Surfside Condo Collapse and How to Improve Urban Life Post Covid
What Happens Next 9.26.2021
Martin Paull QA

Larry Bernstein:

I want to go back first to the quote I gave you about that Surfside, mayor said, this was, "This doesn't happen in America. This is a third-world phenomena." First, is he right?

Martin Paull:

No.

Larry Bernstein:

And was it about the third-world that this is more common? What sort of failures do they have? What are they cheating on? Are they cheating on strength? Are they working with more risk? What's going on in the third world?

Martin Paull:

Well, not everybody waits for permits, not everybody does inspect, and the neighbors don't necessarily care sometimes. It is not at all uncommon for a concrete frame building, say a three-story building, to be built. And when you see it, and then now it's finished, and you walk by and you see rebar sticking out of the top of the top columns. What are they there for? They're there because afterwards, the owner's going to add another one or two stories to the building, illegally. And the neighbors don't necessarily look at it and say, "Oh my God, this guy is making the whole neighborhood dangerous." They say, "He's a smart guy. He's going to be able to rent out two additional spaces." It's a very different approach. In general, we don't do that in this country. But in general is much bigger than, what about this building?

Larry Bernstein:

Let's go to the topic of risk and reward. I'm in the finance business, and as part of that, in every decision every day, we have to evaluate the potential reward, the potential risk, and even the distribution of risk. Is it lopsided to the negative or the positive?? And we consider that in a portfolio context. Here, when you're doing architecture, there's no diversification of risk. It's not like you have a portfolio of buildings. We have to focus on the risk of collapse or disaster for each specific event. What is the current theory on how to apply risk in building structures and how should we think about it differently going forward?

Martin Paull:

Risk is being added more and more to our analysis. We look at minimal structures. There are structures, say, a roof over a sports arena of a complicated three-dimensional trust system that might be so optimized in this design that the failure of one member could bring down the entire building. And so redundancy becomes, for instance, in that case, something to be looked at and we do more of it than we used to, but it isn't that long ago, and there are loads of buildings still there, where this was not looked at. And it's not even generally a part of everyday discussion, which is part of what concerns me.

Larry Bernstein:

You mentioned salt water as being particularly corrosive, so let's start with saltwater as the first example. There were 2 major hurricanes in New Orleans, huge saltwater flooding. So is water corrosion, as an example, a flood really problematic or is it the constant salt in the air eating away at the concrete? How do we think about, an enormous percentage of America now lives on these salt water areas, how risky is it? What damage does it do?

Martin Paull:

It's really both. Here's the real problem. Concrete is a material that's great in compression and it's awful in tension, and tension is required in structures. And so we put steel in to take the tension and the two of them together are what give the building strength. But they need to be bonded to each other successfully in order for them to work. And when steel starts to rust and salt water rusts it faster, when steel starts to rust, two things happen. One is the rust flakes off the steel, so the concrete is bonded to the rust not to the steel anymore. And the other, which is even worse, is that rusting steel expands, and so it pushes out from the inside and explodes the concrete. And so rusting steel is a major problem and salt water does it even faster. So what sometimes happens, like in the case here, a concern is they were driving forklifts around or things like that to put in the planters and so on, did that make for little micro cracks in the concrete?

Because concrete is not really impervious to water to begin with, but little cracks, make it worse. Okay, then water is getting into the steel even faster and salt water is just relentless. It's hard to keep it back and once it gets in there, a process will start. We've used in recent years, for bridges and stuff, there's epoxy-coated steel, which is having its problems because the epoxy cracks and so on. There's stainless steel that can be used. There's galvanized steel that can be used. The point is that it's such a recognized problem that we continue to work on how to fix it because it's a big deal.

Larry Bernstein:

The city has this 40 year certification process. The building was aware of that. They were cognizant of that. They were more cognizant of the 40 year certification than their own safety in many ways. They hired an engineering firm and the engineering firm came back with some suggestions, but it was expensive. The head of the board recommended doing some changes and she was yelled at, screamed at. She cried. She resigned. We have a situation where we have a group of non-engineers put in charge of evaluating a report from an engineer and then giving that report to people who also aren't experts. How are these communities supposed to evaluate these risks? Why were the reports written in a way suggesting that the building wasn't about to fall down? And how as a community should we make decisions in the context of both government and a board and a condominium community?

Martin Paull:

It's a major, major question. We don't have a specific method of dealing with issues like that, but take something like the 40 years certification. In this country, heart disease affects mainly men in the range of 40 to 50. That's when the numbers start to go up and it gets really significant, and everybody knows that. And so when you do your first examination of a male patient when he's 35 or 40, wouldn't you start much earlier because you can't necessarily reverse these things easily? And the problem with something like a 40 year certification is it gives permission to wait until the 40 years comes up. That's a real problem. It's not at all unusual that when you set a minimum standard it becomes the maximum result, that people won't do more than what the minimum calls for. It's hard to legislate that what should the minimum be, make it high enough. But part of engineering responsibility, part of human responsibility is to look beyond those things. And it's not an easy problem.

Larry Bernstein:

Going back to the board for a second, the board, I was on the board of my condo association, it's a 50 story building. There were no engineers on the board. We had an engineer who worked for the management of the building. He would provide an annual report, but the questions were like, "How long was the useful life of the roof?" It was never a question of, does the sway of the building result in micro cracks that could result in the building coming down? How should non-experts in this area evaluate these questions and should they be more proactive or are they going to be afraid that if they are more proactive and they find something and they don't do something, now they can go to jail? I mean, where does ignorance play in this risk?

Martin Paull:

Well, take something like your situation in particular, I would want part of the responsibility of that engineer to be that on a regular basis, I don't know, three years, five years, or whatever, do exactly the kinds of questions that you said. He may not be capable himself of answering them, but he could do responsible for pursuing it and that, that would be an expectation that that's what the responsibility of the engineer is. He would deal with problems that happen as they happen. The front door broke, and how do we fix that? And then who do we call? But also, on a regular basis, worked out with him or others what kinds of big questions should be asked. Even if the consultant that comes in and says, "You don't have a problem here." "Great, thank you. See you next time." But we have to be purposeful about it.

Larry Bernstein:

If you were going to live in a community like Miami Beach, would you want to live in a condominium, or would you want to live in a single family home given the risks of massive flooding and hurricanes?

Martin Paull:

I would be reluctant to be in a concrete structure within, I don't know, a quarter of a mile of the ocean, or at least I'd like to know how it was built. And I don't mean someone tell me personally, but a real expert be looking at that. But also, how is it aging? And on a regular basis, I want to hear about it. If at the end of 40 years, we'll tell them the state and the city about it, that's nice too. But I'm not moving in unless I have some idea of what condition this is in beyond just somebody standing outside and saying, "It looks great to me."

Larry Bernstein:

Millions of Americans live within a quarter of a mile the ocean.

Martin Paull:

Yes.

Larry Bernstein:

Millions. And I'm just wondering, we talked about risk earlier, there's all sorts of risks. Obviously, there's a risk of a building falling down and corrosion. There's also the risk your house can burn down or that you can be robbed and burglarized and murdered. So, how risky is it compared to some of these other risks that you take every day? Going back to the Mayor of Surfside, it doesn't happen in America. This is the only building we know of that's come down. Is it really once in a blue moon or is it something that is of real concern?

Martin Paull:

Well, first of all, it's not really true that these don't happen, because things like parking lots collapsing do happen. They're not that unheard of. The question is, in this case, being attached to an apartment house. It's not the apartment house that failed here, understand. It was really the parking structure that failed. But in terms of how risky, well, everything has risk. I get it. And it's hard to compare one risk to another. But there are those where you feel like, well, but this one I could do something about, and others maybe I can't do something about. Just nice to be knowledgeable.

Larry Bernstein:

Well, I mean, I've often heard every building will burn down at some point given enough time, as example.

Martin Paull:

Right.

Larry Bernstein:

But when I compare a single family home fire risk with a fire risk at a condominium, the fire risk, I think-

Martin Paull:

Well, let me back you up for a second.

Larry Bernstein:

Yeah.

Martin Paull:

The reason we have fire codes and so on is not to protect the building. It's to protect the people. So, when a building, a multi-story building, say a four-story building has corridors that are fire rated for, say, one hour. That means they there's about an hour for people to get out of the building before the building is at risk of collapsing. The collapse of the building, the burning of the building that's between the insurance company, lawyers, and so on. The rules that we have are about protecting people. What you saw is in this case, the building collapsed in 10 seconds.

Larry Bernstein:

Yeah.

Martin Paull:

So, nobody's getting out. Right? But I want to know that in my house, I could get out of the building. Every bedroom needs to have an egress, needs to have a way to get out. Right? That's not protecting the building from burning. That's protecting the users of the building. So, you don't have to get the risk down to zero.

Larry Bernstein:

Right. We have a question from the audience. This is from Alan Herskowitz. He wants to know, do we have technology like a sensor that we can install inside the rebar so we can monitor the corrosion deep within the structure? Because it seems like how are we supposed to evaluate what's going on inside that?

If we send in a probe from the outside, are we making a micro problem itself like the Heisenberg uncertainty principle where we affect what goes on inside potentially to the worse? It's like a biopsy. And is technology getting better where we can start to see inside to find out what's going on? Because even afterwards it seems here, we still don't even know how much rebar was in there.

Martin Paull:

That's true. And it's a difficult problem. It's not a simple one to go inside and look. There are x-ray techniques and so on. You don't want to just cut whole all over the place exactly for that reason. But there's often some evidence on the outside. There are cracks. There are sizes of cracks. When steel starts to rust, you see staining.

Many times I'll drive past a project. On the freeway route, I'll drive past an overpass, and I'll see a chunk of concrete that's come off the top of... above me on the overpass. Years ago, I thought, oh, that's interesting. A truck that was too tall must have hit it and it knocked off some concrete. And now you can see the rebar starting to rust from the inside.

But no, it's the other way around. The rebar started to rust because of cracks, because of handrails that were improperly installed. And the rust started to expand and it pushed the concrete out. So, you can see it. With a trained eye, there's a lot that you can tell from the outside about what probably is going on in the inside. A complete investigation, that would be very difficult.

Larry Bernstein:

I see often relatively new concrete buildings on their facades, you see cracks all over the place. And then you often see they've called somebody and they patch it up, and you can see where the patchwork has been done. What's going on there?

Martin Paull:

Well, first of all, concrete cracks, that's true. And it's not a material that can easily be patched from the outside. We sometimes try and fill the cracks with epoxy or other things like that, but it's difficult. But has corrosion started? Maybe. In that case, maybe you do want to do a little opening up to see going on. But I would also look at where is this. Is this spacing the ocean? Would I be more concerned with cracks here?

Martin Paull:

We have rules for how far from the surface of the concrete the steel should be. I'd probably like to review the drawings to be sure that that was done. We also more recently, we use as-built drawings we because changes take place during construction. And so, I'd like to know, well, what was actually built.

Larry Bernstein:

Okay.

Martin Paull:

But you can't get the risk down to zero, that's true.

Larry Bernstein:

I want to switch from water to wind for a second, because I was born in Chicago and it's more of a windy city. Recently, they put in some new buildings and they tested for wind and they decided it didn't have enough wind stability. So, they didn't build a couple of floors in the middle. There's a hole in the building, if you will, allowing the wind to go through. What do you think about that as a method of reducing the power of wind? And as buildings age, should large buildings consider opening up a floor to reduce the wind as its strength declines?

Martin Paull:

Well, let me answer the second part first. It's hard to go back to an existing building, especially against lateral loads of wind and seismic, and really change what their resistance is without doing really major work. It's certainly done, but it's not a trivial thing to do.

In terms of the first question, the problem of wind and earthquake at a certain level is that energy is being put into the building at an uncontrollable rate. And we'd like to use up the energy. And one of the things that uses up energy is letting the building sway, having the building move. The big buildings move a few feet on really windy days. That has to be a part of the engineering on some of the buildings, especially for wind-

Larry Bernstein:

And that's healthy, right?

Martin Paull:

... it's the seasickness, it's the comfort that gets to be a problem. The well-known one of Citicorp in New York that eventually had major problems. I won't go into the whole story. But their tuned mass damper on the roof, or at the top floor, was really there for comfort, initially, not for strength. They eventually decided they need to use it for strength, and so a whole bunch of things were done.

But the movement of buildings is... It would be worth it for someone to Google the Tokyo buildings in earthquakes and to see how much buildings move around. It blows me away. I show it to my classes. It's hard to imagine that big buildings are moving the way they move, but they do.

Larry Bernstein:

Yeah, I lived in Tokyo. I lived in Tokyo for a year and there were earthquakes all the time. Nothing major, just minor stuff. And you're right. You wake up and go, "Oh my goodness." And I guess sway, I think what you're saying is, is that allowing for sway is a benefit to the building because you don't have to require... it doesn't undermine the strength of that rebar and the concrete. It's moving around and the energy is being dissipated.

The John Hancock building in Chicago, which is one of the largest buildings there, it really sways a lot. And as a matter of fact, if you go up to the bathroom on top of the building, the water in the toilet is just moving. I mean, it could slap you in the ass.

Martin Paull:

Yep.

Larry Bernstein:

That really indicates that there's a lot of sway there, and I never focus as the sway as being a benefit.

Martin Paull:

Yeah, but assuming that, and I think that building was very well designed, but assuming that we're talking about a building that is well designed. When it's moving around like that, I don't expect people really to do this. But what they should be doing is saying, "Boy, am I glad this building is moving around, because that's using up a lot of energy. And that's the problem this building is having right now. And so, this is good news. Look, the building is moving. Also, I'm getting seasick, but that is the way it goes."

Larry Bernstein:

Let's change the subject to your example of multiple failure, that the collapse of one floor resulted in the collapse of a column and then the collapse of an entire building. And it brings to mind the World Trade Center as an example of failure. Now this was something obviously they didn't design it to withstand a major airline with all that jet fuel-

Martin Paull:

Well, they did, actually. They designed it to resist the physical force of a 707 airline. Not a 737 because they wouldn't exist yet, but it was actually designed for the impact of a 707. And the impact, other than local destruction, did not do major damage to the building. The building shuttered and then stopped, and it was okay. The problem was the fire. One of the problems with steel is that when steel gets to a thousand degrees, approximately, it turns into spaghetti. It just gets incredibly weak. It's not melting. Steel doesn't melt till 4,000 degrees, and the fire is not getting that high-

Larry Bernstein:

But it just lost its strength.

Martin Paull:

It loses its strength. In that case, the impact say, I'll just use these numbers, say the impact is on the 90th floor out of 110 stories, when the columns on that level lose their strength, a 20-story building from 90 up now falls onto the 89th floor, which is not prepared to have a building fall on it, and so it collapses. Now a 21-story building falls onto the 88th floor and so on. That's progressive collapse, where the initial event may be sizeable, but what ultimately happens is enormous compared to it. It came from one thing compromising the next, compromising the next and compromising the next. It's hard to interrupt that vertically.

Larry Bernstein:

Would you view that as a design flaw, the World Trade Center, or would you just say the World Trade Center was not designed to handle a 737 with a full tank of gas?

Martin Paull:

No, I think actually, it's a little different than that. It did resist the 737 in terms of the impact, and the tank of gas probably burned off in the first few seconds. The fire that ensued is what did the damage, and it is not easy to make a building today that it can't have fire. In this case, the impact probably blew out all of the fireproofing, the drywall and so on around the steel, so the steel was more vulnerable. It probably blew out whatever sprinklers would have been in the building to try and control the fire. It's hard to harden those things enough, though we do change the standards, and we have been trying to address that and make the buildings more resistant to things like explosion and so on.

Larry Bernstein:

I worked at 7 World Trade Center in the years before 9/11. I spoke to the CEO, Mr. Gutfreund, about it. He told me that they had put an oil tank in the basement to handle a situation where power was out in New York City for an extended period of time that Salomon Brothers could continue to operate. Then during 9/11, shrapnel from the World Trade Center hit 7 World, started some local fires. Everyone was able to get out of the building safely, which may be your point, is how it was designed, but sooner or later, the fire made its way into the basement and hit that oil tank, and the building collapsed.

I contrast that with there was a building that was built in the '20s, a brick building, very limited glass and steel, that was right next door to the 7 World Trade Center, and that building was perfectly fine. How do we think about these glass and steel modern buildings compared to the old brick buildings in comparison in terms of risk?

Martin Paull:

Well, this is not only the physical risk that we're initially talking about, but it's also sort of the economic risk. Can you really have a society that says, "We're going to only build completely fireproof buildings"? I mean, in Los Angeles, if you wanted to build only earthquake-proof buildings, they would be half-buried, concrete, one-story bunkers with no windows, and we're not going to do that. We're not going to have a society that way. We kill 30,000 people on the highway every year. We could reduce that to zero by just making the speed limit three and enforce it, but we're just not interested in doing that.

Larry Bernstein:

Right.

Martin Paull:

This is a balance. The risk needs to be evaluated. It needs to be looked at. We need to be conscious of it. It doesn't mean we're going to aim to zero.

Larry Bernstein:

One last question on the Surfside condo building. In the first couple of days, or maybe even the first day, there was discussions about the fact that the building had sunk by two millimeters or something. Everyone said, "Oh my God, that's a big deal." I kept saying, "Two millimeters. I mean, my god, that seems like nothing. Who would even know?" Was there anything to that?

Martin Paull:

Probably not. It's the differential. If the entire building sinks as a unit, it's a nuisance, but it's not necessarily a problem. The problem is differential settling, where one part sinks and another part isn't. On brittle materials like concrete, that introduces cracks into the concrete. It's the cracks that give you a problem.

Larry Bernstein:

Got it. As you know, we end each session at a note of optimism. Marty, what are you optimistic about as it relates to structures?

Martin Paull:

Well, this has to do with COVID and the discussion that, in general, is out there. COVID has been awful. I don't think we've handled it very well. I'm not going to go there. But the discussion has very much been about risk, and the word risk. The idea of risk is now a much more ordinary part of our discussion of the impact of something. The discussions about COVID are not, what's the mechanics of how one cell gets affected by another. There are people who do that, but the public is not looking at that, but we do look at risk. We'd look at what the rates of hospitalization are and so on. Having the discussion turn towards risk and become an ordinary part of discussion, I think, is ultimately going to be helpful to our society.

Larry Bernstein:

Marty, thank you so much.

Martin Paull:

Thank you.