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How To Build Today's Supertalls

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Elegance, not machismo, is behind Chicago's unprecedented reach for the sk

August 19, 2007 | By Blair Kamin, Tribune architecture critic

A white hard hat on his head, the earnest look of a professor on his face, Bill Baker has a ready metaphor to reveal the hidden structural logic behind Chicago's unprecedented reach into the sky. Mimicking the cores of concrete that shoot up the center of today's supertall skyscrapers, Baker stands like a soldier at attention, his feet touching. The silolike cores are too thin to single-handedly brace the towers against howling winds, he says. So Baker extends his left arm and puts it on the shoulder of a colleague standing with him in front of Donald Trump's ever-growing skyscraper on the Chicago River's north bank.

"That steadies me," says Baker, a 53-year-old partner and structural engineer at the Chicago architecture, engineering and planning firm of Skidmore, Owings & Merrill. "It's like ski poles."

He has just illustrated the essence of a relatively new but little-noticed way of erecting skyscrapers, in which massive arms of steel or concrete extend outward from a building's core and grab high-strength structural columns at or near the perimeter, bracing the building against gravity and the overturning force of the wind. This is the method, called core and outrigger, that is propelling a skyscraper boom unlike any other in Chicago, birthplace of the skyscraper. Today, for the first time in its history, the city has three supertall skyscrapers -- those 1,000 feet or higher -- under construction simultaneously. And owing to shifts in both physics and aesthetics, they aim to become icons of a new post-industrial, post-lunch bucket city -- less about old-fashioned machismo than new-age elegance.

"It's the difference between somebody who is a gymnast and a dancer," said Zurich-based architect and engineer Santiago Calatrava, designer of the now-under-construction Chicago Spire, in a telephone interview from Spain. "We try to be elegant -- we are not being athletic. We are not showing muscles."

At this stage, the most visible of the new giants is the Trump International Hotel & Tower, which now reaches more than 500 feet into the air on its way to a total height of 1,362 feet -- 88 feet shorter than Sears Tower. Then there is the Waterview Tower, where the superstructure has just popped out of the ground at the southwest corner of Wacker Drive and Clark Street. This hotel and condominium skyscraper eventually will stretch to 1,047 feet, a foot taller than New York's celebrated Chrysler Building. Finally, there is the Spire, the twisting 2,000-footer at 400 N. Lake Shore Drive, which will be the nation's tallest building and the world's tallest all-residential structure. For now, it consists of a few holes in the ground, into which contractors will drive steel and concrete caissons reaching 120 feet down to bedrock.

While other places have far more supertall towers under way -- the oil-rich Middle East playground of Dubai has a staggering 15, according to the Emporis international building database -- Chicago offers something that no other city can: a chance to view the present generation directly alongside the previous generation -- Sears Tower, the Aon Center and the John Hancock Center. That trio of giants, which was based on the structural concept of a "framed tube," redefined the skyline's silhouette between 1969 and 1974.

Evolution of the art

"What's going on here is fairly phenomenal," said Antony Wood, executive director of the Chicago-based Council on Tall Buildings and Urban Habitat, an international organization of architects, engineers, planners and builders. "It's a unique place to watch the evolution of the skyscraper art."

That evolution is inseparable from the work of structural engineers such as Baker, who tend to work in the shadows of more celebrated architects. But maybe that is changing. The current cover of the trade journal Architectural Record carries the headline "Engineering the New Architecture." The

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lead story is titled "The Engineer's Moment." The point, as author Nina Rappaport asserts, is that engineers are assuming an expanded role in design rather than simply laboring as "consultants after the fact."

"They're very important," agrees Chicago architect Adrian Smith, who collaborated with Baker on both Trump and the Burj Dubai, the under-construction, mixed-use tower in Dubai that is expected to hit a record-shattering height of around 2,650 feet, more than half a mile into the sky. "The architects can conceive things to be built," adds Smith, who left Skidmore last year to start his own firm. "But very rarely do they have the expertise for how to keep it up and build it in the most efficient ways. You need a team of structural engineers to do that."

Indeed, structural engineers have played an integral role in the development of tall buildings for nearly 125 years.

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