TYPOLOGIES AND EVALUATION OF OUTDOOR PUBLIC SPACES AT STREET LEVEL OF TALL BUILDINGS IN CHICAGO

Abstract

Outdoor public spaces are key to human interactions, promoting public life in cities. The constant increase in world population has led to increased tall urban conditions making the study of outdoor public spaces around tall buildings very popular. This paper outlines typologies for outdoor public spaces occurring at street level of tall buildings in downtown Chicago, the birthplace of skyscrapers and an ideal case study for an American city. The study uses online data archives, Google Maps, and on-site surveys as research techniques for the analysis. The result depicts around 50% of all the tall buildings in Chicago foster public life at its street level through public spaces. The other key finding is the outline of seven typologies based on their position around the tall building. Further, a comparative analysis is conducted using one example of each typology based on three criteria adopted from 'Project for Public Spaces,' namely (1) Accessibility; (2) Design and Comfort, and (3) Users and Activities.

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Keywords

Public spaces, tall buildings, urban forms, rating system

Introduction

Outdoor public spaces at street level of tall buildings play a significant role in sustainable city development. The rapid increase in world population and constant growth of urbanization has led many scholars to support Koolhaas' statement (1994): "dense urban cities with tall structures is likely to be the future of many existing cities with the current world population rate" in his theory of "culture of congestion." The new tall urbanism created a shift in urban scenarios that affected the social, economic, and environmental conditions of cities (Ruchelman, 1988). As a result, many studies were conducted to reconsider the policies for urban development. Some of them specifically focused on integrating tall buildings and their connections to the public realms of the city. In his work, Paul Goldberger (1985) states: "The challenge is to make the connections that turn a complex (tall buildings) into something that possesses genuine urban qualities and is not simply an array of big buildings side by side." This integration of tall structures in the urban fabric and its connection to the ground is an important realm of study. "One of the key ways that tall buildings contribute to the public realm is by framing and creating open spaces at their base," (Parakh, 2015).

Outdoor public spaces have been studied extensively for decades, but very little research is available in the tall urban context. Architects and urban planners seek to explore new typologies of outdoor public spaces that can serve as a benchmark for their new designs. This paper is an investigation to identify different typologies through a formal configuration of urban forms in downtown Chicago, which has illustrated tall urban conditions since its inception. The research uses a rating system to evaluate the design and success of these typologies.

Methodology

The method involves data mining from websites, Google Maps, and on-site observations. 'Skyscraper Center' from the CTBUH (Council of Tall Buildings and Urban Habitat) database and Emporis have been the primary source for collecting data on tall buildings. Next, an analysis is performed on this data based on a theoretical and analytical framework, discussed in the following section.

THEORETICAL FRAMEWORK

Outdoor public spaces are defined by their contextual urban form. Amongst various physical design parameters such as location, position, orientation, size, and many more, position with respect to its immediate built form is very primal. It could result in endless variations in general until a pattern is frequent enough to be identified as a typology. This parameter is used in this study to identify the typologies. A comparative analysis is conducted in the later section of the study using a rating system adapted from Projects for Public Spaces (PPS) that evaluates the success of an outdoor public space based on a list of design criteria.

Success is a relative term, but in this context, it is defined as the phenomenon where more people are attracted to inhabit the space and contribute to a livable city. "Great public spaces are those places where celebrations are held, social and economic exchanges occur, friends run into each other, and cultures mix...When these spaces work well, they serve as the stage for our public lives," Project for Public Places (1975). PPS lists the design criteria for successful outdoor public spaces, including: (A) Accessibility, (B) Design & Comfort, (C) Users & Activities, (D) Environmental Sustainability, and (E) Sociable. The scope of this research is limited to the first three design criteria since the last two require a bigger timeframe and is addressed for future research.

ANALYTICAL FRAMEWORK—RATING SYSTEM

This study develops a rating system for each of the design criteria discussed earlier. Each criterion is designated with points which are elaborated in the section below.

(A) ACCESSIBILITY

Accessibility to a space is defined as the ease by which a user can reach the space without many obstructions. Accessible spaces are well connected to the users through public and private modes of transportation. It can be analyzed through: (1) total number of mass rapid transit system (MRTS) stops available within 5-minute walkable distance radii; (2) total number of bicycle stations within 5-minute walkable distance radii; and (3) distance from the nearest transit stop. Maximum available points in this category is 12, where each metric can have a maximum of 4 points. For instance, within the MRTS stops metric, if the stops within a 5-minute radius are between 4–7, the space gets 1 point. Similarly, between 8–10 is 2; 11–12 is 3; and 13–15 is 4. The other two metrics are the number of bike-stops and the distance from the nearest transit stop (Table 1).

(B) DESIGN & COMFORT

Design & Comfort is key to determine the success of an outdoor space. "Comfort includes perceptions about safety, cleanliness, and the availability of places to sit—the importance of giving people the choice to sit where they want is generally underestimated," (PPS, 1975). Some of the elements are (1) sufficient seating facility (benches, tree shade, pavilions); (2) shaded and non-shaded areas; (3) green spaces; and (4) special features of visual appeal or landmark contributors (height, art form). Maximum available points in this category are 5 where each metric is either 1 or 0 (Table 2).

(C) USERS & ACTIVITIES

People are attracted to the spaces due to curiosity or a sense of safety. Various activities and programs act as magnets drawing people closer to the space. Different types of activities govern different types of residents or tourists, characterizing different age groups. Quantifying this criterion includes assessing (1) types of user groups (transient/permanent and young/old); (2) types of activities for users (eating, relaxing, playing, socializing); (3) multiple uses of space; and (4) land-use. Maximum points in this category are 18 where each metric can have a maximum of 2 points except for the multiple usage of space, which can yield up to 4 points. Depending upon the different metrics, the points are distributed. For instance, there are mainly four types of programs, namely cafés/restaurants, banks/markets, retail stores, and tourist-oriented functions such as museums/galleries/exhibition spaces.

	Number of transit stops					Number of bike stops					Distance from nearest stop				
Rating scale	15 to 13	11 to 12	8 to 10	4 to 7	0 to 3	4	3	2	1	0	0 to 10	11 to 25	26 to 50	51 to 80	81 & beyond
Rating points	4	3	2	1	0	4	3	2	1	0	4	3	2	1	0

Table 1: Rating scale and points for metrics in Accessibility category. (Source: Author.)

Rating scale	Open space (green)	Shaded vs non shaded	Ample seating availability	Visibility
Rating points	0 or 1	0 or 1	0 or 1	0 or 1

Table 2: Rating scale and points for metrics in Design & Comfort category. (Source: Author.)

	Program				Users		Usability	
Rating scale	Variety of program	Types (eating joints)	Types (shopping joints)	Types (tourist joints)	Types of users (transient)	Types of users (age group)	Multiple use of space	Allows mass gathering
Rating points	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 4	0 to 2

Table 3: Rating scale and points for metrics in Users & Activities category. (Source: Author.)

CASE STUDY

Selected case study is the city of Chicago, the third most populous city in the U.S. that housed the world's first sky-scraper (Marshall, 2015). "The maturing of an original sort of skyscraper design around 1890 is a Midwestern, and almost specifically a Chicago story, to which New Yorkers made little or no contribution," (Miller, 1990). The scope of this research is limited to the downtown central business district of Chicago showing the highest concentration of tall buildings.

According to CTBUH, there is no absolute definition of what constitutes a "tall building," but CTBUH typically uses 200m as the threshold for their annual report of tall buildings. Given the limited number of tall buildings with 200m or above, the authors use 150m as the height criteria of tall buildings for this study. A statistical data on tall buildings of Chicago shows that with 3% of the global 150m+ completed tall buildings, Chicago ranks 6th in the world and with 16% of the total lot nationally, it ranks 2nd in the United States (CTBUH Skyscraper Center, n.d.).

Figure 1: Growth of tall buildings with social spaces at ground level in Chicago in the 1970s, 1980s, 1990s, and 2000s (left to right). (Source: Author.)

Figure 2: Left, tall buildings with/without outdoor public spaces. Right, outdoor public spaces in public vs. private tall building development in Chicago. (Source: Author.)

Results

TYPOLOGIES

Data analysis from the listed primary sources demonstrated that Chicago has around 116 tall buildings (constructed) till date with 150m+ heights. Using Google Maps and on-site observations, this data was filtered to show only the buildings with outdoor public spaces (Table 9). The result showed that 56 buildings have outdoor public spaces at the ground level, which is about 48.3% of the total tall structures. Amongst these 56 buildings, 43% are private developments, such as residences, whereas 57% are public in nature, such as office, commercial, and governmental buildings (Figure 2).

The study identified eight typologies of outdoor public spaces based on their position in the built form (Figure 3). Further analysis shows their frequency of distribution (Figure 4). These typologies are listed as:

— **TYPOLOGY 1:** At street level, around the building
— **TYPOLOGY 2:** Below street level, the building as sunken plaza
— **TYPOLOGY 3:** At street level with community space as indoor space
— **TYPOLOGY 4:** Above street level, as podium/plinth of the building
— **TYPOLOGY 5:** At street level and on podium level of the building
— **TYPOLOGY 6:** At street level near community park
— **TYPOLOGY 7:** Above street level, sandwiched between the building floors
— **TYPOLOGY 8:** At or below street and building level near water body

A comprehensive list of buildings with their typologies, building usage, year of construction and height ranking order can be referred to in Table 4.

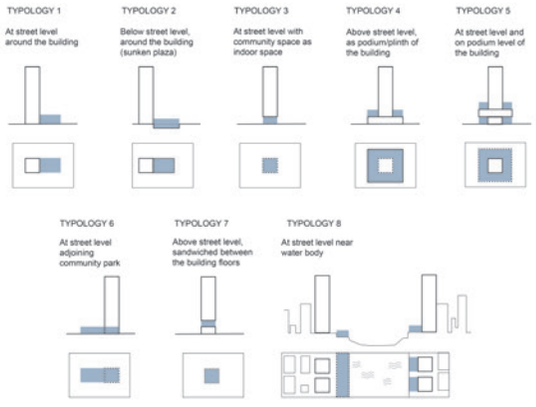

Figure 3: Typologies of outdoor public spaces at ground level of tall buildings in Chicago illustrating buildings and plazas, from left to right: Typology 1: Federal Plaza; Typology 2: John Hancock Center; Typology 3: Water Tower Place; Typology 4: 311 S. Wacker Drive; Typology 5: Aqua Tower; Typology 6: Two Prudential Center; Typology 7: Marina City; Typology 8: Riverwalk (Source: Author.)

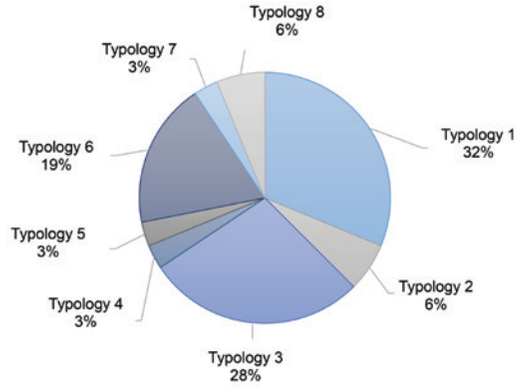

Figure 4: Frequency of typologies in downtown Chicago. (Source: Author.)

Year	Name	Function	Type	Ranking	Typology
1974	Willis Tower	Office	Public	1	1
1973	Aon Center	Office	Public	3	1
2009	300 North LaSalle	Office	Public	14	1
1981	Three First National Plaza	Office	Public	15	1
1972	AMA Plaza	Office	Public	20	1
2001	UBS Tower	Office	Public	28	1
1965	Richard Daley Center	Government	Public	29	1
1982	Madison Plaza	Office	Public	46	1
2005	One South Dearborn	Office	Public	59	1
1974	Kluczynski Federal Building	Office	Public	63	1
1985	Michigan Plaza South	Office	Public	72	1
1969	John Hancock Center	Mixed use	Public	4	2
1969	Chase Tower	Office	Public	9	2
1989	The Franklin - North Tower	Office	Public	5	3
1989	900 North Michigan Avenue	Mixed use	Public	8	3
1976	Water Tower Place	Mixed use	Public	10	3
1986	Olympia Centre	Mixed use	Public	18	3
2004	55 East Erie	Residential	Public	30	3
1991	Chicago Place, 700 N Michigan Ave	Residential / Retail	Public	41	3
1929	Palmolive Building	Residential / Retail	Public	62	3
1973	Elysees Condominiums	Residential / Retail	Public	84	3
1990	311 South Wacker Drive	Office	Public	7	4
2009	353 North Clark	Office	Public	38	5
1990	Two Prudential Plaza	Office	Public	6	6
2000	Park Tower	Mixed use	Public	12	6
1989	NBC Tower	Office	Public	37	6
1955	One Prudential Plaza	Office	Public	44	6
2015	455 North Park Drive	Residential / Hotel	Public	76	6
2008	The Tides	Residential	Public	107	6
1964	Marina City	Mixed use	Public	51	7
1990	Boeing International Headquarters	Office	Public	65	8
1981	200 South Wacker Drive	Office	Public	108	8
	Selected case studies				

Table 4: Tall buildings with public spaces at ground level. (Source: Author.)

COMPARATIVE ANALYSIS OF TYPOLOGIES

In order to understand why some typologies are more successful than others, a comparative analysis is conducted based on the rating system discussed in the methodology section. In order to narrow the scope of this study, public spaces in non-residential development have been studied. Additionally, out of 56, only 20 specific buildings are studied based on the selection criteria of including top 15 tallest buildings and at least one building of each typology (Table 4). Each criterion is discussed in the following section.

A — RATING CRITERIA 1: ACCESSIBILITY

Chicago's central business district has a very good mass rapid transit system which includes CTA trains, CTA buses and ferry services along the Chicago river. Moreover, the Divvy bike system offers abundant opportunities for public bike access. The analysis is based on these parameters (Table 5, Figure 5).

B — RATING CRITERIA 2: DESIGN & COMFORT

The analysis of this criteria shows Richard Daley Center, Chase Plaza, and Federal Plaza have the highest points of 5, followed by 311 S Wacker Drive and Boeing International headquarters with a score of 4. The rest of the places have the following distribution: 4 spaces scoring 3, 3 spaces scoring 2, and 5 spaces scoring 1 (Table 6, Figure 6).

C — RATING CRITERIA 3: USERS & ACTIVITIES

The rating criteria for Design & Comfort is a function of different programs, users, and usability of space. For instance, in the 'program' metric, the retail component in the Water Tower Place is the highest, making it the best public space for shoppers, whereas the Richard Daley Center and Federal Building show the highest component of tourist activity. Eating joints on an average exist in almost all the buildings. Based on the rating metrics, Daley Center, Federal Plaza and Chase Plaza have the highest points (Table 7, Figure 7).

The total ranking for the studied sites shows that the top three public spaces at ground level belong to typology 1 and 2 with a rating point closer to 30. The next five public spaces in the list show a dip of 10 points ranging between 15–18 points. The next range is between 8–14 points, which could be considered average on the performance scale.

Conclusions and Research Limitations

This study provides a research framework to identify (1) typologies of outdoor public spaces in tall urban conditions and (2) KPIs to assess public space design, which can be applied to other cities.

The limitation of this study is the study scope, which is restricted to Chicago. Additionally, there are other criteria contributing to public space design as highlighted by PPS which hasn't been considered in this study. Further research can be conducted to address these limitations.

Figure 5: Total points scored on Accessibility. (Source: Author.)

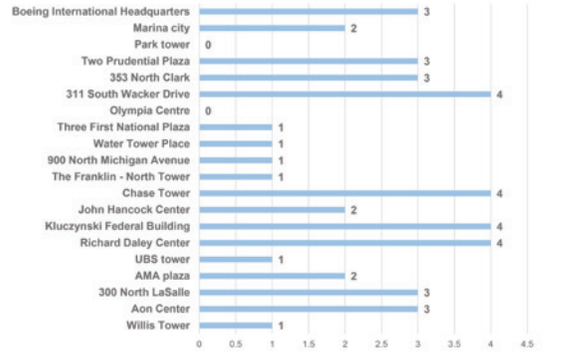

Figure 6: Total points achieved on Design & Comfort. (Source: Author.)

Figure 7: Total points achieved on Uses & Activities. (Source: Author.)

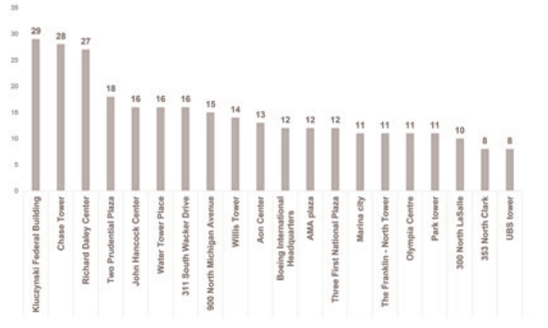

Figure 8: Tall buildings with the successful public spaces on the ground level. (Source: Author.)

	Number of transit stops					Number of bike stops					Distance from nearest stop				
Rating scale	15 to 13	11 to 12	8 to 10	4 to 7	0 to 3	4	3	2	1	0	0 to 10	11 to 25	26 to 50	51 to 80	81 & beyond
Rating points	4	3	2	1	0	4	3	2	1	0	4	3	2	1	0
Willis Tower			•				•							•	
Aon Center				•				•						•	
300 North Lasalle				•						•			•		
AMA Plaza				•					•			•			
UBS Tower				•					•		•				
Richard Daley Center			•					•				•			
Kluczynski Federal Building		•					•					•			
John Hancock Center				•				•				•			
Chase Tower		•							•		•				
The Franklin - North Tower				•					•			•			
900 North Michigan Avenue				•						•	•				
Water Tower Place				•			•						•		
Three First National Plaza			•						•		•				
Olympia Centre			•					•					•		
311 South Wacker Drive				•				•				•			
353 North Clark				•						•					•
Two Prudential Plaza			•				•							•	
Park Tower			•					•					•		
Marina City				•					•				•		
Boeing International Headquarters				•				•						•	

Table 5: Rating metrics on Accessibility. (Source: Author.)

Rating scale	Open space (green)	Shaded vs non shaded	Ample seating availability	Visibility
Rating points	0 or 1	0 or 1	0 or 1	0 or 1
Willis Tower				•
Aon Center	•	•	•	
300 North LaSalle	•		•	•
AMA Plaza	•			•
UBS Tower	•			
Richard Daley Center	•	•	•	•
Kluczynski Federal Building	•	•	•	•
John Hancock Center		•	•	
Chase Tower	•	•	•	•
The Franklin - North Tower			•	
900 North Michigan Avenue			•	
Water Tower Place			•	
Three First National Plaza			•	
Olympia Centre				
311 South Wacker Drive	•	•	•	•
353 North Clark	•	•	•	
Two Prudential Plaza	•	•	•	
Park Tower				
Marina City			•	•
Boeing International Headquarters	•	•	•	

Table 6: Rating metrics on Design & Comfort. (Source: Author.)

	Program				Users		Usability	
Rating scale	Variety of program	Types (eating joint)	Types (shopping joint)	Types (tourist joint)	Types of users (transient)	Types of users (age group)	Multiple use of space	Allows mass gathering
Rating points	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 2	0 to 4	0 to 2
Willis Tower	•	•	•	•	•	••		
Aon Center	•	•		•	•	•	•	
300 North LaSalle	•	•	•		•			
AMA Plaza	•	•	•	•	•			
UBS Tower		•						
Richard Daley Center	••	•	•	••	••	••	••••	••
Kluczynski Federal Building	••	•	•	••	••	••	••••	••
John Hancock Center	••	•	•	•	•	•		•
Chase Tower	••	•	•	••	••	••	••••	••
The Franklin - North Tower	•	•	•	•	•			
900 North Michigan Avenue	•	•	••	•	••	••		
Water Tower Place	•	•	••	•	••	••		
Three First National Plaza	•	•	•		•			
Olympia Centre	•	•	•		•	•		
311 South Wacker Drive		•		•	•	•	•	•
353 North Clark		•		•	•	•		
Two Prudential Plaza	•	•		•	•	••	••	•
Park Tower	•	•	•		•	•		
Marina City	•	•		•	•	•		
Boeing International Headquarters					•	•	••	•

Table 7: Rating metrics on Uses & Activities. (Source: Author.)

Year	Name	Function	Type	Total Rating	Typology	Height
1974	Kluczynski Federal Building	Office	Public	29	1	171.3
1969	Chase Tower	Office	Public	28	2	264.6
1965	Richard Daley Center	Government	Public	27	1	197.5
1990	Two Prudential Plaza	Office	Public	18	6	303.3
1969	John Hancock Center	Mixed use	Public	16	2	343.7
1976	Water Tower Place	Mixed use	Public	16	3	261.9
1990	311 South Wacker Drive	Office	Public	16	4	292.2
1989	900 North Michigan Avenue	Mixed use	Public	15	3	265.0
1974	Willis Tower	Office	Public	14	1	442.1
1973	Aon Center	Office	Public	13	1	346.3
1990	Boeing International Headquarters	Office	Public	12	8	170.7
1972	AMA Plaza	Office	Public	12	1	211.8
1981	Three First National Plaza	Office	Public	12	3	233.6
1964	Marina City	Mixed use	Public	11	7	179.2
1989	The Franklin - North Tower	Office	Public	11	3	306.9
1986	Olympia Centre	Mixed use	Public	11	3	222.9
2000	Park Tower	Mixed use	Public	11	6	257.4
2009	300 North LaSalle	Office	Public	10	1	239.1
2009	353 North Clark	Office	Public	8	5	190.0
2001	UBS Tower	Office	Public	8	1	198.6

Table 8: List of Tall Buildings with the overall rating points. (Source: Author.)

Year	Name	Function	Type	Height (m)	GFA (sqm)	Ranking	Typology
1974	Willis Tower	Office	Public	442.1	416,000	1	1
2009	Trump International Hotel & Tower	Residential / Hotel	Private	423.2	241,548	2	3
1973	Aon Center	Office	Public	346.3	334,448	3	1
1969	John Hancock Center	Residential / Office	Public	343.7	260,126	4	2
1989	The Franklin - North Tower	Office	Public	306.9	157,934	5	3
1990	Two Prudential Plaza	Office	Public	303.3	130,063	6	6
1990	311 South Wacker Drive	Office	Public	292.9	130,942	7	4
1989	900 North Michigan Avenue	Residential / Office / Hotel	Public	265	-	8	3
1969	Chase Tower	Office	Public	264.6	204,385	9	2
1976	Water Tower Place	Residential / Hotel / Retail	Public	261.9	287,997	10	3
2009	Aqua Tower	Residential / Hotel	Private	261.8	184,936	11	5
2000	Park Tower	Residential / Hotel	Public	257.4	77,632	12	6
2010	The Legacy at Millennium Park	Residential	Private	249.3	99,649	13	4
2009	300 North LaSalle	Office	Public	239.1	102,192	14	1
1981	Three First National Plaza	Office	Public	233.6	156,912	15	1
1986	Olympia Centre	Residential / Office	Public	222.9	131,921	18	3
2009	One Museum Park	Residential	Private	221.3	92,987	19	4
1972	AMA Plaza	Office	Public	211.8	126,258	20	1a
2007	340 On The Park	Residential	Private	204.9	-	26	4
1992	77 West Wacker Drive	Office	Private	203.6	98,618	27	8
2001	UBS Tower	Office	Public	198.6	156,076	28	1
1965	Richard Daley Center	Government	Public	197.5	136,102	29	1
2004	55 East Erie	Residential	Public	197.1	-	30	3
1968	Lake Point Tower	Residential	Private	196.4	120,773	31	4
2003	Grand Plaza Apartments	Residential	Private	195.4	-	33	4
2005	The Heritage at Millennium Park	Residential	Private	192.4	103,938	36	4
1989	NBC Tower	Office	Public	191.1	-	37	6
2009	353 North Clark	Office	Public	190	133,780	38	5
1991	Chicago Place, 700 N Michigan Ave	Residential / Retail	Public	185.3	-	41	3
1955	One Prudential Plaza	Office	Public	183.2	-	44	6
1982	Madison Plaza	Office	Public	182.5	96,228	46	1
2010	The Grant	Residential	Private	181.3	85,868	47	4
1964	Marina City	Mixed use	Public	179.2	-	51	7
1990	North Pier Apartments	Residential	Private	177.1		55	4
2005	One South Dearborn	Office	Public	173.9	-	59	1
1929	Palmolive Building	Residential / Retail	Public	172.2	-	62	3
1974	Kluczynski Federal Building	Office	Public	171.3	105,514	63	1
1990	Boeing International Headquarters	Office	Public	170.7	95,792	65	8
1991	The Parkshore	Residential	Private	169.5	87,886	66	6
1988	North Harbor Tower	Residential	Private	169.5	86,082	67	6
1975	Harbor Point, 155 North Harbor Drive	Residential	Private	169	-	69	6
2009	Streeter Place	Residential	Private	168.8	-	70	6
1985	Michigan Plaza South	Office	Public	168.6	107,158	72	1
2015	455 North Park Drive	Residential / Hotel	Public	166.6	86,121	76	6
2002	Park Millennium, 222 North Columbus Drive	Residential	Private	165.9	-	77	1
1973	Elysees Condominiums	Residential / Retail	Public	161.2	-	84	3 & 4
1977	River Plaza, 405 N Wabash	Residential	Private	159.7	-	85	4
2007	The Streeter	Residential	Private	156.7	-	95	1 & 4
2009	600 North Lake Shore Drive - South Tower	Residential	Private	156.4	50,302	96	1
1973	Park Tower Condominiums	Residential	Private	156.3	-	97	1 & 4
1987	321 North Clark Street	Office	Private	155.4	74,320	99	8
2010	215 West Washington Street	Residential	Private	155.1	-	101	4
2008	The Tides	Residential	Public	152.4	70,451	107	6
1981	200 South Wacker Drive	Office	Public	152.4	78,968	108	8
1983	Ontario Place	Residential	Private	150.9	-	112	1 & 4
2008	50 East Chestnut Street	Residential	Private	150.7	-	114	4 & 6

	Private
	Public
-	Data not available

Table 9: List of 150 m+ tall buildings with community spaces in Chicago.

References

CTBUH, Ali, M. M., & Armstrong, P. J. (Eds.). (1995). *Architecture of Tall Buildings.* McGraw-Hill Inc.

CTBUH, Skyscraper Center (n.d.). *Online global tall building database of the Council of Tall Buildings and Urban Habitat.* https://www.skyscrapercenter.com/cities

Goldberger, P. (1985, December 29). Photography view; Is Trump's latest proposal just a castle in the air? *The New York Times,* pages 2–3.

Koolhaas, R. (1994). *Delirious New York: a retroactive manifesto for Manhattan.* Monacelli Press.

Marshall, C. (2015, April). A history of cities in 50 buildings. *The Guardian.* https://www.theguardian.com/cities/2015/apr/02/worlds-first-skyscraper-chicago-home-insurance-building-history

Miller, R. (1990). *American apocalypse: the great fire and the myth of Chicago.* University of Chicago Press.

Parakh, J. (2015). The Network of Urban Spaces Surrounding Tall Buildings. *Global Interchanges: Resurgence of the Skyscraper City.* New York: Council of Tall Buildings and Urban Habitat.

PPS. (1975). *Project for Public Spaces.* https://www.pps.org/article/grplacefeat

Ruchelman, L. I. (1988). The Urban Ecology of Tall Buildings. In L. S. Beedle, *Second Century of the Skyscraper* (p. 1095). Van Nostrand Reinhold Company.