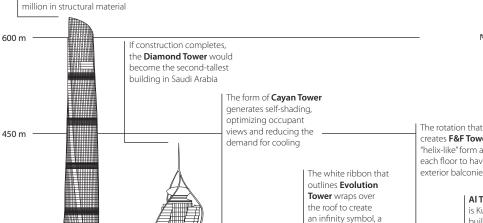
Tall Buildings in Numbers

Twisting Tall Buildings

CTBUH defines a "twisting" building as one that progressively rotates its floor plates or its façade as it gains height. Usually, but not always, each plate is shaped similarly in plan and is turned on a shared axis a consistent number of degrees from the floor below. A stunning variety of textures, view angles, and ripple effects results from these manipulations, making these "twisters" some of the world's most iconic buildings – and in many cases, aerodynamic and energy-efficient. In this study, we rank the world's 28 tallest twisting towers (either completed or currently under construction) and display selected variations on the theme.

Global Twisting Icons

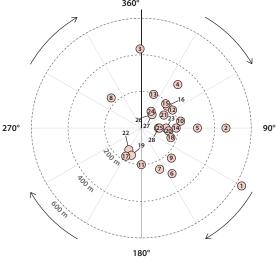
To accommodate typhoonforce winds, the twist of the Shanghai Tower reduces wind-load by 24%, saving \$58



creates F&F Tower's "helix-like" form allows each floor to have four exterior balconies

Al Tijaria Tower is Kuwait's tallest building, and features direct reference to vertically stacked, human evolution six-story-high atrium gardens throughout its height.

Comparison of height vs. total rotation for 90 m+ buildings currently complete or under-construction



Note: All numbers in dots correspond to the table on the right

Once completed. United Tower will become the tallest mixed-use project in Bahrain

> Turning Torso is widely considered the first "twisting" skyscraper, inspiring countless other designs

Shanghai Tower 632 m / 2,073 ft Shanghai, 2015

300 m

150 m

Diamond Tower 432 m / 1,417 ft Jeddah, 2019*

Cavan Tower 306 m / 1,005 ft Dubai, 2013

Evolution Tower 246 m / 807 ft Moscow, 2015

F&F Tower 233 m / 763 ft Panama City, 2011 Al Tiiaria Tower 218 m / 716 ft Kuwait City, 2009

United Tower 200 m / 656 ft Manama, 2016*

Turning Torso 190 m / 623 ft Malmö, 2005

The Chicago Spire, designed to mimic a nautilus shell, started construction in 2007 and was set to become the USA's tallest building and the world's tallest residential building. Construction stopped in 2008, due to the recession.

In addition to being planned as the world's next-tallest twisting tower, Diamond Tower would also be the only building to twist a full 360 degrees along its height.

Dubai's proposed Dynamic Tower consists of individually motorized, rotating floor plates, built around a central core. Wind turbines, to be situated between floors, would generate enough energy to power the building. The project is currently on hold, and many are skeptical it will be completed.

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The World's Tallest "Twisting" Towers

Included below are all buildings, over 90 meters, currently under construction or complete, that "twist" through a gradual rotation of floor plates, ranked in order from the tallest. The table identifies the absolute degrees of rotation from the ground floor to the top floor plate, typically determined through an examination of technical drawings and comparison of floor plans. It also shows the average floor rotation, determined by dividing total rotation by the total floor count (record holders in each category indicated in bold).

Shaded rows indicate buildings under construction as of July 2016.

No.	Building	City	Country	Completion Year	Architectural Height (m)	Floor Count	Average Floor Rotation	Total Rotation
1	Shanghai Tower	Shanghai	China	2015	632	128	0.938°	120°
2	Lakhta Center	St. Petersburg	Russia	2018 (expected)	462	86	1.047°	90.0°
3	Diamond Tower	Jeddah	Saudi Arabia	2019 (expected)	432	93	3.871°	360°
4	Ocean Heights	Dubai	United Arab Emirates	2010	310	83	0.482°	40.0°
5	Cayan Tower	Dubai	United Arab Emirates	2013	306	73	1.233°	90.0°
6	Supernova Spira	Noida	India	2017 (expected)	300	80	1.825°	146°
7	Evolution Tower	Moscow	Russia	2015	246	55	2.836°	156°
8	F&F Tower	Panama City	Panama	2011	233	53	5.943°	315°
9	Al Majdoul Tower	Riyadh	Saudi Arabia	2016 (expected)	232	54	2.500°	135°
10	Al Tijaria Tower	Kuwait City	Kuwait	2009	218	41	1.951°	80.0°
11	United Tower	Manama	Bahrain	2016 (expected)	200	47	3.830°	180°
12	Al Bidda Tower	Doha	Qatar	2009	197	44	1.364°	60.0°
13	SOCAR Tower	Baku	Azerbaijan	2015	196	40	0.500°	20.0°
14	Turning Torso	Malmo	Sweden	2005	190	57	1.580°	90.0°
15	Trump International Hotel & Tower Vancouver	Vancouver	Canada	2016 (expected)	188	63	0.714°	45.0°
16	Generali Tower	Milan	Italy	2017 (expected)	185	44	1.127°	49.6°
17	Absolute World Building D	Mississauga	Canada	2012	176	56	3.732°	209°
18	Mode Gakuen Spiral Towers	Nagoya	Japan	2008	170	38	3.000°	114°
19	Absolute World Building E	Mississauga	Canada	2012	158	50	4.000°	200°
20	Baltimore Tower	London	United Kingdom	2017 (expected)	149	44	2.182°	96.0°
21	Avaz Twist Tower	Sarajevo	Bosnia and Herzegovina	2008	142	39	1.539°	60.0°
22	The Point	Guayaquil	Ecuador	2014	137	36	5.833°	210°
23	Sichuan Radio & TV Centre	Chengdu	China	2010	136	31	2.903°	90.0°
24	PwC Tower	Midrand	South Africa	2018 (expected)	106	26	1.154°	30.0°
25	Xiamen Suiwa Tower	Xiamen	China	2016 (expected)	100	22	4.091°	90.0°
26	Grove at Grand Bay North Tower	Miami	United States of America	2016 (expected)	94	21	1.843°	38.7°
27	Grove at Grand Bay South Tower	Miami	United States of America	2016 (expected)	94	21	1.843°	38.7°
28	Tao Zhu Yin Yuan	Taipei	Taiwan	2016 (expected)	93	21	4.286°	90.0°

Fondly dubbed the "Marilyn Monroe towers" by local residents, **Absolute World** parallels the twisting fluidity of natural lines found in life

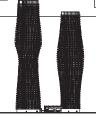
A school of fashion, computer science and medicine each occupy one of the three twisting ribbons that wrap the central core of the **Mode Gakuen Spiral Towers**

Currently, the **Avaz Twist Tower** is the tallest building in Bosnia & Herzegovina

The shape of **The Point** is intended to
mimic the whirlwinds
that occur next to
the tower, where the
Guayas, Babahayo
and Daule rivers meet

Upon completion, **PwC Tower** will be the first high-rise to be built in Midrand, a developing precinct north of Johannesburg

Upon completion, **Grove at Grand Bay** will be the first truly twisting high-rises in _ the USA Inspired by a DNA double helix, the mega-column structure lining the exterior of **Tao Zhu Yin Yuan** allows for columnfree interior spaces



Absolute World Towers 176 m / 576 ft (Building D); 158 m / 518 ft (Building E) Mississauga, 2012



Avaz Twist Tower 142 m / 466 ft Sarajevo, 2008



PwC Tower 106 m / 348 ft *Midrand, 2018**



Grove at Grand Bay 94 m / 308 ft (North Tower); 94 m / 308 ft (South Tower); Miami, 2016*



Tao Zhu Yin Yuan 93 m / 306 ft Taipei, 2016*

* Expected completion date

Guangzhou's Canton Tower, appears to gradually rotate through the use of an hourglass-shaped steel hyperboloid structure as the primary reinforcement and a spiraling steel lattice as the secondary structure. 5.9°

F&F Tower, Panama City, holds the record for the "tightest" twist, that is, the highest average rotation per floor, at 5.943 degrees across each of its 53 floors.



The **Aufzugstestturm** elevator test tower and observatory, in Rottweil, Germany, will be clad in 17,000 square meters of self-cleaning, durable and translucent fiberglass, giving the structure its twisting shape.

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