Profile

Skyscraper expert John Viise can trace his structural engineering ancestry back to pioneers in the field. But the American counsels modern engineers to "work the problem" for themselves rather than rely too much on computers. During a recent trip to the UK, he spoke to Jackie Whitelaw.

It's a bit of a surprise when structural engineer John Viise says he's "not fond of heights". After all, he's had over 20 years of experience helping design some of the world's most impressive tall structures including the current biggest of them all, the Burj Khalifa in Dubai, which tops out at a staggering 830m.

"I did have to go right to the top during construction to check things out before the cladding went on," he remembers. "That was a bit of an out of body experience. I was clinging to the elevator until 30 or 40 floors up and then it was like being in an aeroplane; like you are not really there and so I was fine. I still stood pretty far back though!"

Viise was facing his fears when he was an associate at Skidmore, Owings & Merrill (SOM), working on the Burj under the supervision of the building's chief design engineer, Bill Baker. The structure is just one of many skyscraper designs that he had been involved with since he joined the SOM practice in Chicago in 1993 and then later at Halvorson & Partners in 2006 as Associate Principal.

His project credits with Halvorson include the competition-winning design for the Wuhan Greenland Center (>600m) and several other towers in China including the Samsung China Headquarters in Beijing (Figure 1). John also served as project engineer for the 380m World Trade Center Abu Dhabi (Figure 2) and the 1 Dubai tower which, had the project gone ahead, would have broken the 1000m mark (Figure 3). With SOM, Viise was working on the Pearl River Tower in Guangzhou, China just before he switched firms and, of course, there was the Burj.

Throughout a career of designing cutting edge buildings, he has had the benefit of working with several ground breaking structural engineers of his time. He is quietly proud to be able to list, along with Bill Baker and Bob Halvorson: Lawrence Novak, Stan Korista, John Zils and even Hal Iyengar who was mentored by Fazlur Khan.

"I feel very fortunate in my career to have been trained by engineers who are giants in the field of innovative structural design – particularly tall buildings – and who were demanding and sparked my interest in the field," he says.

That career started after Viise had completed a degree in mechanical engineering at Virginia Polytechnic Institute and State University followed by a Masters in Civil Engineering at University of Illinois at Urbana-Champaign.

"There was certain coursework in mechanical engineering I really enjoyed like mechanical vibrations and structural dynamics but I didn't care for thermodynamics. I'd taken some undergraduate courses in structural engineering, and interdisciplinary fields of study like earthquake and wind engineering were especially interesting to me. So it was a natural shift to go for a graduate degree in structural engineering. Illinois was a recruiting ground for Chicago firms including SOM and that's where I started out."

The world was a different place in 1993, Viise who is now 46, remembers. "I think it is a fortunate thing that I was trained by engineers at the forefront of tall building design before computers were really common. In fact, I remember Bill Baker helping me to develop my first computer analysis model!

" When I started there was one phone at the end of the desk aisle, so you barely made external calls and email did not exist. You got used to the idea of studying a problem; you could be more thoughtful and work on something undistracted for a period of time so you could really delve into it. Now computers and software programs are so powerful that young engineers do four or five things at once. They are highly

skilled at manipulating a lot of data but when there is an issue the software can't handle they are a bit more challenged.

"The engineers I was trained by had done a lot of design work prior to the advent of extensive computer software and, as a result, they were well versed in the practice of checking their designs by hand. They drummed into my head that I really needed to understand the behavior of structural systems to design efficiently and to work a problem."

Engineers have to understand what they are building, how the structures work, he says. "Hand sketching is very important in the design process to help others understand your structural system ideas. Concept sketches are crucial because they are generally clearer. If you have a bad concept the computer doesn't sort it out."

Viise is a strong proponent of the use of the latest digital design tools and he is watching the development of the use of BIM with interest. "Obviously, today's engineers need to be skilled in the use of current digital design tools and these tools help us solve very complicated design problems we could not solve by hand. Being able to utilise these tools to collaborate and develop design concepts is one reason high end architects work with Halvorson and Partners. But there is a risk when an engineer feels pressing a button can be a substitute for intuition developed through experience."

China is the main focus of his work at present and Viise is enjoying the experience which is developing his already extensive tall building design knowledge - particularly as it relates to earthquake engineering. At Halvorson and Partners he often leads performance-based design efforts on projects to verify unique and super-tall building system seismic design for expert panel approval.

"In China, local design institutes (LDIs) do most of the designs, but over 200m their approval process requires that a group of independent experts review the design. I think they have it right. LDIs have many of the tools and the expertise to design tall buildings but have an appreciation of when they are going beyond what they are used to doing, so they bring in someone with more experience to partner with, to complete the design."

The market for tall buildings in China has a long life ahead, Viise says. "I think building tall is a sustainable option, particularly for China because of the density of population."

Viise who is MIStructE, had a couple of stints working in the UK, particularly on the Broadgate, Canary Wharf and Ludgate developments and is now on the Institution Council and its Earthquake Engineering Advisory Group. Additionally, he is involved with the ASCE 41 committee which deals with the criteria to quantify results of performance based analysis.

He clearly enjoys working with other cultures. "When I came to London I had to learn quickly how the work gets done, in particular that planning approval takes a long time in London. At one of my first meetings for a London project [SOM's 5 Fleet Place project] I was surprised to hear that an individual in an Indiana Jones hat had such a prominent role in the project meeting. I came to find he was an archaeologist who was involved because our project site was on the site of an old Roman prison. I was familiar with the idea of digging test pits to avoid conflicts during foundation construction but in my experience test pits were conducted to avoid obstructions like main electrical feeds for airports, not Roman coins!"

Working in China also required a change in John's personal approach to design. "I am used to being proactive and pushing a structural engineering agenda during design. In China I have learned to be more patient and subtle in achieving the same goal; I would say I am now much more conscious about stopping to listen hard to what other people are trying to say. That said, when I am dealing with some of the new generation of developers in China who may approach project management in a more traditionally western way, I can switch back to my old self."

Viise reveals himself as a purist. He wants the best, most elegant, most beautiful solution to a design challenge and he knows everything can always be improved.

"I was influenced by phenomenal engineers, teachers and authors like David Billington of Princeton whom I have heard speak a couple of times. If you read his books or listen to his talks, you are struck by how he describes great structural engineers as their own harshest critics who constantly rethink and rework design to improve upon even their most successful completed works.

"Really good engineers understand that structural engineering is an art but at the same time they are very rigorous in the science of the field. By being true to a design concept you inevitably produce something elegant and appealing."

Figure 1 Samsung China Headquarters, Beijing (currently under construction)

Figure 2 World Trade Center, Abu Dhabi

Figure 3 1 Dubai Tower, Dubai