[SQUEAKING][RUSTLING][CLICKING]

RICHAED DE NEUFVILLE: I'm now coming to the end of this series of presentations, and I'd like to share with you what I think are the important takeaways from these series of sessions. So the first takeaway is that the forecast is "always" wrong, where always is in quotation marks, that it is the probability of any deterministic forecast of what will happen over a period, not just at the end, but all the ways in between.

The probability of that forecast represent what actually happens is very small. Other things happen because there's variability, first of all, because the world changes. There's new technologies, new competitors, economic good situations, bad situations, new regulations, whatever. Things happen, and the future is not what the single forecast might be. That's number one.

The second is the complementary aspect that, since it's wrong, we ought to recognize the reality when we do our design, and we do our calculations as to what is the best solution. Otherwise, if we don't recognize that, we get a wrong valuation from it, and we get the wrong answer. So you need to take that into account.

In particular, we need to do it because of that phenomenon, that fact of the Flaw of Averages, that is, if you calculate the value of the system using the most likely parameters for the average demand, the average cost, the average use, and so forth, then you'll get the wrong answers.

This is a mathematical triviality in many ways. But we've got to keep it in mind because it means that that shortcut route that needed to be done in the past but does not need to be done in the edge of computers leads you to the wrong answer. We need to take into account the range of possibilities that occur, so we get the right answer.

Simulation is the way to go in terms of an easily accessible way to sample the space of the possibilities by looking at 1,000 or so different scenarios that might occur. That's take away number one, the reality of uncertainty.

Take away number two is that there are remarkable benefits from flexible designs for dealing with uncertainty. In general, they give you the win-win situations at a lower cost. Less loss and more gain. Less investment compared to alternative choice without the flexibility. And what's not to like? That is the message.

Now, their actual results depend upon the situation, the level of uncertainty, and so forth and so on. But it is a route to explore. If you do not explore that possibility, you don't tend to get the best that you possibly could. And that best may be significantly higher than without the flexibility.

There's two references on it that I could share with you. The first one is this book of a few years back by the MIT Press. *It's Flexibility in Engineering Design,* which I co-authored with my colleague Stefan Scholtes at Cambridge University in the UK. And the second one is coming out in 2018, very soon now. Or maybe, when you listen to that, it's already come out.

And it is published by Wiley in the UK. And it's*Flexibility and Real Estate Valuation Under Uncertainty.* And it's a practical guide for developers, that is, in it, we look not just at the principles. But it includes all kinds of Excel spreadsheets and softwares that look at the various conditions that may occur before designers. So it's a roadmap of how to apply this in the real estate world.