Chicago Building Code Modernization

Implications for High-Rise Safety

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Preface

The City of Chicago and the Department of Buildings (CDOB) are issuing a comprehensive revision to the Chicago Building Code (CBC) for the first time in 70 years. Previous editions of the CBC have only contained small edits and added clarifications. This effort, led by Commissioner Judy Frydland, is described as a modernization of the entire code that will enhance public safety, promote energy efficiency, foster innovative design, and benefit from national code development efforts.

The New Chicago Building Code

The new CBC is reorganized to better align its construction requirements with national model codes and standards. The formatting and terminology of the CBC will match the International Building Code (IBC) and will be published by the International Code Council (ICC). The new code will be a hybrid of that model code, with some longstanding provisions and requirements that are unique and important in Chicago to remain. The change to the IBC format will bring Chicago's building code up to date with what is used in other major US jurisdictions, and publishing via the ICC will allow Chicago to stay current with regular revisions and provide access to its support services. This process will be implemented in three phases.

Phase 1 of the modernization process was started in 2018, when the Electrical and Conveyance Device code sections were rewritten and portions of the High-Rise chapter were revised. Phase 2 will update the Administrative, Building, Structure, Life Safety, Rehabilitation, Accessibility, and Energy Efficiency sections. The ordinance that was passed on 10 April 2019 amended the Municipal Code Title 14A, concerning various provisions of the Chicago Construction and Building Codes. Implementation began with selected test projects in fall 2019, and elective use began in December 2019. The new code will become mandatory for all building projects in August 2020. Phase 3 will revise the Plumbing and Mechanical

sections. Research committees began discussions in fall 2019 for publication in future ordinances.

The April 2019 ordinance is written as an edit of the 2018 IBC sections that will become the new CBC. The new code books were published in late October 2019 and are now available for sale, which will provide a full document of the hybrid code that will facilitate comparison of the old and new versions and illustrate what has changed and what remains from the old code. There are likely to be some adjustments made during the coming year, as the test projects uncover situations and questions that require clarification and edits. For this paper, the author references what is published in the ordinance to highlight examples of what is, and in some cases, what is not changing, from the current IBC model code. Much of the code terminology, definitions, and metrics are being changed to align with the model codes.

The focus of this review will be the ways in which the CBC will affect some basic elements of the schematic floor plan and design for a high-rise office tower greater than 400 feet (122 meters) tall, around the dimensions of occupancy, special high-rise provisions, and exiting.

> **"The new code will be a hybrid of the model code, with some longstanding provisions and requirements that are unique and important in Chicago…"**

Implications for High-Rise Safety

1.0 Occupancy

1.1 Classification Changes

Chicago's unique classification of occupancy classification types will be changed to match the IBC terminology. This allows for more uses to be referenced and provides a more logical naming convention. The classification list will be similar to IBC Section 302, with some Chicago-specific provisions added to address existing building types here (see tables 1 and 2).

Occupancy Classification and Use	
New Chicago Building Code reference Section 302	Existing Chicago Building Code reference CBC 13-56-010
Group A: Assembly	Class C: Assembly
Group B: Business	Class E: Business
Group E: Educational	Class C-3: Schools
Group F: Factory & Industrial	Class G: Industrial
Group H: High Hazard	Class I: Hazardous Use
Group I: Institutional	Class B: Institutional
Group M: Mercantile	Class F: Mercantile
Group R: Residential	Class A: Residential
Group S: Storage	Class H: Storage
Group U: Utility & Miscellaneous	Class J: Miscellaneous

Table 1. Comparison of the occupancy classifications and uses as specified in the new and existing Chicago Building Code.

Occupant Load *reference Table 1004.5	
Function of Space	Occupant Load Factor
Accessory Storage Area, Mechanical Equipment Room	300 gross
Assembly, with fixed seats	See Section 1004.6
Assembly, without fixed seats	
Concentrated, chairs only	7 net
Standing space	5 net
Unconcentrated, tables and chairs	15 net
*Outdoor area, greater than 400 ft^2	*20 net
Business Area	*100 net
*Concentrated business area	*20 net
Excercise Room	
With equipment	50 gross
Open floor	20 net
Mercantile	
First story above grade	*30 net
Basement sales floor	*30 net
Other floors	*60 net
Storage, stock, shipping	*300 gross

** Indicates Chicago-specific provision*

Table 2. Occupant load factors as specified in CBC Table 1004.5.

1.2 Revised Occupancy Area Allowances

With these occupancy classification changes, the floor area allowances per occupant are also changed, similar to IBC Table 1004.5, making the calculation of floor loading uniform and more familiar compared to other jurisdictions. Here again, there are additions and updates to the CBC version that include the clarifications that were previously located in the appendix of the code book. The basic population density for an "Office" occupancy remains the same at 100 square feet (9.3 square meters) per person, but there are new function types for "Assembly-Outdoor" areas (greater than 400 square feet (37 square meters) and for "Concentrated Business Use Areas" to accommodate call centers and trading floors that will alter occupancy count for these special conditions.

1.3 Effects on Core Planning

The classification and population for a typical Office use will remain the same, with only the letter designation of the type changing to something more intuitive. Atypical uses, like outdoor roof terraces, high-density seating areas, and conference rooms have new or revised occupant area factors.

2.0 High-Rise Provisions

2.1 Special Requirements

The special requirements for High-Rise buildings in IBC Section 403 will be a hybrid with edits and exceptions from the CBC. A careful study of how the final version of the hybrid code is written will be required to understand all the new requirements, differences, and exceptions in CBC Section 403 compared to the national IBC. Most of these stricter provisions are triggered at 400 feet (122 meters) of building height in the new CBC, instead of 420 feet (128 meters) as in the IBC.

Refer to the list below for highlights and notable differences in the new CBC compared to IBC Section 403:

- A "High-Rise Building" is defined as 80 feet (24.3 meters) in building height, instead of 75 feet (22.9 meters) (Section 202-Definitions), but sprinklers are required in buildings more than 70 feet (21.3 meters) in building height (903.2.11.3).
- Reduction in fire-resistance ratings are changed (403.2.1).
- Additional shaft construction and partition integrity requirements (403.2.1, 403.2.3).
- Additional seismic and wind studies are now required (403.2.2).
- Sprinkler systems are required to have a two-source water supply at 300 feet (91.4 meters) of building height (403.3.2).
- Remoteness of interior exit stairways is defined with specific parameters (403.5.1).

Below are notable IBC High-Rise provisions that are NOT required in the new CBC:

- An added interior exit stair (403.5.2 is deleted).
- Smokeproof enclosure at exit stairways (403.5.4 is deleted).
- Luminous egress path markings (403.5.5 is deleted).

2.2 Effects on Core Planning

These changes appear to be minor, especially because of the sections that were specifically not adopted, compared to the existing CBC Chapter 13-76, and mean that the design and planning of most high-rise office towers should not expect to be fundamentally different. The biggest impact may be for high-rise buildings below 300 feet (91.4 meters) that will now experience changes to their structural design for the new seismic considerations, and towers with very large footprints that may find the stair-separation math to be a challenge.

3.0 Means of Egress

3.1 Revised Methodology

The new exiting and egress requirements will present the biggest differences for planning a typical office high-rise floor compared to the existing CBC. Here again, Chicago's unique method of calculating exit capacity will change in favor of IBC-based sizing, terminology, and methodology. Travel distances have changed, mostly as a permitted increase in length, but the requirements for the number of exits will remain similar to the existing CBC for high-rise office buildings.

3.1.1 Exit Capacity

For sizing the exit capacity of stairs and doors (Section 1005), the existing "Exit Unit Width" formula is replaced with a simple factor multiplied by the width (see Table 3).

	New CBC IBC Section 1005		Existing CBC Reference CBC 13-160-210	
	Non-Sprinklered	Sprinklered	Non-Sprinklered	Sprinklered
Stairs	0.3	0.2	40 / U.E.W.	60 / U.E.W.
Door	0.2	0.15	60 / U.E.W.	90 / U.E.W.

Note: Stair width is 48" (1,219 mm) min, unless equipped with an automatic sprinkler system.
Unit of exit width = 22" (559 mm); 1/2 Unit = 12" (305 mm)

Table 3. Required egress capacity of stairs as specified in the new and existing CBC.

3.2 Travel Distance

The permitted "Exit Access Travel Distance" in an Office occupancy is 200 feet (61 meters) (non-sprinklered) and 300 feet (91.4 meters) (sprinklered).

The "Common Path of Travel" (Section 1006) is a new metric for Chicago, defined as the portion of travel distance from the most remote point of a space to the point where the occupants have separate access to two exits. It is in addition to (and does not replace) the maximum distance from end of corridor, (the "Dead End Corridor"). In an Office occupancy, the Common Path of Travel is 75 feet (22.9 meters) (non-sprinklered) and 115 feet (35 meters) (sprinklered). This differs in the new CBC Table 1006 from IBC (see Table 4).

	New CBC IBC Tables *1006.2 & 1017.2		Existing CBC Reference CBC 13-160-110	
	Non-Sprinklered	Sprinklered	Non-Sprinklered	Sprinklered
Exit Access Travel	200' (61 m)	300' (91 m)	150' (46 m)	225' (69 m)
Common Path of Travel	*75' (23 m)	115' (35 m)	N/A	N/A
Dead End Corridor	20' (6 m)	50' (15 m)	75' (23 m)	112' (34 m)

** Indicates Chicago-specific provision*

Table 4. Common Path of Travel requirements for Chicago buildings.

For Dead Ends, the maximum distance from end of corridor is 20 feet (6.1 meters) (non-sprinklered) and 50 feet (15.2 meters) (sprinklered). This is a sharp reduction compared to the old CBC and, when analyzed with the Common Path of Travel requirements, will further encourage pushing the stairs farther apart and lengthening multi-tenant corridors.

3.3 Sprinkler Bonuses

Buildings equipped with automatic sprinkler systems retain their bonus factors for capacity and travel distances as a way to encourage their use and increase safety. A new bonus available in Chicago after the passage of the updated 2018 Illinois Accessibility Code (IAC) is that an "Area of Refuge" is not required in the stairwell per IBC 1009.3 if the building is sprinklered.

3.4 Effect on Planning

The calculation method of egress capacity is different and less complicated than that specified in the existing CBC, but will ultimately result in a similar maximum floor population. The travel distance and inclusion of Common Point of Travel will alter the strategies in multi-tenant corridor configuration and tenant interior planning.

4.0 Vertical Conveyance

4.1 Elevator Vestibules

The updated Conveyance Device Code was published in 2018 as part of the Phase 1 modernization. This revised chapter in the new CBC contains notable differences from IBC Chapter 30, which Chicago chose not to adopt with the passage of the ordinance this year. The exclusion of these sections allows for the elevator vestibules in a typical office floor plan to remain essentially the same as under the existing Chicago code.

Refer to the list below for and notable differences in the new CBC compared to IBC Section 3000:

- Only one fire service access elevator, in accordance with Section 3007, is required in lieu of two (403.6 is revised).
- Enclosed elevator vestibules are not required (3006 is not adopted).
- Fire service access elevator lobby is not required (3007.6 is deleted).

4.2 Effects on Core Planning

Passenger elevator vestibules will not be required to be contained by hold-open doors or other operable barriers. The service elevator vestibule is not required to have adjacent access to a stairway. Both of these vestibule types will allow for the continuation of efficiencies in core plans that are familiar to the Chicago market.

5.0 Case Study

5.1 Sample Floor Plan

The sample office floor plan of a 25,000 gross square-foot (2,323 square-meter) area with a generic multi-tenant corridor is used here to illustrate a number of the topics discussed in the previous sections. This plan makes use of the bonuses provided by an automatic sprinkler system per Section 403.3 (see Figure 1, Table 5, and Table 6).

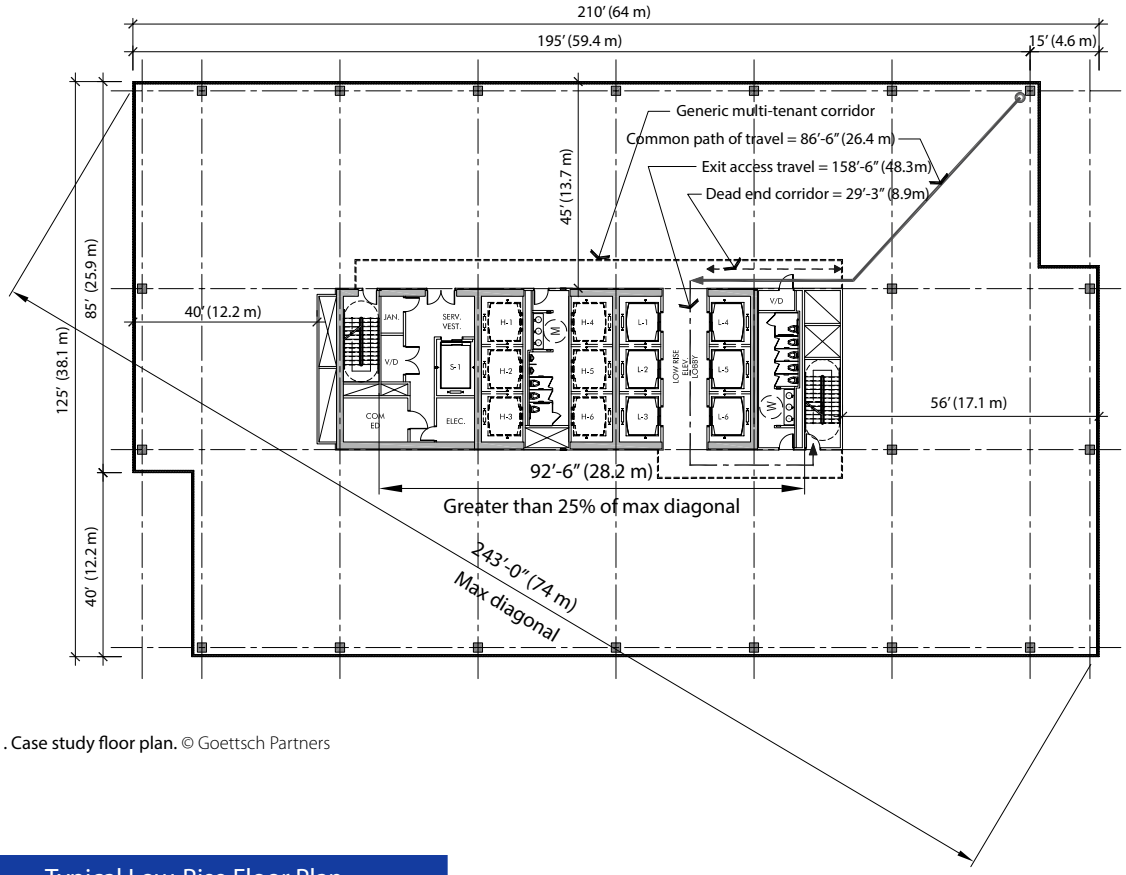

Figure 1. Case study floor plan. © Goettsch Partners

Typical Low-Rise Floor Plan	
Gross Area	21,050 ft² (2,327 m²)
Net Area	21,220 ft² (1,971 m²)
Group B: Business @ 100 ft² (9 m²)/people	
Occupancy	211 people
Assumes use of an automatic sprinkler system (Section 403.3)	

Table 5. Area for the case study floor plan depicted in Figure 1.

	Egress Capacity			
	Unit	Required	Width	Capacity
Stairs	0.2	42.2" (1,072 mm)	3' 8" (1,117 mm)	220
Doors	*0.15*	*31.65" (804 mm)*	3' 0" (914 mm)	240

Table 6. Egress capacity for the case study floor plan depicted in Figure 1.

About the Author

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Erik Harris is an associate principal and senior project architect at Goettsch Partners. With more than 20 years of experience, he has worked on a variety of complex projects, including the firm's largest assignment to-date: the five-building, 5.7 million-square-foot (529,547 square-meter) Abu Dhabi Global Market Square complex in the UAE. He has also worked on the 150 North Riverside and 110 North Wacker Drive high-rise office building projects in Chicago. As a senior project architect, he works closely with the design and consultant team to assure that a consistent, high-quality set of documentation is produced. He holds a Bachelor of Architecture degree from the Illinois Institute of Technology and is a member of the American Institute of Architects.

About the CTBUH

The Council on Tall Buildings and Urban Habitat (CTBUH) is the world's leading resource for professionals focused on the inception, design, construction, and operation of tall buildings and future cities. Founded in 1969 and headquartered at Chicago's historic Monroe Building, the CTBUH is a not-for-profit organization with an Asia Headquarters office at Tongji University, Shanghai; a Research Office at Iuav University, Venice, Italy; and an Academic Office at the Illinois Institute of Technology, Chicago. CTBUH facilitates the exchange of the latest knowledge available on tall buildings around the world through publications, research, events, working groups, web resources, and its extensive network of international representatives. The Council's research department is spearheading the investigation of the next generation of tall buildings by aiding original research on sustainability and key development issues. The Council's free database on tall buildings, The Skyscraper Center, is updated daily with detailed information, images, data, and news. The CTBUH also developed the international standards for measuring tall building height and is recognized as the arbiter for bestowing such designations as "The World's Tallest Building."

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