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New Codes for Old Buildings: Comparing Rehabilitation Codes and Evaluating Their Effects

Adrian L. Seward
University of Pennsylvania

A Thesis in Historic Preservation Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the Requirements for the Degree of Master of Science in Historic Preservation 2007.
Advisor: David Hollenberg

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NEW CODES FOR OLD BUILDINGS: COMPARING REHABILITATION CODES AND EVALUATING THEIR EFFECTS

Adrian L Seward

A THESIS
In
Historic Preservation

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the Requirements of the Degree of
MASTER OF SCIENCE IN HISTORIC PRESERVATION
2007

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all of the faculty of the Historic Preservation program,

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CHAPTER 1: INTRODUCTION

▪*PROBLEMS OF BUILDING CODES FOR EXISTING BUILDINGS*

Building codes are often cited as a reason that historic buildings remain empty or in disrepair. It is commonly perceived that the requirements of the building code make renovation and re-use of these building economically impossible. In many cases this is true. This problem has long been recognized, and various attempts have been made to address the situation. In recent years, a set of codes for existing buildings has emerged which represent the most careful and comprehensive attempt at a solution thus far. These codes attempt to make a careful balance between minimal requirements for existing buildings and a level of safety equivalent to new buildings.

Codes were originally written in a way that would encourage demolition of older buildings to make way for safer, modern buildings. These codes required that older buildings be made to meet current code requirements when substantial work was done to the building. In many cases, this was deemed economically infeasible and buildings were replaced instead. Today, the substandard building stock which created this concern is long-gone, but the codes are only beginning to become more accommodating to the older buildings which remain.

While requirements that were originally intended to encourage the replacement of old buildings with new ones have been dropped, other code requirements still pose significant problems for the renovation or reuse of many historic buildings.

Requirements for egress, fire suppression, and fire containment can be difficult or expensive to meet for a number of reasons. There is no simple solution to this situation. These regulations exist for good reasons, and cannot simply be dropped or waived without affecting the safety of occupants.

In addition to the substantive problems for renovation and reuse which codes still present, there is a problem of perception. Whether or not codes make it difficult or even impossible to renovate or adapt an older building, there may be an assumption that they do. This may prevent owners or developers from even contemplating a project. In other cases, the supposed impossibility of reusing a building may be presented by a developer or owner as a justification for razing and replacing a protected historic building. In many cases, local officials do not have adequate knowledge of code application to historic buildings to evaluate such claims. The idea that historic buildings cannot be reused because of code issues has become so widespread that it almost seems self-evident, and such claims may be accepted all too easily when reuse is, in fact, feasible.

Faced with high costs, complicated renovation requirements, and uncertainty regarding both, many buildings were demolished and replaced or left to decay. This represents a major loss, particularly in older cities, where historic preservation may result in job growth, more affordable housing, and the retention of high quality pedestrian-oriented buildings.

There has been an increasing appreciation of the problem that this represents. Particularly in older cities, the number of buildings which do not meet current codes is significant. Nationally, 28% of residential and 20% of commercial buildings are over 50 years old.[1] Many of these buildings are desperately in need of repair or adaptation to a new use. The re-use of such buildings could curb sprawling growth and help revive moribund neighborhoods. However, conventional building codes often make this expensive and difficult. In recognition of this situation, a new generation of building codes is being created which focus less on strict requirements for materials, methods, and configuration of construction and more on evaluating whether the building as it exists meets safety goal, and which are tailored to older buildings. These are generally referred to as "rehabilitation codes" or "smart codes". In this thesis, the terms will be used interchangeably and will refer to prescriptive codes tailored to existing buildings, as opposed to scoring-based performance codes. This distinction is important. Rehabilitation codes are prescriptive codes. The goals and philosophy of rehabilitation codes represent a departure from traditional codes, but their mechanism is unchanged. Performance codes lack prescriptive requirements and rely on scoring systems or the discretion of code officials to evaluate whether a building fulfills the desired safety goals. The International Existing Building Code is the only rehabilitation code which incorporates a substantial performance-based alternative to its prescriptive provisions.

1 NAHB Research Center, Inc. "Innovative Rehabilitation Provisions: A Demonstration of the Nationally Applicable Recommended Rehabilitation Provisions," March 1999: 2

There have been substantial problems with applying codes that are intended for new construction to older buildings. First, the materials and assemblies which make up older buildings may simply not be recognized in the code. This does not necessarily mean that the materials are unsuitable. A related problem is the larger degree of variation present in older materials and assemblies. This may make the properties of the material or construction more difficult to evaluate.

The second major problem concerns the relationship between the scope of a project and the code requirements triggered by that scope. Most codes contained some variation of the "25-50" rule. This rule stated that if the cost of renovation exceeded 50% of the cost to replace a building, the entire building must be made to meet current code. If the value of renovation was 25-50% of the building value, the area being renovated was required to meet current code. This had the effect of discouraging renovation of older buildings.

Most codes also contained a change of occupancy rule, which required that the entire building be made to meet code requirements for new construction when the use of the building was changed. This presented a real problem for older cities since historic buildings may be the key to economic revitalization and affordable housing, but will often require adaptive re-use. This rule was particularly onerous in cases where the new use was actually less hazardous than the old use.

Finally, egress requirements pose substantial problems for existing buildings. Most older buildings do not conform to modern code requirements for the dimensions, fireproofing, and configuration of doors, windows, stairs, and corridors. This is particularly difficult to address. It is not as simple as replacing old materials with new ones or adding new systems. It is often simply impossible to incorporate the required features in the existing structure of a building because of dimensional restrictions.

Access requirements are also a major problem for older buildings. Though codes address the degree to which access requirements must be met by older buildings, this is an issue primarily related to the requirements of the Americans with Disabilities Act, and will be addressed minimally in this thesis.

▪*BACKGROUND: ABOUT BUILDING CODES*

The original building codes which are the root of modern codes were created in a time when many substandard buildings existed and in reaction to disasters such as the Triangle Shirtwaist Factory fire.[2] Similar disasters over time have led to the further development and strengthening of codes. These codes were initially concerned mostly with fire prevention and the safety of occupants in case of fire. As a result of this emphasis on occupant safety, most codes include strict requirements for ease of egress. Over time, building codes grew to encompass more and more aspects of building design and construction, but their purpose has remained the same—to ensure the safety of

2 In 1911, a fire at the Triangle Shirtwaist Company in New York, NY resulted in 146 deaths. Lack of efficient exits was a major contributor to the death toll.

building occupants. Specifically, building codes aim to prevent and slow the spread of fire and to ensure that occupants can evacuate the building with maximum speed and safety. Their intent is saving lives, not property.

There are two basic approaches that can be taken to building codes: codes may be prescriptive or performance-based. Prescriptive codes specify such details as what materials may be used, minimum dimensions for door and window openings, and hallway width. Performance-based codes share the same goals for fire resistance, speed and ease of egress, and other aspects of building performance related to safety, but set standards for the result rather than dictating the mechanism. Prescriptive codes emphasize the means, while performance codes emphasize the end, but the goal of occupant safety is the same.

The advantages and disadvantages of each approach are obvious. Prescriptive codes provide a great deal of certainty for builders and code officials by stating exactly what materials and configurations are required. On the other hand, they may require unnecessary replacement of materials or reconfiguration of buildings. This is a particular problem with older buildings, whose materials and methods of construction may not be recognized by prescriptive codes.

Performance-based codes offer the potential for a more rational and flexible response to the desire to provide high levels of occupant safety within an existing building. This

goal-oriented approach attempts to ensure that shortcomings will be remedied and a desired level of safety ensured. At the same time, it allows choices to be made which minimize the degree of replacement and reconfiguration. Despite these advantages, performance-based codes remain little-used because they offer less apparent certainty and predictability than prescriptive codes. Their application is more complex and may rely more heavily on the judgment of code officials, which can make it difficult to anticipate work requirements and costs. Additionally, when called upon to make such judgments, code officials may feel a responsibility to err heavily on the side of caution, and may require a very high level of safety. Most codes in use today are prescriptive, but almost all incorporate provisions which allow for a performance-based approach as an option.

Historically, the codes adopted by government have been based on model codes. These model codes were formulated by various non-governmental organizations and offered for adoption. Such code organizations are made up largely of representatives of the design, construction, building materials, and insurance industries. These model codes were written so as to able to be adopted as published, but in many cases were altered to some degree by state or municipal governments upon adoption. Increasingly, states are adopting model codes on a statewide basis, rather than letting municipalities create or adopt codes on an individual basis. Buildings are regulated on a local level, so codes may vary not just by state but by municipality. Adoption on a statewide basis ensures a

greater level of consistency, but most states still allow municipalities to amend or alter the statewide codes, and most states introduce their own changes to the model codes.

There were three major code organizations throughout most of the twentieth century, with slightly different model codes. Model codes were offered by the Building Officials Code Administrators (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building Code Conference International (SBCCI). In 1994, these organizations were merged into the International Code Council (ICC), with the goal of promoting a single nationally-consistent code. The ICC model codes have been widely adopted, and the ICC now offers a true "smart code" for existing buildings. Today, there are only two significant model codes: the ICC's International Building Code and the National Fire Protection Association's NFPA 5000. The NFPA 5000 is the most recent model code.

▪*INTENT OF THIS THESIS*

This thesis will attempt to answer several questions about the recently-developed prescriptive rehabilitation codes. It will attempt to characterize the differences between the various codes and the advantages and disadvantages of each. It will consider whether these codes favor small or large projects, and, if so, what impact that has on communities. It will attempt to determine whether these new codes are succeeding and, if not, why not. It will consider whether these codes are the best response to the problem, or whether other approaches are more favorable.

It is assumed that these codes favor small projects, that they reduce costs and uncertainty, and that they are more easily and predictably applied than other approaches which evaluate buildings individually. Such performance-based approaches use a scoring system to evaluate a building's safety, rather than applying prescriptive requirements, as do smart codes.

It has been expected that these codes will meaningfully impact the ease with which affordable housing may be created through the renovation of older buildings, and that they will have a meaningful impact on the revitalization of older communities. This thesis will argue that these codes have widely varying impacts on different types of projects and buildings, that there are specific building types and project types which are not benefited by these codes, and that in many cases these buildings and projects may actually be better served by tools taken from earlier building codes.

Chapter 2 will outline the history of code reform and examine the successes and shortcomings of previous attempts at code reform. Chapter 3 will explore the similarities and differences of current smart codes. There will be a particular emphasis on the New Jersey Rehabilitation Subcode and on Chapter 34 of the BOCA building code. Chapter 4 will review the literature on the subject of building codes as applied to older buildings and on the need for and effects of smart codes. Chapter 5 will examine two case studies with the goals of evaluating the likely impact of smart codes and showing the limitations of such studies. Chapter 6 will consider the importance of

smart codes to the field of historic preservation. Chapter 7 will draw conclusions regarding the potential of smart codes, the problems they are likely to create, and possible solutions to those problems.

CHAPTER 2: PREVIOUS APPROACHES TO CODE REFORM

The history of building code reform is almost as long as the history of building codes. Until the 1960s, efforts at code reform were focused largely on enabling the use of new technology and prefabricated materials. In 1968, HUD called for code reform which would promote and facilitate the renovation of existing buildings. This was the first major recognition of the problems that codes presented for existing buildings. Despite this recognition, the first significant effort at code reform focused on existing buildings did not occur until 1979. Efforts at reform and study of the problem continued and gained momentum, but produced few successes. Three major attempts at code reform will be described here.

▪*ARTICLE 22 OF THE MASSACHUSETTS BUILDING CODE*

The first substantive attempt to address the problem of the application of building codes to existing buildings was the enactment of Article 22 of the Massachusetts Building Code. Article 22, later renamed Article 34, was added to the Massachusetts Building Code in 1979. It was noteworthy for its new approach to changes of use. Rather than applying new building requirements to any building undergoing a change of use, Article 22 introduced a set of hazard rating categories. Code requirements were relaxed for buildings undergoing a change of use if the new use was categorized as lower-risk than the existing use.

Article 22 was partially a performance-based code and, as such, allowed for alternative means of compliance. In most cases, Article 22 required only that attributes of an existing building that were specifically identified as hazardous be corrected. Article 22 also allowed this mitigation to be done through alternative means; as long as the result was mitigation of the danger, the means chosen to mitigate the danger could differ from that prescribed by the building code. Article 22 defined hazardous conditions related to structure and egress. These hazards were required to be eliminated wherever they were present.

Article 22 also established levels of performance which buildings undergoing renovation would be required to meet if they were undergoing a change of use. The level of performance required was determined by the relative hazard ratings of the new versus the old use. Hazard ratings for various uses were an important and innovative feature of Article 22. These hazard ratings in turn determined the prescriptive requirements of Article 22.

For buildings undergoing a change of use to an equal or lesser hazard rating, the performance level of the building had to be maintained. Materials equivalent to those already in place could be utilized. New systems were to conform to the code for new

buildings "to the fullest extent practical."[3] There were specific requirements for exit lighting, egress signage, and fire alarms.

Buildings undergoing a change of use in which the new use was one step higher on the hazard rating scale were to meet new construction requirements for the entire building, with some specific exceptions. Buildings undergoing a change of use in which the new use was more than one step higher on the hazard scale were required to comply in all respects to the code requirements for new buildings. In both cases, alternate means of compliance were encouraged, once again balancing prescriptive requirements with the option of a performance-based approach.

This approach was particularly noteworthy in two respects. It pioneered the use of hazard rating scales to apply code requirements to changes of use in a graduated manner. It was also the first approach which treated the building's existing state as the baseline measurement of performance, rather than treating new construction as the baseline. This is embodied in the requirement that a building be no less conforming after renovation than before. Both of these features were later utilized by the New Jersey Rehabilitation Subcode.

3 Hattis, David B. "Some Current Regulatory Innovations Related to Building Rehabilitation," Bulletin of the Association for Preservation Technology, Vol. 13, No. 2, Regulating Existing Buildings. (1981): 16

Another significant innovation was the allowance for "alternative means" of compliance. This concept was expanded upon and systematized by the BOCA Code's Chapter 34, which allowed a performance-based approach as an option to the BOCA code's prescriptive requirements. This feature was adopted by the other major model codes, and persists today in the current model codes.

▪*HUD REHABILITATION GUIDELINES (1980)*

In 1980, HUD published a set of documents addressing many of the problems with the application of codes to older buildings.[4] One, "Guideline for Setting and Adopting Standards for Building Rehabilitation," laid out the problems of codes for older buildings and attempted to guide policy makers in finding solutions to these problems. The two major problems with traditional codes as applied to older buildings, as cited in this Guideline document, are the 25-50 and change of occupancy rules. The second document in the series, "Guideline for Approval of Building Rehabilitation", recognized that apart from the letter of the codes, the attitude, philosophy, and knowledge of local officials is vital to encouraging rehabilitation of older buildings.

4 The 1980 Guidelines were as follows:

1- Guideline for Setting and Adopting Standards for Building Rehabilitation,

2- Guideline for Approval of Building Rehabilitation

3- Statutory Guideline for Building Rehabilitation,

4- Guideline for Managing Official Liability Associated with Building Rehabilitation.

5- Egress Guideline for Residential Rehabilitation,

6- Electrical Guideline for Residential Rehabilitation

7- Plumbing DWV Guideline for Residential Rehabilitation

8- Guideline on Fire Ratings of Archaic Materials and Assemblies

The remaining publications were devoted to technical standards and attempted to establish practices which would balance safety with reuse of existing materials and systems. While these publications have been widely acknowledged and praised, it is uncertain how much real impact they had. There is little doubt that the HUD guidelines were critical in persuading the major model code organizations to drop the 25-50 rule from their codes, but this rule persisted in codes as enacted even after it was dropped by the model codes. In addition, even where this rule was dropped, the practices of local officials may have led to it remaining functionally intact.

The HUD guidelines had even less impact on change of use requirements. A few municipalities and states adopted change of use policies modeled on Article 22 of the Massachusetts Building Code, which attempted to ease these requirements by considering the relative risks of different uses. Change of use requirements remained unchanged in most municipalities, however. As will be explored in Chapter 3, Article 22 was problematic in practice, and it is questionable how much effect it had. Chapter 34 of the BOCA code offered another solution. Its reliance on alternative means of hazard mitigation was similar to that of Article 22, but its administration was made more predictable through a scoring system. This system remains an option in current codes.

The HUD guidelines were notable mainly for clearly identifying and examining the problems that modern codes presented when applied to existing buildings. Solving

these problems required more than changes to existing codes, partially because subtle changes to established procedures might not be fully understood or applied. Code enforcement did not change significantly until entirely new codes were offered for existing buildings. It may be that these codes benefit from the mere fact that they are separate documents, and it is therefore clear that they are intended to represent an approach separate from that taken for new buildings. Nonetheless, the HUD guidelines form the basis for, and inform the philosophy of, all of the more recent rehabilitation codes.

Each model code organization responded to the HUD guidelines with a code for existing buildings. In 1984 BOCA issued the Existing Structures Code. In 1985 ICBO issued the Uniform Code for Building Conservation. In 1988 SBCCI issued the Standard Existing Building Code. However, none of these codes were widely adopted or utilized. BOCA's Existing Structures Code eventually became merely a building maintenance code, an indication of its lack of influence on rehabilitation.

▪*CHAPTER 34 OF THE BOCA BUILDING CODE*

In 1984, the BOCA Code adopted an alternative approach to evaluating existing buildings. Eventually, this approach was copied by the other model codes. These "Chapter 34" provisions consisted of a safety scoring system. Buildings were to be evaluated according to their individual attributes. Attributes that enhanced safety were granted points, and points were deducted for hazards. An aggregate score above zero

would allow a project to go forward. This approach was significant because some existing features of older buildings could earn scores sufficient to negate shortcomings in other areas. For example, framing might be so overbuilt as to cancel out the fact that ceilings and walls provided insufficient fire protection to the structural members. Chapter 34 also allowed new systems which exceeded requirements to negate the shortcomings of the existing structure. For example, fire suppression systems which exceeded code requirements could cancel out the negative score of insufficiently fire-resistant construction. Until the New Jersey Rehabilitation Subcode, this was the most significant alternative available for existing buildings.

Chapter 34 is laudable for the fact that it attempted to evaluate the safety of buildings on a systematic basis, taking into account the building as a whole rather than considering the attributes of individual building elements separately from each other. It allowed building owners and developers to look for alternative means of compliance that would be less expensive or have less impact on the building than would the BOCA code's prescriptive requirements for new buildings. Since Chapter 34 used a systematic scoring method, its intention was to simplify the evaluation of existing buildings and make the results of such evaluations more predictable. Despite this, Chapter 34 was perceived to be unpredictable and complicated and to rely too heavily on the discretion of code officials.

Considering that Chapter 34 was essentially identical in the three major model codes, and widely available as an option nationwide, it appears to have been little-utilized. The common complaint that the application of Chapter 34 relied too much on the discretion of officials may indicate that it was not adequately understood by potential users. The fact that it was little-used undoubtedly means that it was also little-understood by most officials.

Nonetheless, Chapter 34 was enlightened in its consideration of the building as a whole, and in its attempt to evaluate the way the building might actually function in a fire or emergency. Skilled application of Chapter 34 requirements could reduce costs or the amount of work triggered by code requirements. Chapter 34 is still available as an option in the current ICC codes, and may still offer a valuable alternative in situations where modern rehabilitation codes fail to meet their goals.

Each of these previous approaches to code reform correctly identified the problems that codes had presented for the renovation and reuse of older buildings. Just as importantly, they recognized why it is important to facilitate rather than discourage renovation and reuse. Each approach introduced important innovations, but none of these approaches ultimately had a significant impact.

CHAPTER 3: MAJOR SMART CODES

The most recent approach to code reform has been a trend toward prescriptive codes which are designed specifically for older buildings and which are to be used in place of codes for new construction. These have come to be called "smart codes." There are three important examples of smart codes. The New Jersey Rehabilitation Subcode was the first mature smart code to be enacted, in 1998. HUD's NARRP model code was developed concurrently with the New Jersey Rehabilitation Subcode, using the New Jersey Rehabilitation Subcode as a model, and was released in 1997. These two codes are nearly identical. NARRP is a model code offered as an example which may be adopted by states or municipalities. The International Code Council offers the International Existing Building Code as a model smart code. This code is very similar to NARRP and the New Jersey Rehabilitation Subcode, but there are some substantial differences.

There are two other important code components which fall short of being major, self-contained smart codes like the three above. Chapter 34 of the BOCA Code has long offered an alternative to prescriptive code compliance for existing buildings, and has been incorporated into the IBC and IEBC. This is a scoring system for evaluating the suitability of alternative means of code compliance, and not a code in and of itself. The National Fire Protection Association has published its own model code, the NFPA 5000, which incorporates provisions similar to the three major smart codes in its Chapter 15.

Chapter 15 is not a self-contained code, but modifies the prescriptive requirements of the NFPA 5000 code.

▪*THE NEW JERSEY REHABILITATION SUBCODE*

The problematic situation of applying building codes to older buildings in New Jersey was similar to that other states, but more severe, due to two conditions. First, New Jersey has a particularly high percentage of older buildings. According to the New Jersey Department of Community Affairs, 50% of New Jersey's houses were built before 1959, while nationwide 29% of homes were built before 1950. New Jersey also had particularly strict scoping requirements in its code regarding additions, which discouraged the renovation of these buildings. Additions over 5% of the area of the existing building necessitated bringing the entire building up to current code.[5] As a result, the building stock of New Jersey's cities was suffering from obsolescence and decay.

New Jersey responded to this by enacting a building subcode targeted at older buildings. The goal was to provide a complete, self-contained code which would address the needs of existing buildings. The New Jersey Rehabilitation Subcode does refer to the code provisions for new buildings for some of its requirements, but the Subcode contains most of the requirements for existing buildings. The Subcode was an attempt to address

5 Syal, Matt; Shay, Chris; Supanich-Goldner, Faron "Streamlining Building Rehabilitation Codes to Encourage Revitalization," Housing Facts & Findings Vol. 3, No. 2; Fannie Mae Foundation, 2001: 4

code requirements for older buildings in a rational way. It attempted to make requirements proportional to the work proposed and also to recognize the fact that older buildings had served safely for many years. The authors of the Subcode recognized that some improvement in safety was better than none, and that if renovation was discouraged because of issues of code compliance, no improvement would occur.

▫*INTENT AND PHILOSOPHY*

The New Jersey Rehabilitation Subcode was not the first attempt at code reform, but it has had more success and attracted more attention than previous attempts. This is partly because of its technical requirements. It is probably also due to the fact that the Subcode is philosophically different from other codes, and makes that difference clear. The developers of the Subcode must have been aware that the intent of BOCA's chapter 34, in particular, had not been grasped by officials and potential users.[6] According to William Connelly, one of the developers of the Subcode:

> "The Rehabilitation Subcode is not only a change in building code requirements, it is a change in building code philosophy. The past philosophy had been that if a building owner has to spend money on his building, he should be required to spend a good portion of that money to make that building approach the current code for new structures. There are two flaws with this way of thinking. The first is assuming that the goal is to have existing buildings meet the current code for new building construction. Using new building standards for renovated buildings can result in expensive improvements that have little real benefit in terms of occupant safety. The second is that this philosophy ignores the positive effect of money invested to improve an existing building even when not specifically earmarked for code compliance. The past philosophy said to building owners, if you can't make the leap up to the standards we have set, don't take the step to make your building better. The Rehabilitation Subcode addresses this problem by, to the

6 See page 42 "Philosophy"

> greatest extent possible, letting the applicant choose the scope of the project, and by establishing specific requirements that made sense in existing buildings."[7]

There had long been acknowledgement and discussion of the fact that building codes were problematic for rehabilitation, and there had been attempts to solve this problem. None of these attempts were successful, and the developers of the New Jersey Rehabilitation Subcode sought to learn from the failure of previous attempts. The developers of the Subcode included David Listokin, William Connelly, and David Hattis. The developers of the Subcode investigated numerous approaches to code reform, and identified three approaches as having particular potential: BOCA's Chapter 34, the Massachusetts Building Code's Article 22, and the Uniform Code for Building Conservation (UCBC). They sought to combine the best aspects of all three approaches.[8]

The influence of BOCA's Chapter 34 and of Massachusetts' Article 22 on the New Jersey Rehabilitation Subcode is clear. The influence of the UCBC is seen in the way that hazard categories are used. Article 22 used a single hazard scale, in which each use was rated and requirements in all areas of code compliance were triggered by the application of that scale. The UCBC also contained hazard scales, but there were multiple scales, each of which related to a particular code concern. Since different uses

7 Mattera, Philip "Breaking the Codes: How State and Local Governments are Reforming Codes to Encourage Rehabilitation of Existing Structures," January 2006: 14

8 NAHB Research Center and Building Technology, Inc. "The Status of Building Regulations for Housing Rehabilitation– A National Symposium: Summary Report," U.S. Department of Housing and Urban Development, August 1995: 20

have different hazards, this is a more rational way to apply requirements. For example, a use with more potential sources of ignition might receive a high hazard rating for fire and egress, but a lower rating for structural requirements. This approach allows code requirements to be tailored more closely to the actual hazards presented by various uses.

The New Jersey Rehabilitation Subcode's authors also sought to make requirements for alteration clearer than under BOCA's Chapter 34. They felt that Chapter 34 addressed changes of use effectively, but that Chapter 34 was confusing and ineffective for alteration projects.[9]

▫*AUTHORS AND DEVELOPMENT*

The New Jersey Rehabilitation Subcode was developed by the New Jersey Department of Community Affairs, in cooperation with the Federal Department of Housing and Urban Development and the Center for Urban Policy Research at Rutgers University. Guidance was provided by an advisory group composed of code and fire officials, architects, historic preservationists, government officials, and other stakeholders.

The involvement of HUD was notable because it led to HUD's release of a model code based on the New Jersey Rehabilitation Subcode. This is HUD's Nationally Applicable Recommended Renovation Provisions, or NARRP. NARRP and the Subcode are very

9 NAHB Research Center and Building Technology, Inc. "The Status of Building Regulations for Housing Rehabilitation– A National Symposium: Summary Report," U.S. Department of Housing and Urban Development, August 1995: 20

similar, and NARRP has no doubt been instrumental in allowing the innovations of the Subcode to spread to other states and municipalities.

▫*INNOVATIONS*

The New Jersey Rehabilitation Subcode was influential in its adoption of six categories of work. Traditionally, codes divide work on existing buildings into four categories of repair, alteration, change of occupancy, and addition. The Subcode further divided "alteration" into the categories of renovation, alteration, and reconstruction.

These categories are the possibly the most important innovation made as part of the Subcode, and also the most potentially confusing aspect of its application. For the code to function well, it must be clear what category or categories will apply to a project. Regarding categorization, there is some exercise of discretion on the part of code officials, but generally, the categories are clear.

The New Jersey Rehabilitation Subcode differs from traditional codes in other ways. One is scoping. In most cases, no work is required by the code outside the work area that the building owner designates. The Subcode also attempts to eliminate requirements which do not rationally contribute to safety goals. Arbitrary requirements, such as door width, are dropped or softened. The Subcode also recognizes the inherent safety of older building materials and drops requirements that they be replaced. It makes few requirements for replacement and alteration outside of the scope of the work proposed. Finally, it utilizes new, graduated categories of work with correspondingly

graduated requirements. An important innovation is that a single project can be split into areas which may fall into different categories, further tailoring code requirements to the degree of work proposed.

▫*SIGNIFICANCE AND REACTION*

The New Jersey Rehabilitation Subcode was adopted in 1998 as a statewide mandatory code, meaning that it is to be used for all existing buildings in the state. It is not merely available as an option, and its availability does not depend on adoption by individual municipalities. This is not always the case when a state adopts a building code, and has caused particular interest in New Jersey as an example by which to measure the effects of such a code.

The New Jersey Rehabilitation Subcode has been widely recognized as an important innovation, and great claims have been made for its effectiveness. It has won numerous awards, and has been much imitated by other codes. It has been credited with causing a huge jump in the number of rehabilitation projects undertaken in New Jersey. According to the New Jersey Department of Community Affairs, spending on rehabilitation projects increased 60% in the year after the adoption of the Subcode. It increased an additional 20% the following year, for an aggregate increase of 90% over two years.[10] This data is derived from building permit applications.

10 Connelly, William "Rules That Make Sense—New Jersey's Rehabilitation Subcode," New Jersey Department of Community Affairs, <http://www.state.nj.us/dca/codes/rehab/pioneerart.shtml>

Any examination of smart codes must start with New Jersey's Rehabilitation Subcode because of its status as the first mature and complete smart code, and should try to assess the effectiveness of the Subcode. There is reason for skepticism about the claims made for its effectiveness, given the fact that the jump in rehabilitation work happened so suddenly after the adoption of the Subcode. It is unusual for any set of regulations to be understood and embraced quickly enough to have had this sort of effect. The effects of the Subcode will be examined in depth in other sections. There is no question that there was a huge increase in rehabilitation work on older buildings following the enactment of the Subcode, but it is important to attempt to tease out how much of this increase is due to the Subcode itself and how much is due to other factors.

▫*APPLICATION OF THE NEW JERSEY REHABILITATION SUBCODE*

The New Jersey Rehabilitation Subcode employs code requirements similar to those for new construction, but applies them selectively; more requirements apply to projects involving more alteration and reconfiguration of the building. The goal of the Subcode is to reduce the amount of work required for code compliance that would not otherwise be part of the project. This supports the Subcode's philosophy that some renovation is better than none, and that renovations should not be discouraged by extensive code requirements. The Subcode attempts to increase the safety of buildings, but largely allows buildings to remain unchanged, as long as alterations or a change of use do not demonstratively result in a lesser degree of occupant safety.

Another important innovation of the New Jersey Rehabilitation Subcode is the establishment of the "building as it exists" as the baseline to measure safety, rather than measuring the safety of all buildings against standards for new construction. The Subcode also attempts to eliminate requirements which do not rationally contribute to increased safety and allows materials and methods which duplicate existing construction, even when these materials and methods are prohibited by the new building code.

As stated above, one of the most important innovations of the New Jersey Rehabilitation Subcode was its definition of six categories of work. Previous codes divided work into four categories: repair, alteration, change of occupancy, and addition. Repairs were generally replacement-in-kind of minor building components. Change of occupancy requirements were triggered when the use of a building was changed. This holds true for the Subcode. Under traditional codes work more extensive than a renovation but less extensive than a change of use is considered an alteration. The code requirements for alterations under traditional codes are extensive. The Subcode adds the categories of Renovation and Reconstruction. Under the Subcode, Renovations involve more extensive replacement than repairs, but no reconfiguration of spaces. Alterations are projects which involve reconfiguration of spaces. Reconstruction is differentiated from Alteration by the fact that it encompasses an entire tenancy or prevents the building from being occupied during work. The categories and their general requirements are as follows:

Repair:

Under the New Jersey Rehabilitation Subcode, the lowest category of work is Repair. Repair work consists of bringing existing elements back to good condition or full functionality. The Subcode allows repairs to be carried out with materials identical to the existing ones, even if these materials are not allowed in new construction. Repair work is also exempt from requirements regarding methods of construction or configuration of building elements. Pre-existing work may be duplicated. The Subcode does specifically prohibit certain materials which are considered inherently dangerous, such as lead paint, asbestos, and certain wiring devices.

Renovation:

The New Jersey Rehabilitation Subcode defines Renovation as the replacement of building elements, without altering the configuration of space. The difference between Repair and Renovation is largely one of extent, with Renovation including more new elements or systems than Repair. Renovations must conform to the materials and methods requirements of the new building code for those elements which are replaced, but no additional work is triggered by Renovation work.

Alteration:

Alteration is defined by the New Jersey Rehabilitation Subcode as work which involves the reconfiguration of space. The requirements for an Alteration are slightly more complex than those for the lower categories of work. The Subcode states that in addition to complying with the materials and methods requirements of the lower

categories, an Alteration must not make the configuration of spaces less conforming than they were previously. The important distinction here is that egress requirements and other regulations regarding building configuration need not be met. They are only used as a basis to evaluate whether the changed configuration is less compliant than the previous configuration.

Reconstruction:

The New Jersey Rehabilitation Subcode defines Reconstruction as work whose extent makes it impossible to occupy the project area during the project and which results in the necessity of obtaining a new Certificate of Occupancy. The Subcode also states that a Reconstruction project "must always involve an entire use, primary function space, or tenancy."[11]

The requirements of Reconstruction versus Alteration are not easy to characterize. As in Alteration projects, all new elements must comply with the new building code. The additional requirements of the Reconstruction category are contained in "basic and supplemental requirements," which are broken down by building use. In general, these requirements regard fire prevention and suppression and egress. These requirements are detailed and prescriptive. The particular requirements vary significantly according to

11 "Primary function space" means a room or space housing a major activity for which the building or tenancy is intended including, but not limited to, office area, auditorium, assembly space, dining room, bar or lounge, warehouse, factory, dwelling, care, confinement, retail, and educational spaces, but not including kitchens, bathrooms, storage rooms or other spaces supporting a primary function space; a building or tenancy may contain more than one primary function space.

the building's use, reflecting an attempt to tailor requirements to the particular hazards presented by each use.

Change of use:
The New Jersey Rehabilitation Subcode's change of use requirements are based on a hazard rating system that seems to have been borrowed from the Massachusetts Building Code's Article 22. Under the Subcode, changes of use in which the new use is of an identical or lower hazard rating are subject to few code requirements, and triggered work will be minimal. Changes to a use with a higher hazard rating are subject to numerous requirements of the codes for new construction, including those related to egress and fire prevention and suppression. There are separate hazard rating tables for various code requirements.

Addition:
The New Jersey Rehabilitation Subcode applies requirements for new construction to additions, but no work is triggered in the existing portion of the building.

Historic Buildings:
The New Jersey Rehabilitation Subcode does not have extensive provisions specific to designated historic buildings. The only special consideration given to historic buildings generally is the possibility of obtaining variances from code requirements to allow the retention of character-defining features. Historic buildings are defined as buildings which are listed on or eligible for the National Register of Historic Places or which

contribute to a local historical district which substantially meets National Register criteria. The Subcode allows a number of additional exemptions from code requirements for historic buildings which are undergoing renovation according to the Secretary of the Interior Standards for the Treatment of Historic Properties.

In these cases, many requirements are waived. Of particular importance, the New Jersey Rehabilitation Subcode allows replica materials and methods of construction for all categories of work. It also accepts plaster and lath construction where 1-hour fire ratings are called for and exempts exterior walls from fire-resistance requirements. Door dimensions and hallway dimensions are exempted from code requirements so long as, in the opinion of the code official, there is "sufficient width and height for a person to pass through the opening or traverse the exit."[12] Requirements for ceiling height, stair dimensions and enclosure, and railing heights are also relaxed. The Subcode also allows historic finishes to remain in place regardless of whether they meet requirements for fire resistance. Transoms are also allowed to remain without modification. Historic hardware may remain in place where it meets the goals of New Jersey's Barrier-free Subcode, which seeks to ensure that hardware is operable for those with disabilities. Alternatively, existing historic hardware may be retained if it can be fixed in place or modified to mitigate any potential problems its operation would present.

12 New Jersey Rehabilitation Subcode 5:23-6:33 (b)5

General:

The New Jersey Rehabilitation Subcode is innovative in limiting the code requirements to the work area and allowing a project to be broken into multiple work areas. This allows different code requirements to be applied to various components of a single project, with the intention of minimizing the amount of work which will be triggered by the code. NARRP shares this characteristic.

The New Jersey Rehabilitation Subcode also attempts to eliminate code requirements which do not contribute significantly to safety. A frequently-cited example of this is the fact that conventional codes require 30-inch doors to be replaced with 32-inch doors. David Listokin, who has written extensively on building codes, cites an example where a hallway that was ¾ inch too narrow had to be widened and windows which were 5/8 inch too narrow had to be replaced.[13] Requirements like this have little or no effect on occupant safety, but may add significantly to the cost of a project, and may necessitate extensive replacement of related building components. In addition, such changes may compromise the character or configuration of historic buildings. The exemption from such requirements is a result of the Subcode's provision that alteration work may not make the configuration of spaces less conforming, but need not make them conform to requirements for new buildings.

13 Listokin, David, and Barbara Listokin. "Barriers to the Rehabilitation of Affordable Housing, Vol. 1." Office of Policy Development and Research, U.S. Department of Housing and Urban Development , Washington, D.C. 2001

The New Jersey Rehabilitation Subcode was probably the first code to specifically allow materials which are no longer permitted by codes for new construction. This is of significance for two reasons. First, it supports preservation practices. Retention of existing fabric is always a goal for preservation, and it is usually preferable to execute repairs with materials that are as close as possible to the original. Second, it may further facilitate retention of existing features by making repairs possible where replacement would be necessary if such materials were prohibited. In some cases, assemblies cannot be repaired but must be replaced if materials which duplicate the original cannot be used. By making repair rather than replacement an option in this situation, this provision enables the realization of both preservation goals and cost savings.

Under the New Jersey Rehabilitation Subcode, methods or configuration of work are governed similarly to materials. For Repair projects, methods which do not comply with code requirements for new buildings are permitted. This has similar effects to the materials provisions explained above. Allowing methods which are no longer permitted by new building standards enables existing work to be repaired rather than replaced. This reduces costs and aids preservation goals. Waiving the methods requirements of the new construction building code also allows repairs to retain the function and appearance of existing building elements.

The New Jersey Rehabilitation Subcode has two ways of addressing requirements. For lower categories of work, requirements are explained within the Subcode and are relatively simple; for example, that replacement of components may not result in a reduction of strength. In other cases, new work must conform to standards for new construction, but the amount of new work to be done is determined only by the project's needs and not by the code. For higher categories of work, and for changes of occupancy in particular, the Subcode generally refers to codes for new construction and requires buildings to conform to certain aspects of the new construction requirements.

The New Jersey Rehabilitation Subcode contains Basic and Supplemental Requirements for each category of work. These requirements are broken down by use category. In this way, the Subcode addresses the unique hazards and requirements of various uses. This also minimizes the degree to which the Subcode refers to the code for new buildings to explain requirements.

▪*HUD'S NARRP MODEL CODE*

HUD's NARRP model code was developed concurrently with the New Jersey Rehabilitation Subcode, using the Subcode as a model. NARRP is a model code offered as an example which may be adopted by states or municipalities. Although these two codes are identical in many respects, there are two significant differences. The first difference is that the NARRP code does not contain an equivalent to the Basic and Supplemental Requirements which are part of the Subcode. In place of these specific

requirements, the NARRP refers to other codes and industry standards which must be complied with, and states to what degree and in what situations they must be complied with. The second difference regards categories of work. The NARRP code duplicates the categories of the Subcode, but there are subtle differences in how those categories are defined. Differences are as follows:

Repair:
Repair is defined and treated as in the New Jersey Rehabilitation Subcode.

Renovation
NARRP specifically states that extensive repairs will constitute a Renovation and that, ultimately, the distinction is to be made according to the discretion of the building code official. In contrast, the New Jersey Rehabilitation Subcode does not treat the distinction between Repair and Renovation as an area where any discretion must be exercised. It distinguishes between repairs to existing components and systems and renovations, which replace existing components and systems but which do not alter function or configuration of space.

The requirements are similar to renovation the renovation requirements under the New Jersey subcode, but are slightly more restrictive. There are additional seismic requirements, and new elements must conform to the requirements for accessibility of the code for new construction. For some residential uses, egress requirements of the code for new construction must be met.

Alteration

NARRP's definition of Alteration is similar to New Jersey's, but there is an important difference. Under the New Jersey Rehabilitation Subcode, there is no limit to the amount of alteration which can take place. In contrast, NARRP considers alterations which affect more than 50% of the area of a building to constitute Reconstruction. (This percentage trigger does not apply to mechanical and electrical systems.)

NARRP also has slightly more extensive requirements for Alterations. Notably, reconfigured spaces must meet current code requirements for egress. Structural requirements differ in that any unsound elements must be made to conform to the code for new buildings.

Reconstruction

NARRP's definition of Reconstruction varies from New Jersey's. NARRP considers Reconstruction to be alteration which involves reconfiguration of shared spaces or exits. Reconstruction requirements may also be triggered by work in which the work area is not permitted to be occupied during work because egress or fire protection systems are not maintained. Alterations whose total area is over 50% of the area of the building also constitute Reconstruction. Under NARRP, Reconstruction of over 50% of a floor may trigger requirements affecting the entire floor.

NARRP's requirements for Reconstruction are similar in intent to the New Jersey Rehabilitation Subcode's, but the provisions are more generalized. The requirements

for Reconstruction are primarily concerned with egress, smoke and fire containment, and fire detection and suppression. These requirements do vary by building use, but to a lesser degree than in the New Jersey Rehabilitation Subcode.

Change of use:
NARRP's change of use provisions are similar in effect to those in the New Jersey Rehabilitation Subcode, but the code itself is structured differently. There are fewer hazard rating tables, and requirements refer to the code requirements for new buildings to a greater degree. The requirements for changes of use also differ from New Jersey's where they refer to requirements for lesser categories of work such as Renovation and Alteration, whose requirements differ from those of the New Jersey Rehabilitation Subcode.

Addition:
NARPP requires that additions comply with the code requirements for new buildings. Any differences compared to the New Jersey Rehabilitation Subcode will be the result of differences between New Jersey's code for new construction and the new building code in place in a community which has adopted NARRP.

Historic Buildings:
NARRP's provisions for designated historic buildings differ significantly from the provisions of the New Jersey Rehabilitation Subcode. Where the Subcode makes additional exceptions to code requirements for buildings which are undergoing

restorations that meet the Secretary of the Interior Standards, NARRP treats all historic buildings identically. NARRP's provisions for historic buildings are applicable to any work on National Register eligible buildings. In general, NARRP is more specific than the Subcode regarding historic buildings. Except for the New Jersey Rehabilitation Subcode's special provisions for restorations meeting the SOI standards, NARPP is slightly more permissive regarding materials. It allows replica materials for repair and replacement, including replacement of missing elements. Other notable differences regard sprinklers. NARRP states that historic buildings which do not conform to the requirements of the other sections of NARRP and which constitute a fire safety hazard in the opinion of the code official must have a sprinkler system. However, sprinkler systems may not be used as a substitute for compliance with egress requirements for historic buildings.

In general, NARRP relaxes fire and egress requirements somewhat for historic buildings. Stairway enclosures, for example, are required to limit the spread of smoke, but need not be fire rated, and egress requirements regarding door, corridor, and stair dimensions are waived. Most of these eased requirements also apply to historic buildings undergoing a change of use.

General:
NARRP shares with the New Jersey Rehabilitation Subcode the important characteristic of allowing projects to be broken into portions which may be governed by differing categories of work.

▪*THE INTERNATIONAL EXISTING BUILDING CODE*
The International Code Council offers the International Existing Building Code as a model smart code. This code is very similar to NARRP and has some similarity to the New Jersey Rehabilitation Subcode, but there are some substantial differences. The IEBC contains six categories of work, which are similar to those of the New Jersey Rehabilitation Subcode and NARRP, but terms the additional categories to be levels of alteration. IEBC's categories of Alteration 1 and Alteration 2 correspond closely to Renovation and Alteration under New Jersey and NARRP. Differences regarding categories are as follows:

Repair:
The definition of Repair under the IEBC is the same as under the New Jersey Rehabilitation Subcode and NARRP. The code requirements are substantially similar, but the structural requirements are more extensive. There are seismic and wind design requirements for structural repairs, which could impose significant costs on projects. Repairs to "less than substantial" structural damage may use materials and strengths which duplicate the existing work, but methods must comply with the new building

code. Like the New Jersey Rehabilitation Subcode, the IEBC does not limit the amount of Repair work that may be undertaken.

Alteration 1:
IEBC's category of "Alteration 1" is identical to the category of Renovation under the New Jersey Rehabilitation Subcode and NARRP.

Alteration 2:
The IEBC's definition of "Alteration 2" is similar to the Alteration category of the New Jersey Rehabilitation Subcode and NARRP. The only substantial difference is that the extension or reconfiguration of any system or the installation of any additional equipment will constitute an "Alteration 2" project. The IEBC differs from the New Jersey Rehabilitation Subcode and NARRP by having more detailed requirements for accessibility, structure, and egress in this category. The egress and sprinkler requirements could represent a substantial impact on project costs.

Alteration 3:
The IEBC's category of "Level 3 Alterations" is equivalent to the category of Reconstruction in the New Jersey Rehabilitation Subcode and NARRP. The definition of Level 3 Alterations is simple, if vague. Level 3 Alterations are defined as applying "where the work area exceeds 50 percent of the aggregate area of the building." Presumably, this means where *alteration* work exceeds 50 percent of the aggregate building area. Requirements are very similar to those of NARRP. The impact of the

IEBC in this category is likely to be similar to the New Jersey Rehabilitation Subcode but, unlike the Subcode and NARRP, the IEBC refers to the code for new construction for its requirements rather than defining basic and supplemental requirements like the New Jersey Rehabilitation Subcode. This means that regional variations in the code for new construction will be reflected in the application of the IEBC, though most municipalities that adopt the IEBC can be expected to adopt the IBC as well.

Change of use:
The IEBC treats changes of use similarly to the New Jersey Rehabilitation Subcode and NARRP, with somewhat less reliance on hazard rating tables. In general, when the new use is of an equal or lower hazard rating, only new or altered elements must comply with the code requirements for new construction. Notably, the IEBC does not rely on hazard ratings to determine sprinkler requirements. Sprinkler requirements are identical to new construction requirements for the new use.

Addition:
The IEBC subjects additions to code requirements for new buildings, as do the New Jersey Rehabilitation Subcode and NARRP.

Historic Buildings:
The IEBC's provisions for designated historic buildings are nearly identical to NARRP's. There are additional requirements for fire-rated glazing in some areas, and requirements relating to accessibility. The most notable difference is that the IEBC has

a brief section on structural requirements. This section provides that when work is undertaken, structural requirements will be met according to the category of work, as they would be in the case of a non-historic building. The only special exception is that in the case of historic buildings, if a structure is deemed to be unsafe, only that specific component which is unsafe is required to be replaced, repaired, or strengthened.

General:

The New Jersey Rehabilitation Subcode and NARRP allow projects to be broken into work areas that constitute different categories of work. This minimizes the amount of work that is triggered by code requirements. The IEBC does not explicitly allow this.

The IEBC is generally more restrictive than the other two codes, and contains a number of unique requirements. It is vital to consider the effects of the IEBC's unique requirements, because the IEBC is likely to become the most widely adopted smart code. Most states and municipalities adopt the International codes, of which the IEBC is one. The IEBC has been adopted, or is offered as an option, by far more states than has been the NARRP.

The IEBC is more restrictive in a number of ways. The other smart codes allow structural repairs which duplicate the existing structure, even if they do not meet modern code requirements. The IEBC generally requires that structural repairs meet requirements for new buildings. Like NARRP, the IEBC also considers the scope of

the project; Level 3 Alterations are defined as those which affect over 50% of the area of the building.

▪*THE NATIONAL FIRE PROTECTION ASSOCIATION'S NFPA 5000*

The final code which should be considered is the NFPA 5000. This code is important for several reasons, but mostly for what it says about the political aspects of building codes. The purpose of the ICC codes was to unify the patchwork of existing codes into one consistent, nationwide code. A single widely-applied code would be more clearly understood, more likely to be applied fairly and consistently, and more likely to be updated in a regular and rational manner.

During the creation of the IEBC, there was conflict between various organizations involved in its creation. One of these, the National Fire Protection Association, refused to participate in further consultation. The NFPA was joined by a number of other industry organizations unhappy with the ICC. This coalition created its own competing code, the NFPA 5000. The creation and use of the NFPA 5000 was widely opposed by other industry organizations, including the National Association of Home Builders and the American Institute of Architects.

NFPA's Chapter 15 is substantially similar to the three major rehabilitation codes. Like the others, it divides the traditional category of Alteration into three graduated categories of work; in this case, Renovation, Modification, and Reconstruction. Chapter 15 has received far less attention and scrutiny than the three rehabilitation

codes. In fact, there is no meaningful literature on Chapter 15 of NFPA 5000. Listokin and Hattis alone include it in their analysis of rehabilitation codes, and they do not address it in any detail. They only make a general characterization of what its impact in cost and complexity might be when compared to the three major rehabilitation codes. While NFPA 5000 as a whole is seen as being more restrictive and likely imposing higher costs than the IBC, Chapter 15 appears to be less restrictive than IEBC. Interestingly, Listokin and Hattis conclude that IEBC requirements are likely to be more expensive than NFPA requirements for Rehabilitation. In practice, IEBC will be very widely applied, and it is likely that NFPA's Chapter 15 will see little use. This will limit the amount of data available for real-world comparative studies.

▪*CHAPTER 34 OF THE BOCA BUILDING CODE (SAFETY SCORING)*

Chapter 34 of the BOCA Building Code borrowed many of the ideas which originated in Chapter 22 of the Massachusetts Building Code. It attempted to solve many of the problems which had been experienced with Article 22 by creating a safety scoring system. This system allowed alternative means of compliance to be evaluated in a systematic way, rather than relying on the judgment of code and fire officials.

Chapter 34 was applicable to existing structures undergoing repair, alteration or a change of use. Hospital and institutional uses could not employ Chapter 34, and were required to comply with the code for new buildings. Chapter 34 did not address materials or methods. It merely defined which code requirements could be met through

alternative means and provided a mechanism for evaluating alternative means of compliance. Evaluation was performed by use of Chapter 34's scoring system.

By incorporating a scoring system, which should provide predictable and repeatable results, Chapter 34 attempted to solve the problems which plagued Article 22 of the Massachusetts Building Code. Article 22 also encouraged alternative means of compliance, but the evaluation and approval of such means was based entirely on the discretion of code and fire officials. By comparison, Chapter 34 offers a great deal of certainty.

However, when examining the language of Chapter 34, it is easy to see why potential users might hesitate to rely on it. The language of Chapter 34 is confusing and makes numerous references to the approval of the code official. In the case of Chapter 34, the code official was obligated to approve projects based on the rules of the scoring system without the exercise of discretion, but the language may easily give the impression that the code official exercised discretion.

▫*PHILOSOPHY*

The stated goal of Chapter 34 was to ensure that buildings were not made less safe as the result of alterations, repairs, or a change of use. However, the scoring system seems to have as its goal a building whose safety is equivalent to new construction. The scoring system allowed hazardous characteristics of the building to be compensated for by new or existing characteristics which offer a higher than required level of safety.

This interpretation was contradicted by Ken Schoonover, Vice President of Codes for BOCA. At a 1995 symposium, he stated the philosophy of the BOCA approach as: "except for some specific improvements related to hazards, allow changes to buildings if they become at least as good or better than they were before." According to a HUD account of the symposium: "He further stated that using BOCA Chapter 34 compliance alternatives as equivalent to the intent of code for new construction was incorrect. He stated that they provided an 'acceptable level' different from new construction." [14]

The intent of Chapter 34, therefore, was to maintain the level of safety in existing buildings. Chapter 34 did have a specific provision that any work or change of use which made a building less safe would result in the requirement that the building meet the code requirements for new buildings.

▫*SCORING SYSTEM*

Chapter 34's scoring system scored buildings in three categories: fire safety, means of egress, and general safety. Points were assessed using a series of tables which compared a building's construction to the prescriptive code requirements for new buildings. In general, points were deducted for systems or components which fell short of new building requirements and points were credited for components or systems which exceeded requirements for new construction. The building's total score was then

14 NAHB Research Center and Building Technology, Inc. "The Status of Building Regulations for Housing Rehabilitation– A National Symposium: Summary Report," U.S. Department of Housing and Urban Development, August 1995: 21

adjusted according to the building's use. If the resulting score was zero or above, the building was to be accepted by the code official.

Points were given based on building height and area, the building's ability to resist the spread of fire and smoke, and the degree to which a building was divided into fire-resistant compartments. Means of egress and egress capacity were evaluated based on whether the building was under-performing or over-performing in comparison to new building requirements. Points were also assigned based on travel distance for egress, presence of dead ends, and egress lighting. Points were also given for fire detection and suppression systems, and the high number of points given for sprinklers meant that they were often the single surest means of assuring that a building would receive a passing score.

The scoring system gave differing numbers of points for different building systems, weighting the results to reflect the particular impacts of various safety features. It is notable that in many categories, the maximum negative scores are far higher than the maximum positive scores. For example, corridor construction may result in a maximum deduction of 30 points, but a maximum credit of only 5 points. This indicates that there was still a necessity under Chapter 34 to remedy many potentially hazardous construction features; it is not enough to compensate with other features such as sprinklers.

Chapter 34's scoring system is also weighted according to use. Identical construction may receive widely varying scores depending on a building's use. Different use categories stress different safety requirements. This represents an attempt to rationally tailor code requirements to the particular dangers presented by each use. Chapter 34 also required that a structural analysis be performed to assure that a building's existing structural capacity was suited to its proposed use.

▫*APPLICATION*

The success of Chapter 34 is extremely difficult to evaluate. The literature on the subject is almost non-existent. The HUD symposium cited above provides some useful insight from those with practical experience with Chapter 34:

> "Over 70 building Rehabilitations have been done in the past 10 years using the Chapter 34 evaluation system which can be used for buildings built before 1959. However, this condition has not reduced the number of appeals. Mr. Gecks[15] noted that Cincinnati has a management problem related to uniformity in applying Chapter 34 among its eight plan examiners.
>
> Mr. Brashear,[16] whose office does a lot of Rehabilitation work, presented the perspective of an architect who deals with code enforcement in Cincinnati. He stated that the compliance alternatives approach of Chapter 34 'is not a cure-all, a panacea,' but merely a useful tool. It is a tool, however, that he does not use often. If he can get the building approved under the traditional building code requirements (Sections 3401-3407 of the NBC), he prefers to do so because the compliance alternatives of Chapter 34 are 'stricter than the building code.' He does not use the compliance alternatives approach in alterations with no change of use, and uses it in a small percentage of projects (three or four projects in a year) involving a change of use. The latter are usually large buildings. The main reasons he uses the approach in such cases:
>
> . Building exceeds the height and area requirements.
>
> . Issues of horizontal separation.
>
> Mr. Brashear noted the following specific problems with the Chapter 34 compliance alternatives:
>
> . They are hard to use, although it may be getting simpler.

15 David A. Gecks, P.E., of the Cincinnati Department of Buildings and Inspections

16 Joseph Brashear, R.A., of Brashear - Bolton, Inc., architects in Cincinnati

. The cost of the trade-offs in smaller projects is problematic.

. The conversion of small houses to commercial use creates problems with exterior wall fire ratings.

. Unprotected vertical shafts penalize buildings disproportionately.

. The method for computing the score for building area provides little benefit for small buildings by not giving much credit for a 'tiny footprint.'

. 'Meaningless systems' are sometimes supported by the process, e.g., smoke detectors in assembly occupancies.

. There is no provision for additions without a fire wall if heights and areas are exceeded."[17]

As can be seen from this account, the experience of practitioners who found that Chapter 34 requirements were "stricter than the building code" contradicts the intention of Chapter 34 as stated by Ken Schoonover above. The problems cited relating to uniformity of application speak to the fact that Chapter 34 was not altogether successful in solving the problems of Article 22 of the Massachusetts Building Code. Though it was not the intent of Chapter 34 to grant code officials discretion, some discretion must be exercised in interpreting the language of any code.

The contention that Chapter 34 was relatively little-used is reinforced by the need for a study like "Turning on the Lights Upstairs," which will be explored in Chapter 5. According to HUD's account of the 1995 symposium, "Mr. Schoonover stated that BOCA does not receive many enquiries on interpretation of Chapter 34 and has no information on its use."[18]

17 NAHB Research Center and Building Technology, Inc. "The Status of Building Regulations for Housing Rehabilitation– A National Symposium: Summary Report," U.S. Department of Housing and Urban Development, August 1995: 12-13

18 Ibid: 11

▫*LEGACY*

Chapter 34 of the BOCA code lives on in the current International Building Code. The provisions of Chapter 34 of the IBC are substantially the same as BOCA's Chapter 34, but there are some differences. These differences reflect the influence of the New Jersey Rehabilitation Subcode. There are differences in structural requirements, and in rules concerning fire escapes and permissible materials. As in the New Jersey Rehabilitation Subcode, structural loads may not be increased by more than five percent, unless the structure complies with capacity requirements for new buildings when the increased loads are taken into account. IBC's Chapter 34 also requires that structural elements found to be unsound or otherwise deficient be made to conform to code requirements for new buildings. Where BOCA permitted only existing fire escapes as a means of egress, the IBC permits new fire escapes to satisfy egress requirements where other solutions are not feasible. Finally, IBC's Chapter 34 allows nonstructural alterations and repairs to be made with materials which duplicate the existing construction, so long as they do not adversely affect the fire rating of structural members or of the building as a whole.

As can be seen from the comparison above, current prescriptive smart codes are extremely similar to each other and can be expected to have similar results. The safety-scoring approach of the IBC's Chapter 34 is very similar to Chapter 34 of the BOCA code, and can be expected to have similar results. The similarities between smart codes

represents the confidence that many have that they will finally constitute an effective solution the problem of building codes for older buildings. The existence of safety-scoring as an alterative approach offers a valuable opportunity for comparison, and such comparison should show the strength and weaknesses of each, and hopefully allow both approaches to be refined.

CHAPTER 4: LITERATURE REVIEW

▪*STATE OF THE LITERATURE*

Any examination such as this thesis should include a survey of the existing literature on the subject. Unfortunately, the literature is sparse and many authors on the subject do not sufficiently support the assertions they make regarding the success of smart codes. The literature is not as timely as might be hoped—there was a flurry of activity after the enactment of the New Jersey Rehabilitation Subcode in 1998, but there has been less discussion of smart codes and their results in recent years.

Much of the literature that exists examines the need for smart codes and the roots of the smart codes that now exist. Though many claims are made about the success of smart codes, there is only one careful study regarding their success. Much of the literature is devoted to explaining what smart codes are and to advocating for their adoption and use. There is surprisingly little critical examination of whether the codes accomplish what their advocates hope for when actually applied to real buildings.

This situation is not unique to smart codes. Carlos Martin[19] offers a pessimistic analysis of the state of the literature regarding building codes in general. His pessimism is justified, and the situation is particularly bad when it comes to rehabilitation codes. Martin acknowledges the contribution of scholars like David Hattis and David Listokin

19 Martin, Carlos "Response to 'Building Codes and Housing' by David Listokin and David B. Hattis," Cityscape: A Journal of Policy Development and Research • Volume 8, Number 1 • 2005

(whose work will be examined later) in taking consideration of building codes "beyond anecdotes," but notes that discussion and understanding of building codes is still more likely to revolve around anecdotes than to be based on widespread or quantitative evidence. He notes that much research, despite the appearance of analysis, is little better than anecdote. This is because much research is survey-based, pointing to the fact that identical codes may be enforced differently and that differences in enforcement are as important to examine as the codes themselves. Unfortunately, differences in enforcement are far more difficult to measure and accurately characterize. Martin posits that the inadequacy of the literature is due to a general unwillingness to take on the "leviathan of building codes." He points out that a real examination of the problems of building codes would require an examination of the history and practices of the building industry in general, a task for which he feels there is little enthusiasm.

According to Martin:

> "Economists and policymakers refrain from this because of its too 'technical' nature and the perceived diminishing returns from this exhaustive work. Homebuilders and developers naturally refrain because they have spent a century perfecting a production system based on these seemingly unfair and antiquated regulations. As such, we are left with anecdotes not only about building codes, but also about the homebuilding industry in general."[20]

Martin's bleak assessment of the literature is justified, but the existing literature does address some issues relatively comprehensively. In particular, the need for smart codes and the history of smart codes have been well-covered. The anticipated benefits of smart codes have been discussed at length, but there is little real assessment of the

[20] Ibid: 257

actual results. Finally, there has been some consideration of the future of smart codes, but without a real assessment of the results of current smart codes, it is hard to speculate on their future.

▪*NEED FOR SMART CODES*

There is wide agreement that traditional building codes have presented obstacles to renovation. The 25-50 and change of occupancy rules are frequently cited as having had a significant chilling effect on renovation of older buildings. These rules increased the cost and complexity of renovation, resulted in unnecessary losses of original fabric and architectural character, and in many cases made renovation too expensive to pursue.

Syal et al[21] note that the 25-50 rule granted a great deal of discretion to local code enforcement officials. This tended to increase uncertainty and make it difficult to estimate project costs. According to Syal, this forced estimators to include safety factors which resulted in cost estimates so high as to discourage some rehabilitation projects. Syal notes that this problem was even more severe in New Jersey, where if rehabilitation work covered more than 5% of the floor area of a building, the entire building had to be brought up to current code. Syal concludes that the effect of these rules was to encourage new construction rather than renovation.

21 Syal, Matt; Shay, Chris; Supanich-Goldner, Faron "Streamlining Building Rehabilitation Codes to Encourage Revitalization," Housing Facts & Findings Vol. 3, No. 2; Fannie Mae Foundation, 2001

Burby et al[22] also note the degree of latitude that local officials have in determining how closely renovation work must conform to current codes. They cite examples of code requirements which add to the cost and complication of a project without appreciably increasing safety, such as replacing 28-inch-wide doors with 32-inch-wide doors. They also cite the 25-50 rule as an impediment to renovation, and note that it persisted in many local codes even after it was dropped from the model codes. They note that the exercise of discretion by local officials may substantially increase soft costs, including professional fees and holding costs. They note that such local discretion dampens renovation activity by creating uncertainty about costs. They make a convincing case that this uncertainty prevents investment in older buildings, leading to deterioration and ultimately to abandonment.

Sara Galvan[23] notes that "building codes are not neutral documents" and that they provide incentives for certain types of buildings while deterring rehabilitation. Galvan does not support this position as carefully as Burby, but does cite the 25-50 and change of occupancy rules as presenting problems for renovation. Additionally, she notes that the 25-50 rule was particularly problematic because it was based on determining the replacement cost of the building. The difficulty of determining replacement cost added uncertainty by making it difficult for those contemplating renovation to anticipate which level of code compliance would be required. She notes that HUD recommended

22 Burby, Raymond J.; Salvesen, David; Creed, Michael "Encouraging Residential Rehabilitation with Building Codes: New Jersey's Experience," Journal of the American Planning Association Vol. 72, No. 2, Spring 2006

23 Galvan, Sara C. "Rehabilitating Rehabilitation Through State Building Codes," The Yale Law Journal, 2006

alterations to the change of occupancy rule in 1980, but that these suggested changes were employed by less than 4% of code officials nationwide.[24]

A National Association of Home Builders study[25] also notes that the 25-50 rule presents problems for renovation, and asserts that the rule was designed to discourage the rehabilitation of existing structures.

Philip Mattera[26] also notes that the 25-50 and change of occupancy rules posed significant problems for renovation. He cites two specific examples from Massachusetts in which the 25-50 rule made renovation impossible or necessitated the granting of a great number of variances. He notes that the granting of many variances was possible only for a large and prominent project, and was unlikely for most small renovations.

▪*HISTORY OF SMART CODES*

Mattera provides a particularly thorough examination of the history of building codes. He notes the root of modern building codes in such disasters as the Triangle Shirtwaist fire and in the conditions documented by Jacob Riis.[27] He delineates a history of code reform movements including significant activity in the 1920s and 1950s. This activity

24 Ibid: 1760

25 NAHB Research Center, Inc. "Innovative Rehabilitation Provisions: A Demonstration of the Nationally Applicable Recommended Rehabilitation Provisions," March 1999

26 Mattera, Philip "Breaking the Codes: How State and Local Governments are Reforming Codes to Encourage Rehabilitation of Existing Structures," January 2006

27Riis was a photographer and journalist who extensively documented the living conditions in the slums of New York City.

was largely focused on making codes more accommodating to mass production and modern materials and methods. According to Mattera, the first attempt to reform building codes to make renovation easier was in 1968, when the National Commission on Urban Problems called for HUD to develop new model standards for existing construction.

He considers the first significant step toward the implementation of smart codes to be HUD's 1980 Rehabilitation Guidelines, which made clear the problems of the 25-50 and change of occupancy rules. He notes that between 1979 and 1982, all model codes dropped these rules. By 1988, each model code body had issued a code to address renovation, but Mattera finds that these did not significantly improve the situation. He notes that these primarily provided guidance for how to apply existing codes to older buildings, and that in 1991 HUD's Advisory Commission found that codes were still a significant obstacle to renovation.

Mattera does credit the 1979 adoption of Article 22 in Massachusetts as a significant first step in effective code reform. The problem with Article 22 was that it relied a great deal on the discretion of code officials. The identification of dangerous features involved some discretion, and the approval of alternative measures to mitigate hazards involved a great deal of discretion. Listokin et al[28] write that on larger projects officials

28 Listokin, David, and Barbara Listokin "Barriers to the Rehabilitation of Affordable Housing, Vol. 1" Office of Policy Development and Research, U.S. Department of Housing and Urban Development, Washington, D.C, 2001

tended to require a higher level of mitigation, undermining the intent of Article 22, and reverting to a sort of unofficial 25-50 rule. They also note that training and familiarity with the use of Article 22 varied among officials and municipalities, and that their corresponding comfort level with its application was key to its success. Because of this, Article 22 was used with far more success in larger cities than in small communities. Without experience and comfort with the application of Article 22, officials were hesitant to allow a deviation from code based on personal judgment. He also explores the problems presented by the necessity for approval from both building and fire officials, and notes that solutions approved by building officials were often not approved by fire officials.

NAHB also cites Article 22 as a significant step, and explains it more fully. NAHB also notes the publication of the Uniform Code for Building Conservation in 1985, but acknowledges that it had little impact.

The most widely applied code alternative for existing buildings has been Chapter 34 of the three major model codes. This was a safety-scoring approach, but it relied somewhat on the discretion of code officials and on understanding and clever application of the code by architects. In many cases, alternatives such as sprinklers were just as expensive as the prescriptive requirements that they sought to avoid, though such alternatives could offer design flexibility and less intrusive options for existing

buildings. The application of Chapter 34 did not limit required work to the work area, and in many cases did not significantly reduce costs, though it did provide more certainty and predictability than Article 22.

Mattera seems to consider NARPP to be the first example of a modern smart code, but later credits the New Jersey Rehabilitation Subcode as the model for NARPP. NAHB also considers the Subcode to be the first modern smart code, and says, correctly, that NARPP used New Jersey as a model.

▪*BENEFITS OF SMART CODES*

Advocates of smart codes have consistently anticipated great benefits from the implementation of such codes. The direct benefits include increases in predictability and reductions in the cost and complexity of projects. These benefits should spur renovation activity. A range of indirect benefits are anticipated from this increased renovation activity. Galvan offers a good examination of the indirect benefits which may be expected. In examining smart codes, it is helpful to consider the indirect benefits first; if we accept that the direct benefits of cost savings and simplification will encourage more renovation activity, we are led to the question of why it is so important to encourage it. Galvan makes a thorough case for the importance of renovation. She states that renovation and preservation of existing buildings has four main benefits: the preservation of a historical record, a revitalizing impact on central cities, significant benefits to local economies, and increasing affordable housing.

A study prepared for the Federal Department of Housing and Urban Development [29] makes clear the connection between smart codes and smart growth. It notes that renovation can revitalize older cities and inner-ring suburbs, relieving development pressure in other areas. By bringing population back to denser areas, congestion and miles traveled may be reduced.

The indirect benefits of smart codes, which form the compelling rationale for such codes, are not easily measurable. The direct benefits of reductions in cost, complexity, and uncertainty should be more easily measurable. Remarkable claims have been made regarding the effects of the New Jersey Rehabilitation Subcode; the state of New Jersey cites a 90% increase in spending on rehabilitation projects in the two years following its enactment.[30] Nonetheless, only one study (Burby et al) has attempted to quantify the degree to which this increase is due to the Subcode. There is wide agreement that the Subcode has had a positive effect, but there is a great deal of uncertainty about the magnitude of that effect and about its measurability independent of other influences from the real estate market in general.

Two basic approaches may be taken when attempting to measure the benefits of smart codes—statistical analyses and case studies. Case studies are appealing because they

29 Building Technology Inc "SMART CODES in Your Community: A Guide to Building Rehabilitation Codes," Department of Housing and Urban Development Office of Policy Development and Research, August 2001

30 Connelly, William "Rules That Make Sense—New Jersey's Rehabilitation Subcode," New Jersey Department of Community Affairs, <http://www.state.nj.us/dca/codes/rehab/pioneerart.shtml>

are easily grasped, they may show the effects of new codes very dramatically, and they can be undertaken relatively simply. Statistical analyses have the advantage of measuring a large sampling of projects or of characterizing not the impact on individual projects but the aggregate impact on the economy and the built environment. However, statistical analyses are a considerably more specialized type of scholarship and are difficult to undertake. For the conclusions of statistical analyses to be reliable, outside factors must be controlled for. Unfortunately, there can be little certainty about which control factors are most crucial or whether the application of these controls has been successful.

Burby et al make the most careful examination of the effects of the New Jersey Rehabilitation Subcode, and theirs is the only statistical analysis of its overall impact. They attempt to establish whether the Subcode in itself led to a significant increase in renovation activity. They note that there is very little empirical examination of the subject. Some estimates[31] have claimed that the Subcode resulted in as much as a 60% increase in renovation activity in the year following its implementation. Burby's study compares the increase in permits issued for renovation in New Jersey to data from neighboring states. It finds that renovation activity actually increased more in neighboring states. The study then attempts to control for other factors, including economic conditions, the character of building stock, and the character of code

31 Connelly, William "Rules That Make Sense—New Jersey's Rehabilitation Subcode," New Jersey Department of Community Affairs, <http://www.state.nj.us/dca/codes/rehab/pioneerart.shtml>

enforcement activities. The study concludes that when these factors are controlled for, the implementation of the Subcode can be shown to have had a modest, but significant, positive effect on the number of permits issued for renovations in New Jersey.[32]

Burby's study is notable for the fact that it is unique in trying to separate the effects of the Subcode from the other factors that may affect renovation activity. The authors are confident that the Subcode can be shown to have increased renovation activity, but this sort of analysis seems to present significant problems. The study attempts to control for a number of factors, and to thereby arrive at a true estimation of the role of the Subcode. The choice of factors to control for is vital to the result, and it is questionable how well such factors can be controlled for.

For example, this study attempted to control for market effects on rehabilitation activity by accounting for competition from new construction. The assumption was that more new construction would result in less need for rehabilitated older buildings. It also took into account the record of rehabilitation activity in communities, assuming that communities which had more rehabilitation activity in the past would continue to do so. Finally, the study attempted to control for differing approaches to code enforcement. The assumption was that a facilitative approach to enforcement would increase

32 Burby, Raymond J.; Salvesen, David; Creed, Michael "Encouraging Residential Rehabilitation with Building Codes: New Jersey's Experience," Journal of the American Planning Association Vol. 72, No. 2, Spring 2006

rehabilitation activity and a by-the-book philosophy would dampen activity. The data to control for this factor came mainly from a survey conducted by the study's authors.

The survey asked code officials how frequently they heard complaints about the code and whether they felt that their code was a barrier to rehabilitation. The survey also attempted to measure whether officials in each municipality took a facilitative or by-the-book approach and to measure the amount of effort they took to try to catch and correct violations. The questions used in this survey are not included in the published report.

The study finds that the New Jersey Rehabilitation Subcode had a "modest but statistically significant" impact on the number of rehabilitation projects. The authors do not cite a percentage increase which they determined to be due to the Subcode; they say instead that each municipality experienced an average of 116 additional projects due to the Subcode. It is frustrating that this study is difficult to understand, since it is the only one of its kind. It concludes that the Subcode has had a positive effect, but does not clearly express what that effect has been.

Another, more common, approach to demonstrating the effectiveness of smart codes is case studies. A number of these are alluded to in the literature, and they have consistently claimed that the New Jersey Rehabilitation Subcode or the related NARPP result in significant cost savings. Mattera alludes to a number of examples. Every case

study he cites finds that the Subcode resulted in significant cost and time savings. For example, in the case of the Bramhall Avenue apartments in Jersey City, approximately 20% was saved by not having to widen hallways and stairs, according to Mattera. Mattera provides other impressive examples, but most are from an unpublished study[33], and the claims therefore cannot be examined in detail. Interestingly, this study was written by Burby et al. The fact that the same authors eventually published a statistical analysis instead may point to the problems of the case study approach.

The most impressive case study cited by Mattera is "Innovative Rehabilitation Provisions," which is concerned with the Stone Lodge in Chester, New Jersey. As will be shown in the next chapter, the claims made about this project are questionable. Another example cited by Mattera is that of the Essex and Sussex apartments in Spring Lake, NJ. This example is from a published article, but the article contains no information about cost savings or details of what the New Jersey Rehabilitation Subcode made possible. In general, Mattera notes that case studies show that the Subcode allows retention of historical fabric and architectural detailing that would have been lost under the requirements of conventional codes. This may be true, but the specific examples provided here are insufficient to constitute proof.

33 Salvesen, David; Burby, Raymond; Creed, Michael "The Impact of Rehabilitation Codes on Building Rehabilitation in New Jersey and Maryland," May 2004 (unpublished)

Unfortunately, many purported case studies are little more than anecdotes, and it is remarkable how frequently they contain no economic data or make careless assertions about the work that would have been required under conventional codes. Many authors allude to the results of particular projects in lieu of substantive case studies.

Galvan acknowledges that estimates of the effects of the New Jersey Rehabilitation Subcode vary widely, but concludes that there has been a positive effect. She cites Burby, and notes that case studies have universally shown cost savings, though estimates of cost reductions have varied from 50% to 10%. This range is not surprising given the differences among projects.

Syal notes claims that the New Jersey Rehabilitation Subcode contributed to a 60% increase in renovation activity in New Jersey and that cost reductions may be as much as 50%, but does not critically examine such claims.

▪*FUTURE OF SMART CODES*

There is widespread consensus that smart codes will become increasingly common, as evidenced by the number of states which are working toward adoption of some version of the New Jersey Rehabilitation Subcode or HUD's NARPP model code. Most of the literature on the subject of smart codes takes it for granted that these or other codes will be used as models and eventually implemented in the same way that other model codes have been used as the basis for state and local codes. Several publications offer advice to advocates of smart codes.

Only Galvan offers an additional insight into what will be necessary to make smart codes effective. Reviewing the efforts prior to the introduction of the New Jersey Rehabilitation Subcode, Galvan finds several common shortcomings which are relevant to the ongoing efforts to develop smart codes. Most importantly, she concludes that to be effective, renovation codes must be statewide and mandatory. Statewide applicability leads to better understanding of requirements and consistent application. Mandatory adoption means that the renovation code must be applied to older buildings. It cannot be applied only at the code enforcer's discretion, which would create too much uncertainty and be a disincentive to the renovation of older buildings. Finally, she finds that it is crucial for rehabilitation codes to apply to all buildings past a certain age; codes which apply only to buildings which have been designated as historic do not satisfy the wider goals she has outlined.

Galvan therefore considers the New Jersey Rehabilitation Subcode to be the most effective smart code implementation because it is mandatory and statewide. Allowing municipalities the option of adopting such codes does not do enough to reduce uncertainties and to promote clear understanding of such codes. She cites Maryland as an example of this problem. Maryland made the NARPP model code available as its rehabilitation code, but the code had to be adopted by individual municipalities. Moreover, municipalities which did adopt it could modify it. The resulting patchwork of differing codes may lead to a situation in which a rehabilitation code is available, but

property owners, architects, and developers are unaware of it or do not understand that the code is somewhat different within each municipality.

Since Galvan's article was published, Maryland has abandoned its own rehabilitation code and adopted the International Existing Building Code on a mandatory, state-wide basis. The reasons cited for this are exactly those which Galvan cautions could raise problems. When Maryland had its own NARRP-based rehabilitation code, it allowed municipalities to amend it. This created confusion which made this code difficult to apply. Further, Maryland's new construction code varied from one community to another. Since NARRP refers to the new construction code for some of its requirements, this added more inconsistency across the state. Maryland has adopted the ICC codes statewide to solve this problem.

She finds a similar situation in Pennsylvania, where the International Existing Building Code is an option available for adoption by municipalities. The situation in Pennsylvania is further complicated by variations in who is responsible for code inspection and enforcement and by varying fee structures for inspections.

Finally, Galvan considers how supporters of smart codes might hasten their adoption. She stresses her position that these codes will only be effective if mandatory and statewide. She suggests strategies for building public support, and considers what alliances might be formed between groups interested in adoption.

John M. Watts[34] is one notable dissenter regarding smart codes. He asserts that their requirements are complicated and difficult to understand, that their updating will present problems, and that they are not based on any scientific evidence. He states that they are supposed to provide some "in-between" level of safety which is greater than existing construction but less than new construction. He does not argue that this "in-between" level of safety is inappropriate—in fact he calls the concept "excellent," but he argues that because there is no measurable way to characterize current baseline levels of safety, there can be no adequate way to decide what intermediate level is appropriate for existing buildings. It is also his contention that there is no sound basis for the assumption that an in-between level of code compliance will result in an in-between level of safety. He proposes safety scoring as an alternative to smart codes. His position is that since safety scoring considers the way that the building functions as a whole, it is more effective in ensuring the safety of buildings while allowing elements of a building which do not limit its safety to remain.

His points may be valid, and are worth examining in more depth. It is true that, in some categories of work, smart codes seem to aim at an in-between level of safety. As projects become more involved, smart codes call for a higher level of improvement in safety. These categories of work seek to provide a level of safety more closely equivalent to conventional codes, while minimizing costs and the replacement of

34 Watts, John M. Jr. "Fire-Risk Indexing: A Systemic Approach to Building- Historic Buildings," APT Bulletin, Vol. 34, No. 4. (2003), pp. 23-28.

materials. The proponents and authors of these codes make the point that some renovation, with some resulting increase in safety, is better than none. They argue that the requirements of traditional codes discouraged renovation and that an increase in life safety, however small, is an improvement. Watts seems to argue that the code requirements which are applicable under smart codes may not necessarily be the ones which will increase a particular building's safety. Safety scoring, like smart codes, attempts to apply only certain elements of current code requirements to existing buildings. In this sense, both safety scoring and smart codes result in an in-between level of compliance. Watts' contention is that safety scoring makes the choice of which requirements are applicable more rationally. He therefore feels that safety scoring will result in a real increase in safety, whereas smart codes may not.

Watts' contention is that safety scoring is based on an objective and scientific understanding of how a building will function with respect to occupant safety. This is questionable, since safety scoring depends largely on a fixed set of rules, and not on an in-depth study of the function of each building in relation to safety. Since the basis for safety scoring is a comparison to prescriptive codes, any irrationality in the requirements of the prescriptive code will be reflected in the safety scoring system. If it is true that prescriptive codes contain requirements of questionable rationality, it is hard to accept Watts' assertion that safety scoring, which depends on these requirements, is objective and scientific.

Gentry[35] has a provocative perspective on Rehabilitation codes. He states that rehabilitation codes do result in buildings which are less safe than new construction. He also states that rehabilitation codes are successful in creating additional affordable housing. He takes the position that it is acceptable for low-income households to tolerate a lower level of safety than that found in new construction because it is not economically possible for them to live in new construction, or in old buildings renovated to meet the requirements for new construction. He states that many low income families live in buildings which are overcrowded or have serious code violations. Therefore, a level of safety somewhat less than that of new construction should, in his opinion, be seen as a welcome improvement for these families. He goes so far as to propose that this lower level of safety would also be acceptable for new construction if it provided more affordable housing.

Gentry and Watts are among the few critics of smart codes, and even they find the intent and concepts behind smart codes generally laudable. Their concerns seem to regard the likely efficacy of smart codes, and there is good reason for this concern. While overwhelmingly positive regarding the potential of smart codes, the literature does not clearly demonstrate their effectiveness, either in reducing costs and spurring renovation, or in ensuring safety in the process. Further consideration of the effects of smart codes, and of how to remedy their shortcomings, is called for.

35 Gentry, T. A., "Developing Smart Codes for Environmentally Sustainable Affordable Urban Housing," Symposium on Building a Sustainable City Through Sustainable Enterprise, 2004 BELL Conference, George P. Nassos, Stuart Graduate School of Business & Center for Sustainable Enterprise, Illinois Institute of Technology, Chicago, Illinois 2004.

CHAPTER 5: CASE STUDIES

As mentioned in the previous chapter, case studies are the most popular way to assess the effectiveness of new tools and policies like smart codes. In the case of smart codes, there are few thorough published case studies. This chapter will examine two existing case studies. "Turning on the Lights Upstairs" was a study concerned with the application of safety scoring rather than smart codes, but there are important lessons to be drawn by examining this study in an effort to see how the results would differ with the application of smart codes. The second half of this chapter will be devoted to a critique of "Innovative Rehabilitation Provisions," a study of the effects of the New Jersey rehabilitation subcode published by HUD. This study was supposed to show the benefits of the subcode and NARRP, but is problematic for several reasons.

▪ *"TURNING ON THE LIGHTS UPSTAIRS"*

In 1996, the Center City District of Philadelphia commissioned a study, entitled "Turning on the Lights Upstairs," on the feasibility of re-using the vacant upper floors of a number of older buildings. These buildings had various original uses, but all had been converted to office space at some point. Under the requirements of older codes, any change of use requires buildings to meet code requirements for new construction. In the case of the buildings in the study, these code requirements were believed to be a significant factor in causing the upper stories of the buildings to remain vacant because meeting code requirements was infeasible or too expensive.

This study sought to demonstrate that the use of safety scoring could help address this problem. The Philadelphia building code offered an equivalent to BOCA's Chapter 34. The authors and proponents of the study felt that this section of the code was being overlooked and underutilized, and sought to show that if it were utilized it could help solve the problem of empty buildings in Philadelphia.

▫*METHODOLOGY*

The study brought together an advisory group composed of property owners, developers, real estate professionals, architects, and city officials. The goal of the study was to demonstrate that buildings such as those studied could be renovated and reused despite the obstacles imposed by the prescriptive provisions of the building, fire, and zoning codes. The study considered likely expenses and income in attempting to demonstrate that the buildings could feasibly be reused. The authors considered the impact of other expenses, apart from those triggered by the building code, and of incentives available to reduce project costs, but the primary focus of the study was the building code.

The study presented a pro-forma for one building, the Delong building, which was used as the primary example. For the remaining nine buildings, the study outlined the history and existing conditions of the building, then showed how, in a likely reuse, improvements could be made that would allow a passing safety score while minimizing costs. Each example includes a safety scoring worksheet showing the building's score

in its unaltered state, a projected score after renovations without sprinklers, and a projected score after renovations with sprinklers.

Code officials and architects involved in the project chose means which could be used to achieve a passing score and evaluated these proposed improvements according to Philadelphia's safety scoring provisions to demonstrate that the proposed work would be sufficient to achieve a passing score. Philadelphia's scoring system was based on the 1990 edition of the BOCA code, and did not differ significantly from the model code. The most substantial differences in compliance issues were due to the fact that Philadelphia's Fire Code had unique sprinkler requirements. The consideration of these requirements does not make the study any less useful for comparing BOCA's Chapter 34 to the more recent prescriptive smart codes.

▫STUDY CONCLUSIONS

The primary example in this study was the Delong building. In the case of the Delong building, all systems on the upper floor were unusable and would have to be replaced, regardless of code requirements. The code requirements that the study anticipated would be triggered concerned fire resistance and egress. The study not only found that the building could achieve a passing score without sprinklers, but that sprinklers would be less cost-effective than the installation of gypsum wallboard to achieve the fire rating necessary for a passing score.

This was typical. The study proposed sprinkler installation for only two buildings out of the ten studied. In one of these cases, the study proposed an unconventional system in which sprinklers would be fed from an existing wooden roof tank through the existing standpipe system. This was used as an example of how existing infrastructure could be used to reduce the cost of required systems. In this example, the goal was to find an alternative to the expensive pump and back-up power generator that would pressurize the sprinkler system in case of a power outage.

All of the studied buildings would have required new or updated fire detection and alarm systems, and emergency egress lighting. Seven out of ten buildings would have required additional gypsum wallboard to provide fire resistant partitions and ceilings. Two buildings would have required variances because they lacked a second exit route.

The study acknowledged that the single item which would have the greatest positive effect on a building's safety score would be a sprinkler system. Despite this, the authors favored other means of achieving a passing score, due to the cost of sprinkler systems. The study found that the installation of sprinklers was a particular problem for small buildings.

▫*DIFFERENCES UNDER NARPP OR THE NEW JERSEY REHABILITATION SUBCODE*

"Turning on the Lights Upstairs" proposed apartment use for most of the buildings and regarding egress and sprinklers, this represents a higher hazard rating than office use. Under all three smart codes, extensive requirements are triggered by a change to a

higher hazard rating. It is easy to appreciate the limitations of smart codes by considering what impact they would have on the feasibility of reuse of the buildings in this study. It is also revealing to consider the differing impacts of the various smart codes.

Application of the New Jersey Rehabilitation Subcode would have required sprinklers in all cases. Because the new use (residential) is more hazardous that the former use (office), this and other significant upgrades would be required. Many of the buildings in the study would require additional fire-rated walls and ceilings under the scoring system. The application of the Subcode would also require this in most cases. As a result, there may be no savings in these cases from applying the Subcode. In fact, the Subcode would likely increase costs and the amount of triggered work. The only likely reduction in costs and work would be due to the fact that the subcode accepts plaster and lath where a one-hour fire rating is called for. This could minimize the amount of new gypsum wallboard required.

The other problem shared by a number of these building is a single exit. The study assumed that for residential use, an exception could be obtained to allow the single exit. The New Jersey Rehabilitation Subcode does not allow a single exit. This is one problem that is not alleviated by the Subcode. In one case, the study's authors proposed the installation of a new fire escape. This is not permitted by traditional codes, but the

Subcode does specifically allow fire escapes when there is no room for an additional stair tower.

The application of the New Jersey Rehabilitation Subcode, as opposed to safety scoring, would appear to actually have had a significant negative impact on these projects. It would increase the amount of work required, increase costs, and possibly result in more loss of the original character and fabric of the buildings. Despite the fact that the structure of the NARPP codes differs, the results under the NARRP code would be essentially identical. One difference is that NARRP may reduce the cost of sprinklers by allowing more options for water supply. In particular, standpipes may be used in place of pumps, provided that they are of adequate capacity.

▫*DIFFERENCES UNDER THE IEBC*

It is particularly relevant to consider what effect the IEBC would have on these buildings, as the IEBC is now available as an option in Pennsylvania. Under the provisions of NARRP and the New Jersey Rehabilitation Subcode, very few requirements are triggered when a change of use is to a new use with an equivalent or lower hazard rating. Results under the IEBC would be similar, though its structure differs from the other two codes. Like NARRP, it relies less on hazard ratings to determine requirements than the New Jersey subcode. The IEBC would likely result in more extensive and costly repairs where structural damage exists.

▫CONCLUSIONS REGARDING SMART CODES

"Turning on the Lights Upstairs" offers a good basis for comparison between the effects on project costs and complexity of safety scoring versus smart codes. Smart codes are least effective when it comes to changes of use—their application is most complicated in change of use situations and reductions in triggered requirements may be least. All of the examples in this study involved a change of use. Under all three of the smart codes, the requirements for changes of use are more variable than for any other category of work. The degree of work required for a change of use will depend on the hazard ratings of the new and old uses and on each code's particular requirements for the new use.

This study presented the probable results of the use of a safety scoring system similar to Chapter 34 of the BOCA Code as a less-expensive option to Philadelphia's prescriptive code. The cost, complexity, and uncertainty of this option is attested to by the fact that, 11 years later, the buildings in the study remain empty, despite a booming real estate market. However, the smart codes offer no significant help with this situation. In particular, all three smart codes require sprinklers and prohibit single exits.

This shows the greatest shortcoming of these prescriptive smart codes. The preservation of historic buildings is highly dependent on adaptive reuse. While many older buildings are obsolete for their original or former use, they may function quite well in a new use. In particular, adaptive reuse is the best way to provide additional

affordable housing, and reuse can revitalize marginal neighborhoods and towns. Occupant safety must be the highest priority of any code, but enabling changes of use to go forward as easily as possible must also be a high priority for these codes if they are to fulfill their proponents' hopes that they will increase reuse of vacant buildings and help provide additional affordable housing, within a context of reasonable levels of safety.

It may be possible to reduce the difficulties encountered with changes of use by refining the application of hazard categories. In addition to applying hazard categories carefully to particular categories of code requirements, it may be necessary to re-examine the hazard categories themselves. It may be found that there is some benefit in expanding the number of categories or further dividing uses. At a minimum, the particular hazards of each use should be considered carefully. This may allow code requirements to be relaxed for many reuse projects while maintaining a reasonable level of occupant safety.

"Turning on the Lights Upstairs" emphasizes the difficulty that smart codes experience in attempting to address the requirements of one type of building which it was hoped they would benefit: small, slender, multi-story buildings in older cities. These buildings are typified by the examples in this study. They are common in older cities, and they are commonly empty above the first floor. The re-use of these buildings is vital to the recovery of moribund neighborhoods, and could provide additional housing or small

spaces for startup businesses. Their location in urban cores makes them uniquely appealing.

It was expected that rehabilitation codes would be most effective for the smallest projects, and that they would offer little advantage for projects involving large buildings. As reflected by these examples, the reality is somewhat more complex. Smart codes probably result in the most significant reduction in cost and code requirements in single-family homes. In small commercial or apartment buildings which are not undergoing a change of use, smart codes may also have significant benefits. Their benefits for larger buildings are likely to be highly variable, depending on the intensity of rehabilitation activity and the particulars of the building's construction. Where rehabilitation codes fall short is for conversion to a higher hazard category. This is unfortunate since the most likely use for many vacant commercial buildings is conversion to residences, and this will trigger more stringent requirements in these codes. As mentioned, small buildings suffer particularly because of the economics of sprinkler installations and the low likelihood that they possess a second exit. It is somewhat surprising to find that these codes do not benefit these small multi-story buildings, and that they actually make re-use more difficult than existing safety-scoring approaches.

All of the buildings in this study can be considered historic as defined by these codes. In this case, this is of little help. Second exit and sprinkler requirements still apply, and

single-exit buildings could not be utilized above the first floor. The only significant benefit that might be expected from these buildings' historic status is that there are additional allowances for the retention of plaster and lath, reducing the amount of gypsum wallboard which would have to be installed to meet requirements for fire-resistant construction.

The considerations regarding sprinklers in this study point to an example of the uncertainties that are encountered in constructing codes. An issue for several of the studied buildings is the fact that, at the time the study was conducted, Philadelphia's code required sprinklers for all buildings over 75 feet in height unless they were used for multi-family residential use. This would imply that such use presents a low degree of hazard. On the other hand, this use has a relatively high hazard rating according to the major building codes, and the change from office use to this use would require sprinklers under all of the major rehabilitation codes. If the change of use were to a lower hazard rating, all three smart codes would likely result in cost reductions for reuse of all of these buildings. Savings would come as a result of not having to enclose stairwells or install gypsum wallboard to achieve fire ratings for walls and ceilings and from not having to install sprinklers.

It is unclear why these codes consider residential use to be a more hazardous use, yet Philadelphia's Fire Code specifically exempted residential uses from sprinkler requirements. It is likely that the codes' hazard categories more accurately reflect the

degree of fire danger. The Philadelphia Code may have exempted residential uses for reasons having more to do with politics than with estimates of risk.

An additional point which arises in "Turning on the Lights Upstairs" is that sprinkler requirements are far less onerous in large buildings than in small ones. Particularly where a pump and backup power supply are required, there is an economy of scale for large buildings. In a large building the price per square foot of the sprinkler system will be lower, allowing the cost to be recovered by rents. The study's authors found that sprinklers in the small buildings in the study were often cost-prohibitive. Unfortunately, by the rationale proposed above, sprinklers are a reasonable response to the hazards presented in a residential use, particularly in a multi-story configuration. NARRP and the IEBC allow standpipes instead of pumps in many cases, which may mitigate this problem.

One benefit offered by rehabilitation codes is the fact that they specifically allow new fire escapes as a solution for buildings which only possess a single exit. This could ameliorate the egress problems of the buildings in the study. The study's authors assumed that it would be possible to obtain variances for the single exits in these buildings. It is not certain that variances could be obtained, so the option of new fire escapes may make the projects more feasible, and would certainly make the finished buildings safer.

The situation presented by the application of these codes to the reuse of small urban buildings is certainly not unique to Philadelphia. A similar situation exists in Pittsburgh, and has received quite a bit of study and publicity.[36] It was expected that the adoption of the IEBC in Pennsylvania would help to solve this situation. In 2004, the Pittsburgh Downtown Living Initiative released "The Vacant Upper Floors Project,"[37] which is extremely similar to "Turning on the Lights Upstairs." The influence of the IEBC is reflected in the fact that every example studied by the Vacant Uppers Floors Project will require the installation of sprinklers.

The re-examination of this study in an effort to assess the likely impact of current smart codes seems to reveal shortcomings that are not anticipated by the current literature on smart codes. This shows the necessity to more fully explore the real effects of smart codes in a variety of situations.

▪*HUD'S "INNOVATIVE REHABILITATION PROVISIONS"*

As outlined in the literature review, there have been a number of attempts to assess the effectiveness of the New Jersey Rehabilitation Subcode and other smart codes. The statistical analysis undertaken by Burby et al is unique. Other examinations of the

36 Lowry, Patricia "Can Pittsburgh's 'sliver' buildings be saved? - Downtown's distinctively long, narrow buildings await restoration or the wrecker's ball," Pittsburgh Post-Gazette, Monday, February 16, 1998

And:

Hylton, Thomas "A no-cost boost for cities and towns: The new statewide construction code makes it far easier to renovate existing buildings," Pittsburgh Post-Gazette, Wednesday, July 28, 2004

37 The Pittsburgh Downtown Living Initiative "The Vacant Upper Floors Project," June 2004

effects of the Subcode have utilized case studies and have attempted to generalize from these case studies.

Case studies cannot measure how well smart codes are utilized where they are available, or the overall impact of smart codes on the economy, housing stock, and revitalization of communities. But case studies can suggest the degree to which smart codes will reduce costs and encourage renovation and reuse. Given enough case studies addressing a range of different building types and projects of varying scales, it should also be possible to draw some conclusions about whether smart codes favor certain types of projects.

The published case studies concentrate mostly on the application of the New Jersey Rehabilitation Subcode and NARPP, as opposed to the IEBC. They are also biased towards smaller projects. This may be because smaller projects allow for an easier and clearer case study, or because small projects show the desirable effects of the smart codes more strongly. This is an area where Martin's complaint about anecdotal evidence is particularly striking. Many supposed case studies present no substantive data, but instead only claim that the project being described could not have been done without the new codes.

HUD's "Innovative Rehabilitation Provisions" is an in-depth case study of an addition and renovation to a historic home, utilizing the New Jersey Rehabilitation Subcode.

Because of the similarities between the two codes, this study was also meant to act as a demonstration of the NARRP. The results of this study seem to agree with the general estimates of the savings to be realized from smart codes. Unfortunately, this study primarily shows the problems which can arise with the case study approach.

This study centered on renovations and an addition to a stone house in New Jersey dating from 1747. There are several questionable aspects of this study. The most striking thing about the study is that the work mainly consists of an addition. The reconstruction portion of the project constitutes only a small portion of the existing house. The study's conclusions are based on an assumption that under older codes, the entire house would have to be brought into compliance. The study offers two justifications for this assumption. One is that the cost of the project would exceed 50% of the value of the house. This is a questionable justification, since the 25-50 rule was dropped by most model codes long before the introduction of smart codes. (On the other hand, it persisted in many codes as adopted by local governments.) The second justification for this assumption is that the area of the addition would exceed 5% of the total area of the building, which would trigger code requirements for the entire building. This requirement was unique to New Jersey, and therefore is entirely specious in a study addressing the application of NARRP.

▫METHODOLOGY

The study identified work which would have been required under the prescriptive provisions of the BOCA Code using the 25-50 rule. (This ignores the possibility of using the Chapter 34 safety-scoring alternative in the BOCA code.) It estimated the costs for a renovation that would include this work. This estimate was supposed to show the additional costs that would have been imposed by the codes that existed before the advent of the New Jersey Rehabilitation Subcode.

The study identified a number of requirements which would have been triggered by the 25-50 rule, including requirements for the foundation, egress, corridor widths, stair geometry, and ceiling heights. The study acknowledged that it is not certain that all of these requirements would have been enforced in all cases. The study also acknowledged that these costs estimates were unusually high due to the stone construction of the house. It included a second set of estimates for an equivalent wood-framed building.

▫STUDY CONCLUSIONS

The study estimated that correcting all of these conditions would have cost an additional $27,000 and added two weeks to the project. It was judged that these requirements would have made the project infeasible because of both costs and loss of architectural character. The study includes many caveats stating that it is not certain that all of these costs would have been incurred under older codes.

▫LIKELY DIFFERENCES UNDER OTHER SMART CODES

All codes would require the addition to comply with standards for new construction. Any differences in these requirements would depend on the particular requirements for new construction where the project took place. No differences would be attributable to differences in smart codes.

The work on the existing portion of the house consisted of "reconstruction" of the kitchen and a portion of the basement. Unfortunately, the study does not detail what work was executed in the existing portion of the house. It concentrates solely on work which the authors assert would have been triggered under the BOCA Code.

To evaluate the relative impacts that the various rehabilitation codes might have had on this project, it is necessary to make some assumptions about the scope of work. The plans included in the study show no significant reconfiguration of space. It is likely that the bulk of the kitchen renovation consisted of the replacement of appliances, systems, cabinets, counters, and finishes. Since the most significant differences between the three major smart codes are those which concern structural work, it may be expected that there would be little difference in the relative impacts of the three codes. The one likely exception would be the creation of a doorway between the existing basement and the basement of the addition. This might trigger more stringent structural requirements under the IEBC than under NARRP or the New Jersey Rehabilitation Subcode.

Under BOCA's Chapter 34, or equivalent sections of other codes, triggered work would have been far less than what is assumed by this study. This is relevant because Chapter 34 was widely available prior to the development of smart codes and would have offered a solution to the problems which this study asserts would have been created by traditional codes. Under Chapter 34, as under all other codes, the addition would have to comply with requirements for new construction. The kitchen and other parts of the project would be required to comply with new building requirements or be subject to Chapter 34's scoring provisions, and to its requirement that alterations do not make a building less safe than it previously was. Notably, unaltered areas would not be subject to any requirements under Chapter 34.

Since the area being altered in this project was small and was on a ground floor with access to several exits, it is likely that it would have achieved a passing score easily. Fire-rated construction may have been required within the kitchen, but assuming that the kitchen renovation was extensive, this would have added little cost. Only if the kitchen renovations were intended to leave cabinets, counters, and plaster walls in place would there have been a notable impact on the project.

▫CONCLUSIONS REGARDING SMART CODES

In this example, smart codes would have a notable impact only if the 25-50 rule remained in place and was strictly enforced. With the elimination of the 25-50 rule, this study loses much of its impact. Chapter 34 of BOCA would further ease requirements

and would likely result in costs and triggered work equivalent to the actual project as realized under the New Jersey Rehabilitation Subcode. In this particular case, smart codes cannot be shown to have significant effects. Furthermore, the application of different smart codes would appear to have little difference in likely outcomes in this case. Excepting the possibility that structural requirements would increase costs under the IEBC, the three major smart codes could be expected to have nearly identical results.

▫FLAWS OF ORIGINAL STUDY

As explained above, smart codes may actually have had very little effect on this project. The conclusions of the case study are questionable for reasons which will be explained below. The fact that smart codes cannot be shown to have had a significant impact on this project does not mean that they are not significant or successful. It merely indicates that this project is not a suitable vehicle to show their effects.

The reality is that it is extremely unlikely that all of the costs that this study anticipated would have been incurred. The 25-50 rule had been dropped prior to the adoption of the New Jersey Rehabilitation Subcode, and it is questionable to use the requirements of the 25-50 rule as a basis for this study. Some localities did retain the rule, so there is basis for acknowledging the possible effects of the rule, but it is disingenuous to imply that

the rule was not already disappearing. The 25-50 rule had been deleted from all the model codes by 1982, well before the adoption of the Subcode in 1998.[38]

There are other reasons that these costs would likely not have been incurred. The study acknowledges that the discretion and philosophy of local officials would affect which elements were required to comply, and that it is likely that some requirements would have been waived. The study does not acknowledge that variances could be sought to obtain relief from those requirements that local officials might enforce. Seeking a variance can be complicated, and there is no certainty that one will be obtained, but the possibility should have been acknowledged.

More importantly, the BOCA Code incorporated Chapter 34, which allowed safety scoring as an alternative to prescriptive requirements. If BOCA requirements seemed to make this project impossible, a rational response under the BOCA code would have been to look for ways to realize the project under the provisions of Chapter 34.

Based on the assumptions of the study, the conclusion is that the New Jersey Rehabilitation Subcode saved approximately 20% on this project. For a similar structure of wood-framed construction, savings would have been approximately 14%. These are significant savings, but quite a bit less than the possible 40% savings which

[38] Mattera, Philip "Breaking the Codes: How State and Local Governments are Reforming Codes to Encourage Rehabilitation of Existing Structures," January 2006: 10

many have claimed are possible as a result of smart codes. The reality is that, given the uncertainty about which code requirements would have been strictly enforced and the fact that the 25-50 rule had already been removed from major codes, the savings claimed by this study are certainly overstated, and may be entirely imaginary. It is by no means certain that any of these additional costs would have been incurred, and if they were not, no savings would have been seen.

This is only one study, but it is worth considering because it is the most thorough published case study of the application of smart codes. It is frustrating that such a flawed study should represent smart codes, and strange that HUD offers this study as evidence for the effects of their NARRP code. The example chosen fails to show the potential effects of smart codes fully. The project which forms the basis of the study primarily involved an addition. Since an addition must be built in accordance with requirements for new buildings, smart codes will have no effect on the portion of the project involving the addition. A project which primarily involved renovation of an existing building would likely show a greater reduction in costs and triggered work.

This particular house makes a strange example as well. The strongest proponents of smart codes have hoped that such codes will increase renovation of neglected structures, particularly in urban environments. It is hoped that such activity will provide additional affordable housing and revitalize neighborhoods. Such rehabilitation activity is likely to involve adaptive re-use. For all of these reasons, the house in the study is a strange

choice. It does not involve any change of use, it involves very little renovation of the existing structure (which was in very good condition), and is not in the urban neighborhoods which were a particular concern for the proponents of these codes.

The example chosen is problematic for yet another reason. The study cites the added costs imposed by the building's stone construction. According to the study, this makes work which would have been triggered under traditional codes more expensive. As stated above, all of the examples of triggered work were outside of the work area of the actual project. However, one might assume that the costs of the actual project, including alterations to the existing kitchen, were affected by the stone construction. This appears not to be the case. The house has had several previous additions, and the kitchen appears to be of wood-framed construction. This has the effect of further reducing the costs of the actual project in contrast to the inflated costs which were presented as likely results of traditional codes and code enforcement.

This study vividly shows the problems which can arise with the case study approach. Case studies must be chosen carefully to ensure that they do not overstate the positive effects of smart codes. On the other hand, some projects will receive little benefit from smart codes. It is essential to try to select case studies which avoid these extremes. Such studies will serve better as the basis for generalizations about the effects and problems of smart codes.

CHAPTER 6: SMART CODES AND HISTORIC PRESERVATION

Though smart codes target all existing buildings, they are of particular interest to the field of historic preservation. Preservationists have an obvious interest in retaining the existing materials and character of old buildings. What may not be obvious is that preservationists are concerned with whole neighborhoods and cities rather than just with individual buildings, and with the built environment in general rather than just those buildings which are exceptional because of their architecture, materials, or history. Because of the multi-faceted and far-reaching goals of preservation, it will be difficult for smart codes to fulfill all of the hopes of preservationists.

Smart codes will have different benefits depending on the age and significance of the buildings to which they are applied. In the case of relatively modern buildings, the benefits are likely to be more and will consist primarily of cost reductions. Older buildings which do not have special significance or architectural features will benefit to a greater degree in terms of cost savings and reduction of project complexity. Where the architecture or fabric of a building has special significance, smart codes will have a special impact.

This is of importance as it becomes recognized that the character of historic buildings is an economic asset. For example, if original doors and trim are character-defining features of a historic building, widening doorways may have a real impact on that

building's desirability, and thus its value. If it were necessary to replace these original elements, but to retain the character of the building, it would result in costly duplication or imitation of original features in a new configuration that would meet code. In other cases, it would be impossible to replicate original fabric, and if its retention were a priority, it would be necessary to obtain variances or exceptions.

Smart codes have inherent benefits for the preservation of historic buildings. This is vital because preservation has benefits not just for buildings which are recognized for their significance and historicity; a preservationist approach also has benefits for the large inventory of older buildings which may not have special significance but which make up a vital part of our built fabric. All of the smart codes examined here also have special provisions for historic buildings which are listed on or eligible for the National Register of Historic Places due to their special significance.

▪*CONTINUING/NEW USE*

When considering the relationship between historic preservation and smart codes or safety scoring, it is vital to consider that preservation means much more than the retention of fabric. Preservation really means keeping a building in use. Very few buildings merit preservation as museums, and preservation of the vast remainder of older buildings means finding a use which will earn an economic return. This means that adaptive reuse is absolutely vital to preservation. Many older buildings are no longer suitable for the use for which they were built, and in many cases the original use

has ceased to exist. This does not mean that there is no use for the buildings, and there are a number of goals which are well-served by adaptive reuse of older buildings.

As noted, changes of occupancy create major problems with code compliance. Many older buildings are obsolete in terms of their originally intended use, but this does not mean that they are useless. On the contrary, some consider that the reuse of existing buildings is the most effective way to create additional affordable housing and that reuse can provide ideal low-cost space for new businesses.[39] In some cases, this re-purposing can take place with little or no physical change to the building, but in most cases some changes are necessary. The problem has been that, under traditional building codes, any change of use requires that the entire building be made to meet current code requirements for new buildings. This is often not possible, and is almost always expensive. It is also not a rational response in many situations. Buildings which have provided a reasonable degree of safety for many years should be allowed to be converted to a less hazardous use without significant changes. Yet traditional codes mandate compliance with current codes, regardless of the building's inherent level of safety and regardless of the relative risks of the new use.

39 Rypkema, Donovan "The Economics pf Historic Preservation: A Community Leader's Guide" National Trust for Historic Preservation, Washington, DC 1994: 25, and generally for an excellent discussion of the favorable economic and social impacts of preservation.

Because adaptive reuse is so crucial to the practice and goals of historic preservation, and because it also supports economic, social, and environmental goals, it is disappointing to find that smart codes do not necessarily make adaptive reuse easier. In fact, there are cases in which smart codes will make the most likely reuse more difficult than previously existing codes.

▪*RETENTION OF FABRIC/LIKE MATERIALS*

Smart codes have great benefits for historic preservation because they allow the retention of existing materials that new building codes do not allow. Keeping plaster and lath and tin ceilings can not only lower project costs, it can contribute greatly to the character of the building. Codes have their greatest impact on older buildings regarding requirements for egress and fire-rated construction. Smart codes have egress requirements similar to those of conventional codes when work falls under the categories of reconstruction or change of use. There is good reason for such requirements, and in some cases they are not expensive or difficult to meet. In other cases, such as slender multi-story buildings in cities, egress and second-exit requirements can be all but impossible to meet, or may result in significant losses of historic fabric. Recognizing plaster and lath as suitable where a one-hour fire rating is called for helps with this problem, but this benefit applies only to designated historic buildings. Easing dimensional requirements may have an even more significant impact because reconfiguration can result in great losses of historic fabric.

▪*RETENTION OF CHARACTER*

It is important to realize that when original fabric is retained, it is not only material which is being retained. Older materials often have features which cannot be replicated by modern materials, or may show their age in a way which contributes to the character of the building. In addition, the accretion of materials over time can tell the story of the building and of those who did the work. Materials are a record of fashions, of attitudes toward the building, and of methods of work. This is not to say that all materials must or always should be retained, but in any older building it is worth considering which materials make the building what it is, and in buildings with special significance even undesirable alterations may have significance because of the story they tell.

Architectural features may be replicated in new materials, but often they are not due to costs or a lack of skilled laborers. This is another reason why it is important to retain original materials. In other cases, the architectural features themselves may be deemed to be non-conforming under the new building code. Taken together, architectural features and original fabric constitute the character-defining features of a building. For preservationists, the need to preserve them is almost self-evident. However, there is also an economic argument which is not often made: it is the sum of these features which makes a historic building different from a new building. In many cases, historic buildings have a special economic value because they are historic. If codes cause the loss of these features, they effectively cause a loss of value. A historic building

becomes simply an old building, with all of the possible condition and maintenance problems of an old building, but without the virtues that might compensate.

These smart codes define historic buildings as those which are listed on or eligible for the National Register of Historic Places, or which are considered "contributing" to a National Register district or an equivalent state or local district. For these buildings, many requirements can be waived, leaving decisions about code requirements to the discretion of the code inspector. In many cases, only building features specifically identified as hazards must be remediated. The historic building provisions of these codes also allow even more extensive retention and use of archaic or non fire-rated materials than the general provisions.

These provisions for historic buildings offer valuable options, but there are disadvantages to these provisions which are similar to the problems experienced with the application of Article 22 in Massachusetts. Code officials are called upon to exercise a great deal of discretion in the application of these provisions, which may result in a great deal of uncertainty. It may also delay projects as decisions are negotiated. In the case of buildings with special significance, the possibility of negotiating such exceptions may be a satisfactory option, and may be beneficial by allowing the particular traits and demands of each building to be considered. However, as explained above and as stressed by David Listokin and Sara Galvan, the proponents of such codes have larger goals. Preservation and reuse of existing buildings have come

to be seen as a powerful tool for revitalization of cities and towns, as a way of building diverse and sustainable communities, as an environmentally-friendly alternative to new building in general and sprawl in particular, and as a tool uniquely able to promote economic growth which is sustainable and whose favorable effects tend to stay within the community and gain momentum. To fulfill these larger goals, smart codes must have the greatest benefits possible for the widest variety of buildings possible, while still ensuring safety.

CHAPTER 7: CONCLUSION

Smart codes are an overdue and necessary tool for preservation. For a range of reasons, ranging from the need to retain existing fabric in significant buildings to the hope of turning decaying urban neighborhoods into revitalized affordable housing, much has been hoped for from smart codes. The impact of smart codes could be tremendous. The economic and social benefits of preservation and reuse are significant and these codes may greatly facilitate that work. It is important that rehabilitation codes be adopted on a mandatory, statewide basis and that they be clearly understood and consistently applied.

Maryland's experience proves this point. Maryland created its own smart code based on NARRP. However, it was incumbent on municipalities to adopt this code individually, and it could be altered or amended by them. The same was true of the building code for new construction in Maryland. This created a situation where there was a patchwork of slightly different codes. In 2006, it was decided that this situation had to be remedied, and the state chose to adopt the International codes on a statewide basis, including the IEBC, which will replace the Maryland Rehabilitation Code.

Smart codes could also allow the historical fabric and character of older buildings to be retained to a greater degree. In some cases, there will be an accompanying cost reduction, as existing fabric is allowed to remain untouched. In other cases, these codes will allow replacement-in-kind or reinforcement and minor alteration rather than

replacement with contemporary materials. This may not result in cost savings, but may better realize preservation goals.

The New Jersey Rehabilitation Subcode provides a good basis for smart codes, but has some shortcomings. The most obvious is the complexity presented by its six categories of work. Though these finely-tailored categories are one of the best features of the code, it is not always easy to understand which category or categories will apply to a project. In particular, the distinction between a Repair and a Renovation can be difficult to discern. On the other hand, the fact that a project can be divided into components which will fall into different categories is highly advantageous. For this code to be truly successful, it must be clear what category or categories will apply to any given project.

The most glaring shortcoming of smart codes concerns their change of use requirements. It was hoped by many that these codes would facilitate the creation of affordable housing and the reuse of vacant buildings. As shown in Chapter 5, these codes may not make such reuse significantly easier or less costly. The failure of these codes to facilitate common changes of use is largely due to their reliance on hazard rating categories. It seems conceptually sound to use a system of hazard ratings to govern requirements for changes of use, but the categories themselves may require more careful tailoring.

It is also worth considering what types of projects are favored by smart codes. It may be that smart codes will have little impact on large commercial projects. These projects may involve so much renovation, regardless of code requirements, that lessening requirements will have little effect. In these cases, there may be little cost savings from the application of smart codes. It would be desirable to look for ways to further maximize cost savings on large projects without compromising safety. On the other hand, small residential projects are likely to be most affected by smart codes. This is of interest from a policy perspective because of the lack of tax credits for non-commercial uses of historic buildings. Tax credits can make reuse of historic buildings possible by helping to defray costs which are imposed partially by code requirements. If smart codes disproportionately reduce costs on small residential projects, this may amount to leveling the playing field and may result not in a preponderance of small projects, but a more equal mixture of projects.

The success of smart codes will be based largely on the degree to which code officials, architects, contractors, and preservationists understand, embrace, and refine them. Their application is not simple, and it will take time for practitioners to understand all of their potential advantages and to learn how to apply them most effectively.

The existence of multiple rehabilitation codes will have unpredictable effects. The existing model rehabilitation codes are all extremely similar. They are all based on the New Jersey Rehabilitation Subcode. While this similarity is preferable to a situation in

which widely differing models exist, it does present the possibility of needless complication. It would be preferable to unify the three major examples of rehabilitation codes into one code which could be maintained and modified to take into account the experience of communities which have implemented rehabilitation codes. The Subcode and NARRP are already so close to identical that it would not be difficult to merge them. There is more significant variation in the IEBC.

The primary differences between the two approaches regard categories of work and change of occupancy requirements. Each of the three codes defines the highest level of alteration differently. Each code takes a slightly different approach to regulating changes of use, though the resulting requirements of all three codes are very similar.

Whether the existence of competing codes is a help or hindrance is largely a question of philosophy. On the one hand, a single dominating code will encourage communities to use similar approaches to code enforcement, and will not encourage modifications to the model code. If this dominant code is well-constructed and does its job well, it may be desirable for it to be the only model. On the other hand, a competing code may offer innovations which will become an example for amendments to the dominant model code. It is relevant to consider the NFPA 5000 code for this reason. The consensus seems to be that the NFPA is more restrictive and goes further than the ICC code in attempting to protect property as well as life. If this assertion is accepted, it leads to the

conclusion that the influence of the NFPA may undermine some of the goals and philosophy of the IEBC and other smart codes.

The existence of the NFPA also points to a situation which has existed historically, in which building officials and fire officials may have different priorities regarding safety. This was cited as one of the reasons that Article 22 was not effective in Massachusetts; alternative means of compliance had to be approved by both code and fire officials. These officials often differed, and resolving these differences could slow a project or result in requirements as restrictive as the normal code requirements.

Smart codes have attracted relatively little criticism. This may be because they are still relatively new and little-known. Watts offers the most substantial criticism of smart codes. Watts finds several shortcomings for smart codes. While his points are well-considered, it is not clear that they apply to smart codes any more than to conventional codes. His proposal to use safety scoring in place of smart codes seems to misunderstand one of the primary goals of smart codes, which is to increase certainty and reduce the number of code issues left to the discretion of officials. Safety indexing may prove most valuable in situations where it is desirable to retain original fabric that does not meet even the more sympathetic requirements of smart codes. Safety indexing could be offered as an adjunct to smart codes in this case. Safety indexing would seem to be most valuable where changes of use are concerned.

Change of use requirements showcase the difficulty of making decisions regarding what is "safe enough" when constructing a code. Smart codes struggle with this issue. Buildings which are already in use as residences may be less safe than buildings which are converted to residential use without significant changes, and these buildings are subject to few triggered requirements when work is undertaken under smart codes. However, without attempting to evaluate the safety of individual changes of use, codes must set a standard. There must be a basis for comparison, and in this case the basis for comparison is not the building as it exists, but a newly-constructed building. There is a rational basis for this—since the building will be subject to a new use that presents a different set of hazards, it does not seem satisfactory to use the building as it exists as a baseline, as is done for lower categories of work. On the other hand, as shown by reconsidering "Turning on the Lights Upstairs" in the context of smart codes, the hazard category approach to changes of use may be problematic for adaptive reuse. This does not mean that this approach is conceptually flawed, but it may point to a need to further refine or revise the hazard categories.

Another major issue for changes of use is egress requirements. It is difficult to write prescriptive exit requirements which take into account the configuration of exits as well as the number of exits. In many of the buildings studied by "Turning on the Lights Upstairs," there are two stairs but they are so close together that it is questionable whether they represent a real improvement in safety over a single exit. Codes which do not account for this may create situations where a second exit is added for code

conformance but does not appreciably improve egress because it is located where it is easiest to construct, rather than where it would be most effective.

Today's smart codes are no doubt having a positive impact, but it has not yet been well-quantified. Given the long and ineffective history of code reform, the advent of smart codes is a welcome breakthrough, even if they still present problems. Some of these problems will be solved as experience is gained with smart codes and their problems become apparent. Other problems are far more difficult, and get to the root problem of all building codes: how safe is safe enough, how is "safe enough" measured, and how can it be ensured given our inability to measure it quantitatively?

APPENDIX A: GLOSSARY OF ACRONYMS

AIA- American Institute of Architects

Article 22- Article 22 of the Massachusetts Building Code. Later redesignated Article 34.

BOCA- Building Officials Code Administrators

Chapter 15- Chapter 15 of the NFPA 5000

Chapter 34- Chapter 34 of the BOCA building code, or of the international building code

HUD- The Federal Department of Housing and Urban Development

IBC- International Building Code

ICBO- International Conference of Building Officials

ICC- International Code Council

IEBC- International Existing Building Code

NARRP- Nationally Applicable Recommended Rehabilitation Provisions

NFPA- National Fire Protection Agency

NFPA 5000- The National Fire Protection Agency's model building code

SBCCI- Southern Building Code Congress International

SOI- Secretary of the Interior

UCBC- Uniform Code for Building Conservation

APPENDIX B: COMPARATIVE MATRICES

Regulations governing changes of use			
Requirement	NJ Subcode	NARRP	IEBC
Number of exits	Must meet requirements of the IBC	For change to higher hazard rating subject to requirements for new construction. For equal or lower rating, subject to requirements for reconstruction. Generally, no single exits over two stories.	No specific requirements or exceptions. See means of egress.
Means of egress	Change to higher hazard category subject to IBC requirements, except dimensional requirements.	Change to higher hazard rating subject to requirements for new construction, except dimensional requirements	Change to higher hazard category subject to IBC requirements, except dimensional requirements.
Sprinkler requirements	Change to higher hazard rating is subject to requirements for reconstruction. This requires sprinklers in most cases.	As per reconstruction requirements for the new use. Sprinklers required in most uses.	As per IBC. Sprinklers required in most cases.
Stair enclosures	Change to higher hazard category requires enclosure as per reconstruction	Change to higher hazard category subject to requirements for new construction, unless floors separated by 1-hour fire barrier and corridors sprinklered.	Change to higher hazard category subject to requirements of the IBC, unless floors separated by 1-hour fire barrier and corridors sprinklered.
Fire-rated construction	Lath and plaster acceptable where 1-hour fire rating is required.	Lath and plaster acceptable where 1-hour fire rating is required.	Lath and plaster acceptable where 1-hour fire rating is required.

Comparison of category definitions and requirements of major smart codes					
New Jersey		NARRP		IEBC	
Category name and definition	Requirements	Category name and definition	Requirements	Category name and definition	Requirements
Repair- return existing elements to good condition with like materials	Prohibits specific dangerous materials	Repair- return existing elements to good condition with like materials	Prohibits specific dangerous materials	Repair- return existing elements to good condition with like materials	Similar to NJ and NARPP, with more extensive structural requirements.
Renovation- replacement or extensive repairs not involving reconfiguration of space.	Replacements must conform to materials and methods of code for new buildings	Renovation-"Extensive repairs" Distinction to be made by code official	Structural and seismic requirements more stringent than NJ. New elements must conform to access requirements for new buildings. Some uses must meet egress requirements for new construction.	Alteration 1- extensive repairs not involving reconfiguration of space.	Similar to NJ and NARPP, with more stringent egress and sprinkler requirements.
Alteration- Renovations involving reconfiguration of space.	Configuration of space and egress elements may not be made less conforming	Alteration- Renovations involving reconfiguration of space, but less than 50% of the building.	Egress requirements for new buildings must be met.	Alteration 2- Renovations involving reconfiguration of space.	Similar to NJ and NARPP, requirements for accessibility, structure, and egress. More likely to require sprinklers.
Reconstruction- Alterations so extensive that work area cannot be occupied and a new certificate of occupancy is required	Reconstruction requirements contain specific basic and supplemental requirements for various uses, with focus on egress and fire safety	Reconstruction- Alterations involving reconfiguration of shared space or exits, or alterations over more than 50% of the building.	May trigger requirements over entire floor. Requirements similar to NJ, but less use-specific	Alteration 3- Alterations involving more than 50% of the building	Broadly similar to NJ and NARPP, but refers to code for new construction for requirements rather than defining basic and supplemental requirements.
Change of Occupancy	Requirements minimal if new use is of equal or lower hazard rating. Extensive requirements for changes to higher hazard rating	Change of Occupancy	Similar to NJ. Differences are due to references to code for new construction. Less reliance on hazard ratings, requirements based more on new use.	Change of occupancy	Similar to NARRP. Little reliance on hazard ratings.
Addition	Requirements same as new construction	Addition	Requirements same as new construction	Addition- Requirements same as new construction	Requirements same as new construction

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