



June 2014

**CHPC**  
NEW YORK CITY

**INSIGHT**

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**THE BUILDING ENVELOPE  
CONUNDRUM**

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# INTRODUCTION

‘**Floor area**’ has become a popular public policy currency in New York in recent years. For a city that ordinarily limits the amount of floor area that any new building can develop, bargaining with extra floor area can be a useful tool for government; a seemingly costless and infinite resource, created literally out of thin air, to facilitate and encourage a wide range of goals for our new residential buildings<sup>1</sup>.

And the New York City administration has many goals to fulfill in the coming years. Extra floor area to incentivize the production of affordable housing is widely discussed, but floor area incentives are also used to encourage green technologies in new buildings, to develop sufficient communal spaces for resident services and well designed interior spaces. Any substantial increase in our overall housing stock will also require additional floor area to be made available for new residential development.

But, in order for floor area to have any value as a public policy currency, it must be physically possible to build.

While this may seem like a foregone conclusion, this CHPC study of seventeen residential development projects found that many buildings in certain zoning districts across the city are unable to build all of their allotted floor area because of the rules that dictate their permitted three-dimensional shape - the **building envelope**.

In other words, **it is often the building envelope that is the determinant of the development capacity of a new building rather than its floor area.**

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<sup>1</sup> The maximum permitted floor area for each new building is calculated by multiplying the lot size by the given ‘floor area ratio’ for the zoning district.

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## WHAT IS THE BUILDING ENVELOPE?

A building envelope defines the maximum three-dimensional space that a new building can occupy.

The current dimensional limits for new buildings in New York City were devised in 1987 as an attempt to better match new buildings with the existing buildings around them. The rules were established for all new buildings in certain zoning districts, known as *contextual districts*. It was also made optional in other districts. Housing built in contextual districts is classified as *Quality Housing*.

The envelope of a new building in a contextual district is established by a combination of controls on the following:

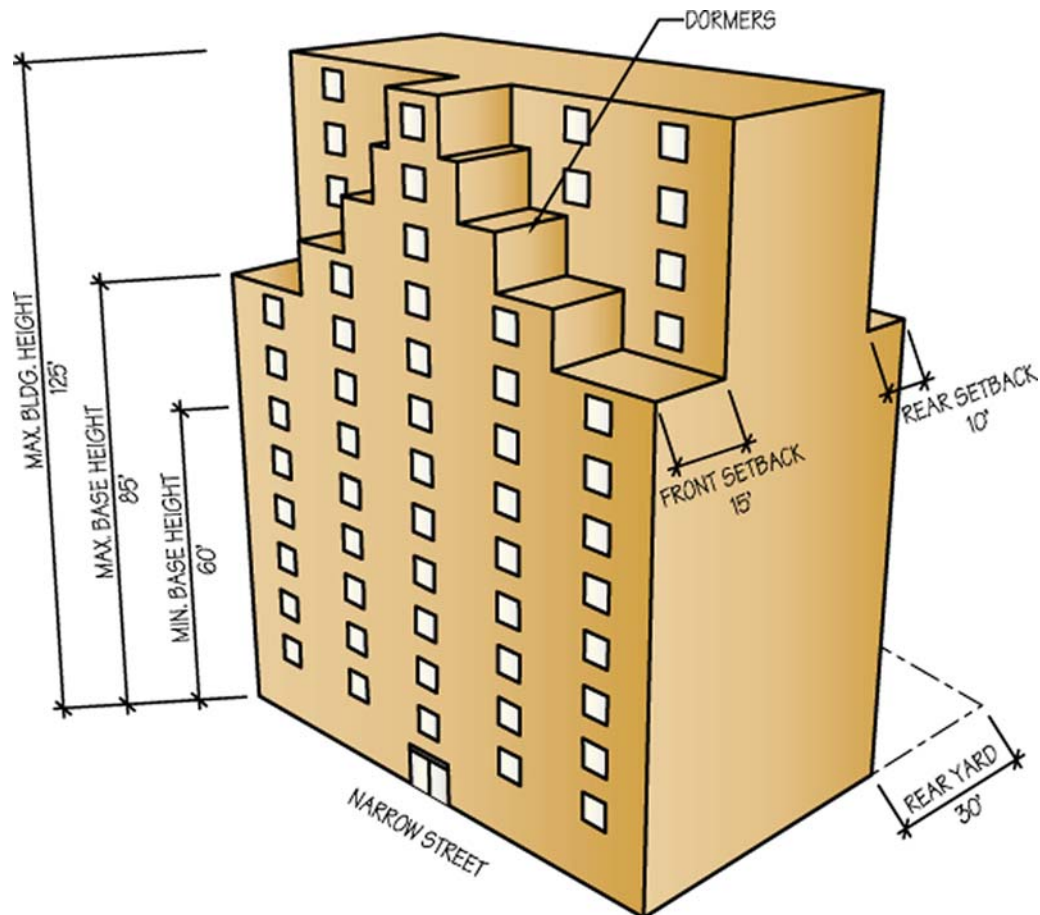
- **the maximum lot coverage of a new building;**
- **building height;**
- **minimum and maximum building base height (the height of the front wall of a building before any required setback);**
- **height and depth of a building's setbacks;**
- **length and location for street walls;**
- **size, location, and depth of courts;**
- **size, location, and depth of side yards and rear yards;**
- **dormers (permitted projections of the building above the maximum base height);**
- **distances between buildings.**

Increasingly viewed as providing community protection from excessively tall buildings, 43% of New York City zoning lots are now zoned as contextual districts<sup>2</sup>.

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2      Analysis of PLUTO data undertaken by the Furman Center for Real Estate and Urban Policy

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This is a graphic representation of a typical new building in an R7X district - which covers areas such as the major thoroughfares in Harlem in Manhattan and Jackson Avenue in Long Island City in Queens - illustrating how the contextual building envelope rules limit the size and shape of a new building.



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# OUR STUDY

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## OUR STUDY

CHPC worked with architects from four architectural design firms specializing in affordable housing in New York City to explore the impact of the building envelope rules in contextual districts on a number of recent residential developments.

We determined that a case study of actual projects was the most effective way to examine a broader issue often faced by new residential buildings in New York City, and to analyze its causes and impact. The application of building envelope and floor area rules are different for every site and zoning district across the city, and we needed to work closely with each architect to obtain the level of information required about each project<sup>3</sup>.

We asked the four architects to submit four or five recent projects that they had worked on that had been subject to the contextual building envelope rules. Each project had to be built ‘as of right’, without any zoning variances or zoning changes<sup>4</sup>.

They gave us the full design details of **seventeen** residential buildings from a variety of sub-districts in R6, R7, and R8 zoning districts in Manhattan, Brooklyn, and the Bronx<sup>5</sup>.

We then conducted a technical review of each project.

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<sup>3</sup> We believe the Department of City Planning should conduct further studies on this issue using a similar methodology but with development details they can more readily obtain for the city as a whole.

<sup>4</sup> 16 of the projects are built or currently under construction. 1 was part of an RFP that was not selected for construction.

<sup>5</sup> The projects were all located in these zoning districts because these are the prime areas for the development of affordable multi-family housing in the city. The architectural firms that we worked with focus on the design of this type of building. We would recommend that the Department of City Planning expand the zoning districts examined for their own study - to better understand the impact of the envelope rules across a greater variety of districts.

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The two stages of analysis that we conducted for each project were:

**1) Building envelope**

We examined each dimension of the building based on the contextual regulations for that zoning district. The building envelope dimensions for the projects included: lot coverage, height, setbacks, street walls, courts, side yards, rear yards, and distance between buildings.

**2) Floor area**

We then calculated:

- a) the total amount of floor area that the building was permitted to develop;
- b) the amount of floor area that could actually fit into the building envelope.

The total floor area permitted for each project was calculated by adding bonuses and deductions to the floor area allowance for the building.

**Bonuses** allow a building to develop more floor area in exchange for satisfying certain public policy goals, such as supplying affordable housing through the Inclusionary Housing Program.

**Deductions** allow certain features of the building to be excluded from the total floor area calculations. In other words, they offer ‘free’ floor area. Approved deductions include: mechanical and plumbing spaces, well-designed corridors, parking, bicycle parking, laundry rooms, trash rooms (12 sq ft per floor), recreation rooms, and energy efficient exterior walls.

We also conducted a separate study to examine the impact of using modular construction for the development of residential buildings within each contextual district.

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**KEY**

**RESULTS**

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## KEY RESULTS

For the **seventeen** projects examined we found that:

Only **one** project was able to develop all of its allotted floor area.

In **eight** projects, floor area was left unbuilt because of their building envelope rules. For these projects, it was the contextual building envelope rules that determined the development capacity of the buildings rather than their allotted floor area.

The buildings that were limited by their envelope were under-built by an average of **11%**. In total **56,543 square feet of buildable space was lost** from these eight projects.

In a further **eight** buildings, neither the allotted floor area nor the building envelope was maximized. This was typically because the number of housing units for the building was determined by the subsidy program it was constructed under, or the developer simply chose to limit the size of the building for other reasons. Because of this, we are unaware of whether the development capacity of these buildings would have been determined by the floor area or the building envelope rules. CHPC will further scrutinize this issue in a subsequent report.

You can see more information on these seventeen projects in the Appendix.

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## **Why is floor area left unbuilt on many residential projects today?**

The building envelope limits for contextual buildings were devised in 1987, using the development assumptions of the time. But realities have changed since then:

- a. We are now allowing extra floor area to be built in exchange for the satisfaction of newly defined public policy goals;
- b. Floor to floor heights have changed;
- c. Construction materials and techniques have changed which favor different envelope dimensions;
- d. Our buildings are now frequently on irregularly shaped lots that make the application of the envelope rules highly complicated and more restrictive.

(see more details in section 4)

## **Why do we need to revise the contextual building envelope rules?**

This “building envelope conundrum” has many negative repercussions for our city - in particular for the new municipal plans to increase the development of housing:

- a. The growth of our housing supply is constrained - the building envelope rules in contextual districts act like a downzoning;
- b. Floor area incentives are undermined and lose their value because they cannot fit into the building envelope;

- 
- c. The quality of the interior design of our residential buildings is sacrificed;
  - d. The application of new building techniques such as modular construction is inhibited.

(see more details in section 5)

We believe the City administration should begin a revision of contextual zoning to find some ways to reform the building envelope rules to make it easier to build much needed residential floor area. It is imperative that housing development, and our public policy goals for the residential built environment, are not constrained by this technical issue.

At the end of this report, we offer some suggested next steps to address this significant, yet little-understood constraint on the construction capacity of our residential buildings.

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# WHY IS FLOOR AREA LEFT UNBUILT?

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## WHY IS FLOOR AREA LEFT UNBUILT IN MANY RESIDENTIAL PROJECTS TODAY?

When the contextual building envelope limits were devised in 1987 for new buildings, they were calculated so that the allotted floor area for each building could be used, plus they offered an additional 25-30% floor area contingency to allow for some flexibility in internal layouts<sup>6</sup>.

That cushion has now largely disappeared. Why?

### a. Extra floor area is used to achieve public policy goals

Some floor area bonuses and deductions were permitted in 1987. However, in recent years, they have become a more common feature of zoning policy, to accomplish an array of newly identified public policy goals.

The development of affordable housing, the use of sustainable design practices and green technologies, bicycle parking, and flood-proofing building features are all now facilitated and encouraged by offering additional floor area.

These goals are necessary and laudable. However, **no flexibility is granted to a building's envelope in order to offset the internal space used for these incentivized features<sup>7</sup>.**

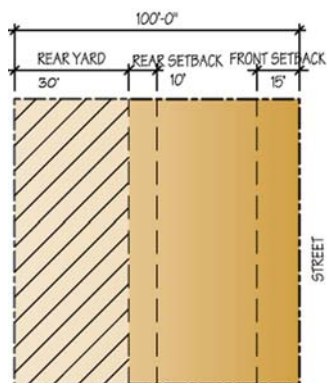
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<sup>6</sup> The extra space to maximize floor area within the building envelope was in the original EIS for the Quality Housing Program and was verified verbally by City Planning staff. Our analysis showing how this contingency has been eradicated verifies this 25-30% calculation.

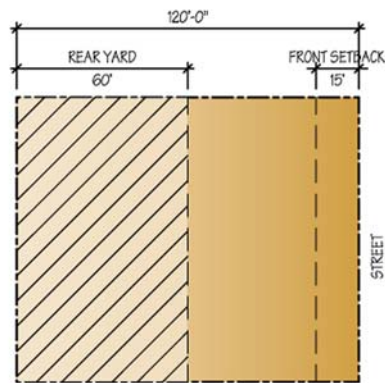
<sup>7</sup> One notable exception is in the 2009 Fresh Zoning text which does permit an increase in height of the building by authorization. However, this requires going through a public review process that triggers the City Environmental Quality Review—creating additional uncertainty for the feasibility of the project and adding time and cost to the project.

## b. The building envelope rules were designed for regularly shaped sites

The dimensional rules for lot coverage, setbacks, courts, side yards, and others were designed for a rectangular 100 foot deep lot. They become complicated and more restrictive when applied to deeper, shallower and/or irregular lots - which are increasingly common in such a mature, developed city as New York. It becomes harder to maximize floor area inside the building.

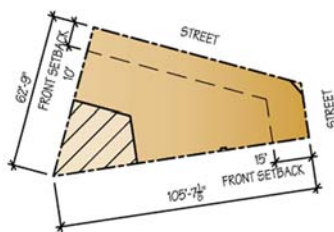


REGULAR SITE

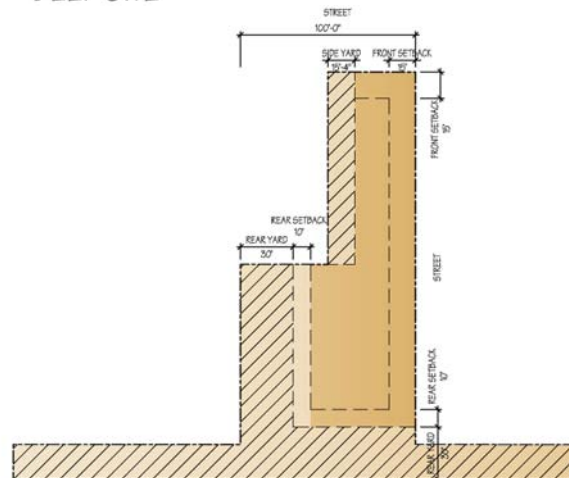


DEEP SITE

*These graphics illustrate that the application of the building envelope rules to irregular lots can create a restrictive and complicated building envelope.*



IRREGULAR SITE



IRREGULAR SITE



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## c. Floor to floor heights for apartments have changed

In 1987, a typical floor to ceiling height for an apartment was 8 foot - despite this being far less than a typical pre-war building. An 8 inch thick structural floor slab between floor and ceiling would provide an 8 foot 8 inch floor to floor height. This assumption was used to establish the building envelope regulations<sup>8</sup>.

However, the accepted floor to ceiling height for an apartment today is a minimum of 8 foot 4 inches - in both subsidized and market rate housing. On top of this, there are other requirements that now add to the floor to floor heights, such as required sprinkler piping or thicker insulation for floors that are set back. The typical floor to floor height in a residential building is now 9 foot 4 inches.

For modular construction, the floor to floor heights are even greater. A modular system has a 10-12 inch space between the ceiling system of the lower floor module and the floor system of the apartment immediately above, creating a typical floor to floor height of 10 foot 1 inch<sup>9</sup>.

If the building's envelope cannot adapt to accommodate these higher floor to floor dimensions, then the number of stories that can fit inside the building is reduced - and the floor area that can fit into the building is reduced accordingly.

For example, if we use a contextual district with a 100 foot height limit, when each floor to floor height is 8 ft 8 inches the building can accommodate eleven stories. However, with a 9 foot 4 inches floor to floor height, only ten stories can fit into the building.

For modular construction, with a higher floor to floor height, only nine

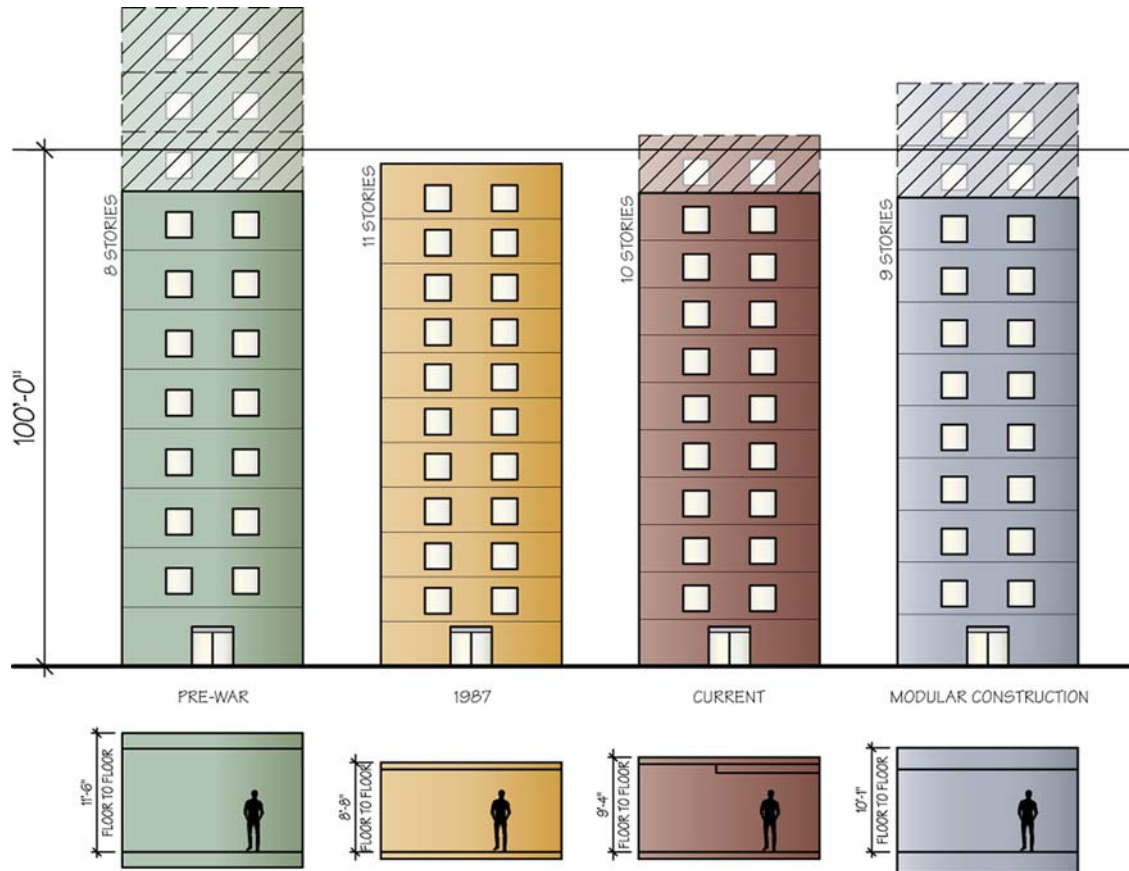
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<sup>8</sup> Stated in the original EIS for the Quality Housing program

<sup>9</sup> Information obtained from modular manufacturer, Capsys.

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stories can fit into the building.



We did not include a modular building as part of our case study but we did conduct a separate analysis to examine the impact of the floor to floor heights of modular construction based on the building envelope limits of each sub-district from R6-R8. Our study showed that the use of this building technology, in conjunction with building height limits, reduces the potential floor area of a building by 13-25%—with an average of 17% reduction.

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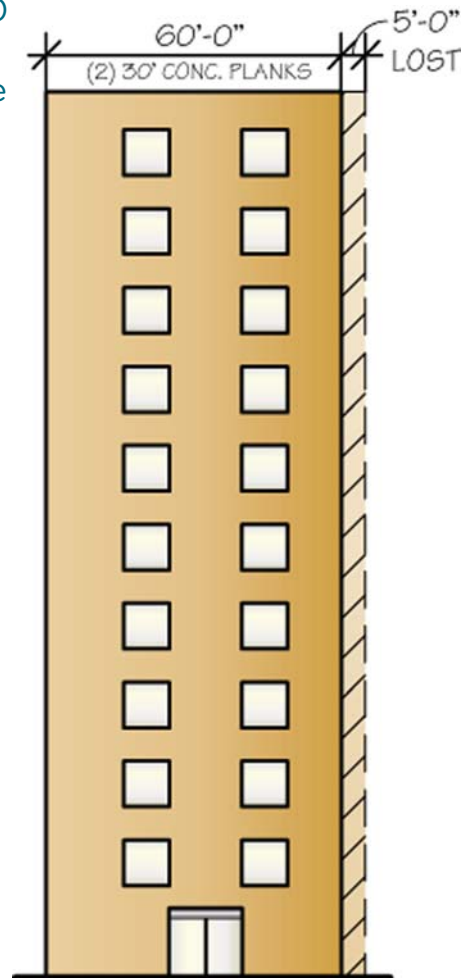
## d. Construction materials and techniques have changed

When the building envelope rules were devised it was assumed that a typical 100 foot deep lot would produce a building of 65-70 foot deep using poured-in-place concrete.

However, construction methods change over time. Today “block and plank” construction (masonry-bearing wall and precast-concrete plank) is now seen as the most cost effective construction system for mid-rise residential buildings. It costs approximately 25% less than poured in place concrete—a saving particularly significant in non-luxury market rate and affordable housing developments.

Block and plank construction favors different building envelope dimensions than the original regulations established. Rather than 65-70 foot deep, block and plank construction favors a 60 foot deep building, because each plank spans 30 foot allowing two spans to equal a building depth.

Our study showed that using block and plank construction in a contextual zone shrinks the building envelope by an average of 7%-8%; making it even harder to maximize floor area inside of the building.



*This graphic shows how the whole building envelope shrinks when one dimension becomes constrained.*

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# WHY DO WE NEED TO REVISE THE CONTEXTUAL BUILDING ENVELOPE RULES?

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## WHY DO WE NEED TO REVISE THE CONTEXTUAL BUILDING ENVELOPE RULES?

### **a. They are acting like a hidden cap on the development capacity of the city**

For a city with limited land, demand for new housing, a growing population, and a new mayoral administration committed to expanding housing opportunities, it is imperative that the production of new housing units be maximized.

If the building envelope effectively reduces the floor area that can be built, then the development capacity of the city is capped even further and in ways that are difficult to track, calculate, and plan for.

### **b. Floor area incentives lose their value**

If a building fills its permitted envelope before all floor area is used, then the offer of additional floor area loses its value.

For the eight out of seventeen projects that could not maximize their floor area because of their building envelope constraints, any promise of additional floor area bonuses or deductions would have no value for a developer. They would not fit inside the building envelope.

This is a key concern in our public policy landscape today. If we want floor area to be a useful tool for creating more housing, making our buildings green, or adding resident services then we must allow our buildings to have three-dimensional room to be able to use it.

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### **c. The quality of the interior design of our residential buildings is sacrificed**

When the building is limited by the dimensions of its envelope, the layout of the interior space is highly constrained. The design work becomes how to fit as much floor area as possible into the plan, and then how to make the most functional and graceful plan within these constraints. This greatly limits the opportunities for design options, innovation, and creativity for the interior of buildings.

For example, if it is difficult to fit all of the required stories into a building with a fixed building height, developers may also be incentivized to build apartments with just the Building Code minimum floor to ceiling height of 8 ft.

### **d. The application of new building techniques such as modular construction is inhibited**

As discussed above, using modular construction in areas with fixed building heights reduces the number of stories that can fit inside the building.

This limits and discourages the use of modular construction in New York City at a time when its application should be expanded. Every modular development with this issue has to apply for a height variance, adding time and cost to the project, negating the core benefits of modular construction.

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# NEXT STEPS



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## NEXT STEPS

We believe the city should begin a revision of contextual zoning to find ways to alter the building envelope rules so that they allow more room for buildable floor area.

It is imperative that residential development is not constrained by this technical issue – especially if we want to increase our housing stock and continue to use floor area incentives as a key zoning and affordable housing tool.

We understand that this is a complicated, and sometimes controversial, topic and that any change in the building envelope will need careful study and review by city government, community organizations, and the design and development industry. The CHPC staff and board look forward to providing whatever assistance we can in furthering this discussion.

We have included some suggestions here for areas that could be explored for revision within the current contextual zoning program. We believe any changes should be made to the ‘as of right’ envelope and should not rely on applying for an authorization or certification for an exemption or variance.

### **Height limits**

For buildings that are eligible for floor area bonuses, additional height could be also granted. There are already some examples of this, like the Fresh Zoning program.

Buildings in contextual districts could be limited by a maximum number of floors rather than height limits (but with a maximum permitted height per floor).

### **Contextual rules**

Where the context is different from what the building envelope rules permit, we could allow the envelope to conform to the context. For



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example, in many parts of the city, buildings have no setback in their street wall. New buildings could be allowed to follow this context. This would offer some additional flexibility for the building envelope without sacrificing the aesthetics of the building in relation to its context.

### **Setbacks**

If a building is unable to maximize its depth, then setback requirements could be amended to offset the loss.

The rear yard line setback provision could be eliminated, or at least reduced for lower height buildings.

### **Lot coverage**

Lot coverage limitations could be eliminated for corner lots.

### **Court Requirements**

Court requirements could be eliminated, or at least reduced for lower height buildings.

Court requirements for dormers could be eliminated.

Outer courts wider than 30 feet could be permitted to be of any depth.

### **Yard Requirements**

Yard requirements could be based on the size of the building<sup>10</sup>.

### **Distance Between Buildings**

Buildings could be allowed to be built closer together depending on whether the building is of combustible or noncombustible construction, locations or angles of windows, privacy between apartments etc.

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<sup>10</sup> Yard requirements are in the State Multiple Dwelling Law therefore would require more than a zoning change.

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Furthermore, it should be noted that many CHPC board members believe that New York City should begin to move away from such prescribed requirements for our built environment and make a shift toward performance zoning - an alternative system to traditional land use planning that uses performance-based, or goal-oriented criteria, to establish review parameters for proposed development projects.

This could be introduced into a few amenable community districts in New York City as an innovative pilot initiative.

Again, CHPC offers our assistance to explore more substantial reform.

We believe the city should begin a revision of contextual zoning to find

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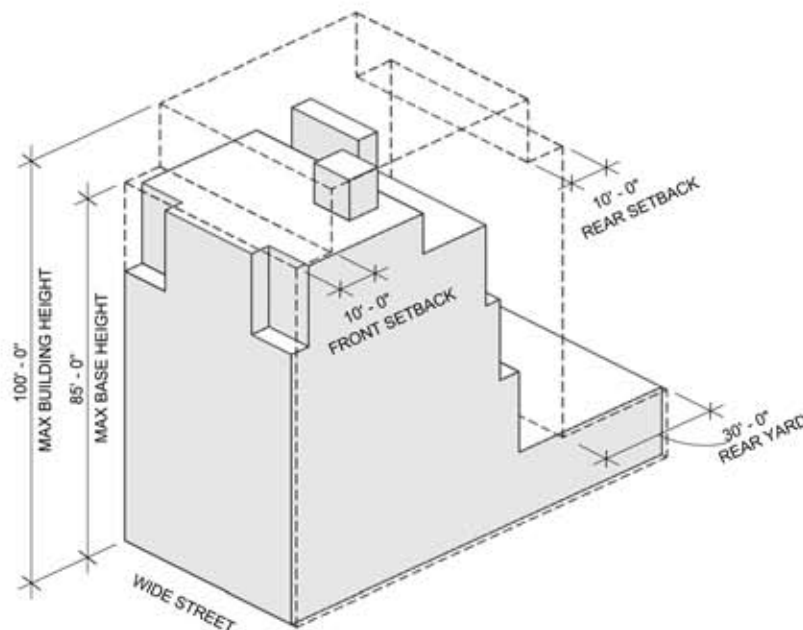
**[www.chpcny.org](http://www.chpcny.org)**

# Appendix

## PROJECT 1

### Able to develop all of its allotted floor area

Interestingly, it was designed before the permitted deductions for thicker energy efficient walls. If it had built these thicker walls and claimed the deduction, the total allotted floor area would not have fit into the building envelope.



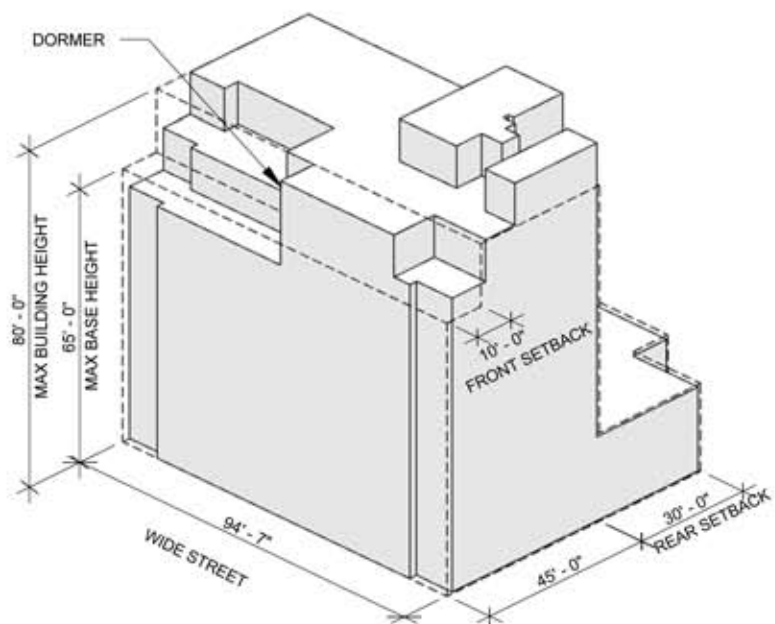
**Total permitted floor area:** **22,661**

**Actually built:** **22,661**

# PROJECT 2

## Limited by the building envelope

It was unable to use all of its permitted floor area

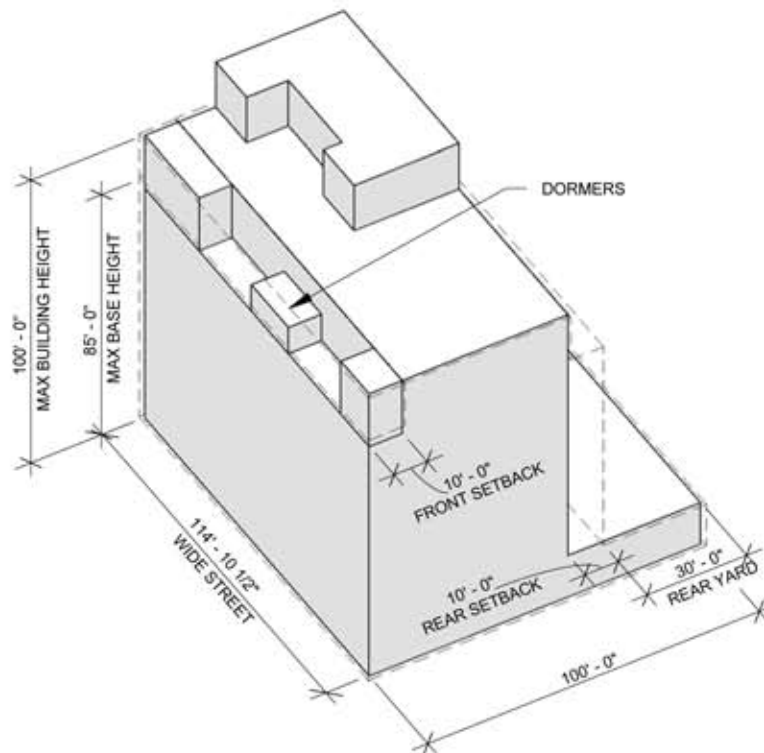


<b>Total permitted floor area:</b>	<b>55,685</b>
<b>Actually built:</b>	<b>40,803</b>
<b>Floor area left unbuilt:</b>	<b>14,882</b>

# PROJECT 3

## Limited by the building envelope

It was unable to use all of its permitted floor area



**Total permitted floor area:** **73,294**

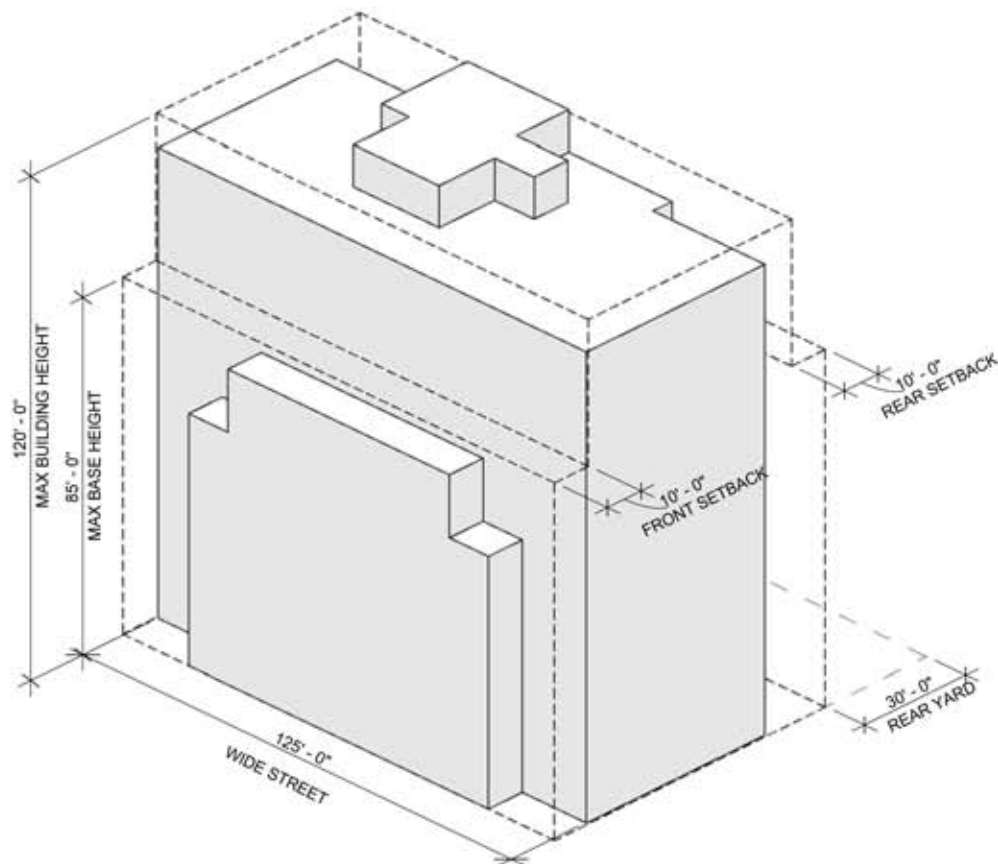
**Actually built:** **72,830**

**Floor area left unbuilt:** **464**

# PROJECT 4

## Limited by the building envelope

It was unable to use all of its permitted floor area

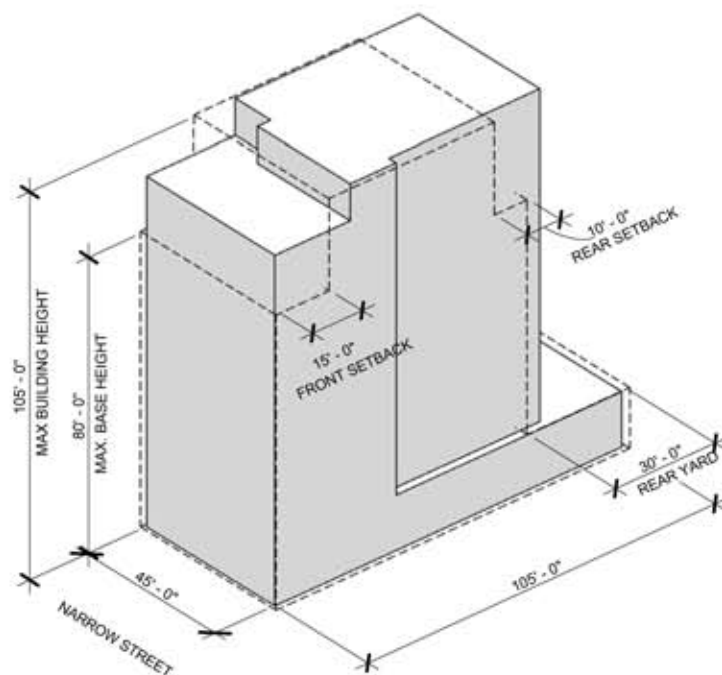


<b>Total permitted floor area:</b>	<b>92,918</b>
<b>Actually built:</b>	<b>89,878</b>
<b>Floor area left unbuilt:</b>	<b>3,040</b>

# PROJECT 5

## Limited by the building envelope

It was unable to use all of its permitted floor area



**Total permitted floor area:** **34,589**

**Actually built:** **33,570**

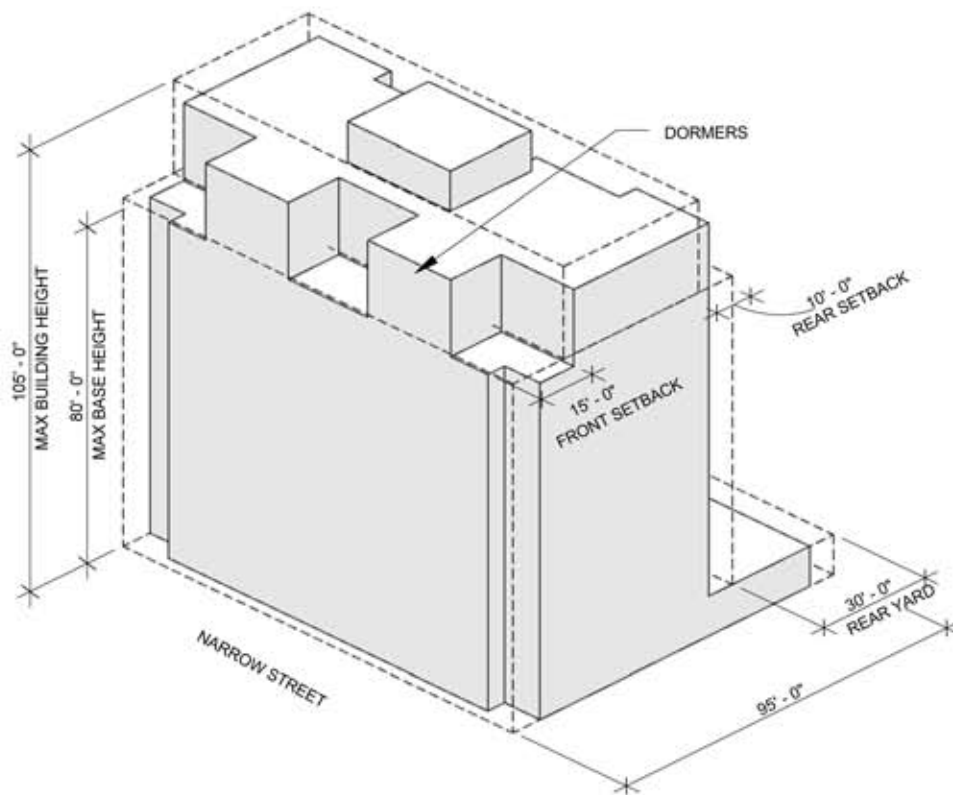
**Floor area left unbuilt:** **1,019**



# PROJECT 6

## Limited by the building envelope

It was unable to use all of its permitted floor area



<b>Total permitted floor area:</b>	<b>68,129</b>
<b>Actually built:</b>	<b>67,623</b>
<b>Floor area left unbuilt:</b>	<b>506</b>

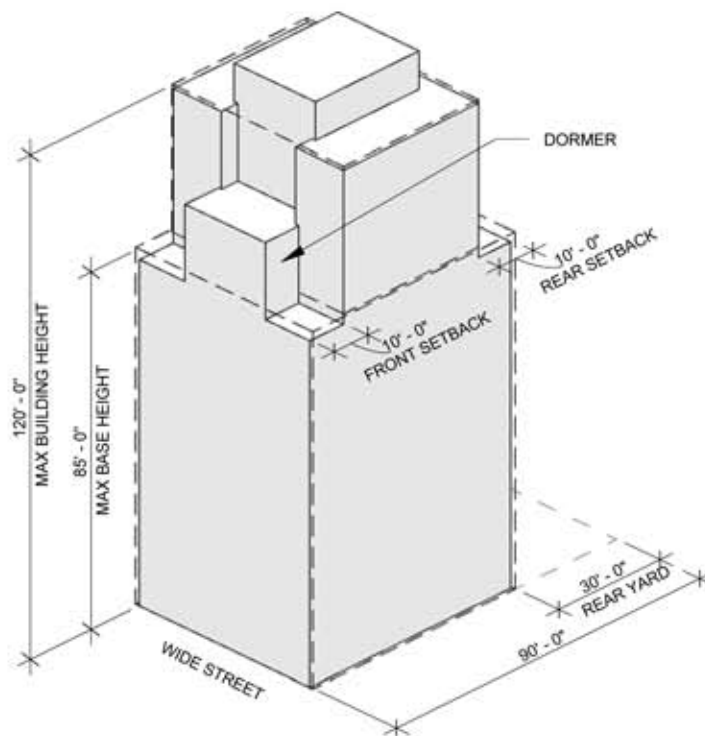
# PROJECT 7

## Limited by the building envelope

It was unable to use all of its permitted floor area

While this project is only unable to fit 2 square foot into its building envelope, its development capacity is still controlled by its envelope.

It would also be unable to accept any additional bonuses or deductions.



**Total permitted floor area:** **35,190**

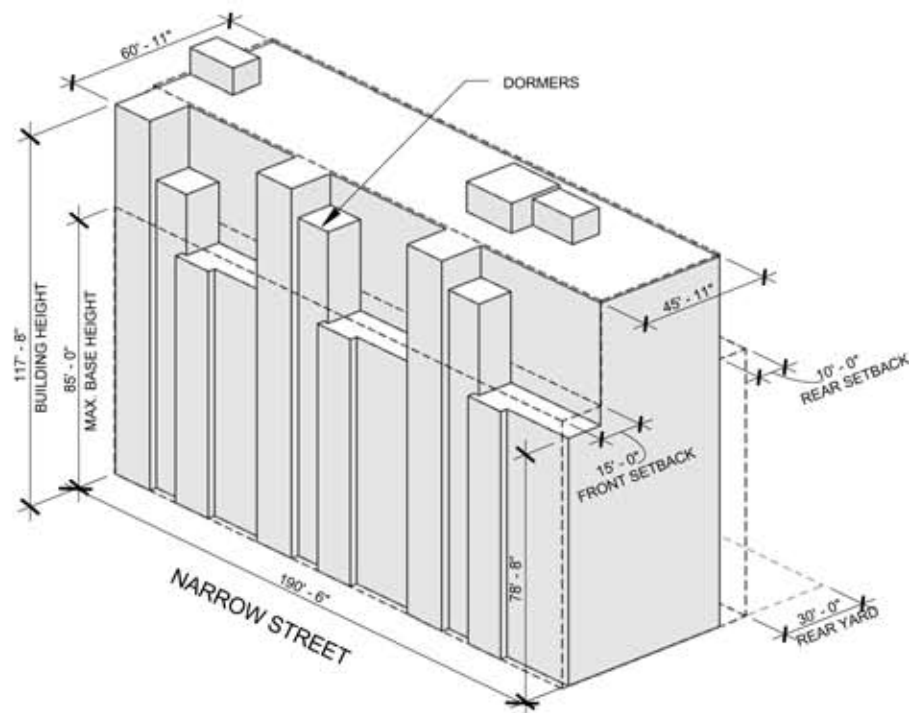
**Actually built:** **35,188**

**Floor area left unbuilt:** **2**

# PROJECT 8

## Limited by the building envelope

It was unable to use all of its permitted floor area



**Total permitted floor area:** **162,221**

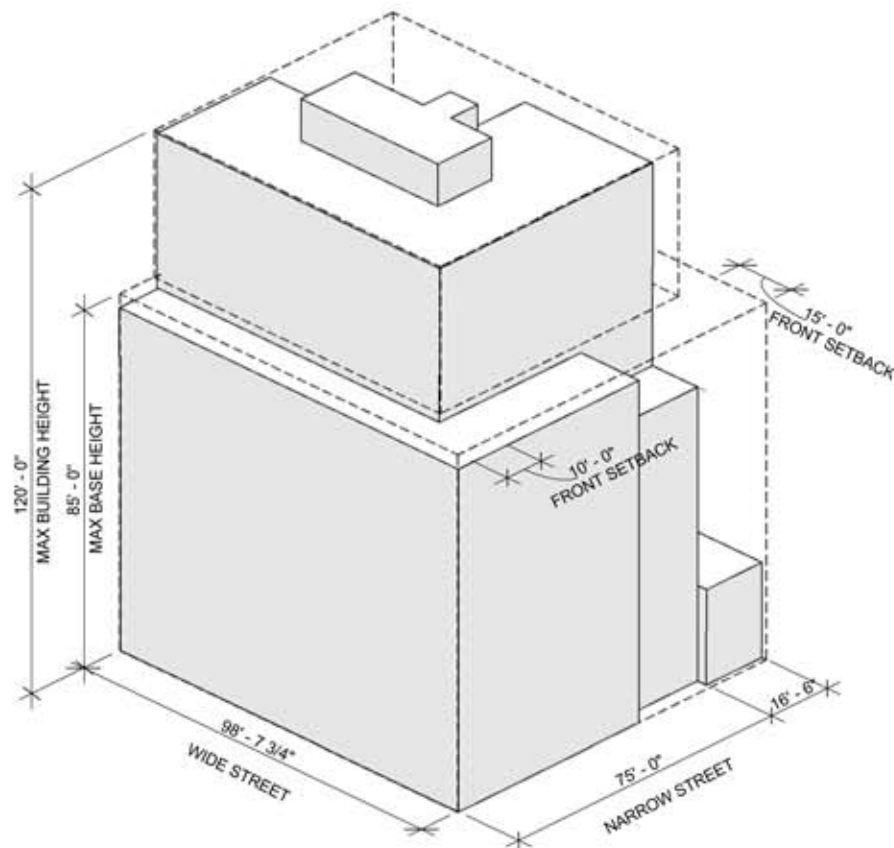
**Actually built:** **129,440**

**Floor area left unbuilt:** **32,781**

# PROJECT 9

## Limited by the building envelope

It was unable to use all of its permitted floor area



<b>Total permitted floor area:</b>	<b>71,979</b>
<b>Actually built:</b>	<b>68,130</b>
<b>Floor area left unbuilt:</b>	<b>3,849</b>

**The remaining projects neither maximized their floor area nor their building envelope**

