



The ENGINEERING CAREER COACH PODCAST SESSION #37

18 Characteristics That Made John Roebling One of the Greatest Engineers of All Time - Part 1 of 2

Show notes at: engineeringcareercoach.com/roebing1

Anthony's Upfront Intro: In this episode I am going to visit a museum that highlights one of the greatest engineers of all time and I'm going to find out what made him so great and then distill it for you so that you can use the same strategies in your engineering career. Lets do it!

Episode Intro: Welcome to *The Engineering Career Coach Podcast*, where it's all about helping real engineers to overcome real challenges and get real results. And now for your host, who is on a mission to inspire as many engineers as possible, professional engineer and certified career coach, Anthony Fasano.

I welcome you to another episode of the podcast. This is a special episode because it's the first episode that I'm actually getting out of the office and going onsite somewhere to record the show. I'm really, really, really, really excited about this. I went to the Roebling museum down in Roebling, New Jersey and I interviewed a historian who wrote a book about John Roebling, who in my opinion is one of the greatest engineers of all time. And it was a two-hour interview so this is actually going to be broken up into a two-part podcast.

But I took away a series of points that really blew me away about what made John Roebling such a great engineer. So I'm going to dive into them here and we're going to go through it and hopefully it's something that you can take as a blueprint for you moving forward. Before I do that though, I want to mention just a few quick things.

First of all I want to mention our sponsor for today, which is Purdue University's Masters of Engineering Management Program. And this is something that is a big deal for me and I say that because everybody that I talk to when I go to conferences, when I get contacted through LinkedIn, through the podcast the question is always, "Should I get an MBA or should I get a Masters in Engineering?" Well that's a great question and it's probably a different answer for every single person.

But Purdue University's MEM Program is something that you should definitely consider if you're kind of a motivated engineer looking to get into the management side in the engineering industry. Their Masters degree is specifically designed to advance your career in industry and they have both on campus and online study options available. So please check it out. It's a topnotch program, one of the top ranked programs of it's kind in The United States. And I've met with Melanie Shram from the

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

MEM Program there several times. She came to our meet-up down in Austin, Texas, talked to her about the program. I really like what they're doing. We have a couple of their students that are IECD members and I'm actually going to try to get them on the show as well, to talk to you about the educational side of the MEM so you can understand what it's like as a student.

So if you're interested in the Purdue Masters of Engineering Management Program you can call 1 877 598 4233, again that's 877 598 4233 or just send an email to promasters@purdue.edu.

And then one other announcement - the Kickstarter page for the event, I'm trying to create this event for engineers that will be extremely helpful going forward. It's going to focus a lot around productivity, around work-life balance, around goal-setting, around networking - all these skills that I talk about all the time. It's going to be all there for you in one weekend down in Washington DC.

And I understand that those of you that can't make it because you have to travel and there's expenses so what I've done is I've added another reward to the Kickstarter page. It's a \$10 reward. So what I'm going to do is I'm going to take the information from all those fifteen or sixteen sessions and I'm going to write a summary of each one and put it into an e-book or some kind of a format, where you can have it and you can take that information and use it. And again, a lot of it's going to be work-life balance and productivity related, which I know is a huge challenge for engineers right now. So just for \$10 you can get that information. So I really ask you to please go to engineeringevent.com and if you can afford to put the ten dollars in I promise you that the information you're going to get is going to be a huge return.

If you can come live and attend the event please trust me it will be career changing and life changing. But I understand if you can't maybe you can donate in some way, shape or form. That would be great. Again that's engineeringevent.com.

Alright let's jump into the show here and let me explain to you how this is going to work. So I interviewed Clifford Zink, who wrote the Roebing Legacy. He knows everything there is to know about John Roebing and his family. Because it was so long I'm breaking it up into two parts. So today you're going to hear the first half of the interview, for the next half hour or so. Then after that, at the end segment of the show I'm going to distill that part of the interview.

Basically there's eighteen points that I took out of this whole interview, that I believe made him a great, superb, excellent engineer and if you apply even some of these you can do the same. So after the interview gets played I'll come back on for the end segment and I'll distill the first eight points of the eighteen. And then the part two, which will be out next week, I'll go through the other ten points at the end of that show.

So with that let's just get going. I'll give you a quote from the author of the book that I'm going to be

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

interviewing and then we'll jump right in. **"It's utilitarian structure but he made of a work of art."** And that's from Clifford Zink. And again, this is a quote about John Roebling because one of the things that he was brilliant at was taking engineering and making it beautiful. So the quote is, **"It's a utilitarian structure** - meaning that it's useful - **but he made it a work of art."** Let's get into the interview.

Coaching Segment:

Anthony: So now it's time for the main segment of today's show and I'm excited to be here at *The Roebling Museum* down in the Trenton, New Jersey area. It's the first time I'm actually doing a show outside of the studio, outside of the office. And as a Civil Engineer it's exciting to be here. Looking around at some of the pictures of the different bridges that John Roebling worked on, who in my opinion is one of the greatest engineers of all time.

And I'm going to be speaking with Clifford Zink today, who is the author of the book *The Roebling Legacy*. He's a Roebling historian and I'm excited to dig into John Roebling and his background here with Clifford. In my opinion, like I said, since John Roebling is one of the greatest engineers of all time I want to understand a little bit of his background, a little bit of his approach, his mental approach, some of his tendencies so that maybe by listening to the show you can kind of feed off of some of that and implement that in any way you can into your engineering career. So Clifford welcome to the show.

Clifford: Thank you.

Anthony: It's great to be here and great to be in this museum. And for those of you that are not familiar with John Roebling, he is most well known for his design work on the Brooklyn Bridge in the engineering realms but he's a very interesting individual. I've read many articles about him and books that have referenced him. And I guess the best way to start is, Clifford maybe you can just give us kind of a background of yourself first before we get into John Roebling and how you got into being so interested in him.

Clifford: Well I'm an historian and I focus on architectural and industrial history, mostly of this region where we are. And I was born in New York City and growing up around New York. The Brooklyn Bridge is the icon of New York City. That's why I was always aware of it. And in 1983 the city had a big celebration for the 100th and there was David McCullough's book was published and Ken Burns did a film and there was a great interest about it.

And I was living in Princeton at the time and I knew that there was a big Roebling factory in Trenton but there wasn't really much information available on it. And so I got interested in the topic and started doing research and eventually discovered so much information that it became obvious that I

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

could write a book about it. So I actually wrote a previous book to this one and this is a follow up book.

Anthony: Wow. So again, the name of the book is *The Roebling Legacy*, which we're going to dig into. And all of the information that we talk about in this show is going to be located on our website at engineeringcareercoach.com/roebing, that's r-o-e-b-l-i-n-g. And we'll link to Clifford's books and some of the other information that we can get to you on this so that basically you can take advantage of it and use it.

So Clifford, let's get into John Roebling himself. And there's certainly some listeners that probably don't know much about him at all so why don't you give us a little bit of a background on John Roebling, kind of as he grew up and got into engineering?

Clifford: So John Roebling was born in Mühlhausen in Prussia. This was before Germany was united. It was in 1806. And Mühlhausen was a small town about 200 miles southwest of Berlin. Mühlhausen had about 10 000 residents. It was an old medieval town with Gothic churches and with a wall around it.

And his family was middle class. They were tobacco merchants. He was the third of three sons and also had a younger sister. When he was born in 1806, in June about four months later Napoleon marched into Prussia and defeated the Royal Prussian Army in a big battle out of town called Jena, which is only about thirty or so miles east of Mühlhausen.

So young John Roebling grew up in French occupied Prussia for the first six years of his life, before the Prussians expelled the French. And that turned out to be a very auspicious time to grow up. Roebling benefited from a really excellent education. Probably it was among the best educations available in the whole world at that time for engineers.

Anthony: Wow.

Clifford: And the Prussians realized when Napoleon conquered them that they were behind the French in terms of their organization and even in terms of their technology. Napoleon's army was better organized and better able to travel quickly than the Prussians could. And their engineers could build temporary bridges for going across streams very quickly.

Anthony: Okay.

Clifford: And so the Prussians realized that they had to catch up to the French and so they instituted educational reform. And so by the time Roebling got to school he benefited from this new curriculum that the Prussians developed to catch up with the French. And the old curriculum was reading,

writing and arithmetic and some German history and Latin. And the new curriculum had more intense mathematics. It had some physics and it had drawing, fairly extensive drawing. And so as a very young man he was exposed to these things that would not have come as early as they did if it wasn't for Napoleon.

Anthony: Mm, that's interesting. So the invasion caused them to have to improve to keep up and because of that Roebling benefited, which is amazing. And I've read about his education and it does sound like he had a brilliant education with brilliant educators, from some of his professors and teachers that I've read about, which is wonderful. Tell us about his family a little bit, growing up, his family life.

Clifford: So the parents owned a house on an urban street in Mühlhausen and the tobacco shop was on the first floor and the family lived on the floor above. So in those days the tradition of parents, particularly fathers passing on their businesses to their crafts or professions to their children was even more prominent than it is today. And so the problem for John Roebling, being the third son, was that the business wasn't big enough to support three families in the future.

Anthony: Okay.

Clifford: So his two older brothers were pretty obviously going to take over their father's business but that meant that John Roebling had to find a different profession. So it turns out that he was extremely gifted in mathematics and the schooling that he had really enabled him to take great advantage of that, where if he hadn't had that schooling that gift may not have really developed to its full extent. So Prussia was really interesting in the early 19th century because Prussia had free public education, which dated back to 1762. We didn't get free public education in this country until the 1850's. I think Massachusetts was the first state. I don't think it came to New Jersey until the 1860's.

Anthony: Wow, that's a hundred years before here.

Clifford: So the Prussian education involved going to something called a gymnázium or gymnasium, which was a school that went through elementary, middle and upper school levels all in one school. And the school that John Roebling went to is actually still there. The building is still in existence.

Anthony: Wow.

Clifford: And there's really no evidence of how he got so interested in mathematics other than he just had this really great innate ability. His father was not an engineer. There's no other family background that would be an automatic and obvious reason for him to have an early exposure to mathematics.

Anthony: That's interesting.

Clifford: But thanks to the reform education he had at the gymnasium he actually left that at the age of fifteen and he went to a town called Belfort, which is about 40km away from Mühlhausen.

Anthony: Okay.

Clifford: And he went there to a boarding school. The boarding school was run by a man named Solomon Unger and Unger was the foremost mathematician of Thuringia. The Prussian state that Mühlhausen is located in was called Thuringia. Unger taught at The University of Erfurt for a while. But then for some reason The University of Erfurt was dissolved and then he started this mathematics Institute and he ran it in his own house. And so John Roebling went to board with him in The Unger Institute and while he was there he studied advanced mathematics during the day and also he studied surveying, which was a practical application in mathematics. And then he studied quite a bit of drawing, including mechanical drawing. So at the age of fifteen and sixteen he had the great benefit to study under the foremost mathematician in his region.

Anthony: Wow.

Clifford: And in those days way before all the media we have available to us now.

Anthony: Uh-huh.

Clifford: Movies, radio, television, cellphones. In those days the way people socialized and interacted with each other had a lot to do with music so many people learned to play instruments. It was fairly common in those days. And Dr. Unger was a musician himself so young John Roebling learned to play the piano and the violin and I think fairly decently. His son in Washington said he was quite good at both of them. And so he picked that up in the Unger household and possibly even in the Roebling family household before that. Unger was also very interested in philosophy.

Anthony: Right.

Clifford: You know one can imagine fifteen, sixteen year old John Roebling. During the day he's studying mathematics with the foremost mathematician in his region. At night the family around the table, they're discussing philosophy and the current events of the day. And then after supper they're playing music and violins.

Anthony: Yeah.

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

Clifford: You know a pretty good education for a teenager back in those days.

Anthony: No absolutely. And that's one of the reasons that I wanted to come here and talk to you about this. As a listener of this show you know that we're trying to help you in your engineering career and this is why we're kind of laying out John Roebling's life here as he grew up. Because it all contributes to the outstanding engineer that he was and it's obvious now from what Clifford told us that his education was phenomenal. I mean the math and the drawing and all that stuff is kind of a, would make it obvious that that would help him in his engineering career.

But it's the other aspects of it that I've read about, which is his interest in philosophy and his ability to play musical instruments, which you would consider more of a right-brain, more creative style than a lot of engineers - which is left-brain, very technical, very black and white, which I'm sure because he had this more whole-brained education it definitely contribute to his successes as an engineer. But this is an important, all these things that we're talking about are important leading up to his career. So Clifford let's fast-forward a bit and how does John Roebling get to the United States? Tell us that story.

Clifford: Well just before we talk about how he gets to the United States it would be interesting to talk about The Royal Building Academy.

Anthony: Okay.

Clifford: So when he was eighteen.

Anthony: Uh-huh.

Clifford: After finishing up at the Unger Institute he won a seat at The Royal Building Academy in Berlin. So by this time The Royal Building Academy was one of the best polytechnic schools in the world. The best was most likely The French School of Roads and Bridges. So in those days engineering meant pretty much building roads and bridges because those were the main problems of the day, how to expand transportation.

Anthony: Okay.

Clifford: So the Prussian government created The Royal Building Academy for engineers to learn how to mostly do roads and bridges.

Anthony: Is this college level Clifford or high school?

Clifford: Yes, college level.

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

Anthony: Okay.

Clifford: And in 1799 they created The Royal Building Academy. And we talked a little bit earlier about the educational reforms that the Prussians instituted after Napoleon. By the time John Roebing, at the age of eighteen, got to The Royal Building Academy they had the best architects and the best engineers in Germany teaching there. And in those days there wasn't really a distinction between architects and engineers. The degree or the certification one got after finishing at The Royal Building Academy was called a Baumeister.

Anthony: Okay.

Clifford: Which means a master builder.

Anthony: Mm.

Clifford: And so Roebing studied architecture and engineering. You know today those two fields are divided.

Anthony: Yeah, distinctly.

Clifford: Architects, you know, study a minimal amount of engineering just to get some basic concepts. Engineers study a little bit about architecture to understand some architectural principles. But in those days you really studied both. And there are two aspects to John Roebing's success that could be significantly compelling for your listeners.

Anthony: Sure.

Clifford: One is that he had this exposure to a world-class education, one of the best in the world and the second is he made the most of it. You know you can expose somebody to a really good education but that doesn't necessarily mean that the person is going to really soak up that education and learn everything they can possibly can.

Anthony: Right, gotcha.

Clifford: And he did. And while he was at The Royal Building Academy in Berlin he kept these extensive notebooks..

Anthony: Okay.

Clifford: ..of his work. He studied architecture. He studied bridges. He studied dykes. He studied dams. He studied hydrology. And he completed at least five notebooks. And when you look at these notebooks they are jammed full of information. Every single square inch on the page is filled with his notes and little sketches that he took in class.

Anthony: Wow, that's interesting.

Clifford: So it's obvious that he was a very, very rigorous student. And he also took advantage of other opportunities that he found in Berlin at the time. This was 1824.

Anthony: How old is he now about?

Clifford: He's eighteen.

Anthony: He's eighteen, okay.

Clifford: And so he was at The Royal Building Academy. There was also a Royal Academy of Art. He went to The Royal Academy of Art and studied drawings.

Anthony: Wow.

Clifford: And so he really proved his ability to draw, not just by doing mechanical drawings but actually by doing artistic drawings. And then another major opportunity he took advantage of in Berlin was at The University of Berlin, which was a third separate school, the philosopher Georg Wilhelm Friedrich Hegel was teaching philosophy. And Hegel was a philosophical rock star of his day. He was very, very prominent and a brilliant thinker. And Roebing went to Hegel's lectures and that's documented because in his notebooks he recorded attending those lectures.

Anthony: Wow.

Clifford: And so he not only took advantage of the educational opportunities in his own particular field in engineering and in architecture but he expanded his capacity so to speak, his perspective by studying art and also by studying philosophy.

Anthony: Again, back to some of those right-brain, not just in engineering drawing but in artistic drawing, which I think is a pattern here that certainly would help lead to his success, but also the fact that he's a rigorous learner. I mean that's interesting, those notebooks. I mean are these things that they have available somewhere, that they found them, that they have them?

Clifford: The notebooks are at Rutgers University.

Anthony: Okay.

Clifford: And they're marvelous to look at. They have wonderful little sketches in the pages that he took. So these are notes that he took during class.

Anthony: Wow.

Clifford: Or perhaps reading.

Anthony: That's amazing.

Clifford: So the problem with them is that they're written in the old German gothic script.

Anthony: Okay.

Clifford: And they're very, very hard to read. So even if you have a working knowledge of modern German it's still almost impossible to read because they're in the old gothic script.

Anthony: Gotcha.

Clifford: It's hard to access all the information in it. Some of them have been partially translated but they have not been completely translated.

Anthony: And isn't it true that he did quite a bit of philosophical writing himself?

Clifford: So he had two influences with him. One was Dr. Unger.

Anthony: Right.

Clifford: Who when Roebing was a teenager was family discussions of philosophy but then the exposure to Hegel and so that led later in his life to him really pursuing philosophy more.

Anthony: Okay.

Clifford: But when he was a young man, the evidence is that he more focused on his engineering development.

Anthony: Got it.

The **ENGINEERING CAREER COACH**

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Clifford: So one thing that he also was exposed to, which was very fortuitous to him, was in many ways the coolest and newest type of bridge that was being built at that time, was the suspension bridge. Because obviously there are a lot of very beautiful stone art bridges in Europe and elsewhere and some iron bridges were starting to be made as well. But the construction of bridges and the principles of suspension, now of course that's been around for thousands of years with people, like in Peru - you know building suspension bridges with hemp ropes.

Anthony: Yeah, yep.

Clifford: But modern suspension bridges really started to develop in the early 19th century. An engineer named Navier in France published a book on the principles and theory of suspension bridges and Roebing's professor at The University of Berlin wrote a German translation of that book.

Anthony: Oh wow.

Clifford: So Roebing got a copy of that German translation and he also got the original French book and he brought both of those to America with him. So those are examples of opportunities that he was exposed to that really grasped and he made himself an expert by studying Navier's theory of suspension bridges. He made himself an expert in that new technology and he got very excited about that. He thought that this would be a really interesting field to work in.

And after he finished his studies at The Royal Building Academy, in exchange for his education he had to work for the State and Road Department for three years. And while he was there he proposed building two small suspension bridges. And they actually are very crude, I wouldn't say crude but very sort of draft level sketches of these. And his superiors praised him for his innovative thinking but they turned down his proposals.

And so the fact that he was turned down partly reflected that people were uncomfortable with this new technology of suspension bridges and they were afraid of it and also partly it reflected the fact that the bureaucratic hierarchy in Prussia was such that no senior engineer was going to allow a young upstart engineer to come along and propose something new. You had to put in your dues for decades before you got to a level of authority, where you would be able to introduce something new because the older engineers really didn't want to be upstaged....

Anthony: Sure, sure.

Clifford:by new ideas, new young engineers. It was a very traditional sort of bureaucracy. So Roebing was very frustrated by that and that plus, I think he was influenced partly by Hegel because Hegel taught a great deal about freedom and he actually said to his students that America is the land

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

of desire. Those were the words he used - land of desire for young people who wanted to work in an atmosphere of freedom, where they could pursue their ideas.

And so that must have been really appealing to young John Roebling, that America had these opportunities that he might not be able to find at home. And then secondly, he might be able to pursue specifically his interest in suspension bridges, which was thwarted during his experience with the Road Department.

Anthony: Okay. So before we get into Roebling's life now here in the US, a couple things that I think that we can take away from that. The early part of his life, we talked about the world-class education. We talked about he was a rigorous learner. Clifford highlighted his work at the state for the Roads Department, which I think is important because one of the things that I've always been a proponent of for engineers is to get field experience in your career, and also as early as possible because that's where you get to see things being built and that makes you just a better designer. When you know the way something is put together and then you go to lay it out for someone else, you're more practical.

And so we know now, based on what Clifford told us, that Roebling had some field experience very young, which I'm sure was important. We also know that he was very innovative. He had a lot of interest in a lot of those right-brain activities we talked about and you can see that he learned about this new technology of suspension bridges and then immediately learned about it and tried to implement it and be innovative in his, I guess you can call it internship, with the Roads that was denied but nonetheless he was definitely innovative.

And then I guess one last component of this is that he identified something in engineering that he was excited about and he was pretty much ready to pursue it at whatever cost; leaving his home country. At that time a trip to the US was a big deal, a big trip. So that's another thing I've seen with a lot of successful engineers is that there's a lot of different engineering disciplines but of you want to be super successful you've got to go with the one that's interesting to you, that you're passionate about and we know Roebling did that. So now he's headed to the US. Take us through that journey.

Clifford: So in 1831, at the age of 25 he left Germany with some other German settlers who also wanted to come to America. And so he came to Philadelphia and they were interested in establishing a German village. So they went out to Western Pennsylvania and north of Pittsburgh they bought land and they built a German village. And the idea was they wanted it to be a self-sufficient village where Germans would come there with a variety of skills.

Not only would they be able to do some farming but a blacksmith would come, a carpenter would come and a barrel maker so that the village would have all these different skills and they could have kind of a German village there. And then his idea was later on they would look to build some

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

productive facilities like mills. So they wanted to be in an area where there was timber that you could set up a sawmill for.

And so he arrived in this country in 1831, at a very auspicious time because America and the industrial revolution are starting to expand significantly. And here he shows up and he's got this superb technical education from Germany at a time when there are hardly any trained engineers or architects in America. Rensselaer Polytechnic Institute in Troy, New York....

Anthony: Sure.

Clifford:where John Roebling sent his son in Washington and actually two sons went there, that just started in 1824. So there weren't very many graduates from there. I think West Point, the military academy, started a little earlier than that but that would have been military studies in addition to some engineering studies.

Anthony: Uh-huh.

Clifford: So Roebling arrives with this really first class education and after working and setting up this farming village, where he designed and built the houses and he designed and built the church, which drew upon his architectural training that he had back in Germany. He then took a job surveying for the Pennsylvania canal system and there he was able to use some of his experience that he learned at the German Roads Department because they had some road building practices, particularly small culverts over streams and things that nobody was doing here. So he was really able to use, as you called it, his sort of internship experience....

Anthony: Sure.

Clifford:and apply it in a new situation. And then while he was working for the Pennsylvania canal system he observed these inclined planes that were used in the canal system to get canal boats over the Allegheny mountains. So the boat would come on the Pennsylvania canal up to the foot of the mountain and then there was a little railroad car that would be submersed and the boat would go on top of the car. And then the car would be hauled up the mountain and the boat would go on the car to the top of the mountain and then it would be let down the other side, and then to another section of the canal and go to the next mountain.

So this was a complicated mechanical setup to be able to haul these boats up to the top of the mountain and the original equipment for that included hemp ropes. Hemp, of course, is a natural vegetable fiber. And the hemp ropes were about three inches in diameter.

Anthony: Okay.

Clifford: And they were the biggest maintenance item on the Pennsylvania canal system because, being a vegetable material, the hemp rotted and so it had to be replaced quite frequently, every year or two. And they were very expensive to make and install these ropes. So Roebing observed this and realized that maybe it was possible to do something better. And so here's an example of his problem solving.

Like I said earlier, we really don't have evidence of how he got his keen interest in mathematics other than his own innate ability in math. And nor do we have evidence of how as a child growing up he may have become interested in problem solving but he clearly was. When he saw something that he could do something about he was very, he wasn't afraid to jump in and take some risks and try to do something that no one else had ever done before. And I think that's a characteristic certainly of innovative people in many different fields....

Anthony: Sure.

Clifford:besides engineering, is ability to take risks. So a friend of his in Germany sent him an article that a German mining engineer had written about a wire rope that he had made for this mine that he was working on. And so this German engineer also was using hemp ropes to haul ore out of this mine in Germany, and hemp ropes were less than satisfactory so he got some wires and he twisted these wires and made a rope out of them. And this is really the earliest evidence of somebody making a wire rope. This would be around 1835/1837.

And so Roebing read this and you know someone said recently that innovation is studying one situation really, really carefully so you fully understand it and then studying another situation really, really carefully until you understand that one and then smashing those two ideas together and trying to figure out what you come up with. So in this case Roebing studied the canal incline planes very carefully and he saw how these hemp ropes worked and where the problems were. And then he studied this article on a wire rope. Two independent ideas and he took these two and he smashed them together.

Anthony: Yeah, amazing.

Clifford: And he thought, "I can do something to improve this situation. I can solve the problem of these hemp ropes being less than satisfactory on these incline planes." So then the risk taking, so there's a great innovation on his part to be able to think of that but then he had to take the risks and the risks involved the fact that he had never seen a wire rope.

So what he did was he went to Pittsburgh, which was 35 miles south of the village that they created which was called Saxonburg, and he bought wire from a Pittsburgh wire drawer. And he took that

wire back to his farm and he got a bunch of his German farmers together. And remember I said that some of these farmers were master craftsmen?

Anthony: Right.

Clifford: They knew iron blacksmithing and they knew carpentry. So these were skilled, skilled men. And they stretched out these wires and created a ropewalk on the back of his farm, on his meadow. So ropes have been traditionally made for millennia by process of ropewalk. So in terms of ropes made of hemp or other vegetable fibers, you stretch it out. You stretch the fibers out on a long walk, it's called, and then you twist them together.

Anthony: Okay.

Clifford: So Roebling, of course, had never done this but nevertheless he studied the process and he created a ropewalk on his farm and he built this wire rope never having seen one.

Anthony: Wow.

Clifford: So the first one he made he installed on the, as a temporary trial installation and it failed because he hadn't made it properly.

Anthony: On one of these rail carts? On one of these boat lifts?

Clifford: He did it on the incline plane.

Anthony: Okay.

Clifford: And it started to come apart because he hadn't assembled it properly. So a lot of people when they would reach that point they would throw up their hands and maybe say that, "I failed, I can't do it," but he was persistent and he went back to the farm and he came up with an improved version, the second version of this wire rope and he thought this one was going to work. So by now the Pennsylvania Canal System, the officials are reluctant to test this new rope because nobody's had a wire rope before.

Anthony: Right.

Clifford: So what Roebling does is he takes another risk and he says to them, "I will install this rope on one of these incline planes at my own expense and if it works after one year you can pay me." And so they agreed to that and he installed it. He had to make new machinery for it because the

The ENGINEERING CAREER COACH

WITH
ANTHONY
FASANO 

hemp rope machinery with the big wheels and the steam engine and everything, he had to adapt and change all that for this wire rope.

Anthony: Okay.

Clifford: Anyway he installed it. The wire rope worked and the Pennsylvania Canal System immediately started ordering more wire rope from him. The next step he did after this is also very instructive I think for some of your listeners, which is that he thought a fair amount about marketing. You know whether you are a business and you have to market your product or market your services or if you're just an individual and you have to put yourself out there so people know who you are and what you do, you have to do it. You can't sit around and wait for people to knock on your door and Roebling understood this. So after his rope was successful he wrote an article for The American Railroad Journal, which was the wired magazine of it's day.

Anthony: Uh-huh.

Clifford: Because most of the technological improvements at that time were taking place in railroads and The American Railroad Journal is where these kind of improvements were written up. And so Roebling wrote an article about this new wire rope that he developed for these incline planes and got it published in The American Railroad Journal.

Anthony: Wow.

Clifford: Of course now he started getting a lot more orders for his wire rope.

Anthony: Wow.

Clifford: So he started building this wire rope business and not just waiting for the customers to come along but actually to go out there and say, "Here's a new product I have and here's how well it worked on the Pennsylvania Canal System." And then he started getting orders from other canal systems.

Anthony: Wow, so he was a real entrepreneur as well.

Clifford: He was an excellent entrepreneur.

Anthony: That's interesting. That is something that I do talk to engineers a lot about, is that you have to market yourself. You're not just going to go through your engineering career hoping that you're going to get the next promotion or the next big project. You've got to work. You've got to show your craft to people, what you're capable of and take some risks and go look for opportunities.

Otherwise you get stuck in your same cubicle or the same desk or the same office or the same project. It's not a waiting game.

So it's obvious that John Roebling, as soon as he saw an opportunity he tried to capitalize on it. I mean that's brilliant writing an article in that journal. I mean to think about the marketing. I mean obviously today there's a lot more avenues to do something like that but even back then that, that's amazing.

Anthony's Closing Remarks:

Anthony: Alright, so I hope that you enjoyed that first half of the interview with Clifford Zink. And what I'm going to do is I'm going to distill it a little bit here for you and I'm going to go through eight points that we can pull out of that portion of the interview that will be very helpful for you in your engineering career if you think about them, if you apply them.

- And the first one is that his world-class education that Clifford talked about. John Roebling had a world-class education, which is huge and very important.
- And the second point is that he made the most of it. And that's something that I want all of you to think about. I'm sure most of you on this show either have an engineering degree from a good school or are in the process of getting one. The question is how are you going to make the most of it? How are you going to use that education? How are you going to lean on everything that goes along with that education, like the professors, are you going to stay in contact with them? You have to think about, when you have an opportunity to education, how are you going to utilize that? So be mindful of that.
- The third point was field experience. Roebling was able to get that internship. He was able to work on a couple suspension bridges. You need to get field experience. I don't care how old you are. I don't care what field you're in. Get on the shop floor. Get on the construction site. If you think you're too old or you missed that shot, interview people that have, watch videos, read things. You need to have field experience because you won't understand everything that goes into a project if you do not.
- Fourth point - be innovative. Try different things. John Roebling was innovative. He heard about the new technology around suspension bridges and immediately tried to implement it. He just went right after it. Try different things in your career.

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WITH
ANTHONY
FASANO 

- Tip number five or point number five - follow your passion. John Roebling had a passion for suspension bridges so he went to the US to find them. And I'll give you an example. I have a member of the Institute, Elias. I know he's a big listener, he might be listening right now. His passion was to be a structural engineer and he followed it at all costs. He's given up a professional soccer career on teams like a Real Madrid type of career to become a structural engineer. He left a small country in Africa and came to the US to chase his dream but then he was kind of stuck in the environmental field and he kept telling me, "Anthony, I want to get into structural. I want to get into structural." So I helped him the best I could. Now he's got a great job as a structural engineer and he's really becoming a world-class structural engineer. So follow your passion.
- Be a problem solver. And that's kind of obvious right. As an engineer we need to solve problems but identify problems and solve them. And remember you have to look at a problem and not just see the bad in it but understand where there's opportunities and how you can take that problem, turn it into an opportunity and solve it.
- The seventh point was take risks. John Roebling took risks. When he developed the wire rope and it didn't work and then he brought out the second version of it, he took a risk of installing the stuff on bridges and saying, "Listen, just pay me in a year if it works." That's a risk. So you can take a risk in your career. You can go into your boss's office and say, "This job's not challenging enough," or, "I want to start a new department," or, "I want to take a job that's International and outside of my country and my comfort zone." Take a risk in your career. That's what makes you great. That's what made John Roebling great.
- And the last point for this segment is persistence. John Roebling's wire rope failed. It failed miserably and he came back and he did it again. He could have given up but then the John Roebling Company and all of his legacy with the wire ropes never would have happened. So you're going to fail in your career or at least it's going to appear that you've failed, whether you didn't get the job you wanted, you didn't get the raise you wanted, whatever the case may be - be persistent. If you have clear goals and a passion, follow it at all cost and be persistent.

So with that, I hope you enjoyed this first segment. I'd love to get feedback. You can email me at afasano@engineeringcareercoach.com or you could visit the show notes for this show, which will be at engineeringcareercoach.com/roebing1 and you can leave some comments there. I want to hear how this format of the show worked for you, if you liked it and if these points are helpful. Certainly let me know and I'll be back next week with the second half of the interview and another ten points that you can take and implement into your career.

With that, I hope that you continue to engineer your own success!

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