



CITY OF CAMBRIDGE

Community Development Department

To: Planning Board

From: Community Development Department (CDD) Staff

Date: June 20, 2023

Re: **Ian Ferguson, et al., Zoning Petition**

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Overview

Petitioner: Ian Ferguson, et al., (group of at least 10 registered voters)

Zoning Articles: 5.000 (Development Standards)

Petition Summary: To amend Section 5.24.4 "Measurements for minimum yards which are determined by formula" by amending how the denominator in the yard formula is calculated in Section 5.30 for buildings of forty feet or less in height; by amending the language used to determine the average height in a required yard formula for a building with various roof levels in Section 5.24.4.2; and by amending the multi-plane setback formula in Section 5.24.4.3 to account for non-vertical planes and alternative roof shapes. The petition further amends Section 5.24.4 to add a height bulk control plane requirement for One- and Two-Family buildings over fifty feet in length.

Planning Board Action: Recommendation to City Council

Memo Contents: Summary of the proposed zoning, background information on the topic of the Petition, and considerations and comments from staff.

Existing Formula Setback Regulations

Formula-based yard setbacks were first introduced in Cambridge as part of a major zoning overhaul that occurred in 1961, following a City planning effort that reflected a movement toward urban revitalization at a time when residential and economic growth was expanding to the suburbs. In addition to the introduction of yard setbacks, the 1961 rezoning included the introduction of density standards (FAR, Minimum Lot Area per Dwelling Unit), creation of the class of “Office” districts, and introduction of minimum off-street parking requirements. One potential rationale for creating formula-based minimum yard setbacks was that the bulk of the building determines the shadow impacts on neighboring properties and therefore, the yard setbacks should be directly related to the design of the building. In other words, bigger buildings create bigger shadows, which means they should be set further back from the property line to reduce impacts on neighboring properties.

Formula setbacks are currently used in Residence C districts (C, C-1, C-1A, C-2, C-2A, C-2B, C-3, C-3A), all Office districts (O-1, O-2, O-2A, O-3, O-3A), and Business A, A-1, A-3, and A-4 districts. In these districts, setbacks are calculated by adding the vertical height of the building facing the corresponding lot line and the length of the building facing that lot line and dividing the sum by some denominator as defined by district in the Table of Dimensional Requirements. The denominator usually differs between front, rear, and side yard requirements in the same district. Essentially, the rule is the larger the denominator, the smaller the setback. For example, in a Residence C-1 district, the setbacks are calculated as follows:

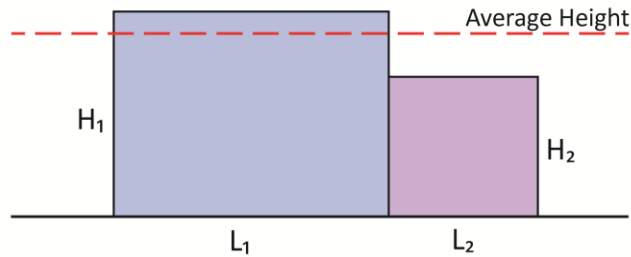
- **Front: (Height + Length)/4**
- **Side: (Height + Length)/5**
- **Rear: (Height + Length)/4**

In the example above, a simple building that is a simple 50' x 50' cube would result in the following setbacks:

- Front: $(50 + 50) / 4 = 25'$
- Side: $(50 + 50) / 5 = 20'$
- Rear: $(50 + 50) / 4 = 25'$

Calculating setbacks for a simple box-shaped building is relatively straightforward. However, the calculation becomes more complicated for buildings with multiple heights and/or multiple planes. Section 5.24.4.2 defines how to calculate the average height of a building with varying roof levels, using the following formula:

$$\frac{(H_1 \times L_1) + (H_2 \times L_2)}{L_1 + L_2}$$



Above is a diagram of the profile view of a building with two distinct parts (planes), each with a different roof height. To find the average height, you take the area of the first plane ($H_1 \times L_1$) plus the area of the second plane ($H_2 \times L_2$) and divide the sum by the total length of the building ($L_1 + L_2$). That “average height” will be used as the height in the appropriate setback formula as defined by district. Assuming the planes are flush with one another, meaning neither plane is set back further than the other, for a front yard setback in a Residence C-1 district, the setback formula would be:

$$\text{(Average Height + Length)/4}$$

However, if the two building planes in the example above are NOT flush, the Zoning Ordinance establishes a multi-plane setback formula in Section 5.24.4.3. For a multi-plane setback, the planes must follow the following requirements:

1. No plane is allowed to be closer to the lot line than the setback calculated as if that plane were its own building. For example, if a rear-facing plane is 20 feet high and 16 feet long in a Residence C-1 district, the required setback would be: $(20 \text{ feet} + 16 \text{ feet})/4$, which is equal to 9 feet. Therefore, that portion of the building can be no closer to the lot line than 9 feet.
2. For all planes set closer to the lot line than the setback required as if the building were all one plane, other planes must be set behind that setback line such that the volume between each plane and the lot line is at least equal to the volume between the lot line and the setback required as if the building were all one plane.

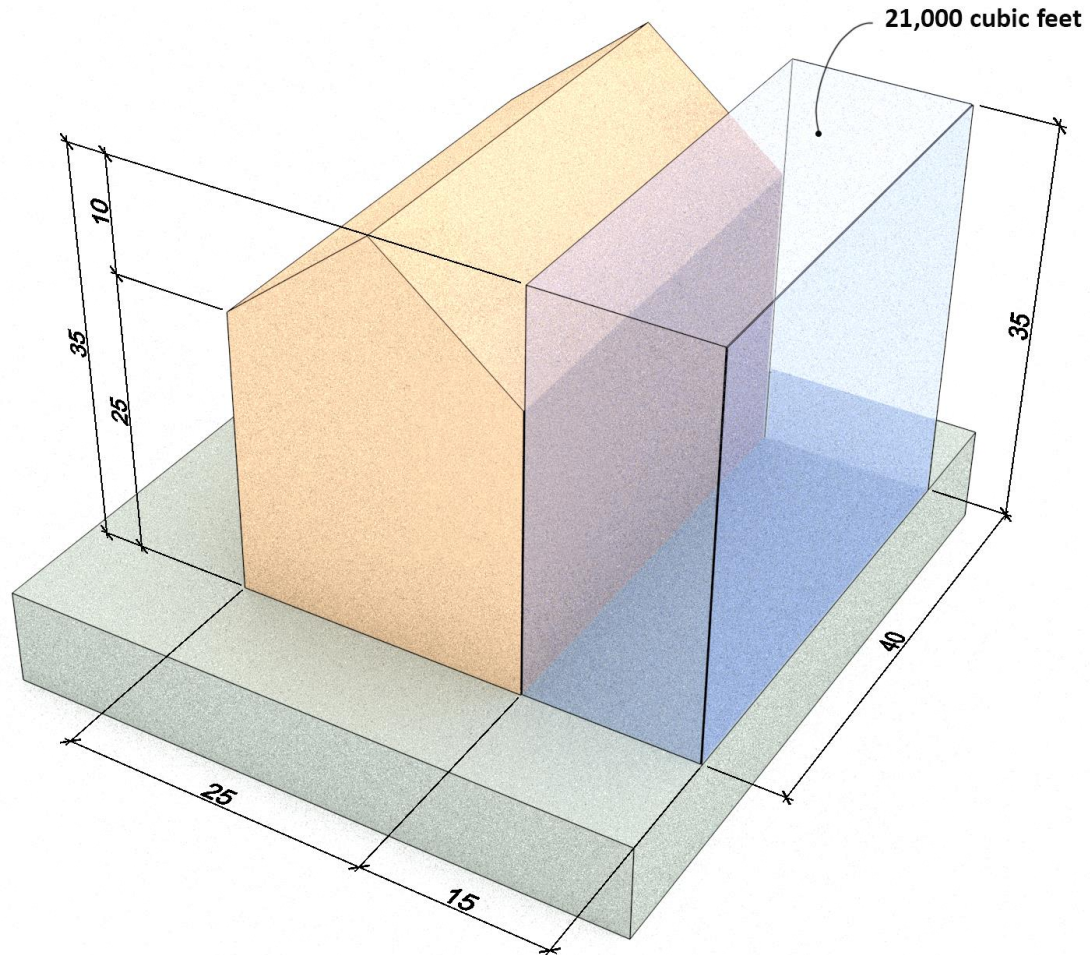
To understand the second rule, the setback must first be calculated as if the building were all one plane (a “Single Plane Setback”). This is calculated using the **(Average Height + Length)/Denominator** formula described above. Therefore, the volume between the single plane setback and the lot line would be calculated by multiplying the Average Height times the total Length of the building times the Single Plane Setback **(Average Height x Length x Single Plane Setback)**. That volume must be greater than or equal to the total volume between each individual plane and the lot line:

$$\text{(Height}_1 \times \text{Length}_1 \times \text{Setback}_1) + \text{(Height}_2 \times \text{Length}_2 \times \text{Setback}_2) \geq \text{(Average Height} \times \text{Length} \times \text{Single Plane Setback)}$$

In other words, the volume between all components of the building and the lot line must be greater than or equal to the volume between the single plane setback line and the lot line. The limit, speaking to

the first rule, is that no individual plane can be closer to the lot line than the setback calculated as if that plane were its own building.

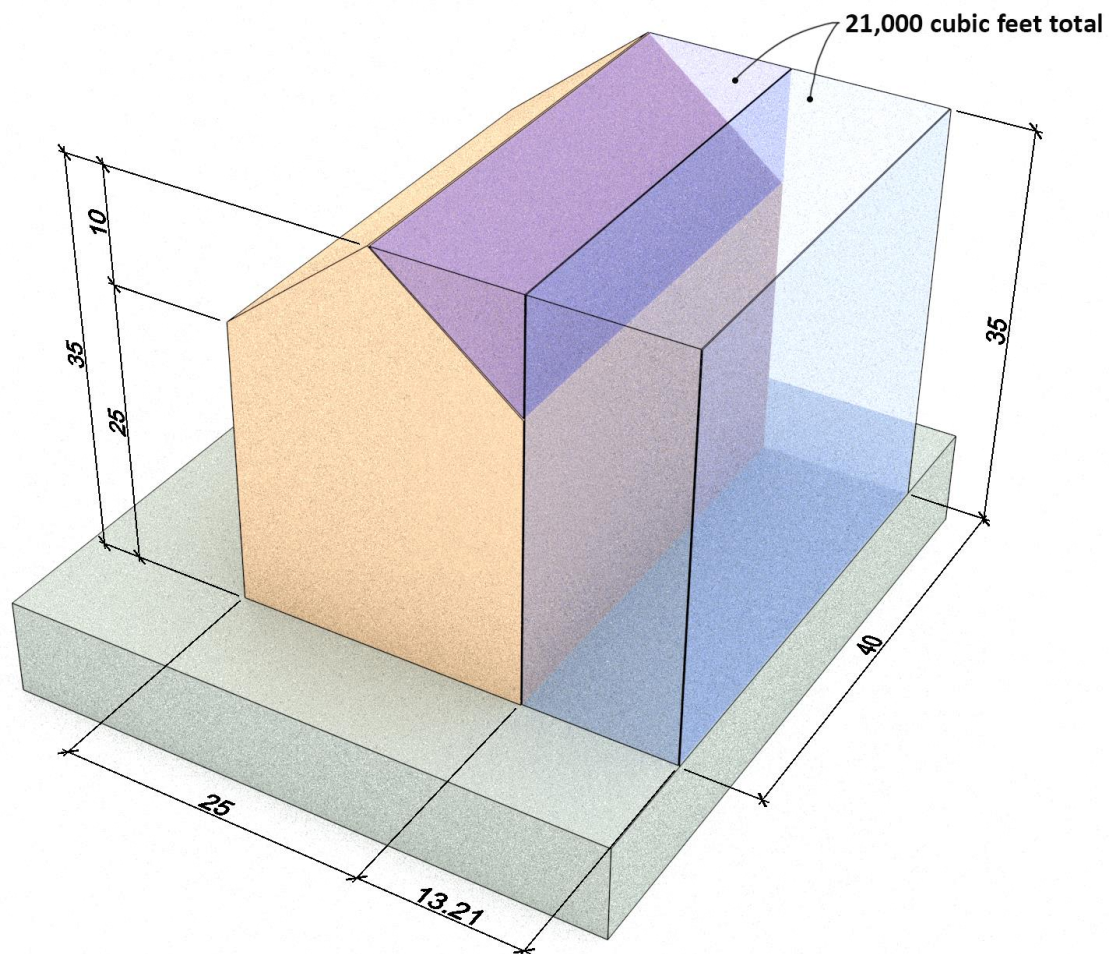
It is crucial to note that the zoning only refers to “vertical planes.” Therefore, a plane with a sloped roof facing the corresponding lot line would be treated as if the vertical wall extended all the way to the peak of the roof when determining the volume between the building and the lot line. Effectively, the volume between the actual roof and the “vertical plane” is ignored (see diagram below for explanatory purposes).



Proposed Petition

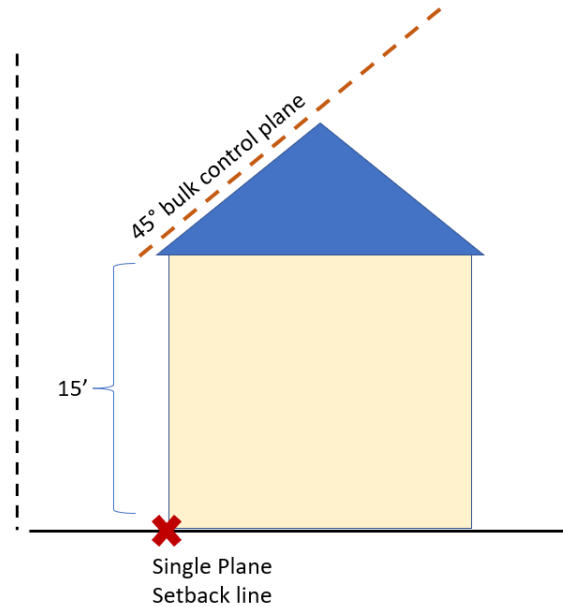
The Petitioner’s proposed changes to the setback formulas are predicated on the idea that sloped roofs allow for more light and air to extend into abutting properties than a flat roof of the same height. Therefore, the multi-plane setback formula should reflect the actual volume between the building and the lot line, instead of treating it as if it were one vertical plane. In other words, the volume between the actual roof and the vertical plane should be accounted for when comparing the volume between the building and the lot line to the volume between the single plane setback line and the lot line.

To achieve this outcome, the Petitioner proposes to amend Section 5.24.4.3 to read, “When a building presents a variety of vertical, sloped, and other planes facing any given lot line or street line...” which has the effect of explicitly incorporating planes other than vertical planes into the required calculation. The Petition further amends the multi-plane setback formula to clarify that the “volume between the proposed building and a given lot line be at least as great as the volume between the Single Plane and the given lot line.” This is mostly a rephrasing of the existing language – putting the formula in terms of volume instead of the area of a plane multiplied by the setback – however, it also has the intended substantial effect of measuring the volume from the building itself to the lot line instead of the vertical plane to the lot line as it is currently measured. In terms of practicalities, this means that buildings that incorporate sloped or other roof shapes would have a smaller yard setback than what is currently calculated in the multi-plane formula (see diagram below for explanatory purposes).



The other major change is the introduction of Section 5.24.4.4 that adds a height bulk control plane requirement for One- and Two-Family buildings over fifty feet in length. Specifically, it states that “all portions of the building within twenty feet (20’) of the rear setback line shall be set below a 45-degree bulk plane starting at the intersection of the Single Plane Setback line and a height of 15’ above average grade” (see diagram below for explanatory purposes). This would encourage or perhaps require sloped

roofs facing rear lot lines, because the bulk control plane would require that portions of the building above twenty feet (20') be located behind this diagonal line. Staff have not been able to fully study the implications of this change, but it does present the possibility of making previously conforming buildings non-conforming.



Other Language Edits

The Petition includes a few other minor edits throughout Section 5.24.4. In Section 5.24.4.1, the Petition proposes to change the front yard setback to be measured from the street centerline instead of the street line or building line as it is currently written. This change only impacts the BA-4 district as every other district subject to formula front setbacks is subject to a footnote to the Table of Dimensional Requirements that states the front yard shall be measured from the centerline of the street in that district. The BA-4 district is a small area of Walden Street along the eastern border of Danehy Park, consisting of a few triplexes and condominiums. The proposed change would reduce the required setback for these structures. The Petition also amends Sections 5.24.4.1 and 5.24.4.2 to replace the word “may” with “shall,” which would remove ambiguity about whether applying certain provisions of the formula setback is voluntary rather than a requirement.

The Petition includes changes to Section 5.24.4.2 regarding the explanation of the formula to determine average height. These language edits put the formula in terms of area instead of a simple height times length equation, which would be applicable given that the formula for area will change depending on the shape of the plane itself. The new formula would look like this:

$$\frac{\text{Area}_1 + \text{Area}_2}{L_1 + L_2}$$

The Petition also adds to Section 5.24.4.2 that the “average height ‘H’ and total length ‘L’ shall be used to determine the Single Plane and Single Plane Setback required in items (3) and (4). This does not effectively change the formula in any way as the average height and total length are already used to determine the single plane setback. It does, however, introduce the terms “Single Plane” and “Single Plane Setback” without clear definitions.

Petition Considerations

Overall Considerations

The Petition attempts to make a surgical edit to the City’s formula setback standards which would account for building and roof designs that are not simple, vertical planes. The premise has merit – formula setbacks were created in part to ensure that the Purpose clause in Section 1.30 of the Zoning Ordinance is effective – that Zoning would help, in part, to “provide adequate light and air”. However, the multi-plane setback formula seemingly punishes buildings with sloped roofs by requiring that they be set back as if they were full, vertical boxes; despite the fact that sloped roofs would result in lower light and air impacts when the building is at the same setback. To that end, there is logic to having a slightly different requirement for non-vertical roof shapes.

In the recent past, the Planning Board and City Council have had many discussions about formula setbacks in the context of zoning petitions and removing barriers to multifamily housing citywide. In those conversations, staff and Board members alike have noted that formula setbacks are needlessly complicated, both to interpret and administer, and often run counter to some of the City’s broader planning and urban design goals, such as encouraging a continuous street wall and predictable block pattern. The petition offers refinement to the way formula setbacks are calculated, but perhaps a further step should be taken to eliminate them altogether.

The Petition does not include analysis or study of how the proposed changes might affect existing developments throughout the City, or what the implications might be from adopting the proposed changes. In Residence C and Office districts, specifically, the changes would apply to how *all* yard setbacks (front, side and rear) would be calculated – and could result in buildings being sited on lots in rather random or unpredictable ways. The Petition generally has the effect of reducing a required yard setback when a sloped roof is provided; even when the interior area within that sloped plane still constitutes gross floor area. This could, in turn, result in additional developable area than what currently exists on most lots in these districts.

Administrative Considerations

Most of the minor edits proposed in the Petition do well to clarify some of the more complicated aspects of the formulas. However, the most substantial change, regarding incorporating sloped roofs and other planes, would present some significant challenges in many real-life cases. Calculating the

volume between a building and the lot line is relatively straightforward when the building has a simple gable roof with a constant slope that spans the entire length of the building. However, the calculations become a lot more complicated for a roof with a varying slope, especially a curved slope. It may be relatively simple for an architect to determine those numbers with the 3D modeling software they use to design the building, but the Inspectional Services Department may not have access to those models and would need to verify those calculations by hand to ensure compliance. Staff have not been able to test these changes on a variety of roof types and plane shapes to get a clear understanding of how complex the calculations may become.

Conclusions

The Petitioner's proposed changes to incorporate sloped roofs into the formula-based setback calculations more accurately reflect the original conceit of the formula setbacks – that the bulk of the building determines the shadow impacts on neighboring properties, therefore, the yard setbacks should be directly related to the design of the building. However, the administrative challenges and uncertainties need to be considered when weighing the pros and cons of the Petition. Overall, it is unclear how much an impact this change would have on actual outcomes and there may be cases where a conforming building becomes non-conforming if the Petition is adopted.

An alternative approach may be to reconsider using formula setbacks at all. Height, FAR, and other dimensional requirements may have the effect of standardizing the bulk of buildings such that the setbacks are more or less the same across the district, which could suggest a simpler path forward would be to replace the formulas with absolute numbers, as is the case with many of Cambridge's other zoning districts. Any substantial change to setbacks should be followed by a comprehensive study.