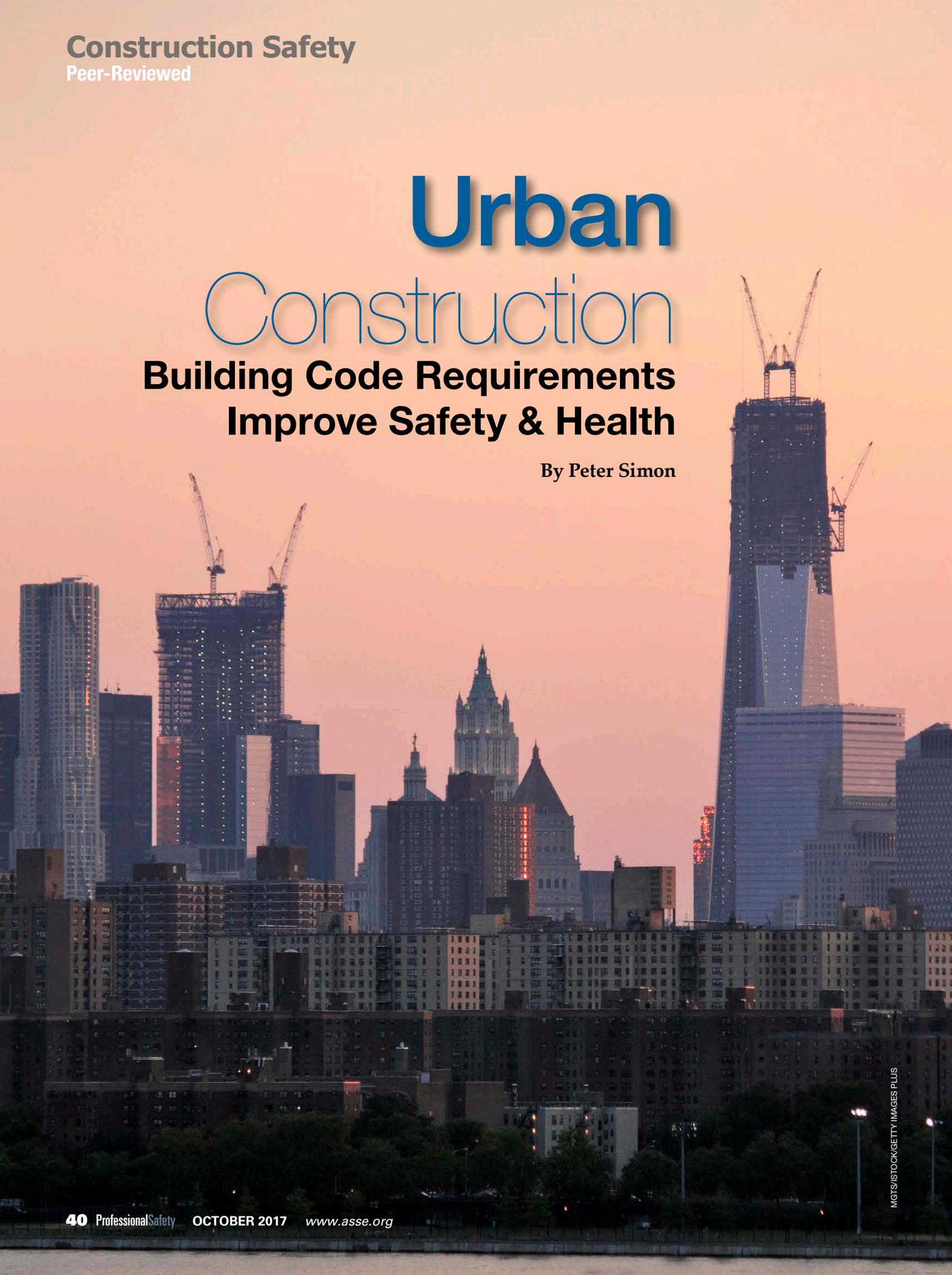


Urban Construction

Building Code Requirements Improve Safety & Health

By Peter Simon



Throughout history building codes have been a means to protect people and property. History provides many examples of catastrophic losses of life and property attributable in part to building codes or lack thereof.

New York City (NYC) offers a classic example of how important building codes are in protecting residents' safety and health. Regulation of construction operations is an aspect of building codes that is crucial in densely populated areas. NYC residents face increased risks of death or serious injury due to construction operations in areas with high population density, vertical high-rise construction, zero lot line construction and proximity to operations that require heavy materials and equipment.

In response to multiple high-profile incidents, city officials added a code requiring major construction projects to have an approved site safety plan and licensed site safety manager on site during operations. OSH literature supports this approach to increasing safety and health.

To the author's knowledge, no other jurisdiction worldwide through its building code licenses site safety managers and requires their presence on site during construction operations. The city's requirements are progressive and urban areas could improve safety and health by enacting similar requirements via their respective building codes.

Codes Borne Out of Disaster

Throughout history, communities have used codes and rules related to buildings to increase the population's safety and health. For example, the Code of Hammurabi (circa 1772 B.C.) stated that if a builder constructs a house improperly and it collapses and kills the owner, then the builder should be put to death (Gross, 1996).

Over time, it became evident that stand-alone sets of specific rules, codes or laws were needed to regulate and establish minimums for building design, construction, alteration and maintenance. Building codes or specific code provisions are often established in response to events or disasters that have resulted in fatalities, injuries or destruction of public property. Consider these examples:

- Financial district, 1835. Fire consumed 52 acres in the financial district, destroying 674 buildings and about 25% of NYC. The large conflagration was attributed in part to the fact that wood was the primary material used in the destroyed buildings (Costello, 1997).

- Brooklyn Theatre, 1876. Nearly 300 individuals died, due in part to use of flammable building materials, lack of a firewall between stage and audience, lack of sprinklers and insufficient egress corridor width (Curry, 2013).

- Triangle Shirtwaist Factory, 1911. In this tragedy, 146 individuals died due to insufficient egress and lack of building firefighting provisions above 75 ft (Kosak, 2009).

- World Trade Center, 2001. Terrorist attacks destroyed all stairwells in the North Tower and two of three stairwells in the South Tower. As a result, 1,462 building occupants died in the North Tower and 630

building occupants died in the South Tower. Estimates indicate that all but 107 occupants in the North Tower and 11 occupants in the South Tower were trapped at or above the impact zone. All stairwells were enclosed with relatively nonimpact-resistant sheetrock. The city's building code was subsequently amended to require that newly constructed stairwells be enclosed in masonry, concrete or other impact-resistant material (Shelhammer, 2010).

The effect of building codes on OSH is often more pronounced in the developing world. For example, in Haiti in 2010, more than 230,000 residents died, primarily because structures collapsed during an earthquake. Approximately 80% of schools in Port-Au-Prince collapsed (Bilham, 2010).

Building codes aim to protect occupants' safety and health by regulating the finished building product. However, the codes are often as important in protecting the safety and health of the community's residents during the construction process.

Such safety protections are magnified in urban locations with dense populations (e.g., Manhattan had 69,467.5 people per square mile in 2010) (U.S. Census Bureau, 2014), because construction operations often occur near or directly above residents. Construction safety failures in such environments can be dramatic and fatal.

In the early 1980s, four crane collapses in NYC directly resulted in the death and injury of pedestrians and workers. The public subsequently demanded greater public safety protections and oversight of the city's construction sites. The tipping point occurred when a crane run by an unlicensed operator and without proper permits collapsed and trapped a pedestrian under the crane boom for more than 6 hours. The incident received extensive live local television coverage and brought traffic to a standstill (Rohter, 1985).

In 1983, NYC's City Council passed Local Law 45, which included three critical provisions:

- 1) required the creation and filing of a site safety plan for major construction projects in the city;

- 2) created the site safety manager license and required the presence of a qualified licensed site safety manager on major construction projects (defined as 15 stories or more, 200 ft vertical or higher, lot coverage of 100,000 sq ft or more, or as designated by building commissioner) during construction operations;

- 3) created a special unit in the city's Department of Buildings, the Building Enforcement Safety Team (BEST Squad). This team enforces safety and health

IN BRIEF

- Building codes are one measure communities use to protect people and property.
- Urban areas with dense populations, such as New York City, are particularly vulnerable to hazards related to building construction.
- To address these hazards, New York City now requires approved site safety plans and a licensed site safety manager on site during operations of major construction projects.

Peter Simon, J.D., CSP, is a safety consultant and risk manager in New York, NY, and Miami, FL, with Total Safety Consulting. He is a former professional firefighter and current board member with the Construction Safety Advisory Committee of New York. Simon is a professional member of ASSE's New York City Chapter and a member of the Construction Practice Specialty.



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requirements and can stop work or stop all activity on an entire construction site (Bifulco, 2003).

The legacy of this law lives today in Chapter 3310 of the NYC Building Code. It requires a site safety plan and a licensed site safety manager for construction, demolition or alteration of a facade of a "major building." The code defines a major building as one that is at least 10 stories tall and at least 125 ft high, has a footprint of 100,000 sq ft or as designated by the commissioner of the Department of Buildings (NYC Government, 2008).

Site Safety Plan

An efficient plan that includes site layout can control and prevent construction safety and health hazards (Elbeltagi, Hegazy & Eldosouky, 2004). In NYC, many construction operations are conducted in public ways or areas (e.g., sidewalks, streets, plazas, public spaces), at property lines and over adjoining buildings. The public can be affected by a safety failure or incident, such as a piece of heavy equipment or materials falling from significant height into a public way or onto an adjoining building or space. A site safety plan helps contain collateral damage when an incident occurs at height above the public and adjoining property, and can help workers develop and apply judgment to avoid incidents (Saurin, Formoso & Cambraia, 2004).

NYC's Department of Buildings will not issue a construction or demolition permit until it approves the submitted site safety plan (NYC Government, 2008). This plan requires collaboration among builders, safety professionals and regulators to ensure that code compliance and potentially haz-

ardous issues are identified before construction begins. This process moves the decision-making process from an impromptu practice that involves the input of a few to a planned approach that involves multiple stakeholders.

Two components are essential to safety planning: 1) anticipation of where resources will be needed to control risks; and 2) identification and control of risks that originate in planning decisions (Ghosh & Young-Corbett, 2009). In NYC, safety planners identify risks to the public and apply safety engineering controls or other methods to mitigate the risk.

The code requires that a site safety plan specifically contain 21 elements (NYC Buildings, 2008c):

§ 28-110.1 Site Safety Plan

Where a site safety plan is required by chapter 33 of the New York City building code, such plan shall include the following:

- 1) Location of all construction fences around work site.
- 2) Location of all gates in construction fences.
- 3) Location of standard guardrails around excavations, when required.
- 4) Horizontal and vertical netting program, including details of the initial installation, schedule of horizontal jumps and vertical installations, and designated crane and derrick lifting areas where horizontal netting is omitted. The program shall include as an attachment any department approval obtained regarding required safety netting during construction or demolition operations; the revised site safety plan shall be approved.
- 5) Location of all sidewalk sheds, including appropriate department application numbers and department of transportation permit numbers and expiration dates.
- 6) Location of all temporary walkways, including appropriate department application numbers and department of transportation permit numbers and expiration dates.
- 7) Location of foot bridges and motor vehicle ramps, including appropriate department application numbers and department of transportation permit numbers and expiration dates.
- 8) Protection of side of excavation, when required, including appropriate department application numbers and department of transportation permit numbers and expiration dates.
- 9) Location of all street and sidewalk closing(s), including appropriate department application numbers and department of transportation permit numbers and expiration dates.
- 10) Approximate location of material and personnel hoist(s) and loading areas, including appropriate department application numbers and department of transportation permit numbers and expiration dates.
- 11) Approximate location of all crane and derrick loading areas.
- 12) Location of all surrounding buildings, indicating occupancy, height and type of any required roof protection.
- 13) Location of all standpipe system and siamese hose connections.

14) Location of all temporary elevators for fire department use when building is above 75 ft (22,860 mm) in height.

15) Location of all exterior contractors' sheds.

16) All required safety netting and scaffolding.

17) Widths of all sidewalks and roadways; all traffic information; all exits from the work site.

18) A copy of the proposed site safety manager or site safety coordinator certificate, as applicable, including the certificate for any alternate site safety manager or site safety coordinator.

19) Such features requiring special sequencing in order to maintain safe conditions with a written description of those sequences.

20) A statement that prior to performing any work on the project all workers have successfully completed the training required by section 3310.10.2 of the New York City building code.

21) A statement that all workers employed on the construction site will receive a site-specific orientation program required by section 3310.10.1 of the New York City building code. (NYC Government, 2008)

Construction safety planning can increase the safety of public and property, but only if steps are taken to ensure that it is implemented. That is the domain of the licensed site safety manager.

Site Safety Manager

Safety standards, building codes and safety plans are effective only to the degree in which they are followed or enforced. This is why the NYC Building Code requires a site safety manager or coordinator on site. The on-site safety manager is responsible for all safety requirements established in Chapter 33 of the code.

Identifying a designated individual with personal accountability is tacit acknowledgment that the construction environment often fosters rule breaking. Studies show that assigning specific responsibility for safety compliance is a vital part of organizational or work-site regulatory compliance (Hopkins, 2007). Site safety managers regularly encounter challenges, ranging from language barriers to limited space. However, perhaps the most difficult challenge involves speed. Due to high stakes in real estate investment, the interest in completing construction tasks and projects quickly is also high. In some cases, the site safety manager is the only guard against taking risks for the sake of speed.

The concept of having a single individual accountable for safety is not a novel one. Studies indicate that workers are more comfortable when they have a supervisory figure who cares and promotes safety; as a result they are more likely to perform operations in a safe manner (Langford, Rowlinson & Sawacha, 2000). Cognitive theories also support the idea that worker perception is correlated to performance because perception can directly shape behavior that is the basis for performance (O'Reilly, 1973). Establishing a dedicated on-site safety manager can heighten the workers' perception that safety is a company priority. This perception can increase safe actions.

The designated site safety manager must be licensed by the NYC Department of Buildings. A licensee must have a requisite number of years' experience working on major buildings; complete an approved course; and pass a written examination administered by the Department of Buildings. The licensed site safety manager requirements bear some similarities to those OSHA has established for a competent person in that the individual will be someone "capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them."

Under the NYC code, the designated site safety manager's duties include conducting required safety compliance inspections and ensuring that mandated daily safety checks are performed. The site safety manager must also immediately notify the regulatory authority (i.e., NYC Department of Buildings) of conditions that could be immediately hazardous to the public. These conditions include: 1) a person operating a crane, derrick, hoist or hoisting equipment without a permit who refuses to desist; 2) a crane being operated by an unlicensed operator and unlicensed operator who refuses to desist; 3) no flag person present during crane operations where required; 4) sidewalk shed required by site safety not in place as required; 5) permits have not been issued for sidewalk shed; 6) erection of shed not certified in accordance with plans by designer or erector; 7) incident involving public or private property (NYC Buildings, 2008a).

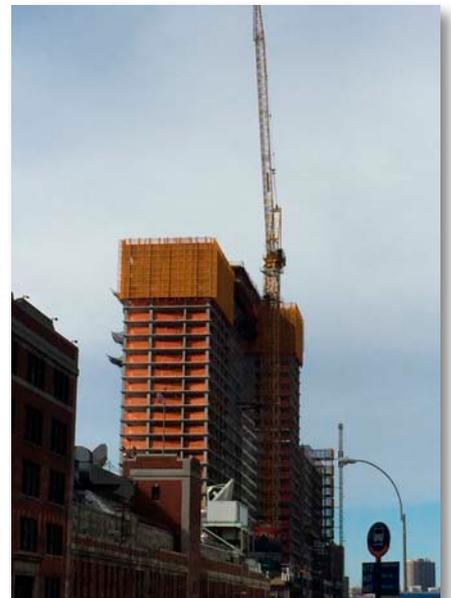
Under the code, a site safety manager must document required safety inspections and notify responsible personnel of code/rule violations. The goal is to quantify, create evidence and show patterns of non-compliance that regulatory entities and others can use to address such behavior. This log also tracks whether the site safety manager is performing the requisite safety inspections.

All such violations and corrective work must be recorded in the site safety manager's daily log. Under the city's building code, contractors must implement all orders and directives relating to safety requirements (NYC Buildings, 2008b).

Conclusion

As the global population concentrates in urban areas, the risk posed by construction and demolition operations in these areas becomes more significant. NYC has proactively addressed some risks by enacting building codes that require an approved site safety plan for major construction operations and mandate that a qualified safety professional be on site and held account-

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able for implementing provisions to safeguard and improve public safety and health.

However, prescriptive legislation has limitations and can hinder innovation and risk control. Some might simply seek to comply with the letter of the law without embracing the intent of the rule, and might ignore ways to innovate beyond minimum compliance (Hopkins, 2007). Faced with highly prescriptive safety laws, developers and constructors may ignore a law's intent or spirit as well as the risks that those rules aim to control. A highly prescriptive and complex regulatory system can discourage stakeholders from using systems or innovations that are not considered within such a system.

These limitations aside, NYC's Building Code has led to better protection of public and property during construction operations. Requiring an approved site safety plan and a licensed site safety manager for major construction projects has produced a safer and healthier environment for people near construction sites.

NYC's site safety planning and monitoring provisions are viewed as an effective solution to increasing safety and accountability on city construction sites. Legislators in other jurisdictions would do well to adopt similar requirements for major construction projects. These requirements have reduced the probability of tragedies that affect the safety and health of public, property and workers. **PS**

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