ALKIRE, JENNIE G., M.S. Replacement Windows in Historic Houses: A Study of the College Hill Historic District in Greensboro, North Carolina. (2008)
Directed by Professor Jo Ramsay Leimenstoll. 80 pp.

The purpose of this study is to contribute to the current body of information about the use of replacement windows in historic buildings by providing data on the frequency of window replacement and lifespan within a residential historic district. College Hill Historic District, the first designated district, and the oldest of the three such districts in Greensboro, North Carolina, provided the data set for this research. This Historic District has 28 years of records since its inception, in 1980, and therefore a significant depth of information was gleaned from the minutes and files that are maintained by the City of Greensboro Historic District Commission. Furthermore, it was listed on the National Register of Historic Places in 1993, which provided background information about the architectural characteristics of the neighborhood. The researcher developed an Excel spreadsheet to collect, sort, and analyze the data; delineating between contributing dwellings and non-contributing single-family residence dwellings, and the Housing and Community Development purchased houses, as the control group. Primary information noted if, when, and where approval for Certificate of Appropriateness' for window replacements were granted, including any additional replacements. The data revealed that the majority of the windows, nearly 85%, were retained over the 28-year time-frame. The research also revealed patterns indicating learned cluster behavior in replacing windows; and that suggests that age and architectural style may be influencing factors.

REPLACEMENT WINDOWS IN HISTORIC HOUSES: A STUDY OF THE COLLEGE HILL HISTORIC DISTRICT IN GREENSBORO, NORTH CAROLINA

by

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A Thesis Submitted to
The Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirement for the Degree
Master of Science

Greensboro
2008

Approved by

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APPROVAL PAGE

This thesis has been approved by the following committee of the Faculty of The Graduate School at the University of North Carolina at Greensboro.

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ACKNOWLEDGEMENTS

I wish to express my appreciation for the help that I have received as I worked to complete this thesis. Professor Jo Ramsay Leimenstoll, chair of my committee, was steadfast in her commitment to steering my work to its completion. Dr. Keith Debbage and Assistant Professor Robert Charest, fellow members of my committee, each contributed encouragement and insight for the research, and its relevancy, in the finished product.

The data collection for this study could not have happened without the knowledge, assistance, and patience of Mr. Mike Cowhig, Community Planner, and Ms. Stefan-Leih Geary, Preservation Planner within the Department of Housing and Community Development at the City of Greensboro, North Carolina. They, and the staff at City Hall, were helpful and courteous in their support of the research carried out amidst their busy days. I also want to thank Dr. Kenneth J. Gruber, Research and Statistical Services Coordinator at the University of North Carolina at Greensboro. His assistance and encouragement has been deeply appreciated.

My son, daughter, and friends, especially Debra McCahan have encouraged me and supported me as I worked to complete each step of this work. My gratitude to you all, thank you.

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CHAPTER I

INTRODUCTION

This research was conducted to provide a contribution to the ongoing replacement window debate in the field of Historic Preservation. The intent behind this research is that, by providing data on the frequency of replacement and the lifespan of replacement windows, more informed decisions can be made by those within the field and those with whom preservationists communicate. The goal is to provide an analysis of this case study, selected based on its relevancy in this aspect of historic preservation. Research has been conducted in an attempt to map the reliability of the units over the anticipated length of service; contrasting replacement windows data with data collected on the surviving original wooden windows in a designated historic district in Greensboro, North Carolina.

In traditional historic buildings, windows make up less of the overall skin of the building, than in some more modern buildings, where windows may be the fabric of an entire wall. However, windows, which are still a significant percentage of a building's exterior fabric even in historic buildings, contribute significantly to the authenticity of the original building. Even so, windows are a frequent topic among historic homeowners interested in energy efficiency and conservation. Tremblay and Sims argued that the since architectural elements, such as windows, were originally joined, the discussions which present options for replacing windows seem counterintuitive and unnecessary, at best (1997, p. III-14). Others, such as Sedovic and Gotthelf, have likened the discussion

on replacing windows to a discussion on how to restore an antique automobile; questioning the likelihood of anyone entertaining the idea of using alternative, non-original type materials (2005, p. 29).

However, the pressures of modern economics cannot help but factor into the decision-making process for those who occupy the dwellings in an historic district. Seeking perceived energy savings, some owners argue for the practice of replacing windows with their local historic commissions; evidenced by the debates which the homeowner and commissioners engaged in discussing the issue of energy-efficient replacements in the minutes of the Historic Commission meetings, utilized by this researcher for this study. Windows are frequently targeted for replacement in older and historic homes, even though there are a variety of materials available to restore even the most dilapidated sash or frame; the variety of which is not important to this research. While the field of preservation has a longstanding edict of replacing the historic fabric of a building as a last resort, current public perception of realizing energy savings through modern replacements presents a difficult position for local preservation commissioners. Arguments for replacement center around perceived savings delivered through utilizing modern technologies to control costly unwanted air exchange. This is not necessarily true, as Sedovic and Gotthelf (2005) point out, “empirical knowledge based on field experience covering a wide variety of window types suggests that restoration is on a par, cost-wise, with a middle-of-the-road replacement (p. 29).” General economic discussions on original windows versus replacement windows frequently fail to discern the quality of replacement being referenced, as that statement highlights.

Sustainability is an increasingly important issue in the professional field of historic preservation, and in the non-professional arena, as evidenced by the plethora of published works in the consumer-oriented magazines in the field. Notwithstanding the abundant press that the preservation field has given the issue of sustainability recently through conferences, the media, frequent articles and editorials in general-audience 'renovators' magazines such as *Fine Woodworking* or *This Old House*, the issue of sustainability is not clear-cut. Many preservationists agree with the sentiment that even professional preservationist and historic building owners can be swayed to act by the advertising campaigns and government programs that espouse 'modernizing' windows as a matter of course in rehabilitation. Historic Preservation professionals can better utilize their expertise in considering the entire structure's viability and work to preserve every element possible, while increasing its modern comfort, joining the interests of preservation and sustainability (Sedovic and Gotthelf, 2005).

There are several overlaps for the two fields of preservation and sustainability. The skilled-labor-intensive preservation agenda provides local employment opportunities, which has significant economic impacts, beyond those at the retail level for replacements. Further, a symbiotic relationship is formed in the level of low impact, that both fields desire, for mechanical equipment use and new materials use. It is not difficult to grasp the concept that reusing existing materials negates the need for new material to be harvested thereby saving both the landfill space needed and the enormous amount of energy needed to prepare new replacement elements (Sedovic and Gotthelf , 2005). Some preservationists, such as Carl Elefante, perceive the energy savings brought about by

utilizing the earth's natural energy, wind and sun, with the perceived limitations of modern technology in historic structures, and espouse maximizing the synergy effect of natural energy outputs with natural and man-made elements to moderate comfort in a structure (2007). Substantiating these observations, Farneth (2007), too, emphasizes the mutual concern that both historic preservation and the sustainability movement have "underlying values, such as an emphasis on resource conservation and energy efficiency (¶ 13)."

Historic preservationists, in America, and sustainability advocates have a common dilemma, too. The process of acting in a sustainable manner is rather unclear (Elefante, 2007). For example, eating an unprocessed tomato is better for the environment than expending energy to process it, but is that still true if the tomato is trucked across hemispheres to arrive in its final destination? These types of questions do not release us of our need to be conscious of our actions, in fact, they spur us on to deeply contemplate our actions; to search out their completeness to our purpose.

Those in the preservation field have understood the validity of claiming to act responsibly, relative to economic issues, in preserving the existing structures and cultural knowledge associated with many traditional building practices. These efforts are unconventional in today's economic climate of immediate gains through shoddy architectural practices, or the emphasis on 'green construction' as opposed to maintenance or repairs of older structures (O'Connell, 2007).

Carl Elefante refers to this concept, 'green new construction' as opposed to preserving existing construction, as the "elephant in the room (2007, pp. 26-27)." Acting

upon ‘green building practices’ is commendable, and desirable, for new construction; however, as Farneth (2007) notes, energy efficiency is inherent in pre-twentieth century architecture. Previous eras of construction were called upon to heat with the sun and cool with the breeze; and the architecture styles that support this methodology should not be discounted simply because they existed before the tightly sealed, energy consuming buildings of the modern era became the standard. Edwards asserts that relying on the “interaction of architecture, people and nature…to evaluate design and product life cycle and reinterpret the concept of waste …(2005, p.98)” unites important principles of good design, its impact upon the earth and its user. The conclusion is that changing or altering any part of an existing structure requires balancing these non-tangible roles that our surroundings take. Decisions about whether or not to change one, some, or all windows, in a structure are about more than the financial cost at the time the project is proposed.

Patrice Frey noted a resounding statistic in the draft discussion paper written for the National Trust for Historic Preservation, in October of 2007. Frey related that research conducted by the government has found that windows are not the ‘energy hogs’ they are made out to be, as only 10% of air loss is attributable to well maintained windows. Frey built upon this 1996 study’s finding that historic windows in good condition were comparable in efficiency to modern windows by elaborating on the high-energy use demanded to manufacture new windows. Frey’s observations dovetail with Elefante’s, adding weight to both of their arguments, that the soundest building practice is to preserve and maintain the existing structures before initiating new construction.

Sedovic and Gotthelf note that “no one should take lightly the option of discarding authentic historic materials (2005, p. 25),” which is the issue this thesis addresses. This research is an effort to contribute sound research data to both the preservation concerns of maintaining original windows and the current trend of applying sustainable building concepts for ‘green’ buildings. The life-cycling data provided by this research shall illuminate the actual life span differentiation between historic wood windows and their modern, replacement counterparts.

Research Questions and Objectives

The focus of this study is to contribute to the ongoing replacement-window debate by providing data on the frequency of window replacement and lifespan of replacement windows. The hypothesis of this thesis investigates the perception that, in the face of rising costs in maintaining temperate interior climates, older, perhaps historic, windows are replaced with some frequency due to the theoretical energy savings generated by new, replacement windows. There are examples of public information that contribute to this perception. One example is the Federal tax incentives have been available to offset the cost of new ‘energy replacement windows’ while restoring older homes. Another example is the national advertising campaigns which promote the cause, despite the Advisory Council on Historic Preservation policy which states that “national historic preservation policy [is to] encourage the public and private preservation and utilization of all usable elements of the Nation’s historic built environment (2001, p.9).”

The National Parks Service (NPS) and the National Trust for Historic Preservation (NTHP), both key figures of federal policy for preservation, maintain that

keeping, maintaining, and repairing existing historic windows is not only better for the architectural integrity and character of the structure: it is more energy efficient and ecologically friendly to do so. This sentiment was substantiated with a speech delivered at the 12th International Conference of National Trusts, on December 3, 2007, by David Brown, Executive Vice-President of the NTHP. He presented the core concept to the benefit in unity between the fields of sustainable architecture and historic preservation when he acknowledged that working together strengthens the effects of both efforts. Brown further purports that the NTHP, who have recently launched an initiative to publicize the National Trust's role, did so "… in addressing environmental concerns and in fostering sustainable design and development, noting that because of embodied energy the greenest building is one that is already built (¶ 13 -15)".

However, a limitation in the preservation field, as pointed out by Frey in her 2007 work, is that the research completed on the energy efficiency of historic and commercial structures does not account for varying important factors. Frey noted that aspects such as climate conditions, building techniques and renovation work can greatly influence any buildings' efficiency ratings, much less very old buildings. She cautions against making generalized statements as to comparable energy efficiency without accounting for those types of factors. These variables each contribute to the difficulty in generalizations available from current research; which this research attempted to minimize through examining the single entity of windows.

An in-depth look at the service life of common replacements utilized was undertaken which focused on the reliability of the units over the anticipated length of

service. One assumes the lifespan of a window to be the duration of the dwellings' viable life. By documenting the replacement of historic wood windows within the College Hill Historic District over the past 28 years, a valuable contribution to the information on this current issue of window replacement was made.

Several questions were addressed through this research:

- During the last 28 years, how many contributing buildings within the historic district replaced all or some of their windows?
- Have any retained all their windows during the specified timeframe?
- What type of replacement units were used?
- Of the replacements, how many were subsequently replaced, if so, with what?
- Do patterns exist that can be linked to the date of construction, window location, or architectural style with either replacement or original windows, or both?

Significance

Given the importance of preservation of the historic built environment of culture and economics, replacement of historic windows needs to be researched and assessed in order to contribute to this knowledge base. Research is needed to add to the base of knowledge concerned about preserving our national heritage. This research contributes much needed data on the life cycle of historic wood windows and replacement windows, utilizing data collected from the long-standing files of the College Hill Historic District in Greensboro, North Carolina.

The National Trust for Historic Preservation hosted a 'Sustainable Preservation Research Retreat' for which Patrice Frey developed a white paper in October 2007. In her

paper, Frey states that while comprehensive analysis of generalized buildings would be difficult given the variances inherent in the subject units, case studies may be beneficial in assessing a structure's performance, and identifying where efficiencies may be gained. Another aspect Frey's paper raises concerns about was the lack of study on the issue of windows and their life cycle assessment (LCA). Given the reparability of many historic windows, Frey was outspoken in her position on the likelihood that historic windows would prove to have a longer life cycle than the un-repairable modern replacements. This research sought to address these concerns and contribute to the scant body of information of life cycle assessment on this one particular issue.

CHAPTER II

LITERATURE REVIEW

Literature that focuses on the individual aspects of this study is prolific. Only a sampling of the available works from these fields will be utilized for this study. The selected sources are those that provide some clarity in this subject matter. Sources include those from preservation, sustainability, and culture.

Preservation

The National Park Service is the standard-bearer of the Secretary of the Interior's Standards for Rehabilitation, and publishes these guidelines in various forms, including on the easily accessible internet. The internet version of the Standards' guidelines, 'Exterior features: Windows,' headlines "identify, retain, and preserve (retrieved 2008, ¶ 1)" as the crux of the standards. The extensive list of window components that are an important part of the historic fabric of the building includes not only the frame, sash, and glazing, but the sills, heads, and hoodmolds, too. The list of components that are important to the historic fabric highlights the overall importance and added character that the original windows lend to historic structures. In keeping with this sentiment, the Secretary's Standards clearly state that common problems of minor window damage such as broken panes or stuck sash, or even failing paint or excessive air infiltration, do not indicate the need to replace windows as "these conditions, in themselves, are no

indication that windows are beyond repair (¶ 8).” Maintenance is the best solution to protecting the windows in historic structures.

The National Park Service, as the government oversight office for historic preservation, at the national level, covers several of the most common problems in Preservation Brief 9, *The repair of historic wooden windows*. John Myers, author of Brief 9, points out that while ornamental windows are easily recognizable as worthy of preserving, even utilitarian windows, such as those in an old mill, will sometimes be the dominate feature in a otherwise ordinary building. He finds that the major factors to evaluate a window’s condition are location of the unit, loose or missing glazing, hardware, paint, and sash and sash member condition. When evaluating, the number one concern is moisture, and the number one priority is to minimize further contact with the window unit’s structure membranes, paying particular attention to the joints and horizontal members; simple tasks, to be sure, but particularly important, nonetheless. Attending to the maintenance of original windows is the first priority of those in the preservation field.

In the City of Greensboro Historic Commission (CGHC) program manual and design guidelines, the “residents and property owners (2003, p.1)” are provided clear information on the process of alterations to properties included in the historic districts. The CGHC recognizes that the Historic District neighborhoods should not be living museums, and accord the residents modern conveniences. The premise of the historic district designation, and underlying principle of its innate importance, is honored. Acknowledging that each of the buildings is unique, the Commission is charged with

maintaining the overall "character and spirit of the historic neighborhood (p. 4)." Receiving a 'certificate of appropriateness,' or COA, from the commission is an indication that the requirements for the intended project meet these guidelines; and there is a monetary penalty for failure to comply with the commission's rules, and also an appeals process for the property owner, if one is warranted.

Each type of project has its own guidelines, which can be simply minor repairs, not usually requiring a hearing or committee approval, or larger, more complex projects. Larger projects require a COA, obtained by presenting the Commission's meeting with documentation that clearly presents the components involved in the project. These projects, that require Commission approval before commencement, are modifications to the "original fabric of a building or property (CGHC, 2003, p.12)." Guidelines for windows within this framework are "because of their strong link to and indication of the architecture and style of a building, original windows and doors should be maintained, repaired when necessary, and preserved as one of the defining elements of a historic structure (p.55)." This research utilized the records of the Commission to determine which windows have been replaced in keeping with their guidelines on windows, which according to guideline number three, is:

> when repair is not feasible, as determined by City staff, true divided light wood windows are an appropriate replacement product for original wood windows, when designed to match the original in size, composition, material, profile, and overall size as closely as possible. Double-paned glass may be considered when they are true divided and can accurately resemble the original window design. (p.57)

These rules all support the general consensus among professionals, the national Secretary's Standards, and the local historic commission's stated recommendation that original fabric be retained whenever possible, and if the condition of the original fabric is such that it must be removed, then the replacement material should be similar.

The CGHC guidelines further describe the project application requirements to include, 1) a description, 2) drawings of existing and replacement units to scale, 3) proposed changes to the units, in a scaled drawing, and 4) other visual media that supports the choice, such as samples or brochures from the window maker (CGHD, 2003).

Beyond the regulatory national and local commission guidelines, many practitioners, including Sedovic and Gotthelf (2005) contend that historic windows are superior to modern replacement windows both aesthetically and materially. The wood used to construct modern wooden windows is not as structurally sound. The wood density difference is due to the speedy growth method of raising wood for industry consumption, utilizing chemical fertilizers today versus the denser slow growth wood of a century ago.

Providing proof that preservationist are dedicated to retention, Elefante (2007) describes how many preservationists are so committed to the preservation of traditional wooden windows that they have developed many techniques for attempting to maintain the integrity of this architectural element. He emphasizes the description of the ecologically friendly practice of repairing windows with the observation that "it is an absolute mystery why so many 'high-performance' windows are designed without any consideration for their renewal. Such systems are sold as maintenance-free. In fact, they

cannot be repaired (p. 34).” This fact highlights the inherent irony in the design of non-repairable ‘energy efficient’ window replacement units.

Preservationists are dedicated to preserving the integrity of the authentic fabric of historic buildings. In theory and in practice, valuable cultural and physical material retention is key to the principles of historic preservation. Preserving the original fabric of a building is paramount to preserving our national heritage.

Sustainability

The link between building and environment takes on new importance in light of the current multidisciplinary focus on the environment and maintaining the environment for the betterment of local, regional, national, and international societies. Stated in many ways, such as ecological and ‘green,’ the use (or misuse) of natural resources has gained prominence in the last decade, as well it should, given the quantity of waste produced in the United States. In maintaining our standards of the built environment, the United States consumes right at “136 million tons per year of construction and demolition waste (approximately 2.8 pounds per person per day) (Edwards, 2005, p.97).” Worldwide, humans use “40 percent (3 billion tons annually) of raw materials (p. 97).” Preservation of existing structures and their components, contributes to the solution of this global problem. Elefante (2007) suggests that the answer lies in the focus of human activity; sustainability will become easier once humans focus on increasing the earth’s health instead of harming it. In this sense, O’Connell (2007) agrees that honest efforts toward sustainability do not consider the whole of the picture, heralding the use of salvaged

materials while not factoring in the simplicity of saving the entire structure in the first place.

Challenging the status quo of continual consumption, Edwards (2005) provides a succinct observation about the plethora of materials used in modern times for shelter. He states that the "present unsustainable path marked by an unrelenting economy that methodically depletes the Earth's ecosystems will have to change (p. 2)." Despite the inception of grassroots programs that have heralded a change of the state of affairs at the governmental level with "environmental clean-up programs such as Superfund, and protection programs such as the Clean Air Act, Clean Water Act, Safe Drinking Water Act and Endangered Species Act (p. 6)," the ecosystems are in danger, which has brought about global concern.

Addressing the concern for global sustainability, an initiative was started in 2000, referred to as LEED:

> which stands for Leadership in Energy and Environmental Design,[and] is a third-party rating system designed to encourage the implementation of green-building practices in commercial, institutional and residential structures. LEED criteria emphasize sustainable site development and maintenance, water efficiency, energy conservation, renewable or recycled materials and resources, indoor environmental quality and design innovation. These criteria are broken down into checklists through which projects can earn basic certification or silver, gold and platinum ratings. Currently, LEED standards are available for new construction and major renovation projects, existing building operations, commercial interiors, core and shell projects, homes and neighborhood development. (O'Connell, 2007, p.16)

Farneth (2007) sees potential for LEED, in that "the LEED system offers up to two credits for reusing a percentage of an existing building's walls, floors, and roof, as well as

one credit for reusing at least 50 percent of interior non-structural elements (¶ 9).” Yet, “LEED does not distinguish between reusing portions of a building that is five years old and preserving one that is more than a century old (¶ 9).” Even though these programs have provided a strong base for present citizens to reap benefits from, efforts are still needed that take the ideal of stewardship of the earth to even further levels by promoting the sustaining of existing built environments as much as possible, whenever possible. When we reuse existing buildings, and all of their components, whenever possible, we contribute to ‘best-use’ of our resources.

“Windows are a critical element of sustainability, but sustainability is not just about energy. …The answer is not as simplistic as some would have us believe (Sedovic, and Gotthelf, 2005, p. 29).” Common convention dictates that evaluating window performance should include the life-cycle cost of the unit. These life-cycle costs could be calculated in many ways. Carmody, Selkowitz, Arasteh, & Heschong offer a laundry list of factors that should be included in the decision making process for LCA. Some of these factors are easily understood, such as the initial cost of the new units, maintenance that will still be required further down the road, other factors are more difficult to ferret out. Of the less considered items mentioned, the current and expected cost of heating and cooling are not often compared, nor the resale value of a historic structure without its original windows (2000). These factors are proposed for inclusion in the list of guides for the decision-making process regarding replacing windows.

Baird Smith, in National Park Service Preservation Brief 3, further question the benefit of replacing older windows. He notes that not only are older structures usually

more energy efficient than modern ones, they frequently make use of passive energy practices through solar heat gain and natural cooling. Smith provides further arguments in favor of historic window retention by noting that storm windows increase the thermal barrier capability of an uncovered window. If a preassembled triple-track stock storm window is installed over an original window unit, an "R factor of 1.79 [is achieved], which outperforms a double paned window assembly (with an air space up to ½") that only has an R factor of 1.72 (n. d., p. 6)." This is a very strong discussion point for preservationists to use to persuade homeowners, and others, that retention of the original unit is good for energy savings, too. These energy savings strengthen the arguments for the increased embodied energy savings gained when retaining original windows during rehabilitation processes.

Architect Carl Elefante, keynote speaker at the 2007 Preservation North Carolina Annual Conference, declared that his speaking services are in great demand in the area of sustainability. Referencing embodied energy is an aspect of sustainability that counters many energy-based arguments proffered by those who only measure energy in immediate and continuous needs use, such as keeping warm in the winter or cool in the summer. Embodied energy refers to the non-replaceable energies used to 'make' something; beyond the inherent material. Elefante has written that "conservators pick apart each assembly into its components and repair or replace what needs to be attended to. Following this process gives preservationists a very clear view of the life-cycles of buildings (2007, p. 33)." In his work, Elefante agrees that LCA and life-cycle cost analysis (LCCA) are essential to providing ratings regarding the long-term impacts of any

materials performance and associated environmental costs for the disposal of unwanted materials. However he points out that the number of variables for any one material staggering, for example: is the granite countertop as earth friendly in Florida where it is trucked in for use as it is in Tennessee where it is cut from the earth? Yet the LCCA ratings and standards ignore best case scenario of *not* disposing of materials, but encourage reusing them and restoration of their usefulness (Elefante, 2007). Farneth (2007) contends that, while the issues of surrounding rehabilitation is not new to the field, the current trend is that governments from the local level to the federal level demand LEED certification, despite the shortcomings just mentioned, which does not always bode well for the historic elements that are important to the architectural fabric of the structure.

The Australian government has posted this definition on its www.greenhouse.gov.au web site:

> embodied energy is the energy consumed by all of the processes associated with the production of a building, from the acquisition of natural resources to product delivery. This includes the mining and manufacturing of materials and equipment, the transport of the materials and the administrative functions. Embodied energy is a significant component of the lifecycle impact of a home. (¶ 1)

Embodied energy provides an accurate gauge of the 'true costs' of the buildings we inhabit; and the costs of replacing the components of existing buildings, beyond the immediate action of paying for a component at the local hardware store.

Embodied energy and sustainability are complex issues. Canada has developed their ecological guidelines, called the ORTEE [Ontario Round Table on Environment and

Economy], which include twelve principles. Of these twelve principles, embodied energy is upheld in three of them. These guidelines include recommending that one "make the best use of local efforts and resources (Edwards, 2005, p. 32);" that what one attempts to do "minimizes harm to the natural environment (p. 32);" and the best principles "fosters activities which use materials in continuous cycles (p. 32)." Each of these principles points to the validity of maintaining existing structures and their components to help achieve a healthier earth. Sedovic and Gotthelf (2005) ascertain that "preserving whole buildings, restoring historic windows is a solid step forward into the realm of sustainability (p. 25)."

Patrice Frey (2007) expounds further on the preservation of existing windows as a contribution to preserve the "embodied energy in the building element. [Stating that] it further eliminates the need to expend energy on replacement windows, which are typically made of aluminum and vinyl – two materials that have some of the highest embodied energy values of any building material (p.13-14)." Other contributions Frey cites referencing the issue of sustainability are somewhat commonsense. These contributions listed by Frey include the reduction of landfill waste; the questionable materials used to manufacture new windows, which are frequently made of vinyl or aluminum and are energy intensive to construct (considered a high-embodied energy product), and "toxic for the environment (p.14)." Frey lists those sustainability issues along with the concern for the difficulty of repairing modern units when they fail to operate properly (pp. 13-14), as also previously noted by Elefante. Frey points out that the "vinyl, fiberglass, sealants, desiccants, and coating systems all degrade, and are not

easily recycled or repaired, [and that] manufactures' warranties for replacement windows are typically two to ten years, and have far shorter expected service lives than historic windows (p. 14)."

Windows

In the rehabilitation process, the treatment of historic windows is a critical decision. A decision often clouded by conflicting messages regarding preservation values, sustainability and energy concerns. As Carl Elefante notes "energy modeling shows that there is no "one size fits all" solution to improving energy efficiency (2007, p. 35)." Other conflicting "premise[s] are issues about material quality, assembly, and conservability (p. 29)," as noted by Sedovic and Gotthelf (2005), as "some material choices (e.g., PVC) incorporated into replacement- window units are inherently not able to be conserved (p. 29)." As "a hallmark of sustainability is long-term performance (p. 29)," "one of the great virtues of historic windows is the quality of the wood with which they were constructed (p. 29)." Given the denser, non-fertilized wood stock that was used in historic homes, and the care to carefully mill the stock with stable cutting practices, the "resulting window performs with greater stability than its modern counterpart. This alone has far-reaching benefits, from minimizing dimensional change, to holding a paint coating, to securing mechanical fasteners (28)." Also contributing to the discussion are the overall "nuances in molding profiles, shadow, line, and color of windows, along with quality and appearance of the glass, [which] contribute greatly to the overall building aesthetic and generally emulate the stylistic details of the building as a whole (p. 29)." (pp. IV-3-14).

In the Historic Preservation Education Foundation's tome, *Window rehabilitation guide for historic buildings*, Rose (1997) concludes, from an engineer's standpoint, "in summary, there are no compelling arguments from the field of mechanical engineering for replacing historic windows, provided the windows are moderately airtight, treated to prevent excessive UV and visible light transmission, and not prone to excessive condensation (p. IV-13)." As Shapiro and James (1997) found in their field study on the energy impacts of original and repaired older windows that the level of skill in maintenance and repair can contribute to energy performance in older structures if well done. Shapiro and James also found that, "window heat loss accounts for approximately 20 percent of the total heat load for the typical building studied," cautioning that efforts to conserve energy should factor that into account. Overall, the driving forces within the decision-making process can be summed up with McCluney's (1997) observations of what contribute to "meeting human needs with energy efficiency (p. IV-52)." Important considerations for comfort include: 1) visual appearance, 2) daylighting and productivity, 3) visual comfort, 4) thermal comfort, 5) energy, 6) electric demand, and 7) laminated glass for high safety concern areas (pp. IV-52-53).

As Carmody, Selkowitz, Arasteh, and Heschong (2000) noted in their comprehensive guide for window technologies and energy efficiency:

> until about the end of World War II, housing in the United States was designed with an understanding of site and climate. Although the windows were not particularly energy efficient, traditional house designs evolved that took advantage of the natural elements of sunlight, wind, the earth, and vegetation to help provide light, heating, cooling, and ventilation. A house built in Florida looked quite different from a house built in Maine, reflecting their climate

> differences. While these buildings were not always comfortable by today's standards, energy use was minimized as much as possible. (p. 10)

Windows represent a large portion of exterior wall space, and the "material used to manufacture the frame governs the physical characteristics of the window, such as frame thickness, weight, and durability, but it also has a major impact on the thermal characteristics of the window (Carmody, Selkowitz, Arasteh, & Heschong, 2000, p. 97)." Sedovic and Gotthelf (2005) state that "replacement windows nearly always incorporate insulated glass (IG) units….[which is] greatly dependent on the depth of the airspace between inner and outer panes, …[and] the nature, type, and amount of desiccant and seals employed around the unit perimeter (p. 28)." These authors expand on the concept of insulated glass units attested to by Elefante, agreeing that the insulated glass units are time consuming to replace, due to their structure, and "the additional weight and thickness of IG units preclude their use as retrofits in historic sashes of either wood or metal (p. 28)." An often-unconsidered circumstance of the additional thickness of the support members is that "the result is that visible daylight levels are reduced by 15 percent or more and views are interrupted. Reducing daylight and negatively affecting views are explicitly not consistent with a sustainable approach (p. 28)." Sedovic and Gotthelf contend that "even what might seem like small changes in these elements can and does have a noticeable and usually detrimental effect on many historic facades.…[and] result in a mechanical, contrived, or uniformly sterile appearance. Worse, …authenticity is lost forever (p. 29)."

Frey (2007, p. 13) reports that "a 1996 study by the State of Vermont indicates that repairing and insulating historic windows is nearly as effective in reducing energy costs as the installation of replacement windows." This study examined the performance of windows in multifamily and single family residences, in northern and central Vermont. Of the 151 windows studied, "sixty-four of these windows were in original condition, while 87 were upgraded in some way (p.13)." The report found that even when the upgrades were made using existing sashes, the air filtration of the original window was still important in the upgrades effectiveness to provide reduced energy consumption. This study also determined that when the air infiltration condition between the rough opening and the window frame is addressed, an upgrade is not cost beneficial. The conclusion of the study determined that it is cost-effective to utilize storm windows (p.13). In addition, there are various add on products on the market, such as weatherizing strip or seals made of pile, brush, bulb, or even metal-such as the "Z" spring which may prove even more energy conserving than a new replacement window. Sedovic and Gotthelf (2005) further contend that:

> focusing on windows as the principal source of heat transfer may lead to the conclusion that windows are more important than, say, insulating the attic, foundation, or walls. While data vary somewhat, up to 25 percent of heat may be lost through doors and windows. But when the aforementioned potential 50 percent loss through infiltration is taken into account, the total effective percentage of heat loss attributed to the window units themselves would be only 12.5 percent. That is a relatively small percentage for a potentially large investment, especially when other options are available. In actuality, typical window-replacement systems offer payback periods that are often nowhere near manufacturers' claims: the payback of a typical unit could take as long as 100 years. (p. 27)

A window is a unique stylistic contribution to the historic house, which in turn contributes to the district, and which then contributes to the city in which it sits. “Once authentic material is lost, it is lost forever. It does not matter how accurate the replacement window, it never reflects the nuances of the original (Sedovic and Gotthelf, 2005, p. 25).” Given the physical properties and contributions to the dwelling the unit is in, the state of the window is important, overall. Original, repaired, or replaced; these issues cannot be swept away with the flick of a hand, but must be weighed carefully. This research strives to provide another tool for accurate, informed decision-making for this complex aspect of historic preservation.

College Hill Historic District, Greensboro, North Carolina

Greensboro, North Carolina, established in 1808, covered one-quarter of a square mile. The architecture in Greensboro was indicative of the buildings erected in flourishing communities in 1808. Terms such as “picturesque,” “florid,” and “decorative” have been used to describe the existent houses that were built in the first era of Greensboro’s history (Brown, 1995, p.45). The original development of the areas of land around Greensboro’s central business district allowed the communities close to downtown to thrive. Stability of the central business district, based on the textile and tobacco industry, gave efforts to raise the level of education for its citizens’ credence. The metropolis of Greensboro brought to life four colleges, two of which are situated only a few blocks from each other, in the area now known as College Hill Historic District.

In 1837, the trustees of the fledgling Greensboro Female College purchased 211 acres of land south of Market Street and West of Cedar Street. Forty acres were reserved for the campus; the rest of the land was to be re-sold to cover the costs of acquisition. In 1838, the college became the first chartered women's college in the state. In 1846, it opened classes in the first Main Building; which is thought to have been designed by nationally renowned architect Alexander Jackson Davis. In 1920, the school became known as Greensboro College (Brown, 1995, p. 336).

Spurred on by the formation of the Normal and Industrial School for White Girls (now grown into the University of North Carolina at Greensboro), in 1892, the area that has come to be known as College Hill maintained steady growth through otherwise trying times until 1947 (Brown, 1995, 336-337). Then the neighborhood went through a period of decline, until the 1970s; when urban revitalization efforts were begun in this historic district. The revitalized efforts saved early twentieth-century residential and commercial buildings that provide a snapshot of the early development of some of Greensboro's neighborhoods as related in the City of Greensboro Department of Housing and Community Development (HCD) report (2006, p. 1). The orchestrated effort to revitalize this section of Greensboro began after independent research and surveys of the city were completed in 1974. These documents provided evidence that the neighborhood had enough significant structures to warrant application for a historic district designation (HCD, 2006, p.3).

The District is known for its intact cluster of buildings, residential and religious, which provide significant architectural and community planning and development

examples. As the1993 nomination and registration form for inclusion in the National Register of Historic Places states, the district has a 105-year period of significance. Once the Greensboro Female College was founded in 1837, up until the era of World War II, in 1941, this section of Greensboro flourished; and the architecture which was built reflects that exuberance (Brown & Graybeal, 1993, p. sections 6,7,& 8). The nomination for receiving designation as an historic district provides a summary of the importance of the area in Greensboro's history. Brown and Graybeal (1993) refer to this neighborhood in Greensboro as:

> one of the largest collections of Queen Anne and transitional Queen Anne/Colonial Revival style residences in the city. …these generally substantial dwellings were joined in the following two decades [1910s-1920s] by an impressive assortment of bungalows and Colonial Revival and Craftsman style of foursquares. Modest Period and Colonial Revival style dwellings filled the district's few remaining open lots in the 1930s. Interspersed among the primarily frame single-family residences are a small number of apartment buildings and non-residential buildings – including three churches, two former firehouses, and two former groceries—erected to meet the needs of the busy, densely populated neighborhood. All of the district's buildings stand shoulder to shoulder on deep, narrow, urban lots, buffered from the street by shallow front lawns and mature shade trees. (Section 7, p. 1)

The lack of widespread tear-downs, removals, or modern infill contribute to this district's appropriateness as a capsule of Greensboro's history.

While the district did not undergo the mass razing that occurred in the downtown area, just a few blocks from its easterly border, it did succumb to urban blight. The neighborhood was on the verge of collapse when the City of Greensboro stepped in and began its campaign to save the district. According to the city's Department of Housing &

Community Development department, there were "766 dwelling units in College Hill (2006, p. 22)" at the start of the 1970s revitalization efforts. The neighborhood's decades long instability withstood the urban blight; as today, after 30-years of care and attention, there are "788 dwelling units (p. 22)." Of these units, some of which are contained in apartment structures, there are a total of 320 contributing buildings, including secondary structures, and 55 non-contributing buildings (Brown & Graybeal, 1993, section 5).

Urban renewal was in its infancy in the 1970s. For the City to achieve the neighborhood turnaround that the visionaries contemplated, various factors needed to add up. Starting with the 1974 survey, the City then finalized the "*College Hill Concept Plan* [which] was approved by the neighborhood and adopted by the Greensboro City Council in 1978 (HCD, 2006, p.6)." In response to the community wide efforts, the City was able to solicit funds from the Community Development Block Grants for the, then, newly created "Community Development Target Area in 1979 (p.6)." Building on the success of their efforts to that date, the City designated the neighborhood as the first local historic district. In 1980, the College Hill Historic District was created; lending preservationist oversight to the renovations that were to follow. One of the major contributors to the revitalization of the newly designated College Hill Historic District was the receipt of Community Development Block Grants. The City utilized these grants through application of the '*Concept Plan*' to identify the residents' perceived needs, and the follow through in implementing that plan. Key to this revitalization was the purchase and re-sale of "blighted" dwellings to purchasers who were contractually bound to rehabilitate the properties. Twenty-seven dwellings were purchased at this time (roughly

10 % of the buildings within the not yet designated district) and underwent virtually a complete rehabilitation (HCD, pp. 7-9; Brown & Graybeal). This improvement effort came at a time when, according to interviews with Mike Cowhig of the City Planning Department, wholesale replacement of windows in these houses was deemed acceptable. This set of houses, scattered within the Historic District will provide the control group numbers for the research undertaken on the frequency of replacement and expected lifespan of replacement windows.

CHAPTER III

METHODOLOGIES

Research Target Selection

The College Hill Historic District provides valid parameters for this research. Registered with the National Register of Historic Places in 1993, it has documented historic housing stock, which provides records of the year of construction and style of architecture for the dwellings being studied. Target units were limited to the single-family residences located within the Historic District boundaries, and strictly to replacement of existing window units at the time the COA was requested. This constraint eliminates new additions and replacement units used to re-introduce a window that had previously been altered by remodeling efforts that may have changed a window into a door, or covered up the opening entirely. Also, the thirty-four-year timeframe for the City of Greensboro's HCD revitalization efforts which, according to Mike Cowhig who was, and currently is, with HCD, resulted in "wholesale replacement" of windows, provides a control group for the replacements longevity data.

The number of homeowner occupied dwellings has remained fairly constant throughout the districts' designation and revitalization. Homeowner occupied housing was at 38% in 1978, and currently hovers at 33% (HCD, 2006, p. 22). This similarity indicates that the investment nature of the neighborhood is fairly constant. Since the 1980 inception of the Historic District designation, all "inappropriate alterations to historic

structures have been prevented while new construction and renovation projects have had to follow architectural guidelines (p. 13).” The Housing and Community Development Report further states that “the cumulative effect of 25 years of historic district designation is evidenced by carefully restored historic homes…(p. 13).” Additionally, the related survey documents from the original 1977 architectural inventory of the area, conducted by Glave, Newman, Anderson, and Associates, were perused for pertinent information.

Windows are specifically addressed in the City of Greensboro Historic District Program Manual and Design Guidelines. Stated as “primarily double-hung wooden sash windows with a variety of muntin arrangements (2003, p. 55),” the comparative stock of the College Hill Historic District’s windows, both original and replacements, will be similar. Further regulation of the Historic District’s windows is the guideline that “when considering replacement windows, determine the original window material, window pattern and configuration, dimensions, design, and any key detailing that is unique to the window, and use this information to assist you when selecting a window that will meet the intent of the guidelines (p. 56).” Additionally, some aspects of window maintenance do not require a Certificate of Approval. Actions that do not require a COA are re-glazing windows, windowpane replacement, painting, certain types of storm windows and doors, and similar materials used to repair broken or rotted original materials, without a change in appearance to the exterior structure (p. 56). Eliminating the routine maintenance activities from the data enables the researcher to focus only on actual replacements, and

make the assumption that if the dwelling unit is not included in a Certificate of Approval request, it continues to retain its original windows.

Research Data

The primary sources of data for this research were the files kept on the College Hill Historic District at the City of Greensboro's Department of Housing and Community Development, along with the information contained in the National Register nomination (HCD, 2006; Brown & Graybeal, 1993). Files kept on the College Hill Historic District at the Department of Housing and Community Development in City Hall, Greensboro, North Carolina, contain all the minutes from the first meeting of the Greensboro Historic District Commission in 1980, onward. Each property must legally have a Certificate of Appropriateness issued to commence work that alters a structure's exterior. The City of Greensboro Historic District Program Manual & Design Guidelines (HDPM) (Fall, 2003) state: "a Certificate of Appropriateness (COA) is similar to a Building Permit and is required before beginning exterior work in Historic Districts (p.12)." This mandate provides the basis of the recorded changes and records of approval for the specific windows controlled by the design review process.

When changes that require a COA are requested, such as the replacement of an original window or the removal or addition of a window that is located on the street elevation, Commission approval is required. However, if a dwelling unit owner is requesting to place a replacement window in a location that was closed in previously, that request may be granted by the staff at the Department of Housing and Community

Development (HDPM, 2003, p. 55). This differentiation determines what is available in the records about altering windows in the College Hill Historic District.

All issues addressing windows, and their appropriateness and compatibility as replacements, which require Historic District Commission approval, were to be recorded in the minutes, with the accompanying data about the product requested and approved. The data to be presented for Historic District Commission consideration for the granting of a COA is: (1) a product description, (2) scaled elevation drawings of existing and replacement windows, (3) scaled drawings of any proposed changes to window openings, and (4) photographs, illustrations, and/or samples of the proposed window replacements (HDPM, 2003, p. 56). All information received for Commission consideration should be information that is stored in the files for each house within the district, at the City Planning Office in Greensboro. The files allowed the opportunity to analyze the chronology of replacements, whether or not the replacements, themselves, have been replaced, and the product approved each time a COA was issued. By reverse analysis, the structures that have not had COA's issued for windows can be assumed to retain original windows, or at the very least, windows that were in place at the time the district was designated in 1980. Researching the Historic Commissions files provided the data on windows; researching the National Register Nomination provided the data for the architectural style, age, and material of each contributing structure. This data was used when correlating patterns as they relate to these particular aspects of the historic structures within the College Hill Historic District.

Evaluation Process

In an attempt to anticipate various scenarios, prior to inspecting the available minutes and the related National Historic National Registration document, a detailed list of questions anticipated to be answered in the data was developed. From this list, to collect, sort, and analyze the data, a computer spreadsheet was developed to individually list each property within the College Hill Historic District. To correlate the two data sources, the spreadsheet enabled delineating between contributing dwellings and non-contributing single family residence dwellings and the other structures within the Historic District parameters. Included in this spreadsheet was a space for noting if, when, and where any COA's for windows were issued. Also provided for is the type of replacement and space for recording multiple replacements.

To complete the spreadsheet, the list of houses that were purchased by the Department of Housing and Community Development and the list of houses provided in the National Register Nomination were entered into their respective pages. The resulting list of contributing single-family residence dwelling structures numbered 231. After the list of contributing dwellings was finalized, including the architectural style of each dwelling and its recorded date of construction, with the HCD purchased houses noted; a thorough examination of the Greensboro Historic District Commission minutes for the College Hill Historic District boundaries was completed. Inspection of the minutes determined that thirty-four properties have received COA's related to windows since the inception of the Historic District designation. These files were then inspected for data that contributed to the research questions. Anticipated file information was determined by the

requirements for the COA application as specified in the City of Greensboro Historic District Program Manual and Design Guidelines.

Analysis Process

Once the data was collected and scribed in the appropriate designated spreadsheet columns, emerging patterns were observed. After initial observations were made, mapping diagrams and graphs were developed to enhance the understanding of what insights the data provided about replacement windows in the historic district. The research data proved suggestive of several questions, so an effort has been made to include these questions in the research analysis. The graphic representation of data will also include photographs of the typical houses of the housing types which received replacements within the College Hill Historic District, providing examples of window styles and condition.

An investigation of the compiled data was intended to provided information about several concepts. The key concepts searched for include: (1) the percentage of contributing historic dwellings that received replacement window COAs; (2) what type of replacements were they; (3) whether or not the replacements were replaced again; (4) patterns which exist that can be linked to the date of construction, window location, or architectural style with either replacement or original windows, or both. The data further suggested that a look at whether or not learned behavior cluster effect might be occurring within the district, regarding replacement windows.

Summary

The College Hill Historic District provided valid parameters for this research, as it has documented historic housing stock. Designated as the first local historic district in Greensboro, North Carolina, in 1980, and subsequently registered in the National Register of Historic Places as a district, the documentation on the historic data of the district is thorough. Given the extended timeframe for the City of Greensboro's HCD revitalization efforts, which resulted in "wholesale replacement" of some dwellings windows, there is substantial argument for using these units as a control group for the replacements' longevity data. Windows are specifically addressed in the City of Greensboro Historic District Program Manual and Design Guidelines, which will influence the variety of window styles for comparison. The primary sources of data for this research consisted of the minutes and files kept on the College Hill Historic District at the City of Greensboro's Department of Housing and Community Development, along with the information contained in the National Register nomination (HCD, 2006; Brown & Graybeal, 1993). After the institution of the Greensboro Historic District Commission to act as the oversight committee on all changes which occur within the designated district, property owners must legally have a Certificate of Appropriateness issued to commence work that alters a structure's exterior. However, some requests, which do not require COAs may be granted by the staff at the Department of Housing and Community Development (HDPM, 2003, p. 55). This differentiation determines some of what is available in the records about altering windows in the College Hill Historic District.

Researching the Historic Commission's files provided the data on windows, indicating requested changes; researching the National Register Nomination provided the data for the architectural style, age, and material of each contributing structure. A detailed list of anticipated questions were developed and entered into a specifically designed computer spreadsheet to correlate the data collected. The resulting list of contributing single-family residence dwelling structures numbered 231. After the list of contributing dwellings was finalized, a thorough examination of the Greensboro Historic District Commission minutes for the College Hill Historic District boundaries was completed. Corresponding files from the Department of Housing and Community Development office were then inspected for data that would provide details of the information that is required to receive a COA for the window alterations. Once the data was collected and scribed, emerging patterns were observed. After initial observations were made, mapping diagrams and graphs were developed to enhance the understanding of what insights the data provided about replacement windows in the historic district. Communication of the research data through mapping, graphing, and tables will provides a graphic framework to assist visualizing the findings of the research.

CHAPTER IV

ANALYSIS

Analysis of the data began once all available data had been thoroughly researched. Maps and graphs were utilized to assist in analyzing the data. The data was searched for a clear indication on the lifespan of replacement windows and original wooden windows in the historic dwellings located within the College Hill Historic District of Greensboro, North Carolina.

Originally, several questions were addressed through this research. These questions were developed to guide the question of replacement windows in historic houses generally, and in the College Hill Historic District specifically. Five questions were conceptualize to provide the desired insight. Questions to be answered were as follows:

- What number of contributing buildings within the historic district received COAs to replace all or some of their windows?
- Have any retained all their windows during the specified timeframe?
- When approved, what type of replacements were they?
- Of the replacements, how many have been subsequently replaced, if so, with what?
- Do patterns exist that can be linked to the date of construction, window location, or architectural style with either replacement or original windows, or both?

Addressing the first question, of the simple number of dwellings in the historic district, which received replacements, the researcher found that only 35 of the contributing 231 single-family residence dwellings had received COAs. Additionally, a total of 24 of the total contributing dwellings pertinent to the research were HCD purchased houses. Fourteen of the COAs issued for window replacements were for the HCD owned dwellings. This data shows that 15% of the total contributing units were awarded COAs to install replacement windows. HCD homes, considered the structures in poorest repair when the initial neighborhood improvement program began, accounted for only 12% of the total contributing dwellings. Yet a full 40% of the COAs received for window replacement were these HCD units. Conversely, in responding to the second question, as only 15% of the contributing dwellings were found to have record of window replacement, a large percentage (85%) of single-family residences in the College Hill Historic District retained their original windows.

The following figures are photographs of several of the houses in the College Hill Historic District which have had their windows changed, and several examples which have not.

Figure 1. 130 S. Tate St., ca. 1905-10; Queen Anne: Original Windows.

Figure 2. 200 S. Tate St., ca 1920-25; Four-square: Original Windows.

Figure 3. 204 S. Tate St., ca.1917; Craftsman - Neo-Classic: Original Windows: Note Streetscape Interest Developed by the Variety of Window Styles in the Adjacent Dwellings.

Figure 4. 822 Rankin St., ca. 1900-03; Cottage with Hip-roof: HCD Purchased / Rehab Dwelling: No Replacement COAs on Record.

Figure 5. 308 S. Tate St., ca 1905-10; Queen Anne - Colonial-Revival: 1983 Window Replacements: Non-HCD House.

The Greensboro Historic District Commission, as per the Secretary's Standards and local commission guidelines, approved wood products in 91.67% instances. Only two single-family dwelling units were approved in an alternate material. Both were special instances, and, noted as such during the approval process. Very early in the revitalization effort, aluminum replacements were approved, in 1983. After two meetings and extended debate, the party seeking to utilize aluminum windows was granted a COA. The approved COA was based upon the reasoning that the house was already sided in aluminum, producing a consistent image in that fashion; and the trim was to remain wood, maintaining the historic essence of the windows. According to the Minutes of the Greensboro Historic District Commission, on August 12, 1983, page 2, the windows were mechanically in poor condition, adding weight to the decision to allow the aluminum windows for 'energy efficiency' for an older woman's home. The other instance of an alternative material was the unique request that glass block be allowed in the bathroom of a dwelling, to negate the effects of continued moisture problems for a wood window located in a shower area. This unusual request, proposed by the contractor, was granted for a remodel completed in 2000. A stipulation was proposed by the homeowner that the storm window be retained to maintain the exterior look of the house.

Of the 35 single-family residences with COAs for replacements, only four received COAs for subsequent replacement of the replacement windows. Only one of these dwellings was a HCD home. That particular unit had four windows replaced a scant four years after the first ones were installed in 1990. One residence had a single unit replaced only one year after the remodel in 1983. A COA was not issued for one dwelling

that changed out their windows in 2008; they had replaced the units without notifying any officials of their intents. The unit's windows had been replaced previously, at an unknown time, before the district was designated. The final example of replaced replacement units were four windows that were changed in 2007, which had only been in place since 1996. All of the second windows replacement units were wood. Three of the units received double-paned replacements. The fourth, the 1983-84 example, was not specified as to pane type.

The final intent of the research was to investigate for patterns that could be linked to the date of construction, window location, or architectural style with either replacement or original windows, or both. The research did find several links. Not too surprising was the link with the date of construction. Figure 1 provides a clear image of how the age of the building is represented in the granting of COAs for window replacement. It is easy to note that 28.57% of the single-family residences built before 1900 have had replacements installed. Houses constructed in the decade between 1900 and 1909 had barely more than 20% with windows replaced. In the dwellings constructed from 1910 to 1919, just 16.98% of the units have replacement windows in them, while the number of replacements for the decade between 1920 and 1929 dropped significantly, by 10% to 6.67%. The more recently constructed houses, from 1930 to 1940, the end of the period of significance within the district, had not had any windows replaced.

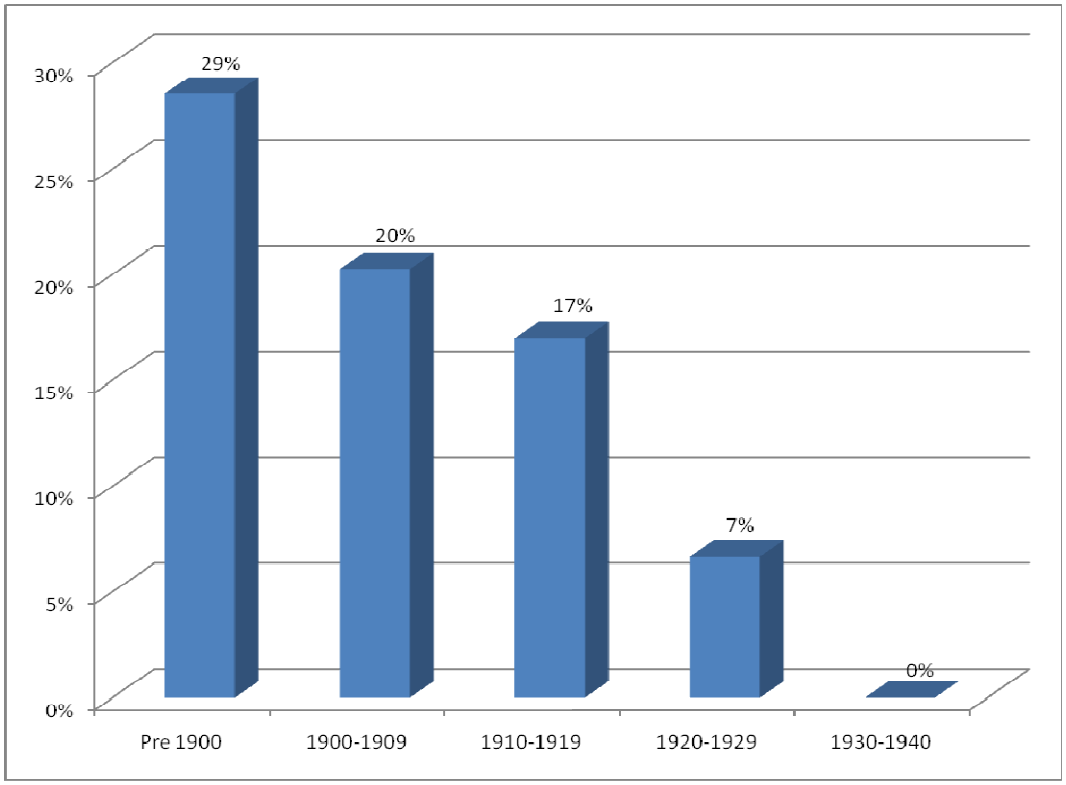

Figure 6. Percent of Structures with Window Replacements, by Original Construction Decade.

Of the 35 structures identified in the minutes having some window replaced, 24 of these COAs were identified as wood replacements, a full 91.67%. Table 2 shows the type of replacement units with recorded COAs. Of these units, four were identified as single pane and 10 were double pane units, the other units were unspecified. Twenty-two (62.86%) were wood, representing 9.52% of the total 231 structures. Of the identified window replacement types, 28.57% single pane units, while 71.43% of all the identified window types were double pane. Eight of the 24 contributing HCD homes were granted COAs for replacement windows. Of these eight, only one had received an additional replacement request. The eight HCD houses represent 22.86% of the total COA granted

for window replacement, 3.46% of the total number of 231 contributing single-family residences.

	Structures	
Pane Type	**Number**	**Percent**
Single-Wood	**4**	**11**
Double-Wood	**10**	**29**
Not Specified - Wood	**8**	**23**
Not Specified - Aluminum	**1**	**3**
Not Specified - glass block	**1**	**3**
Type and Material - Not Reported	**11**	**31**
Total	**35**	**100**

Table 1. Types of Window Replacement Units Receiving COAs.

Another question asked by the researcher concerned patterns that may exist that could be linked to the date of construction, window location, or architectural style with either replacement or original windows, or both. Investigation of the data revealed no pattern in original window style. Bungalow's, Queen Anne's, and Four-square's alike had one-over-one, or two-over-two, or any arrangement of panes in their window sashes. However, there was some data of note when considering architectural style. Table 2.

depicts grouping of the data to show window replacement approval by architectural style, which is listed in the first column. In the second column of the table, the number of houses represented in the district, by architectural style, is shown. The third column is the total number of houses, within each architectural style, that had a COA granted that fit within the parameters of this research project. Several styles in the College Hill Historic District had no replacements represented in the data. In examining Table 2, one can note that there are seven Cottage style; 20 Craftsman; two Italianate examples; and four each of the L-plan and Tudor styled houses that have not received any COAs related to replacement windows. One can note the remaining represented architectural styles and the number of existing structures within the district. There are 61 examples Bungalow's, 7 of the Gable style, 10 of the houses are Four-square, Queen Anne has the largest represented number at 75, and there are 2 Shingle style houses; all of which had at least one representative structure with replaced windows that fit within the parameters of this research.

		With Window Replacement	
Type	**Total**	**N**	**Percent**
Shingle	2	1	50%
Gable	7	3	43%
Four-square	10	4	40%
Queen Anne	75	18	24%
Bungalow	61	6	10%
Revival	39	2	5%
Cottage	7	0	0.00%
Craftsman	20	0	0.00%
Italianate	2	0	0.00%
L-plan	4	0	0.00%
Tudor	4	0	0.00%

Table 2. Percentage of Replacements by Architectural Style.

Close examination of the data led to the recognition of a learned cluster behavior, an unanticipated development in analyzing the research data. Cotic-Svetina, Jaklic, and Prodan, while exploring the phenomenon of cluster behavior as it relates to innovation performance, still provide a clear definition of cluster, or collective, learning. Cotic-Svetina, Jaklic, and Prodan observe that "there are several definitions of collective learning but in general, authors refer to a social process of learning, based on a set of shared rules and procedures that allow individuals to coordinate their actions…(2008, p. 336)." These authors further explain that the socialization that occurs between individuals due to proximity factors such as geography, socio-economic, or cultural can play into the

phenomenon. Spin-off activity is also a process that Cotic-Svetina, Jaklic, and Prodan note as contributing to cluster behavior. Cotic-Svetina, Jaklic, and Prodan concluded that "a strong, localized, common knowledge base is established within clusters, which is created and reproduced by constant communication between local actors (p. 339)." Figure 2. on the following page illustrates an example of cluster effect which is indicated in the College Hill Historic District. Note the several small clusters, generally located at the edges of the district. The figure shows the location of all of the contributing structures which have received COAs for window replacement based upon decade.

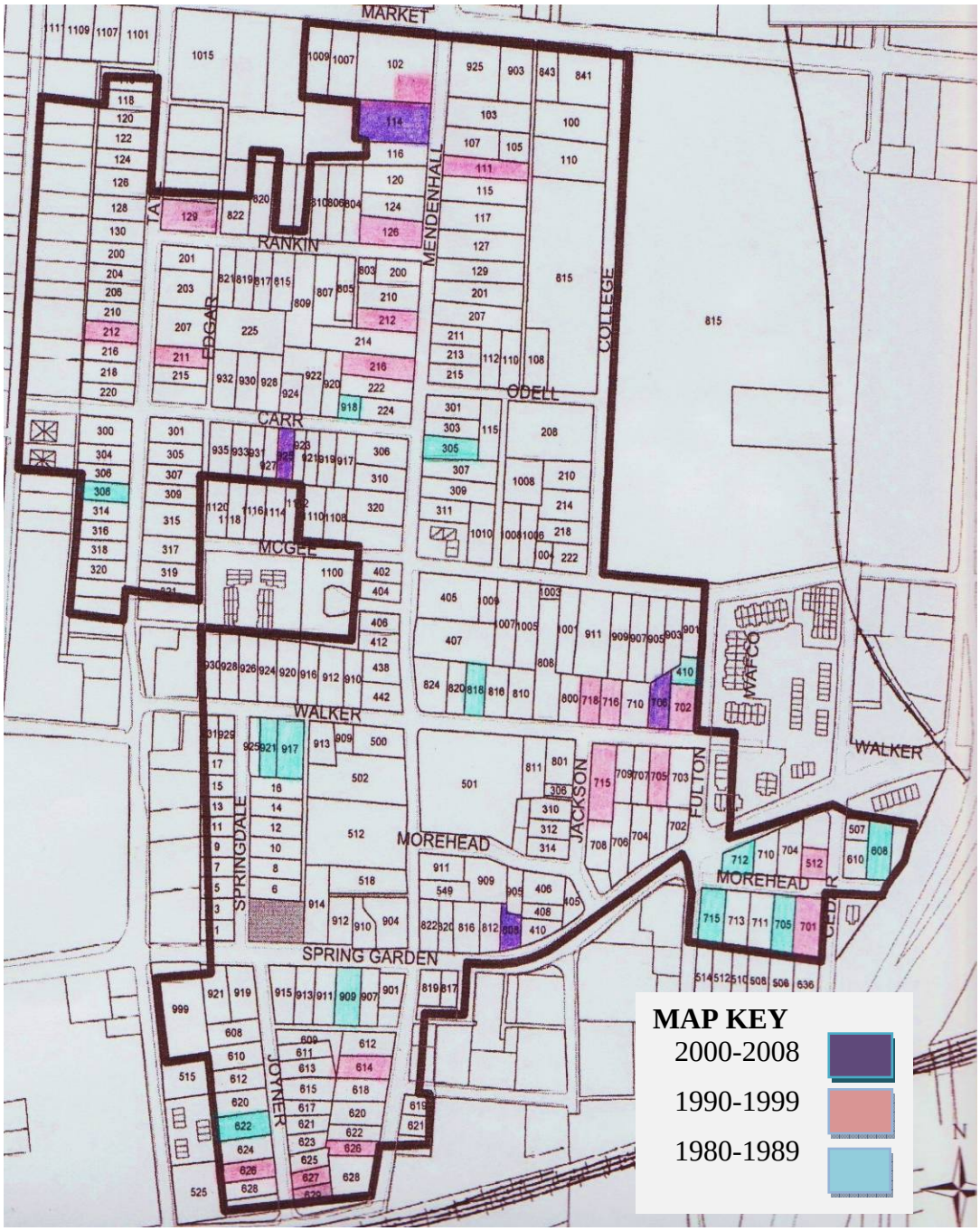

Figure 7. Single-Family Residences within College Hill Historic District that Received COAs for Window Replacement, by Decade.

The following figure shows the HCD purchased dwellings and the non-HCD purchased dwellings, showing the cluster effect of the replacement window activity since the designation of the College Hill Historic District.

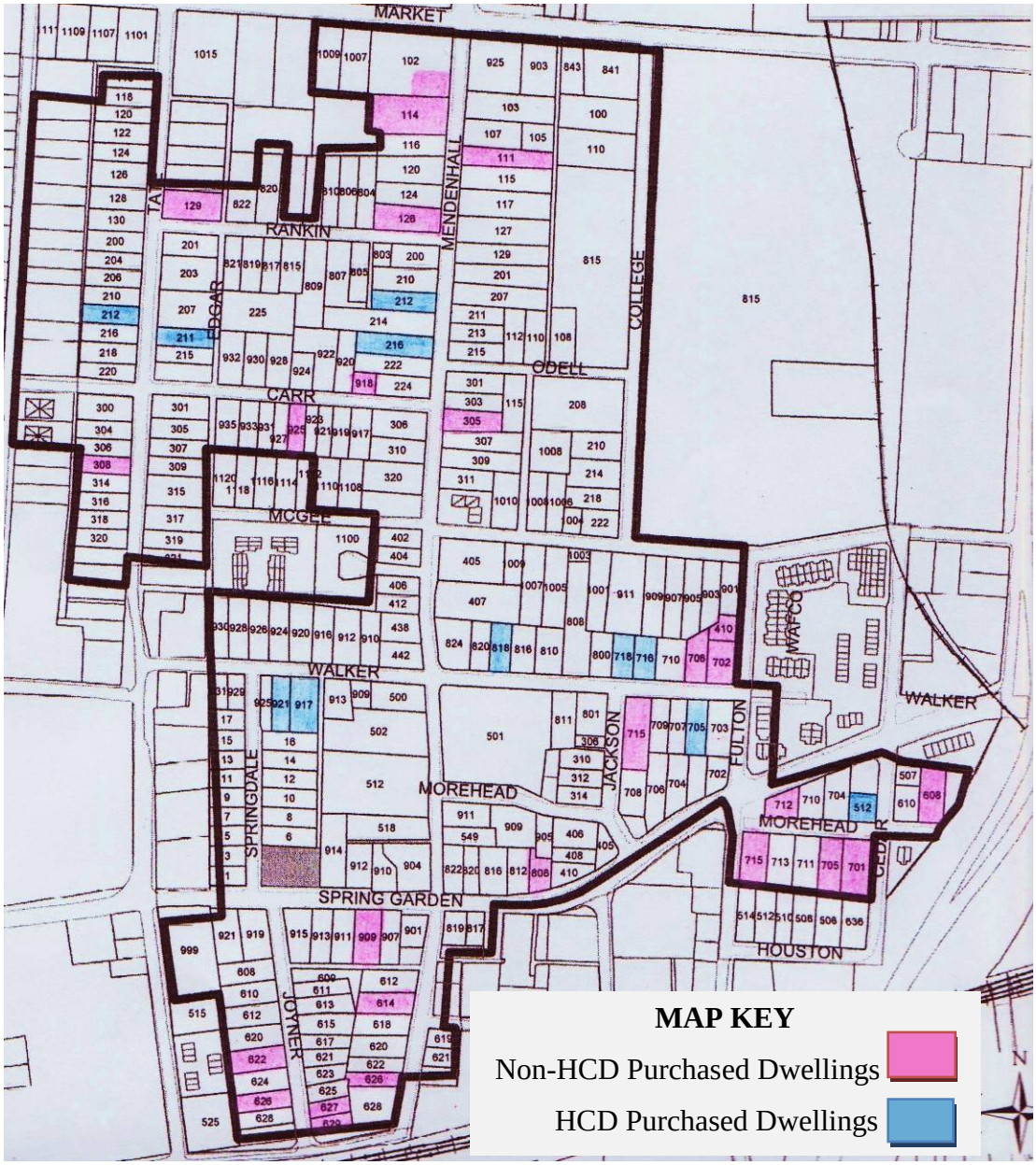

Figure 8. Cluster Effect of HCD and Non-HCD Dwelling Units, with Window Replacements.

The following graph is a depiction of the number of HCD purchased dwellings, a total of 24, which were recorded as contributing, viewed as the percentage of the total number of non-HCD houses in the district, 207, and the percentage of HCD houses that received COA's for replacement windows, 58.3%, as they fit within the limits of the research. The graph shows that more than half of the HCD purchased houses, which were admittedly the ones in the worst repair in the district, received window replacements. Yet, the HCD houses make up just 10.6% of the total district. The graph includes the COA's granted for replacement units for any number of windows in the HCD purchased houses.

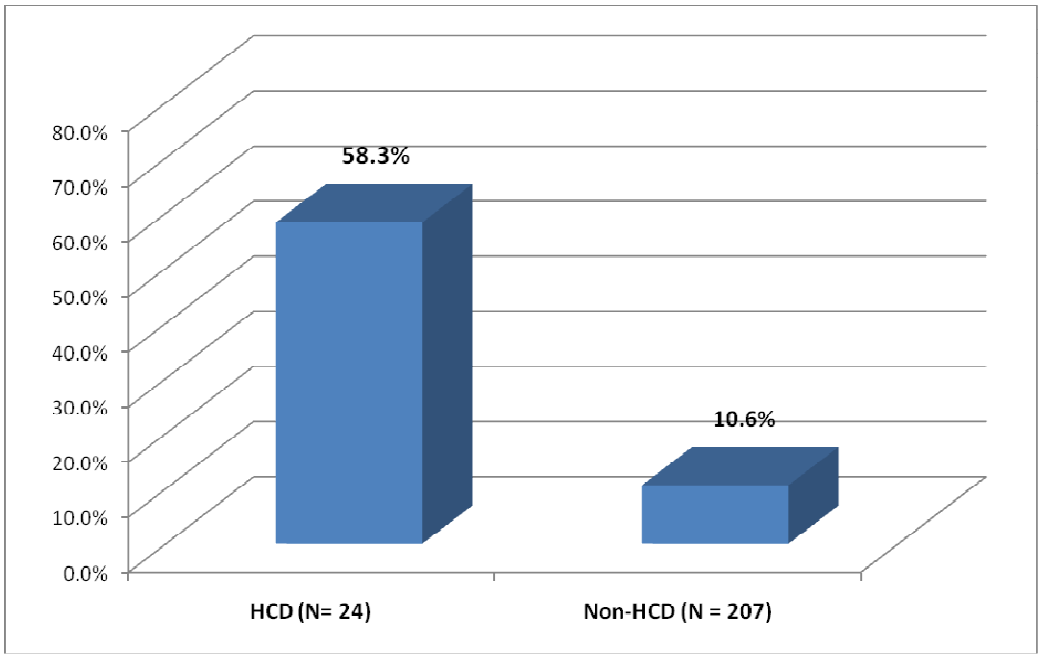

Figure 9. Percentage of HCD Status Structures with Replaced Windows.

This data set came with limitations that were not apparent when the research was commenced. The data had been compromised in an unusual fashion, as an unknown number of the COA documentation for numerous files had inadvertently been destroyed.

Only continuing with the research would provide information of which COA files had been compromised in this fashion. To compensate for this lose of data, the minutes were re-investigated for any data that would prove helpful in filling in the lapses of data created by this mishap. Further investigation of the files on the contributing dwellings proved to be unfruitful in another area, the exact number of units were not consistently named in either the minutes, on the COA application, or approved COAs. Additionally, in some instances ‘packets were distributed to the commissioners,’ but did not make it into the files of record, leaving several questions unanswerable. These questions were about how many windows, what types of windows, and where the units were located in plan or elevation, that had actually been replaced in many units. These limitations were unfortunate, however the researcher utilized the available data to provide insight to many of the original research questions, and identified several other contributions which the data could provide to the question of the lifespan of replacement windows in historic single-family dwellings.

CHAPTER V

CONCLUSION

General Conclusions

Brown uses terms such as “picturesque,” “florid,” and “decorative” have been used to describe the existent houses that were built in the first era of Greensboro’s history (1995, p.45). Preserving the dwellings that evoked such a respond is the task of the City of Greensboro Historic Commission (CGHC), recognizes that the Historic District neighborhoods should not be living museums, yet they strive to maintain the underlying principle of the districts innate importance in the character and history of the city by maintain the historic nature of the neighborhood. Assistance in this endeavor comes from the Secretary of the Interior’s Standards for Rehabilitation guidelines. In the guidelines the identification, retention, and preservation of all exterior features are identified as the crux of the standards. The extensive list of window components that are an important part of the historic fabric of the building includes not only the frame, sash, and glazing, but the sills, heads, and hoodmolds, too.

John Myers, points out that while ornamental windows are easily recognizable as worthy of preserving, sometimes windows can be the dominate feature in a otherwise ordinary building, as seen in the example of the simple cottage at 822 Rankin Street. As shown in the photographs, figures 1 through 5, a window is a unique stylistic contribution to the historic house, which in turn contributes to the district, and which then contributes

to the city in which it sits. Given the physical properties and contributions to the dwelling the unit the state of the window is important overall. Myers stresses that the major factors to evaluate a window's condition are location of the unit, loose or missing glazing, hardware, paint, and sash and sash member condition, not the evasive 'energy efficiency' factor.

The link between building and environment has become important in the current multidisciplinary focus on the environment and maintaining the environment for the betterment of local, regional, national, and international societies. Even so, efforts are still needed that take the ideal of stewardship of the earth to even further levels by promoting the sustaining of existing built environments as much as possible, whenever possible. When we reuse existing buildings, and all of their components, whenever possible, we contribute to 'best-use' of our resources.

There are no compelling arguments from the field of mechanical engineering for replacing historic windows, provided the windows are moderately airtight, treated to prevent excessive UV and visible light transmission, nor prone to excessive condensation. Given that only 20 percent of the total heat load for a building is accounted for in the context of windows, as Shapiro and James found, a larger portion of investment in energy efficiency should be spent elsewhere on the structure. Overall, the driving forces within important considerations for comfort include the visual appearance, comfort, along with fresh air and sunshine. Noting that not only are older structures usually more energy efficient than modern ones, as passive energy use was once commonplace, these structures inherently take advantage of solar heat and natural cooling

convection properties. A very strong discussion point for preservationists to use to persuade homeowners that retention of the original unit is good for energy savings, is the government research findings of the higher R-factor when combining original wood windows with triple-track storm windows.

Also contributing to the discussion are the subtleties of light and shadow, increasing the entire structure's contribution to the varieties of life, when the older windows, varied sashes are intact. An often-unconsidered circumstance of the double-glazed replacement window is the additional thickness of the support members requires to support the additional weight of the extra pane. Common convention dictates that factors such as the initial cost of the new units, maintenance that will still be required further down the road, and the resale value of the home that retains its original windows, should also be considered.

This research was conducted to provide a contribution to the ongoing replacement-window debate in the field of Historic Preservation. The intent behind this research is that, by providing data on the lifespan of replacement windows, more informed decisions can be made by those within the field and those that Preservationist communicate with. The goal has been to provide an analysis of this case study, selected based on its relevancy in this aspect of historic preservation. Research has been conducted in an attempt to map the reliability of the units over the anticipated length of service; contrasting replacement windows data with data collected on the surviving original wooden windows in a designated historic district in Greensboro, North Carolina.

The available data was searched for a clear indication on the lifespan of replacement windows and original wooden windows in the historic dwellings located within the College Hill Historic District of Greensboro, North Carolina, there were no absolutes presented. However, there were some generalizations that seem apparent, regarding the issue if replacement windows in the College Hill Historic District.

From the data that address the first question, regarding the number of dwellings in the historic district, which received replacements, the researcher found that only 35 of the contributing 231 single-family residence dwellings had received COAs. This seems to indicate that replacement issues are minimal in historic districts. While it is true that a full 40% of the COAs received for window replacement were HCD units, these were admittedly the structures in the poorest condition when the revitalization effort began in the late 1970s. Even though several HCD dwellings received replacement windows, 85% of the units within these parameters retained their original windows. Unfortunately, these numbers are not definitive; however they do present a strong case that window replacement is not as pressing an issue in the historic district as theorized at the onset of the research.

Preservationists are dedicated to preserving the integrity of the authentic fabric of historic buildings. In theory and in practice, valuable cultural and physical material retention is key to the principles of historic preservation. Preserving the original fabric of a building is paramount to preserving our national heritage. The unfortunate aspect of this research was the lack of hard data. Records providing the type of detailed information expected by the explicit requirements of obtaining a COA could be utilized to guide the

process and discussions on the issue both in the general community and during the application process.

Recommendations for Further Study

One might conclude that the Greensboro Historic District Commission's guidelines, the Secretary's Standards aided in damping any excessive action toward replacing window units. It is also possible that individuals who purchase houses in historic districts appreciate the nuances that the older windows provide in the dwellings. These are subjects that can be addressed in other research.

An area of the research that was interesting was that only four of the 35 single-family residences with COAs for replacements were again replaced. However, such a large majority of dwellings apparently retain original windows, that the replacement of these units is, by contrast, excessive, lending credence to the argument that the modern replacements are not as reliable as the original older windows. Further research could delineate a different, perhaps larger, set of data that might provide insight into that question.

The final intent of the research was to investigate for patterns that could be linked to the date of construction, window location, or architectural style with either replacement or original windows, or both. The research did find several links. Not too surprising was the link with the date of construction. However, there was no conclusive data that age was the largest factor, as style was also evident in the data analysis. Another factor found in the data, that of small clusters of activity, also warrants further research. The small amount of evidence collected suggests that the proximity and time-frame may

play a part in the initiation of the COA application. Research set up to investigate that might shed further light on the issue. These issues along with related research such as the social-economic demographics of the dwellings with replacements versus those without; an education-level based investigation; or a project which researches the social-interactive factors could all shed further light on this delicate issue.

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APPENDIX A

MAP OF COLLEGE HILL HISTORIC DISTRICT, GREENSBORO, NORTH CAROLINA

College Hill Local Historic District

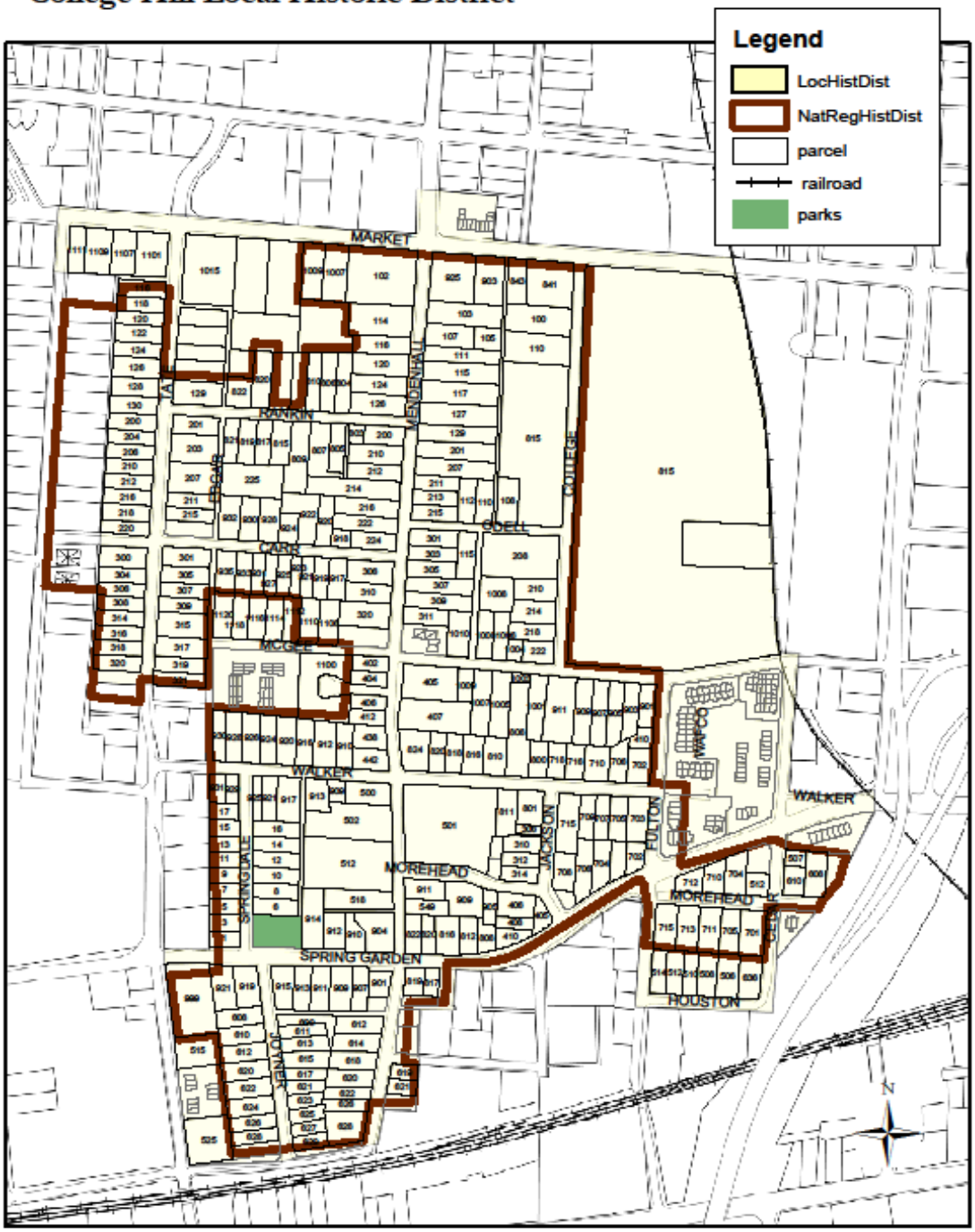


Figure 10. College Hill Historic District.

APPENDIX B

SECRETARY'S GUIDELINES FOR PRESERVING HISTORIC WINDOWS

PRESERVATION
the approach

When the property's distinctive materials, features, and spaces are essentially intact and thus convey the historic significance without extensive repair or replacement; when depiction at a particular period of time is not appropriate; and when a continuing or new use does not require additions or extensive alterations, Preservation may be considered as a treatment. Prior to undertaking work, a documentation plan for Preservation should be developed.

Choosing Preservation as a Treatment

In Preservation, the options for replacement are less extensive than in the treatment, Rehabilitation. This is because it is assumed at the outset that building materials and character-defining features are essentially intact, i.e, that more historic fabric has survived, unchanged over time. The expressed goal of the **Standards for Preservation and Guidelines for Preserving Historic Buildings** is retention of the building's existing form, features and detailing. This may be as simple as basic maintenance of existing materials and features or may involve preparing a historic structure report, undertaking laboratory testing such as paint and mortar analysis, and hiring conservators to perform sensitive work such as reconstituting interior finishes. Protection, maintenance, and repair are emphasized while replacement is minimized.

top

Identify, Retain, and Preserve Historic Materials and Features

The guidance for the treatment **Preservation** begins with recommendations to identify the form and detailing of those architectural materials and features that are important in defining the building's historic character and which must be retained in order to preserve that character. Therefore, guidance on ***identifying, retaining, and preserving*** character-defining features is always given first. The character of a historic building may be defined by the form and detailing of exterior materials, such as masonry, wood, and metal; exterior features, such as roofs, porches, and windows; interior materials, such as plaster and paint; and interior features, such as moldings and stairways, room configuration and spatial relationships, as well as structural and mechanical systems; and the building's site and setting.

top

Stabilize Deteriorated Historic Materials and Features as a Preliminary Measure

Deteriorated portions of a historic building may need to be protected thorough preliminary stabilization measures until additional work can be undertaken. ***Stabilizing*** may include structural reinforcement, weatherization, or correcting unsafe conditions. Temporary stabilization should always be carried out in such a manner that it detracts as little as possible from the historic building's appearance. Although it may not be necessary in every preservation project, stabilization is nonetheless an integral part of the treatment Preservation; it is equally applicable, if circumstances warrant, for the other treatments.

top

Protect and Maintain Historic Materials and Features

Preservation of the exterior of the Hale House, Los Angeles, California, involved repainting the exterior walls and decorative features in historically appropriate colors. In excellent example of the Preservation treatment focused upon the ongoing maintenance of historic materials and features. Photo: Before, NPS files; After: Bruce Boehner.

After identifying those materials and features that are important and must be retained in the process of **Preservation** work, then ***protecting and maintaining*** them are addressed. Protection generally involves the least degree of intervention and is preparatory to other work. For example, protection includes the maintenance of historic materials through treatments such as rust removal, caulking, limited paint removal, and re-application of protective coatings; the cyclical cleaning of roof gutter systems; or installation of fencing, alarm systems and other temporary protective measures. Although a historic building will usually require more extensive work, an overall evaluation of its physical condition should always begin at this level.

top

Repair (Stabilize, Consolidate, and Conserve) Historic Materials and Features

Next, when the physical condition of character-defining materials and features requires additional work, ***repairing*** by ***stabilizing, consolidating, and conserving*** is recommended. **Preservation** strives to retain existing materials and features while employing as little new material as possible. Consequently, guidance for repairing a historic material, such as masonry, again begins with the least degree of intervention possible such as strengthening fragile materials through consolidation, when appropriate, and repointing with mortar of an appropriate strength. Repairing masonry as well as wood and architectural metal features may also include patching, splicing, or otherwise reinforcing them using recognized preservation methods. Similarly, within the treatment **Preservation**, portions of a historic structural system could be reinforced using contemporary materials such as steel rods. All work should be physically and visually compatible, identifiable upon close inspection and documented for future research.

top

Limited Replacement In Kind of Extensively Deteriorated Portions of Historic Features

If repair by stabilization, consolidation, and conservation proves inadequate, the next level of intervention involves the ***limited replacement in kind*** of extensively deteriorated or missing parts of features when there are surviving prototypes (for example, brackets, dentils, steps, plaster, or portions of slate or tile roofing). The replacement material needs to match the old both physically and visually, i.e., wood with wood, etc. Thus, with the exception of hidden structural reinforcement and new mechanical system components, substitute materials are not appropriate in the treatment **Preservation**. Again, it is important that all new material be identified and properly documented for future research. If prominent features are missing, such as an interior staircase, exterior cornice, or a roof dormer, then a Rehabilitation or Restoration treatment may be more appropriate.

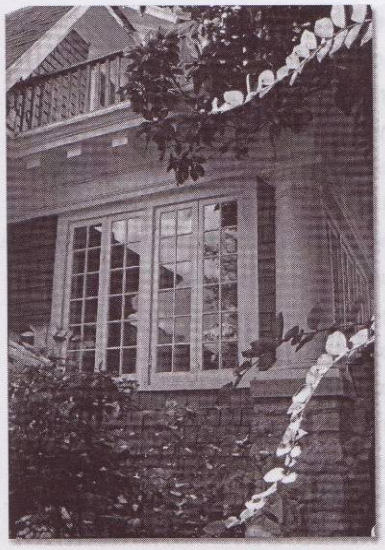
top

Energy Efficiency/Accessibility Considerations/Health and Safety Code Considerations

These sections of the **Preservation** guidance address work done to meet accessibility requirements and health and safety code requirements; or limited retrofitting measures to improve energy efficiency. Although this work is quite often an important aspect of preservation projects, it is usually not part of the overall process of protecting, stabilizing, conserving, or repairing character-defining features; rather, such work is assessed for its potential negative impact on the building's historic character. For this reason, particular care must be taken not to obscure, damage, or destroy character-defining materials or features in the process of undertaking work to meet code and energy requirements.

APPENDIX C

EXCERPTS FROM: CITY OF GREENSBORO HISTORIC DISTRICT PROGRAM MANUAL AND DESIGN GUIDELINES: WINDOWS AND DOORS



Windows and doors are prominent visual elements of historic structures, and often reflect the architectural style or period of construction. The pattern, arrangement, location, size, and shape of windows and doors contribute significantly to a building's historic character.

Windows in the Historic Districts are primarily double-hung wooden sash windows with a variety of muntin arrangements. Casement windows and a variety of other types are found on some houses in addition to double-hung windows. The number of lights (panes) in the sash varies with the style and period of the house. Most Victorian buildings have windows that are tall and narrow. Colonial Revival windows have multiple light divisions, with either six-over-six or six-over-one patterns. Bungalows and American Foursquares often have long narrow lights in the upper sash and a solid pane in the lower sash. Smaller fixed windows with a border of small panes can be found in the gable ends of Queen Anne and Craftsman style architecture. Often the entrance door will have this same treatment.

The front door is usually the focal point of the house and a key architectural feature. Original doors found in Historic Districts typically are wood panel doors with a fixed pane of glass, often with a muntin pattern similar to that of the windows. Solid wood doors are also seen in the districts, and usually have sidelights and fanlights with fixed panes of clear, beveled, or stained glass surrounding the doorframe.

Because of their strong link to and indication of the architecture and style of a building, original windows and doors should be maintained, repaired when necessary, and preserved as one of the defining elements of a historic structure. Studies have shown that repair of original windows is typically less expensive than replacement, and the proper installation of storm windows and doors ensures energy efficiency.

- Studies by the Energy Research and Development Administration show that the buildings with the poorest energy efficiency are those built between 1940 and 1975.
- A "muntin" is the thin strip of wood used to hold the panes of glass within a window. Often the muntin arrangement is an indicator of the architectural style of a building.
- Inspect sash locks for optimal performance, as their role is to securely hold the windows in place, and they will help to resist air infiltration when tightly sealed.
- Windows can be made weather tight by re-caulking and replacing broken glass and installing weather-stripping.

- Adding storm windows, especially if they are weather-stripped, will improve thermal efficiency and protect the windows from the elements.
- When considering replacement windows, determine the original window material, window pattern and configuration, dimensions, design, and any key detailing that is unique to the window, and use this information to assist you when selecting a window that will meet the intent of the guidelines.
- With proper weather-stripping and good locks, old doors can easily be made energy efficient and secure.
- With routine maintenance and repair, original windows and doors can be preserved. Preserving original windows and doors is always more desirable, and generally less expensive than replacing them. Frequently, repair or replacement of only the damaged portion of the frame, sash, sill, threshold, or jamb will eliminate common problems with a window or door.
- Add integrated weather-stripping to windows and doors to improve energy efficiency.
- Replace deteriorated caulking and glazing putty to prevent air or water infiltration around glass.
- Inspect windowsills and door thresholds to make sure water does not collect and cause deterioration.
- Regularly inspect windows and doors to make sure the paint film is in sound condition.

The following projects DO NOT require a COA:

- Re-glazing of windows
- Broken windowpane replacement
- Repairs to original wood windows and doors when there is no change in appearance and materials
- Painting of windows
- Installation of full view (glazed) storm windows and doors. Either wood or aluminum with baked enamel or painted finish is acceptable.

The following commonly requested projects require a COA:

- Replacement of original windows (Commission)
- Removal or addition of a window or door opening on elevations visible from the street (Commission)
- Exposing a previously covered window unit with replacement according to guideline #3 (staff approval)

Application Requirements:

- Project description
- Scaled elevation drawings of exiting windows and replacement windows
- Scaled elevation drawings of proposed changes to window and door openings
- Photos, illustrations, samples of proposed replacement units

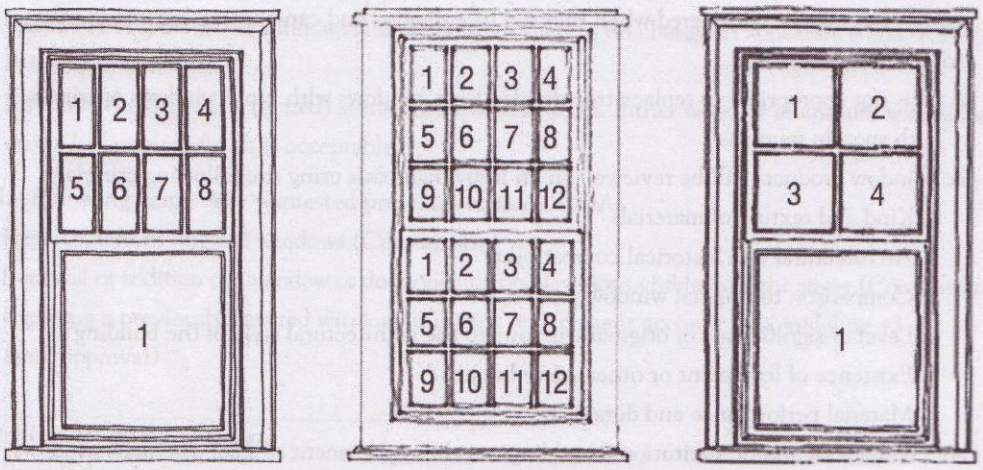
GUIDELINES FOR WINDOWS AND DOORS

1. Retain and preserve the pattern, arrangement, and dimensions of window and door openings on principal elevations. Often the placement of windows is an indicator of a particular architectural style, and therefore contributes to the building's significance. If necessary for technical reasons, locate new window or door openings on secondary elevations, and introduce units that are compatible in proportion, location, shape, pattern, size, materials, and details to existing units. For commercial and/or institutional buildings in need of a utility entrance on secondary elevations, select a location that meets the functions of the building, but is least visible from the street and causes the least amount of alteration to the building. It is not appropriate to introduce new window and/or door openings into the principal elevations of a contributing historic structure.
2. Retain and preserve original windows and doors, including such elements as sash, glass, sills, lintels, casings, muntins, trim, frames, thresholds, hardware and shutters. If repair of an original window or door element is necessary, repair only the deteriorated element to match the original in size, composition, material, dimension, and detail by patching, splicing, consolidating, or otherwise reinforcing the deteriorated section. The removal of historic materials shall be avoided.
3. When repair is not feasible, as determined by City staff, true divided light wood windows are an appropriate replacement product for original wood windows, when designed to match the original in appearance, detail, material, profile, and overall size as closely as possible. Double-paned glass may be considered when they are true divided and can accurately resemble the original window design.
   A. It is not appropriate to replace true divided light windows with vinyl windows or windows with snap-in muntins.
   B. Window products will be reviewed on an individual basis using the following criteria:
      1. Kind and texture of materials
      2. Architectural and historical compatibility
      3. Comparison to original window profile
      4. Level of significance of original windows to the architectural style of the building
      5. Existence of lead paint or other safety hazards
      6. Material performance and durability
4. For commercial and/or institutional buildings, or the replacement of steel casement windows, if it is not feasible to repair original windows as determined by City staff, select replacement products that are compatible in proportion, location, shape, pattern, size, and details to the original window component using the criteria as stated in 3B.
5. Select exterior storm windows and doors that are wood or painted/coated with a baked enamel

finish, and that do not damage or obscure the original windows and doors when installed. Select storm doors with full glazing to maximize the view of the door. Unfinished aluminum windows and doors are inappropriate for the Historic Districts.

6. Where historically appropriate, install fabric awnings so that they do not damage or conceal architectural details or historic materials. It is not appropriate to install aluminum awnings over windows, doors or porches on residential structures. Metal awnings may be appropriate for commercial and/or institutional properties when historically compatible with the architecture of the building.
7. Window shutters should be wood and designed to fit the window opening and attached to the window casing. Shutters should be introduced only when historically appropriate to the architecture of the building, or when it is documented that shutters are original to the building. Aluminum or vinyl shutters that are attached to the side of a building are inappropriate for the Historic Districts.

Eight over one *Twelve over twelve* *Four over one*



What is a Muntin? ***A muntin is a thin wooden bar used to hold panes of glass in place. Often the muntin configuration is indicative of the architectural style of the house. Most historic windows have "true-divided light windows," which means that each window section is an individual pane of glass with a wood muntin that goes from the outside of the window all the way through to the inside of the window.***

Scanned images from City of Greensboro Historic District Program Manual (2003) used with permission.

APPENDIX D

GREENSBORO HISTORIC DISTRICT COMMISSION CERTIFICATE OF APPROVAL APPLICATION

CITY OF GREENSBORO
HISTORIC DISTRICT PROGRAM

CERTIFICATE OF APPROPRIATENESS APPLICATION FORM

LOCATION _____
Street Address Where Work Will Be Undertaken

PROPERTY OWNER _____
Last Name | First Name | MI

ADDRESS _____
Number | Street

_____
City | State | Zip

CONTACT INFO _____ _____ _____
Daytime Phone No. | Email | Fax

APPLICANT
(If different from owner) _____
Last Name | First Name | MI

ADDRESS _____
Number | Street

_____
City | State | Zip

CONTACT INFO _____ _____ _____
Daytime Phone No. | Email | Fax

PROPERTY OWNER'S SIGNATURE
(required)

_____

APPLICANT'S SIGNATURE

_____

Mail or Fax Application To
Department of Housing and Community Development
City of Greensboro
PO Box 3136
Greensboro, NC 27402-3136
Fax: 336-412-6315 Phone: 336-373-2349

FOR OFFICE USE ONLY

Date Received _____

Application # _____

ACTION	DATE
☐ Approved	_____
☐ Approved with Conditons	_____
☐ Denied	_____
☐ Withdrawn	_____
☐ COA Not Required	_____
☐ Staff Approval	_____

Revised 1-03-08

PROVIDE THE FOLLOWING INFORMATION

Note: Documentation must be provided in a format that is legible and and can be copied easily. Ledger size paper (11" x 17") is best for most elevation drawings. For additional information consult the guidelines manual.

Exterior Repairs

Photograph of repair site for replacement of deteriorated porch railings, columns, steps, slate or terra cotta tile roof shingles, or other architectural features; describe replacement materials.

Exterior Alterations

- Scaled elevation drawings for alterations such as adding or removing window or door openings.
- Construction details for adding features such as porch columns, railings, steps, etc.
- Photograph of site of proposed alterations.

Additions to Buildings

- Scaled elevation drawings of all sides of the proposed addition.
- Site plan or survey showing the building footprint with the proposed addition. Indicate distances to property lines.
- Photograph of site of proposed addition.

Landscaping and Site Improvements

- Drawing, illustration, photograph, etc. showing design and dimensions of fences, walls, etc.
- Site plan showing location of proposed fences, walls, walks, patios, driveways, parking areas, pools, dumpsters, mechanical equipment, etc.
- Sample or illustration of materials for walks, patios, etc.

New Buildings

- Scaled elevation drawings of all sides of the proposed building.
- Site plan showing building footprint and distances to property lines, site improvements including utilities, lighting, and mechanical equipment, and all existing trees larger than 4" dbh (diameter at breast height).
- Landscape plan showing location, type, and size of new plant materials.
- Materials specifications, color, samples, and illustrations.

Demolition

- Site plan showing location of trees larger than 4" dbh, and site features such as fences, walks, etc.
- Photographs of all sides of the building to be demolished

Moving Buildings

- Site plan showing location of trees larger than 4" dbh and features such as fences, drives, walls, walks, etc.
- Photographs of all sides of the building to be moved.
- Site plan, landscape plan, etc. if new location is within the historic district boundaries.

Special Exceptions
Provide site plan that identifies any Special Exceptions to dimensional or parking requirements being requested as part of the COA application. **Note: The Historic Preservation Commission may recommend Special Exceptions to zoning requirements or design standards as part of its review of a COA application. However, only the Board of Adjustment can grant Special Exceptions. Applications for Special Exceptions are filed in the Zoning Enforcement Office and there is a filing fee.**

The application for a Certificate of Appropriateness and all supporting information must be received no later than 14 days prior to the Historic Preservation Commission meeting. Incomplete applications will not be reviewed by the Commission. The Commission meets on the last Wednesday of each month at 4:00 PM in the Plaza Level Conference Room of the Melvin Municipal Office Building, 300 W. Washington Street. **Applicants are strongly encouraged to attend the meeting.** Decisions of the Historic Preservation Commission may be appealed by filing notice with the Board of Adjustment within 15 days after the meeting. Appeals are filed in the Zoning Enforcement Office of the Planning Department.

Certificates of Appropriateness remain in force for the duration of a project. However, if a period of one year passes and no progress has been made toward completing the project, the COA is voided and a new application must be submitted and approved before work may resume.

A new COA application must be submitted for any changes to approved plans. Deviating from approved plans constitutes a violation of the historic district regulations and is subject to a civil penalty. The maximum penalty is $50 for the first day of a violation, $100 for the second day, $200 for the third day and $500 for the fourth and any succeeding day of a continuing violation.

The Certificate of Appropriateness does not relieve the property owner from the responsibility of obtaining any other required permits. Building Permits and other permits may be required even if a Certificate of Appropriateness is not required. For more information contact the Building Inspections Office at 373-2155.

The **Design Review Committee** provides technical advice for historic district residents and property owners. The committee meets at 4:00 PM in the Plaza Level Conference Room.

2008
HISTORIC PRESERVATION COMMISSION
MEETING SCHEDULE

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	30	27	26	39	28	25	30	27	24	29	26	No Meeting
Application Deadline	16	13	12	16	14	11	16	13	10	15	12	
Design Review Committee	10	7	6	3	1	5	10	7	4	2	6	

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Copy of Certificate of Appropriateness Application used by permission, retrieved October 31, 2008; used with permission.

APPENDIX E

TABLE AND FIGURE CREDITS

Table 1

Types of Window Replacement Units Receiving COAs. Table based on spreadsheet developed by researcher, constructed in collaboration with Dr. Kenneth Gruber, University of North Carolina at Greensboro.

Table 2

Percentage of Replacements by Architectural Style. Table based on spreadsheet developed by researcher, constructed in collaboration with Dr. Kenneth Gruber, University of North Carolina at Greensboro.

Figure 1

130 S. Tate St., ca. 1905-10; Queen Anne: Original Windows. Photo by author.

Figure 2

200 S. Tate St., ca 1920-25; Four-square: Original Windows. Photo by author.

Figure 3

204 S. Tate St., ca.1917; Craftsman - Neo-Classic: Original Windows. Photo by author.

Figure 4

822 Rankin St., ca. 1900-03; Cottage with Hip-roof: HCD Purchased / Rehab Dwelling: No Replacement COAs on Record. Photo by author.

Figure 5

308 S. Tate St., ca 1905-10; Queen Anne - Colonial-Revival: 1983 Window Replacements: Non-HCD House. Photo by author.

Figure 6

Percent of Structures with Window Replacements, by Original Construction Decade. Figure based on spreadsheet developed by researcher, constructed in collaboration with Dr. Kenneth Gruber, University of North Carolina at Greensboro.

Figure 7

Single-Family Residences within College Hill Historic District that Received COAs for Window Replacement, by Decade. Figure based on spreadsheet developed by researcher, constructed in collaboration with Dr. Kenneth Gruber, University of North Carolina at Greensboro.

Figure 8

Cluster Effect of HCD and Non-HCD Dwelling Units, with Window Replacements. Map constructed by researcher utilizing shell of the City of Greensboro College Hill Historic District Map, downloaded May 8, 2007, from http://www.greensboro-nc.gov/departments/hcd/planning/maps/ used with permission.

Figure 9

Percentage of HCD Statue Structures with Replaced Windows. Map constructed by researcher utilizing shell of the City of Greensboro College Hill Historic District Map, downloaded May 8, 2008, from http://www.greensboro-nc.gov/departments/hcd/planning/maps/ used with permission.

Figure 10

College Hill Historic District. Downloaded May 8, 2008, from http://www.greensboro-nc.gov/departments/hcd/planning/maps/ used with permission.

APPENDIX F

CONSENT FORMS

Jennie Alkire
203 Oak Street
Morganton, North Carolina 28655

November 18, 2008

Mike Cowhig
Community Planner
City of Greensboro
300 W. Washington Street, Room 315
Greensboro, North Carolina

Dear Mr. Cowhig:

I am completing a masters' thesis at the University of North Carolina at Greensboro entitled "Replacement Windows in Historic Houses: A Study of the College Hill Historic District, Greensboro, North Carolina." I would like your permission to reprint in my thesis excerpts from the following:

City of Greensboro Historic District program manual & design guidelines. (2003, Fall). (Available from the City of Greensboro Department of Housing & Community Development, 300 W. Washington Street, Room 315, Greensboro, NC 27402-3136).

The COA form downloaded from the City of Greensboro web site.

The College Hill Historic District map, downloaded from the City of Greensboro web site.

The excerpts to be reproduced are: the pages from the manual that relate to window guidelines, in an appendix; and information which pertain to the background of the district and the HCD houses.

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If these arrangements meet with your approval, please sign this letter where indicated below and return it to me in the enclosed return envelope. Thank you very much.

Sincerely,

Jennie Alkire

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

Mike Cowhig

Mr. Mike Cowhig

Date: Nov. 26 2008