TAYLOR WELLS, GISÈLE, M.S. The Greening of Historic Places: Finding Common Ground Between Historic Tax Credits and LEED Certification. (2008)
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The number of LEED certified historic buildings continues to increase as the use of the LEED rating system becomes more wide-spread. This increase has led to the need to understand the impact of the LEED rating system on historic buildings. This thesis focused on the study of projects involving the rehabilitation of historic buildings using federal historic tax credits and seeking LEED certification. The decision to only evaluate federal historic tax credit projects was made in order to have a means of measuring the impact on the historic character of the building. All projects using federal historic tax credits must adhere to the Secretary of the Interior's Standards for Historic Rehabilitations, a set of guidelines for the proper treatment procedures to insure the protection of the historic integrity of the built environment. The LEED certification serves as a means to judge the quality of green design employed in the rehabilitation.

For each of the ten identified projects the national register nomination, federal historic tax credit application, and LEED scorecard was evaluated to identify commonalities and relationships that exist between the two independent processes. The evaluation yielded an ideal building and project profile for projects seeking federal historic tax credits and LEED certification, commonalities in LEED points earned, and the investigation of relationships that exist between the two processes. These findings will serve to inform both the preservation and green building communities of physical characteristics, project types, how dual certification projects earn LEED points, and an understanding of the relationships that exist between federal historic tax credit and LEED certification processes.

THE GREENING OF HISTORIC PLACES:

FINDING COMMON GROUND BETWEEN

HISTORIC TAX CREDITS AND LEED

CERTIFICATION

by

Gisèle Taylor Wells

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Approved by

_____
Committee Chair

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.

Committee Chair _____

Committee Members _____

_____

_____
Date of Acceptance by Committee

_____
Date of Final Oral Examination

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CHAPTER I

INTRODUCTION

"We can't build our way out of our environmental problems, but we can – and must – make better, wiser use of what we've already built. That's what sustainability is all about." (National Trust, 2007). This quote from Richard Moe, current president of the National Trust for Historic Preservation, is at the heart of this thesis study and puts into words the mindset society needs to have when planning the rehabilitation of historic structures.

For the purpose of this study the term "sustainable design" will be defined as "a design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating the negative impact to the natural environment" (McLennan, 2004, pg 4). Sustainable design considers a holistic approach to creating a healthier and less wasteful society. The term "green building" will be used when referring to the actual building practices and professionals that deal with the built environment. In the United States LEED, Leadership in Energy and Environmental Design, is the most widely accepted evaluation system used to determine how "green" a building and site are relative to a conventional building constructed to meet current building codes; however, it is not the only system in use world wide. Canada and the UK both employ their own version of a green rating system to evaluate their buildings. The Canadian system, known as LEED Canada, is an adaptation of the USGBC's LEED-NC 2.1 rating system. The most widely used rating system in the UK is known as BREEAM, recognized by the UK Green Building Council. This system has a proven track record in

Europe but has not been tested in the US. For frequently used historic preservation definitions see appendix A.

Beginning in late 2005, the National Trust for Historic Preservation, the National Park Service, the American Institute of Architects (AIA), and the Association of Preservation Technology (APT) came together to write a joint letter to Richard Fedrizzi, the US Green Building Council president, to look for common ground between preservation and LEED certification (O'Connell, 2007). The letter called for the US Green Building Council to recognize that "[o]lder and historic buildings comprise more than half of the existing buildings in the United States and the retention and reuse of these buildings preserves materials, embodied energy, and human capital already expended in their construction"(O'Connell, 2007, pg 18). In a later document the authors of the letter stated that the current LEED "rating systems overlook the impact of [historic rehabilitation] projects on cultural value; nor do they effectively consider the performance, longer service lives and embodied energy of historic materials and assemblies; and are overly focused on current or future technologies, neglecting how past experience helps to determine sustainable performance" (National Coalition, 2007, pg 1). The preservation and sustainable design communities both hold stewardship at the core of their beliefs; the differences arise from the ways each community approaches that stewardship.

The dialogue on this topic started more than twenty-five years ago when the National Trust for Historic Preservation began to promote the inherent sustainability of historic preservation by promoting the ideas of embodied energy and preservation as the "ultimate recycling." In recent years this topic has received increasing professional attention from both communities due to increased awareness of the growing

environmental challenges that society is facing. The combination of sustainability and preservation was a focus at the 2006 National Preservation Conference in Pittsburgh, PA, at which a national summit on the greening of historic properties was held. The summit consisted of professionals from the preservation and green building communities; their aim was to formulate common goals and guidelines for greening historic properties. The white paper that was the product of the summit expressed the conflicts that the participants believed came with the greening of historic properties. One of the main conflicts identified came from the perceived inflexibility of both the Secretary of the Interior's Standards for Historic Preservation and the Green Building Guidelines set forth in the LEED system (National Summit White Paper, 2006).

Others in the preservation community, including the National Trust for Historic Preservation and APT, felt that the white paper called for "one-dimensional" changes. Carl Elefante, AIA, and Susan Ross, co-founders of APT's technical committee on sustainable preservation stated that "by dwelling on the purported conflicts, the white paper underemphasizes the fundamental challenge facing both green building and historic preservation communities: defining strategies to sustain the existing building stock" (O'Connell, 2007, pg 18). Since the 2006 National Trust conference the amount of research being conducted on the issues that face the combination of green building and historic preservation practices has increased. The green building community has also become involved in this research with interest from the US Green Building Council (USGBC) and the recent Greenbuild conference held in Chicago, November 2007, where the National Coalition on Sustainable Preservation made recommendations to the USGBC on ways to adapt the current LEED rating system to better recognize the inherent green qualities of historic and existing buildings.

While there has been increased communication between the two communities, the successful combination of these two areas continues to present challenges. Many of the assessment guidelines for LEED certification are written for new construction, leaving only 11 out of a possible 69 points that specifically apply to existing building reuse. Such a lack of consideration for the application of LEED requirements to the unique characteristics of historic structures leads to conflicts between the preservation and sustainable design communities (The Greening of Historic Properties, 2006). The lack of consideration for the reuse of existing buildings led to the aforementioned joint letter from the preservation community to the USGBC and the "creation of an historic-projects committee, [that] will work to devise a guideline for applying existing LEED standards to older structures or will develop an entirely new LEED rating system for historic buildings" (O'Connell, 2007, pg 20). The committee formed to develop the proposed guidelines for LEED is the National Coalition on Sustainable Preservation. In July of 2007 they presented preliminary Preservation Metrics for USGBC's LEED Products, which address the need for more consideration of sustainable opportunities found in building reuse.

The application of the LEED rating system to historic buildings is becoming a growing trend. In 2007 the National Trust of Historic Preservation formed a Sustainability Initiative and had identified more than 30 registered historic properties that have become LEED certified (NTHP, 2007). The increasing number of LEED certified historic buildings led the researcher to ask: What effect does the application of the LEED rating system have on a historic building? In early 2007, there was no completed research addressing this question.

In order to address the identified current need this study was designed to increase the understanding of the effect that the LEED certification process and requirements has had on the historic built environment and in turn the effect that the federal historic tax credit process has had on achieving LEED certification. To meet that goal, the study investigated the potential overlap existing between historic preservation and green design approaches to the rehabilitation of a historic building.

To create her sample, the researcher first generated a list of historic rehabilitation projects using federal historic tax credits and seeking LEED certification. From that list only the ten projects that had an approved Part II of the federal historic tax credit application and already received LEED certification were included in the evaluation process. An approved Part II for historic tax credits indicated the proposed rehabilitation work complied with the Secretary of the Interior's Standards for Rehabilitation of Historic Properties. For each project the national register nomination, federal historic tax credit application, and LEED scorecard was collected for evaluation. These documents were reviewed to identify the physical characteristics of the buildings, NPS approved changes, LEED rating levels earned, and specific categories met.

The researcher outlined a series of research questions to guide the evaluation of the projects that met the specified requirements for inclusion. Those research questions were as follows:

- What types of projects used federal historic tax credits and achieved LEED certification? Were they large, small, tenant up-fit, rural, urban?
- What impact, if any, did the age, original construction method, original use, and existing conditions of the building prior to the rehabilitation have on the

success of the project? Were these common factors among the different projects?

- What changes were made to the building as part of the NPS approved rehabilitation work? Were there additions removed or added? Was the facade or interior configuration altered?
- Which of the approved changes could have resulted in LEED points? Did those changes impact the historic character of the building?

The research questions were designed to aid in identifying commonalities and trends that could have existed between the projects. It was thought that the identification of commonalities would lead to a building and project profile and an understanding of how dual certification projects earn LEED points. The commonalities would also aid in the investigation of the relationship between the two processes.

In addition to the development of specific research questions, the researcher also hypothesized potential existing relationships between the federal historic tax credit and LEED certification processes: mutually supportive, parallel, and conflict. An overlap between the two processes with successful results would be a reflection of a mutually supportive relationship. A finding of a parallel relationship would reflect the two processes working separately but with a successful result. The third hypothesized relationship was to find the two processes in conflict, meaning that one process dominated another with unsuccessful results. Evaluating the included projects for evidence of these three potential relationships served to increase the understanding of the way in which the two processes interact. The researcher anticipated that she would find evidence of mutually supportive relationships existing between the two processes due to the nature of the sample projects. Because the sample only included projects

with an approved Part II and LEED certification, she felt that there must be an overlap. In addition to the nature of the projects, historic preservation and green design both have a common core belief of stewardship toward the natural and built environments which should result in some type of overlap in practice.

Because LEED certification only began in 2000, the sample is small; however, it is anticipated that the creation of the identified project list and the evaluation of the identified projects will be useful for both the preservation and sustainable design communities when involved in rehabilitating a historic or existing building. By promoting the preservation of the historic built environment and the sustainability of the built environment, society benefits on many levels. "Reusing, restoring, and adapting historic structures to the needs of today, allows society to effectively leverage the energy and resource expenditures of past generations [embodied energy], while minimizing waste and current energy and materials usage" (The Greening of Historic Properties, 2006, pg 5). As the amount of existing and historic buildings that need rehabilitation increases, it will become essential that the rehabilitations are sensitive to both the built and natural environments. By evaluating the techniques and solutions of past projects through the use of qualitative analysis this study may aid the preservation and green building communities in understanding the profile of projects that are likely to succeed.

CHAPTER II

REVIEW OF LITERATURE

This chapter focuses on the history, development, and impact of preservation and sustainable design on current practice and thought. In the course of this research understanding the federal preservation tax credit application process and the LEED rating systems is vital to the evaluation of the identified projects, a detailed explanation of each was included in this section.

Preservation

Modern Preservation Theory and the Secretary of the Interior's Standards

The US Department of the Interior defines preservation as "the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property" (US Department of the Interior, 1992). This definition stresses the importance of maintaining the authenticity and integrity of the historic building environment while preserving it for future generations. Modern preservation theory can find its roots in the nineteenth century philosophical approach of "anti-scrape." The "anti-scrape" movement grew out of the writings of John Ruskin, a renowned art and architecture critic in nineteenth century England. This approach advocates the retention of alterations and additions to the built environment as they enhance the significance of the built environment and represent the history of the various inhabitants. The "anti-scrape" philosophy promotes the principle of equivalence in which all phases of a building's existence hold equal importance with the significance of the building. It is this

philosophy that the Secretary of the Interior used to guide the development of the Standards for Rehabilitation.

In contrast to “anti-scrape” philosophy is the “scrape” approach, which is also based in nineteenth century preservation philosophy. This approach is based on the principle of preference, which does not recognize all time periods of a building as having equal significance. The “scrapist” method of restoration promotes the removal of later alterations to a building in order to return the building to the appearance it would have had in the determined period of significance. “Scrapist” techniques are used in restoration projects, such as house museums or at historic sites like Old Salem, NC, and Colonial Williamsburg, VA.

In 1976 the Secretary of the Interior issued standards for the preservation, restoration, rehabilitation, and reconstruction of historic properties as a set of guidelines for preservation professionals and historic property owners. For the purpose of this study the Secretary of the Interior’s Standards for Rehabilitation (see appendix B) have the most significance. These are the standards that must be met for a project to be considered a certified rehabilitation of a historic property and to be eligible for federal grants, monies, and federal preservation tax credits. The Secretary of the Interior’s Standards are often referred to as the Secretary’s Standards.

The US Department of the Interior defines rehabilitation as “the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values” (US Department of the Interior, 1992, pg 5). The purpose of the Standards for Rehabilitation is to assist in the long-term preservation of a property’s significance through the

preservation of historic materials and features. The guidelines can be applied to all types of historic materials and construction methods to aid in their preservation. The Standards can also be applied to a building site and surrounding landscape if those elements are deemed significant to the character of the building.

Current preservation philosophy is reflected in the first three standards for rehabilitation:

> #1 A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
>
> #2 The historic character of a property shall be retained and preserved. The removal of historic materials or alterations of features and spaces that characterize a property shall be avoided.
>
> #3 Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

These initial standards speak to the philosophy of retention over replacement and specifically address the authenticity and integrity of the building. The preservation of the building as a document of the past and the importance of preserving the character of the built environment are featured in these three standards. The retention of original features and elements aids in the preservation of the authenticity and maintains the integrity of the design.

The fundamentals of the Anti-Scrape Philosophy are represented in the fourth standard:

> # 4 Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

This standard expresses the principle of equality stating that alterations gain their own significance over time, a significance that is equal to the significance of the original

structure. The “anti-scrape” philosophy advocates the preservation of a building versus its restoration to a specific time frame, which stresses the significance of one time period.

In addition to the Secretary’s Standards for Rehabilitations, the Department of the Interior also created Guidelines for Rehabilitating Historic Buildings indicating how to apply the standards to a rehabilitation project. These guidelines are a set of “recommended” and “not recommended” treatments for various exterior and interior elements and materials, such as roofs, masonry, and windows. These guidelines focus on three options for damaged elements that are character defining to the building: “protect and maintain, repair, and replace” (US Department of the Interior, 1992, pg 8). “Protect and maintain” is the least invasive treatment for an element and can mean as much as the protection from additional deterioration until a decision is made about the proper course of action or as little as a scheduled gutter cleaning to prevent damage. “Repair” of character defining elements is more involved than “protect and maintain,” but it enables the retention of the original building material by repairing the damage. Replace is the last resort when the damage is too severe to be repaired. When replacement is the appropriate course of action, the damaged element should be replaced in kind. Replacement “in kind” means that the new element is the same as the original in appearance, detail, and material if possible. However, the replacement element should remain distinguishable from the original fabric.

The Secretary’s Standards for Rehabilitation embody sentiments of the anti-scrape philosophy as well as the importance of preserving the integrity and authenticity of the historic built environment. These standards for rehabilitation are intended to be

applied to specific projects to guide the preservation of the building while allowing it to be adapted to meet the current needs of its community.

The Modern Preservation Movement

Society seeks to preserve its heritage because historic resources are the relics of its past. Historic sites and structures are preserved because of their relationship to past events, eras, movements, and people that society considers important to honor and understand. Noted preservationist Robert E. Stipe (2003) wrote that "[a]rchives, photographs and books are not sufficient to impart the warmth and life of a physical heritage" (pg xiii). Stipe (2003) said that it is in the preservation of the built environment that society can witness the "warmth and life" of its past. David Lowenthal (1985), in his book *The Past is a Foreign Country*, described the historic built environment as relics which are the residues of the processes of society that continually refurbish society's understanding and awareness of the past along with memory and history. Lowenthal (1985) expanded upon that idea by explaining that relics, unlike memory or history, are mute objects that require interpretation by society; they can not stand on their own. It is the task of the preservationist to protect and interpret the historic built environment for the public to appreciate and understand. Both Stipe and Lowenthal advocate the founding principles of the modern preservation movement and reinforce the important role that the historic built environment plays in society.

The modern preservation movement, on the federal level, can see its beginnings in the 1930s. In 1933, as part of the "New Deal," unemployed architects and photographers were put back to work through social work programs documenting historic buildings, which became the Historic American Buildings Survey (HABS), the

first national survey of historical sites. Later in the decade, the "Historic Sites Act of 1935 called upon the Secretary of the Interior to conduct surveys of historic places throughout the nation and to identify properties that might be included in the National Park System" (Stipe 2003, pg 8). This list later became the basis for the National Register of Historic Places, a program which the National Park Service administers.

The National Register of Historic Places has four criteria that are used to determine the significance of a property seeking designation. Those criteria are as follows (US Department of the Interior, 1995):

A. That [the property] is associated with events that have made a significant contribution to the broad patterns of [society's] history.

B. That [the property] is associated with the lives of persons significant in society's past.

C. That [the property] embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

D. That [the property] has or may be likely to yield information important to prehistory or history.

If a property meets one or more of those criteria at either a local, state, or national level, then it will be considered for inclusion on the National Register of Historic Places. The National Park Service will generally not approve the inclusion of cemeteries, birthplaces, graves, religious properties, structures that have been moved from their original site, reconstructed buildings, commemorative properties, or those properties under 50 years old. There have been exceptions to the 50 year criteria if the property is found to be of exceptional quality. Since the creation of the National Register of Historic Places, over 80,000 properties and districts that consist of more than one

million buildings have been listed, with 40,017 added in 2006 alone (National Park Service, 2006).

On October 17, 1949, Congress chartered the National Trust for Historic Preservation as a non-governmental agency that would and still does rely heavily on support from volunteers. The Trust acts as a liaison between the public and private preservation organizations and works to promote historic preservation on a national level.

"Preservation, as a movement, began with history and architecture as the most valued cultural resources" (Stipe, 2003, pg 23). The National Historic Preservation Act (NHPA) of 1966, which came out of that view on preservation, was adopted to address the need for a federal leadership role that would manifest itself in a series of innovative measures that are still an essential part of today's preservation programs. Since 1966, the preservation community has broadened its view of what cultural resources should be preserved. It is now commonplace for diverse sites such as mill villages, battlefields, designed and vernacular landscapes, mines, early Modernist buildings, entire inner-city neighborhoods, and vernacular buildings to be listed on the National Register (Stipe, 2003).

Historic Preservation as Economic Development

Historic preservation provides more than a sense of place and identity to society, it offers widespread economic benefits. In 2007 the economic stimulation provided by historic preservation created more than $4,000,000,000 in private investment, 40,755 local jobs, 1,045 tax credit projects, and 18,006 housing units were created or renovated

with 6,553 of those units providing low or moderate income housing (National Park Service, 2008).

One of preservation's most valuable incentives for economic development is the federal preservation tax credit available for certified rehabilitations of historic buildings. In the 1976 Tax Reform Act, Congress amended the tax code to redress the imbalance between the tax treatment of new construction and rehabilitation of historic properties. It was not until the Economic Recovery Tax Act of 1981, however, that there was a total transformation of the economics of preservation. This act helped to increase private preservation investment and rehabilitation of historic properties soared over the next five years, surpassing all expectations. This unprecedented activity was significantly affected by the Tax Reform Act of 1986, which reduced the amount of tax incentives for investors, and caused the amount of private sector funded historic rehabilitation projects to decline (Stipe, 2003). The tax incentives and, to a lesser degree, federal grants, remain the most important part of federal financial support for historic preservation in the private sector.

There is a 20% federal tax credit for rehabilitations of historic buildings that are income-producing. Those buildings must also be listed on, or eligible for an individual listing on, the National Register of Historic Places or be located in and certified as a building contributing to a National Register Historic District, thus being a certified historic structure. The proposed rehabilitation work must be reviewed for compliance with the Secretary's Standards and approved to qualify for the tax credits. In order to meet this requirement the investment must be substantial and the rehabilitation work must conform to the Secretary's Standards for Rehabilitation. A project is considered substantial when the rehab expenditures exceed $5,000 or the adjusted value of the

building and its structural components, in a 24-month period that has been selected by the taxpayer. Qualified rehabilitation expenditures include: architectural / engineering fees, site survey fees, legal expenses, development fees, and other construction-related costs. The taxpayer cannot include costs from acquiring or furnishing the building, new additions, new construction, parking lots, sidewalks, landscaping, or other facilities that relate to the site (US Interior, 1996).

The federal government also has a 10% tax credit for non-historic, non-residential, income producing buildings that were built before 1936 (National Park Service, 2007). This provides a good option for developers that do not want to adhere to the Secretary's Standards, while encouraging the reuse of older buildings.

The momentum that is created by tax credit incentives impacts communities in ways beyond preservation. The projects generate jobs and housing, aid in the rejuvenation of communities, and boost local economies. Since the creation of the historic tax credit incentives in 1976, over 35,000 projects have qualified for tax credits, generating more than $45,000,000,000 in private investment. Through the tax credit program, 204,985 housing units have been rehabilitated, 176,696 housing units have been created. 93,061 of those units were created for low to moderate income families (National Park Service, 2008). There is a five to one ratio of private investment to federal preservation tax credits; "the program is an outstanding means of leveraging private investment in adaptive reuse and preservation of our nation's historic buildings" (National Park Service, 2007). Today the average historic tax credit project investment exceeds "$4,000,000 and the total investment set a record high of $4,300,000,000" (National Park Service, 2008, pg 2).

Tax Credit Application

The tax credit application is a three part process that any owner of a historic structure seeking federal preservation tax credits must complete in order to be eligible for rehabilitation tax credits. The application process begins at the state level with the State Historic Preservation Office (SHPO). The SHPO reviews the submittals, assists the owner with questions and suggestions of changes, and may conduct site visits if necessary. Once the SHPO determines the application is complete it sends the application to the National Park Service with its recommendations. The National Park Service (NPS), taking the comments for the SHPO into consideration, reviews the application to determine if the proposed work meets the Secretary's Standards for Rehabilitation. The applicant must also pay a fee to the National Park Service for the certification process. The fee is determined by the cost of the rehabilitation project, Table 1 illustrates the fee to cost of rehabilitation ratio (National Park Service, 2008).

Fee	Cost of Rehabilitation
$500	$20,000 to $99,000
$800	$100,000 to $499,999
$1,500	$500,000 to $999,999
$2,500	$1,000,000 or more

Table 1. National Park Service Fee Chart for Tax Project Certification.

Part I is required for any properties that are either not listed on the National Register or are listed as part of a historic district. If the property is already individually listed on the National Register, Part I is not necessary, as the significance of the structure was determined when the property was approved for listing. This section of the

application is used to evaluate the significance of the property, to determine if it is a contributing structure within its historic district or eligible for individual listing. In order for a project to be eligible for the tax credits, this step must be completed and the property deemed certified.

In Part II the owner or project manager must describe the proposed rehabilitation work that is planned in the project. The description of work must illustrate its compliance with the Secretary's Standards for Rehabilitation. If the proposed work is deemed compliant, a preliminary approval of the work is issued and the owner may commence work. If the work is found noncompliant, a conditional approval with modifications to the proposed work in order to meet the Secretary's Standards can be issued.

Part III, the final step, is the certification requested by the owner of the completed work. The completed work is evaluated for its compliance with the Secretary's Standards and compared to Part II of the application. If the work is found to be in compliance with the Secretary's Standards then the project is certified and the owner can apply to the IRS for the tax credits. See Appendix C for a full set of blank tax credit application forms.

Sustainable Design

The idea of sustainable design is not new. Ancient cultures used local materials to create their dwellings; these materials could easily be returned to the earth when the structures were no longer needed. Until the industrial revolution and the latter advent of HVAC systems, it was common practice to design structures to take advantage of prevailing winds and the angles of the sun. By using local natural materials and designing by taking into account the elements, the builders created structures that were

compatible with their environment. They were sustainable. But this sustainable history of the built environment was not recognized as such until the beginning of the environmental / sustainable movement of the late 1960s and early 1970s.

Designers and scholars in the field of sustainability have chosen to examine ideas of sustainability in a variety of different ways, but many can be categorized as either addressing the built environment or product development. Noted sustainability author and architect, Jason McLennan, examines the world of sustainability from the perspective of the built environment. In contrast, architect William McDonough and chemist Michael Braungart approach sustainability in the built environment from a product development point of view. McDonough and Braungart take a critical look at the way contemporary society designs products and their impact on the environment. Most importantly for this study, they discuss the idea of "cradle to cradle," which promotes "up-cycling" rather than "down-cycling" the materials society manufactures (McDonough and Braungart, 2002).

The History of the Sustainability Movement

McLennan divides the evolution of sustainability into four major sections: Biological Beginning, Indigenous Vernacular Beginning, Industrial Beginning, and the multi-parted Modern Beginning. His approach looks at the history of the planet and its inhabitants to see the evolutionary process that has led to the current ideas of sustainability.

The Biological Beginning of Sustainable Design looks at the most basic desire for comfort that creatures have on some level. The second stage, Indigenous Vernacular Beginning, is the point at which humans learned to use the natural world to their

advantage, such as the cliff dwellings of the Anasazi. In this stage cultures begin to harness the available resources such as sun, wind, earth / stone, and water, using them to improve their comfort. It is from this stage of first using local materials that today's sustainability movement bases the idea of regionalism.

The third stage of McLennan's evolution of sustainable design is the Industrial Beginning. This is the time period when the Industrial Revolution radically changed the way humans designed buildings. The advent of electric light, elevators, the proliferation of steel, HVAC systems, and other technological advances ushered in a new era for construction technology. This time period also saw the end of regionalism, as advances in transportation made cost the only limitation of material selection.

McLennan's fourth and continuing stage is the Modern Beginning of Sustainable Design. This stage grew out of the environmental movement and energy crisis of the 1970s. During that time the Architecture and Design (A&D) community "revived the ideas of passive, climate responsive, bioregional strategies that form the foundation of sustainable design" (McLennan, 2004, pg 28). The main focus of the A&D community was energy conservation; building envelopes were made tighter and new technologies were employed to reduce the amount of energy a building would consume with its HVAC, lighting, and other daily functions.

The 1970s also saw the creation of the Environmental Protection Agency to address the increased effects of industry at a time when rivers caught on fire and industrial cities were being blackened by clouds of smoke. Public concerns for the environment led to the first Earth Day in 1970, when over 20 million people gathered together to celebrate the environment. By the end of the decade the EPA had banned the use of DDT (a cancer causing pesticide), restricted the use of lead-based paints in

residences and children's products, phased out leaded gasoline, initiated the process of cleaning up America's waterways, established fuel economy and emission standards, and mandated stricter controls on air pollution (Environmental Protection Agency, 2007).

In the 1980s the energy conservation efforts of the A&D community suffered when "sick building" syndrome was linked to the energy conservation techniques employed in the 1970s. The phenomenon of "sick building" syndrome is caused by tightly designed building envelopes that do not allow the off-gassing from interior finishes and excess carbon-dioxide to escape from the interior of the building. The lack of ventilation also led to the growth of mold and fungus which led to headaches and respiratory problems. By the end of the decade, little had been done to advance sustainable design for the country as a whole and its buildings were consuming more energy than ever before.

In the 1990s, the Rio Earth Summit (1992) and the creation of the US Green Building Council (1993) both marked progress for the sustainable design movement. In 1996 the EPA released energy statistics stating that the use of new technologies in new construction and retrofits of existing buildings could reduce energy consumption by 20% (EPA, 2007). These data along with increased concern about humanity's impact on the environment led to increased interest in energy saving techniques and how to measure them. The desire to quantify the impact of a building on the environment led the US Green Building Council to create the first LEED rating system, which was released in pilot form in 1999.

By the turn of the twenty-first century, the terms "sustainability" and "green" design were quickly becoming commonplace in the A&D community with the general public following their lead. The nation was slowly coming to understand that sustainable

design was the best approach for an improved built and natural environment. "Several cities and government entities have adopted the LEED rating system as their minimum standard [for new construction]" (McLennan, 2004, pg 34). It was estimated that "by 2003, approximately four percent of all new construction in the United States were pursuing a LEED rating" (McLennan, 2004, pg 34). In a recent conference presentation Carl Elefante, estimated that only 0.2% of the existing building stock is currently LEED certified, but that over the next 25 years over 43% would become certified (Preservation North Carolina's Annual Conference, Raleigh, NC, October 2007).

Principles of Sustainable Design

Jason McLennan defines the philosophy of sustainability as a design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating negative impact to the natural environment. In his book, *The Philosophy of Sustainable Design*, he outlines six principles that should be followed when designing for a sustainable future. (See appendix G for the complete list.) For the purpose of this study, the sixth principle has the most relevance. The sixth principle is as follows:

6. Respect for Process – The Holistic Thinking Principal
    a. A Commitment to Collaboration and Interdisciplinary Communication
    b. A Commitment to Holistic Thinking
    c. A Commitment to Life-Long Learning and Continual Improvement
    d. A Commitment to Challenging Rules of Thumb
    e. A Commitment to Allowing for Time to Make Good Decisions
    f. A Commitment to Rewarding Innovation

McLennan developed this principle to address what he viewed as the biggest single change that is needed in the design community: to change the mindset of the professionals who are involved in the projects. He advocated taking down barriers between professions and recommended communication as the key to successfully incorporating green building practices into projects (McLennan, 2004). McLennan is not the only green building professional who stressed the importance of communication. In 2005 in his white paper contribution to the *Sustainable Architecture White Papers,* Harry Gordon (2005) recognized that traditionally the design and construction processes of a project have been separate. Gordon (1995) stated that "this approach almost assures conflict and inefficiency" (pg 38). Gordon echoed McLennan in advocating the need for interdisciplinary coordination. This is crucial to the success of green building projects since all aspects of the project, from building siting to finish selection, impact the final outcome.

Respect for the Process is about challenging conventional thought and using a holistic approach to problem solving. If conventional thinking created the problem, then it will require unconventional thought to solve it. The holistic approach and unconventional thinking also include the remaining elements of the principle. The importance of continuing to learn and challenging the "norm" are the ways that society moves toward a sustainable future. Education and innovation in the design process often results in challenges and this is why sub-principle "e" is vital to any good project. Allowing for time to make well thought out decisions is what can distinguish a well designed building from a bad one (McLennan, 2004).

This is a "big picture" or holistic principle that can be applied to any process or any type of project. Respect for the Process along with McLennan's other principles for

sustainable design outline an approach that can lead to good design and a healthier natural environment, while allowing innovation and creativity to flourish.

Green Economics

The idea that green or sustainable design is too expensive has plagued the green building movement since its inception. This comes from the practice of some builders who tack on a "green mark-up" because they are unfamiliar with the techniques and new technologies that often accompany sustainable design projects (McLennan, 2004). As the knowledge of green design and green technology becomes more widespread, the practice of "green mark-up" is becoming less common. Some sources judge the cost of green design is 1-6% higher using green techniques verses traditional construction methods (Von Hagen, 2003). In contrast to those figures the USGBC makes the statement that "green buildings do not have to cost a penny more" based on strategy and level of certification desired (US Green Building Council, 2007), perhaps recognizing the construction and design communities' increased knowledge in the last four years.

In his research, McLennan found that the areas of design and construction with the most reduced costs on a sustainable project are the site design / infrastructure elements and the mechanical systems. The structural and interior systems are typically unaffected by cost premiums or savings. The three areas of the design process that typically have increased first-costs are the design fees, envelope design, and lighting design. These increases come from the extra design time it takes to achieve new levels of excellence and innovative thinking. (McLennan, 2004)

It is hard to truly judge the cost differentials between traditional construction and sustainable design methods. The real cost benefit of sustainable design becomes evident through “life-cycle” analysis. This takes into account the payback on the building and its maintenance over a given number of years and the money that is saved when operating a sustainable building. There are also benefits to the employers of the companies in these buildings because their employees are healthier. The “US Environmental Protection Agency (EPA) estimates that the loss in productivity from ‘sick building’ syndrome to be as high as $60 billion dollars annually, this figure alone is a reason to consider green practices” (Hagen, 2003, pg 18). In addition to health benefits, recent research has shown that increased daylight and climate control in the workplace can improve employee productivity from six to 16 percent (Gordon, 2005, pg 38).

One of the most recent advancements for sustainability is that developers and property owners are starting to see that not only is green building good for the users of the building but that there are economic benefits for the properties. Typically a LEED certified building has lower operation and maintenance costs, has higher leasing rates, and physically demonstrates the values of the owners and occupants of the building (US Green Building Council, 2007). The increased attention to how “green” things are produced or constructed has made LEED and “green” certifications a very valuable marketing tool for developers and manufacturers. Currently there are no federal incentives for LEED certified projects and there can be substantial fees, but LEED certification does seem to increase market appeal for the developer or manufacturer.

LEED

Since its public release in 2000, LEED has gained recognition with the construction, design, environmental communities, and the general public. Many professionals now proudly put their LEED certification on their business cards and developers use it in their brochures. Numerous federal agencies and state and local governments require some form of LEED certification in new construction projects or to receive government funding (Solomon 2005). The federal government has mandated that "all new buildings over two million dollars must achieve a LEED silver rating" (McLennan 2004, pg 143). As of February 2008 there were 10,311 registered projects, green design has become mainstream (US Green Building Council, 2008). Registering a project with the US Green Building Council (USGBC) is the first step in the LEED certification process. There is fee of $450 for members of USGBC and $600 for non-members to register a project.

LEED is a third party rating system administered by the US Green Building Council, which evaluates the building and surrounding site based on six categories. Five of the categories are for environmental concerns: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. The sixth category is for innovations that do not fall into the other categories. It is not necessary to fulfill all of these categories to achieve the minimum LEED certification, but the more requirements a project meets the higher the LEED rating.

The sustainable site category takes into account the reuse of brown fields and existing buildings. The reuse of existing buildings is an area of overlap between green building and historic preservation. Both of the groups believe that historic buildings are a valuable resource that is better put to use than wasted. Water efficiency can include the

use of gray water for toilets or landscape irrigation. Energy and atmosphere takes into account the use and amounts of energy consumed by the operations of the building. The category for materials and resources considers the types of products and their content. Recycled content, rapidly renewable materials, and regionality are very important to the number of points that a project can earn in the materials and resource category. This would be a category in which the rehabilitation of a historic building could earn points.

The last defined category is for indoor environmental quality; part of this category evaluates the amount of off-gassing from products such as paints or carpets. The category also closely evaluates the HVAC system. The remaining category is for innovation, which is judged on a project by project basis relying on the ingenuity of the design team. In a recent LEED-CI project in Raleigh, NC, a company designed a walking tour of their offices that highlighted the "green" aspects of their project in hopes of achieving innovation points on their LEED application (K. Henderson, personal communication, September 18, 2007).

These categories are "broken down into specific design goals that have the potential to improve a building's environmental performance within the areas of focus" (Solomon, 2005). Each goal is given one point; all the points get added up resulting in the LEED score. It is the total number of points that is important, not which of the six categories the points come from. Out of a possible score of 69 points, 33 points are required for silver, 39 for gold, and 52 for platinum ratings.

The LEED certification level is 26-32 points, a fairly easy rating to achieve with only a few changes to traditional building habits. The next level, Silver, requires 33-38 points; this level is typically the threshold between good construction and sustainable

design. It is attainable through changes to the design process and the potential of first-cost increases. Most of the projects that apply for LEED certifications earn a Silver rating. As of February 2008, there were 430 Certified and 432 Silver rated LEED projects (US Green Building Council, 2008).

The LEED Gold rating, 39-51 points, requires a firm commitment to all aspects of sustainable design because the project will need points from almost all of the six categories. Only a small number of projects achieve this rating because it requires advanced planning in all aspects of the design process, but the number is growing. As of February 2008, the US Green Building Council (2008) had issued a Gold rating to 382 projects.

Currently the highest level is LEED Platinum requiring 52+ points. Very few projects can reach this level of sustainable design. According to the US Green Building Council (2008), only 71 projects have achieved a Platinum rating as of February 2008. To illustrate the superior quality that must be achieved to attain a Platinum rating, the first version of LEED (which was a less complex than the current version) only had one project achieve a Platinum rating (McLennan, 2004). This rating level means that all of the six categories that LEED identifies are being met.

In addition to meeting the point requirements, each project must pay a registration fee and certification fees to the US Green Building Council. The registration fee is a flat rate, but the certification fee varies based on the size of the project. Table 2 illustrates the fee differences based on project size. Note there is a different rate for members of the USGBC. If a project achieves a Platinum rating, certification fees are refunded.

Status	< 50,000 sqft	50,000 – 500,000 sqft	> 500,000 sqft
Member	$3,500	$0.07 per sqft	$35,000
Non-Member	$4,500	$0.09 per sqft	$45,000

Table 2. US Green Building Council's Fee Chart for LEED-NC Certification.

In 2002 the US Green Building Council released its program for existing buildings (LEED-EB). It focuses on the building operations and maintenance program. The first version of the LEED-EB (pilot) certified 25 total projects evenly spread across the country. The LEED-EB 2.0 has yielded 16 rated projects as of spring 2007 per data from the USGBC website database of certified projects. Some of the projects that have used a combination of sustainable design and historic preservation fall into this rating system of the LEED program. But for many rehabilitation projects involving historic buildings the renovation work is too extensive to qualify for the LEED-EB rating. Those projects must follow the LEED-NC (new construction) point system.

The LEED-NC rating system applies to new construction or major renovations of existing buildings. The system was designed to guide and distinguish high performance commercial and institutional projects, with a special focus on office buildings. LEED-NC has also been applied to schools, multi-unit residential buildings, manufacturing plants, and other types of commercial structures. The first LEED rating system to be released, it was piloted in March of 2000 with 12 initial projects becoming certified. In 2002 the USGBC modified its LEED-NC rating system to reflect the changing technology and to respond to the needs of the changing market. The most current version of the LEED-NC system was released in 2005 (LEED-NC 2.2). This is the system that any new or

renovated building wishing to achieve a LEED rating must meet. As of January 2008 906 projects have become LEED-NC certified, with many more registered.

There are also LEED rating systems for commercial interiors, core and shell development projects, homes, school, and guidelines for multiple buildings and on-campus building projects. As of Spring 2008, the US Green Building Council has released a LEED rating system for retail in the pilot phase and the much antipicated LEED rating system for healthcare was in the public comment phase, the last step before release for public use (US Green Building Council, 2008).

LEED and Historic Preservation

At the 2006 National Trust for Historic Preservation conference, held in Pittsburgh, there was discussion of the USGBC developing a LEED rating system for use with historic building rehabilitations. Recent evaluation of the current LEED-NC point system found that of a possible 69 points, 20 points were considered "existing building neutral" and 11 points were categorized as rewarding the reuse of an existing building (O'Connell, 2007). Thus, fewer than half the points available to a new construction LEED-NC building are available for existing buildings.

Wishing to expand upon this research through her master's thesis, Patrice Frey, a 2007 graduate from the University of Pennsylvania, evaluated the performance of historic buildings under the LEED-NC rating system as compared to non-historic buildings (Frey, 2007). During her research Frey deconstructed the LEED-NC rating system and predicted the probability of a historic building's ability to earn points from each category and subcategory as compared to a non-historic existing building renovation or new construction project. She rated their probability as weak, average, or

strong; for a breakdown of these findings see appendix E. Frey then did an actual comparison of historic and non-historic project's LEED-NC scorecards. She found that on average historic buildings earned fewer points than non-historic buildings in the Sustainable Sites, Indoor Environment Quality, and Innovation categories. For the Water Efficiency and the Energy & Atmosphere category the point totals earned were very similar. The only category where historic buildings outscored non-historic buildings was Materials & Resources, earning on average 1.5 points more. In her conclusions Frey made suggestions on how to modify the current LEED-NC system to better account for the unique opportunities found with historic buildings. Ms. Frey's findings have influenced some of the actions of the National Coalition for Sustainable Preservation and their work to improve LEED-NC for historic buildings.

The National Coalition for Sustainable Preservation, which includes representatives from the National Trust for Historic Preservation, the Association of Preservation Technology, the American Institute of Architects, and the National Park Service, advocates amending the existing rating system, not the creation of a separate rating system, as a possible solution to the discrepancy in the LEED system. The coalition has developed a set of preliminary preservation metrics for the USGBC to incorporate into the current LEED rating system (B. Campagna, personal communication, November 16, 2007). The preservation performance metrics will place higher emphasis on energy savings (through embodied energy calculations), avoidance of environmental impact (using life-cycle analysis), reduction of waste generation, and lessening of new construction (sprawl) (Making the Case, 2007).

The coalition presented preliminary suggestions to the USGBC in July 2007. The proposal consisted of eight metrics; four were based on life cycle analysis (LCA) and

four focused more on the qualitative effect of preservation. Of the four metrics based on LCA, two are focused on recognizing the reduction of the carbon footprint that a project reusing existing and historic buildings allows. The first proposed carbon footprint metric called for the consideration of the construction process. The metric compared the amount of energy that would be expended to construct a new building and creation of new products to the amount of energy saved by reuse of existing materials and structures. The second proposed metric stressed the inherent sustainability found in historic buildings such as passive climate control. Rewarding the restoration and reuse of these features would reduce energy consumption for the building. It emphasized that new technology should only be used to supplement these features not replace them (National Coalition, 2007).

The third proposed metric recognized and rewarded the relative durability of traditional materials found in historic buildings. These materials have a longer life cycle than modern building materials. The coalition suggested referencing LEED Canada's durability credit to create an equivalent point for the US LEED system. The fourth proposed metric focused on Life Cycle Flexibility, which recognized that the reuse of existing and historic buildings will increase the life cycle of those buildings (National Coalition, 2007). The coalition called for the implementation of the "cradle-to-cradle" approach of William McDonough and Michael Braungart.

The first four proposed metrics were based on the use of life cycle analysis and focused on quantifiable savings. The remaining suggested metrics focus on areas that are less quantifiable: social sustainability, health and comfort, social capital, and density. The social sustainability metric provided more reward for the reuse of sites that are recognized for their architectural, cultural, or social significance. The existing system for

the National Register could be used to identify the properties of significance. The health and comfort category rewarded the reuse of historic buildings that provide passive climate control and allow the occupants of the building to actively control their environment. The social capital metric suggested that LEED recognize the "success of historic buildings in relating and connecting to their context…and recognize that 'historic districts' have comparable values which give them a unique sense of place or 'neighborhood'" (National Coalition, 2007, pg 7). LEED should reward the social benefits that established neighborhoods bring to their communities. The final proposed metric involved "smart growth" through the promotion of density. By encouraging development density, new urban sprawl could be reduced and open space could be preserved (National Coalition, 2007).

In summation the coalition recognized that there are aspects to existing and historic buildings that are not 'green,' but the current LEED system does not recognize the additional elements, besides energy conservation, that the reuse of existing and historic buildings can bring to a community.

Preservation and Sustainable Design

A common saying in the preservation community is that "the greenest building is… the one that is already built," a phrase coined by Carl Elefante, AIA, LEED AP over the last ten years. Green design has become a mainstream topic for preservationists since the beginning of the decade. Many, including Elefante, feel that the green building community remains blind to the fact that society cannot build its way to a sustainable future. Looking to new green construction projects fails to account for the vast existing

building stock. Elefante (2007) explains: “We can not *build* our way to sustainability; we must *conserve* our way to it” (pg 26).

Elefante was the keynote speaker at the 2007 Preservation North Carolina Annual Conference in Raleigh, NC, and spoke at the 2007 National Trust for Historic Preservation’s Annual Conference in St. Paul, MN. In his presentation and also in his article “The Greenest Building Is…One That Is Already Built” he discussed the challenges facing the existing building stock and the role that both green building practices and historic preservation will have in addressing the future of the built environment. He advocated that the green building community can learn from the preservation community and the knowledge that the preservation community has accrued in the last century dealing with historic and existing buildings. Elefante pointed out that in the next 25 years 84% of the existing building stock will need rehabilitation (Elefante, 2007).

Considering that only 16% of the existing building stock was built before WWII and the other 84% of the buildings were designed with the new and innovative materials of their time, society’s approach to their preservation and reuse will need to be modified (Elefante, 2007). The materials that were cutting edge, but untested, do not have the same longevity found in traditional building materials. An example of this was evident with the Lever House Building, an architectural icon, in New York City. The Lever House restoration team was faced with the challenge of restoring or replacing the existing curtain wall system. The system that architects Skidmore, Owings, and Merrill employed in 1952 was experimental and untested. The curtain wall system failed, moisture penetrated the wall, corroding the glazing channels and the wire in the spandrel glass panels. As a result the spandrel glass panels that covered the building were cracking.

The original glazing system was not like a traditional wooden window that could be disassembled, have the damaged pieces replaced, and then be reassembled. The restoration team replaced the entire skin of the building to remedy the problem (Curtis, 2002).

Post WWII buildings were designed to incorporate new mechanical and engineered systems that did not need to rely on natural ventilation or daylighting, they were closed systems that created their own environments independent of the outside world. Both preservation and green building advocates readily agree that modern-era buildings present greater challenges than the pre WWII building stock to both disciplines (Elefante, 2007).

How will society address the millions of buildings that already exist but are not being used to their fullest potential, despite their historic character and environmental features (Roberts, 2007)? Sometimes these buildings were created for a purpose that has changed or is no longer viable, such as American textile mills that have closed down and moved their businesses overseas leaving millions of square feet of real estate empty. The underutilized structures like mills would be good candidates for a rehabilitation that combines preservation and sustainable design practices and principles.

A 2001 project in Portland, Oregon, attempted to combine federal preservation tax credits and LEED certification in the rehabilitation of an 1895 warehouse into a mixed use development of retail, restaurant, and office spaces. The company, Ecotrust, undertook the rehabilitation of an existing historic building with a goal of combining preservation and sustainability as a reflection of the company ideals. The building achieved a LEED rating of Gold in 2001 and passed Part II of the federal preservation

tax credit application. However, the project was ultimately denied federal preservation tax credits due to the unapproved alteration of the distinctive roofline and the addition of a penthouse structure to the roof, which compromised the historic character of the building. In the end the project only achieved half of its set goals. In this instance it was not a conflict between the Secretary's Standards and the LEED rating system that prevented the project from achieving its goals of federal preservation tax credits. Rather, it was a series of unapproved changes that damaged the authenticity and integrity of the building's significant features which ultimately led to the removal of the property from the National Register of Historic Places.

Different Approaches Create Challenges

The Secretary's Standards encourage the preservation of significant existing materials and architectural features such as doors, windows, roofs, facades. On the other hand, green building emphasizes energy efficiency and often involves the replacement of some of the historically significant elements such as doors and windows to meet this goal. One of the biggest issues over which the preservation and green building professionals often clash is the retention of historic windows. The green building community can become so focused on energy savings that their initial reaction to solve energy waste is to pour in insulation and replace windows (Jackson, 2005). The 2005 APT Halifax Symposium looked at the role of sustainability in preservation and, in addition to the windows, concluded that preservationists and green designers need to reevaluate the energy-conservation code for historic buildings (Jackson, 2005).

Elefante offered a solution to this ongoing disagreement by suggesting the use of energy modeling before making decisions about windows and insulation in existing

buildings. Energy models are simulation tools that predict the energy performance of a building using computers. The models take into account all environmental (interior and exterior) elements, as well as the construction materials and methods. Elefante uses this tool in his own practice to determine the best course of action when undertaking rehabilitation projects. The use of energy modeling has been a valuable tool in determining if the replacement of windows or additional insulation would, in fact, improve the energy efficiency of the building. In one project, the renovation of Eastern Market in Washington, DC, the energy modeling showed that a replace in kind approach to window renovation would not have an adverse effect on the energy efficiency, while total replacement with modern windows would only create a 4% increase in energy efficiency. Energy modeling does not always produce such favorable results; his firm has found with another project that the energy efficiency of the building could be increased by 60% with an upgrade of existing windows. The results of energy modeling is greatly effected by the original construction methods and types of windows found in the structure.

In a paper they presented at the 2005 APT Halifax Symposium, Walter Sedovic and Jill H. Gotthelf looked at the retention of original windows and how windows protect the authenticity of the structure and a sustainable future. They argued that the retention of historic windows allows the conservation of embodied energy and eliminates the energy that would have to be spent to create replacement windows. Reusing historic windows eliminates the need for the removal and disposal of the windows at a landfill, as well as related transportation energy. There are also the economic benefits that accompany any restoration project as well as the continuation of the craft of window repair. The final points they made in favor of historic window retention was the advantage of being able to repair the windows and the longevity of the materials

associated with historic windows. Historic windows are not maintenance free, but they can be repaired if they are damaged thus increasing their life-cycle. Most modern replacement windows cannot be repaired and often wear out within 20 years. The cost that a property owner will incur with replacement windows will take up to 100 years to earn back in energy savings and by then the windows will have been replaced five times, making replacement windows an illogical choice in the long term (Sedovic and Gotthelf, 2005).

Another aspect of building energy conservation is related to embodied energy which directly relates to the reuse of existing and historic buildings. Embodied energy is the "sum total of the energy required to extract raw material, manufacture, transport, and install building products" (Sedovic and Gotthelf, 2005, pg 25). When an existing building is demolished, all of the embodied energy in the structure and building elements is lost. The loss of embodied energy is extremely detrimental to historic and natural resources and in addition, it creates tons of material waste that will be added to local landfills.

The preservation community has been promoting the correlation between reuse of historic buildings and the conservation of embodied energy for over 25, years but it has yet to be fully recognized by the green building community (Jackson, 2005). Current sustainability-rating tools do acknowledge the concept of embodied energy, but they are not able to properly equate the amount of embodied energy found in historic buildings. Mike Jackson, in his 2005 APT Bulletin article, pointed out that the presence of embodied energy in existing buildings offsets the fact that historic buildings may be less energy efficient than new green buildings. Elefante, in a 2007 presentation, equated the embodied energy found in one square foot of an existing masonry wall as equal to the energy in five gallons of gasoline (Elefante, 2007). A current life cycle analysis found

that it would take 65 years for a building constructed today to recoup the amount of energy that was expended in its construction (B. Campagna, personal communication, November 16, 2007).

The idea that historic buildings are not energy efficient has been a point of argument between the green building and preservation communities. The fact is that the data does not support this conception. The US Energy Information Administration has found that commercial buildings built prior to 1920 have an average energy consumption of 80,127 BTUs per square foot, while more efficient building built after 2000 have an average consumption of 79,703 BTUs per square foot (Curtis, 2008). These findings reflect the energy friendly traditional building practices that were common before the advent of modern building systems. Traditional building practice relied on the natural environment for comfort control and lighting of the built environment.

Currently, a good portion of the LEED rating system is based on energy efficiency, but these points come at the loss of materials that contain embodied energy. The use of recycled materials, salvaged or reclaimed materials, and regionally available materials will earn the project points while creating a reduction of embodied energy (Jackson, 2005). The feeling in the preservation community is that LEED-NC drastically undervalues the true ecological benefit of building reuse (Jackson, 2005). These concerns from the preservation community are something that the National Coalition for Sustainable Preservation was attempting to address with its suggested preservation metrics.

In keeping with the ideas of embodied energy and energy conservation, many historic buildings (pre-WWII) were originally designed to take advantage of natural daylighting and ventilation, especially those created before the advent of modern HVAC

systems, as well as being constructed with materials superior to those available today. The operable windows can be restored and existing materials repaired. An original heart pine floor has no comparable equivalent today, due to the depletion of slow growth forests. The preservation and reuse of historic materials takes advantage of embodied energy and preserves trees from being harvested.

The vast stock of post WWII buildings are opportunities for the preservation and green building communities to come together to find innovative solutions to preserving the historic character defining elements of these modern-era buildings, while improving on the previous technology that was not designed to last. One of the problems that will be faced is the treatment of windows and curtain wall systems that were meant to be maintenance free, usually meaning they are also non-repairable (Elefante, 2007). This will require a combined effort on the parts of both the preservation and green building communities to preserve the recent past while ensuring an environmentally sound future.

The preservation community and green building community need to become effective advocates for the greening of historic buildings. By rewarding the amounts of embodied energy stored in existing buildings, promoting the life-cycle and longevity of historic materials, recognizing the amount of waste avoided with reuse, and striving to find common ground for the two communities to meet, both communities will increase the awareness of the importance of reusing existing buildings. In addition to promoting the inherent “greenness” of historic buildings, preservationists need to stress the importance of the preserving the history of society found in the built environment while continuing to promote the inherent commonalities between preservation and green building. The nation has accepted historic preservation and the environmental

movement as important parts of the future, now it needs to recognize the benefits of combining the two.

CHAPTER III

METHODOLOGY

This study was designed to increase the understanding of the effect that the LEED certification process and requirements have had on the historic built environment and in turn the effect that the federal historic tax credit processes have had on making possible the achievement of LEED certification. To meet these goals, the study set out to examine the overlap of historic preservation and green design approaches used in the rehabilitation of historic buildings. To help with the exploration of this relationship, a list cataloging the projects that have combined historic preservation (federal historic tax credits) and green design (LEED certification) was created. (See Appendix F.) The researcher identified ten projects that qualified for inclusion in this study. According to the National Trust for Historic Preservation, less than 40 historic buildings had become LEED certified as of early 2008 so the researcher expected the sample to be small. Only commercial buildings that have Part II federal historic tax credit application approved by the SHPO and NPS (historic preservation status) and have received LEED certification by the USGBC (green design status) were included in this study. This requirement was set in order to have a standard to comfirm that sound preservation and green design practices were employed in the rehabilitation projects.

Requirements for Inclusion

In order for a project to be included in the study, the project needed to have Part II of the federal historic tax credit application approved by SHPO and NPS and be LEED

certified. All of the projects identified had Part II approvals but not all had completed their LEED certification process as of February 2008. The researcher did make one exception to the requirements for inclusion: the Moseley Architects' Office project. The Moseley project had not fully completed the LEED certification process as of February 2008, but they had a working LEED point checklist that identified the points that the architects knew they would receive, hoped they might receive, and knew they would not receive. The researcher used this checklist in place of a LEED scorecard and only evaluated the points the architects knew they would receive. In total only ten projects were selected for evaluation.

Documents Required for Sample

Given the requirements for inclusion of properties into the sample, the researcher chose to use the National Register Nominations, the federal historic tax credit three-part applications and related correspondence (Federal), and the LEED scorecard to evaluate each project. These documents allowed the researcher to evaluate a range of features and other factors relating to both green and historic preservation practices.

The researcher reviewed the National Register nominations to identify the historic significance of the building. If the historic building was part of a historic district, the researcher referred to Part I of the federal tax credit application which establishes the significance for the individual site, as it related to the significance of the district. The nominations and federal tax credit applications were obtained from the State Historic Preservation Offices and the National Park Service, either from their websites or by contacting them directly.

Part II of the federal tax credit application informed the researcher of the National Park Service approved changes to significant features of the historic building. The tax credit information collected included the formal application, images and written descriptions of the identified significant features that were affected by the proposed work, and any correspondence or amendments requested between the SHPO and the project managers.

The LEED scorecard allowed the researcher to identify from which of the LEED categories the project earned points and to compare the distribution of those points by type of category. The scorecard provided a means of determining the relative contribution that each possible category made to the building's total LEED score. The USGBC's website listing of certified projects was used to locate the scorecards. If the scorecard was not available online, the researcher contacted the property owner to obtain the required information. Unlike the National Register nominations and federal tax credit applications, LEED certification is not a federal procedure and the scorecards are not available to the public without the property owner's permission.

Sample

To identify the projects that met the scope of this study, the researcher contacted the North Carolina State Historic Preservation Office to request their assistance in contacting other SHPO offices through their SHPO listserve. From the posting on the listserve, as well as contact with NPS and the National Trust for Historic Preservation, possible projects for inclusion in the study were identified. See Appendix F for the full list. While the researcher identified seventeen projects, only ten met the requirements for inclusion in the study. The small sample indicated the young nature of this

movement, while the number of projects in process but not eligible for inclusion showed that the combination of the two processes was becoming more common. This sample is also a reflection of the small number of LEED certified historic properties, less than 40, so the 10 identified projects represent 20% of that group. The researcher collected the required documents for the ten identified projects. Table 3 is a spreadsheet of basic information gathered from the required documents for the ten included projects and is followed by images of the completed projects (Figures 1-12).

Fig. #	Project Name and Number of Buildings	Location	Date Built	Original Construction Method	Original Use	New Use	LEED-NC Score
1	Balfour-Guthrie 1	Portland, OR	1913	Reinforced Concrete	Office / Light Industrial	Office	Silver
2	First Regiment Armory / Gerding Theater 1	Portland, OR	1891	Brick and Stone	National Guard Armory	Theater	Platinum
3	Scowcroft Building 1	Ogden, UT	1906	Brick and Heavy Timber	Dry Goods Wholesale Facility	Offices	Silver
4	WP Fuller Paints / Big-D Construction 1	Salt Lake City, UT	1922	Reinforced Concrete / Block	Paint Manufacturing Facility	Offices	Gold
5	The Cobb Building 1	Seattle, WA	1908	Steel Frame and Masonry	Commercial	Retail, Office, Apartments	Silver
6	109-119 Whitaker Street Project 1	Savannah, GA	1890	Brick	Commercial with Residential	Commercial with Offices	Silver
7 & 8	Martineau Project 4	Grand Rapids, MI	1905 1920	Brick, Steel Frame with Masonry, and Frame	Commercial	Commercial / Residential	Certified
9	Bazzanni Associates 2	Grand Rapids, MI	1901 1918	Brick, Reinforce Concrete / Block, and Frame	Office / Residential	Office / Residential	Silver
10	Kelsey Project Avenue for Arts 3	Grand Rapids, MI	1912 1914	Brick, Block, Frame	Office / Residential Rooming House	Office / Residential, Apartments, Live / Work Units	Certified
11 & 12	Moseley Architects 1	Richmond, VA	1938	Brick	Manufacturing Facility	Office	Project Gold

Table 3. Spreadsheet of basic information for the identified and included projects.

Identified and Included Project Images

Figure 1. Balfour-Guthrie
Portland, OR

Figure 2. First Armory / Gerding Theater
Portland, OR

Figure 3. Scowcroft Building
Ogden, UT

Figure 4. WP Fuller Paint / Big-D Construction
Salt Lake City, UT

Figure 5. The Cobb Building
Seattle, WA

Figure 6. 109-119 Whitaker Street Project
Savannah, GA

Figure 7. Martineau Project
Grand Rapids, MI

Figure 8. Martineau Project
Grand Rapids, MI

Figure 9. Bazzanni Associates
Grand Rapids, MI

Figure 10. Kelsey Project Avenue for Arts
Grand Rapids, MI

Figure 11. Moseley Architects, Feb 2008
Richmond, VA

Figure 12. Moseley Architects
Proposed completed appearance

Evaluation Process

Once the sample was determined and the required documents obtained, the researcher reviewed the projects to gain an understanding of the role that preservation and LEED each had in the rehabilitation process. The researcher developed a series of research questions in order to address the potential relationships, patterns, and commonalities that this study would reveal. Those research questions were:

- What types of projects used federal historic tax credits and achieved LEED certification? Were they large, small, tenant up-fit, rural, urban?
- What impact, if any, did the age, original construction method, original use, and existing conditions of the building prior to the rehabilitation have on the success of the project? Were these common factors among the different projects?
- What changes were made to the building as part of the NPS approved rehabilitation work? Were there additions removed or added? Was the facade or interior configuration altered?

- Which of the approved changes could have resulted in LEED points? Did those changes impact the historic character of the building?

While reviewing the tax credit application and LEED scorecard for each project, the researcher identified and documented any changes made to the building as well as the categories in which the project earned LEED points. The following areas, based on the research questions, were used to guide, but not limit, the evaluation of preservation's role in the changes made to the property and to look for patterns and commonalities between the different projects:

1. Age of the building: pre or post WWII
2. Original construction method: masonry, frame, timber
3. Original use/ design: mills, warehouse, office building, etc.
4. Existing condition prior to rehabilitation: mothballed, condemned, in use, vacant, etc.
5. Existing windows, new openings, old ones reopened, new windows
6. Addition of new or removal of existing additions, types of alteration
7. Types of exterior changes
8. Subdivision or alteration of interior spaces

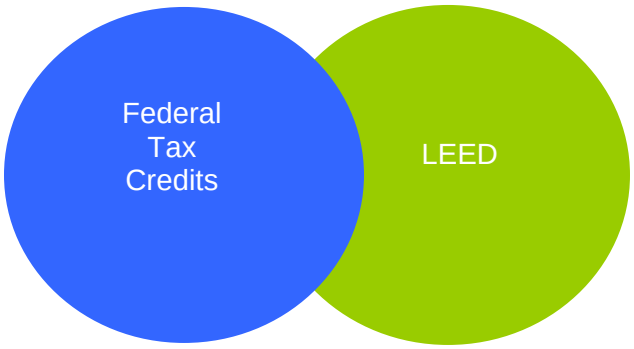
Once the commonalities between the physical characteristics of the buildings and approved rehabilitation changes were identified, the researcher compared the findings to the characteristics of a typical federal tax credit project, not attempting to earn LEED points. That comparison allowed the researcher to compare the identified projects to the larger pool of federal tax credit projects to look for commonalities. The researcher used the *Statistical Report and Analysis for Fiscal Year 2007 of Federal Tax Incentives for Rehabilitating Historic Buildings* generated by the National Park Service (2008) to make the comparisons.

To evaluate the LEED scorecards the researcher created a spreadsheet (see Appendix G) in order to compare the different LEED points earned between the different projects. Another spreadsheet was then created in order to see how many of the

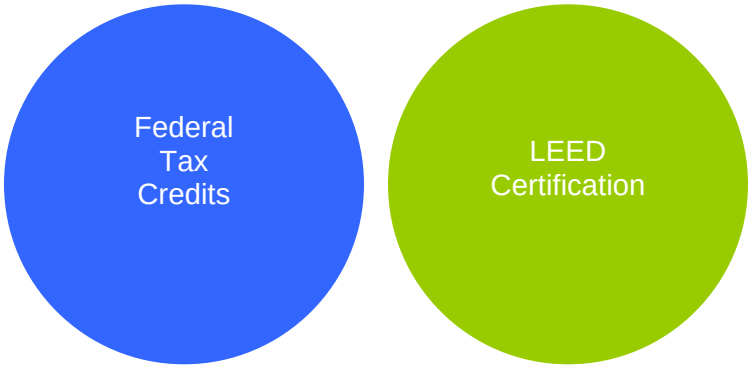
projects had earned each point. Then, those findings were compared to Frey's predictions of probability for a historic building to earn each LEED point (see appendix G & H to view comparisons and Frey's findings).

Analysis Process

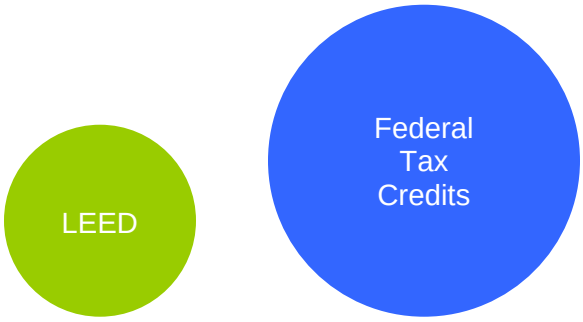
When the required documents had been evaluated and findings compared, the researcher began looking for conclusions that could be drawn from the commonalities between the projects. In this phase the researcher examined whether the qualifying standards for the two certification processes (LEED and tax credits) reflected a mutually supportive, parallel, or conflict relationship. Those three relationships were defined by the researcher for this study as:



Mutually Supportive, overlap for successful results



In Parallel, working separately and not interacting



In Conflict, one more important than the other

In cases of overlap, an assessment of the extent of the overlap was made. Greater overlap indicated that changes/renovations were highly consistent with both sets of qualifying standards. Minimal overlap indicated that changes/renovations were only slightly to somewhat consistent between the two sets of standards.

Summary

The goal of the study was to determine if commonalities existed between the rehabilitation projects that have successfully combined LEED certification and federal preservation tax credits. Identifying indicators for projects that have succeeded could increase the success of future projects. The researcher expected that these indicators would include the age, type, construction method, and existing condition of the building at the start of the project. In addition to the existing conditions having significant influence on the success of the project, initial research had shown that issues involving energy efficiency such as windows and insulation would have a great effect on the project. The information gathered in this research could expand the understanding of how preservation guidelines and LEED requirements work with one another. Determining whether there was a mutually supportive, parallel, or conflicting relationship between the two processes could influence future changes to those guidelines and requirements. If the two processes worked in a mutually supportive manner, with one process creating or providing for a successful result in the other process, additional research projects would need to be designed to further clarify that relationship. Showing that the processes worked in parallel, meaning that they did not have to interact to have a successful result, would question whether either of the processes need to be changed. Should the researcher find that they worked in conflict, that the two processes worked against each other and inhibited a successful result, then identifying the areas of conflict would be important. Given the limited number of projects that fit the defined parameters of this thesis, the ability to generalize of these results may be limited. However, the researcher believed that this is a first step into an arena of study that will continue to grow as society moves toward greener living.

CHAPTER IV

DATA ANALYSIS AND RESULTS

The Data Analysis for this study began with the collection of the national register nominations, federal historic tax credit applications, and LEED Scorecards for the ten included projects. The researcher then evaluated the documents to identify the physical characteristics of the buildings, NPS approved changes, LEED rating levels earned, and specific LEED point categories met. The documents were individually reviewed, then compared to identify commonalities. Once commonalities were identified, the researcher compared and looked for overlaps and relationships to gain an understanding of ways in which the two processes of federal tax credits and LEED certification functioned in relation to each other.

The evaluation and comparison of the ten identified projects resulted in the creation of an ideal building and project profile. The profile identifies key physical characteristics and NPS approved changes to the historically significant elements that the majority of the buildings had in common. The researcher based the profile on the commonalities identified in buildings and the rehabilitation process. These findings were also compared to the characteristics of typical tax credit projects.

The evaluation of the LEED scorecards enabled the researcher to identify the commonalities in the types of LEED points earned by the included projects. The identified common LEED points were then compared to Frey's predictions to determine if the findings were consistent with her predictions. By comparing the identified commonalities to Frey's predictions the researcher was able to determine that the

projects earned the majority of their points in a manner consistent with Frey's predictions.

The final step was to examine the relationships that existed between the two processes. The researcher hypothesized that there were three possible relationships that could exist between the processes. The researcher expected to find that the processes worked in a manner that was mutually supportive, parallel, or in conflict. The researcher found that, for the projects included in this study, the processes either worked in a mutually supportive or parallel manner. For the complete analysis of the findings see the following sections.

Profile of the Ideal Building and Project

One of the goals from the outset of this study was to determine, based on the identified commonalities found between the ten projects, the ideal building and project profile for this type of combined certification project. The physical characteristics of the ideal building were a product of the commonalities identified from the national register nominations and the physical descriptions of the buildings in Parts I & II of the tax credit applications.

Ideal physical characteristics include:

- Pre-WWII construction, preferably prior to 1920
- Urban location or high density location
- Original construction methods of masonry, heavy timber, or reinforced concrete
- Original use was commercial

- Ideally the interior spaces should have either an open plan or little of the original fabric intact

The ideal project profile was compiled from the commonalities identified in Part II of the historic tax credit applications. The researcher found that the planned rehabilitation work should include:

- Minimal changes to the exterior of the building
- Retention and repair of elements deemed significant to the historic character of the building
- New proposed use similar to the historic use

Only half of the projects had open floor plans or a great deal of non-original partitions; the rest were a mixture of original and non-original interior partitions. Having an open floor plan or little of the original interior fabric intact would allow for the greatest flexibility for changes to the interior. The researcher also found that if the original use and proposed use are similar the achievement of the tax credits is likely enhanced because less alteration would be needed. For example, three of the projects included buildings that were originally commercial on the first floor with residential on the upper floors and the new use maintained the commercial first floor with either office or residential space on the upper floors. All of the projects included in the study were originally commercial buildings and remained commercial after the rehabilitation.

This ideal building and project profile, created from identified commonalities in the ten projects that successfully attained an approved Part II of the historic tax credit application and LEED certification, could be used by the preservation and green building communities as a predictor for success in future projects with a goal of dual certification. It should be remembered that this profile is based on the evaluation and comparison of

only ten projects that successfully achieved a joint certification status independently from the NPS and USGBC. As the number of projects that meet this challenge increases, this ideal profile should be updated to incorporate the most current information. However, these projects are generally consistent with the larger pool of tax credit projects so one would not expect dramatic changes to the profile.

Commonalities in the Buildings and the Rehabilitation Process

Identified Common Physical Characteristics

The physical commonalities between the buildings became evident as the researcher reviewed Part I and Part II of the tax credit application for the ten included projects. All of the buildings were located in urban areas, either in business districts or industrial areas. The sample had projects from each of the NPS geographic regions: Mountain / Plains, Northeast, Southeast and Far West. Figure 13 shows the distribution of tax credit projects per state.

Figure 13. Map of the Geographic Regions the NPS uses for Tax Credit Projects statistical data analysis. The numbers indicate the number of projects from that state included in this study.

The geographic distribution of the included projects is fairly consistent with the 2007 National Park Service report on federal tax credit project distribution. Table 4 illustrates the difference between the sample's geographic distributions as compared to the geographic distribution of all federal tax credit projects (National Park Service, 2008).

Geographic Area	Sample	Total Federal Tax Credit Projects, 2007
Northeast	40%	47%
Southeast	10%	13%
Mountain / Plains	20%	32%
Far West	30%	8%

Table 4. Geographic Distribution of Federal Tax Credit Projects

This comparison was made in order to understand where these projects fit into the larger pool of historic tax credit projects. An interesting finding from the evaluation of the geographic distribution was that five of the ten projects are located in only two cities. Portland, OR, has two of the projects included in this study, which is not surprising because Portland is the greenest city in the United States (Neves, 2008). The unexpected finding was that Grand Rapids, MI, has three of the included projects and two of them were developed by same company, Dwelling Place of Grand Rapids.

All buildings in the sample were constructed prior to WWII, with nine of the projects involving buildings constructed from 1890 to 1922. The original construction methods included masonry, heavy timber, reinforced concrete, steel frame, and wood framing.

The buildings were historically used for income producing endeavors. The researcher expected to find this commonality, but it is not a requirement that the historic use was income producing; only the new use must be income producing to qualify for federal tax credits. The historical uses included: manufacturing / warehousing, office, commercial, retail, rooming houses, and military purposes. The post rehabilitation uses included the combination of: eight office, one entertainment, four apartment, four commercial, and one retail spaces. The majority of the projects' post rehabilitation uses involved a combination of the previously listed uses, making them mixed-use. The post rehabilitation uses for these projects are consistent with the general pool of federal tax credit projects: 45% housing, 21% office, 27% commercial, and 7% other (National Park Service, 2008).

One of the original hypotheses was that the existing condition of the property would be a factor in the success of projects with a goal of LEED certification after

rehabilitation process was completed. The researcher found that five of the projects involved buildings that were vacant at the time of the rehabilitation. Of these five, the Scowcroft Building and the Martineau Project buildings had been vacant for 50 years or more. For these projects, there was a substantial deterioration of the interior features, which resulted in greater flexibility in the redesign of the interior spaces. The other five projects involved buildings that were in use at the time of the rehabilitation. Given that half the buildings were vacant and the other half occupied at the start of the rehabilitation process, the researcher could not determine with certainty if occupancy played a part in the success of the projects. It was found that buildings with little original interior historic fabric appeared to have more leeway in approved changes. In some cases they were allowed to completely redesign the major interior spaces, such as The Cobb Building in Seattle, WA, which no longer had the original floor plan or hallway configuration.

The physical commonalities continued with the size and cost of the properties as seen in Table 5 on the next page. The projects range in size from 10,800 sq.ft. to 170,000 sq.ft. with an average size of 68,756 sq.ft. The rehabilitation costs for the projects range from an estimated cost of $850,000 to $32 million with the average cost $6,812,169. However, if The Cobb Building ($32 million price tag) is removed the average project cost drops to $4,013,522. The average cost for the ten projects per sq.ft. was $109. The average cost for the sample projects is much higher than the average cost nation-wide for federal tax credit projects which is around $831,589 per project (National Park Service, 2008). The scale and associated cost of these projects may indicate that only large commercial federal tax credit projects would attempt LEED certification.

Project	Total Square Footage	Total Cost (applicable to Tax Credits)	Cost Per Square Foot
Balfour-Guthrie	19,500	$2.2 million	$113
First Armory	52,000	$4.78 million	$92
Scowcroft Building	133,000	$12 million	$90
Fuller Paints / Big-D	67,900	$4.5 million	$66
The Cobb Building	128,930	$32 million	$248
Bazzanni Assoc.	37,749	$3 million	$80
Martineau Project	47,932	$8.2 million	$171
Kelsey Project	21,402	$3 million	$140
Moseley Arch.	170,000	$3 million	$18
Whitaker	10,800	$850,000	$79

Table 5. Project size, cost, and cost per square foot. Note: The cost per square foot is rounded to the nearest dollar.

Identified Commonalities in NPS Approved Changes

After the researcher had identified the physical commonalities between the buildings in the sample, she began to identify commonalities in the NPS approved rehabilitation work. The researcher referred to Part II of the tax credit applications, correspondence, and the SHPO review and recommendation sheets to identify commonalities. A comparison was made of the NPS approved changes to the exterior, openings / windows, roofs, interiors, building systems, public interest considerations, and additions to identify similarities.

When comparing the NPS approved exterior changes, the researcher found that all of the masonry exteriors were cleaned, areas repaired or replaced as needed, and repainted if the surface was already painted to meet the Secretary's Standards. Only The Cobb building had a new exterior finish material applied and that was only on the small existing infill addition that was not original to the building's period of significance. Two of the projects added or altered existing exterior decks or porches. The Kelsey

Project Avenue for Arts installed new decks for the residential units that it rehabilitated. The Martineau Project removed existing rear exterior decks for the three adjacent buildings to create one continuous porch.

The researcher next reviewed the approved changes made to the openings and windows of the buildings. Of particular interest was the treatment of the windows, as preliminary research had indicated that windows were often problematic for historic buildings seeking LEED certification. The Armory and two of the buildings involved in the Kelsey Project retained and restored all of their original windows. Eight of the projects involved buildings that restored some windows (normally on prominent facades) and replaced windows that were either not original or damaged beyond repair. Some of the buildings involved in these eight projects also created new or reopened windows and doors. The third building in the Kelsey Project was permitted to replace its windows due the deteriorated state of the original windows. All the replacement or new windows had to match the appearance of the original windows if the configuration and profile was known.

In addition to the repair or replacement of windows, the researcher found that creative alternatives were employed to improve energy efficiency. The Scowcroft project installed interior storm windows to increase the energy efficiency of the original windows that were restored. The installation of interior storm windows is a preferred practice on historic buildings since it does not affect the overall appearance of the window from the exterior, but they do affect the operability of the window. The tax credit applications for the three projects in Michigan indicated that the replacement of the existing single pane glass with 1” insulated glass for the metal windows that they retained was approved. The final findings for changes to the opening and windows was that four of the projects

installed awnings over storefronts and/or windows to aid in heat control and consumer appeal.

When reviewing the approved changes or alterations to the project buildings' roofs, five of the projects installed new roof coverings in keeping with the original material, one (Moseley) installed a new roofing material, and one (Bazzanni) installed a new roof terrace. This was of interest to the researcher as roof changes or alterations can result in LEED points. The researcher also noted that eight of the projects either added or restored existing skylights; these changes could also result in LEED points.

The researcher also closely reviewed the approved changes made to the interior spaces of the projects. The changes approved for interior spaces were affected by the existing condition of the building and its intended reuse. Four of the spaces were originally open spaces, six projects involved buildings that had some or all non-original partition walls, and one (The Cobb Building) no longer had its original configuration of interior spaces. The integrity of the interior spaces was also affected by the existing condition of the building prior to the rehabilitation. For example, one of the buildings involved in the Martineau Project had all of the interior plaster and lath removed by a previous occupant, so the installation of gypsum board interior walls was permitted.

If it was determined that interior features were significant to the historic integrity of the building those elements were noted and restored. For some of the buildings these were the public spaces such as the lobbies and stairwells. An example of this would be the 1936 main elevator lobby of The Cobb Building which was deemed significant to the building and had to be restored as part of the rehabilitation project. For other projects it may be the feeling of space, like the First Armory in Portland which had always been an open space and that feeling was deemed significant. As a result the design team had to

create a box within a box to meet the rehabilitation requirements. In other projects it was required that period decorative elements be restored, such as original wood trim or doors. None of the sample projects had highly detailed interior spaces, this allowed for changes to be approved without much conflict. All of the projects added new partition walls to some degree. These conditions also allowed for changes to the interior finishes, a possible LEED point earner. Nine of the projects had new interior stairs added and five of the projects created new openings between floors or to create light wells.

Not surprisingly the researcher found that all of the projects incorporated new plumbing, electrical, and HVAC systems. These are items that are normally upgraded in rehabilitation projects and the changes did not appear to be an issue in any of the documentation that the researcher gathered for evaluation. These changes, like those made to the windows and roofs, were of interest to the researcher due to the possibility of earning LEED points as a result of making them.

The projects also had alterations made for the protection of Public Interest. Door hardware and building access were added or altered to meet ADA requirements and in the Oregon, Washington State, and Utah projects seismic upgrades were made to the buildings. The other projects were stabilized and reinforced to meet the requirements of load changes or to repair damage caused by years of deterioration from the building standing vacant.

Once the national register nominations and federal historic tax credit applications had been reviewed, evaluated for commonalities, and recorded the researcher began to compare and evaluate the LEED scorecards.

Commonalities in the Type of LEED Points Earned

The first step in comparing the LEED aspects of the included projects was to compare the different LEED certification levels achieved. Of the ten projects one Platinum, one Gold, one projected Gold, five Silver, and two Certified LEED ratings were achieved. To find that the majority of included projects earned a Silver or Certified LEED rating was expected since 66% of the projects currently LEED rated are either Certified or Silver.

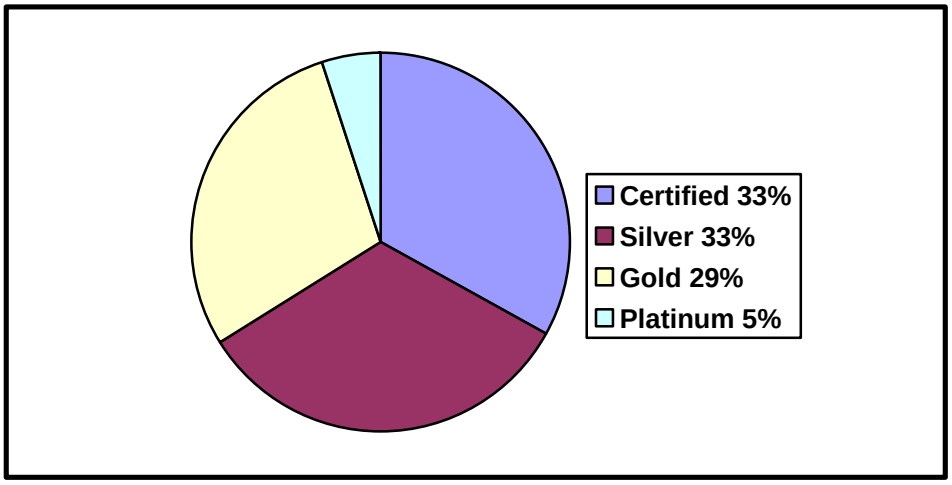


Figure 14. Percentage of LEED ratings achieved by LEED certified projects nation-wide.

In the evaluation of the LEED data, the researcher first reviewed all the LEED scorecards. This review allowed the researcher to see which points each project earned. In order to facilitate the comparison of earned LEED points a spreadsheet was created. (See appendix G.) From that spreadsheet the researcher was able to determine which points were earned with the most frequency between the ten projects. The researcher then compared the commonly earned points to Frey's determination of

probability for a historic building to earn a particular LEED point as compared to a newly constructed building to identify if these projects had earned their LEED points in a predictable manner. See appendix H for the complete list of comparisons.

Commonalities in LEED Points Earned

Further elaboration on the commonly earned points that the majority, 7 or more, of the projects earned is described below. As seen in Table 6, all ten projects earned points for site selection, alternative transportation (parking capacity point), building reuse (maintaining 75% of existing shell), daylight & views (views for 90% of spaces), and having LEED accredited professionals involved with the project.

LEED Categories / Subcategories	Number of Projects	Frey's Probability
Site Selection	10	Strong
Alternative Transportation / Parking Capacity	10	Average - Strong
Building Reuse / Maintain 75% of Existing Shell	10	Strong
Daylighting & Views / Views for 90% of Spaces	10	Strong
LEED Accredited Professional	10	Average

Table 6. LEED Point Categories earned by all projects.

Frey determined that historic buildings have a strong probability of earning points in these categories. This is not surprising given the nature of the projects included in this study. The sample projects were located in urban areas and had predetermined parking areas. The fact that each project earned the building reuse point for maintaining 75% of the shell was a given since all the projects were using federal historic tax credits. The NPS places the retention of exterior features at the highest level of importance. The

daylight and views for 90% of the spaces was also expected since all the buildings were built prior to WWII, before the use of air conditioning was common place and operable windows were essential to the comfort of the occupants and the ventilation of the building. The final point that all ten projects shared was the LEED accredited professional and all projects seeking LEED certification should earn that point.

Nine of the projects gained points for alternative transportation (public transportation access and bicycle storage / changing room), water efficient landscaping (reducing water by 50%), water use reduction (20% reduction), construction waste management (diverting 50%), local / regional materials (20% manufactured locally), and low-emitting materials (paints).

LEED Categories / Subcategories	Number of Projects	Frey's Probability
Alternative Transportation / Bicycle Storage / Changing Room	9	Average - Strong
Alternative Transportation / Public Transportation Access	9	Average - Strong
Water Efficient Landscaping / Reducing water by 50%	9	Average
Water Reduction / 20% Reduction	9	Average
Construction Waste Management / Diverting 50%	9	Average
Local / Regional Materials / 20% Manufactured Locally	9	Average
Low-emitting Materials / Paints	9	Average

Table 7. LEED Point Categories earned by nine of the ten projects.

Again the researcher compared these findings to Frey's predictions and found that Frey had determined that historic buildings had an average probability of earning these points, as seen in Table 7. Of these seven point categories, only the access to public transportation is potentially based on the existing site conditions. The remaining

points were earned by adding, managing, or reducing materials and resources used in the rehabilitation process.

The next set of point categories was earned by eight of the projects. These categories were landscape and exterior design to reduce heat island effect for roofs, specifying materials with recycled content, specifying low-emitting adhesives / sealants and carpet, and earning at least two of the possible four points for innovation in design. When compared to Frey's predictions, all of these categories presented an average probability for a historic building except for the landscape and exterior design to reduce heat island effect for roofs; this latter category was determined to have weak probability, as seen in Table 8.

LEED Categories / Subcategories	Number of Projects	Frey's Probability
Landscape and Exterior Design to Reduce Heat Islands : Roof	8	Weak
Recycled Content	8	Average
Low-emitting Materials / Adhesives & Sealants and Carpet	8	Average
Innovation in Design	8	Average
Sustainability Education	8	Average

Table 8. LEED Point Categories earned by eight of the ten projects.

The researcher found this inconsistency a startling development and referred to the tax credit application to look for possible contributing factors to explain these findings. Review of the tax applications identified that six of the eight projects which earned this point had changes to or replacement of the existing roofing material approved by NPS. An additional project, Moseley Architects' new headquarters, had a new roofing style and material approved by NPS. The eighth project, Bazzanni

Associates new headquarters, created a roof garden. USGBC outlines three options in order to earn this point: installing roofing materials that have a specified Solar Reflectance Index, installing a vegetated roof over at least 50% of the roof surface, or doing a combined approach (2005). It should be noted that the majority of the projects included in the sample have flat roofs which are not visible from the street and thus not a high priority in the preservation tax credit review which is very concerned with maintaining the historic integrity of the exterior of a building; alterations made that do not affect the primary façade and street view generally have more flexibility. This could explain why the researcher's findings were inconsistent with Frey's findings.

The final set of point categories identified were ones that seven of the projects achieved. They included optimizing energy performance of the building (both the 20% new / 10% existing and 30% new / 20% existing), minimizing ozone depletion, construction waste management (diverting 75%), and a construction IAQ management plan during construction. The findings support Frey's predictions for a historic building's point earning probability, except for the optimizing of energy performance, as seen in Table 9.

LEED Categories / Subcategories	Number of Projects	Frey's Probability
Optimize Energy / 20% New / 10% Existing	7	Weak
Optimize Energy / 30% New / 20% Existing	7	Weak
Ozone Depletion Protection	7	Average
Construction Waste Management / Divert 75%	7	Average
Construction IAQ Management Plan / During Construction	7	Average

Table 9. LEED Point Categories earned by seven of the ten projects.

Frey's research found that historic buildings had a weak probability of earning these points, yet seven of the ten included projects achieved four of the possible ten points available in this category. The category for optimizing energy performance has the potential for ten points distributed over five subcategories that assess the percentage of energy performance improvement. The subcategories increase at 10% intervals from 20% New / 10% Existing to 60% New / 50% Existing, each level has two points associated with it. Finding that seven of the data sample projects were able to achieve these points is good support for improving energy efficiency of a historic building without compromising the integrity of the building. It will be interesting to see if future projects of a similar nature become better at optimizing energy use in rehabilitation projects.

After evaluating and comparing the LEED points that the majority of the ten projects had in common, the researcher then looked for the points that none of the projects earned and compared those to Frey's findings. The included projects did not earn points for reduced site disturbance (protect or restore open spaces), optimizing energy performance of the building (60% new / 50% existing), or any of the points for the use of renewable energy. The fact that the projects did not earn any of these points was

consistent with Frey's research; she found that a historic building had a weak probability of earning these points.

One unexpected finding was that only one project earned a point from the category for specifying resource reuse (at either 5% or 10%) which rewards the reuse of existing resources. The researcher had expected most of the projects would earn these points given not only Frey's determination that a historic building has an average probability of earning these points but also that the nature of these projects would seem to lend themselves to earning points that reward reuse of resources. When the evaluation of the LEED scorecards showed that only the Bazzanni Associates project earned a point in the category the researcher looked deeper. The point requirements per the USGBC (2005) LEED-NC rating System are as follows:

> Use salvaged, refurbished or reused materials such that the sum of these materials constitutes at least 5%, based on cost, of the total value of materials on the project. Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits. (pg 51)

The researcher speculates that the types of buildings being used in these rehabilitations are the reason for the projects not earning these points. It could be a lack of existing interior elements to salvage in the building included in this study either due to the deteriorated state of the interior or that the buildings did not have much interior ornamentation due to their original use or stylistic design.

Overall the findings of the LEED point evaluations were in keeping with Frey's predictions for the probability of a historic building earning specific points with the exception of a few categories as described above. The researcher continued the

evaluation of the sample projects by next comparing the commonalities identified from the tax credit applications to the LEED scorecard findings to identify possible overlaps.

Tax Credits and LEED: Relationship Analysis

In the next phase of the data analysis process, the researcher evaluated the commonalities previously identified to see how the qualifying standards for the two certification processes (tax credit applications and LEED) related to each other. The researcher had hypothesized three possible relationships that could exist between the two processes. Those relationships were defined as being mutually supportive, working in parallel, or in conflict. A relationship identified as being mutually supportive will need to show that an overlap existed between the two processes, meaning that the action of one process resulted in an action from the other process. Given the nature of the documents available for the evaluation of the ten included projects, the researcher can not know with certainty if the NPS approved changes resulted in a specific LEED point. However, knowing the nature and requirements for the LEED categories, the researcher drew conclusions as to the relationship between the NPS approved changes and the resulting LEED points. The idea of the two processes working in parallel was defined as the two processes working separately to a successful end but not interacting or influencing each other. For the two processes to be found as working in conflict, one process would have to been seen as more important than the other.

Mutually Supportive Relationship

The researcher first reviewed the NPS approved changes to see which changes may have resulted in LEED points and hypothesized which category of LEED points

would have resulted from the change. The areas where NPS approved changes resulted in possible LEED points were found to have a relationship of being mutually supportive. The researcher identified changes such as window repair / replacement, installing insulated glass in existing window frames, installation of interior storm windows, installation of exterior awnings, new exterior doors or storefronts, and the upgrading of HVAC and electrical systems all of which could result in improved energy efficiency and possible LEED points in the Energy & Atmosphere categories. The tax credit applications also indicated a commonly approved change was new plumbing systems and fixtures which could result in the reduction of water consumption and possible LEED points from the Water Efficiency categories.

The researcher determined that six of the projects had NPS approval for roof material repair, replacement, or alteration in common. This most likely resulted in LEED points for reduction of heat island effect for roofs since eight of the projects earned this point. In support of this claim, the tax credit applications for the Martineau Project specifically referred to the NPS approving the use of "LEED approved TPO roof in lieu of the EPDM roof originally specified." The Martineau Project tax credit application reference to LEED approved materials is the only one that the researcher found in her evaluation of the project documents. As previously noted in this chapter, changes to the roofs included the installation of roofing materials that have a specified Solar Reflectance Index or installing a vegetated roof over at least 50% of the roof surface or doing a combined approach could result in LEED points.

The last common NPS approved change among the sample addressed interior finishes and materials. The replacement or change to interior materials and finishes could result in earning LEED points in the Materials & Resources and Indoor

Environmental Quality categories. All of the identified NPS approved changes that could potentially result in LEED points were defined by the researcher as representative of a mutually supportive relationship between the federal tax credit process and the LEED point process.

Parallel Relationship

The researcher next identified commonalities between the two processes that functioned in a parallel manner. First the researcher reviewed common physical characteristics that may have resulted in LEED points. The LEED rating system has points that relate to the sustainable nature of the site; some of these are non-changeable factors and rely on the type of project being undertaken. Of the ten identified projects in this study, the majority earned points for site selection, brownfield redevelopment, and alternative transportation – public transportation access. The researcher determined that these points were earned due to the choice of existing building and site, not changes made to the property. These LEED points were earned by working in parallel with the tax credit application process.

Other LEED points earned by working in parallel with the tax credit process were found to include points for building reuse, construction management, daylight & views, sustainability education, and management by a LEED accredited professional. These points were earned by a combination of project type, building selection, who was involved and how they managed the project, not by an action that had to be approved by both processes for a successful result. For instance, NPS does not require approval for how a contractor manages his/her site in regards to waste disposal. So, if a project earns the Construction Waste Management: Divert 50% from Disposal point, the point

does not come from a change that NPS had to approve, thus there would be no overlap between the two processes.

The lack of procedural overlap does not mean that the two processes do not share the common views and goals. Both the preservation and green building communities hold stewardship of the built and natural environment as core values. In addition both communities promote the reuse of existing materials. Preservationists have advocated the "recycling" of buildings and existing materials for more than 25 years. The LEED rating system rewards building and material reuse, use of materials with recycled content, and reuse of salvaged materials.

Conflict Relationship

The third hypothesized relationship, the two processes working in conflict, was not supported by the materials and documentation that the researcher gathered for data analysis. The requirement documents, especially the LEED scorecards, did not elaborate on potential conflicts. The researcher did note that some of the received tax credit application files did include NPS requested changes to the submitted proposed Part II before they would issue an approval. These requested changes involved retention, not replacement, of existing windows or the removal of interior finishes, such as plaster. In all cases the requested changes were met, otherwise they would not have been included in this study since one of the requirements for inclusion was an approved Part II. Eight of the ten included projects have completed Part III of the tax credit application which is the final step in the certification process. Completion of Part III allows the applicant to file with the IRS for tax credits. Therefore, if there were any conflicts, they were resolved to the NPS' satisfaction before certification of the

rehabilitation could be issued. The results of this study found no data to support the preconception that attempting dual certification results in conflict.

Summary

This research study was designed to examine whether there were commonalities between the handful of certified historic rehabilitation projects that have achieved LEED certification at any level. The commonalities found were explored to see what conclusions could be drawn that could aid future projects seeking the same results. Knowing how these projects earned their LEED points and what NPS approved changes may have facilitated those points informs both the preservation and green building communities regarding how to approach future projects for a successful result. The most important result was to show that these projects remained faithful to the historic integrity of the buildings while improving the quality of life for future generations and minimizing the built environments' impact on the natural environment.

This study created better understanding of how the LEED certification and federal tax credit processes interact with each other to reach a successful result. The findings were based on the list of identified projects. (See appendix F.) As the number of projects in this field increases, so will our understanding of the relationships between the two processes.

The findings of this research produced a profile of building and project characteristics, based on identified commonalities between the physical characteristics and approved rehabilitation changes that could be used as a predictor for success when designing a project that would seek federal tax credits and LEED certification. The study also yielded information on how these types of projects earn LEED points as compared

to Frey's predictions. By comparing Frey's predictions to the LEED points earned by these projects the researcher was able to increase the understanding of how these types of projects earn LEED points as compared to previous studies of LEED certified projects involving historic buildings, but not tax credits.

The final information gained from the evaluation of the projects was a better understanding of the relationships between the two processes. By comparing the NPS approved rehabilitation changes and the earned LEED points the researcher was able to draw conclusions about the relationships that existed between the two processes. The comparisons showed that the processes could work together to create successful results either by working in a mutually supportive manner with a cause and effect relationship or in a parallel manner where success was achieve independently of each other. These ten projects show the preservation and green building communities that it is possible to have thoughtful and respectful historic rehabilitation that also receives LEED certification. Projects that combine the principles of historic preservation and sustainability truly embody the "7 R's of Green Design": reduce, reuse, recycle, repair, recover, remove, and respect (New England Interior Design Studio, 2008).

CHAPTER V

CONCLUSIONS

"Reusing, restoring, and adapting historic structures to the needs of today allows society to effectively leverage the energy and resource expenditures of past generations [embodied energy], while minimizing waste and current energy and materials usage"(The Greening of Historic Properties, 2006, pg 5). This excerpt, taken from the white paper produced by the 2006 Greening of Historic Properties National Summit, sums up the goals of the projects identified and included in this research study. While confirming that the sample projects successfully met the review criteria for both preservation and green design certification, this study has produced a number of questions. One of those is: what is the biggest challenge to the success of projects seeking to use federal tax credits, becoming a certified historic rehabilitation, and earning LEED certification? These results suggest that the professionals involved in the projects need to understand and incorporate components that would enable them to obtain federal historic tax credits *and* LEED certification. The ten included projects demonstrated that this can be done successfully but that the two processes must work to the benefit of each other and recognize the limitations that come with rehabilitating a historic building. If a project wants to use federal tax credits then the project managers should know that they will not be allowed to replace the windows unless they are beyond repair, so creative solutions such as insulated replacement glass or interior storm windows need to be employed. The owners, occupants, designers, LEED and

preservation professionals need to have open lines of communication and work to find solutions to the challenges that arise. Based on the findings of this study, having the goal of a Certified or Silver LEED rating for a historic tax credit rehabilitation project is very achievable.

The study results did not show the anticipated conflicts that the preliminary research had identified. The researcher anticipated finding documentation in the federal tax credit applications of conflicts involving replacement windows or the addition of insulation. The federal tax credit applications did mention windows, their repair, restoration, replacement in kind, or thermal upgrade but there was no noted conflict. The SHPO offices and NPS were very clear in their expectations in regards to the treatment of windows. The researcher found no mention of additional insulation in any of the documentation.

A related question that the results of this study raised is whether historic buildings benefit from the LEED rating system. Normally financial incentives are not associated with LEED certification, unlike federal tax credits which can result in tax credits for 20% of the rehabilitation cost. In fact, the fees for LEED certification are an additional project cost. The projects included in this study practiced sound preservation techniques and added green building practices when it would not interfere with the historic integrity of the building. These projects embody more than twenty-first century green building technology; they celebrate and honor our past while providing for future needs. So, the researcher wonders why a historic building needs LEED certification. If a building can have green upgrades made while maintaining the historic integrity then what is the benefit of a third party certification? Perhaps the growing emphasis on good stewardship through green practices as well as the reuse of historic buildings will be the

impetus. The increasing number of adaptively reused historic buildings implementing green building techniques will test the LEED rating system and its validity.

An article in the January / February issue of *Preservation* by Wayne Curtis has coined a new term that describes the buildings included in this study perfectly, "Stealth Green." Rather than just adding twenty-first century technology to the historic buildings, the rehabilitations enhanced the inherent green traditional building techniques the buildings already had. They are commercial, turn of the twentieth century buildings that retained their historic character while lessening their impact on the natural environment. The examination of the ten projects in this study serve to support the phrase coined by Carl Elefante (2007) that "the greenest building is … the one that is already built."

Future Study

The results of this study have raised questions that indicate the need for further study by the preservation and green building communities. Future study should include the addition of new projects to the identified project list and comparison to the ten included projects to see if this study's findings are supported by future projects. An evaluation of the projects that were unsuccessful at achieving dual certification would also be enlightening. Studying the unsuccessful projects could offer better understanding of the conflicts that a project seeking dual certification faces, something that this study was not able to clearly identify. Understanding why these projects failed to meet their goals could also lend support to reconsidering the LEED rating system regarding embodied energy and unique qualities found in historic buildings.

An additional means to understand the conflicts would be to conduct interviews with the SHPO staff and project mangers involved in the projects to identify the

challenges and conflicts each project faced that are not evident from the paper trail. As previously mentioned the collected documents for the data analysis did not describe any conflicts that the projects may have faced while completing the work. It would be helpful to know of any perceived conflicts in order to understand what solutions were reached to allow the project to be approved by the SHPO and NPS for tax credits. Also a better understanding of how the projects earned their LEED points would increase understanding of how the NPS approved changes resulted in points; it would also help confirm or contradict the researcher's analysis of the relationships from this study.

There is an ongoing debate between the preservation community and the green building community as to whether the current LEED-NC rating criteria need to be altered to explicitly recognize the embodied energy and quality of materials found in historic buildings as well as the social benefits associated with historic buildings. These ten projects clearly demonstrate that a certified historic rehabilitation can indeed earn LEED certification within the current LEED-NC rating system. Analyzing the projects that attempted and failed to achieve both certifications might be a better method for answering the question as to the need for any modification of the current LEED rating system. If embodied energy, historical significance, and sense of place provided by historic buildings were explicitly rewarded then the sample projects would have received a higher LEED rating. They would be considered more green, meaning more successful in the eyes of the green building community. The examination of projects that use federal tax credits and LEED certification is a young field and warrants further study.

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APPENDIX A

COMMONLY USED HISTORIC PRESERVATION TERMS

These definitions are from the US Department of the Interior.

Preservation

The act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.

Rehabilitation

The process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values.

Restoration

The act or process of accurately depicting the form, features, and character of a property as if appeared at a particular period of time by means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate with a restoration project.

Reconstruction

The act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for

the purpose of replicating its appearance at a specific period of time and in its historic location.

Additional term with definition taken from *Historic Preservation: Curatorial Management of the Built World* by James Marston Fitch.

Adaptive Use

The adaptation of old buildings to meet the requirements of new tenants is often the only economic way in which an old building can be saved. This can sometimes involve fairly radical interventions, especially in the internal organization of space, in which any or all of the levels of intervention may be called for.

APPENDIX B

The Secretary of the Interior's

Standards for Rehabilitation

The Secretary of the Interior is responsible for establishing standards for all national preservation programs under Departmental authority and for advising Federal agencies on the preservation of historic properties listed or eligible for listing in the National Register of Historic Places.

The Standards for Rehabilitation, a section of the Secretary's Standards for Historic Preservation Projects, address the most prevalent preservation treatment today: **rehabilitation**. *Rehabilitation is defined as the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values.*

The Secretary of the Interior's
Standards for Rehabilitation

The Standards that follow were originally published in 1977 and revised in 1990 as part of Department of the Interior regulations (36 CFR Part 67, Historic Preservation Certifications). They pertain to historic buildings of all materials, construction types, sizes, and occupancy and encompass the exterior and the interior of historic buildings. The Standards also encompass related landscape features and the building's site and environment as well as attached, adjacent or related new construction.

The Standards are to be applied to specific rehabilitation projects in a reasonable manner, taking into consideration economic and technical feasibility.

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a property shall be preserved.

6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

Note: To be eligible for Federal tax incentives, a rehabilitation project must meet all ten Standards. The application of these Standards to rehabilitation projects is to be the same as under the previous version so that a project previously acceptable would continue to be acceptable under these Standards.

Certain treatments, if improperly applied, or certain materials by their physical properties, may cause or accelerate physical deterioration of historic buildings. Inappropriate physical treatments include, but are not limited to: improper repointing techniques; improper exterior masonry cleaning methods; or improper introduction of insulation where damage to historic fabric would result. In almost all situations, use of these materials and treatments will result in denial of certification. In addition, every effort should be made to ensure that the new materials and workmanship are compatible with the materials and workmanship of the historic property.

Guidelines to help property owners, developers, and Federal managers apply the Secretary of the Interior's Standards for Rehabilitation are available from the National Park Service, State Historic Preservation Offices, or from the Government Printing Office. For more information write: National Park Service, Preservation Assistance Division-424, P.O. Box 37127, Washington, D.C. 20013-7127.

APPENDIX C

FEDERAL HISTORIC TAX CREDIT APPLICATION

PARTS I, II, III

Form 10-168
Rev. 12/90

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

OMB Approved
No. 1024-0009

HISTORIC PRESERVATION CERTIFICATION APPLICATION
PART 1 – EVALUATION OF SIGNIFICANCE

NPS Office Use Only
NRIS No:

NPS Office Use Only
Project No:

Instructions: Read the instructions carefully before completing application. No certifications will be made unless a completed application form has been received. Type or print clearly in black ink. If additional space is needed, use continuation sheets or attach blank sheets.

1. Name of Property: _____

Address of Property: Street _____

City _____ County _____ State _____ Zip _____

Name of historic district: _____

☐ National Register district ☐ certified state or local district ☐ potential district

2. Check nature of request:

☐ certification that the building contributes to the significance of the above-named historic district (or National Register property) for the purpose of rehabilitation.

☐ certification that the structure or building, and where appropriate, the land area on which such structure or building is located contributes to the significance of the above-named historic district for a charitable contribution for conservation purposes

☐ certification that the building does not contribute to the significance of the above-named historic district.

☐ preliminary determination for individual listing in the National Register.

☐ preliminary determination that a building located within a potential historic district contributes to the significance of the district.

☐ preliminary determination that a building outside the period or area of significance contributes to the significance of the district.

3. Project contact:

Name _____

Street _____ City _____

State _____ Zip _____ Daytime Telephone Number _____

4. Owner:

I hereby attest that the information I have provided is, to the best of my knowledge, correct, and that I own the property described above. I understand that falsification of factual representations in this application is subject to criminal sanctions of up to $10,000 in fines or imprisonment for up to five years pursuant to 18 U.S.C. 1001.

Name _____ Signature _____ Date _____

Organization _____

Social Security or Taxpayer Identification Number _____

Street _____ City _____

State _____ Zip _____ Daytime Telephone Number _____

NPS Office Use Only

The National Park Service has reviewed the "Historic Certification Application – Part 1" for the above-named property and hereby determines that the property:

☐ contributes to the significance of the above-named district (or National Register property) and is a "certified historic structure" for the purpose of rehabilitation.

☐ contributes to the significance of the above-named district and is a "certified historic structure" for a charitable contribution for conservation purposes in accordance with the Tax Treatment Extension Act of 1980.

☐ does not contribute to the significance of the above-named district.

Preliminary determinations:

☐ appears to meet the National Register Criteria for Evaluation and will likely be listed in the National Register of Historic Places if nominated by the State Historic Preservation Officer according to the procedures set forth in 36 CFR Part 60.

☐ does not appear to meet the National Register Criteria for Evaluation and will likely not be listed in the National Register.

☐ appears to contribute to the significance of a potential historic district, which will likely be listed in the National Register of Historic Places if nominated by the State Historic Preservation Officer.

☐ appears to contribute to the significance of a registered historic district but is outside the period or area of significance as documented in the National Register nomination or district documentation on file with the NPS.

☐ does not appear to qualify as a certified historic structure.

Date	National Park Service Authorized Signature	National Park Service Office/Telephone No.

☐ See Attachments

HISTORIC PRESERVATION
CERTIFICATION
APPLICATION –
PART 1

Property Name

NPS Office Use Only
Project Number:

Property Address

5. Description of physical appearance:

Date of Construction: _____ Source of Date: _____

Date(s) of Alteration(s): _____

Has building been moved? ☐ yes ☐ no If so, when? _____

Form 10-168a
Rev. 12/90

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

OMB Approved
No. 1024-0009

HISTORIC PRESERVATION CERTIFICATION APPLICATION
PART 2 – DESCRIPTION OF REHABILITATION

NPS Office Use Only	**NPS Office Use Only**
NRIS No:	Project No:

Instructions: Read the instructions carefully before completing the applications. No certifications will be made unless a completed application form has been received. Type or print clearly in black ink. If additional space is needed, use continuation sheets or attach blank sheets. A copy of this form may be provided to the Internal Revenue Service. The decision by the National Park Service with respect to certification is made on the basis of the descriptions in this application form. In the event of any discrepancy between the application form and other, supplementary material submitted with it (such as architectural plans, drawings, and specifications), the application form shall take

6. Statement of significance:

7. Photographs and maps.

Attach photographs and maps to application

Continuation sheets attached: ☐ yes ☐ no

precedence.

1. **Name of Property:** _____

Address of Property: Street _____

City _____ County _____ State _____ Zip ____

☐ Listed individually in the National Register of Historic Places; give date of listing: _____

☐ Located in a Registered Historic District; specify: _____

Has a Part 1 Application (Evaluation of Significance) been submitted for this project? ☐ yes ☐ **no**

If yes, date Part 1 submitted: _____ Date of certification: _____ NPS Project Number: _____

2. **Data on building and rehabilitation project:**

Date building constructed: _____ Total number of housing units before rehabilitation: _____

Type of construction: _____ Number that are low-moderate income: _____

Use(s) before rehabilitation: _____ Total number of housing units after rehabiltation: _____

Proposed use(s) after rehabilitation: _____ Number that are low-moderate income: _____

Estimated cost of rehabilitation: _____ Floor area before rehabilitation: _____

This application covers phase number ____ of ____ phases Floor area after rehabilitation: _____

Project/phase start date (est.): _____ Completion date (est.): _____

3. **Project contact:**

Name _____

Street _____ City _____

State _____ Zip _____ Daytime Telephone Number _____

4. **Owner:**

I hereby attest that the information I have provided is, to the best of my knowledge, correct, and that I own the property described above. I understand that falsification of factual representations in this application is subject to criminal sanctions of up to $10,000 in fines or imprisonment for up to five years pursuant to 18 U.S.C. 1001.

Name _____ Signature _____ Date _____

Organization _____

Social Security or Taxpayer Identification Number _____

Street _____ City _____

State _____ Zip _____ Daytime Telephone Number _____

NPS Office Use Only

The National Park Service has reviewed the "Historic Certification Application – Part 2" for the above-named property and has determined:

☐ that the rehabilitation described herein is consistent with the historic character of the property or the district in which it is located and that the project meets the Secretary of the Interior's "Standards for Rehabilitation." This letter is a preliminary determination only, since a format certification of rehabilitation can be issued only to the owner of a "certified historic structure" after rehabilitation work is completed.

☐ that the rehabilitation or proposed rehabilitation will meet the Secretary of the Interior's "Standards for Rehabilitation" if the attached conditions are met.

☐ that the rehabilitation described herein is not consistent with the historic character of the property or the district in which it is located and that the project does not meet the Secretary of the Interior's "Standards for Rehabilitation." A copy of this form will be provided to the Internal Revenue Service.

Date	National Park Service Authorized Signature	National Park Service Office/Telephone No.

☐ See Attachments

HISTORIC PRESERVATION CERTIFICATION APPLICATION – PART 2

Property Name

Property Address

NPS Office Use Only

Project Number:

5. DETAILED DESCRIPTION OF REHABILITATION / PRESERVATION WORK – Includes site work, new construction, alterations, etc. Complete blocks below.

Number 1	Architectural feature _____ Approximate Date of feature _____	Describe work and impact on existing feature:
Describe existing feature and its condition: Photo no. _____ Drawing no _____		
Number 2	Architectural feature _____ Approximate Date of feature _____	Describe work and impact on existing feature:
Describe existing feature and its condition: Photo no. _____ Drawing no _____		
Number 3	Architectural feature _____ Approximate Date of feature _____	Describe work and impact on existing feature:
Describe existing feature and its condition: Photo no. _____ Drawing no _____		
Number	Architectural feature _____	Describe work and impact on existing feature:

4	Approximate Date of feature _____	
	Describe existing feature and its condition:	
	Photo no. _____ Drawing no _____	

Part II continues in this format until all changes and treatments have been identified.

Form 10-168c
Rev. 12/90

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

OMB Approved
No. 1024-0009

HISTORIC PRESERVATION CERTIFICATION APPLICATION

REQUEST FOR CERTIFICATION OF COMPLETED WORK
PART 3

NPS Office Use Only
NRIS No:

Instructions: Upon completion of the rehabilitation, return this form with representative photographs of the completed work (both exterior and interior views) to the appropriate reviewing office. If a Part 2 application has not been submitted in advance of project completion, it must accompany the Request for Certification of Completed Work. A copy of this form will be provided to the Internal Revenue Service. Type or print clearly in black ink. The decision of the National Park Service with respect to certification is made on the basis of the descriptions in this application form. In the event of any discrepancy between the application form and other, supplementary material submitted with it (such as architectural plans, drawings and specifications), the application form shall take precedence.

1. **Name of Property:** _____

Address of Property: Street _____

City _____ County _____ State _____ Zip_____

Is property a certified historic structure? ☐ yes ☐ no

If yes, date of certification by NPS: _____

or date of listing in the National Register: _____

2. **Data on rehabilitation project:**

National Park Service assigned rehabilitation project number: _____

Project starting date: _____

Rehabilitation work on this property was completed and the building placed in service on: _____

Estimated costs attributed solely to rehabilitation of the historic structure: $ _____

Estimate costs attributed to new construction associated with the rehabilitation, including additions, site work, parking lots, landscaping: $ _____

3. **Owner:** (space on reverse for additional owners)

I hereby apply for certification of rehabilitation work described above for purposes of the Federal tax incentives. I hereby attest that the information provided is, to the best of my knowledge, correct, and that, in my opinion the completed rehabilitation meets the Secretary's "Standards for Rehabilitation" and is consistent with the work described in Part 2 of the Historic Preservation Certification Application. I also attest that I own the property described above. I understand that falsification of factual representations in this application is subject to criminal sanctions of up to $10,000 in fines or imprisonment for up to five years pursuant to 18 U.S.C. 1001.

Name _____ Signature _____ Date: _____

Organization _____

Social Security or Taxpayer Identification Number _____

Street _____ City _____

State _____ Zip _____ Daytime Telephone Number _____

NPS Office Use Only
The National Park Service has reviewed the "Historic Certification Application – Part 2" for the above-listed "certified historic structure" and has determined:

☐ that the completed rehabilitation meets the Secretary of the Interior's "Standards for Rehabilitation and is consistent with the historic character of the property or the district in which it is located. Effective the date indicated below, the rehabilitation of the "certified historic structure" is hereby designated a "certified rehabilitation." A copy of this certification has been provided to the Department of the Treasury in accordance with Federal law. This letter of certification is to be used in conjunction with appropriate Internal Revenue Service regulations. Questions concerning specific tax consequences or interpretation of the Internal Revenue Code should be addressed to the appropriate local Internal Revenue Service office. Completed projects may be inspected by an authorized representative of the Secretary to determine if the work meets the "Standards for Rehabilitation." The Secretary reserves the right to make inspections at any time up to five years after completion of the rehabilitation and to revoke certification, if it is determined that the rehabilitation project was not undertaken as presented by the owner in the application form and supporting documentation, or the owner, upon obtaining certification, undertook unapproved further alterations as part of the rehabilitation project inconsistent with the Secretary's " Standards for Rehabilitation."

☐ that the rehabilitation is not consistent with the historic character of the property or the district in which it is located and that the project does not meet the Secretary of the Interior's "Standards for Rehabilitation." A copy of this form will be provided to the Internal Revenue Service

Date	National Park Service Authorized Signature	National Park Service Office/Telephone No.

☐ See Attachments

REQUEST FOR CERTIFICATION OF COMPLETED WORK, *continued*

NPS Project No.

Additional Owners:

Name _____

Street _____

City _____ State _____ Zip _____

Social Security or Taxpayer Identification Number: _____

Name _____

Street _____

City _____ State _____ Zip _____

Social Security or Taxpayer Identification Number: _____

Name _____

Street _____

City _____ State _____ Zip _____

Social Security or Taxpayer Identification Number: _____

Name _____

Street _____

City _____ State _____ Zip _____

Social Security or Taxpayer Identification Number: _____

Name _____

Street _____

City _____ State _____ Zip _____

Social Security or Taxpayer Identification Number: _____

Name _____

Street _____

City _____ State _____ Zip _____

Social Security or Taxpayer Identification Number: _____

Name _____

Street _____

City _____ State _____ Zip _____

Social Security or Taxpayer Identification Number: _____

APPENDIX D

MCLENNAN'S PRINCIPLES OF SUSTAINABLE DESIGN

1. Respect for the Wisdom of Natural Systems – The Biomimicry Principle
2. Respect for People – The Human Vitality Principle
3. Respect for Place – The Ecosystem / Bioregion Principle
4. Respect for the Cycle of Life – The "Seven Generations" Principles
5. Respect for the energy and Natural Resources – The Conservation and Renewable Resources Principle
6. Respect for Process – The Holistic Thinking Principal
    g. A Commitment to Collaboration and Interdisciplinary Communication
    h. A Commitment to Holistic Thinking
    i. A Commitment to Life-Long Learning and Continual Improvement
    j. A Commitment to Challenging Rules of Thumb
    k. A Commitment to Allowing for Time to Make Good Decisions
    l. A Commitment to Rewarding Innovation

APPENDIX E

SUMMARY OF PATRICE FREY'S PROBABILITY PREDICTIONS

Evaluation of the probability of a historic building earning LEED-NC points as compared to a non-historic building.

Categories and the probability of a historic building earning points

Sustainable Sites (8 sub-categories), 14 total points possible

Site Selection	Strong
Development Density	Strong
Alternative Transportation	Average to Strong
Brownfields	Strong
Site Development	Weak
Storm Water Quality Control	Weak
Heat Island Effect	Weak
Light Pollution	Average

Water Efficiency (3 sub-categories), 5 total points possible

Water Efficient Landscaping	Average
Innovative Water Technology	Average
Water Use Reduction	Average

Energy Atmosphere (6 sub-categories), 17 total points possible

Optimizing Energy Performance	Weak
On-site Renewable Energy	Weak
Additional Commissioning	Average
Ozone Depletion	Average
Measurement and Verification	Average
Green Power	Average

Materials and Resources (7 sub-categories), 13 total points possible

Building Reuse	Strong
Construction Waste Management	Average
Resource Reuse	Average
Recycled Content	Average
Local / Regional Materials	Average
Rapidly Renewable Materials	Average
Certified Wood	Average

Indoor Environmental Quality (8 sub-categories), 15 total points possible

Carbon Dioxide Monitoring	Average
Increased Ventilation Effectiveness	Strong
Construction IAQ Management Plan	Average
Low-Emitting Materials	Average
Indoor Chemical & Pollutant Source Control	Weak
Controllability of Systems	Average – Strong
Thermal Comfort	Average
Daylight & Views	Strong

Innovation and Design Process (2 sub-categories), 5 total points possible

Innovation in Design	Average
LEED Accredited Professional	Average

APPENDIX F

IDENTIFIED PROJECT LIST

Virginia Projects:

Included in Study
DHR Project 2005-137
Moseley Architects
1700 Highpoint Ave.
Richmond, VA
Federal Tax Credits – Part II Approved
LEED-NC 2.1 Registered 6/24/04, Projected LEED-NC Gold Summer 2008

DHR Project 2006-191
Marshall Hall
2503-2505 East Broad Street
Richmond, VA
Federal Tax Credits – Part II Approved
LEED Registered, did not receive LEED Certification

DHR Project 2006-102
Richmond and Chesapeake Bay Railway Car Barn
1620 Brook Road
Richmond, VA
Federal Tax Credits – Part II Approved
LEED Registered 2007

DHR Project 2005-297
Tymoff + Moss Office
512 Botetourt Street
Norfolk, VA 23510
Federal Tax Credit – Part II Approved
LEED Registered 2007

Oregon Projects:
SHPO: Joy Spears

Included in Study
First Regiment Armory Annex into the Gerding Theater
128 NW 11th Street
Portland, OR
Federal Tax Credit Application – Completed Part III
LEED-NC Platinum 2006

Included in Study
Balfour-Guthrie Building
Portland, OR
Federal Tax Credit Application – Completed Part III
LEED-NC Silver

Utah Projects:
SHPO: Nelson Knight
nwknight@utah.gov
801-533-3562

Included in Study
Big-D Corporate Office Headquarters
Salt Lake City, UT
Federal Tax Credit Application – Completed Part III
LEED-NC Gold, first in Utah

Included in Study
Scowcroft Building
Ogden, UT
Federal Tax Credit Application – Completed Part III
LEED-NC Silver

Michigan Projects:
SHPO: Robert McKay
mckayr@michigan.gov

Included in Study
Bazzanni Associates Headquarters
Grand Rapids, MI
Owner / Developer: Guy Bazzanni
Located in Wealthy Theater Historic District
Federal Tax Credit Application – Part II Approved
LEED-NC Silver

Included in Study
Martineau Project
Grand Rapids, MI
Dwelling Place of Grand Rapids
Federal Tax Credit Application – Part II Approved
LEED-NC Certified

Included in Study
Kelsey Project Avenue for Arts
Grand Rapids
Federal Tax Credit Application – Part II Approved
LEED-NC Certified

Washington Projects:
SHPO: Stephen Mathison
Stephen.Mathison@dahp.wa.gov
360-586-3079

Included in Study
The Cobb Building
1301-1309 4th Avenue
Seattle, WA
Federal Tax Credit Application – Part II Approved
LEED-NC Silver

Georgia Projects:

Included in Study
Whitaker Street Project
109-119 Whitaker Street Project
Savannah, GA
Federal Tax Credit Application – Part II Approved
LEED-NC Silver 2005

North Carolina Projects: None are included in the study due to LEED certification type or status
SHPO: Tim Simmons

Heilig-Levine / Cherokee Offices
Harget Street and Wilmington Street
Raleigh, NC
Passed Part 2 for all buildings in the complex, One building has passed Part 3 of the Federal Tax Credit Application
Cherokee Offices received LEED-CI Platinum, 11/2007

The Hill Building
111 North Corcoran Street
Durham, NC
Federal Tax Credit Application – Part II submitted, on hold
LEED Registered

Golden Belt Center
807 E. Main Street
Durham, NC
Federal Tax Credit Application – Part II approved on condition 2007
LEED Registered

Gastonia Multi-Use Building
169 W. Main Street
Gastonia, NC
Federal Tax Credit Application – Part II Approved on Condition 2004
LEED Registered

APPENDIX G

LEED SCORECARD EVALUATION

Categories / Subcategories	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sustainable Sites (14 points)										
Site Selection (1)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Urban Development (1)	Y	Y	Y		Y					Y
Brown Field Development (1)		Y		Y	Y	Y		Y	Y	
Alternative Transportation										
Public Transportation Access (1)	Y	Y	Y	Y	Y	Y	Y	Y		Y
Bicycle Storage and Changing Room (1)	Y	Y		Y	Y	Y	Y	Y	Y	Y
Alternative Fuel Refueling Stations (1)		Y			Y				Y	
Parking Capacity (1)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Reduced Site Disturbance										
Protect or Restore Open Space (1)										
Development Footprint (1)					Y					
Storm water Management										
Rate and Quantity (1)		Y					Y		Y	
Treatment (1)		Y							Y	
Landscape and Exterior Design to Reduce Heat Islands										
Non-Roof (1)		Y	Y	Y	Y				Y	
Roof (1)	Y	Y	Y	Y		Y	Y	Y		Y
Light Pollution Reduction (1)	Y			Y		Y	Y	Y	Y	
Water Efficiency (5 points)										
Water Efficient Landscaping										
Reducing by 50% (1)		Y	Y	Y	Y	Y	Y	Y	Y	Y
No Potable Use or No Irrigation (1)		Y				Y	Y	Y		Y
Innovative Wastewater Technologies (1)		Y								
Water Use Reduction										
20% Reduction (1)	Y	Y	Y		Y	Y	Y	Y	Y	Y
30% Reduction (1)	Y	Y			Y		Y		Y	Y
Energy & Atmosphere (17 points)										
Optimize Energy Performance									Y4	
20% New / 10% Existing (2)	Y	Y	Y	Y			Y			Y
30% New / 20% Existing (2)	Y	Y	Y	Y			Y			Y
40% New / 30% Existing (2)	Y 1	Y	Y1				Y			Y
50% New / 40% Existing (2)										Y
60% New / 50% Existing (2)										
Renewable Energy										
5% (1)										
10% (1)										
15% (1)										
Additional Commissioning (1)	Y	Y			Y				Y	
Ozone Depletion Protection (1)		Y			Y	Y	Y	Y	Y	Y
Measurement & Verification (1)		Y	Y						Y	
Green Power (1)		Y	Y	Y						

Categories / Subcategories	1	2	3	4	5	6	7	8	9	10
Materials & Resources (13 points)										
Building Reuse										
Maintain 75% of Existing Shell (1)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maintain 100% of Existing Shell (1)			Y	Y			Y			Y
Maintain 100% of Existing Shell & 50% non-Shell (1)			Y	Y			Y			Y
Construction Waste Management										
Divert 50% (1)	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Divert 75% (1)	Y	Y	Y	Y	Y		Y		Y	
Resource Reuse										
Specify 5% (1)							Y			
Specify 10% (1)										
Recycled Content (2)		Y	Y1	Y	Y1	Y	Y1		Y1	Y1
Local / Regional Materials										
20% Manufactured Locally (1)	Y	Y		Y	Y	Y	Y	Y	Y	Y
20% Manuf. Local / 50% Harvested Local (1)	Y	Y		Y	Y		Y			Y
Rapidly Renewable Materials (1)							Y			
Certified Wood (1)	Y	Y					Y			
Indoor Environmental Quality (15 points)										
Carbon Dioxide Monitoring (1)		Y	Y	Y					Y	
Increase Ventilation Effectiveness (1)		Y	Y	Y						Y
Construction IAQ Management Plan										
During Construction (1)		Y	Y	Y	Y	Y		Y	Y	
Before Construction (1)	Y	Y		Y	Y			Y	Y	
Low-Emitting Materials										
Adhesives & Sealants (1)	Y	Y		Y	Y	Y	Y	Y	Y	
Paints (1)	Y	Y		Y	Y	Y	Y	Y	Y	Y
Carpet (1)	Y	Y	Y	Y	Y	Y	Y		Y	
Composite Wood (1)	Y	Y		Y		Y		Y	Y	
Indoor Chemical & Pollutant Source Control (1)		Y	Y	Y	Y				Y	
Controllability of Systems										
Perimeter (1)		Y			Y			Y	Y	
Non-Perimeter (1)		Y						Y		
Thermal Comfort										
Comply with ASHRAE 55-1992 (1)	Y	Y	Y	Y					Y	Y
Permanent Monitoring System (1)		Y	Y	Y				Y	Y	
Daylighting & Views										
Daylight 75% of Spaces (1)	Y	Y	Y		Y		Y			Y
Views for 90% of Spaces (1)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Innovation & Design Process (5 points)										
Innovation in Design (3)		Y	Y1	Y	Y	Y2		Y1	Y	Y1
Sustainability Education (1)		Y	Y		Y	Y	Y	Y	Y	Y
LEED Accredited Professionals (1)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Project Key:

1 – Balfour-Guthrie, 33 points, LEED-NC Silver

2 – The Armory / Gerding Theater, 53 points, LEED-NC Platinum

3 – Scowcroft Building, 33 points, LEED-NC Silver

4 – WP Fuller Paint / Big-D Construction, 39 points, LEED-NC Gold

5 – The Cobb Building, 34 points, LEED-NC Silver

6 – Martineau Project, 29 points, LEED-NC Certified

7 – Bazzanni Associates Headquarters, 34 points, LEED-NC Silver

8 – Kelsey Project Avenue for Arts, 26 points, LEED-NC Certified

9 – Moseley Architects' New Headquarters, projected 41 points, projected LEED-NC Gold

10 – 109-119 Whitaker Street Project, 33 points, LEED-NC Silver

Note: A "Y" with a number indicates that project did not earn the full amount of possible points for that category. Example: Y1 = only one point earned from total possible points.

APPENDIX H

STUDY LEED POINT RESULTS COMPARED TO FREY'S PROBABILITY

PREDICTIONS

Categories / Subcategories	# of Project	Frey's Probability
Sustainable Sites (14 points)		
Site Selection (1)	10	STRONG
Urban Development (1)	5	STRONG
Brown Field Development (1)	6	STRONG
Alternative Transportation		AVERAGE - STRONG
Public Transportation Access (1)	9	
Bicycle Storage and Changing Room (1)	9	
Alternative Fuel Refueling Stations (1)	3	
Parking Capacity (1)	10	
Reduced Site Disturbance		WEAK
Protect or Restore Open Space (1)	0	
Development Footprint (1)	1	
Storm water Management		WEAK
Rate and Quantity (1)	3	
Treatment (1)	2	
Landscape and Exterior Design to Reduce Heat Islands		WEAK
Non-Roof (1)	5	
Roof (1)	8	
Light Pollution Reduction (1)	6	AVERAGE
Water Efficiency (5 points)		
Water Efficient Landscaping		AVERAGE
Reducing by 50% (1)	9	
No Potable Use or No Irrigation (1)	5	
Innovative Wastewater Technologies (1)	1	AVERAGE
Water Use Reduction		AVERAGE
20% Reduction (1)	9	
30% Reduction (1)	6	
Energy & Atmosphere (17 points)		
Optimize Energy Performance		WEAK
20% New / 10% Existing (2)	7	
30% New / 20% Existing (2)	7	
40% New / 30% Existing (2)	5	
50% New / 40% Existing (2)	1	
60% New / 50% Existing (2)	0	
Renewable Energy		WEAK
5% (1)	0	
10% (1)	0	
15% (1)	0	
Additional Commissioning (1)	4	AVERAGE
Ozone Depletion Protection (1)	7	AVERAGE
Measurement & Verification (1)	3	AVERAGE
Green Power (1)	3	AVERAGE

Categories / Subcategories	# of Project	Frey's Probability
Materials & Resources (13 points)		
Building Reuse		STRONG
Maintain 75% of Existing Shell (1)	10	
Maintain 100% of Existing Shell (1)	4	
Maintain 100% of Existing Shell & 50% non-Shell (1)	4	
Construction Waste Management		AVERAGE
Divert 50% (1)	9	
Divert 75% (1)	7	
Resource Reuse		AVERAGE
Specify 5% (1)	1	
Specify 10% (1)	0	
Recycled Content (2)	8	AVERAGE
Local / Regional Materials		AVERAGE
20% Manufactured Locally (1)	9	
20% Manuf. Local / 50% Harvested Local (1)	6	
Rapidly Renewable Materials (1)	1	AVERAGE
Certified Wood (1)	3	AVERAGE
Indoor Environmental Quality (15 points)		
Carbon Dioxide Monitoring (1)	4	AVERAGE
Increase Ventilation Effectiveness (1)	4	STRONG
Construction IAQ Management Plan		AVERAGE
During Construction (1)	7	
Before Construction (1)	6	
Low-Emitting Materials		AVERAGE
Adhesives & Sealants (1)	8	
Paints (1)	9	
Carpet (1)	8	
Composite Wood (1)	6	
Indoor Chemical & Pollutant Source Control (1)	5	WEAK
Controllability of Systems		AVERAGE – STRONG
Perimeter (1)	4	
Non-Perimeter (1)	2	
Thermal Comfort		AVERAGE
Comply with ASHRAE 55-1992 (1)	6	
Permanent Monitoring System (1)	5	
Daylighting & Views		STRONG
Daylight 75% of Spaces (1)	6	
Views for 90% of Spaces (1)	10	
Innovation & Design Process (5 points)		
Innovation in Design (3)	8	AVERAGE
Sustainability Education (1)	8	AVERAGE
LEED Accredited Professionals (1)	10	AVERAGE

Note:

Frey's probability rating of strong, average, or weak represents the probability of a historic building, based on her 2007 research, to earn a given LEED point as compared to a newly constructed building. For further information please reference the Literature Review of this thesis or refer directly to Patrice Frey's thesis, The University of Pennsylvania, 2007.

APPENDIX I
FIGURE CREDITS

Figure 1

Balfour – Guthrie Building, Portland, OR. Courtesy of Joy Sears and the Oregon SPHO.

Figure 2

First Armory / Gerding Theater, Portland, OR. Courtesy of Joy Sears and the Oregon SHPO.

Figure 3

Scowcroft Building, Ogden, UT. Photograph taken by Paul Richer, US Department of Energy. www.eere.energy.gov.

Figure 4

Big-D Corporate Headquarters, Salt Lake City, UT. Photograph taken by Korral Broschinsky, published in Utah Preservation Magazine, 2005.

Figure 5

The Cobb Building, Seattle, WA. Photograph by Joe Mabel, GFDL granted by photographer. Downloaded from Wikimedia Commons, March 2008.

Figure 6

109-119 Whitaker Street Project, Savannah, GA. Courtesy of Jenny Parker and the National Park Service.

Figure 7 & 8

Martineau Project, Grand Rapids, MI. Courtesy of Jarrett DeWyse and Dwelling Place.

Figure 9

Bazzanni Associates Headquarters, Grand Rapids, MI. Courtesy of Nate Gillette and Bazzanni Associates.

Figure 10

Kelsey Project Avenue for Arts, Grand Rapids, MI. Courtesy of Jarrett DeWyse and Dwelling Place.

Figure 11 & 12

Moseley Architects' New Headquarters, Richmond, VA. Courtesy of John Nichols and Moseley Architects.

Figure 13

US Map from www.nationsonline.org/maps/USA_blank_map.jpg , permission to use for educational purposes. Research added the red division lines and text.

Figure 14

Pie Chart of the current (Feb 2008) LEED rating percentage breakdown. This was based on the LEED score spreadsheet that the research received from Sara Schoen at the USGBC.