



# CTBUH Tall Building Height Calculator

For use with approximating tall building height when only the number of stories is known

See also [heightcalculator.ctbuh.org](http://heightcalculator.ctbuh.org)

Note: The CTBUH have developed this tall building height calculator to assist in determining tall building heights when only the storey count is known. The calculator is divided into three categories representing the three major functions represented in tall buildings;

- (i) Office
- (ii) Residential/Hotel
- (iii) Mixed-use or when the function unknown.

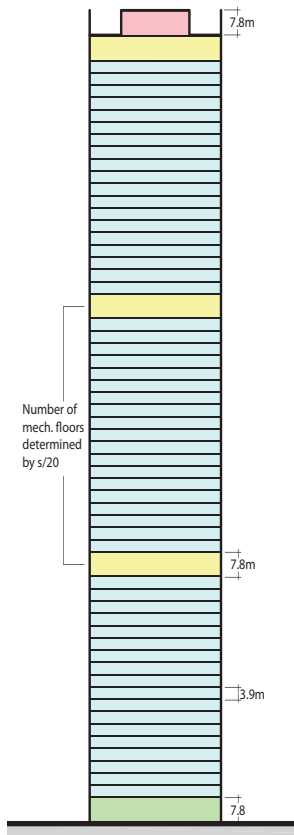
The calculator will provide an approximate height for a single tall building, but as tall building characteristics vary significantly with location, structural material, form, profile, etc, in some instances estimates will vary considerably with actual building height. As such, the calculator is best utilized to determine heights in multiple building / statistical studies, where there are many unknown building heights. In these instances the greater number of buildings examined will reduce any overall variations (see 'examples and verification', page 3).

The calculator does not include any factors for spires or any other major projections at the roof plane, due to the wide ranging nature of these.

The height calculator is never utilized by the CTBUH to determine any building heights as part of the CTBUH tall building database i.e. all published heights within the CTBUH database are accurate, confirmed heights according to published data.

Height Calculator Assumptions	Office	Residential/Hotel	Function Unknown or Mixed-Use <sup>1</sup>
Floor-to-floor height (f)	3.9m	3.1m	3.5m
Entrance lobby level floor-to-floor height	2.0f = 7.8m	1.5f = 4.65m	1.75f = 6.125m
Number of mechanical floors above ground, excluding those on the roof	s/20 = One mechanical floor every 20 stories	s/30 = One mechanical floor every 30 stories	s/25 = One mechanical floor every 25 stories
Height of mechanical floors	2.0f = 7.8m	1.5f = 4.65m	1.75f = 6.125m
Height of roof-level mechanical areas / parapets / screen walls <sup>2</sup>	2.0f = 7.8m	2.0f = 6.2m	2.0f = 7.0m
<b>Key</b> H = Building Height f = Typical occupied floor-to-floor height s = Total number of stories <sup>3</sup> Useable floors Entrance lobby Mechanical floors Roof	<sup>1</sup> Mixed-use assumptions derived from the average values between office and residential/hotel figures. <sup>2</sup> Figures do not assume spires or other major projections at the roof plane. <sup>3</sup> The number of stories should include the ground floor level and be the number of main floors above ground, including any significant mezzanine floors and major mechanical plant floors. Mechanical mezzanines or penthouses should not be included if they have a significantly smaller floor area than the major floors below. CTBUH floor counts may differ from published accounts, as it is common in some regions of the world for certain floor levels not to be included (for example, the level 4, 14, 24, etc in Hong Kong).		

## 1. Calculating the height of an office tall building where only the number of stories is known



Number of stories (known) = s

Assumed floor-to-floor height = f = 3.9m

### Factor for increased ground level floor-to-floor height

Assuming the entrance lobby floor-to-floor height is 7.8m, the factor will be an additional 7.8 minus (-) 3.9 = 3.9m (e.g. discounting the 3.9m of the ground level floor-to-floor height that has already been counted).

### Factor for increased mechanical levels floor-to-floor height

Assuming the mechanical levels are 7.8m high, the factor will be an additional 7.8 minus (-) 3.9 = 3.9m per mechanical floor (e.g. discounting the 3.9m of the mechanical floors that have already been counted). The number of mechanical floors is calculated by the total number of floors divided by 20 = s/20.

### Factor for roof level mechanical systems / parapets / roof features

Assume this is an additional 7.8m in height (there is no need to discount any stories as roof level mechanical systems / parapets / roof features are not included in the figure for total storey count).

- Height of building = number of stories x floor-to-floor height = 3.9s
- + Factor for increased ground level floor-to-floor height = 3.9m
- + Factor for increased mechanical levels floor-to-floor height = 3.9m x (s/20)
- + Factor for roof level mechanical systems / parapets / roof features = 7.8m

Final formula for calculating the height of an office tall building:

$$H_{\text{office}} = 3.9s + 11.7 + 3.9(s/20)$$

2. Calculating the height of a **residential/hotel tall building** where only the number of stories is known

Number of stories (known) =  $s$

Assumed floor-to-floor height =  $f = 3.1\text{m}$

**Factor for increased ground level floor-to-floor height**

Assuming the ground level floor-to-floor height is 4.65m, the factor will be an additional 4.65 minus (-) 3.1 = 1.55m (e.g. discounting the 3.1m of the ground level floor-to-floor height that has already been counted).

**Factor for increased mechanical levels floor-to-floor height**

Assuming the mechanical levels are 4.65m high, the factor will be an additional 4.65 minus (-) 3.1 = 1.55m per mechanical floor (e.g. discounting the 3.1m of the mechanical floors that have already been counted). The number of mechanical floors is calculated by the total number of floors divided by 30 =  $s/30$ .

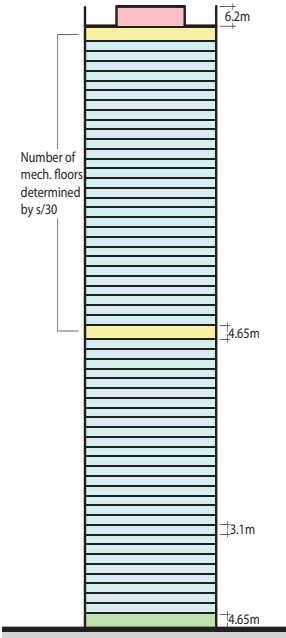
**Factor for roof level mechanical systems / parapets / roof features**

Assume this is an additional 6.2m in height (there is no need to discount any stories as roof level mechanical systems / parapets / roof features are not included in the figure for total storey count).

- Height of building = number of stories x floor-to-floor height =  $3.1s$
- + Factor for increased ground level floor-to-floor height = 1.55m
- + Factor for increased mechanical levels floor-to-floor height =  $1.55m \times (s/30)$
- + Factor for roof level mechanical systems / parapets / roof features = 6.2m

Final formula for calculating the height of a residential/hotel tall building:

$$H_{\text{residential}} = 3.1s + 7.75 + 1.55(s/30)$$



60 Residential/Hotel Building

3. Calculating the height of a **mixed-use tall building** or where the **function of the building is unknown** and the number of stories is known

Number of stories (known) =  $s$

Assumed floor-to-floor height =  $f = 3.5\text{m}$

**Factor for increased ground level floor-to-floor height**

Assuming the ground level floor-to-floor height is 6.125m, the factor will be an additional 6.125 minus (-) 3.5 = 2.625m (e.g. discounting the 3.5m of the ground level floor-to-floor height that has already been counted).

**Factor for increased mechanical levels floor-to-floor height**

Assuming the mechanical levels are 6.125m high, the factor will be an additional 6.125 minus (-) 3.5 = 2.625m per mechanical floor (e.g. discounting the 3.5m of the mechanical floors that have already been counted). The number of mechanical floors is calculated by the total number of floors divided by 25 =  $s/25$ .

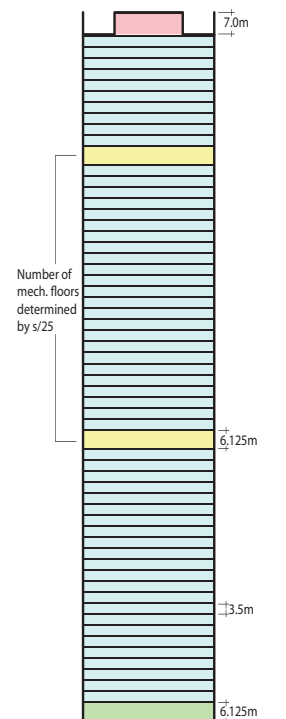
**Factor for roof level mechanical systems / parapets / roof features**

Assume this is an additional 7.0m in height (there is no need to discount any stories as roof level mechanical systems / parapets / roof features are not included in the figure for total storey count).

- Height of building = number of stories x floor-to-floor height =  $3.5s$
- + Factor for increased ground level floor-to-floor height = 2.625m
- + Factor for increased mechanical levels floor-to-floor height =  $2.625m \times (s/25)$
- + Factor for roof level mechanical systems / parapets / roof features = 7.0m

Final formula for calculating the height of a mixed-use or function unknown tall building:

$$H_{\text{unknown}} = 3.5s + 9.625 + 2.625(s/25)$$



60 Story Mixed-use or Function Unknown Building

## Height Calculator Examples and Verification

Note: To validate the CTBUH Tall Building Height Calculator, the actual height of 15 buildings in each of the three categories has been compared to the height as determined by the height calculator. The estimated and actual heights are presented with the percent variation.



### Office Buildings

CTBUH Height Calculator Formula:  $H_{office} = 3.9s + 11.7 + 3.9(s/20)$

Name	Location	Year Completed	Story Count	Known building height (m)	CTBUH height calculator figure (m)	% Variation
GE Building	New York, NY	1933	70	259	298	15.19%
BP Centre	Cape Town, South Africa	1972	32	126	143	13.29%
Sears Tower	Chicago, IL	1974	110	442	462	4.56%
First Canadian Place	Toronto, Canada	1975	72	298	307	2.87%
OUB Centre	Singapore	1986	66	280	282	0.70%
Rialto Tower	Melbourne, AUS	1986	63	251	270	7.44%
ASEM Tower	Seoul, South Korea	1992	42	176	184	4.37%
DG Bank	Frankfurt, Germany	1993	53	208	229	9.97%
BOCOM Financial Towers	Shanghai, China	2001	50	230	216	-5.89%
40 Bank St.	London, UK	2003	33	153	147	-4.03%
AZIA Center	Shanghai, China	2006	36	168	159	-5.29%
Hearst Headquarters	New York, NY	2007	46	182	200	10.13%
Torre YPF	Buenos Aires, Argentina	2009	36	160	159	-0.55%
Breeze Tower	Osaka, Japan	2009	34	175	151	-13.75%
Manitoba Hydro Place	Winnipeg, Canada	2009	22	115	102	-11.49%
<b>Aggregated variance:</b>						<b>1.82%</b>

### Residential/Hotel Buildings

CTBUH Height Calculator Formula:  $H_{residential} = 3.1s + 7.75 + 1.55(s/30)$

Name	Location	Year Completed	Story Count	Known building height (m)	CTBUH height calculator figure (m)	% Variation
Marina City Towers	Chicago, IL	1964	61	179	200	11.73%
Park Inn Berlin	Berlin, Germany	1970	41	125	137	9.57%
Residencias Tajamar	Caracas, Venezuela	1972	44	120	146	22.02%
Residencial del Bosque I	Mexico City, Mexico	1997	30	110	102	-7.00%
Baiyoke Sky Hotel	Bangkok, Thailand	1999	88	309	285	-7.74%
Sorrento 1	Hong Kong	2003	75	256	244	-4.64%
World Tower	Sydney, Australia	2004	73	230	238	3.40%
Tehran International Tower	Tehran, Iran	2007	54	162	178	9.84%
Beetham Tower	Manchester, UK	2007	50	169	165	-2.26%
Eureka Tower	Melbourne, Australia	2007	91	297	295	-0.88%
Het Strijkijzer	Hague, Netherlands	2007	42	132	140	6.15%
Saigon Pearl Tower	Ho Chi Min City, Vietnam	2007	38	135	128	-5.55%
Shaiba Tower 1	Dubai, UAE	2007	34	155	115	-25.87%
Marquis	Miami, FL	2009	63	207	206	-0.32%
301 Mission	San Francisco, CA	2009	58	197	191	-3.08%
<b>Aggregated variance:</b>						<b>0.36%</b>

### Mixed-Use or Function Unknown Buildings

CTBUH Height Calculator Formula:  $H_{unknown} = 3.5s + 9.625 + 2.625(s/25)$

Name	Location	Year Completed	Story Count	Known building height (m)	CTBUH height calculator figure (m)	% Variation
Torre Velasca	Milan, Italy	1958	26	106	103	-2.50%
John Hancock Center	Chicago, IL	1969	95	343	352	2.65%
Torre Costa Rica	A Coruna, Spain	1975	31	119	121	2.00%
Trump Tower	New York, NY	1982	58	202	219	8.27%
The Peak	Makati, Philippines	1991	38	138	147	6.24%
Fujairah Tower	Fujairah, UAE	1992	47	155	179	15.52%
Rinku Gate Tower	Izumisano, Japan	1996	56	256	212	-17.38%
Tuntux Sky Tower	Kaohsiung, Taiwan	1998	85	348	316	-9.18%
Millenium Tower	Rotterdam, Netherlands	2000	34	149	132	-11.28%
Hundai 41 Tower	Seoul, South Korea	2001	41	168	157	-6.29%
City Gate Tower	Ramat-Gam, Isreal	2007	68	244	255	4.41%
Naberezhnaya Tower C	Moscow, Russia	2007	61	268	230	-14.35%
SYV Tower	Madrid, Spain	2008	52	236	197	-16.49%
China World Trade Center Tower III	Beijing, China	2009	74	330	276	-16.24%
Nile City	Cairo, Egypt	2009	36	143	139	-2.51%
<b>Aggregated variance:</b>						<b>-3.81%</b>