The ENGINEERING CAREER COACH PODCAST
SESSION #38
18 Characteristics That Made John Roebling One of the Greatest Engineers of All Time - Part 2 of 2

Show notes at: engineeringcareercoach.com/roebling2

Anthony's Upfront Intro: In this episode I will finish my interview with a John Roebling historian and bring you ten more characteristics of one of the greatest engineers of all time. 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.

Hello everyone. This is Anthony Fasano and this is the podcast for engineers that want to create extraordinary careers and lives. And I'm excited because today is part two of the John Roebling special that I did, where I visited The Roebling Museum and interviewed historian Clifford Zink on the life of John Roebling. And for those of you who are not familiar with him, he designed the Brooklyn Bridge along with some other suspension bridges and really is very well noted in the engineering world, especially here in the New York City area.

So I will dive into that more today but before I do that I just want to talk to you about one announcement - The Engineering Career Success Summit. This is an event that I'm trying to create for engineers. It will be what I consider the most important event out there because if you're not taking care of your career both personally and professionally, from both sides of it, then what's the point of what you're doing?

And I've spent years now putting together *The Engineering Career Coach* website with all the content on it, most of which is free including this podcast. And the response has been great and all of your emails to me thanking me for everything I've helped you with has been really heartwarming and I like to read them over and over. They come from people all over the world that tell me that my blog posts or the podcast or my book changed their life, changed their careers, and that's awesome. And now I want to create this event because I still want people to respect engineers for what they do and to give them the career development training that they need. There's still a gap there. It's still too easy for an engineer to go into an engineering company and to sit there for years without advancing, without being given the proper training to do so and we need to change that.

And by having this event and growing this event and moving it around to different locations each year,

companies are going to say, "Wow, this is an event that we've got to send our engineers to because we want them to have training from the professional side of things and also with their personal skills," which is ultimately going to help the companies as well. It's going to help you communicate better with clients and speak.

And so what I'm asking for you to consider doing is go to the website for our Kickstarter campaign at engineeringevent.com and make some kind of a pledge. If you can get to the event then there's really inexpensive ticket prices through the Kickstarter campaign. But if you can't get there there's other inexpensive options. One of them is a $10 option, where basically I'm going to distill everything from the conference into an e-book or some kind of a digital format and send it to you, if you opt for this. And one of our keynote speakers is going to be Julie Cohen, if we can fund it through Kickstarter, who has a book on work-life balance. And I don't care what anyone says, the biggest challenge for every engineer out there is work-life balance. You can be the best engineer in the world but at what sacrifice? And so a big part of that digital product or digital format is going to be learning about ways to achieve that balance in your career and in your life.

So please support the event if you can, come to the event if you can and I will be absolutely grateful. And again, that's engineeringevent.com. We only have a few days left to fund the event. I appreciate that.

Alright now we're going to jump into the show for today and this is part two of the interview I did with Clifford Zink, the Roebling historian about John Roebling. The first part of the interview, if you missed it can be found at engineeringcareercoach.com/roebling1 and the second part of the interview, this show and the show notes associated with it will be found at engineeringcareercoach.com/roebling2. So I'm going to let you listen to the rest of the interview now and then I'm going to come back at the end and I'm going to summarize these eighteen characteristics that made John Roebling one of the greatest engineers of all time so that hopefully you can take them and start to implement them in your career. Let's do it!

Coaching Segment:

Clifford: Another example of his putting himself out there is his continuing interest in suspension bridges. While he was developing this new wire rope that he came up with, he continued to be interested in suspension bridges. And in Philadelphia a big covered bridge across the Schuylkill River, burned down.

And there was a young engineer named Charles Eliot, who had studied in France, and he proposed building a suspension bridge across the Schuylkill. And another man named Finley had built an

earlier suspension bridge using wire across the Schuylkill. That was just a pedestrian bridge. But Eliot proposed a bridge that could actually carry carriages and horses at the same time.

Anthony: Mm, okay.

Clifford: So when Roebling read about this, this was 1841, he immediately wrote to Eliot saying that he thought the proposal to build the suspension bridge there was brilliant and he offered his services to Eliot. And the letter is very interesting because he doesn't do it in an arrogant way, he does it in a way where he says, "I applaud you for taking the initiative to propose the suspension bridge and when I was in Europe, studying suspension bridges was my favorite pastime," he wrote in this letter. And then he said, "If I can be of service to you as an assistant I would be happy to do that and I happen to have good drafting skills."

So he put himself out there and made himself known to Eliot. So Eliot apparently may have thought he didn't really want to have a rival assistant engineer and he declined to hire Roebling.

Anthony: When was this Clifford, when he initially asked him, 1840 or?

Clifford: 1841.

Anthony: 1841, okay.

Clifford: So a few years later, oh by the way what Roebling then did was realizing that Eliot had now introduced the concept of suspension bridges to America, Roebling wrote another article for The American Railroad Journal about suspension bridges and he wrote about the theory of suspension bridges. Now this was not a technical article that you would use to actually design a bridge but he wrote about the basic concept of suspension bridges.

Anthony: Okay.

Clifford: And how they are going to have great potential in America because the country is so big and we have so many large rivers. And it's only through suspension bridges Roebling realized that these really large bridges are going to be able to be spanned. Because imagine, if you think of the George Washington Bridge crossing the Hudson River.

Anthony: Uh-huh.

Clifford: Imagine the scale of a steel or iron bridge what it would look like if it had to go across there. It would be just a colossal structure.

Anthony: Yeah.

Clifford: And probably not very efficient. But a suspension bridge is much more efficient to build and to maintain.

Anthony: Sure.

Clifford: There's a second example of him putting himself out there and writing a second article. So now he's under forty. He's still in his thirties.

Anthony: Still so young, that's amazing.

Clifford: So he's now written an article on wire rope and one on suspension bridges. So people are starting to know there's this man named John Roebling out there.

Anthony: And his letter to Eliot also exhibited his abilities to communicate with people. It sounded like he was a good communicator. He wasn't just trying to force his ideas on people. He took a good approach or at least he tried.

Clifford: The point about being a good communicator is excellent because one thing that Roebling did was he had a facility with languages. Remember we talked about Napoleon had taken over Prussia when he was a boy. So you can imagine young John Roebling in his father's tobacco shop when he's four and five and six years old.

Anthony: Right.

Clifford: And the French soldiers come in to buy tobacco. Well you know the French were occupying the country so he grew up at least being exposed to some French.

Anthony: Sure.

Clifford: And when he went to the gymnázium and also to The Royal Building Academy in Berlin he studied French. So he was already fluent in French and German.

Anthony: Right.

Clifford: And then when decided to immigrate to America he actually started studying English while he was still in Germany. And then when he came here he studied English even more so that he turned out to be a really excellent writer in English. So you know it's a good example for people who are coming to a new country. One thing you want to do to be able to communicate really well is to

become really good at the language of your new country.

Anthony: Mm.

Clifford: And so some of his writing is very, it's clear. His writing is very clear but it's also elegant in a way.

Anthony: That's interesting. And the thing that keeps popping up through our whole conversation is his ability to learn and he was obviously a fast learner. He was interested in learning. It sounded like he loved to dive into new things and learn them and dissect them and solve problems and so I think that that's something that you can continually see as a theme through his entire life really.

Clifford: So in 1844 the next big event in John Roebling's life and big opportunity was a request for proposals that the city of Pittsburgh put out in 1844 for a new bridge to replace an existing aqueduct across the Allegheny River. So part of the canal system included an aqueduct that went across the river on several stone piers. So the separation between the piers was I think a hundred and twenty and maybe a hundred and forty feet on another pier. I think there was seven spans for this aqueduct. And the original aqueduct was built like a timber truss, like we would look at a covered bridge. You know the traditional covered bridges in places like New England.

Anthony: Yep.

Clifford: So that's what this aqueduct looked like. It was all timber with these heavy trusses. And of course but it was for holding water instead of fro a road because it was for the canal boats. So this timber was rotting and they were afraid this bridge was going to fail. So the city of Pittsburgh put out a request for a proposal for a new bridge. And remember I mentioned that John had gone to Pittsburgh to buy wire?

Anthony: Uh-huh.

Clifford: From the wire drawer.

Anthony: Yep.

Clifford: Well the person who was selling him the wire for his wire rope wrote to him about this request for a proposal, this RFP from Pittsburgh, and said, "Here's an opportunity for you to build a bridge." And so Roebling seized upon that and he designed a suspension aqueduct, a suspension bridge that would be used to convey canal boats across the Allegheny River.

Anthony: Wow.

Clifford: Nobody had ever thought about or conceived a suspension aqueduct. I think Roebling instilled confidence in people, which you have to do when you're doing something really innovative and out there, when you're proposing something nobody else has done.

Anthony: Sure.

Clifford: People are going to be skeptical. And he instilled confidence in people because he studied the problems so thoroughly that it was obvious that he mastered them. His papers have these detailed proposals that he'd put together, which show all the calculations that he did for his suspension bridges. So he studied the problems so carefully and he did all the calculations so carefully that when he proposed something he would show people the extent that he went through to analyze the problem and how his solution would solve that problem, that I think that gave people a lot of confidence.

Anthony: Mm.

Clifford: And the city of Pittsburgh hired him to build the suspension aqueduct, something that nobody had ever thought about before.

Anthony: Wow, that's amazing. Again, it's the learning and I can see as an engineering manager or project manager, which I know a lot of our listeners are in that position, I think what Clifford has just laid out for us is very valuable. Because when you have a team of consultants, a team of people in there looking at you as the project manager, if you have this in depth knowledge of the problem, the project and you laid out some potential solutions, it's going to be easier to get the rest of that team behind you because they're going to feel confident in the proposed solutions because they know that you've given it time instead of just rush something along and threw it out there. So I think that's a real interesting point about Roebling.

Clifford: So he built that canal aqueduct and then got contract to build four more aqueducts.

Anthony: Wow, this is all in the forties still right? The mid forties or?

Clifford: This is in 1840.

Anthony: Okay.

Clifford: So he would have been forty in 1846.

Anthony: SO he never ended up working with Eliot on that bridge?

Clifford: He never worked with Eliot.

Anthony: Okay.

Clifford: And so after he built the Pittsburgh aqueduct he actually built another suspension bridge in Pittsburgh called the Monongahela Bridge, which was for horses and pedestrians and carriages.

Anthony: Okay.

Clifford: And it was a similar multi-span bridge of small spans. And then there was another RFP put out in 1846 for a bridge across the Niagara River, near Niagara Falls.

Anthony: Okay.

Clifford: And Eliot and Roebling both submitted proposals on that and Eliot's proposal got accepted because Eliot had actually built a larger suspension bridge, the one over the Schuylkill River that I mentioned earlier.

Anthony: Uh-huh.

Clifford: And so his proposal was accepted but it turns out that Eliot was unable to complete his bridge. He actually just simply built a footbridge across the Niagara River. And he pretty much left the project and then the people that were running the project turned to Roebling and they accepted his proposal.

Anthony: Wow.

Clifford: To build this wire bridge for a railroad. It was a railroad bridge across the Niagara River. So what's really interesting about Roebling's Niagara Bridge is that it spans 800 feet and the purpose was for a railroad track to go across the river. So now the bridges that he built in Pittsburgh, the longest span between the piers was 180 feet. So now he's going from a 180-foot span to 800-foot span.

Anthony: Wow.

Clifford: A big leap.

Anthony: Wow.

Clifford: His Niagara Falls proposal, when you look at this proposal it is so beautifully presented.

Anthony: Mm.

Clifford: You know today when an engineer working on his own or an engineering firm puts out a proposal it's so important what that proposal looks like.

Anthony: Right.

Clifford: Because you want to instill in the client an understanding that you have completely mastered the subject and that you're doing it with some level of grace. You know you want the proposal to look really good.

Anthony: Right.

Clifford: And so he made these beautiful proposals that are still in existence. They've survived. And so they have all the calculations in them. They have all the sketches.

Anthony: Wow.

Clifford: Everything is scaled out.

Anthony: That's amazing.

Clifford: And you look at this and you just say, "Yes, I think this man can build this because look how carefully...."

Anthony: Right, again it goes back to the confidence he instilled in the people that were going to hire him.

Clifford: Right. So he studied the problem thoroughly and then he did a superb presentation of his proposal.

Anthony: Wow. Let me ask you this question Clifford, about these projects that he's working on and the wire ropes business. How did they come together? Is it, I mean he uses the wire ropes on the bridges? He gets paid for the engineering and the wire ropes? How did that all work? Was the wire ropes business part of his engineering and what he did or?

Clifford: He was primarily an engineer.

Anthony: Okay.

Clifford: He got into the wire rope business because he came up with an engineering solution, which was to use a wire rope instead of a hemp rope on the incline plane. But there was nobody making wire ropes in America at the time so he pretty much had to make it and once he set up the machinery and solved the problem of actually making the wire rope he realized that this could be a revenue source.

Anthony: Sure.

Clifford: And so he started making these for other people. So his son, Washington Roebling, wrote that John realized that he could never get rich, become wealthy being an engineer so he looked at the wire rope business as a way to build wealth and to build capital.

Anthony: Okay.

Clifford: Because engineering fees, as we know, you're not going to become a wealthy person.

Anthony: Yeah.

Clifford: However, the two businesses went hand in hand because by doing the metalwork with the wire and twisting them into ropes....

Anthony: Yup.

Clifford: ....it really furthered his knowledge of metallurgy. It furthered his knowledge of fabrication,...

Anthony: Okay.

Clifford: ...how you fabricate metal and things, appliances to twist rope and etcetera.

Anthony: Yeah.

Clifford: And then of course when he built the cables for his suspension bridges, the cables are always parallel wires. The bridge cables are not twisted, they're parallel.

Anthony: Okay.

Clifford: But of course they have suspender ropes that hang down that hold the deck.

Anthony: Yeah.

Clifford: So of course he was able to make the suspender ropes for his own bridges.

Anthony: Okay.

Clifford: And so he was able to go back and forth and use these two businesses were sort of sympathetic or simpatico with each other.

Anthony: Yeah, that's interesting. Okay.

Clifford: They were related to each other.

Anthony: Okay, so now we're at the point where he's building bridges. He did the Niagara Bridge, correct, over the Niagara River?

Clifford: Uh-huh.

Anthony: So how do we get to the one of the most famous bridges, the Brooklyn Bridge?

Clifford: Well after the Niagara Bridge he was asked to develop a proposal to build a bridge across the Ohio River in Cincinnati.

Anthony: Okay.

Clifford: And he was first asked that in 1846. His original proposal for that bridge was to have a single, large stone pier in the middle of the Ohio River because that would enable him to build the most efficient structure with one big stone pier. And that turned out to be very disconcerting to steamboat operators because they were worried about this one pier in the middle of the river and sometimes the currents in the river are difficult to navigate. And they were afraid that this would be an obstruction to river traffic because at that time there was a tremendous amount of steamboat traffic on the Ohio River.
So this is an example where something Roebling proposed generated, not the concept of building a bridge but the type of bridge that he proposed generated a great deal of opposition. So he went back and he redid his plan and he came up with another proposal that has two towers on either side of the Ohio River, which is the current bridge that's there today, which is this bridge.

Anthony: Okay.

Clifford: So the piers for that bridge were started and the towers were started in 1856 but then they

were interrupted by the Civil War. And after the Civil War he was working fulltime on that bridge. And he was very interested in the fact that the bridge not only should be a utilitarian structure but that it should be a beautiful structure. And he wrote that, "Public works should educate public taste," which is a very interesting concept and I think one that your listeners would benefit from. You know a lot of engineering proposals today, the client wants the cheapest solution possible.

Anthony: Right.

Clifford: And so sometimes when you look at highway bridges and other things, they're not really objects of beauty, they're just a utilitarian structure.

Anthony: Right.

Clifford: Roebling felt that a major public work should educate public taste and he thought it should express the quality and the culture of the community.

Anthony: Mm.

Clifford: And that goes back, I believe, to his youth in Germany where he grew up in the medieval town with two gothic churches and the quality if the architecture was very high. And then of course when he went to Berlin he studied architecture.

Anthony: Sure, yeah definitely.

Clifford: And when he was in Berlin, the German architect Schinckel was actually designing buildings in Berlin and Schinckel was a neoclassicist and an excellent architect. So while Roebling was an engineer he never lost sight of that aesthetic component of engineering that he studied. He didn't call himself an architect, he called himself a civil engineer but he really felt the aesthetics were really important. So when he designed this Cincinnati Covington Bridge, as it was originally called, he designed it with buttresses and he designed decorative stonework and a big arch so it was like a triumphal arch as you entered the bridge and you went from one bank to another. Then he crowned it, as you can see here.

Anthony: Sure.

Clifford: With these like cupolas on the top. So he made it a very symbolic structure and today it's the icon of Cincinnati.

Anthony: Wow.

Clifford: It's now called the John A. Roebling Bridge. And then when he finished that bridge he developed his design for the Brooklyn Bridge and you can see from this drawing - this is his drawing of one of the towers.

Anthony: Okay.

Clifford: And just look at the quality of that drawing in terms of the precision of what he presented.

Anthony: Yeah.

Clifford: So this bridge has 1600 feet between the towers and the previous bridge that he built, The Cincinnati Covington Bridge, was about 1056 between the towers.

Anthony: Okay.

Clifford: So the Brooklyn Bridge was one and a half times the width, the span of the previous record bridge, which is the one that he built. So it was a big leap in technology.

Anthony: That's amazing.

Clifford: And a lot of people felt that you couldn't build a bridge that big. But again he did a superb analysis of all the engineering requirements and all the forces and how they would handled.

Anthony: And Clifford just so everyone knows what we're referring to is we're looking at the cover of Clifford's book *The Roebling Legacy* and I'll put a photo of this book cover in the show notes so you can see. It's just a beautiful engineering drawing with dimensions and everything but it's perfect.

Clifford: And you can see how the purpose of this tower is simply to support the cables and deliver the load forces from the cables down through the vertical portions of the tower to the foundation.

Anthony: The foundations, yeah.

Clifford: And it's a utilitarian purpose. It's not a symbolic building like a palace or a courthouse or a city hall.

Anthony: Right.

Clifford: It's got a utilitarian purpose. But he thought that it should have a monumental appearance and so the Brooklyn Bridge Towers are 370 feet tall and they were built at a time when the buildings in Manhattan and Brooklyn were about six stories tall, which would have been 60/70 feet. So this

towered above everything, not the church spires. Some of the church spires were as tall as this. But certainly the regular buildings, this towered over them. And so knowing the presence that he had, he wanted it to be a monumental structure. So you can see how he designed it with these details at the top and the cornice molding and the little details here.

Anthony: It's just beautiful. It's beautiful.

Clifford: And how he detailed the arch stones. And then of course he chose the gothic arches to relate the Brooklyn Bridge to the great cathedrals of Europe because they are really among the most impressive buildings ever erected by mankind.

Anthony: Sure.

Clifford: The church cathedrals in Germany, English cathedrals. But he wanted to relate it to that, that's why he chose the gothic arches.

Anthony: I think the more you talk about this Clifford too is, like you said, his background and having the foundation in architecture and engineering was so valuable for him. Because I know from my own experience that what happens a lot in the building industry is that the architects are very much focused on the aesthetic side of things, sometimes to the point where excess where it becomes hard to build it almost whereas the engineers are on the other spectrum, where they're focused so much on the practical and the building side of it that they neglect the aesthetic side of it. But he is able to take those two and bring them together, which is amazing and very difficult to do.

Clifford: So that's a good point. He didn't just stick to his own specific field of engineering.

Anthony: Right.

Clifford: Because he called himself John A. Roebling, Civil Engineer. He taught himself enough and he learned enough about architecture that when he realized he was designing a monumental structure like the Cincinnati Bridge or even more significantly, the Brooklyn Bridge, he knew he was designing a utilitarian structure. The purpose of this is to get people from one side of the river to the other. It doesn't have a political or religious function or even, it does have a bit of an economic function. But it's a utilitarian structure but he made it a work of art. And the impact with which he did that is evidence today, I guess it's 131 years after the bridge opened and the Brooklyn Bridge is the icon of New York City.

Anthony: It is. I drove over it yesterday and I went through the arches and you still look up and you're just like, well obviously I'm a civil engineer so a little bit biased but still it just stands out there and it's just there.

Clifford: Have you walked across it?

Anthony: I've never walked across it. I thought about it yesterday, I said I've got to walk across this one day. You see people walking across but..

Clifford: Well any of your listeners, and I encourage you as well, who are in or near New York City, make the time to go over there and park on one side of the bridge or take the trains to get there and walk across the bridge. Because here's another example of him thinking about the aesthetics of the experience of this bridge - he designed the Brooklyn Bridge with an elevated walkway, which he called the promenade. Think about that - he called it a promenade. Now most bridges, the vast majority of bridges in the world, if they have a walkway the walkways are on either side of the bridge.

Anthony: Right.

Clifford: So that you walk along one side of the bridge with the other and on the side that you're on you have an unobstructed view of whatever's out there from that side.

Anthony: Yeah.

Clifford: But you can't really see that well on the other side. And then of course you're at the level of the traffic. So if you walk across the George Washington Bridge the trucks and cars go zooming by and it's hard to not experience that whereas he elevated the walkway on the Brooklyn Bridge....

Anthony: Oh I didn't realize that.

Clifford: ...above the grade so when you get up there and walk across the Brooklyn Bridge you have an unobstructed view from both sides.

Anthony: Wow.

Clifford: And in his day of course it was horses and carriages but it's even more valuable today because now we have cars and taxis.

Anthony: Sure.

Clifford: Trucks aren't allowed on the Brooklyn Bridge. But you're above that traffic.

Anthony: Right.

Clifford: And you'll see when you walk across it what a wonderful feeling it is. And he wrote in his report on the bridge, in his proposal, that the promenade would attract people, not only New Yorkers but would attract visitors. And when you walk across it and when some of your listeners walk across it, who haven't already, they will see that there are people from all over the world coming to see this bridge and to enjoy the view.

Anthony: That's nice. It's iconic. It really is. And of course, unfortunately, this is where he lost his life working on this project. Tell us about that, which is sad but it's part of his legacy.

Clifford: I guess the story of his death is also an example for people to avoid being too stubborn.

Anthony: Uh-huh.

Clifford: I mean a lot of his perseverance and a lot of his intense study of the problems he was investigating, the intensity with which he did everything was a huge factor in his success. But in a way it was also part of his undoing because when he and his son, Washington, were serving for the Brooklyn Tower, they were standing on the pier of the Fulton ferry - this was 1869.

Anthony: Uh-huh.

Clifford: And John was standing right on the edge of the pier and a ferry boat was coming in and because of a wave the ferry boat lurched instead of going into the slip. It lurched towards the pier where John was standing and pushed the timbers of the pier into one another and his foot got caught and crushed his toes. And the doctors wanted to amputate his toes because they were fairly crushed. And he wouldn't let them do it because he stubbornly adhered to this idea, which was popular at the time, of what was called the water cure. And the water cure was basically that whatever ailed you could be treated by either drinking lots of water or by washing thoroughly.

So he had his son, Washington, set up this dripping apparatus at the foot of his bed where he was taken after this accident. And this dripping apparatus continually dripped water onto his foot. But that wasn't enough to stop infection and he eventually got gangrene and it eventually killed him. So in this case perhaps he was a little bit too stubborn and if he had allowed the doctors, who were experts in a field that he knew very little about.

Anthony: Right.

Clifford: If he had acknowledged that maybe they know better than I do, maybe he would have survived that.

Anthony: Right. And that all happened fairly quickly right, from the accident to the time of his death?

Clifford: He died about ten days after the accident. And then his son, Washington Roebling, who had helped him build the Cincinnati Bridge and therefore was the second most knowledgeable person about suspension bridges in the entire world, he took over the job of building the Brooklyn Bridge and he was only 32 years old. And I think your readers probably know a little bit about that story, which is in those days building the piers of a big bridge like that meant that you used caissons, which were sort of big wooden boxes. Imagine an upside down wooden box.

Anthony: Right.

Clifford: And it was built along in a dock and it was floated out to where the tower was going to be built and then this caisson was sunk and the stones were piled on top of it and then when it went below the water, the cavity on the inside, the water was pumped out and that became an air chamber. And that kept it sinking down to the bottom of the river. And of course as it went down the atmospheric pressure increased inside that chamber because when you go below the surface of the water the atmospheric pressure increases. So Washington Roebling going down inside there knew that the disease that you got, which we now refer to as the Bends, which is also nitrogen narcosis.

What happens is when you go down and atmospheric pressure increases, nitrogen in our blood gets compressed and then when you come up quickly that nitrogen expands very fast because the pressure is decreased and instead of staying in solution in our blood it becomes a little air bubble. So now if you've got air bubbles in your blood and they get into your joints or they get into your brain you could actually have a stroke. And so now we know the solution is you either, which is what divers do, you come up very slowly and you allow that nitrogen to slowly expand but not to become a gas.

Anthony: Right.

Clifford: Or once you come out you go into a decompression chamber, which allows the nitrogen to do the same thing, to expand slowly. But nobody knew that at that time. And Washington went down into the caissons many, many times and he became disabled in 1872, only two years after construction started. And fortunately his wife, Emily Warren Roebling was a very well educated woman for her day and was very courageous and brave.

Anthony: Right.

Clifford: And she stepped in to help him at a time when women had no role in engineering whatsoever. And so he basically couldn't leave his house in Brooklyn heights overlooking the bridge but he continued as the chief engineer and Emily became his assistant and she conveyed information and drawings and specifications from him to the assistant engineers who actually worked on the bridge site. And she had to educate herself enough about what was going on with the bridge

construction that she could convey information between the assistant engineers and the chief engineer.

So she was actually credited with a role in building the Brooklyn Bridge in the 1950s when the, I think it was the Brooklyn Engineering Society erected a plaque on the bridge that mentions Emily Warren Roebling for her contribution. So we actually have three really interesting people in this portion of the Roebling story. One is John Roebling, who we've spoken about. Second is Washington, who stepped in to fill his father's shoes.

Anthony: Yeah.

Clifford: Had never been in charge of a major project himself.

Anthony: Sure.

Clifford: And despite his own self-doubts, he took on the job of building the Brooklyn Bridge. And then is wife, with no precedent whatever of women playing a role in a construction project...

Anthony: Right.

Clifford: ...she stepped up and she made a major contribution and Washington would not have been able to remain as chief engineer were it not for his wife. And together they were able to successfully complete the Brooklyn Bridge.

Anthony: Yeah, and for those of you out there that are women in the engineering field - because I know I talk to many of you and there's a lot of challenges with that because of the lack of women in the field - if you want to do some research I'm sure you can find a lot of information about Emily Roebling out there. And in fact, I've done some research on her and she has been called the first woman field engineer because of her contributions on the Brooklyn Bridge. So that's something that I would encourage you.

So as we wrap things up here what I want to do, before we get a couple of final thoughts from Clifford, is just quickly walk through some of the key points here that made John Roebling such a great engineer. Because that is what we kind of wanted to get to the bottom of here today and I think we've done that. So some of the points that came up was:

- He had a world-class education, which was obvious and Clifford gave us a lot of the details of that. When he was in Prussia in Germany he made the most of his education. Anyone could sit in a class with some of the best professors in the world but it's up to you to ultimately take

that education and utilize it and it was obvious that Roebling did that.

- He had field experience at an early age. He had that internship, at least what I called it, with the state roads department there and he got field experience.

- He was innovative. He learned about new technologies with these new cables, suspension bridges and he tried to implement them right away even on his internship when he was young.

- He followed his passion. He was passionate about this new technology to the point of he picked up and left his home country and came here to the United States.

- He was definitely a problem solver as well as an entrepreneur. He found this problem with the inclines, that we talked about with the boats, and he figured out a way to solve that problem. However, he had to take risks to do that.

- And that was another point was that he was a risk taker and he was very persistent. He took a risk. He tried something. It didn't work the first time he tried the wire ropes yet he persisted at it. He did it again. He took a risk by not getting paid for a year on it and that ultimately worked out for him.

- He had this mindset where he knew how to market things. He wrote these two articles we talked about for the Railroad Journal, which I'm sure in that time was a novel thing to do, to market himself in that way, which is definitely relevant to all of you as engineers.

- He was a great communicator. He was able to communicate. He wrote that letter to Eliot, even though he wasn't successful in getting the job, the approach that he took showed that he had an ability to communicate with people effectively.

- He wrote well or at least he tried to write and he learned a different language, showing his learning, and he did it in a way that he was able to write in that language, which is extremely difficult to do. And writing is a huge part of engineering - sometimes something that people don't know about engineering but it's very important.

- He had a great ability to instill confidence in people, which is huge in engineering because you're going to have plenty of teams that work for you and if you can't inspire them to unite on a project then it's going to be challenging for you, especially when you're dealing with architects, engineers, contractors all in the same room. And Roebling did that by understanding the problems and laying out solutions, which were well thought out, which made people comfortable in trying to implement them. So that was a big thing.

- He had an ability to present, powerfully present these proposals. Clifford kind of detailed these proposals, the way he laid them out, the drawings and the sketches. Again, made people comfortable to want to utilize his services, which is a big deal.

- He was sensitive to the community that he worked in. He didn't want to just design something that worked and that was efficient. He wanted to design something that people could be proud of, that could be part of the community, that could be an icon and he did that with his bridges. Clifford especially highlighted the bridge in Cincinnati, which is now called the John Roebling Bridge, and the Brooklyn Bridge, which has the iconic, the pillars, the arches, the gothic arches, which are beautiful.

- We talked about his ability to learn a little bit more than just his chosen field. So he learned about architecture enough that he was able to bring that aspect of the aesthetics into his engineering projects, which is rare.

- He was intense, which was probably a positive but also did lead to his downfall in the end but I'm sure people will take the intensity if they had the opportunity to because it sounds like he was able to utilize it.

- And another thing that we learned about him that maybe was a little bit of a weak point tied into his intensity was there are going to be times where you need to let the other experts do what they have to do. Like the doctors in his case. He didn't listen to them. But sometimes in the case of an engineer you might have to say, "Okay the architect knows better here," or, "The contractor's built a project like this before so let's look at their solutions." And then also that can come down to your ability to be a great engineer.

So those are the points that we'll outline in the show notes. Again, which you can get at engineeringcareercoach.com/podcast and you can find the show about the Roebling, at the Roebling Museum.

And Clifford, before we wrap up here, why don't you tell our listeners, maybe give them your website, some information they can find out a little bit more about Roebling. If they want to get your book, just give them that information. I'd like them to be able to find that.

Clifford: So The Roebling Legacy, you can find it at http://www.roeblinglegacy.com. It is also available at Amazon. And my own website for my consulting and also for other books that I've written is http://www.cwzink.com.

Anthony: Great, and we're also going to link to the museum website at the Roebling Museum and put the links up for their Facebook page and everything about the museum so that you can access that information. And after we finish this recording here I'll be walking around the museum and taking photos of the museum and I will put those photos also in the show notes on our website so that you can view some of the wonderful things that you can see here in the museum. And we'll get into the details of them so that you can see them. So with that, Clifford thank you so much for your time and all of your knowledge.

Clifford: Thank you Anthony. It's been a pleasure.

Anthony's Closing Remarks:

Anthony: So I hope you enjoyed my interview with Clifford Zink. It was certainly something different for me and I'd love to hear the feedback and you can leave a comment at engineeringcareercoach.com/roebling2 on the show notes, which would be great. But what I want to do now just to close off this episode is just to summarize the eighteen characteristics. I summarized the first eight already in the last show so I won't go into detail on them. I'll just read them off. So the first eight characteristics were:

1. Roebling had a world-class education.
2. He made the most out of it.
3. He had field experience early on.
4. He was innovative.
5. He followed his passion.
6. He was a problem solver.
7. He took risks.
8.

So now I'm moving into the second part of the interview, there was ten more points.

9. He had a marketing mindset or kind of that entrepreneurial flair, which I'm going to cover more in my next session with Sam Lydell. But he had that. He wrote an article in these journals, these railroad journals, about his wire ropes. This is like way before all this content marketing time. So he had that marketing mindset. So you have to think about how you can market yourself as an engineer.

10. He was an entrepreneur, again along the same lines. He took that problem of the wire, of the ropes, of the cables and he made those wire ropes. He solved the problem and that's what an engineer does and that's what an entrepreneur does.

11. He communicated well with people, whether it was through writing his articles. He knew many languages. He just spoke really well with people and that's something that is very big for you in regards to your success as an engineer. I can tell you that right now from my studies on this topic.
12. He was a great writer. And I know I talk to a lot of engineers that say, "The reason I became an engineer was because I didn't want to write and I didn't want to speak." But writing is one of the most important things we have to do as engineers to communicate to people and John Roebling was excellent at it and he was writing in English, which wasn't even his native language.

13. He instilled confidence in other people. He was able to look at a group of people or work with a group of people and then inspire them and help them to be confident. That's leadership. If you can do that on your engineering teams, you're going to be a great engineer.

14. Had the ability to present proposals. I'm sure your company would love for you to have that ability. Again, making you a better engineer overall.

15. He was sensitive to the culture of the community that he worked in. As an engineer you work in a community. I don't care what kind of engineer you are, you work for someone, you work in some type of community. Are you sensitive to their needs or are you just in there ploughing away on engineering designs because that's what you do? Think about that.

16. He learned about stuff outside of his field. So as a civil engineer he learned about architecture and was able to bring the two together. You don't have to be an expert in every field but knowing about the field that touch your fields can help you to be a better engineer for sure, especially if you work in a company that offers multiple service lines.

17. He was intense. He was just an intense guy. And I think having that intensity about you is going to drive you towards your goals and I hope that you can do that as an engineer because that will be helpful for you.

18. Don't go too far outside your field okay. That's why these two points, 16 and 18, you have to distinguish between the two of them. John Roebling knew about architecture enough to integrate it into his engineering but he didn't do architecture. He said let the architects do architecture. So you have to kind of balance that. You have to know enough about your field

and the other aspects of your field but then you have to just do what you're good at and let everyone else do the rest.

So those are your eighteen characteristics of one of the greatest engineers of all time. I had a lot of fun doing this show. I had a lot of fun visiting the museum. And I hope that you enjoy the show and utilize it in your engineering career.

And again, I'll make one last plea to please check out engineeringevent.com and please help me to create this movement for engineering career development, this once a year event that will really elevate engineer in the training that they deserve. I would really appreciate that.

Until next time, I hope that you continue to engineer your own success!

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You can also follow Anthony Fasano on Twitter @anthonyjfasano or Facebook at facebook.com/engineeryourownsuccess. Until the next time, thanks for listening!