Existing Commercial Buildings and the Energy Code

An Illinois Enforcement Survey

Ian Blanding & Nicole Westfall

April 2018

MEEA
MIDWEST ENERGY EFFICIENCY ALLIANCE

Existing Commercial Buildings and the Energy Code:

An Illinois Enforcement Survey

Executive Summary

Although much less discussed than new commercial construction, modifications to existing buildings comprise the vast majority of building permits that must comply with state and local building code requirements. This paper analyzes results from a recent survey of local code officials in Illinois about existing commercial buildings under the purview of the 2015 Illinois Energy Conservation Code. To date, scant research has been conducted on the implementation and enforcement of the energy code in existing commercial buildings. The intent of this survey is to improve understanding, spur discussion and promote further research.

Sixty-nine active code officials from across Illinois were surveyed in order to determine the frequency in which building modifications are required to meet the energy code, the typical level of enforcement by code officials, and the builder's ability to comply with the code when faced with existing structural elements. Data from the survey revealed that significantly more permits were issued for lighting and HVAC modifications compared to permits issued for changes to the building thermal envelope. Improving the level of efficiency was frequently required to comply with the energy code when modifying windows, lighting, and HVAC, yet this was less common in roof and wall modifications. Regardless of the type of building modification, builders and designers very rarely requested, and code officials rarely granted, a variance exempting compliance with the energy code. However, if a code official were to grant a variance, it was typically due to physical or structural constraints if insulation modifications were made to the building envelope, while the overall compliance of the project was given consideration for windows, lighting and HVAC changes.

Code officials felt that the primary challenge to enforcing the energy code in existing buildings was a lack of understanding of the energy code by builders and designers (73.2%). Other common enforcement issues included a lack of uniform enforcement between jurisdictions, varying levels of leniency by the code official, and the lack of clarity on when and how the energy code applies in existing building projects. Code officials had varying ideas about how to improve the level of understanding and compliance with the commercial energy code. Their wide-ranging responses are included in Appendix III.

Introduction

Although major renovations, retrofits, and alterations are under the purview of the commercial energy code, there is little data regarding how the code is enforced in the real world. New commercial construction accounts for only 2% of the total commercial building square footage in a given year, so the vast majority of energy use (and potential energy savings) are in existing

buildings.[1] The code clearly states that when modifications would increase energy use, or when a regulated building component is replaced, the resulting use, modification, or component must comply with the energy code adopted by the jurisdiction.

However, in-field conditions may make compliance excessively costly or technically infeasible. The building code typically provides for this reality by giving the code official the leeway to authorize alternate solutions. For example, the International Existing Building Code (IEBC) section 104.10 states, "Wherever there are practical difficulties involved in carrying out the provisions of this code, the *code official* shall have the authority to grant modifications for individual cases on application of the owner or owner's authorized representative, provided that the *code official* shall first find that special individual reason makes the strict letter of this code impractical with the intent and purpose of this code and such modification does not lessen health, accessibility, life and fire safety, or structural requirements." Data on the number of times this situation occurs, or the factors influencing the decision, are virtually nonexistent.

This study aimed to gain insight into how the commercial chapter of the 2015 Illinois Energy Conservation Code (energy code) is understood and enforced in existing building alterations, renovations or retrofits. By surveying code officials directly, MEEA sought to better understand how the energy code is enforced on commercial alteration projects, how often variances to the energy code are requested, the reasons these requests are made, and the factors influencing the decision to approve these requests.

Methodology

In order to understand how code officials enforce the energy code in existing commercial buildings, MEEA designed a brief survey (10-15-minutes) that could be distributed to code officials using the online survey tool, Survey Monkey. Proposed questions were drafted and presented to stakeholder organizations to elicit feedback. This process had the added benefit of informing key stakeholders about the upcoming survey and learning about their connections with, and ability to reach, code officials. After questions were finalized, MEEA worked with national, state, and local code official associations to distribute the survey to code officials across the state of Illinois. As an incentive, participants were offered a $5 gift card upon completion of the survey.

The survey was organized in three distinct sections. The first section of the survey asked general questions which assured that all respondents completing the survey had direct involvement in commercial alteration plan reviews or inspections for the energy code. Questions were also asked regarding background data to better understand the types of jurisdictions participating, the percentage of existing building permits being issued relative to the total number of permits, and the degree to which the code official understands the energy code. The second section asked a set of questions to specifically address permitting differences in five different building components often included in commercial alterations. These five components included roof, wall, and window modifications, and alterations to lighting or mechanical systems. The goal here was to understand which modifications were made most frequently, and to assess differences in the number of variances requested or approved by building component. The third section of the survey focused on what tools or guidance would be useful to code officials to improve their understanding and application of the energy code in existing buildings.

[1] See Building Efficiency Initiative. Why Focus on Existing Buildings? http://www.buildingefficiencyinitiative.org/articles/why-focus-existing-buildings

Survey responses were collected from January 4 through February 4, 2018. Upon completion, the collected data was analyzed using Survey Monkey analytics, Microsoft Excel and Tableau. The following section highlights key themes found in the responses.[2]

Results

Qualifying Questions

This survey was completed by sixty-nine code officials working in Illinois. A majority of these officials reported that their jurisdiction was located in climate zone 5 (67.7%), or in both climate zones 4 and 5 (27.9%). Jurisdictions with varying levels of construction were also represented in the data. As shown in Figure 1, over 50% of code officials worked in jurisdictions with 50 commercial building permits or fewer, while over 20% worked in jurisdictions with over 351 permits, annually. All sixty-nine stated they were directly involved in ensuring compliance with the commercial energy code.

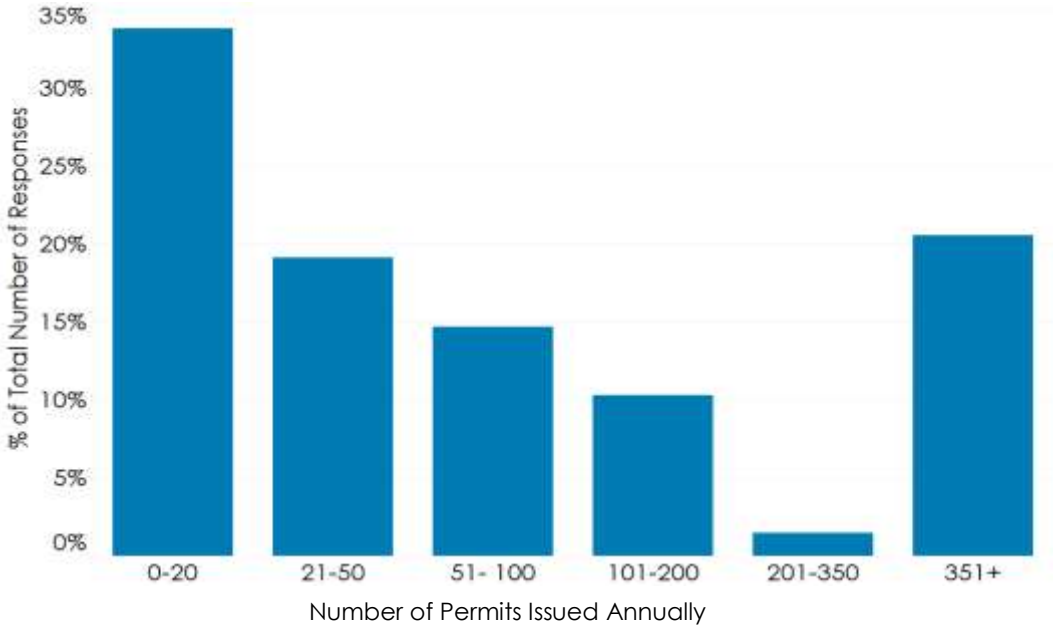


Figure 1: Number of permits issued annually in the jurisdictions of code officials responding to this survey

Most of the code officials reported that they had a good or very good understanding of energy code requirements for alterations in commercial buildings. As displayed in Figure 2, the vast majority of code officials also reported that they believed enforcing the energy code on commercial alteration projects was important or extremely important (Appendix I).

[2] The full list of questions and results in the order they were asked can be found in the appendices.

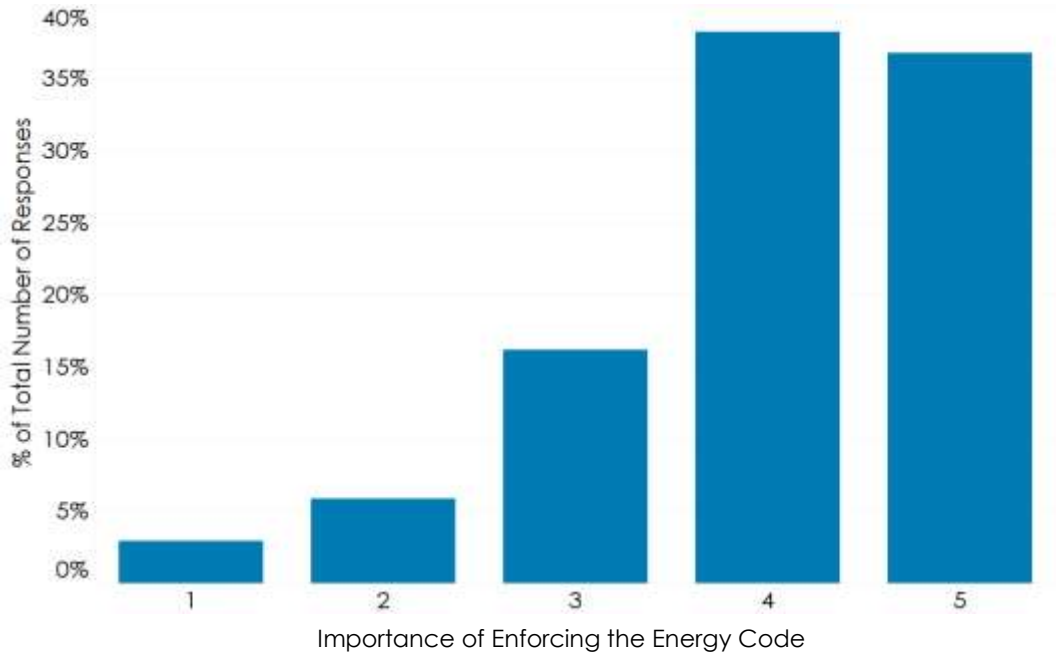


Figure 2: Responses by code officials to the question 'In your opinion, how important is it to enforce energy code requirements for alterations in existing buildings?' with 1 being not important at all and 5 being extremely important.

Permits

When asked about whether their jurisdiction requires permits for the types of building modifications specified in the survey, the vast majority of code officials said "yes". (Table 1).

Project Type	Requires Permits	Does Not Require Permits
Roof Alterations	94.12%	5.88%
Exterior Wall Modifications	97.01%	2.99%
Window Alterations	82.26%	17.74%
Lighting Alterations	80.33%	19.67%
HVAC Alterations	86.44%	13.56%

Table 1: Table depicting the percentage of reporting code officials that require permits for listed project types

While the number of permits jurisdictions issued annually varied significantly, most officials reported that the majority of the permits issued were for modifications of existing buildings. Of the reporting code officials, 60% stated that existing building permits made up over 71% of the total number of permits issued annually in their jurisdiction (Figure 3).

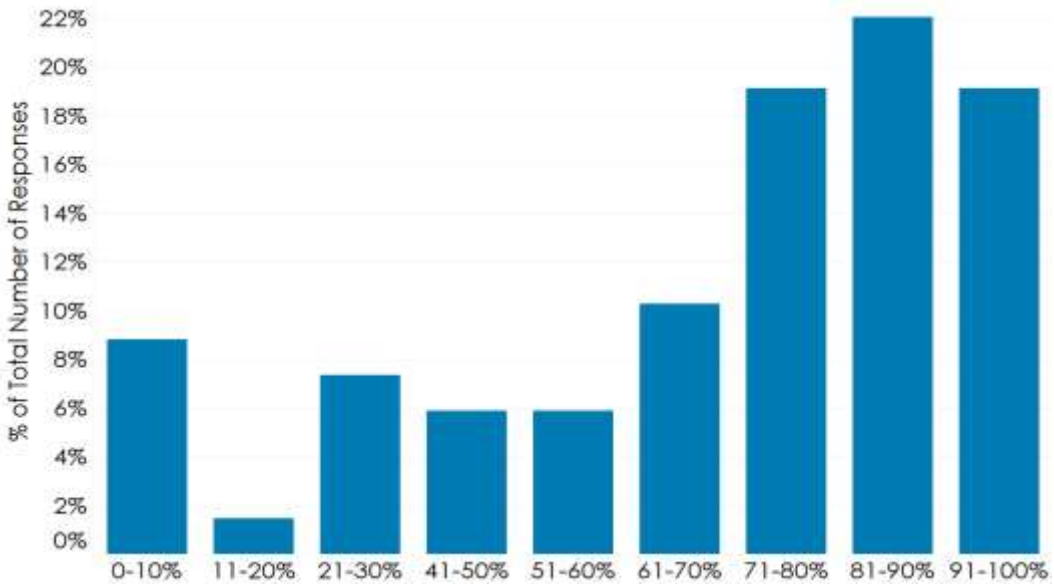


Figure 3: Percent of total permits issued for existing buildings as reported by code officials.

Further analysis revealed that lighting modifications were consistently made most frequently, with HVAC modifications having the second largest percentage. In comparison to lighting and HVAC, code officials reported that modifications to the building thermal envelope were made less frequently. For example, as a percentage of total permits issued for existing commercial construction, code officials reported that relatively few permits were issued for alterations that involved roof replacement (Figure 4). Similarly, fewer permits were issued for projects involving other thermal envelope components, with the 0-10% category being the most common response for windows and wall insulation. (Appendix II).

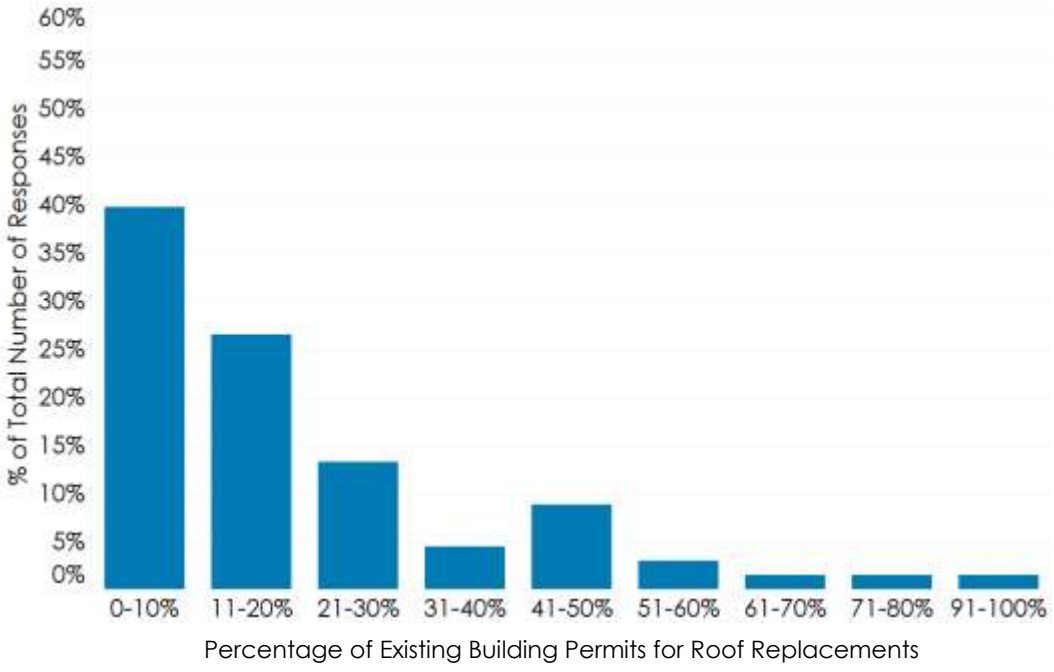


Figure 4: The percentage of total commercial building alteration permits issued for roof modification projects as reported by code officials.

Building Modifications

Of all permits issued for roof and wall modifications, the number of projects which required updating replaced or exposed components to meet the current energy code varied substantially. However, roof and wall modification upgrades were required less frequently than other project types (Appendix II). This can partly be explained by the fact that permits for "re-roofing" may involve either a roof "recover" or a roof "replacement," and only the latter is required to comply with energy code's insulation R-value requirements. Typically, a roof is only replaced after it has already been recovered once or if the roof covering is damaged. Half of the code officials surveyed stated that 91-100% of window alteration projects permitted in their jurisdiction required an increase in window efficiency to meet energy code requirements (Figure 5). Over a third of code officials found the same to be true for lighting alteration projects, with 37.5% reporting that over 90% of lighting projects permitted in their jurisdiction needed to increase the efficiency of lighting to meet energy code requirements. Code officials also saw a need for efficiency updates in HVAC alterations, with 31% stating that of commercial HVAC alterations permitted in their jurisdiction, 91-100% of them required an increase in efficiency to meet energy code standards (Appendix II).

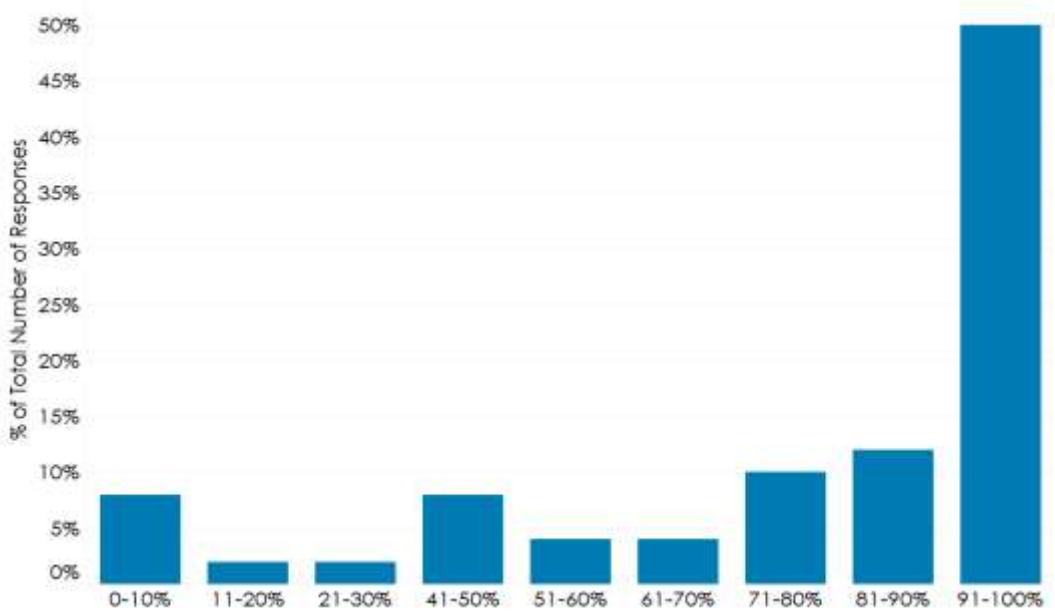


Figure 5: Percentage of window alteration projects that need to increase the energy efficiency of the windows in order to meet energy code requirements as reported by code officials.

Alternative Methods/Variance Requests

Code officials saw few requests for alternative methods or variances for all building components. For example, in roofing alteration projects, 53.6% of code officials stated that 0-10% of all roof alteration projects request a variance from the code. Even though infrequent, when these roofing variances were requested, they were typically denied. Of the officials reporting, 47.6% said that 0-10% of these requests are granted (Figure 6). Similar trends were found for exterior wall modifications, window alterations, lighting alterations, and HVAC system alterations (Appendix II).

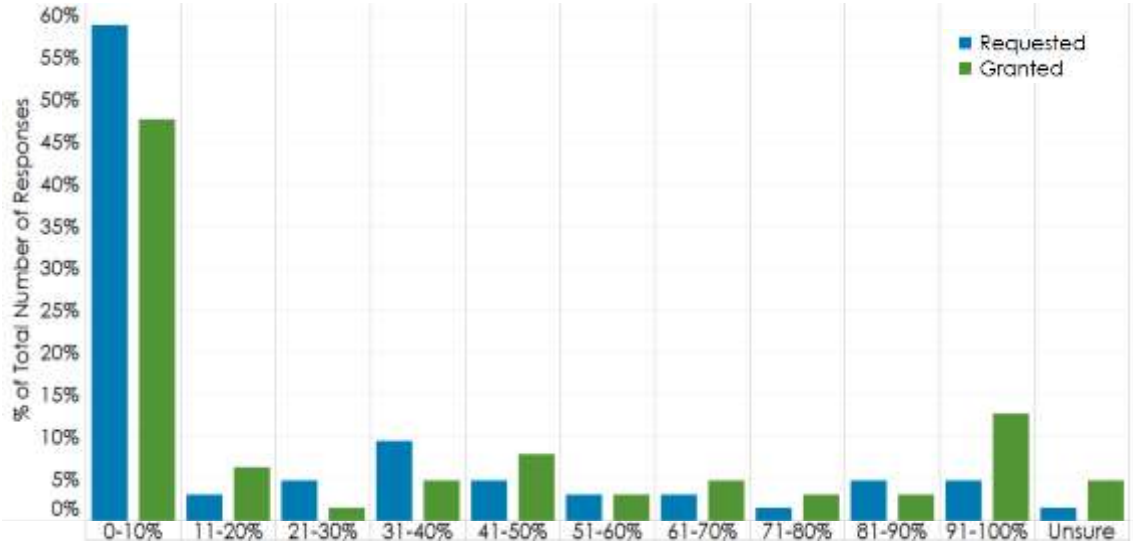


Figure 6: Percent of roof alterations requesting an alternative method or variance to the energy code compared to the percent of those requests granted as reported by code officials.

Interestingly, the survey revealed that variances for different building components were requested for different reasons. For projects involving roofing alterations, 55.6% of code officials reported that a variance was requested because it was physically or structurally infeasible to meet the energy code requirements (Figure 7). The majority of code officials said the same reason was given for requests on exterior wall modification projects.

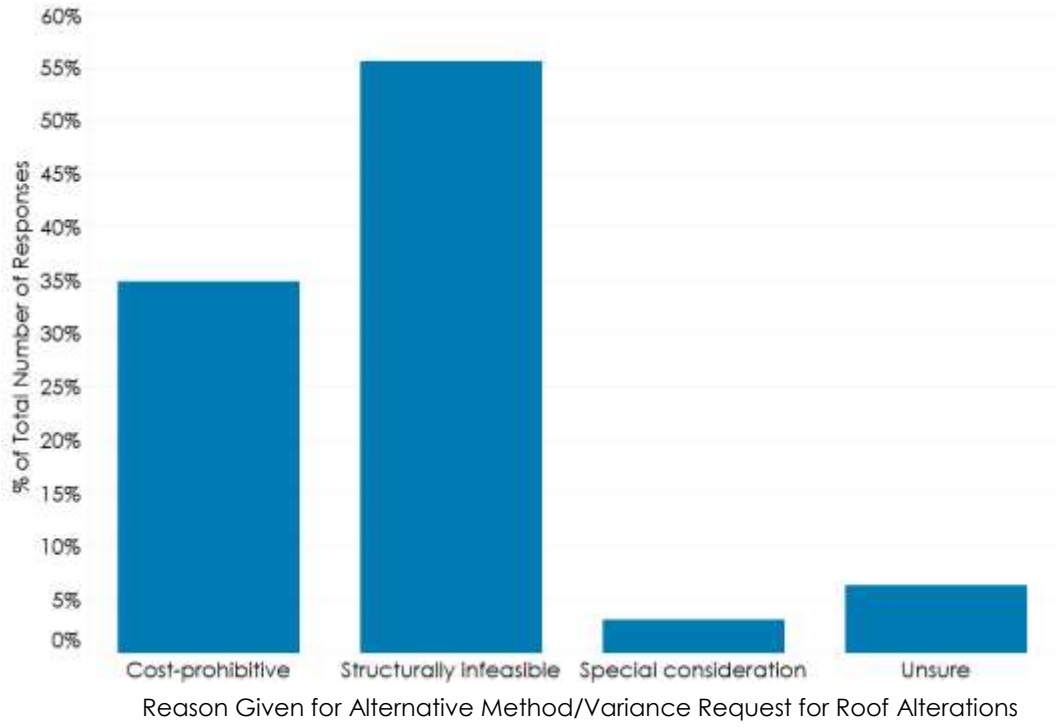


Figure 7: Primary reason given to code officials for requesting a roof alteration alternative method/variance

On the other hand, code officials stated that window and lighting alteration projects typically applied for a variance because it was cost prohibitive to comply with the requirements of the

energy code. Variances for HVAC systems were requested in for both infeasibility and cost prohibitive reasons (Appendix II).

Code officials also seemed to have different reasons for granting requests for alternative methods or variances. While the majority of officials stated that physical or structural infeasibility was the primary reason they granted variance requests for roofing alteration and exterior modification projects, variance requests for windows, lighting, and HVAC alterations was primarily granted because the *overall project* was in compliance with the energy code (Appendix II).

Issues with Enforcement and Potential Improvements

Code officials identified a lack of understanding among builders and designers as the primary challenge with enforcing the commercial energy code in existing buildings (73.2%) (Figure 8). However, many other reasons were given as well, including financial constraints, unwillingness of building owners to invest in efficiency updates, jurisdictional challenges, inaccessibility of data on existing buildings, lack of available code officials and inspectors, and resistance to behavior modifications.

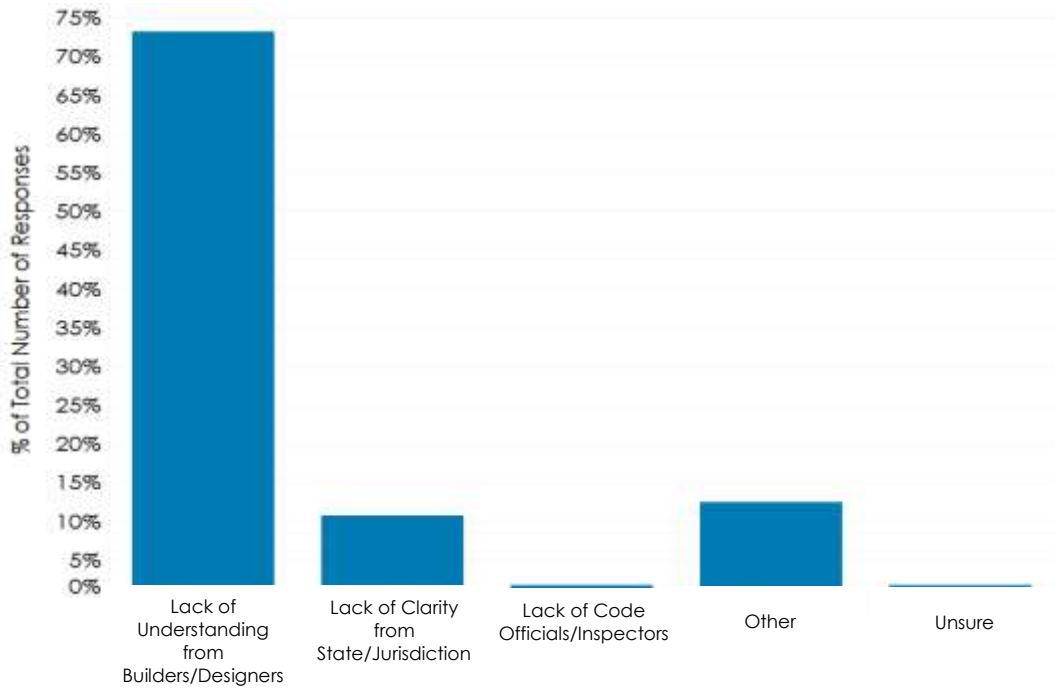


Figure 8: The biggest issue in enforcing the commercial energy code in existing buildings as identified by reporting code officials

Responses to questions about how best to improve the level of compliance were mixed. While most officials did not think that having more guidance about when variances to the energy code are warranted in existing buildings was necessary (55.4%), a substantial minority believed that it would be beneficial. Most code officials also thought that sufficient clarity was given in the code regarding alternative methods or variances (53.7%). However, a number of code officials (46.3%) thought additional guidance would be beneficial and suggested that specific, real-world examples would be helpful when applying the commercial energy code to existing

buildings. Most expressed interest in receiving ICC certified trainings on energy code compliance (58.93%)(Appendix III).

In addition to responding to the multiple-choice questions above, code officials responded to open ended questions regarding the lack of enforcement or understanding of the energy code in existing buildings. Common issues identified included lack of uniform enforcement between jurisdictions, varying levels of leniency by the code official, and the lack of clarity on when and how the energy code applies in existing building projects. Finally, some code officials erroneously viewed the energy code as unrelated to matters of public health and safety. Clearly this viewpoint would influence a code official tasked with enforcing the energy code and could impact the stringency of enforcement (Appendix III).

While most code officials support strict enforcement of the energy code, the survey results show a range of how, why, and when the energy code is applied to commercial projects in existing buildings. All of the enforcement issues identified in the survey can have a significant impact in how architects and builders learn, understand, and comply with energy code requirements. Obviously, these same issues would influence how a given code official interprets and enforces the energy code. Importantly, to help overcome these barriers to improved compliance, code officials value educational opportunities to learn more about the energy code. Unfortunately, most training and education opportunities often lack the real-world applications and case studies most valued by code officials. Additionally, trainings can be improved by tailoring them to specific industries involved in commercial building modifications and retrofits.

Conclusion

In terms of commercial energy codes, professionals tend to focus on new construction to drive energy savings through code enforcement and compliance. However, as shown in the survey results, modifications to existing buildings make up the vast majority of all commercial building permits issued, and therefore a ripe opportunity for energy savings in the state. Despite this potential, the building community knows very little about when and how the commercial energy code is applied to existing buildings in the field. This survey was developed to gain a better understanding of those applications.

Based on the results, several key takeaways stand out. Permits are typically required by the jurisdiction when modifications are made to any of the building components discussed in the survey. Existing building permits for building thermal envelope projects, including roof, wall and window modifications, represent a small percentage of total issued permits. Changes to lighting and HVAC make up a much larger percentage of existing building permits. HVAC, lighting and window modifications were typically required to improve the level of efficiency to comply with the state commercial energy code, while improved efficiency to roof and wall modifications were required less frequently. In terms of the ability to consistently meet the code, we found that builders and designers very rarely applied for, and code officials rarely granted, variances to meet the energy code, and this was equally true for all components. However, if a code official approved a variance, it was generally due to an inability to meet the code for physical or structural reasons. Lastly, code officials indicated that a lack of understanding from the building and design community was the primary issue when enforcing the energy code in existing commercial buildings.

We hope these findings will spur conversation and new ideas about how best to address code enforcement and compliance in existing commercial buildings throughout the state. Existing buildings make up the majority of potential energy savings. Improving the understanding of how the energy code is implemented during building modifications is critical to improving compliance and reducing energy use in the state.

Acknowledgements

The authors wish to acknowledge the Polyisocyanurate Insulation Manufactures Association (PIMA)[3] for their financial support for this survey and the International Code Council (ICC) for their invaluable assistance in helping to formulate the questions and distributing the survey to their members. Any opinions expressed in this paper are solely those of the authors and do not reflect the opinions of PIMA or ICC.

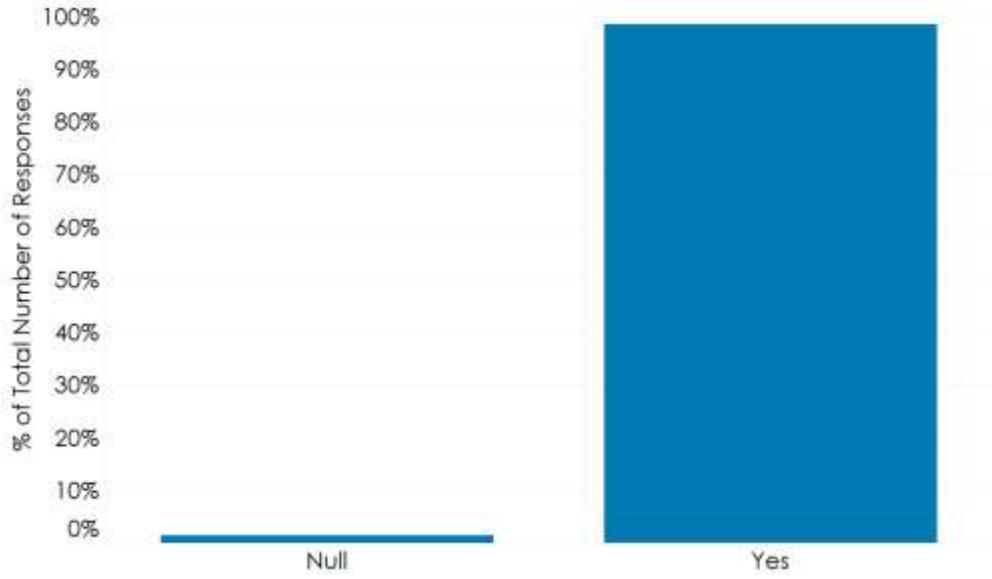
Additionally, we wish to express our sincere gratitude to our team at MEEA of Alison Lindburg, Chris Burgess, Chris Partridge and Stacey Paradis for their support and guidance throughout the development and analysis of this survey.

[3] The Polyisocyanurate Insulation Manufacturers Association represents the U.S. and Canadian polyisocyanurate insulation industry. More information is available at www.polyiso.org

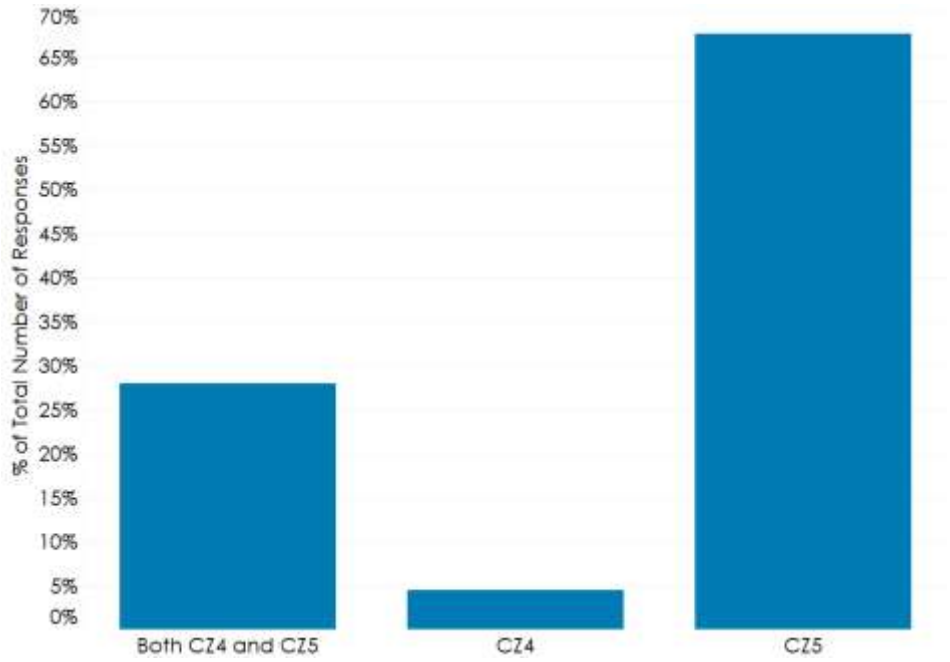
Appendices I – III include all survey questions and accompanying results in order of how they were asked in the survey. All questions received 69 answers from code officials involved with the statewide commercial energy code. Questions are organized by appendix into three distinct sections: General Questions, Building Components, and Tools and Guidance.

Appendix I – General Questions

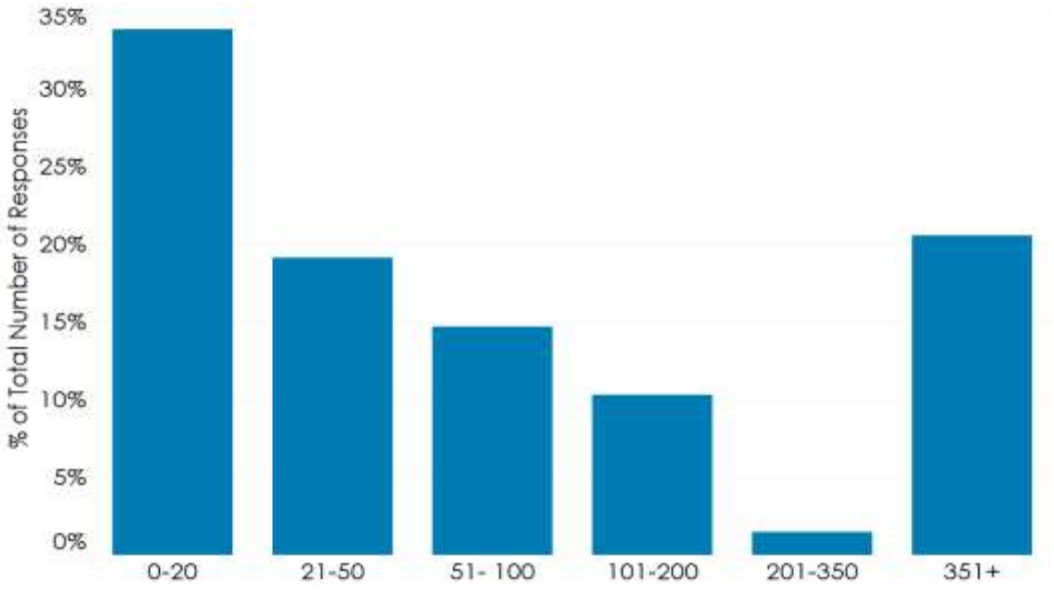
1. **Are you personally involved with ensuring compliance with the energy code in your jurisdiction?**



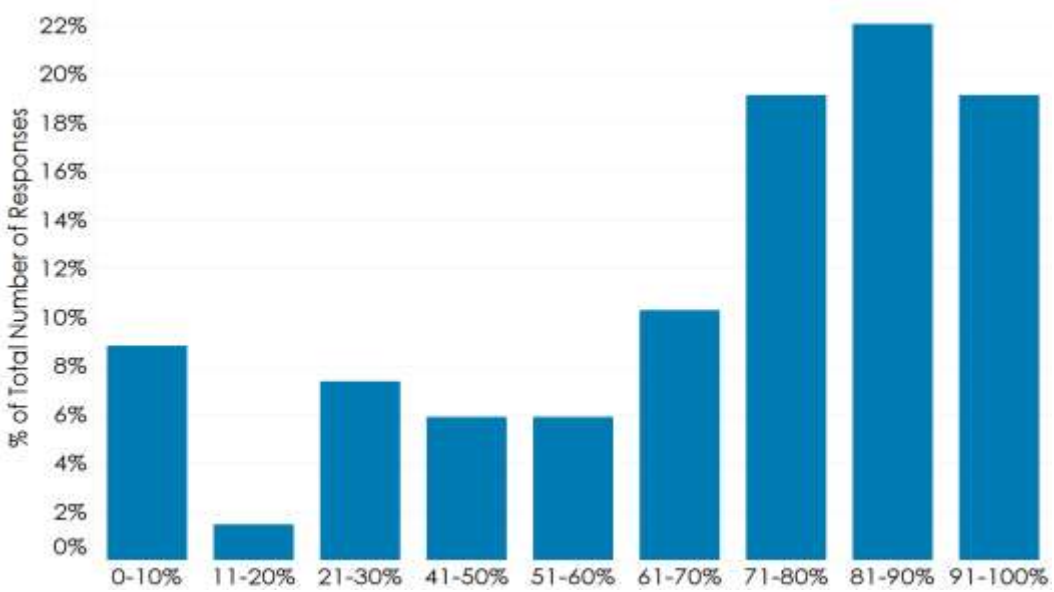
2. **In what energy code climate zone is your jurisdiction?**



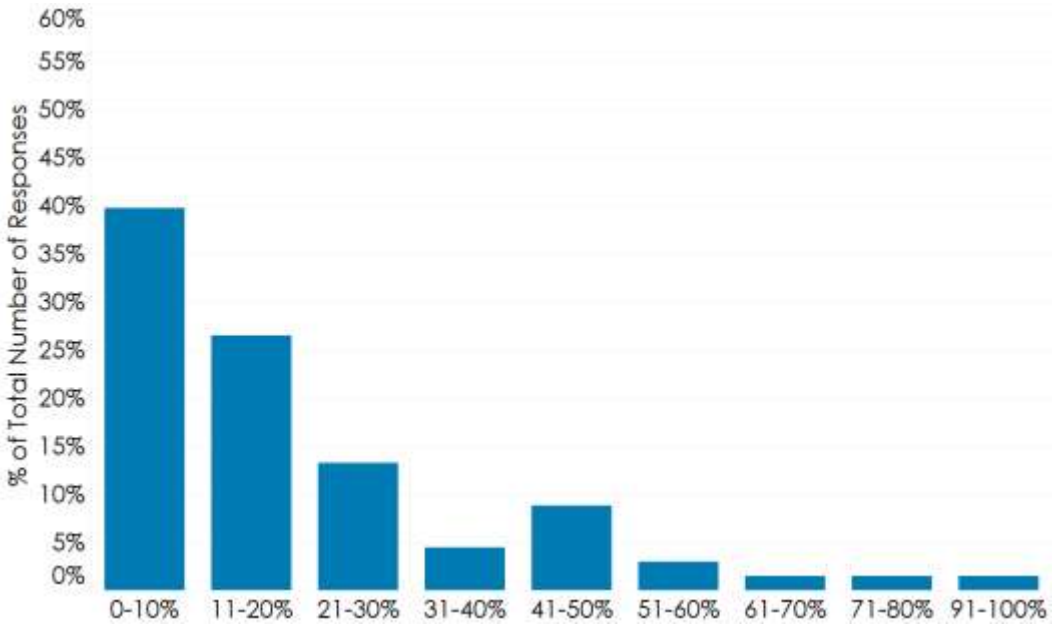
3. **Approximately how many commercial building permits (new construction and alterations) does your jurisdiction issue annually?**



4. **Of the annual commercial building permits issued, approximately what percentage involve existing buildings?**

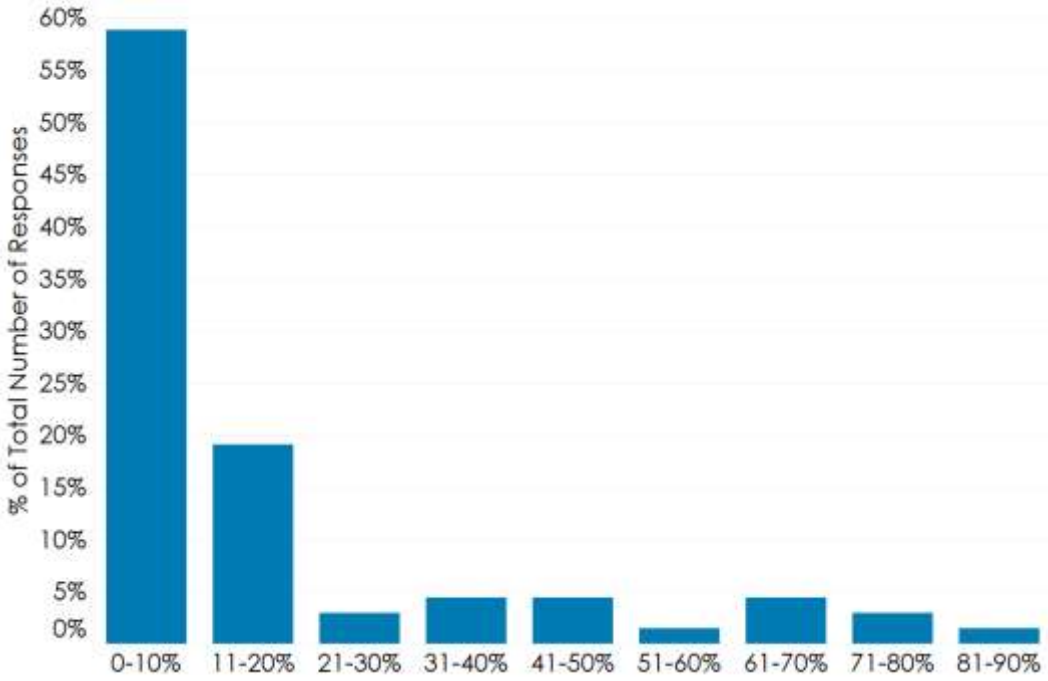


5. **Of the annual existing building permits, in your best estimation, what percentage involve roof replacements?**



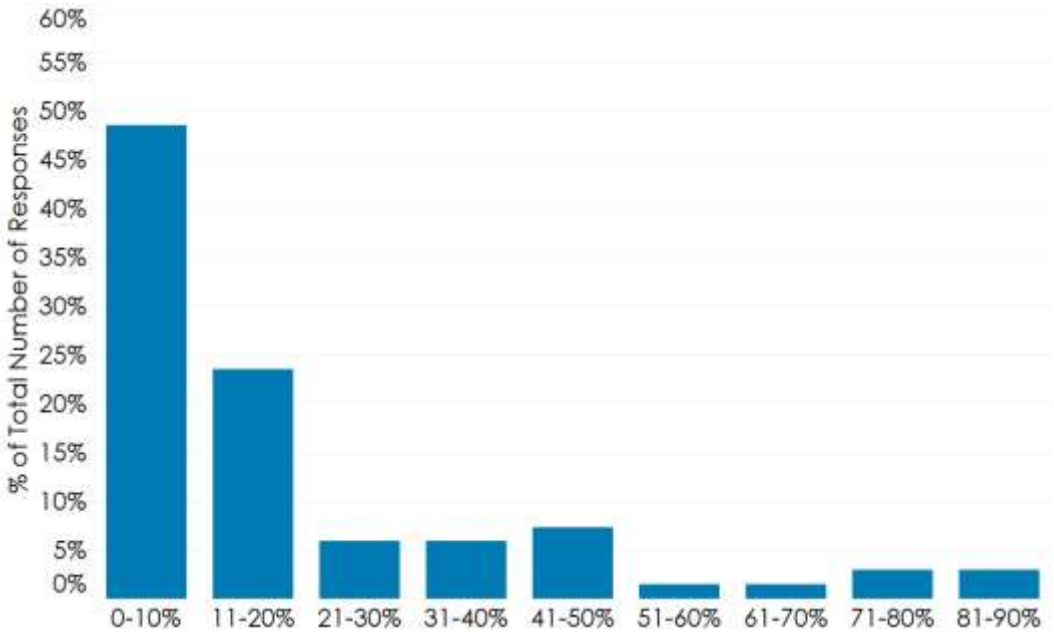
Percentage of Existing Building Permits for Roof Replacements

6. **Of the annual existing building permits, in your best estimation, what percentage involve exterior wall modifications?**



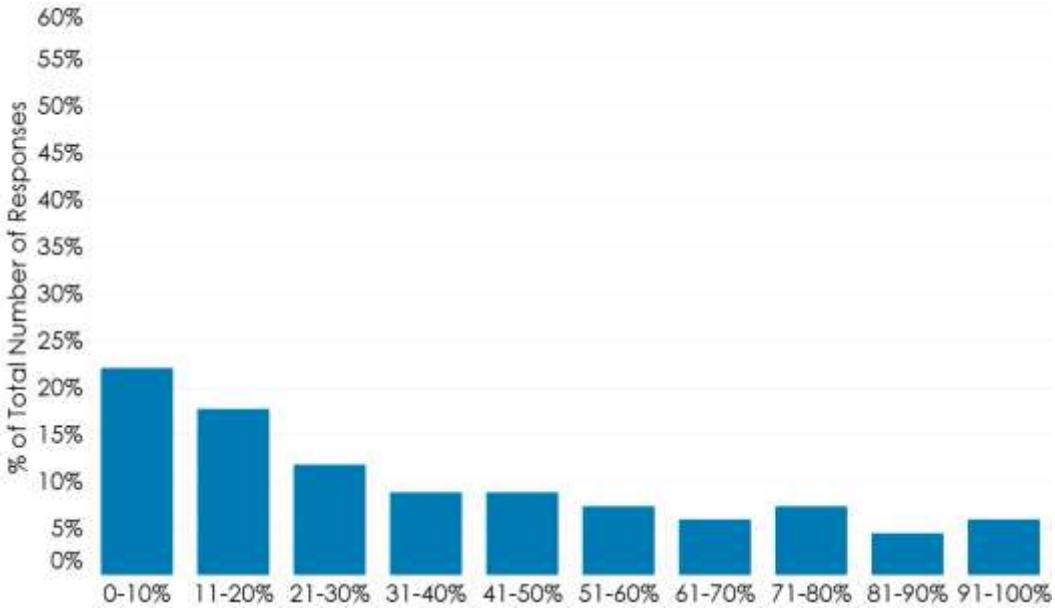
Percentage of Existing Building Permits for Exterior Wall Modifications

7. **Of the annual existing building permits, in your best estimation, what percentage involve window replacements?**



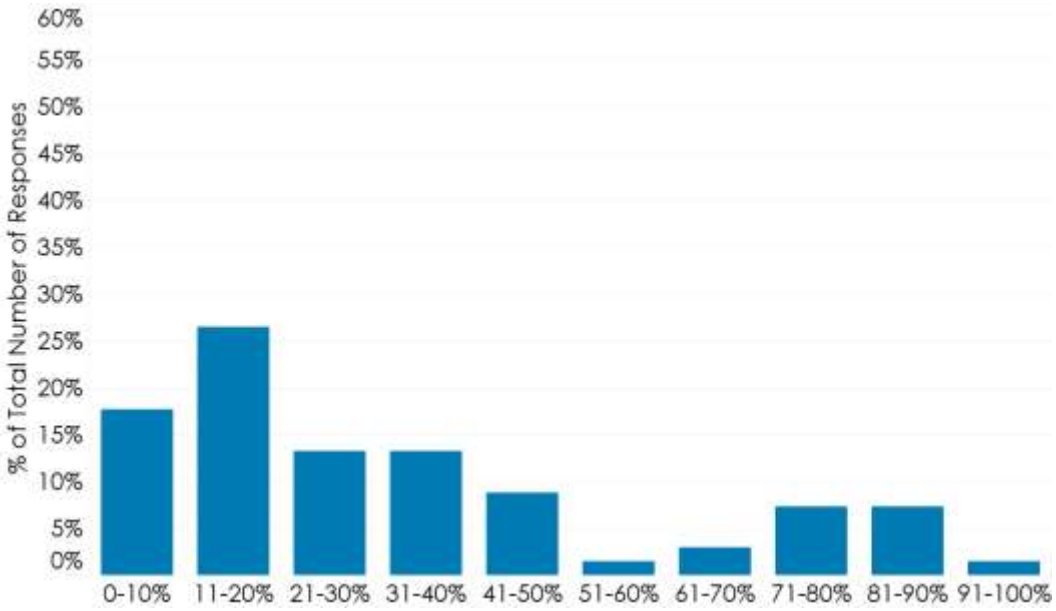
Percentage of Existing Building Permits for Window Replacements

8. **Of the annual existing building permits, in your best estimation, what percentage involve lighting alterations?**



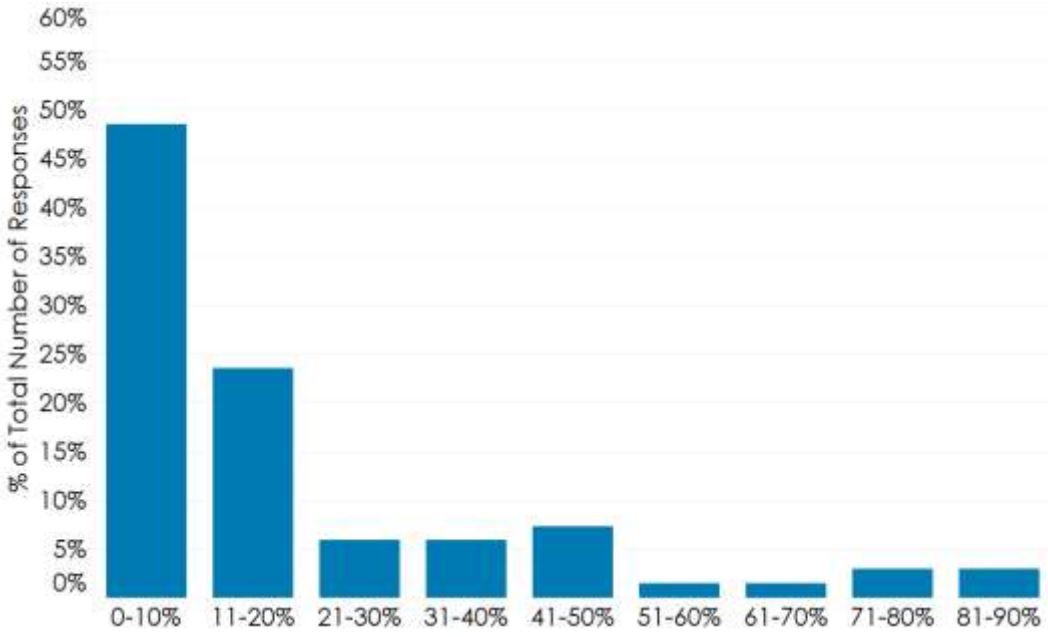
Percentage of Existing Building Permits for Lighting Modifications

9. **Of the annual existing building permits, in your best estimation, what percentage involve HVAC alterations?**



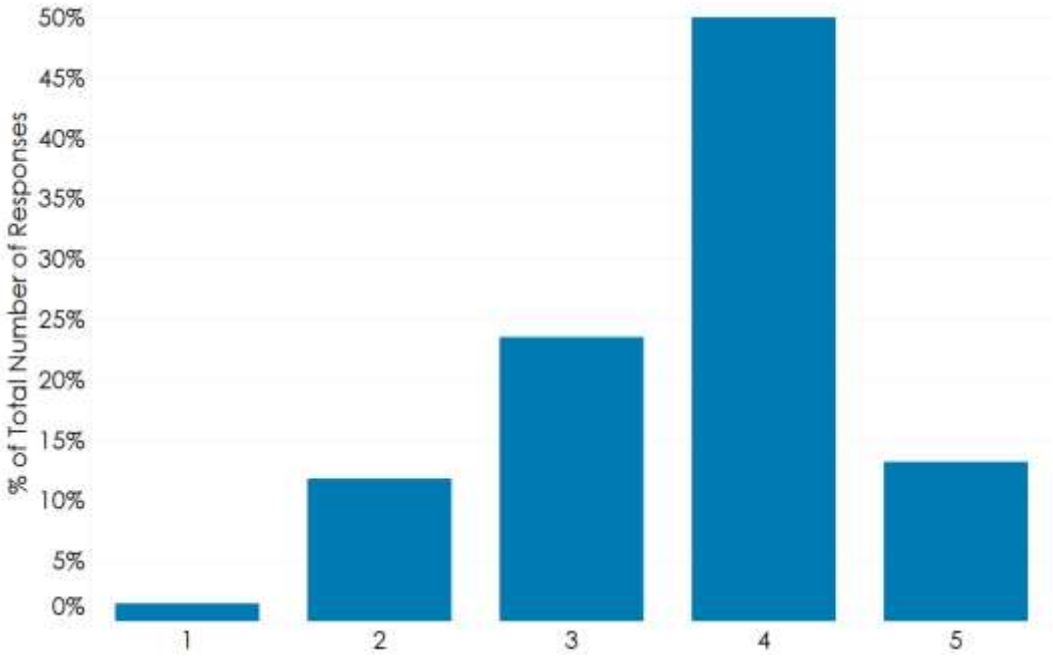
Percentage of Existing Building Permits for HVAC Alterations

10. **Of the annual existing building permits, in your best estimation, what percentage involve other/not listed modifications?**



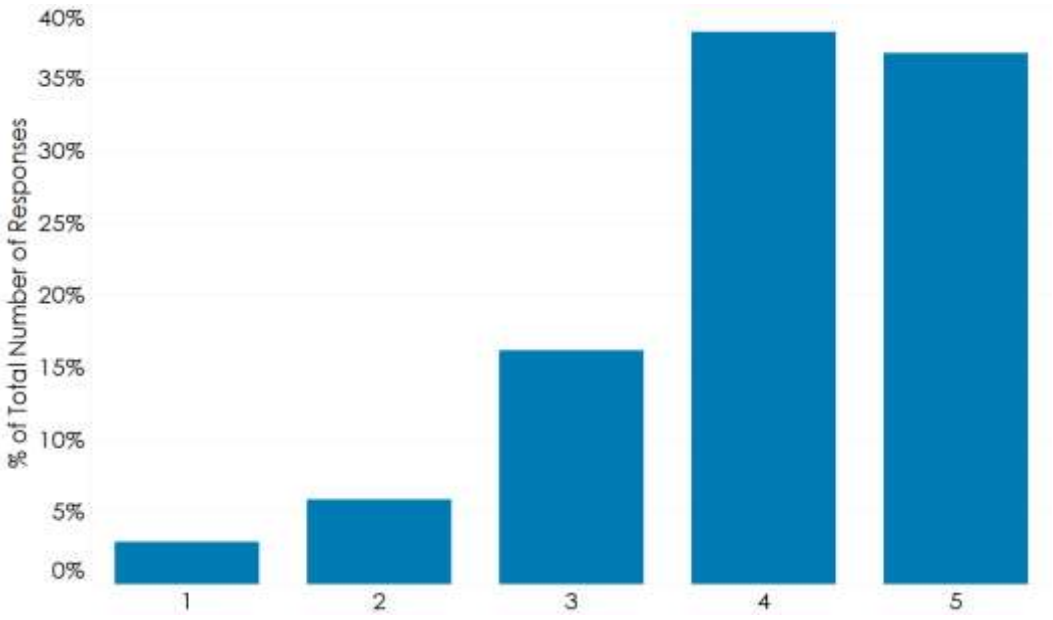
Percentage of Existing Building Permits for Not Listed Projects

11. **What is your level of understanding of energy code requirements for alterations in commercial buildings? Please rate on a scale 1-5, with 1 being not familiar at all and 5 being deep understanding**



Understanding of Energy Code

12. **In your opinion, how important is it to enforce energy code requirements for alterations in commercial buildings? Please rate on a scale from 1-5, with 1 being not important at all and 5 extremely important**



Importance of Enforcing the Energy Code

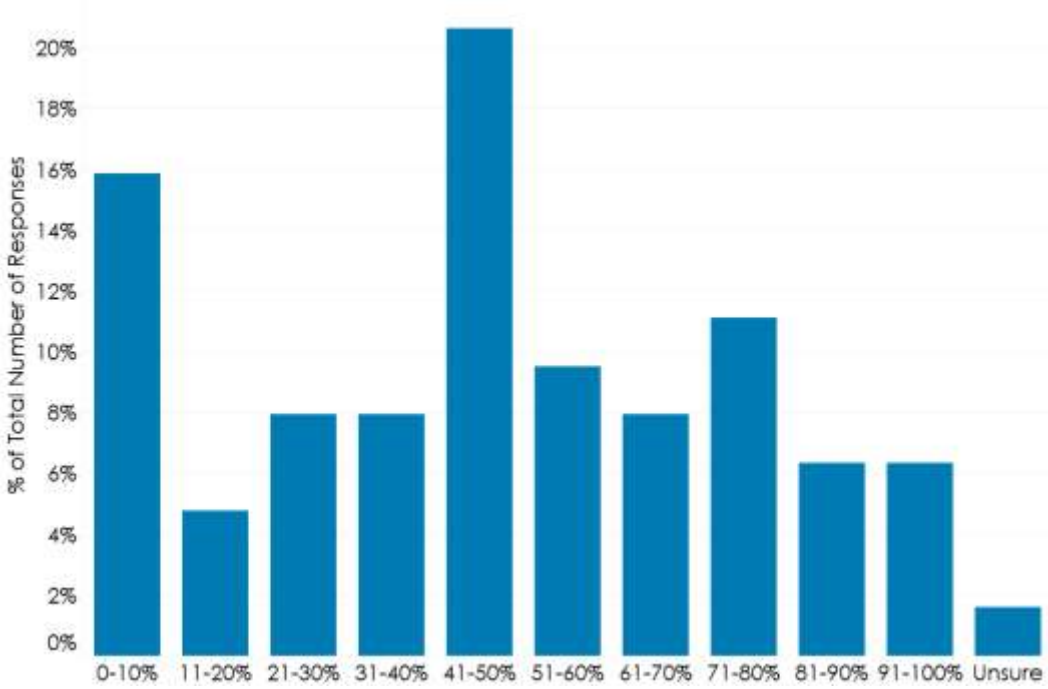
Appendix II – Building Components in Commercial Alterations

13. Do you require permits for…?

Project Type	Requires Permits	Does not Require Permits
Roof Alterations	94.12%	5.88%
Exterior Wall Modifications	97.01%	2.99%
Window Alterations	82.26%	17.74%
Lighting Alterations	80.33%	19.67%
HVAC Alterations	86.44%	13.56%

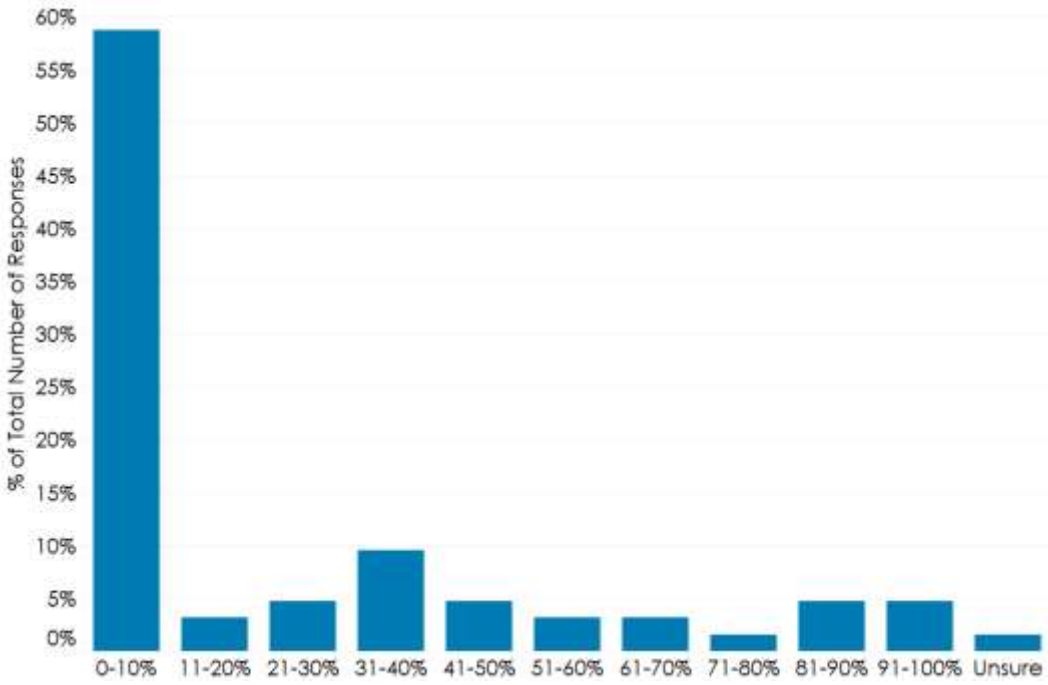
Table 1: Table depicting the percentage of reporting code officials that require permits for listed project types

14. What percentage of roof alteration projects need to increase the R-values or amount of insulation in order to meet energy code requirements?



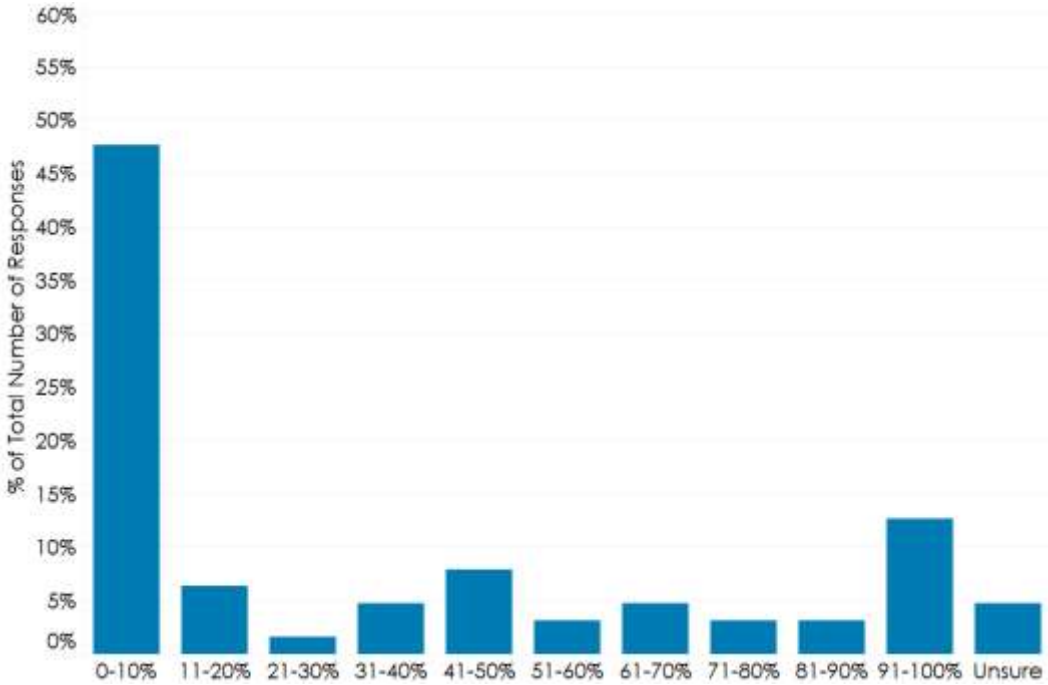
Percentage of Roof Alteration Projects that Require Increased Insulation

15. **Approximately what percentage of applicants altering roofs request an alternative method/variance to meet the energy code?**



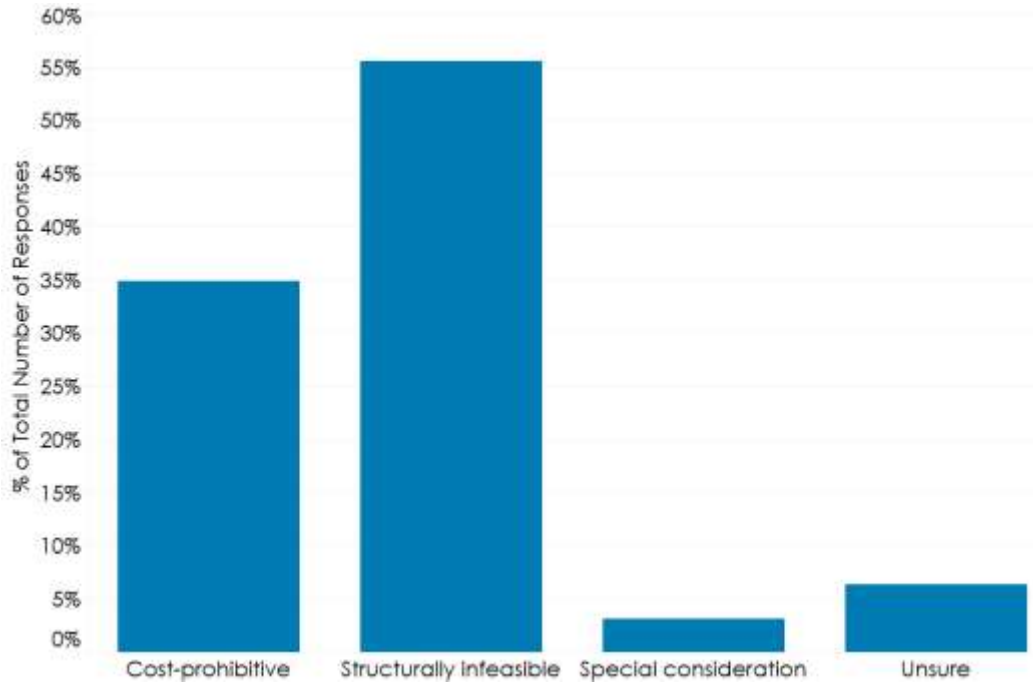
Percent of Roof Alteration Requesting Alternative Method/Variance

16. **Of those applications for an alternative method/variance from energy code requirements in roof alterations, what percentage are granted?**



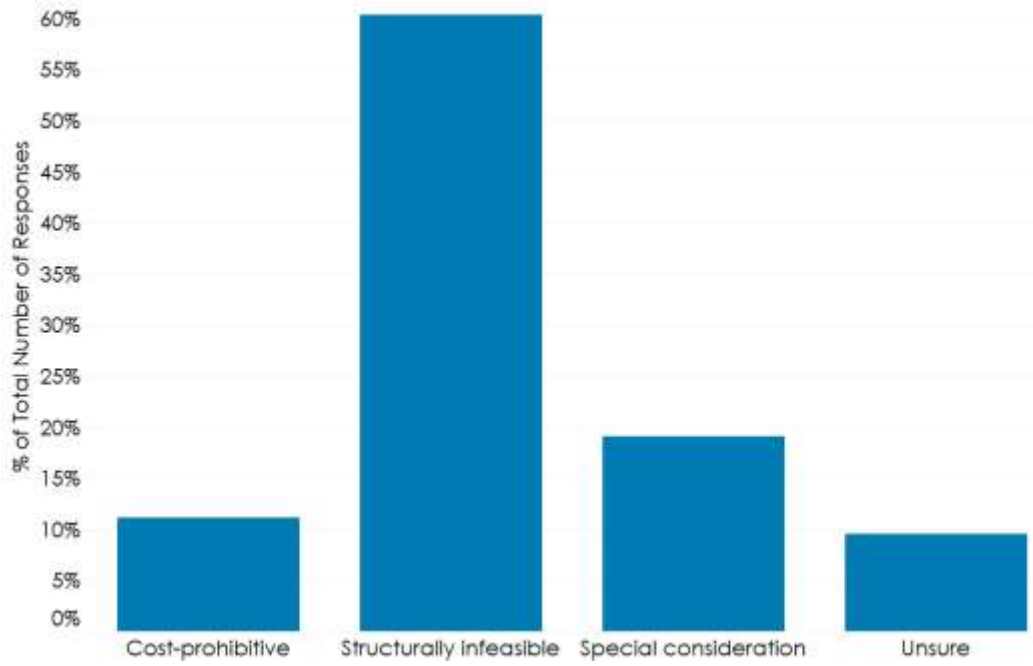
Percent of Roof Alteration Granted Alternative Method/Variance

17. **What was the primary reason given for requesting a roof alteration alternative method/variance?**



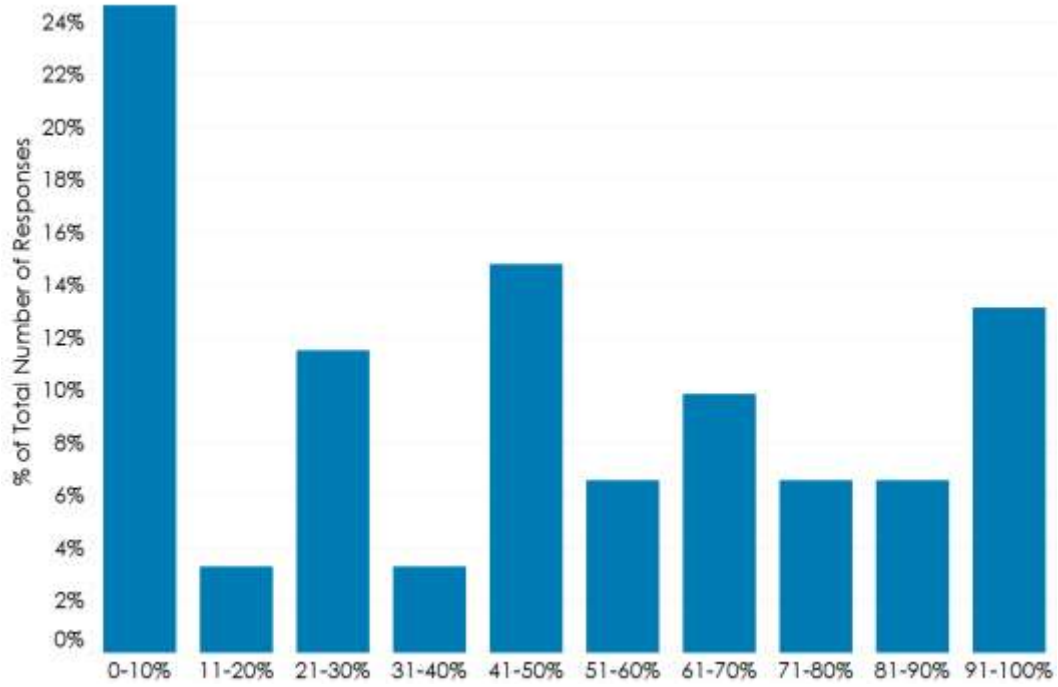
Reason Given for Alternative Method/Variance Request for Roof Alterations

18. **What was the primary reason given for granting a roof alteration alternative method/variance?**



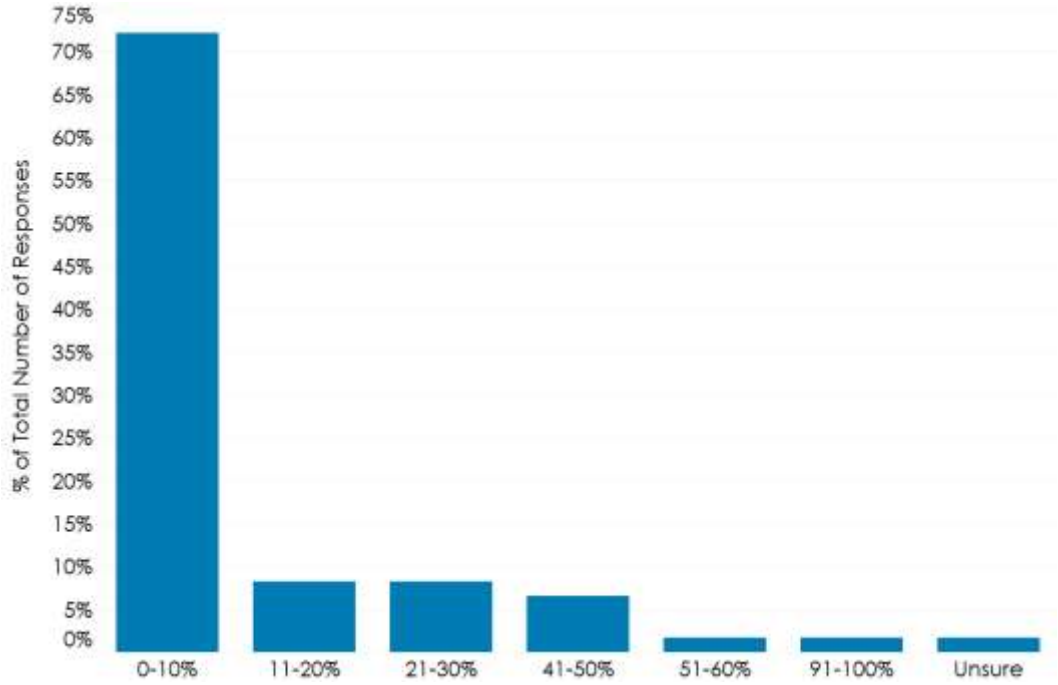
Reason for Granting Alternative Method/Variance Request for Roof Alterations

19. **What percentage of exterior wall alteration projects need to increase the R-value or amount of insulation in order to meet energy code requirements?**



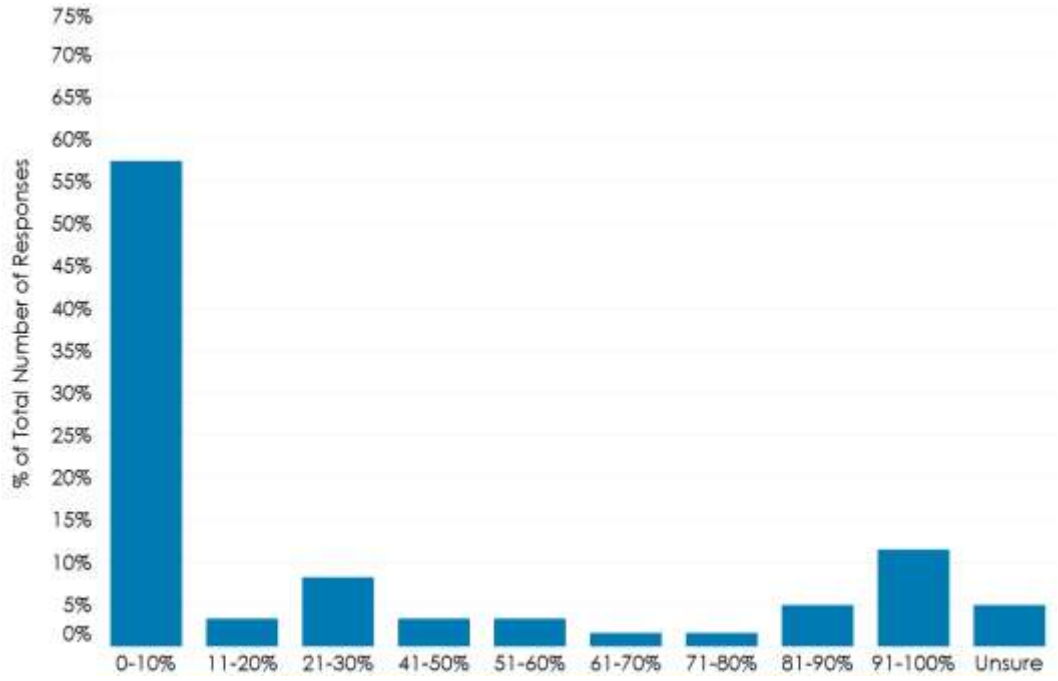
Percentage of Exterior Wall Alterations that Require Increased Insulation

20. **Approximately what percentage of applications altering exterior walls request an alternative method/variance to meet the energy code?**



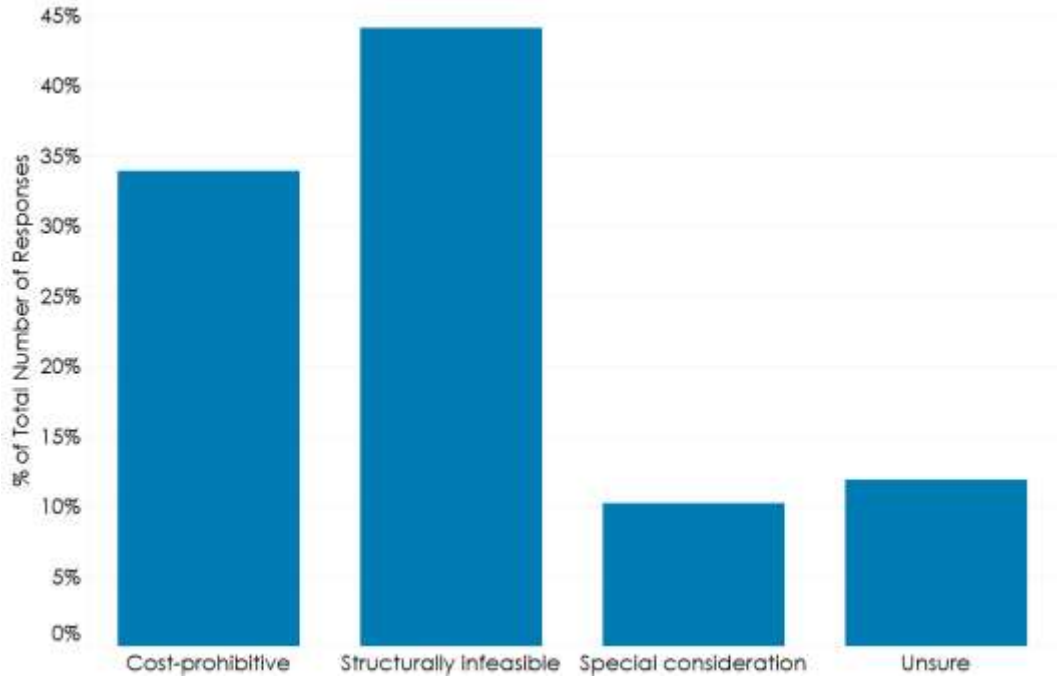
Percent of Exterior Wall Alterations Requesting Alternative Method/Variance

21. **Of those applications for an alternative method/variance from energy code requirements in exterior wall alterations, what percentage are granted?**



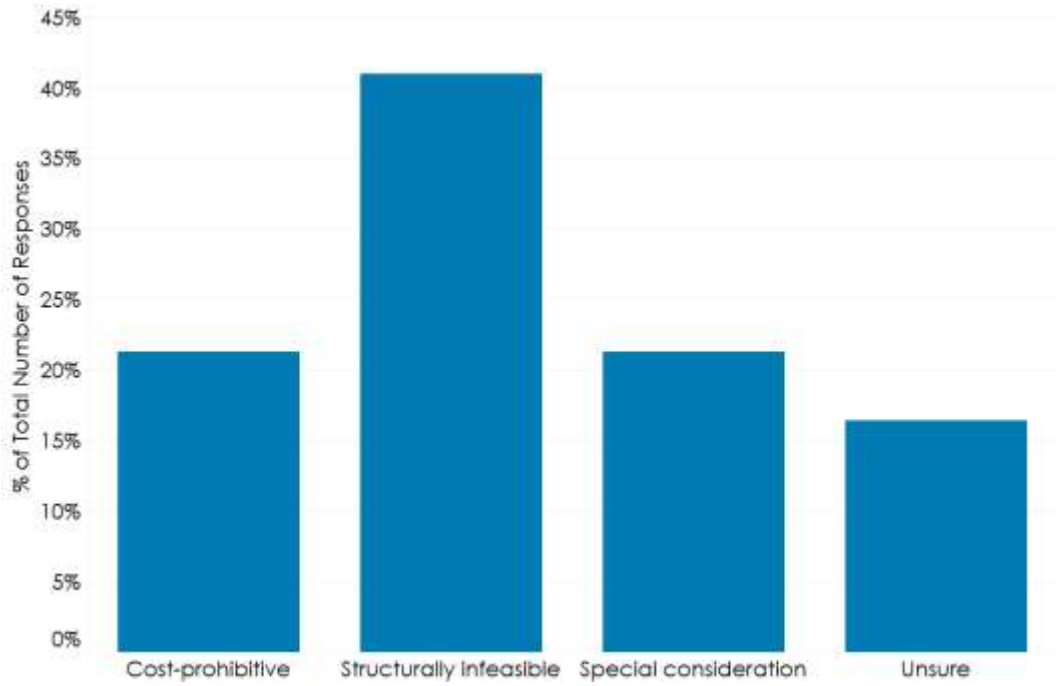
Percent of Exterior Wall Alterations Granted Alternative Method/Variance

22. **What was the primary reason given for requesting an exterior wall alteration alternative method/variance?**



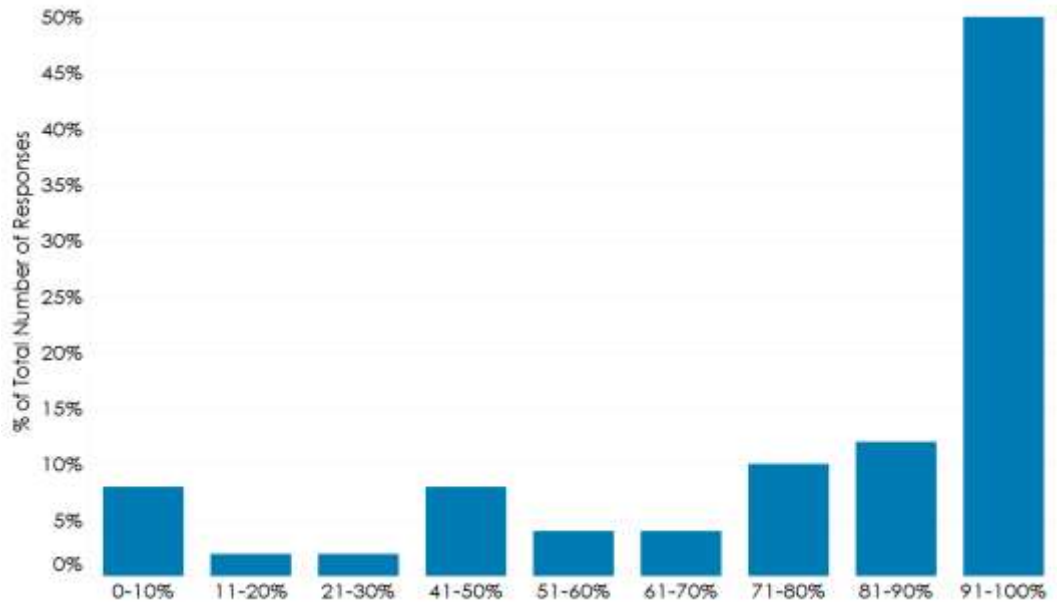
Reason Given for Alternative Method/Variance Request for Exterior Wall Alterations

23. What was the primary reason given for granting an exterior wall alteration alternative method/variance?



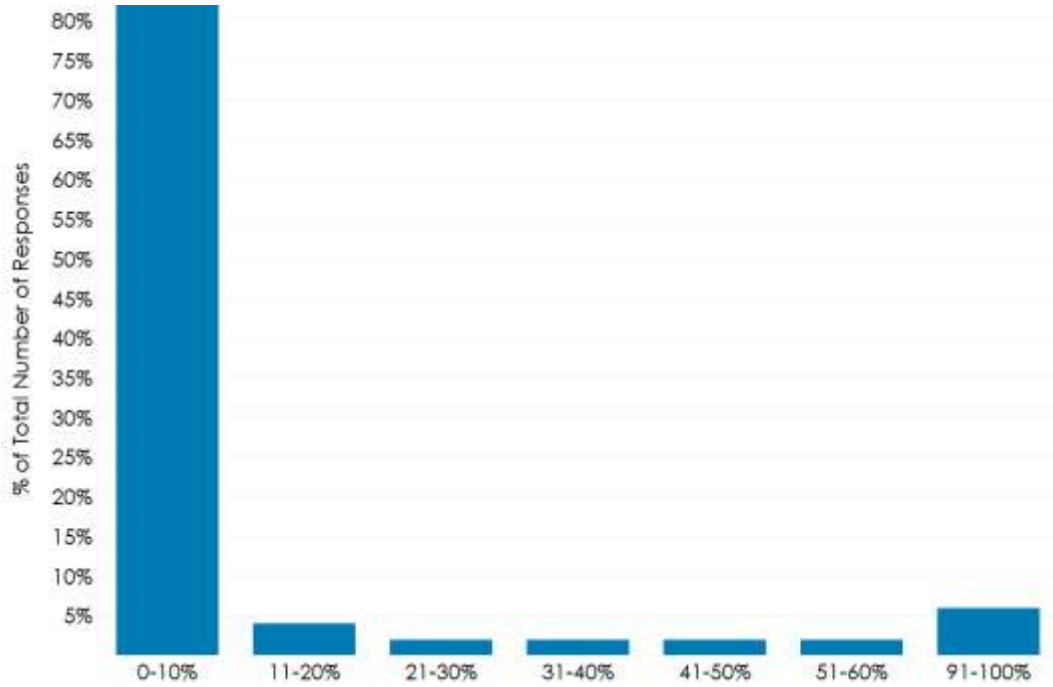
Reason for Granting Alternative Method/Variance Request for Exterior Wall Alterations

24. What percentage of window alteration projects need to increase the energy efficiency of the windows (lower U-value) in order to meet the energy code requirements?



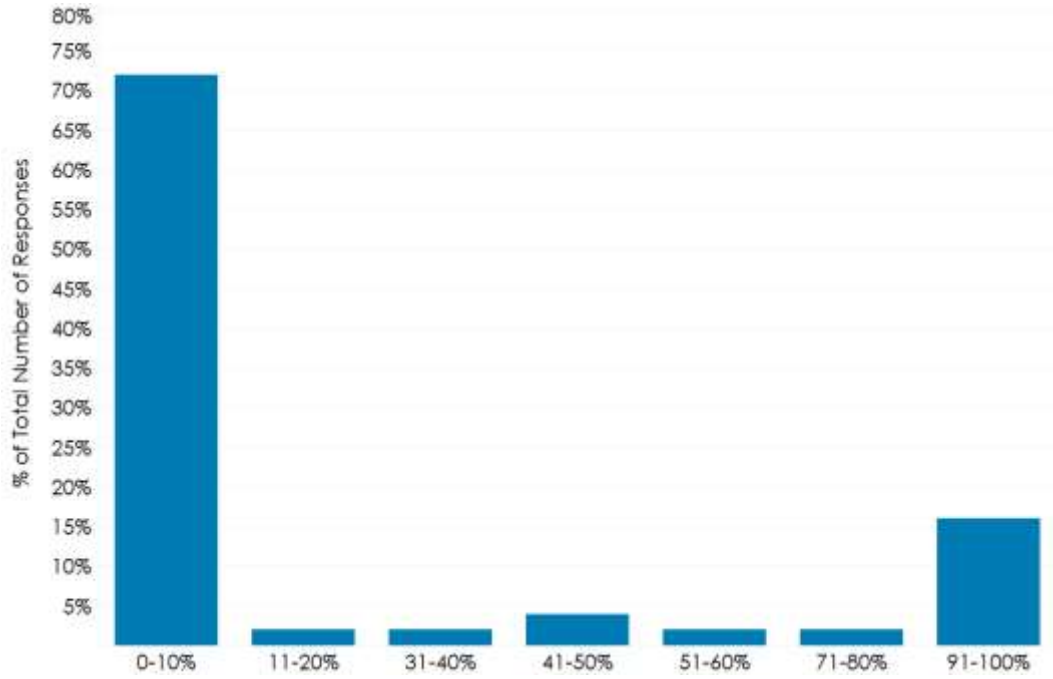
Percent of Window Alterations Requiring Increased Efficiency

25. **Approximately what percentage of applicants with window alteration projects request an alternative method/variance to meet the energy code?**



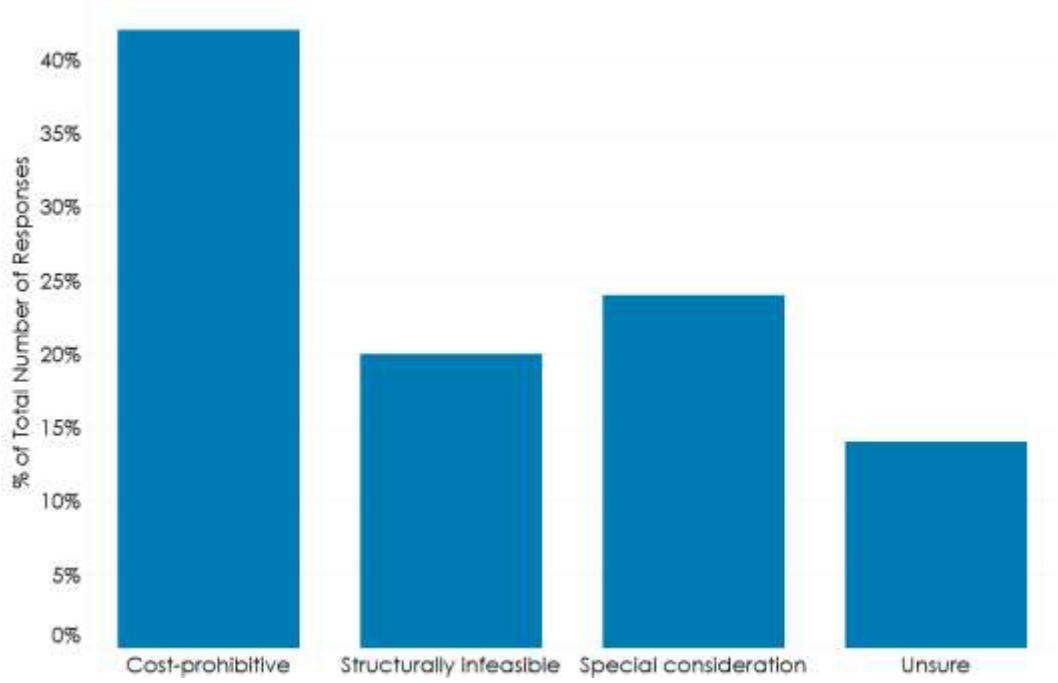
Percent of Window Alterations Requesting Alternative Method/Variance

26. **Of those applications for an alternative method/variance from energy code requirements in window alterations, what percentage are granted?**



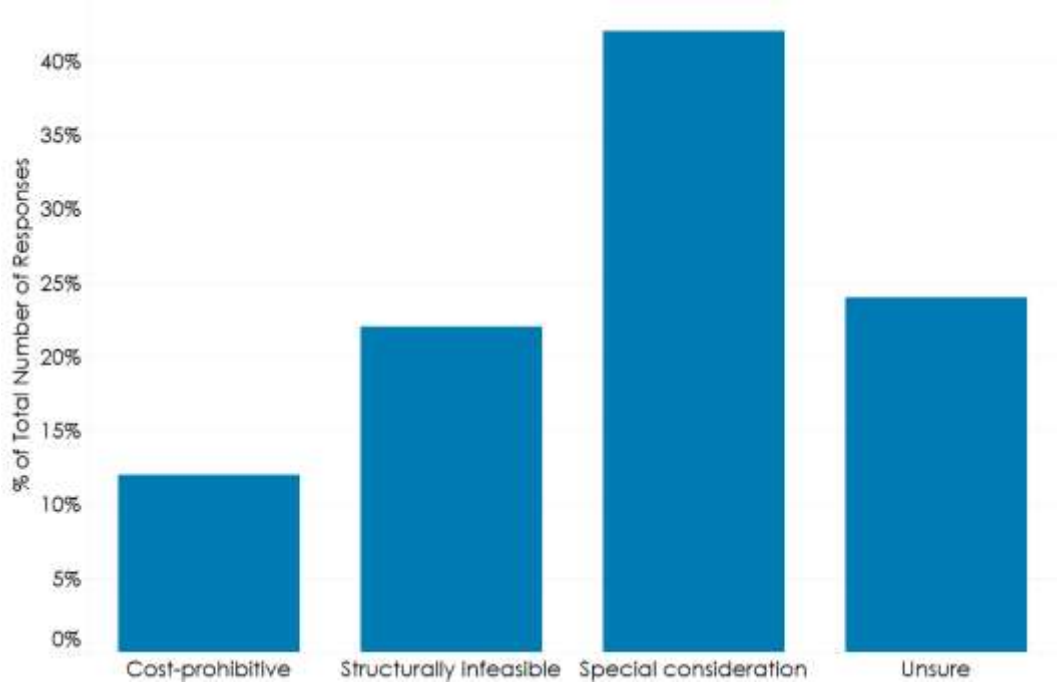
Percent of Window Alterations Granted Alternative Method/Variance

27. What was the primary reason given for requesting a window alteration alternative method/variance?



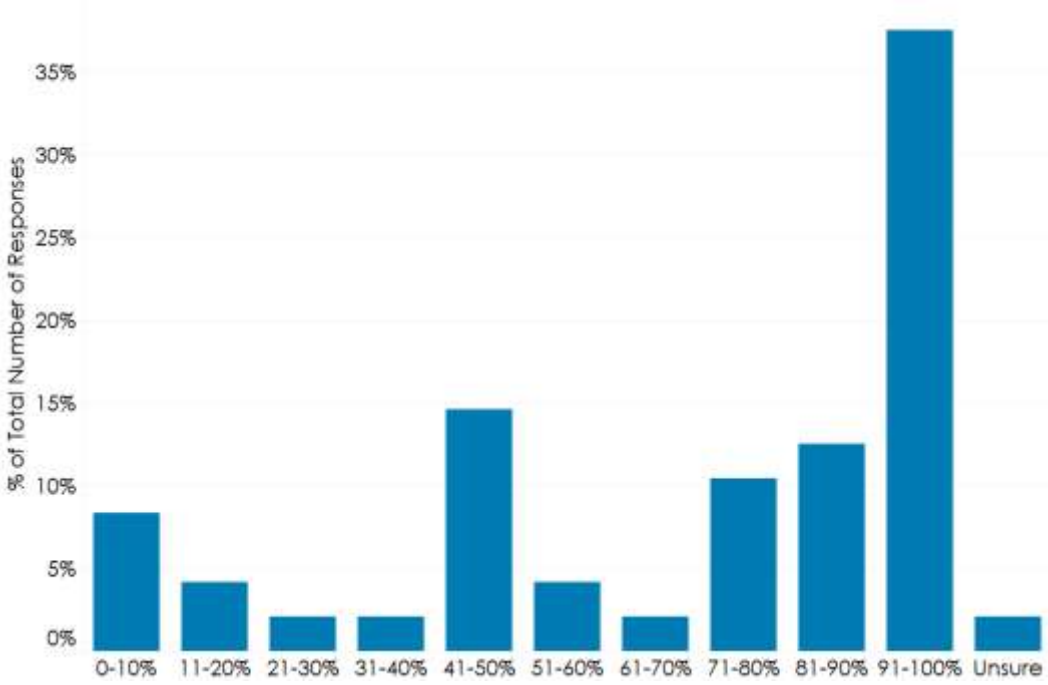
Reason Given for Alternative Method/Variance Request for Window Alterations

28. What was the primary reason given for granting a window alteration alternative method/variance?



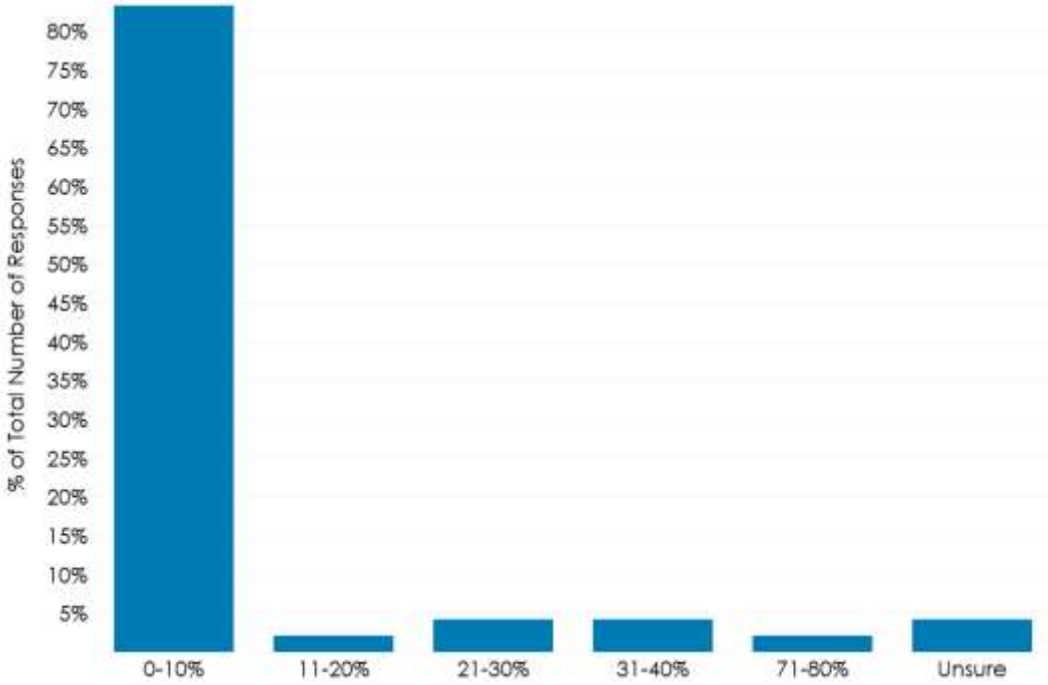
Reason for Granting Alternative Method/Variance Request for Window Alterations

29. **What percentage of lighting alteration projects need to increase the efficiency of lighting in order to meet the energy code requirements?**



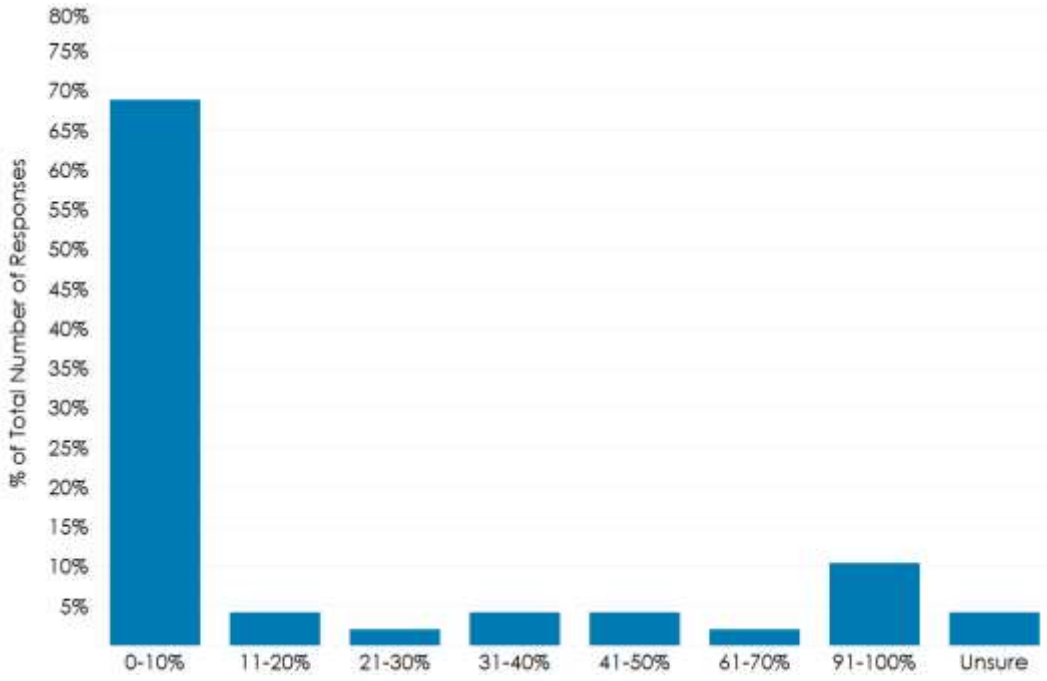
Percent of Lighting Alterations Requiring Increased Efficiency

30. **Approximately what percentage of applicants altering lighting request an alternative method/variance to meet the energy code?**



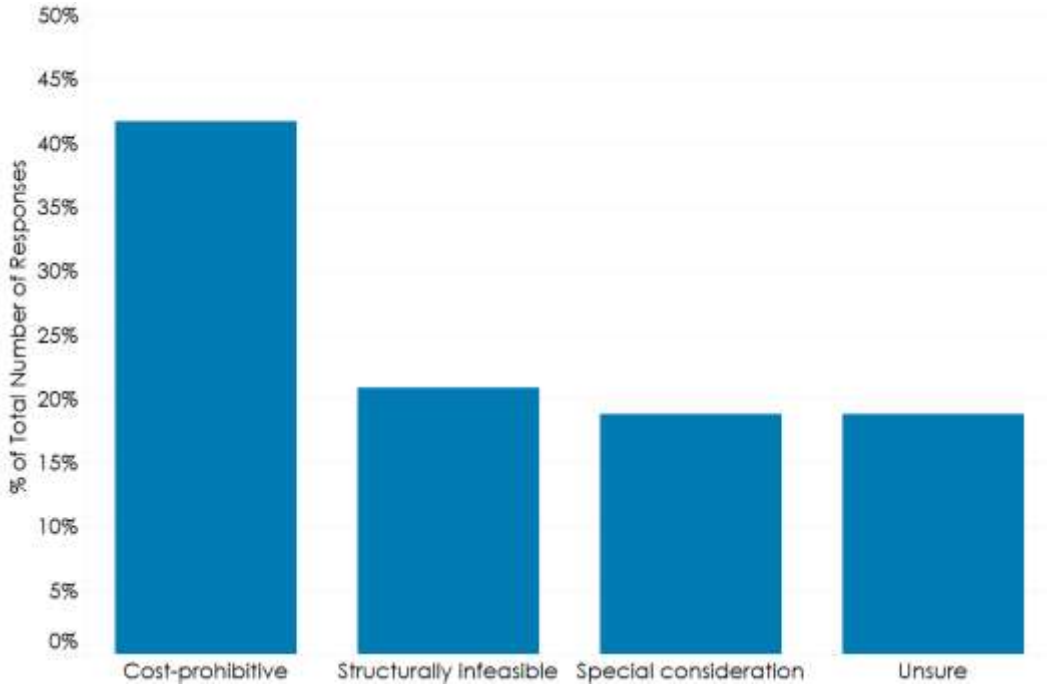
Percent of Lighting Alterations Requesting Alternative Method/Variance

31. Of those applications for an alternative method/variance from energy code requirements in lighting alterations, what percentage are granted?



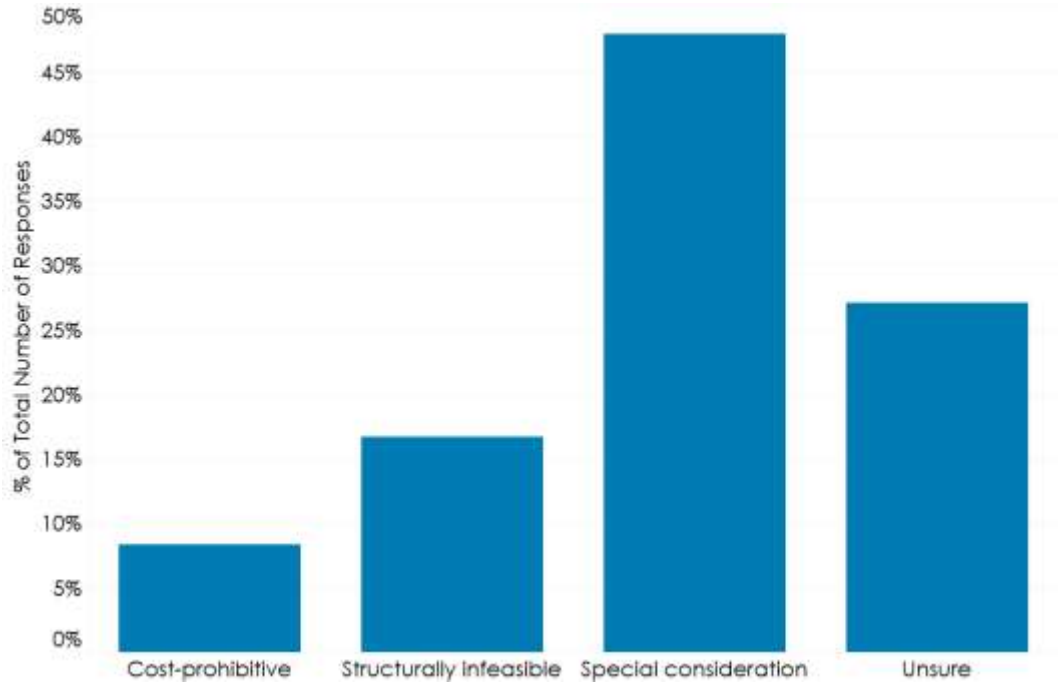
Percent of Lighting Alterations Granted Alternative Method/Variance

32. What was the primary reason given for requesting a lighting alteration alternative method/variance?



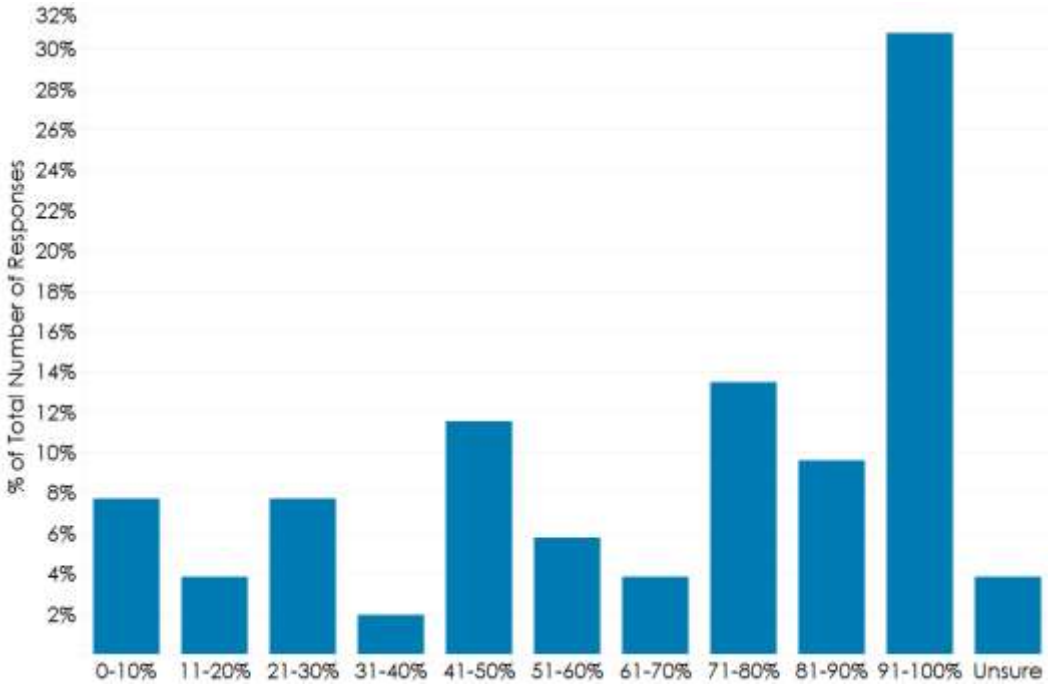
Reason Given for Alternative Method/Variance Request for Lighting Alterations

33. What was the primary reason given for granting a lighting alteration alternative method/variance?



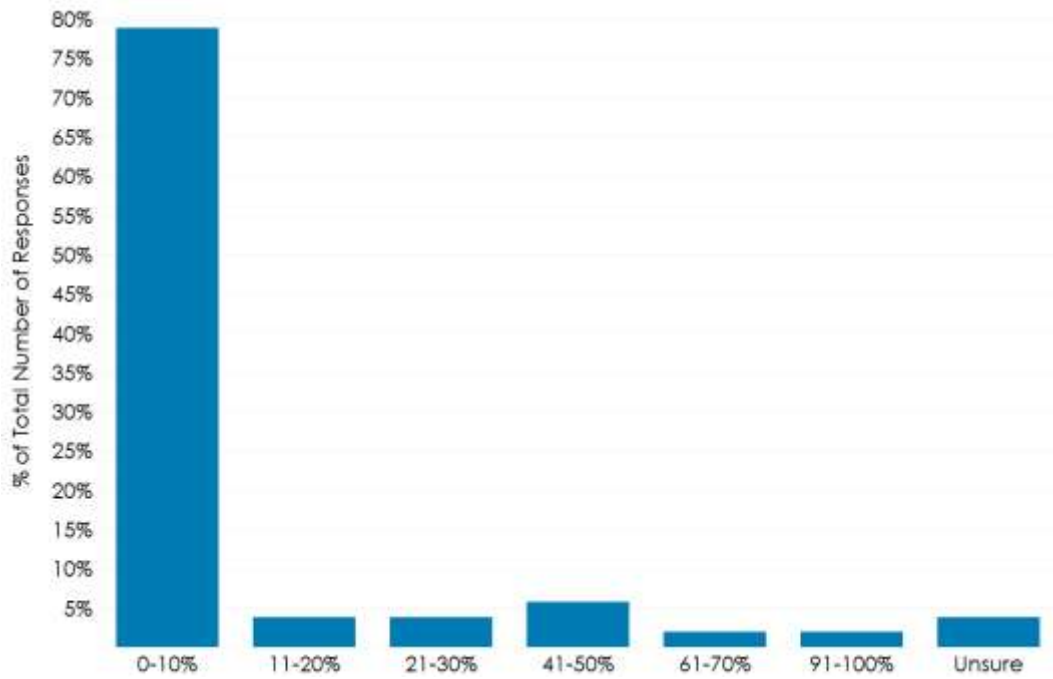
Reason for Granting Alternative Method/Variance Request for Lighting Alterations

34. What percentage of permits that involve altering an existing HVAC system require equipment or materials to be improved in order to meet energy code requirements?



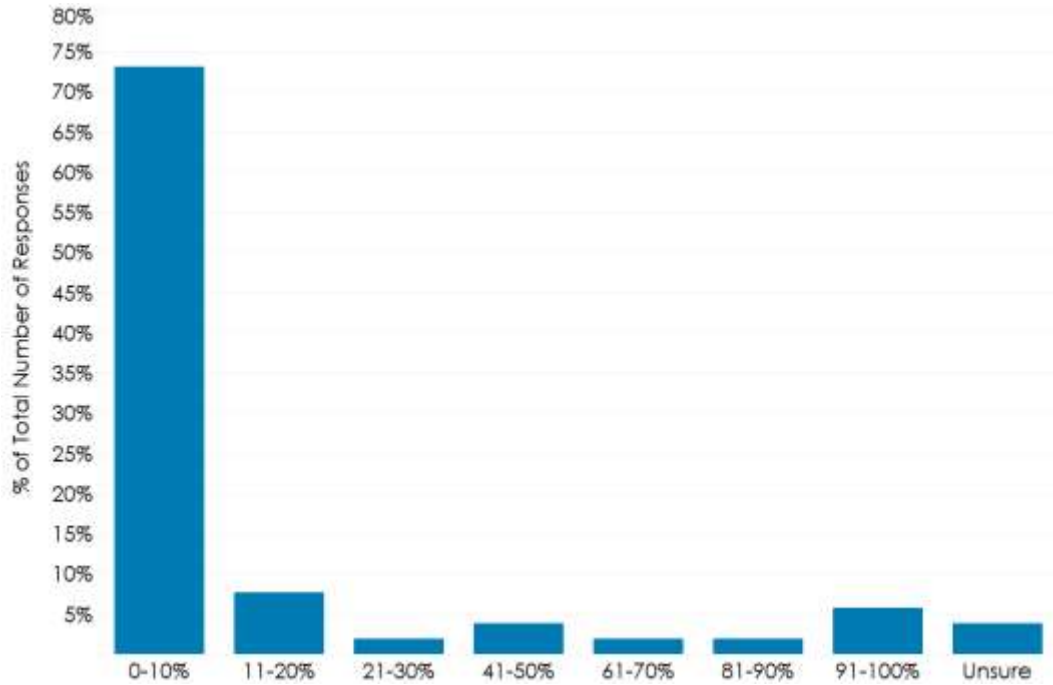
Percent of HVAC Alterations Requiring Increased Efficiency

35. **Approximately what percentage of applicants request an alternative method/variance when altering an existing HVAC system?**



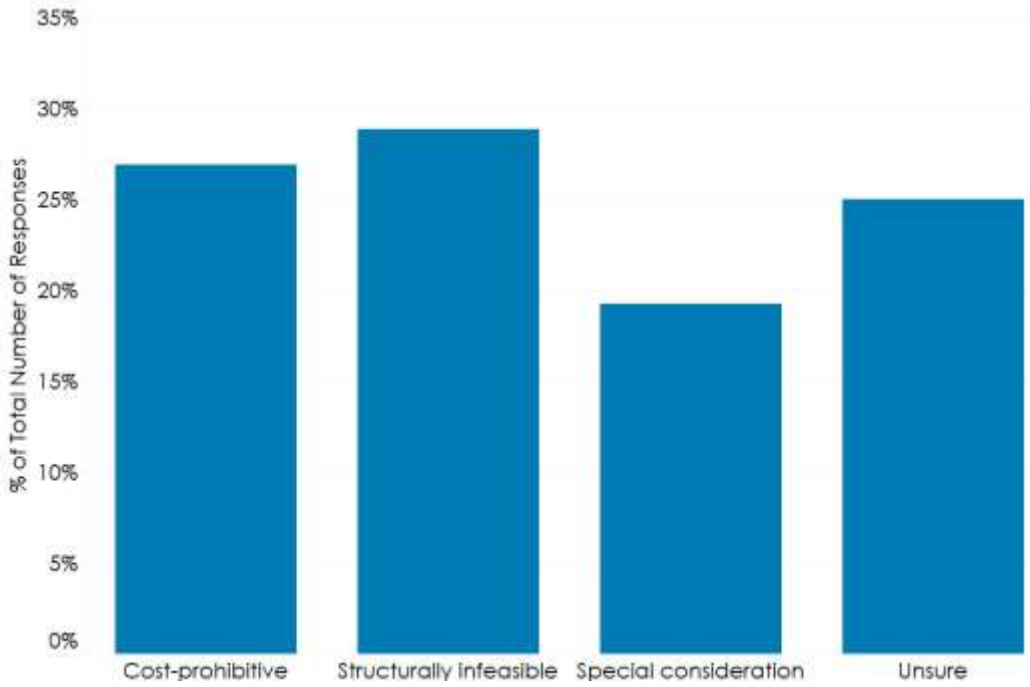
Percent of HVAC Alterations Requesting Alternative Method/Variance

36. **Of those applications for an alternative method/variance when altering an existing HVAC system, what percentage are granted?**



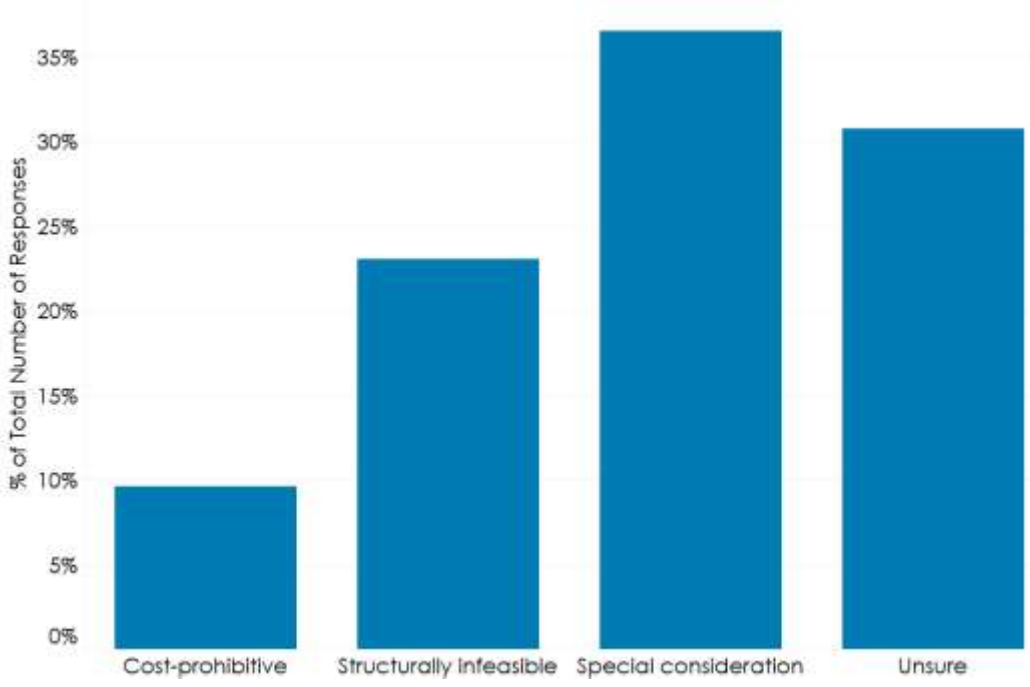
Percent of HVAC Alterations Granted Alternative Method/Variance

37. What was the primary reason given for requesting an HVAC alteration alternative method/variance?



Reason Given for Alternative Method/Variance Request for HVAC Alterations

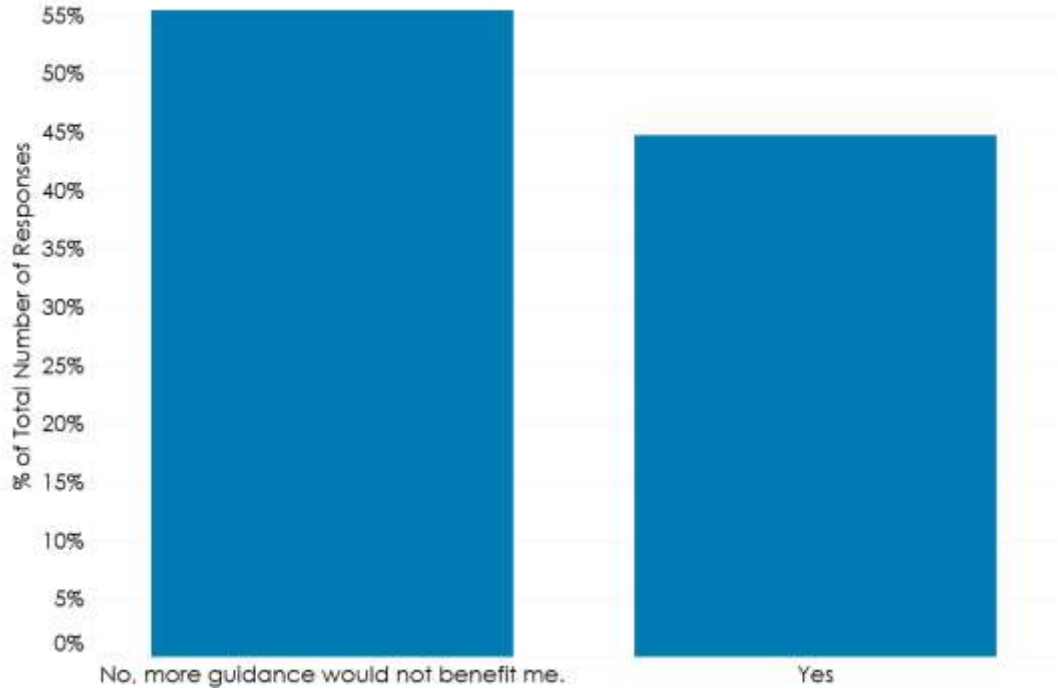
38. What was the primary reason given for granting an HVAC alteration alternative method/variance?



Reason for Granting Alternative Method/Variance Request for HVAC Alterations

Appendix III – Tools and Guidance for Understanding and Applying the Energy Code

39. **Would having more guidance about when alternative methods/variances are warranted in relation to energy codes and existing buildings be beneficial to you?**

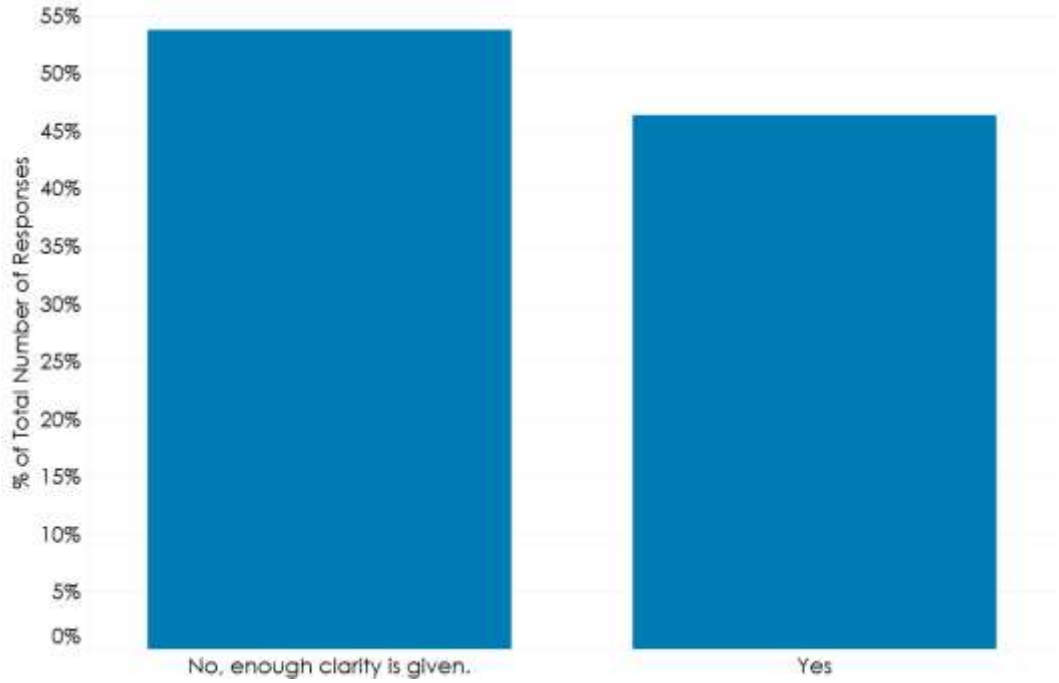


Yes. This is the type of guidance that would be helpful (please specify):

Provide more exceptions from questions that are submitted to the state.
More clarity or better commentary
More info is helpful
Provide written guides
Any help is appreciated
Exterior wall compliance
Specific parameters of what and when is acceptable
Guidance on the multiple paths allowed for conformance
Details of equivalencies would be helpful
Clarity
Roof R-value upgrade
Any additional information is helpful.
Insulation requirements for existing conditions.
Easier to explain to applicants and government officials
Provide common solutions to specific problems encountered.

Will it be standardized in future publications/adoptions of the IECC
Options for special situations
I want more training.
Classes/ forums
More Training
Examples of alternative methods and variances allowed in other jurisdictions.
Good interpretations
Uniform enforcement

40. **Should more clarity about when alternate methods/variances are warranted for existing buildings be written into the energy code or code commentary?**

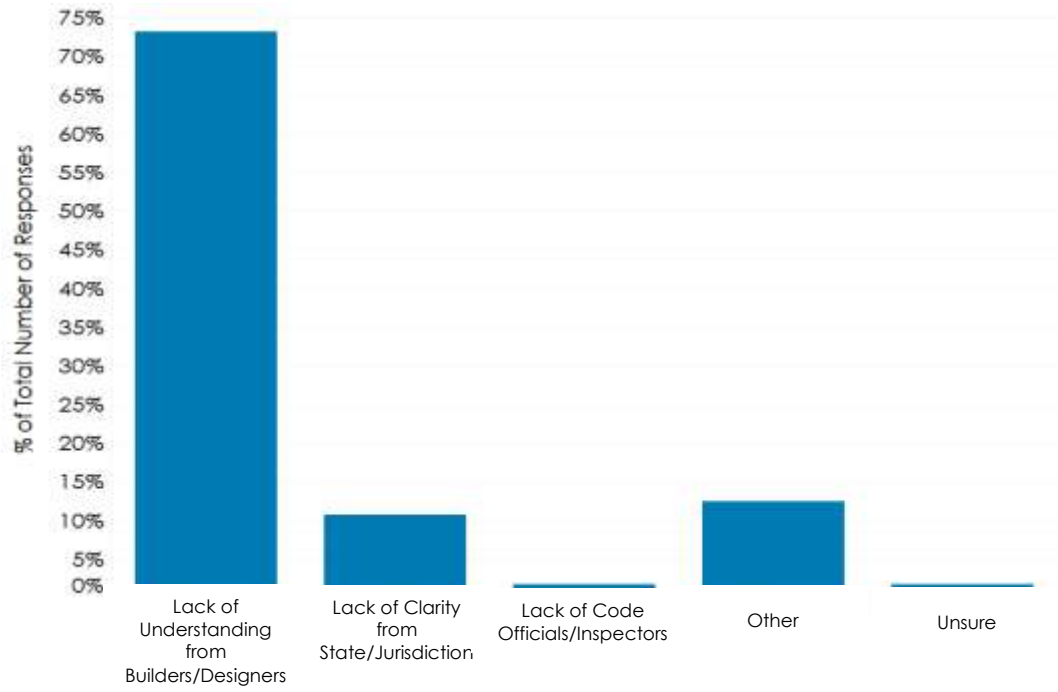


Yes. More clarity should be provided because…

Provide examples of granted variances.
More clarity or better commentary
More info is helpful
Provide written guides
More clarity is always good
Should specify alternative methods like rem rate/com check
Depends on clarity offered for #23
Guidance on multiple paths allowed for conformance
Details of equivalencies would be helpful
All aspects
Additional clarity should be added to commentary. For example, existing homes sometime have furring strips fastened to masonry. Per existing code, only enough insulation to fill cavity is required, which in this case is only 1".
Examples of accepted code variances would be helpful
Easier to make applicants understand the requirements
Being part of the code/amendment helps to enforce between jurisdictions-continuity
Current code is very open ended
I want more training.
The code does not do a good job explaining real life scenarios

Additional information helps.
More Training
List of the types of alternative methods.
Good interpretations
It's complicated

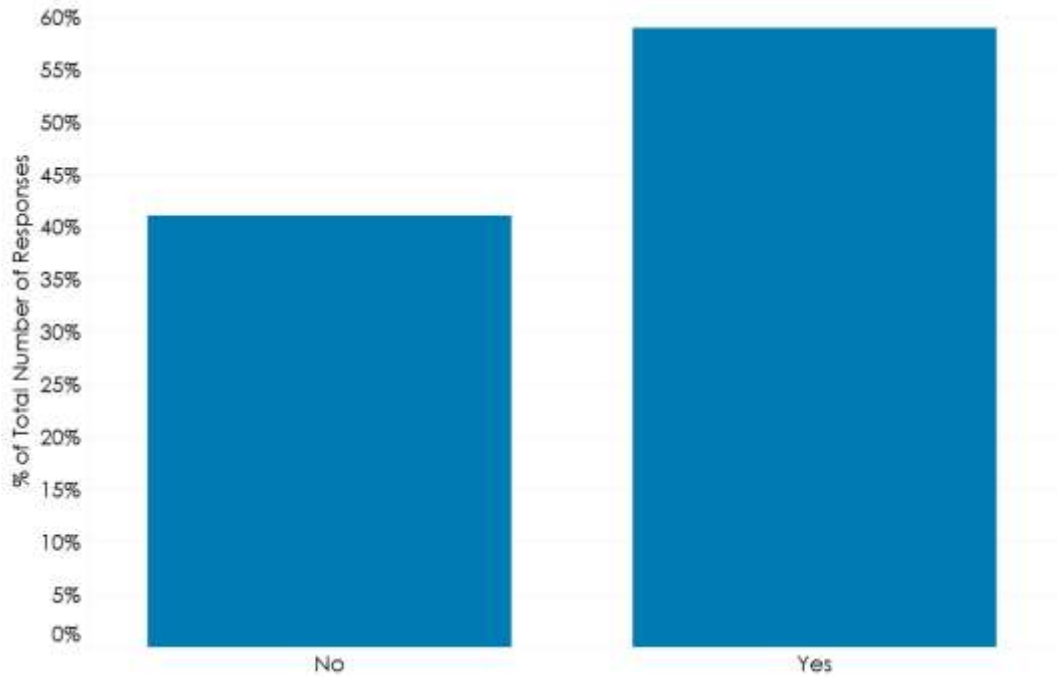
41. **What do you see as the biggest issue when enforcing the commercial energy code in existing buildings?**



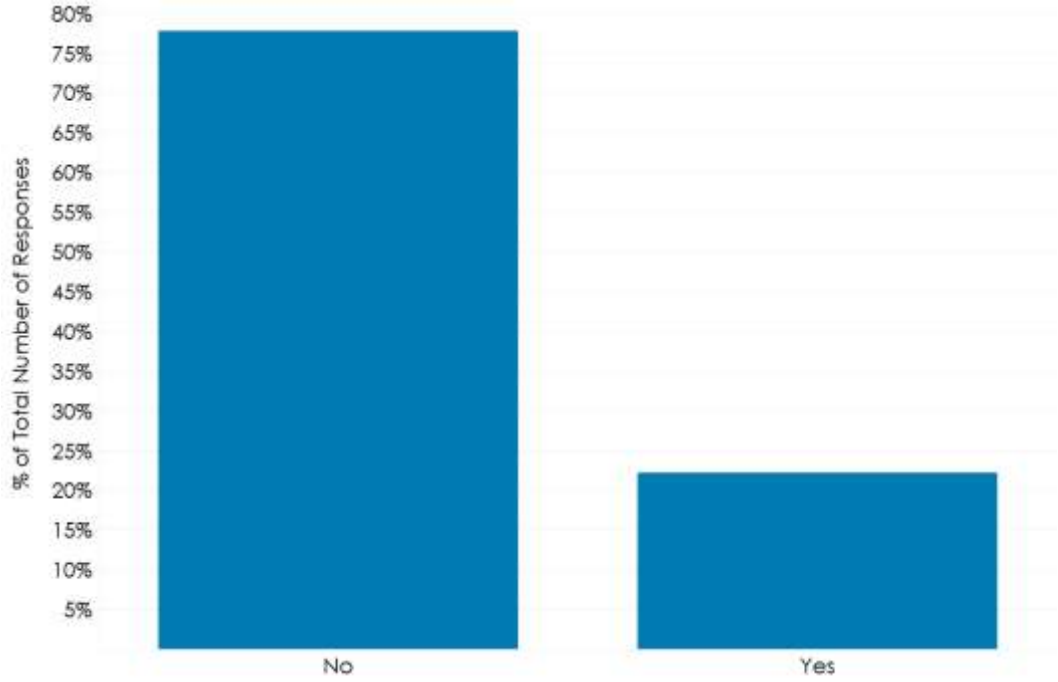
Other:

All of the above would apply in some way
No data on existing building
Behavior modification of an aging workforce
Lack of understanding by code officials/inspectors & builders/designers as well as lack of enforcement from one AHJ to another
Unwillingness for building owners to spend the money
People just don't have the money to meet the higher standard
Overreaches local government's purpose of protecting safety, health and general welfare.

42. **Would you be interested in receiving ICC certified training on energy code compliance in existing buildings?**



43. **Would you be interested in participating in a collaborative group to discuss the issues you face with energy code compliance in existing buildings?**



44. **Do you have additional thoughts or feedback about energy codes and commercial building alterations?**

In lieu of or in addition to unsure box one should be for complied with the Code, or a comment of a similar nature.
The enforcement of codes, especially energy codes have become very complex and may not apply to each situation that is presented in existing building environments.
Guidance with the residential requirements would also be helpful.
When a built-up roof is being upgraded and the HVAC roof-top units are not, there is guidance needed on the requirement to install deeper support curbs at the unit to accommodate the increased depth of the insulation.
Forced to select "Unsure" (closest choice) when the real answer was we haven't yet felt justified granting request to waive code requirements
If every Jurisdiction did an accurate and consistent job enforcing the Energy Code as written, then the Architects and Builders would learn to comply with the code. As it is right now, I get builders who say, "every town is different. What's it in your town?"
Additional training for my inspectors and for local contractors (both residential and commercial) would be GREATLY helpful.
Lets all get on the same page and educate the construction industry
I think the biggest challenge with energy codes is addressing existing conditions in a practical yet conscientious manner that meets the intent of the code.
Politically charged topic. We enforce. Most adjacent jurisdictions do not. This has nothing to do with protection of life, limb, or property.
Existing Commercial Buildings seem to be the largest area where enforcing code compliance is lacking. More & more buildings are being renovated rather than torn down for new. Energy training specifically designed to address use types, multi-level, stand alone, historic, change of use--all regarding existing structures would be tremendous. I think separating code officials/inspectors from architects, design engineers, builders may also be highly valuable when instructing these specially designed training classes. Thank you
I look forward to additional training when offered or available on the energy code.