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REPORT

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Executive Summary

Both Pennsylvania (Department of Labor and Industry) and New Jersey (Division of Codes and Standards, Department of Community Affairs) have adopted statewide mandatory codes applicable to the new construction and rehabilitation of commercial buildings, as shown in Summary Table 1. In Pennsylvania the codes may be locally amended and are enforced by local government in jurisdictions that have "opted in", or by the Department of Labor and Industry in jurisdictions that have "opted out". Most Pennsylvania jurisdictions have "opted in", and some of them have contracted with private third parties for enforcement plan reviews and inspections. In New Jersey the codes cannot be locally amended and are enforced by local governments with some private contracting of inspections.

Summary Table 1.
Building Regulations Applicable to Commercial Buildings in Pennsylvania and New Jersey.

	Pennsylvania	New Jersey
New Construction	*International Building Code* 2009 *International Energy Conservation Code* 2009 Other I-codes	*International Building Code* 2009 ASHRAE 90.1-2007 Other I-codes
Rehabilitation	*International Existing Building Code* 2009	*Rehabilitation Subcode*

Pennsylvania and New Jersey present a picture of what may be the two extremes in the regulations governing energy efficiency retrofit of commercial buildings. This becomes evident based on a summary of the development of building regulations in the United States, and the development of "smart rehabilitation codes" in the late 1990s. New Jersey led the development of smart rehabilitation codes with its *Rehabilitation Subcode* in 1998. It was based on the concept of achieving **predictability** and **proportionality** in the requirements applicable to construction work in existing buildings.

Initially it was thought that the New Jersey approach, supported by the US Department of Housing and Urban Development (HUD) with its Nationally Applicable Recommended Rehabilitation Provisions (NARRP), would become a national model through the development of the *International Existing Building Code* (IEBC) in 2003, but subsequent amendments in 2006, 2009 and 2012 have moved the IEBC away from proportionality, and, to some extent from predictability.

New Jersey has maintained its *Rehabilitation Subcode* while Pennsylvania applies the 2009 edition of the IEBC. What this means for the regulation of energy retrofit in existing commercial buildings is that in New Jersey the requirements are limited, predictable, and well-defined. In Pennsylvania the energy retrofit requirements are unpredictable, subject to discretion of the regulators, and may be more or less extensive. In the case of alterations, Pennsylvania requires alterations to comply with the new building requirements of the *International Energy Conservation Code*, with eight specific exceptions, while New Jersey requires compliance with American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE 90.1) in four specific alterations. In the case of change of occupancy, Pennsylvania requires full compliance with the *International Energy Conservation Code* when the change involves increase in the use of fossil fuel or electrical energy, while New Jersey has no requirements applicable to a change of occupancy. Summary Table 2 displays a summary of energy conservation retrofit regulations for commercial buildings in Pennsylvania and New Jersey.

Summary Table 2.
Energy Conservation Retrofit Regulations for Commercial Buildings in Pennsylvania and New Jersey.

	Pennsylvania	New Jersey
Governing Codes	*International Energy Conservation Code* *International Existing Building Code*	*Rehabilitation Subcode* ASHRAE 90.1
Enforcement Basis	Judgment/unpredictable: Specific exceptions for alteration compliance with new building requirements may be ambiguous as to what is required, and commentary in the *International Existing Building Code* addresses reconfiguration of space which is not mentioned as an alteration in the *International Energy Conservation Code*.	Prescriptive/predictable: Four specific alterations require compliance with new building requirements.
Alterations	Alterations to existing buildings are permitted without requiring the entire building to comply with the energy requirement of the *International Energy Conservation Code*. The alterations shall conform to the energy requirements of the *International Energy Conservation Code*. There are eight of specific exceptions. In certain cases where the reconfiguration of space might have resulted in creation of new spaces, the newly created space should be evaluated as a whole for compliance with the energy provisions, even though some of the elements within the space might actually not have been altered.	⅄ When the work exposes the roof decking/sheathing or the framing of any wall, floor, ceiling, or roof assembly that is part of the building thermal envelope . ⅄ When fenestration is newly installed or replaced. ⅄ Ducts that are newly installed or replaced. ⅄ The total replacement of a building lighting system or a newly installed building lighting system.
Change of Occupancy	Buildings undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with the *International Energy Conservation Code* for the new occupancy.	No requirements for the new occupancy.

A. Building Regulations—General Background

The regulation of building construction in the United States is an exercise of government police power, and with very few exceptions (e.g., accessibility for the disabled and manufactured housing), it is legislated at the local or state government levels. It traditionally has been accomplished by means of a set of inter-related codes, each addressing a specific building system or a specific building attribute. While these codes may be packaged in different ways in different jurisdictions, they generally can be described as follows:

- A building code that addresses the building's structural system, fire safety, general safety, enclosure, interior environment, and materials.
- A plumbing code that addresses the building's potable water supply and waste systems.
- A mechanical code that addresses the building's combustion and mechanical equipment.
- An electrical code that addresses the installation of electrical wiring and equipment in buildings, and a gas code that does the same with respect to the installation of gas piping and gas-burning equipment.
- An energy code that addresses all parts of the building that consume, or contribute to the consumption of energy.
- Other specialty regulations, such as an accessibility code, that addresses building accessibility to the physically disabled.

Because of the technical complexity of these codes and the time and money needed to keep them updated, most state and local governments have abandoned the development and maintenance of their own codes, and rely on adoption (with or without amendment) of a model code (developed by a regional or national association). All of these codes make use of extensive references to voluntary consensus standards on design methods, test methods, materials, and systems. By reference, these standards become part of the building regulatory system. These codes typically are enforced at the local level in a process that begins with the application for a building or construction permit, and followed by plan review, permit issuance, inspections, and certificate of occupancy issuance.

A related but different set of regulations that sometimes are packaged together with the above-described measures are those that control the use and maintenance of existing buildings. Parts of these codes sometimes may overlap with the plumbing, mechanical, or electrical codes, such that some aspects of operation and maintenance are included therein. They generally can be described as follows:

- A fire prevention code, sometimes called a fire code, which regulates the building's fire safety throughout its occupancy and use.
- A housing code that regulates the health and sanitation of residential buildings throughout their occupancy and use.

- A property maintenance code that expands the scope of the housing code to include other types of buildings.
- A hazard abatement code that identifies building conditions that are so hazardous that immediate remedial action may be required.

These codes are generally enforced at the local level by means of periodic inspections and citation of violations.

A third category of building regulation is referred to as retroactive regulations. These generally address hazards in existing buildings that, while not necessarily imminent, are identified by society as needing remediation. Some examples of such regulation are the enclosure of open stairs in public buildings, the installation of sprinklers, the reinforcement of unreinforced masonry buildings in zones of high seismicity, and the stabilization of exterior wall finishes in high-rise buildings. Due to the extremely high costs imposed by such regulations on building owners, retroactive regulations are quite rare and local in nature.

Historical Development

The current building regulatory system in the U.S. is the product of several diverse trends. When viewed in a historical perspective, it may be thought of (somewhat allegorically) as resting on four foundations, and as supported by three buttresses. The foundations include the:

- Insurance industry
- Tenement and housing movements
- Engineering profession
- Construction industry

The buttresses are the:

- Federal government
- Model codes groups
- Voluntary standards organizations

The Insurance Industry. In the 19th century, the insurance industry was the regulator of fire safety in buildings, with an institutional framework created to regulate, as well as to provide research and technical support. For over the past half century, the regulation of fire safety in buildings has been a function of state or local governments, while some of those originally

insurance-related organizations continue to perform regulatory support functions to this day: the National Board of Fire Underwriters (today called the American Insurance Association); the National Fire Protection Association (NFPA); and Underwriter Laboratories. The early concerns of these organizations were related to property risk and the risk of conflagration. Concern for life safety became articulated and institutionalized in 1913. It was the National Board of Fire Underwriters that developed and published in 1905 the first model building code in the U.S.: the *National Building Code,* which also included housing and structural requirements in addition to fire safety, and continued to be updated and published until 1976.

The insurance industry also was the earliest regulator of electrical safety in building, where the diversity of early local regulations was overcome when many entities came together to create the first *National Electrical Code* in 1897 in a conference that anticipated in some ways today's consensus processes. The *National Electrical Code* has been periodically updated to this day, and has been published exclusively by NFPA since 1965.

Today, in addition to the continued activities of the early organizations, other insurance industry organizations continue to be active in the building regulatory arena. The Institute for Business and Home Safety (IBHS) was created specifically to support the development of regulations in the natural disaster areas of earthquakes, hurricanes, and floods. The Insurance Services Offices (ISO) evaluates building code enforcement programs in states and local jurisdictions throughout the U.S., and provides relative ratings to assist insurance underwriting.

The Tenement and Housing Movements. These movements arose in various U.S. cities toward the end of the 19th century in response to blatantly unhealthy housing conditions. Charitable organizations were established, and many of them joined to form the National Housing Association in 1900 to press for housing reform. Tenement laws developed in American cities in the second half of the 19th century, and in the early years of the 20th century began to reflect these concerns by regulation of health and sanitation, as well as the fire protection aspects of housing. The New York Tenement House Act of 1901 served as a model for many other cities.

Tenement laws also were included in the 1905 *National Building Code*. Since 1939, the American Public Health Association (APHA) has been concerned with housing standards, and usually is credited with development of the prototype for modern housing codes, as well as the health and sanitation requirements in model building codes (including room dimensions and arrangements). In recent years, the latter have been reduced in scope, based on the assumption that they were provided for adequately by the marketplace.

The Engineering Profession. Civil and structural engineering provided the foundation for the structural requirements of building regulations. By the second half of the 19th century, structural analysis and design methods had been developed for various structural materials. These were accepted by a consensus of the profession and were incorporated into early city building codes

and the 1905 National Building Code. In more recent years, engineering associations have been involved in developing consensus standards for structural design (American Society of Civil Engineers (ASCE)), mechanical codes and standards (American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and American Society of Mechanical Engineers (ASME)), and plumbing codes and standards (American Society of Plumbing Engineers (ASPE)).

The Construction Industry. The construction industry always has had a vital interest in building regulations, often as a way of furthering—and at other times, limiting—the use of certain materials and construction trades. Perhaps the industry's strongest influence can be seen directly in the plumbing codes, though self-serving provisions can be found in all the codes. Plumbing codes developed early at the local level. The earliest on record is that of Washington, DC, in effect in 1870. Since its organization in 1883, the National Association of Master Plumbers had been concerned with plumbing codes. Nevertheless, extreme diversity reflecting local practices and conditions typified the early plumbing codes.

The National Association of Master Plumbers itself did not publish a model plumbing code until 1933. The National Association of Plumbing-Heating-Cooling Contractors, successor to the National Association of Master Plumbers, has been publishing the *National Standard Plumbing Code*, which is used in many jurisdictions, since the 1970s.

The Federal Government. The federal government has played two roles in buttressing the current building regulatory system: provider of technical expertise and formulator of national policies.

As a provider of technical expertise, the National Institute of Standards and Technology (NIST) (formerly the National Bureau of Standards (NBS)), has played a paramount role. Starting with the testing of materials and structural systems in the early part of the 20th century, NIST's role has expanded. Most of the publications of NBS' unique Building and Housing Series from 1921 to 1932 directly addressed the regulatory system (building code organization and format, structural provisions, fire resistance provisions, and a model plumbing code—the "Hoover Code" of 1928). These have had great influence on subsequent modern codes. Since then, NIST has continued to develop technical materials in various areas directly usable by the building regulatory system. Today, NIST provides leadership to, or participation in, multiple voluntary standards activities at the American Society for Testing and Materials (ASTM) International, NFPA, ASHRAE, ASCE, and other voluntary standards organizations that support the regulatory system.

As a formulator of national policies, various federal agencies have often interfaced with building regulations or influenced them directly. Notable in this capacity is the U.S. Department of Housing and Urban Development (HUD), which developed its own *Minimum Property*

Standards for underwriting its mortgage insurance programs, and has pressed for the widespread adoption of building and housing codes and code reform, as well as specific provisions. These include accessibility in housing, lead-based paint regulations, and, most recently, codes related to rehabilitation (rehabilitation codes). The Federal Consumer Product Safety Commission (CPSC) has developed safety standards that have been incorporated in building codes (for example, safety glazing). The U.S. Department of Energy (DOE) has been a strong advocate for the development of energy codes. The Federal Emergency Management Agency (FEMA) developed and administers the Federal Flood Insurance Program, many provisions of which have been incorporated in building codes, and FEMA's National Earthquake Hazards Reduction Program (NEHRP) has provided the impetus for current seismic provisions in the building codes. Federal regulations governing manufactured housing are described shortly.

The Model Code Groups. The original three regional model code groups, Building Officials and Code Administrators International (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International (SBCCI), were established as professional associations of building officials and code enforcement personnel (BOCA primarily in the Northeast and Midwest, ICBO primarily in the West, and SBCCI primarily in the Southeast). The impetus for these organizations to enter the code development field, in which they have been predominant for the past 50 years, was provided by the increasing difficulty for state and local governments to develop and maintain technically complex building codes, the recognized need for uniformity in building codes and code enforcement methods, as well as encouragement from industry and government. BOCA was founded in 1915 and published its first model building code, the Basic Building Code, in 1950. ICBO was founded in 1922 and published its first model code, the Uniform Building Code, in 1927. SBCCI followed shortly thereafter, with the publication of the Standard Building Code in 1945.

Until the 1990s, when the three regional groups joined together, each of these organizations published and updated comprehensive suites of model building regulations, including building, plumbing, mechanical, housing, fire prevention, and other related requirements. Amendments to the model codes could be proposed annually by anyone with an interest or stake in building design and construction. These amendments would be heard and debated before code change committees, and ultimately would be voted for approval or denial by the membership representing federal, state, and local governments. Supplements to the model codes were published annually, and a revised edition of the model codes was published every three years. These model codes typically would be adopted, with varying degrees of amendment and modification, as regulations by states or local jurisdictions in their respective geographic regions (with some notable exceptions).

In the 1990s, the three regional model code groups merged into the International Code Council (ICC) and the ICC began the production a single family of codes: the International, or I-codes. The first set of I-codes was promulgated in 2000. In 2003 a new code applicable to work in

existing buildings was added to the set of I-codes, the *International Existing Building Code* (IEBC), which is discussed in the next section. Since then, states and local jurisdictions have begun adopting them in place of one of the three (originally four) models previously developed. The process for developing and modifying the I-Codes is much the same as that used by the three regional model code groups. In other words, amendments can be proposed by a variety of interested parties; code change committees and the membership at large then review these proposed changes. Table 1 provides and overview of the I-codes regulation of new construction and rehabilitation as of 2003.

Table 1.
Overview of the I-Codes Regulation of New Construction and Rehabilitation (2003)

	International Building Code (IBC) 2003	*International Existing Building Code* (IEBC) 2003
New Construction	Applicable to all buildings.	N.A.
1 & 2 Family Housing and Town Houses	Reference to *International Residential Code* (IRC) for conventional wood frame construction.	
Commercial Buildings (including multiple-family housing)	Compliance with fire safety, structural load, and materials standards.	
Existing Buildings	Chapter 34, applicable to repairs, alterations, additions, and change of occupancy (unless IEBC adopted)	Alternative to IBC chapter 34, applicable to all building undergoing repairs, alterations, additions, and change of occupancy. Based on NARRP (see next section) with added requirements, and specific references to IBC.

The Voluntary Consensus Standards Organizations. Finally, the building regulatory system is buttressed by the voluntary standards consensus process, which develops and updates the numerous standards referenced in every building code. The organizations involved in this process include ASCE, ASTM, ASHRAE, and NFPA, to name but a few. These organizations establish committees to develop and maintain specific standards. Standards can be proposed by anyone with an interest or stake in building design and construction. They are debated in the committees and voted on in a process that attempts to ensure balance among the various stakeholders (e.g., producers, consumers, and general interest).

B. Development of Smart Rehabilitation Codes

Recent policy initiatives at the federal, state and local levels have been directed at managing uncontrolled urban growth. A central feature of these initiatives is the development of methods to encourage the revival and reuse of existing neighborhoods and buildings. These policy initiatives have come to be known as "smart growth". "Smart growth" programs have produced an arsenal of tools to accomplish their goals. These have included:

- Zoning that encourages urban infill and reuse of sites and buildings.
- Enterprise zones that attract investment to inner cities.
- "Brown-fields" development that provides for the reuse of abandoned industrial sites.
- Mass transit and transportation planning.
- "Smart codes".

"Smart codes" is the term used to describe building and construction codes that encourage the alteration and reuse of existing buildings. It sometimes also refers to the other zoning and regulatory statutes that affect building, but for the sake of clarity this document discusses building codes only. "Smart codes" were developed because the building regulatory system in the US, including building codes, is a significant impediment to investments in the alteration and reuse of existing buildings. This has led to a complete re-thinking of how existing buildings should be regulated.

HUD's 1998 study entitled *A National Survey of Rehabilitation Enforcement Practices* concluded that the regulation of design and construction in existing buildings in many communities in the US was non-uniform (in that requirements placed on similar projects differed from community to community, and in the same community over time), unpredictable (in that requirements were unknown to building owners in advance), and arbitrary (in that there was no apparent basis for requirements imposed).

Building or construction codes generally were and continue to be oriented to the design and construction of new buildings. For example, of the 35 chapters and nearly 700 pages of the *International Building Code* (IBC) 2000, only Chapter 34 and its 14 pages addressed existing buildings. In many cases this disproportionate consideration of existing buildings forces building owners and builders to rely on the discretion and judgment of the code official.

The IBC 2000 and previous model codes addressed four categories of work in existing buildings: repairs, alterations, additions, and change of occupancy. IBC 2000 defined "Alteration" as "any reconstruction or renovation to an existing structure other than repair or addition". This definition covers a wide range of work, from the addition of plumbing fixtures or electrical circuits to "gut rehab". The code specified that alterations must comply with the requirements of the code for new construction, and that alterations shall not cause the existing building "to be in

violation of any provisions of this code". While these requirements may seem clear and unambiguous, there is great diversity among communities in the U.S. on how to apply them. Earlier model codes applied a so-called "25-50 percent rule" that related the extent of requirements to the ratio of the cost of the alteration to the value of the existing building. When this ratio exceeded 50 percent, the entire building had to be brought into compliance with the code for new construction, and when the ratio was between 25 and 50 percent, the building official determined the extent of building improvement. While this requirement was dropped from the model codes in the 1980s, HUD reported in the 1998 study mentioned above that 38 percent of surveyed jurisdictions still used such a trigger, and another 16.4 percent stated that while they do not have such triggers, they are useful rules-of-thumb.

With respect to change of occupancy, The building code classifies all buildings into specific categories called occupancy classifications. The adaptive re-use of existing buildings often involves changing from one occupancy classification to another. Earlier model codes promulgated by BOCA, SBCCI and ICBO required that an existing building in which the occupancy classification is changed should be brought into compliance with all provisions of the code for new construction, or with the "intent of the code" for new construction. Section 3405.1 of the IBC 2000 reads as follows: "No change shall be made in the use or occupancy of any building that would place the building in a different division of the same group of occupancy or in a different group of occupancies, unless such building is made to comply with the requirements of this code for such division or group of occupancy. Subject to the approval of the building official, the use or occupancy of existing buildings shall be permitted to be changed and the building is allowed to be occupied for purposes in other groups without conforming to all the requirements of this code for those groups, provided the new proposed use is less hazardous, based on life and fire risk, than the existing use." No guidance is provided in the code on how to conduct the implied "life and fire risk" analysis. The result is more diversity among communities as to what requirements apply.

These definitions have remained in Chapter 34 of the subsequent editions of the IBC. This results in a lack of predictability and in arbitrariness, both of which deter investment in existing buildings.

The New Jersey Rehabilitation Subcode. The most significant reform in the regulation of work in existing buildings, and "smart code" development, happened in New Jersey with the adoption of the *New Jersey Uniform Construction Code—Rehabilitation Subcode* in January 1998. Prior to that, New Jersey enforced an earlier edition of the BOCA code that included the 25-50 percent rule, and the requirement that in any change of occupancy the building had to be brought up to compliance with the code for new construction. The new subcode was developed because it was recognized that the then current code was constraining the re-use of older buildings in New Jersey.

Three criteria were defined for the new system in New Jersey:

- Timeliness of processing and enforcement (i.e., most projects should be handled routinely rather than as special cases).
- Predictability (i.e., people should know the law applicable to them and be free from arbitrary treatment).
- Reasonableness (i.e., provide a reasonable level of safety without imposing excessive additional costs).

The *Rehabilitation Subcode* that was developed to meet these criteria reflected a true paradigm shift in the regulation of alteration work in existing buildings. It takes the rather broad building code definition of "alteration" and splits it up into three well-defined categories of work in progressive increase of complexity:

- Renovation——defined in general as work involving no reconfiguration of spaces in the building.
- Alteration——defined in general as work involving reconfiguration of spaces.
- Reconstruction——defined as work so extensive that the work area cannot be occupied during the work.

Another element of the paradigm shift was the creation and definition of the term "work area". Both innovations go a long way toward achieving predictability and reasonableness. Progressively more complex rehabilitation work entails progressively more extensive additional required life safety improvements. Reasonableness is achieved by establishing proportionality between the voluntary work proposed by the owner and the additional work imposed by the regulatory system.

The *Rehabilitation Subcode*'s approach to change of occupancy in an existing building established multiple hazard scales, and a change of occupancy that involves an increase in hazard on one or more of the scales triggers specific additional requirements to address the added hazard.

The *Rehabilitation Subcode* has been in place in New Jersey for over 15 years, and it is serving its purpose. The State reported that investment in building rehabilitation in cities such as Trenton, Newark and Elizabeth had increased substantially due to the code.

The Nationally Applicable Recommended Rehabilitation Provisions (NARRP). HUD published the *Nationally Applicable Recommended Rehabilitation Provisions*, or NARRP, in May 1997. The NARRP set out to adapt the innovations and principles of the New Jersey *Rehabilitation*

Subcode into a model rehabilitation code that could be used by other states and local jurisdictions.

The NARRP were developed by HUD to serve as a model. The Foreword to the NARRP states:

> "These provisions are intended to be suitable for use by State and local jurisdictions or model code organizations with a minimum of adaptation."

The Introduction expands on this:

> "[T]he NARRP are being developed for HUD with the expectation that they will be made available to interested state and local government agencies and offered for consideration by the ICC in resolving the rather extensive differences among the three current versions of Chapter 34."

There are many similarities between the New Jersey *Rehabilitation Subcode* and the NARRP. The key paradigm shift happened in New Jersey, and the NARRP was beholden to New Jersey in adopting the concepts. The NARRP condensed New Jersey's three criteria into two: **predictability** and **proportionality**. It achieves predictability and proportionality by borrowing four concepts from New Jersey each of which is discussed briefly below.

Categories of work

The model codes addressed and continue to address work in existing buildings under four categories:

- Repair
- Alteration
- Addition
- Change of occupancy

Following New Jersey, the NARRP expands "alteration" into three further categories, resulting in the following six categories:

- Repair
- Renovation—defined, as in New Jersey, as work involving no reconfiguration of spaces in the building
- Alteration—defined, as in New Jersey, as work involving reconfiguration of spaces or extension of plumbing, mechanical or electrical systems
- Reconstruction—defined, unlike in New Jersey, as work involving reconfiguration of spaces including corridors and exits
- Addition
- Change of occupancy

This categorization provides predictability, in that the respective requirements are known at the start. It provides proportionality, in that requirements are proportional to the extent of the intended work. Work in each category is addressed by a separate chapter of the NARRP.

Work area

Work area is defined in the NARRP as "that portion of a building affected by any renovation, alteration or reconstruction work as initially intended by the owner…"

The concept of work area provides predictability by specifying exactly where requirements are imposed by the NARRP. It also provides proportionality by its use in defining the applicability of "supplemental requirements" when there is extensive reconstruction.

Hazard category scales

The NARRP establishes four hazard category scales for classifying building occupancies. In this it differs from the New Jersey *Rehabilitation Subcode*, which has six. These differences are not significant.

The NARRP scales are as follows:

- Life safety and Exits (five hazard categories)
- Heights and Areas (four hazard categories)
- Exposure of Exterior Walls (four hazard categories)
- Seismic (six hazard categories)

The NARRP hazard scales provide predictability by clearly relating specific requirements to specific increased hazards in the existing buildings.

Supplemental requirements

Supplemental requirements are triggered in the NARRP when reconstruction work is extensive. When the reconstruction work area exceeds 50 percent of the area of the floor, the NARRP extends some life safety improvements to the entire floor. When the total of reconstruction work areas in a building exceed 50 percent of the building area, the NARRP extends these life safety improvements to the entire building, up to the highest work area floor.

The concept of *supplemental requirements* provides predictability by specifying exactly where these additional requirements are imposed by the NARRP. It also provides proportionality by determining the extent of additional life safety improvements.

The NARRP began to meet the stated intent of serving as a model. The following discussion covers some high points.

NARRP as a Model.

Maryland Building Rehabilitation Code

In 1999 the Governor of Maryland initiated a policy of "smart growth/smart codes". The State opted to use the NARRP as the basis for developing a new *Maryland Building Rehabilitation Code* (MBRC). It then initiated intense activity that resulted in the publication of the new code in the Code of Maryland Regulations in December 2000. The MBRC took effect on June 1, 2001.

Other Jurisdictions that Considered the NARRP

Soon after publication of the NARRP The following jurisdictions undertook the development of a rehabilitation code, or considered such an undertaking:

- Wichita
- State of New York
- State of Rhode Island
- Kansas City

The International Existing Building Code (IEBC). In late 1999, the International Codes Council (ICC) created a drafting committee for a new code to be called the *International Existing Building Code* (IEBC). Among other resource documents, the drafting committee considered both the New Jersey *Rehabilitation Subcode* and the NARRP. For this purpose, the NARRP was revised to be compatible with terminology and requirements of the IBC. HUD supported this effort.

The IEBC was first published in 2003, and was intended as an alternative to the provisions of Chapter 34 of the IBC. It has subsequently been republished in 2006, 2009, and 2012 editions.

Chapters 3-11 of IEBC 2003 were mostly similar to the NARRP and the *Maryland Building Rehabilitation Code.* They included the six **categories of work**, but substituted Alteration Level 1, Alteration Level 2, and Alteration Level 3 for NARRP's Renovation, Alteration, and Reconstruction respectively. They included the **work area** concept much as it was used in the NARRP and the New Jersey *Rehabilitation Subcode*. They included the **supplemental requirements** triggered when the work area exceeded specified limits. They included the first three of NARRP's **hazard scales** for establishing change of occupancy requirements, and had similar seismic requirements.

Chapter 12 of IEBC 2003, entitled Compliance Alternatives, was essentially a duplication of Section 3410 of the IBC. This alternative approach reviews all the fire and safety features of the building and uses a point or score approach to determine the adequacy of of the building's fire and life safety systems. The structural safety parameter of this method is somewhat confusing in that it specifies full compliance with the IBC.

IEBC 2003 deviated from the NARRP, the New Jersey *Rehabilitation Subcode*, and the *Maryland Building Rehabilitation Code* in several significant ways:

1. It dropped the stated objective of encouraging the reuse of existing buildings, and substituted the "purpose of this code is to establish the minimum requirements to safeguard the public health, safety, and welfare insofar as they are affected by the repair, alteration, change of occupancy, addition and relocation of existing buildings".
2. It required compliance with the IBC flood requirements when the cost of rehabilitation equals or exceeds 50% of the market value of the building before the rehabilitation, defined as "substantial improvement".
3. It added requirements to the change of occupancy section.

See Table 2 for summaries and comparisons of the New Jersey *Rehabilitation Subcode*, The NARRP, IBC Chapter 34, and IEBC 2003.

Table 2

	New Jersey *Rehabilitation Subcode*	**NARRP**	**IBC Chapter 34**	**IEBC 2003**	**Cost Impact**
Applicability	All work in existing buildings.	All work in existing buildings.	All work in existing buildings, unless IEBC is adopted.	All work in existing buildings, if adopted.	
Format	Bulk of the subcode addresses reconstruction & is organized by occupancy classification.	Chapters organized by rehabilitation category of work.	Small chapter organized into sections.	Chapters organized by rehabilitation category of work.	Some argue NJ format more user-friendly.
Repairs	Repairs may be made using like materials, except for limited number of plumbing & electrical repairs, & replacement glass must comply with safety glazing requirement.	Repairs may be made using like materials, except for limited number of plumbing & electrical repairs, & replacement glass must comply with safety glazing requirement.	No specific regulation, except that replacement glass must comply with all new construction requirements.	Repairs may be made using like materials, except for limited number of plumbing & electrical repairs, & replacement glass must comply with safety glazing requirement. New construction	IEBC may have significant cost impact for repair of structural damage. Others are essentially the same.

	New Jersey *Rehabilitation Subcode*	NARRP	IBC Chapter 34	IEBC 2003	Cost Impact
				structural requirements are triggered as a function of the extent of repair of structural damage.	
Alterations	Divided into 3 categories as a function of the extent & nature of the work: - Renovation - Alteration - Reconstruction Requirements increase respectively. At lower end existing condition that violate the building code may be continued, but not made worse. Reconstruction triggers specified life safety improvements within the work area, & when the work area exceeds specified percentages, the life safety improvement extend beyond the work are to other parts of the building.	Divided into 3 categories as a function of the extent & nature of the work: - Renovation - Alteration - Reconstruction Requirements increase respectively. At lower end existing condition that violate the building code may be continued, but not made worse. Reconstruction triggers specified life safety improvements within the work area, & when the work area exceeds specified percentages, the life safety improvement extend beyond the work are to other parts of the building.	Alterations must conform to new construction requirements & not cause building to be in violation of code. Parts of building not affected by alteration not required to comply, except "substantial improvements" to buildings in flood plane trigger full compliance with flood design requirements for new construction. Nonstructural alterations may be made using same materials if no adverse effect on structural member of fire-resistance.	Divided into 3 categories as a function of the extent & nature of the work: - Alteration Level 1 - Alteration Level 2 - Alteration Level 3 Requirements increase respectively. Levels 2 and 3 trigger specified life safety improvements within the work area, & when the work area exceeds specified percentages, the life safety improvement extend beyond the work are to other parts of the building. "Substantial improvements" to buildings in flood plain trigger full compliance with flood design requirements for new construction. Extensive structural upgrades triggered by structural damage.	IBC Ch.34 not predictable; other 3 are. IBC and IEBC apply FEMA's "substantial improvements" trigger, & will have significant cost impact in the flood plane. IEBC has extensive cost impact from its structural damage repair requirements.
Additions	Additions must conform to new construction requirements & not create or extend a nonconformity. Existing building plus addition to comply with	Additions must conform to new construction requirements & not create or extend a nonconformity. Existing building plus addition to comply with	Additions must conform to new construction requirements & not create or extend a nonconformity. Existing building plus addition to comply with heights	Additions must conform to new construction requirements & not create or extend a nonconformity. Existing building plus addition to comply with heights	Essentially the same, except NJ and NARRP allow up to 25% increase in allowable area for 1- and 2-story buildings.

	New Jersey *Rehabilitation Subcode*	NARRP	IBC Chapter 34	IEBC 2003	Cost Impact
	heights & areas requirements, with up to an addition 25% for 1- and 2-story buildings.	heights & areas requirements, with up to an addition 25% for 1- and 2-story buildings.	& areas requirements.	& areas requirements.	
Change of use	Use groups categorized into 6 hazard category tables. Compliance with selective requirements based on specific increases in hazards. Minimal requirements when hazards equal or reduced in all categories. New construction structural live load must be met when moving to a higher hazard category.	Use groups categorized into 4 hazard category tables (including seismic). Compliance with selective requirements based on specific increases in hazards. Minimal requirements when hazards equal or reduced in all categories. New construction structural (wind & snow) when moving to a higher importance factor.	Buildings must comply with all the new construction requirements for the new occupancy. Building official may accept less provided the new use is less hazardous "based on life and fire risk".	Use groups categorized into 3 hazard category tables (not including seismic). Compliance with selective requirements based on specific increases in hazards. Minimal requirements when hazards equal or reduced in all categories. New construction structural (wind & snow) when moving to a higher importance factor except when the change is to less than 10% of building area. Seismic requirements similar to NARRP with a few more exceptions.	IBC not predictable. The rest are essentially the same.
Compliance alternatives	Owners may request a variation when compliance would result in practical difficulties.	Equivalent alternatives may be authorized by building official. Other alternatives may be accepted if compliance is infeasible.	Section 3410 provides a safety scoring system for 18 parameters.	Equivalent alternatives may be authorized by building official. Chapter 12 reproduces Section 3410 of the IBC as an alternative.	NJ and NARRP allow for "infeasibility" alternatives.
Historic buildings	Special variations may be granted to historic buildings when compliance will damage historic fabric.	Alterations and change of use may comply with reduced requirements based on filing a report demonstrating that compliance will damage historic	Alterations and change of use regulations do not apply if building official judges them "to not constitute a distinct life safety hazard".	Alterations and change of use may comply with reduced requirements based on filing a report demonstrating that compliance will damage historic	All are essentially the same technically, but may vary in terms of administrative requirements for submissions.

	New Jersey *Rehabilitation Subcode*	**NARRP**	**IBC Chapter 34**	**IEBC 2003**	**Cost Impact**
		fabric.		fabric.	
Retroactive regulations	Not in scope of the subcode, but recognizes currently existing fire code, housing code, and other retroactive regulations.	Not in scope of the NARRP, but recognizes currently existing retroactive regulations.	Compliance with Property Maintenance and Fire Codes.	Compliance with Property Maintenance and Fire Codes.	All are essentially the same. None of them are retroactive, but they recognize locally adopted retroactive requirements.

IEBC 2006 reproduced the provisions of Chapter 34 of the IBC into the IEBC, thereby providing three alternative compliance methods (instead of the two in IEBC 2003):

1. Prescriptive Compliance Method, which was a duplication of Sections 3401-3409 of the IBC, with its lack of predictability and arbitrariness.
2. Work Area Compliance Method, which consisted of the provisions of the IEBC 2003.
3. Performance Compliance Method, which was previously Chapter 12 of IEBC 2003.

It should be noted that the use of the terms "prescriptive" and "performance" to characterize the compliance methods has introduced an element of confusion to the subject. These terms have been used in characterizing two different approaches to the regulation of buildings, with "prescriptive" defining specific technical solutions that comply while "performance" allowing a variety of technical solutions that comply with a defined set of criteria. The IBC is considered to include a combination of prescriptive and performance requirements, The *International Residential Code (*IRC) is considered as a set of prescriptive requirements. The *International Energy Conservation Code* (IECC) includes alternative prescriptive and performance approaches to compliance. The *International Performance Code* (IPC) contains only performance requirements. The use of these terms in the IEBC is arbitrary and inconsistent with the general use of these terms. The IEBC Prescriptive Compliance Method is not "prescriptive" and the Performance Compliance Method is not "performance". The IEBC could have used Compliance Methods A, B, and C just as well.

IEBC 2006 made some minor modifications to the seismic requirements and fire alarm requirements, as well as some format changes.

IEBC 2006 extended the deviations from the earlier "smart codes" significantly:

1. It added energy conservation requirements to Alteration Levels 1, 2, and 3 by reference to the IECC.
2. It eliminated the exclusion of certain requirements in a change of occupancy involving reductions in all the hazard scales.

IEBC 2009 included technical modifications to the earlier edition, but is essentially the same, including the three alternative compliance methods.

Melvyn Green, in his 2012 book *Building Codes for Existing and Historic Buildings*, included comparisons of the three IEBC compliance methods applied to two buildings—a low rise "Main Street" retail or office building, and a high rise multistory office building. The low rise mercantile building was evaluated for:

1. A simple project tenant improvement, including new lighting, ceiling, floor covering, and painting, no change of occupancy.
2. Same as 1 but the project changed the building from mercantile to office use (M to B).
3. Change from mercantile to assembly, changing the space to a small dining facility (M to A-2).

The high rise was evaluated for:

1. A tenant improvement project involving new lighting, floor covering, and ceiling, with no reconfiguration of space.
2. A larger tenant alteration that involves the addition of a door into a corridor as well as some minor reconfiguration of interior space.
3. A tenant alteration that exceeds 50 percent of the floor area.

In summary, in the example buildings, no one compliance method was appropriate for all types of alteration and change of occupancy projects. One or the other may be simpler to implement. Each may trigger unanticipated requirements. The prescriptive approach is the simplest for the smaller projects but may have additional requirements that cannot be anticipated. The work area method is predictable, but improvements may be required beyond the owner's defined work area to provide additional safety in the building. The performance compliance approach provides a good understanding of the fire safety issues with a building, whether the project is proposed as an alteration or as a change of occupancy.

The findings are summarized in Table 3.

Table 3
Comparisons of IEBC Compliance Alternatives

Low Rise Example	Compliance Methods		
	Prescriptive*	Work Area	Performance*
1. M to M	New work complies with IBC. Additional work triggered is difficult to anticipate.	New work complies with IBC. Defined area limits trigger limited additional work.	Must analyze entire building for the safety measures. Exit signage and lighting may be required.
2. M to B	Building must conform to IBC as if new. Building Official has authority not to mandate full compliance based on life and fire risk.	Egress capacity must be reviewed. Step by step list of requirements, but this building should not pose any special problems.	Must analyze entire building. Scoring system allows give-and-take to achieve compliance. Cumbersome for change to lower risk.
3. M to A-2	Building must conform to IBC as if new. Building Official has authority not to mandate full compliance based on life and fire risk.	Follow step by step. There may be work triggered due to increased risk from M to A-2.	Must analyze entire building. Scoring system allows give-and-take to achieve compliance.
High Rise Example			
1. Tenant improvement on one floor	New work complies with IBC. Additional work triggered is difficult to anticipate.	Alteration Level 1. New work complies with IBC. Defined area limits trigger limited additional work.	Must analyze entire building, expanding scope beyond intended. Allows less than IBC for some items.
2. Tenant improvement plus corridor door on 6th floor	New work complies with IBC. Additional work triggered is difficult to anticipate. Triggered work may exceed intended work area by additional corridor requirements.	Alteration Level 2. New work complies with IBC. Triggered work may include the enclosure of the stair at the 6th floor. The enclosure requirements are less rigorous than the IBC.	Must analyze entire building. Scoring system allows give-and-take to achieve compliance.
3. Complete remodeling of 6th floor	New work complies with IBC. Additional work triggered is difficult to anticipate. Extent of stair enclosure may exceed level of work area.	Alteration Level 2. New work complies with IBC. Step by step list of requirements, including reference to *International Energy Conservation Code*. Stairway enclosure must extend from 6th floor to the floor of exit.	Must analyze entire building. Scoring system allows give-and-take to achieve compliance. Allows flexibility to achieve compliance by correcting various deficiencies.

* See discussion above on the use of these terms.

C. Summary of Building Regulations for Commercial Buildings in Pennsylvania and New Jersey

Pennsylvania

Pennsylvania is currently enforcing the 2009 I-codes for commercial buildings with minimal amendments. Relevant to this White Paper are the *International Building Code*, *International Energy Conservation Code* (unamended), and the *International Existing Building Code* (unamended). Adoption of the 2012 I-codes is currently under way in Pennsylvania.

The codes may be locally amended and are enforced by local government in jurisdictions that have "opted in", or by the Department of Labor and Industry in jurisdictions that have "opted out". Most Pennsylvania jurisdictions have "opted in", and some of them have contracted with private third parties for enforcement plan reviews and inspections.

The updating of the codes is currently uncertain. When a new edition of the ICC codes are published, the Uniform Construction Code Review and Advisory Council (RAC) is required to evaluate changes from the prior edition of the codes based on their impact on the health, safety and welfare of the public, the economic and financial impact, and technical feasibility. The RAC then makes a binding decision as to which new code provisions should be adopted. Code provisions must receive a two thirds majority of the entire RAC membership to be adopted. If a provision is not recommended for adoption by the required two thirds majority, the relevant provisions of the prior version of the code remain in effect.

In the spring of 2011, the RAC began to evaluate the more than 900 changes to the 2009 codes. The RAC held three public hearings, and public comments were also submitted. Ultimately, however, the RAC was unable to review every change individually. Instead, the RAC voted on the 2012 code changes as a whole. Adoption of the entirety of the 2012 code changes did not get a two thirds majority. Therefore, the RAC rejected all of the 2012 code changes, and the 2009 codes remain in effect.

At the May 29, 2013 meeting of the RAC, the RAC approved recommendations to the General Assembly that, if adopted, would significantly alter the process for reviewing and adopting building and energy codes in the commonwealth. The RAC's Legislative Working Group (LWG) chair stated that the outcome of the new process would be to move away from the model codes developed by the ICC towards Pennsylvania specific building codes.

New Jersey

New Jersey is currently enforcing the following codes for commercial buildings relevant to this White Paper: *International Building Code* 2009 (with amendments), ASHRAE 90.1-2007 (unamended), and the *Rehabilitation Subcode* 2011.

The codes cannot be locally amended and are enforced by local governments without the option of opting out as in Pennsylvania. There is some private contracting of inspections, and some smaller jurisdictions may share enforcement with neighboring jurisdictions..

At the August 2012 meeting of the Uniform Construction Code Advisory Board, the Board voted to propose the 2012 ICC national model codes (with amendments) and the 2012 National Standard Plumbing Code (NSPC) for public comment.

After the Department of Community Affairs (DCA) staff completes the draft statements and rule proposal, they are staff-reviewed, and then moved through the Division and Department to the Governor's office for review and approval at each step before publication as a rule proposal in the *New Jersey Register.* As of July 15, 2013, the rule proposal is under review in the Governor's Office. The process was delayed when work related to hurricane Sandy took priority.

Table 4
Current Building Regulations Applicable to Commercial Buildings

	Pennsylvania	New Jersey
New Construction	*International Building Code* 2009 *International Energy Conservation Code* 2009 Other I-codes	*International Building Code* 2009 ASHRAE 90.1-2007 Other I-codes
Rehabilitation	*International Existing Building Code* 2009	*Rehabilitation Subcode*

D. Energy Conservation Retrofit Regulations for Commercial Buildings

Energy conservation retrofit requirements are found in the *International Energy Conservation Code* and the *International Existing Building Code* (or in the case of New Jersey, the *Rehabilitation Subcode*). The 2009 *International Energy Conservation Code* exempts historic buildings and addresses existing buildings as follows.

Section 101.4.3 of the *International Energy Conservation Code* addresses additions, alterations, renovations and repairs:

> "Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code."

There are eight exceptions to the compliance requirement, provided the energy use of the building is not increased:

> "1. Storm windows installed over existing fenestration.
> 2. Glass only replacements in an existing sash and frame.
> 3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
> 4. Construction where the existing roof, wall or floor cavity is not exposed.
> 5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
> 6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door.
> 7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
> 8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power."

Simply stated, new work must comply with the current requirements for new work, with a few exceptions.

Section 101.4.4 addresses change of occupancy or use:

> "Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code..."

The commentary on this Section is revealing:

> "When a building undergoes a change of occupancy, energy-using systems (envelope, mechanical, service water heating, electrical distribution or illumination) must be evaluated to determine the effect the change of occupancy has on system performance and energy use. For example, if a mercantile building were converted to a restaurant, additional ventilation would be required for the public based on the increase occupant load...
>
> Buildings undergoing a change of occupancy must meet the applicable requirements of the code when peak demand is increased. For example, if a hotel is converted to multiple-family residential use and the conversion results in an increase in the building's peak connected load (space conditioning, lighting or service water heating), the entire building must be brought into compliance.
>
> When the occupancy changes in a portion of an existing building (residential or commercial) and the new occupancy results in an increase in the peak demand for either fossil fuel or electrical energy supply, the portion of the building associated with the new occupancy must meet the code.
>
> When a permittee claims that a change in occupancy will not increase the peak design rate of energy use for the building, it is the applicant's responsibility to demonstrate that the peak load of the converted building will not exceed the peak load of the original building. Without supporting documentation, the peak load generally must be assumed to increase with a change in occupancy..."

It should be noted that the *International Energy Conservation Code* includes both prescriptive requirements and an alternative performance compliance approach, and the alternatives may be applicable when the code is applied to existing buildings.

The 2009 *International Existing Building Code* includes the following reference to the *International Energy Conservation Code* under the Work Area Compliance Method (formerly "smart code") for Alteration Levels 1, 2 and 3:

> "...alterations to existing buildings or structures are permitted without requiring the entire building or structure to comply with the energy requirement of the *International Energy Conservation Code*...The alterations shall conform to the energy requirements of the *International Energy Conservation Code*..."

The commentary on this section for Alteration Levels 2 and 3 includes the following:

> "A building that undergoes (Level 2 or 3) alterations is required to meet a certain level of energy compliance. The level of compliance depends on the extent of the alteration

> taking place... Essentially, the entire building is not required to meet the energy provisions; only a degree of possible improvement in the energy performance of the building is intended to be achieved by making the new elements meet the IECC...In certain cases where the reconfiguration of space might have resulted in creation of new spaces, **the newly created space should be evaluated as a whole for compliance with the energy provisions, even though some of the elements within the space might actually not have been altered**..." (emphasis added)

Note that "newly created space" is not mentioned in Section 101.4.3 of the *International Energy Conservation* Code, which may introduce an ambiguity to the scope of compliance required. For example, what is required if a suite of offices is changed into conference rooms, without modification of the building envelope and mechanical systems? The decision will be based on the judgment of the enforcement official.

For a change of occupancy, the 2009 *International Existing Building Code* repeats Section 101.4.4 of the *International Energy Conservation Code* under the Prescriptive Compliance Method (but curiously not under the Work Area Compliance Method):

> "Buildings undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with the *International Energy Conservation Code*."

The *New Jersey Rehabilitation Subcode* takes a different approach. Rather than a general reference to the *International Energy Conservation Code* for all new alteration work, it specifies four cases where renovation, alteration or reconstruction work must comply with commercial energy code requirements of ASHRAE 90.1:

- "When the work being performed creates or exposes the roof decking/sheathing or the framing of any wall, floor, ceiling, or roof assembly that is part of the building thermal envelope (encloses conditioned space), any accessible voids in insulation shall be filled using insulation meeting the R-values...of Table 5.5-4 or 5.5-5" of AHRAE 90.1.

  "i. In the event that insulation meeting the R-values above cannot be installed due to space constraints, insulation that fills the cavities of the framed assembly shall be installed."
- "When fenestration (windows, skylights or doors) is newly installed or replaced, the U-factor shall not exceed the U-factor...of Table 5.5=4 or 5.5-5" of AHRAE 90.1.
- "Ducts that are newly installed or replaced shall be installed with insulation meeting the R-values...of Section 6.4.4.1.2" of AHRAE 90.1.
- "Unless exempted by Section 9.2.2.3 of the commercial energy code, the total

> replacement of a building lighting system or a newly installed building lighting system shall meet the...controls and...lighting power densities...” of ASHRAE 90.1.

There are no reconstruction supplemental requirements for energy efficiency.

It should be noted that ASHRAE 90.1 includes both prescriptive requirements and an alternative performance compliance approach. However, the preceding four requirements appear to relate to the prescriptive requirements only.

The *New Jersey Rehabilitation Subcode* has no energy conservation requirement in a change of occupancy.

E. Summary of Energy Conservation Retrofit Regulations for Commercial Buildings in Pennsylvania and New Jersey

When considering commercial building energy conservation retrofit in Pennsylvania and New Jersey, the applicable codes in Pennsylvania are the *International Energy Conservation Code* and the *International Existing Building Code*. In New Jersey they are the *Rehabilitation Subcode* and ASHRAE 90.1. Based on the analysis of these codes discussed in Section D, Table 5 summarizes the requirements in each state.

Table 5
Energy Conservation Retrofit Regulations for Commercial Buildings

	Pennsylvania	New Jersey
Governing Codes	*International Energy Conservation Code* *International Existing Building Code*	*Rehabilitation Subcode* ASHRAE 90.1
Enforcement Basis	Judgment/unpredictable: Specific exceptions for alteration compliance with new building requirements may be ambiguous as to what is required, and commentary in the *International Existing Building Code* addresses reconfiguration of space which is not mentioned as an alteration in the *International Energy Conservation Code*.	Prescriptive/predictable: Four specific alterations require compliance with new building requirements.
Alterations	Alterations to existing buildings are permitted without requiring the entire building to comply with the energy requirement of the *International Energy Conservation Code*. The alterations shall conform to the energy requirements of the *International Energy Conservation Code*. There are eight of specific exceptions. In certain cases where the reconfiguration of space might have resulted in creation of new spaces, the newly created space should be evaluated as a whole for compliance with the energy provisions, even though some of the elements within the space might actually not have been altered.	⅄ When the work exposes the roof decking/sheathing or the framing of any wall, floor, ceiling, or roof assembly that is part of the building thermal envelope. ⅄ When fenestration is newly installed or replaced. ⅄ Ducts that are newly installed or replaced. ⅄ The total replacement of a building lighting system or a newly installed building lighting system.
Change of Occupancy	Buildings undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with the *International Energy Conservation Code* for the new occupancy.	No requirements for the new occupancy.

F. Code Compliance Reconnaissance—Commercial Building Energy Code Compliance Focus Groups and Survey of Pennsylvania Building Officials

The preceding summary displays the significant differences between the New Jersey and Pennsylvania approaches to energy conservation retrofit regulations. The effectiveness of these regulations and their enforcement were explored in two code compliance reconnaissance efforts, where discussions with NJ and PA practitioners contributed feedback from field level experience.

The first code compliance reconnaissance effort consisted of the Commercial Building Energy Code Compliance Focus Groups convened October 29, 2013 at the EEB HUB. Two focus groups met:

- New Jersey code officials
- A/E/C firms and building owners

New Jersey code officials

As shown in the preceding summary, New Jersey code officials enforce a few simple requirements for alterations and no requirement for change of occupancy. Building owners often voluntarily propose to alter beyond the minimum code requirements for market or competitive reasons, and one code official said that he encourages voluntary improvements based on the willingness of the applicant.

Energy requirements, initially absent from the New Jersey Rehabilitation Subcode, were added in recent editions. They seem to be minimal, and are generally complied with. “I've been doing this since the early 90's...Energy was not talked about in the rehab code, the builder wouldn't put in insulation. We changed the rehab code to make it better. I imagine that it will and should keep progressing.”, said one official. Another said: “For me, the cost is the 800-pound gorilla in the room. The biggest problem in terms of rehab is prior approvals meeting environmental requirements. If the energy code gets too strict, it may force builders away.”

A/E/C firms and building owners

The focus group highlighted the differences between Class A and lower class commercial building owners, and between larger and smaller commercial building owners. Class A owners usually go beyond minimum code requirements in their renovations, spurred by market forces and ratings such as LEED and Energy Star. They use competent architects and engineers who aim for building performance rather than code compliance. Larger owners monitor their buildings and pay attention to energy use. Lower class owners and smaller owners don't have these capabilities.

For both categories of owners there is sometimes a problem of tenant fit-outs that are inconsistent with owner energy objectives. This problem could be addressed by improved communications between the owner and tenant designers.

When probed about the significant difference between New Jersey and Pennsylvania on the energy requirements in case of a change of occupancy, and the complexity of enforcement (requiring extensive energy modeling) of the Pennsylvania (and IECC) requirement, an architect said "I never had a conversation with a code official on change of use". This is consistent with a prior finding that Pennsylvania officials may not be aware of the change of occupancy requirement, or if aware of it, would consider it a significant barrier to many renovations.

The second reconnaissance activity consisted of a literature review of previous studies and research on the subject of energy code compliance. An earlier survey of Pennsylvania building officials was conducted by the Building Codes Assistance Project (BCAP) for the Commonwealth of Pennsylvania. In general, this survey confirmed one of the findings reported in the *EEB HUB Region Energy Code Gap Analysis: Preliminary Findings*, January 2013, that energy code enforcement has a lower priority because it is not a health and safety issue. Several Pennsylvania building officials said they do not enforce the energy code because they have no political pressure to do so, while pressure is applied to enforce other regulations, such as accessibility. The gap analysis paper also suggested that the energy code is not enforced on commercial rehabilitation projects in Pennsylvania because the Uniform Construction Code in the Commonwealth does not require code compliance for residential alterations. In addition, BCAP found that Pennsylvania code officials also lacked adequate training and technical assistance in municipalities that had a code enforcement agency as well as a lack of funding to provide enforcement for those without enforcement resources.

Another study conducted by the Pennsylvania Housing Research Center (PHRC), *PHRC Research Series Report No. 106 – Energy Code Enforcement and Compliance in Pennsylvania: Lessons from the Field*, July 2008, corroborated these findings and offered some recommendations for code officials and policymakers. The report called for the establishment of quality assurance practices in code enforcement, such as the institution of checklists. The study also recommends greater focus on plan review in order to ensure all of the necessary information to perform an energy code compliance check is provided in the plan and to avoid confusion during the inspection process.

According to the New Jersey Department of Community Affairs, the rehabilitation subcode in the State is not well understood by building code officials. Thus, it can be expected that uniform enforcement of the building code across the State is unlikely and the facilitation of rehabilitation of buildings throughout the municipalities may not be well supported (*Encouraging Residential Rehabilitation with Building Codes: New Jersey's Experience*, Raymond J. Burby, David Salvesen and Michael Creed, Journal of the American Planning Association, Spring 2006). Although the report did not directly address this, our impressions from our focus group of NJ code officials suggests the same challenge exists with commercial buildings.

G. Recommendations from Regulatory Review and Reconnaissance Field Discussion

- Expand code official training on the energy code and the rehab code.

  The application of the IECC to existing buildings and its relationship to the IEBC is not well understood by code officials. Training is also identified as a need in the *EEB HUB Region Energy Code Gap Analysis: Preliminary Findings*, January 2013.

- Resolve policy differences between the energy code and the rehab code.

  One of the unstated objectives of the IEBC is the encouragement of the re-use of existing buildings, which is an objective of the New Jersey Rehabilitation Subcode. The objective of the IECC is the improvement of energy efficiency of buildings. In some cases these objectives are in conflict.

- Explore the relationships between building owner and tenant objectives and practices as related to renovation and energy efficiency.

  Commercial building renovation is frequently split between owner and tenant design and construction. They may have different objectives which may constrain the achievement of DOE policy of improved energy efficiency.

- Develop tools for the achievement of energy efficiency in lower class commercial buildings and by smaller building owners.

  These categories of owners may not have the capabilities to carry out energy analyses or to hire architects and engineers who do. They may benefit from the use of simplified tools to help achieve energy efficiency in their buildings.