# Small Building Stair Requirements (10412)

IBC: 1006.3.4, 1006.3.5 (New), 1006.3.5.1 (New), 1006.3.5.2 (New), 1006.3.5.3 (New), 1006.3.5.4 (New), 1006.3.5.5 (New), 1006.3.5.6 (New), 1023.12, 1031.2; IFC: [BE] 1006.3.4, 1006.3.5 (New), 1006.3.5.1 (New), 1006.3.5.2 (New), 1006.3.5.3 (New), 1006.3.5.4 (New), 1006.3.5.5 (New), 1006.3.5.6 (New), [BE] 1023.12, [BE] 1031.2

**Proponents:** Stephen Smith, Center for Building in North America, Center for Building in North America (stephen@centerforbuilding.org); Scott Brody, Self (sbrody96@gmail.com); Trevor Acorn, PE SE, Myself (tjacorn@gmail.com)

# 2024 International Building Code

**Revise as follows:**

**1006.3.4 Single exits.**

A single *exit* or access to a single *exit* shall be permitted from any *story* or *occupiable roof* where one of the following conditions exists:

1. The *occupant load*, number of *dwelling units* and exit access travel distance do not exceed the values in Table 1006.3.4(1) or 1006.3.4(2).
2. Group R-2 occupancies complying with Section 1006.3.5.
3. ~~2~~Rooms, areas and spaces complying with Section 1006.2.1 with *exits* that discharge directly to the exterior at the *level of exit discharge*, are permitted to have one *exit* or access to a single *exit*.
4. ~~3~~Parking garages where vehicles are mechanically parked shall be permitted to have one *exit* or access to a single *exit*.
5. ~~4~~Group R-3 and R-4 occupancies shall be permitted to have one *exit* or access to a single *exit*.
6. ~~5~~Individual single-story or multistory *dwelling units* shall be permitted to have a single *exit* or access to a single *exit* from the *dwelling unit* provided that both of the following criteria are met:
   ~~5.1~~ 6.1. The *dwelling unit* complies with Section 1006.2.1 as a space with one *means of egress*.
   ~~5.2~~ 6.2. Either the exit from the *dwelling unit* discharges directly to the exterior at the *level of exit discharge*, or the *exit access* outside the *dwelling unit's* entrance door provides access to not less than two *approved* independent *exits*.

**TABLE 1006.3.4(1) STORIES AND OCCUPIABLE ROOFS WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES**

| STORY | OCCUPANCY | MAXIMUM NUMBER OF DWELLING UNITS | MAXIMUM EXIT ACCESS TRAVEL DISTANCE |
|---|---|---|---|
| Basement, first, second or third story above grade plane and occupiable roofs over the first or second story above grade plane | R-2[a, b, c] | 4 dwelling units | 125 feet |
| Fourth story above grade plane and higher | NP | NA | NA |

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.

b. This table is used for Group R-2 occupancies consisting of dwelling units. For Group R-2 occupancies consisting of sleeping units, use Table 1006.3.4(2).

c. This table is for occupiable roofs accessed through and serving individual dwelling units in Group R-2 occupancies. For Group R-2 occupancies with occupiable roofs that are not accessed through and serving individual units, use Table 1006.3.4(2).

**TABLE 1006.3.4(2) STORIES AND OCCUPIABLE ROOFS WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES**

| STORY AND OCCUPIABLE ROOF | OCCUPANCY | MAXIMUM OCCUPANT LOAD PER STORY AND OCCUPIABLE ROOF | MAXIMUM EXIT ACCESS TRAVEL DISTANCE (feet) |
|---|---|---|---|
| First story above or below grade plane and occupiable roofs over the first story above grade plane | A, B[b], E, F[b], M, U | 49 | 75 |
| | H-2, H-3 | 3 | 25 |
| | H-4, H-5, I, R-1, R-2[a, c] | 10 | 75 |
| | S[b, d] | 29 | 75 |
| Second story above grade plane | B, F, M, S[d] | 29 | 75 |
| Third story above grade plane and higher | NP | NA | NA |

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.

b. Group B, F and S occupancies in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or an occupiable roof of such buildings shall have a maximum exit access travel distance of 100 feet.

c. This table is used for Group R-2 occupancies consisting of sleeping units. For Group R-2 occupancies consisting of dwelling units, use Table 1006.3.4(1).

d. The length of exit access travel distance in a Group S-2 open parking garage shall be not more than 100 feet.

**Revise as follows:**

**1006.3.4.1 Mixed occupancies.**
Where one *exit*, or *exit access stairway* or *ramp*providing access to exits at other *stories*, is permitted to serve individual *stories*, mixed occupancies shall be permitted to be served by single *exits* provided that each individual occupancy complies with the applicable requirements of Table 1006.3.4(1) or 1006.3.4(2) for that occupancy. Where applicable, cumulative *occupant loads*from adjacent occupancies shall be considered to be in accordance with the provisions of Section 1004.1. In each *story* of a mixed occupancy *building*, the maximum number of occupants served by a single exit shall be such that the sum of the ratios of the calculated number of occupants of the space divided by the allowable number of occupants indicated in Table 1006.3.4(2) for each occupancy does not exceed one. Where *dwelling units* are located on a story with other occupancies, the actual number of *dwelling units* divided by four plus the ratio from the other occupancy does not exceed one.

**Add new text as follows:**

**1006.3.5 Group R-2 occupancies.** In Group R-2 occupancies, a single exit shall be permitted from any story or occupiable roof where the number of dwelling units served per exit at each story comply with one of the following:

1. The basement and first through sixth story above grade plane with a maximum of 4 dwelling units served per exit on each story.
2. The basement and first through third story above grade plane with a maximum of 6 dwelling units served per exit on each story.

Such building shall comply with Sections 1006.3.5.1 through 1006.3.5.6.

**1006.3.5.1 Construction type.** The building is Type IA, IB, IIA, or IV construction.

**1006.3.5.2 Corridors.** Dwelling units that do not open directly into an exterior exit stairway shall exit directly to a corridor complying with Section 1020.

**1006.3.5.3 Travel distance.** Maximum exit access travel distance shall be not more than 125 feet (38.1 m). Travel distance from the exit access door of the unit to the exit door for the stairway shall be not more than 25 feet (7.62 m).

**1006.3.5.4 Exit stairways.** Means of egress shall be provided from each story above the level of exit discharge by an interior exit

stairway or exterior exit stairway. Exit stairways shall be protected with 2-hour fire barriers in accordance with Section 707 or a 2-hour horizontal assemblies in accordance with Section 711. An interior exit stairway shall be a smokeproof enclosure in accordance with with Section 909.20.

**1006.3.5.5 Emergency escape and rescue openings.**
Emergency escape and rescue openings shall be provided in accordance with Section 1031.

**1006.3.5.6 Mixed occupancies.**
Mixed occupancies shall be permitted at and below the level of exit discharge. Other occupancies shall not have direct access to the Group R-2 occupancy portion of the building or to the exit stairway serving the Group R-2 occupancy.

**Exception:** Parking garages and occupied roofs that serve the Group R-2 occupancy shall be permitted to have direct access to the exit stairway.

**Revise as follows:**

**1023.12 Smokeproof enclosures.**
Where required by Section 403.5.4, 405.7.2, ~~or~~ 412.2.2.1 or 1006.3.5.4, interior exit *stairways* and *ramps* shall be *smokeproof enclosures* in accordance with Section 909.20.

**1031.2 Where required.**
In addition to the *means of egress* required by this chapter, *emergency escape and rescue openings* shall be provided in the following occupancies:

1. Group R-2 occupancies located in *stories* with only one *exit* or access to only one *exit* as permitted by Tables 1006.3.4(1) and 1006.3.4(2) and Section 1006.3.5.5.
2. Group R-3 and R-4 occupancies.

*Basements* and sleeping rooms below the fourth *story above grade plane* shall have not fewer than one *emergency escape and rescue opening* in accordance with this section. Where *basements* contain one or more sleeping rooms, an *emergency escape and rescue opening* shall be required in each sleeping room, but shall not be required in adjoining areas of the *basement*. Such openings shall open directly into a *public way* or to a *yard* or *court* that opens to a *public way, or to an egress balcony that leads to a public way*.

**Exceptions:**

1. *Basements* with a ceiling height of less than 80 inches (2032 mm) shall not be required to have *emergency escape and rescue openings*.
2. *Emergency escape and rescue openings* are not required from *basements* or sleeping rooms that have an *exit* door or *exit access* door that opens directly into a *public way* or to a *yard*, *court* or exterior egress balcony that leads to a *public way*.
3. *Basements* without *habitable spaces* and having not more than 200 square feet (18.6 $m^2$) in floor area shall not be required to have *emergency escape and rescue openings*.
4. *Storm shelters* are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
5. Within individual *dwelling* and *sleeping units* in Groups R-2 and R-3, where the *building* is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3, *sleeping rooms* in *basements* shall not be required to have *emergency escape and rescue openings* provided that the *basement* has one of the following:
   5.1. One *means of egress* and one *emergency escape and rescue opening*.
   5.2. Two *means of egress*.

# 2024 International Fire Code

**Revise as follows:**

**[BE] 1006.3.4 Single exits.**

**[BE] 1006.3.4 Single exits.**

A single *exit* or access to a single *exit* shall be permitted from any story or *occupiable roof*, where one of the following conditions exists:

1. The *occupant load*, number of *dwelling units* and exit access travel distance do not exceed the values in Table 1006.3.4(1) or 1006.3.4(2).

2. Group R-2 occupancies complying with Section 1006.3.5.

~~2~~3. Rooms, areas and spaces complying with Section 1006.2.1 with *exits* that discharge directly to the exterior at the *level of exit discharge*, are permitted to have one *exit* or access to a single *exit*.

~~3~~4. Parking garages where vehicles are mechanically parked shall be permitted to have one *exit* or access to a single *exit*.

~~4~~5. Group R-3 and R-4 occupancies shall be permitted to have one *exit* or access to a single *exit*.

~~5~~6. Individual single-story or multistory *dwelling units* shall be permitted to have a single *exit* or access to a single *exit* from the *dwelling unit* provided that both of the following criteria are met:

~~5.1~~ 6.1. The *dwelling unit* complies with Section 1006.2.1 as a space with one *means of egress*.

~~5.2~~ 6.2. Either the exit from the *dwelling unit* discharges directly to the exterior at the *level of exit discharge*, or the *exit access* outside the *dwelling unit's* entrance door provides access to not less than two *approved* independent *exits*.

**[BE] TABLE 1006.3.4(1) STORIES AND OCCUPIABLE ROOFS WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 OCCUPANCIES**

| STORY | OCCUPANCY | MAXIMUM NUMBER OF DWELLING UNITS | MAXIMUM EXIT ACCESS TRAVEL DISTANCE |
|---|---|---|---|
| Basement, first, second or third story above grade plane and occupiable roofs over the first or second story above grade plane | R-2[a, b, c] | 4 dwelling units | 125 feet |
| Fourth story above grade plane and higher | NP | NA | NA |

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.

b. This table is used for Group R-2 occupancies consisting of dwelling units. For Group R-2 occupancies consisting of sleeping units, use Table 1006.3.4(2).

c. This table is for occupiable roofs accessed through and serving individual dwelling units in Group R-2 occupancies. For Group R-2 occupancies with occupiable roofs that are not accessed through and serving individual units, use Table 1006.3.4(2).

**[BE] TABLE 1006.3.4(2) STORIES AND OCCUPIABLE ROOFS WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES**

| STORY AND OCCUPIABLE ROOF | OCCUPANCY | MAXIMUM OCCUPANT LOAD PER STORY AND OCCUPIABLE ROOF | MAXIMUM EXIT ACCESS TRAVEL DISTANCE (feet) |
|---|---|---|---|
| First story above or below grade plane and occupiable roofs over the first story above grade plane | A, B[b], E, F[b], M, U | 49 | 75 |
| | H-2, H-3 | 3 | 25 |
| | H-4, H-5, I, R-1, R-2[a, c] | 10 | 75 |
| | S[b, d] | 29 | 75 |
| Second story above grade plane | B, F, M, S[d] | 29 | 75 |
| Third story above grade plane and higher | NP | NA | NA |

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.

b. Group B, F and S occupancies in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or an occupiable roof of such buildings shall have a maximum exit access travel distance of 100 feet.

c. This table is used for Group R-2 occupancies consisting of sleeping units. For Group R-2 occupancies consisting of dwelling units, use Table 1006.3.4(1).

d. The length of exit access travel distance in a Group S-2 open parking garage shall be not more than 100 feet.

**[BE] 1006.3.4.1 Mixed occupancies.**
Where one *exit*, or *exit access stairway* or *ramp* providing access to *exits* at other stories, is permitted to serve individual stories, mixed occupancies shall be permitted to be served by single *exits* provided that each individual occupancy complies with the applicable requirements of Table 1006.3.4(1) or 1006.3.4(2) for that occupancy. Where applicable, cumulative *occupant loads* from adjacent occupancies shall be considered to be in accordance with the provisions of Section 1004.1. In each story of a mixed occupancy building, the maximum number of occupants served by a single *exit* shall be such that the sum of the ratios of the calculated number of occupants of the space divided by the allowable number of occupants indicated in Table 1006.3.4(2) for each occupancy does not exceed one. Where *dwelling units* are located on a story with other occupancies, the actual number of *dwelling units* divided by four plus the ratio from the other occupancy does not exceed one.

**Add new text as follows:**

**1006.3.5 Group R-2 occupancies.** In Group R-2 occupancies, a single exit shall be permitted from any story or occupiable roof where the number of dwelling units served per exit at each story comply with one of the following:

1. The basement and first through sixth story above grade plane with a maximum of 4 dwelling units served per exit on each story.
2. The basement and first through third story above grade plane with a maximum of 6 dwelling units served per exit on each story.

Such building shall comply with Sections 1006.3.5.1 through 1006.3.5.7.

**1006.3.5.1 Construction type.**
The building is Type IA, IB, IIA, or IV construction.

**1006.3.5.2 Corridors.** Dwelling units that do not open directly into an exterior exit stairway shall exit directly to a corridor complying with Section 1020.

**1006.3.5.3 Travel distance.** Maximum exit access travel distance shall be not more than 125 feet (38.1 m). Travel distance from the exit access door of the unit to the exit door for the stairway shall be not more than 25 feet (7.62 m).

**1006.3.5.4 Exit stairways.** Means of egress shall be provided from each story above the level of exit discharge by an interior exit stairway or exterior exit stairway. Exit stairways shall be protected with 2-hour fire barriers in accordance with Section 707 or a 2-hour horizontal assemblies in accordance with Section 711. An interior exit stairway shall be a smokeproof enclosure in accordance with with Section 909.20.

**1006.3.5.5 Emergency escape and rescue openings.** Emergency escape and rescue openings shall be provided in accordance with Section 1031.

**1006.3.5.6 Mixed occupancies.** Mixed occupancies shall be permitted in the building provided there are no exit access doors into the dwelling units or dwelling unit corridors directly from the other occupancies. Other occupancies shall not communicate with the Group R-2 occupancy portion of the building or with a single-exit stairway.

**Exception:** Parking garages and occupied roofs that serve the Group R-2 occupancy shall be permitted to communicate with the exit

stairway.

**Revise as follows:**

**[BE] 1023.12 Smokeproof enclosures.**
Where required by Section 403.5.4, 405.7.2, ~~or~~ 412.2.2.1 or 1006.3.5.4, interior exit *stairways* and *ramps* shall be *smokeproof enclosures* in accordance with Section 909.20.

**[BE] 1031.2 Where required.**
In addition to the *means of egress* required by this chapter, *emergency escape and rescue openings* shall be provided in the following occupancies:

1. Group R-2 occupancies located in *stories* with only one *exit* or access to only one *exit* as permitted by Tables 1006.3.4(1) and 1006.3.4(2) and Section 1006.3.5.5.
2. Group R-3 and R-4 occupancies.

*Basements* and sleeping rooms below the fourth *story above grade plane* shall have not fewer than one *emergency escape and rescue opening* in accordance with this section. Where *basements* contain one or more sleeping rooms, an *emergency escape and rescue opening* shall be required in each sleeping room, but shall not be required in adjoining areas of the *basement*. Such openings shall open directly into a *public way* or to a *yard* or *court* that opens to a *public way* , or to an egress balcony that leads to a *public way* .

**Exceptions:**

1. *Basements* with a ceiling height of less than 80 inches (2032 mm) shall not be required to have *emergency escape and rescue openings*.
2. *Emergency escape and rescue openings* are not required from *basements* or sleeping rooms that have an *exit* door or *exit access* door that opens directly into a *public way* or to a *yard*, *court* or exterior egress balcony that leads to a *public way*.
3. *Basements* without *habitable spaces* and having not more than 200 square feet (18.6 $m^2$) in floor area shall not be required to have *emergency escape and rescue openings*.
4. *Storm shelters* are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
5. Within individual *dwelling* and *sleeping units* in Groups R-2 and R-3, where the building is equipped throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3, sleeping rooms in *basements* shall not be required to have *emergency escape and rescue openings* provided that the *basement* has one of the following:
   5.1. One *means of egress* and one *emergency escape and rescue opening*.
   5.2. Two *means of egress*.

**Reason:** Please refer to our attachment for an in-depth discussion of life safety and other issues.
The 2024 International Building Code allows buildings up to three stories of R-2 occupancy to have up to four dwelling units at each story served by a single exit. Our proposal acknowledges the rising demand for infill multifamily development and a growing movement across the United States to modify local building codes for this purpose. We recommend enabling a single exit to serve up to six stories of R-2 occupancy above the grade plane, or up to six units per floor in cases of at most three stories.

In return for the increased height or dwelling unit allowance, buildings would adhere to more stringent conditions than a traditional building. The building would be of Type IA, IB, IIA, or IV 1-hour fire resistant construction, dwelling units could not directly access the exit, active or passive smoke control systems would be required in the single exit, and there would be strict limits on travel distances and the number of dwelling units per floor. The whole suite of ordinary fire safety measures contained in the IBC – access to the building by fire apparatus, fire sprinklers, etc. – would also still apply.

Our language is adapted from codes in Seattle, Honolulu, New York City, and Western European countries, collectively forming the most rigorous set of conditions for six-story buildings in the developed world. The limitations and requirements in our proposal match or

exceed those in cities, suburbs, and rural areas around the developed world, where fire death rates are at or below the United States median. Within the U.S., Seattle, Honolulu, and New York City have allowed buildings with generally fewer restrictions, to no ill effect or local controversy, and no major fires that we are aware of.

Our proposal is intentionally cautious and may be subject to adjustment in future code cycles based on additional research and experience, expanding possibilities for such construction.

**Bibliography:** See attached.

**Cost Impact:** Decrease

**Estimated Immediate Cost Impact:**

We believe the cost of constructing multifamily buildings on small lots will decrease by roughly 7 percent, in line with the reduction in circulation area required.

**Estimated Immediate Cost Impact Justification (methodology and variables):**

See attachment for details.

**Attached Files**

- **Single-stair proposal attachment.pdf**
  https://www.cdpaccess.com/proposal/10412/30836/files/download/4800/

# Single-exit R-2 occupancies, up to six stories

Proponents: Stephen Smith, Scott Brody, Trevor Acorn


*Proponent's condo building, featuring seven dwelling units over one store, outfitted with NFPA 13R sprinklers and served by a single exit, per New York City Building Code 1006.3.2.7 (photo by author)*

# Change description

The 2024 International Building Code (IBC) allows buildings up to three stories of R-2 occupancy to have up to four dwelling units at each story served by a single exit (typically a stairway). Our proposal acknowledges the rising demand for infill multifamily development and a growing movement across the United States to modify local building codes for this purpose. We recommend enabling a single exit to serve up to six stories of R-2 occupancy above the grade plane, or up to six units per floor in cases of at most three stories.

In return for the increased height or dwelling unit allowance, buildings would adhere to more stringent conditions than a traditional building. The building would be of Type IA, IB, IIA, or IV 1-hour fire resistant construction, dwelling units could not directly access the exit, active or passive smoke control systems would be required in the single exit, and there would be strict limits on travel distances and the number of dwelling units per floor. The whole suite of ordinary fire safety measures contained in the IBC – access to the building by fire apparatus, fire sprinklers, etc. – would also still apply.

Our language is adapted from codes in Seattle, Honolulu, New York City, and Western European countries, collectively forming the most rigorous set of conditions for six-story buildings in the developed world. The proposal is intentionally cautious and may be subject to adjustment in future code cycles based on additional research and experience, expanding possibilities for such construction.

*A series of modern, non-combustible single-stair buildings*

# Architectural and planning needs

In 1977, the City of Seattle's new building code, recognizing the desirability of developing small, infill lots in inner-city neighborhoods like Capitol Hill, introduced an amendment to allow small-lot single-stair apartment buildings to the then-adopted Uniform Building Code. These changes survive to this day in a more elaborate form.[1] Recently, the City and County of Honolulu (comprising two-thirds of the State of Hawaii), in a similar effort to encourage similar infill development to provide affordable housing, copied Seattle's single-stair code section almost verbatim, allowing six-story, single-stair buildings with a maximum of four dwelling units per floor.[2] New York City, with its long history of small lots and housing shortage, has long had separate code language with similar intent and effect.[3] Outside of the United States, countries in Western Europe, which are more urban and have non-combustible construction traditions, have long allowed single-stair buildings much taller than the IBC's three-story limit.[4]

As the United States grapples with the dual challenges of climate change and urban housing unaffordability, the specific circumstances that created the need to allow taller single-stair apartment buildings in Seattle, Honolulu, and New York City are now national in scope. In California, Minnesota, Nashville, New York City, New York State, Oregon, Virginia, and Washington State – plus other jurisdictions that have not made their plans public at the time of this proposal submission – officials are considering amending the IBC in similar ways to allow taller single-stair apartment buildings.[5]

We believe that now is the time for the International Code Council (ICC) to introduce language of its own into the model IBC. While the conditions laid out in this proposal are generally stricter than those found in cities like New York City or Seattle, with large, professional, well-resourced fire departments, we believe our conditions are conservative enough to work in a range of different jurisdictions, and can serve as the basis for modifications in future code cycles as research and understanding of these smaller, denser building types progresses.

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[1] "1977 Seattle Building Code, Amendments to 1973 Uniform Building Code."
[2] 2023 Revised Ordinances of Honolulu, § 16-1.1, 74.
[3] "2022 New York City Building Code," 1006.3.2.
[4] Speckert, "Jurisdictions - The Second Egress: Building a Code Change."
[5] Smith, "Single-Stair Tracker."


*Typical American downtown (Morristown, NJ), hard to recreate above three stories under current IBC*

*Typical double-loaded corridor building with two remote exits*

Many architects, urban planners, developers (both market-rate and affordable) find the current code has impeded construction of smaller buildings.[6] With building lots in downtown and downtown-adjacent areas becoming scarce, and growing concerns about the environmental, economic, and social consequences of car-centric building patterns, planners and politicians have set their sights infilling core urban neighborhoods with lots typically no wider than 50 or even 25 feet. These lots are very difficult to develop to heights above three stories given the IBC's requirements for two remote exits in even small buildings.

Furthermore, even where larger parcels of land are available, criticism is growing of large, boxy "5-over-1" apartment buildings – both of their monolithic exterior appearance, but also of their internal layouts, with hotel-like double-loaded corridors and thick floor plates that make it difficult to provide family-sized apartments.[7] The larger double-loaded building allows less sun penetration, is less architecturally interesting, and the long corridors and anonymity of having hundreds of units sharing the same circulation space present security issues.[8]

These designs are deeply embedded in American zoning codes and go beyond the scope of building codes, however egress provisions do contribute to them, and building code modifications are necessary (if not sufficient) to reintroduce more fine-grained and diverse development patterns to American cities.

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[6] Grabar, "The Single-Staircase Radicals Have a Good Point."
[7] Smith, "Why We Can't Build Family-Sized Apartments in North America."
[8] Jacobs, *The Death and Life of Great American Cities*.

# Fire service operations

## Attack vs. evacuation stair

Fire service officials often state that two stairs are necessary to segregate firefighter attack and occupant evacuation. We believe this is not a significant issue in the building sizes that would fit within our proposal for two reasons: the size of the building means that evacuation needs are small and many people will have left the building before the fire department even arrives. Additionally, neatly segregating fire suppression operations from evacuation is difficult, if not impossible.

Interviews with fire service officials show that in practice occupants rarely segregate to a designated evacuation stairway, but instead use whichever exit is closest. Given that there is no code requirement for a public address system in a mid-rise multifamily building (and even one New York City proposal to introduce one would not have applied to buildings of not more than six stories), there would be no way to communicate with occupants about which exit is to be used for evacuation.[9] This sometimes has tragic consequences, as in a 2014 high-rise fire in Manhattan. Firefighters held open an exit door to run a hose, and a resident above the level of fire used that exit when trying to evacuate, not knowing it was the attack stair, and died of smoke inhalation.[10] In our case, the buildings are low enough that a general evacuation is feasible within a short amount of time. This is very different from a skyscraper, where fire services could want to commence an attack before waiting what could be minutes to fractions of an hour for people on high floors to make their way down.

FDNY's *Probationary Firefighters Manual* recognizes the difficulties of neatly segregating attack and evacuation stairs. It states, in a section on fireproof high-rise apartment building fires:

> Be aware that the building occupants opening their apartment doors to evacuate should be advised to stay in their apartment, if it is tenable. They will not know which stairway is being used for evacuation."[11]

Vincent Dunn, in *Strategy of Firefighting*, writes:

> Dividing up stairways for fire attack and evacuation is easier said than done. To do this, there must be a public-address system in the building, allowing the fire chief to speak to the people trapped above the fire. If there is no public-address system, there can be no organized movement of people in the burning building. People not knowing what to do

[9] Schwirtz, "Counterintuitive Advice When You Hear 'Fire!' In a High-Rise: Stay Put."
[10] Sandoval and Moore, "Man Who Died in Manhattan High-Rise Fire Should Have Stayed in Apartment: FDNY."
[11] Kavanagh et al., *F.D.N.Y. Probationary Firefighters Manual, Volume II*, 2:72.

may attempt to escape the fire—tragically leaving a safe apartment and entering a deadly smoke-filled hallway or stairway.[12]

## Shelter in place

One key risk factor for fire death is the presence of a disability and intoxication.[13] Provision of a second exit will not typically help occupants who lack the physical or mental capacity to self-evacuate. Alternative measures, such as more fire resistant construction and smoke control, would likely be more useful for improving survivability. From an equity lens, our proposed solution is superior to the status quo.

## Rescue options

In other countries, building codes commonly require access to the apartment building through a window or balcony in single-stair buildings, for redundant egress and rescue if the stair is blocked. This can sometimes be waived if stairways are enclosed and, beyond a certain height, protected in some way. In order to present a conservative code change proposal that is acceptable in a wide range of jurisdictions, we have included a requirement for emergency escape and rescue openings (EEROs) in addition to – not instead of – stairway protection and the standard fire apparatus access road requirements in the International Fire Code.[14] These EEROs offer a variety of options for evacuation in the unlikely event that a fire is uncontrolled by the sprinkler, smoke control, and other systems.

Evacuation methods in the case of a fatally compromised single stair include, ,from the most common to least common:

### Evacuation via aerial apparatus

Pursuant to IFC Appendix D, aerial fire apparatus access roads must extend to within 15 to 30 ft. of a building taller than 30 ft., and be positioned so that access can be made to at least one side of the building.

We anticipate that first, people in units facing the apparatus would be lowered. Then, fire services would escort people out from units across the hallway and through dwellings that were previously evacuated.

Even if an aerial apparatus access road were not required in accordance with Appendix D, the regular IFC access road requirements would apply. These provide sufficient room for the vast majority of ladder trucks of the size needed for this type of operation. The ladder truck outrigger

[12] Dunn, *The Strategy of Firefighting*, 108.
[13] Jonsson et al., "The State of the Residential Fire Fatality Problem in Sweden."
[14] "2024 International Fire Code," Section 503, Appendix D.

can also be placed on the sidewalk or grass with extra support pads. Outriggerscan also often be placed around parked vehicles and obstructions such as bollards, with a well trained operator.

We recognize that there are options to seek approval for placing the access road farther in cases of sprinklered buildings, and omit aerial access in buildings with standpipes. We anticipate such options would generally be inconsistent with fire/rescue needs, and therefore not be approved.

### Evacuation via ground ladder

If a ladder truck is not used, a 35-ft. extension ladder, standard on most aerial apparatus, would be sufficient for reaching three to four floors, depending on exact elevations. Some jurisdictions also carry taller Bangor ladders, which can typically reach up to five stories.

### Occupants walk out with smoke hoods

The fire service can distribute smoke hoods for occupants to leave their dwellings. Smoke hoods combine the particle blocking function of a mask with elements like charcoal that react with carbon monoxide so that it is not harmful to the breather.[15] If there is considerable heat or flame risk, the fire service can also provide protective clothing for occupants to wear as they walk down.

### Other advanced options

There are many other options for rescues, ranging from fire-resistant inflatables called air rescue cushions (which LAFD firefighters train on, and of which the Berlin Fire Brigade has 170) to apparatus-mounted articulated booms, and other rope systems.[16]

## Egress comparison

In the event of a fire that is not controlled by fire sprinklers, it may be necessary for building occupants to evacuate the building, similar to a building with two exits. Given the limited size of buildings that would comply with our proposal – at most 24 dwelling units above the ground floor, with at most four units per floor in buildings up to six stories – the number of occupants evacuating would be low.

If they do need to evacuate, it may be possible that the amount of time they spend traveling through the very short exit access corridor and down the exit stairway would be roughly equal to the amount of time that an occupant would spend merely in the exit access corridor of a

[15] “iEvac® Smoke Hood / Fire Escape Mask.”
[16] LAFD, “LAFD: Jump for Your Job!”; “Rescue Cushions”; Petrillo, “Booms on Apparatus Have Their Place in the Fire Service.”

traditional double-loaded corridor building with two stairs, even before counting time in the exit. In normal circumstances, the exit in our proposed buildings would be pressurized, naturally ventilated, or protected by a naturally ventilated vestibule, so the evacuee would spend far less time in an unprotected corridor before reaching a protected stair, but active systems like pressurization sometimes fail, so the scenario is worth considering.

The IBC allows up to 200 feet of travel distance in an unprotected corridor. Assuming an average travel speed of 4.66 feet per second, the occupant would spend 42.9 seconds simply traveling from the dwelling unit door to the exit stair door.[17]

In a single-stair building meeting our proposal's requirements, on the other hand, the travel distance within the exit access corridor is limited to 25 feet, taking 5.4 seconds to traverse. The average time to descend down a flight of stairs is about 13.1 seconds per story.[18] Therefore, for a four-story building, the combined travel time would be just 44.7 seconds – barely more than the occupant would spend in the unprotected exit access corridor alone. For a six-story building, the combined exit access corridor and exit stair evacuation time reaches just 70.9 seconds.

This is a crude model, but more advanced modeling could show even greater uncertainty in a typical large double-loaded corridor building. Pre-movement time could be more significant in a building with a complex warren of corridors. With stairs deemphasized in the design of modern double-loaded corridor buildings, residents of large multifamily buildings may not be aware ahead of time where the stair is even located, especially if the stair nearest to them is far from the elevator. And in buildings fitted with NFPA 13 sprinklers, dead-end corridors of up to 50 feet are permitted, introducing even more potential confusion into double-loaded corridor evacuations.[19] In a single-stair building, on the other hand, residents and even non-resident occupants will have a much simpler and shorter path to the exit stair, reducing uncertainty in evacuations.

[17] Browning et al., "Effects of Obesity and Sex on the Energetic Cost and Preferred Speed of Walking."
[18] Shah et al., "Elevators or Stairs?"
[19] "2024 International Building Code," 1020.5.

# Comparison to other single-stair codes

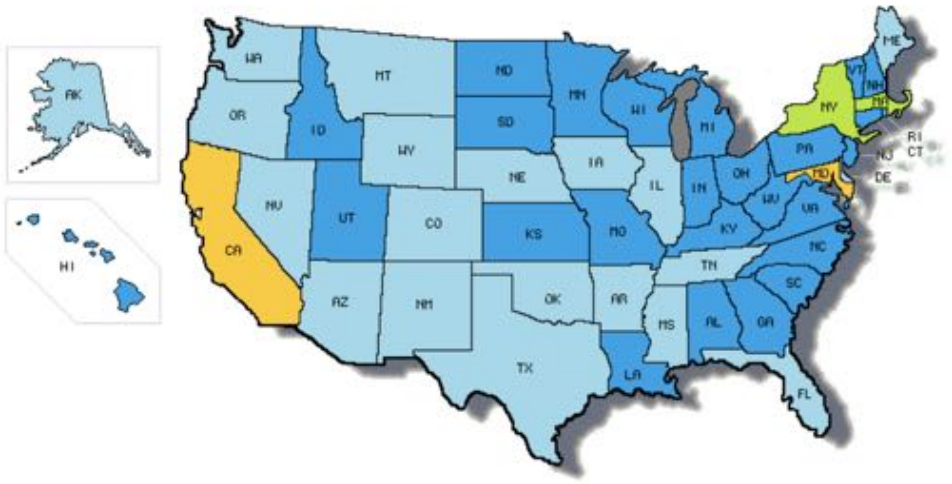
Below, we compare our proposal to codes in three other jurisdictions allowing a single-stair up to at least six stories: Seattle (recently copied by Honolulu), New York City, and Italy (with three different routes for compliance). We chose Italy because their code is straightforward and typical of continental European approaches generally. As the table shows, in other jurisdictions, some items from a menu of options are required, while others are not. To be conservative, we chose to require all elements from among other jurisdictions' menus of options. With time and experience, this may prove to be overly restrictive and could be revised in later code cycles. Given the novelty of the concept in North America, we feel these requirements are acceptable in order to expedite acceptance, and that they will result in viable small-lot infill development in jurisdictions with rents high enough to support the increased construction costs.

| | **Our proposal** | **Seattle and Honolulu[20]** | **NYC[21]** | **Italy (option 1)[22]** | **Italy (option 2)** | **Italy (option 3)** |
|---|---|---|---|---|---|---|
| **Maximum height** | 6 stories | 6 stories | 6 stories | 8 stories | 8 stories | 25 stories |
| **Light wood frame?** | Not allowed | Allowed | Not allowed | Not allowed | Not allowed | Not allowed |
| **Sprinklers** | NFPA 13 or 13R depending on height | NFPA 13 | NFPA 13R | None required | None required | None required |
| **Non-stair firefighter access** | One opening per floor by aerial | One opening per floor by aerial | One opening per floor by aerial | One opening per floor by aerial | None required | None required |
| **Enclosed stairway shaft** | Required | Required | Required | Not required | Required | Required |
| **Ventilated or pressurized stairway** | Required | Required | Not required | Not required | Not required | Required |
| **Maximum floor size** | 4 units (6 units up to 3rd floor) | 4 units | 2,000 sq. ft. | 5,400 sq. ft. | 5,400 sq. ft. | 5,400 sq. ft. |

[20] "2018 Seattle Building Code," 1006.3.3.
[21] "2022 New York City Building Code," 1006.3.2, subsection 7.
[22] "Testo coordinato del DM 16 maggio 1987: Norme di sicurezza antincendi per gli edifici di civile abitazione."

# Realistic alternative site uses

The United States has a relatively high rate of fire death compared to other high-income countries.[23] We believe this stems not from inadequately strict model codes for new construction, but from the large building stock that does not meet current code – and in particular, unsprinklered light wood-frame dwellings. This includes older dwellings, but potentially also newer ones built in the majority of states whose governments have amended the International Residential Code (IRC) to strike the requirements for sprinklers. The trend of politicians ordering the adoption of the IRC with no sprinkler requirements for three- to six-family dwellings may also increase the size and scope of new unsprinklered construction.[24]




*States shaded in light or dark blue have had single-family sprinkler requirements "defeated," in the words of the National Association of Home Builders*

Given restrictions on the size of apartment buildings served by a single exit stair in our proposal, dwellings meeting our proposed code sections will likely be built on sites that otherwise would continue to have older houses, or which might only be appropriate for new, unsprinklered single- and two-family houses. As such, we believe it's important for the committee to consider our proposal's level of safety not only compared to the worst-case scenario apartment building that complies with the IBC (a large, double-loaded corridor building in light wood-frame with dead-end corridors and dozens of units per floor with access to two stairs), but also compared to existing buildings that are unlikely to be redeveloped under current code.

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[23] Brushlinsky et al., "Center of Fire Statistics: World Fire Statistics," 39.
[24] Zeanah, "Memphis, TN Amends Local Building Code to Allow up to Six Units Under Residential Building Code (IRC) to Enable Missing Middle Housing."

To illustrate the above, the following are typical before-and-after images of sites that have been developed with single-stair buildings above three stories in New York City (examples from Seattle would show something similar). None of the older structures had sprinklers, or were built using the construction types that we propose to require (types IA, IB, IIA, or IV).


*Before and after: 415 E. 162nd St., Bronx*

*Before and after: 916 Bergen St., Brooklyn*

# Track record in jurisdictions which allow taller single-stair buildings

Neither in the United States nor abroad is there any jurisdiction that maintains data on the number of exits in a building. However, a few jurisdictions do publish data indicating a strong safety track record for buildings with a single stair.

In the Netherlands, *portiekflats* – what in America we would call single-stair point access block apartments – account for roughly 1 in 10 Dutch homes.[25] Like virtually all apartments in Europe, these are built overwhelmingly in concrete or masonry, with a single exit, and no active pressurization or sprinklers (so, a less protected version of what we are proposing). They account for 11 percent of total fire fatalities in the Netherlands. In other words, their safety profile is not meaningfully different from that of the Dutch housing stock as a whole.[26] Since the Netherlands has 0.32 annual fire deaths per 100,000 residents, compared with 1.06 in the United States, we can conclude that these buildings are far safer than the typical American dwelling unit.[27] And of this low number of fire deaths, only roughly 1 in 11 occurred in circulation areas – far fewer than would be expected if single-stair conditions were especially dangerous.[28]

*A* porktiekflats *building in the Netherlands (photo by Grotevriendelijkereus, Creative Commons license)*

[25] van der Graaf, Huijzer, and Eggink-Eilander, "Brandveiligheid portiekwoningen," 66.
[26] Kobes et al., "Wat als er brand uitbreekt? Een onderzoek naar fatale woningbranden en reddingen door de brandweer," 35.
[27] Brushlinsky et al., "Center of Fire Statistics: World Fire Statistics," 32.
[28] Kobes et al., "Wat als er brand uitbreekt? Een onderzoek naar fatale woningbranden en reddingen door de brandweer," 37.

In other countries, we do not have as granular information about fire deaths by building typology, but we can draw similar conclusions based on the composition of the total housing stock and overall fire death rates. Spain is the most urban country in Europe, and 47 percent of its total housing stock is in multifamily buildings of at least 10 dwelling units – these are, like the Dutch *portiekflats*, virtually always unsprinklered, built from concrete, with a single exit without any active pressurization. Typically multifamily buildings in Europe have two dwelling units per floor, so these buildings will be at least between four and six stories. Spain's total fire fatality rate is 0.36 people per 100,000 residents per year – so low that it is not mathematically possible for these 10-plus-unit apartment buildings to be as dangerous as the U.S. overall average.[29]

And Singapore has all but eliminated fire death, despite the fact that 95 percent of the population lives in apartments, most of which are single-stair towers above three stories (Singapore allows apartments up to 24 meters off of a single stair, or 60 meters if the circulation area is naturally ventilated, as it almost always is in the tropical country).[30]

Neither Seattle nor New York City keep data on fires in single-stair buildings. Anecdotally, a building official in Seattle told us that she is not aware of any fatal fires in single-stair buildings in that city. New York City has had its single-stair provision for decades, and it has never been subject to any controversy.

*A series of attached five-story single-exit buildings built in Brooklyn, NY, in the 2010s, per NYC BC 1006.3.2.7 (photo by Andressa Randis, used with permission)*

[29] Brushlinsky et al., "Center of Fire Statistics: World Fire Statistics," 32; "Número de viviendas principales según tipo de edificación y régimen de tenencia."
[30] Brushlinsky et al., "Center of Fire Statistics: World Fire Statistics"; Singapore Department of Statistics, "Households"; Speckert, "Jurisdictions - The Second Egress: Building a Code Change."

# Major building fires and their relevance

## 2017 Grenfell Tower fire

The Grenfell Tower tragedy is commonly cited by Americans as an example of the dangers of single-stair buildings, but the details of an exhaustive investigation suggest otherwise. The 72 deaths occurred due to a series of failures: flammable facade cladding and insulation, the breakdown of compartmentation, and an extended stay-put order whose removal was not communicated properly. The single stair was not identified as a contributing factor to the fire at all in the Phase 1 report of the official Grenfell Tower Inquiry.[31]

A fire broke out in a kitchen on the fifth floor (using U.S. floor numbering) of the 24-story building, reported at 12:54 a.m. The single stairway remained free of life-threatening smoke for at least 56 minutes, during which time 168 occupants successfully evacuated through it – much longer than realistically necessary for evacuating a six-story single-stair building with at most 24 dwelling units (as allowed by our proposal), even with disabled or elderly individuals.[32] By 2:20 am, the stairwell became hazardous for those within it, but some individuals still managed to evacuate after this point. Ultimately, only two people lost their lives in the stairway, and no casualties occurred below the 15th floor (10 stories above where the fire originated).[33]

Buildings built to our proposal's standards would have many safety features and limitations that Grenfell Tower lacked: sprinklers (Grenfell did not on the apartment floors), at most six total stories so all units in range of aerial apparatus and many in range of ground ladders (Grenfell had 24 floors), at most four apartments per floor above the third floor (Grenfell had six on all residential floors), and no flammable cladding of the type that ignited at Grenfell.

## 2022 Bronx apartment tower fire

A fire broke out in a 19-story high-rise in the Bronx in 2022, killing 17 people by smoke inhalation. The lack of sprinklers or stairway pressurization or ventilation and the failure of self-closing doors allowed smoke to rise through both of the stairways (arranged in a scissor stair configuration, as is still allowed in New York City, although we have not seen any evidence that smoke penetrated between the two stairways).[34] This fire showed that a second exit, in addition to redundancy, also means a second chance for doors to be held open, and a second chance for a chimney to form.

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[31] Moore-Bick, "Phase 1 Report."
[32] Purser, "Appendix A: Timings and Reported Smoke Conditions in the Stairs."
[33] Purser, "Summary of Approximate Fire Arrival and Occupant Flat Exit Times and Outcomes from Detailed Accounts in Section 6 Floor by Floor Analysis."
[34] Singhvi et al., "The Chain of Failures That Left 17 Dead in a Bronx Apartment Fire."

# Cost impact

The cost impacts of our proposed code changes are difficult to assess, given that they remove the requirement for a significant amount of non-rentable floor area, while at the same time raising construction costs for what remains by increasing standards. However, since our proposal adds options for code compliance without removing any, the economics of any given project will either remain the same, or will improve. There are many different ways to assess the impact on costs, but all are speculative and the exact impact would depend greatly on the site and the market. In many cases, the proposal would allow for the development of buildings that simply could not be built otherwise.

As a simple way to visualize the impact on a small building, however, we have illustrated a typical floor of a four-story proposed infill building in Jersey City, NJ, complying with the current IBC.

*101 Storms Ave., Jersey City, NJ, as drawn by Alfred Twu*

The second stair (shaded solidly in yellow, taking up 7 percent of the floor) could be eliminated entirely under our code proposal, and a smaller corridor area (green, with thatched shading, 2 percent of the floor) could be moved inside of the apartment on the right. The result is that total construction cost would fall by approximately 7 percent, while rentability of the remaining floor area would improve would improve, as 2 percent of the floor area could be made rentable out of formerly unrentable circulation space, while the living room (unit in upper left) and one bedroom (unit on right) would improve in desirability to tenants or condo buyers due to the greater light.

Ongoing operating costs would likely fall by a similar amount (around 7 percent), since operating costs are proportionate to floor area constructed.

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