**With Dennis Abel, PE, Chief Engineer, and Rakesh Khan, PE, Director, Technology Solutions FDH Infrastructure Services**



Daniel Litwin (00:00):

Welcome to Tech Talks with FDH Infrastructure Services. Listen in monthly, as we talk engineering innovation and the future of critical infrastructure. Hello, everyone. Welcome to this episode of FDH Tech Talks by FDH Infrastructure Services. I'm your host Daniel Litwin, the voice of B2B. So with today's conversation, we're chronicling the evolution of one of FDA's most renowned services, nondestructive testing, or NDT. And though this is a chance to highlight FDH's unique and quality focused approach to NDT. It's really a broader conversation breaking down today's field needs and applications, how data and analytics are supporting infrastructure monitoring, and what a proactive and reactive future looks like for critical infrastructure asset management. For this conversation, I'd like to welcome our two guests, Dennis Abel, chief engineer, and Rakesh Khan, director of technology solutions, both for FDH. Dennis, Rakesh, thank you for joining us today. How are you all doing?

Dennis Abel, PE (01:10):

Great, Daniel, thanks.

Rakesh Khan, PE (01:11):

Well, Daniel, happy to be here.

Daniel Litwin ([01:13](#)):

Absolutely. So just for some context, as we jump into the conversation, FDH has been pioneering new standard setting innovations in NDT for at least the last 25 years. Could y'all give us an overview of some of the work that FDH has done in different, uh, you know, sectors of the industry with different infrastructure projects and walk us through how those projects have changed over time?

Dennis Abel, PE ([01:40](#)):

Sure. So, FDH was started just over 25 years ago, by two professors and a PhD student from North Carolina State University, and using dispersive wave technology, they developed a method for determining the length of bridge piles. Um, now state departments of transportation didn't always have design drawings or construction records that would have this information, but when there was, you know, when there would be flooding or other events like that, that would cause scouring of the supporting soils around bridge piles, they needed this information to determine what loading the bridge could still support. So that was the beginning of our nondestructive technology, and it spread from one state DOT to many others. And from there to communication towers and electrical transmission towers and other types of critical infrastructure, and through the years, we've adapted to other technologies also and added those to what we can offer our clients.

Daniel Litwin ([02:47](#)):

Being a pioneer in NDT technology, I'm sure has supported those projects and a force, I guess, evolution in NDT technology as well. How has tech evolved alongside the work FDH has done? And how has that supported, uh, those different projects over the years?

Rakesh Khan, PE ([03:11](#)):

NDT technology as a whole has really evolved, not so much in the physics of testing and the acoustic, uh, excitation or the electromagnetic behavior, not so much in the physics of the test, but in the software and the hardware that we're able to use to collect better and better data in the field. What this really amounts to is we're able to see in the field a lot of what used to take several hours of analysis time in the office to get a good look at. There are, uh, ways that you can change the gain. You can stitch together different tests and look at something in a 3D view in the field, and all of this, uh, all of this technology evolution has really enabled NDT to be able to provide better and better information about where to test and what to test in the field. So the physics itself, uh, hasn't really evolved a lot, but all of the supporting technology, the software and hardware has enabled us to get a lot smarter about where and when and how we test.

Daniel Litwin ([04:15](#)):

What has made some of those process improvements and technology improvements possible for FDH over the years to always be one step ahead of the curve? Um, what sort of support and resources are y'all able to draw on? And, um, you know, how does that support that work?

Rakesh Khan, PE (04:33):

For several years, we relied on our civil engineering groups, our field technician groups to go out and get the data, bring it back, make sense of that data and produce engineering deliverables. But as software and hardware have become more and more evolved, we actually needed to add a software group of our own so that we could write software. That was very specific to what we needed. We could use, uh, tablets that, uh, these days are very powerful, much more powerful than the computers we had 10 years ago. And so by adding the software group to FDH, we're able to not only provide that civil engineering, uh, value, but also provide that level of field capability. That's only possible with custom-made software, with well-made software that looks at not just how to collect information correctly, but also how to enhance the user experience so that any, any person experienced or novice would be able to successfully run these tests in the field.

Daniel Litwin (05:40):

It's pretty incredible that y'all have that kind of network, um, and those resources to make that possible. How did FDH go about crafting that kind of network and getting all those bright minds under one roof to further NDT testing? Was there any strategy there or did it just happen naturally?

Rakesh Khan, PE (05:59):

One of the main changes, um, that enabled us to add this kind of, uh, core competency to FDH was really the, we went out and we got some executives that, uh, are much better versed at the software aspect of anything. So currently our CEO came from the technology sector, uh, computer science major, and our vice president of technology currently is also a computer scientist. So we had, we identified as a company that we needed leadership in this area that we didn't, we couldn't home grow. We found some great executives there. Uh, we, we have a great CEO now that has a software background and they have enabled us to change our recruiting strategy to be able to add quality folks to a group that, uh, conventionally we never really had before.

Daniel Litwin (06:57):

One of the main reasons why we wanted to have this conversation is because as of late FDH, uh, has seen a shift in its NDT services. And I wanted to unpack that shift and how you see it impacting the industry at large. And what that shift has been, uh, is one from a traditional nondestructive testing field investigation, run by FDH employees, uh, transitioning over to NDT as a service, providing tools for your clients to do some of this data capture themselves. Could y'all break down that transition from a classic NDT field investigation to NDT as a service for FDH? What motivated it, uh, and why is it happening? How is it happening?

Rakesh Khan, PE (07:45):

The motivation was to be able to provide the service to a wider audience, and in order to do that, it needed to cost less. And it needed to be something that currently, uh, embedded inspection companies could just add to their portfolio of service. Uh, as so as software and hardware had evolved supporting the NDT tech, we finally got to a point here where we were able to make a step change in who could

actually run this test in the field. And that's really, the evolution was kind of gradual as we got better and better software in hardware in the field. And then we've really come to a step change here, what, where now a true novice, somebody who's not well versed in NDT technology, can use a walk through type software to capture the correct data in the correct place. So really the evolution was gradual, then a step change. And now we're in this post step change era where we're helping clients decide how to use this information, how to get their technicians trained up. A generally very small amount of training is needed to be able to do this kind of work. And we're in a kind of a post NDT era as we've, we've learned and have created the software that enables others to do this work instead of us.

Daniel Litwin ([09:03](#)):

What's unique about this shift is that it really reprioritizes customer service strategy, uh, and just business model strategy as well. So I'm very interested in how FDH has tried to restructure their business model around a more software heavy, um, and a more remote focused service. How have y'all aimed to retain quality and create that longevity with your clients when the process itself has a little less, uh, FDH in-person oversight and it's a different kind of oversight?

Dennis Abel, PE ([09:42](#)):

Um, sure. So we've put a lot of focus on our, um, you know, software and hardware to make sure that it's going to work for the, for the field crews. Um, you know, when we're talking about NDT as a service, uh, when it's the field crews of the owner operator that are, that are using this, and we have to make sure that, you know, they're going to be comfortable, that they're going to be able to use this, um, you know, in any type of, uh, project that they want to, and that they're not going to have any kind of problems or issues that they'll need our, um, you know, immediate support for.

Dennis Abel, PE ([10:17](#)):

Yeah. So, uh, another one of the changes is that by having this as a service that our clients can use, um, instead of calling us up every time they need this done is that helps lower the cost for them. And it makes it so that they can use us more often and on, you know, potentially all of their, uh, you know, their entire portfolio instead of picking just one or two where they have special needs for, you know, a particular site or particular, uh, structure.

Daniel Litwin ([10:53](#)):

And what about the client relationships there? Uh, as you bring on clients that now have never had the classic NDT field investigation as part of their repertoire, and all they know FDH for is NDT as a service, how do you approach, uh, retaining those clients and building strong relationships with them when the service is a little more detached, uh, and you know, they're not interfacing in person with as many FDH, uh, employees?

Rakesh Khan, PE ([11:27](#)):

There's a few things we're doing to change the way we're providing customer support. One is, uh, we're paying very close attention to the information that feeds into this field software. How does that client

manage their programs? What kind of structure information needs to be fed in the front end of the software to help the technician, uh, organize their day, organize their testing, uh, and then on the back end, where does this information go? Um, some clients already have a pretty sophisticated way of, uh, of managing and archiving all of their inspection data. Uh, so how do we make sure that our software plugs into that? So there is that aspect of customer service that has had to change. In general, we're, we have always been, uh, a subject matter expert available on the phone, and we don't have any intent to change that part of it.

Rakesh Khan, PE ([12:23](#)):

Uh, as there's questions about how many tests are run or, or where to run, or how to prioritize structures, all of that kind of interaction is something that we don't intend on getting rid of. That's, that's really, uh, the, the fun part for us. And it's, it's a part that's valuable for the client, and can't really be replaced by software. Uh, so in some ways the customer service is really staying the same, but in other ways, we do have to recraft aspects of it to make sure that a remote service can actually plug into their other systems in a way that is as seamless as possible.

Dennis Abel, PE ([13:00](#)):

Another value that we bring to our clients is that we have a full multidisciplinary engineering staff that can help with any issues that they might have with their structures, so that if they do, you know, determine that they're, um, you know, the NDT, uh, results are finding some sort of issues, they can come to us and we can help solve their problems by designing modifications or, um, you know, determining what other kind of, uh, what kind of things we can do to their structures to help them.

Daniel Litwin ([13:37](#)):

When you're interfacing with these clients. And you are pitching NDT as a service, what is the value proposition for clients? How are their needs better met with NDT as a service versus a classic field investigation? Um, and have you had to change up, you know, how you pitch, uh, the service based around maybe how needs are changing for your clients as well?

Rakesh Khan, PE ([14:02](#)):

I think the, the central portion of that pitch is that NDT is valuable, and that's not really changing. Uh, we know that NDT, uh, testing, monitoring, looking at the empty structures prior to failure is a good way to, um, identify issues and fix them before they become a lot more expensive. So that part is, is pretty much the same. What's really changed is our ability to say, and now you can do this for a lot lower costs on a lot more structures, because you can do it yourself. That part really is enhancing our value proposition because we're able to say, you're able to test more structures. You're able to increase the service life of your portfolio, and you can do it at lower cost. It's been a pretty compelling value proposition for several new customers, particularly those that don't have huge budgets to take care of this kind of stuff.

Daniel Litwin ([15:02](#)):

All right. I'd like to break down what the main steps are during the NDT, as a service process compared to a classic NDT field investigation, so that, you know, potentially folks out there wanting to do this can better understand what that workflow looks like. So could y'all give us the rundown of the data capture and the data analysis, uh, and what that looks like during an NDT, as a service process? Let's start with the capture, um, break down what that looks like in the field. And then I'll ask a few follow ups.

Rakesh Khan, PE ([15:38](#)):

Data capture in the field for, uh, a technician that's part of, uh, the customer's already, uh, incorporated fleet really looks like pulling out the tablet, going to that particular project in the software. The software tells them what test needs to be run when they look at, when they select a test to run, it walks through how to run that test right. And then at certain points, depending on whether they're using accelerometers to capture data, or maybe they're just running a standard ASTM test, it gives them direction and diagrams on how to do that properly. In the case of accelerometer data, it goes a step further and it tells them, okay, you're, you're impacting the structure in a way that's causing the accelerometers to respond, um, giving us bad data. So, so try to impact the structure lightly. When I say impact the structure, a lot of the tests we do rely on vibration and wave propagation.

Rakesh Khan, PE ([16:42](#)):

So they're tapping with hammers. In the field when they're tapping, or they're trying to excite the structure with these low energy vibrations. The, the software can say, okay, hit it harder, hit it, hit it softer, uh, back away from the accelerometers a little bit, and they can get that perfect strike without having years of experience. And then the, the software lays green, says you're good to go, this test is done, good job. And then they can finish their project, run, whatever tests are part of that inspection program and move on to the next structure. So in the field, the whole goal is, is for the technician to be able to, they need to have a basic understanding of the reason for the inspection, but everything else is provided by the software direction.

Daniel Litwin ([17:27](#)):

When that data capture software was being designed, what did y'all find needed to be user friendly and intuitive, and what aspects of it needed to be more flexible and customizable for more seasoned clients that were more, um, familiar with the software and with NDT as a service.

Rakesh Khan, PE ([17:50](#)):

Our approach really came down to a very packaged, clean, uh, mode, per se, where an unseasoned, a novice technician could run this and have all the choices made for them. And as you can imagine, all of our seasoned technicians wanted to be under the hood, wanted to be able to tweak the gains and tweak, uh, pre and post, uh, data acquisition windows, and that kind of stuff. So we also incorporated an under-the-hood mode where a more seasoned technician could mess with those things if they wanted to. Uh, we really don't anticipate, uh, many customers wanting to use that under the hood mode, which has really doubled as our diagnostic mode, but it's something that's available as, as their technicians

become more experienced. There, there are some additional, um, features additional power to the, to the software that can be done in that mode. Uh, but really that's how we approach it, just two modes, one, one under the hood, and one, tell me exactly what to do, and I'll do what you say.

Daniel Litwin (18:57):

The second main step for this is the data analysis, which then provides all of the insights for the client. How did you approach the data analysis portion of NDT as a service compared to a classic NDT field investigation? Does that side of it change much? Um, or is there a, a clear differentiation between processing and analyzing data captured by the client versus captured by your own team?

Rakesh Khan, PE (19:24):

So the data analysis side on the backend has changed, but it's really only changed a little bit. Uh, one advantage of having all these extra screening tests done with the software in the field is that the quality of the data that actually comes back to the office is already guaranteed to be high quality data, and high quality data is easier to analyze. So in, in one way that the analysis has become easier because we're getting only high quality data now, and we've actually pushed these same features back out to our own crews, so that they're only giving us high quality data as well. Uh, the, the challenging part now is that generally with the, with this kind of analysis, that these kinds of volumes, we need to try to automate what we can about the analysis, and yet there needs, there still needs to be a human factor to looking at this data and making sure that everything makes sense. It makes sense for how the test was run and makes sense for, uh, that particular structure. And that part is, is more difficult to automate. And yet now there's more data coming in. So the challenge really is, is on how we switch from a, like a medium volume variable quality data analysis backend to a higher volume, high quality data. Uh, so the problems that we're facing right now, I would say are good problems. Um, or maybe not even problems; they're challenges, but they're challenges associated with changing the way that the data is coming in so that the service itself can be provided at a lower cost.

Daniel Litwin (21:03):

Where are we seeing this NDT as a service already in use? And how is it affecting some of those different infrastructure projects in ways that y'all perceive as positive?

Rakesh Khan, PE (21:17):

For many of the infrastructure owners out there, they can't afford to run proactive tests. And when we were able to drop the cost of being able to do this by enabling their people to do it, it enables more owners to be able to do it at all. I think the biggest benefit is it's opened up the number of people that can actually contemplate running these tests and not blowing their budget out.

Rakesh Khan, PE (21:48):

A great example is internationally. We're working with an owner, and they have wanted to be able to run foundation mappings for their structures for a long time, but they haven't been able to because the cost of bringing in people that know how to do that, are seasoned in doing that, is prohibitively high for

that country. Uh, but now that we're able to do it, we're able to provide the tools so that the people in country can perform the service for themselves. It has enabled them to get into a more proactive stance about their asset management. Uh, so the biggest change really is, is the step change in availability from, from those conventionally proactive, uh, better off structure owners now to people structure owners that are dealing with lower budgets are dealing with different regulatory environments where they can bring this into their inspection program at relatively low cost.

Daniel Litwin ([22:48](#)):

At the end of the day, uh, NDT as a service, or even just NDT in its original form is still a relatively reactive way of maintaining critical infrastructure. It's obviously important. Um, but it's hard to be entirely proactive with it. It also is very dependent on how often your clients ask for these tests and conduct these tests. This is where a proactive piece to this entire process can come in and support NDT as a service that has materialized itself as structural health monitoring. And I know FDH sees these two processes, SHM, structural health monitoring, and NDT, or NDT as a service, as coexisting for proper infrastructure management. How does structural health monitoring create a symbiotic relationship with NDT as a service, and how do they support each other?

Dennis Abel, PE ([23:46](#)):

Sure, so, um, structural health monitoring involves measuring the physical responses of the structure while it's being loaded. So you've got responses that, uh, such as vibration, deflection, rotation, strain, and then you can also measure the loading that's on there, uh, or, or know what the loading is such as gravity loads, wind loads, seismic, temperature, um, and you can set up the structural health monitoring system so that it can provide alerts and alarms if the response that's measured exceeds a predefined threshold. And then these kinds of responses may indicate if there's a problem with the structure, such as there's too much bending or sway or something like that. And the owner or operator can send out engineers and technicians then to inspect the structure for specific problems. So that's where our NDT, um, services, um, would, would come in and be able to identify exactly what the problem is.

Daniel Litwin ([24:49](#)):

Anything to add to that one, Rakesh?

Rakesh Khan, PE ([24:51](#)):

Sure. Uh, so SHM can identify, uh, where it would be helpful to run NDT testing. Um, but also NDT testing can identify where it would be helpful to install SHM. Uh, we, for instance, we inspected a structure in Illinois that had some obvious foundation problems, but the structure itself had been there for five years, standing tall, no obvious, um, signs of movement, no problems with providing the, uh, the support for the wires and the, the equipment on that structure. So we decided that the best course of action at this time, despite the fact that we see some problems is to just keep an eye on this structure. Whatever's going on with the foundation here. It looks like it's not getting any worse, and your structure is doing fine. And depending on the timing of their budget, the way that that structure fits into their system, it may not be on the table to do some kind of expensive repair to that foundation. So instead we

said, well, hey, you can just keep an eye on this. It's been working for awhile. Uh, it's, it's in an area where, uh, if something does happen, it's not good for the system, but it's not really a problem with public safety. So just put an SHM system on there and we can watch the tilt. We can watch a few of the stresses and strains and make sure that everything continues to act the same way. And as long as it does, the structure can stay in place without them forking over a ton of money to upgrade or repair something.

Daniel Litwin ([26:25](#)):

So to wrap up our conversation, I want to look really big picture. I'm sure this is a stat that y'all have interfaced with before, but American infrastructure last time, it was great. It got a whopping D plus. So as a whole, there is a lot of infrastructure that needs maintenance. It needs immediate repair and also needs longterm proactive monitoring. How do y'all see SHM and NDT playing into a more focused strategy for longterm infrastructure health for the nation as we, uh, come to grapple with the fact that so much of our infrastructure really is inadequate or falling apart?

Dennis Abel, PE ([27:14](#)):

Yeah, I think both of these are gonna, um, help bring, you know, a lot more knowledge and a lot more information of what exactly is wrong with the infrastructure, um, to the owners and operators of the infrastructure. And so it'll be able to be more widely distributed and be able to pinpoint exactly where the worst problems are. So energy can be focused on, on, on the worst problems.

Daniel Litwin ([27:42](#)):

Any other thoughts on that one?

Rakesh Khan, PE ([27:44](#)):

We do expect NDT and SHM to become more and more incorporated into infrastructure owners' strategies. Uh, one of the next steps really is education, um, education of the owners, and what's available out there. And also as an industry, we need to work harder to really solidify the bond between this proactive testing monitoring and the, the quantitative asset life extension we're achieving and how that affects, um, public safety and how that affects the financials of the infrastructure owners. So there's, we know, and we've seen several cases where this kind of technology has saved a bunch of money for infrastructure owners. Well, I think we can do a better job of really tying together as an industry, here's how let's say that the bridge industry, here's how monitoring can enhance public safety and, and decrease your budget and quantitate, in like a quantitative hard coded way. With that information in hand, it becomes a lot easier for those infrastructure owners to make the decision to jump into a new technology. Um, and so I think that the next step really is that education getting those value propositions really tightly knit, and then showing everybody in both within the industry, that is the providers of NDT and SHM, and also the, the buyers, people with the infrastructure, what they can do and how it can really, uh, help them and, and help the customers that they serve and help the general public.

Daniel Litwin ([29:25](#)):

All right. Rakesh, Dennis, thank you both so much for your thoughts on today's podcast, breaking down this evolution from NDT to NDT as a service and why it's important to have a cohesive approach to infrastructure management. Again, we've been chatting with Rakesh Khan, director of technology solutions, and Dennis Abel, chief engineer, both with FDH Infrastructure Services. Dennis, Rakesh, appreciate your time on the podcast today. Any final thoughts?

Rakesh Khan, PE ([29:53](#)):

I think we pretty much covered it, Daniel, thanks for having us today.

Dennis Abel, PE ([29:57](#)):

And I think that was great. Thank you very much.

Daniel Litwin ([29:59](#)):

And thank you everyone for listening to this episode of FDH Tech Talks, a podcast by FDH Infrastructure Services. If you like what you heard and want to listen to previous episodes, you can head to our website, www.FDH-IS.com, click on the resources tab, and there you'll see our full webpage for our podcast series. You can also find our podcast on Apple podcasts and Spotify, and make sure you're leaving a rating and a comment whenever you listen to your podcast content. I'm your host, Daniel Litwin, the voice of B2B, until next time.