloud services that are used to create and leverage digital twins in infrastructure workflows.

Nicholas Cumins:

Close. What also saw is increasing number of use cases for potential digital twins. So much that not one vendor can actually address all of them. So clearly this is about an ecosystem. In order to address all of these use cases and it does create an opportunity for us to provide a platform for that ecosystem. So our opportunity as Bentley is to be the platform for infrastructure digital twins, to be the platform of choice for infrastructure digital twins. So what is that platform and what makes it unique? Five things actually, first of all, our platform is purpose built for infrastructure digital twins. You can use some of the services independently and deploy value on their own. You can use some of the services of the platform to visualize, for example, some engineering data coming from some application without having to access that application. But of course the beauty is to be able to leverage all of these services in the context of a digital twin. Second, that platform is proven. The company had been added for a while when I joined and we're still investing a lot into that platform. It's proven because it is used today in multiple use cases across the infrastructure life cycle, through applications that are coming from Bentley, through applications coming from partners. It is used today to power digital twin, so it's proven. Third it's fundamentally open. The core of it. The core of the platform is open source. Why is that important in the infrastructure industry? The life cycle of an assets can be 5,100 years. So you do not want to have any vendor lock in if you want to have a chance for your platform to be adopted by owners, operators and other companies. It is open because of the breadth of file formats that the platform is able to ingest.

Nicholas Cumins:

Whether we're talking about ET, IT or OT data, as Greg was explaining, whether we're talking about file formats that are preparatory to Bentley or other vendors, even competitors or standard formats. The platform is able to ingest all of that. And it's open in a sense that it's interpretable with all the platform, for example, Omniverse from Nvidia. Third it's the most advanced platform for infrastructure digital twins. At the heart of it. It is its trends, its ability to synchronize, to align and to aggregate data without losing any of the quality of that data of that engineering quality so that it can be used in engineering workflows. You might see some other platforms out there who do a fabulous job in creating a beautiful visualization in 3D, and even 4D of an infrastructure asset through a mesh, but it will be at the expense of the quality of the data.

Nicholas Cumins:

And therefore that representation cannot be used in engineering workflows. Well, that's not the case with the iTwin platform. We make sure that as we synchronize and align and aggregate that data, we are not losing any of that quality. And along the way, of course we are tracking all of the changes to that data. So you can roll it back to understand who change what for what reason you can roll it forward to address questions, what happens if and so on and so forth. And then last piece, last point is flexibility. The platform can be used to create a digital twin from a design model or simply by capturing reality. It is

flexible in a sense that it runs on public and private cloud platforms or default public cloud platform is Azure, but you could run it also into a private cloud platform like Azure government cloud.

Nicholas Cumins:

And it's flexible because of its pricing model. It is based on consumption. You only pay for what you use. Next slide please. So if I look at the history of Bentley, this is not the first time we've been building a platform. In fact, our first platform was micro station and Bentley had an ecosystem of ISVs creating vertical application based on micro station. But what we're talking about now is building a platform and an ecosystem, which is an order of magnitude more sophisticated, broader than what we had with micro station, because we are talking about an ecosystem of partners creating solutions that cover the full scope of the life cycle of the infrastructure, not just 3D design applications in design engineering, but digital twin solutions in construction, or even in operations, which is where actually 80% of the life cycle costs of the infrastructures are incurred.

Nicholas Cumins:

Next slide please. So the approach we're taking to building up that ecosystem first and foremost is comprehensive because we intend to move the entire industry forward together with our partners. We are reaching out and working with strategic partners, such as Microsoft, Siemens, knowledge partners such as the digital twin consortium of which we're a founding member, system integrators, digital integrators, and ISVs. Now it's a long term play for sure how long, how far out. We at the start of our journey. And we know that it's going to be a marathon. It's not going to be a sprint.

Nicholas Cumins:

If you can. Next slide please. So in order to ramp up the ISV part of the ecosystem, we've established the iTwin ventures fund to invest \$100 million in startups, early stage companies to evangelize to use the iTwin platform to create digital twin applications. And we are on track to meet our first year goals. We just announced actually investments into two companies, Pure AI and Hertz. We've also launched a iTwin ecosystem sponsorship program where we offer grants to both ISVs to create digital twin application using the iTwin platform and also a two system integrators so that they can build up their team, their skills in leveraging the iTwin platform to create digital twin solutions. Next slide.

Nicholas Cumins:

Now the infrastructure industry is at a pivotal moment, build back better means obviously building better infrastructure, but it also means building better and building better means building digitally. So one of the most fundamental changes in our industry is the role of the engineering firms. They are truly going digital. So what do we mean by that? Increasingly when they hand over the infrastructure asset at the end of their project, they're heading over a digital twin of that asset. And in fact, in the recent survey, almost 40% of the CEOs of engineering firms expect that in three years, their clients will require that they deliver digital twins and simulation results together with infrastructure assets. Now, many of them are actually going one step beyond they're going beyond the handover of the infrastructure asset and the digital twin to the owners and operators. They are offering digital services to the owners and operators powered by digital twins.

Nicholas Cumins:

In fact, almost 50% of the CEOs of the same engineering firms expect digital twins to be the most valuable in operations in 2024. So what are they doing? They're establishing digital business units.

They're actually truly becoming digital integrators. Now, when I talk to CIOs and CTOs of these digital business units of these newly reformed digital integrators of these engineering firms, I really tell them that they shouldn't have to resort to DIY, to do it yourself. I tell them that they should leverage our platform and focus on creating these digital twin solutions on top, especially as all of them will say that their number one challenge is their ability to attract and retain talent. They have to be able to do more with less. They have to be able to do more with the team that they have at hand, and therefore it will be a waste of their time and effort to build everything from scratch.

Nicholas Cumins:

So we encourage them of course, to use the iTwin platform, to create their solutions. Now, digital twin solutions are a way for engineering firms to leverage their domain expertise, their proprietary analytics, and even to innovate on their own business model by taking responsibility for the outcomes of the infrastructure assets, they are uniquely positioned to do this, that we think this can be a significant enhancement to the enterprise value. Now we serve as a platform for that transformation to them. We are not at all into the data business. We are not into the analytics business. We are truly a platform business back to you, Greg.

Greg Bentley:

Thank you, Nicholas. And I'd like to conclude here with helping you as investors to or be oriented and calibrate how far this has come infrastructure digital twins. So, first of all we have a going digital award series. That's part of our year in infrastructure event, virtual event, that's going on now. So hundreds of our accounts nominate their projects for going digital awards, independent juries boil it down to 57 finalists in these 19 categories that are shown here. But I want to report that this year 36% of the finalist credit reality modeling, the continuous surveying process I described from overlapping imagery to start with the reality mesh and engineer to that capturing in effect the beginning of a digital twin. So that's 36% significantly up. This didn't exist. Wasn't possible five years ago. There's one in particular I'd like to bring to your attention because it won the next reality award in Microsoft US this year at their ignite conference and it has to do with bridge inspection.

Greg Bentley:

So in the upper left here is the way it's traditionally been done on this bridge in Minnesota an engineering firm used reality modeling, our context capture and the Microsoft mixed reality, including HoloLens, as you can see in the lower right to a step change in improvement in bridge inspection can be pertained to any bridge or any asset actually. And so it's mainstreamed now on the main stage for Microsoft. And of course this enables the engineer to be virtualized and the right engineer do a better job of inspection and resilience of such infrastructure assets as this. And then coming right up to the present this week. If we all wondered what Jensen Huang video would reveal, it was our iTwin for the Nvidia Omniverse. And we all want to be well versed in this. I'm going to show on the right iTwin for the omniverse in the case of the design of the rail station on the left is the unreal engine.

Greg Bentley:

So all of these immersive environments, the better they get the more valuable digital twins are. And the immersive environments in these meta versus anomal versus are great for 3D visualization and navigating scenes, which could be actual infrastructure. But for infrastructure engineering, you would like a 4D visualization. As you see, for instance, on the left with a time slider that needs the iTwin platform and it's ledger of changes of the physical and engineering reality over the life cycle of the

infrastructure so we're unique in being able to do that and eager to do that with all of these last mile, go to market visualization.

Greg Bentley:

That can be 4D visualization environments when used with the iTwin platform. And then there was reference to the news of the day. Of course, the UN climate conference in Glasgow is prioritizing the work for civil and structural and geo technical engineers, but here's Goldman Sachs estimate of \$6 trillion a year needed annually in investment to meet those goals. You could translate those to our areas of market leadership. Now those are needs, but in the US finally we have incremental

Greg Bentley:

Investment for infrastructure. This incremental investment can likewise be mapped to these needs. The point is even if you had all of that investment, you could only add a bit of capacity to our existing infrastructure. The infrastructure we depend upon for all goals, including energy transit, resilience, and adaptation, is the infrastructure we have today.

Greg Bentley:

And infrastructure digital twins are the most economical way to capture and increase their fitness for purpose, taking advantage of the modeling and simulation that already exists for most of these assets and making it available in ways that I'm going to suggest could be priceless.

Greg Bentley:

So we don't know forensically what were the reasons for disasters such as this one yet, or I don't know, probably had to do with some subsurface conditions, some construction inspection issues, and aging and deterioration.

Greg Bentley:

But if there would be a living digital twin, I'm confident that we could avert such disasters in our infrastructure as occurred in our own country this summer and elsewhere in the world this month.

Greg Bentley:

So I want to conclude here with examples. These are the 26% of this year's finalists unveiling digital awards who credit explicitly our I twin platform for their digital twin endeavors.

Greg Bentley:

And here are to start with a bunch of them, which where the projects absolutely had to be done during the pandemic years. So they advanced ahead in adoption of digital twins so that they could work virtually everywhere and with everyone to get this done.

Greg Bentley:

An example here, I think on the lower right, is the world cup soccer for younger players. They couldn't have gotten that project done during the pandemic without digital twins and advanced that significantly.

Greg Bentley:

This set of examples are those having to do with 4D construction modeling. And that jumped ahead in a pandemic where you couldn't be literally on the job site and where distancing was important.

Greg Bentley:

So the top two are in Singapore are always at the lead in going digital. And then the lower left is actually the U.S., believe it or not. And then in the lower right, this is the project in Switzerland, international consortium for fusion energy.

Greg Bentley:

And then the last examples I'd like to show you if I can advance this final slide are examples in China. So China, everything we do is adopted first and fastest in China, including for infrastructure digital twins, where they use their private cloud environments. And this is the way that projects are done at the scale of scope and innovation in China.

Greg Bentley:

China would like to be the engineers to the world. Digital twins should enable the rest of us to catch up in ambition and scope because, with digital twins, infrastructure engineers can work on projects anywhere and especially for the resilience and adaptation of our existing infrastructure. So with that, Nicholas and I would welcome your questions. Jackson, back to you.

Jackson Ader:

That's great, Greg. Thank Nicholas, thank you so much for that. So Greg, if you want to... You can stop sharing your screen that way, we can all, there we go. And now they can see us in the full screen.

Jackson Ader:

There's a bunch that I want to follow up on. And probably if we just start fundamentally, there was one thing that you mentioned about the trough of disillusionment with digital twin or the IoT in product or discrete or what people would think of as in non-infrastructure.

Greg Bentley:

Industrial IoT if you like.

Jackson Ader:

Sure. And your point was that actually an infrastructure you don't expect to go through that trough. And you mentioned a couple of reasons why, but could we just go into a little bit more detail? What gives you the confidence there, and why is there such a difference?

Greg Bentley:

Well, we're later in it. So, the Army Corps of Engineers is one of our largest users in the world and responsible for a lot of the infrastructure in the U.S.



Greg Bentley:

The Army Corps of Engineers says that this is the year of sensors and IoT in the U.S. So you're starting it in 2022 when these approaches for digital twins have now ripened so that we can bring the OT the sensors together.

Greg Bentley:

In fact, we have software to drag and drop them into a digital twin with an existing 3D model and where we can capture and semantically align and open for analytics, the engineering applications as well.

Greg Bentley:

Industrial IoT, you just started with sensors before this greater maturity had been possible. Even five or six years ago, it would not have been possible for the reasons I described to have an infrastructure digital trend because you couldn't have the ace-operated 3D model and the exact act operating conditions.

Greg Bentley:

Now, not only can you have the ace operated 3D model and continuously survey it because all you need to do is send the drones up again in the same flight pattern and so forth, and then record the differences, look at the corrosion, advancing and so forth from machine learning and bring any needed interventions to the attention of the engineers.

Greg Bentley:

But then they can jump into these immersive visualization environments and find all the engineering information. They wouldn't even have looked for before because they knew they couldn't find it. To be able to find it immersively in the 3D ace operated digital twin that's familiar with them.

Greg Bentley:

These are opportunities that industrial IoT didn't have that way of being sure that how you put the sensor information into the context of what was engineered and does it. Is it an exception to react to or not? I think that the work of infrastructure engineers now will include designing the sensor environment and triggers and so forth and a digital twin.

Jackson Ader:

Gotcha. Now, does Bentley have their own, like you said, finding the trigger or the anomaly in the real-time data coming from the sensors in the field? Have you developed your own predictive maintenance or algorithms there, or can customers maybe go outside the company and get some solutions that way?

Greg Bentley:

Well, of course, it's all about an ecosystem, but we are the leaders in software for asset reliability. According to ACE, we're by far the leader. And so we have many applications to do with... I like to say APM would be asset performance management. I say it means asset performance modeling, where you use the engineering for reliability strategies. So we are a leader in that.

Greg Bentley:

What we don't do is work order management. To respond to that, we work with, for instance, the Maximo environment to connect that up. So it's all about an ecosystem, but engineering, asset performance modeling, we are rather advanced in our own right on that.

Jackson Ader:

Should we be thinking then that... is it your expectation that because the infrastructure digital twins are like you said, they're you let the industrial IoT work out some of the kinks, right. And we're starting a little bit later. Do you expect a growth rate of use cases or just overall use of digital twin to be faster or greater in infrastructure rather than the traditional industrial IoT?

Greg Bentley:

Okay. Well, this is what I tried for investors to see we're at 26% with the winning of the finalist projects. We're at 36%, where you have the ace-operated 3D model that could give rise to a digital twin. So I do not wish to overstate the pace at which we move in infrastructure.

Greg Bentley:

I like to say. People ask why the software why is going digital slower in infrastructure than it is in product and part management. And I say because infrastructure organizations aren't R& D organizations. They are public works, its governments, and so forth.

Greg Bentley:

And then the engineering firms that do half the work, that's half of our business, the other half is the own, but they're not R&D organizations either. So we do a lot of the R&D for going digital, and we can push, but we can't pull.

Greg Bentley:

That's why it's really important that the engineering firms now want to improve their own business models so that they don't only sell their hours during project delivery but have a longitudinal recurring revenue subscription opportunity by being the creators and the curators of the digital twin services.

Greg Bentley:

So we'll simply be the platform behind their white labeling of our infrastructure, digital twins with their own proprietary analytics and brands is the hope, and that will help us sell to the owner-operators at a greater rate, which is what it takes to catch up to that potential.

Greg Bentley:

It's still early, but I use the example of communication towers because all the world's communication towers are now owned by special purpose tower codes who have purchased the assets from the carriers and are now sharing the towers across multiple carriers. And they are very motivated in going digital.

Greg Bentley:

They need to know what their inventory is, how much they can add their revenue potential. And it enables, of course, the rest are going digital. We can't do that without the communication towers, adding capacity for 5g, and so forth.

Greg Bentley:

That is going very quickly and on our own operating results call earlier this week, we reported a jump in our new business growth rate from a multi-million dollar ARR accretion and communication tower operators.

Greg Bentley:

So what they're doing is exactly what should apply to every other infrastructure asset in turn. The drone surveying, the machine learning, the corrosion management, the engineering remodeling. It's the same game plan, but communication towers are on the run. Everyone else is going to catch up over a period of time, which I think is during the coming decade.

Jackson Ader:

Great. Nicholas, I think it was in your portion of the presentation, when you were talking about the ventures, the IoT ventures and that you had actually incorporated, brought two of those partners in-house and acquired them recently.

Jackson Ader:

And so I'm curious. I assume you look at that venture, see what the usage is, and maybe bring some people in house, but I'm just curious. First of all, do I have that characterization right? And then secondly, what's the make versus buy decision like, especially when we're talking about technology that's tuck in or unproven at this point, I guess in terms of its commercial.

Nicholas Cumins:

Yeah. Well, you did explain it well in a sense that we are using the ventures fund to really seed the market with more companies using our technology. And then we're learning from that also on how they're using the technology on what works, what can be done better, et cetera.

Nicholas Cumins:

The primary intent is not actually to find companies that we could potentially acquire. Now, this could be the case in the longer run. Why not, but that's not the primary intent. The primary intent is really to see the market to help ISVs adopt the platform and then get all the learnings along the way on our site.

Greg Bentley:

The two examples that Nicholas mentioned, sewer, AI, and unearth, are only minority investments on our part. They are not acquisitions.

Nicholas Cumins:

Correct. Now, on the other hand, if you followed our company, we've been quite active in acquisitions that complement the platform. Greg mentioned a very large acquisition we made with Sequin, which is all about getting a better understanding of what's happening under the ground, which helps us be

Nicholas Cumins:

... So much more performance with the engineering construction project themselves and then with the performance of the asset itself, with just a better understanding of what lies beneath. Greg also mentioned acquisitions of sense metric and this data vision, which is an additional IoT layer that we are

bringing to the platform. So those are two parallel activities, right? One is to really see the markets invest minority in some companies to encourage them to use the IoT platform and another one is constantly on the lookout for technology that will be needed in order to accelerate our strategy when it comes to the IoT platform.

Jackson Ader:

Are there any things within the product, either the product portfolio or maybe, or use case wise that you feel still has room Bentley to either build-out or acquire to kind of round out your positioning in the space?

Nicholas Cumins:

I mean, I think I mentioned it, the number of use cases of digital twins is growing very rapidly. And, what I mean by the number is really just the sheer scope you know. There are new use cases that come up that keep taking us by surprise. So of course, along the way we learn about how we need to evolve our platform to better support those use cases. And that's why we always on the lookout we need for some technology that could be built, or that could be acquired order to make the platform stronger and support those use cases.

Jackson Ader:

Okay. Now, one of the things about, about expanding the platform is that I imagine you're also bumping up against different competitors or new competitors. So, when I hear, when we saw the Sequin acquisition, I thought, hmm, okay that kind of sounds like Hexagon, right? Or when you're talking about certain and infrastructure projects, I think to myself, hmm, okay that sounds like autodesk. So I'm curious, who do you see as your core competitors across the platform and then by extension, by extending the platform, are you indeed bumping into some competitors that you might not have; 5, 10 years ago?

Nicholas Cumins:

We really see ourselves as the infrastructure digital twin platform, a purpose built for infrastructure digital twins. For sure, we're going to run into other platform who have capabilities that can overlap with ours. For sure. You mentioned some of the competitors who are also investing in digital twins. We actually welcome that. We really see that more as a proof of where the market is going as an endorsement. But we really have built platform, which is purpose built for infrastructure digital twins. What makes us unique? I commented on that a bit, this besides the fact that we're purpose built. That platform is really used today. It's really put it's established. It is powering multiple applications from Bentley and foreign partners alike. Its ability to bring together all sorts of different data, to really align it with high level precision, engineering precision. And it's our fundamental commitment to openness.

Jackson Ader:

So one of the things you mentioned about, and I definitely want to get into the infrastructure bill in a minute, but before we get there, one of the things I think you mentioned was that building back better means like better as well. And that engineering companies aren't going to be handed over more than just like, okay, here's blueprints and goodbye. Could I possibly, between fatigue solvers and structural simulation, could I instead of needing the real time 4d digital twin. Could I cobble together some collection of solvers and simulation tools to say, well, I really I can kind of simulate how this

infrastructure plan is going to look over the next, fill in the blank number of years and do people try that rather than adopting your software?

Greg Bentley:

Well no, I don't think so, but a huge job opportunity just to talk about structural and solvers, that's kind of an image that can come to mind as the bridge ages or suffers collision damage and so forth. A very interesting counterpart to that is water systems underground that start to leak and so forth. If there exist the engineering models for these assets, but the engineering models are models of the way it was meant to be built. Maybe even it wasn't built that way, but certainly it's corroded, damaged and so forth.

Greg Bentley:

But if you and you would want to say, well, how do we know if it was designed with eight inch members, but they look rusty and so forth. How? What are? Is it still safe? We have the original engineering model, but you run the engineering, real original engineering model on the original dimensions it's going to tell you it's safe.

Greg Bentley:

So the answer is a strategy where you recalibrate the existing model. And it turns out that if I use the example of bridges and the counter corresponding example below ground with measuring capacities and actual observed pressures in a water system, but suppose it's a bridge. You use video to watch the bridge deflect, as a truck goes over it. You use machine learning to say, how heavy was that truck based on how squished the tires were. Then you back into, if it was, you got to rerun the model to say, what does it act like the capacity of that eight inch member is? And it might act like it's now a six inch member given the fatigue and then you say, okay, well now is it still safe recalibrating? So those are just examples. You know, genetic algorithms are used to converge to what is the recalibration of the model.

Greg Bentley:

It's a whole aspect of science that becomes important now that you can actually observe. And so when we talk about sensors and cameras and video and so forth, just embedded cameras ultimately will be, there'll be cameras everywhere in what we do. They may be there for consumer purposes or otherwise, but we'll have constant inputs to be able to, the point is the original engineering information, the ET, the brain power for the digital twin. You can't be without that. And it's synchronizing that, aligning it semantically.

Greg Bentley:

So the applications you're describing, the simulation applications, the BIM and modeling, those can continue to advance. There's no reason to change those. Nothing needs to start over. We'll have this cloud service layer that puts this reverse or an inverse modeling. When Nicholas talks about subsurface conditions, what's above the ground we can see it's deterministic. What's below the ground, we can't see, so it's probabilistic and the way you put those together, because it's that combination that determines the safety and when every city will flood, we just don't know when, what is at risk, how do you harden the infrastructure assets against environmental threats and so forth? It just all comes together. And in ways that this, what makes it possible is finally being able to have the engineering data, not be trapped in inscrutable formats, but rather be opened up to this analytics.

Greg Bentley:

The analytics I'm describing is this future stuff of infrastructure engineering, when their tasks get automated by our better software all the time, this is what infrastructure engineers will primarily work on is analytics for better performance. And I thought you were going to ask the question, would it be possible to have a business model where they get paid for how much throughput occurs in the train station or, what's the uptime of the Metro and so forth, and just work out their own analytics to improve that?

Greg Bentley:

I think that that time will come when these things are, possible, and the challenges are so important and to quality of life, it will ultimately come about. It'll benefit a whole ecosystem and not only us, but the iTwin platform to provide this semantic alignment, spacial alignment, synchronization, and then the immersive visualization will be using everyone's technologies for that. But it is adding the change ledger of time, the overtime that corresponds to the project planning, the design review, and then the construction modeling, the 4D modeling is really important in construction because if the construction modeling starts all over again, you'll lose the engineering modeling that was done during the design stage. So that's why we work on all of this at once comprehensively for the big opportunity.

Jackson Ader:

Okay, so we only have a couple of minutes left, so I'll leave the infrastructure bill you guys talked about it on your last quarter earnings call. So I encourage investors if you want to get more into the weeds on that, just go back to transcript on the earnings call because we don't have time here. But one question I did have, so you mentioned construction. How does the Bentley platform interact with some of the major, kind of, the project management of the construction of these infrastructure projects and does that feed back into your iTwin platform?

Greg Bentley:

The low hanging fruit in construction is 4D modeling. So we say constructioneering, the engineering and the construction should be considered together. Dumbing down 3D designs to 2D digital paper for construction is an approach that we don't need to help with. It's enriching the 3D design to a 4D construction sequence, which is a digital twin. The digital twin is of the essence in making headway and actually reducing risk and improving visibility door and construction. So there's a lot of construction, digital initiatives that are working on going from 3D to 2D. What we're working on is going from 3D to 4D that's ultimately where it winds up.

Jackson Ader:

Why not have a Bentley construction management or project management solution that can handle the 3D and 4D digital twin so that someone can actually be on the construction site and not have to dumb it down?

Greg Bentley:

Well, we want to do that for the substantive modeling and constructioneering and the industrialization of modular construction. That if you're going to industrialize construction, so not everything is one off and the simulation, the digital twin of how it comes together is of the essence, you can see the interfaces and so forth. And industrial has actually made some considerable progress in that. But on

construction administration, there are good solutions. We just generally don't work on administration sorts of things. We would rely on an ecosystem for that as well.

Jackson Ader:

Okay, awesome. All right we're a little over time. This was great, Greg, Nicholas, thank you so much and thanks for the presentation, I thought it was wonderful. But really appreciate everybody joining us this morning and really appreciate Bentley's participation.