EF 4: PROMOTE SUPER-INSULATED EXTERIOR WALLS

Summary

Issue:
The City’s definition of “floor area,” which determines how large a building can be, includes exterior wall thickness. This penalizes thick, energy-efficient walls, and rewards poorly insulated thin-wall construction.

Recommendation:
For super-insulated walls, exclude up to eight inches of the exterior wall thickness from the “floor area” calculation.

Proposed Legislation, Rule or Study

Amendments to Zoning Resolution of the City of New York

1. Amend Section 12-10 to add the following definition:

   Exterior Building Envelope: the elements of a building that separate conditioned spaces from the exterior; Definition of Roof; the upper portion of the building envelope, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60° from the horizontal; Definition of Skylight; a fenestration surface having a slope of less than 60° from the horizontal plane. (All definitions from ASHRAE 90.1, 2007)

2. Amend Section 12-10 as follows:

   ...However the “floor area” of a building shall not include: <Add the following to the list>

   (12) Floor area used to add thermal insulation to the exterior of an existing building or to super-insulate a new building, subject to the following:

   (i) In buildings constructed or permitted prior to July 1, 2011, the exempted floor area is the thickness of the insulated wall assembly added to the existing exterior side wall, rear wall, or rear wall equivalent, limited to a maximum of 8” added to any wall, and provided that the added insulated wall assembly achieves a minimum R-value of 3.5 times its thickness in inches, the windows achieve a minimum of R-3.5, and within the walls being insulated, the window area does not exceed 50% of the wall area.

   (ii) In buildings or additions permitted after July 1, 2011, the exempted floor area is up to 8” of exterior wall thickness in excess of 8” thickness (i.e. for exterior wall thickness between 8” and 16”), measured at a point 30” above the finished floor, provided that the thermal performance of the building envelope meets the minimum prescriptive or performance requirements listed below, that the total exempted floor area does not exceed 5% of the allowable floor area, and that the building implement measurement and verification protocols to determine whether the envelope is performing as predicted with respect to thermal transmission.

   • The minimum prescriptive requirement is that average U-value of the exterior building envelope excluding roof but including skylights is less than .75 the average U-value allowed by the New York City Energy Conservation Code.

   • The minimum performance requirement is that on an annual basis the modeled envelope must perform better than or equal to an envelope where average U-value of the exterior building envelope excluding roof but including skylight area in excess of 5% of roof area is less than .70 the average U-value allowed by the New York City Energy Conservation Code and the vision glass has a SHGC of less than 0.4; but in no case can the average U-value of the exterior building envelope excluding roof but including skylight area in excess of 5% of roof area be greater than the average U-value allowed by the New York City Energy Conservation Code.

   (iii) The calculation of R-values, the average U-value, and any modeling shall be as per the requirements of the New York City Energy Conservation Code and submitted to the Department of Buildings.
Supporting Information

Issue - Expanded
This proposal has two parts: one part that impacts existing buildings, and another for new construction. The part that impacts existing buildings would allow owners of currently existing buildings to add insulation to the side or rear of a building even if the building had already utilized all of the area available (its FAR). This is beneficial because it is much more effective to add insulation to the exterior of the building than the interior.

The more complex part of this proposal affects new construction, and is meant to compensate for a problematic side-effect of current zoning calculations for developers. Poorly insulated building envelopes (i.e., exterior walls) are an unintended consequence of New York’s zoning laws. This is because the floor area a developer is allowed to build is measured to the outside of the building envelope, whereas the useable space is the area within the inside face. In order to maximize the useable area within the maximum allowed floor area, it behooves a developer to make the exterior walls as thin as possible. These thin walls often perform poorly from a thermal standpoint, but the developer can still meet the energy code by compensating with higher performing mechanical and lighting systems. This is very detrimental to the city because, although the lighting and mechanical systems will be changed out within 10 to 25 years, these poorly performing facades will be around for decades or more, increasing the city’s energy costs and greenhouse gas emissions far into the future.

This proposal seeks to level the playing field by discounting the space used to create thicker and better performing walls. It allows flexibility in terms of how this can be achieved by allowing both a prescriptive and a performance path within the envelope design only. (The envelope will not be able to be traded off against other systems.) Doing so will provide designers with the flexibility to utilize dynamic systems (shading, double walls, glass that responds to light, etc.) which may perform as well as highly insulated walls, but which cannot be described by a single insulating value. The performance requirement is slightly higher than the prescriptive one, in order to compensate for errors or gaming introduced by the modeling process.

EF 4, Limit Heat Loss Through Exterior Walls, and EF 3 are intended to work together as a carrot and stick to spur significant improvements to the energy efficiency of exterior walls in New York City. EF 3 sets a minimum level, while EF 4 offers an incentive for exemplary performance, and the threshold for both of them will increase over time. Thus, developers are incentivized to create better facades, utilizing either technologically based or design based solutions, or both, and over time the technologies and design strategies they have helped to create will become better known and more available and affordable. This in turn will allow the city to require better performing facades for all buildings.

The date presented in the draft code language (July 1, 2011) is exemplary. The actual transition date must be adjusted to coordinate with implementation of EF3, since that contains the U-values to which Sections 12-10 (12) ii & iii refer.

Environmental & Health Benefits
This proposal will lead to better insulated exterior walls, reducing energy use, air pollution, and greenhouse gas emissions.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a positive, indirect health impact.

Cost & Savings
This will not add directly to development costs since this proposal is optional for buildings. Instead, it will make the development of better insulated projects more financially attractive for developers and help correct an unintended consequence of zoning area calculations, which encourages thin facades, and a misaligned incentive between the developer and future tenants. For new buildings, it will allow developers to create thicker, better insulated walls without being penalized by losing floor area. This is extremely valuable because developers pay for the cost of building, but are repaid in rents or sales that are proportional to the habitable floor area. If floor area is lost, the developer will lose potential income. On the other hand, future tenants serve to benefit from better insulated walls, since their energy bills will be lower, but they are not at the table when decisions about the building envelope are being made. For existing buildings that may have already reached the maximum size allowed by the zoning rules, this measure will simply allow the addition of exterior insulation, which is far more effective than adding insulation to the inside, as well as being technically simpler.

Impacts on various sizes and configurations of buildings with 8” walls. Calculations showing the percentage area to be excluded with 8” walls.
### Calculations for Freestanding Buildings (8'' walls)

<table>
<thead>
<tr>
<th>floor plate size (ft)</th>
<th>floor plate with 8'' wall (ft)</th>
<th>% floor area gain (exempted floor area)</th>
<th>% area with 5% cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>200x200</td>
<td>201.34x201.34</td>
<td>1.34%</td>
<td>1.34%</td>
</tr>
<tr>
<td>100x100</td>
<td>101.34x101.34</td>
<td>2.70%</td>
<td>2.70%</td>
</tr>
<tr>
<td>50x50</td>
<td>51.34x51.34</td>
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<tr>
<td>25x25</td>
<td>26.34x26.34</td>
<td>11.01%</td>
<td>5.00%</td>
</tr>
</tbody>
</table>

### Calculations for Corner Buildings (8” walls)

<table>
<thead>
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<th>floor plate size (ft)</th>
<th>floor plate with 8” wall (ft)</th>
<th>% floor area gain (exempted floor area)</th>
<th>% area with 5% cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>200x200</td>
<td>200.67x200.67</td>
<td>0.67%</td>
<td>0.67%</td>
</tr>
<tr>
<td>100x100</td>
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<td>1.34%</td>
<td>1.34%</td>
</tr>
<tr>
<td>50x50</td>
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<td>2.70%</td>
<td>2.70%</td>
</tr>
<tr>
<td>25x25</td>
<td>25.67x25.67</td>
<td>5.43%</td>
<td>5.00%</td>
</tr>
</tbody>
</table>

### Calculations for Townhouses (8” walls)*

<table>
<thead>
<tr>
<th>floor plate size (ft)</th>
<th>floor plate with 8” wall (ft)</th>
<th>% floor area gain (exempted floor area)</th>
<th>% area with 5% cap</th>
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<td>25x50</td>
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<td>2.68%</td>
<td>2.68%</td>
</tr>
</tbody>
</table>

* Townhouses will be granted the zoning incentive only for the 25 feet wide wall; in the town houses case, only a corner situation (no freestanding) is expected

### Precedents

Within CD-1 districts, Vancouver’s new Zoning and Development By-law, dated Feb. 2009, excludes wall thickness greater than 152 mm (6”), up to a maximum excluded thickness, provided that such walls are highly insulated. See Section 10: 10.34.

### LEED

The measure outlined in this proposal will positively impact the feasibility of super-insulating existing walls, thereby increasing the potential of meeting LEED requirements.

In an existing building, this recommendation will assist in complying with:
- LEED EB-EA prerequisite 2, Minimum Energy Performance
- LEED EB-EA cr.1, Optimize Energy Performance.

For existing walls in a new construction project, this recommendation will assist in complying with:
- LEED NC-EA prerequisite 2, Minimum Energy Performance
- LEED NC-EA cr.1, Optimize Energy Performance
- LEED for Schools EA prerequisite 2, Minimum Energy Performance
- LEED for Schools EA cr.1, Optimize Energy Performance
- LEED CI-EA prerequisite 2, Minimum Energy Performance
- LEED CI-EA cr. 1.3, Optimize Energy Performance, HVAC

This recommendation will also assist in complying with:
- LEED for Homes EA cr.1, Optimize Energy Performance.

Since numerous points can be acquired under all of these rating systems, any code changes involving energy performance could have a significant influence.
Implementation & Market Availability

There are no known implementation issues for this proposal. Systems and techniques to utilize the newly available wall depth to provide superior insulation are readily available.

Notes

For (i) existing buildings. Most rigid insulation panels currently on the market achieve R-3.5 per inch. Moderately priced insulation panels tend to be in the range of R-5 per inch, so a building adding 8’’ of insulation can readily achieve an R-30, which is what is required to meet Passive House Standard in NYC’s temperature zone. NOTE: this depends on building compactness. R20 is sufficient in many cases.

For (ii) new buildings and additions. EF 4, Limit Heat Loss Through Exterior Walls, proposes a minimum average U-value of 0.25 as a mandatory requirement, and it can be achieved fairly easily with traditional construction; for curtain walls, it can be achieved using triple glazing or double glazing with a central film. In order to receive the floor area exemption, new construction would need to considerably out-perform the minimum wall required by code; still, the first standard of avg. U < 0.15 is achievable in an affordable manner using current technology (for example a wall with 50% solid area and 50% fenestration, achieving R-20 for the solid portion and R-4 for the fenestration). Even the avg. U-value of 0.10 required by 2015 is achievable now (for example a wall with 63% solid area and 37% fenestration, achieving R-25 for the solid portion and R-5 for the fenestration), although these evolving standards will certainly push the industry to provide a range of affordable solutions with a high percentage of glazed area.

ENDNOTES:

1 City of Vancouver, Ca., Zoning and Development Bylaws § 10.34 (2009) available at http://vancouver.ca/COMMSVCS/Bylaws/zoning/sec10.pdf. Vancouver’s new Zoning and Development By-law, excludes wall thickness greater than 152 mm (6’’), up to a maximum excluded thickness, provided that such walls are highly insulated.