

Why are so many tall and supertall buildings under construction?

February 6 2023, by Jodi Heckel



Very tall buildings are attractive options in cities where land is at a premium, but they come with construction challenges, said University of Illinois Urbana-Champaign architecture professor Abbas Aminmansour, who specializes in the design of tall buildings and is a 2022 Fellow with the Council on Tall Buildings and Urban Habitat. Credit: Fred Zwicky/University of Illinois at Urbana-Champaign

Tall, supertall (heights of 300 meters or 984 feet or taller) and even megatall (at least 600 meters or 1,968 feet) buildings are being added to city skylines around the world.

University of Illinois Urbana-Champaign architecture professor Abbas Aminmansour specializes in the design of steel and reinforced [concrete structures](#) and of tall buildings. He is one of four Fellows selected globally in 2022 by the Council on Tall Buildings and Urban Habitat and a member and past chair of the Chicago Committee on High Rise Buildings. He spoke with News Bureau arts and humanities editor Jodi Heckel about the challenges of [building](#) supertall.

Why do developers build tall and supertall buildings?

The primary reason is the need for space, both residential and commercial, in urban areas. Globally, about 10 million people move to urban areas each month. Some very large cities don't have much land available to build on, driving developers to build tall, supertall or even megatall buildings. There have even been cases when project owners purchased what are known as the excess development rights from adjacent buildings to build a taller building on their site. And there are the personality aspects of some developers and occupants to want to build taller than the competition or to have a condo or office address in a supertall building.

Cities with skylines including tall buildings are viewed by many as forward-looking and prosperous. In addition, tall buildings have proved to be magnets for new developments, bringing in more businesses and helping the local economy. After completion, some tall buildings end up in the portfolios of investment and insurance companies, providing economic benefits for more than just the developer.

What are some of the technical challenges with building tall?

Tall buildings are susceptible to lateral movement, or what we call drift, due to wind or earthquakes. Therefore, you need a fair amount of structure beyond what is necessary to support the weight of the building and its contents to make sure the building movement stays within acceptable limits. A building that moves excessively is not necessarily structurally unsafe but may cause people to feel sick and may damage walls, pipes or the elevator system.

Then there is the design of the elevator system. You want to have enough elevators to provide reasonable wait times for users. At the same time, elevator shafts take up area on every floor. That is a loss of potential revenue for the owner. There have been recent innovations that let elevator cabs move not only vertically but horizontally on certain floors to allow more than one elevator cab to operate in the same shaft, thus increasing efficiency.

Mechanically, you need to deliver conditioned air and water to very high heights for occupants' consumption, as well as for fire suppression systems. Just imagine the [water pressure](#) in the pipes at the base of a tall building. It is tremendous and takes hefty material and equipment for its operation. From a construction point of view, you need to deliver material to great heights, which requires special equipment and expertise.

These are all very well-understood challenges with solutions. The key is for the architect, [structural engineer](#), [mechanical engineer](#) and even the contractor to work in an integrated way to design a building that meets the architectural aspirations of the project and is economical to construct and to operate.

Are tall buildings as energy efficient and sustainable as shorter ones?

Tall buildings are typically designed by the best in the profession and are as efficient and economical as they can be. However, they are not as sustainable as their shorter counterparts. For example, modern tall buildings have a significant amount of glass on their exterior walls. Glass is not the most energy-efficient material when it comes to heat gain and heat loss.

And there are the challenges that we spoke about earlier. For instance, to have a stiff enough structure to limit the drift of a tall building, it takes a lot more structural material to build than shorter buildings with similar total floor area. So, if you use the same measuring sticks that we use for other buildings—[energy consumption](#), the amount of construction material used, the efforts and energy consumed during construction, and the carbon footprint per square foot of usable floor area—tall buildings are not as sustainable as shorter buildings.

However, they have what I call a considerable sustainability impact. Imagine a tall residential building with 400 units in downtown Chicago. If these residences were to be built in the suburbs, they would take up a considerable amount of land—likely agricultural land—and require significant infrastructure such as new roads, water, sewage, electricity, gas and other services, requiring a large amount of material and having a high carbon footprint. Plus, there is the need for repair and maintenance of the roads and other infrastructure, more vehicles on the roads, fuel consumption and fume generation, commuting time and other factors.

So, no, tall buildings are not as sustainable as short buildings, but they have a significant sustainability impact. We just need to think outside the box, both figuratively and literally, when considering sustainability.

Provided by University of Illinois at Urbana-Champaign

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