

OC 1: ADD ENVIRONMENTAL PROTECTION AS FUNDAMENTAL PRINCIPAL OF THE CONSTRUCTION CODES

Administrative Code of the City of New York
Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Although environmental protection is not expressly recognized as a principle informing the building code, environmental risks are more likely to affect New York City buildings and their residents than many other risks currently addressed in the code.

Recommendation:

Amend the intent section of the building code to include environmental protection as a fundamental principle.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Amend Section 28-101.2 as follows:

§28-101.2 Intent. The purpose of this code is to provide reasonable minimum requirements and standards, based upon current scientific and engineering knowledge, experience and techniques, and the utilization of modern machinery, equipment, materials, and forms and methods of construction, for the regulation of building construction in the city of New York in the interest of public safety, health and welfare, including environmental protection, and with due regard for building construction and maintenance costs.

Supporting Information

Issue – Expanded

The codes regulating the construction and maintenance of buildings were developed in response to serious threats to health and safety, and include requirements for structural integrity, fire prevention, emergency egress, and access to light and air. In particular, many provisions of the New York City building code arose in direct response to disasters or epidemics. The 1911 Triangle Shirtwaist Factory fire led to requirements for fire drills and automatic sprinklers, and widespread problems exiting darkened stairways during the 2003 blackouts have brought about enhanced requirements for emergency lighting in those stairways. Similarly, epidemics led to New York's tenement laws, which require access to light and air. These core functions are enshrined in the pre-ambles to the building code, which lays out the intent of the code as the protection "of public safety, health and welfare."

As new technologies arise and new public hazards are identified, the Construction Codes are regularly updated. For example, the energy crisis of the 1970's spurred the adoption of energy codes in order to protect against spiraling prices and the threat of shortages. Today, a group of issues, including energy consumption, indoor air quality, and storm water run-off, are commonly seen to impact public safety, health, and welfare at the broadest scale. These concerns, which generally encompass "environmental protection", are critically impacted by the way buildings are designed and constructed. For example, in New York City buildings are responsible for 75% of carbon emissions, 85% of water use and over 60% of solid waste. In response, environmental issues are rapidly being added to the Construction Codes, but in a piecemeal fashion. The impact of environmental issues -- including the imminent threat of climate change -- on human health, safety, and welfare, combined with the vast impact of buildings on the environment, means that it is time to place these issues on a more solid intellectual footing by adding "environmental protection" as a core principle of the Construction Codes.

Certainly, the risks posed by environmental degradation are as - or more - significant than any other risk the city regulates. For example, in 2008, out of New York City's more than one million buildings, there were only 26,862 structural fires, yet the Fire Code makes up an entire book of the city's administrative code.¹ In comparison, every person in the city will likely be exposed to unhealthy levels of volatile organic compounds and suffers if droughts are

exacerbated by wasteful water use. In the medium-term future, New York will be subject to extreme weather events that will stress our infrastructure and affect every building and every resident.ⁱⁱ The New York City Climate Change Adaptation Task Force predicts that in New York in 2050 sea level will rise 7-12 inches, temperatures will be 3-5° F hotter, precipitation will be 10% greater and there will be more extreme weather events.ⁱⁱⁱ

In addition, New York City will be unable to achieve many of the targets set in PlaNYC for sustainable growth through 2030 without systematically addressing the environmental impacts of the building sector. For example, the New York City Climate Protection ACT (Local Law 55 of 2007) requires the city to reduce greenhouse gas emissions by 30% by 2030. This will only be possible through changes to the design, construction and operation of buildings, given the outsized impact of buildings on New York City's environment.

Finally, New Yorkers' expectations have changed. Increasingly, people are looking to live and work in buildings that are healthy and reflect their values. For this reason, there are new efforts around the country, such as those by the International Code Council and ASHRAE, to incorporate green principles into building codes.

Environmental & Health Benefits

The environmental and health benefits of this proposal are far-reaching since incorporating environmental protection as a principle of the Construction Codes provides the intellectual underpinning for all the recommendations of the NYC Green Codes Task Force.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a study which will have no direct impact on construction costs.

Precedents

Environmental codes have a long history in the U.S. in the form of energy codes, which are widespread and widely accepted. California recently adopted the Green Building Standards Code, potentially the first broad-intent code expressly intended to address environmental issues.^{iv} The stated purpose of this code is "to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts having a positive environmental impact and encouraging sustainable construction practices."^v

A few months after California adopted statewide green building standards, San Francisco followed suit with its own green building code.^{vi} The codified intent of the San Francisco code is "to promote the health, safety and welfare of San Francisco residents, workers, and visitors by minimizing the use and waste of energy, water and other resources in the construction and operation of the City"^{vii}

As mentioned in the Issue-Expanded section, the International Code Council and ASHRAE are in the process of developing green codes.

LEED

There are no LEED credits affiliated with this proposal. However, this amendment corresponds with the intent of LEED.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

ⁱ NEW YORK CITY FIRE DEPARTMENT, FDNY VITAL STATS (2008), http://www.nyc.gov/html/fdny/pdf/vital_stats_2008_final.pdf.

ⁱⁱ NEW YORK CITY PANEL ON CLIMATE CHANGE, CLIMATE RISK INFORMATION (2009), http://www.nyc.gov/html/planyc2030/downloads/pdf/nyc_climate_change_report.pdf.

ⁱⁱⁱ Ibid. at p. 3.

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^{iv} Mathew Yi, State is First to OK Green Building Standards, S.F. CHRONICLE, July 18, 2008, available at <http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/07/18/MNMG11R59J.DTL>.

^v CAL. CODE, Tit. 24 § pt. 11 § 101.2 (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

^{vi} Press Release, Office of the Mayor, City of San Francisco, CA., Mayor Newsom Signs Groundbreaking Green Building Ordinance to Reduce Greenhouse Gas Emissions (Aug. 4, 2008), http://www.sfgov.org/site/mayor_index.asp?id=85918.

^{vii} CITY OF SAN FRANCISCO, CA., DEP'T OF BUILDING AND INSPECTION, IMPLEMENTATION OF GREEN BUILDING REGULATIONS: ch. 13, § 1301C – INTENT, AB-093, (Sep. 24, 2008), available at <http://www.sfgov.org>.

OC 2: FULLY ENFORCE NYC's CONSTRUCTION CODES

Study

Proposal developed by the Steering Committee

Summary

Issue:

Codes are increasingly viewed as an essential, low-cost strategy for achieving energy and carbon reduction targets. However, to be effective, codes must be enforced.

Recommendation:

Develop a strategy to achieve 90% code compliance citywide, and address known impediments to enforcement.

Proposed Legislation, Rule or Study

The Mayor's Office of Long-Term Planning, in conjunction with the Department of Buildings, should undertake an analysis of code compliance. This analysis should determine the current level of code compliance, assess the resource requirements to enforce all provisions of the Energy Code and the provisions developed by the Green Codes Task Force, and develop a strategy to achieve 90% compliance with the New York City Construction Codes. The analysis should consider the following issues and recommendations:

1. Issue: During the recent building boom, Department of Building staffing did not keep pace with the increase in building permits. In addition, Department of Building has begun enforcing the Energy Code for the first time, and does not have expertise on this code as well as the new code changes that may result from the Green Codes Task Force.

Recommendations:

A) Hire expert energy code technical authorities, reviewers and inspectors.
B) Provide training for plan examiner staff on these codes.
C) Provide training for Department of Building construction, plumbing and electrical inspectors.
D) Consider increasing permit fees or structure the cost of building permit fees to increase as the number of permits increases, thereby enabling DOB to hire more staff in lockstep with its workload. The revenue from these increased fees should be dedicated specifically for DOB, rather than the city's general fund, to ensure they serve their intended purpose.

2. Issue: The Department of Building does not receive or review electrical drawings, although the Construction Codes require submission of every other discipline of the design drawings for a building. Since energy efficiency standards, including but not limited to the Energy Code, involve electrical work as well as mechanical and architectural, the coordination of energy compliance technical requirements and procedures is awkward. The separation of the Electrical Division from the Construction Division has no apparent rationale.

Recommendation: Shift the Electrical Division into the Construction Division, which has longstanding experience with multidisciplinary administration and enforcement of the Codes.

3. Issue: Critical onsite inspections of construction work are currently undertaken by "special inspectors" who are authorized by the department yet paid for by the building owner. This system creates clear conflicts of interest for firms wishing to be hired again by an owner to undertake future special inspections or design work.

Recommendation: Payments for special inspectors should either: (1) be used to increase department inspection staff, rather than hire outside inspectors; or (2) be deposited into a fund administered by the department, which would hire the special inspectors from an approved list.

4. Issue: Many building projects are "professionally certified" by architects or engineers for compliance with New York City's zoning and construction laws. Department audits of these plans, however, regularly discover violations of the city's construction laws. The Department is currently reviewing its self-certification program.

Recommendation: Withdraw the professional certification authority of architects and engineers found to submit plans with significant violations of the city's laws, including the energy code and other green codes.¹

Supporting Information

Issue – Expanded

Increasing the level of building and energy code compliance is increasingly seen as central to achieving New York City's new sustainability goals as well as continuing to ensure health and safety. After all, codes are merely words on paper if no one complies with them. The U.S. Department of Energy regards energy code compliance as so important that it has made the awarding of energy stimulus grants to states contingent on achieving a 90% compliance rate. Similarly, the energy bills currently being considered by the U.S. Congress tie the receipt of energy dollars to achieving equally high documented energy code compliance rates. Some of these federal mandates have already trickled down to New York State as reflected in increased funding for code training and enforcement by NYSERDA and others.

Code compliance is an issue that also extends beyond the energy code. Concern about code enforcement was voiced by every technical committee and in almost every meeting with stakeholders.

There are two basic approaches to increasing compliance rates. First, one can improve the level of knowledge within the design and construction community. (Benjamin Franklin coined his aphorism, "An ounce of prevention is worth a pound of cure" in relation to fire-prevention.) California has taken this approach to energy code compliance for decades by providing training and resource centers, and it has achieved generally positive results. Second, there needs to be sufficient review, accountability, and repercussions on the back end to ensure that the codes are taken seriously.

Environmental & Health Benefits

Improving enforcement of the Construction Codes may lead to a broad range of unquantifiable environmental and health benefits including increased energy and water efficiency, reduced greenhouse gas emissions and air pollution, enhanced indoor air quality, and reduced stormwater runoff.

For the purposes of the Executive Summary, this proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs.

Precedents

The Task Force researched building department enforcement, internal training and funding practices in four cities regarded as leaders in green building: Chicago, San Francisco, Portland, and Seattle. All of these cities have training programs for permit staff, while only some have funding to also train field inspectors. All identified funding as a significant limitation on their enforcement capability since educating building permit and inspection staff requires money that is not usually part of building department budgets. When funding is lacking, some cities have provided permit examiners and field inspectors with checklists to help them track green code changes.

Chicago's Department of the Environment has been training Building Department intake staff on new code requirements. They also provide reviewers with a Rescheck or Comcheck printout, a checklist for compliance. The department would like to increase staff because of the extra time required to review drawings and to extend training to building inspectors, which they see as necessary, but is constrained by funding.²

San Francisco's Department of the Environment provides staff training for both permit reviewers and inspectors. This is funded by waste fees, a public benefit charge on utility bills (Pacific Gas and Electric, the local private sector gas and electric provider), and work orders from other city departments, including the Department of Building Inspection.³

Portland's Bureau of Development Services, which includes building permit and inspection staff, is funded by permit fees alone. In accord with city bylaws, no further funding is possible. The current economic downturn has brought a 20% reduction in permit applications, but a 50% reduction in permit fees due to a more dramatic cutback in large-scale projects. Staff has been cut in half and field inspectors are limited to focusing on fire and safety issues.⁴

Seattle's Sustainable Infrastructure and Energy Department trains Building Department reviewers in green techniques and processes as a part of job training. Due to lack of funds, it does not train field inspectors.⁵

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES

¹ See Proposed Legislation, Rule or Study 4 (It will also be necessary to educate architects and engineers on the energy code and codes changes to ensure maximum compliance. Education is the subject of a separate recommendation: Professional Education and Code Training.)

² Interview with Elizabeth Scanlan, Director of Code Development, Dept. of Buildings, City of Chicago, IL. (Jan. 6, 2010); and Interview with Javier Ceballos, Mechanical Engineer, Energy and Sustainable Business, Dept. of the Environment, City of Chicago, IL. (Jan. 6, 2010).

³ Interview with Barry Hooper, Private Sector Green Building Program Specialist, Dept. of the Environment, City of San Francisco, CA. (Jan. 21, 2010).

⁴ Interview with Vinh Mason, Policy Analyst, Bureau of Planning and Sustainability, City of Portland, OR. (Jan. 7, 2010).

⁵ Interview with Jayson Antonoff, Policy Advisor, Sustainable Infrastructure & Energy/Climate Change, Department of Planning & Development, City of Seattle, WA. (Jan. 7, 2010).

OC 3: DON'T EXEMPT EXISTING BUILDINGS FROM GREEN CODES

New York City Building Code

Proposal developed by the Steering Committee

Summary

Issue:

Buildings constructed before the 2007 building code went into effect can use the laxer standards of the 1968 code for alterations. This exception allows existing buildings to bypass the environmental and health enhancements recommended by the NYC Green Codes Task Force.

Recommendation:

Require all buildings to comply with improved environmental and health standards.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 28-101.4.3 to add the following new paragraph:

8. All work shall comply with the following sections of the New York city construction codes as applicable: [List all sections added or amended by the NYC Green Codes Task Force]

Supporting Information

Issue – Expanded

In 2007, New York City adopted a modified version of the International Code Council's family of construction codes, replacing the city's 1968 building code that was largely outdated. Since July 2009, the new codes have been mandatory for new buildings. This tremendous achievement was the result of several years of work by the Department of Buildings in conjunction with hundreds of stakeholders including real estate, design, construction, labor and government experts.

This new code, however, contains a major loophole: existing buildings constructed under the 1968 building code can still, with certain exceptions,¹ renovate under the standards of this outdated code or earlier codes. Since 85% of the buildings currently in NYC will still be here in 2030,² this means that the vast majority of the city's buildings would effectively be exempt from many modern standards of the 2008 codes. It also means most buildings would be exempt from many enhancements to the building code resulting from the recommendations NYC Green Codes Task Force. As such, addressing this loophole is essential for NYC buildings to become environmentally responsible and healthy places to live and work. In keeping with this proposal, the Energy Code enacted in December 2009 specifically includes existing buildings.

Environmental & Health Benefits

This proposal will have enormous environmental impact by determining the reach of many recommendations of the NYC Green Codes Task Force. Without its implementation, much of the work of the Task Force will only apply to the small subset of building constructed after 2008 – by 2030, according to the Mayor's Office, only 15% of the city's buildings.

For the purposes of the Executive Summary, this proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

The impact of this proposal on capital costs is complex given the wide range of project scopes for renovations and will

require further study. For the purposes of the Executive Summary, it was assumed this proposal will not have any significant impact on capital costs.

Precedents

The Task Force researched code practices as they apply to existing buildings in four cities regarded as leaders in green building: Chicago, San Francisco, Portland, and Seattle. Most of these cities require existing buildings that file for renovations to comply with all current energy and building codes. Exemptions are typically made only for historic structures if compliance would compromise the historic integrity.

In Chicago, all new construction and renovations are required to comply with the Chicago Energy Conservation Code. Historic structures are exempt only when the Landmarks Commission deems significant features would be impacted.³

San Francisco's Green Building Ordinance did not address existing buildings. Tenant improvements are required to be LEED certified for commercial interiors projects 25,000 square feet or larger. The State of California's energy codes apply to all retrofits.⁴

Portland has a proposal, but no requirement yet, to require existing buildings filing for a building permit to renovate to meet up-to-date energy codes.⁵

All renovations in Seattle are subject to current building and energy codes.⁶

LEED

Implementation of this proposal could help buildings achieve credits under many LEED rating systems.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

¹ See Issue-Expanded (All buildings, for example, still must comply with the mechanical, fuel gas and plumbing codes for alterations.).

² CITY OF NEW YORK, NY, PLANYC, A GREENER, GREATER NEW YORK, 135 (2007)
http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf.

³ Interview with Elizabeth Scanlan, Director of Code Development, Dept. of Buildings, City of Chicago, IL. (Jan. 6, 2010); and Interview with Javier Ceballos, Mechanical Engineer, Energy and Sustainable Business, Dept. of the Environment, City of Chicago, IL. (Jan. 6, 2010).

⁴ Interview with Barry Hooper, Private Sector Green Building Program Specialist, Dept. of the Environment, City of San Francisco, CA. (Jan. 21, 2010).

⁵ Interview with Vinh Mason, Policy Analyst, Bureau of Planning and Sustainability, City of Portland, OR. (Jan. 7, 2010).

⁶ Interview with Jayson Antonoff, Policy Advisor, Sustainable Infrastructure & Energy/Climate Change, Department of Planning & Development, City of Seattle, WA. (Jan. 7, 2010).

OC 4: RECONVENE THE GREEN CODES TASK FORCE

New York City Building Code
Proposal developed by the Steering Committee

Summary

Issue:

Green building is a rapidly evolving field, and New York City's construction laws need to keep pace with these changes.

Recommendation:

Reconvene the NYC Green Codes Task Force every three years.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new Section 28-101.6 as follows:

§ 28-101.6 Convening the Green Codes Task Force. Beginning July 1, 2011 and every third year thereafter, the Mayor and Speaker of the City Council shall convene a Green Codes Task Force to recommend changes to city laws and regulations to improve the environmental and health performance of new and existing buildings. The task force shall be led by a chairperson with expertise on green building policy whose responsibilities shall be to:

1. Guide the work and schedule of the task force;

2. Select the chairs and members of each sub-committee;

3. Chair a steering committee, which shall be composed of a representative of the Mayor, a representative of the Speaker, the chairs of each technical committee, and other members as necessary;

4. Form an advisory committee, whose membership shall include representatives of real estate owners, tenants, labor, construction, the environment, social justice organizations, affordable housing and other interests as necessary; and

5. Form technical committees, whose members shall be subject matter experts.

Supporting Information

Issue – Expanded

The real estate industry has undergone a period of remarkable change over the last decade with the shift in green building from a niche practice to mainstream for Class A and government buildings. The laws governing construction in New York City, however, have not kept up with this pace. Codes have largely not been updated to reflect new practices and regulatory impediments are sprinkled through the city's laws.

The codes affecting construction span at least one dozen titles of the city's Administrative Code and its related rules. While concentrated in the Construction Codes and Zoning Resolution, these regulations are also found in the Health Code and Fire Code, as well as codes and rules for Environmental Protection, Consumer Affairs, Parks and Recreation, Sanitation, Housing Preservation and Development, Transportation, and Emergency Management. Until the NYC Green Codes Task Force was convened, no forum had yet considered the impact of all these agencies and codes on green building.

New York City also has the capacity to undertake code development through local access to many national green building leaders. Many architectural and engineering firms are headquartered or have offices in the city, along with leading real estate owners, environmental groups, university research departments, and green entrepreneurs.

Finally, the first NYC Green Codes Task Force has been an incredible success. This initiative brought together over 200 pro-bono members and other volunteers, generating thoughtful and well-researched code proposals. The 111 proposals

in the Task Force report range from minor codes changes to significant shifts that will make New York City buildings more energy and water efficient, and healthier places to live, work, and learn.

For these reasons, the NYC Green Codes Task Force should be reconvened every three years, ensuring New York City's place as a capital of urban green building.

Environmental & Health Benefits

Reconvening the Task Force will provide a wide range of ongoing environmental and health benefits.

For the purposes of the Executive Summary, this proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is to reconvene the Task Force, which will have no direct impact on construction costs.

Precedents

The Task Force researched the code development process in four cities regarded as leaders in green building : Chicago, San Francisco, Portland, and Seattle. All these cities have worked with local experts on initiatives to green their construction laws and building codes. Typically, these task forces have not been convened as part of a regular and systematic process but instead at the request of the city executive.

Chicago previously had a standing body to address energy issues, but it has been inactive for several years. In 2003, the city convened a task force to identify code impediments to green building. Since then, the Department of the Environment retained a consultant to propose updates to the energy code, which was reviewed and amended by the Department of Buildings before going to city council for approval. Chicago is now in the process of adopting the International Building Code, which has reactivated many code committees, though the Energy Code Committee is not one of them at present.¹

In San Francisco, building code changes are made at the discretion of the Mayor who identifies a policy priority, which is referred to a task force with the pertinent expertise and to stakeholder groups. Participants agree to a finite period of service advising the Mayor on a specific question in public meetings, which may result in an advisory report. The task force is infrequently invoked due to significant statewide efforts on codes, especially the new Green Building Standards Code.²

Portland's Bureau of Development Services is pursuing creation of a local building code amendment for sustainable construction standards. If successful, the local amendment will augment existing State building code requirements. A draft of the Local Code Amendment was finished in June 2009 but the project is on hold due to staff shortages.³

Seattle convened a one-off green building task force. It created policies with a narrow focus and will not be continued on a recurring basis.⁴

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

¹ Interview with Elizabeth Scanlan, Director of Code Development, Dept. of Buildings, City of Chicago, IL. (Jan. 6, 2010); and Interview with Javier Ceballos, Mechanical Engineer, Energy and Sustainable Business, Dept. of the Environment, City of Chicago, IL. (Jan. 6, 2010).

² Interview with Barry Hooper, Private Sector Green Building Program Specialist, Dept. of the Environment, City of San Francisco, CA. (Jan. 21, 2010).

³ Interview with Vinh Mason, Policy Analyst, Bureau of Planning and Sustainability, City of Portland, OR. (Jan. 7, 2010).

⁴ Interview with Jayson Antonoff, Policy Advisor, Sustainable Infrastructure & Energy/Climate Change, Department of Planning & Development, City of Seattle, WA. (Jan. 7, 2010).

OC 5: CONSOLIDATE REGULATION OF LANDSCAPE PRACTICES

New York City Building Code or New Landscape Local Law
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Landscape and site design have an impact on important urban environmental issues, such as the urban heat island effect, stormwater capture and run-off, species diversity, maintenance, toxicity, and materials flows. However, New York City does not have a code or ordinance to address these issues comprehensively.

Recommendation:

Add a chapter on landscape and site to the city's Building Code.

Proposed Legislation, Rule or Study

New York City Building Code or New Landscape Local Law

Add new chapter to the New York City Building Code or enact a new landscape local law containing at a minimum the following sections covering the key issues listed within each section:

CHAPTER 34 SITE AND LANDSCAPING

SECTION BC 3401 GENERAL

23.01 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of the site and landscaping.

SECTION BC 3402 DEFINITIONS

SECTION BC 3403 ADMINISTRATION

- Documentation and Filing

SECTION BC 3404 CONSTRUCTION PRACTICES

- Protection of Soils
- Retention and Protection of Trees

SECTION BC 3405 GRADING

SECTION BC 3406 DRAINAGE AND STORMWATER MANAGEMENT

- Irrigation
- Adaptation to Climate Change and Flood Zone Issues

SECTION BC 3407 SUBGRADE

- Utilities

SECTION BC 3408
PAVING

- Reflectivity
- Permeability
- Recycled content
- Sidewalks

SECTION BC 3409
VEGETATION AND SHADING

- Native species
- Biodiversity
- Tree canopy coverage
- Habitat protection and enhancement
- Shading
- Reduction of turf grass

SECTION BC 3410
ACCESSORY FACILITIES

- Parking
- Bicycle parking
- Trash storage
- Cleaning areas
- Physical Activity and Exercise

SECTION BC 3411
MAINTENANCE

- Fertilizers
- Pesticides

SECTION BC 3412
SITE LIGHTING

- Light pollution
- Light trespass

SECTION BC 3413
SURFACES

- Blue roofs
- Green roofs
- White roofs

Supporting Information

Issue - Expanded

In recent years, it has become increasingly clear that landscaping and construction sites have a major impact on the environment. Sustainable landscaping and responsible construction site management can provide well-designed open spaces, improve air and water quality, plan for climate change, and reduce energy consumption – all goals of PlaNYC. However, there is no comprehensive code or ordinance in New York City that addresses the issues of site and landscaping to establish pre- or post construction standards or requirements related to environmental sustainability. The few related ordinances are scattered in the Zoning Code, fragmented according to building type.

This proposal would create a new chapter of the Building Code that establishes standards for the materials, design, construction and quality of the site and landscape. Having one comprehensive code will make these standards easier to understand, increasing compliance and simplifying enforcement. It will also facilitate code development by enabling policy makers to identify where the city may be over- or under-regulating site and landscaping. Many proposals from the Task Force report touch on these topics and might ultimately find a home in this new chapter.

Environmental & Health Benefits

The environmental and health benefits of this proposal are wide and far reaching. Examples of the effects of this proposal include reduction of the heat island effect, storm water capture and run-off, increased species diversity, and reduction in the use of hazardous chemicals.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a new code section, which will have no direct impact on construction costs.

Precedents

Several cities have implemented landscape regulations, each addressing different areas of this proposal.

The City of Oklahoma City has zoning and planning codes that aim to “enhance, protect and promote the economic, ecological and aesthetic environment.”¹

Chicago’s landscape ordinances require parking lots to integrate landscape islands and trees, and new developments to include landscaping.² These ordinances help to reduce air and noise pollution, protects the soil, cools the air and increases the aesthetic attractiveness of the surroundings. The Department of Zoning co-administers the Landscape Ordinance with the Department of Streets and Sanitation’s Bureau of Forestry.

Sacramento, CA also established landscape requirements for single-family and two-family residential units. A maximum of 40% of the required front yard setback area may be paved for off-street parking and driveways.³ The remaining unpaved portion of the setback areas must be landscaped, and only living vegetation may be used as the primary ground cover.⁴

Irvine, CA is an example of a sustainable landscape code that supplements their community landscaping and urban forest ordinance. Its intent is to provide policy, guidelines, standards and procedures to obtain sustainable landscapes within the city. The city has also developed a Sustainable Landscaping Guideline manual, a plan review procedure and permitting policy to help guide this initiative.⁵

Collier County, FL enacted uniform standards for the installation and maintenance of landscaping. In addition, it recognizes the importance of water conservation through the use of native and drought-tolerant vegetation. The ordinance is applicable to all developments including single family dwellings. Plans must be prepared by a licensed landscape architect (single-family homes are exempt from this requirement). Plant material standards are divided into quality, native vs. exotic, type, prohibited species, and receive credit for plant preservation. The ordinance includes detailed specifications for trees, shrubs, hedges and ground covers, in addition to maximum percentages of particular plants in order to promote specie diversity.⁶

Seattle, WA has several landscape ordinances that include a community landscape code, a tree ordinance, and sustainability design requirements for neighborhood business districts. The sustainability code requires that landscape plans be developed for new development or redevelopment in commercial areas; these plans are prepared and reviewed based on a rating system of a range of sustainable practices. This ordinance, adopted in January 2007, requires landscape plans to address ecological function and aesthetic principles using point-based criteria to measure sustainable factors such as canopy coverage, permeability and visual access. Points are given if the landscape plan preserves trees, installs green roofs, green walls and irrigation systems that reduce the use of potable water. Extra bonus points are awarded for the use of drought-tolerant plants.

LEED

There are no LEED credits directly affiliated with this proposal. However, this amendment corresponds with the intent of LEED Sustainable Sites sections in all rating systems with the exception of LEED for Neighborhood Development. LEED ND (pilot program) will address landscaping issues in a section designated Green Construction and Technology, though this rating system is concerned with overall land and community issues and the proposed code revisions could have broad reaching effects on this system as a whole.

Implementation and Market Availability

There are no known implementation issues for this proposal. Materials that might be used under this proposal are widely available. Plant nurseries have greatly expanded their inventories of native and naturalized species; multiple competitive manufacturers exist for paving, furnishings, fencing and lighting that incorporate recycled content, are dark-sky compliant and have high albedo.

Notes

In addition to the table of contents, there will need to be sections on “Compliance” and “Administration” to discuss the

requirements associated with submittal and review of site plans, supporting documentation and the manner in which this code is administered and enforced. The precedents offered above have a number of different strategies that could be considered as a starting point for NYC.

ENDNOTES:

¹ OKLAHOMA CITY, OK., art. IV, § 59-11100, (2007), available at http://www.okc.gov/Planning/landscape/documents/LandOrd_013004.pdf.

² New Rules Project, Landscape Ordinance, <http://www.newrules.org/environment/chiland.html> (last visited Jan. 26, 2010).

³ SACRAMENTO CITY CODE, tit. 17 § 68.010 (2007), available at http://www.sacgardens.org/news/codes_sacramento_revisions_2007_025.pdf

⁴ SACRAMENTO CITY CODE, tit. 17 § 68.010 (2007), available at http://www.sacgardens.org/news/codes_sacramento_revisions_2007_025.pdf

⁶ Buck Abbey, Landscape Online, Green Building Irvine, <http://www.landscapeonline.com/research/article.php?id=11448> (last visited Jan. 26, 2010).

⁷ COLLIER COUNTY, FL: LAND DEVELOPMENT CODE, § 4.06.00 (2009), available at <http://library.municode.com/html/13992/book.html>.

SEATTLE, WA., MUN. CODE, § 25.09 - 25.11; § 23.44 - 23.45; and 23.47 - 23.50 (2009), available at <http://clerk.ci.seattle.wa.us/~public/code1.htm>.

OC 6: STREAMLINE APPROVALS FOR GREEN TECHNOLOGIES & PROJECTS

Expedite green building projects and technologies
Proposal developed by the Steering Committee

Summary

Issue:

New products and technologies that address environmental concerns are rapidly being developed, and many building owners and developers are eager to implement them. However, there are often no rules governing the use of new products. There are also interagency regulatory issues, which can prohibit or delay projects that utilize new technologies.

Recommendation:

To facilitate the use of innovative technology that can have significant environmental benefits, the city will establish an Interagency Green Team to assist innovative projects in overcoming interagency regulatory hurdles. It will also establish an Innovation Review Board to evaluate technologies for pilot projects or recommend that rules be established for their use. Independent of the Task Force proposal, the New York City Department of Buildings has initiated a Building Sustainability Board to streamline approvals of new green technology.

Proposed Legislation, Rule or Study

Part I: Interagency Green Team

The City of New York should convene an Interagency Green Team, managed by the Mayor's Office, to streamline city permitting of the most sustainable building projects.

The following agencies should have permanent seats:

- Department of Buildings
- Department of Environmental Protection
- Department of Health and Mental Hygiene
- Department of City Planning

The following agencies should designate a representative to the innovation review board, to participate as needed:

- Fire Department of New York
- Department of Transportation
- Department of Parks and Recreation
- Department of Consumer Affairs
- Office of Emergency Management
- Housing Preservation and Development
- Department of Sanitation
- Landmarks Preservation Committee

Part II: Innovation Review Board

The Department of Buildings should convene an Innovation Review Board to review new green technologies and determine under what circumstances they can be safely piloted in NYC or whether they could be used more broadly. If the board determines that a product is safe and effective, the board should designate oversight responsibilities to the appropriate city agency and authorize the agency to establish rules and regulations for the use of the product.

In addition to the Department of Buildings, the following agencies should have permanent seats:

- Department of Environmental Protection
- Department of Health and Mental Hygiene
- Department of City Planning
- Department of Design and Construction

The following agencies should designate a representative to the Innovation Review Board, to participate as needed:

- Fire Department of New York

- Department of Transportation
- Department of Parks and Recreation
- Department of Consumer Affairs
- Office of Emergency Management
- Housing Preservation and Development
- Department of Sanitation
- Landmarks Preservation Committee

Supporting Information

Issue – Expanded

Many innovative green building projects have difficulty obtaining permits because the technologies they utilize introduce interdisciplinary issues that are hard to regulate by separate agencies. Nonetheless, the city benefits from the experimental efforts of early adopters and should facilitate their work. To do so, this proposal recommends that the Office of the Mayor establish an interagency green team to assist advanced green building projects in the regulatory review process and resolve issues they may encounter during permitting.

There is also growing demand for green technologies, and new green products are being developed at a rapid pace. New York City building codes, however, are unable to keep up with the market and do not provide regulations for many new products—meaning new technologies and products are prohibited de facto. In order to encourage timely adoption of new technologies, this proposal recommends the Department of Buildings establish an innovation review board to review new products and expedite their implementation.

Since the Innovation Review Board was first proposed, the Department of Buildings has convened a Building Sustainability Board to review new technologies. This goes a long way toward addressing the issues noted above. In order to provide one forum to consider all new green technologies, this board could be broadened to include other city agencies.

Environmental & Health Benefits

Streamlining green buildings and technologies will speed up the adoption of sustainable building practices and technologies, providing the range of environmental and health benefits associated with green building.

For the purposes of the Executive Summary, this proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for an Interagency Green Team and an Innovation Review Board, both of which will have no direct impact on construction costs.

Precedents

The Task Force researched ways that four cities – Chicago, San Francisco, Portland and Seattle – streamline approvals for green technologies and projects. Only Portland has a dedicated bureau specific to green technologies, others process them as they do all products/procedures new to the code. To encourage sustainable buildings, some building departments accelerate the timeline to secure approvals.

Chicago building designs that include elements that are new to the code are presented to the Committee on Standards and Tests, which makes recommendations to the Commissioner of Buildings. There is no special consideration or path for new green technologies.¹

San Francisco approves the use of new materials and technologies based upon documentation from trustworthy US testing agencies. Preference is for demonstrated durability rather than “green.”²

Portland’s Bureau of Development Services (BDS) has established the Alternative Technology Advisory Committee, made up of experts in sustainable technologies and emerging construction techniques, to help the bureau evaluate new technologies. Applications to the Alternative Technology Advisory Committee may be for either a technology that will be used in a specific project being reviewed by BDS, or for a particular technology (such as a new building product) that may be used in multiple future projects. Applications can be made in advance of a building permit application, or as part of the permit review process. The Committee review is an optional process that is intended to help applicants get innovative products approved into their projects. An applicant may proceed directly to a building code appeal, without a committee recommendation, if desired. With any application to the Committee the burden of proof is on the applicant to show that the proposed technology promotes a more positive impact to the earth’s natural systems, when compared to similar, approved technologies. BDS is not bound by the recommendations of the Committee. A favorable

recommendation of a technology by the Committee does not guarantee approval of a building code appeal by BDS for the use of the technology. The Alternative Technology Advisory Committee meets once a month; therefore it may take several weeks for an application to be reviewed by the Committee. Applicants interested in using this process are encouraged to submit their applications as early in their design process as possible.³

In San Francisco, projects committing to at least LEED Gold certification receive priority service from the Departments of Planning, Building Inspection, and Public Works.⁴

Seattle has a dedicated Priority Green Team to review buildings with a high level of sustainability. This hastens the approval process.⁵

LEED

The implementation of this proposal may encourage the use of new green technologies, which will may increase achievement of LEED Innovation in Design credits in all rating systems.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

¹ Interview with Elizabeth Scanlan, Director of Code Development, Dept. of Buildings, City of Chicago, IL. (Jan. 6, 2010); and Interview with Javier Ceballos, Mechanical Engineer, Energy and Sustainable Business, Dept. of the Environment, City of Chicago, IL. (Jan. 6, 2010).

² Interview with Barry Hooper, Private Sector Green Building Program Specialist, Dept. of the Environment, City of San Francisco, CA. (Jan. 21, 2010).

³ Interview with Vinh Mason, Policy Analyst, Bureau of Planning and Sustainability, City of Portland, OR. (Jan. 7, 2010).

⁴ Interview with Barry Hooper, Private Sector Green Building Program Specialist, Dept. of the Environment, City of San Francisco, CA. (Jan. 21, 2010).

⁵ Interview with Jayson Antonoff, Policy Advisor, Sustainable Infrastructure & Energy/Climate Change, Department of Planning & Development, City of Seattle, WA. (Jan. 7, 2010).

OC 7: ENHANCE CODE TRAINING FOR ARCHITECTS & ENGINEERS

Study

Proposal developed by the Steering Committee

Summary

Issue:

With the adoption of the 2008 New York City Construction Codes, along with regular revisions and the addition of new green provisions, the city's building codes are continuously changing. It is important that the city informs building professionals of all code changes and ensures that training is provided so that practitioners can comply with new requirements.

Recommendation:

Develop a strategy to ensure that building professionals are aware of code changes and able to access training on the most current versions of the New York City Construction Codes. The Mayor's Office began working with industry associations, including Urban Green, AIA New York, and ASHRAE New York, to develop training prior to issuance of this report.

Proposed Legislation, Rule or Study

The City should develop a strategy to create a standardized curriculum and delivery mechanisms for training architects, engineers, lighting designers, and design professionals on the New York City Construction Codes. In developing this strategy, the City should:

1. Work with professional societies representing design professionals;
2. Explore means to maximize participation and ensure knowledge of codes, including adding code training as a requirement for continuing education of existing designers, licensing for new designers, and for accreditation of architectural and engineering schools; and
3. Consider options for funding the development and delivery of this training.

Supporting Information

Issue – Expanded

Construction in New York City is governed by a large and complex set of codes and regulations. The Construction Codes include half a dozen books – the Building Code, Energy Code, Electrical Code, Mechanical Code, Fuel Gas Code, and Plumbing Code – that change regularly. Many other codes and regulations, such as the Zoning Resolution, also affect construction. Compliance with these numerous and complex laws is only possible if designers know what the laws say and keep abreast of changes to them.

Preliminary efforts are already underway to educate designers on the Energy Code, which the Department of Buildings began enforcing for the first time in 2009. At the request of the Office of the Mayor, the AIA New York Chapter, ASHRAE-NY and Urban Green Council assembled a group of speakers to train design professionals on the Energy Code. Each organization offered a 5-part training session that covered the content of the energy code, preparing submittals, and documenting compliance. These sessions were filled to capacity, indicating the tremendous demand for education on codes.

To further these initial efforts, this proposal recommends that the City work with professional societies to develop a standardized curriculum that can be offered regularly and revised as codes change, as well as explore mechanisms for delivery. It is also essential to consider options to maximize participation and ensure knowledge of codes, such as adding code training as a requirement of continuing education for designers to maintain their licenses, for the licensing exams of new designers, and for the accreditation of design schools. Finally, the experience from other cities indicates that funding is required for program development and delivery.

Environmental & Health Benefits

This proposal will enhance code compliance, achieving the range of environmental and health benefits addressed under the Construction Codes and other laws, including energy and water efficiency, indoor air quality, and stormwater reductions.

For the purposes of the Executive Summary, this proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs.

Precedents

The Task Force researched efforts to train architects and engineers in four cities regarded as leaders in green building: Chicago, San Francisco, Portland, and Seattle. Three of the four cities have extensive programs to train design professionals on compliance with energy codes, working with professional and non-profit organizations to deliver training. Some cities contribute to the funding of these programs, but most training funding comes from other sources, including from individual professionals paying a fee to attend programs. Chicago has leveraged the annual licensing program for engineers to implement a mandatory one-day class on energy conservation code.

The City of Chicago works with the International Code Council (ICC) to provide a one-day training class on the Chicago Energy Conservation Code for registered professional engineers and architects. Drawings submitted to the Building Department that are required to comply with the energy code must be signed by a “Registered Energy Professional” (REP). To become a REP, a licensed professional must complete the ICC class.¹

In San Francisco, the Pacific Energy Center (part of Pacific gas and Electric Company) offers educational programs (mostly focused on commercial buildings), free to the public, but targeting design, operation and construction professionals. These programs are primarily funded by a 3% surcharge on gas and electric bills. Significant additional resources come from university programs, union training, design professionals’ organizations and city-funded outreach.²

Portland’s Bureau of Planning and Sustainability has been working with other city bureaus to develop an implementation guide for the city’s green building policy.³

The AIA+2030 Professional Series in Seattle aims to help design professionals meet the energy efficiency goals of Seattle’s 2030 Challenge. Ten, 4-hour sessions offer strategies to reach 50% reduction in fossil fuel greenhouse gas emissions, with the goal of creating the next-generation of super-efficient buildings. Mostly technical in scope, the series also addresses project contract, relevant codes and management. Funding comes from the city of Seattle and Seattle City Light (a publicly-owned utility).⁴

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

¹ Interview with Elizabeth Scanlan, Director of Code Development, Dept. of Buildings, City of Chicago, IL. (Jan. 6, 2010); and Interview with Javier Ceballos, Mechanical Engineer, Energy and Sustainable Business, Dept. of the Environment, City of Chicago, IL. (Jan. 6, 2010).

² Interview with Barry Hooper, Private Sector Green Building Program Specialist, Dept. of the Environment, City of San Francisco, CA. (Jan. 21, 2010).

³ Interview with Vinh Mason, Policy Analyst, Bureau of Planning and Sustainability, City of Portland, OR. (Jan. 7, 2010).

⁴ Interview with Janet Stephenson, Programs Director, Sustainability and 2030 Initiatives, Seattle Chapter, American Institute of Architects (Sept. 29, 20009).

HT 1: LIMIT HARMFUL EMISSIONS FROM CARPETS

New York City Health Code; New York City Building Code; New York City Administrative Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Carpet, carpet backing, carpet cushion and adhesives emit respiratory irritants and cancer-causing compounds, which are harmful to the comfort and well-being of installers and occupants.

Recommendation:

Establish standards, in accordance with national industry programs, to limit the presence of volatile organic compounds in carpet, carpet backing and carpet adhesives.

Proposed Legislation, Rule or Study

Amendments to the New York City Health Code:

1. Add a new section 131.12 as follows:

§131.12 Volatile organic compounds. (a) Any new carpet, carpet cushion, and carpet adhesive installed in any building shall comply with the standards in this section; provided, however, that this section shall not apply to:

(1) Until July first, two thousand sixteen, carpet, carpet cushion, and carpet adhesive installed in any building classified in occupancy group R-3 under the New York City Building Code; and

(2) Antique carpets, area rugs and similar non-adhered carpets.

(b) It shall be unlawful to buy or sell or offer to buy or sell, or cause any person to buy or sell any carpet, carpet cushion or carpet adhesive that does not comply with the standards in this section.

(c) Carpet cushion and, until July first, two thousand sixteen, carpet shall comply with the following twenty-four hour testing criteria:

<u>Volatile Organic Compound</u>	<u>(Qg/m²·hr)</u>
<u>Butylated hydroxytoluene</u>	<u>300</u>
<u>Formaldehyde</u>	<u>50</u>
<u>4-phenylcyclohexene (4PCH)</u>	<u>50</u>
<u>Total Volatile Organic Compounds</u>	<u>1000</u>

(d) Beginning July first, two thousand sixteen, carpet shall comply with the following twenty-four hour and fourteen-day testing criteria:

HT 1: LIMIT HARMFUL EMISSIONS FROM CARPETS

Carpet 24-Hour & 14-Day Test Criteria					
Target Contaminant	CAS #	Maximum Emission Factor(EF) (ugm ² -hr)	Maximum Air Concentration (ug/m ³)	Maximum Emission Factor (EF) (ugm ² -hr)	Office Building Target Air Concentration (for reference only) (ug.m ³)
Acetaldehyde	75-07-0	20	11	16	9
Benzene	71-43-2	55	30	55	30
Caprolactam	105-60-2	120	65	190	100
2-Ethylhexanoic Acid	149-57-5	46	25	46	25
Formaldehyde	50-00-0	50	27	30	16
1-Methyl-2-pyrrolidinone	872-50-4	300	160	300	160
Naphthaline	91-20-3	20	11	8.2	4.5
Nonanal	124-19-6	24	13	24	13
Octanal	124-13-0	24	13	13	7.2
4-phenylcyclohexene	4994-16-5	50	27	17	9.3
Styrene	100-42-5	410	220	410	220
Toluene	108-88-3	280	150	280	150
Vinyl acetate	108-5-4	400	220	190	100
Total Volatile Organic Compounds	-	500 ^a	270	NA	NA

(e) Carpet adhesive shall comply with the following twenty-four hour and fourteen-day testing criteria:

	(Qg/m ² ·hr)	(Qg/m ² ·hr)
Formaldehyde	50	31
2-ethyl-1-hexanol	300	300
Total Volatile Organic Compounds	8000	-

(f) Testing of materials covered by this section shall be in accordance with ASTM D 5116 (guide for small-scale environmental chamber determinations of organic emissions from indoor materials/products).

(g) By July first, two thousand thirteen, and at least every three years thereafter, the department shall review and, if necessary, update or revise the standards in this section.

Amendments to the New York City Building Code:

1. Add a new Section 804.6 as follows:

804.6 Volatile organic compounds. Any new carpet, carpet cushion and carpet adhesive installed in any building shall comply with the standards of section 131.12 of the New York City Health Code.

Amendments to the New York City Administrative Code:

1. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to subchapter 12 (Endangered or Threatened Species) but contains the following prohibition language:

§20-xxx Volatile organic compounds. a. It shall be unlawful to buy or sell, offer or attempt to buy or sell, or cause any person to buy or sell any carpet, carpet cushion, and carpet adhesive that does not comply with section 131.12 of the New York City Health Code.

Supporting Information

Issue – Expanded

Volatile organic compounds (VOCs) are common chemical contaminants that can easily evaporate into the air and are found in homes and offices.¹ Their presence can be noticed as an odor, such as paint and “new car smell.”² Many building materials and indoor furnishings release VOCs, contributing to “sick building syndrome.”³ Even if a building’s ventilation system is properly designed and well maintained, VOCs and other chemical contaminants must be controlled to ensure healthy indoor air.⁴

EPA studies have found that levels of common VOCs are consistently higher indoors than outdoors. VOC levels in homes can be 2 to 5 times higher inside than outside, with some indoor air levels over 1,000 times higher following certain activities such as paint stripping.⁵

Exposure to VOCs can cause short and long-term health problems. Some VOCs are known carcinogens; several studies have found a link between exposure to formaldehyde and increased incidence of nasal cancer, nasopharyngeal cancer, and leukemia.⁶ VOCs can also cause eye, nose, and throat irritation; headaches, fatigue, loss of coordination, dizziness, and nausea; and damage to the liver, kidney, and the central nervous system.⁷

VOCs also contribute to ground-level ozone formation (smog). When VOCs are released into the air, the organic compounds react with nitrogen oxides to form ozone.⁸ High concentrations of ground-level ozone can cause respiratory problems and exacerbate asthma, emphysema, and bronchitis.^{9,10} Ground-level ozone also adversely affects the local ecosystem, damaging or weakening trees and plants, and reducing forest growth and crop yield.¹¹

Environmental & Health Benefits

Limiting VOC levels in carpet, carpet cushions, and carpet adhesives will reduce human exposure to VOCs and the associated health effects. According to the California Air Resources Board, scientific study has only touched the ‘tip of the iceberg’ in understanding all VOCs in indoor air. Because the link between indoor air pollutants and health impacts is so complex, researchers are also investigating the reaction of VOCs with other compounds present in indoor air and are discovering new areas for future study.¹²

Limiting VOCs will also help lower ground-level ozone concentrations in outdoor urban air, and alleviate the health and environmental risks associated with ground-level ozone.¹³

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

Cost & Savings

This proposal is not expected to have any impact on capital costs.

Precedents

The standards included in this proposal are consistent with the Green Label Plus program for carpets and the Green Label programs for cushions and adhesives established by the Carpet and Rug Institute (CRI).¹⁴ While the Green Label and Green Label Plus programs are currently voluntary standards for the carpet industry, CRI worked with California’s Sustainable Building Task Force and the Department of Health Services, Indoor Air Quality Section, to meet testing protocols used by the Collaborative for High Performance Schools (CHPS) in California.¹⁵

The 2008 California Green Building Standards Code references the Green Label and Green Label Plus in section 804.4.3 as one of four possible testing and product requirements that all installed interior carpeting must meet.¹⁶ The California

Gold Sustainable Carpet Standard also includes the Green Label Plus program in two of the possible Indoor Air point credits.¹⁷

In 2005, the City of New York enacted laws creating an environmentally preferable purchasing program, which requires the City to only purchase carpet and carpet adhesives that meet the CRI standards.¹⁸ The Battery Park City Authority's building guidelines also require compliance with the CRI Green Label and Green Label Plus programs.¹⁹

On June 19, 2009 new rules regarding commercial and consumer products were adopted by the state of Illinois. The adopted rule, Standards and Limitations for Organic Material Emissions for Area Sources, 35 Ill. Adm. Code 223, regulates the VOC content of a wide array of products, including carpet, and carpet pad or cushion adhesives.²⁰

LEED

If this recommendation is implemented, buildings in NYC will automatically be in compliance with several points: LEED-CI and LEED-NC credits EQ4.3 Low-Emitting Materials, Carpet and EQ Credit 4.1: VOC limit of 50 g/L, and LEED for Homes credit MR2, Environmentally Preferable Products.

Since these recommended NYC code revisions do not directly reference the CRI standards or the SCAQMD ruling, the recommendation is in line with LEED only as long as those standards remain consistent.

This recommendation will also facilitate achieving LEED-NC and LEED-CI credit EQ3.2 Construction IAQ Management Plan, Before Occupancy and LEED EB credit EQ3, Construction IAQ Management Plan and LEED for Homes credit EQ8, Contaminant Control. These points are concerned with reducing overall Indoor Air Quality problems throughout the building or space.

Implementation & Market Availability

There are no known implementation issues for this proposal as compliant carpet systems are readily available. The CRI standards are well established in the industry and already used by the City of New York, Battery Park City Authority, and many other municipalities and school districts. All major carpet manufacturers carry a full line of compliant materials, and several companies only manufacture compliant products. It is the professional opinion of the Materials & Ventilation Committee that promulgating this standard for NYC will not result in a limited selection.

ENDNOTES:

- ¹ The Nat'l Inst. for Occupational Safety and Health, Chemicals and Odors, NIOSH Safety and Health Topic: Indoor Environmental Quality, <http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html> (last visited July 21, 2009).
- ² BuildClean, Volatile Organic Compounds (VOCs), <http://www.buildclean.org/?id=279> (last visited July 21, 2009).
- ³ U.S. EPA, Indoor Air Facts No. 4 Sick Building Syndrome, <http://www.epa.gov/iaq/pubs/sbs.html> (last visited July 21, 2009).
- ⁴ The Nat'l Inst. for Occupational Safety and Health, NIOSH Safety and Health Topic: Indoor Environmental Quality; Chemicals and Odors, <http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html> (last visited July 21, 2009).
- ⁵ U.S. EPA, An Introduction to Indoor Air Quality, <http://www.epa.gov/iaq/voc.html> (last visited Jan. 25, 2010).
- ⁶ THE NAT'L CANCER INSTIT., FORMALDEHYDE AND CANCER: QUESTIONS AND ANSWERS (2009), <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde>
- ⁷ Ibid.
- ⁸ U.S. EPA, OZONE: GOOD UP HIGH, BAD NEARBY (2003), <http://www.epa.gov/oar/oaqps/gooduphigh/ozone.pdf>.
- ⁹ U.S. EPA, AIR QUALITY GUIDE FOR OZONE (2009), <http://www.epa.gov/airnow/ozone/air-quality-guide-0308.pdf>.
- ¹⁰ CALIFORNIA EPA, EVALUATION OF HEALTH EFFECTS OF TOXIC AIR POLLUTANTS IN A SOUTHERN CALIFORNIA COMMUNITY: A PILOT STUDY (2002), <ftp://ftp.arb.ca.gov/carbis/research/apr/past/99-302.pdf>.
- ¹¹ U.S. EPA, Ground-level Ozone: Health and Environment, <http://www.epa.gov/air/ozonepollution/health.html> (last visited Jan. 25, 2010).
- ¹² CALIFORNIA EPA, REPORT TO THE CALIFORNIA LEGISLATURE, INDOOR AIR POLLUTION IN CALIFORNIA (2005), <http://www.arb.ca.gov/research/indoor/ab1173/rpt0705.pdf>.
- ¹³ South Coast Air Quality Management District, Painter's Guide to Clean Air, <http://www.aqmd.gov/prdas/brochures/paintguide.html> (last visited July 21, 2009).
- ¹⁴ Carpet and Rug Institute, Green Label/Green Label Plus, <http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus> (last visited March 30, 2009).
- ¹⁵ CARPET AND RUG INSTITUTE, GREEN LABEL PLUS FACT SHEET, http://www.carpet-rug.org/pdf_word_docs/CRI_GLP_factsheet.pdf.
- ¹⁶ CAL. CODE, Tit. 24 § pt. 11 § 804, 43 (2008), available at <http://www.documents.dgs.ca.gov>.
- ¹⁷ CALIFORNIA DEP'T. OF SERVICES, CALIFORNIA GOLD SUSTAINABLE CARPET STANDARD, 11 (2006) <http://www.documents.dgs.ca.gov/green/epp/standards.pdf>; and BILL BALEK, ISSA, NEW VOC LIMITS FOR CLEANING PRODUCTS EFFECTIVE BEGINNING OF 2009, (2009) http://www.greensafecertified.com/PDFs/VOC_Limits_2009.pdf.
- ¹⁸ THE NAT'L CANCER INSTIT., FORMALDEHYDE AND CANCER: QUESTIONS AND ANSWERS (2009), <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde>.
- ¹⁹ HUGH L. CAREY, BATTERY PARK CITY AUTHORITY, COMMERCIAL/INSTITUTIONAL ENVIRONMENTAL GUIDELINES 29 (2002), http://www.batteryparkcity.org/pdf/BPCA_CommercialGuidelines.pdf; HUGH L. CAREY BATTERY PARK CITY AUTHORITY, RESIDENTIAL ENVIRONMENTAL GUIDELINES, 17 (2005) http://www.batteryparkcity.org/pdf/BPCA_GreenGuidelines.pdf; and HUGH L. CAREY BATTERY PARK CITY AUTHORITY, COMMERCIAL/INSTITUTIONAL ENVIRONMENTAL GUIDELINES, 29 (2002), http://www.batteryparkcity.org/pdf/BPCA_CommercialGuidelines.pdf.
- ²⁰ ILL. ADM. CODE 35 § 223 (2009), available at <http://www.ipcb.state.il.us/documents/dsweb/Get/Document-65421>.

HT 2: LIMIT HARMFUL EMISSIONS FROM PAINTS & GLUES

New York City Building Code

Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Volatile organic compounds (VOCs) are emitted from building materials, glues, adhesives, paints and lacquers. These compounds are respiratory irritants that adversely affect the health of workers and occupants.

Recommendation:

Reduce indoor air contaminants by limiting VOCs in adhesives, sealants, paints and coatings.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new section 801.1.3 as follows:

801.1.3 Volatile organic compounds. These provisions shall limit the volatile organic compounds of interior finishes, adhesives and sealants.

2. Add a new section 803.10 as follows:

803.10 Volatile organic compounds. No interior wall or ceiling finish shall contain any volatile organic compound in any concentration exceeding that permitted under Rule 1113 of the South Coast Air Quality Management District.

3. Add a new section 804.6 as follows:

804.6 Volatile organic compounds. No interior floor finish shall contain any volatile organic compound in any concentration exceeding that permitted under Rule 1113 of the South Coast Air Quality Management District.

4. Add a new section BC 806 as follows:

SECTION BC 806 - ADHESIVES & SEALANTS

806.1 Volatile organic compounds. No interior adhesive or sealant shall contain any volatile organic compound in any concentration exceeding that permitted under Rule 1168 of the South Coast Air Quality Management District

Supporting Information

Issue – Expanded

Volatile organic compounds (VOCs) are common chemical contaminants that can easily evaporate into the air and are found in homes and offices.¹ Their presence can be noticed as an odor, such as paint and “new car smell.”² Many building materials and indoor furnishings release VOCs, contributing to “sick building syndrome.”³ Even if a building’s ventilation system is properly designed and well maintained, VOCs and other chemical contaminants must be controlled to ensure healthy indoor air.⁴

EPA studies have found that levels of common VOCs are consistently higher indoors than outdoors. VOC levels in homes can be 2 to 5 times higher inside than outside, with some indoor air levels over 1,000 times higher following certain activities such as paint stripping.⁵ Paint emits numerous chemicals that the California EPA has deemed as toxic air compounds (TACs),⁶ and emissions can continue for extended periods of time. One study found that less than 50% of the VOCs in latex paint are emitted in the first year.⁷

Exposure to VOCs can cause short and long-term health problems. Some VOCs are known carcinogens; several studies have found a link between exposure to formaldehyde and increased incidence of nasal cancer, nasopharyngeal cancer, and leukemia.⁸ VOCs can also cause eye, nose, and throat irritation; headaches, loss of coordination, and nausea; and

damage to liver, kidney, and the central nervous system.⁹

VOCs also contribute to ground-level ozone formation (smog).¹⁰ When VOCs are released into the air, the organic compounds react with nitrogen oxides to form ozone.¹¹ High concentrations of ground-level ozone can cause respiratory problems and exacerbate asthma, emphysema, and bronchitis.¹² Ground-level ozone also adversely affects the local ecosystem, damaging or weakening trees and plants, and reducing forest growth and crop yield.¹³

Environmental & Health Benefits

Limiting VOC levels in adhesives, paints, coatings and sealants will reduce human exposure and avoid potential health risks associated with indoor air exposure. According to the California Air Resources Board, scientific study has only touched the 'tip of the iceberg' in understanding all VOCs in indoor air. Because the link between indoor air pollutants and health impacts is so complex, researchers are also investigating the reaction of VOCs with other compounds present in indoor air and are discovering new areas for future study.¹⁴

Limiting VOCs will also help lower ground-level ozone concentrations in outdoor urban air, and alleviate the health and environmental risks associated with ground-level ozone.¹⁵

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

Cost & Savings

This proposal is not expected to have any impact on capital costs.

Precedents

These limits are more stringent and comprehensive (in terms of the number of materials addressed) than the limits established in current New York State Department of Environmental Conservation (DEC) Regulations.¹⁶

These VOC limits are consistent with the South Coast Air Quality Management District's (SCAQMD) Rules 1113 and 1168, which have been incorporated into the 2008 California Green Building Standards Code¹⁷ and adopted by numerous municipalities throughout the country.¹⁸ Regionally, the Bay Area Air Quality Management District also established VOC limits for adhesive and sealant products.¹⁹

Additionally, the Green Seal® has set guidelines for VOC levels in paints that manufacturers must follow to obtain a certification.²⁰ A variety of industry associations have also implemented guidelines addressing VOC levels for their respective products, including the Carpet and Rug Institute²¹ and Resilient Flooring Institute.²²

In 2005, the City of New York enacted laws creating an environmentally preferable purchasing program, which establishes VOC limits for coatings purchased by the city.²³ Within New York City, the Battery Park City Authority has requirements for sealants, adhesives, paints and coatings in all new construction to abide by the South Coast Air Quality Management District's Rule 1168.^{24 25}

A number of states, including California, New Jersey, Texas and Arizona, have enacted laws limiting VOC content in paints and coatings. EPA laws in effect since September 13, 1999 establish limits of VOC's contained in the Architectural and Industry Maintenance (AIM) industry. All of the states in the northeast region have enacted regulations on the content of VOC's in consumer products including cleaning products and products used in architectural and interior applications (NY, PA, NJ, MD, DE, DC, ME, CT, MA, NH, RI, VT, VA).

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is developing Proposed Standard 189.1 - Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings. Section 8.4.2 of the standard calls for the use of low emitting building materials including adhesives, sealants, paints and coatings that are in compliance with SCAQMD Rules 1113 and 1168, and Green Seal Standards GS-36 (aerosol adhesives) and GS-11 (paints, coatings and primers). The Standard is expected to be finalized in early 2010.²⁶

LEED

These recommendations correspond with many requirements of

- LEED-CI credit EQ4.1 Low-Emitting Materials: Adhesives & Sealants;
- LEED-CI credit EQ4.2 Low-Emitting Materials: Paints & Coatings;
- LEED-NC credit EQ4.1 Low-Emitting Materials: Adhesives & Sealants;
- LEED-NC credit EQ4.2 Low-Emitting Materials: Paints & Coatings; and
- LEED for Homes credit MR2, Environmentally Preferable Products.

It should be noted that the reference standards vary significantly depending upon the type of application for the product. For example; topcoat paints, primers and sealers all have differing requirements. Adherence to these

recommendations will likely assist in achieving LEED credits, though each material must be researched independently under the selected rating system.

This recommendation will also facilitate achieving LEED-NC and LEED-CI credit EQ3.2 Construction IAQ Management Plan, Before Occupancy and LEED EB credit EQ3, Construction IAQ Management Plan and LEED for Homes credit EQ8, Contaminant Control. These points are concerned with reducing overall Indoor Air Quality problems throughout the building or space.

Adhesives for carpet and laminate adhesive are addressed separately by LEED, and do not apply to these recommendations.

Implementation & Market Availability

There are no known implementation issues for this proposal. Low VOC and VOC-free products are readily available.

Notes

Researchers have investigated VOCs in buildings for many years. There are many thousands of different types of compounds that are considered VOCs. Given this fact, research on the human health effects of VOCs is limited. Below is a summary of the current information related to VOCs, exposure, and health effects.

Human Exposure Standards:

The following information is taken from the Health Canada technical guide on indoor air quality in office buildings:

The threshold limit values (TLVs) for individual chemical substances that have been adopted by the American Conference of Governmental Industrial Hygienists (ACGIH) are not appropriate for office environments, for several reasons. For example, ACGIH TLVs apply to industrial workers who may be exposed to a few known contaminants at high concentrations over a 40-hour work week. Industrial workers are usually provided with adequate protective equipment (e.g., source ventilation, protective clothing or face masks, breathing equipment). In addition, the industrial workforce is generally made up of young, healthy, adult males.

Office workers, on the other hand, are exposed, without protective equipment, to a broad spectrum of contaminants at low concentrations over periods often longer than 40 hours per week. The synergistic effect of these compounds on occupant comfort is not known. As well, the population composition of the office workforce covers a much broader spectrum than that of the industrial workforce. It would therefore seem that individual limits much lower than ACGIH TLVs are more appropriate.²⁷

ASHRAE Standard 62-2007 observes that one approach has been to assume that some fraction of TLV is applicable and would not lead to adverse health effects or complaints in general populations; however, ASHRAE cautions that this approach should not be used without first assessing its suitability for the contaminant of concern. ASHRAE indicates that concentrations of concern range from less than one part per billion (ppb) for some very toxic compounds or for compounds having very low odor thresholds up to concentrations several orders of magnitude higher. "Not all compounds can be identified, and toxicological data are incomplete for many compounds." Although there are at present no U.S. standards for Total VOC, the U.S. Green Building Council Leadership in Energy and Environmental Design target is 500 micrograms per cubic meter. The European Community has prepared a target guideline value for TVOC of 300 micrograms per cubic meter, where no individual VOC should exceed 10% of the TVOC concentration.²⁸ ASHRAE 62-2007 states that precise guidance on TOC concentrations cannot be given, and that setting target concentrations for TVOCs is not recommended.

Health Effects:

Of the VOCs typically found indoors, only a few, such as formaldehyde and acrolein, are irritants at levels typically measured. A few of the VOCs commonly found in indoor environments are known carcinogens (e.g., benzene), although evidence for carcinogenicity is extrapolated from high-level exposures in industrial environments.²⁹ Others (e.g., carbon tetrachloride, chloroform) have produced cancer in laboratory animals, but no direct evidence exists for human effects.³⁰ Most VOCs are lipid soluble, readily cross the blood-brain barrier, and are easily absorbed through the lungs. Most are neurotoxic and, in levels in excess of occupationally acceptable limits, may cause central nervous system depression, vertigo, visual disorders, and occasionally tremors, fatigue, anorexia, and weakness. Potential genotoxic effects are still under investigation. Effects of low-level exposures to VOC mixtures over long periods of time are still being researched.

The following information is taken from the Health Canada technical guide on indoor air quality in office buildings:

Research in North America and Europe has demonstrated that VOCs at concentrations much lower than the ACGIH TLVs can cause discomfort. In an exposure range of 0.3-3 mg/m³, odors, irritation, and discomfort may appear in response to the presence of TVOC together with thermal comfort factors and stressors. Above about 3 mg/m³, one may expect complaints; above 25 mg/m³, temporary discomfort and respiratory irritation have been demonstrated for a common mix of chemicals in an office building.

Hypersensitive individuals can have severe reactions to a variety of VOCs at very low concentrations. They can react to organic compounds that are released by building materials, carpets, and various consumer products, including plastics, soaps and dyes. These reactions can occur following exposure to a single sensitizing dose or sequence of doses, after which time a much lower dose can provoke symptoms. Chronic exposure to low doses can also cause reactions. Symptoms are usually non-specific and may be insufficient to permit identification of the appropriate compounds. Because the available knowledge of toxicological and sensory effects of VOCs and their mixtures is incomplete, reduction of overall exposure to VOCs is desirable.³¹

ENDNOTES:

¹ National Institute for Occupational Safety and Health, Safety and Health Topic: Indoor Environmental Quality. Chemicals and Odors, <http://www.cdc.gov/niosh/topics/indoorenv/ChemicalsOdors.html> (last visited Jan. 13, 2010).

² BuildClean. Volatile Organic Compounds (VOCs), <http://www.buildclean.org/?id=279> (last visited Jan. 13, 2010).

³ U.S. EPA, Indoor Air Quality. Indoor Air Facts No. 4: Sick Building Syndrome, <http://www.epa.gov/iaq/pubs/sbs.html> (last visited Jan 13, 2010).

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- ⁴ National Institute for Occupational Safety and Health, Safety and Health Topic: Indoor Environmental Quality, <http://www.cdc.gov/niosh/topics/indoorenv/> (last visited Jan. 26, 2010).
- ⁵ U.S. EPA, An Introduction to Indoor Air Quality, <http://www.epa.gov/iaq/voc.html> (last visited Jan. 26, 2010).
- ⁶ CAL. HEALTH AND SAFETY CODE § 39655 (2005) (An air pollutant is defined as an airborne substance which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health.).
- ⁷ STATE OF CALIFORNIA EPA, REPORT TO THE CALIFORNIA LEGISLATURE: INDOOR AIR POLLUTION IN CALIFORNIA (2005) available at <http://www.arb.ca.gov/research/indoor/ab1173/rpt0705.pdf>.
- ⁸ National Cancer Institute, Formaldehyde and Cancer: Questions and Answers, <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde> (last visited Jan. 13, 2010).
- ⁹ U.S. EPA, An Introduction to Indoor Air Quality, <http://www.epa.gov/iaq/voc.html>. (last visited Jan. 13, 2010).
- ¹⁰ Ibid.
- ¹¹ U.S. EPA, OZONE: GOOD UP HIGH, BAD NEARBY (2003), available at <http://www.epa.gov/air/ozonepollution/pdfs/ozonegb.pdf>.
- ¹² U.S. EPA, AIR QUALITY GUIDE FOR OZONE, <http://www.epa.gov/airnow/ozone/air-quality-guide-0308.pdf> (last visited Jan. 13, 2010).
- ¹³ U.S. EPA, Ground-level Ozone: Health and Environment, <http://www.epa.gov/air/ozonepollution/health.html> (last visited Jan. 13, 2010).
- ¹⁴ STATE OF CALIFORNIA EPA, REPORT TO THE CALIFORNIA LEGISLATURE: INDOOR AIR POLLUTION IN CALIFORNIA (2005).
- ¹⁵ South Coast Air Quality Management District, Painter's Guide to Clean Air, <http://www.aqmd.gov/prdas/brochures/paintguide.html> (last visited Jan. 13, 2010).
- ¹⁶ 3 NYCRR § 228, 235 (2009), available at <http://www.dec.ny.gov/regs/2492.html>.
- ¹⁷ CAL. CODE, Tit. 24 § pt. 11 § 804, 42-43 (2008), available at <http://www.documents.dgs.ca.gov>.
- ¹⁸ Susan Brimo-Cox, VOC Regulations: Regional VOC regulations, PAINTPRO, January/February 2007, available at http://www.paintpro.net/Articles/PP901/PP901-Business_Strategies.cfm.
- ¹⁹ BAY AREA AIR QUALITY MANAGEMENT DISTRICT, 8 § 51 (2002), available at <http://www.baaqmd.gov/dst/regulations/rg0851.pdf>.
- ²⁰ GREEN SEAL, GS-11: ENVIRONMENTAL REQUIREMENTS FOR PAINTS (3D. ED. 2010) available at http://www.greenseal.org/certification/standards/GS-11_Paints_and_Coatings.pdf.
- ²¹ Carpet and Rug Institute, Green Label/ Green Label Plus, <http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/index.cfm> (last visited Jan. 13, 2010).
- ²² SCIENTIFIC CERTIFICATION SYSTEMS, INDOOR AIR QUALITY PERFORMANCE: RESILIENT FLOORING INSTITUTE FLOOR SCORE, (2007), available at http://rfci.com/SCS-EC10.2_2007.pdf.
- ²³ City of New York Local Laws 118 & 120 of 2005 (2005). Available at http://www.nyc.gov/html/nycwasteless/html/at_agencies/laws_directives.shtml
- ²⁴ HUGH L. CAREY, BATTERY PARK CITY AUTHORITY, COMMERCIAL/INSTITUTIONAL ENVIRONMENTAL GUIDELINES 29 (2002), http://www.batteryparkcity.org/pdf/BPCA_CommercialGuidelines.pdf.
- ²⁵ HUGH L. CAREY, BATTERY PARK CITY AUTHORITY, RESIDENTIAL ENVIRONMENTAL GUIDELINES 17 (2005) http://www.batteryparkcity.org/pdf/BPCA_GreenGuidelines.pdf.
- ²⁶ ASHRAE, Proposed Standard 189.1 Begins Third Public Review with Increased Energy Savings (Mar. 4, 2009), <http://www.ashrae.org/pressroom/detail/17123>.
- ²⁷ HEALTH CANADA, CAN. MIN. OF NAT. HEALTH AND WELFARE, INDOOR AIR QUALITY IN OFFICE BUILDINGS: A TECHNICAL GUIDE, (1995), available at http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/air/office_building-immeubles_bureaux/93ehd-dhm166-eng.pdf.
- ²⁸ Ibid.
- ²⁹ Robert Rinsky, et al., Benzene and Leukemia: An Epidemiologic Risk Assessment, 316:17 N. ENGL. J. MED., 1044-1050 (1987), available at <http://content.nejm.org/cgi/content/abstract/316/17/1044>.
- ³⁰ JV RODRICKS, ASSESSING CARCINOGENIC RISKS ASSOCIATED WITH INDOOR AIR POLLUTANTS (1996).
- ³¹ HEALTH CANADA, CAN. MIN. OF NAT. HEALTH AND WELFARE, INDOOR AIR QUALITY IN OFFICE BUILDINGS (1995).

HT 3: RESTRICT CANCER-CAUSING FORMALDEHYDE IN BUILDING MATERIALS

New York City Health Code; New York City Building Code; New York City Administrative Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Formaldehyde is a carcinogen and irritant found in composite wood materials, which are widely used in construction.

Recommendation:

Limit the content of formaldehyde in non-structural composite wood products.

Proposed Legislation, Rule or Study

Amendments to the New York City Health Code:

1. Add a new section 131.14 as follows:

§131.14 Formaldehyde. (a) This section shall apply to any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product containing such materials, installed in a building; provided, however, that this section shall not apply to any building classified in occupancy group R-3 under the New York City Building Code until July first, two thousand sixteen and shall not apply to manufactured homes.

(b) Any material or product covered by this section shall comply with the following standards as of the dates set forth therein and as tested by a third-party certification organization using the protocols of ASTM E 1333-96:

Formaldehyde Limits		
Maximum formaldehyde emissions in parts per million allowable for installation in buildings:		
	As of July 1, 2010	As of July 1, 2013
Hardwood Plywood Veneer Core	0.05	--
Hardwood Plywood Composite Core	0.08	0.05
Particleboard	0.18	0.09
Medium Density Fiberboard	0.21	0.11
Thin Medium Density Fiberboard (max. thickness 8 mm.)	0.21	0.13

[.] (c) By July first, two thousand sixteen, and at least every 3 years thereafter, the department shall review and, if necessary, update or revise the standards in this section.

Amendments to the New York City Building Code:

1. Add a new Section 2303.8 as follows:

2303.8 Formaldehyde limits. Any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product containing such materials installed in a building shall comply with the standards of section 131.14 of the New York City Health Code.

Amendments to the New York City Administrative Code

1. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to Subchapter 12 (Endangered or Threatened Species) but contains the following prohibition language:

Composite wood products. (a) It shall be unlawful to buy or sell, offer or attempt to buy or sell, or cause any person to buy or sell any hardwood plywood, particleboard or medium density fiberboard, or pre-manufactured product containing such materials, intended for installation in a building, that do not comply with section 131.14 of the New York City Health Code on formaldehyde limits.

Supporting Information

Issue – Expanded

Formaldehyde is a colorless, flammable, strong-smelling gas that is often used as a fungicide and germicide. The use of urea-formaldehyde resins as adhesives by the forest products industry is due to this chemical's low cost, ease of use under a wide variety of conditions, low cure temperatures, water solubility, resistance to microorganisms and to abrasion, hardness, excellent thermal properties, and lack of color.¹

Materials that contain formaldehyde can release formaldehyde gas into the air. The Environmental Protection Agency (EPA) classifies formaldehyde as a probable human carcinogen, and the International Agency for Research on Cancer lists formaldehyde as a known human carcinogen.² Formaldehyde was also designated as a toxic air contaminant (TAC)³ in California in 1992 with no safe level of exposure.⁴ High concentrations of formaldehyde may trigger attacks in people with asthma.⁵ Studies have also found a link between exposure to formaldehyde and increased incidence of nasal cancer, nasopharyngeal cancer, and leukemia.⁶ Exposure to formaldehyde is known to cause eye, nose, and throat irritation, nausea, fatigue, skin rash, difficulty in breathing and sensitization.⁷

As a volatile organic compound (VOC), formaldehyde also contributes to ground-level ozone formation (smog). When VOCs are released into the air, the organic compounds react with nitrogen oxides to form ozone. High concentrations of ground-level ozone can cause respiratory problems and exacerbate asthma, emphysema, and bronchitis. Ground-level ozone also adversely affects the local ecosystem, damaging or weakening trees and plants, and reducing forest growth and crop yield.⁸

Environmental & Health Benefits

Limiting formaldehyde in wood products will reduce exposure to a known human carcinogen.^{9 10}

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus given a health score of 3.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.0%, depending on building type. This proposal was estimated to increase first capital costs by up to 0.01%, depending on building type. It was thus categorized as not incurring a capital cost increment.

Precedents

The requirements of this proposal are consistent with regulations in the California Code of Regulations¹¹ and formaldehyde limits in the 2008 California Green Building Standards Code.¹²

HT 3: RESTRICT CANCER-CAUSING FORMALDEHYDE IN BUILDING MATERIALS

Numerous federal agencies have established limits on formaldehyde for their own buildings or non-standard housing. The EPA has established a limit of 0.0163 ppm for formaldehyde in its new buildings.¹³ HUD has established a limit of 0.4 ppm for formaldehyde in mobile homes.¹⁴ FEMA has also established a maximum exposure limit of less than 0.016 ppm for temporary housing units.¹⁵

The federal Agency for Toxic Substances and Disease Registry summarized the state of regulation of formaldehyde in 1999 as follows:

Several international, national, and state authorities have established regulations or guidelines for the use and production of formaldehyde. OSHA has established the permissible exposure limit (PEL) 8-hour time-weighted average (TWA) at 0.75 ppm and the 15-minute Short-Term Exposure Limit (STEL) at 2 ppm. The EPA sets regulations for reporting quantities used and how much formaldehyde can legally be produced from automobile exhaust; the FDA also has regulations about the use of formaldehyde in the food you eat.

Non-enforceable guidelines have also been established for formaldehyde. The American Conference of Governmental and Industrial Hygienists (ACGIH) has established a ceiling limit for occupational exposure (Threshold Limit Value [TLV]) of 0.4 ppm. NIOSH has a recommended exposure limit for occupational exposure (8-hour TWA) of 0.016 ppm, and a 15-minute ceiling limit of 0.1 ppm.”¹⁶

LEED

LEED rating systems do not adhere to guidelines denoting a permissible level of formaldehyde. Rather, it is the absence of urea-formaldehyde resins that is required for LEED. While the LEED criteria differ from this proposal, projects complying with the recommendations of this proposal will inevitably find it more feasible to acquire LEED points. However, additional research and attention to product specifications will be required to verify conformance.

The following credits may apply:

- LEED NC-EQ cr.4.4 Low-Emitting Materials, Composite Wood & Agrifiber Products;
- LEED CI-EQ cr.4.4 Low-Emitting Materials, Composite Wood and Laminate Adhesives;
- LEED EB-MR cr.3 Optimize Use of IAQ Compliant Products;
- LEED for Schools-EQ cr.4 Low-Emitting Materials;

Although building classified in R-3 occupancy are not included, other residential projects applying under the LEED for Homes rating system may be eligible for credit MR cr.2.

Implementation & Market Availability

“No added formaldehyde” products are widely available. Examples of manufacturers who offer alternative building materials in the New York market include Columbia Forest Products¹⁷, Homasote and Viroc.¹⁸ A search on the Columbia Forest Products website identified 4 suppliers within 10 miles of the NYC metro area that carry their products. Twenty businesses were also found to either carry Homasote products or offer assistance with obtaining products within 6 miles of lower Manhattan.

The California EPA website includes a list of over 600 mills that have been identified by a California Air Resources Board (CARB)-approved Third Party Certifier as producers of CARB compliant composite wood products.¹⁹

The use of alternative resin binders are also being researched by manufacturers. However, no new products have been identified that can replace urea-formaldehyde (UF) that do not raise some other environmental health concerns.²⁰

Notes

The US Department of Housing and Urban Development has set formaldehyde emission standards in manufactured homes,²¹ preempting states and their political subdivisions from enacting such regulations.

Pressed wood products, especially those containing urea-formaldehyde glues, are a major source of formaldehyde. These products are manufactured using urea-formaldehyde resins which are used as interior-grade adhesives in many wood products and in finish coatings applied to hardwood cabinetry and furniture. Such products include particleboard used as flooring underlayment, shelves, cabinets, and furniture; hardwood plywood wall panels; and medium density fiberboard used in drawers, cabinets and furniture. When the surfaces and edges of these products are unlaminated or uncoated they have the potential to release more formaldehyde.²²

Urea-formaldehyde resins are chemically unstable and can release formaldehyde from unreacted formaldehyde trapped in the resin and from the hydrolytic decomposition of the resin polymer itself. It is the release of the unreacted formaldehyde that is primarily responsible for high initial indoor formaldehyde levels. There does not appear to be a population threshold for the irritant effects of formaldehyde, and sensitization may result in symptom initiation even at low levels of exposure.²³

How to quantitatively relate measured air levels of formaldehyde to cancer risk is uncertain. Because many other factors play a role in the development of cancer and because formaldehyde is ubiquitous in the environment, no

definitive level can be established that places humans in a “high-risk” category. The safest way to reduce risk for cancer is to limit exposure. Clinically useful biologic markers, such as blood or urine tests, also are lacking, further complicating the ability to link exposure with outcome. Because formaldehyde plays integral physiologic roles and has a short half-life in the body, determining what is necessary for normal physiologic function and what is excessive and potentially harmful is difficult. In general, the lower the level and shorter the duration of exposure, the lower the risk for cancer and other health effects.²⁴

ENDNOTES:

¹ ANTHONY H. CONNER, UREA-FORMALDEHYDE ADHESIVE RESINS, 2 POLYMERIC MATERIALS ENCYCLOPEDIA, (1996), available at <http://www.fpl.fs.fed.us/documnts/pdf1996/conne96a.pdf>.

² Clifford Weisel, et al., Relationships of Indoor, Outdoor, and Personal Air: Collection Methods and Descriptive Analyses, , 130:1 HEALTH EFFECTS INST. 1-107 (2005).

³ As defined by the California Health and Safety Code § 39655 (2005). (Definition: (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health. California Health and Safety Code, Section 39655 (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health.)

⁴ State of California EPA, Air Resources Board, Composite Wood Products ATCM, <http://www.arb.ca.gov/toxics/compwood/compwood.htm> (last visited July 21, 2009).

⁵ Ibid.

⁶ The National Cancer Institute, Formaldehyde and Cancer Risk, <http://www.cancer.gov/cancertopics/factsheet/risk/formaldehyde> (last visited Oct. 14, 2009).

⁷ U.S. EPA, An Introduction to Indoor Air Quality: Formaldehyde, <http://www.epa.gov/iaq/formalde.html> (last visited Jan. 12, 2010).

⁸ U.S. EPA, Ground-level ozone: Health and Environment, <http://www.epa.gov/air/ozonepollution/health.html>. (last visited Jan. 12, 2010).

⁹ International Agency for Research on Cancer, IARC Classifies Formaldehyde as Carcinogenic to Humans, <http://www.iarc.fr/en/media-centre/pr/2004/pr153.html>. (last visited Jan. 13, 2010).

¹⁰ U.S. EPA, Integrated Risk Information System (IRIS): Formaldehyde, <http://www.epa.gov/iris/subst/0419.htm>. (last visited Jan. 13, 2010).

¹¹ CAL. CODE, Tit. 17 § 93120-93120.12, (2008).

¹² CAL. CODE, Tit. 24 § pt. 11 § 804, (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

¹³ U.S. EPA, Testing for Indoor Air Quality, § 1.81.9 3 (2007), available at <http://www.epa.gov/rtp/campus/environmental/018109.pdf>.

¹⁴ US Consumer Product Safety Commission, An Update on Formaldehyde: 1997 Revision, (2007) <http://www.cpsc.gov/cpscpub/pubs/725.html> (last visited Jan. 13, 2010).

¹⁵ FEMA, 2009 DISASTER HOUSING PLAN, (2009) <http://www.fema.gov/pdf/emergency/disasterhousing/FEMA2009HousingPlan.pdf>.

¹⁶ Agency for Toxic Substances and Disease Registry, Public Health Statement for Formaldehyde, (1999), <http://www.atsdr.cdc.gov/toxprofiles/phs111.html> (last visited Jan. 13, 2010).

¹⁷ Cora Roelofs, et al., Encyclopedia of Earth, Alternatives for Significant uses of Formaldehyde in Massachusetts (2008) http://www.eoearth.org/article/Alternatives_for_significant_uses_of_formaldehyde_in_Massachusetts. (Columbia Forest Products offers a soy-based resin hardwood veneer core plywood panel (Purebond) that can be used to make cabinets, built-in furniture, paneling, shelving, doors and other uses requiring a high end wood product. Purebond is superior to formaldehyde-resin plywood from a health perspective as it eliminates potential formaldehyde exposures for users. However, its production involves use of epichlorohydrin as an intermediate. Epichlorohydrin is classified as a probable human carcinogen and poses other hazards to human health and the environment. This chemical could be a hazard to workers and the environment during production. Both Purebond and formaldehyde-resin plywood exhibit a similar environmental profile with regard to minor ecotoxicity. Technically, Purebond is similar to formaldehyde-containing plywood for the parameters of appearance/construction, fire resistance, and product availability. It has a glue bond superior to that of urea-formaldehyde plywood under conditions of moisture, but its warp resistance has not been fully assessed. Purebond is currently available at a similar cost to formaldehyde-resin plywood.).

¹⁸ Ibid. http://www.eoearth.org/article/Alternatives_for_significant_uses_of_formaldehyde_in_Massachusetts (last visited on Jan. 25, 2010), (Homasote and Viroc offer alternatives to softwood plywood panels (Homasote's recycled paper panel boards and Viroc's wood fiber Portland cement panels). Neither product presents a health hazard to building occupants, but there are some occupational exposure concerns, such as exposure to wood and cement dust during cutting. Both products are superior to formaldehyde-resin plywood from the perspective of carcinogenicity of the binder. The Homasote panels are superior from the perspective of irritant in binder, while the Viroc panels are similar to formaldehyde-resin plywood on this metric. Both products are superior to formaldehyde-resin plywood from the perspective of ecotoxicity and natural resource conservation. However, the Viroc product is inferior from an energy intensity life cycle perspective. Technical and performance criteria of interest for these uses include strength, weight, response to moisture, storage, handling, fastening, finishing, fire resistance, thermal resistance, and mold, rot and insect resistance. Both alternatives present some advantages and some disadvantages on these metrics. For example, Homasote is superior to formaldehyde-resin panels on several measures including resistance to insects, rot, and mold, and is inferior on certain other measures, such as impact resistance and tensile strength. Viroc is superior on measures including resistance to insects, rot, and mold, fire resistance, and impact resistance, and inferior on parameters such as tensile strength. Both Viroc and Homasote panels must be thicker and heavier than formaldehyde-resin panels to withstand an equivalent load over the same span.).

¹⁹ State of California EPA, List of Mills Producing CARB Compliant Composite Wood Products (2009), <http://www.arb.ca.gov/toxics/compwood/tpc/listofmills.htm> (last visited Jan. 13, 2010).

²⁰ HEALTHY BUILDING NETWORK, GLOBAL HEALTH AND SAFETY INITIATIVE, FACT SHEET: ALTERNATIVE RESIN BINDERS FOR PARTICLEBOARD, MDF AND WHEATBOARD (2008) <http://www.healthybuilding.net/healthcare/Alternative%20Resin%20Binders.pdf> (last visited Jan. 13, 2010).

²¹ 24 U.S.C. § 3280.308 (1984).

²² US Consumer Product Safety Commission, An Update on Formaldehyde: 1997 Revision, (2007) <http://www.cpsc.gov/cpscpub/pubs/725.html> (last visited Jan. 13, 2010).

²³ THAD GODISH, AIR QUALITY 357-60 (2d ed. 1990).

²⁴ CENTERS FOR DISEASE CONTROL AND PREVENTION, FINAL REPORT ON FORMALDEHYDE LEVELS IN FEMA-SUPPLIED TRAVEL TRAILERS, PARK MODELS, AND MOBILE HOMES 4-5 (2008), available at <http://www.cdc.gov/nceh/ehhe/trailerstudy/pdfs/FEMAFinalReport.pdf>.

HT 4: KEEP STREET CONTAMINANTS OUT OF BUILDINGS

New York City Health Code

Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Foot traffic brings many indoor air contaminants and bacteria into buildings. These particulates irritate the respiratory system and can trigger asthma.

Recommendation:

Require new buildings to install permanent entry mat systems to capture particulates.

Proposed Legislation, Rule or Study

Amendments to the New York City Health Code:

1. Add a new Section 131.14 as follows:

§131.14 Entrance particulate control. (a) Public entrances of any new building, other than any building classified under the New York City Building Code in occupancy group R-3, or with a floor plate less than 3000 square feet, shall install a permanent mat system to capture particulates entering the building.

(b) For the purposes of this section, “permanent mat system” shall mean a permanently installed grate, grille or slotted system and recessed collection area that allows for the capture of particulates that are carried into buildings by normal foot traffic. The permanent mat system shall be at least six feet long, measured in the primary direction of travel, and no less wide than the width of the entry opening. Revolving doors may alternatively include the mat system within such doorway.

Supporting Information

Issue – Expanded

Many indoor air contaminants enter buildings via foot traffic. During dry weather conditions, 1,000 people can track a quarter pound of dirt per day into a building.¹ Since vacuums only pick up about 10% of dirt from carpets, requiring permanent entry mat systems will result in better indoor air quality.² According to a microbiologist at the University of Arizona, “as many as 5,000 bacteria can cling to one square inch of footwear... 100 times more than can be found on a similar-sized area of a toilet seat.”³

Environmental & Health Benefits

A New York City Department of Health report indicates that buildings with LEED certification show improved post-construction indoor air quality by lowering levels of PM10s (particles smaller than 10 microns). The preliminary findings were recently presented at the American Academy of Allergy, Asthma, and Immunology annual meeting.⁴

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. It was thus categorized as not incurring a capital cost increment.

Precedents

The 2008 California Green Building Standards Code requires permanent entryway systems be installed at all entryways connected to the outdoors.⁵

Numerous Agencies and School Systems include recommendations or requirements for entry systems, including but not limited to:

- NYC School Construction Authority “Green Schools Guide”⁶
- Washington State Department of Health
- National Best Practices Manual for High Performance Schools
- Minnesota Department of Health
- Texas Department of State Health Services

Additional Agencies recommending Entry Systems:

- EPA Indoor Air Quality Building Education and Assessment Model
- Battery Park City Guidelines for Commercial Buildings and Residential Buildings
- WTC Redevelopment Projects Sustainable Design Guidelines (LMDC, PANYNJ, NYSEDA)

LEED

LEED NC Indoor Environmental Quality Credit 5, Indoor Chemical and Pollutant Source Control, requires that projects employ permanent walk-off entryway systems at main building entrances that are directly connected to the outdoors. This recommended code revision is in accordance with LEED criteria.

LEED CI Indoor Environmental Quality Credit 5, Indoor Chemical and Pollutant Source Control, identifies the locations for permanent entryway systems at all high volume exterior entryways within the tenant area. These are not necessarily main public entrances to the building. Therefore, additional entryway systems beyond what these recommendations outline may be required in order to comply with LEED CI.

LEED for Homes credit EQ8, Contaminant Control, requires installation of permanent walk-off mats at each entry. Although this proposal excludes buildings in occupancy group R-3, other residential buildings applying for certification under this LEED rating system must comply to receive this credit.

Entryway systems are only one component of the LEED NC, CI, and LEED for Homes EQ credits and providing the mat system does not guarantee compliance.

This recommendation will also facilitate achieving LEED NC and LEED CI credit EQ3.2, Construction IAQ Management Plan, Before Occupancy and LEED EB credit EQ3, Construction IAQ Management Plan. These points are concerned with reducing overall Indoor Air Quality problems throughout the building or space.

Implementation & Market Availability

There are no known implementation issues for this proposal. Permanent mat systems are widely available. Permanent mat systems require detailing of finish and structural floor to receive mat system and maintain flush floor conditions consistent with the ADA Accessibility Guidelines for Buildings and Facilities (ADAAG).

Notes

The Committee discussed at length what buildings and entrances should be covered by this proposal. The Committee used the 2004 ADAAG as a basis to decide these questions and its deliberations are noted below.

How to define public entry? The committee sought precedents for the definition of public entry. NYC Building Code defines a public entrance as “an entrance that is not a service entrance.” The 2004 ADAAG defines public entrance as any entrance that is not service or restricted. Example – a manufacturing facility might have an area for administrative workers which would be considered a public entrance, while the entrance for the processing area would be considered a service entrance. Entrance to a parking facility would be considered a service entrance.

How to not create undue hardship for manufacturing processing? The Committee concluded that the NYC Building Code definition, which excludes service areas, covers the concept of exemption for manufacturing processing areas. The Committee also felt that by limiting the requirement to new buildings, hardship that may be present for rehab projects, such as not having sufficient depth to recess floor mat, would be avoided.

How to not create undue hardship for small establishments (primarily retail and restaurant/hospitality)? ADAAG 2004 allows exceptions for facilities less than 3,000 sf as explained in the Preamble to the ADA Guidelines and published in the Federal Register on July 23, 2004.

ENDNOTES:

¹ Amy Streeton, Walk-Off Mats are Green & Contribute to Building Safety, <http://www.mcmorrowreport.com/sfm/articles/mats.asp> (last visited Jan. 13, 2010).

² Ibid.

³ Today's Facility Manager, Walk Off Mats can Aid in Healthy Facilities, <http://todaysfacilitymanager.com/facilityblog/2009/01/walk-off-mats-can-aid-in-healthy-facilities.html> (last visited Jan. 13, 2010).

⁴ E. Horner, et al., Green buildings: LEED Certification Requirements for Indoor Airborne Particles Can Reduce Indoor PM10 Exposure, 123:2 J. OF ALLERGY AND CLINICAL IMMUNOLOGY (2009).

⁵ CAL. CODE, Tit. 24 § pt. 11 § 804, 43-44 (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

⁶ NYC DEP'T. OF ED , NYC SCHOOL CONSTRUCTION AUTHORITY. GREEN SCHOOLS GUIDE (2007), <http://source.nycsca.org/GreenSchools/nycgsg-031507.pdf>.

HT 5: FILTER SOOT FROM INCOMING AIR

New York City Mechanical Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

HVAC systems bring outside air into buildings, along with airborne pollutants. Without proper filters, this can lower the quality of indoor air.

Recommendation

Require the use of HVAC systems that filter soot and other pollutants from indoor air.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code

1. Add a new Section 605.2.1 as follows:

605.2.1 Standards for air handlers. Air handlers with a design capacity greater than or equal to 5,000 cfm, any portion of which provides outdoor air ventilation shall utilize a MERV 11 or greater filtration system.

Supporting Information

Issue – Expanded

Air handling equipment from the start has been equipped with filters as a means of protecting and keeping clean internal components such as coils, fans and the ductwork distribution system itself. A clean system is an energy efficient system as dirt accumulation on coils reduces heat transfer and increases pressure drop. Filtering of this type tends to have at best Minimum Efficiency Reporting Value (MERV) of 7 to 8 (in accordance with ASHRAE standard 52.2), which will have an arrestance of greater than 90% of particles with 3 microns diameter and above.

There has been increased health concerns with particles 2.5 microns and smaller because they stay suspended in the air for long periods and are able to penetrate deep into the lungs. This measure proposes establishing a filtering requirement with a minimum MERV value of 11 which has an arrestance of greater than 95% of particles 1 to 3 microns in size. Typical particles of this size tend to be termed “soot” in the outdoor urban environment and form part of automobile, bus, and truck emissions. Other particles of this size include: Legionella bacteria, lead dust, coal dust, welding fumes, and nebulizer drops.

Several issues were examined before arriving at the MERV 11 selection. First there appear to be diminishing returns at filter efficiencies beyond MERV 11-13. A study has noted that increasing filter efficiency beyond these values in residential building has only a marginal decrease in the concentration of fine particles¹. This is probably due to unfiltered air infiltrating the buildings through cracks and crevices around windows and doors and indoor particulate generation from within the space itself.

Second, there are additional maintenance and operations cost associated with higher levels of filtration. In general an additional set of filters, called prefilters are more likely to be required on filtration systems higher than MERV 11. The prefilters extend the life of the higher efficient final filters, but require additional maintenance and are more expensive. Increased filter efficiency also requires additional fan energy to push the air through the filter.

MERV 11 is a practical balance between the competing parameters and recognizes the increased awareness of the hazards associated with very small particles.

Environmental & Health Benefits

Clean air can help support worker comfort leading to greater productivity with the expectation of increased company profitability. The avoidance of a headache or two is of substantial value in the workplace, while avoidance of a lost day of work has this measure paying for itself. From a community benefits standpoint cleaner air should lessen respiratory related illnesses and the associated health costs of such issues.

A New York Department of Health report indicates that buildings with U.S. Green Building Council LEED-certifications help reduce post-construction indoor air pollution by lowering levels of PM10s (particles smaller than 10 microns). The preliminary findings were recently presented at the American Academy of Allergy, Asthma, and Immunology annual meeting.²

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a high positive health impact per building and to impact a small number of buildings. It was thus given a health score of 2.

Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.09%. It was thus categorized as incurring a medium capital cost increment.

Precedents

Other state and city energy codes have requirements or recommendations for using high efficiency HVAC filters to help maintain better indoor air quality. In Boulder, Colorado, the Boulder Revised Code includes a section called Green Building and Green Points Program, similar to the LEED system, which awards points for various green building features. In the Indoor Air Quality section, projects using a high efficiency HVAC filter are awarded 1 point.³

In addition, New York City's PlaNYC calls for a reduction in pollutants classified as PM 2.5, or soot.⁴ The report indicates that buildings and industry accounts for 55% of PM 2.5 emissions.

LEED

This proposal does not have a direct correlation to LEED.

Implementation and Market Availability

Low capacity packaged air handling systems (below 5,000 cfm) might have difficulty achieving this benchmark due to filter size and pressure drop. It would be anticipated that these difficulties would diminish with time as advanced filter media become more prevalent and HVAC equipment manufacturers adjust to code requirements.

ENDNOTES:

¹ W.J. Fisk, et al., *Performance and cost of particle air filtration technologies*, 12:4 INDOOR AIR (2008).

² E. Horner, et al., *Green buildings: LEED certification requirements for indoor airborne particles can reduce indoor PM10 exposure?*, 123:2 J. Allergy & Clinical Immunology (2009).

³ City of BOULDER, CO., REVISED CODE tit. 10, ch. 10-7.5 (2008), available at <http://www.colocode.com/boulder2/chapter10-7-5.htm>.

⁴ CITY OF NEW YORK, PLAN NYC, A GREATER, GREENER, NEW YORK, 120 (2007) available at http://www.nyc.gov/html/planyc2030/downloads/pdf/report_air_quality.pdf.

HT 6: ENSURE VENTILATION AIRFLOW IN RESIDENCES

New York City Mechanical Code

Summary

Issue:

The new requirements for ventilation in the Building Code save a great deal of energy. However, if the systems are not adjusted properly, the energy savings will come at the expense of indoor air quality.

Recommendation:

In new construction, require improved design parameters, testing, and balancing for exhaust ventilation systems.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code:

1. Add a new Section 516 as follows:

SECTION MC 516: KITCHEN AND BATHROOM EXHAUST SYSTEMS

516.1 General. Mechanical exhaust systems, in Occupancy Groups R1 and R2, shall meet the following criteria:

1. Maintain a minimum negative static pressure of 0.2" w.g. at the furthest register or grille in the system.
2. Be provided with adjustable speed controls: systems 2,000 CFM or less shall be provided with direct drive fans with speed controls; systems greater than 2,000 CFM shall be direct drive with speed controls or belt drive with variable frequency drives.
3. Dampers installed in intermittent systems shall be UL Class 1, low leakage type with local switch control.
4. Exhaust fans serving intermittent systems shall shutdown on no demand.
5. Each exhaust grille assembly must be equipped with a self-balancing damper that responds to changes in duct pressure to allow a constant airflow (+/- 20%) over a range of operating pressures from 0.2 in WC to the greater of: 0.5 in WC or the maximum system operating pressure at the particular exhaust register/grille. Adjustable register assemblies that allow for the free area to be manually adjusted in the field shall not be permitted to meet this requirement. Self-balancing dampers shall be designed and installed so that they may be easily removed for cleaning or replacement.
6. In central exhaust systems, the minimum requirements for continuous exhaust ventilation at kitchen and bath outlets in Table 403 shall not be exceeded by more than 100%. Timers shall not be installed on systems designed based on continuous ventilation rates in Table 403.
7. All transverse joints in exhaust duct systems shall be sealed including but not limited to connections between ductwork and registers/grilles, branch connections and duct connections to roof membrane/deck, etc. In existing buildings, all connections between ductwork and registers/grilles and duct connections to roof membrane/deck shall be sealed at the time of substantial repair/upgrade work including roof fan replacement.
8. Except where noted, all of the requirements in this section apply to existing systems at the time of substantial repair/upgrade work including roof fan replacement.
- 9.

2. Amend Section 403 to add a note under Table 403.3 as follows:

i. The ventilation rate shall be the minimum rate required at the air outlet. Total fan airflow rate shall include a duct leakage component equal to 15% of outlet design flow.

3. Amend Section 202 to include the following definition:

Joint, Transverse Duct: Transverse joints are connections of two duct sections oriented perpendicular to airflow, including but not limited to connections between ductwork and registers/grilles, spin-ins, taps, and other branch connections, access door frames and jambs, duct connections to equipment and duct connections to roof membrane/deck, etc.

Supporting Information

Issue- Expanded

The lower kitchen, bath and corridor ventilation requirements in the new 2008 New York City construction code compared to the 1968 code will result in 10% - 30% reductions in heating energy use in residential buildings and 50% reductions in exhaust fan electricity use for all buildings with kitchen or bath central exhaust ventilation systems. However, these energy benefits will come at the expense of indoor air quality if the code does not address the reality of the balancing issues associated with systems that attempt to exhaust a relatively small amount of air from multiple locations in a building. The lower kitchen and bath exhaust ventilation rate requirements in the new 2008 code are acceptable for indoor air quality only if these exhaust rates are actually realized. As the exterior envelopes of buildings are tightened to reduce energy waste, effective ventilation system performance is becoming that much more critical. In addition to new construction, this code will apply when ventilation systems in existing buildings are being renovated. Existing ventilation ductwork originally designed for 100+ CFM per kitchen and 50 CFM per bath per the 1968 code is ideally suited to be rehabbed to exhaust lower airflow rates from these spaces per the 2008 code. In this case, existing ductwork is effectively over sized, which reduces the pressure drop between the exhaust fan and individual exhaust registers/grilles. Such a reduction in pressure drop has two primary benefits: (1) improved balancing performance and (2) reduced fan electricity use.

Environmental & Health Benefits

As the exterior envelopes of buildings are tightened to reduce energy waste, effective ventilation system performance is becoming that much more critical. The proposed changes will preserve the energy benefits of the 2008 code while assuring adequate indoor air quality.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a high positive health impact per building and to impact a small number of buildings. It was thus given a health score of 2.

Cost / Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

Other Jurisdictions:

1. Note that multi-story central kitchen and bath ventilation systems with severe balancing problems are much more represented in NYC than in other locations. As such, NYC should be a leader on these issues.
2. California's Title 24 requires pressure testing of HVAC ducts.

LEED:

LEED requires building designs to comply with ASHRAE Standard 62.1 as a prerequisite and buildings are commissioned to ensure that they perform as designed. The proposed code change is consistent with these LEED prerequisites.

Implementation and Market Availability

1. Passive, self-balancing dampers that regulate airflow by responding to changes in duct pressure without the requirement of electric power are an off-the-shelf technology.
2. Improved duct sealing strategies are well known to the industry.
3. In practice, proposed language change to 513.10.5 means that belt driven fans are acceptable and all direct drive fans should have speed controllers, which are very low cost and readily available add-ons.

Notes:

1. The following supporting findings are from a recent New York State Energy Research and Development (NYSERDA) research project undertaken by Steven Winter Associates to assess the performance of conventional bath and kitchen central exhaust ventilation systems and to evaluate performance upgrades:¹
 - One-time balancing of conventional systems with manually adjustable registers (even if done properly) is subject to particular environmental conditions at the time of balancing (wind and stack effect). In a tall building, a system balanced in the winter will not be balanced in the summer.
 - Conventional adjustable registers have relatively large free areas that result in relatively small pressure differences across the registers. Such small pressure differences result in significant fluctuations of exhaust airflow in response to changing outdoor ambient conditions (wind and stack effect).
 - Measurements of the leakage of 30 exhaust shafts in new NYC multifamily buildings indicate that the leakage levels required by the new code are not realistically achievable without code language that calls out in greater detail the particular leakage locations that must be addressed in these systems.
 - In order to function properly, an exhaust ventilation system must operate at a high enough pressure to minimize the impact of fluctuations due to wind and stack effect. Leaky duct systems make operation of systems at

sufficiently high pressures difficult.

2. Relevant parts of the New York City Mechanical Code:

All of the following sections below impact the performance of central exhaust ventilation systems:

403.1 Ventilation system... The system to convey ventilation air shall be designed and installed in accordance with Chapter 6.

403.3.4 Balancing. Ventilation systems shall be balanced by an approved method. Such balancing shall verify that the ventilation system is capable of supplying the airflow rates required by Section 403.

513.10.5 Fans... Calculations and manufacturer's fan curves shall be part of the documentation procedures.

603.2. Duct sizing. Ducts installed within a single dwelling unit shall be sized in accordance with ACCA Manual D or other approved methods. Ducts installed within all buildings shall be sized in accordance with the ASHRAE Handbook of Fundamentals or other equivalent computation procedure.

603.9. Joints, seams and connections. All longitudinal and transverse joints seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA HVAC Duct Construction Standards.

603.17. Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's installation instructions. Balancing dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser.

¹ Party Walls, (Steven Winter Associates, Norwalk, CT.), Nov/Dec 2007, available at <http://www.swinter.com/partywalls/PWNov-Dec07.pdf>.

HT 7: REDUCE MOLD IN BATHROOMS

New York City Building Code

Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Mold is common in moist areas of many buildings, such as showers. Exposure to mold can cause negative health effects, including allergic responses, asthma and other respiratory irritations.

Recommendation:

Require the use of mold-resistant gypsum board and cement board in water-sensitive locations.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend section 2501.1.1 as follows:

2501.1.1 General. Provisions of this chapter shall govern the materials, design, construction and quality of gypsum board, lath, gypsum plaster, cement plaster and cement board.

2. Add a new definition to section 2502 as follows:

CEMENT BOARD. A fiberglass reinforced concrete sheet most commonly used under floors or as a tile backing board.

3. Add a new section 2506.3 as follows:

2506.3 Gypsum and cement board in showers, and water closets, and other areas likely to be subject to water or moisture damage.

2506.3.1 Cement board only. The walls of all shower and bath surrounds up to six feet above the finished floor shall be composed of cement board, fiber-cement or glass mat gypsum backers in compliance with ASTM C 1178, C 1288 or C 1325 and installed in accordance with manufacturer recommendations. Gypsum board shall not be permitted in such locations.

2506.3.2 Mold resistance. In any area where there will be direct exposure to water or that is subject to continuous high humidity, any gypsum board or cement board used on walls or ceilings shall be rated as mold resistant (rating of 10) in accordance with ASTM D3273-00 and water-resistant gypsum board ("greenboard") shall not be permitted. Such areas shall include the following:

1. walls of basements and other below grade rooms;
2. walls of mechanical rooms and closets housing air conditioning equipment;
3. rear walls of fan coil/unit ventilator type HVAC unit chases;
4. ceilings beneath cold water pipes;
5. ceilings beneath air handlers in ceiling plenums;
6. ceilings of bathrooms;
7. walls of plumbing and electrical chases;
8. walls of laundry rooms;
9. walls beneath kitchen sinks and splash areas above sinks;

10. walls behind kitchen stoves; and.
11. walls of bathrooms other than walls specifically required to be cement board.

Supporting Information

Issue – Expanded

Molds can grow on almost any surface as long as moisture and oxygen are present. Molds can be allergens, irritants, and even produce toxic substances (mycotoxins).¹ They can also trigger asthma attacks and other chronic conditions.² In New York City, where the asthma hospitalization rate in some neighborhoods is four times as high as the national average, complaints of mold infestations are on the rise. In 2008, the City's 311 service received 7,658 mold-related complaints of which 6,566 were from residential locations. As of July 2009, the City has received 5,779 mold-related complaints—almost a 32% increase over the same period in 2008.

While it is impossible to eliminate all mold and its spores in the indoor environment, mold growth can be controlled.³ To prevent the proliferation of mold—and address associated health impacts from mold exposure discussed below—this proposal requires the use of cement board in areas that are subject to constant moisture. Cement board has better long-term performance than paper-faced gypsum core and water-resistant products because it does not mold, mildew or physically break down in the continued presence of moisture or leaks.

Most manufacturers of drywall and water-resistant drywall (often referred to as “greenboard”) agree that in areas continually exposed to water such as showers and tubs, cement board is the best choice to prevent the formation of mold. Water and water vapor easily pass through ceramic tile grout and cause the paper facing of drywall to disintegrate. Water-resistant drywall is not recommended for areas that are subject to constant moisture such as bathrooms and laundry areas and should not be used as tile substrate.

This proposal also requires the use of mold-resistant drywall instead of regular drywall for other water-sensitive areas such as laundry rooms and basements. Mold resistant drywall is waterproof and can inhibit the growth of mold on the surface of the panel.

Environmental & Health Benefits

Enhanced safety and quality of life are expected with the reduction in exposure to biocontaminants such as mold. Mold results from moisture problems, poor maintenance, or inadequate ventilation and has been known to cause and exacerbate serious, sometimes life threatening respiratory diseases which themselves can lead to chronic respiratory conditions.⁴ Inhalation of fungal spores, fragments, or mycotoxins can lead to or exacerbate allergic reactions and cause infections, eye irritation, cough, congestion, headache, and fatigue. Severe illnesses such as Organic Dust Toxic Syndrome (ODTS) and pulmonary hemosiderosis have also been attributed to fungal exposures. Illnesses can result from both high level, short-term exposures and lower level, long-term exposures.⁵

For these reasons, and because measurements of exposure are not standardized and biological markers of exposure to fungi are largely unknown, it is not possible to determine “safe” or “unsafe” levels of exposure for people in general.⁶ This proposal is a precautionary measure to address increasing citywide incidents of mold infestation.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.2%, depending on building type. It was thus categorized as incurring no to a medium capital cost increment.

Precedents

The 2006 International Residential Code (IRC) requires the use of cement, fiber-cement or glass mat gypsum backers for wall tile in tub and shower areas and wall panels in shower areas.⁷ It also prohibits the use of water-resistant gypsum backing board where there is direct exposure to water.⁸

Similarly, the City of Palo Alto, CA, prohibits the use of gypsum products in steam showers and that the use of

greenboard in shower and tub compartments.⁹ The California Building Code strictly mandates the use of cement board as a base for wall tile in tub and shower areas and also in all wall and ceiling panels in shower areas.¹⁰ This proposal is less strict than California's Building Code in that the requirement only applies to walls of all shower and bath surrounds up to six feet above the finished floor.

In addition, the design and construction guidelines and standards in some states prohibit the use of greenboard in bathroom and laundry areas. In the State of Massachusetts, for example, the Department of Housing and Community Development requires the use of cement backer boards in wet areas "such as tub surrounds, showers, janitor's closets or for entry vestibules/stairwells subject to freezing temperatures" and specifically states that "moisture-resistant paper-faced drywall is **not** acceptable as a backer."¹¹

LEED

There are no LEED credits directly affiliated with this proposal to utilize mold-resistant materials. However, the LEED ratings systems incorporate provisions under the Indoor Air Quality Divisions for air ventilation. Adequate ventilation will assist in protecting materials from moisture. Therefore, while the proposal will not assist in achieving LEED certification, it is in conformance with the intent of LEED.

LEED for Homes specifically addresses dehumidification systems in EQ cr. 3 Moisture Control.

Implementation and Market Availability

There are no known implementation issues for this proposal. Materials are readily available. Most U.S. gypsum board manufacturers have developed gypsum board products that are mold and mildew resistant and score highly on the ASTM D3273-00 mold resistance standard test method.

ENDNOTES:

¹ U.S. EPA, A Brief Guide to Mold, Moisture and Your Home: Mold Basics, <http://www.epa.gov/mold/moldbasics.html> (last visited Jan. 13, 2010).

² *Ibid.*

³ U.S. EPA, Mold, <http://www.epa.gov/mold/index.html> (last visited Jan. 13, 2010).

⁴ U.S. EPA, Indoor Air Quality in Large Buildings, <http://www.epa.gov/iaq/largebldgs> (last visited Jan. 13, 2010).

⁵ NYC Dept. of Health and Mental Hygiene, Guidelines on Assessment and Remediation of Fungi in Indoor Environments (2008), <http://home2.nyc.gov/html/doh/html/epi/moldrpt1.shtml#health> (Human exposure indoors occurs via inhalation, through physical contact (dermal exposure), or ingestion. Whether or not symptoms develop in people exposed to fungi depends on the nature of the fungal material (e.g., allergenic, toxic, or infectious), the amount of exposure, and the susceptibility of exposed persons. Susceptibility varies with genetic predisposition to allergic reactions, age, state of health, and concurrent exposures. Exposure to mold through renovation work may also lead to initiation or exacerbation of allergic or respiratory symptoms.).

⁶ Harris County Public Health and Environmental Services, General FAQ's about Mold, <http://www.hcphe.org/eph/moldfaqs.htm> (last visited Jan. 19, 2010).

⁷ INTL. RES. CODE § R702.4.2 (2006) (The International Residential Code states that “cement, fiber-cement or glass mat gypsum backers in compliance with ASTM C1288, C1325 or C1178 and installed in accordance with manufacturers’ recommendations shall be used as backers for wall tile in tub and shower areas and wall panels in shower areas.”); and INTL. BUILDING. CODE § 2509.2 (2003) (In comparison, the International Building Code requires the use of water resistant gypsum backing board when gypsum board is used as a base for tile and wall panels in showers and tubs. Ideally, gypsum board should not be used at all in wet areas. The backing paper on gypsum board provides excellent food for mold to grow. Alternatives to gypsum board include concrete masonry, ceramic tile on cement backer board, or cement plaster, which perform well in high-moisture areas.).

⁸ INTL. RES. CODE § R702.3.8.1 (“Water-resistant gypsum backing board shall not be used where there will be direct exposure to water.”). (Additionally, section 2509.3 of the International Building Code (2003) contains a similar provision, prohibiting the use of gypsum board, including water-resistant gypsum backing board, over a vapor retarder in a shower or bathtub. Although water-resistant gypsum board is required when used as a base for tiles or wall panels in showers and tubs under, in extreme conditions, even water-resistant gypsum board will not provide an adequate level of moisture protection. Installing water-resistant gypsum board over a vapor retarder would create a waterproof membrane on both sides of the gypsum board. Moisture would become trapped in the gypsum board, causing it to fail. Ideally, gypsum board should not be used at all in wet areas.).

⁹ CAL. BLDG. CODE § 2508.2 & 2509.3 (2008)

¹⁰ OHIO BLDG. CODE 4101 § 2509, available at <http://codes.ohio.gov/oac/4101:1-25> (“Cement, fiber-cement or glass mat gypsum backers in compliance with ASTM C 1178, C 1288 or C 1325 and installed in accordance with manufacturer recommendations shall be used as a base for wall tile in tub and shower areas and wall and ceiling panels in shower areas.”).

¹¹ STATE OF MASSACHUSETTS, DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT, DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS, DIVISION 9: 09 30 00 TILE, 2 (JUNE 2007) available at www.mass.gov/Ehed/docs/dhcd/ph/dcguidestandard/tile.pdf.

HT 8:

IMPROVE AIR QUALITY DURING & AFTER CONSTRUCTION

New York City Building Code
Proposal developed by the Construction Practices Committee

Summary

Issue:

Construction activities can lead to the release of substances, such as volatile organic compounds (VOCs) and particulates, that have an adverse effect on the health of construction workers and occupants alike.

Recommendation:

Provide ventilation during construction, protect the HVAC system from contaminants and absorptive materials from moisture, and flush out bad air before occupancy.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 3302.1 to include the following defined terms:

APPROVED AIR FILTER. An air cleaning device that achieves either a minimum efficiency reporting value of 8 as measured by ANSI/ASHRAE 52.2-2007 (Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size) or an average efficiency of 30% as measured by ANSI/ASHRAE 52.1-1992 (Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter).

DUST-PRODUCING CONSTRUCTION OPERATIONS. Construction activities, including sweeping, sanding, grinding, cutting, and polishing, that result in the dispersal of particles into the air.

HEPA FILTER. High efficiency particulate air filter capable of removing 99.97% of airborne particles that are at least 0.3 micrometers (Qm) in diameter.

IMPERMEABLE SEPARATION. A barrier, typically composed of plastic, sheetrock, or plywood, that prevents the transmission of dust and air from construction areas to occupied spaces.

2. Add a new Section 3303.15 as follows:

3303.15 Protecting indoor air quality.

3303.15.1.1 Cleanliness of HVAC system. Construction sites shall comply with the following:

- 1) Supply and return ductwork delivered to and stored at sites shall be sealed on both ends with a dust barrier to prevent contamination. The ends of installed ductwork shall be sealed daily to prevent dust and debris from settling inside the ductwork.
- 2) During dust-producing construction operations, HVAC system openings shall be protected from dust and contamination by either temporarily sealing such openings in the construction work areas or, if the system is in use, installing an approved air filter over each return opening. Prior to occupancy of any space, air filters in such space shall be replaced.

3303.15.1.2 Ventilation during construction operations. In enclosed spaces without an outside air source, such as operable windows or an opening in the exterior wall, the HVAC system shall be run during construction activities if it is functional. If the HVAC system is not functional and there is no outside air source, then construction workers may open any operable windows for the purposes of temporary ventilation or thermal comfort. This permission may be suspended during precipitation or severe cold that could damage building materials or systems.

3303.15.1.3 Protecting occupied spaces. At any time that construction work is in progress in an occupied building:

1. An impermeable separation shall be maintained between work areas and adjacent occupied spaces to reduce the flow of contaminants into the occupied space.

Exception. Elevators or elevator shafts.

3303.15.2 Other air quality protection measures during construction.

- 1) Absorbent materials including, but not limited to, insulation, sheetrock, carpet, ceiling tile, fabric, and fabric based materials shall be protected from moisture at all times prior to installation. During storage, such materials shall be within an enclosure, protected with a waterproof cover, and raised above the floor.
- 2) During sweeping, dust shall be suppressed with wetting agents or sweeping compounds. When using such agents and compounds, the work space shall be ventilated in accordance with manufacturer recommendations.
- 3) Any accumulated water on a floor surface shall be removed immediately.
- 4) Any vacuum used indoors prior to the issuance of a temporary certificate of occupancy for the work area shall be equipped with a HEPA filter.

3303.15.3 Post-construction flush out. After construction work is completed, sites with an indoor work area greater than 5,000 square feet shall comply with either Section 3303.15.2.1 or 3301.15.2.2.

3303.15.3.1 Flush out option. Flush the interior air through either of the following methods:

- 1) Prior to occupancy of a portion of a structure intended for any occupancy classification, deliver a total air volume of 14,000 cubic feet of outdoor air per gross square foot of indoor work area while maintaining an internal air temperature of at least 60 degrees Fahrenheit and a relative humidity no greater than 60%.
- 2) Prior to occupancy of a portion of a structure intended for any occupancy classification other than Institutional Groups I-1, I-2, I-3 and I-4 or Residential Groups R-1, R-2 and R-3 or that is to be occupied by persons more than 21 hours per day, deliver a total air volume of 3,500 cubic feet of outdoor air per gross square foot of work area while maintaining an internal air temperature of at least 60 degrees Fahrenheit and a relative humidity no greater than 60%. After occupancy, until a total of 14,000 cubic feet per square foot of outside air has been delivered to the indoor work area, ventilation of the indoor work area shall commence at least 3 hours prior to occupancy at a rate of 0.3 cubic feet per minute of outside air per square foot and continue throughout such occupancy.

3303.15.3.2 Testing option. Demonstrate safe air quality through air quality testing that complies with Sections 3303.15.3.2.1 and 3303.15.3.2.2.

3303.15.3.2.1 Maximum concentrations. Prior to occupancy, demonstrate through air quality testing that no substance listed in Table 3303.15.3.2.1 is present in concentrations greater than that permissible in such table.

Table 3303.15.3.2.1

Maximum Permissible Concentration of Air Contaminants

<u>Contaminant</u>	<u>Maximum Permissible Concentration</u>
<u>Formaldehyde</u>	<u>50 parts per billion</u>
<u>Particulates (PM10)</u>	<u>50 micrograms per cubic meter</u>
<u>Total Volatile Organic Compounds</u>	<u>500 micrograms per cubic meter</u>
<u>4-Phenylcyclohexene</u>	<u>6.5 micrograms per cubic meter</u>

<u>Carbon Monoxide</u>	<u>9 parts per million and no greater than 2 parts per million above outdoor levels</u>

3303.15.3.2.2 Air quality testing procedures. Air quality testing shall follow the following procedures:

- 1) Indoor air quality testing shall be conducted after construction ends and prior to occupancy using testing protocols in accordance with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air.
- 2) All air samples shall be conducted during normal hours in which the work area is intended to be occupied, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
- 3) All interior finishes shall be installed, including but not limited to millwork, doors, paint, carpet, and acoustic tiles. Non-fixed furnishings such as workstations and partitions are not required to be in place for the testing.
- 4) The number of sampling locations will vary depending on the size of the building and number of ventilation systems. For each portion of the work area served by a separate ventilation system, there shall be no less than one sampling point per 25,000 square feet, or for each contiguous floor area, whichever is smaller, and shall include areas with the least ventilation and greatest presumed source strength.
- 5) Air samples shall be collected between three feet and six feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.
- 6) When retesting indoor work areas where one or more substance was present in concentrations greater than that permissible in Table 3303.15.3.2.1 in prior tests, samples shall be taken from the same locations as the first test.

Supporting Information

Issue - Expanded

Indoor air quality is important to everyone, since Americans spend about 90% of their time indoors. Both construction workers on the job site and building occupants face a range of health risks from indoor air quality.

On construction sites, tasks such as abrasive blasting, emptying bags of cement, cutting wood and masonry, painting, gluing, cleaning with solvents, welding, and using diesel-powered heavy equipment contribute to poor indoor air quality. Data from the National Center for Health Statistics indicate that construction workers face an increased risk of dying from lung cancer compared to the general population; for crane operators, the risk is 80% higher.¹

Workers are often discouraged from opening windows during construction activities, limiting access to a ready source of fresh outside air. If the option is available, workers should be able to open windows to increase ventilation levels or, if possible, permanent building ventilation systems should be run to increase the amount of fresh air delivered to the construction workers. This will contribute to a better working environment for the construction workers.

Ventilation systems, if unprotected, can become contaminated with dust, debris, and/or organic material that could support the growth of mold. Covering ductwork at the manufacturer's facility and covering ductwork as it is installed will reduce contamination and provide the permanent building occupants with a cleaner air delivery system.

Buildings under construction can be open to the outdoors, permitting moisture infiltration and high humidity. Coupled with the right temperature range and a food source, this can create conditions that support mold growth. Absorptive materials should be protected from moisture by covering them and keeping them off the floor, and by delaying the loading of such materials as long as is reasonable practical.

New or fresh adhesives, paints, carpets, and sealants emit volatile organic compounds (VOCs) that can be irritating or even harmful to the respiratory system. Other Green the Codes proposals limit the amount of VOCs allowed in building products, but there will still be residual VOCs in building interiors upon completion of a project. Ultimately these VOC's dissipate once the tenant occupies the space and operates the air systems or opens windows to circulate air. Prior to building occupancy, the level of VOCs in the air should be reduced to acceptable levels. This can be accomplished by flushing out air from the building for a defined duration, or as an alternative, sampling the air to demonstrate that the VOCs in the space are within acceptable levels.

Currently, the operation of permanent ventilation systems is at the discretion of the owner / builder. This proposed code amendment will avoid situations where the permanent ventilation system is turned off for cost or convenience, promoting better indoor air quality in buildings under construction by increasing the amount of fresh air delivered to workers.

Environmental & Health Benefits

This proposal will improve air quality on the job site and after construction work has occurred. As a result, it will improve the health of construction workers and building occupants.

This proposal was found to have no significant environmental impact.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus give a health score of 3.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.02% to 0.09%, depending on building type. It was thus categorized as incurring a low to medium capital cost increment.

Precedents

New York City already has laws in place requiring all new school construction to align with the New York City Green Schools Guide, which includes two Indoor Air Quality measures. These measures, based on similar credits in the LEED rating system, are Q2.1R: Construction IAQ Management Plan, During Construction and Q2.2R: Construction IAQ Management Plan, Before Occupancy. Measure Q2.1R requires the management plan to meet the IAQ Guidelines for Occupied Buildings of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and use filters with a Minimum Efficiency Reporting Value (MERV) of 8. Measure Q2.2R requires a full flush-out be done prior to occupancy.²

California requires rooms where activities produce hazardous fumes or chemicals to exhaust the fumes and isolate them from adjacent spaces. Filters that provide a MERV of 13 are also required in occupied areas of mechanically ventilated buildings.³

LEED

This proposal will facilitate achievement of the following credits: LEED NC-EQ cr. 3.1 & 3.2 Construction IAQ Management Plan; LEED CI-EQ cr. 3.1 & 3.2 Construction IAQ Management Plan; LEED EB-EQ cr. 3 Construction IAQ Management Plan; LEED for Schools EQ cr. 3.1 & 3.2 Construction IAQ Management Plan; and LEED for Homes EQ cr. 8 Contaminant Control.

To earn credits under the LEED 2009 rating systems, during construction projects must meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3). Since the measures outlined in this proposal do not make reference to these standards, project teams must research to verify LEED compliance for individual projects.

Air filtration devices are required by LEED to achieve a minimum efficiency reporting value of 8 as measured by ANSI/ASHRAE 52.2-2007. Therefore, this proposal has a direct relationship with LEED for filtering media standards.

LEED for Homes does not follow these criteria, and has its own established guidelines. Some aspects of this proposal will be applicable.

Implementation & Market Availability

This proposal is similar to credits outlined in current LEED rating systems, which many projects throughout the country have used as guidelines for implementing similar measures. Most of the largest construction companies, including those with active projects in New York City, have already successfully implemented similar measures on completed projects. Items such as filters and components to construct impermeable barriers are readily available in the marketplace.

Concerning method 1 of 3303.15.3.1, a 14,000 cf / sf flushout in a regular commercial building typically translates to 10-12 days of continuous flushout. High rise residential buildings relying on operable windows as their primary ventilation methods typically lack sufficient mechanical ventilation capacity to meet the intent of a flush out.

Notes

- 1) The committee broadly supported the proposition that green building standards should address indoor air quality during construction, not just during occupancy. The committee also noted that worker health and safety is regulated by OSHA, although the construction industry, particularly smaller-scale projects, does not always comply with these standards. Thus, there is a need to balance the reality of construction practice with the fact that air quality would be adequate on all sites if there were full compliance with OSHA. The committee considered a range of requirements to ventilate spaces during construction, including requiring fans to bring fresh air directly from the outside. Ultimately, the committee settled on a requirement that HVAC systems (if working) be activated during construction and that workers have the option of opening windows when the HVAC system is not operational. Doing so is standard practice in well-managed construction projects and will improve air quality in a reasonable and cost-effective manner.
- 2) Requiring that ductwork be delivered to the site sealed at both ends results in a substantial increase in transportation impacts since it prevents the ductwork from being “nested” one inside the other. According to several local sheet metal (ductwork) fabricators, an inability to deliver ductwork nested can increase the number of truck trips by as much as 30%. The committee decided to proceed with the requirement of sealing supply and return ductwork because it offers a direct benefit to the building occupant and there may be alternative means of nesting ductwork or reducing travel trips that could still protect ductwork from contamination during delivery. Exhaust ductwork, on the other hand, should not be sealed to keep the number of truck trips as low as possible. The proposal expressly limits the requirement that ductwork be delivered covered to supply and return ducts, and does not extend the requirement to exhaust ducts (which has no impact on indoor air quality).
- 3) Sealing the ends of lined ductwork could capture moisture inside the duct that could condense and sustain mold growth. To avoid this build up, sheet metal fabricators should make a minor perforation in the seal to allow moisture to escape.

ENDNOTES:

¹ NATL. INSTIT. FOR OCCUPATIONAL SAFETY AND HEALTH, WORK-RELATED LUNG DISEASE SURVEILLANCE SYSTEM (2008), <http://www2a.cdc.gov/drds/WorldReportData/pdf/N2006T13-02a.pdf>.

² NEW YORK CITY SCHOOL CONSTRUCTION AUTHORITY, *NEW YORK CITY GREEN SCHOOLS GUIDE* (March 15, 2007), available at <http://source.nycsca.org/GreenSchools/nycgsg-031507.pdf>, 106-109.

³ CAL. CODE, Tit. 24 § pt. 11 § 804 (2008), available at http://www.documents.dgs.ca.gov/bsc/prpsd_stds/2007/2007_cgbsc_9-23-08.pdf.

HT 9: PHASE OUT DIRTY BOILER FUELS

New York City Fuel Gas Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Boilers that use #4 and #6 fuel oils emit a substantial portion of the city's air pollution.

Recommendation:

Do not issue new permits for boilers using #4 and #6 fuel oils, and require all new burners to utilize only #2 fuel oil and/or gas fuel. The issue addressed by this proposal is already under consideration by the City.

Proposed Legislation, Rule or Study

Amendments to the New York City Fuel Gas Code

1. Add a new Section 631.4 as follows:

631.4 Phase Out of Boilers Using #4 and #6 Fuel Oil.

631.4.1. New boilers. No new boiler shall utilize #4 or #6 fuel oil.

631.4.2. New burners. Any new burner for an existing boiler shall only utilize #2 fuel oil and/or gas fuel.

631.4.2. Permit modification. No burner or boiler that uses #2 fuel oil and/or gas fuel shall covert to use #4 or #6 fuel oil.

Exceptions:

1. If the commissioner determines the building does not have access to gas fuel.

Supporting Information

Issue – Expanded

According to New York City's analysis of National Emissions Inventory data from the U.S. Environmental Protection Agency, heating oil is responsible for approximately 14% of local emissions of fine particulate matter (PM 2.5) and is a significant source of NOx, a precursor to smog. The burning of heating oil emits large quantities of particulate matter because of its high sulfur content – heating oil contains 2000-3000 parts per million of sulfur compared with 15 parts per million for on-road diesel. Because of heating oil and other sources, New York City does not comply with federal Clean Air Act standards for PM 2.5.

Particulate matter is made up of many compounds, most of which are highly toxic, but some sources of particulate matter are worse than others. PM 2.5 from residual heating oil tends to have high levels of nickel, vanadium and elemental carbon. PM 2.5 and ozone are linked to respiratory problems, such as: irritation of the airways, coughing, or difficulty breathing; decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; heart attacks; and premature death in people with heart or lung disease. New York City asthma rates are consistently higher than elsewhere; 300,000 children in the City have been diagnosed with asthma and hospitalizations cost over \$10,000 per visit and over \$240 million a year. In addition, cardiovascular disease is the number one cause of death, killing over 22,000 New Yorkers a year.

The effect of heating oil on local air quality is exacerbated by the fact that the oil is burned in the midst of densely populated areas, creating high levels of exposure. It will be difficult, if not impossible, to improve air quality in the City without reducing the use of No. 4 and No. 6 fuel.

The New York City Department of Environmental Protection issues permits for space heating equipment and approximately 9,900 permit holders use No. 4 or No. 6 oil as their primary or secondary fuel. This proposal addresses both new boilers and new burners, which is the portion of the boiler that injects and ignites a fuel air mixture into the

combustion chamber. There are some known instances of boilers using #2 fuel oil or gas fuel converting to #4 or #6 fuel oil – the proposal would prohibit this practice.

Environmental & Health Benefits

Conversion from dirtier residual oils (#4 and #6) to cleaner fuels (natural gas or #2) has the potential to reduce the emissions of particulate matter and other pollutants, as well as reduce CO₂ emissions.

Improvements in air quality – particularly reductions in PM 2.5 and ozone precursors – will improve the health of New Yorkers. A recent study in the New England Journal of Medicine showed that decreases in PM 2.5 were associated with increases in life expectancy.¹ An analysis by the City of New York, using emission factors from EPA AP-42, shows that conversion of No. 6 boilers to No. 2 oil will decrease PM emissions by approximately 52% and NOx emissions by approximately 61%. Conversion of existing permitted No. 6 boilers to natural gas would reduce PM pollution by 86% and NOx pollution by approximately 73%.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus given a health score of 3.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase capital cost by between \$0.01 and \$0.10/square foot depending on the building type. It was thus categorized as incurring no to a low capital cost increment.

Market Availability

National Grid and Con Ed are confident in their ability to absorb additional demand for natural gas. The amount of natural gas already used in NYC is many times more than would be required to replace residual oil. NYSERDA figures show that natural gas use in New York City is approximately 262 trillion BTUs a year. The energy content of residual heating oil in New York City is approximately 46 trillion BTUs, or 17% of the energy content of current natural gas use. Therefore, conversion phased in over 20 years means an average 1-1.5% increase per year.

In addition, regional gas supply is increasing. Millennium Pipeline began service in December 2008, with the potential of bringing an additional 525,000 mmBTU per day and 1/3 of capacity is free. Other new projects include the Iroquois, Algonquin, Empire and Islander East pipelines. Williams is in the preliminary stages of developing an expansion of its existing Transco pipeline to the Northeast to accommodate new Rocky Mountain sources, and the plans include new lateral connections to Manhattan and the Rockaways.

Precedents

There are no known precedents for this proposal.

LEED

There are no LEED credits associated with this proposal.

ENDNOTES:

¹ C. Arden Pope III, et al., Fine-Particulate Air Pollution and Life Expectancy in the United States, 360:4 N. ENGL. J. MED. 376-86 (2009) available at <http://content.nejm.org/cgi/content/full/360/4/376>.

HT 10: PHASE OUT TOXIC & INEFFICIENT LIGHT FIXTURE COMPONENTS

New York City Building Code

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

The EPA banned the manufacture of polychlorinated biphenyls (PCBs) in 1978, but old and inefficient ballasts containing PCBs are still in use today. PCBs are chemicals that bioaccumulate in the environment, threaten the reproduction of many species of plants and animals, and are linked to certain cancers.

Recommendation:

Institute a mandatory phased removal of all existing PCB and magnetic ballasts, starting with the largest buildings by 2013 and working down to all buildings by 2019.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Delete Chapter 34 (Reserved) and add a new Chapter 34 as follows

CHAPTER 34 GREEN BUILDING STANDARDS

SECTION BC 3401 DEFINITIONS

3401.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the following meanings.

LAMP. A device that produces light from electricity.

BALLAST. A device used with an electric discharge lamp to obtain the necessary circuit conditions (voltage, current, and wave form) for starting and operating the lamp.

MAGNETIC BALLAST. A ballast that operates at 60 hertz internally, generally with lower efficiency than an electronic ballast.

PCB BALLAST. A magnetic ballast in which internal insulation is provided by dielectric fluids including polychlorinated biphenyls (PCBs).

ELECTRONIC BALLAST. A ballast that operates at an internal frequency of 20 kilohertz or higher, at considerably higher efficiency than a magnetic ballast.

SECTION BC 3402 HAZARDOUS MATERIALS

§3402.1 Replacement of Magnetic ballasts.

a. The owner of any building shall inspect the ballasts in such building and remove any magnetic ballasts. The owner shall file a report according to the schedule described in Section 3402.2, signed by an approved professional, that states if magnetic ballasts were found in the building and, if so, the number of such magnetic ballasts. If magnetic ballasts were found, the report shall include documentation demonstrating that the magnetic ballasts were removed and either:

1. All magnetic ballasts were collected by a hazardous waste transporter with a United States Environmental Protection Agency identification number; or

2. An approved professional determined which magnetic ballasts were PCB ballasts and only such PCB ballasts were collected by a hazardous waste transporter with a United States Environmental Protection Agency identification number.

§3402.2 Applicability: The department shall establish a schedule for certification of compliance with Section 3402.1. Such schedule shall ensure that buildings with areas described below shall comply with the requirements of Section 3402.1 prior to the following dates:

1. January 1, 2013: buildings 1,000,000 square feet or more;
2. January 1, 2016: buildings between 50,000 and 999,999 square feet; and
3. January 1, 2019: all buildings.

Supporting Information

Issue – Expanded

Ballasts are electronic devices used to control the start and operation of electrical gas discharge lamps, such as fluorescent light bulbs and neon lights. There are two types of ballasts – old, “magnetic” ballasts and modern, “electronic” ballasts. Compared with electronic ballasts, magnetic ballasts are energy inefficient and can also cause a noticeable flicker and humming sound. If they were manufactured before 1979, it is also likely that they contain polychlorinated biphenyls (PCBs). In contrast, electronic ballasts use substantially less energy, do not cause flicker or hum, and do not contain PCBs.

PCBs are found in older magnetic ballasts because until 1979 they were commonly used in the manufacture of small capacitors contained in those ballasts. PCBs have been demonstrated to cause cancer, as well as have a variety of other adverse health effects on the immune system, reproductive system, nervous system, and endocrine system. They have been banned from use and production in the United States since 1978.^{1 2}

According to California’s Consumer Energy Center, replacing magnetic ballasts and T-12 lamps with electronic ballasts and T-8 lamps will reduce energy use by 17-48% depending on the particular lamps and ballast.³ In many cases, given the better performance of T-8 lamps, one can also remove some T-12 fixtures entirely, further reducing lighting energy use.

Environmental & Health Benefits

Phasing out magnetic ballasts will reduce energy consumption and greenhouse gas emissions and improve air quality. It will also reduce the potential for human exposure to PCBs.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a low, positive health impact per building and to impact a large number of buildings. It was thus given a health score of 2.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase capital cost by \$3.60/square foot. It was thus categorized as incurring a higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in more than ten years depending on the building type.

Precedents

The California Department of Education (CDE) and Department of Toxic Substances Control (DTSC) recommend removal of pre-1979 PCB ballasts from schools as soon as practicable. They recommend that school districts planning modernization projects should include PCB fluorescent light ballast removal where pre-1979 lighting systems are still in use.⁴

LEED

For existing buildings, LEED EB-EQ Prerequisite 4 addresses reducing the potential exposure of building occupants to PCB’s. This proposal would directly assist projects in compliance with LEED.

Implementation & Market Availability

There are no known implementation issues for this proposal. Electronic ballasts are readily available.

ENDNOTES:

¹ U.S. EPA, PCBs: Basic Information, <http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/about.htm> (last visited Jan. 25, 2010).

² DEBRA JACOBSON, PRINTER'S NATIONAL ENVIRONMENTAL ASSISTANCE CENTER, FACT SHEET: PCB AND DHP IN LIGHTING BALLASTS, (2004) <http://www.pneac.org/sheets/pdfs/PCBinBallast.pdf>.

³ California Energy Commission, Consumer Energy Center, Lighting Questions and Answers, <http://www.consumerenergycenter.org/lighting/lighting-faq.html> (last visited Jan. 25, 2010)

⁴ U.S. EPA, Region 9: PCBs: Storage and Disposal, <http://epa.gov/region09/toxic/pcb/ballast.html> (last visited Jan. 25, 2010).

HT 11:

CONVENE TASK FORCE ON RECYCLING FLUORESCENT LIGHT BULBS

Study

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

Despite increased use of fluorescent lamps and ballasts, there is a lack of public information about these lights and limited options for their safe disposal.

Recommendation:

The Department of Sanitation should convene a task force to study and determine the best bulb recycling program for NYC.

Proposed Legislation, Rule or Study

The Department of Sanitation should convene a task force to study the most effective options for recycling ballasts and mercury-added light bulbs from users not already required to do so under federal, state or local law. The goals of the task would be to determine:

- A. For linear lamps (fluorescent tubes) and ballasts, the best recycling program to implement in New York City. The majority of spent linear lamps and ballasts is generated by commercial and large residential building users, many of whom are already required to collect and handle them as hazardous waste or Universal Waste under state and federal law.
- B. For compact fluorescent lamps (CFLs), evaluate the advantages and disadvantages of requiring the recycling of CFLs in New York City. This portion of the study should result in a recommendation of whether NYC should require CFL recycling at this time and, if so, recommend the appropriate program.

In order to make its determinations, the task force should undertake the following tasks:

- (1) Estimate the volume and diversion potential of fluorescent light bulbs and ballasts in 2009 and future years.
- (2) Identify a range of possible methods for collection and recycling of spent light bulbs and ballasts (each a "recycling method"), including the responsibilities of various entities (consumer/building manager, retailer, manufacturer, government) under each scenario. For CFLs, the considered recycling methods shall include, but not be limited to, the following: (i) a refundable deposit system; (ii) requiring take-back from retailers; (iii) expansion of the current city collection program; and (iv) providing significant assistance to existing, voluntary programs.
- (3) Evaluate each potential recycling method, including factors such as convenience, likely compliance rate, potential citywide impact, estimate of costs, burden and monitoring requirements; such evaluation shall also consider safe handling methods, potential for breakage and liability issues.
- (4) Consider implications for special groups, such as small retailers and mail-order purchasers, especially for CFL recycling.
- (5) Recommend an education program on the importance of recycling light bulbs and ballasts, proper management and opportunities for recycling; this program should address building managers, consumers and retailers, and should consider product labeling and information at collection locations.
- (6) Identify the steps required to implement the recommended recycling method, including action required by city government and target dates for implementation.

Supporting Information

Issue – Expanded

Mercury exists in several forms, including elemental and metallic mercury, which are the types used in fluorescent light bulbs. At room temperature, elemental mercury can evaporate and become an invisible, odorless toxic vapor. When fluorescent bulbs are broken in landfills, the evaporated mercury eventually settles into water or land, where it can be washed into water streams. Once deposited, microorganisms can convert it to methylmercury, a highly toxic form of mercury that builds up in fish, shellfish, and animals that eat fish.¹

All fluorescent bulbs contain mercury, which is necessary for their operation. The amount varies, depending on the type, manufacturer and when the bulb was manufactured. The amount in linear fluorescent lamps ranges from 3.5-15 milligrams, with the older linear tubes (T-12s) at the higher end. Lighting manufacturers have reduced the amount of mercury over the years, and low-mercury linear tubes (with green tips or green markings) are more common. These contain 3.5-4 milligrams of mercury. Compact fluorescents contain an average of 5 milligrams of mercury, although this also varies by manufacturer and type.² Overall, CFLs and linear fluorescent lamps are responsible for a very small portion of national mercury emissions³ and pose a limited health risk if handled properly. However, the potential for direct human exposure from improper handling and breakage means these lamps warrant greater attention than might otherwise be apparent.

Disposal of spent fluorescent bulbs is regulated under federal and NYS laws and these regulations require that all bulbs be handled as hazardous waste or “universal waste.” Certain small businesses and residences are exempt. Despite the regulations in place, EPA estimates that approximately 76% of bulbs are improperly discarded.⁴

Environmental & Health Benefits

New York State Department of Environmental Conservation (NYS DEC) and the U.S. Environmental Protection Agency (EPA) have identified mercury as a persistent and toxic pollutant that accumulates in the environment. According to NYS DEC, “the removal of mercury-containing products from the waste stream prior to incineration is a cost-effective means of reducing the generation of mercury from solid waste management facilities.”⁵

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs.

Precedents

Several states including California, Maine and Massachusetts have mandated recycling of CFLs.^{6 7 8} These and other states require used CFLs be brought to special recycling facilities or dropped off at various municipal and retail outlets, such as Home Depot stores, that offer collection of CFLs for recycling.

The EPA recommends recycling CFLs since all parts of the bulbs can be recycled and used for new CFLs. Because mercury is a hazardous material, the EPA warns against disposing of CFLs in regular trash that might be incinerated or sent to landfills where the mercury can seep into the environment.⁹ NYS DEC strongly recommends the recycling of all mercury-containing lamps by both businesses and households.¹⁰

LEED

This proposal will not directly assist in meeting LEED requirements. However, LEED does address mercury levels in light bulbs.

LEED EB-MR Prerequisite 2 Toxic Material Source Reduction addresses reducing the amount of mercury brought into buildings through purchases of light bulbs. LEED EB-MR Cr.6 Additional Toxic Material Reduction can be achieved by establishing and maintaining a toxic material source reduction program.

Should the recommendations in this proposal be implemented, projects could subsequently collect the recyclable light bulbs, and/or divert the material as part of construction waste management. This would help make these projects eligible for additional Materials and Resources credits across most rating systems.

Implementation & Market Availability

This proposal requires additional consumer education on the proper use and disposal of CFLs, in addition to recycling information in order to heighten consumer awareness and participation in the recycling effort.

There is an established network of mercury lamp recyclers for both linear tubes and compact fluorescent bulbs.

ENDNOTES:

¹ U.S. EPA, Mercury: Basic Information, <http://www.epa.gov/mercury/about.htm> (last visited Aug. 3, 2009).

² U.S. EPA, Mercury-Containing Light Bulb (Lamp) Frequent Questions, <http://www.epa.gov/epawaste/hazard/wastetypes/universal/lamps/faqs.htm> (last visited Sep. 23, 2008).

³ ENERGYSTAR, FREQUENTLY ASKED QUESTIONS: INFORMATION ON COMPACT FLUORESCENT LIGHT BULBS (CFLs) AND MERCURY (2008), http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf. (If all CFLs sold in 2007 (290 million) were sent to landfills, rather than recycled, it would result in 0.13 metric tons of mercury emissions. This would represent just 0.1% of all mercury emissions caused by humans in the US.).

⁴ Ibid.

⁵ N.Y. ENVTL. CONSERV. LAW ch. 145 (2004), available at <http://www.dec.ny.gov/chemical/8853.html>.

⁶ Maine Bureau of Remediation and Waste Management, Fluorescent Light Bulb Information, <http://maine.gov/dep/rwm/homeowner/fluorescent.htm> (last visited Jan. 25, 2010).

⁷ Massachusetts Department of Environmental Protection, Consumer Information: Compact Fluorescent Lamps (CFLs), <http://mass.gov/dep/toxics/stypes/cflinfo.htm> (last visited Jan. 25, 2010).

⁸ CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL, FACT SHEET: MANAGING HAZARDOUS WASTE (2007), http://dtsc.ca.gov/HazardousWaste/Mercury/upload/HWMP_FS_Fluorescent_Tubes_Trash.pdf

⁹ U.S. EPA, Mercury-Containing Light Bulb (Lamp) Basic Information, <http://www.epa.gov/epawaste/hazard/wastetypes/universal/lamps/basic.htm> (last visited Jan. 25, 2010).

¹⁰ NYS Department of Environmental Conservation. Disposal Options for Fluorescent and HID Lamps in New York State, <http://www.dec.ny.gov/chemical/9088.html> (last visited Jan. 25, 2010).

HT 12: REDUCE OVERSIZED BATTERIES IN EMERGENCY LIGHTING

New York City Building Code

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

Much emergency lighting is powered by batteries, which contain heavy metals and other hazardous substances. By mandating twice as much emergency illumination as the rest of the country, the NYC building code promotes excessively large battery systems.

Recommendation:

Reduce the required level of emergency lighting, thereby reducing battery size.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1006.3.2 as follows:

1006.3.2 Performance of System. Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of [2 foot-candle (22 lux)] 1 foot-candle (11 lux) and a minimum at any point of [0.2 foot-candle (2.15 lux)] 0.1 foot-candle (1.1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 foot-candle (6.46 lux) average and a minimum at any point of 0.06 foot candle (0.646 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded.

Supporting Information

Issue – Expanded

The vast majority of buildings in New York City rely on batteries to provide power for emergency lighting equipment when normal power fails. There are two basic technologies used for these batteries: lead-acid (also referred to as sealed lead-acid, sealed lead-calcium, valve-regulated lead acid, VRLA, or SLA), and nickel-cadmium (Ni-Cd). Lead-acid batteries are much more common because they are cheaper, but both are extremely toxic.

Children who ingest lead can suffer from damage to the brain and nervous system, behavior and learning problems, such as hyperactivity, slowed growth, hearing problems, and headaches. Adults can suffer from reproductive problems, high blood pressure and hypertension, nerve disorders, memory and concentration problems, and muscle and joint pain.¹

The United States EPA has found cadmium to potentially cause nausea, vomiting, diarrhea, muscle cramps, salivation, sensory disturbances, liver injury, convulsions, shock and renal failure when people are exposed to it at unsafe levels for relatively short periods of time. Long-term exposure has the potential to cause kidney, liver, bone and blood damage.²

Ni-Cd rechargeable batteries were estimated to represent approximately 75 percent of the cadmium found in municipal solid waste in 1995. Lead-acid batteries represent approximately 65 percent of the lead found in municipal solid waste in 1995.³

Sometimes the batteries used to power emergency lighting equipment are clustered together in a central location (often called a central inverter). Central inverters always use lead-acid batteries, and often contain in excess of 750 lbs. of lead. When they fail (after 10-15 years), they are usually recycled, partly because special handling is required for anything this heavy, and partly because the lead itself is valuable.

But central inverters are relatively rare. Much more often smaller batteries are installed within individual emergency light fixtures. These batteries are a mix of lead-acid and Ni-Cd. 2-4 lb. batteries are common in these installations, and they need to be replaced every 5-15 years. Even though these should be recycled, anecdotal evidence suggests that

these are often disposed of as regular trash because they are smaller, and they fail one at a time, making it more difficult for building maintenance personnel to make special arrangements for their proper disposal.

The risk of contamination within buildings is unknown. Under ordinary operating conditions the toxic materials remain sealed within the emergency lighting units. However, if these units are damaged by physical abuse or fire they could leak out and contaminate a building interior.

These products are still on the market because there is no economical alternative. Nickel-metal hydride (NiMH) batteries are about 3 times as expensive as lead-acid, and lithium ion batteries are 6-8 times as expensive. Because of this increased cost, almost no emergency lighting manufacturers incorporate these technologies into their products. Despite all of this, if reducing light levels in egress areas were to compromise safety in buildings, it would be a bad idea. But there is no evidence to indicate that this will happen. On the contrary, New York City's current code requires double the illuminance in the rest of the nation (see precedents listed below).

Our current understanding of vision indicates that there is almost no improvement in evacuation times when light levels are increased from 1 foot-candle to 2 foot-candles average illuminance.⁴ Rather, once the critical threshold of about 0.5 foot-candles is reached there is little benefit to increasing light levels further. The codes used in the rest of the nation are conservative in requiring 1 foot-candle of illumination.

Environmental & Health Benefits

Better enforcement of existing disposal laws and increased awareness among building maintenance personnel would help keep lead and cadmium out of landfills, but the best course of action is to reduce the quantity of toxic materials being installed in our buildings in the first place. There is a one-to-one relationship between the emergency light levels required by code and the number of batteries required to meet that light level. Halving emergency light level requirements will halve the amount of lead and cadmium installed in our buildings. All things being equal, this will halve the amount of these materials that eventually end up in our landfills.

Similarly, halving egress light levels will halve the amount of energy being used to illuminate means of egress. Since the lights in means of egress are currently required to operate 24 hours a day, 365 days a year, this adds up to a great many lights burning in empty corridors, stairwells, and parking garages around the city.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents

The National Fire Protection Association's Life Safety Code (NFPA 101 – 2009) 7.9.2.1 states that, "Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 ft-candle (10.8 lux) and, at any point, not less than 0.1 ft-candle (1.1 lux) measured along the path of egress at floor level."⁵ The following codes all use identical language:

- International Building Code (I.B.C. 2006) 1006.4
- Massachusetts State Building Code, 780 C.M.R. 1006.4, which is the building code for the City of Boston
- 2003 Seattle Building Code 1006.4.2

The New York City Building Code is based on the IBC 2006 and uses the same language as IBC 2006, but the values have been doubled.

LEED

Due to improved energy performance resulting from these measures, this proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems.

These recommendations will also facilitate achieving LEED Energy and Atmosphere credits:

- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED ND-GCT cr.2 Energy Efficiency in Buildings

- LEED for Schools EA cr.1 Optimize Energy Performance
- Additional credits under LEED pilot programs

These credits require exceeding the minimum standards established by the Energy and Atmosphere prerequisites.

LEED CI-EA cr.1.1 Optimize Energy Performance, Lighting Power, specifically addresses reducing lighting power throughout the entire tenant space. According to the LEED CI Reference Manual, for commercial interior projects, the reduction of interior lighting power stands to be the greatest energy conservation method available. Therefore, this proposal will have a significant positive impact on LEED certification.

Implementation and Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

¹ U.S. EPA, Lead in Paint, Dust and Soil, <http://www.epa.gov/lead/pubs/leadinfo.htm#facts> (last visited June 16, 2009).

² U.S. EPA, Consumer Factsheet on Cadmium, http://www.epa.gov/OGWDW/contaminants/dw_contamfs/cadmium.html (last visited Jan. 21, 2010).

³ U.S. EPA, IMPLEMENTATION OF THE MERCURY-CONTAINING AND RECHARGEABLE BATTERY MANAGEMENT ACT (1997), <http://www.epa.gov/osw/hazard/recycling/battery.pdf>.

⁴ ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA, THE IESNA LIGHTING HANDBOOK, Ch. 29, Fig. 29-1 (Mark Stanley Ray ed., IESNA, 9th ed., 2000).

⁵ NATIONAL FIRE PROTECTION ASSOCIATION, NFPA 101: LIFE SAFETY CODE 101 § 7.9.2.1 (NFPA, 2009).

HT 13:

TREAT CORROSIVE CONCRETE WASTEWATER

New York City Building Code

Proposal developed by the Construction Practices Committee

Summary

Issue:

Concrete trucks, buckets and washout pump trucks are typically rinsed at construction sites, and the runoff is then directed to a stormwater drain. This water is corrosive and should not be discharged onto public streets or into rivers.¹

Recommendation:

Require wastewater from concrete mixer trucks to be either treated on site or returned to the manufacturing plant for treatment.

Proposed Legislation, Rule, or Study

Amendments to the New York City Building Code:

1. Amend Section 3302.1 to include the following defined terms:

CONCRETE BUCKET. A receptacle of one half cubic yard or greater capacity used to convey concrete.

CONCRETE WASHOUT WATER. Wastewater from the rinsing of equipment used to mix, transport, convey, and/or place concrete manufactured by a permitted batch or mixing plant. Examples include concrete buckets, the concrete hose lines and pumps of concrete pump trucks, and the chute of concrete mixer trucks. This definition does not include equipment involved in the preparation, conveyance, or application of concrete mixed on site from bagged ready-mix.

NORMAL SEWAGE. See Section 24-523(a)(10) of the *Administrative Code*.

SEWER SYSTEM. See Section 24-523(a)(2) of the *Administrative Code*.

2. Add a new Section 3303.17 as follows:

3303.17 Concrete washout water. Concrete washout water from mixer trucks shall be collected and either:

1. allowed to evaporate;
2. returned to the concrete batch plant for treatment;
3. treated onsite to the standard of normal sewage prior to release into the sewer system; or
4. treated onsite prior to release into the sewer system according to a treatment protocol established by the commissioner.

Supporting Information

Issue - Expanded

Concrete contains Portland cement, and typically also antifreeze and fly ash or slag. The residue from these materials gives concrete washout water a pH above 12, which is comparable to Drano® Clog Removers. Concrete washout water also contains metals and metalloids, at least four of which are toxic². Concrete washout water flowing down the street gutter can harm the public by direct contact or ingestion. Undiluted, the water would also be lethal to aquatic life. NYC's sewer system commonly outflows into local rivers.

Although NYC law prohibits the discharge of substances with a pH above 12 and that contain toxic materials to the City sewer system, the rule is not enforced for concrete washout water. Construction projects are permitted to release the water to the ground, street, and City sewer once it is filtered of sediment through the use of filter fabric and straw bales. This proposal requires projects to employ low cost and practical measures that are currently available to eliminate the

release of the primary source of untreated washout water, which results from rinsing the barrel and chute of mixer trucks.

For a 1.2 million square foot project, this strategy was estimated to prevent the release of approximately 163,500 gallons of untreated concrete washout water to neighboring city streets and the City sewer system. This equates to five times the amount of water in a 25 yard-long, three lane-wide and four foot-deep swimming pool.

Environmental & Health Benefits

Concrete contains Portland cement, as well as often antifreeze and fly ash or slag. The residue from these materials gives concrete washout water a pH above 12, which is comparable to Drano® Clog Removers.

In addition to a high pH, concrete washout water also contains the following metals, of which the first four—arsenic, chromium, lead, and zinc—are defined as toxic by the NYC building code and federal Clean Water Act:

• Arsenic	• Barium	• Potassium
• Chromium	• Calcium	• Selenium
• Lead	• Iron	• Sodium
• Zinc	• Magnesium	• Vanadium
• Aluminum	• Manganese	

Concrete washout water also contains sulfur trioxide, which can react with water to form sulfuric acid.

A recent test of the concrete washout water from a local project confirmed the above information.

In addition to the dangers related to direct contact with the water, waste discharged into the City's combined sewer system empties into the local rivers during Combined Sewer Overflow (CSO) events. These events occur about 50 times per year, on average, and up to 70 times per year at some outfall locations.³

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents

1. California, Washington, Minnesota, and land areas where the EPA is the permitting authority prohibit construction sites greater than 1 acre from releasing concrete washout water to the ground, sewer system, or local water body without prior treatment.⁴
2. Section a(1) of Rules of the City of New York (RCNY) Title 15, Chapter §19-03, Materials and Substances Excluded from Public Sewers, currently prohibits construction materials from being discharged, allowed to run, leak, or escape into any public sewer. The rule also prohibits substances having the following characteristics from being discharged into the public sewer:
 - (9) Wastewater having a pH lower than 5.0 or higher than 12.0 or having any other corrosive property likely to cause damage to structures or equipment of the sewerage system or create a hazard to personnel;
 - 10) Toxic substances in such quantities, which the person knows or has reason to know, may when discharged from a single source or in combination with other sources:
 - (ii) limit the City's options for operating its sewerage system or disposing of the sewage sludge, grit or scum generated at water pollution control plants;

(iii) be detrimental to the health of human beings, animals, or aquatic life;

Under this existing NYC law, concrete washout water should not be permitted to enter the City's sewer system.

3. Section 16-119 of the Administrative Code of the City of New York states:

It shall be unlawful for any person, his or her agent, employee, or any person under his or her control to suffer or permit any dirt, sand, gravel, clay, loam, stone, rocks, rubble, building rubbish, sawdust, shavings or trade or household waste, refuse, ashes, manure, garbage, rubbish or debris of any sort or any other organic or non-organic material or thing or other offensive matter being transported in a dump truck or other vehicle to be dumped, deposited or otherwise disposed of in or upon any street, lot, park, public place or other area whether publicly or privately owned.

Under this existing NYC law, concrete washout water should not be permitted to be dumped on City streets.

LEED

All new construction and major renovation projects pursuing LEED certification are required to comply with the requirements of the EPA Construction General Permit (CGP). Compliance is mandated by Sustainable Sites Prerequisite 1. Thus all LEED projects in the City should already be following the requirements proposed herein (though none currently are doing so).

Implementation & Market Availability

A project with a large site area will be able to use watertight concrete washout bins, in which the water can be left until it evaporates. Permanent bins with a nonstick surface are best for this application, because the concrete can be slid out and recycled. The alternative is to use plywood boxes lined with a plastic sheet. Once the concrete cures in this type of box, the whole box has to be disposed of and the concrete cannot be recycled. Plywood boxes cost about \$400 to make.⁵

An alternative is to capture the water and return it with the truck to the concrete plant for treatment. Concrete plants have water treatment facilities by law because they generate a significant amount of washout water rinsing trucks and equipment themselves. An off-the-shelf solution for capturing the water and returning it to the plant costs about \$1,400 per truck to purchase and two hours to install. This solution consists of a pail that hooks onto the bottom of the concrete truck chute while the chute is being rinsed down. The pail empties into a 30-gallon tank installed on the truck. Back at the plant, the tank is emptied while the truck is rinsed down more thoroughly, as is currently the practice. For a large project (e.g. 1.2 million SF) about 10 trucks would need to be fitted out with the system to service the job effectively. Using the system could add 10-15 minutes to the washout process, but it also offers cost savings through the following:

- Reducing the need to chop concrete out of sewers, which costs about \$480 per session.⁶ Current practice can result in sewers needing cleaning as often as once a week on a large project.
- Reducing the need for washout boxes (lined with filter fabric) on site. Current practice typically requires large jobs to fabricate 2 plywood washout boxes a week. The cost of this practice is about \$4,120 per month.⁷
- Reducing potential for fines related to sewer blockages: Fines range from \$350 - \$10,000.
- Reducing potential for personal injury related to concrete washout water.

Concrete Slurry Solutions (www.concreteslurrysolutions.com) has developed a product as described above for capturing rinse water off the chute and returning it to the concrete plant for treatment with the truck. It is called the Concrete Washout Watchdog. It has been installed on the fleets of the following concrete manufacturers.

Strata Corp	West Fargo ND
Central Iowa RM	Ankeny IA
Crosslakes RM	Crosslakes MN
Cemstone	St. Paul MN
Superior Supplies	Santa Rosa CA
Nevada Ready Mix	Las Vegas NV
Sacramento Concrete	Sacramento CA
Over & Over Ready Mix	Sun Valley CA
Associated Ready Mix	Los Angeles CA
A&A Supply	Sacramento
Cadman	Redmond WA
Carl's Ready Mix	Windsor CA
Catalina Pacific, Geiger Ready Mix	Kansas City MO
Matthew's Ready Mix	Yuba City CA
Livingston Concrete	N. Highlands CA
Rinker Materials	Fairfield CA
Rinker Materials	Everett WA

Concrete Washout Systems™ offers permanent concrete washout boxes with a nonstick surface. The company has numerous containers at various sites throughout New Jersey and New York State. Recently completed jobs in NYC include Pier 53 (Trevcon), Pier 98 (D'Onofrio), The Willis Avenue Bridge (Kiewit), The Throgs Neck Bridge (American Bridge), East 80th Street (Ryan Associates), and several projects for Cross Country Construction, Atlantic Sub-Sea, DKN Concrete, and Gotham Construction. Current projects include Astoria Power Plant (Jingoli), World Trade Center (Rogers & Sons, Collavino Construction), and The Harlem River Tunnel (Kiewit).

Other off-the-shelf solutions are also available to satisfy the requirements of this proposal.

ENDNOTES:

¹ Riverkeeper, Sewage and Combined Sewage Overflows, <http://www.riverkeeper.org/campaigns/stop-polluters/cso> (last visited Jan. 12, 2010); New York Dep't of Environmental Conservation, Combined Sewer Overflow (CSO): Impact on Receiving Water and Recreational Activities, <http://www.dec.ny.gov/chemical/48595.html> (last visited Jan. 12, 2010). (The DEC page on CSO does not provide an estimate of the number of CSO events per year. A call to the office was not returned.).

² 33 U.S.C. §§ 1251-1376 (1948)(amended 1987) available at <http://www.fws.gov/laws/lawsdigest/FWATRPO.HTML> (last visited Jan 26, 2010). (New York City Building Code refers to the Federal Clean Water Act for its definitions of toxic substances).

³ Riverkeeper, Sewage and Combined Sewage Overflows, <http://www.riverkeeper.org/campaigns/stop-polluters/cso> (last visited Jan. 12, 2010);

⁴ U.S. EPA, National Pollutant Discharge Elimination System, <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=117> (last visited Jan. 12, 2010); MINNESOTA POLLUTION CONTROL AGENCY, CONCRETE WASHOUT GUIDANCE: NPDES/SDS CONSTRUCTION STORMWATER PERMIT REQUIREMENTS (2009), <http://www.pca.state.mn.us/publications/wq-strm2-24.pdf>; CALIFORNIA STORMWATER QUALITY ASSOCIATION, CALIFORNIA STORMWATER BMP HANDBOOK (2003) <http://www.cabmphandbooks.com/Documents/Construction/WM-8.pdf>; Washington State Department of Ecology, Construction Stormwater General Permit, <http://www.ecy.wa.gov/programs/wq/stormwater/construction/#More%20Stormwater%20Guidance%20Information%20> (last visited Jan. 12, 2010).

⁵ Assumes that the cost includes four sheets of plywood at \$75/box and one hour of carpenter time at \$100/hour.

⁶ Assumes one sewer cleaning involves two laborers working for four hours at \$60/hour with benefits

⁷ Assumes two boxes are fabricated each week at a cost of \$75/box of plywood and one hour of carpenter time at \$100/hr, and then two boxes are broken down at a cost of four hours of laborer time at \$60/hour.

HT 14: REDUCE “RED TAPE” FOR ASBESTOS REMOVAL

Rules of the City of New York

Proposal developed by the Construction Practices Committee

Summary

Issue:

Products containing encased asbestos, such as vinyl tile or window putty, can be safely removed using simpler procedures than those required for the removal of crumbly asbestos products. While New York State allows the use of such simplified procedures, the New York City Department of Environmental Protection (NYCDEP) requires contractors to obtain a variance in order to do so.

Recommendation:

NYCDEP should allow projects removing encased asbestos products to utilize approved, simpler procedures without a variance. This proposal was incorporated into DEP Rules prior to the issuance of this report.

Proposed Legislation, Rule, or Study

Rules of the City of New York, Title 15, Chapter 1

NYCDEP should revise its filing procedures to allow the removal of non-friable asbestos materials via currently approved procedures without the necessity of applying for a variance. The standard procedures should allow the abatement of the three major categories of non-friable asbestos materials—vinyl asbestos tile; flat roofing materials; and other exterior ACM, including shingles, siding, putty, and caulking—without the administrative burden of a variance process. Note that there would be no change in the actual procedures required for the removal of products containing non-friable asbestos.

In response to a Task Force inquiry on this issue in fall 2008, NYCDEP agreed to modify its regulatory program to reflect the recommendations of the Task Force. DEP proposed the regulatory modifications in the City Record of September 11, 2009. They were finalized and became effective on November 13, 2009.

Supporting Information

Issue – Expanded

There is no additional explanation for this proposal.

Environmental & Health Benefits

This proposal was found to have no significant environmental impact.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

NY State Department of Labor (NYSDOL) has modified its regulations to allow the abatement of non-friable asbestos via an analogous generic procedure that was incorporated into their regulations in 2007. The NYSDOL process has thereby become a one-step process as compared to the NYCDEP two-step process.

LEED

LEED for Existing Buildings directly addresses asbestos abatement in LEED EB-SS EQ prerequisite 3, Asbestos Removal or Encapsulation. Since this issue is a prerequisite, the proposal will have a strongly positive influence on attaining LEED certification.

The recommendations outlined in this proposal will make asbestos abatement more feasible under certain conditions, and will therefore assist in achieving credit for LEED NC-SS cr.3 Brownfield Redevelopment; LEED for Schools SS prerequisite 2 Environmental Site Assessment; LEED for Schools SS cr.3 Brownfield Redevelopment; LEED ND (pilot program)-SLL cr.1 Brownfields Redevelopment; and LEED CI-SS cr.1 Option A, Brownfield Redevelopment, provided that certain provisions are met as specified by LEED.

Other LEED pilot programs address asbestos in a similar manner.

Implementation & Market Availability

The removal of this regulatory impediment will allow abatement of the three major categories of non-friable asbestos materials to be accomplished by specific published protocols via a less onerous regulatory process, while saving two to three weeks of administrative time for the contractor. As a result of this procedural change NYCDEP will be able to reassign staff to conduct higher priority work.

Notes

Under most conditions, NYCDEP does not treat vinyl asbestos tiles and asbestos shingles as friable. However, under extreme environmental conditions or standard drilling, sawing, sanding, etc. they would be considered friable asbestos material in which the release of asbestos fibers may easily result.¹

ENDNOTES:

¹ CITY OF NEW YORK EPA, REGULATORY INTERPRETATION MEMORANDUM TO THE BUREAU OF AIR RESOURCES ASBESTOS CONTROL PROGRAM, 1-87 (May 14, 1987).

HT 15: ALLOW STAIRWAY USE

New York City Building Code

Proposal developed by the Physical Activity Committee

Summary

Issue:

Locked doors inhibit the use of stairs, deterring physical activity and fitness.

Recommendation:

Encourage regular physical activity in buildings by requiring stair doors to be unlocked, while allowing exceptions for security access devices.

Proposed Legislation, Rule or Study

Amendments to the New York City Buildings Code

1. Add a new definition for “STAIRWAY, PUBLIC ACCESS” to Section 1002.1 as follows:

STAIRWAY, PUBLIC ACCESS. A continuous stairway accessible from the ground floor lobby and to all floors, which enables building occupants to utilize stairs to travel between floors.

2. Add a new Section 1007.3.1 as follows:

1007.3.1 Public access stairway. At least one exit stairway shall function as a public access stairway. Doors opening into a public access stairway may not be locked from either side. However, doors opening into a public access stairway may be locked from the stair side provided that any such door shall be open to authorized occupants of each floor by use of security devices such as keys, codes or card key access, and provided that such locked door does not violate any other section of this code.

Exceptions:

1. Buildings no more than three stories in height that contain an unenclosed stairway open to building occupants at all levels.

2. Buildings having a stairway other than an exit stairway that serves all floors in the building is accessible to all building occupants.

Supporting Information

Issues – Expanded

The obesity epidemic is a major health crisis facing the American public, leading to a rapid increase in the incidence of type 2 diabetes and other ailments.¹ This crisis is particularly acute in NYC: fifty-eight percent of adults² and nearly 40 percent of elementary and middle school children³ are overweight or obese. Rates of overweight and obesity in children in New York are higher than national rates (31 percent),⁴ and prevalence of obesity and diabetes in NYC adults is also increasing faster than national prevalence rates.⁵ Between 2002 and 2004, the prevalence of obesity and diabetes among NYC adults rose by 17 percent, while the national prevalence of obesity grew by 6 percent.⁶ These trends have a direct impact on hospitalization costs from diabetes in NYC, which doubled between 1990 and 2003 to \$480 million yearly.⁷ Additionally, obesity has been directly linked to coronary heart disease, different types of cancers, hypertension, high cholesterol, stroke, liver and gallbladder disease, sleep apnea, respiratory problems, and osteoarthritis.⁸ Cardiovascular diseases, such as heart disease and strokes, are the leading causes of death in New York City.⁹ Independent of weight, physical activity is also protective against cardiovascular disease, type 2 diabetes, some of our most common and deadly cancers such as colon cancer, osteoporosis, depression, and age-related cognitive decline.¹⁰

Stair climbing is a vigorous form of incidental physical activity, which can easily be incorporated into the daily lives of most able-bodied people. In many NYC buildings, stairways are locked on the stair side except for the point of egress from the building. As a consequence, occupants are impeded from using the stairs and instead resort to the elevator. In addition to difficult egress, stairways are often located at the sides or back of the building. Signage at key points to

help people locate staircases and encourage stair use is currently not required as part of the signage at elevators. Stairway doors are not required to have glass and allow for visibility of the stairs but are instead opaque and unwelcoming. All of the above make stairways difficult to locate and access, inconvenient, and uninviting to use.

To remedy this situation and to both allow and further promote stair use, the proposal calls for designating at least one stairway, which may be one of the fire stairs, as a public access stair. A public access stair will allow entry and egress at each floor, have doorways with visibility into stairs, and include signage. In order to address concerns for safety and security, which are the reason that stairways have been locked, the proposal allows the use of code or card key access, which can enable security to be maintained while stairways are accessible to the building occupants.

Environmental & Health Benefits

Stair use burns calories, and research has linked stair use to other health benefits such as better cardiovascular health.¹¹ Stair climbing has been shown to raise individuals' good cholesterol levels.¹²

A comprehensive review of the literature conducted by the Task Force on Community Preventive Services convened by CDC has shown that increasing access to places for physical activity consistently increases physical activity.¹³ Access to stairwells, in addition to stair signage prompting stair use for health benefits, stair visibility, convenience, width and aesthetics, facilitate increased stair use.¹⁴ In studies of point-of-decision prompt signage, tailoring the health benefits to a specific group or community can further increase stair usage. For example, weight messages have been found to increase stair use in those who are overweight or obese.¹⁵

In a recent study by the NYC Dept of Health and Mental Hygiene, staff who reported using the stairs were less likely to be obese compared to staff who reported not using the stairs. The Health Department also modeled the potential impacts of increasing stair access alone and found it could prevent approximately 250,000 pounds (~8% of NYC annual average weight gain). Combining this with stair signage would result in an approximate doubling of impacts, resulting in prevention of ~550,000 pounds gained by New Yorkers each year (~18% of NYC annual average weight gain). Just as the control of major diseases of the past, such as cholera and tuberculosis, relied on drastic changes to living conditions, addressing the current epidemics relies on access to health-protecting and -promoting environments.¹⁶ To this end, climbing stairs can be easily incorporated into a person's daily routine.

Decreased elevator use will also have a beneficial effect on the environment. Elevators in tall office buildings use approximately 4-7% of the building's energy.¹⁷ This can result in as much as 15,000 Kilowatts used per year. As a comparison, heating a 1,700 square foot house electrically for an entire year uses only 7,100 Kilowatts per year.¹⁸

Overall, this proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a high positive health impact per building and to impact a large number of buildings. It was thus given a health score of 3.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.02%, depending on building type. It was thus categorized as incurring no to a low capital cost increment.

Precedents

Although we are unaware of legal precedents for promoting stair use per se outside of emergency circumstances, precedence for codifying physical-activity promoting design for health purposes exists in building codes elsewhere. In Berlin, Germany, building codes require the installation and maintenance of a playground for housing developments with six apartments or more. Under § 8 Sect. 2 of the Berlin Building Code, it is stated that "at least 4 sq. m. of usable play area per residential unit should be provided."¹⁹ The size of the area should amount to at least 50 sq. m., and should be suitable for play by small children. If a construction project with more than 75 apartments is planned, the playground should also be suitable for play by older children. Exceptions are only admissible if the intended use of the building makes the presence of children unlikely. The care and maintenance of private playgrounds is generally the responsibility of the owner.

Although there is a lack of legal precedents for promoting stair use for exercise, corporations and schools have begun a movement to promote stair use for exercise. At Sprint Nextel's Overland Park office, the elevators run especially slowly in order to promote stair use. The California Department of Transportation office in California has an elevator that stops on every third floor, in order to prompt users who can take the stairs. At Virginia Commonwealth University, the newly designed business school has placed its elevator in a non-obvious place, and the stairs in a prominent area, in

order to promote stair use.²⁰

LEED

There are no routine LEED credits directly affiliated with this proposal. However, the Riverside Health Center, a NYC Department of Health and Mental Hygiene facility, received a LEED innovation credit for physical activity promoting design. One of the design elements include stairs that are accessible (a pre-requisite are stairs that are accessible to at least the building occupants).

The Riverside Health Center LEED innovation credit also includes the following design elements: stairs that are visible through the use of fire-rated glass on doors, located within 25 feet of the main building entrance, located on the principal path of travel on each floor and visible from the elevators, are 20 percent wider than the code minimum, and use of stair prompt signs at elevators and at stairs.

The physical activity promoting design items in the above LEED NC (New Construction and Major Renovations) innovation credit proposal also complement sustainable site credits to promote walking and biking (SS Credit 2, SS Credit 4.1 and SS Credit 4.2), as well as other LEED precedents for promoting occupant health, including tobacco smoke control (EQ Prerequisite) and indoor pollutant source control (EQ Credit 5). LEED ND (Neighborhood Development) also has at least six credits that have the specific stated intent to encourage physical activity and promote public health.

Implementation & Market Availability

Multiple options for handling security issues are readily available. Additionally, if stair access is promoted and more people use the stairs within buildings, then such use will decrease risks that occur in less populated staircases.

ENDNOTES:

- ¹ U.S. Department of Health and Human Services, The Surgeon General's call to action to prevent and decrease overweight and obesity, in Public Health Service, Office of the Surgeon General (2001) available at <http://www.surgeongeneral.gov/topics/obesity/>
- ² New York City Dep't of Health and Mental Hygiene, Community Health Survey 2008, (2008) http://sasebiweb100.health.dohmh.nycnet/SASStoredProcess/guest?_PROGRAM=%2FEpiQuery%2FCHS%2Fchs2008a&var=bmicat3&crude=uncrude.
- ³ New York City Dep't of Health and Mental Hygiene. Obesity Begins Early: Findings Among Elementary School Children in New York City 2:5 NYC VITAL SIGNS (2003) available at <http://www.nyc.gov/html/doh/downloads/pdf/survey/survey-2003childobesity.pdf>.
- ⁴ Press Release, The New York City Department of Health and Mental Hygiene. Obesity and Diabetes Rising Faster in NYC than Nationally (Mar. 26, 2008) available at <http://www.nyc.gov/html/doh/html/pr2008/pr022-08.shtml>.
- ⁵ Press Release, The New York City Department of Health and Mental Hygiene. Obesity and Diabetes Rising Faster in NYC than Nationally (Mar. 26, 2008) available at <http://www.nyc.gov/html/doh/html/pr2008/pr022-08.shtml>.
- ⁶ Van Wye, G., et al., Obesity and diabetes in New York City, 2002 and 2004. 5:2 PREV CHRONIC DIS. 48 (2008).
- ⁷ NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE. DIABETES IN NEW YORK CITY: PUBLIC HEALTH BURDEN AND DISPARITIES (2007) available at http://home2.nyc.gov/html/doh/downloads/pdf/epi/diabetes_chart_book.pdf.
- ⁸ Centers for Disease Control and Prevention. Overweight and Obesity: Health Consequences (2009) <http://www.cdc.gov/obesity/causes/health.html>.
- ⁹ New York City Department of Health and Mental Hygiene. Summary of Vital Statistics 2007 (2008) <http://www.nyc.gov/html/doh/html/vs/vs.shtml>. (last visited Jan 27, 2010).
- ¹⁰ Centers for Disease Control and Prevention. Physical Activity and Health: The Benefits of Physical Activity (2008) <http://www.cdc.gov/physicalactivity/everyone/health/index.html> (last visited Jan 27, 2010).
- ¹¹ I.M. Lee and R.S. Paffenbarger, Jr., Physical activity and stroke incidence: the Harvard Alumni Health Study. 29:10 STROKE 2049-54 (1998); K.D. Brownell, A.J. Stunkard, and J.M. Albuan, Evaluation and Modification of Exercise Patterns in the Natural Environment 137:12 AM J PSYCHIATRY 1540-5 (1980); and C. Zimring, et al., Influences of building design and site design on physical activity: research and intervention opportunities 28:2:2 AM J PREV MED 186-93 (2005).
- ¹² C.A. Boreham, et al., Training effects of accumulated daily stair-climbing exercise in previously sedentary young women 30:4 PREV MED 277-81 (2000).
- ¹³ Task Force on Community Preventive Services, Recommendations to Increase Physical Activity in Communities 22 AM J PREV MED 67-72 (2002).
- ¹⁴ G. Nicoll, Spatial measures associated with stair use, 21:4 AM J HEALTH PROMOT 346-52 (2007); N.A. Kerr, et al., Increasing stair use in a worksite through environmental changes. 18:4 AM J HEALTH PROMOT 312-4 (2004); Centers for Disease Control and Prevention, StairWELL to Better Health (2007) <http://www.cdc.gov/nccdphp/dnpa/hwi/toolkits/stairwell/index.htm>. (last visited Jan. 28, 2008); and K.N. Boutelle, et al., Using signs, artwork, and music to promote stair use in a public building 91:12 AMERICAN JOURNAL OF PUBLIC HEALTH 2004-6 (2001). 91(12).
- ¹⁵ R.E. Andersen, et al., Can inexpensive signs encourage the use of stairs? Results from a community intervention. 129:5 ANN INTERN MED 363-9 (1998).
- ¹⁶ D. ROSNER, A SOCIAL HISTORY OF DISEASE IN THE 19TH AND EARLY 20TH CENTURY NEW YORK: LESSONS LEARNED FOR THE 21ST CENTURY (2008); M.M. JONES, PROTECTING PUBLIC HEALTH IN NEW YORK CITY: 200 YEARS OF LEADERSHIP; 1805-2005 (2005) available at <http://www.nyc.gov/html/doh/downloads/pdf/bicentennial/historical-booklet.pdf>; and J. DUFFY, A HISTORY OF PUBLIC HEALTH IN NEW YORK CITY: 1866-1966 (Russell Sage Foundation, New York ed. 1974).
- ¹⁷ 6TH WORLD CONGRESS OF THE COUNCIL ON TALL BUILDINGS AND URBAN HABITAT. TALL BUILDINGS AND URBAN HABITAT: CITIES IN THE THIRD MILLENNIUM, 559 (Feb-Mar. 2001).
- ¹⁸ H. SACHS, AMERICA COUNCIL FOR ENERGY-EFFICIENT ECONOMY, OPPORTUNITIES FOR ELEVATOR ENERGY EFFICIENCY IMPROVEMENTS (2005), Available at <http://www.aceee.org/buildings/com1 equip/elevators.pdf>.
- ¹⁹ BERLIN SENATE DEPARTMENT FOR URBAN DEVELOPMENT. CHILDREN'S PLAYGROUNDS: PRIVATE PLAYGROUNDS, available at http://www.stadtentwicklung.berlin.de/umwelt/stadtgruen/kinderspielplaetze/en/private_spielplaetze/index.shtml.
- ²⁰ N. Gautam, New Building Designs Help People to Fight Flab WALL STREET JOURNAL, November 18, 2005, available at <http://www.realestatejournal.com/propertyreport/office/20051118-naik.html>.

HT 16: ENCOURAGE STAIRWAY USE WITH TRANSPARENT DOORS

New York City Building Code

Proposal developed by the Physical Activity Committee

Summary

Issue:

Opaque doors discourage stair use by making them difficult to locate, uninviting and less safe.

Recommendation:

Require doors to public access stairs to include glass.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new Section 1008.1.10 as follows:

1008.1.10 Glazing in doors. All doors in public access stairways required by Section 1007.3.1 shall have fire-protection rated glazing in accordance with Section 715.3.4.1. Glazing shall be present at eye level (between 5'7" and 6'5" measured from the floor), and shall encompass at least one third of the area of the door and half of the area of the door for doors accessible from the ground floor. Doors in any other stairway may include glazing that complies with Section 715.3.4.1.

Supporting Information

Issue – Expanded

For additional background see HT15 “Allow Stairway Use”

Stair climbing is a vigorous form of incidental physical activity that can easily be incorporated into the daily lives of most able-bodied people. Most doors to stairwells, however, are opaque, making the stairwells hard to find and uninviting. People also feel less safe traveling in spaces with limited visibility.

This proposal will require new stairwell doors for public access stairways (the proposal Allow Stairway Use requires each building to have at least one publicly accessible stairwell) to incorporate glass at eye level. Doing so will greatly improve stair visibility, increasing stair usage. It can also lead to a stronger sense of safety among people using the stairs, who may otherwise be uncomfortable traveling on a less visible staircase.

Environmental & Health Benefits

For environmental and health benefits see HT15 “Allow Stairway Use”

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.02%, depending on building type. It was thus categorized as incurring no to a low capital cost increment.

Precedents

For precedents see HT15 “Allow Stairway Use”

LEED

For LEED information see HT15 “Allow Stairway Use”

Implementation & Market Availability

There are no known implementation issues for this proposal. Doors with fire-rated glass are readily available. As market demand for these doors increases, we anticipate supply of such doors to increase and costs to decrease.

HT 17: PROMOTE STAIR USE THROUGH SIGNAGE

New York City Building Code

Proposal developed by the Health Committee.

Summary

Issue:

People are insufficiently aware of the health benefits of using stairs.

Recommendation:

Encourage stair use by requiring signs that prompt stair use and that provide floor re-entry information.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1026.3 as follows:

1026.3 Stairway and elevator identification signs. Stairway floor number and stairway identification signs shall be provided in accordance with Section 1019.1.7. Elevator identification and emergency signs shall be provided in accordance with Section 3002.3. Active living signs that prompt stair use and signs that provide floor re-entry information shall be provided in accordance with Section 3002.3.1.

2. Add a new Section 3002.3.1 as follows:

3002.3.1 Active living signs. An approved pictorial sign of a standardized design at least 11" x 8.5" in size shall be posted adjacent to each passenger elevator call station on all floors that encourages occupants to use the exit stairways. The sign shall be in accordance with a design developed by the Department of Health and Mental Hygiene.

Supporting Information

Issue – Expanded

For additional background see HT15 “Allow Stairway Use”

Stair climbing is a vigorous form of incidental physical activity, which can easily be incorporated into the daily lives of most able-bodied people. Studies have shown that signage at points of decision, like elevators and escalators, consistently increases stair use. Signs that encourage stair use for health benefits and placed at elevators and escalators have been shown to increase stair use 6-129%, with a median increase of ~50% across multiple studies.¹ Weight-specific messages have been found to increase stair use in those who are overweight or obese.² In NYC, The Department of Health and Mental Hygiene, working with the Department of Design and Construction, GreeNYC, AIANY, and REBNY, launched a “Burn Calories, Not Electricity. Take the Stairs!” Campaign in May 2008. This campaign was evaluated in three New York City buildings, a 10-story affordable housing complex in the South Bronx, an 8-story academic building in Brooklyn, and a 4-floor health center in Manhattan. Increases in stair use were significant at all sites, even in the health center where baseline stair use was already extremely high (70%) likely due to good stair placement and aesthetics. In addition, a significant increase in the proportion of people taking the stairs up (which is classified as ‘vigorous’ activity) was observed. Long-term studies conducted at the 10-story building showed that stair use increases remained elevated at 9 months after simple stair prompt placement at elevator call areas and outside stairs. An Australian study found that employees of a healthcare facility were more likely to use the stairs when stair use was highlighted by signs.³

Environmental & Health Benefits

For additional environment and health benefits see HT15 “Allow Stairway Use”

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. It was thus categorized as not incurring a capital cost increment.

Precedents

For additional precedents see HT15 “Allow Stairway Use”

Although there are no known precedents for promoting stair use outside of emergency circumstances, precedence for codifying physical-activity promoting design for health purposes exists in building codes elsewhere. The Center for Disease Control found that Point of Decision prompts near elevators influenced people to take the stairs more often, especially when “the prompts [were tailored] to describe specific benefits or to appeal to specific populations.” Point of Decision prompts were found to be effective on their own, without any additional enhancement of stairs.⁵⁴

LEED

For LEED information see HT15 “Allow Stairway Use”

Implementation & Market Availability

There are no known implementation issues for this proposal. Stair signs are readily available.

ENDNOTES:

¹ Guide to Community Preventive Services, Environmental and Policy Approaches to Physical Activity: Point-of-Decision Prompts to Encourage Use of Stairs, <http://www.thecommunityguide.org/pa/environmental-policy/podp.html> (last visited Jan. 19, 2010).

² R.E. Andersen, et al., Can inexpensive signs encourage the use of stairs? Results from a community intervention. 129:5 ANN INTERN MED 363-9 (1998).

³ A. L. Marshall, et al, Can Motivational Signs Prompt Increases in Incidental Physical Activity in an Australian Health Care Facility, 17:6 HEALTH EDUCATION RESEARCH 748 (2002) available at <http://her.oxfordjournals.org/cgi/reprint/17/6/743>.

⁴ The Guide to Community Preventive Services. Environmental and policy approaches to physical activity: point-of-decision prompts to encourage use of stairs. <http://www.thecommunityguide.org/pa/environmental-policy/podp.html>. (last visited Sept. 25, 2009).

HT 18: ENCOURAGE STAIRWAY USE BY HOLDING DOORS OPEN

New York City Building Code

Proposal developed by the Health Committee

Summary

Issue:

One means of encouraging stair use is to hold doors open by magnets that release the doors when smoke is detected. But the building code does not permit the use of these magnetic devices for stair doors.

Recommendation:

Allow the use of magnetic devices to hold doors open for stairs of three stories or less.

Proposed Legislation, Rule or Study

Amendments to the New York City Buildings Code

1. Amend Section 707.7 as follows:

707.7 Openings. Openings in a shaft enclosure shall be protected in accordance with section 715 as required for fire barriers. Such openings shall be self-closing or automatic-closing by smoke detection. Automatic-closing by smoke detection is not permitted for required vertical exit doors.

Exception:

The use of magnetic devices for automatic-closing by smoke detection for vertical exit doors shall be permitted only for a maximum of three interconnected floors for only one egress stairway, provided there are at least two means of egress.

Supporting Information

Issues – Expanded

For additional background see HT15 “Allow Stairway Use”

Stair use is good for public health and stairs are more likely to be used if doors are open. Research indicates that grand staircases in buildings tend to invite use. The evidence suggests that stairs attract more use when they are highly visible from paths of travel, easy to access, and feature finishes consistent with other public corridor finishes.¹¹ The NYC Building Code, however, does not permit the use of magnetic door holders for automatic-closing by smoke detection in the cases of vertical exit doors due to safety issues. If there is fire and one of the vertical exit doors does not close automatically, the smoke will spread out through the stairway very quickly – a phenomenon referred to as the ‘chimney effect.’ While the chimney effect is a serious concern where exit stairs connect multiple floors and not allowing for automatic-closing in these cases is a good practice, the chimney effect is not a serious issue for stairs that connect up to three floors.

To promote stair use, the proposal calls for allowing the use of magnetic door holders to hold exit stair doors in the open position on one of the egress stairways for the maximum of three interconnected floors, provided there are at least two means of egress. This proposal is consistent with the provision in the building code to allow open stairways for up to three stories and the one that allows open atriums up to three stories. Permitting the use of magnetic devices in these cases will provide high visibility and easy access of the stairs even if stairway doors are solid.

Environmental & Health Benefits

For additional environment and health benefits see HT15 “Allow Stairway Use”

This proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

For additional precedents see HT15 “Allow Stairway Use”

The Kentucky Building Code and Kentucky Fire Code allow for stairway and corridor to be maintained in an open position by magnetic door holders interconnected to the fire alarm system. If doors are held open, the installation of a smoke detector at the topmost level of the stairway is required. The International Building Code also allows for use of such tested devices. In NYC, AIA NY’s Center for Architecture obtained a reconsideration from the Department of Buildings to hold open the doors of its 3-story egress stairwell.

LEED

For LEED information see HT15 “Allow Stairway Use”

Implementation & Market Availability

Multiple options for handling security issues are readily available. This includes a range of electromagnetic door holders and closers, smoke curtain releasers, and other activation devices, which are used as an integral part of a fire, security or ventilation systems. These products are a battery powered, electromagnetic system linked by radio signals to a central controller, which can be a part of the existing building fire system or a separate fire system. Smoke detectors, fire alarm, and other sensors allow fire and smoke doors to be open under conditions. They can activate the magnetic door holders and shut doors as needed in the case of emergencies such as fires.

The products enable fire doors to be legally held in an open position to ease access through a building, in compliance with the Disability Discrimination Act.⁴²

Products are well suited for wall, floor or ceiling mounting in a variety of plain or decorative finishes to fit the decor of both existing and new buildings. The high quality of the finish ensures that little or no servicing is required once these products are fitted. Unlike traditional fire door holders, magnetic door holders and closers do not require wiring (even though wired options are available) throughout the building, making the system more cost-effective and convenient to install.

ENDNOTES:

¹ G. Nicoll, *Spatial measures associated with stair use*, 21:4 AM J HEALTH PROMOT 346-52 (2007).

² Geofire Innovators of Fire Technology. Salamander is the Safe, Legal and Cost Effective Solution, <http://www.geofire.co.uk/Geofire-Products-Salamander-Wire-Free-Door-Holders.html>. (Last visited Jan 31, 2010).

HT 19:

PROVIDE ZONING BONUS FOR INVITING STAIRCASES

New York City Zoning Resolution
Proposal developed by the Health Committee

Summary

Issue:

When stairs are easy to locate, convenient, and attractive they are well used. But in most new buildings, stairs are built as hidden necessities.

Recommendation:

Reward buildings with a zoning bonus for designing stairs that are prominent and accessible.

Proposed Legislation, Rule or Study

Zoning Resolution of the City of New York

Add the following:

12-10 Definitions “Floor Area”

... However the “floor area” of a building shall not include: <Add the following to the list>

Up to 50% of the stair area on any floor where the stairs meet the following criteria:

- i) On the main floor: located within 25 ft of and visible from the entrance, OR located and visible BEFORE elevator(s) from entrance, OR adjacent to and visible from at least the main elevator waiting area serving the lowest bank of the building; AND
- ii) On all other floors: more prominent than elevator from main path of travel, OR adjacent to and visible from at least the main elevator waiting area, OR visible and accessible from tenant areas; AND
- iii) Is 48 inches or wider; AND
- iv) Provides daylighting (e.g. extension of the Housing Quality bonus for daylighting in corridors) on each floor if the stair is located at the perimeter of a building and where the perimeter is not along a lot line; AND
- v) EITHER
 - a) is an open interconnecting stair additional to required fire stairs, OR
 - b) is an open interconnecting stair serving as a fire stair using allowable fire safety systems such as a deluge sprinkler system, OR
 - c) is an enclosed fire stair made visible and accessible by all of the requirements proposed for Building Code inclusion (see proposals with Health and Physical Activity Committee Ranking 1-3), except that minimum fire-rated transparent glazing used to provide visibility must be at least 50% of the door rather than 1/3 of the door, OR
 - d) any combination of a, b, and c on different floors.

*Stairs as defined above do not include escalators.

Exceptions:

The zoning bonus will not be granted if escalators are provided along with the best practice stairs or to buildings classified in Group H, High Hazard.

Supporting Information

Issue – Expanded

For additional background see HT15 “Allow Stairway Use”

Stair climbing is a vigorous form of incidental physical activity that can easily be incorporated into the daily lives of most able-bodied people. Stairs, however, are often difficult to locate, inconvenient, unpleasant, and inaccessible. Inclusion of at least one “Public Access Stair” in every building that allows access, is visible, and provides information encouraging stair use is critical for facilitating stair use to help address the urgent obesity crisis in New York City. These very basic and no cost or inexpensive requirements have been proposed for inclusion in the Building Codes. In addition to these basic requirements, however, are design factors, such as stair placement and location, which also play an important role in promoting stair use. Because the latter can be more costly and need to be determined on a case by case basis, these additional design factors should be included in zoning incentives (Floor Area Ratio Exemption).

The purpose of these design features is to make stairs more prominent than, or as prominent as, elevators in terms of placement, visibility, and aesthetics. This will make stairs a truly competitive and viable option compared to elevators for vertical transport of able-bodied persons in a building.

Environmental & Health Benefits

For additional environment and health benefits see HT15 “Allow Stairway Use”

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost & Savings

This proposal is for a zoning bonus, and therefore have no direct impact on construction costs.

Precedents

For additional precedents see HT15 “Allow Stairway Use”

Although there are no known precedents for promoting stair use outside of emergency circumstances, precedence for codifying physical-activity promoting design for health purposes exists in building codes elsewhere. The CDC, through its Healthy Workforce Initiative, has proposed several optional steps to increase stair usage. Through a pilot program at the Rhodes Building in Atlanta, Georgia they implemented a stair usage plan that included adding carpeting, artwork and music to the stairwells. The CDC also posted motivational signs near elevators that encouraged people to use the stairs as opposed to the elevator. Additionally, they installed tracking mechanisms to monitor people traveling in the staircase. The entire cost of this plan was \$16,000 for the five-story building.¹

LEED

For LEED information see HT15 “Allow Stairway Use”

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

¹ Center for Disease Control and Prevention, StairWELL to Better Health, (2007), <http://www.cdc.gov/nccdphp/dnpa/hwi/toolkits/stairwell/index.htm>.

HT 20: INCREASE AVAILABILITY OF DRINKING FOUNTAINS

New York City Plumbing Code

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:

People buy and consume bottled water and sugary drinks, in large part, because there are not enough easily accessible water fountains. All bottled drinks stress the environment by wasting materials, using energy for transportation, and creating waste. Also, sugary drinks can contribute to chronic diseases.

Recommendation:

Increase the number of required drinking fountains, and also require that they include faucets for filling bottles. Do not allow bottled water to substitute for fountains.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Amend applicable portions of Table 403.1 as follows:

DRINKING FOUNTAIN

Occupancies A-1, A-2, A-3 (Auditoriums)	1 per [500] <u>250</u>
Occupancies A-3 (Passenger terminals), A-4	1 per [1000] <u>500</u>
Occupancy A-3 (Places of worship)	1 per [1000] <u>333</u>
Occupancy M	1 per [1000] <u>500</u>

2. Amend Section 410 as follows:

410.1 Approval. Drinking fountains shall conform to ASME A112.19.1M, ASME A112.19.2M or ASME A112.19.9M, and water coolers shall conform to ARI 1010. Drinking fountains and water coolers shall conform to NSF 61, Section 9. Drinking foundations shall include both a drinking faucet and a separate faucet suitable for filling a bottle that is at least 10 inches high. Where water is served in restaurants, drinking fountains shall not be required. [In other occupancies, where drinking fountains are required, bottled water dispensers shall be permitted to be substituted for not more than 50 percent of the required drinking fountains.]

Supporting Information

Issue – Expanded

New Yorkers consume large amounts of bottled water and sugary drinks, resulting in negative health and environmental impacts.

The affect of sugary drinks on the obesity epidemic and related diseases such as diabetes has been described extensively in medical literature. But even consuming bottled water can carry health-related risks. In a 1999 study, the Natural Resources Defense Council found that one-third of tested bottled water had some level of contamination.ⁱ

Moreover, the plastic used to contain bottled water is believed to leach chemical phthalates into the water.ⁱⁱ Even when bottled water is as clean as tap water, consumers are not always aware what they are paying for - about 25% of bottled water is actually just bottled tap water.ⁱⁱⁱ

The bottles themselves also affect the environment. Each year, billions of bottles of water are shipped to U.S. ports, creating vast quantities of global warming pollution and other air pollution. The transportation of bottled water from Western Europe to New York City alone releases an estimated 3,800 tons of global warming pollution.^{iv} Although

bottles can be recycled, only about 13% make their way to recycling plants; the rest end up in landfills.^v In addition, the amount of energy expended to transport the bottled water across states or from other countries means more fossil fuels are burned, emitting higher amounts of greenhouse gasses.

Despite negative health concerns and environmental impacts, New Yorkers still consume large amounts of sugary drinks and bottled water consumption doubled between 1999 and 2004.^{vi} Part of the reason for these consumption habits is that New Yorkers have little choice because water fountains are hard to find. Even when fountains are available, some people do not use them from fear the spigot may be unsanitary.

This proposal would increase the number of drinking fountains required in places where large numbers of people gather and undo a previous change to the Plumbing Code that permitted the substitution of 50% of drinking fountains with bottled water dispensers. The proposal would also require fountains to include a separate faucet to fill bottles, which could be utilized by people who carry their own bottles or are concerned about using a public fountain.

Environmental & Health Benefits

Reducing the consumption of sugary drinks and bottled water will improve the health of New Yorkers and reduce numerous environmental impacts from the transportation and production of bottles.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by up to 0.01%.

Precedents

There are no known precedents for this proposal. However, many municipalities throughout the U.S. and Canada have banned the purchase of bottled water using city funds, such as Seattle^{vii}, San Francisco^{viii}, and Toronto.^{ix} Calls for better access to public water fountains have grown in conjunction with these bans.^x

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal. Water fountain equipment is readily available.

Notes

Drinking fountains typically include cooling units and water storage, in which bacteria could grow if the fountains are not used regularly. Buildings should consider periodic maintenance and testing of fountains.

ENDNOTES:

ⁱ NATURAL RESOURCES DEFENSE COUNCIL, SUMMARY FINDINGS OF NRDC'S 1999 BOTTLED WATER REPORT, <http://www.nrdc.org/water/drinking/nbw.asp> (last visited Jan. 21, 2010).

ⁱⁱ NATURAL RESOURCES DEFENSE COUNCIL, BOTTLED WATER, <http://www.nrdc.org/water/drinking/qbw.asp> (last visited Jan. 21, 2010).

ⁱⁱⁱ Ibid.

^{iv} Ibid.

^v Ibid.

^{vi} James Owen, Bottled Water Isn't Healthier Than Tap, Report Reveals, National Geographic News, NAT'L. GEOGRAPHIC NEWS, February 24, 2006, available at http://news.nationalgeographic.com/news/2006/02/0224_060224_bottled_water.html.

^{vii} Colin Dunn, City of Seattle gives Bottled Water the Boot, Treehugger, Mar. 19, 2008, available at <http://www.treehugger.com/files/2008/03/city-of-seattle-bottled-water-ban.php>.

^{viii} Associated Press, S.F. mayor bans bottled water at city offices, MSNBC, June 25, 2007, available at <http://www.msnbc.msn.com/id/19415446>.

^{ix} CBC News, Toronto Council Approves Plastic Bag Charge, Bottle Plan, CBS NEWS, Dec. 3, 2008, available at <http://www.cbc.ca/consumer/story/2008/12/03/plastic-bags.html>; and Jennie Day-Burget, Toronto passes Bottled Water Ban, CITY OF PORTLAND Water Bureau, Dec. 4, 2008, <http://www.portlandonline.com/water/index.cfm?a=221126&c=45214>.

^x Richard Girard, Where Have All the Water Fountains Gone?, ALTERNET, Oct. 29, 2008, http://www.alternet.org/water/105051/where_have_all_the_water_fountains_gone/?page=entire.

EF 1: SIMPLIFY COMMERCIAL ENERGY CODE TO CURRENT ASHRAE 90.1

Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

The Energy Code provides commercial buildings two major compliance paths with over a dozen sub-paths. This results in an excessively complex code structure, which creates loopholes and makes enforcement difficult.

Recommendation:

To simplify compliance and enforcement, require that all commercial buildings follow ASHRAE 90.1.

Proposed Legislation, Rule or Study

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Delete Chapter 8 and replace with a new Chapter 8 as follows:

CHAPTER 8

BUILDING DESIGN FOR COMMERCIAL BUILDINGS

SECTION 801

ADOPTION OF ANSI/ASHRAE/IESNA Standard 90.1 (2007)

801.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. Buildings constructed in accordance with this chapter are deemed to comply with this code. These commercial buildings shall meet the requirements of ANSI/ASHRAE/IESNA Standard 90.1 (2007), Energy Standard for Buildings Except for Low-Rise Residential Buildings.

Supporting Information

Issue – Expanded

The Energy Conservation Code of New York State for commercial buildings essentially consists of two separate but comprehensive codes, allowing users to choose their compliance option: ASHRAE Standard 90.1 and Chapter 8 of the International Energy Conservation Code. Anecdotal evidence suggests that the origin of this arrangement was a compromise between two competing Code bodies (ASHRAE and the Uniform Building Code, now the International Code Council); instead of integrating the best aspects of each code, both codes were included as options.

Having two codes in New York State has proven untenable for many reasons. Each code is more than 100 pages long and is intricate and complex; together they provide at least one dozen potential sub-paths. Thus, it is very difficult for a practitioner or code enforcement official to be highly knowledgeable about both codes. This is especially challenging because both the two codes share many similarities in structure and organization, but are very different in detail—thus causing even more confusion when attempting to commit requirements to memory.

In addition, the energy codes in the U.S. are being upgraded on a regular basis and there is no systematic means to maintain uniformity of overall performance requirements between the two codes. Anecdotal evidence suggests that at one time this role was informally played by US Department of Energy staff, but that is not currently the case.

In recent years, ASHRAE Standard 90.1 has emerged as the dominant venue for debating and enacting energy performance policy within the US, both in government and the private sector. ASHRAE 90.1 is the standard referenced consistently within Federal energy legislation, including recent Energy Policy Acts as well as bills now pending in

Congress. ASHRAE 90.1 was developed and is maintained through a rigorous national consensus based development and upgrade process. ASHRAE 90.1 is also the primary energy standard utilized in the LEED Rating System by the US Green Building Council. Moreover, ASHRAE 90.1 is most often utilized by the industry in New York City for energy code performance.

For all these reasons, this proposal would simplify the Energy Code to require compliance with ASHRAE 90.1, and no longer include Chapter 8 of the International Code Council as an alternative path.

Environmental & Health Benefits

A simplified energy Code structure for commercial buildings will enable greater understanding of the Code requirements by practitioners, greater ability to enforce the requirements of the Code by City officials, and thus greater energy performance of New York City's commercial buildings.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. It was thus categorized as not incurring a capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Indirectly, a simplified energy Code structure would result in reduced cost to practitioners to obtain and maintain proficiency with the Code, and reduced cost to New York City government to interpret and enforce the Code.

Precedents

There are no known precedents for this proposal.

LEED

Current LEED prerequisites for Minimum Energy Performance under the Energy & Atmosphere sections require that the scope of work complies with ANSI/ASHRAE/IESNA standard 90.1-2007, or the local energy code, whichever is more stringent. In New York City, this means that all projects that participate in LEED must comply with ASHRAE 90.1, thus the proposed Code simplification is consistent with LEED.

Implementation & Market Availability

There are no significant barriers to implementation of this proposal.

More engineers and architects are familiar with ASHRAE 90.1 than with Chapter 8 of the International Code Council. Some design professionals may require training on ASHRAE 90.1.

EF 2: BUILD NEW HOMES TO ENERGY STAR® STANDARD

New York City Building Code

Proposal developed by the Homes Committee

Summary

Issue:

New homes are not designed to take advantage of cost-effective energy-saving measures. ENERGY STAR is a widely accepted national standard for energy-efficient housing design.

Recommendation:

Require all new residential buildings of three stories or less to be constructed to ENERGY STAR standards.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Chapter 13 to include a new section 1302 as follows:

1302 Energy star homes.

1302.1 Definitions. For the purposes of this Section 1302 only, the definitions found in chapter 4 of the Energy Conservation Construction Code of New York State shall apply. In addition, for the purposes of this Section 1302, the following terms shall have the following meaning:

ENERGY STAR HOMES STANDARDS. Energy efficiency standards for homes set forth by the New York State Energy Research and Development Authority in the New York ENERGY STAR Homes Technical Specifications.

CERTIFIED HERS RATER. A person with certification as a Certified Home Energy Rater by the Residential Energy Services Network.

1302.2 Energy Star requirements. In addition to the requirements of Section 1301.1.1, any residential building classified in occupancy group R-2 and 3 stories or less or classified in occupancy group R-3 shall be designed and constructed in accordance with the Energy Star homes standards. Any application for a permit for such construction shall include a statement from a registered design professional or certified HERS rater that the construction documents comply with such standards. Prior to sign-off, such building shall schedule a final Energy Star inspection by a certified HERS rater and submit documentation to the department demonstrating that such inspection has been scheduled.

Supporting Information

Issue – Expanded

Residential buildings consume over 37% of the energy used in NYC.¹ Energy is used in homes either through direct burning of fossil fuels or in the use of electricity produced by burning fossil fuels at power plants. This energy use contributes to smog, acid rain, and global warming; the less energy we use in our homes, the less air pollution we generate.²

ENERGY STAR is a certification for homes that have met energy efficiency guidelines established by the U.S. Environmental Protection Agency (EPA). These homes must be at least 15% more energy efficient than required under the 2004 International Residential Code, and “include additional energy-saving features that typically make them 20-

30% more efficient than standard homes.”³

Over 1 million homes have been certified under this program, which relies on tried and true energy-efficiency technologies.⁴ The features of ENERGY STAR homes include effective insulation, high-performance windows, tight construction and ducts, efficient heating and cooling equipment, and efficient electrical products and appliances. The EPA uses independent Home Energy Rates to verify compliance with the standard.

Environmental & Health Benefits

ENERGY STAR certified homes use less energy than conventional homes, reducing climate change, improving air quality, and increasing energy independence.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

Countless jurisdictions across the country have mandated ENERGY STAR for new homes. In Long Island, towns representing more than half of the new home starts in 2008 require compliance with ENERGY STAR.⁵

LEED

LEED for Homes requires that the building or space meets the performance requirements of ENERGY STAR for Homes (including third party inspections) as a prerequisite for the Energy & Atmosphere sections. LEED for Existing Buildings requires that a building or space meet a minimum ENERGY STAR rating as outlined by LEED, or for buildings types not addressed by ENERGY STAR demonstrate that the building has an equivalent rating as calculated by an alternative method described by LEED. Therefore, this proposal will assist in achieving LEED certification under these rating systems provided that these provisions are met.

Other rating systems utilize differing criteria for compliance with LEED.

Implementation & Market Availability

The expertise and materials to construct ENERGY STAR homes is widely available since over 1 million homes have been certified under the program and it is mandatory across much of Long Island.

As of July 2009, there were 87 Certified HERS Raters statewide (up from 65 in May⁶), a clear indication of how fast the market is adapting to the growing demand. There are 15 Energy Star builders in New York City at the moment, a number that is expected to rise at the same rate as the HERS raters.⁷

ENDNOTES:

¹ CITY OF NEW YORK, PLANYC: A GREENER GREATER NEW YORK, 107 (2007), http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf.

² U.S. EPA, Energy Star, New Homes: Benefits for Homeowners http://www.energystar.gov/index.cfm?c=new_homes.nh_benefits (last visited January 21, 2010).

³ U.S. EPA, Energy Star, New Homes, http://www.energystar.gov/index.cfm?c=new_homes.hm_index (last visited January 21, 2010).

⁴ U.S. EPA, Energy Star, New Homes: Celebrating 1 Million Energy Star Homes http://www.energystar.gov/index.cfm?fuseaction=ml_homes.showSplash (last visited January 21, 2010).

⁵ RICHARD FAESY, RATCHETING RESIDENTIAL ENERGY CODES UP TO ENERGY STAR: THE LONG ISLAND MODEL AS AN EXAMPLE OF WHAT CAN BE ACHIEVED (March 2, 2007) http://www.hersindex.com/ratings/codes/faesy-white_paper.pdf.

⁶ RESNET, Certified Rater Directory, <http://www.natresnet.org/directory/raters.aspx> (last visited January 21, 2010).

⁷ New York State Energy Research and Development Authority, Resource Locator Map, <http://www.getenergysmart.org/Resources/FindPartner.aspx?t=1> (last visited January 21, 2010).

EF 3: LIMIT HEAT LOSS THROUGH EXTERIOR WALLS

ANSI/ASHRAE/IESNA 90.1 (2007) and the Energy Conservation Construction Code of New York State
Proposal developed by Energy & Ventilation Committee

Summary

Issue:

Building envelope design has a major impact on both heat loss in winter and solar gain in summer. Using the flexibility in current energy codes, designers can meet energy-efficiency requirements by trading off the efficiency of mechanical and lighting equipment against the thermal integrity of the envelope. Since the building envelope will be in use for a century or more, this trade-off is short-sighted.

Recommendation:

Establish fixed performance requirements for building envelopes with respect to heat loss, independent of mechanical and lighting equipment choices.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 5.4.4 as follows:

5.4.4 Maximum Exterior Building Envelope Heat Transfer.

5.4.4.1 *Exterior building envelopes* shall comply either with the prescriptive option of subsection 5.4.4.2 or the performance option of subsection 5.4.4.3 notwithstanding whether the overall building design complies with the requirements of the *Energy Cost Budget* Method of Section 11. In addition to the foregoing, if the *energy cost budget* trade off option as set forth in Section 11 is chosen as a compliance path and requires a lower average U-factor than .25 Btu/hr-sf-°F, then that lower value must be utilized in the *proposed design*.

Exception: Any building with a peak design rate of energy usage less than 3.4 Btu/hr-sf or 1.0 watt/sf of floor area for space conditioning purposes.

5.4.4.2 *Exterior building envelopes* excluding the *roof* but including *skylight* area in excess of 5% of roof area shall have a maximum average U-factor of 0.25 Btu/hr-sf-°F for *buildings* receiving permits before July 1, 2016, 0.20 Btu/hr-sf-°F for *buildings* receiving permits after July 1, 2016 but before July 1, 2022, or 0.16 Btu/hr-sf-°F for *buildings* receiving permits after July 1, 2022, notwithstanding whether the *exterior building envelope* has a sufficiently high *envelope performance factor* as set forth in Section 5.6, except as permitted in subsection 5.4.4.3. The maximum average U-factor shall be calculated by averaging the U-factor of each component of the *exterior building envelope* excluding *roof* but including *skylights* over the entire *above-ground wall* and *fenestration* areas that enclose *heated spaces* but excluding *semiheated spaces*. The average U-factor shall be calculated as follows:

$$\text{Average U-factor} = U_{\text{ref}}/A_{\text{total}} = (UA_1 + UA_2 + \dots UA_n) / A_{\text{total}}$$

where

$UA =$ the U-factor for each individual *exterior building envelope* component excluding the *roof* but including *skylights* (except those over *semiheated spaces*) multiplied by the total area of such component incorporated in the *exterior building envelope*. The U-factor for each component shall be calculated by taking into account thermal bridging at metal studs and members, shelf angles, floor edges, projecting balconies, window frames, and other components passing through the thermal barrier. U-factors can be determined using test results as required by this standard, tabulations provided by this standard, Standard NFRC-100-2004 methods, or two-dimensional or three-dimensional heat flow modeling, provided that three-dimensional heat flow modeling shall not be used to determine the U-value for standard wall-types listed in the above referenced tables. For residential construction with exposed slab edges, the following table must be used for U-factors.

U_{Aref} = the sum of all of the UAs for the *exterior building envelope* components excluding *roof* but including *skylights* ; and

A_{total} = the total area of the *exterior building envelope* excluding *roof* but including *skylights*

(RESIDENTIAL SLAB-EDGE TABLE TO BE PROVIDED HERE DURING IMPLEMENTATION).

5.4.4.3 A building may comply with this section by employing the *building envelope* trade-off option in Section 5.6 to demonstrate that the *proposed envelope performance factor* is 10% less than the *base envelope performance factor*, where the base building complies with subsection 5.4.4.2 and for which all fenestration has an *SHGC* of 0.40 or less. In no case shall the average U-factor of the proposed building exceed 0.28 Btu/hr-sf-°F for buildings receiving permits before July 1, 2016, 0.23 Btu/hr-sf-°F for buildings receiving permits after July 1, 2016 but before July 1, 2022, or 0.18 Btu/hr-sf-°F for buildings receiving permits after July 1, 2022.

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 402.1.5 as follows:

402.1.5 Maximum Building Envelope Heat Transfer. Notwithstanding any provision of Section 402 to the contrary, building envelopes excluding *roof* but including *skylights* shall have a maximum average U-factor of 0.25 Btu/hr-sf-°F for buildings receiving permits before July 1, 2016, 0.20 Btu/hr-sf-°F for buildings receiving permits after July 1, 2016 but before July 1, 2022, or 0.16 Btu/hr-sf-°F for buildings receiving permits after Jul 1, 2022. The maximum average U-factor shall be calculated by averaging the U-factor of each component of the building envelope over the entire above-ground wall and fenestration areas that enclose heated spaces but excluding semiheated spaces. For the purposes of this Section 402.1.5, the definitions of “wall”, “fenestration” and “semiheated spaces” shall have the meanings set forth in ANSI/ASHRAE/IESNA Standard 90.1(2007). The average U-factor shall be calculated as follows:

$$\text{Average U-factor} = U_{\text{Aref}} / A_{\text{total}} = (UA_1 + UA_2 + \dots UA_n) / A_{\text{total}}$$

where

U_A = the U-factor for each individual building envelope component excluding *roof* but including *skylights* (except for those over semiheated spaces) multiplied by the total area of such component incorporated in the building envelope. The U-factor for each component shall be calculated by taking in account thermal bridging at metal studs and members, shelf angles, floor edges, projecting balconies, window frames, and other components passing through the thermal barrier. U-factors can be determined using test results as required by ANSI/ASHRAE/IESNA Standard 90.1(2007), ANSI/ASHRAE/IESNA Standard 90.1(2007) tabulations, Standard NFRC-100-2004 methods, or three-dimensional heat flow modeling;

U_{Aref} = the sum of all of the UAs for the *building envelope* components excluding *roof* but including *skylights* ; and

A_{total} = the total area of the *building envelope* excluding *roof* but including *skylights* .

Supporting Information

Issue – Expanded

Many buildings being constructed today – particularly the large ones – have poorly performing exterior envelopes. This is because the energy code allows a “performance path”, wherein the thermal efficiency of the envelope can be diminished if other systems, such as lighting or the mechanical system, are made more efficient to compensate, as documented using an energy model. Many builders decide to utilize this trade-off because it is the least expensive way to meet the code and provide highly glazed facades or simply built brick high-rise buildings. But the price for this trade-off is a generation of buildings with poorly performing facades that will far outlast their efficient lighting and mechanical systems, which are changed out within 15 to 25 year cycles. Building envelopes will typically survive for the life of the building, which can easily exceed 100 years, so their impact on fuel and electric use and carbon emissions is substantial. This proposal aims to improve the long-term efficiency of the building stock by requiring that all building envelopes achieve a minimum thermal performance that is independent of the other trade-offs pursued.

How will this proposal impact the way the way buildings are built? There has been concern that this proposal will make it impossible to build all-glass buildings, which is not the case. Many trade-offs are available to the designer of a façade, including not just the amount of glazing, but the amount of glazing that is actually clear (i.e. the vision glazing), the amount of insulation used in the spandrel panels, the thermal properties of the glass, the properties of the mullions, and

the inclusion of shading devices, double walls, or glass with well-tuned solar heat gain factors. As the Cost / Savings section shows, some of these strategies will result in increased cost, but that is not inevitable, as there are no-cost ways to comply.

Nonetheless, the proposal will increase the cost of buildings that have clear floor-to-ceiling glass, at least in the near term. It should be noted such floor-to-ceiling glass is not a benefit from the point of view of day-lighting; there is no gain in daylighting advantages (reduction in lighting electric use) from more than 40% vision glazing, since when the sun is out the additional glare usually leads occupants to draw the blinds or erect shades. And there is a serious thermal penalty for such glass when built utilizing the current generation of mullions and double glazed panels, a fact that is well known in the industry.

Still, looking out of floor-to-ceiling glazing is unarguably a striking experience, and many developers find this effect to be sought by tenants. In such cases, many existing technologies can bring a highly glazed facade into compliance—see the Cost and Market Availability sections below.

It should be noted that this proposal only impacts the insulating value of the glass. Considerable time was spent trying to construct a meaningful overall limit on solar heat gain factor, but due to the complexity of the issue and fact that New York City buildings are either heating dominated or, if cooling dominated, driven largely by internal loads, this component was dropped from the measure. Improved solar heat gain performance can be incorporated by using the trade-off option, 5.4.4.3.

The result of adoption of this proposal will be a generation of buildings that out-perform many of today's buildings both immediately (for buildings that follow the prescriptive path) and over the long haul for all buildings, since their performance will be much less subject to compromise should a future owner decide to replace the original mechanical equipment with less efficient substitutes at the time of failure. If owners continue to use the best available equipment, savings will be even greater. The task force expects this measure to generate a new level of common practice, much as the NYS ECCC resulted in the adaptation of double-glazed windows, which became relatively low-cost items as industry adopted them as the standard.

EF04 and EF03 are intended to work together in order to ensure significant improvements in the energy efficiency of exterior walls in New York City and consequently lead to substantial energy savings over time. The two proposals will transform the industry by pushing it to adopt new technology and design exterior walls that will outperform comparable existing walls by a substantial margin. The phased approach to new maximum U-values makes the transition feasible and allows for flexibility as developers, building owners and designers will be able to follow either the performance or prescriptive path in many ways as long as they meet the prescribed criteria. The performance path in particular will give more flexibility to designers to use dynamic systems (shading, double walls, glass that responds to light conditions, etc.) and other new strategies to meet the requirements.

Section 5.6 of and Appendix C of ASHRAE 90.1 have been used as the basis of the trade-off option. An alternative, possibly superior, approach would be to use the building modeling constraints of EPAAct 2005 – the system used for Federal tax credits. This would not affect the criteria presented here, only the details of how the modeling will be carried out, and can be incorporated into the legislation if appropriate.

Further development may be needed for the case of roofs with large areas of skylights. Also, since ASHRAE 90.1 does not provide adequate tables for effective R and U values for exposed slab edges, the Task Force will provide such tables. They have not yet been prepared, so a place-holder has been inserted in the code language above.

Environmental & Health Benefits

Adaptation of this measure will result in substantially lowered fuel and electric use in large buildings, with associated reductions in pollutants and CO2 emissions.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

Capital cost impact will vary widely with building type and alternative designs. For buildings with less than 40% vision glass, current good design practice can meet these criteria at no additional cost. Construction with more than 60% vision glass would be more expensive under this proposal, since triple or quadruple glazing and/or high performance mullions would be required. Between 40 and 60% vision glass there may or may not be an increase in cost depending on the particular design. The minimum U-factor of 0.25 Btu/sf-°F was chosen because it can be reached (at some additional expense) with a façade incorporating a high percentage of vision glass.

Typical construction utilizes double-glazing with moderately thermally broken aluminum mullions. Typical overall U-values for this vision glass are around 0.5 Btu/ft²-°F, or R-2. Improvements are commonly made using low emissivity coatings, improved mullions, and argon or krypton fill. (There is ongoing uncertainty about the long-term integrity of

the gas fills.) The following table shows the whole window U-value required to meet the criterion of $U_{Ave}=0.25 \text{ Btu/ft}^2\text{-}^\circ\text{F}$ if the non-vision glass parts are insulated to R-12, easily achieved with continuous insulation. (The table is exemplary and does not take many details of construction into account.)

Vision glass fraction:	40%	50%	60%	70%
Whole-window U-value ($\text{Btu/ft}^2\text{-}^\circ\text{F}$):	0.50	0.42	0.36	0.32

However, it is possible to do considerably better even with materials readily available today. A prominent mid-town skyscraper currently under construction has achieved an overall U-value of $0.28 \text{ Btu/sf-}^\circ\text{F}$ with floor-to-ceiling vision glass on 60% of the envelope by selecting high quality materials based on double-glazing at costs well within the budget of a building of this class.¹ Utilization of higher quality mullions, low-e coatings, and finally triple glazing do lead to somewhat higher costs, but these will normally be repaid through fuel savings.

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For this proposal, costs were developed for many different combinations of building type and vision glass, and are summarized in Appendix A. For the large scale commercial building with a curtain wall, the type perhaps of most concern to New York City business, there was no increase in overall building construction cost at the 40% vision wall level, a 0.7% increase for 52.5% vision wall, and a more significant 1.3% increase for 65% vision wall. Fuel savings were estimated for this building type, and were sufficient to pay for the increased cost in twelve years for the 52.5% vision glass case, and slightly over twenty years in the case of 65% glazing.

For the other building types, the cost increases range from zero (for 40% vision glass) to values higher than for the large commercial building. Savings were not estimated for these buildings, but should be comparable, since the improvement in envelope is roughly the same. For masonry buildings, Bovis found cost increases in all cases, but the task force believes this stemmed from a misunderstanding about the base case, which should have been chosen to meet the new criterion without improvements in the case of 40% vision glass.

All these cost estimates were based on current pricing for widely used and standard materials. Newer multi-glazed window materials, based on internal polymer films rather than a third layer of vitreous glazing, are available at substantially lower cost. The primary obstacle to their use appears to be lack of familiarity and experience, but as they become better known, the capital cost increments will shrink, drawing the payback periods down with them.

Precedents

All energy codes seem to include limits on building thermal losses, often this stringent, but they also permit performance trade-offs so that better mechanical equipment can offset a poor façade. No codes were found with a similar absolute limit on thermal performance.

LEED

Current LEED prerequisites for Minimum Energy Performance under the Energy & Atmosphere sections of almost all of the rating systems require that the scope of work complies with *ANSI/ASHRAE/IESNA standard 90.1-2004*. This proposed code requires compliance with measures exceeding *ASHRAE 90.1-2007*. Since LEED 2009 prerequisites for Minimum Energy Performance also reference *ASHRAE 90.1-2007*, the measures outlined in this proposal will be correlated with the next generation of LEED.

However, LEED qualifies that a more stringent local code requirement becomes the LEED prerequisite requirement as well. Therefore, this proposal will change the baseline criteria that registered projects must meet for LEED certification.

Implementation & Market Availability

Given the significance of this proposal, members of the Steering Committee and real estate members of the Industry Advisory Committee held several meetings to discuss its content and implementation. These discussions provided valuable input and are reflected in revisions to the proposal content (shifting the first trigger date from 2013 to 2016) and in the discussion that follows.

All alternative façade options are mature. Thermally improved and broken mullions are widely available and currently in use in select buildings. Triple glazing is widely used in Europe and provides the envelope for a 15 story building in Calgary, Alberta². Manufacturers³ assured that although triple glazing has not been widely used in the US, it is readily

available should demand arise. Although concerns were raised about the increased weight of vitreous triple glazing, other knowledgeable engineers asserted that the additional weight could be readily incorporated into standard design practice, and that steps taken to incorporate blast resistance into critical buildings already had a greater impact.

Concerns were raised that visual distortion, which can be a modest problem with large double glazed panels, would be exacerbated in triple-glazed products. Others thought the effect would be minimal or could be countered through quality control, and cited the availability of European technology that minimizes this effect.

Manufacturers of products with a central polymer layer⁴ offer vision glass that will allow construction of buildings with high vision glass fractions that meet the proposed thermal criteria at substantially lower cost than standard triple glazing. Serious Materials, for example, offers multiply glazed panels for curtain walls up to twelve feet high and six feet wide. The polymer layer will not produce any distortion of transmitted light, even if it is not quite flat, due to its thinness. These newer products have not been used widely in New York City high-rise buildings, so dealers, architects, and contractors will have to develop confidence in the products and production may have to ramp up.

Notes

The section for the NYS ECCC is included to apply to additions and alterations of existing buildings, since new low rise construction is covered by our Energy Star requirement. An exemption is granted by NYS ECCC 101.5.2.1 for low energy buildings with design load of less than 3.4 Btu/hr-sf. The Task Force has used this criterion as an exception for the high rise/commercial case also.

ENDNOTES:

¹ For an excellent discussion of the technical side of this issue, see John Straube, *Can highly glazed building facades be green?* BUILDING SCIENCE INSIGHT May 22, 2009, http://www.buildingscience.com/documents/insights/bsi-006-can-fully-glazed-curtainwalls-be-green/?full_view=1.

² Brookfield Properties, Bankers Court (2010), <http://www.brookfieldproperties.com/building/detail.cfm?BID=257> (last visited Jan. 30, 2010).

³ Benson Industries, Home Page (2010), <http://www.bensonglobal.com> (last visited Jan. 30, 2010); Permasteelisa North America, Home Page (2010), <http://www.permasteelisa.com> (last visited Jan. 30, 2010); Saint Gobain, Home Page (2010), <http://www.saint-gobain.com/en> (last visited Jan. 30, 2010); Soto Glazing, Home Page (2010), <http://www.sotawall.com> (last visited Jan. 30, 2010); Viracon, Home Page (2010), <http://www.viracon.com> (last visited Jan. 30, 2010); and J.E.Berkowitz, Home Page (2010), <http://www.jeberkowitz.com/default.aspx> (last visited Jan. 30, 2010).

⁴ Southwall Energy Technologies, Home Page, <http://www.southwall.com/southwall/Home.html> (last visited Jan. 30, 2010); and Vision Wall, Home Page (2010), <http://www.visionwall.com> (last visited Jan. 30, 2010).

EF 4: PROMOTE SUPER-INSULATED EXTERIOR WALLS

Zoning Resolution of the City of New York
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

The City's definition of "floor area," which determines how large a building can be, includes exterior wall thickness. This penalizes thick, energy-efficient walls, and rewards poorly insulated thin-wall construction.

Recommendation:

For super-insulated walls, exclude up to eight inches of the exterior wall thickness from the "floor area" calculation.

Proposed Legislation, Rule or Study

Amendments to Zoning Resolution of the City of New York

1. Amend Section 12-10 to add the following definition:

Exterior Building Envelope: the elements of a building that separate conditioned spaces from the exterior; Definition of Roof: the upper portion of the building envelope, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60° from the horizontal; Definition of Skylight: a fenestration surface having a slope of less than 60° from the horizontal plane. (All definitions from ASHRAEA 90.1, 2007)

2. Amend Section 12-10 as follows:

...However the "floor area" of a building shall not include: <Add the following to the list>

(12) Floor area used to add thermal insulation to the exterior of an existing building or to super-insulate a new building, subject to the following:

(i) In buildings constructed or permitted prior to July 1, 2011, the exempted floor area is the thickness of the insulated wall assembly added to the existing exterior side wall, rear wall, or rear wall equivalent, limited to a maximum of 8" added to any wall, and provided that the added insulated wall assembly achieves a minimum R-value of 3.5 times its thickness in inches, the windows achieve a minimum of R-3.5, and within the walls being insulated, the window area does not exceed 50% of the wall area.

(ii) In buildings or additions permitted after July 1, 2011, the exempted floor area is up to 8" of exterior wall thickness in excess of 8" thickness (i.e. for exterior wall thickness between 8" and 16"), measured at a point 30" above the finished floor, provided that the thermal performance of the building envelope meets the minimum prescriptive or performance requirements listed below, that the total exempted floor area does not exceed 5% of the allowable floor area, and that the building implement measurement and verification protocols to determine whether the envelope is performing as predicted with respect to thermal transmission.

- The minimum prescriptive requirement is that average U-value of the exterior building envelope excluding roof but including skylights is less than .75 the average U-value allowed by the New York City Energy Conservation Code.
- The minimum performance requirement is that on an annual basis the modeled envelope must perform better than or equal to an envelope where average U-value of the exterior building envelope excluding roof but including skylight area in excess of 5% of roof area is less than .70 the average U-value allowed by the New York City Energy Conservation Code and the vision glass has a SHGC of less than 0.4; but in no case can the average U-value of the exterior building envelope excluding roof but including skylight area in excess of 5% of roof area be greater than the average U-value allowed by the New York City Energy Conservation Code.

(iii) The calculation of R-values, the average U-value, and any modeling shall be as per the requirements of the New York City Energy Conservation Code and submitted to the Department of Buildings.

Supporting Information

Issue – Expanded

This proposal has two parts: one part that impacts existing buildings, and another for new construction. The part that impacts existing buildings would allow owners of currently existing buildings to add insulation to the side or rear of a building even if the building had already utilized all of the area available (its FAR). This is beneficial because it is much more effective to add insulation to the exterior of the building than the interior.

The more complex part of this proposal affects new construction, and is meant to compensate for a problematic side-effect of current zoning calculations for developers. Poorly insulated building envelopes (i.e., exterior walls) are an unintended consequence of New York's zoning laws. This is because the floor area a developer is allowed to build is measured to the outside of the building envelope, whereas the useable space is the area within the inside face. In order to maximize the useable area within the maximum allowed floor area, it behooves a developer to make the exterior walls as thin as possible. These thin walls often perform poorly from a thermal standpoint, but the developer can still meet the energy code by compensating with higher performing mechanical and lighting systems. This is very detrimental to the city because, although the lighting and mechanical systems will be changed out within 10 to 25 years, these poorly performing facades will be around for decades or more, increasing the city's energy costs and greenhouse gas emissions far into the future.

This proposal seeks to level the playing field by discounting the space used to create thicker and better performing walls. It allows flexibility in terms of how this can be achieved by allowing both a prescriptive and a performance path within the envelope design only. (The envelope will not be able to be traded off against other systems.) Doing so will provide designers with the flexibility to utilize dynamic systems (shading, double walls, glass that responds to light conditions, etc.) which may perform as well as highly insulated walls, but which cannot be described by a single insulating value. The performance requirement is slightly higher than the prescriptive one, in order to compensate for errors or gaming introduced by the modeling process.

EF 4, Limit Heat Loss Through Exterior Walls, and EF 3 are intended to work together as a carrot and stick to spur significant improvements to the energy efficiency of exterior walls in New York City. EF 3 sets a minimum level, while EF 4 offers an incentive for exemplary performance, and the threshold for both of them will increase over time. Thus, developers are incentivized to create better facades, utilizing either technologically based or design based solutions, or both, and over time the technologies and design strategies they have helped to create will become better known and more available and affordable. This in turn will allow the city to require better performing facades for all buildings.

The date presented in the draft code language (July 1, 2011) is exemplary. The actual transition date must be adjusted to coordinate with implementation of EF3, since that contains the U-values to which Sections 12-10 (12) ii & iii refer.

Environmental & Health Benefits

This proposal will lead to better insulated exterior walls, reducing energy use, air pollution, and greenhouse gas emissions.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a positive, indirect health impact.

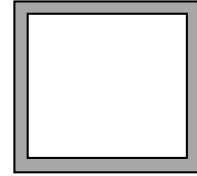
Cost & Savings

This will not add directly to development costs since this proposal is optional for buildings. Instead, it will make the development of better insulated projects more financially attractive for developers and help correct an unintended consequence of zoning area calculations, which encourages thin facades, and a misaligned incentive between the developer and future tenants. For new buildings, it will allow developers to create thicker, better insulated walls without being penalized by losing floor area. This is extremely valuable because developers pay for the cost of building, but are repaid in rents or sales that are proportional to the habitable floor area. If floor area is lost, the developer will lose potential income. On the other hand, future tenants serve to benefit from better insulated walls, since their energy bills will be lower, but they are not at the table when decisions about the building envelope are being made. For existing buildings that may have already reached the maximum size allowed by the zoning rules, this measure will simply allow the addition of exterior insulation, which is far more effective than adding insulation to the inside, as well as being technically simpler.

Impacts on various sizes and configurations of buildings with 8" walls. Calculations showing the percentage area to be excluded with 8" walls.

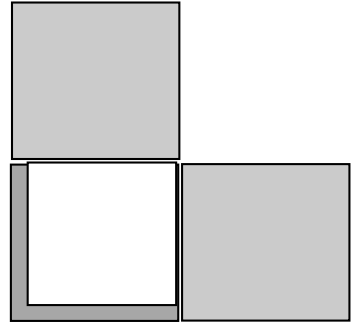
Calculations for Freestanding Buildings (8" walls)

floor plate size (ft)	floor plate with 8" wall (ft)	% floor area gain (exempted floor area)	% area with 5% cap
200x200	201.34x201.34	1.34%	1.34%
100X100	101.34x101.34	2.70%	2.70%
50x50	51.34x51.34	5.43%	5.00%
25X25	26.34x26.34	11.01%	5.00%



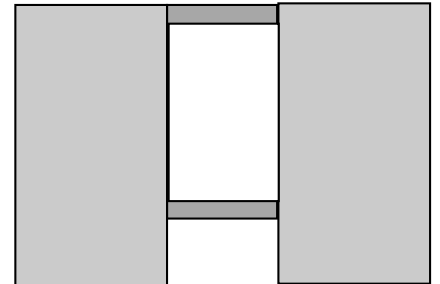
Calculations for Corner Buildings (8" walls)

floor plate size (ft)	floor plate with 8" wall (ft)	% floor area gain (exempted floor area)	% area with 5% cap
200x200	200.67x200.67	0.67%	0.67%
100X100	100.67x100.67	1.34%	1.34%
50x50	50.67x50.67	2.70%	2.70%
25X25	25.67x25.67	5.43%	5.00%



Calculations for Townhouses (8" walls)*

floor plate size (ft)	floor plate with 8" wall (ft)	% floor area gain (exempted floor area)	% area with 5% cap
25X50	25x51.34	2.68%	2.68%



* townhouses will be granted the zoning incentive only for the 25 feet wide wall; in the town houses case, only a corner situation (no freestanding) is expected

Precedents

Within CD-1 districts, Vancouver's new Zoning and Development By-law, dated Feb. 2009, excludes wall thickness greater than 152 mm (6"), up to a maximum excluded thickness, provided that such walls are highly insulated.¹ See Section 10: 10.34.

LEED

The measure outlined in this proposal will positively impact the feasibility of super-insulating existing walls, thereby increasing the potential of meeting LEED requirements.

In an existing building, this recommendation will assist in complying with:

- LEED EB-EA prerequisite 2, Minimum Energy Performance
- LEED EB-EA cr.1, Optimize Energy Performance.

For existing walls in a new construction project, this recommendation will assist in complying with:

- LEED NC-EA prerequisite 2, Minimum Energy Performance
- LEED NC-EA cr.1, Optimize Energy Performance
- LEED for Schools EA prerequisite 2, Minimum Energy Performance
- LEED for Schools EA cr.1, Optimize Energy Performance
- LEED CI-EA prerequisite 2, Minimum Energy Performance
- LEED CI-EA cr. 1.3, Optimize Energy Performance, HVAC

This recommendation will also assist in complying with:

- LEED for Homes EA cr.1, Optimize Energy Performance.

Since numerous points can be acquired under all of these rating systems, any code changes involving energy performance could have a significant influence.

Implementation & Market Availability

There are no known implementation issues for this proposal. Systems and techniques to utilize the newly available wall depth to provide superior insulation are readily available.

Notes

For (i) existing buildings. Most rigid insulation panels currently on the market achieve R-3.5 per inch. Moderately priced insulation panels tend to be in the range of R-5 per inch, so a building adding 8" of insulation can readily achieve an R-30, which is what is required to meet Passive House Standard in NYC's temperature zone. NOTE: this depends on building compactness. R20 is sufficient in many cases.

For (ii) new buildings and additions. EF 4, Limit Heat Loss Through Exterior Walls, proposes a minimum average U-value of 0.25 as a mandatory requirement, and it can be achieved fairly easily with traditional construction; for curtain walls, it can be achieved using triple glazing or double glazing with a central film. In order to receive the floor area exemption, new construction would need to considerably out-perform the minimum wall required by code; still, the first standard of avg. $U < 0.15$ is achievable in an affordable manner using current technology (for example a wall with 50% solid area and 50% fenestration, achieving R-20 for the solid portion and R-4 for the fenestration). Even the avg. U-value of 0.10 required by 2015 is achievable now (for example a wall with 63% solid area and 37% fenestration, achieving R-25 for the solid portion and R-5 for the fenestration), although these evolving standards will certainly push the industry to provide a range of affordable solutions with a high percentage of glazed area.

ENDNOTES:

¹ CITY OF VANCOUVER, CA., ZONING AND DEVELOPMENT BYLAWS § 10.34 (2009) available at <http://vancouver.ca/COMMSVCS/Bylaws/zoning/sec10.pdf>. Vancouver's new Zoning and Development By-law, excludes wall thickness greater than 152 mm (6"), up to a maximum excluded thickness, provided that such walls are highly insulated.

EF 5: ALLOW EXTERNAL INSULATION BEYOND THE ZONING LIMITS

New York City Zoning Resolution: Various sections
Proposal developed by the Energy & Ventilation Committee.

Summary

Issue:
Insulating the exterior of a building is often the most effective way to reduce heat transfer and fuel consumption. But many buildings are built up to the zoning setbacks, making it impossible to add insulation to the exterior.

Recommendation:

Allow exterior insulation on existing buildings to extend into side and rear yard setbacks.

Proposed Legislation, Rule or Study

Amendment to the Zoning Resolution of the City of New York

1. Include the following as a permitted obstruction in the sections listed below:

For #buildings# constructed prior to July 1, 2009, insulation added to an existing exterior side wall, rear wall, or rear wall equivalent, up to a maximum added wall assembly thickness of 6", provided that the added insulated wall assembly achieves a minimum R-value of 3.5 times its thickness in inches, and provided that such added wall assembly shall not encroach on the required width of any driveway up to a height of 8'- 0" above the driveway.

Section 23-12 (Permitted Obstructions in Open Space)
Section 23-44 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 23-62 (Permitted Obstructions)
Section 23-87 (Permitted Obstructions in Courts)
Section 24-33 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 24-51 (Permitted Obstructions)
Section 24-68 (Permitted Obstructions in Courts)
Section 33-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 33-42 (Permitted Obstructions)
Section 37-721 (Sidewalk Frontage)
Section 37-723 (Circulation Paths)
Section 37-726 (Permitted Obstructions)
Section 43-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 43-42 (Permitted Obstructions)
Section 62-626 (Permitted Obstructions)
Section 81-252 (Permitted Obstructions)
Section 84-135(e) (Limited Height of Buildings)
Section 84-333(b) (Limited Height of Buildings)
Section 104-322 (Permitted Obstructions)

Supporting Information

Issue- Expanded

Applying insulation on the exterior of a building is a relatively easy and effective way to substantially improve the R-value of existing walls without interrupting occupancy or requiring expensive renovation. Creative techniques for application are currently being developed in Canada, Europe and the US. Some techniques, such as spray foam and EIFS (Exterior Insulation Finishing System) have the added value of creating an air barrier, a necessity for managing and lowering energy use in the building. In addition, insulation applied to masonry walls encloses the existing masonry, allowing the thermal mass of the masonry to buffer temperature swings that tax

mechanical systems. Exterior application of insulation to existing buildings has become a common option in Europe and will become a necessity in the US as energy becomes less available. If enough insulation is added to a structure, some building types and uses may not need traditional heating and air conditioning systems.

The Zoning Resolution requires buildings to be setback from lot lines under many circumstances. Since many buildings are constructed right up to their zoning setbacks, this means they would be unable to add exterior insulation. This proposal would add external insulation as a “permitted obstruction” under the Zoning Resolution, enabling the insulation to extend over setbacks. The proposal includes minimum R-value requirements to ensure the insulation’s effectiveness and sets a cap on the distance the insulation may extend over setback lines.

Environmental & Health Benefits

By directly reducing building loads, increased insulation will lower emissions associated with boilers, furnaces, and the power plants that supply electricity to air conditioners. By reducing thermal gradients and drafts within buildings, external insulation will contribute to greater occupant comfort and fewer colds. Because the cost effectiveness of external insulation varies widely between buildings, it is not possible to project implementation rates or overall impacts.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

There are no known precedents for this proposal. .

LEED

The measure outlined in this proposal will positively impact the feasibility of insulating existing walls, thereby increasing the potential of meeting LEED requirements.

In an existing building, this recommendation will assist in complying with:

- LEED EB-EA prerequisite 2, Minimum Energy Performance
- LEED EB-EA cr.1, Optimize Energy Performance.

For existing walls in a new construction project, this recommendation will assist in complying with:

- LEED NC-EA prerequisite 2, Minimum Energy Performance
- LEED NC-EA cr.1, Optimize Energy Performance
- LEED for Schools EA prerequisite 2, Minimum Energy Performance
- LEED for Schools EA cr.1, Optimize Energy Performance
- LEED CI-EA prerequisite 2, Minimum Energy Performance
- LEED CI-EA cr. 1.3, Optimize Energy Performance, HVAC

This recommendation will also assist in complying with:

- LEED for Homes EA cr.1, Optimize Energy Performance.

Since numerous points can be acquired under all of these rating systems, any code changes involving energy performance could have a significant influence.

Implementation & Market Availability

Technology is currently available to add insulation to the exterior of buildings. The Issue – Expanded section listed EIFS as one way to add insulation to the exterior of buildings, and it is. However, misuse of EIFS has resulted in rot and structural damage to buildings and must be avoided by good practice. In general, insulation must be added in ways that do not trap moisture in the interior of building walls, and competent professionals commonly do this.

EF 6: INCREASE ALLOWABLE SIZE OF SOLAR SHADES

Zoning Resolution & New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue

Shading devices help combat heat gain and prevent glare, decreasing cooling energy requirements. The Building Code only permits these shading devices to extend 10 inches from the building, thus restricting their effectiveness. They are also not “permitted obstructions” under the Zoning Resolution.

Recommendation:

Treat shading devices the same as awnings and canopies, which are permitted to extend five feet from the building. Also add these devices to the list of “permitted obstructions” in the Zoning Resolution.

Proposed Legislation, Rule or Study

Text Amendments to the Zoning Resolution:

1. Include the following definition of “sun control device” in Section 12-10 (Definitions):

Sun control device

A “sun control device” is an architectural projection as defined in Section 202 of the *New York City Building Code*.

2. Include “sun control devices” as a permitted obstruction in the following sections:

Section 23-12 (Permitted Obstructions in Open Space)
Section 23-44 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 23-62 (Permitted Obstructions)
Section 23-87 (Permitted Obstructions in Courts)
Section 24-33 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 24-51 (Permitted Obstructions)
Section 24-68 (Permitted Obstructions in Courts)
Section 33-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 33-42 (Permitted Obstructions)
Section 37-721 (Sidewalk Frontage)
Section 37-723 (Circulation Paths)
Section 37-726 (Permitted Obstructions)
Section 43-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 43-42 (Permitted Obstructions)
Section 62-626 (Permitted Obstructions)
Section 81-252 (Permitted Obstructions)
Section 84-135(e) (Limited Height of Buildings)
Section 84-333(b) (Limited Height of Buildings)
Section 104-322 (Permitted Obstructions)

Amendments to the New York City Building Code:

1. Include the following definition of “sun control device” in Section 202:

SUN CONTROL DEVICE. An architectural projection that provides protection against solar radiation entering a building through glazed areas and is supported by the building to which it is attached. A sun control device may be a fixed sun control device, a retractable sun control device, a rotating sun control device or other similar device. A fixed sun control device has no moving parts and is typically composed of horizontal overhangs or vertical fins. A retractable sun control device extends or retracts, and in the extended position casts a shadow on designated glazed portions of the building. A rotating sun control device may be of fixed or adjustable length and pivots at its base.

2. Amend Section 3101.1 as follows:

3101.1 Scope. The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, awnings [and], canopies[,], and sun control devices, marquees, signs, telecommunications towers and antennas, swimming pools and enclosures, sidewalk cafés, and fences.

3. Amend Section 3105 as follows:

SECTION BC 3105 AWNINGS, [AND] CANOPIES AND SUN CONTROL DEVICES

3105.1 General. Awnings, [and] canopies and sun control devices shall comply with the requirements of this section, the requirements of Chapter 32 for projections over public ways, and other applicable sections of this code.

4. Amend Section 3105.3 as follows:

3105.3 Design and construction. Awnings, [and] canopies and sun control devices shall be designed and constructed to withstand wind or other lateral loads and live loads as required by Chapter 16 with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration. Awnings shall have frames of noncombustible material, covered with flame-resistant fabric in accordance with NFPA 701, plastic in accordance with Section 2605, sheet metal, or other equivalent material, and shall be either fixed, retractable, folding or collapsible.

5. Amend Section 3202.2.3 as follows:

3202.2.3 Awnings and sun control devices. Awnings and sun control devices constructed in accordance with Section 3105 and supported entirely from the building may project beyond the street line as follows:

3202.2.3.1 Store front awnings. Store front awnings may project beyond the street line not more than 8 feet (2438 mm), provided no part of the awning is less than 8 feet (2438 mm) above the ground or sidewalk level, except for a flexible valance which may be not less than 7 feet (2134 mm) above the ground or sidewalk level, and provided that the awning box or cover does not project more than 12 inches (305 mm).

3202.2.3.2 Awnings and sun control devices over windows or doors. Awnings and sun control devices over windows or doors may project beyond the street line not more than 5 feet (1524 mm), provided that no part of the awning or sun control device is less than 8 feet (2438 mm) above the ground or sidewalk level.

6. Amend Section 3202.2.1.2 as follows:

3202.2.1.2 Architectural details. Details such as cornices, eaves, bases, sills, headers, band course, opening frames, [sun control devices,] rustications, applied ornament or sculpture, grilles, windows when fully open, air conditioning units, and other similar elements may be constructed:

Supporting Information

Issue – Expanded

Prior to the advent of mechanical cooling, standard building design included awnings and other solar shading techniques like inset windows. Early pictures of iconic buildings like the Flatiron Building, City Hall and just about any New York street show awnings over many windows. Although these techniques fell out of fashion, new exterior sun control devices have been developed which save energy, improve user comfort in summer and reduce glare. As the amount of glass in buildings has increased, exterior solar shading has become an increasingly important tool to combat solar heat gain, reduce glare and improve occupant comfort. Since solar shading is a passive design element, it reduces cooling loads on mechanical equipment.

Due to an anomaly in the Building Code and Zoning Resolution, modern solar shades are regulated differently than awnings and face more restrictions on their use. However, in shading and visual impact they are equivalent. This proposal seeks to apply the same standards to exterior solar shades as apply to awnings.

Environmental & Health Benefits

According to analysis by the Office of Long-Term Planning and Sustainability, 15 to 20% of the energy use in New York

City is related to cooling buildings. In the summer, energy consumption for cooling purposes increases dramatically and accounts for 40% of the energy use in the city. Solar shading is a passive design technique that presents a long-term solution to reducing cooling of buildings. Most importantly, sun shade devices can reduce peak energy loads and thus, conserve energy at times when it is most valuable, expensive, and polluting. When mounted on the outside, solar shades can decrease 30% to 60% of air-conditioning loads and substantially lower room temperatures in uncooled spaces. Unlike interior curtains or shades, exterior solar shading devices do not impede window view or disrupt airflow through open windows. As a result, they facilitate passive, natural ventilation.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

There are no known precedents for this proposal.

LEED

The implementation of this proposal will encourage the use of sun control devices that would assist in LEED compliance across numerous rating systems (including pilot programs under development).

Used in conjunction with daylighting strategies, sun control devices will provide daylight redirection and/or glare control to ensure daylight effectiveness. Therefore, this proposal could facilitate achieving the following credits:

- LEED NC-EQ cr. 8.1 & 8.2, Daylight & Views
- LEED CI-EQ cr. 8.1 & 8.2, Daylighting & Views
- LEED for Schools EQ cr. 8.1 & 8.2, Daylight & Views
- LEED EB-EQ cr.8, Daylight & Views

This proposal could be advantageous for projects utilizing the Performance Rating Method for compliance with LEED Energy & Atmosphere credits. Shading projections in the proposed design, which reduce the solar gains on the glazing, can be modeled to demonstrate energy savings compared to the baseline model which will have fenestration flush to the exterior wall. This would facilitate achieving the following credits:

- LEED NC-EA cr.1, Optimize Energy Performance
- LEED for Schools EA cr.1, Optimize Energy Performance
- LEED EB-EA cr.1, Optimize Energy Performance
- LEED ND-GCT cr.2, Energy Efficiency in Buildings (pilot program)
- LEED for Homes EA cr.1, Optimize Energy Performance

Implementation & Market Availability

Sun control devices are fabricated from standard construction components. In addition to custom devices, many curtain wall and window manufacturers offer them as options in their systems.

One concern sometimes expressed about solar shades is ice and snow build-up. This is an issue for all projections such as cornices, eaves, lintels and sills, railings, ornamental work, sculpture, signage and signage supports, air conditioning units, and fire escapes. Snow and ice can be mitigated by providing:

- A canopy or awning at sidewalk level;
- Less solid horizontal surface areas for ice and snow to build up on, such as fin-shaped or vertical louvers, or perforated metal; or
- If horizontal surfaces are used, include projections, such as fins at the edge of a device that will catch snow and ice so that it melts gradually rather than blows off in large portions.

It should be emphasized again that snow and ice is a concern for all projections, and so solar shades should not be singled out on this issue. In addition, sun shade devices are typically arrayed one atop another – falling ice from one would tend to shatter on a device below before falling to the ground.

EF 7: MINIMIZE AIR LEAKAGE THROUGH BUILDING EXTERIORS

ANSI/ASHRAE/IESNA 90.1 (2007) and Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code

This proposal was developed by the Energy & Ventilation Committee.

Summary

Issue:

Energy code requirements for air barriers are insufficient to prevent air leakage both in and out of buildings. An effective air barrier permits controlled levels of ventilation, prevents drafts, lowers heating loads and contributes to overall energy savings.

Recommendation:

Strengthen the energy code to include requirements for –more-effective air barriers.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Amend Section 5.4.3.1 as follows:

5.4.3.1 Building Envelope Sealing. [The following areas of the *building envelope* shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:

- a. joints around *fenestration* and *door* frames
- b. junctions between *walls* and foundations, between *walls* at building corners, between *walls* and structural *floors* or *roofs*, and between *walls* and *roof* or *wall* panels
- c. openings and penetrations of utility services through *roofs*, *walls*, and *floors*
- d. site-built *fenestration* and *doors*
- e. building assemblies used as ducts or plenums
- f. joints, seams, and penetrations of vapor retarders
- g. all other openings in the *building envelope*]

Openings and penetrations in the *building envelope* shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

5.4.3.1.1 Continuous Air Barrier. Except in unheated structures and as permitted by this section, a continuous air barrier shall be installed and shall have all of the following characteristics:

- a. continuous throughout the *building envelope* with all joints and seams sealed and with sealed connections between all transitions in planes and changes in materials and at all penetrations
- b. joined and sealed in a flexible manner to the air barrier component of adjacent assemblies, allowing for the relative movement of these assemblies and components
- c. installed in accordance with the manufacturer's instructions and in such a manner as to achieve the performance requirements as contained in Section 5.4.3.1.2
- d. penetrations of the continuous air barrier shall be made in a way such that the integrity of the continuous air barrier is maintained

5.4.3.1.2 Requirements for Continuous Air Barrier. The continuous air barrier must meet one of the following three criteria;

- a. Materials. Using individual materials whose air permeability shall not exceed 0.02 L/s·m² under a pressure differential of 75 Pa (0.004 cfm/ft² under a pressure differential of 0.3 in. water (1.57 lb/ft²)) when tested in accordance with ASTM E2178.

b. Assemblies. Using assemblies of materials and components whose average air leakage shall not exceed 0.2 L/s·m² @ 75 Pa (0.04 cfm/ft² under a pressure differential of 0.3" w.g. (1.57 psf)) when tested in accordance with ASTM E2357 or ASTM E1677. In addition these assemblies must meet the requirement for joints per Section 502.4.3. 3. Building. Demonstrating through testing that the air leakage rate of the completed *building envelope* shall not exceed 2.0 L/s·m² @ 75 Pa (0.40 cfm/ft² at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent approved method.

5.4.3.1.3 Moisture Control. All framed *walls, floors* and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7×10^{-11} kg/Pa·s·m²) or less, when measured in accordance with the desiccant method using Procedure A of ASTM E96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

- a. Construction where moisture or its freezing will not damage the materials.
- b. Where the department approves other means to avoid condensation in unventilated framed *walls, floors, roofs*, or ceiling cavities.

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Amend Section 402.4.1 as follows:

402.4.1 Building [thermal] envelope. [The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped, or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams, and penetrations
2. Site-built windows, doors, and skylights
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls
7. Walls and ceiling separating a garage from a conditioned space.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Other sources of infiltration.]

Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

402.4.1.1 Continuous Air Barrier. Except in unheated structures and as permitted by this section, a continuous air barrier shall be installed and shall have all of the following characteristics:

1. Continuous throughout the building envelope with all joints and seams sealed and with sealed connections between all transitions in planes and changes in materials and at all penetrations;
2. Joined and sealed in a flexible manner to the air barrier component of adjacent assemblies, allowing for the relative movement of these assemblies and components;
3. Installed in accordance with the manufacturer's instructions and in such a manner as to achieve the performance requirements as contained in Section 402.4.1.2; and

4. Penetrations of the continuous air barrier shall be made in a way such that the integrity of the continuous air barrier is maintained.

402.4.1.2 Requirements for Continuous Air Barrier. The continuous air barrier must meet one of the following three criteria:

1. Materials. Using individual materials whose air permeability shall not exceed 0.02 L/s·m² under a pressure differential of 75 Pa (0.004 cfm/ft² under a pressure differential of 0.3 in. water (1.57 lb/ft²)) when tested in accordance with ASTM E2178;
2. Assemblies. Using assemblies of materials and components whose average air leakage shall not exceed 0.2 L/s·m² @ 75 Pa (0.04 cfm/ft² under a pressure differential of 0.3" w.g. (1.57 psf)) when tested in accordance with ASTM E2357 or ASTM E1677. In addition these assemblies must meet the requirement for joints per Section 502.4.3;
3. Building. Demonstrating through testing that the air leakage rate of the completed building envelope does not exceed 2.0 L/s·m² @ 75 Pa (0.40 cfm/ft² at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent approved method.

402.4.1.3 Moisture Control. All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7x10⁻¹¹ kg/Pa·s·m²) or less, when measured in accordance with the desiccant method using Procedure A of ASTM E96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

3. Construction where moisture or its freezing will not damage the materials
4. Where the department approves other means to avoid condensation in unventilated framed wall, floor, roof, ceiling cavities.

Supporting Information

Issue - Expanded

A well-sealed building plays an important role in energy savings. Preventing the flow of cold winter air and warm summer air into a building reduces the amount of energy needed to condition the space. When the leakage occurs around a window frame, the increase in heating and cooling is direct. When it occurs through an opaque wall, infiltration can also result in a reduction in the effective R-value of the insulation. A good air barrier can lessen these heat losses and lower fuel use.

However, traditional buildings relied on air leaks to ensure adequate ventilation. Increased building tightness can result in inadequate air exchange if pursued without regard for other building systems. A tight envelope must be combined with correct design and operation of mechanical ventilation to insure adequate indoor air quality

An air barrier is made of a material that is specifically permeable to water vapor, while preventing the flow of liquid water or air. A vapor barrier, conversely, is impermeable to the passage of any of these substances. Vapor barriers can consist of metal foil or solid polymer films (such as polyethylene), while air barriers are made from microscopically porous films engineered to permit the passage of water vapor (e.g., Tyvek). The theoretically optimal design for a building in the New York City climate zone will have an impermeable vapor barrier on the interior to prevent the flow of moist, heated air into the wall cavities in winter, and an air barrier under the exterior cladding to keep drafts and liquid water out of the wall cavities. If quantities are small, any moisture that does accumulate in the wall cavities can evaporate out through the air barrier when heated in summer.

However, when there is a large difference between inside and outside temperatures, any air infiltration into walls through leaks in the barriers from the interior in winter can result in moisture condensation. Likewise, contaminants from outside and from within the walls can also be brought into the interior via air infiltration. A correctly installed air barrier can prevent this flow and these effects, but errors in installation or subsequent damage can cause leakage, giving rise to problems.

For these reasons, and because there may be limitations in the skills available at the job site or other difficulties, it may not be practical to execute the requirements we propose exactly as written. This proposal includes a substantial exception, allowing the designer to propose an alternative method to control the migration of water vapor, as long as it is approved by the Department of Buildings

Environmental & Health Benefits

Reduced energy use will result in increased energy efficiency and reduced greenhouse gas emissions. Reduced drafts inside the building will increase comfort, and lower the risk of colds and long-term breathing ailments. Research conducted at Oak Ridge National Laboratories, the Canadian Mortgage Housing Corporations, Sweden and Germany has found that controlled air flow reduces moisture problems such as corrosion, deterioration, and the growth

of mold, mildew and fungus. Air flow has the ability to transport substantially more moisture into and through the building enclosure system than occurs through vapor migration.¹

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.10% to 1.5%, depending on building type. It was thus categorized as incurring a medium to higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years for some building types.

Precedents

There are several related sections already in place within New York City and New York State codes:

Relevant NYC BC Entries:

1403.2 Weather protection. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.3. The exterior wall envelope and its drainage system shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in Section 1404.2 and a means for draining water that enters the assembly to the exterior of the veneer, unless it is determined that penetration of water behind the veneer shall not be detrimental to the building performance. Protection against condensation in the exterior wall assembly shall be provided in accordance with the New York State Energy Conservation Construction Code.

1403.3 Vapor retarder. An approved vapor retarder shall be provided.

Relevant NYS ECCC item:

The following item from the NYS ECCC was incorporated into these modifications of ASHRAE 90.1 since 90.1 does not include a comparable section on moisture control.

802.1.2 Moisture Control. All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7×10^{-11} kg/Pa.s.m²) or less, when measured in accordance with the desiccant method using Procedure A of ASTM E96. The vapor retarder shall be installed on the warm-in-winter side of the insulation. (2 exceptions)

The NYS ECCC now contains the first paragraph of the addition proposed above:

“802.3.3 Sealing of the Building Envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.”

But the NYS ECCC lacks the succeeding three detail sections. 802.3.3 and those three detailed sections are currently scheduled to be included in the 2009 NYS ECCC, numbered as 502.4 due to reorganization. However, the future of the 2009 NYS ECC is currently uncertain.

MA Energy Code:

This proposal (except moisture control) is essentially the same as language that has been adopted and implemented in Massachusetts since 1995.

NIST Study

There are considerable energy, comfort and cost savings to be realized by providing air barriers in commercial buildings, as substantiated by the NIST study cited below. Further, there is a great deal of support from the ABAA and materials manufacturers, as well as several different types of air sealing materials and dozens of products to address the market.²

LEED

An air barrier could qualify as an energy-saving system under the EAc1 “Optimize Energy Efficiency.”

Implementation and Market Availability

There are no known implementation issues for this proposal. Air barriers are readily available and in widespread use.

ENDNOTES:

¹ Air Barrier Association of America, Upcoming Events, http://www.airbarrier.org/events/index_e.php (last visited Jan. 28, 2010).

² S. EMMERICH, ET AL., NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, INVESTIGATION OF THE IMPACT OF COMMERCIAL BUILDING ENVELOPE AIRTIGHTNESS ON HVAC ENERGY USE (2005), <http://fire.nist.gov/bfrlpubs/build05/PDF/b05007.pdf>.

EF 8: PROVIDE WINDOW SCREENS TO ENCOURAGE NATURAL VENTILATION

New York City Health Code

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Many people do not open their windows in the summer due to concern for insect bites, but this also prevents the use of natural, energy-free ventilation. This issue is likely to become more important in the future as climate change expands the habitat of tropical insects.

Recommendation:

Provide fitted window screens on all new windows at seven stories or lower. Beginning in 2016, provide expandable screens on request for all windows.

Proposed Legislation, Rule or Study

Amendments to the New York City Health Code:

1. Add a new section 131.16 as follows:

§131.16 Window screens. (a) The owner, lessee, agent or other person who manages or controls a building or portion of a building classified in occupancy group R shall install and maintain a window screen for:

i. any new openable window located on the seventh story or below of any portion of the building classified in occupancy group R; and

ii. beginning July 1, 2016, for any openable window in any portion of the building classified in occupancy group R upon written request from the tenant of a dwelling unit.

(b) For new windows, the window screen shall be integrated into the window frame assembly. For existing windows, the window screen shall either be integrated into the window frame assembly or shall be a removable screen with fixed height and expandable width.

(c) For the purposes of this section, an “openable window” is defined as an exterior window in a portion of a building classified in occupancy group R that may be opened without a key or specialized tool, but shall not include any windows for which a window screen would be considered an impermissible obstruction under the New York city building code, New York city fire code or other applicable law or regulation. An “openable window” shall not include pivot windows.

Supporting Information

Issue – Expanded

In the United States, insect bites are typically no more than a nuisance. In much of the world, however, insects are a major vector of disease, and may become so in the U.S. and New York due to climate change - West Nile virus is just one example of an insect-borne disease. Also, if biting insects come in through windows, residents will understandably close them, eliminating an energy-free source of ventilation.

Cooling is responsible for approximately 5% of energy use in multi-family residential buildings.¹ During warm months, residents can often achieve a comfortable indoor temperature through a combination of open windows and fans, which requires significantly less energy than air conditioning. This is part of a major movement in green building towards non-mechanical, “passive” design methods that do not require energy to function. People on low floors of buildings, however, will close windows and will not rely on natural ventilation if insects are prevalent.

In addition, according to the Centers for Disease Control and Prevention (CDC), climate change may expand the distribution of insect-borne diseases in the United States.² The CDC hypothesizes that not only could “formerly-prevalent diseases such as malaria and dengue fever” return, but climate change could “facilitate the introduction and

EF 8: PROVIDE WINDOW SCREENS TO ENCOURAGE NATURAL VENTILATION

spread of new disease agents, such as West Nile virus.”³ Mosquitoes, for example, feed more often as temperatures rise.⁴ While research on the relationship between climate change and infectious disease is still being conducted and refined, some studies indicate a global increase in temperature of 2-3 degrees Celsius would increase the number of people at risk of contracting malaria by 3-5% (several hundred million).⁵

There have been over 254 human cases and 26 deaths from West Nile virus in New York State since 2000,⁶ and 159 cases and 23 deaths in New York City from 1999-2007.⁷ In 2007 alone, 18 people in New York City were infected with West Nile virus.⁸

Environmental & Health Benefits

Around the world, screens or bed nets are the first line of protection against disease-carrying pests and the CDC recommends window screens as a “[k]ey” household West Nile virus prevention measure.⁹ Since 2000, New York City has spent tens of millions of dollars on West Nile Virus prevention and education.¹⁰ It is estimated that each case of West Nile virus in the United States costs \$20,000-\$59,000.¹¹ In New York today, window screens reduce the incidence of West Nile virus and the inconvenience of itchy insect bites; in the future, screens may protect against much more serious disease.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.06% to 0.26%, depending on building type. It was thus categorized as incurring a medium capital cost increment.

Precedents

The International Property Maintenance Code requires window screens for all doors, windows and other outside openings in residential units.¹² In addition, the Massachusetts State Sanitary Code requires window screens for the first four floors of dwelling units.¹³

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

Large manufacturers of windows (Marvin, Pella) have provisions for screens in most of their series, even if screens were not part of the original order. For windows where screens are not a standard option (such as custom made windows) retrofitting them into wood frames are relatively easy with grommets and a drill. It is more complicated with metal frames – drilling into them can be difficult and may void the window warranty.

It is recommended that screens be taken down for the winter – leaving them in place can prevent the circulation of air on the window causing frost to collect.

For windows in a landmarked building, or within an historic district, New York City Landmarks Preservation Commission requires a permit if screens are added on the exterior (which is the case for double-hung windows, inward opening hoppers, casements, etc).

Screens cannot be placed on pivot windows. The largest size screen areas are 5' x 5' (larger ones require a cross brace).

Notes

With the large numbers of multi-storied buildings in New York City, the vertical limit of mosquitoes' habitats is an important consideration for this proposal. It had been thought that mosquito species that bite humans generally do not fly above 25 feet.¹⁴ Wind speeds and temperature changes were thought to be barriers that kept mosquitoes close to the ground.¹⁵ Mosquitoes, however, have been found as high as 1000 feet¹⁶ and the Asian Tiger Mosquito is known to breed in pools of water as high as 40 feet.¹⁷

Urban environments have the potential to vastly expand the height of a mosquito's habitat.¹⁸ In the first study of vertical dispersion of mosquitoes, it was found that vertical distance "constitutes no barrier to movement" for mosquitoes.¹⁹ In the study, researchers released mosquitoes on the 12th floor of a 21 story building in Singapore and then measured mosquito density on each floor.²⁰ Mosquitoes were found to have rapidly dispersed throughout the building.²¹ Mosquitoes, particularly females, "move about extensively and the potential for virus dissemination in a building is great."²² The researchers concluded that the study was of particular importance to Singapore because 85% of the population lives in high-rise apartment buildings;²³ a similar conclusion could be drawn for New York City.

Furthermore, as temperatures rise, the mosquitoes' environmental barriers could diminish.²⁴ This has already been seen in mountainous regions in Asia, Africa and Central and South America.²⁵ Historically, mountains have "limited the spread of diseases carried by insects," but as a result of rising temperatures, "mosquito-borne diseases such as malaria and dengue fever are being reported at increasing elevations."²⁶

Due to the uncertainty regarding the vertical limit of mosquitoes, the committee was reluctant require window screens as a matter of course beyond lower stories where mosquitoes are certainly found. At the same time, the committee recommended that screens be provided upon demand for windows at any story.

ENDNOTES:

¹ THE CITY OF NEW YORK, PLANYC: A GREENER GREATER NEW YORK 107 (April 22, 2007), available at www.nyc.gov/html/planyc2030/html/downloads/pdf/full_report.pdf.

² Centers for Disease Control and Prevention, Vector-borne and Zoonotic Diseases, <http://www.cdc.gov/ClimateChange/effects/vectorborne.htm> (last visited Jan. 26, 2010).

³ Ibid.

⁴ Ibid.

⁵ WORLD HEALTH ORGANIZATION. CLIMATE CHANGE AND HUMAN HEALTH - RISK AND RESPONSES (2003), <http://www.who.int/globalchange/publications/climchange.pdf>.

⁶ NYS Dep't of Health, West Nile Virus Update - January 1, 2007 - December 31, 2007, http://www.health.state.ny.us/nysdoh/westnile/update/2007/wnv_summary.htm (last visited Jan. 26, 2010).

⁷ CITY OF NEW YORK DEP'T OF HEALTH AND MENTAL HYGIENE, COMPREHENSIVE MOSQUITO SURVEILLANCE AND CONTROL PLAN OF 2008 2 <http://www.nyc.gov/html/doh/downloads/pdf/wnv/wnvplan2008.pdf>.

⁸ Ibid. at 1.

⁹ CENTERS FOR DISEASE CONTROL AND PREVENTION, EPIDEMIC/EPIZOOTIC WEST NILE VIRUS IN THE UNITED STATES: GUIDELINES FOR SURVEILLANCE, PREVENTION, AND CONTROL, 36 (2003), available at <http://www.cdc.gov/ncidod/dvbid/westnile/resources/wnv-guidelines-aug-2003.pdf>.

¹⁰ Sarah Kershaw, City to Spray for West Nile In Central Park and Queens, N.Y. TIMES, August 23, 2001, available at <http://www.nytimes.com/2001/08/23/nyregion/city-to-spray-for-west-nile-in-central-park-and-queens.html?pagewanted=1>; and

CITY OF NEW YORK DEP'T OF MENTAL HEALTH AND HYGIENE, FISCAL 2009 PRELIMINARY 2009 BUDGET HEARINGS, COMMITTEE ON HEALTH, 3 (2008), http://council.nyc.gov/html/budget/briefings/FY09capital_preliminary_DOHMH.pdf.

¹¹ Armineh Zohrabian, et al., Cost-effectiveness of West Nile Virus Vaccination, 12:3 EMERGING INFECTIOUS DISEASES (2006), available at <http://www.medscape.com/viewarticle/525114>.

¹² INTERNATIONAL PROPERTY MAINTENANCE CODE, AMENDMENTS TO THE IPCM, § 304.14 (2006), http://www.northglenn.org/WEB-PDF/Amendments_Int'l_Property_Maintenance_Code2006.pdf; and Alliance for Healthy Homes, Housing and Building Codes, http://www.afhh.org/aa/aa_housing_codes_pest-free.htm (last visited Jan. 26, 2010).

¹³ 105 MASS. CODE REGS. 410.000: Minimum Standards of Fitness for Human Habitation (Chapter II), available at <http://www.mass.gov/Eeohhs2/docs/dph/regs/105cmr410.pdf>.

¹⁴ The American Mosquito Control Association, Frequently Asked Questions: How High do Mosquitoes Fly?, <http://www.mosquito.org/mosquito-information/faq.aspx#9> (last visited Jan. 26, 2010).

¹⁵ Sherry Seethaler, Questions Answered, S.D. UNION TRIBUNE, July 20, 2006, available at http://www.signonsandiego.com/uniontrib/20060720/news_1c20sciq.html.

¹⁶ Ibid.

¹⁷ The American Mosquito Control Association, Frequently Asked Questions: How High do Mosquitoes Fly?, <http://www.mosquito.org/mosquito-information/faq.aspx#9> (last visited Jan. 26, 2010); and Lee Dye, Ferocious Tiger Mosquito Invades the United States, ABC NEWS, July 26, 2001, available at <http://abcnews.go.com/Technology/Story?id=98380&page=1>. Asian Tiger mosquitoes were accidentally introduced in the United States in the 1980's and have spread rapidly throughout the Southeast and Mid-Atlantic.

¹⁸ Christina Liew and Chris Curtis, Horizontal and Vertical Dispersal of Dengue Vector Mosquitoes, *Aedes Aegypti* and *Aedes Albopictus*, in Singapore, 18:4 MED. VETERINARY ENTOMOLOGY 51-360 (2005).

¹⁹ Ibid. at 358-9.

²⁰ Ibid. at 355.

²¹ Ibid. at 358.

²² Ibid.

²³ Ibid.

²⁴ Sherry Seethaler, Questions Answered, S.D. UNION TRIBUNE, July 20, 2006, available at http://www.signonsandiego.com/uniontrib/20060720/news_1c20sciq.html.

²⁵ Ibid.

²⁶ Ibid.

EF 9: ENSURE OPERABLE WINDOWS IN RESIDENTIAL BUILDINGS

New York City Building Code; New York City Health Code
Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Operable windows permit cooling without power, which saves energy and allows buildings to remain habitable during power outages. Builders have misinterpreted Health Code regulations to limit window openings to 4.5 inches, which is inconsistent with the Building Code.

Recommendation:

DOB should require documentation showing that residential properties provide window openings as required by code, counting only the actual area that can be opened with window stops, if stops are provided.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1203.4.1 as follows:

1203.4 Natural ventilation. Natural ventilation of occupiable and habitable space shall be through openings to the outdoors. The openings shall be of a type permitted under Sections 1203.4.1.1, 1203.4.1.2, 1203.4.1.3 and 1203.4.1.4. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants. Compliance of all permitted openings with this section shall be demonstrated in a form acceptable to the commissioner.

Amendments to New York City Health Code:

1. Add a new paragraph (6) to subdivision G of Section 12-10 as follows:

6. Notwithstanding the requirements of this section, stops shall not limit the openable area to less than the minimum required by Section 1203.4.1 of the New York City Building Code and Section 27-2058 of the New York City Housing Maintenance Code.

2. Add a new paragraph (3) to subdivision B of Section 12-11 as follows:

3. Notwithstanding the requirements of this section, stops shall not limit the openable area to less than the minimum required by Section 1203.4.1 of the New York City Building Code and Section 27-2058 of the New York City Housing Maintenance Code.

Supporting Information

Issue - Expanded

For many years the New York City Building Code has required naturally ventilated buildings to provide a minimum openable area to the outdoors that is equivalent to 5 percent of floor area.¹ Buildings that mechanically supply fresh air into habitable spaces must also provide openable windows (though the minimum operable area required is reduced to 2½ percent of the floor area if a minimum of 40 cubic feet per minute of fresh air is supplied). The advantage of natural ventilation is that it does not use energy or fail during blackouts.

In 1976, in response to children accidentally falling out of apartment windows, the New York City Department of Health and Mental Hygiene enacted Window Guard Regulations to require landlords, building managers or owners (in condominium units) to install window guards and/or stops. They are required in all windows of apartments where

children 10 years or younger reside, except at fire escapes, and must reject the passage of a solid 5 inch sphere.ⁱⁱ This is straightforward for some windows as guards on double hung windows are now common in the city. Depending on the configuration, some pivot windows present particular complications for using guards, in which case window stops must be installed to prevent the window opening beyond 5 inches.ⁱⁱⁱ

Window stops are inexpensive, simple to install and not unsightly as are guards. For these reasons, many developers are installing all windows with stops in order to comply with the Department of Health, whether or not children reside in the apartment. Even manufacturers of double hung windows are incorporating them as an option in the window assembly.

Windows with stops, however, do not provide the amount of ventilation required under the Building Code. While tenants or owners of apartments without children 10 years or younger can remove windows stops, those with children 10 years or younger cannot. Moreover, the use of stops has grown more widespread as recent residential construction has incorporated large fixed expanses of glass with minimal openings, increasingly turning to pivot-style windows.

There is a lack of coordination between the window requirements in the Health and Building codes. Windows are being installed that open a maximum of 5", resulting in less available ventilation than the Building Code requires.

Environmental & Health Benefits

Before mechanical means, natural ventilation via windows and skylights was the only way to flush stale, hot or dirty air out of an interior space and New York City's ground-breaking Tenement House Act of 1901 ensured that all apartments would have access to fresh air and natural light. Operable windows are still the most efficient way to provide fresh air and the NYC Building Code still requires that residential spaces have operable windows.

Using natural ventilation can substantially reduce energy use, especially during spring and fall when the temperature and humidity match human comfort levels.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

This proposal clarifies existing regulations under New York City law.

LEED

All projects pursuing LEED certification must meet minimum indoor air quality performance (AE Prerequisite 1), in conformance with ASHRAE Standard 62.1-2004. Buildings that are not mechanically ventilated are required in Section 5.1 to have all naturally ventilated spaces permanently open to and within 25 feet of operable wall or roof openings and that the opening area be at least 4% of the net occupiable floor area.

Implementation & Market Availability

Marvin Windows manufactures all of its sashes with optional limiters that are installed in the field. They can be removed with normal tools.^{iv} Pella Windows produces vent stops for their double hung windows only. The vent stops can be popped out and are not tamper proof. Their double hung windows require guards or stops as per the requirements of the Department of Health.^v

ENDNOTES:

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- ⁱ CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE §1203.4.1.2 (2009) available at http://www.nyc.gov/html/dob/downloads/pdf/cc_chapter12.pdf. (The minimum operable area to the outdoors shall be 5 percent of the floor area of the habitable space to be ventilated. Every opening providing required natural ventilation shall be at least 12 square feet, providing a minimum of six square feet of openable space. Exceptions: 1. Where fresh air is furnished in any habitable room or space by mechanical means supplying a minimum of 40 cubic feet per minute, the free openable area of the openings may be reduced to 2 ½ percent of the floor area but each such opening shall provide not less than 5 ½ square feet of openable area. 2. The minimum free openable area of a mullioned casement window shall be 5 ½ square feet provided that the minimum ratio of floor area to openable area is met); CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE § 27-2058(c) (2009) available at http://www.nyc.gov/html/dob/downloads/pdf/cc_chapter12.pdf. (1. The total area of all windows in the room shall be at least one-tenth the floor area of such room... 3. At least one-half of every required window shall open, except that for a mullioned casement window a minimum of five and one-half square feet is sufficient. In a room where a centralized mechanical ventilating system provides forty cubic feet of air per minute, twenty-five percent of the window area or five and one-half square feet of such area, whichever is greater, shall be openable).
- ⁱⁱ CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE § 12, (2009). (Requires the installation of window guards “on all windows except fire escape access windows and secondary egress windows in first floor apartments, where the fire escapes are on the upper floors. Choice of unguarded window is optional in latter cases.” Section 12-10 specifies that window guards must be at least 15 inches high and capable of rejecting “the passage of a solid five (5) inch sphere at every space and interval.” That section also requires the installation of stops to prevent “the lower window from being raised more than 4 ½ inches above the lowest section of the top horizontal bar of the window guard.”).
- ⁱⁱⁱ CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE § 12-11 (2009), available at <http://www.nyc.gov/html/doh/html/win/wincha.shtml#12-11>.
- ^{iv} Telephone Interview with Doug Andersen, Technical Staff, Marvin Windows (June 10, 2009).
- ^v Telephone Interview with Mr. Cricket, Technical Staff, Pella Windows (June 10, 2009).

EF 10: REDUCE ARTIFICIAL LIGHTING IN SUNLIT SPACES

New York City Building Code

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

Many of New York's buildings have been designed to maximize daylight in interior spaces. However, these buildings often waste energy by using artificial light when daylight could provide much of the required illumination.

Recommendation:

Require daylight responsive controls that reduce artificial light when sufficient daylight is present.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 9.4.1.5 as follows:

9.4.1.5 Daylight Responsive Controls. In spaces greater than 5000 square feet at the perimeter of a building where more than 25 percent of the area of the exterior wall consists of a glazed area, the lighting fixtures located within 15 feet of such exterior walls shall be controlled by an automatic control device or dimming controls capable of reducing lighting energy consumption by at least 50% whenever daylight provides a minimum of 20 horizontal footcandles, measured at an unobstructed point located 30 inches above the floor and 15 feet from the glazing.

Exceptions:

- Spaces where the height above the floor of buildings or structures outside the glazing is greater than their distance away from the glazing.
- Spaces where daylight will not provide a minimum of 20 horizontal footcandles, measured at an unobstructed point located 30 inches above the floor and 15 ft from the glazing, for at least 1000 hours per year.
- Spaces with less than 90 watts of lighting installed within 15 ft of the glazing.
- Saunas, steam rooms, and spaces containing swimming pools or spa pools.
- Spaces where medical care is rendered.
- Spaces within dwelling units.
- Spaces within guest rooms and suites.
- Retail spaces.
- Spaces in which the lighting is dimmable and controlled by dimming controls that are located within the space and accessible to the space occupant.

Supporting Information

Issue – Expanded

Many historic and new green buildings were designed to maximize interior daylight. Using daylight rather than electronic illumination can save significant amounts of energy and improve the psychological wellbeing of building occupants.

Numerous studies have documented lighting energy savings greater than 30% when daylight-responsive lighting controls are used in commercial spaces. According to the Lawrence Berkeley National Laboratory, “35% energy savings from daylighting controls in daylit spaces is typical of documented energy savings from available, monitored case

studies.”¹ This finding is consistent with studies from many other organizations, some of which estimate even greater savings.² In addition to energy savings, daylight responsive controls significantly reduce peak electricity demand since peak demand usually occurs in the middle of a sunny summer afternoon, which coincides with peak daylight availability. An 80% reduction in electricity demand for lighting is typical at these times.

Daylight also promotes productivity and health benefits. People intuitively prefer daylight over artificial light, and studies have demonstrated that access to views and natural light can increase productivity in the workplace. According to the Lighting Research Center at Rensselaer Polytechnic Institute, daylight reduces eye strain and skin problems, alleviates sleep disorders and seasonal affective disorder (SAD), and provides vitamin D and stress relief.³

Energy savings from daylight can only be realized if electric lights are dimmed or turned off in daylit spaces to avoid over-lighting. While some people who work in spaces with windows will turn their lights off during the day to save energy, in commercial spaces this is relatively rare. The greater the financial savings from daylight, the more likely that daylight will also be incorporated into the design of new buildings and that people will receive the associated psychological and health benefits.

Environmental & Health Benefits

In typical office installations (1.1 watt/square foot of lighting operating 3,000 hours per year) this proposal will save 1 kWh of electricity per square foot per year, or 100 kWh per year for a typical private office. There will also be a peak load reduction of 0.9 watts/square foot, or 90 watts for a typical private office.

Control systems that switch lamps off also extend lamp life, reducing lighting maintenance costs.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.09% to 0.7%, depending on building type. It was thus categorized as incurring a medium to a higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents

The Seattle’s Energy Code requires daylight zone controls, defining parameters for a space to be considered as a daylight zone and specifying what kinds of controls are required in these areas. That code specifically requires automatic controls as a means of reducing lighting power in areas that have sufficient daylight. The code also includes extensive requirements for the operation of the automatic controls depending on the numbers of lighting sources and levels of automatic control.⁴

California’s 2008 Building Energy Efficiency Standards includes prescriptive requirements for Automatic Daylighting Control Devices used to control lights in daylit zones. These guidelines require that the control devices reduce power consumption in daylit areas but maintain sufficient levels of illumination, as well as guidelines for set-up, operation and maintenance of the system.⁵

ANSI/ASHRAE/IESNA 90.1 (2010) is expected to include daylight responsive controls as a mandatory provision. BSR/ASHRAE/USGBC/IESNA Standard 189.1 will also require daylight responsive controls using language that is very similar to this proposal.

LEED

This proposal may facilitate achieving the following LEED Energy and Atmosphere credits:

- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED CI-EA cr.1.2 Optimize Energy Performance, Lighting Controls
- LEED ND-GCT cr.2 Energy Efficiency in Buildings
- LEED for Schools EA cr.1 Optimize Energy Performance
- Additional credits under LEED pilot programs.

Implementation & Market Availability

There are no known implementation issues for this proposal. Daylight-responsive controls have been in widespread use for over 10 years, and there are a number of prominent new installations in New York City, including the New York Times building and One Bryant Park.

ENDNOTES:

¹ Integrated Building Environmental Communications System, Research: Energy Savings, http://lighting.lbl.gov/IBECs/ir_savings.html (last visited Jan. 21, 2010).

² Joel Loveland, Daylighting Lessons 2002, LIGHTING DESIGN LAB NEWS, Winter/ Spring 2003, http://www.lightingdesignlab.com/ldnews/daylighting_lessons_02_jl.pdf (“A well daylight illuminated building can be built for the capital budget allocations typical of common construction, and these buildings can save 40-60% on their overall electric lighting operations costs with daylighting controls.”); The New Buildings Institute, Advanced Lighting Guidelines, Table 8-4 (2003 Edition), available at <http://www.newbuildings.org/lighting.htm> (estimating savings of 35-40%); R. Leslie, et al., The Potential of Simplified Concepts for Daylight Harvesting, 37:1 LIGHTING RESEARCH CENTER, Fig. 1, available at <http://www.lrc.rpi.edu/programs/daylighting/pdf/simplifiedConcepts.pdf> (estimating energy savings from daylight harvesting of 24%-38% for office spaces located in Albany, NY).

³ Lighting Research Center, Daylight Dividends: Health, http://www.lrc.rpi.edu/programs/daylighting/dr_health.asp (last visited Jan. 21, 2010). (Other studies have also documented the health benefits of daylight. Sasha Brown, Building Technology Expert Describes studies of Daylight, MIT NEWS, Nov. 8 2006, available at <http://web.mit.edu/newsoffice/2006/building-tech-1108.html>.)

⁴ CITY OF SEATTLE ENERGY CODE Ch. 15 § 1513.3.2 (2006), available at http://www.seattle.gov/DPD/Codes/Energy_Code/Nonresidential/Chapter_15/default.asp.

⁵ California Energy Commission, 2008 Building Energy and Efficiency Standards for Residential and Non-residential Buildings, CAL. ENERGY COMM’N. (2008), available at http://www.documents.dgs.ca.gov/bsc/prpsd_chngs/2008StandardsDoc.pdf#search=building%20energy%20efficiency%20standards&view=FitH&pagemode=none.

EF 11: REDUCE SUMMER HEAT WITH COOL ROOFS

New York City Building Code
Developed by the Site & Site Stormwater Committee

Summary

Issue:

Light-colored roofs reflect light and heat back into the atmosphere, thereby cooling buildings and cities. The building code mandates white roof coatings, but the standards are not aligned with LEED, which is used by many developers.

Recommendation:

Amend specifications for cool roof coatings to align them with LEED.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1502 to include the following definitions:

EMITTANCE. A measure of the ability of a surface material to release absorbed heat, determined as per ASTM 408 or ASTM C 1371.

INITIAL SOLAR REFLECTANCE. The solar reflectance of a material, measured when that material is first installed.

SOLAR REFLECTANCE. The measure of the ability of a surface material to reflect sunlight, including visible, infrared, and ultraviolet light, determined as per ASTM E 903, ASTM E 1918, or ASTM C1549.

SOLAR REFLECTANCE INDEX. A measure of the ability of a surface to reject solar heat that incorporates both solar reflectance and emittance, as determined by ASTM E 1980.

2. Amend Section 1504.8 as follows:

1504.8 Reflectance. Roof coverings on roofs or setbacks with slope less than three units vertical in 12 units horizontal (25 percent) shall be white in color or ENERGYSTAR as highly reflective for at least 75 percent of the area of the roof or setback surface.] At least 75 percent of the area of roofs and setbacks shall have a covering with a minimum solar reflectance index in accordance with Table 1504.8.

Table 1504.8

Roof or Setback Type	Slope	Solar Reflectance Index
Low-sloped	<= 2:12	78
Steep-sloped	> 2:12	29

Exceptions:

1. Any steep-sloped roof composed of copper, lead or tile, wood or slate shingles.
2. Terraces on setbacks comprising less than 25 percent of the area of the largest floor plate in the building.
- [2]3. Green roofs in compliance with Section 1507.16 shall be permitted to comprise part or all of the 75 percent required area coverage.
- [3]4. Roofs used as [outdoor] passive or active recreation space by the occupants of the building shall be permitted to be either landscaped or covered with a walking surface or other protective surface with [an albedo] an initial solar reflectance [index] of 30 percent or greater.
5. Ballasted roofs, provided that the ballast has an initial solar reflectance of 30 percent or greater.
6. Any portion of a roof that is under a planter, mechanical equipment, photovoltaic or solar thermal equipment or any other structure or equipment exempted by the commissioner.

3. Amend Section 1510.1 as follows:

1510.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exception:

Re-roofing shall not be required to conform to Section 1504.8 if the re-roofing is less than 50 percent of the roof area and less than 500 square feet.

Supporting Information

Issue – Expanded

Cool roofs are an extremely cost-effective strategy to combat high peak demand for cooling and the urban heat island effect, which is the tendency of urban areas to be hotter than their suburban surroundings because of dark absorbent surfaces and a lack of vegetation. New York City began addressing these issues by incorporating a requirement for white roofs in its last code cycle. This proposal seeks to build on that requirement by better aligning with LEED. For instance, the Building Code allows “white” coatings and references “albedo”, whereas LEED measures reflectivity using solar reflectance index, which also takes into account emittance. In addition, the Building Code only covers low-sloped roofs, while LEED covers both low- and steep-sloped roofs. Since roofs are replaced every 15 to 25 years, capturing re-roofing means that within 20 years, most of New York City’s low-sloped roofs will be cool roofs. It is estimated that this would decrease the City’s urban heat island effect by at least 1 degree F.

The proposal will have impacts on three levels. On an individual building level, installing cool roofs will lower the roof surface temperature and, consequently, the need for air-conditioning, especially during summer peaks. On a hot, sunny day, the temperature of a black roof can reach 90° above the ambient air temperature (i.e. 180° on a 90° day). This is because non-reflective roofs absorb and retain solar energy as heat, which contributes not only to a hotter roof, but also to uneven thermal expansion/contraction and aging of the roof. The top floors of the building underneath are heated up by the hot roof, causing discomfort for the building inhabitants as well as increased local cooling loads, particularly in older buildings, which tend to have less insulation.

On a citywide level, this proposal will help mitigate the “urban heat island effect”. This is a major problem in New York City due to the preponderance of dark roofs (944 million square feet of roof surface) as well as dark surfaces on roads and parking areas -- together causing summer temperatures to be 5 to 8 degrees F hotter than surrounding areas.¹ Installing light roofs on a large percentage of the city’s buildings will collectively reflect enough heat to cool down not only the individual buildings but the city.

On a global level, implementing the proposal will also help combat global warming. The heat from the infrared and near infrared components of solar radiation is readily absorbed by dark roofs and radiated back at night as infrared radiation, which is then trapped by the CO₂ blanket in the atmosphere. By locking in heat, this CO₂ layer warms up the Earth and its atmosphere -- the phenomenon of global warming. Light colored roof surfaces reflect more sunlight in the form of visible light rather than infrared radiation. Visible light does not get trapped by the CO₂ blanket but rather passes through it and thus does not contribute to the warming up of the atmosphere.

Environmental & Health Benefits

Implementing the proposal will have significant environmental and health benefits:²

- Cool roofs and cooler air temperatures mean a cooler city and buildings and/or less energy consumed for air-conditioning purposes and consequently, lower carbon footprint.
- Reduced energy consumption during summer peaks of energy use, related to increased air conditioning requirements, will increase peak capacity and thus, help prevent frequent blackouts.
- Cool roofs will reduce the heat island effect and minimize the impact on microclimate and human and wildlife habitat. Lowering urban heat will also mitigate air pollution caused by the increased emission of nitrous oxides, sulphur dioxide and carbon dioxide associated with the increased energy use for cooling purposes. These pollutants combine photochemically in the presence of sunlight and heat and produce ground level ozone (smog), which is a health hazard. Reducing the heat island effect by installing light roofs will slow down this process, which occurs much more readily at the higher temperature.
- Reducing urban heat will also prevent life loss during extreme heat. A 1995 heat-wave in Chicago is estimated to have killed over 700 people – over twice as many as perished in the infamous Chicago Fire of 1871. Many of those who died were low-income persons who did not have air-conditioning and were unable to protect themselves from the ambient temperatures. Even more shocking was the European heat wave of August 2003, which is estimated to have claimed the lives of 35,000 people, with over 14,000 dying in France alone.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

New York City placed cool roof requirements in the last iteration of the New York City Building Code.

City of Chicago's energy code requires that roof installations on most commercial low-sloped air-conditioned buildings meet SRI criteria.

State of Georgia "Georgia White Roof Amendment" requires the use of additional insulation for roofing systems whose surfaces do not have SRI test values of 0.75 or more.

California's Title 24 of the Energy Code requires the installation of cool roofs and California's Cool Savings Program provides rebates to building owners for installing roofing materials with high SRI values.

LEED

This measure is applicable to:

- LEED CI-SS cr.1 Option E: Heat Island Reduction, Roof (1/2 point);
- LEED NC-SS cr.7.2: Heat Island effect, Roof (1 point);
- LEED EB-SS cr. 6.2 Heat Island Reduction, Roof (1 point).

Each rating system provides various options for achieving LEED points. Compliance with the code requirements of this new proposal may assist in achieving these LEED credits, provided that certain additional provisions are met.

This proposal does not include steep sloped roofs. The NYC building code and LEED have differing criteria for defining low vs. steep roof slopes; therefore calculations for and compliance with solar reflectance will vary accordingly. Additionally, LEED does not differentiate roofs used as outdoor recreation spaces.

The proposal is consistent (for low sloped roofs) with LEED 2009 language currently under consideration.

ENERGYSTAR products do not automatically achieve credits under LEED.

Taking advantage of the exemptions to this proposed code revision may negatively impact the ability to achieve LEED credits.

Implementation & Market Availability

There are no known implementation issues associated for this proposal.

Green roofs or roofs with high Solar Reflectance Indexes reduce costs associated with cooling and HVAC equipment. Green roofs typically require an additional up-front investment, while cool roofs may or may not cost more than other roofs. However, any up front investment is likely to result in energy cost savings throughout the lifecycle of the project.

This proposal would not unduly limit the use of wood or other decking as only 75% of a roof surface must comply with the SRI requirements and the NYC Fire Code already restricts the use of wood decking to not more than 30% of the roof surface.

ENDNOTES:

¹ CITY OF NEW YORK DEP'T OF DESIGN AND CONSTRUCTION, DDC COOL AND GREEN MANUAL, (2007), *available at* http://www.nyc.gov/html/ddc/downloads/pdf/cool_green_roof_man.pdf.

² Ibid.

EF 12: REDUCE SUMMER HEAT WITH COOL, SHADY BUILDING LOTS

New York City Building Code

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Unbuilt areas on private building lots make up approximately one third of New York City's space. Because these areas are often covered in dark, unshaded pavement, they contribute to the city's heat island.

Recommendation:

Require light-colored pavement, trees or plantings on 50% of the unbuilt areas of building lots.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Chapter 34 as follows:

CHAPTER 34 **SITE AND LANDSCAPING**

SECTION BC 3401 **GENERAL**

3401.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of the site and landscaping.

SECTION BC 3402 **DEFINITIONS**

3402.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the following meanings.

HARDSCAPE. Non-built area that is impervious, such as roads, walks, courtyards and parking lots.

OPEN-GRID PAVEMENT. Pavement that is at least 50% pervious and contains vegetation in the open cells.

NON-BUILT AREA. The area of a site that does not include the building footprint or any area used exclusively for athletic activities, such as ballfields, tennis courts, basketball courts or swimming pools. This definition includes turf grass areas that may be used for multiple purposes, including athletic activities.

PERVIOUS. The surface area of a paving material that is open and allows moisture to pass through the material and soak into the earth below the paving system.

SHADE TREE. A tree with a spreading canopy that screens the sun, such as honey locust, sweetgum, elm, linden, maple and oak.

SOLAR REFLECTANCE INDEX. A measure of the ability of a material to reject solar heat as calculated using ASTM E1980.

SECTION BC 3403 **PAVED AREAS**

3403.1 Cooling and shading. Any site, except any site subject to Section 3403.2, shall provide any combination of the following for fifty percent (50%) of the site hardscape:

1. Paving material with a solar reflectance index of 29 or greater;
2. Shading from plants or other landscaped features such as trellises; or

3. Open-grid pavement.

The shade attributed to plants, including trees, hedges and shrubs, shall be based on an estimate of plant coverage after 5 years and the shade provided at 12:00 P.M. on June 21 of such year.

3403.2 R-3 Buildings. This section shall apply to any site on which more than fifty percent (50%) of the uses of a building, measured in square feet, are classified in occupancy group R-3. If at least fifty percent (50%) of the non-built area is hardscape, such site either comply with the provisions of Section 3403.1 or provide one shade tree per 1,000 square feet of non-built area.

3403.3 Exceptions. Sections 3403.1 and 3403.2 shall not apply to any site in which:

1. At least seventy-five percent (75%) of the non-built area is shaded at noon on June 21; or
2. The non-built area is less than 500 square feet.

Supporting Information

Issue – Expanded

The term "heat island" describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with one million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Heat islands increase summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality. The Lawrence Berkeley National Lab researchers estimate that about 10% of current U.S. air conditioning demand results from the urban heat island.

In addition, asphalt that is exposed to direct sunlight and high temperatures wears quicker. High temperatures lead to volatilization of asphalt binder and oxidation, which causes progressive hardening of the pavement and fatigue cracking. Cracking leads to water infiltration that can weaken the layers underneath. Higher surface temperatures also make asphalt pavement more prone to rutting. A study conducted in Modesto California showed that asphalt roads with shade required resurfacing every 12 years whereas unshaded roads required resurfacing every five years. This resulted in a savings of \$.66/SF over a 30 year period compared to an unshaded street.

Environmental & Health Benefits

Reducing the heat island effect will reduce the need for air conditioning in the summer, thus reducing energy consumption, decreasing greenhouse gas emissions, and improving air quality.

Lower temperatures also reduce a series of negative health impacts - during periods of elevated temperatures, human health and comfort are compromised; respiratory disorders are exacerbated and vulnerable populations, such as children and the elderly, suffer disproportionately. Elevated air temperatures resulting from the heat island effect also increase the rate of ground level ozone formation.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

Several small jurisdictions in the United States require site shading or limit pervious surfaces. For example, Altamonte Springs, Florida requires 15% shade coverage within five years over private property.¹ The ordinance gives shade values and points for different tree species. Kinston, North Carolina requires 20% shade coverage for all parking spaces, drives, walks and loading areas within private property.² The State of North Carolina prohibits more than 80% of the surface area of a "vehicular surface area" from being an impervious material if the vehicular surface area exceeds one acre.³

LEED

The following LEED credits address mitigating the heat-island effect through the use of light-colored/high-albedo materials:

- LEED NC-SS cr. 7.1 Heat Island Effect, non-roof
- LEED CI-SS cr.1D Heat Island Effect, non-roof
- LEED EB-SS cr.6 Heat Island Reduction
- LEED for Schools SS cr.7.1 Heat Island Effect, non-roof

- LEED for Homes SS cr.4.1 Surface Water Management
- LEED ND-GCT cr.10 Heat Island Reduction (pilot program).

This measures outlined in this proposal will positively impact achieving these LEED credits across the various rating systems.

Implementation & Market Availability

There are no known implementation issues for this proposal.

Many high albedo pavement options, including cement concrete and whitetopping, light-colored unit pavers, and pervious concrete pavers, are widely available and are being implemented for a full array of applications. Others, such as high albedo asphalt, are not as widely used but are beginning to be used in NYC for bike and bus lanes.

Notes

The committee considered requirements for light-colored asphalt aggregate given that roads represent a large portion of the city's dark surfaces. This issue is currently being investigated by the NYC Department of Transportation and it remains a challenge to source and transport such aggregate. For these reasons, the committee declined to recommend any course of action regarding light-colored aggregate.

ENDNOTES:

¹ CITY OF ALTAMONTE SPRINGS, LAND DEV. CODE., art. VIII (1993)

² CITY OF KINSTON, UNIFIED DEV. ORDINANCE, art. XIX (1992).

³ Impervious Parking Legislation, S. Res. 845 S.L. 2008-198 (Nc. 2008).

EF 13

CLARIFY STANDARDS FOR ATTACHING ROOFTOP SOLAR PANELS

New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

The Building Code does not specify acceptable criteria for the attachment of solar panels to rooftops, inhibiting the installation of solar energy systems.

Recommendation:

Require the Department of Buildings to develop detailed criteria for roof attachment of solar panels.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Amend Section 1502.1 as follows:

1502.1 General. The following terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ADDED COVERING. Covering added over a roof covering.

2. Add a new Section 1509.1.1 as follows:

1509.10 Anchorage. Installation of equipment on a roof or roof setback shall be in accordance with Chapter 16. Any system, equipment, added covering or other building-related load on roofs or roof setbacks shall be anchored to the building in a manner consistent with Section 1604.8.3. Ballast shall be prohibited on roofs one hundred (100) feet or higher above grade. For roofs less than one hundred (100) feet above grade, ballast shall be fully contained.

Supporting Information

Issue- Expanded

Ambiguity as to acceptable practice in the installation of solar collectors can inhibit their adaptation. This proposal clarifies the requirements so that designers will know the standards they must meet, removing one barrier to the implementation of solar energy.

Environmental & Health Benefits

Since solar collectors decrease the use of fossil fuels, the increased rate of implementation due to removing this barrier will result in decreased emissions of both global warming emissions and Clean Air Act pollutants.

This proposal was determined to have a low environmental impact per building and to impact a low number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have an indirect health impact.

Cost & Savings

This proposal is to clarify code requirements, and will therefore have no direct impact on construction costs.

Precedents

There are no known precedents for this proposal.

LEED

This proposal will make it more feasible for projects to utilize solar energy installations, which will facilitate achieving the following LEED credits (among other credits in pilot programs):

- LEED NC-EA cr.2, On-Site Renewable Energy
- LEED CI-SS cr.1 Option K, On-Site Renewable Energy
- LEED EB-EA cr.2, On-Site and Off-Site Renewable Energy
- LEED for Schools EA cr.2, On-Site Renewable Energy
- LEED for Homes EA cr. 1, Optimize Energy Performance
- LEED ND-GCT cr.13, On-Site Renewable Energy Sources

Implementation Market Availability

The technologies are well known, although market penetration in NYC is not high and experience somewhat limited.

EF 14

ALLOW LARGE SOLAR ROOFTOP INSTALLATIONS

New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Current regulations limit the area of roof that solar panels can cover without counting as another floor. This can increase the effective cost of solar panels, or prevent their installation.

Recommendation:

Exempt solar panels from limits on rooftop coverage.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 504.3 as follows:

504.3 Rooftop structures. Rooftop structures including but not limited to roof tanks and their supports, ventilating, air conditioning and similar building service equipment, bulkheads, penthouses, chimneys, and parapet walls 4 feet (1219 mm) or less in height shall not be included in the height of the building or considered an additional story unless the aggregate area of all such structures exceeds 33 and one-third percent of the area of the roof of the building upon which they are erected. Rooftop structures shall be constructed in accordance with Section 1509.

Exception: Solar thermal and solar electric (photovoltaic) collectors and/or panels and their supporting equipment, but not including any accessory plumbing or electrical equipment, shall not be included as rooftop structures subject to the 33 and one-third percent limitation on roof coverage.

Supporting Information

Issue- Expanded

This proposal will eliminate a barrier to the deployment of solar collectors and make possible an increase in the rate at which they are implemented. As written the restriction is reasonable for the structures listed, which do not take up much area. Solar collectors, however, cover as much of the roof as is practical, but do not constitute rentable space or project up as far as another story would. Because of their obvious benefits, and the absence of any detriments, solar collector usage should be encouraged, not limited or inhibited.

Environmental & Health Benefits

Since solar collectors decrease the use of fossil fuels, the increased rate of implementation due to removing this barrier will result in decreased emissions of both global warming emissions and Clean Air Act pollutants.

This proposal was determined to have a low environmental impact per building and to impact a low number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have an indirect health impact.

Cost & Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

There are no known precedents for this proposal.

LEED

This proposal will make it more feasible for projects to utilize solar, thermal and photovoltaic panels, which will facilitate achieving the following LEED credits (among other credits in pilot programs):

- LEED NC-EA cr.2, On-Site Renewable Energy
- LEED CI-SS cr.1 Option K, On-Site Renewable Energy
- LEED EB-EA cr.2, On-Site and Off-Site Renewable Energy
- LEED for Schools EA cr.2, On-Site Renewable Energy
- LEED for Homes EA cr. 1, Optimize Energy Performance
- LEED ND-GCT cr.13, On-Site Renewable Energy Sources

Implementation and Market Availability

There are no known implementation issues for this proposal.

EF 15: REMOVE ZONING IMPEDIMENTS TO ALTERNATIVE ENERGY

New York City Zoning Resolution

Proposal developed by the Homes Committee

Summary

Issue:

The Zoning Resolution allows many categories of mechanical equipment on a roof to exceed the allowable building height. However, equipment used for alternative or distributed energy is not treated as such a “permitted obstruction.”

Recommendation:

Treat alternative and distributed energy equipment, such as photovoltaic and solar thermal collectors, as “permitted obstructions.”

Proposed Legislation, Rule or Study

Amendments to the New York City Zoning Resolution:

1. Amend Section 23-62 as follows:

23-62

Permitted Obstructions

* * *

(d) Elevators or stair bulkhead, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage

* * *

2. Amend Section 23-621 as follows:

23-621

Permitted obstructions in certain districts

R2A R3 R4 R4A R4-1 R5A

(a) In the districts indicated, permitted obstructions are limited to those listed in paragraphs (b), (d) (with respect to alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures) only), (e) and (g) of Section 23-62 (Permitted Obstructions).

R2X

(b) In the district indicated, permitted obstructions are limited to those listed in paragraphs (b), (d) (with respect to alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures) only), (e) and (g) of Section 23-62. Dormers may be considered permitted obstructions if:

* * *

R5D

(d) In R5D Districts, permitted obstructions shall be as set forth in Section 23-62, except that elevator or stair bulkheads, roof water tanks, cooling towers, other mechanical equipment, or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures) may exceed a maximum height limit provided that the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to eight times the width, in feet, of the street wall of the building facing such frontage.

3. Amend Section 24-51 as follows:

24-51

Permitted Obstructions

* * *

(c) Elevators or stair bulkhead, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage;

* * *

4. Amend Section 33-42 as follows:

33-42

Permitted Obstructions

* * *

(c) Elevator or stair bulkheads, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage;

* * *

5. Amend Section 43-42 as follows:

43-42

Permitted Obstructions

* * *

(b) Elevator or stair bulkheads, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage;

* * *

6. Amend Section 81-252 as follows:

81-252

Permitted obstructions

With the exception of unenclosed balconies conforming to the provisions of Section 23-13 (Balconies) and alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines, the structures which under the provisions of Sections 33-42 or 43-42 (Permitted Obstructions) or 34-11 or 35-11 (General Provisions), are permitted to penetrate a maximum height limit or a sky exposure plane shall not be permitted as exceptions to the height limitations, setback requirements or rules for the measurement of encroachments or compensating recesses set forth in Section 81-26 (Height and Setback Regulations), nor shall they be excluded in determining daylight blockage pursuant to the provisions of Section 81-27 (Alternate Height and Setback Regulations).

7. Amend Section 84-135 as follows:

84-135

Limited Height of Buildings

* * *

(e) Sections 23-62 (Permitted Obstructions) and 33-42 (Permitted Obstructions) are hereby made inapplicable. Any portion of a building or other structure that exceeds an established height limit shall be subject to the following provisions:

(1) The following shall not be considered obstructions and may thus penetrate a maximum height limit:

- Chimneys or flues, with a total width not exceeding 10 percent of the aggregate width of street walls of a building at any level
- Elevator or stair bulkheads, roof water tanks, cooling towers or other accessory mechanical equipment (including enclosure walls), provided that either the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage times their average height, in feet, shall not exceed a figure equal to eight times the width, in feet, of the street wall of the building facing such frontage at curb level, or the lot coverage of all such obstructions does not exceed 20 percent of the lot coverage of the building and the height of all such obstructions does not exceed 40 feet

- Flagpoles and aerals
- Heliostats, wind turbines, solar panels and other alternative or distributed energy equipment
- Parapet walls, not more than four feet high
- Wire, chain link or other transparent fences

* * *

8. Amend Section 84-333 as follows:

Section 84-333

Permitted Obstructions

* * *

(b) Sections 23-62 and 33-42 (Permitted Obstructions) are hereby made inapplicable. Any portion of a building or other structure that exceeds an established height limit shall be subject to the following provisions:

(1) The following shall not be considered obstructions and may this penetrate a maximum height limit:

- Chimneys or flues, with a total width not exceeding 10 percent of the aggregate width of street walls or a building at any level;
- Elevator or stair bulkheads, roof water tanks, cooling towers, alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines or other accessory mechanical equipment (including enclosure walls), provided that either the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage times their average height, in feet, shall not exceed a figure equal to eight times the width, in feet, of the street wall of the buildings facing such frontage at curb level, or the lot coverage of all such obstructions, does not exceed 20 percent of the lot coverage of the building and the height of all such obstructions does not exceed 40 feet;
- Fences, wire, chain link or other transparent type;
- Flagpoles and aerals;
- Parapet walls, not more than four feet high;

* * *

9. Amend Section 104-322 as follows:

Section 104-322

Permitted Obstructions

The following shall not be considered obstructions and thus may penetrate the applicable maximum building height and the applicable maximum height for mechanical equipment set forth in Appendix B of this Chapter, and may also penetrate the sky exposure plane set forth in Section 104-321 (Mechanical equipment).

* * *

Alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines;

Antennae and structural support thereto;

* * *

Supporting Information

Issue – Expanded

Alternative and distributed energy is considered an important part of the city and country's long-term plan to reduce greenhouse gas emissions.

Distributed (on site) generation, including cogeneration, solar photovoltaic and wind power, prevents transmission losses, offsets fossil fuel combustion, and increases grid reliability. Approximately 30% of the electricity created at power plants is lost during transmission to the point of use. Distributed generation prevents these losses, substantially reducing carbon emissions associated with electricity generation. Furthermore, distributed generation, especially solar photovoltaic, produces the most energy when the chances of a brown/black-out are highest – on hot days in the summer. Distributed generation will make the power grid more reliable and may ultimately reduce the need for grid upgrades. Similarly, solar thermal technology reduces the burning of fossil fuels. This technology uses the sun to heat water, replacing fossil fuels otherwise needed for heating and domestic hot water, improving local air quality and reducing carbon emissions.

The current Zoning Resolution, however, was enacted in 1961, a time when alternative energy sources and distributed generation were not incorporated into buildings. As a result, the Zoning Resolution did not make any provision for their use. These and other administrative barriers discourage the installation of distributed and alternative generation systems in New York City and drive up costs. Solar installations in New York City, for example, are approximately 1/3

more expensive than those in New Jersey and Long Island. Even with incentives from the state and federal government, New York City has only installed 1.1 MW of solar capacity.¹

In comparison, mechanical equipment, such as cooling towers and water tanks, is treated as a “permitted obstruction” and exempted from certain limitations under the Zoning Resolution. Most importantly, rooftop mechanical equipment is not counted towards building height limitations.

This proposal would provide alternative and distributed energy equipment with the same exceptions under the Zoning Resolution now enjoyed by mechanical equipment.

Environmental & Health Benefits

This proposal would make it easier to receive approvals for cogeneration, wind power, solar photovoltaic and solar thermal systems, thus reducing greenhouse gas emissions and improving local air quality.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is an allowance and is not expected to have any impact on capital costs.

Precedents

In Berkeley, CA, solar projects do not require zoning permits or design review.² The Berkeley Planning Department offers free non-binding design review evaluation of solar equipment installations.³

LEED

This code revision may result in more projects implementing alternative energy solutions when it wasn’t previously feasible due to height restrictions.

These solutions assist in achieving points for

- LEED NC-EA cr. 2 Onsite Renewable Energy;
- LEED CI-SS cr.1 Option K. Onsite Renewable Energy;
- LEED EB-EA cr. 2.1-2.4 On-site and Off-Site Renewable Energy;
- LEED for Schools-EA cr.2 On-Site Renewable Energy;
- LEED ND (pilot program)-GCT cr. 13 On-Site Renewable Energy Sources;
- LEED for Retail NC (pilot program) EA cr.2 On-Site Renewable Energy; and
- LEED for Retail CI (pilot program) SS cr. 1 Option K. Onsite Renewable Energy.

LEED for Homes addresses renewable electric systems in EA cr.10, and solar hot water heating systems under EA cr. 7.3. A project receiving points for LEED for Homes EA 1 is not eligible for these credits, and vice versa.

Implementation and Market Availability

There are no implementation or market barriers to this proposal.

ENDNOTES:

¹ plaNYC, Energy Initiatives: Foster the Market for Renewable Energy, http://www.nyc.gov/html/planyc2030/html/plan/energy_renewable.shtml (last visited Oct. 14, 2009).

² CAL. GOV’T CODE § 65850.5 (1978).

³ City of Berkeley, CA, Office of Energy and Sustainable Development, Residential Solar Photovoltaic Permit Guide, <http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=37848> (last visited Oct. 14, 2009).

EF 16: REMOVE LANDMARKS IMPEDIMENTS TO ALTERNATIVE ENERGY

New York City Landmarks Preservation Commission Rules
Proposal Developed by the Homes Committee

Summary

Issue:

In historic districts, rooftop equipment – including solar panels, wind turbines and micro-turbines -- is not permitted if visible from the street without a lengthy review by the Landmarks Preservation Commission.

Recommendation:

Treat alternative and distributed energy equipment the same as other rooftop mechanical equipment, which is allowed to be visible from the street.

Proposed Rule, Legislation or Study

Amendments to the Rules of the City of New York:

1. Amend the definition of “Mechanical Equipment” in Subdivision (a) of Section 2-19 of Title 63 as follows:

Mechanical equipment. “Mechanical equipment” shall include, but not be limited to, heating, venting and air conditioning equipment, alternative or distributed energy equipment, such as solar panels, wind turbines, or micro-turbines, watertanks and their supporting structures, satellite dishes, stair and elevator bulkheads, screens, dunnages, baffles and other accessory installations but shall not include telecommunication equipment and conventional television antennas. For the purpose of this rule, mechanical equipment shall also include unenclosed decks, garden trellises, or associated railings.

Supporting Information

Issue – Expanded

Alternative and distributed energy is considered an important part of the city and country’s long-term plan to reduce greenhouse gas emissions.

Distributed (on site) generation, including cogeneration, solar photovoltaic and wind power, prevents transmission losses, offsets fossil fuel combustion, and increases grid reliability. Approximately 30% of the electricity created at power plants is lost during transmission to the point of use. Distributed generation prevents these losses, substantially reducing carbon emissions associated with electricity generation. Furthermore, distributed generation, especially solar photovoltaic, produces the most energy when the chances of a brown/black-out are highest – on hot days in the summer. Distributed generation will make the power grid more reliable and may ultimately reduce the need for grid upgrades. Similarly, solar thermal technology reduces the burning of fossil fuels. This technology uses the sun to heat water, replacing fossil fuels otherwise needed for heating and domestic hot water, improving local air quality and reducing carbon emissions.

When the Landmarks Preservation Council created its rules, alternative energy sources and distributed generation were not incorporated into buildings. As a result, the Commission did not make any provision for their use. These and other administrative barriers discourage the installation of distributed and alternative generation systems in New York City and drive up costs. Solar installations in New York City, for example, are approximately 1/3 more expensive than those in New Jersey and Long Island. Even with incentives from the state and federal government, New York City has only installed 1.1 MW of solar capacity.¹

In comparison, mechanical equipment, such as cooling towers and water tanks, are permitted by the rules of the Landmarks Preservation Commission to be visible within certain parameters. This proposal would treat alternative and distributed energy equipment the same as mechanical equipment for the purposes of historic preservation.

Environmental & Health Benefits

New York City’s Landmarks Districts are filled with vast acreage of residential buildings. This proposal will make it easier to get approvals for cogeneration, wind power, solar photovoltaic and solar thermal systems.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is an allowance and is not expected to have any impact on capital costs.

Precedents

There are no known precedents for this proposal.

LEED

This code revision may result in more projects implementing alternative energy solutions because it was previously more difficult to do so, due to visibility restrictions.

These solutions assist in achieving points for:

- LEED NC-EA cr. 2 Onsite Renewable Energy;
- LEED CI-SS cr.1 Option K. Onsite Renewable Energy;
- LEED EB-EA cr. 2.1-2.4 On-site and Off-Site Renewable Energy;
- LEED for Schools-EA cr.2 On-Site Renewable Energy;
- LEED ND (pilot program)-GCT cr. 13 On-Site Renewable Energy Sources;
- LEED for Retail NC (pilot program) EA cr.2 On-Site Renewable Energy; and
- LEED for Retail CI (pilot program) SS cr. 1 Option K. Onsite Renewable Energy.

LEED for Homes addresses renewable electric systems in EA cr.10, and solar hot water heating systems under EA cr. 7.3. A project receiving points for LEED for Homes EA 1 is not eligible for these credits, and vice versa.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

¹ plaNYC, Energy Initiatives: Foster the Market for Renewable Energy, http://www.nyc.gov/html/planyc2030/html/plan/energy_renewable.shtml (last visited Oct. 14, 2009).

EF 17:

ALLOW USE OF BIOFUELS

New York City Mechanical Code

Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Biofuels can create energy from waste, while reducing resource consumption and air pollution. However, they are not permitted under the Mechanical Code.

Recommendation:

Revise the definition of fuel oil to allow the use of alternative fuels.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code:

1. Amend the definition of “FUEL OIL” and add the definitions of “BIODIESEL”, “NON ESTER RENEWABLE DIESEL” and “NONPETROLEUM RENEWABLE RESOURCE” in Section 202 as follows:

BIODIESEL. Fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100, that meets the requirements of ASTM D 6751.

FUEL OIL. Kerosene, any hydrocarbon oil having a flash point not less than 100°F (38°C) or fuel comprised of biodiesel or non ester renewable diesel blended with petroleum heating oil in accordance with ASTM D 396.

NON ESTER RENEWABLE DIESEL. Fuel or fuel additive that meets all of the following criteria:

1. The registration requirements for fuels and fuel additives established by the United States Environmental Protection Agency under section 7545 of title 42 of the United States Code (Section 211 of the Clean Air Act).
2. Is not a mono-alkyl ester.
3. Is intended for use in engines that are designed to run on conventional, petroleum-derived diesel fuel.
4. Is derived from nonpetroleum renewable resources.

NONPETROLEUM RENEWABLE RESOURCE. Nonpetroleum renewable resources including, but not limited to, the following:

1. Plant oils;
2. Animal fats and animal wastes, including poultry fats and poultry wastes, and other waste materials; and
3. Municipal solid waste and sludges and oils derived from wastewater and the treatment of wastewater.

Supporting Information

Issue - Expanded

According to New York City’s analysis of National Emissions Inventory data from the U.S. Environmental Protection Agency, heating oil is responsible for approximately 14% of local emissions of fine particulate matter (PM 2.5) and is a significant source of NOx, a precursor to smog. The burning of heating oil emits large quantities of particulate matter because of its high sulfur content – heating oil contains 2000-3000 parts per million of sulfur compared with 15 parts per million for on-road diesel. Because of heating oil and other sources, New York City does not comply with federal Clean Air Act standards for PM 2.5.

Particulate matter is made up of many compounds, most of which are highly toxic, but some sources of particulate matter are worse than others. PM 2.5 from residual heating oil tends to have high levels of nickel, vanadium and elemental carbon. Particulate matter and ozone are linked to respiratory problems, such as: irritation of the airways, coughing, or difficulty breathing; decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; heart attacks; and premature death in people with heart or lung disease. New York City asthma rates are consistently higher than elsewhere; 300,000 children in the City have been diagnosed with asthma and hospitalizations cost over \$10,000 per visit and over \$240 million a year. In addition, cardiovascular disease is the number one cause of death, killing over 22,000 New Yorkers a year.

The effect of heating oil on local air quality is exacerbated by the fact that the oil is burned in the midst of densely populated areas, creating high levels of exposure. Unlike diesel trucks or power plants, there are no commercially viable emission control devices for small and medium residential and commercial boilers. Cleaner fuel is the only control method.

Biodiesel is a liquid fuel produced from renewable, biological resources. In the United States, biodiesel is usually made from soybean oil or recycled restaurant grease. A blend of pure biodiesel with petroleum-based home heating oil known as “bioheat” can be substituted for heating fuel in domestic and commercial boilers with few or no modifications to the boiler. Bioheat contains less sulfur than conventional heating oil, decreasing harmful emissions while also improving fuel efficiency since lower sulfur content improves burner efficiency.

The Building Codes currently defines fuel oil as a hydrocarbon-based fuel. Since this definition does not include fuels derived from renewable sources, biofuels are not permitted for use as a heating fuel in New York City.

Environmental & Health Benefits

The combustion of fuel oil produces a significant amount of PM, NOx, and other pollutants. Indeed, recent research has found that communities with higher PM 2.5 content of nickel, vanadium, and elemental carbon and related sources have higher risk of hospitalizations associated with short term-exposure to PM 2.5¹, and that high nickel content is associated with the use of residual oil in New York City.²

Alternative fuels such as bioheating fuel generate fewer combustion emissions and thus improve air quality. Biodiesel blends have been shown to reduce the sulfur, carbon monoxide, and nitrous oxides content, leading to lower emissions in sulfur oxides, carbon emissions and particulate matter.^{3 4}

Common blends include B20 (a mixture of 20% biodiesel with 80% heating oil), B10 (a mixture of 10% biodiesel with 90% heating oil) and B5 (a mixture of 5% biodiesel with 95% heating oil). Biodiesel is sulfur-free and will therefore dilute the overall sulfur content of any heating fuel by displacing a percentage of the petroleum-based diesel in the blend. Studies show that, when compared with regular No. 2 or No. 6 petroleum fuel oil, bioheating fuel with even a low percentage of biodiesel achieves a significant decrease in emissions of particulate matter and sulfur oxide.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

There are no known precedents for this proposal. David Gardiner & Associates, LLC prepared a report for the Northeast Regional Biomass Program titled “Bioheat Laws, Regulations and Policies: Impediments and Solutions in the Northeast United States.”⁵ This report provided summary and general overview of relevant laws, regulations and policies in the Northeast that posed obstacles to the distribution, use or sale of bioheating fuel. Their review of the NYC building code yielded the impediment cited above and is the impetus for this proposal.

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal. Bioheating oil is widely available and its use is widespread in some areas of New York City.

Notes

Extensive research has shown that operational concerns related to bioheating fuel are largely eliminated with the use of blends of B20 or lower.⁶ Laboratory and field tests have demonstrated that B2, B5, B10 and B20 bioheating fuel can be used in almost every home or building without any additions or modifications to existing heating systems.^{7,8} In fact, results have demonstrated identical, if not improved, combustion performance with bioheating blends up to B30.⁹

As bioheating fuel has become more widely used, boiler manufacturers are responding positively. Given the track record of B20 and lower bioheating blends in unmodified No. 2 boilers, boiler manufacturer Beckett Corporation has issued a statement in support of the use of biodiesel blends up to B5 in Beckett burners without retrofits.¹⁰ Other major manufacturers of oil, gas, residential and commercial burners such as Carlin Combustion Technology, Power Flame Incorporated, Riello Corporation of America, and Industrial Combustion, among others, have informally declared that the use of B5 bioheating fuel does not affect their product warranties because their testing has shown no adverse effects to the equipment and combustion.

Key definitions used in this recommendation were taken from the following federal regulations:

- “NON ESTER RENEWABLE DIESEL” from 40 CFR Part 80
- “NONPETROLEUM RENEWABLE RESOURCE” from 40 CFR 80.1101

ENDNOTES:

¹ Michelle L. Bell et al., *Hospital Admissions and Chemical Composition of Fine Particle Air Pollution*, 179 AM. J. OF RESP. AND CRITICAL CARE MED., 1115-20 (2009), available at <http://ajrccm.atsjournals.org/cgi/content/short/179/12/1115>.

² Morton Lippmann et al., *Seasonal and Spatial Distributions of Nickel in New York City Ambient Air*, 19.6 EPIDEMIOLOGY (2008) available at http://journals.lww.com/epidem/Fulltext/2008/11001/Seasonal_and_Spatial_Distributions_of_Nickel_in.878.aspx.

³ James F. Gennaro, *Why a Bioheat Mandate?*, GOTHAM GAZETTE, Apr. 21, 2008, available at <http://www.gothamgazette.com/article/fea/20080421/202/2497>.

⁴ HARVARD GREEN CAMPUS INITIATIVE, *BIOHEAT FACT SHEET*, <http://green.harvard.edu/sites/default/files/attachments/renewables/bioheat-fact-sheet.pdf> (last visited Oct. 14, 2009)

⁵ DAVID GARDINER & ASSOCIATES, *BIOHEAT LAWS, REGULATIONS AND POLICIES: IMPEDIMENTS AND SOLUTIONS IN THE NORTHEAST UNITED STATES* (2007), http://www.dgardiner.com/doc/CONEG%202007%20Bioheat_Laws_Regs_Policies.pdf.

⁶ C.R. KRISHNA WITH R.J. ALBRECHT, *BROOKHAVEN NATL. LAB., BIODIESEL FOR HEATING OF BUILDINGS IN THE UNITED STATES* (2008), <http://www.bnl.gov/est/erd/biofuel/files/pdf/AlbrechtKrishnaPaper.pdf>.

⁷ C.R. KRISHNA WITH R.J. ALBRECHT, *NATL. RENEWABLE ENERGY LAB., BIODIESEL BLENDS IN SPACE HEATING EQUIPMENT* (2004), <http://www.nrel.gov/docs/fy04osti/33579.pdf>.

⁸ STATE OF VERMONT DEPARTMENT OF BUILDINGS AND GENERAL SERVICES, *VERMONT BIODIESEL PILOT PROJECT: EMISSIONS TESTING OF BIODIESEL BLENDS WITH NO. 6 FUEL OIL AT THE WATERBURY STATE OFFICE COMPLEX* (2006), http://vsjf.org/biofuels/documents/BGS_EmissionsReportFinal.pdf.

⁹ C.R. KRISHNA WITH R.J. ALBRECHT, *BROOKHAVEN NATL. LAB., BIODIESEL FOR HEATING OF BUILDINGS IN THE UNITED STATES* (2008), <http://www.bnl.gov/est/erd/biofuel/files/pdf/AlbrechtKrishnaPaper.pdf>.

¹⁰ R.W. BECKETT CORPORATION, *BECKETT BURNERS BIOHEAT® READY!*, www.beckettcorp.com/protect/techsuppt/.../BioHeat_Questions.pdf, (last visited Jan. 28, 2010).

EO 1: RE-TUNE LARGE BUILDINGS EVERY SEVEN YEARS

NYC Building Code

This proposal was developed by the Energy & Ventilation Committee.

Summary

Issue:

Even the best-designed building systems drift away from optimal performance over time, due to broken parts, changes in use, and the accumulation of small changes in procedures and equipment.

Recommendation:

Every seven years, buildings larger than 50,000 square feet must be retro-commissioned, re-tuning the major building systems to ensure they all work together correctly. A similar proposal was incorporated into the Greener, Greater Buildings Plan, which became law prior to the issuance of this report.

Proposed Legislation, Rule or Study

Amendments to the New York City Administrative Code:

1. Add a new subchapter to Chapter 3 of Title 28 as follows:

Chapter 3 MAINTENANCE OF BUILDINGS

Article 308 RE-COMMISSIONING AND RETRO-COMMISSIONING OF EXISTING BUILDINGS

308.1 Definitions:

The following words and terms shall, for purposes of this chapter, applicable appendices and as used elsewhere in this code, have the following meanings:

CENTRAL SYSTEM. Includes (i) the exterior building envelope, as defined in Section 1402.1, and (ii) all energy-using building systems, not including that portion of any energy-using building system that the building owner may not access to the extent necessary for inclusion in any commissioning process under the terms of any applicable lease executed with respect to a portion of a large building occupied by more than one tenant prior to the effective date of the local law that added this section.

COMMISSIONING. A systematic process for investigating, analyzing, and optimizing the performance of building systems through the identification and implementation of low or no cost Facility Improvement Measures and ensuring their continued performance. The term “commissioning” shall include re-commissioning and retro-commissioning, as defined below.

COMMISSIONING AGENT. A person or agency approved by the department to perform commissioning and produce a commissioning report.

COMMISSIONING REPORT. A document setting forth the results of any commissioning process in the form provided by the department.

LARGE BUILDING. Any building or combination of buildings with a gross floor area equal to or greater than 50,000 square feet and located on a single lot.

RE-COMMISSIONING. The periodic re-implementation of the commissioning.

RETRO-COMMISSIONING. The application of the commissioning process to an existing building that has not previously undergone the commissioning process.

308.2 Re-commissioning or retro-commissioning required. a. With respect to a large building having received either a temporary or permanent certificate(s) of occupancy pertaining to the entire building as of the effective date of the local law that added this section, the owner shall submit a commissioning report indicating that a commissioning

agent has re-commissioned or retro-commissioned the central system of such building no earlier than two years prior to the date set forth in Section 308.3.

308.3 Schedule. A commissioning report shall be submitted to the department:

1. Within 180 days of issuance of an amended certificate of occupancy for a large building or any portion thereof that (i) changes the permitted use or occupancy of an area equal to or greater than 10,000 square feet, or (ii) changes the gross floor area of such large building by an area equal to or greater than 10,000 square feet; and

2. On a regular basis, as set forth below:

(a) A commissioning report shall be submitted to the department prior to the second anniversary of the effective date of the local law that added this article; and (b) Subsequent commissioning reports for the building shall be due seven years after the submittal date of the previous commissioning report.

308.4 Notification. The department of finance shall notify every building two years prior to the due date, and each year thereafter until the due date.

Supporting Information

Issue – Expanded

There is growing recognition that most existing buildings have major opportunities for energy use reductions by better utilizing systems and equipment already in the building. Commissioning existing buildings, either through “retro-commissioning” or “re-commissioning”, as described in the proposed code language, can result in both substantial energy use reductions and improvements in occupant comfort conditions.

While commissioning of new buildings has become more common in recent years due to initiatives such as LEED and other high performance building programs, existing building commissioning has taken somewhat longer to catch on in the building industry. Recent research (see cost/savings section below) has demonstrated the significant energy savings potential from existing building commissioning, along with the extremely attractive economics. Beyond energy cost savings, many case studies of existing building commissioning also show additional non-energy benefits, such as improved system capacity and availability for comfort conditioning systems, and improved indoor environmental quality leading to increases in occupant comfort and productivity.

Environmental & Health Benefits

The need to address indoor air quality issues is often a driver of an existing building commissioning project. In fact, a recent review of 332 existing building commissioning projects, representing over 90 million square feet, showed that more than half of those projects were undertaken to “ensure adequate indoor air quality” or “ensure or improve thermal comfort.”¹ While the valuation of improved occupant productivity is less rigorous than energy cost savings, many analyses have shown that productivity improvement benefits can often be several times larger than energy benefits.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to cost \$0.30/square foot. It was thus categorized as incurring a higher cost increment. This proposal was also estimated to generate financial savings that will pay for the costs in less than three years.

Precedents

No direct requirement for commissioning has been found. California enthusiastically endorses the practice.²

LEED

For new construction, LEED Enhanced Commissioning requires the involvement by the CxA in reviewing building operation within 10 months after substantial completion, including a plan for resolution of outstanding commissioning-related issues. However, there is no long-term re-commissioning initiative in LEED for new construction projects.

Under LEED EB-EA prerequisite 1 Existing Building Commissioning, teams may carry out a comprehensive commissioning process, or the team may choose to submit a 1- to 5-Year Plan for continuous improvement of commissioning requirements until all aspects are completed. While this time frame differs from the 7-year recommendation in this proposal, projects pursuing this 5-year LEED path will inevitably find it more feasible to document re-commissioning for the revised NYC building code.

Additional credits under LEED EB-EA credit 3.1, 3.2, & 3.3 Building Operations and Maintenance, require supporting appropriate operations and maintenance of buildings and building systems so that they continue to deliver building performance goals over the performance period. The LEED for Existing Buildings Performance Period is the period during which building performance data is collected for inclusion in a LEED for Existing Buildings certification application. While this time frame also differs from the 7-year recommendation in this proposal, projects pursuing the LEED path will similarly find it more feasible to document re-commissioning for the NYC building code.

Implementation & Market Availability

There is currently a shortage of energy engineers and auditors to supply the required services; however, this is quickly changing due to other PlaNYC initiatives.

ENDNOTES:

¹ E. MILLS, LAWRENCE BERKELEY NATIONAL LABORATORY, BUILDING COMMISSIONING: A GOLDEN OPPORTUNITY FOR REDUCING ENERGY COSTS AND GREENHOUSE GAS EMISSIONS (2009), <http://cx.lbl.gov/documents/2009-assessment/LBNL-Cx-Cost-Benefit.pdf>.

² Green California, Commissioning and Retro-Commissioning Buildings (2007), <http://www.green.ca.gov/CommissioningGuidelines/default.htm> (last visited Jan. 28, 2010).

EO 2: Measure Electricity Use in Tenant Spaces

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

Proposal developed by the Energy & Ventilation Committee

Summary

Issue

Because electricity is often unmetered in commercial tenant spaces, tenants are unaware of the energy they consume. This, in turn, can lead to excessive use and waste.

Recommendation

All new residential dwelling units and all new commercial tenant spaces of 10,000 square feet or larger shall be metered for electricity. A similar proposal was incorporated into the Greener, Greater Buildings Plan, which became law prior to the issuance of this report.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 8.4.2 as follows:

8.4.2 Electrical Metering

8.4.2.1 Residential metering. In buildings having individual dwelling units, electric metering shall be included capable of measuring, at a minimum, the electrical energy consumed in each dwelling unit on a monthly basis or more often. Metering may be supplied either by the owner or by the electric utility.

8.4.2.2 Commercial metering. Commercial spaces occupied by a single tenant and comprising one or more complete floors of a building or 10,000 square feet or more shall be supplied with electric metering capable of recording, at a minimum, electric energy consumption and peak demand within the space either monthly or more often. Metering may be supplied either by the owner or by the electric utility.

Exceptions:

- a) In the case of renovations and retrofits of existing commercial spaces, this requirement is waived if it would require that the space be re-wired.
- b) This requirement is waived for tenant spaces for which the inception of the lease of the commercial space that would otherwise be covered by this requirement precedes the enactment of this requirement.

Supporting Information

Issue – Expanded

It is well established that payments directly coupled to energy and/or demand usage lead to lower consumption. NYSERDA studies indicate that sub-metering a master-metered multifamily building can reduce apartment electricity consumption by approximately 17% - 27%.¹ This measure will ensure that all newly constructed residential buildings, and all or almost all new or renovated commercial spaces will have meters installed and available for use. Since building code has no control over operations, the actual use of the meters as a basis for billing will be controlled by Public Service Commission regulations. Whether new or existing buildings are master metered with no individual billing (despite the presence of individual meters), master metered with sub-meters, or directly metered by Con Edison is under the purview of the PSC and cannot be decided within New York City.

Environmental & Health Benefits

Lower electricity consumption will lead to lower emissions from generating stations, improved air quality and decreased release of greenhouse gases.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.07% to 0.1%, depending on building type. It was thus categorized as incurring a medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years for certain building types, assuming that billing for individual usage is instituted in one form or another.

Precedents

This item is included in the New York State Energy Conservation Construction Code, 805.8, for multifamily residential buildings. It is repeated here since ASHRAE 90.1 2007 has been designated as a replacement for the New York State code, and there is no metering provision in 90.1.

Other Jurisdictions

Metering is nearly universal. No specific information available.

LEED

This measure will have little impact on LEED certification.

Implementation & Market Availability

Electric sub-meters are widely available.

¹ NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY, APPLIED ENERGY GROUP: INCENTIVES TO REDUCE ELECTRICITY USAGE, <http://www.nyserda.org/programs/pdfs/Applied%20Energy%20Group.pdf>.

EO 3: TRAIN BUILDING OPERATORS IN ENERGY EFFICIENCY

Amendments to the New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Current requirements for building operators do not include training in efficient building operations, energy efficiency, or monitoring of overall building performance.

Recommendation:

In buildings larger than 50,000 square feet, require operators to be trained and certified for energy-efficient operations. Fund a study to establish the appropriate training and certification requirements.

Proposed Legislation, Rule or Study

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code, Title 28, Chapter 4

1. Amend Section 28-401.3 as follows:

Building Operator. Engineering staff involved in the direct supervision, management, and maintenance of a building's mechanical and electrical systems and equipment. For commercial office buildings and institutional buildings, this shall refer to Stationary Engineers. For multifamily apartment buildings, this shall refer to Building Superintendents. In some cases, where mechanical and electrical Operations and Maintenance is largely outsourced, the term shall refer to Mechanical and/or Electrical Maintenance firms and their mechanics and supervisors. The term "Building Operator" shall not refer to Owners or to Property Managers, who may be direct staff of the Owner or who may be in the employ of third-party property management firms.

2. Add a new Article 420 as follows:

Article 420

Building Operator Certification

Section 28-420.1 Certificate required. It shall be unlawful to operate mechanical equipment in a building over 50,000 square feet in size unless such work is done by a person trained and certified as a building operator under the provision of Article 420.

Section 28-420.2 Classification: Training and certifications shall be classified (Class A, Class B, Class C, etc.) as determined by (rules of the Department of Buildings).

Section 28-420.2 Phasing: An optimal phase-in schedule for the size of buildings the mechanical equipment of which are to be managed by a trained and certified building operator shall be determined by the proposed study.

Proposed Study

The City of New York should allocate sufficient funds (an estimated \$50,000 to \$100,000) for the Department of Buildings, working in coordination with the Office of Long-Term Planning and Sustainability, to hire consultants to analyze what trainings and certifications should be required for building operators and to make recommendations to the City.

Schedule and Content of Study:

No later than July 1, 2010, the City should issue an RFP for a study to be completed by April 1, 2011. The study should contain an analytical portion and a set of recommendations.

Analysis:

- An analysis of the skill sets required to efficiently operate building equipment of various types in buildings of various type and size (larger than 50,000 sq. ft.) that are typical in NYC.
- A description of existing training programs and/or certifications for operators that concentrate on energy efficiency, including standards and training products that have been developed by NYSERDA and the unions and requirements that have been set in the Housing Maintenance Code.
- An analysis of how well existing trainings and certifications meet the skill sets required in NYC buildings, and what gaps exist.
- A study of best practices in North America and around the world in setting standards for operators, looking at large portfolios such as government agencies, universities, businesses, etc.; any mandated standards for the private sector; or industry standards such as LEED or Green Seal.
- A determination of whether a certification program or a license requirement will best serve the purpose of this proposal.

Recommendations:

- The study should recommend an overall structure for trainings and certifications to be required to operate buildings of various sizes and types, with a range of equipment types. Should there be a single training or certification required for all building operators? Should there be a graded series of requirements – i.e. Class A, Class B, Class C, etc. – depending on the complexity of the building systems? Or should there be a general module required for all building operators, with additional specialized modules for different building types or systems?
- The study should recommend what existing trainings and/or certifications the city could start to require right away with fairly minor modifications. Continuing education requirements should be included because technologies and regulations are changing rapidly.
- The study should assess whether those initial standards are sufficient or whether the city should develop more stringent and/or more comprehensive standards.
- If it is determined that more stringent and/or more comprehensive standards should be developed, the study should outline what the city should require in terms of trainings, certifications, experience, and continuing education, along with the outline of any curriculum that should be developed.
- If curriculum should be developed, the study should make recommendations on how the city might best partner. Possible partners to consider include NYSERDA, CUNY, USGBC, BPI, the unions, the Department of Energy, and/or the professional organizations such as ASHRAE or AEE.
- The study should determine an optimal phase-in schedule, e.g. buildings larger than 200 ksf by 2013, 50ksf by 2016, etc.

Supporting Information

Issue – Expanded

The best equipment cannot ensure energy efficiency without the proper training of building operators. Current requirements for operating and stationary engineers and for multi-family building superintendents are meant to ensure that equipment is operated safely, but they do not include required training in sustainable building operations, energy efficiency, or associated monitoring. In order to ensure that the efficiency requirements mandated by the energy code achieve the intended results, New York City needs to establish minimum standards for the building operators who operate and manage the city's largest buildings – those that are over 50,000 square feet in size. Such standards would be located in Title 28 (The New York City Construction Codes), Chapter 2 (Licensing and Registration of Businesses, Trades, and Occupations Engaged in Building Work). Since standards have not yet been developed, the City needs to undertake a study to develop the appropriate standards and then require them.

This proposal would ensure that the operators of the largest buildings in New York City are trained to operate their equipment efficiently. The impact of this will be quite large, since the buildings directly impacted constitute roughly half of the city's total square footage, and are responsible for roughly 40% of the city's overall energy consumption and greenhouse gas emissions. In addition, over time there will be indirect impacts on smaller buildings, since there will be a certain amount of movement of trained operating staff from large buildings into smaller ones.

Environmental & Health Benefits

The impact of proper operations and maintenance on building efficiency is significant. The experience of Texas A&M University and the Council Rock School District in Pennsylvania show that aggressive improvements in O+M, including monitoring and continuous commissioning, can result in as much as a 35% decrease in energy consumption across a portfolio. One would not expect such radical improvement across the board in NYC, and proper training is only one part of a preventative maintenance plan. Still, if training resulted in only a 2% improvement in efficiency in the largest buildings, it would result in a greenhouse gas emissions reduction of 0.8%, and decreased annual energy expenditures of

approximately \$150 million citywide. Reduced demand for energy would also result in reductions in the emissions of air pollutants from the burning of fossil fuel within buildings and at electrical power plants.

This proposal is for a study, and therefore environmental and health rankings are not applicable.

Cost / Savings

This proposal is for a study that will have no direct impact on construction or operating costs.

Precedents

In NYC, subchapter 2 of the Housing Maintenance Code, section 27-2055 "Certification of Competency" requires a similar process for building superintendents in multifamily housing, under HPD enforcement. Training programs exist. Training also exists, in particular through unions, on the non-residential side, for the state title of Stationary Engineer but this designation is not a NYC legal requirement.

LEED

Training of operators is consistent with LEED scoring, in particular for the EB product.

Implementation & Market Availability

By Oct. 1, 2011, DOB should submit to the City Council proposed code changes establishing initial requirements for building operators in buildings larger than 50,000 square feet.

If the study has determined that a second generation of standards is required, by Dec. 31, 2013, DOB should submit to the City Council code changes with amended standards.

The proposed code changes should allow for a phase-in of the requirements as required to allow sufficient time for the training of all impacted operators.

Appropriate training is available, e.g. union courses such as 32BJ. However, based on existing requirements, sustainability and energy efficiency are not emphasized, if included at all. NYSEERDA and its related service providers have developed standards and training products. National training and certifications do exist. A list of such certifications is provided in the table below. Phasing-in would be necessary to avoid the market of service providers from being swamped.

Certifications relating to building operations for sustainable high-performance buildings *

Organization	Certification
Building Owners and Managers Institute (BOMI)	- Real Property Manager (RPM) - Facilities Management Administrator (FMA) - Systems Maintenance Technician (SMT) - Systems Maintenance Administrator (SMA)
USGBC	LEED Accredited Professional (AP)
Association of Energy Engineers (AEE)	- Certified Energy Manager (CEM), original and flagship certification - Certified Lighting Efficiency Professional - Certified Power Quality Professional - Certified Indoor Air Quality Professional - Distributed Generation Certified Professional
Association of Heating Refrigeration and Air-conditioning Engineers (ASHRAE)	Operations and Performance Management Professional (OPMP)
International Facilities Management Association (IFMA)	- Certified Facility Manager (CFM) - Facility Management Professional
Building Operator Certification (the non-profit that manages this has the same name as the certification)	Building Operator Certification (BOC)

Building Performance Institute	• Energy Analyst I and II • Residential Retrofit Specialist • Multifamily Energy Analyst • Energy Efficient Building Operations (multifamily)
National Association for Technical Excellence (NATE)	• Provides a range of certification standards aimed primarily at the installation and service trades.
Association of Physical Plant Administrators (APPA)	• Educational Facilities Professional • Certified Educational Facilities Professional
Association for Facilities Engineering (AFE)	• Certified Plant Engineer • Certified Plant Maintenance Manager • Certified Plant Supervisor

Source: Michael Bobker

Notes

1. Note possible savings redundancy with controls measures, system documentation, and retro-commissioning.

EO 4: AUTOMATE TRACKING OF BUILDING ENERGY USE

Amendments to the New York City Building Code and to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Many building managers and operators do not know how efficiently (or not) their buildings' energy systems are performing. This can lead to poor performing systems and missed opportunities for energy savings.

Recommendation:

For all new buildings of 50,000 square feet and larger, require computerized building control systems that capture energy data and provide useful information to building managers and operators.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

Add the following defined term to Section 3.2:

building management system: a computer-based control system installed in buildings that monitors and controls the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.

Add a new Section 6.4.6 as follows:

6.4.6 Energy System Measurement and Monitoring

6.4.6.1 Measurement and Monitoring Systems – New Construction

All new construction buildings over 50,000 square feet gross floor area shall incorporate a *building management system* capable of capturing metered data from building wide energy, demand and water meters, including those supplied by utilities, and from sub-meters installed for any building system including heating, ventilating, air-conditioning, elevators, and transportation systems, expected to use more than 20% of the building's annual electric energy, or 20% of the building's annual peak electric demand, or 20% of the building's annual fuel use, or 10% of a building's water use, and from sub-meters installed in the *spaces* of individual tenants.

6.4.6.2 Measurement and Monitoring Systems – Existing Buildings

a. Existing buildings undergoing renovations or repair of any building system including heating, ventilating, air-conditioning, elevators, and transportation systems expected to use more than 20% of the building's annual electric energy, or 20% of the building's annual peak electric demand, or 20% of the building's annual fuel use or 10% of the building's water use, shall install meters capable of capturing electric energy and demand and fuel and water use data and transmitting it to a *building management system*.

b. Existing buildings undergoing renovations or repairs of any building system including heating, ventilating, air-conditioning, elevators, and transportation systems expected to incur a total cost more than \$1.00 per square foot of gross floor area shall add a *building management system* capable of capturing metered data from building level energy and water meters, including those supplied by utilities, and from sub-meters installed for any building system including heating, ventilating, air-conditioning, elevators, and transportation systems expected to use more than 20% of the building's annual electric energy, or 20% of the building's annual peak electric demand, or 20% of the building's annual fuel use, or 10% of a building's water use, and from sub-meters installed in the *spaces* of individual tenants. Any sub-meters not yet installed under para. (a) of this subsection shall also be installed at this time. Installations shall be required for existing buildings per the following schedule: over 100ksf by July 1, 2013, and over 50ksf by July 1, 2016.

Amendment to Title 28 of the Administrative Code, Chapter 3, Maintenance of Buildings:

1. Add a new Article 308 PERIODIC REPORTING OF BUILDING ENERGY AND WATER USE as follows:

28-308.1 General. Every building having a building management system with energy and water use data recording capability shall report this data in accordance with this article.

28-308.2 Information to be reported shall include data on whole-building energy, demand, and water use, and from sub-meters installed for any building system including heating, ventilating, air-conditioning, elevators, and transportation systems expected to use more than 20% of the building's annual electric energy, or 20% of the building's annual peak electric demand, or 20% of the building's annual fuel use, or 10% of a building's water use, and from sub-meters installed in the spaces of individual tenants.

28-308.3 Reporting from the computerized building management system shall take place monthly with an annual summary to building tenants and building operators, with a minimum format to be established by Commissioner.

Supporting Information

Issue – Expanded

Although readily feasible with existing technology, most current Building Automation/Control/Building Management Systems do not integrate data from existing energy and water meters nor do they facilitate tracking of usage back to systems, equipment and their operations. Data as presently made available through current practice does not allow building performance to be matched against building models and does not adequately support on-going monitoring and commissioning. When high consumption is identified available building-level data is of limited use in diagnosis and correction of system-specific problems. Moreover, there is currently no requirement for transmission of energy or water data. Operators and tenants do not receive regular information that would help them to understand how energy is being used at the building, space or system levels.

This proposal has two components, a requirement of a Building Management System and associated meters to be installed when a building is constructed or upgraded, and a separate requirement that the equipment be used to further awareness of building operations.

The proposed measure will effectively put an end to buildings with only "master meters" where individual energy usage cannot be directly identified. It will inform tenants in those buildings with "utility rent inclusion" of their energy usage so that they may be able to understand their improvement opportunities. Other measures propose a requirement for sub-meters or direct meters and the abolition of utility rent inclusions. The availability and feedback of actual usage data has been shown repeatedly to have a strong impact on the control and reduction of energy use.

The proposed system is in many respects similar to the sub-metering that is commonly used for pass-through billing of tenants. The proposal would systematize data and provide improved uniformity across properties and would thus enhance fairness and transparency in the real estate market.

This measure does not call for public disclosure of the data, since it refers to detailed internal operations. Current legislation before City Council will require publication of overall building data as part of the benchmarking program.

Environmental & Health Benefits

Knowledge of energy use invariably results in less energy use, although with wide variation in the extent of the reduction. Reductions in energy use will result in reduced emissions of climate change gasses and pollutants affecting human health.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of two.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.01% to 0.2%, depending on building type. It was thus categorized as incurring a low to medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years for the building types studied.

Precedents

Similar provisions for reporting and posting (labeling) of building energy performance are part of the European Directive on Buildings. The proposed energy recording and reporting is well below the standard set by the European Directive on Buildings.

Other Jurisdictions

Similar provisions for reporting and posting (labeling) of building energy performance are part of the European Directive on Buildings.

LEED

Supports the LEED points for Monitoring and supports the LEED EB product.

Implementation & Market Availability

Necessary technology is available "off-the-shelf" in terms of hardware. In most cases, existing building control systems will accept the necessary meter inputs and can download the data to a computer for storage and management.

Specific configurations will vary. Guidance should be provided for acceptable metering and reporting under various building/system configurations. This would enhance the market's comfort with the requirement.

Notes

1. The original proposal suggested this be a modification to section 405 of the Mechanical Code. Since that refers only to ventilation systems, and this proposal reaches across all building systems, it is a better fit in ASHRAE 90.1.
2. This measure works in tandem with EO02 for tenant sub-meters.
3. The \$1/sf in 6.4.6.2 (b) is exemplary and presented for comment and adjustment. Similarly, the 20% and 10% are intended to capture a few items of major equipment and can be adjusted per advisement.

EO 5: INSPECT & MAINTAIN COMMERCIAL HVAC SYSTEMS

New York City Mechanical Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Without routine inspection and maintenance, HVAC systems do not deliver on energy efficiency, thermal comfort and indoor air quality.

Recommendation:

Adopt ASHRAE 180P for the inspection and maintenance of HVAC systems in commercial buildings.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code:

1. Amend Section 102.as follows:

102.3 Maintenance. Mechanical systems, both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards that are required by this code shall be maintained in compliance with the applicable provisions under which they were installed. The owner shall be responsible for maintenance of mechanical systems. To determine compliance with this provision, the commissioner shall have the authority to require existing mechanical systems to be inspected. For all buildings of 20,000 square feet or more and, for all buildings classified in occupancy group R-2 that are four stories or more in height above grade, "ASHRAE Standard 180-2008 -- Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems" or a more recent version of such standard approved by the Commissioner shall be a part of minimal compliance with this section, in accordance with the schedule in Table 102.3. Buildings shall file a copy of the Maintenance Plan called for in ASHRAE Standard 180-2008 with the department in accordance with the schedule in Table 102.3.

Table 102.3

Building Size (square feet)	Compliance with ASHRAE Standard 180- 2008 Required	Maintenance Plan Submitted to Dept. Of Buildings
Over 250,00 sf	July 1, 2013	July 1, 2014
Over 100,000 sf	July 1, 2016	July 1, 2017
Over 50,000 sf	July 1, 2019	July 1, 2020
Over 20,000 sf	July 1, 2022	July 1, 2023

2. Amend Section 1502 as follows:

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329-2305	
Standard Reference Number	Title	Referenced in code section number
180 - 2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems 102.3	
ASHRAE—2001	ASHRAE Fundamentals Handbook—2001 312.1, 603.2	
15—2001	Safety Standard for Refrigeration Systems 1105.8, 1105.10, 1108.1	.1101.6, 1101.11, 1104.2, 1105.3, 1105.7,

34—2001	Designation and Safety Classification of Refrigerants 202, 1102.2.1, 1103.1
ASHRAE—2000	HVAC Systems and Equipment Handbook—2000 312.1

(Line for “180-2008” added.)

Supporting Information

Issue – Expanded

Current building codes and regulations do not set forth a specific minimum standard of care in the inspection and maintenance of commercial building heating, ventilating and air conditioning (HVAC) systems. The owners of commercial, institutional and other building facilities often enact inconsistent practices for inspecting and maintaining their HVAC systems. Many choose to follow rigorous policies that maintain the system in new or nearly new condition. Other owners either lack policy in this area or have adopted a run-to-failure approach where the system or components of the system are attended to only when there is a total failure. When there is no routine inspection and subsequent adjustment or maintenance of system operation and components, the system typically performs poorly. Consequently, the system does not provide the intended energy efficiency to the owners or thermal comfort and indoor air quality to the occupants.

ASHRAE 180 was developed in response to this situation to provide a basic guideline to good practice in HVAC maintenance. It is now a mature and approved standard. The primary requirement is that a specific plan be developed for the building at hand that recognizes each significant piece of equipment and establishes a schedule for inspection, adjustment, and replacement when needed. The description of Standard 180 specifically states that it does not comprise a complete maintenance program by itself: “Ancillary maintenance issues related to equipment reliability, equipment robustness and minimizing overall maintenance costs are also appropriate in order to protect the HVAC capital investment and/or minimize system downtime. These issues, however, are outside of the scope of this standard.” Hence Standard 180 is necessary but not sufficient for minimal compliance with Section 102.3.

Environmental & Health Benefits

This measure will help ensure that the indoor environment in all buildings where persons work, visit, or reside will be maintained at the healthiest and most comfortable level possible. The enhanced energy efficiency and boiler operations will result in lower emissions of pollutants and greenhouse gases.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. This proposal was also estimated to generate significant annual financial savings.

Building operators and owners will bear the slight cost of inspection and maintenance program, but the increment over a competent maintenance program is minimal or negative once the Maintenance Plan has been prepared. These statements refer to the cost of setting up and following the protocols of Standard 180P, but do not include the cost of actual maintenance. However, any apparent increase in actual maintenance costs, such as the cost of fan belts that might not otherwise have been replaced, will be returned many times over either in fuel and electric savings or in avoided lack of services.

Precedents

The Mechanical Code explicitly considers maintenance to be within its purview:

“101.2 Scope. This code shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings.”

This measure ensures that the mandate above will be carried out professionally.

LEED

EO 5: INSPECT & MAINTAIN COMMERCIAL HVAC SYSTEMS

Adherence to this requirement will provide material assistance for buildings striving for a LEED for Existing Buildings – Operations and Maintenance certification.

Implementation & Market Availability

This service is widely available and can be procured from HVAC service contractors. Expertise with the precise requirements of 180P will grow rapidly and naturally as the market expands.

EO 6: ESTABLISH MAXIMUM HEATING & MINIMUM COOLING TEMPERATURES

Study

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

The City Multiple Dwelling Law requires a minimum indoor temperature during the heating season. However, there is no maximum temperature, allowing for overheated buildings. In addition, there are no temperature regulations during the cooling season.

Recommendation:

Undertake a study on the feasibility of limiting heating in winter and cooling in summer from central systems.

Proposed Legislation, Rule or Study

The City of New York should undertake a study, to assess the practicality of establishing an upper temperature limit for heating in winter and lower temperature limit for cooling in summer. This study should be completed within a six-month period and should examine whether temperature limits are enforceable and feasible given the range in capacities of existing central systems. If the study determines the limits are enforceable and feasible, it should also propose a regulatory framework for implementing this proposal.

Supporting Information

Issue- Expanded

Many apartment buildings are overheated in winter and many office buildings are overcooled in summer. It is not uncommon for New Yorkers to leave a sweater at work in August or bring one when going to the movie theatre, or to see open apartment windows in the depth of winter. In addition to being wasteful, these practices increase the likelihood of summer brownouts and can affect worker health.

The Multiple Dwelling Law establishes minimum temperatures for multi-family residential buildings. However, neither this law nor any other establishes maximum heating temperatures or limits on summer cooling.

While limiting heating and cooling of central systems may seem like matter of simply changing the temperature on a thermostat, the reality of complex building systems means that regulation of temperatures may prove challenging. For instance, the top apartment in a building might require excessive heat due to poor roof insulation, leading to overheating on lower floors. Conversely, a strong “stack effect” may cause heat to rise rapidly in the building, overheating the top floors. In addition to these technical issues, it may be difficult to enforce such temperature limits. Nonetheless, the potential energy savings for doing so make this an issue for further investigation.

Environmental & Health Benefits

Reducing winter heating and summer cooling would save energy, improve air quality, and improve working and living environments. Reductions in summer electricity demand would also reduce the likelihood of brownouts. Since this proposal is for a study, there are no direct environmental or health impacts.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs. However, this proposal was estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents

There are no known precise precedents for this proposal. The Multiple Dwelling Law provides precedent for regulating indoor temperatures during the heating season.

LEED

Implementation of temperature limits could help a project achieve LEED energy points under almost all of the various LEED rating systems.

EO 6: ESTABLISH MAXIMUM HEATING & MINIMUM COOLING TEMPERATURES

Implementation & Market Availability

There are no implementation or market barriers to this proposal.

EE 1: IMPROVE ENERGY MODELING FOR BUILDING DESIGN

ANSI/ASHRAE/IESNA Standard 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue :

ASHRAE 90.1 allows designers to follow a prescriptive path or to use energy modeling to demonstrate compliance. Energy modeling, however, is prone to manipulation because it lets enhanced efficiency in one energy system be traded off against poor efficiency in another system.

Recommendation

Require projects using energy modeling to demonstrate design energy use that is 14% lower than the prescriptive path.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Amend Section 4.2.1.3 as follows:

4.2.1.3 Alterations of Existing Buildings. *Alterations of existing buildings* shall comply with the provisions of Sections 5, 6, 7, 8, 9, and 10 or Section 11 provided, however, that nothing in this standard shall require compliance with any provision of this standard if such compliance will result in the increase of energy consumption of the building.

2. Amend Section 11.1.4 as follows:

11.1.4 Compliance. Compliance with Section 11 will be achieved if

a. all requirements of Sections 5.4, 6.4, 7.4, 8.4, 9.4, and 10.4 are met;

b. the *design energy cost*, as calculated in Section 11.3, does not exceed 90% of the *energy cost budget*, as calculated by the simulation program described in Section 11.2, for New Buildings, or does not exceed 95% of the *energy cost budget*, as calculated by the simulation program described in Section 11.2, for alterations of existing buildings or additions to existing buildings; and

c. the *energy efficiency level* of components specified in the building design meet or exceed the *efficiency levels* used to calculate the *design energy cost*.

Supporting Information

Issue- Expanded

The currently allowable tradeoffs permit, for instance, that the energy efficiency gained by lower lighting density in MEP rooms can be traded off against a lower efficiency for the façade, even though the life expectancy of the two systems is greatly different. This type of allowable tradeoff creates a problem, since the short-life energy efficiency measures may not be continued after their useful life ends, while the inefficiency of long-lived systems will remain in place for a very long time. Also, while very hard to quantify, there is no doubt that a certain amount of gaming is possible under the performance path, leading to buildings whose actual performance falls short of the estimates generated during design. The purpose of this proposal is to level the playing field on both counts, and to ensure that buildings permitted using the performance path perform during their lives as well as buildings permitted under the prescriptive path.

Environmental & Health Benefits

Environmental and health benefits, in terms of calculated savings, at level of building/installation (and sometimes at citywide level) will accrue due to lower energy use.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.3% to 2.9%, depending on building type. It was thus categorized as incurring a medium to higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years depending on the building type.

Precedents

There are no known precedents for this proposal

LEED

LEED prerequisites for Minimum Energy Performance under the Energy & Atmosphere sections of LEED NC, LEED CS, LEED CI and LEED for Schools require that the scope of work complies with *ANSI/ASHRAE/IESNA standard 90.1-2007*. In addition, a greater number of LEED points or “Optimize Energy Performance” accrue as the project’s energy cost budget decreases below that of the base case building. This proposed code requires compliance with measures exceeding *ASHRAE 90.1-2007*, and will require performance consistent with two points in this category.

Implementation and Market Availability

There are no known implementation difficulties for this proposal.

Notes

The committee notes that if the percentage savings were calculated under Appendix G instead of Chapter 11, the buildings would have a more uniform baseline. The difference in baselines is most important for residential-type buildings (housing, hotels, and dormitories). Under Appendix G all residential-type buildings would have as a baseline PTACs. Under Chapter 11, a residential building using PTACs would have PTACs as a baseline, if using water loop heat pumps would have water loop heat pumps as a baseline, and if using an absorption chiller would have an absorption chiller as a baseline. If each of these buildings demonstrated 14% reduction in energy cost against its own baseline, the building with PTACs would probably have a significantly higher energy cost than the one with the absorption chiller. Such difficulties stem from the fact that Chapter 11 was not devised to be used as a baseline in order to demonstrate percentage energy savings; it is Appendix G that was created for this purpose. Yet Chapter 11, rather than Appendix G, forms the basis for the Energy Code.

However, Appendix G requires that the entire energy use of the building be included in the calculation, while Chapter 11 refers only to regulated loads (i.e., excluding computers, printers, copiers, elevators, escalators, kitchen, dishwashing, drying, process and others). Also, for Core & Shell, Chapter 11 refers only to the uses under the control of the developer (i.e., excluding the tenant loads such as lighting and computers). Thus, a 10% reduction under Chapter 11 is easier to attain than a 10% reduction under Appendix G, if the baseline is the same – as is usually the case for office buildings.

The committee will consider the ramifications of substituting the requirements for Appendix G to the ones for Chapter 11. One possibility may be to address the most significant problem in Chapter 11 by requiring, for residential-type buildings, that the baseline be made PTACs regardless of the system type used in the design.

EE 2: Improve Analysis of Heating & Cooling Needs During Design

Department of Buildings Forms; New York City Mechanical Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:
Equipment used to heat and cool buildings is often over-sized, resulting in operating inefficiency. To size the equipment appropriately, it is important to accurately calculate the peak heating and cooling load demands of buildings.

Recommendation:
As part of the plans submitted to the Department of Buildings for approval, require detailed calculations of peak heating and cooling loads.

Proposed Legislation, Rule or Study

Changes to Department of Buildings Forms

To apply to all applications including heating and cooling equipment.

For heating equipment, add to DOB Form PW1C: Schedule C, Section 4 Boiler Specifications a check box certifying that the boiler capacity is consistent with peak load calculations included in plans per section 106.6 of the Mechanical Code.¹

For cooling equipment, add to DOB Form PW4: Equipment Use Application/Permit, Section 5 "Equipment Specifications" a check box certifying that the equipment capacities in BTU per hour are consistent with peak loads presented in the building plans per Section 106.8 of the Mechanical Code.

Amendments to the New York City Mechanical Code

1. Amend section 106.6 as follows:

106.6 Heating systems. Construction documents for heating systems shall include the temperature to be maintained in every room [and the output capacity in BTU per hour (0.2931 W) of the central heating source.], the peak heating demand in BTU per hour in every room, the peak heating demand in BTU per hour in every zone, and the output capacity in BTU per hour of the central heating source. The peak load calculations shall be in accordance with the procedures described in the ASHRAE Fundamentals Handbook, and shall include the following:

1. Thermal transmission load, including thermal bridging of frames and mullions, exposed slab edges, parapets, balconies, concrete columns, steel members, and any other significant thermal connection between the conditioned space and the outdoor and underground environment;
2. Ventilation load, accounting for all specified mechanical ventilation but assuming that windows are closed;
3. Infiltration load, accounting for leakage around all doors, windows, and other envelope penetrations, but recognizing specified air barriers;
4. Internal heat gains when predictable, accountable and manageable; and
5. Solar gains, based on glazing characteristics.

Rooms that are identical with respect to these characteristics may be calculated and reported as aggregates within

zones.

2. Amend section 106.8 as follows:

106.8 Air conditioning and ventilating systems. Construction documents for air conditioning and ventilating systems shall contain plans that include the following data and information:

1. The peak cooling load in BTU per hour in every room, the peak cooling demand in BTU per hour in every zone, and the peak cooling load in BTU per hour on the entire building. The peak load calculations shall be in accordance with the procedures described in the ASHRAE Fundamentals Handbook, and shall include the following:

(a) Thermal transmission load, including thermal bridging of frames and mullions, exposed slab edges, parapets, balconies, concrete columns, steel members, and any other significant thermal connection between the conditioned space and the outdoor and underground environment;

(b) Ventilation load, accounting for all specified mechanical ventilation but assuming that windows are closed;

(c) Infiltration load, accounting for leakage around all doors, windows, and other envelope penetrations, but recognizing specified air barriers;

(d) Internal heat gains when predictable, accountable and manageable; and

(e) Solar gains, based on glazing characteristics.

Rooms that are identical with respect to these characteristics may be calculated and reported as aggregates within zones.

[1] 2. The location and sizes of all ducts; the location of all fire and smoke dampers, motors, fans, and filters; the type, air capacity, and size of all equipment; and where not shown on accompanying structural plans, the operating weight and manner of support of equipment.

[2] 3. The locations of smoke detecting devices.

[3] 4. The location and size of the fresh air intake, the design population, and the required ventilation for each room or space.

[4] 5. The amount of air to be exhausted or supplied from each outlet for each room or space.

[5] 6. In the case of ventilating or exhaust systems for ranges, fryers, ovens, and other similar types of restaurant or bakery equipment, for which a hood is required, the plans shall also show the type of extinguishing system, the location of heat detection devices, nozzles, piping, gas controls, manual and automatic control valves, method of joining ducts, method and location of discharging exhaust from building, the location of break-glass controls, and the quantity in cfm designed for each hood.

Supporting Information

Issue - Expanded

This proposal will enforce good practice in the design of mechanical systems in buildings. In order to specify the correct equipment for a building, the detailed heating and cooling loads must be thoroughly understood. Many engineers currently guess or use rules of thumb or rely on manufacturers who sell the equipment to provide the sizing requirements. Without calculations on the drawings, important communication between the architect, the engineer, and the owner may not take place. Further, authorities having jurisdiction cannot easily review anticipated loads or readily discern whether a building will meet energy efficiency standards without the information called out in this proposal. One effect of this proposal will be to make the oversizing of systems less common. In the absence of careful load calculations, the designer is tempted to specify a generously sized boiler and AC system to ensure that there are no future complaints about failure to meet load on cold or hot days. But the result, especially for small and midsized equipment, is overly rapid cycling, which results in low efficiency and waste. (This is less of a problem with large equipment for which the output can be modulated to match the load.)

Environmental & Health Benefits

Environmental and health benefits will accrue as a result of reduced fuel and electricity consumption, but the savings will vary widely since the measure reduces bad practice, rather than changing any readily calculated metric.

This proposal was found to have a low, positive impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.02% to 0.04%, depending on building type. It was thus categorized as incurring a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years for some building types.

Precedents

This proposal includes a return to the standards of the 1968 code, which required in Article 17, §[C26-116.3] 27-182: "(a) Air Conditioning and Ventilation Systems.- Plans for air conditioning and ventilating systems shall contain at least the following data and information: (1) The location and sizes of all ducts the location of all fire dampers, motors, fans, and filters the type, air capacity, and size of all equipment; and . . . (e) Heating Systems.- Plans for heating systems shall contain at least the following data and information: (1) the temperature to be maintained in every room, and (2) the amount of heat in Btu per hour to be provided in every room, and the output capacity in Btu per hour of the central heat sources" (§[C26-116.3] 27-182 Plans required, Article 17: Applications for Equipment Work Permits of Title 27, Chapter 1: Construction and Maintenance.² It is not clear how well those code requirements were honored. This proposal contains an additional reporting requirement.

Although this measure will result in greater energy efficiency, it is a better fit to sections of the Mechanical Code than to the New York City Energy Code, since it involves system design and sizing.

LEED

There are no LEED credits directly affiliated with this proposal

However, due to improved energy performance resulting from these measures, this proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems. These prerequisites require that the scope of work for Minimum Energy Performance is in accordance with ANSI/ASHRAE/IESNA standard 90.1-2004, or the local energy code, whichever is more stringent. LEED 2009 will reference ANSI/ASHRAE/IESNA standard 90.1-2007.

These recommendations will also facilitate achieving LEED Energy and Atmosphere credits:

- LEED NC- EA cr.1 Optimize Energy Performance;
- LEED CI-EA cr. 1.3 Optimize Energy Performance, HVAC;
- LEED EB-EA cr.1 Optimize Energy Performance;
- LEED ND-GCT cr.2 Energy Efficiency in Buildings;
- LEED for Schools EA cr.1 Optimize Energy Performance;
- LEED for Homes EA cr.1 Optimize Energy Performance;
- Credits under LEED pilot programs.

These credits require exceeding the minimum standards established by the Energy and Atmosphere prerequisites.

The process of including this information in a project's construction documents will expedite the LEED certification process, which requires submittal templates with detailed tables and calculations.

Implementation and Market Availability

There are no known implementation issues for this proposal. The practice was called for in the previous version of the Building Code.

Endnotes:

¹ The City of New York, NY., Forms: Permits, http://www.nyc.gov/html/dob/html/forms/forms_permits.shtml#pw1 (last visited Jan.

28, 2010); and INTERNATIONAL BUILDING CODE § BC 106.14 (2008).

² CITY OF NEW YORK, NY., BUILDING CODE Tit. 27, ch. (2008), available at http://www.nyc.gov/html/dob/downloads/bldgs_code/bc27s1.pdf.

EE 3: Assess Co-generation Feasibility in Large Buildings

ANSI/ASHRAE/IESNA Standard 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

Summary

Issue:

Properly designed co-generation systems are roughly twice as efficient as electricity from the grid because these systems utilize waste heat from electric generation. Owners are often unaware of the potential for co-generation in their buildings.

Recommendation:

Require new developments of 350,000 square feet or more to analyze the potential for co-generation.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA Standard 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

1. Add a new Section 1.1.1.5.1.2(4) as follows:

1.1.1.5.1.2 Energy Analysis

4. For new building projects or substantial improvements larger than 350,000 gross sq. ft., including one or more new buildings on a lot, a feasibility analysis, as defined by the department, for combined heat and power shall be provided. At a minimum, such analysis shall include an identification of operational or technical barriers, conceptual engineering, and a preliminary economic analysis, including a simple payback calculation, as per a Level 1 Feasibility Analysis as defined by the United States Environmental Protection Agency.

Amendments to the New York City Building Code

2. Amend Section 202 to include the following definitions:

CO-GENERATION SYSTEM: See COMBINED HEAT AND POWER SYSTEM

COMBINED HEAT AND POWER SYSTEM: A system, including but not limited to turbines, micro-turbines, reciprocating engines, and fuel cells, that generates both electrical power and heat that can be productively utilized for the heating or cooling of space, domestic water, or processes.

Supporting Information

Issue – Expanded

Cogeneration offers substantial fuel savings when utilized in larger buildings to produce both electric power and heat. But because it is a somewhat unfamiliar technology, which is sometimes thought of as “only for the real pros”, cogeneration is not even considered during design development for many buildings that could profit from its use. This proposal would require buildings large enough to be reasonable candidates for cogeneration to conduct a simple feasibility study to determine whether the option would be worth examining further.

A level 1 feasibility analysis identifies potential operational or technical barriers, such as power purchase contracts that prevent installation of on-site power generation or local utility and regulatory policies that hamper distributed generation. This exercise also includes an economic analysis of the projected budget and payback. The budget estimate includes the cost of construction, CHP system tie-in, and operations and maintenance. The payback calculation takes into account: (1) the amount of heat and power produced by the CHP system, and the estimated amount of each to be used on the site, (2) the avoided costs of utility-purchased heat and power, (3) the amount and cost of fuel associated with running the CHP system, and (4) the budgetary cost to install and maintain the system.

Environmental & Health Benefits

Co-generation offers considerable environmental benefits when compared with purchased electricity and on-site-generated heat. By capturing and utilizing heat that would otherwise be wasted from the production of electricity, co-generation systems require less fuel than equivalent separate heat and power systems to produce the same amount of energy.²

Because less fuel is combusted, greenhouse gas emissions, such as carbon dioxide (CO₂), as well as criteria air pollutants like nitrogen oxides (NO_x) and sulfur dioxide (SO₂), are reduced.³ With electricity created on site, co-generation also means a reduction of the strain on New York City's Electricity grid.⁴

This proposal was found to have a positive indirect environmental impact.

This proposal was found to have a positive indirect health impact.

Cost / Savings

This proposal, which requires only a simple study, is not expected to have any significant impact on capital costs. Nor will the study itself generate any savings.

Precedents

The Revised Code of Washington state includes a section on the investigation and development for cogeneration projects in new and existing state facilities, which includes performing a feasibility study on the project's cost-effectiveness and energy efficiency.⁵

LEED

There are no LEED credits affiliated with the completion of a feasibility analysis.

Should the analysis result in actual co-generation systems being implemented, LEED for Neighborhood Development GCT cr.12 On-Site Energy Generation addresses this type of system. Additionally, there would be applicable LEED credits for meeting energy performance standards under the Energy & Atmosphere sections of the various rating systems, and improved air quality resulting from a reduction in CO₂ emissions, which would assist in complying with Indoor Environmental Quality credits.

Implementation and Market Availability

There are no known implementation issues for this proposal.

¹ U.S. EPA, Combined Heat and Power Partnership: Stage 2: Level 1 Feasibility Analysis, <http://www.epa.gov/CHP/project-development/stage2.html> (last visited Jan. 28, 2010).

² U.S. EPA, Combined Heat and Power Partnership: Basic Information, <http://www.epa.gov/CHP/basic/index.html> (last visited Jan. 28, 2010).

³ Ibid.

⁴ Ibid.

⁵ WASH. REV. CODE § 39.35C.070 (1996), available at <http://apps.leg.wa.gov/RCW/default.aspx?cite=39.35C.070>.

EE 4: IMPROVE ENERGY & WATER EFFICIENCY UPON SALE OF RESIDENCES

New York City Administrative Code and New York City Building Code
Proposal developed by the Homes Committee

Summary

Issue:

Housing stock accounts for over 37% of the total energy consumed in NYC. Year after year, these properties are renovated before or after they are sold. But typically, these renovations do not include cost-effective energy or water efficiency improvements.

Recommendation:

Require one- to two-family houses and apartments to implement simple energy and water conservation measures at the time of sale and major renovation, unless a property has been sold under financial distress

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Add a new Chapter 30 to Title 11 as follows:

Chapter 30

CONSERVATION IMPROVEMENTS UPON SALE OR RENOVATION OF RESIDENTIAL PROPERTY

§11-3001 Definitions

§11-3002 Conservation Improvements

§11-3003 Exceptions

§11-3004 Rules

§11-3001 Definitions. a. For the purposes of this chapter only, the following terms shall have the following meaning:

(1) "Certificate of compliance" shall mean a certificate by a certification agent attesting that a covered property is in compliance with the standards prescribed in this chapter. Such certificate of compliance may be recorded against a covered property.

(2) "Certification agent" shall mean a person who has received a certification by the Department of Buildings demonstrating expertise in energy efficiency and the capability to assess compliance with this chapter.

(3) "Covered property" shall mean a building, or an individual dwelling unit within a building, classified in occupancy group R in accordance with Chapter 3 of the *New York City Building Code* that is less than fifty thousand square feet. A building shall not be a covered building if more than fifty percent of the uses, measured in square feet of floor area, in such building are other than in occupancy group R.

(4) "Insufficient roof cavity" shall mean vertical clear height, measured from the top of the bottom chord of the truss or ceiling joist to the underside of the roof structural members or rafters at the roof ridge or high point, that is less than 12 inches.

b. The terms "consideration", "deed", "grantee", "grantor", "instrument", "net consideration", "transaction", and "transfer" shall have the meaning set forth in section 11-2101 of this code.

§11-3002 Conservation Improvements. a. Prior to the delivery of a deed for a covered property from grantor to grantee, the grantor of such covered property shall submit to the grantee a certificate of compliance demonstrating compliance with the standards prescribed in subdivisions (b) and (c).

b. An entire building shall comply with the following standards:

(1) Any showerhead that consumes more than 2.5 gallons per minute and any toilet that consumes more than 1.6 gallons of water per flush shall be replaced with a showerhead / toilet that is compliant with the water consumption requirements of section 604.4 of the New York City Plumbing Code. Any sink or lavatory faucet that does not comply with the water consumption requirements of section 604.4 of the New York City Plumbing code shall either be fitted with an aerator to bring such faucet into compliance or be replaced with a compliant faucet.

EE 4: IMPROVE ENERGY & WATER EFFICIENCY UPON SALE OF RESIDENCES

(2) Any roof that is uninsulated or whose existing insulation has a thermal resistance value of R-11 or less, shall be insulated to a minimum thermal resistance value of R-38; provided that any building with insufficient roof cavity shall install insulation with the highest thermal resistance value that can fit within such space. Prior to the installation of any such insulation, any roof subject to this subsection shall be inspected for leaks and any leaks shall be repaired.

(3) Any leaks in furnace ducts at all joints in the ducting system and at the plenum shall be sealed with pressure sensitive tape or mastic. Furnace ducts shall be insulated to a minimum thermal resistance value of R-3 except where ducts are inside heated space, between floors, inside interior walls or partitions, are asbestos coated, or otherwise inaccessible without alteration.

(4) Any domestic storage water heater shall be insulated with an external insulation blanket rated at a minimum thermal resistance value of R-12. This requirement shall not apply where there is less than two inches clearance from all walls and other permanent fixtures and where the thermal resistance of the water heater insulation jacket is R-12 or greater. Water heaters shall include a pressure-temperature (PT) safety release valve.

(5) Any uninsulated hot water pipes in pumped, recirculating domestic water heating systems shall be insulated to a minimum thermal resistance value of R-3. This requirement shall not apply to any hot water pipes between floors, inside interior walls, or deemed otherwise inaccessible by the certification agent.

(6) Any exposed, uninsulated hot or cold water pipe within twenty-four inches of a water heater shall be insulated to a minimum thermal resistance value of R-3.

(7) Weatherstripping shall be applied to all exterior doors and caulking shall be applied to any visible cracks in window assemblies and other shell penetrations.

(8) Any fireplace chimney shall include a damper or door to block airflow.

(9) Any building shall install programmable thermostats in compliance with sections 403.1 of the Energy Conservation Construction Code of New York State or energy controls in compliance with either Section 6.3 or Section 6.4.3 of INSA/ASHRAE/IESNA 90.1 (2007), as applicable.

c. An individual dwelling unit shall comply with the following standards:

(1) Paragraph (1) of subdivision (b) of this section.

(2) If heat or hot water is supplied to the individual dwelling unit through a dedicated heating system or hot water heater, and the owner of such unit has the right to access and modify such system or hot water heater, such system or heater and its piping shall comply with any applicable provisions of paragraphs (3), (4), (5) and (6) of subdivision (b) of this section, and shall include thermostatic controls, either through thermostatic controls for the heat supply to the entire unit or on each radiator.

d. In lieu of delivering a certificate of completion as provided in subdivision (a) hereof, prior to the delivery of the deed, the grantor may assign and the grantee may assume any and all of the grantor's obligations under this section pursuant to a contract executed by the grantor and grantee. Such contract shall:

(1) provide that the grantee shall complete any and all of grantor's assigned obligations within a period no later than eighteen months following the conveyance of the deed; provided, however, that the grantee may apply to the commissioner of the department of buildings for an extension of such completion date, which the commissioner may grant in his or her discretion;

(2) require grantor to deposit in escrow funds equal to the maximum required expenditure for the covered property as set forth in subdivision (a) of section 11-2122 of this chapter. The escrow agent shall distribute such funds to grantee, upon grantee's written request, to perform or cause the performance of grantor's obligations under this section that have been assumed by grantee. Any funds remaining in the escrow upon the completion of such work shall be returned to grantor. In the event grantee fails to complete the obligations assumed pursuant to the contract within the period provided in paragraph (1) of this subdivision, then escrow agent shall pay any funds in the escrow to the department to be deposited in a special fund established by the department to further green technologies, energy efficiency and conservation in building construction and operation. Upon the forfeiture of such funds, grantee shall have no further liability under this section. In no event shall grantor have any further liability under this section after depositing in escrow funds in the amount of the maximum required expenditure.

e. At least once every two years, the Commissioner of Buildings, in conjunction with the Mayor's Office of Long-Term Planning & Sustainability, shall review and, if necessary, recommend to the Mayor and the City Council new requirements or standards.

§11-3003. Exceptions.

a. The maximum required expenditure to bring a covered property into compliance with this chapter shall be:

(1) 0.75 percent of the consideration for the transfer of a covered property that is a building (or portion of a building) classified in occupancy groups R-3 or of the consideration for the transfer of a covered property that is an individual dwelling unit classified in occupancy groups R-1 or R-2; and

(2) Fifty cents per square foot for any covered property that is a building classified in occupancy groups R-1 or R-2.

b. This chapter shall not apply to the delivery of a deed:

(1) pursuant to inheritance, involuntary transfer of title resulting from default on an obligation secured by real property, change of title pursuant to marriage or divorce, condemnation, or any other involuntary change of title effected by operation of law;

(2) pursuant to a transaction described in section 11-2106 of this code, other than a transaction described in paragraph (2) of subdivision (b) of such section;

(3) that is for a covered property where the net consideration of the conveyance of such covered property is less than the net consideration paid by the grantor for an economic interest in the covered property;

(4) that is the grant, assignment or surrender of a leasehold interest in a covered property; or

(5) that is for a covered property scheduled for demolition within one year of the delivery of the deed, provided the grantor or grantee has obtained a demolition permit from the Department of Buildings, and such real property is demolished within one year of delivery of the deed.

c. The Commissioner may exempt any covered property from the provisions of this chapter upon a determination of undue hardship.

§ 11-3004. Rules. The Commissioner shall promulgate any rules necessary or appropriate to implement this chapter.

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 401.4 as follows:

401.4 Alterations. Upon any alteration of any individual dwelling unit in a residential building of less than fifty thousand (50,000) square feet costing fifty thousand dollars (\$50,000) or more, the owner of such dwelling unit shall undertake conservation improvements in accordance with chapter 30 of title 11 of the Administrative Code of the City of New York.

Amendments to ANSI/ASHREA/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 4.1.1.6 as follows:

4.1.1.6 Alterations Upon any alteration of any individual dwelling unit in any existing building of less than fifty thousand (50,000) square feet, classified in occupancy group R and costing fifty thousand dollars (\$50,000) or more, the owner of such dwelling unit shall undertake conservation improvements in accordance with chapter 30 of title 11 of the administrative code of the City of New York.

Supporting Information

Issue – Expanded

Green building policy in New York City has focused primarily on large, high-rise buildings because, although few in number, they are responsible for half of building energy use. While this approach is logical, New York City will be unable to reduce its greenhouse gas emissions by 30% by 2030, as required by city law, if all buildings are not part of the solution.

NYC's housing stock accounts for over 37% of the total energy consumed. One challenge to improving the energy (and water) efficiency of housing is that ownership is dispersed and owners have limited access to capital.

Other U.S. cities are improving the efficiency of their housing stock by requiring the most basic and most cost-effective energy and water efficiency improvements when small residential buildings and apartments are sold or undergo expensive renovations. The sale of a property is a logical time to undertake efficiency measures because buyers and sellers typically make improvements to a home either right before or after the sale and it is a time when they have financing. Other municipal energy/water improvement ordinances wisely include provisions exempting properties sold under financial duress and limit the cost of any required improvements to a small percentage of the sale price. It should be noted that this proposal limits the cost of conservation improvements for 1-2 family homes to a maximum of 0.75% of the sale price; in comparison, real estate brokers charge sellers 6% of the sale price for their services.

Environmental & Health Benefits

The wise and efficient use of energy and water is essential to the health, safety and welfare of the people of the City of New York. In 2007, 2.5% of 1-3 family homes in NYC were sold, meaning this proposal has the potential to improve the efficiency of a large number of homes over time.¹

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in

which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase costs at the time of sale by up to 0.75%. It was thus categorized as incurring a higher cost increment.

Precedents

Several U.S. cities have implemented similar standards to this proposal. San Francisco, for example, has required energy conservation upgrades at the time of sale and major renovation since 1982 through the Residential Energy Conservation Ordinance (RECO).² RECO mandates limited energy and water efficiency measures at the time of sale for one- and two-family dwellings, apartment buildings, and residential hotels.³ The ordinance also requires upgrades at major renovations, which is defined as renovations in excess of \$20,000 for one- and two-family dwellings, \$6,000 per unit for apartment buildings,⁵ and \$1,300 per unit for residential hotels.⁴ Upgrades are also required at meter conversions and condo conversions.

Similarly, on November 25, 2008, the Santa Rosa (California) City Council accepted its Green Building Advisory Committee's recommendations, including Recommendation D.⁶ Recommendation D creates "energy efficiency requirements for existing residential and non-residential buildings, to be triggered by a transfer of title or major renovation."⁷

Other Jurisdictions:

1. Berkeley requires homeowners to implement certain energy conservation measures before ownership changes. Homeowners are not required to spend more than .75% of the final sale price for a structure with two units or less, or fifty cents per square foot in a structure containing three units or more.⁸
2. Burlington, VT, Ann Arbor, MI, and the State of Wisconsin have residential energy conservation ordinances for rental properties.⁹
3. The State of California recently amended its Water Code to add a new Section 379, stating that it's the intent of the legislature for lower jurisdictions implementing the code to enact ordinances requiring the retrofit of outdated fixtures at the time of sale of properties.¹⁰
4. Boulder, CO is considering implementing a Residential Energy Conservation Ordinance.¹¹

LEED

LEED does not specifically refer to energy improvements at time of building sale. However, the implementation of this proposal would facilitate achieving credits in numerous areas of the LEED for Homes rating system.

These LEED for Homes credits include but are not limited to: WE cr. 3 Indoor Water Use (requires slightly more efficient fixtures than included herein); EA cr. 1 Optimize Energy Performance (requires compliance with Energy Star); EA cr. 3 Air Infiltration (addresses the air leakage rate of the building envelope); EA cr. 5 Heating & Cooling Distribution System (addresses duct leakage); EA cr. 6 Space Heating & Cooling Equipment (addresses piping designed as part of a heat pump system); EA cr. 7 Water Heating (requires more pipe insulation than included herein).

Many of these credits are mutually exclusive. Project teams must refer to LEED reference manuals to determine compliance.

Any project classified under occupancy group R which is seeking certification via the LEED for Existing Buildings rating system, will more easily achieve Energy & Atmosphere credits by adhering to the measures outlined in this proposal.

Implementation and Market Availability

Any building materials needed to implement this proposal are readily available.

Care should be taken when insulating ceiling cavities to protect lighting housing intended for non-insulated ceilings.

ENDNOTES:

¹ CITY OF NY DEP'T OF FIN., ANNUAL REPORT ON THE NYC PROPERTY TAX FISCAL YEAR 2008 (2008), http://nyc.gov/html/dof/html/pdf/08pdf/nyc_property_tax_fy08.pdf. (As of 2008, there were 1,049,031 one, two and three family residential units in New York City (p. 1) and 26,234 were sold in 2007 (p. 34). Sales %: 26,234/1,049,031 = 2.5%).

² CITY OF SAN FRANCISCO DEP'T OF BLDG. INSPECTION, WHAT YOU SHOULD KNOW ABOUT THE RESIDENTIAL ENERGY CONSERVATION ORDINANCE (2006), http://www.sfgov.org/site/uploadedfiles/dbi/Key_Information/ResidEnergyConsOrd1006.pdf.

³ Ibid. at 2-3.

⁴ Ibid.

⁵ Ibid.

⁶ CITY OF SANTA ROSA CITY COUNCIL, AGENDA ITEM #11.1: GREEN BUILDING ADVISORY COMMITTEE REPORT (Nov. 25, 2008), http://ci.santa-rosa.ca.us/doclib/agendas_packets_minutes/Documents/20081125_CC_Item11.1.pdf.

⁷ Ibid. at 7-9.

⁸ BERKELEY, CA., MUN. CODE ch. 19.16 (1991), available at

<http://www.codepublishing.com/ca/berkeley/html/Berkeley19/Berkeley1916/Berkeley1916.html>.

⁹ HOWARD GELLER, NEVADA ENERGY EFFICIENCY STRATEGY, 37.

¹⁰ CAL. WATER CODE § 379 (“It is the intent of the Legislature that public entities exercise authority pursuant to this chapter to enact ordinances that require the retrofitting of outdated, high water use plumbing fixtures, and the disclosure thereof, in connection with the transfer of real estate.”).

¹¹ RACHEL REISS & JOSH RADOFF, CITY OF BOULDER OFF. OF ENVTL. AFF., CONSIDERATION OF A RESIDENTIAL ENERGY CONSERVATION ORDINANCE FOR BOULDER, CO., (2007), available at http://www.recaonline.com/docs/arc/arc2008/PointofSale_BoulderCO.pdf.

EE 5: IMPROVE EFFICIENCY OF BOILERS & HEATING DISTRIBUTION SYSTEMS

ANSI/ASHRAE/IESNA 90.1 (2007) and Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

The energy code permits the use of inefficient boilers and heat-distribution systems.

Recommendation:

Establish higher efficiency standards for heating systems. Also, prohibit the installation of new one-pipe steam systems and other inefficient systems.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007)

1. Amend Section 6.3.2(d) as follows:

d. Heating (if any) shall be provided by (i) a unitary packaged or split-system heat pump that meets the applicable efficiency requirements shown in Table 6.8.1B (heat pumps) or Table 6.8.1D (packaged terminal and room air conditioners and heat pumps), (ii) a fuel fired furnace (x) with a capacity less than 225,000 Btu/hour that meets the applicable efficiency requirements shown in Table 6.8.1E (furnaces, duct furnaces, and unit heaters); or, (y) with a capacity of 225,000 Btu/hour or more and meeting the greater of the applicable efficiency requirements shown in Table 6.8.1E (furnaces, duct furnaces, and unit heaters) or 81%; in either case using the test procedures specified in Table 6.8.1E; or (iii) [an electric resistance heater, or] a baseboard system connected to a boiler (x) with a capacity less than 300,000 Btu/hour that meets the applicable efficiency requirements shown in Table 6.8.1F (boilers); or, (y) for such units with capacity of 300,000 Btu/hour or more, meeting the greater of the applicable efficiency requirements showing in Table 6.8.1F (boilers) or 81%; in either case using the test procedures specified in Table 6.8.1F. Atmospheric boilers shall not be permitted. The capacity of any auxiliary electric resistance space heater(s) shall be limited to a maximum of 5% of the peak heating load of the building.

2. Add a new Section 6.3.2(p) as follows:

p. One-pipe steam distribution is prohibited. No steam terminal units shall be permitted with capacity less than 500,000 Btu/hour. All hydronic distribution shall utilize radiation sized to permit a heating design point water supply temperature not to exceed 190°F.

Exception: Steam radiators may be replaced by equivalent units of similar or greater capacity and thermal mass if fewer than 10% of the radiators in the building are being replaced in one calendar year.

3. Amend Section 6.4.1.1 as follows:

6.4.1.1 Minimum Equipment Efficiencies – Listed Equipment-Standard Rating and Operating Conditions. Equipment shown in Tables 6.8.1A through [6.8.1G] 6.8.1D and 6.8.1G shall have a minimum performance at the specified rating conditions when tested in accordance with the specified test procedure except that furnaces with capacity of less than 225,000 Btu/hour shall have a minimum performance at the specified rating conditions in Table 6.8.1E when tested in accordance with the specified test procedure. Furnaces with capacity of 225,000 Btu/hour or greater shall have a minimum performance at the greater of the specified rating conditions in Table 6.8.1E or 81% when tested in accordance with the specified test procedure. Boilers with capacity less than 300,000 Btu/hour shall have a minimum performance at the specified rating conditions in Table 6.8.1F when tested in accordance with the specified test procedure. Boilers with capacity of 300,000 Btu/hour or greater shall have a minimum performance at the greater of the specified rating conditions in Table 6.8.1F or 81% when tested in accordance with the specified test procedure. The capacity of any auxiliary electric resistance space heat shall be restricted to 5% of the peak heating load of the building. Where multiple rating conditions or performance requirements....(remainder of 6.4.1.1 is unchanged.)

4. Add Section 6.4.4.3:

6.4.4.3 Heating Distribution Efficiency

6.4.4.3.1 Hydronic Distribution. For hydronic distribution, the heating design point water supply temperature shall not exceed 190°F, and associated radiation shall be sized to permit operation at such temperature.

6.4.4.3.2 One-Pipe Steam. One-pipe steam distribution shall be prohibited in all construction required to conform with this standard.

6.4.4.3.3 Minimum Size of Steam Terminal Units. No steam terminal unit shall be permitted with capacity less than 500,000 Btu/h.

Exception: Steam radiators may be replaced by equivalent units of similar or greater capacity and thermal mass if fewer than 10% of the radiators in the building are being replaced in one calendar year.

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Delete Section 403.7 and replace as follows:

403.7 Mechanical Equipment Efficiency. [The building thermal envelope shall be permitted to meet the requirements of Table 402.1.(2) where the building mechanical system conforms with the requirements of Table 403.7.] (Delete Table 403.7). Equipment, including furnaces having a capacity of less than 225,000 Btu/hour and boilers having a capacity of less than 300,000 Btu/hour, shall meet the minimum efficiency requirements of Tables 803.2.2(1), 803.2.2(2), 803.2.2(3), 803.2.2(4), and 803.2.2(5) when tested and rated in accordance with the applicable test procedure. Furnaces having a capacity of 225,000 Btu/hour or more shall meet the minimum efficiency standards of Table 803.2.2(4) or 81%, whichever is greater, when tested and rated in accordance with the applicable test procedure. Boilers having a capacity of 300,000 Btu/hour or more shall meet the minimum efficiency standards of Table 803.2.2(5) or 81%, whichever is greater, when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through data furnished by the manufacturer or through certification under an approved certification program. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements.

403.8 One-pipe steam distribution. One-pipe steam distribution is prohibited in all construction subject to this chapter.

403.9 Steam terminal units. No steam terminal units shall be permitted with a capacity less than 500,000 Btu/hour.

Exception: Steam radiators may be replaced by equivalent units of similar or greater capacity and thermal mass if fewer than 10% of the radiators in the building are being replaced in one calendar year.

403.10 Auxiliary electric resistance space heat. The capacity of any auxiliary electric resistance space heat shall be limited to a maximum of 5% of the peak heating load of the building.

403.11 Atmospheric boilers. Atmospheric boilers are prohibited in all construction subject to the requirements of this code.

Supporting Information

Issues – Expanded

Boilers and heating distribution systems are available with a wide variety of efficiencies, including some inexpensive but totally outdated technologies. This proposal will raise the floor on boiler efficiency, removing some of the least efficient options (such as atmospheric gas boilers) from consideration and raising minimum efficiencies slightly on larger boilers and furnaces. For smaller boilers and furnaces, federal standards preempt New York City from establishing more rigorous local standards.

One-pipe steam distribution systems are notoriously wasteful of both energy and water,¹ and this measure will prohibit their use in new construction and whenever a renovation is sufficiently extensive to trigger this portion of the code. Electric resistance heat has two or three times the carbon footprint of good gas-fired heating, and it too would be prohibited except as a minor trim capability or for peak loads in heat pump systems (PTHPs).

Hydronic (water) distribution of heat is widely accepted as the most efficient system when fired by gas, oil, or ground-source heat pumps. For oil or gas fired systems, condensing boilers have substantially higher efficiencies, in the 92 to 97% range rather than in the high 80% range, when operating in condensing mode. However, they can only operate in

this mode if return water from the distribution system has been cooled to 140°F and the efficiency increases as the return water temperature is lowered. Although it is not reasonable to expect a heating system to operate in condensing mode at design point (peak) conditions, the larger the radiating surfaces in the heated space, the lower the system water temperature can be, and the more often the boilers can operate in this efficient mode. By requiring that radiation be sized for a design point temperature of 190°F, this proposal moves in the direction of promoting the effective use of condensing technology.

It should be noted that the Committee was not unanimous on what design point temperature was optimal. Some members thought 190°F would be sufficient, others wanted 150 or 160°F (mirroring practice in much of Europe), and the value 190°F is certainly the highest value that would be acceptable. An alternative would be to call for a gradual decline in the temperature, coinciding with the code review cycle.

Environmental & Health Benefits

All of these improvements will lower fuel use and attendant emissions of CO₂ and Clean Air Act pollutants. Energy-related carbon dioxide emissions, resulting from the combustion of petroleum, coal, and natural gas, represented 82% of total U.S. anthropogenic greenhouse gas emissions in 2006.² Pollutants produced by combustion of standard fossil fuels in boilers that are known to have harmful effects on humans and the environment include carbon monoxide, nitrogen oxide, sulfur oxides, volatile organic compounds, and particulate matter. By controlling NO_x levels, along with the other pollutants, the levels of acid rain and ozone can be reduced.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.5% to 5.6%, depending on building type. It was thus categorized as incurring a higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years depending on the building type.

Precedents

This proposal is a straightforward tightening of existing efficiency standards. The proposal does not address boilers and furnaces under 300,000 Btu/hour, which are regulated by AFUE and for which NYS and NYC are therefore preempted.

LEED

Current LEED prerequisites for Minimum Energy Performance under the Energy & Atmosphere sections of almost all of the rating systems require that the scope of work complies with ANSI/ASHRAE/IESNA standard 90.1-2004. This proposed code requires compliance with measures exceeding ASHRAE 90.1-2007. Since LEED 2009 prerequisites for Minimum Energy Performance also reference ASHRAE 90.1-2007, the measures outlined in this proposal will be correlated with the next generation of LEED.

However, LEED qualifies that a more stringent local code requirement becomes the LEED prerequisite requirement as well. Therefore, this proposal will change the baseline criteria that registered projects must meet for LEED certification.

Code revisions under this proposal do not apply to the LEED for Homes or the LEED for Existing Buildings rating systems, which reference Energy Star criteria. For existing buildings, LEED EB provides an alternate calculation method.

Implementation & Market Availability

There are no known implementation issues for this proposal. All the technologies are readily available.

Notes

The committee considered explicit limits on oversizing boilers, but found that various code sections already prohibit it, so the current tendency to oversize is primarily an enforcement problem.

ENDNOTES:

¹ R.W.Leigh and E.Guerra presentation at the Multifamily Building Conference, Tales from the AMP Database (2006) (For copy of presentation please email R.W. Leigh at rwl@urbangreencouncil.org).

² Energy Information Administration, Energy and the Environment Explained: Greenhouse Gases, <http://www.eia.doe.gov/bookshelf/brochures/greenhouse/Chapter1.htm> (last visited Mar. 25, 2009).

EE 6: INCREASE EFFICIENCY OF LARGE COOLING SYSTEMS

ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Air conditioning is responsible for approximately 17% of electricity use in New York office buildings. Buildings often install inefficient air conditioning systems, resulting in excessive electric demand and usage.

Recommendation:

Steer buildings toward more efficient air conditioning by prohibiting outdated, inefficient cooling equipment and limiting the use of other equipment associated with inefficient systems.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add footnote “d” to Table 6.8.1A in Section 6.8.1 as follows:

d. Air Conditioners, water and evaporatively cooled, $\geq$ 240,000 Btu/h shall not contain more than four refrigeration compressors.

2. Amend Table 6.8.1C in Section 6.8.1 as follows:

Under “Water cooled, electrically operated, positive displacement (reciprocating)” under the column entitled “Minimum Efficiency”, delete “4.20 COP 5.05 IPLV” and insert “Not Allowed”.

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency ^a	Test Procedure ^b
Water cooled, electrically operated, positive displacement (reciprocating)	All capacities	-	[4.20 COP 5.05 IPLV] <u>Not Allowed</u>	[ARI 550/590] “NA”, blank or “-“

Supporting Information

Issue Expanded

Air conditioning is the second largest electricity end use in New York office buildings next to lighting,¹ and is responsible for approximately 5% of total office building energy use (taking into account use of both electricity and fuel) in New York City.² Further, the maximum electricity demand for air conditioning occurs during peak summer hours, increasing the risk of brownouts and leading to the use of the city’s oldest, dirtiest power plants. Removing obstacles to the utilization of high efficiency equipment, and encouraging its use, is one of the most straightforward paths to lower stress on the electrical system and reduce related carbon emissions.

A clear example of poor practice is the use of outdated refrigeration compressor technology, particularly reciprocating compressors, for small package water chillers. Reciprocating refrigeration compressors have been superseded for all practical purposes by scroll and screw compressor technology at comparable cost and greater energy efficiency in all sizes, and there is no reason to allow continued use of this technology. The amendments to Table 6.8.1C exclude reciprocating chillers, and will result in a no-cost increase in chiller efficiencies, although one that is hard to quantify given the wide spectrum of choices still available.

The most efficient type of cooling system for commercial buildings is a large central chilled water plant (utilizing large centrifugal chillers) that creates cold water that is circulated throughout the building for use by air handling units and fan coil units (devices that consist of a fan and a chilled water coil). The most common alternatives to this approach are

lower efficiency systems that consist of multiple smaller chillers or multiple package direct expansion (DX) units, often with a separate installation on each floor and commonly cooled by water from a central cooling tower. Both of these alternative approaches utilize multiple compressors (that are not high efficiency centrifugal types), and as such are less energy efficient than single large chillers. The difference in energy efficiency between these two approaches can be significant: as much as 0.20 kw/ton (equivalent to a 25% difference in energy efficiency).

This proposal eliminates the option of a large number of small compressors. It does not require the use of larger, more efficient, and probably more expensive central chilled water systems, although the expense is justified as discussed below. But by requiring the use of larger units, it does put the choice between local DX units and a central chiller on a more level playing field, where the market and good practice can be expected to lead to the use of better systems.

Environmental & Health Benefits

Reduced energy use will result in increased energy efficiency and reduced greenhouse gas emissions.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These draft cost and savings estimates are presented in the February 1st version of Appendix D. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.7%. It was thus categorized as incurring a higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in more than ten year.

Bovis' costing on this measure was augmented by expert opinion from a committee member.³

Under "Option 1" (as reported in Appendix A), there is no increased cost and no savings. This is how the proposal is reported here and in summary tables.

Under "Option 2", where it is assumed the engineer chooses a high efficiency central chilled water system, Bovis' estimate of the increased expenditure was sufficient to merit three dots, and that is what appears in the proposal's entry in the Executive Summary. Subsequently, the task force revised this estimate downward, and now believe the additional cost will be as presented in Appendix A, amounting to a 0.4% increment in the cost of the large commercial building. This would merit two dots, but will not be reported as such, since the proposal does not require the improvement. Still, were the improvement made, savings, based solely on electrical energy and omitting demand charges savings, would pay for this increase in cost in less than seven years. These savings are also omitted from the summary tables.

Precedents

This measure is primarily an adjustment of existing efficiency requirements. As discussed in the notes, some aspects of this issue are specific to New York City.

LEED

The higher efficiency requirements are generally consistent with the current requirements of LEED.

Implementation & Market Availability

There are no known implementation issues for this proposal. All the equipment mentioned is available from multiple manufacturers in a mature market.

Notes

The use of direct expansion air conditioning systems is peculiar to New York City and other large urban markets in the United States. A common air conditioning solution for high-rise office buildings is a local air conditioning system within the building core on each occupied floor. These systems are typically either chilled water type (supplied with chilled water from a central chilled water plant located within the building) or direct expansion refrigeration type (supplied with condenser cooling water from a roof-mounted cooling tower).

The choice between these systems has an impact on how cooling usage can be metered and paid for, and a desire for the tenant to pay for their cooling directly has provided an incentive toward less efficient systems. It is simple to meter the tenant usage of refrigeration energy of floor-by-floor direct expansion air conditioning systems, even if they are energy inefficient, since only electricity need be metered. Metering energy usage from a central chilled water plant, on the other hand, entails measuring the amount of chilled water that is consumed by the local floor air-handling unit. This requires a more expensive metering device than that required to measure electricity consumption, although it is readily available from the market. For this “cooling energy metering” to work, the owner would need to establish a cost for chilled water consumption, which for some period of time will be an unfamiliar leasing parameter to the tenant market.

The NYC Fire Code, section 27-4194 requires an operating engineer to operate all refrigeration systems where there is a compressor horsepower greater than 50 Hp or where the sum of all compressors in the machines larger than 15 Hp exceed a total of 100 Hp. In an effort to avoid this requirement, some buildings opt to install smaller, direct expansion air conditioning systems with multiple compressors. With modern compressor technology, this configuration does not necessarily result in extremely poor energy efficiency, but it precludes the high efficiency of central chilled water plants based on modern centrifugal chillers. Though some perceive this section of the Fire Code as a de-facto disincentive for energy efficiency, in reality it is typical for the operating staff of large buildings to be comprised of licensed engineers and licenses can be obtained without difficulty.

ENDNOTES:

¹ NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY, ENERGY EFFICIENCY AND RENEWABLE ENERGY EFFICIENCY AND RENEWABLE ENERGY RESOURCE DEVELOPMENT POTENTIAL IN NEW YORK STATE, Vol. 3: Energy Efficiency Technical Report 3-42, Table 3.3.1 (2003). The breakdown is as follows: indoor lighting (41%), cooling (18%), office equipment (10%), ventilation (10%), space heating (6%) and other uses (15%).

² CITY OF NEW YORK, NY., PLANYC, A GREATER, GREENER NEW YORK 107 (2007), http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf.

³ Scott Frank, PE, of Jaros, Baum, & Bolles.

EE 7: INCREASE LIGHTING EFFICIENCY IN APARTMENT BUILDINGS

Administrative Code (Housing Maintenance Code)

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

The current lighting requirements in the Housing Maintenance Code for hallways, stairs, and common laundry facilities reference an old terminology for lighting: the use of incandescent lights. They also imply that the lights in hallways, stairs, and common laundry facilities should always be fully on.

Recommendation:

Update the language in the code to match other city codes, particularly the energy code. Specify a minimum efficacy for light bulbs, and expressly allow bi-level lighting for hallways and stairs, and occupancy sensors for laundries.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Amend Section 27-2038 as follows:

§ 27-2038 Electric lighting fixtures in certain public parts of dwellings; fixtures and lights required.

a. In every multiple dwelling and tenant-occupied two-family dwelling, the owner shall provide electric lighting fixtures for every public hall, stair, fire stair and fire tower on every floor, in accordance with the following requirements:

[(1) If an incandescent lighting fixture is provided, it shall be capable of providing illumination of at least ten watts per twenty-five square feet of floor area or fraction thereof. Each lighting fixture shall be provided with one or more lights of a total of not less than sixty watts. Where, under this requirement, the number of watts per fixture would exceed one hundred, one or more additional fixtures shall be provided and shall be located as may be prescribed by the department, except where the distance from the fixture to the farthest intersecting wall does not exceed twenty feet.

(2) If a fluorescent lighting fixture is provided, it shall be capable of providing illumination of at least four watts cool white fluorescent light per twenty-five square feet of floor area or fraction thereof. Each lighting fixture shall be provided with one or more lights of a total of not less than twenty watts. Where, under this requirement, the number of watts per fixture would exceed forty, one or more additional fixtures shall be provided and shall be located as may be prescribed by the department, except where the distance from the fixture to the farthest intersecting wall does not exceed twenty feet.]

(1) Lighting fixtures shall be capable of providing an average illumination level no less than of five foot-candles measured at the floor in hallways, and no less than seven and one half foot-candles measured at the floor in stairs. The lighting fixtures shall be capable of providing minimum illumination levels that are not less than ten percent of the required average levels, measured at floor level no closer than six inches from the wall, and maximum-to-minimum illumination uniformity ratio that does not exceed twenty to one. The minimum luminous efficacy of all light bulbs (lamps) shall be fifty lumens per watt.

[(3)] (2) In every multiple dwelling hereafter erected, in addition to other lighting requirements, a sufficient number of [incandescent or fluorescent] electrical lighting fixtures shall be provided so that the distance between fixtures is not more than thirty feet and so that no wall is more than fifteen feet distant from a fixture.

(3) Automatic, occupant sensor lighting controls shall be permitted provided that the switch controllers are equipped for fail-safe operation ensuring that if the sensor or control fail the lighting levels will be at the levels required when the space is occupied, the illumination times are set for a minimum 15-minute duration, and the occupant sensor is activated by any occupant movement in the area served by the lighting units

[b. The department may approve electric lighting for public halls, stairs, fire stairs and fire towers other than the incandescent and fluorescent lighting required in subdivision a of this section if such other method of electric lighting provides equivalent illumination, and meets the requirements of the electrical code.

c.] b. Notwithstanding any other requirement of this section, the department may require fixtures to be so located, and additional fixtures to be installed, in order to assure that every part of every public hall, stair, fire stair or fire tower is adequately lighted.

2. Amend paragraphs a, b and c of Section 27-2039 as follows:

§ 27-2039 [Lighting] Illumination to be provided [at]day and night; owner's responsibility.

a. [The owner of a multiple dwelling shall turn on all required lights in every public hall and stair at sunset every day and shall keep them on until sunrise the day following.] Any occupied public hall, stair, fire stair or fire tower shall be illuminated by either natural light or electrical lighting to an average illumination level no less than five foot-candles in hallways, and seven and one half foot-candles in stairs, measured at floor level. Minimum illumination levels shall not be less than ten percent of the required average levels, measured at floor level no closer than six inches from the wall, and the maximum-to-minimum illumination uniformity ratio shall not exceed twenty to one.

b. [The owner of a multiple dwelling shall keep all required lights burning continuously (1) in every fire stair and fire tower; (2) in every stair and public hall where there is no window opening on a street, court, yard, space above a setback, or on a shaft; and (3) in every stair and public hall where there is a window which in the opinion of the department does not provide adequate natural light.] Any unoccupied public hall, stair, fire stair or fire tower unoccupied, shall be illuminated by either natural light or electrical lighting to an average illumination level no less than one foot-candle measured at floor level. Minimum illumination levels shall not be less than ten percent of the required average levels, measured at floor level no closer than six inches from the wall, and the maximum-to-minimum illumination uniformity ratio shall not exceed twenty to one.

c. [The owner of a multiple dwelling shall provide electric light at all hours of the day and night in] Any occupied room[s] or space[s] in a multiple dwelling[s] in which laundry equipment is provided for the common use of the occupants [whenever natural light is insufficient in the opinion of the department] shall be illuminated by either natural light or electrical lighting to an average illumination level of at least twenty foot candles measured at a horizontal surface three feet above the floor. Any occupancy sensor lighting switches used in any such room or space shall conform with section 27-2038(a)(3).

Supporting Information

Issue – Expanded

The lights in the hallways, stairs, and laundry rooms of New York City apartment buildings burn all day and night at full brightness regardless of whether anyone is in those spaces or sunlight is streaming in. This is due to outdated requirements in the Housing Maintenance Code, which also specify minimum lighting levels in terms of watts (a measure of energy consumption) rather than foot-candles (a measure of lighting level). These same requirements specify particular lighting technologies rather than provide a performance standard, leaving no room for newer, energy-efficient technologies.

This proposal would treat sunlight as a source of illumination alongside electric lighting, permitting electric lighting to be dimmed during the day thereby saving energy. In keeping with industry standards, it would replace watts as the unit of measurement with foot-candles, replace requirements for particular lighting technologies with a performance standard, and establish minimum energy efficiency standards for lighting. Other provisions would authorize the use of bi-level lighting in hallways and stairs so that sensors can reduce lighting to a lower level when an area is unoccupied (returning to full brightness whenever a person enters the area). Finally, occupancy sensors would be permitted in laundry rooms, automatically turning off lighting when the rooms are unoccupied.

Environmental & Health Benefits

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.03% to 0.09%, depending on building type. It was thus

categorized as incurring a low to medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years depending on the building type.

Precedents

There are no known precedents for this proposal.

The Illuminating Engineering Society of North America (IESNA), which sets the standards for lighting across the country, recommends illumination levels of 5 foot-candles in hallways and 5-10 foot-candles in stairways. Energy analyses commonly identify lighting in unoccupied hallways, stairs, and laundry room as prime opportunities for energy efficiency upgrades.¹

LEED

There are no LEED credits directly affiliated with this proposal. However, due to improved energy performance resulting from these measures, this proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems. These recommendations may also facilitate achieving LEED Energy and Atmosphere credits, which require exceeding the minimum standards established by the prerequisites:

- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED CI-EA cr.1.1 Optimize Energy Performance, Lighting Power
- LEED ND-GCT cr.2 Energy Efficiency in Buildings
- LEED for Schools EA cr.1 Optimize Energy Performance
- LEED for Homes EA cr.1 Optimize Energy Performance
- Additional credits under LEED pilot programs.

Implementation & Market Availability

There are no known implementation issues for this proposal.

Notes

A more efficient use of lighting equipment and power would lead to reduced occurrences of equipment repairs and replacement, thereby reducing the level of building equipment failure and need for frequent building maintenance

ENDNOTES:

¹ SEATTLE CITY LIGHT, BUILT SMART CITY MANUAL ch. 6 (2006), available at http://www.ci.seattle.wa.us/light/Conserve/Resident/BSbinder/docs/cv5_bs1.pdf. (This developer incentive program of the Seattle utility company, Seattle City Light, notes that energy-efficient fixtures should be used common areas such as hallways, stairs, and laundry rooms. The program also recommends the use of sensors to reduce electric lighting when common areas are unoccupied or have adequate levels of daylight.).

EE 8: ENCOURAGE INSTALLATION OF ENERGY STAR® APPLIANCES

New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Home appliances, such as refrigerators, freezers, dishwashers and clothes washers, are a significant contributor to building energy consumption. Energy Star® appliances are more efficient, and they are readily available.

Recommendation:

Require owners of buildings and apartments undertaking kitchen and/or laundry facility construction to either purchase Energy Star® appliances or undertake alternate energy-saving measures.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

Amend Chapter 13 to include a new Section 1302 as follows:

SECTION BC 1302

ENERGY EFFICIENT APPLIANCES

1302.1 Definitions. The following words and terms shall, for the purposes of this Chapter and as used elsewhere in this code, have the meanings shown herein.

LARGE HOUSEHOLD APPLIANCE. Any refrigerator, freezer, dishwasher or clothes washer.

ENERGY CONSERVATION OBJECTIVE. The aggregate difference between the maximum energy consumption permitted under federal law for the expected large household appliances and the maximum energy consumption of the expected large household appliances permitted under Energy Star®.

ENERGY STAR®. A designation and/or labeling indicating that a product meets the energy efficiency standards set forth by the United States Environmental Protection Agency and the United States Department of Energy for compliance with the Energy Star® program.

EXPECTED LARGE HOUSEHOLD APPLIANCE. The number and type of large household appliances typically expected to be found in any building classified in occupancy groups R-1, R-2 or R-3, or any dwelling unit within such building, to be determined based on criteria established by the department.

1302.2 Calculation of the Energy Conservation Objective. The department shall calculate the energy conservation objective and update it every two years thereafter, beginning on the second anniversary of the effective date of the local law that added this section. The energy conservation objective shall be specified in terms of the estimated total consumption of energy, which may be specified in units of energy or its equivalent cost.

1302.3 Appliance or other energy savings. Any construction, alteration or addition of a kitchen in a building classified in occupancy groups R-1, R-2 or R-3, or any dwelling unit within such building, that requires a permit from the department shall achieve the energy conservation objective. The energy conservation objective may be satisfied by either:

1. the installation of large household appliances certified as Energy Star® for all large household appliances in the applicable kitchen or kitchens of such building or dwelling unit; or
2. any other method or combination of methods that will achieve the energy conservation objective as demonstrated through energy modeling methodologies adopted by the department that are distinct from the energy modeling methodology required to comply with Section 1301.1.1, provided that such energy modeling

methodology incorporates the applicable testing procedures set forth in title 42, section 6293 of the United States Code.

Exceptions:

1. Any building or dwelling unit that has received a permit subject to this section within a five (5) year period prior to submitting an application for a new permit.
2. If the percentage aggregate difference between the maximum energy consumption permitted under federal law for the expected large household appliances and the large household appliances is less than 20 percent.
3. Any large household appliance shall be excluded from the calculation of the energy conservation objective if:
 - a. There is no Energy Star® certified large household appliance manufactured that would be of an appropriate size for installation in a building or dwelling unit such that the movement of walls or fixtures would not be necessary to create sufficient space for such large household appliance.
 - b. Such large household appliance was purchased within 5 years of the permit application.
4. The commissioner may exempt any building or dwelling unit from the provisions of this section upon a determination of undue hardship.

Supporting Information

Issue – Expanded

Appliances consume over 40% of the energy in New York residential buildings.¹ Since 1992, the U.S. Environmental Protection Agency and U.S. Department of Energy have certified appliances as Energy Star® if they are significantly more energy-efficient than required under federal law.

In a building where plug loads represent a large portion of total energy consumption, reductions in appliance energy use could result in significant energy savings. Even in buildings that have a smaller proportion of unregulated loads, installing Energy Star appliances is a simple, low-cost way to achieve reductions in energy use and cost, water use, and carbon emissions.

Under this proposal, in accordance with federal law, buildings would have the option of either installing Energy Star® appliances or undertaking other retrofit measures that would achieve equivalent energy savings.

Environmental & Health Benefits

Installing appliances that have the Energy Star® label or comply with the criteria to achieve Energy Star® will result in reduced energy consumption and cost, reduced carbon emissions, and process water savings (depending on the type of appliance). Not only will energy consumption drop substantially as old, inefficient appliances are eliminated, but the summer peak load will be reduced.

While the actual energy savings will vary by building and appliance type, LEED contemplates reductions in total building energy use of 5% or greater from improved appliance efficiency.²

This proposal was found to have a low, positive impact environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents

The California Building Code and at least one proposed model code contain provisions analogous to this Task Force recommendation. The California Green Building Standards Code requires buildings to either follow a prescriptive that

specifies Energy Star® equipment, or follow a performance path that does not specify such equipment.³ Likewise, proposed ASHRAE Standard 189P follows this same model, requiring Energy Star® equipment under a prescriptive path, while also offering a performance path without the requirement.⁴

LEED

Adherence to this provision could help a project achieve LEED points under almost all of the various LEED rating systems. Specifically, Energy Star appliances could help a project achieve the following credits: LEED for Homes EAc9: Appliances, LEED for Schools WEc4: Process Water Use Reduction, LEED for Existing Buildings MRc2.1: Sustainable Purchasing - Durable Goods, LEED for Commercial Interiors EAc1.4: Optimize Energy Performance, Equipment and Appliances. Energy Star appliances are also referred to in LEED systems that are currently in development, like LEED for Healthcare WEc4: Process Water and EAc7: Medical and Process Equipment Efficiency.

Some of these credits specifically require the use of appliances and equipment with the Energy Star label. In the cases where it is not required, a performance target is established that could be met either by products with the Energy Star label or products with equivalent performance efficiency.

Although they are not specifically cited in the Reference Guides, Credit Interpretation Requests have established that under the LEED for New Construction rating system, Energy Star appliances can contribute to a potential Innovation credit (for LEED-NC 2.1) or can contribute to EAc1 using the Exception Calculation Method (LEED-NC 2.2).

Implementation & Market Availability

Energy Star® appliances are readily available on the market.

ENDNOTES:

¹ New York State Energy Research and Development Authority, Energy efficiency and renewable energy resource development potential in New York state, Vol. 5, Appendices 5-12, Table 5.1.2.4 (2003). The breakdown is as follows: refrigeration (20%), electronic equipment (11%), and clothes washing (washer and dryer) (11%). "Electronic equipment" consists of televisions, videocassette recorders, microwaves, stereos, computers, and laser printers.

² Under a LEED-NC 2.1 Credit Interpretation Request, projects can receive an Innovation Credit for Energy Star appliances if the projected appliance energy savings is greater than or equal to 5% of the building's total energy use.

³ CAL. CODE, Tit. 24, pt. 11 § 500 (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

⁴ American Society Of Heating, Refrigerating And Air-Conditioning Engineers, Inc., Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings, Third Public Review, ch. 7 (2009) available at <http://finance.ky.gov/NR/rdonlyres/C350FOAD-FFCF-4EDE-A643-37B81188524A/0/HPBWorkGroup.pdf>.

EE 9: IMPROVE OPERATION OF DRYERS IN APARTMENT BUILDINGS

Administrative Code (Housing Maintenance Code)

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Shared clothes dryers in multifamily residential properties have a large energy impact because they are heavily used. Many dryers sell drying time in large increments (45 minutes to an hour), causing the dryer to run longer than necessary.

Recommendation:

Require dryers to sell time in increments of 15 minutes or less.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Add a new Section 27-2051.1 as follows:

§ 27-2051.1 Common Clothing Dryers. Any clothing dryer purchased or rented after July 1, 2010 and intended for common use by the occupants of a multiple dwelling shall allow the purchase of drying time in increments of fifteen minutes or less.

Supporting Information

Issue- Expanded

Nationally, clothes dryers are the second biggest electricity-consuming home appliance after the refrigerator. According to 2001 Department of Energy statistics, they account for 5.8% of the total residential electricity.¹ While some dryers use moisture sensors that determine when the clothes are dry and automatically shut-off, most dryers have an adjustable timer that shuts the machine off after a pre-selected period. Commercial dryers typically sell drying time in large increments, which results in dryers running longer than required. The situation is exacerbated by the tendency to overestimate required time to dry a load. Over-drying results in wasting energy, time, and money as well as often wear-and-tear of fabric and shrinkage.

While both federal standards and ENERGY STAR criteria for residential clothes washers changed on January 1, 2007 to ensure energy savings, there was no parallel change regarding clothes dryers.² In fact, there is still no federal regulation related to dryers and, consequently, ENERGY STAR does not have a program or labeling system that applies to dryers.

New York City is different from many other cities in that dryers typically utilize gas rather than electricity, which makes them far more efficient. In this context, the most effective approach to reducing energy consumption of dryers in New York City is to reduce the time dryers run by allowing for small increments of drying time to be sold in multi-family residential properties.

Environmental & Health Benefits

Shorter drying times will give consumers more control over the drying, allowing a more efficient use of the dryers. In addition to conserving energy, time and money, this proposal gives the consumer options on how dry and how fast they can complete the task of doing their laundry. Shorter drying times may have the added benefit of making clothes last longer as a result of not over-drying.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost / Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

There are no known precedents for this proposal.

LEED

The government does not test or assign ENERGY STAR ratings to dryers because most dryers use relatively similar amounts of energy. Therefore, dryers will not comply with credits LEED CI-EA cr.1.4 or LEED for Homes EA9, which use ENERGY STAR ratings as the standard for Equipment & Appliances.

The reduction in power usage may assist in achieving Energy & Atmosphere prerequisites and credits in all of the rating systems, depending upon which options are pursued for LEED compliance.

Under the performance method outlined in LEED NC EA prerequisite 2 Minimize Energy Performance and EA cr. 1 Optimize Energy Performance, process energy is considered to include laundry washing and drying. Process loads shall be identical for both the baseline building performance rating and for the proposed building performance rating. However, project teams may follow the Exceptional Calculation Method (ASHRAE 90.1-2007 G2.5) to document measures that reduce process loads.

Implementation and Market Availability

There are no known implementation or market availability issues for this proposal.

¹ Energy Information Administration, U.S. Department of Energy, End-use Consumption of Energy 2001, <http://www.eia.doe.gov/emeu/recs/recs2001/enduse2001/enduse2001.html> (last visited Jan. 28, 2010).

² U.S. EPA, ENERGYSTAR, MARKET IMPACT ANALYSIS OF POTENTIAL CHANGES TO THE ENERGYSTAR CRITERIA FOR CLOTHES WASHERS, (2008), http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/clotheswash/CriteriaAnalysis_2008.pdf.

EE 10: REDUCE OVERHEATING IN APARTMENTS

Administrative Code of the City of New York

Proposal developed by the Energy & Ventilation Committee.

Summary

Issue:

Many apartment residents have little or no control over individual radiators in their living spaces. This results in overheating in the winter. Residents then open windows and waste energy.

Recommendation:

Over a 10-year period, phase in individual room or apartment temperature controls in residential buildings.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York

1. Add a new paragraph (49) to subdivision (a) of Section 27-2004 as follows:

49. A thermostatic control is a heating control, such as a thermostatic radiator control valve, that conforms with the requirements of ASHRAE 90.1 2007, Section 6.4.3.1 "Zone Thermostatic Controls."

2. Add a new Section 27-2034 as follows:

§ 27-2034 Apartment heat control.

a. In accordance with the implementation schedule listed in Table 27-2034, there shall be a thermostatic control in every dwelling unit of a multiple dwelling that shall control the heat sources within such dwelling unit. More than one thermostatic control per dwelling unit is permitted, provided there is not more than one thermostatic control per heat source.

Table 27-2034

Implementation Schedule: Fraction of radiators, fan-coil units, packaged terminal air conditioner, or other heat sources in each building to be controlled by specified date:

<u>Date:</u>	<u>July 1, 2013</u>	<u>July 1, 2017</u>	<u>July 1, 2020</u>	<u>July 1, 2023</u>	<u>July 1, 2026</u>
<u>Fraction:</u>	<u>20%</u>	<u>40%</u>	<u>60%</u>	<u>80%</u>	<u>100%</u>

b. Notwithstanding the foregoing, thermostatic controls shall not be required:

1. If heating is provided by a hydronic system plumbed such that a thermostatic control in one dwelling unit would control heat supplied to a different dwelling unit; or

2. If the building has a central energy management system or building management system that incorporates temperature sensors in twenty percent or more of the dwelling units in the building and controls heat supply on the basis of zones, as such term is defined in ASHRAE 90.1 2007.

Supporting Information

Issue – Expanded

Lack of control over heating and, to a lesser extent, cooling, leads residents of apartment buildings to open their windows during heating season in order to maintain a comfortable environment. This results in substantial fuel being burned to heat air that is vented to the outdoors, a transparent waste. Because central cooling is rare in older

apartment buildings, this proposal is focused on heating.

The same issue can arise in commercial buildings, but happens less often since they are more likely to have zoned controls already, and even if they do not, are required under the Energy Code to install controls during renovations.

In new construction, Section 6.4.3.1, "Zone Thermostatic Controls" of ASHRAE 90.1 2007 requires control of both heating and cooling in all new construction, both residential and commercial. Under this provision, an entire residential apartment can be considered a "zone", and thus run off a single thermostat, even if two rooms have different exposure. While a single thermostat is not ideal, strengthening this requirement would be complex and would not result in substantial savings, since many residential developments use individual radiator controls to meet this requirement.

This proposal is therefore focused on the heating systems of existing residential buildings, three families and larger. These buildings are not normally appropriate for apartment-wide zone controls, since vertical steam or hot water risers provide heat to radiators independently of which apartment they are in. However, there are a wide variety of thermostatic radiator valves (TRVs) that can be retrofitted to control individual radiators.

The proposal also permits control of the entire building through an energy management system or building management system, if such a system includes zoned controls so that, for example, the heat supply to the south side of a building can be restricted while the north side is heated. This is actually the preferred solution, but requires a more rapid investment schedule. Smaller buildings are normally already controlled by thermostats and so are omitted.

Environmental & Health Benefits

Residents who open windows when their apartments are overheated cause the boiler to burn more fuel, which costs money and adds carbon emissions to the atmosphere. This measure will reduce this practice.

Except in extreme cases, no health problems are directly linked to overheated residences. Ambient temperature is a highly subjective matter and discomfort from too much heat varies greatly between people.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost & Savings

Cost will vary dramatically. It is easy to retrofit a TRV on a 1-pipe steam radiator and could cost as little as \$100. For two pipe steam and hydronic systems to which TRVs can be fitted, the valve must be inserted into the circuit, resulting in costs as high as \$600 for contract labor.

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These draft cost and savings estimates are presented in the February 1st version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

At \$600 per radiator, this proposal was found to incur capital cost by between \$1.20 and \$2.20/square foot, and was thus categorized as incurring a medium to higher capital cost. Installation of an energy management system would cost substantially less.

This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years. NYSERDA research reports space heat savings of 9.5% to 15.5% from the installation of thermostatic radiator valves (TRVs).¹ Similar savings would be expected from thermostats on fan-coil units -- with the added benefit of electricity savings from reduced fan run-time. In Appendix A, calculations based on the assumption of 10% savings show payback periods of less than seven years for the high capital cost associated with two-pipe steam in a high rise residential building.

Precedents

Most municipalities in cold and temperate zones, including New York City, require minimum temperatures that landlords must maintain in apartments, but none require that units have devices that can control temperature.

As stated, ASHRAE 90.1 2007 requires apartment heating and cooling controls in all new construction and all construction requiring a building permit for work on the heating system.

LEED

Implementation of this change could help a project achieve points under LEED for Existing Buildings - Operations and

Maintenance as part of a plan to reduce fuel use.

Implementation & Market Availability

There are numerous proven approaches to providing individual apartment heating controls using widely available devices.

One of the most commonly used devices is a thermostatic control valve (TRV), a temperature-regulated control valve that senses room temperature and allows a fluid to pass or not depending on that temperature. For hot water and two-pipe steam systems, the valve controls the inflow of hot fluid. For one-pipe steam systems, the valve controls the outflow of air from the radiator at the start of each boiler cycle. If the room is warm, air cannot leave the radiator, so only a fraction of the normal amount of steam can get in. (TRVs only work well on one-pipe systems if the boiler is operated at low steam pressures, as it should be in any event). The best TRVs have a temperature sensor that mounts on the wall, at a distance from the radiator, to minimize feedback.

Some hot water distribution systems are plumbed so that the installation of TRVs would stop all circulation in the system, rather than in one radiator, and plumbing sufficient to overcome this would be onerously expensive. This proposal offers an exception for such systems.

Some heating systems provide steam or hot water to a contained, finned coil, equipped with a fan that blows room air through the coil. (These are referred to either as fan-coil units if single purpose or Packaged Terminal Air Conditioners, PTACs, if they include a cooling function.) In this case, the thermostat need control only the fan, a much less expensive alternative.

ENDNOTES:

¹ T. Rieger, Radiator valves prevent apartment overheating, HOME ENERGY MAGAZINE ONLINE, May/June 1996, <http://www.homeenergy.org/archive/hem.dis.anl.gov/eehem/96/960509.html>.

EE 11: TURN OFF EQUIPMENT IN EMPTY HOTEL ROOMS

ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code
Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

Currently lights, television sets and excess heating and cooling operations are often running in hotel and motel rooms when no one is there, which uses substantial energy for no purpose.

Recommendation:

Require a master switch, such as a room key electronic control that is commonly used elsewhere in the world, which automatically turns off lighting and television screens, and sets back the temperatures when the room is vacated.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Amend paragraph (c) of Section 9.4.1.4 as follows

c. Hotel, [and] Motel Guest Room, and Guest Suite Lighting & Power–

1. hotel and motel guest rooms and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires [and], switched receptacles and televisions.
2. room heating or cooling units shall be equipped with controls that automatically setback temperatures when the room is unoccupied. The setback temperature for cooling units shall be no lower than 78°F, and the setback temperature for heating units to be no higher than 65°F.
3. enclosed bathrooms shall be controlled by a manual-on/automatic-off occupancy control device(s). Control(s) shall turn the lighting off automatically within 30 minutes of all occupants leaving the room. Bathroom night-lighting, if provided, shall not exceed one watt, and shall be manually controlled independently from the general lighting for the bathroom.

Supporting Information

Issue – Expanded

About half the energy used in hotels is used in guest rooms.¹ Studies on lighting energy use in hotel rooms show that there is not a big dip in energy use during the day - hours when rooms are typically unoccupied.² In addition, 75% of the energy consumption from lighting in hotel guestroom bathrooms is during cycles of two hours or more, indicating that guests often leave bathroom lights on after they exit the room.³ Likewise, hotel rooms are typically heated and cooled regardless of whether the room is occupied, and televisions are sometimes left on.

This proposal would require hotel rooms to be equipped with control devices to reduce energy use when the rooms are unoccupied. Bathroom lighting would turn off 30 minutes after occupants have left and televisions would be controlled by master switch at the front of the hotel room. In addition, the temperature of hotel rooms equipped with individual heating or cooling units would be set back when the room is unoccupied.

Environmental & Health Benefits

Studies have found energy savings of 17%-52% when occupancy based lighting controls are used in a variety of commercial rooms.⁴ A decrease in energy consumption will improve air quality and reduce greenhouse gas emissions.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will

vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.3%. It was thus categorized as incurring a medium capital cost increment.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Precedents

Several model codes and standards include guidelines for master switches in hotels. IECC 2006, 505.2.3 recommends that sleeping units in hotels, motels and similar buildings have at least one master switch and control at the main entry to control all permanently wired luminaries and switched receptacles.

Similarly, ANSI/ASHRAE/IESNA Standard 90.1-2004 require that hotel and motel guest rooms and suites have a master control device at the main entry that controls all permanently installed luminaries and switched receptacles.⁵ The 2007 Addenda expands on this measure to specify that bathrooms in the rooms be required to have an occupancy sensor to automatically turn off bathroom lighting within 60 minutes of non-occupancy.

In addition, Section 503.8.3.3 Control Setback and Shut-Off in Seattle's energy code requires that thermostats or other kind of temperature control switches have a manual or automatic means of reducing energy usage during periods of non-use or reduced need.⁶

LEED

This proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems.

These recommendations will also facilitate achieving LEED Energy and Atmosphere credits:

- LEED NC- EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED CI-EA cr.1.1 Optimize Energy Performance, Lighting Power
- LEED CI-EA cr.1.3 Optimize Energy Performance, HVAC
- LEED ND-GCT cr.2 Energy Efficiency in Buildings
- LEED for Schools EA cr.1 Optimize Energy Performance
- Additional credits under LEED pilot programs.

These credits require exceeding the minimum standards established by the Energy and Atmosphere prerequisites.

Implementation & Market Availability

There are no known implementation issues for this proposal. Occupancy sensors, computer check-in systems, and card-key wall switches are readily available.

Notes

ASHRAE is considering similar measures for future versions of the 90.1 standard.

ENDNOTES:

¹ Hotelsmag, Digital Controls (April 2001), http://www.hotelsmag.com/article/359714-Digital_Control.php.

² ERIK PAGE AND MICHAEL SIMINOVITCH, LIGHTING ENERGY SAVINGS OPPORTUNITIES IN HOTEL GUESTROOMS, LAWRENCE BERKELEY NATIONAL LABORATORY, 6 (October 1999), available at <http://www.osti.gov/bridge/servlets/purl/764355-63RfOi/webviewable/764355.pdf>.

³ Ibid

⁴ Energy Savings and Demand Reduction, Iss. TB151 THE WATT STOPPER: TECHNICAL BULLETIN, February 1, 2002 <http://www.wattstopper.com/getdoc/1328/TB151.demand%20reduction.pdf>

⁵ Hotel Lighting Controls: Reduce Energy while Guests are Away, WALLSTOPPER (Wallstopper New Product Brochure pub no. 27002) 2008, http://wattstopper.com/getdoc/2211/HS_NewProdBroch_08.pdf

⁶ CITY OF SEATTLE ENERGY CODE , ch. 5, § 503.8.3.3 (2006) available at http://www.seattle.gov/DPD/Codes/Energy_Code/Residential/Chapter_5/default.asp

EE 12: PROVIDE VENTILATION AIR ONLY AS NEEDED IN LARGE SPACES

New York City Mechanical Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

HVAC systems typically provide outdoor air based on maximum occupancy, wasting energy when rooms are partially occupied or empty. Demand control ventilation adjusts the amount of air pumped into rooms as needed.

Recommendation:

Require demand control ventilation for large spaces of variable occupancy.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code

1. Amend Section 403.3.1 as follows:

403.3.1 System operation. The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 403.3 and the actual number of occupants present. Intermittent exhaust shall be permitted where an individual exhaust duct and fan are provided and the operation of the fan is controlled by occupants of the space being vented.

Exception: In intermittently occupied spaces that do not have processes or operations that generate dusts, fumes, mists, vapors or gasses and are not provided with local exhaust ventilation in accordance with Chapter 5, the rate of outdoor air may be reduced if the ventilation system serving the space is controlled by a demand control ventilation device complying with Section 403.3.5.

2. Add a new Section 403.3.5 as follows:

403.3.5. Demand control ventilation. Demand control ventilation shall be provided as follows:

1. Demand control ventilation shall be required, and shall have demand ventilation sensors and controls complying with this section, in single-zone HVAC systems where:

1.1. Such system has an outdoor air economizer; and

1.2. The demand control ventilation serves a space with an estimated occupancy load greater than or equal to 25 persons per 1000 square feet (less than or equal to 40 square feet per person).

Exceptions:

1. Natatoriums, classrooms, R-2 and R-3 occupancies and healthcare facilities shall not be required to have demand control ventilation.
2. Demand control ventilation shall not be required where space exhaust is greater than the outdoor airflow rate required by Table 403.3.
3. Spaces that have processes or operations that generate dusts, fumes, mists, vapors, or gasses and are not provided with local exhaust ventilation in accordance with Chapter 5 shall not be required to provide demand control ventilation.

2. Where demand control ventilation is required by this section, sensor and control devices shall be required as follows:

2.1. CO2 sensors shall be installed in each room, between one foot and six feet above the floor.

2.2. In each room with CO2 sensors, demand ventilation controls shall maintain CO2 concentrations less than or equal to 600 parts per million plus the outdoor air CO2 concentration.

Exception: The outdoor airflow rate is not required to be larger than the outdoor airflow rate required by Table 403.3, regardless of CO₂ concentration.

2.3 Outdoor air CO₂ concentration shall be determined by one of the following:

- i. CO₂ concentration shall be assumed to be 400 parts per million without any direct measurement; or
- ii. CO₂ concentration shall be dynamically measured using a CO₂ sensor located within six inches of the outdoor air intake.

2.4 When the system is operating during hours of occupancy, the controls shall maintain system outdoor airflow rates no less than the rate listed in Table 403.3 times the conditioned floor area for spaces with CO₂ sensors, plus the rate required by Section 403.3.1 for other spaces served by the system, or the exhaust air rate, whichever is greater;

2.5 CO₂ sensors shall be certified by the manufacturer to have an accuracy within 75 parts per million and to require calibration no more frequently than once every 5 years, and shall be factory-calibrated or calibrated at start-up.

3. A special inspection shall be required in accordance with department rules to verify that the demand control ventilation system meets the requirements of this section.

Supporting Information

Issue – Expanded

Demand-controlled ventilation reduces energy use by reducing the amount of air that gets heated or cooled. Instead of ventilating all the air in a given space at its maximum capacity at all times, only the amount of air that is actually needed by the occupants gets drawn into and exhausted from the space. Since fresh air must be heated or cooled a good portion of the year, execution of this proposal will reduce heating and cooling costs for the spaces in question. If the space is occupied on an irregular basis, the savings can be substantial.

Various mechanisms are available for controlling the amount of air. The most straightforward may be a carbon dioxide sensor, since the presence of carbon dioxide indicates that people are present and correctly measures how hard they are breathing – useful, for example, in a gymnasium.

Environmental & Health Benefits

This carries the benefits of lowered emissions from boilers and electric generators.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.04%. It was thus categorized as incurring a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in about four years. (Unfortunately, this measure was mis-represented in the Executive Summary as having a payback period greater than ten years.)

Precedents

Demand-controlled ventilation has become more feasible and cost-effective in recent years, and state energy departments such as in Oregon have promoted DCV as a means of cutting energy costs and usage. The conservation division of the Oregon Department of Energy has issued a design guide for Demand-Controlled Ventilation, which can be found here.¹

ASHRAE 90.1 2007 includes a section (6.4.3.9) requiring DCV in high-occupancy areas. This measure extends the coverage to lower occupancy levels, and is necessary because the mechanical code would pre-empt the ASHRAE requirement.

LEED

LEED does not provide credit for utilizing a demand-controlled-ventilation system, although it does cite the logic of implementing a DCV system in certain large spaces.

LEED does provide credit for installing Carbon Dioxide sensors. Therefore, this proposal will assist projects in complying with LEED under the following subsections (including various pilot programs):

- LEED NC-EQ cr.1, Outdoor Air Delivery Monitoring
- LEED CI-EQ cr.1, Outdoor Air Delivery Monitoring
- LEED for Schools EQ cr.1, Outdoor Air Delivery Monitoring
- LEED EB-EQ cr.1, Outdoor Air Delivery Monitoring

LEED for Homes requires Carbon Monoxide detection devices, and thus does not correlate with the requirements of this proposal.

Implementation and Market Availability

There are no known implementation issues for this proposal. CO₂ based demand control ventilation systems are technically mature and widely available.

¹ Oregon Dep't of Energy, Demand-Controlled Ventilation, <http://www.oregon.gov/ENERGY/CONS/BUS/DCV/DCVintro.shtml> (last visited Jan. 28, 2010); and M. STIPE, OREGON DEP'T OF ENERGY, DEMAND-CONTROLLED VENTILATION: A DESIGN GUIDE (2003), <http://www.oregon.gov/ENERGY/CONS/BUS/DCV/docs/DCVGuide.pdf>.

EE 13: USE MANUAL ON- AUTO OFF LIGHTING

New York City Building Code

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

Occupancy sensors turn on lights when a room is entered, then turn them off after people have departed. This does not maximize energy savings because light is not always needed at entry, if the use is transitory or daylighting is available.

Recommendation:

Require vacancy sensors, which contain a manual On switch, coupled with an occupancy sensor that turns lights off after a period of vacancy.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new definition to Section 3.2 as follows:

Vacancy sensor: An occupant sensor for which the lights must be manually turned on but the sensor automatically turns the lights off soon after an area is vacated that meets the following requirements:

- a. Shall not turn on the lighting automatically, except that they shall have a grace period of 15 seconds to 30 seconds to turn on the lighting automatically after the sensor has turned off the lighting; and
- b. Shall not have an override switch that converts occupant sensors from manual on to automatic-on functionality.

2. Amend paragraph (a) of Section 9.4.1.2 as follows:

9.4.1.2 Space Control. Each space enclosed by ceiling height partitions shall have at least one control device to independently control the general lighting within the space. Each manual device shall be readily accessible and located so the occupants can see the controlled lighting.

a. A vacancy sensor [An occupant sensor] shall be installed that automatically turns lighting off within 30 minutes of all occupants leaving a space[, except spaces with multi-scene control,] in

1. classrooms (not including shop classrooms, laboratory classrooms, and preschool [through 12th grade] classrooms),
2. conference/meeting rooms, [and]
3. employee lunch and break rooms, and
4. offices smaller than 200 square feet.

Supporting Information

Issues – Expanded

Occupant sensors have been used for decades, saving tremendous amounts of energy, and are required under the Energy Code. These sensors automatically turn on lights when a person enters a room and then automatically turn the lights off when the room is vacant. Unfortunately, occupant sensors sometimes turn lighting on when it is not needed, such as when a room is already sunlit or when someone is only passing briefly through a room. Once turned on, occupant sensors typically do not turn lights off for 30 minutes.

A variation of occupant sensors, known as a “vacancy sensor,” addresses this problem. Whereas occupant sensors turn automatically on and off, a vacancy sensor requires a person to manually turn the lights on and then automatically turns the lights off when the room is vacant.

This proposal would require vacancy sensors in the place of occupancy sensors for several building areas that are typically lit by natural light or that people often enter only briefly. It would also require vacancy sensors in small offices

where no sensors are currently required under the Energy Code.

Environmental & Health Benefits

Vacancy sensors will reduce energy use, leading to reductions in greenhouse gas emissions and improvements to air quality.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents

There are no known precedents for this proposal.

LEED

This proposal may facilitate achieving the following LEED Energy and Atmosphere credits:

- LEED NC-EA cr.1 Optimize Energy Performance;
- LEED EB-EA cr.1 Optimize Energy Performance;
- LEED CI-EA cr.1.2 Optimize Energy Performance, Lighting Controls;
- LEED ND-GCT cr.2 Energy Efficiency in Buildings;
- LEED for Schools EA cr.1 Optimize Energy Performance;
- Additional credits under LEED pilot programs.

Implementation & Market Availability

There are no implementation issues with this proposal. Vacancy sensors are widely available from manufacturers of lighting controls.

EE 14: LIMIT AFTER-HOURS RETAIL LIGHTING

New York City Building Code

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

Many retail establishments in New York City light their spaces all night long. This wastes energy, especially because stores often use high-wattage fixtures.

Recommendation:

Require retail lighting, other than lighting used in window displays or for egress, to be turned off when stores are unoccupied.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new paragraph (g) to Section 9.4.1.4 as follows:

9.4.1.4 Additional Control

g. Retail lighting--retail spaces shall be equipped with one or more automatic control device(s) to turn off all general interior lighting or to reduce the lighting levels to the minimum required by law for egress. Such lighting reduction shall occur within 20 minutes of store closing. Lighting levels shall be programmed to return to desired levels 20 minutes prior to store opening or initiated by occupancy.

Exceptions:

1. Lighting used for nighttime marketing and not exceeding an interior lighting power allowance of 50 watts per linear foot of the perimeter display window area until midnight, and 25 watts per linear foot of the perimeter display window area after midnight. No more than 20% of the total allowance shall be used by luminaires located more than 15 feet from display windows. All luminaires used for nighttime marketing shall have a luminous efficacy greater than 30 lumens per watt.

2. Light fixtures used in spaces containing automatic teller machines.

3. Zoned lighting controls connected to occupancy sensors or timeclock override switches not exceeding two hours per override that enable cleaning, re-stocking, construction of displays or other activities that occur during off-hours.

4. Zoned lighting controls connected to occupancy sensors for nightlighting or security lighting.

5. Temporary seasonal window displays operating no later than midnight or one hour after store closing, whichever is later.

Supporting Information

Issue - Expanded

Many stores remain illuminated all night long, well after closing time. It is always wasteful to light unoccupied spaces and especially so for retail establishments since their lighting consumption can be equivalent many floors of offices. While retailers feel that lighting stores during off-hours provides a marketing advantage, most merchandise cannot be seen beyond ten or fifteen feet from the perimeter windows.

Limiting lighting to display windows and 15 feet of the store interior will enable retailers to display their goods to consumers, while saving energy. Window display lighting is also sufficient to illuminate the street, promoting pedestrian

street activity and a sense of urban security. In addition, retail security does not require illumination the deep interior of stores. In case of unauthorized entry, lights and alarms can be activated through the use of occupancy sensors, cameras, security sensors, alarms, and other low-energy security devices.

Environmental & Health Benefits

Using less lighting will reduce the demand for electricity and thereby lower carbon emissions and improve air quality.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase capital cost by \$0.05/square foot. It was thus categorized as not incurring a capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years.

Precedents

Automated controls, and separate circuits for decorative and display lighting are already part of existing codes and standards and this proposal would regulate how those controls function. For at least the last seven years, the NYS Energy Conservation Construction Code of 2002 (referencing ASHRAE/IESNA Standard 90.1-1999) has required that all buildings over 5000 square feet be controlled by an automatic control device to shut off lighting in all spaces (this can be a programmed time switch). In addition, each space with full height partitions requires local control of zones (switches or occupancy sensors) that can be between 2500 square feet and 10,000 square feet. The 5000 square foot limit was been removed in Standard 90.1 – 2007, so all buildings now require automatic shut off regardless of size.

The ASHRAE/IESNA/NBI/DOE Advanced Energy Design Guide for Retail recommends the following, “Put all general, all accent, and all display case lighting on separate circuits and switches (use multiple circuits and switches as required). Use automatic time scheduling time switches to turn on accent and display case lighting no more than 20 minutes prior to normal scheduled hours and to turn off accent and display case lighting no more than 20 minutes after normal scheduled hours”.ⁱ

LEED

This proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems.

These recommendations will also facilitate achieving LEED Energy and Atmosphere credits:

- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- Additional credits under LEED pilot programs.

These credits require exceeding the minimum standards established by the Energy and Atmosphere prerequisites.

Implementation & Market Availability

Devices to turn off lighting are readily available. Wireless controls for existing installations are expected to be commonplace within 2-3 years. Utility or NYSERDA incentives for wireless controls would enable existing retail to comply sooner.

EE 15: REDUCE ARTIFICIAL LIGHTING IN SUNLIT LOBBIES & HALLWAYS

New York City Building Code

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

The building code mandates excessive lighting for egress spaces and that they be illuminated by artificial means even when the space is daylit or unoccupied.

Recommendation:

Align NYC egress illumination requirements with national standards and allow natural light to supply the required illumination, while maintaining current NYC standards when spaces are occupied.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Sections 1006.1 and 1006.2 as follows:

1006.1 Illumination Required. Exits, exit discharges, and public corridors shall be illuminated at all times by either natural light or electrical lighting fixtures. Exit access components shall be illuminated by either natural light or electrical lighting fixtures at all times [during occupancy] that the space served by the exit access component is occupied.

1006.2 Illumination Level. The means of egress illumination level shall not be less than 2 foot-candles (22 lux) at the floor levels in exits, at exit discharges, and in public corridors[,] when these spaces are occupied, nor less than 1 foot-candle when these spaces are unoccupied, and shall not be less than 1 foot-candle (11 lux) at the floor level in exit access components other than public corridors.

2. Add a new Section 1006.2.1 as follows:

1006.2.1 Sensors and Controls. Automatic, occupant sensor lighting controls shall be permitted within means of egress, provided that the switch controllers are equipped for fail-safe operation, the illumination times are set for a minimum 15-minute duration, and the occupant sensor is activated by any occupant movement in the area served by the lighting units.

Supporting Information

Issue – Expanded

For obvious safety reasons, the Building Code requires all means of egress to be illuminated. However, the code does not credit daylight as a source of illumination for means of egress. It also requires “exit access components,” such as corridors in offices and aisles in supermarkets, to be fully illuminated even when a space is unoccupied. Moreover, New York City requires twice the illumination as the rest of the nation for means of egress, even in an unoccupied building. These code provisions unnecessarily waste energy without increasing safety.

Since the Building Code does not recognize daylight as illumination in means of egress, buildings cannot use daylight-responsive controls to turn off electric lights when those areas are sunlit. It is common to see new, “green” buildings with daylight-responsive lighting controls where all of the lights in a day lit corridor have been turned off except for the emergency lights, which continue to operate at full output in the midst of streaming sunlight.

Under the code, all exit access components must also remain illuminated whenever any part of a building is occupied. This means that emergency lighting in a locked and vacant supermarket on the ground floor of a 40-storey office building is required to remain on at 2:00 AM if someone is working late on the 23rd floor.

It is wasteful and unnecessary for light fixtures to operate at full output next to a sunny window or to light unoccupied

fire stairs more brightly than the rest of the nation lights occupied fire stairs. This proposal would credit natural light as a source of illumination in means of egress. It would also allow lighting in exit access components to be turned off when an area is unoccupied. Finally, the proposal would permit occupant sensing lighting controls to set back the lighting in means of egress to national standard illumination levels when the space is not occupied. Section 1006.2.1, which describe how these controls would operate, is taken directly from the Life Safety Code of the National Fire Protection Association.

Policy makers may be concerned that lighting controls will malfunction during an emergency and leave fire stairs dark. However, this proposal would maintain lighting in exits, exit discharges, and public corridors 24 hours a day, 365 days a year. Since these spaces are used on a daily basis, any failure of the lighting controls would be as noticeable as a burned out light bulb, and much less likely.

Environmental & Health Benefits

This proposal will result in energy savings since lights could be switched off or dimmed when they do not need to be on. It will also reduce peak electricity demand, because peak demand usually occurs in the middle of a sunny summer afternoon, which coincides with peak daylight availability.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

Several national and state codes already allow the use of automatic lighting controls in means of egress. The International Building Code (IBC 2006 and 2009), Section 1006.1 Illumination Required, states, "The means of egress, including the exit discharge, shall be illuminated at all times the building space served by the means of egress is occupied." This means that lights can be switched off when the building space served by the means of egress is unoccupied. This same language is found in Massachusetts State Building Code¹, which is the building code for the City of Boston.

The National Fire Protection Association's Life Safety Code (NFPA 101 2009) states that, "Automatic, motion sensor-type lighting switches shall be permitted within means of egress, provided that the switch controllers are equipped for fail-safe operation, the illumination timers are set for a minimum 15-minute duration, and the motion sensor is activated by any occupant movement in the area served by the lighting units"²

A 2001 Code Application Notice issued by California's Office of Statewide Health Planning and Development amended previous state egress code regarding illumination. It states that "egress illumination is not needed for portions of the building that are not occupied"³ This allows the egress illumination in unoccupied areas to be monitored and determined by actual user need.

The Lighting & Day Lighting Committee is not aware of any codes aside from New York City's that prohibit the control of lighting in means of egress.

LEED

Due to improved energy performance resulting from these measures, this proposal may assist in compliance with LEED prerequisites for Energy & Atmosphere under most of the rating systems.

These recommendations will also facilitate achieving LEED Energy and Atmosphere credits:

- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED ND-GCT cr.2 Energy Efficiency in Buildings
- LEED for Schools EA cr.1 Optimize Energy Performance
- and credits under LEED pilot programs. These credits require exceeding the minimum standards established by the Energy and Atmosphere prerequisites.

LEED CI-EA cr.1.1 Optimize Energy Performance, Lighting Power, specifically addresses reducing lighting power throughout the entire tenant space. According to the LEED CI 2.0 Reference Manual, for commercial interior projects the reduction of interior lighting power stands to be the greatest energy conservation method available. Therefore, this proposal will have a significant positive impact on LEED certification.

LEED Indoor Environmental Quality subsections regarding daylight illumination, and LEED CI-EA cr.1.2 Daylight response controls, are only applicable to regularly occupied spaces. Therefore, this proposal will not assist in achieving

these credits.

Implementation & Market Availability

There are no known implementation issues for this proposal.

Photosensors have been used for decades to turn off exterior emergency lighting at points of exit discharge from buildings. The proposal would allow this same technology to be used inside the building. Occupancy sensors have also been in widespread use for decades, and are extremely good at detecting the “major body motion” of a person walking.

ENDNOTES:

¹ MASS. BLD. CODE REGS. 780 § 1006.1 (2008).

² NFPA, LIFE SAFETY CODE 101 § 7.8.1.2.2 (2009).

³ STATE OF CALIFORNIA OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT, CODE APPLICATION NOTICE (2004), <http://www.oshpd.ca.gov/FDD/Regulations/CANS/2001/2-1003-2-9.pdf>.

EE 16: INCREASE LIGHTING EFFICIENCY ON CONSTRUCTION SITES

New York City Building Code

Proposal developed by the Construction Practices Committee

Summary

Issue:

The standards for temporary lighting on construction sites are outdated, allowing for inefficient fixtures and wasteful practices.

Recommendation:

Update the efficiency standards for lighting on construction sites, provide separate circuits for life-safety lighting and let natural light illuminate foot bridges, temporary walkways and sidewalk sheds.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 3302.1 to include the following defined terms:

CONSTRUCTION LIGHTING, GENERAL. Temporary lighting of construction sites that is not construction safety lighting.

CONSTRUCTION LIGHTING, SAFETY. Lighting of foot bridges, temporary walkways, sidewalk sheds, stairwells and other pathways through a construction site for the purposes of illuminating ingress and egress pathways 24 hours a day.

PHOTOCELL SENSOR. A device that detects light and varies the electricity provided to a lamp or ballast according to ambient illumination. All photocell sensors shall fail on, such that if the sensor stops working then lamps will receive electricity by default.

2. Amend Section 3303.2.3 as follows:

3303.2.3 Electrical work. All temporary electrical equipment and wiring shall meet the requirements of the New York City Electrical Code, and shall be maintained in compliance with such requirements. Portions of permanent electrical installations may be used for temporary operations provided the requirements of the New York City Electrical Code are met. Safety construction lighting and general construction lighting shall have a luminous efficacy of 45 lumens per watt or greater. In addition, general construction lighting shall be:

1. Separately circuited from safety construction lighting.
2. Controlled by master switches, which shall also control all non-essential power circuits. The master switches shall be located close to the main access to the construction site and be clearly labeled. The ingress pathway to master switches shall be illuminated by safety construction lighting.
3. Turned off when the construction site is not open.

3. Amend paragraph 2 of Section 3307.2.1 as follows:

All temporary walkways shall be illuminated at all times either by natural or artificial light. The level of illumination shall be the equivalent of that produced by [200 watt, 3400 lumen minimum, standard incandescent lamps] 32 watt 2700 lumen minimum T8 fluorescent lamps enclosed in vandal-proof fixtures and spaced 15 feet (4572 mm) apart and 8 feet (2438 mm) above the floor level. All lamps shall have a luminous efficacy of 45 lumens per watt or greater, be instant-start, and be rated for low temperature use. Artificial lighting units shall be inspected [nightly] daily; and burned out or inoperative units shall be replaced or repaired immediately. Photocell sensors may be used to control artificial lighting according to the amount of natural light available.

4. Amend paragraph 2 of Section 3307.2.2 as follows:

All foot bridges shall be illuminated at all times either by natural or artificial light. The level of illumination shall be the equivalent of that produced by [200 watt, 3400 lumen minimum, standard incandescent lamps] 32 watt 2700 lumen minimum T8 fluorescent lamps enclosed in vandal-proof fixtures and spaced 15 feet (4572 mm) apart and 8 feet (2438 mm) above the floor level. All lamps shall have a luminous efficacy of 45 lumens per watt or greater, be instant-start, and be rated for low temperature use. Artificial lighting units shall be inspected [nightly] daily; and burned out or inoperative units shall be replaced or repaired immediately. Photocell sensors may be used to control artificial lighting according to the amount of natural light available.

5. Amend Subdivision 2 of Section 3307.6.5 as follows:

2. The underside of sidewalk sheds shall be illuminated at all times either by natural or artificial light. The level of illumination shall be the equivalent of that produced by [200 watt, 3400 lumen minimum, standard incandescent lamps] 32 watt 2700 lumen minimum T8 fluorescent lamps enclosed in vandal-proof fixtures and spaced 15 feet (4572 mm) apart and 8 feet (2438 mm) above the floor level. All lighting shall have a luminous efficacy of 45 lumens per watt or greater. Lamps shall be 'instant-start' and rated for low temperature use. Artificial lighting units shall be inspected [nightly] daily; and burned out or inoperative units shall be replaced or repaired immediately. Photocell sensors may be used to control artificial lighting according to the amount of natural light available.

Supporting Information

Issue – Expanded

New York City is filled with construction sites and sidewalk sheds that are illuminated 24/7 with inefficient incandescent light bulbs. Typically, sidewalk shed lights remain on all the time, even when daylight is sufficient. Leaving non-essential lighting on while job sites are closed is wasteful and does not enhance public or worker safety – work on a construction site after 6:00 pm requires a special City permit and thus is not the norm.

These wasteful practices are primarily the result of outdated code provisions. For example, the Building code does not mandate minimum energy efficiency measures for construction lighting and power, as it does for permanent installations. Furthermore, it does not differentiate between lighting requirements for emergency access versus general construction activities.

This proposal would create a minimum efficiency standard for construction lighting and require that non-safety lighting on a construction site be turned off after-hours. The fluorescent lamps specified in this proposal use 65 to 75 percent less energy than incandescent lamps to provide the same amount of light and can last up to 10 times longer.

The proposal would also update outdated illumination standards for temporary walkways, foot bridges, and sidewalk sheds. Among other changes, these updates would allow sidewalk sheds to use photocell sensors to turn off artificial lighting when there is sufficient illumination from daylight.

Implementing this proposal would save energy and money with no impact on safety.

Environmental & Health Benefits

This proposal will save substantial energy, improving air quality and reducing greenhouse gas emissions.

Even if existing lighting standards remain in place, just switching off construction lighting after-hours and using photocell sensors in sidewalk sheds would generate enormous energy savings. Turning off lights 12 hours per day (including weekends) at construction could save 11,680 MWh/year of electricity.ⁱ Controlling sidewalk shed lighting with photocell sensors could save approximately 7,712 MWh/year of electricity and reduce peak electric demand on weekdays by 1.8 MW.ⁱⁱ

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score 2.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For some buildings this proposal will result in no increase of capital costs and for others an increase of up to 0.03%. It was thus categorized as incurring no to a low capital cost increment.

Savings to Building Owner:

For a 100,000 SF building with a 10,000 SF floor plate that takes 30 months to construct, turning general construction lighting off after hours would save the building owner approximately \$77,000 if the building has incandescent construction lighting and approximately \$18,000 if the building uses CFL's for construction lighting. This assumes that 75% of the construction lighting is general construction lighting and work takes place 12 hours a day, 5 days a week. Reducing lamps' operation hours also extends their life, thus saving the building owner approximately \$4500 of replacement incandescent bulbs (6 fewer bulb changes at \$1.67 per bulb) or approximately \$4500 of CFL lamps (2 fewer bulb changes at \$5 per bulb). These cost savings do not include potential labor savings in avoided bulb replacement.

For Foot Bridges, Temporary Walkways and Sidewalk Sheds, energy savings will range from 9.7 to 11.1 watts per linear foot of sidewalk and maintenance will be reduced by 80% or more because the higher efficacy lamps also have a longer life and require less maintenance. Maintenance savings are particularly significant for these applications, because burned out lamps are costly to replace and threaten public safety.

Savings to NYC:

The direct energy savings for the measures proposed herein would accrue to the owner, but New York's utility system would also benefit by the corresponding reduction in electricity demand. Switching lights off 12 hours/day during the week and keeping them off throughout the weekend would save 15,000 MWh/year of electricity. This assumes 6 million square feet of building construction illuminated by 100W incandescent bulbs spaced 15' X 15' on center. The savings are less, but still significant, if all construction lighting is 23W CFL spaced 15' X 15' on center: 2687 MWh/year.

Controlling sidewalk shed lighting with photocells would save 7,712 Mwh/year of electricity and reduce peak electric demand on weekdays by 1.8 Mw. This assumes 80% of NYC's estimated 25 miles of sidewalk shed have access to daylight and are currently illuminated by 200W incandescent fixtures spaced 15' on center.

Precedents

The strongest precedent for replacing current code language that specifies illumination in terms of incandescent bulb wattage is the national energy bill George Bush signed into law in 2007. The bill banned manufacturing of 100 watt incandescent bulbs in 2012 and incandescent 40 watt bulbs in 2014.

OSHA's Standards for the Construction Industry(located under Subpart D, Occupational Health and Environmental Controls) are as follows: 3 foot-candles for "general construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling and field maintenance areas" and 5 foot-candles for other "general construction areas."ⁱⁱⁱ

LEED

While this proposal is consistent with the goals of LEED to reduce energy waste and reduce light pollution, LEED does not have any prerequisites or credits dealing with energy use during construction or temporary lighting.

Implementation & Market Availability

The technology and equipment promoted by this proposal are readily available: CFLs fit existing fixtures commonly used in construction lighting and fluorescent lamps specifically designed for rough duty are available. Photocell sensors are widely used for other applications.

Unless the industry begins making left handed screw compact fluorescent lamps, electrical contractors will need to replace the lamp sockets on their temporary light stringers to accept conventional right-handed screw lamps. Conventional sockets are readily available.

Notes

Safety of Photocells:

The committee discussed whether there are any safety concerns with using photocell sensors in sidewalk sheds or other applications.

The issues with doing so are the same as for occupancy sensors, which have been used for years around the country in egress paths. The NFPA 101 2006 Life Safety Code, for example, permits the use of lighting controls (specifically motion

sensors). NFPA addresses safety concerns by requiring occupancy sensors in egress paths to “fail on,” meaning that if the occupancy sensor is no longer working, the lights will come on as the default position.

The principles for photocell sensors are similar. Photocell sensors will only shut lights off if the sensor detects the level of ambient light programmed by the installer. For example, an installer can set a photocell sensor to keep light on until 60 footcandles are detected, even if an area is only required to have 30 footcandles of illumination. This ensures the electric lights controlled by the photocell can be turned off without dropping the illumination level below the design level and that the area is never darker than intended. Many photocell sensors are already designed to “fail on” so that if a photocell stops working for some reason, lights will come on and stay on until the photocell is repaired or replaced.

Requiring Photocell Sensors for Sidewalk Sheds:

The Committee discussed whether to recommend mandating their use in sidewalk sheds. Since sidewalk sheds are located throughout the city, there may be substantial energy savings from requiring this practice.

In particular, the Committee considered including the following language in Subdivision 2 of Section 3307.6.5:

Any lamp located within 15 feet of an open edge of a sidewalk shed shall be controlled by a photocell sensor that shall turn off the lamp when daylight provides a minimum illumination level of 20 foot-candles measured at the ground at the middle of the sidewalk shed.

However, the Committee was unable to identify any locations in NYC that had used photocells in this manner. For these reasons, the Committee opted to leave photocells as an option in this section and will encourage owners and contractors to pilot this sensor application.

Mercury in Fluorescent Lamps:

Unlike incandescent lamps, fluorescent lamps contain mercury, which can be released if the lamps are broken in uncontrolled circumstances. However, the quantity of mercury released poses relatively little risk to an adult. In the event of a breakage, fluorescent lamps should be cleaned up with a HEPA vacuum or damp cloth to contain the mercury. Further, the primary source of mercury emissions in the U.S. is from electricity generation so using fluorescent lamps instead of incandescent will reduce overall mercury exposure levels.^{iv} At the end of their useful life, fluorescent lamps should be recycled to recapture the mercury.

ENDNOTES:

ⁱ Assumes 6 million square feet of building construction is illuminated by 100W incandescent bulbs spaced 15' X 15' on center.

ⁱⁱ Assumes that 80% of New York City's estimated 25 miles of sidewalk shed have access to daylight and are currently illuminated by 200W incandescent fixtures spaced 15' on center.

ⁱⁱⁱ 29 C.F.R. § 1926.56, available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10630.

^{iv} ENERGY STAR®, FREQUENTLY ASKED QUESTIONS: INFORMATION ON COMPACT FLUORESCENT LIGHT BULBS (CFLs) AND MERCURY, 1 (July 2008), http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact_Sheet_Mercury.pdf.

EE 17:

Use Outdoor Air for Cooling

ANSI/ASHRAE/IESNA Standard 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Buildings can be cooled using outside air when temperatures are sufficiently low. ASHRAE 90.1 does not require this energy-efficient practice in New York City's climate zone.

Recommendation:

Require that new HVAC systems be capable of utilizing outside air for cooling, when temperatures permit.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Amend Table 6.5.1 of Section 6.5.1 as follows:

6.5.1 Economizers.

Table 6.5.1 Minimum System Size for Which an Economizer is Required

Climate Zones	Cooling Capacity for Which an Economizer is Required
1a, 1b, 2a, 3a [~~4a~~]	No economizer requirement
4a, 2b, 5a, 6a, 7, 8	$\geq 135,000$ Btu/h
3b, 3c, 4b, 4c, 5b, 5c, 6b	$\geq 65,000$ Btu/h

Supporting Information

Issue Expanded

It is often necessary to cool the interior of a building even though the outdoor temperature is at or below a comfortable level. This occurs because of internal loads, such as computers and lights that emit heat into the interior of the structure. A simple air conditioning system will simply continue to operate under these circumstances, using electricity to power in its compressor. An economizer is a collection of vents and controls that allows the system to substitute cool outdoor air for recirculated indoor air that has been cooled in the air conditioner. Since the economizer relies only on fans and permits the compressor to be shut down (or its use greatly reduced), the use of electric energy is lowered substantially.

The economizer consists of some additional equipment, but is relatively minor in the context of a whole system. The payback period for the additional cost is very short, hence the use of economizers in most applications independent of Code requirements. The reason for adding back this requirement to the Energy Code is simply catch the rare situation whereby a designer may not be informed about the use of this technology. For this reason, we have moved the New York City climate zone (4a) from the group that does not require economizers to the group that require economizers on relatively large systems.

Environmental & Health Benefits

Reduced electric energy use will result in reduced emissions of both Clean Air Act pollutants (particulates, nitrous oxides and sulfur oxides) and carbon dioxide, lowering the carbon footprint.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.01% to 0.02%, depending on building type. It was thus categorized as incurring no to a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents

Economizers have long been required in New York City, under previous versions of ASHRAE 90.1; this measure will merely adjust the regions for which they are required as described above.

LEED

The use of economizers contributes to energy efficiency and to associated LEED points.

Implementation and Market Availability

There are no known implementation issues for this proposal. Economizers are readily available and in widespread use.

EE 18:

USE WASTE HEAT FROM CONED

ANSI/ASHRAE/IES 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Energy is wasted due to the dumping of hot condensate from purchased Con Edison steam. In addition, substantial potable water is wasted cooling the condensate to 150 degrees F. before it is dumped in the sewer.

Recommendation:

Require all new or reconstructed heating systems that use Con Edison's steam to maximize the recovery of heat from steam condensate. Doing so will lead to significant savings of energy and water.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IES 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

1. Amend Section 6.8 as follows:

6.8 Minimum Equipment Efficiency [Tables]

6.8.1 Minimum Efficiency Requirement Listed Equipment Tables – Standard Rating and Operating Conditions

(Tables 6.8.1A - 6.8.1J are unchanged.)

6.8.3 Minimum Pipe Insulation Thickness Table

(Table 6.8.3 is unchanged.)

6.8.4 Steam

6.8.4.1 General. Buildings utilizing district steam service shall either (i) incorporate the technologies listed below in sections 6.8.4.1.1 and 6.8.4.1.2, or (ii) meet the alternative performance standard described in subsection 6.8.4.1.3.

6.8.4.1.1 Service Hot Water. Buildings utilizing district steam for space heating or cooling shall incorporate heat exchangers utilizing the latent heat in the condensate to heat or preheat service hot water used in the building, in accordance with standards for such equipment established by the department.

6.8.4.1.2 Hot Water Space Heat. Buildings utilizing district steam for space heating and for which the design service hot water load will not lower the temperature of the condensate from all steam utilized to 100°F at winter design point conditions shall incorporate hydronic (hot water) radiation circulating the condensate through a portion of the building sufficient to bring the temperature of the condensate down to 140°F. The condensate shall then supply the service hot water heat exchanger required under subsection 6.8.4.2. 6.8.4.1.1.

6.8.4.1.3 Alternate Performance Standard. In lieu of the technologies listed in subsections 6.8.4.1.1 and 6.8.4.1.2, a building may utilize any design that will meet thermal loads within or contiguous to the building and will remove 100 Btus per pound of steam utilized for space heating from the condensate.

Supporting Information

Issue – Expanded

Buildings that use Con Edison district steam for space heat or cooling commonly dump the resulting steam condensate into the sewer. Because of the danger of damage to the sewer system and sanitary requirements, the condensate, which is normally at 212°F, must be cooled to 150°F before it can be released, and this is normally done by adding cold, potable water to temper it. This common practice is wasteful in three different ways: (1) the thermal energy available from the hot condensate is discarded rather than used; (2) potable water is wasted to cool the condensate; and (3) the useful but non-potable condensate is discarded when it could displace potable water for irrigation, sidewalk cleaning, or wet cooling tower use.

This proposal would require buildings to reclaim the useful heat from hot condensate for heating, hot water or other purposes. Using the thermal energy in condensate would also eliminate the waste of potable water, since it would no longer be necessary to cool the condensate for disposal or reuse. WE 7 Reuse Water from ConEd Steam would require the reuse of condensate, addressing the third and final issue noted above.

Environmental & Health Benefits

A 100 unit residential building might use 7,500 million Btu of steam in a year. Complying with the provisions in this proposal will save about 550 million Btu of steam and eliminate the need for over 700,000 gallons of potable water that would have been used to temper the condensate before disposal in the sewer.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.01%. It was thus categorized as incurring a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years.

Precedents

There are no known precedents for this proposal. Many other district steam systems return the condensate to the plant; Con Edison does not.

LEED

Current LEED prerequisites for Minimum Energy Performance under the Energy & Atmosphere sections of almost all of the rating systems require that the scope of work complies with ANSI/ASHRAE/IESNA standard 90.1-2004. This proposed code requires compliance with measures exceeding ASHRAE 90.1-2007. Since LEED 2009 prerequisites for Minimum Energy Performance also reference ASHRAE 90.1-2007, the measures outlined in this proposal will be correlated with the next generation of LEED.

However, LEED qualifies that a more stringent local code requirement becomes the LEED prerequisite requirement as well. Therefore, this proposal will change the baseline criteria that registered projects must meet for LEED certification. Code revisions under this proposal do not apply to the LEED for Homes or the LEED for Existing Buildings rating systems, which reference Energy Star criteria. For existing buildings, LEED EB provides an alternate calculation method. LEED does not address water savings accomplished through reclaiming heat from steam condensate. However, the subsequent reuse of condensate water is addressed under LEED Water Efficiency credits.

Implementation & Market Availability

There are no known implementation issues for this proposal. Con Edison recommends condensate heat recovery as a practice, and has useful information at its website.¹

Notes

This requirement may not eliminate the need for any tempering water, since there are few thermal loads suitable to temper the steam used for absorption chillers once the service hot water loads have been met. It should be practical to make use of condensate from absorption chillers as wet cooling tower make-up water, but because precedents and examples are not available, this is not included as a requirement. This requirement will only affect new or reconstructed buildings.

ENDNOTES:

¹ Con Edison, Knowledge Center: Operational Tips, http://www.coned.com/steam/kc_cri.asp (last visited Jan. 28, 2010).

EE 19: INSULATE PIPES EXPOSED DURING CONSTRUCTION

New York City Building Code
Proposal developed by the Energy & Ventilation Committee.

Summary

Issue:

Pipe insulation is a cost-effective measure to improve energy efficiency. While it is required for new construction, most pipes in existing buildings lack this beneficial insulation.

Recommendation:

Require that all pipes exposed during renovations be insulated.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Section 1303 as follows:

SECTION BC 1303 **INSULATION OF EXISTING PIPING DURING CONSTRUCTION**

1303.1 Piping insulation during construction. Except as noted below, any existing pipe for water distribution, heating, or cooling concealed in a wall, floor, ceiling, or chase that is exposed in the course of repair or renovation shall be insulated to the levels specified in ANSI/ASHRAE/IESNA 90.1 (2007), Table 6.8.3. This requirement shall apply to the entire length of pipe between the top and bottom floor plates of the floor on which the pipe is exposed, and to any further length of pipe that can be directly accessed through the openings exposing the pipe, without removal of existing masonry or other permanent building structures.

Exception. Any pipe used for drainage, venting, or fire suppression or that must be exposed in order to function as intended, including pipes that function as part of a heat delivery system.

Supporting Information

Issue – Expanded

Water pipes of all sorts lack insulation in most New York City buildings constructed before the advent of energy codes. In the case of steam and hot water pipes used for heating, this results in a lack of control and overheating, since the heat is emanating from walls or exposed pipes and cannot be turned off with radiator valves.

Domestic hot water (DHW) pipes, similarly uninsulated, often run in proximity to domestic cold water supply pipes, heating the cold water and draining heat from the hot water. The latter is normally replenished by the recirculation system that ensures adequate DHW at taps far from the boiler. Even if the DHW pipes are isolated in a chase, they lose substantial heat to the surrounding walls, which is either uncontrolled heat during heating season or unwanted heat that must be removed by air conditioners during cooling season. Also, insulating hot water pipes can raise water temperature at the tap by 2 to 4°F, allowing for a lower water temperature setting at the boiler.

Finally, cold water pipes, either for domestic cold water or, far less often, for air conditioning, must be insulated to prevent the accumulation of condensate from natural humidity (“sweating”) during warm weather.

Insulating pipes that are embedded in walls is an expensive and disruptive task, and is normally not worth doing on the basis of expected savings if the walls must be opened. However, if the walls are open for other reasons, the cost of insulation is so low that it is currently installed by many responsible contractors and building operators. This proposal seeks to make this practice universal.

Environmental & Health Benefits

Benefits include fuel saved by not wasting heat in heating and DHW systems and associated reduced air pollution. Also, elimination of condensation on cold pipes reduces moisture in walls, inhibiting the growth of molds and other pests.

This was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.2% to 1.4%, depending on building type. It was thus categorized as incurring a medium to higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years.

Precedents

There are no known precedents for this proposal. However, insulation guidelines are addressed in ANSI/ASHRAE/IESNA Standard 90.1. ASHRAE has also issued Advanced Energy Guidelines for Small Office Buildings.¹

See also International Plumbing Code (IPC) and International Building Code (IBC); IBC section 719, Thermal and Sound-Insulating Materials, has several sections that deal with insulating materials.

LEED

For an existing building filing under the LEED EB rating system, there are no LEED credits directly affiliated with this proposal. LEED EB references Energy Star[®] criteria. However, if the building type is not addressed by ENERGY STAR[®], the team may provide calculations showing equivalent EPA ENERGY STAR[®] rating for the building calculated using the alternate calculation method described in the LEED for Existing Buildings Reference Guide over the performance period. Using this method, the proposed code revision may positively impact compliance with LEED.

The LEED for Homes rating system references Energy Star[®] criteria and does not provide an alternate calculation method. However, this proposal will assist in achieving LEED for Homes EA cr. 5, which requires insulation around distribution pipes in unconditioned spaces as part of a non-ducted HVAC system. Additionally, LEED for Homes EA cr. 7.2 requires that all domestic hot water piping shall be insulated.

If an existing building is seeking LEED certification under any another rating system, the ASHRAE 90.1 20007 standard will be directly applicable for LEED 2009. In this case, the proposal will directly assist in meeting Energy & Atmosphere prerequisites, and EA credits for Optimizing Energy Performance.

Implementation & Market Availability

There are no known implementation issues for this proposal. Insulation materials are readily available.

ENDNOTES:

¹ AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS, ADVANCED ENERGY DESIGN GUIDE FOR SMALL OFFICE BUILDINGS (2004), http://www.energycodes.gov/rc/AEDG_SmallOfficeBuildings.pdf.

EE 20: CLARIFY STANDARDS FOR EQUIPMENT VENTING

New York City Fuel Gas Code

Proposal developed by the Energy & Ventilation Committee.

Summary

Issue:

Venting boilers to the sidewalls of buildings encourages the use of efficient appliances by reducing costs. However, sidewall venting is often rejected by building inspectors for reasons that are not clearly delineated by any agency guidelines. This creates an uncertainty that discourages contractors from installing efficient equipment.

Recommendation:

Establish physical criteria that clarify when sidewall venting is allowable and ensure these criteria are consistent with national practices.

Proposed Legislation, Rule or Study

Amendments to New York City Fuel Gas Code:

1. Amend subdivision 2 of section 503.8 as follows:
 2. Where permitted, through-the-wall vents for Category II and IV appliances and non-categorized condensing appliances shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard, as delineated by physical criteria established by the department, or could be detrimental to the operation of regulators, relief valves or other equipment. Where local experience indicates that condensate is a problem with Category I and III appliances, this provision shall also apply.

Supporting Information

Issues – Expanded

Condensing boilers and other condensing gas-fired equipment are substantially more efficient than traditional, non-condensing designs. They have the added advantage that the exhaust is cooled to temperatures where it is not dangerous to the touch. Further, because condensing equipment is intrinsically clean burning, the exhaust is not noxious. Accordingly, there has been a dramatic increase in the availability of equipment designed to exhaust directly through a wall of the building, rather than using a stack reaching up to the roof.

One nuisance that can result from this sidewall venting is that the exhaust is saturated with water vapor, which can condense and drip. So, for example, if care is not taken, a drip in winter could lead to a trickle of water and then a layer of ice on a sidewalk. Clearly, care and discretion should be brought to bear on any installation. However, these concerns have led to a situation where the use of these efficient devices is fraught with risk for the installer or owner.

Sidewall venting is legal in New York City but is subject to constraints under the New York City Fuel Gas Code. As written, the Code gives great discretion to the building inspector to determine whether a particular installation is acceptable or not, and installers report many instances where inspectors have prohibited an installation for unclear reasons, or have even refused to approve an installation after it was installed in apparent accord with Code requirements. This has led to a situation where installers are reluctant to install this efficient equipment because of potential problems later. This proposal will clarify the conditions under which this equipment can be installed, lessening the uncertainty and encouraging its use.

Environmental & Health Benefits

Increased utilization of condensing equipment will result in decreased fuel use and lowered emissions of both greenhouse gases and Clean Air Act pollutants.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is to clarify code requirements, and will therefore have no direct impact on construction costs.

Precedents

Several national codes have implemented installation and safety guidelines for sidewall ventilation of HVAC equipment in response to the growing number of HVAC products that have been designed for sidewall venting. NFPA 54 Section 12.9 and NFGC Section 12.9 provide standards for through-the-wall ventilation.ⁱ

LEED

This will make achievement of LEED Energy and Atmosphere points easier.

Implementation & Market Availability

There are no implementation issues for this proposal.

ENDNOTES:

ⁱ HVAC Web Connection, Venting Today: A Complex Subject, <http://www.hvacwebconnection.com/hvacarticles/ventingtoday1.htm> (last visited Jan. 28, 2010).

EE 21: MODERNIZE BOILER REGULATIONS

Study

Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

NYC's boiler regulations were written in 1973, and are based on now outmoded technology.

Recommendation:

A dedicated task force -- including boiler experts, DEP Air Engineering Staff, and members of the Green Codes Task Force -- should review existing boiler regulations and propose revisions.

Proposed Legislation, Rule or Study

Study on Local law 49/71 and DEP Rules Regarding Fuel Oil Burning Equipment.

By Jan. 1, 2011, the Department of Environmental Protection shall convene a dedicated task force, including boiler experts from city government, NYPA and the private sector, DEP Air Engineering Staff, and members of the Green Codes Task Force, to update the city's regulatory language for boiler regulations and improved combustion efficiency, along with supporting materials. The updated regulations shall be completed by Jan. 1, 2012, with rulemaking completed by June 1, 2012.

Some preliminary ideas follow:

1. Eliminate the need for separate DEP Air Resources approval of equipment. The buildings department as of July 2008 has eliminated the MEA requirement for burners. The only requirement should be that the burner is listed with a NRTL (Nationally Recognized Testing Laboratory, e.g. UL, ETL, CSA, etc.)
2. Provide standard minimum performance criteria. Suggested standards: Minimum 81% boiler/ burner efficiency with zero trace smoke, less than 100 ppm CO and 8% or less O₂. This regulation should apply to both oil and gas burners.
3. Ban the installation of new oil burners that do not provide 100% of required combustion air. This ban should become effective within two years after passage of new DEP regulations. There should be no exceptions.
4. Eliminate inconsistencies in the DEP regulations (e.g. B8(b) allows #2 smoke for burner acceptance but smoke alarm regulations state a maximum of #1 smoke).
5. Firing rate controls: There should be phased-in regulations of burner firing rate capability and firing rate controls for all burners, both gas and oil. Suggested standards: Burners 450,000 Btuh can be on-off firing. Burners above 450,000 and under 2,000,000 low-high-low with a minimum 1.5 to 1 turndown ratio. 2,000,000 to 2,800,000 low-high-low with a minimum 2 to 1 turndown ratio. Above 2,800,000 the turndown ratio should be at least 3 to 1 using either step modulation or full modulation.
6. Draft regulations: Current DEP regulations are extremely specific regarding minimum draft for a C of O performance test. They say little or nothing regarding draft control itself. Proposed revisions should include requirements for adequate draft controls based upon chimney height or set draft standards. For example, all combustion equipment must provide adequate draft control to maintain draft between -0.02" w.c and -0.10" w.c with outside air between 0 and 94 degrees Fahrenheit.
7. Reevaluate the need for the chimney receptor regulations in view of proposed combustion performance improvement regulations.
8. Eliminate the prohibition against the use of parallel firing rate lead-lag controls.
9. Reevaluate the threshold for the triennial boiler inspection. Possibly it would be advantageous to lower the size threshold to 1.5 or 2MM Btu/hr to include additional boilers and or boilers firing #2 oil or natural gas.

Supporting Information

Issue- Expanded

The current New York City Department of Environmental Protection (DEP) fuel oil combustion code was written in 1973 and has not been updated since. It was designed with regard to horizontal rotary burners and other types of burners that were not designed to supply the air required for proper combustion by themselves. Rather, these devices relied upon chimney draft for the air necessary to achieve complete combustion. Such burners can no longer be installed in NYC. All oil burners currently installed do provide 100% of the air required for combustion and consequently this code is obsolete for the vast majority of installations. The current code also does not apply to burners smaller than 20 gph and is unevenly enforced. A larger set of other accumulated shortcomings is enumerated above in the formal proposal.

Amending the existing regulation to bring the combustion code up to date to address current technology, and expanding the application of the code to smaller boilers could achieve very significant energy savings.

Environmental & Health Benefits

Implementation of a revised set of regulations will result in reduced soot emissions (2.5 micron) as well as energy savings from higher boiler/burner combustion efficiency. It will also result in lower citywide emissions of greenhouse gasses and of Clean Air Act pollutants due to better combustion efficiency.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a positive indirect health impact.

Cost & Savings

This proposal is for a task force, which will have no direct impact on costs.

Precedents

Enabling law covered in section 204 of Title 4 of NYS labor law governing boilers And NYC local law 62/91.

LEED

This proposal will have no direct impact on LEED credits

Implementation & Market Availability

The resultant changes will only include off the shelf technologies that have not necessarily been previously encouraged in NYC.

Notes

Potential energy savings from all boilers in NYC of 8 to 15% per annum depending upon an existing building's combustion efficiency, combustion control options and heating plant application (heating only or heating/DHW combined.)

EE 22

REDUCE LIGHTING POWER REQUIREMENTS FOR OFFICES

Administrative Code of the City of New York (New York City Amendments to National Electrical Code)
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

An outmoded provision of the Electrical Code mandates that spaces have capacity to deliver three times the power for lighting as is allowed under the Energy Code. This increases cooling load requirements, necessitating oversized, expensive HVAC systems.

Recommendation

Reduce the required lighting power capacity to better align with the Energy Code.

Proposed Legislation, Rule or Study

Amendments to Section 220.12 of Section 27-3025 of the Administrative Code of the City of New York (New York City Amendments to the National Electrical Code):

1. Amend Table 220.12 as follows:

Table 220.12 General Lighting Loads by Occupancy

Type of Occupancy	Unit Load	
	Volt-Ampere per Square Meter	Volt- Ampere per Square Foot
Armories and auditoriums	11	1
Banks	(39 ^b) – 14.4^b	(3.5b ^b)- 1.3^b
Barber shops and beauty parlors	33	3
Churches	11	1
Clubs	22	2
Court rooms	22	2
Dwelling units ^(a)	33	3
Garages – commercial (storage)	6	0.5
Hospitals	22	2

Hotels and motels, including apartment houses without provision for cooking by tenants ^(a)	22	2
Industrial commercial (loft) buildings	22	2
Lodge rooms	17	1.5
Office buildings	(39 ^b) - 14.4^b	(3.5b ^b)- 1.3^b

(a) Refer to 220.14(J) in NYC Electrical Code

(b) Refer to 220.14(K) in NYC Electrical Code

Supporting Information

Issue - Expanded

The electrical code prescribes an excessively high wattage per square foot (i.e. power density) – one that is roughly three times the wattage the energy code even *allows* -- to be used in calculating the power requirements for the lighting in commercial and banking space. This overestimation has several negative impacts. Since the electrical load within a space is one of the inputs used in sizing cooling equipment, this provision leads to oversized cooling systems. Oversized cooling systems are expensive to purchase and install, wasting money that could have been used to make the building more efficient; also, often these systems are less efficient when they run on part loads, wasting energy over the long haul. Finally, this minimal code requirement helps create an impression that high power densities are in fact required, causing prudent commercial tenants to think they should ask for even more. Thus, commercial tenants in NYC will commonly ask for 6 to 8 watts per square foot (for lighting and receptacle power) when they will actually use no more than 2.5.

These electrical requirements date from historic conditions that no longer pertain. In the 1980s-1990s commercial office tenants experienced significant hardship in obtaining adequate power from landlords during the introduction of PC's and laser printers to the workplace. Since that time, PC's have become more efficient, particularly due to the increasing use of efficient, flat screen, LCD monitors and through the wide-spread use of laptop computers. In addition, the quality and efficacy of lighting systems have improved dramatically over the past thirty years, with the result that the lighting power density allowed by the 2004 version of ASHRAE is roughly half that allowed in the 1980 version. With the introduction of LED lighting and continual improvements in fluorescent technology, it is clear that power requirements for lighting systems will continue to decrease.

The electrical code has not kept pace with these trends, still prescribing a very a high electrical power density to be used in calculating lighting loads. Thus, it is proposed that the minimum lighting power density prescribed in the electrical code be based on the maximum lighting power density being mandated by the energy code, with a reasonable safety and capacity factor to ensure the safe operation of these systems. ASHRAE 90.1 2007 prescribes a maximum power density of 1w/gsf or approximately 1.1 VA/gsf for lighting in office buildings. The proposed electrical power density of 1.3 VA/gsf for office lighting provides a minimum safety factor and capacity margin of 20%.

Environmental & Health Benefits

The ability to down-size the cooling system will certainly result in lower capital costs, and may produce demand and/or energy savings, depending upon the equipment installed. Depending on individual practice, demand for copper in wiring may also be reduced.

This proposal was determined to have a low environmental impact per building and to impact a low number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have no direct or indirect health impact.

Cost & Savings

This proposal will not cause any increase in capital costs, since it will permit downsizing of equipment. It may result in cost decreases, but on a project-by-project basis, which cannot be projected at a useful level of confidence.

Precedents

There are no known precedents for this proposal.

LEED

There are no LEED credits affiliated with this proposal.

Implementation and Market Availability

There are no known implementation issues for this proposal.

EE 23: REDUCE CO2 EMISSIONS DUE TO CONCRETE

New York City Building Code and Administrative Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Manufacturing cement, a significant component of concrete, requires large amounts of energy that produce significant quantities of CO₂. Cement can easily be replaced in concrete with less energy-intensive materials.

Recommendation:

Limit the amount of cement permitted in concrete, substituting other cementitious materials, such as readily available industrial by-products.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1905.2 as follows:

1905.2 Selection of concrete proportions. Concrete proportions shall be determined in accordance with the provisions of Sections 1905.2.1 through [1905.2.3.] 1905.2.4.

2. Add a new Section 1905.2.4 as follows:

1905.2.4 Maximum cement content. All concrete mixes requiring a compressive strength of 14,000 psi or less shall contain a maximum of 400 lbs. of Portland cement per cubic yard of concrete.

Amendments to the Administrative Code of the City of New York:

1. Add a new Section 6-308.1 as follows:

§ 6-308.1 Maximum cement content.

- a. No concrete mixes requiring a compressive strength of 14,000 psi or less purchased by any agency shall contain more than four hundred pounds of Portland cement per cubic yard of concrete.
- b. The director shall conduct an inter-agency study on the availability and cost of pre-cast concrete units purchased by agencies that could meet the requirements of Portland cement content as set forth in subdivision (a). No later than July 1, 2011, the director shall promulgate rules seeking to minimize the content of Portland cement in pre-cast concrete units purchased by agencies, while considering commercial availability, suitability of use and comparative cost.
- c. The department of transportation shall promulgate rules no later than July 1, 2011 that incorporate the standards for Portland cement content as set forth in subdivision (a) in all specifications for sidewalk construction.

Supporting Information

Issue – Expanded

Cement manufacturing is responsible for 3.4-5% of global carbon emissions and is the largest source of U.S. emissions after fossil fuel consumption.^{1,2,3} The primary source of carbon emissions from cement production is the use of coal and petroleum to fuel kilns. The production one ton of Portland cement results in the emission of approximately one ton of CO₂.

All concrete can be made with reduced amounts of Portland cement by using supplementary cementitious materials. The materials are typically fly ash, ground granulated blast-furnace slag (GGBFS) and silica fume, all of which are by-products of industrial processes that are typically placed in landfills. Since they are waste products, the use of supplementary cementitious materials directly offsets the CO₂ that would otherwise be released in cement production.

Fly ash can replace up to 50% of Portland cement in concrete mixtures, and the use of 25% fly ash is already common. GGBFS commonly replaces up to 40% of cement, and has replaced up to 80%.⁴ Silica fume can replace 5% to 7% of cement. In addition to reducing CO₂ emissions, fly ash and blast furnace slag increase the workability of concrete, which aids finishing operations, and reduce water demand. Supplementary cementitious materials also reduce the permeability of concrete, making them a necessary ingredient in concrete that has reinforcing steel or is subjected to chlorides, such as parking structures, bridge decks, road pavements and marine structures.

Environmental & Health Benefits

As previously discussed, replacing Portland cement with fly ash reduces greenhouse gas emissions. Each cubic yard of concrete produced in New York City is estimated to include 650 lbs of cement, as required under the old building code. By capping cement content at 400 lbs by 2010, this proposal will reduce concrete usage by a minimum of 250 lbs per cubic yard of cement used. With NYC using over 2 million cubic yards of concrete annually, this proposal will result in an annual reduction of 250,000 tons of CO₂.

According to New York City's 2009 Inventory of Greenhouse Gas Emissions, the city's CO₂ emissions were 53.3 million metric tons in 2008. Therefore, this proposal will reduce NYC's CO₂ emissions by 0.5% in 2010. By way of comparison, converting the city's taxi and black car fleet to hybrids is estimated to reduce the city's CO₂ emissions by 0.43%.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

Although no known precedents exist for limiting the amount of Portland cement used in concrete mixtures, several municipalities allow for the substitution of supplementary cementitious materials for Portland cement. For example, California has adopted the use of cementitious alternatives into the state's green building standards, including the use of fly ash, slag cement up to 70% replacement levels, and silica fume up to 7% replacement levels.⁵

The Port Authority of NY & NJ has substituted large quantities of supplementary cementitious materials for Portland cement in concrete mix proportions used at its facilities for various applications. These mix proportions produced concrete with high compressive strength and excellent durability. Some examples of these concrete mix proportions are given below:

Supplementary		
Portland Cement (Lbs.)	Cementitious Materials (Lbs.)	Compressive Strength (PSI)
80	320	5000
340	230	6500
350	300	8000
300	496	12000
300	580	14000

In winter weather, cold temperatures, to increase strength gain an admixture, strength accelerator can be added to the concrete mix.

LEED

LEED credits are available for the use of alternative cementitious materials that are derived from industrial by-products.

These credits include: LEED NC- MR cr.4.1 & 4.2 Recycled Content; LEED CI-MR cr. 4.1 & 4.2 Recycled content; LEED EB-MR cr.2 Optimize use of Alternative Materials; LEED for Schools MR cr.4.1 & 4.2 Recycled Content; LEED for Homes MR cr. 2 Environmentally Preferable Products; and credits under the various pilot programs.

Implementation & Market Availability

There are no known implementation issues for this proposal. Alternative cementitious materials are readily available. There are enormous quantities of fly ash available and presently ample quantities of GGBFS

It may be necessary to bring some concrete suppliers and engineers up to date with the current concrete technology in the use of supplementary cementitious materials. The Concrete Industry Board of NYC is capable and willing to perform this function.

ENDNOTES:

¹ U.S. ENERGY INFORMATION ADMINISTRATION, EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2007 (2008), <ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057308.pdf>.

² Ernst Worrell, et al., Carbon Dioxide Emissions from the Global Cement Industry, 26 ANN. REV. OF ENERGY & ENVT., 306 (2001).

³ L.J. HANLE, ET AL., U.S. EPA AND ICF CONSULTING, CO2 EMISSIONS PROFILE OF THE U.S. CEMENT INDUSTRY (2004), <http://www.epa.gov/ttnchie1/conference/ei13/ghg/hanle.pdf>.

⁴ Concrete Thinking for a Sustainable World, Benefits: Recycled Content, <http://www.concretethinker.com/solutions/Recycled-Content.aspx> (last visited Apr. 6, 2009).

⁵ CAL. CODE, Tit. 24 § pt. 11 § 804, 36 (2008), available at <http://www.documents.dgs.ca.gov>.

EE 24

REDUCE CO2 EMISSIONS FROM SPECIALIZED CONCRETE

New York City Building Code

Proposal developed by the Materials & VOCs Committee

Summary

Issue:

The NYC Building Codes currently limits the amount of recycled material that can be used in concrete exposed to de-icing chemicals.

Recommendation:

Increase the maximum percentage of recycled material that be used in concrete.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Table 1904.2.3 as follows:

TABLE 1904.2.3
REQUIREMENTS FOR CONCRETE EXPOSED TO DE-ICING CHEMICALS

CEMENTITIOUS MATERIALS	MAXIMUM PERCENT OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT ^{a,b}
Fly ash or other pozzolans conforming to ASTM C 618	[25] 30
Slag conforming to ASTM C 989	50
Silica fume conforming to ASTM C 1240	10
Total of fly ash or other pozzolans, slag and silica fume	50 ^c
Total of fly ash or other pozzolans and silica fume	35 ^c

Supporting Information

Issue – Expanded

Cement manufacturing is responsible for 3.4%-5% of global carbon emissions and is the largest source of U.S. emissions after fossil fuel consumption.¹ The primary source of carbon emissions from cement production is the use of coal and petroleum to fuel kilns. The production of one ton of Portland cement results in the emission of approximately one ton of CO₂.

All concrete, including simple flat work and concrete with high compressive strengths, can be made with reduced amounts of Portland cement by using supplementary cementitious materials. These materials are typically fly ash, ground granulated blast-furnace slag (GGBFS) and silica fume, all of which are by-products of industrial processes that are typically placed in landfills. Since they are waste products, the use of supplementary cementitious materials directly offsets the CO₂ that would otherwise be released in cement production.

Fly ash can replace up to 50% of Portland cement in concrete mixtures, and the use of 25% fly ash is already common. GGBFS commonly replaces up to 40% of cement, and has replaced up to 80%.² Silica fume can replace 5% to 7% of cement. In addition to reducing CO₂ emissions, fly ash and blast furnace slag increases the workability of concrete, which aids finishing operations, and reduces water demand. Supplementary cementitious materials also reduce the permeability of concrete, making them a necessary ingredient in concrete that has reinforcing steel or is subjected to

chlorides, such parking structures, bridge decks, road pavements and marine structures.

Environmental & Health Benefits

As previously discussed, replacing Portland cement with fly ash reduces greenhouse gas emissions.

NYC uses over 50,000 cubic yards of concrete exposed to chloride based de-icer per year. This proposal would lead to an average reduction of 25 lbs of cement per yard, reducing CO₂ emissions in NYC by over 50 tons per year.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

Many other municipalities across the country allow for the substitution of supplementary cementitious materials for Portland cement. However, the levels proposed here would become the highest known allowed.

The Port Authority of NY & NJ has been replacing 30% of Portland cement with fly ash in concrete mix proportions used on its bridge decks, parking structures and marine facilities. These structures have been subjected to chloride ions for about ten years and the Port Authority reports that the concrete produced is of high strength and durable.

LEED

LEED credits are available for the use of supplementary cementitious materials that are derived from industrial by-products.

These credits include: LEED NC- MR cr.4.1 & 4.2 Recycled Content; LEED CI-MR cr. 4.1 & 4.2 Recycled content; LEED EB-MR cr.2 Optimize use of Alternative Materials; LEED for Schools MR cr.4.1 & 4.2 Recycled Content; LEED for Homes MR cr. 2 Environmentally Preferable Products; and credits under the various pilot programs.

Implementation & Market Availability

There are no known implementation issues for this proposal. Alternative cementitious materials are readily available. There are enormous quantities of fly ash available and presently ample quantities of GGBFS.

It may be necessary to bring some concrete suppliers and engineers up to date with the current concrete technology in the use of supplementary cementitious materials. The Concrete Industry Board of NYC is capable and willing to perform this task.

ENDNOTES:

¹ U.S. ENERGY INFORMATION ADMINISTRATION, EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2007 (2009), available at <ftp://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057308.pdf>; Ernst Worrell, et al., *Carbon Dioxide Emissions from the Global Cement Industry*, 26 ANNUAL REV. OF ENERGY AND THE ENVIRON. (2001), available at <http://arjournals.annualreviews.org/doi/abs/10.1146%2Fannurev.energy.26.1.303>; and L.J. HANLE, ET AL., US EPA AND ICF CONSULTING, CO2 EMISSIONS PROFILE OF THE U.S. CEMENT INDUSTRY (2004), <http://www.epa.gov/ttnchie1/conference/ei13/ghg/hanle.pdf>.

² Concrete Thinking for a Sustainable World, Benefits: “Recycled Content”, Apr. 6, 2009, <http://www.concretethinker.com/solutions/Recycled-Content.aspx> (last visited Jan. 25, 2010).

EE 25: ENSURE NEW ENERGY SYSTEMS FUNCTION PROPERLY

Amendments to the New York City Building Code and ANSI/ASHRAE/IESNA90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

Commissioning is a quality assurance process that is not typically done on building systems. Although often omitted, commissioning helps identify and correct deficiencies in design or installation, resulting in higher energy efficiency and building performance.

Recommendation:

Require commissioning in all new construction, substantial renovations, and additions of greater than 50,000 square feet. Also, require building acceptance testing ("commissioning light") for projects between 5,000 square feet and 50,000 square feet.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Section 1302 as follows:

SECTION BC 1302

COMMISSIONING OF NEW BUILDINGS

1302.1 Definitions.

The following words and terms shall, for purposes of this chapter, applicable appendices and as used elsewhere in this code, have the following meanings:

BUILDING ACCEPTANCE REPORT. A document setting forth the results of any building acceptance testing process in the most current format made available by the department.

BUILDING ACCEPTANCE TESTING. For new mid-sized buildings, mid-sized additions, and alterations, performance of the procedures required by Section 28-1302.6.

COMMISSIONING. For new large buildings and large additions, performance of the procedures required by Section 28-1302.3 below.

COMMISSIONING AGENT. A person or agency approved by the department to perform commissioning.

COMMISSIONING PLAN. A document outlining the organization, schedule, allocation of resources, and documentation requirements of the building commissioning process, in the format established by the department.

COMMISSIONING REPORT. A document setting forth the results of any commissioning process in the format established by the department.

FINAL COMMISSIONING REPORT. A commissioning report in the format established by the department and containing documentation and verification of the commissioning of all applicable building systems required to be commissioned under Section 28-1302.4 in the format established by the department.

LARGE ADDITION. Any addition of greater than 50,000 square feet of gross floor area.

LARGE BUILDING. Any structure located on a lot on which the total existing and proposed gross floor area is equal to or greater than 50,000 square feet.

MID-SIZED ADDITION. Any addition equal to or greater than 5,000 square feet, and less than 50,000 square feet, of gross floor area.

MID-SIZED BUILDING. Any structure located on a lot on which the total existing and proposed gross floor area is equal to or greater than 5,000 square feet and less than 50,000 square feet.

POST-OCCUPANCY REPORTS. A commissioning report in the format established by the department and containing (i) documentation and verification of the post-occupancy commissioning activities for all applicable building systems required to be commissioned under Section 28-1302.4, and (ii) submission of all post-occupancy reports and building systems operations manuals.

PRELIMINARY COMMISSIONING REPORT. A commissioning report in the format established by the department and containing documentation and verification of the commissioning of all applicable building systems (i) required to be commissioned under Section 28-1302.4, and (ii) capable of being fully commissioned, other than required post-occupancy reports, at the time of year when a temporary or permanent certificate of occupancy is sought.

1302.2 General. Commissioning is required as part of construction of large buildings and large additions. Building acceptance testing is required as part of (i) construction of mid-sized buildings and mid-sized additions, and (ii) alterations of greater than 5,000 gross square feet.

1302.3 Commissioning. Commissioning shall be performed in accordance with this section using generally accepted engineering standards as determined by the department.

Commissioning shall be incorporated into the pre-design, design, construction, and first year occupancy of the building .

(a) Activities prior to issuance of building permit. Prior to issuance of a building permit, the designated commissioning agent shall submit to the department a commissioning plan providing for commissioning of all applicable building systems required under Section 1302.4.

(b) Activities prior to building occupancy. Prior to issuance of a temporary or permanent certificate of occupancy, the commissioning agent shall submit a preliminary commissioning report, which shall include certifications by such commissioning agent that:

1. All systems required to be commissioned under Section 1302.4 , other than those specified systems that cannot be fully commissioned at the time of occupancy due to seasonal operation, have been commissioned other than any required post-occupancy reports.
2. All operating personnel training requirements identified in the commissioning plan and pertaining to those systems fully commissioned under Section 1302.4(b)(1) have been completed.
3. A system manual has been prepared that includes operations and maintenance documentation and complete warranty information and provides operating personnel all information needed to optimally operate the commissioned systems.

(c) Post-occupancy activities. Within one year of issuance of a permanent certificate of occupancy for the building project, the commissioning agent shall submit a final commissioning report to the department, which shall include:

1. A certification by the commissioning agent that all systems required to be commissioned under Section 1302.4 below have been commissioned.
2. All required post-occupancy reports.
3. A certification by the commissioning agent that a system manual has been prepared that includes operations and maintenance documentation and complete warranty information and provides operating personnel all information needed to optimally operate the commissioned systems.

1302.4 Systems. The following systems, if included in any large building or large addition, shall be commissioned:

(a) Heating, ventilating, air conditioning, indoor air quality and refrigeration systems (mechanical and/or passive) and associated controls;

- (b) Building envelope systems, components and assemblies;
- (c) Building envelope pressurization, if air-tightness is specified in the commissioning plan;
- (d) All lighting and shading controls;
- (e) Irrigation;
- (f) Plumbing;
- (g) Domestic and process water pumping and mixing systems;
- (h) Service water heating systems; and
- (i) Renewable energy systems.

1302.5 Documentation. Owner shall retain the system manual and final commissioning report, which manual and report shall be provided to local, state and federal agencies or their representatives upon request.

1302.6 Building Acceptance Testing. Building acceptance testing shall be performed in accordance with this section using generally accepted engineering standards as established by the department.

(a) Activities prior to issuance of building permit. Prior to issuance of a building permit, the designated commissioning agent shall certify to the department that he or she has reviewed construction documents to verify relevant sensor locations, devices and control sequences are properly documented for all applicable building systems required under Section 1302.7.

(b) Activities prior to building occupancy. Prior to issuance of a temporary or permanent certificate of occupancy, the commissioning agent shall submit a building acceptance report to the department, which shall include a certification by such commissioning agent that a system manual has been prepared that includes operations and maintenance documentation and complete warranty information and provides operating personnel all information needed to optimally operate the commissioned systems.

28-1302.7 Systems. The following systems, if included in any mid-sized building, mid-sized addition, or alteration of greater than 5,000 square feet, shall have building acceptance testing:

- (a) Mechanical Systems: Heating, ventilating, air conditioning, indoor air quality, and refrigeration systems (mechanical and/or passive) and associated controls;
- (b) Lighting Systems;
- (c) Automatic daylighting controls;
- (d) Manual daylighting controls;
- (e) Occupancy sensing devices;
- (f) Automatic shut-off controls; and
- (g) Renewable energy systems.

13.2.2.5 Documentation. Owner shall retain the system manual and building acceptance report, which manual and report shall be provided to local, state and federal agencies or their representatives upon request.

Amendment to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code

1. Delete Section 6.7.2.4

[6.7.2.4 System Commissioning. HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition. For projects larger than 50,000 square feet conditioned area, except warehouses and semiheated spaces, detailed instructions for commissioning HVAC systems (see Informative Appendix E) shall be provided by the designer in plans and specifications.]

Supporting Information

Issue – Expanded

No building functions exactly as its designers intended. In part this is due to usage patterns the designers could not or did not anticipate. Often, buildings use more energy and water than necessary because of large or small errors during installation of the countless components that make up a modern building.

Building commissioning is a process for testing building systems to ensure they function according to engineering design objectives or specifications. The commissioning process has been applied to ocean-going ships for centuries, as designers, ship-builders and crews saw the risk-management value in verifying that all systems were working according to design intent before leaving shore. Applied to buildings, the process ensures that owners get what they pay for when constructing or retrofitting buildings, provides risk-management and "insurance" for policymakers and program managers enabling their initiatives to actually meet targets, and detects and corrects problems that would eventually surface as far more costly maintenance or safety issues.

No two commissioning reports are alike because each building has its own particular systems and construction mistakes; but every commissioning report will find a litany of correctable problems that have a major impact on energy and water consumption. A commissioning report might find: control sensors are disconnected, nonfunctional or installed in the wrong place; temperature and other set points are incorrect; valves are open when they should be closed; or a ventilating fan that is installed facing the wrong direction – this list of potential issues is virtually endless.

A recent report on new building commissioning indicates that it is likely the single-most cost-effective strategy for reducing energy, costs, and greenhouse gas emissions in buildings today.¹ Beyond significant energy and other savings, building commissioning also provides occupants with improved indoor environmental conditions.

Environmental & Health Benefits

Building commissioning saves a substantial amount of energy and water, reducing air pollution and greenhouse gas emissions.

Until recently, commissioning services were driven more by other reliability and safety issues, rather than energy or water savings. In the past, the primary goal of commissioning was often occupant safety in laboratory and industrial buildings, and improved occupant comfort in educational and office buildings. Valuation of these benefits can be more challenging than estimating energy cost savings, but interviews among nearly 100 commissioning team members across 21 projects in the Pacific Northwest estimated non-energy commissioning benefits of \$0.17 per square foot, a level nearly as high as energy cost savings.²

This proposal is found to have a low, positive environmental impact and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase capital cost by between \$0.10 and \$0.20/square foot. It was thus categorized as incurring a low to medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years for some building types.

Precedents

California has adopted Green Building Standards Code to supplement the California Building Standards Code. Sections on Commissioning require the inclusion of commissioning be in the design and construction processes of the building project and the completion of a commissioning plan.³

LEED

The measures outlined in this proposal will assist in meeting the following LEED prerequisite and credit requirements:

- LEED NC-EA prerequisite 1, Fundamental Commissioning
- LEED NC-EA cr. 3, Enhanced Commissioning
- LEED CI-EA prerequisite 1, Fundamental Commissioning

- LEED CI-EA cr. 2, Enhanced Commissioning
- LEED for Schools EA prerequisite 1, Fundamental Commissioning
- LEED for Schools EA cr.3, Enhanced Commissioning
- LEED EB- EA prerequisite 1 Existing Building Commissioning
- LEED EB-EA credit 3.1, 3.2, & 3.3 Building Operations and Maintenance

The components of LEED commissioning outlined in this proposal for larger projects exceed LEED criteria. Therefore, adherence to these measures will have a strongly positive impact on LEED certification. For adherence with LEED E&A prerequisites and credits, a Commissioning Authority (CxA) must be assigned to oversee the commissioning process. The CxA will be ultimately responsible to verify the performance of systems for the purposes of LEED certification.

The process of documenting building performance for the code revisions under this proposal will assist in the accumulation of data for the LEED Construction Submittal Template, which is required to verify prerequisite and credit compliance.

LEED has no equivalent for acceptance testing.

Implementation and Market Availability

There are no known implementation issues for this proposal. Commissioning agents are readily available.

Notes

The language in this proposal largely follows a similar provision in ASHRAE 189.1. Further detail that the Department of Buildings may wish to consider during rulemaking include:

- Specification of submissions to the Department.
- The design review stages should be adjusted to conform to architectural terminology, such as 100% DD documents and 80% CDs.
- These steps “verify the installation and performance...” but do not explicitly discuss start-up. The CxA commissioning agent should be present at equipment start-up and at least witness and collect documentation.
- Envelope commissioning should be mentioned. The specifications should require wall mock-ups that are either inspected by the project architect or the commissioning authority. Wall inspection/photographs at all phases of construction should also be required.
- Consider making a building pressurization, infrared scan mandatory prior to occupancy (although this is season-dependent).
- Consider making a digital recording of training part of the commissioning agent's scope. This should include the actual camera/sound recording and the editing of the sessions on a DVD for the convenient future use of the operations and maintenance staff.
- The commissioning agent should meet with each contractor before providing training and discuss noise control and staying on-topic for the training session.
- A systems manual should be assembled by the commissioning agent and should include complete one-line diagrams of air-side and water-side systems and integrated operating sequences of chillers, cooling towers, circulation pumps, AHUs, VAV boxes, etc., prepared by the design engineer.

ENDNOTES:

¹E. MILLS, BUILDING COMMISSIONING: A GOLDEN OPPORTUNITY FOR REDUCING ENERGY COSTS AND GREENHOUSE GAS EMISSIONS, LAWRENCE BERKELEY NATIONAL LABORATORY (2009), <http://cx.lbl.gov/documents/2009-assessment/LBNL-Cx-Cost-Benefit-Pres.pdf>.

²SBW CONSULTING AND SKUMATZ ECONOMIC RESEARCH ASSOCIATES, NORTHWEST ENERGY EFFICIENCY ALLIANCE, COST-BENEFIT ANALYSIS FOR THE COMMISSIONING IN PUBLIC BUILDINGS PROJECT (2003).

³CAL. CODE, Tit. 24 § pt. 11 (2008), *available at* <http://www.documents.dgs.ca.gov>.

EE 26: ENSURE LIGHTING SYSTEMS FUNCTION PROPERLY

New York City Building Code

Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:

Increasingly, lighting systems rely on sophisticated sensors and controls to reduce energy consumption. These systems must be tested and adjusted after installation to ensure that they function properly; unfortunately, this is not common practice.

Recommendation:

Require functional testing of lighting sensors and controls to ensure that the systems perform as designed.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Section 13 of the New York City Building Code:

1. Add a new Section 9.4.6 as follows:

9.4.6.1 Functional testing requirements.

a. Occupant sensors, time switches, or photosensors shall be subject to the functionality testing to verify that:

1. The location, orientation, masking, sensitivity and time-out adjustments for occupant sensors turns lighting off within 30 minutes of all occupants leaving a space and calibrated to minimize false offs,
2. Time switches are programmed to turn lighting off when spaces are unoccupied or control zones are unused, and
3. Photosensor controls are properly located, oriented, shielded and calibrated to reduce electric light levels in accordance with the amount of usable daylight in the space.

Exception: If functional testing of lighting is already required under a mandated building commissioning process.

b. The functional testing described in paragraph (a) shall be documented and certified as required by the department. Construction documents shall indicate the required calibration settings, control intent narrative, and commissioning criteria necessary to comply with the mandatory requirements of this code, and shall identify the responsible party for conducting and certifying the functional testing. Prior to sign-off, the owner shall provide documentation certifying that the installed lighting system meets or exceeds the intended design performance and verifying conformance with paragraph (a) of Section 9.4.6.1. Such documentation shall include the following:

1. Control intent narrative for each type and application of lighting controls, and verification that the installed equipment meets the design intent, including time switch schedules, calibration settings, daylighting set-points, time delays, and fade rates.
2. Verification that the commissioned controls meet the minimum criteria of the energy code.
3. Written certification signed by the functional tester and/or the owner that the functional testing was successfully completed.

Supporting Information

Issue – Expanded

A critical aspect of energy efficient lighting is ensuring that lighting is not used when it is not needed. This is accomplished via sensors and controls, which turn off or dim lights when there is sufficient daylight or when there are no occupants. These systems can achieve dramatic reductions in energy consumption, but they must be properly installed and calibrated in order to work as intended. If this is not done, lights can remain on when light is not needed or lights can turn off when light is needed. The first of these problems wastes energy directly, and the latter can cause widespread irritation and discontent with the systems, often resulting in systems being disconnected or removed – again resulting in wasted energy.

If the lighting sensor and controls have undergone a quality control process called “functional testing” when it is limited to a single system, or “commissioning” when it is more broadly defined, these problems can be avoided. Functional testing has two main parts. The first is the documentation of how the sensors and controls are meant to function – called the “design intent.” The second is the process of testing the components to make sure they work as they were intended, and adjusting them if they are not working properly. This relatively straight forward process is necessary to ensure proper performance.

Section 1513.7 Commissioning Requirements in Seattle’s energy code carries supporting data in a Client Assistant Memo¹ that describes the commissioning process in greater detail, in particular the holistic approach to designing and implementing mechanical and lighting systems. It notes that commissioned systems operate more efficiently and have less operational and equipment failures than those that were not commissioned. The resulting efficiency of a building’s lighting system would reduce maintenance costs from repairs or equipment replacement thereby reducing the accumulation of building material waste as well as providing a more comfortable lighting environment with fewer distractions.

Environmental & Health Benefits

Improving lighting efficiency will reduce citywide energy consumption, resulting in less greenhouse gas emissions and improving air quality.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.02%, depending on building type. It was thus categorized as incurring no to a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents

In Seattle, WA, the city’s energy code includes a commissioning requirement for lighting systems in non-residential buildings that have automatic and timing sensors – such as daylight or occupancy sensors and automatic shut-off controls – to be tested for quality assurance as per the drawings and specifications of the design. The commissioning requirement also includes commissioning for drawing notes. The city requires that a report of the test procedures and results be prepared and filed with the owner² (2).

LEED

LEED requires Fundamental Commissioning of the Building Energy Systems as an Energy & Atmosphere Prerequisite 1 under

- LEED for New Construction
- LEED for Commercial Interiors

- LEED for Existing Buildings
- LEED for Schools rating systems

A project may also achieve LEED credits for Enhanced Commissioning under

- LEED NC-EA cr.3
- LEED CI-EA cr.2
- LEED for Schools EA cr.3

Lighting & Daylighting controls are only one component of LEED commissioning. Additionally, while this proposal addresses only functional testing of specific lighting controls, the LEED commissioning process has a broader scope. However, this proposal will make a contribution towards achieving LEED certification.

For adherence with LEED E&A prerequisites and credits, a Commissioning Authority (CxA) must be assigned to oversee the commissioning process. The CxA will be ultimately responsible to verify the performance of systems for the purposes of LEED certification.

The process of documenting lighting functional testing performance will assist in the accumulation of data for the LEED Construction Submittal Template, which is required to verify prerequisite and credit compliance.

Implementation & Market Availability

In the near term, this proposal could be implemented through owner self-certification that lighting controls have been properly tested and commissioned. Professionals who are qualified to supervise testing in the near term include electrical engineers, lighting designers, interior designers, architects, facilities managers, manufacturer's technicians, or other agents of the owner. It would not be effective or appropriate for the installing contractor to certify the functional testing.

The successful implementation of this proposal in the long term, however, requires the establishment of an educational or certification program so that only individuals with a minimum level of expertise in lighting controls perform functional testing. In New York City, few commissioning agents or licensed professionals currently have expertise in lighting controls.

ENDNOTES:

¹ CITY OF SEATTLE DEPARTMENT ON PLANNING AND DEVELOPMENT, COMMISSIONING FOR NON-RESIDENTIAL MECHANICAL AND LIGHTING SYSTEMS, SEATTLE PERMITS, CAM 419 (2006), available at <http://www.seattle.gov/dpd/publications/cam/cam419.pdf>.

² CITY OF SEATTLE ENERGY CODE Ch. 15 § 1513.7 (2006), available at http://www.seattle.gov/DPD/Codes/Energy_Code/Nonresidential/Chapter_15/default.asp.

EE 27: REDUCE LEAKAGE FROM AIR DUCTS

New York City Mechanical Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issues:

Energy is wasted when air ducts leak and vents are improperly adjusted.

Recommendation:

Test and seal all ventilation ducts, and adjust vents in new construction or renovations.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code:

1. Delete Section 403.3.4 and add a new Section 403.3.4 as follows:

403.3.4 Testing, adjusting and balancing. Ventilation systems shall be tested and balanced in accordance with procedures in one of the following standards:

1. AABC National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems, or
2. NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, or
3. SMACNA HVAC Systems – Testing, Adjusting and Balancing.

2. Amend Section 603.9 as follows:

603.9 Joints, seams and connections. All longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in *SMACNA HVAC Duct Construction Standards—Metal and Flexible* and *SMACNA Fibrous Glass Duct Construction Standards* or *NAIMA Fibrous Glass Duct Construction Standards*. All longitudinal and transverse joints, seams and connections shall be sealed in accordance with the *Energy Conservation Construction Code of New York State*. Ducts concealed in shaft enclosures extending three or more floors shall be leak-tested in accordance with *SMACNA HVAC Air Duct Leakage Test Manual*, and the rate of air leakage (CL) shall be less than or equal to the established criteria set forth in the manual.

3. Amend Chapter 15 to include the following standards:

AABC National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems

NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems

SMACNA HVAC Systems – Testing, Adjusting and Balancing.

Supporting Information

Issue – Expanded

Just like dripping water faucets, even small duct leaks factored over time can add up to substantial cost and wasted energy. Likewise, unbalanced ventilation systems can make conditions uncomfortable for occupants. Recognized national industry standards can ensure that mechanical systems are constructed and operate in accord with their design.

It is particularly important to test vertical duct risers prior to closing in building shaft walls. Unlike ductwork in dropped ceilings that can be readily inspected and repaired, the only opportunity to fix leaks in most vertical duct risers will be during construction. Once concealed behind walls, vertical ducts may leak for the life of the building without ever

being detected. Even if the leaks in vertical risers are caught, the cost to remove and reinstall the shaft enclosure means the leaks will probably not be repaired. Testing ducts extending three or more floors during construction and prior to shaft wall construction would facilitate inexpensive repair and provide the quality assurance that ducts in the shafts are properly sealed

Ventilation systems can also suffer from poor balancing. Some systems over-ventilate certain rooms, making them drafty, noisy, and overheated or overcooled, while under-ventilating others, making them stagnant and under-heated or under-cooled. Poorly balanced systems are inherently wasteful. The Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) has established standards for the testing and balancing of ventilation system. Using this standard provides quality assurance that the balancing process was performed in a reliable and repeatable method.

Environmental & Health Benefits

This proposal will improve indoor air quality by ensuring that the air quantities calculated by the design engineer to provide health and comfort and shown on the contract documents are actually realized in the field. The building code requires minimum ventilation (outdoor air) rates to offset the oxygen intake and carbon dioxide (CO₂) discharge that occurs through the breathing process. When these rates are not achieved due to improper balancing or duct leakage CO₂ concentrations can buildup in occupied areas leading to poor indoor air quality. Pollutants generated in the indoor environment cannot be adequately diluted or flushed out if the space doesn't receive proper airflow.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.07%, depending on building type. It was thus categorized as incurring no to a medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents

Precedents for this proposal include California's Energy Efficiency Standards for Residential and Nonresidential Buildings. Established in 1978, these codes were a response to a legislative mandate to reduce California's energy consumption.¹

LEED

The LEED commissioning process is intended to verify that the project's energy-related systems are installed, calibrated, and perform as intended. Projects that have been tested according to the measures outlined in this proposal will more easily comply with the following LEED prerequisites and credits:

- LEED NC-EA prerequisite 1, Fundamental Commissioning
- LEED NC-EA cr. 3, Enhanced Commissioning
- LEED CI-EA prerequisite 1, Fundamental Commissioning
- LEED CI-EA cr. 2, Enhanced Commissioning
- LEED for Schools EA prerequisite 1, Fundamental Commissioning
- LEED for Schools EA cr.3, Enhanced Commissioning
- LEED EB- EA prerequisite 1 Existing Building Commissioning
- LEED EB-EA credit 3.1, 3.2, & 3.3 Building Operations and Maintenance

For adherence with LEED E&A prerequisites and credits, a Commissioning Authority (CxA) must be assigned to oversee the commissioning process. The CxA will be ultimately responsible to verify the performance of systems for the purposes of LEED certification.

Since indoor air quality may be improved by ensuring that air flows according to the building engineer's design, this

proposal may also facilitate achieving the following credits:

- LEED NC-EQ cr. 3.1 & 3.2 Construction IAQ Management Plan;
- LEED CI-EQ cr. 3.1 & 3.2 Construction IAQ Management Plan;
- LEED EB-EQ cr. 3 Construction IAQ Management Plan;
- LEED for Schools EQ cr. 3.1 & 3.2 Construction IAQ Management Plan;
- LEED for Homes EQ cr. 8 Contaminant Control.

To earn credits under the LEED 2009 rating systems, during construction projects must meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association² (SMACNA) IAQ Guidelines For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3). Since the measures outlined in this proposal do not make reference to this specific standard, project teams must research to verify LEED compliance for projects

Implementation and Market Availability

There are no known implementation issues for this proposal. Testing, Adjusting and Balancing contractors are readily available.

ENDNOTES:

¹ CAL. CODE, Tit. 24 § pt. 6 (2008), *available at* <http://www.documents.dgs.ca.gov>.

² SHEET METAL AND AIR CONDITIONING NATIONAL CONTRACTORS ASSOCIATION, IAQ GUIDELINES FOR OCCUPIED BUILDINGS UNDER CONSTRUCTION, ch. 3 (2d ed. 2007).

EE28: EXPAND BOILER EFFICIENCY TESTING & TUNING

Administrative Code of the City of New York
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:

The Department of Environmental Protection tests boiler combustion efficiency only in very large boilers, and only every three years. Annual testing would detect malfunctions, permit tuning, and result in more efficient boiler operation.

Recommendation:

Require annual testing of boilers that generate more than 2 million BTU per hour or are located in buildings larger than 50,000 square feet. Also require boiler cleaning, tuning and repairs as necessary. The issue addressed by this proposal is already under consideration by the City.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Add new a subchapter 10 to title 24 as follows:

Subchapter 10
Annual Combustion Efficiency Test Requirements

§ 24-190 Definitions. When used in this subchapter 10, the following terms shall have the following meaning:

- (a) Efficiency test shall mean a combustion efficiency test carried out by means of a portable flue gas analyzer capable of detecting oxygen and carbon monoxide concentrations and stack gas temperature.
(b) Fuel burning equipment shall include all boiler/burner combinations of fuel oil fired burning equipment and gas fired installations.

§ 24-191 Permanent criteria and standards. No later than July 1, 2010, the commissioner shall establish criteria and or standards for:

- (a) Combustion efficiency testers. Such criteria shall at a minimum consider professional heating contractor experience, emissions/equipment testing experience, boiler safety inspection experience or a combination of the foregoing.
(b) Portable combustion analyzers that directly measure and display flue gas oxygen, carbon monoxide, nitrogen oxide, stack temperature, draft, differential pressure, combustion air temperature, and calculate carbon dioxide. The analyzer shall have a means for calculating efficiency for the specific fuel used.
(c) Test protocol, which shall include criteria that is included in present fuel burning criteria, including location of test ports, specific boiler operational parameters, steady state and firing rates.

§ 24 -192 Interim criteria and standards. Prior to establishing permanent criteria and standards, the department may establish an interim list of acceptable combustion efficiency testers, portable combustion analyzers, and test protocol. These interim criteria and or standards may be utilized to conduct the testing as required by section 24-193 until superseded by permanent criteria and standards.

§ 24-193 Annual test requirement.

- (a) Effective January 1, 2011 for all boilers in buildings greater than 50,000 square feet, the building owner shall conduct an annual combustion efficiency test utilizing the portable combustion analyzer and submit the results to the department.

(b) Effective January 1, 2011 for any boiler requiring renewal of the department's triennial certification (for boilers greater than 2.8 million btu/hr), the department shall conduct the combustion efficiency test utilizing the portable combustion analyzer technology.

(c) Effective January 1, 2012 for all boilers greater than 2 million btu/hr in buildings smaller than 50,000 square feet, the building owner shall conduct the annual combustion efficiency test utilizing the portable combustion analyzer and submit the results to the department.

§ 24-194 Electronic Submission of Test Results. Effective January 1, 2011, the results of the annual testing required under section 24-193 shall be electronically submitted to both the department and the department of buildings. The department shall establish the template and format that the building owner shall complete and submit. The template shall include a calculation of the annual savings in energy costs if the boiler were functioning at the acceptable passing score, and a calculation of the annual savings in energy costs if the boiler were replaced with a new, high-efficiency boiler.

§ 24-195 Acceptable Passing Score.

(a) Effective January 1, 2011, the acceptable passing score for the SSE (Steady State Efficiency) shall be: for atmospheric gas fired boilers 79%, for all other gas fired boilers 81%; for all oil fired boilers 83%.

(b) If a boiler burner combination is below the passing score, the building owner shall have the boiler and burner repaired, retuned and retested, with the results submitted within sixty days. The building owner shall also complete a 'work order summary' to be submitted to the department indicating the work completed prior to the second testing.

(c) By January 1, 2014, the department shall evaluate the state of boiler and burner technology and combustion efficiency test results received between January 1, 2011 and January 1, 2013 and:

- (1) determine the passing score threshold for combustion efficiency tests commencing thereafter; and
- (2) analyze whether any other efficiency criteria or requirements should be established.

§ 24-196 Filing Fees.

Effective January 1, 2011, the department shall establish filing fees sufficient to cover the costs of administering and enforcing the boiler testing program and the electronic filing system.

Supporting Information

Issue – Expanded

Recent developments in portable technology for testing boiler efficiency now make it feasible to test boilers the way that automobiles have been tested for many years. The current testing program of the Department of Environmental Protection utilizes older technology, limiting testing to the very largest boilers in the city – those over 3.5 million Btu/yr – and it only does so every three years. This proposal enables the use of the newer technology and then expands the city's boiler efficiency testing to cover more boilers -- those larger than 2 million Btu/yr or boilers in buildings larger than 50,000 square feet -- and to test those annually. Combined, these boilers cover buildings larger than roughly 30,000 sq. ft. so this proposal will impact well over half of the energy used for space and hot water heating in the city.

Most of these boilers are not tuned and cleaned frequently to keep them operating close to peak efficiency. This proposal requires the boilers to be tested annually. If any boiler cannot achieve a sufficiently high Steady State Efficiency (SSE) score, it must be cleaned and tuned, and then retested, with the scores for both tests being submitted to DEP. Note that the SSE is a measure of how well a boiler is operating, and is not a measure of the underlying efficiency of the boiler model. Therefore it is expected that, with very few exceptions, all boilers can be cleaned, tuned, and repaired sufficiently to enable them to achieve a passing score. It should be understood that boilers that do not achieve passing scores after having been tuned, will not be required to perform further work that year, nor will they need to be replaced.

As part of the process, each building owner will be informed of the dollar savings that would accrue if the boilers were operating at the passing score, and if the boiler were replaced with a high-efficiency model. It is anticipated that such transparency will help building owners make better decisions and investments in their boilers. In addition, the information obtained about boiler efficiencies across the city will enable DEP to fine-tune its requirements after several years.

It is estimated that an average efficiency improvement of between 3% and 5% will be obtained through the regular tuning of boilers, which translates into decreased energy consumption of 4% to 5%. This will save considerable energy and money.

Environmental & Health Benefits

There should be sizable reductions in soot, also known as PM 2.5 (or particulate matter 2.5), which is a pollutant that causes serious damage to the human respiratory tract because of its tendency to lodge deep in the lungs. PM 2.5 is contained in the smoky emissions resulting from the incomplete combustion within poorly tuned boilers.

The citywide impact on CO2 emissions can be estimated as follows:

Buildings are responsible for 78% of the city's CO2 emissions. Of that, heat and hot water are responsible for 59% of the carbon emissions. The large to medium size boilers targeted generate roughly 55% of the city's heat and hot water. If we assume, on average, that the regular retuning of boilers (in excess of that which is currently occurring) will reduce consumption by 4-5% on average, that only 15% of boilers are currently being tuned, and that the city will achieve a 90% compliance, the CO2 savings across the city would be:

$.78 \times .59 \times .55 \times (.04 \text{ to } .05) \times .85 \times .90 = .77\% \text{ to } .97\%$ of the city's carbon emissions or 485,100 to 604,800 tons of carbon per year. This reduction would occur within a year of beginning to implement the program, and it is equivalent to removing 133,230 to 589,895 cars from the road.

This proposal was found to have a low positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive indirect health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to cost \$0.00 to \$0.01/square foot annually. It was thus categorized as incurring no cost increment. This proposal was also estimated to generate financial savings that will exceed the costs.

Precedents

1. The European Union has a similar testing requirement (EN5037) for gas-fired boilers that have been in place since early 2007.
2. There is also a British standard for these appliances.
- 3. For many years, automobile owners have been required to perform an annual emissions test, which is the equivalent of the efficiency test now being proposed for boilers.**

LEED

This proposal has no direct LEED implications.

Implementation & Market Availability

There are a significant number of national manufacturers marketing the necessary equipment.

BR 1: CREATE & USE 2080 FLOOD MAP BASED ON CLIMATE CHANGE PREDICTIONS

New York City Charter; New York City Building Code
Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Current flood maps are based entirely on historical data and do not account for the predicted sea-level rise due to climate change and the coastal flooding that would ensue.

Recommendation:

Develop flood maps that reflect sea-level rise and increases in coastal flooding through 2080. New developments susceptible to future 100-year floods should meet the same standards as buildings in the current 100-year flood zone.

Proposed Legislation, Rule or Study

Amendments to the New York City Charter:

1. Add a new Section 498 as follows:

Section 498. Flood Protection

a. The department of emergency management shall create, maintain, and regularly update a New York City Climate Change Flood Map, which shall map the New York City coastline at high tide and the projected flood plains and flood levels of the 100 year flood with a layer showing lots and blocks and the 100-year flood level averaged across each affected block. The coastline and flood projections shall be based on:

(1) The 90th percentile sea-level rise projections as developed by the New York City Panel on Climate Change, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the Intergovernmental Panel on Climate Change or other scientific body designated by the Office of Long Term Planning and Sustainability;

(2) The 90th percentile storm surge projections developed by the New York City Panel on Climate Change, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the Intergovernmental Panel on Climate Change or other scientific body designated by the Office of Long Term Planning and Sustainability; and

(3) The topography of the city of New York as documented in the current FEMA map or other map designated by the Office of Long Term Planning and Sustainability.

b. The first New York City Climate Change Flood Map shall be based on projected conditions in 2080, and updates shall be based on projected conditions no earlier than 2080 or 50 years in the future, whichever is later. The New York City Climate Change Flood Map shall be updated regularly, but no less often than every 10 years.

Amendments to Appendix G of the New York City Building Code:

1. Add a new paragraph (7) to Section G101.1 as follows:

7. Take into account the scientific projections of climate change impacts on flooding, including sea-level-rise and storm frequency and intensity.

2. Add new paragraphs (9) and (10) to Section G101.2 as follows:

9. Ensure that properties are habitable for a reasonable period in the event of service disruptions.

10. Decrease the period during which properties are not habitable after floods.

3. Add new paragraph (3) to section 102.2 as follows:

3. New York City Climate Change Flood Map

4. Amend sections G102.2, G102.3, G102.3.1 and G102.3.2 as follows:

G102.2 Establishment of areas of special flood hazard. The following flood hazard map and supporting data are adopted as referenced standards and declared to be a part of this appendix:

1. FEMA FIS 360497.
2. FEMA FIRMs 360497.
3. New York City Climate Change Flood Map (NYC CCM).

G102.2.1 Applicability of maps. The flood hazard map that results in the greatest degree of flood protection measures shall apply. Until such time as the Office of Emergency Management develops a New York City Climate Change Flood Map, the city's 100-year flood plain requirements shall apply to developments and properties within the 500-year flood plain in the current FEMA map.

G102.3 Letters of map change. Map changes to FEMA FIRMs 360497 or NYC CCM shall be administered in compliance with Sections G102.3.1 and G102.3.2.

G102.3.1 Letters of map amendment (LOMA). Where FEMA FIRMs 360497 or NYC CCM indicates that a structure or tax lot is within a delineated area of special flood hazard, but the pre-FIRM ground elevations adjacent to the structure or throughout the tax lot are at or above the base flood elevation, the commissioner shall deem such structure or tax lot as being within the area of special flood hazard and shall not approve plans except in compliance with this appendix, unless a letter of map amendment (LOMA) is issued by FEMA removing such structure or tax lot from the area of special flood hazard.

G102.3.2 Letter of map revision based on fill (LOMR-F). Where FEMA FIRMs 360497 or NYC CCM indicates that a structure or tax lot is within a delineated area of special flood hazard, but post-FIRM compacted fill is proposed to be added adjacent to the structure or throughout the tax lot to an elevation at or above the base flood elevation, the commissioner shall deem such structure or tax lot as being within the area of special flood hazard and shall not approve plans except in compliance with this appendix, unless a conditional or final letter of map revision based on fill (LOMR-F) is issued by FEMA removing such structure or tax lot from the area of special flood hazard. The commissioner shall promulgate rules establishing procedures for processing letters of map revision based on fill (LOMR-F).

5. Add a new definition to G201.2 to read as follows:

NEW YORK CITY CLIMATE CHANGE FLOOD MAP (NYC CCM). The flood map or maps developed, maintained, and updated by the City of New York that depicts the coastline at high tide and the flood plains and flood levels of the 100 year flood based on the most current FEMA topographic maps and the scientific projections of climate change impacts a minimum of 50 years in the future.

Supporting Information

Issues – Expanded

New York City is facing real and significant risks due to climate change; with 580 miles of coastline, it will be impacted the most among US cities by sea level rise. To get a clear sense of how climate change will impact New York, in August 2008 the Mayor convened The New York City Panel on Climate Change (NPCC), a group of experts including climate scientists from NASA GISS. The NPCC projects that New York City's climate will become more like present-day North Carolina's as temperatures increase by an average of 4 to 7.5 degrees Fahrenheit toward the end of the century and annual precipitation increases by 5 to 10 percent. In addition, the City's sea levels could rise by 12 to 23 inches by 2080, with a possibility of up to 41 to 55 inches in the extreme ice meltdown scenario.¹

FEMA's Flood Insurance Rate Maps (FIRMs) are based on historic weather data (at least 20 years old) and inaccurate topography and bathymetry. In addition, these maps do not show how sea level rise will impact flooding. Without such accurate maps, the city cannot create a viable adaptation strategy.

The City is already updating its maps to reflect current conditions -- partnering with FEMA to develop updated FIRMs that will more accurately delineate flood zones in the city based on current weather information and improved topographical and bathymetrical data, including sea level rise that has already occurred. In addition, the City should develop maps based on the topography of the updated maps that will depict projected impacts of climate change, including sea level rise and an associated increase in coastal flooding, out to 2080. Climate change impact data specific

to New York City has been developed by the New York City Panel on Climate Change (NPCC)ⁱⁱ

New development projects, major renovations, extensions, and repurposing of existing buildings should be evaluated using these updated maps to determine if they are in the current 100-year flood zone or will be susceptible to future floods based on climate change projections. Such buildings or projects located within the 100-year flood zone of the NYC CCM should be required to meet the same standards as buildings or projects currently located within the FEMA 100-year flood zone.

Environmental & Health Benefits

Basing code requirements on scientific climate change predictions for 2080 will prevent loss of life and property when floods occur. It will also allow properties to recover more quickly and resume operation, thereby reducing economic losses due to loss of use. This measure will also prevent toxic spills, which can occur if hazardous chemicals within flood prone areas are not stored safely. Finally, this measure will protect buildings (and their inhabitants) located within these future flood zones from the negative health impacts of waterborne diseases and mold – both of which are prevalent during and after floods. Potential health effects and symptoms associated with mold exposures include allergic reactions, asthma, and other respiratory complaints.ⁱⁱⁱ

Cost / Savings

This proposal is for a study which will have no direct impact on construction costs.

Precedents

London, Seattle, San Francisco, and other major world cities are currently developing flood maps based on climate change and exploring the feasibility of tying the building code to these flood maps.

To help regional planning bodies and local planning authorities assess vulnerability to climate change and plan appropriate adaptation strategies, the UK government established the UK Climate Impacts Programme (UKCIP) which in a 2002 report published 4 scenarios providing alternative descriptions of how climate in the UK would evolve over the course of a century. Global mean sea level projections up to 2080 were taken from the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report (TAR) high estimates. Reports have been updated yearly (most recently 2008).^{iv}

LEED

Newly updated maps may redefine the current floodplain location, which could negatively impact properties being eligible for LEED credits that address proximity to floodplains. These credits include LEED ND-SLL prerequisite 6 Floodplain Avoidance; LEED NC-SS cr.1 Site Selection; LEED for Schools SS cr.1 Site Selection; LEED for Homes LL cr.2 Site Selection.

LEED ND specifies that the floodplain is defined and mapped by the Federal Emergency Management Agency or state or local floodplain management entity, whichever has been done most recently. This proposal requires regular updates of flood maps by New York City, ensuring that LEED registrants will be referencing current information.

LEED does not recognize a projected floodplain. Therefore, studies taking into account potential future conditions would not affect LEED certification.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

ⁱ NEW YORK CITY PANEL ON CLIMATE CHANGE, CLIMATE RISK INFORMATION, (2009), http://www.nyc.gov/html/planyc2030/downloads/pdf/nyc_climate_change_report.pdf.

ⁱⁱ Ibid.

ⁱⁱⁱ U.S. EPA, Mold Resources, <http://www.epa.gov/mold/moldresources.html> (last visited Jan. 26, 2010).

^{iv} U.K. Climate Impacts Programme, LCLIP: A Local Climate Impacts Profile, http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=236&Itemid=330 (last visited Jan. 26, 2010); and U.K. CLIMATE IMPACTS PROGRAMME, U.K. 21ST CENTURY CLIMATE SCENARIOS 2008 (2008), available at http://www.ukcip.org.uk/images/stories/Pub_pdfs/O8_booklet.pdf.

BR 2: SAFEGUARD TOXIC MATERIALS STORED IN FLOOD ZONES

Rules of the City of New York

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

The New York City Department of Environmental Protection requires facilities that store hazardous chemicals to file a risk management plan, but it does not require any special provisions for chemicals stored within the 100-year floodplain.

Recommendation:

Require toxic materials within the 100-year floodplain to be stored in a floodproof area.

Proposed Legislation, Rule or Study

Amendments to the Rules of the City of New York

1. Add a new paragraph (5) to subdivision (a) of section 41-05 as follows:

(5) Determination whether the facility, or portions of the facility, lie within the area of special flood hazard (100 year floodplain) as mapped by the Federal Emergency Management Agency on the Flood Insurance Rate Map.

2. Add a new paragraph (5) to subdivision (b) of Section 41-10 as follows:

(5) Determination whether the facility or portions of the facility lie within the area of special flood hazard (100 year floodplain) as mapped by the Federal Emergency Management Agency on the Flood Insurance Rate Map.

3. Add a new paragraph (9) to subdivision (b) of Section 41-11 as follows:

(9) If the facility or portions thereof lies within the area of special flood hazard (100 year floodplain) as mapped by the Federal Emergency Management Agency on the Flood Insurance Rate Map, the risk management plan shall include engineering measures that flood proof any chemicals, processes, and or operations within the floodplain, or operating measures to ensure that chemicals, processes, and or operations shall be located in portions of the facility that are above or beyond the floodplain.

After revision of these rules, the City of New York should modify the Facility Information Forms (FIF), Risk Management Plans (RMP), and the regulatory review procedure at both the Department of Environmental Protection and the New York Fire Department to take into account: the location of facilities in the floodplain; and the potential mitigation measures or prohibition of storage of certain categories of chemicals within the 100 year flood plain. Consider expanding the categories of chemicals or buildings required to file RMPs.

Supporting Information

Issue – Expanded

Storing hazardous materials within floodplains in non-flood proof spaces can lead to serious environmental contamination and threaten health, especially when there is severe flooding. During the great floods in Mississippi (1993) and New Orleans (2005), for example, water became severely contaminated. In New Orleans, floodwaters were found to contain bacteria associated with sewage at least ten times higher than the acceptable safety levels as well as elevated lead levels. Contamination made it dangerous for rescue workers and remaining residents, especially children, to have direct contact with water.ⁱ According to experts, the toxic chemicals in the flood waters in New Orleans will make the city unsafe for full human habitation for a decade.ⁱⁱ

In light of these far reaching consequences, it is crucial that New York City addresses the issue of safe storage of hazardous materials with the 100 year floodplain. Currently, several programs in New York City address toxic chemicals. However, they still do not contain provisions for toxic chemicals within the floodplain. It is anticipated that less than 750 buildings out of the city's million buildings will be impacted if such provisions are incorporated within the existing programs (see Cost/Savings section for information).

New York City Department of Environmental Protection (DEP) has a regulatory program called the Community Right-to-Know for the storage of hazardous chemicals. It requires the annual filing of a Facility Inventory Form (FIF). Buildings that exceed minimum threshold quantities must also submit an annual Risk Management Plan (RMP). The professional who files the RMP must conduct a Risk Assessment, develop an appropriate risk reduction plan, and include appropriate emergency response procedures. DEP reviews the RMP, inspects the facility and forwards the RMP to the New York City Fire Department for their review.

In addition, Building Code Appendix G Flood Resistant Construction has rules for construction in or around the 100-year floodplain. However, there are no provisions for the storage of hazardous materials within the floodplain. Requirements are limited to the construction and location of tanks and sewage facilities and they apply only to newly constructed facilities and sometimes to altered facilities, depending on the extent of the alteration.

Since programs addressing the storage of hazardous materials are already in place in New York City, minimal work is necessary to implement this proposal. Doing so would require an additional determination by the RMP filer as to whether or not the facility lies within the 100 year floodplain. DEP would then inspect the facility to determine the adequacy of the chemical storage as a part of their current inspection practices.

Environmental & Health Benefits

This proposal would mitigate the risk of the release of hazardous chemicals during a significant flood, protecting water supplies and the general public.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

There are numerous jurisdictions and municipalities through out the United States that prohibit hazardous materials from being stored below the floodplain.

LEED

Under most rating systems, LEED prohibits new construction on previously undeveloped land whose elevation is lower than 5 feet above the elevation of the 100-year flood as defined by FEMA (Federal Emergency Management Agency). Therefore, the measures outlined in this proposal do not apply to LEED for these conditions.

Under the LEED for Neighborhood Development rating system, SLL Prerequisite 6 Floodplain Avoidance, a project located on an infill site or a previously developed site must follow the National Flood Insurance Program (NFIP) requirements for developing any portions of the site that lie within the 100-year floodplain. Projects registered for certification under LEED-ND must research NFIP to determine compliance with LEED. Any such regulations regarding toxic materials storage are relevant to this proposal, and these measures will therefore result in a positive impact on LEED ND certification.

Implementation and Market Availability

Since programs addressing the storage of toxic chemicals already exist in New York City, the implementation of the proposal will require minimal additional effort. Modification to the DEP program will involve: 1) revisions to the notification and filing provisions of the RMPs; 2) DEP staff modifying their forms and procedures to require the RMP filing to address this issue; 3) the RMP filing to include a determination as to location vis-à-vis the 100 year floodplain, and if so, appropriate storage procedures; 4) DEP staff evaluation to include knowledge of flood plain boundaries; and 5) the DEP determination of appropriate storage procedures, if the facility is located in the 100 year flood plain.

ENDNOTES:

ⁱ Christine Lagorio, EPA: Danger in the Drinking Water, CBS News, Sept. 7, 2005, available at <http://www.cbsnews.com/stories/2005/09/07/katrina/main823891.shtml>.

ⁱⁱ Geoffrey Lean, Cover-up: toxic waters 'will make New Orleans unsafe for a decade, THE INDEPENDENT, Sept. 11, 2005, available at <http://www.waterconserve.org/shared/reader/welcome.aspx?linkid=46033>.

BR 3: STUDY ADAPTIVE STRATEGIES TO FLOODING

Study

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Current building codes and zoning regulations have not been examined and modified as necessary in the context of rising sea levels and increased frequency of flooding. In addition, strategies that could increase safety may have the unintended consequence of undermining urban design quality.

Recommendation:

The city should undertake a study to determine how the building code and zoning resolution should be strengthened to protect buildings from sea-level rise and flooding. Also, the city should study urban-design strategies to ensure that streetscape vitality is not a casualty of these proactive measures.

Proposed Legislation, Rule or Study

New York City should undertake a study of building codes, zoning resolutions, and urban design in relation to the 100 year flood map projected out to 2080 and hurricane SLOSH zones. The study should be a multi-agency effort, to include the Office of Long Term Planning and Sustainability (OLTPS), the Office of Emergency Management (OEM), the Department of Buildings (DOB), and the Department of City Planning (DCP) as main contributors, with Department of Transportation, Department of Parks and Recreation, Department of Environmental Protection, and Department of Design and Construction acting in consulting and reviewing capacities. The study should be coordinated by the OLTPS with the assistance of the OEM. DOB should be the lead agency for the study on building code revisions, and the DCP should be the lead agency for the studies on zoning revisions and urban planning implications.

Building code revisions to consider shall include but are not limited to:

- Foundation requirements – Rising sea levels will create a rise in the water table. This will have a direct impact on structures and buildings due to buoyancy and water infiltration.
- Freeboard and/or frame and wash-away structures at first floors.
- Areas of refuge – In the event of a citywide power outage, water and electricity would not be available and train lines would be unusable. There are no code requirements to provide temporary emergency habitation during a failure of city services.
- Hurricane resistant buildings – As storms intensify due to climate change, new construction in Hurricane SLOSH zones should be built to withstand severe storms.
- Mold resistant construction.

Zoning revisions to consider shall include but are not limited to:

- Raising “measuring points” within the flood zone.
- Zoning uses to be included within flood zones.
- Requirements for shelter areas and/or areas of refuge.

The urban design study should include:

- An assessment of the design impacts of prudent building code and zoning revisions.
- A catalogue of historic strategies developed by flood-prone communities, such as Venice, Nantucket, Chicago, Holland, and elsewhere.
- Forensic analysis of buildings in recently flooded American cities such as New Orleans or Cedar Rapids, to assess which design or construction strategies proved most resilient.
- An assessment of new technologies and design strategies to mitigate flood damage that are under development.
- A toolkit for designers to include technical and design solutions for the range of urban conditions that will be impacted, including various types of neighborhoods, various scales of development, and new developments vs. infill projects in existing neighborhoods.

Supporting Information

Issue – Expanded

The report, Climate Risk Information, issued in February 2009 by the New York Panel on Climate Change, predicts that by 2080 annual precipitation in New York City will increase by 5 to 10% and that sea level will rise between 12 and 23 inches above current levels, with a possibility of up to 41 to 55 inches in the extreme ice-melt scenario. A one to two foot sea level rise will have minimal impact on the city's coastline in terms areas that are permanently under water. But it will significantly increase the areas of the city that would be exposed to flooding during infrequent but severe storms, and it will increase the frequency of flooding in those areas. For example, an area that would currently experience a flood every hundred years, might experience flooding every twenty years by 2080.

These increases in flooding will occur because of sea level rise alone. According to the Panel, the jury is still out as to whether extreme storm events are becoming more severe and/or more frequent. If there are also increases in storm severity or frequency, the impacts of flooding will be more widespread.

New York City's new construction codes include Appendix G, which establishes requirements for flood-resistant construction within the flood plane. A separate Task Force proposal would apply these requirements proactively to areas of the city that will be subject to floods by 2080, since buildings that are built now will likely experience 2080 climate conditions. This proposal proposes to review Appendix G to ensure that it provides adequate protection within the flood plane at any time.

In addition to the construction code, zoning and urban design issues also need to be considered. New York City has over 580 miles of coastline, much of which had been used for industrial purposes. That land is ripe for redevelopment, and is needed to house New York City's expanding population. How can these waterfront areas be adequately protected from future flooding without sacrificing the use of those areas, raising costs unduly, or destroying the vitality of the streetscape during the vast majority of the time when there is no flooding? For example, if ground floor levels are required to rise by several feet, it could make ground floor retail difficult, if not impossible. And how can all these codes ensure that, if there is flooding, the damage is minimal, and buildings will be up and running again quickly?

To answer these questions, this study proposes an analysis of potential zoning requirements along with a study of urban design impacts and strategies. The urban design study includes the development of a toolkit to enable designers to address flooding while preserving other urban design values.

Environmental & Health Benefits

While there are no direct environmental or health benefits for this proposal, with almost 600 miles of coastline in New York Cityⁱ understanding the life safety needs for a building could affect survival rates in the event of a natural disaster.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a positive, indirect health impact.

Cost / Savings

This proposal is for a study that will have no direct impact on construction costs.

Precedents

Both the Intergovernmental Panel on Climate Change (IPCC) and the New York City Panel on Climate Change (NPCC) have completed studies looking at the impacts of climate change on coastal regions. However, neither one addresses the specific building, zoning and urban design impacts that this study proposes to address.

LEED

There are no LEED credits affiliated with this proposal to undertake a study. Should actual code revisions be implemented, the ability to achieve various LEED credits could be influenced.

Implementation & Market Availability

There are no known implementation or market availability issues for this proposal.

ENDNOTES:

ⁱ Association of Metropolitan Water Agency, Climate Change: New York City, New York, 2009, available at <http://www.amwa.net/cs/climatechange/newyorkcity>.

BR 4: STUDY ADAPTIVE STRATEGIES TO NON-FLOOD CLIMATIC RISKS

Study

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Current building codes and zoning regulations are based on historic data and do not consider the potential impacts of climate change on existing and future development.

Recommendation:

Based on the hazard zone maps and risk assessments developed in the study on non-flood climatic hazards, undertake a further study to recommend building code and zoning changes to diminish the impacts of those hazards.

Proposed Legislation, Rule or Study

The city's construction codes and zoning regulations are based on the climate that New York experienced in the past. Because they do not incorporate the predicted climate, they cannot protect New York City's buildings from the impacts of its future climate. Using the results from the study on non-flood climatic hazards to 2080 called for in BR 4, New York City should undertake a further study to recommend zoning and building code changes to mitigate the potential hazards, other than flooding, that will result from climate change.

For each hazard, the study should assess whether any code changes are required for new and/ or existing buildings. If changes are required, the analysis should:

- propose differing requirements, as appropriate, based on the low, medium, and high hazard zones as defined and mapped in the non-flood climatic hazards study;
- analyze the cost impacts of the proposal and the associated avoided risk to property (monetized) across a variety of building types and hazard zones; and
- assess whether the requirements should be phased in according to when the impacts are projected to occur.

Supporting Information

Issue – Expanded

The New York City Panel on Climate Change Report forecasts climate change projections over a 70 year timeframe between now and 2080. These changes will occur gradually over an extended period. Based on the premise that the lifespan of a typical building ranges between 50 and 100 years, it is prudent to begin studies on adaptation to potential hazards, in order to align with the typical cycle of building upgrades, reconstruction, and planning of future developments. This will ensure a gradual adaptation of the building stock while minimizing associated costs.

Environmental & Health Benefits

There are no known environmental or health benefits for this proposal.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a study which will have no direct impact on construction costs.

Precedents

There are no known precedents for this proposal.

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal.

BR 5: FORECAST NON-FLOOD CLIMATIC HAZARDS TO 2080

Code Location, Study, Regulation

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

New York City will face a series of risks associated with climate change whose impact has not been adequately studied. These risks include rises in the groundwater table, increased wind velocities, changes in rainfall, heat waves, electrical grid disruptions, increased humidity and other extreme weather events.

Recommendation:

Study climate risks to buildings through 2080. Determine whether impacts will vary across the city or have a uniform impact; then, define and map hazard zones in the city based on the risk of these climatic effects.

Proposed Study

The New York City Panel on Climate Change has studied the impacts of climate change in the city, predicting increases in mean annual temperatures, total annual precipitation, rising sea levels and the frequency and severity of short-term climate hazards such as heat waves, droughts and flooding through 2080. From these primary effects of climate change will come a cascade of secondary effects that will ultimately impact New York's buildings. For example, rising sea levels will cause rising ground water tables and an encroachment of salinity which may have an impact on basement flooding, drainage, or the durability of underground pipes; similarly longer and more frequent heat waves may cause more frequent brownouts or blackouts.

Flooding issues have been addressed in these proposals with two separate studies, one of which proposes the creation of predictive flood maps, while the other proposes a study of the building and zoning changes required to adapt to the new flood conditions, along with the urban design strategies that can help the city adapt gracefully to the new requirements. But non-flood hazards, such as heat waves or increased wind velocities, also need to be analyzed and mapped. The impacts of these non-flood hazards could vary across the city because either the hazard itself varies or because the risk varies due to the variation in the density of vulnerable properties or populations. An example of the former is rising groundwater tables, which exhibit local variations depending on elevation and geology. An example of the latter would be a heat wave, which is fairly constant throughout the city, but would have greater impact on certain communities, such as those with a high concentration of elderly people who lack air conditioning.

The study should analyze and map the projected impact of the following non-flood hazards through 2080:

Even hazard	Variable hazard
Rainfall quantity, frequency, intensity, and seasonal modifications	Rise in groundwater table, encroachment of salinity
Heat waves	Increased wind velocities
Increased humidity	Electrical grid disruptions due to extreme weather events
Increased temperatures	Interaction of increased temperatures with the urban heat island effect
Probability of other extreme weather events (ice storms, etc.)	Impact of increased temperature, changes in precipitation and humidity on air quality

For hazards with impacts that will vary across the city, the map should delineate high, medium, and low impact zones. For hazards that will impact the city uniformly, this study should establish the impact level for the entire city. Finally, the study should assess the relative severity of each hazard relative to the others.

Supporting Information

Issue – Expanded

Current building codes and reference standards such as ASHRAE consider historical weather data, including temperature, humidity, cloud cover, wind velocities, and precipitation variations, when establishing parameters for building design. In addition to impacting storm surge and causing sea level rise, climate change may modify design factors such as energy loads, lateral forces, thermal resistance, water infiltration and humidity control, temperature control, snow loads, ventilation requirements, and durability of materials. Analysis of impacts may also affect city planning strategies and planning for emergency measures such as areas of refuge.

The New York City Panel on Climate Change published a Climate Risk Information study for New York City.ⁱ This document provides climate change projections for New York City and identifies some of the potential risks to the City's critical infrastructure posed by climate change. Key findings include the following:

- Warmer temperatures are extremely likely in New York City and the surrounding region. Mean annual temperatures are projected by global climate models (GCMs) to increase by between 1.5 – 3 °F by the 2020s and 4 – 7.5 °F by the 2080s
- Total annual precipitation in New York City and the surrounding region will likely increase. Mean annual precipitation increases projected by GCMs are 0 – 5% by the 2020s to 5 – 10% by the 2080s
- Rising sea levels are extremely likely. GCM-based projections for mean annual sea level rise in New York City are 2 – 5 inches by the 2020s and 12 – 23 inches by the 2080s

The study also notes short-duration climate hazards that can pose particular threats to infrastructure. These events include more frequent, intense and longer heat waves; increase in brief intense precipitation events that can cause inland flooding; increase in storm-related coastal flooding due to sea level rise; and increased severity of droughts.

In addition, the U.S. Global Change Research Program has recently published a study on Global Climate Change Impacts in the United States. The study notes problems in the Northeast such as increased health risks due to extreme heat, declining air quality and increased flooding due to sea level rise and heavy downpours.ⁱⁱ

Environmental & Health Benefits

While there are no direct environmental or health benefits for this proposal, the study aims to address specific regions within New York City and determine where various resources would be best implemented. This could have an indirect effect on environmental and health issues in that resources would be strategically distributed to areas where they are needed rather than requiring them in areas that do not need them.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a study which will have no direct impact on construction costs.

Precedents

The Intergovernmental Panel on Climate Change (IPCC), the New York City Panel on Climate Change (NPCC)ⁱⁱⁱ, and the U.S. Global Change Research program^{iv} have completed studies looking at the impacts of climate change on coastal regions. However, neither one addresses the specific regional impacts that this study proposes to address.

LEED

There are no LEED credits directly affiliated with this proposal though outcomes of the report may affect LEED credits in Sustainable Sites, Water Efficiency, Energy and Atmosphere, and Indoor Environmental Quality categories.

Implementation & Market Availability

There are no known implementation or market availability issues for this proposal.

ENDNOTES:

ⁱ NEW YORK CITY PANEL ON CLIMATE CHANGE, CLIMATE RISK INFORMATION, Feb. 17, 2009, available at http://www.nyc.gov/html/planyc2030/downloads/pdf/nyc_climate_change_report.pdf.

ⁱⁱ THOMAS R. KARL, ET AL., GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, CAMBRIDGE UNIVERSITY PRESS (2009).

ⁱⁱⁱ NEW YORK CITY PANEL ON CLIMATE CHANGE, CLIMATE RISK INFORMATION, Feb. 17, 2009, available at http://www.nyc.gov/html/planyc2030/downloads/pdf/nyc_climate_change_report.pdf.

^{iv} THOMAS R. KARL, ET AL., GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, CAMBRIDGE UNIVERSITY PRESS (2009).

BR 6: ANALYZE STRATEGIES TO MAINTAIN HABITABILITY DURING POWER OUTAGES

Study

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Research on climate change indicates that there will be an increase in the frequency and severity of events that can disrupt the city's power, water, sewer and transportation infrastructure. In the event that city services are not usable, passive and dual-mode functions will be critical

Recommendation:

Undertake a comprehensive study of passive survivability and dual-mode functionality, then propose code changes to incorporate these concepts into the city's building codes. Also include a study on refuge areas in sealed buildings.

Proposed Legislation, Rule or Study

If New York City's power system were seriously disrupted, millions of New Yorkers would likely be stranded within buildings because of the difficulty of quickly evacuating more than eight million people from a series of islands, and also because the subway system, which relies on electric power, would be paralyzed. In order to house the population safely, a certain percentage of the city's building stock would need to maintain conditions of habitability for a period of days, without access to electric power from the grid.

This issue is not a hypothetical concern for New York. The city has experienced power outages due to heat waves and electrical glitches in the past decade; an act of terrorism or a serious flood could also cause a black-out, as occurred in New Orleans. Gradually, climate change may increase the frequency and severity of extreme weather events, and this could increase the occurrence of power outages, particularly if preventative action is not taken. This problem is exacerbated because buildings built over the past fifty years have become increasingly dependent on a continuous supply of energy in order to provide such basic requirements as fresh air.

How much habitability (or survivability or resilience) needs to be provided within New York's building stock, and how should it best be provided? The current approach entails installing diesel back-up generators in buildings containing critical functions. The downside of extending this approach is that these generators are highly polluting, they are expensive, and there are logistical challenges involved in getting fuel to a large number of buildings in an emergency scenario. Other potential strategies include:

- **Passive survivability:** Designing buildings so that they maintain habitability through passive means, such as well-insulated envelopes and access to light and fresh air.
- **Dual mode functionality:** Reducing the emergency energy needs of the building by designing it to function in dual modes, one being the "standard mode", and the other a "low energy" mode.
- **On-site energy generation:** Utilizing a gas-based co-generation system and/or solar or wind installations to meet some portion of the building's emergency energy needs.
- **Providing areas of refuge:** Reducing the emergency energy needs of the building by designating that only some portion of the building - "areas of refuge" -- need remain habitable.
- **Hybrid systems:** Any combination of the above strategies.

Given the array of options, and the large variety of building types and systems within New York, the City should undertake a study of how best to ensure sufficient habitability during the period before service is restored or the population can be evacuated.

The study should include the following:

1. An analysis of the various strategies to ensure habitability during a power outage, to include, at a minimum, the following strategies: emergency back-up generators, passive survivability, dual-mode functionality, on-site generation, areas of refuge, and hybrid systems. Across a representative selection of building types, the study should analyze the effectiveness, feasibility, cost (including both first-cost and life cycle cost), and design implications of each strategy. The study should also consider any collateral damages or benefits of each strategy.

2. An analysis of the performance of New York's existing building stock from various eras under emergency conditions. The analysis should determine how new buildings compare with older, pre-1950, buildings (the latter generally consuming less energy and being more likely to be inhabitable without power). It should also determine what principle design strategies enabled the older generation of buildings to function with less power and the impact of the older generation of codes (1916 Zoning Ordinance, Tenement Laws, etc.) on their design.
3. A review of requirements for emergency power, passive survivability, or basic habitability in other jurisdictions, both national and international.
4. A review of the habitability needs for various building types (commercial, residential, institutional, etc.). The study should consider how long each building type would need to support habitation, how much of the building would need to remain habitable, and what building functions would need to be maintained.
5. An assessment of how parallel efforts to increase the resilience of the city's infrastructure could decrease the requirements for building habitability.
6. An analysis of the code changes necessary to achieve the desired levels of survivability. The study should assess the requirements for both new and existing buildings. It should also recommend whether the requirements should be prescriptive (i.e. should there be specific requirements for certain passive survivability techniques, back up generators etc?) or performance (i.e. should the building be required to demonstrate that it could support certain functions or a certain population for a given length of time).
7. Draft code language for any recommended code changes.

Supporting Information

Issue – Expanded

Under the direction of the Mayor's Office of Long Term Planning and Sustainability, New York has become a national leader in addressing the consequences of climate change. It convened the New York Panel on Climate Change (NPCC) to assess the impacts of climate change through the end of this century in New York. The Panel's findings were published in February 2009 in Climate Risk Information. In addition, the Office convened an Adaptation Task Force, which includes the agencies, public authorities, and private sector companies that manage the city's infrastructure, including Consolidated Edison, to assess how infrastructure can be made more resilient in the face of climate change.

This proposal would complement the efforts to enhance the city's infrastructure by making the buildings capable of supporting the city's population in the event that the electrical grid should fail.

Environmental & Health Benefits

The health benefits of this proposal could be significant if New York experienced an extended power outage because it would enable a large number of people to ride out such a crisis within buildings that maintained habitable conditions.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a study which will have no direct impact on construction costs.

Precedents

In the aftermath of Hurricane Katrina, 30,000 residents of New Orleans sought refuge in the Superdome for several days. This rapidly turned into a nightmare because without electricity and air conditioning, temperatures within the building became almost unendurably hot. In contrast, the people who stayed in the French Quarter were relatively comfortable. This is because the older building in the Quarter were designed for some degree of passive cooling since they were built before air conditioning was available.

This contrast led Alex Wilson, editor of Environmental Building News and a member of the technical sub-committee on Adaptation in the NYC Green Code Task Force, to formulate the concept of "passive survivability". The basic idea behind passive survivability is that buildings should be designed and built so that they can remain habitable in the absence of an outside power supply.

LEED

There are no LEED credits affiliated with this proposal.

BR 6: ANALYZE STRATEGIES TO MAINTAIN HABITABILITY DURING POWER OUTAGES

Implementation and Market Availability

There are no known implementation or market availability issues for this proposal.

BR 7: ENSURE TOILETS & SINKS CAN OPERATE DURING BLACKOUTS

New York City Plumbing Code

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Some toilets and faucets can function only with utility power; this presents a sanitation risk in the event of a long-term power outage.

Recommendation:

Require that toilets and faucets be capable of operating without building power for at least two weeks

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code

1. Add a new Section 424.7 as follows:

424.7 Lavatory sensor control devices. Sensor control devices used for lavatory faucets shall be able to continue normal operation in the event of a loss of building power for a period of at least two weeks, without connection to the building power supply.

2. Add a new Section 425.6 as follows:

425.5 Water closet and urinal flushing sensor control devices. Sensor control devices used for flushing toilets or urinals shall be able to continue normal operation in the event of a loss of building power for a period of at least two weeks, without connection to the building power supply. Sensor control devices shall be based on infrared detection and have a minimum delay of 2 seconds.

Supporting Information

Issue - Expanded

Studies demonstrate that bacteria in bathrooms, even those that are functioning properly, contribute to the spread of infectious illnesses such as the common cold and gastrointestinal illness.ⁱ When lavatories and toilets cannot function properly and people cannot wash their hands, remove waste or clean regularly, bathrooms can become a major vector for illness.ⁱⁱ

Automatic fixtures were created in part to reduce human contact with bathroom surfaces that might spread disease. However, the need of many such fixtures for electricity leaves them vulnerable to disruptions in the power grid, potentially crippling building sanitation during blackouts. The effect of losing sanitation in an occupied building was graphically demonstrated in the aftermath of Hurricane Katrina when lack of water pressure caused toilets to fail in the Superdome, quickly making the building uninhabitable. In addition, the sensors on many automatic fixtures, particularly toilets, malfunction and flush repeatedly, wasting a substantial quantity of water.

Environmental & Health Benefits

This proposal will ensure the proper functioning of building sanitation, even during prolonged power disruptions. In addition, it will improve sensor controls for toilets and urinals, leading to a reduction in water consumption.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the

context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents

There are no known precedents for this proposal.

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal. Lavatory faucet sensors and toilet sensors with the required battery life are readily available. Some flushometer toilets with sensors also provide a manual override.

ENDNOTES:

ⁱ School Network for Absenteeism Prevention, It's a Snap: Statistics, <http://www.itsasnap.org/snap/statistics.asp> (last visited Jan. 21, 2010).

ⁱⁱ Shae Crisson, *Letting toilet water mellow should not pose a health risk*, ASSOCIATED PRESS, Dec. 19, 2007, available at <http://abclocal.go.com/wtvd/story?section=news/local&id=5845834>.

BR 8: ENHANCE BUILDING WATER SUPPLY DURING BLACKOUTS

New York City Plumbing Code

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

Water towers are an energy-efficient method for providing water pressure and ensuring access to potable water during short power losses. The building codes do not require water towers for new construction, and they allow the towers to be removed from existing buildings.

Recommendation:

Prohibit the removal of existing water towers, and require water towers in all new and renovated buildings.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Amend Section 606.5.6 as follows:

606.5.6 Emergency Water Supply to be Provided.

606.5.6.1 Maintain Existing Gravity Tanks. An existing gravity tank shall not be removed unless it is replaced by a gravity tank of greater or equal capacity; it may not be removed and replaced by potable water pressure tanks.

Exception: A gravity tank may be replaced by a gravity tank of smaller size if it can be demonstrated that the water requirements of the building have diminished by more than 30% due to a change of use or occupancy.

606.5.6.2 New Construction. New buildings shall either install a gravity tank or comply with performance standards that shall be established by the department for minimum emergency water supplies according to building occupancy.

Supporting Information

Issue-Expanded

The wooden water towers on New York City's rooftops constitute a signature feature of the City's skyline; in addition, they provide resilience to the City's buildings in the event of power outages, by ensuring that there is some water available. In many older buildings, water from the city system is pumped up to the roof and stored in a water tank, where it is then distributed throughout the building via gravity. Newer systems often do not use such rooftop gravity tanks. Instead they use one or more water pressure tanks, which store very little water and continuously supply water at the necessary pressure by pumping.

In terms of building resilience, the rooftop storage units offer several advantages. If the building's electrical or water systems were to be disrupted, the building would at least have the water stored in the tank. Similarly, because these tanks work by gravity, water could still be distributed through the building without any power supply. In addition to resilience, gravity tanks generally use less energy than water pressure tanks. In the former, pumping is only required intermittently when more water is needed to fill the tank, whereas with the latter, more frequent pumping is needed to maintain the availability of water at the right pressure.

Nonetheless, some building owners are abandoning their old water tanks, often because of maintenance issues. And new buildings often opt for water pressure tanks because they don't impact the design of the roof and they do not require structural supports needed by the gravity fed tanks.

This proposal would prohibit the removal of existing tanks, since they are on buildings that were designed to support them. It would also require new buildings to either install water tanks or comply with emergency water supply standards developed by the Department of Buildings.

Environmental & Health Benefits

Having water available in power outages has obvious health and safety benefits, since water is necessary for drinking and hygiene. In addition, gravity tanks generally use less electric energy for pumping.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given a health score of 1.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.03%. It was thus categorized as incurring a low capital cost increment.

Precedents

There are no known precedents for this proposal.

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

This is a mature technology and is available.

Notes

This proposal is consistent with BR 6 - Analyze Strategies to Maintain Habitability During Power Outages.

BR 9: INCLUDE CLIMATE CHANGE IN ENVIRONMENTAL IMPACT STATEMENTS

Proposal developed by the Climate Adaptation Committee

Summary

Issue:

"CEQR" is the process by which city agencies review proposed actions in order to identify the effects those actions may have on the environment. CEQR guidelines are currently being updated to include an assessment of the impact of climate change on proposed actions.

Recommendation:

The technical committee supports the amendments to the CEQR guidelines underway in the Mayor's Office of Environmental Coordination, which will incorporate climate change. The Mayor's Office began implementing this proposal independently of the Task Force, prior to the issuance of this report.

Proposed Legislation, Rule or Study

Expression of Support for the NYC Mayor's Office of Environmental Coordination's effort to provide guidance for analyzing climate change in environmental assessment conducted pursuant to CEQR.

The Committee endorses the City's effort to provide guidance for both (1) an analysis of an action's greenhouse gas the Committee supports the use of a methodology which pro-rates emissions per square footage and adjusts for building type. Some alternative methodologies are based on total carbon emissions, which can have the unintended consequence of discouraging density, which is typically the least carbon intensive way to build since it facilitates mass transit options. The former type of analysis is proper one as it will promote efficient development without inhibiting high densities. emissions emissions and (2) an analysis of climate change and an action's adaptation to climate change. In particular,

Supporting Information

Issue - Expanded

The City Environmental Quality Review, or "CEQR" is a process by which City agencies review proposed discretionary actions for the purpose of identifying the potential effects those actions may have on the environment, and in some instances, the effects the environment may have on the proposed action. The goal of CEQR is to ensure disclosure of all the potential environmental impacts of an action under consideration so that the decisionmakers are fully informed of its effects before determining whether to directly undertake, approve, or fund that action.

The CEQR Technical Manual (the Manual) provides guidance for City agencies, project sponsors and the public in the procedures and substance of the CEQR process. Chapter 3 of the Manual currently includes a discussion of 22 analysis areas, including land use, zoning and public policy, open space, infrastructure, energy, air quality, solid waste and sanitation services, hazardous materials, etc. For each of the areas, guidance is provided in assessing the existing and future environmental settings, defining study areas, evaluating existing conditions, predicting future changes, identifying significant impacts and developing mitigation measures for any significant adverse impacts. Possible assessment methodologies are explained for each technical area.

The Manual was last updated and published in 2001. This version of the Manual did not include any discussion of, or the need for, assessment of climate change and the effects that such change will have on any proposed action. The Mayor's Office of Environmental Coordination (MOEC) is currently undertaking a complete revision of the Manual, set to be released in 2010. The Committee has been informed by MOEC that this revision will provide guidance for an analysis of climate change. The climate change analysis guidance is being developed by MOEC in collaboration with the New York City Panel on Climate Change; the Mayor's Office of Long Term Planning and Sustainability; the Law Department; the Department of City Planning; the Parks Department; and the Department of Environmental Protection.

Environmental & Health Benefits

This proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal was not part of the cost analysis.

Precedents

There are no known precedents for this proposal.

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation or market availability issues for this proposal.

RC 1: RECYCLE CONSTRUCTION WASTE

New York City Building Code

Proposal developed by the Construction Practices Committee

Summary

Issue:

While most waste from construction sites can be collected in dumpsters and then separated and recycled off-site, certain materials become damaged when commingled. They cannot be reused or recycled unless they are separated at the construction site.

Recommendation:

Require ceiling tiles, carpeting, new gypsum wallboard scrap, and large-dimension lumber to be sorted on-site and reused or recycled. Also, require construction-waste management plans for large projects.

Proposed Legislation, Rule, or Study

Amendments to the New York City Building Code:

1. Add the following definitions to Section 3302.1:

CONSTRUCTION WASTE MANAGEMENT PLAN. A plan outlining procedures for the reuse, including resale, or recycling of recoverable waste materials generated during construction and demolition.

LARGE-DIMENSION LUMBER. Any lumber with a minimum dimension of two inches by eight inches by eight feet.

NEW GYPSUM WALLBOARD SCRAP. Pieces of gypsum wallboard left over from the cutting and installation of new gypsum wallboard.

2. Add a new Section 3303.15 as follows:

3303.15 Waste recycling / reuse.

3303.15.1 Recycling carpet, ceiling tiles and gypsum wallboard scrap. Any construction, alternation, partial demolition, or demolition of a building or space greater than 20,000 square feet (1,858 m²) before July 1, 2013 or greater than 10,000 square feet (929 m²) on or after July 1, 2013 shall comply with this Section 3303.15.1. All waste ceiling tiles, carpet, carpet padding, carpet tiles, and new gypsum wallboard scrap shall be separated from other waste at the construction site, stored in a dry location, and sent to a facility for recycling or reuse. Such materials shall not be commingled with dissimilar material during onsite storage or transportation.

Exception: If the construction or demolition does not involve more than 10,000 square feet (929 m²) of ceiling tiles, 10,000 square feet (929 m²) of, collectively, carpet, carpet padding, and carpet tiles, or less than 1,000 square feet of new gypsum wallboard scrap. Beginning July 1, 2013, this exception shall only apply when there is less than 5,000 square feet (465 m²) of any such materials, except for new gypsum wallboard scrap.

Exception: When prior to commencement of demolition, materials are damaged, contaminated, or do not comply with industry recycling requirements, including foil-backed carpet tiles, wool carpet, and other carpet that cannot be recycled.

3303.15.2 Salvaging large-dimension lumber. Any construction, alternation, partial demolition, or demolition of a building or space greater than 1,000 square feet (93 m²) shall comply with this Section 3303.15.2. All large-dimension lumber shall be separated from other waste at the construction site, stored in a dry location, and sent to a facility for reuse. Such materials shall not be commingled with dissimilar material during onsite storage or transportation. Such material shall not be cut except as necessary for removal and shall be maintained in as large a piece as feasible.

Exception: Large-dimension lumber that has no reclaimed value due to damage by rot, dry rot, termites, splitting, fire, or other damage.

3303.15.3 Construction waste management plan. Any application for a permit for the following work shall include a construction waste management plan:

1. any alternation or partial demolition of a building or space greater than 50,000 square feet (4,645 m²) before July 1, 2013 and greater than 20,000 square feet (1,858 m²) after July 1, 2016; and
2. any new building or full demolition.

3303.15.3.1 Contents of construction waste management plan. The construction waste management plan shall:

1. comply with the requirements of this Section 3303.15;
2. describe how asphalt, cardboard, concrete, gypsum wallboard, masonry, office furniture and furniture systems, steel, and wood will be collected, sorted, transported, and delivered to a facility for reuse, recycling, or landfill disposal;
3. describe procedures for compliance with state or federal laws regarding disposal of any material containing mercury, lead, asbestos, or any polychlorinated biphenyl;
4. list the corporate names and addresses of any organization responsible for transportation, reuse, recycling, or landfill disposal;
5. outline the documentation each party will maintain to verify that material has been diverted from landfill in accordance with this chapter; and
6. be available at the construction site.

Supporting Information

Issue – Expanded

In 2002, waste from construction and demolition in New York City totaled 7.91 million tons.¹ Of this, nearly 70% was recycled, indicating that NYC already has rather high rates of diversion of construction and demolition wastes from landfills. However, there is still significant potential for improvement since many re-useable and/or recyclable materials are still landfilled due to improper handling and/or the comingling of materials.

Sending construction and demolition waste to landfills, rather than recycling the material, clogs our limited landfills and increases the production of new materials, generating greenhouse gas emissions. The number of construction and demolition landfills near New York is declining, which means fuel consumption and related emissions from transporting waste will increase as New York uses more distant landfills in the future.

Large dimension lumber is most commonly found in older townhouses, warehouses, and single-family homes. It is typically old growth lumber, which is a non-renewable resource. Reclaimed lumber can later be re-used as structural members in similar new construction and renovation, made into high-end designer furniture, used as lagging in excavations, cut into blocking, or used for other purposes depending on the quality.

Environmental & Health Benefits

Increasing the quantity of materials recycled will result in better resource utilization, less natural resources depleted, and the encouragement and creation of local NYC (green) jobs.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

The City of Portland Bureau of Planning and Sustainability requires all building projects with a permit value of \$50,000 or more (including construction and demolition phases) to separate and recycle certain materials from the job site. The general contractor is responsible for ensuring recycling at the job site, including recycling by sub-contractors, and for completing a Pre-Construction Recycling Plan Form. Contractors must keep these materials out of the landfill: Rubble (concrete/asphalt); Land Clearing Debris; Corrugated Cardboard; Metals; and Wood.²

In 2006, the City of San Francisco adopted Ordinance No. 27-06 mandating the recycling of construction and demolition (C&D) debris in order to divert a minimum of 65% of the material from landfill.³ This ordinance affects all construction projects such as new construction, remodels, and partial demolitions, and requires the building permit holder or the property owner to make sure that all C&D materials removed from the project are properly recycled. This ordinance prohibits any C&D materials from being placed in trash or sent to a landfill.²

Over the last several years the following companies have had active recycling programs for these materials at de minimus cost: Tiffany, Pfizer, Merrill Lynch.

LEED

All LEED rating systems encourage the reuse or recycling of construction waste including LEED NC-MR cr. 2.1 & 2.2 (Construction Waste Management, Divert from Landfill); LEED CI-MR cr. 2.1 & 2.2 (Construction Waste Management, Divert from Landfill); LEED EB-MR cr. 1.1 & 1.2 (Construction, Demolition, and Renovation); LEED for Homes MR cr. 3.1 & 3.2 (Waste Management); and pilot programs such as LEED for Retail and LEED for Neighborhood Development.

Reporting requirements of new Section 3303.15.3 of this proposal allows for the easy collection of data for submission to the USGBC for LEED Certification or for analysis by the City.

It should be noted that LEED does not differentiate the size of the building or space under consideration, nor does LEED differentiate between types of materials to be segregated.

Implementation & Market Availability

1. The National Carpet Manufacturers (through the Carpet America Recovery Effort - CARE) are committed to increasing the recycling of carpet and carpet tile through a national network of consolidators, one of which is in the NYC New York City area. It would be beneficial to have additional consolidators in the New York City area. For single stream waste recyclers, a permit from NYSDEC is not required; although their support and cooperation would be helpful. For carpet and carpet tile, the economical breakpoint (as of 12/08) is approximately 10,000 to 20,000 sf. National carpet manufacturers participating in these recycling programs include Shaw, Interface, Mohawk, and Milliken.
2. For ceiling tile, Armstrong and US Gypsum, the two largest manufacturers, both have national programs to recycle ceiling tile, although only Armstrong's program is operational in the New York City region. For ceiling tile the economical breakpoint is approximately 20,000 to 30,000 sf.
3. Clean gypsum scrap can easily be incorporated into the manufacture of new gypsum wallboard however no collection facilities currently exist in the New York City region. Typically 100% of pre-consumer gypsum scrap is recycled, however close to 0% of post-consumer scrap is.
4. Preliminary estimates of materials to be recycled annually during the initial three years of the program are 11 million sf of ceiling tile and 57 million sf of carpet/tile. The existing consolidator projects that his company can handle 1 to 3 million sf of ceiling tile and 7 to 15 million sf of carpet tile with his present capacity (the lower end of the range). The carpet manufacturers are recycling at a rate in excess of 200 million pounds (equivalent to 300 million sf @ 6 pounds/square yard or 0.67 pounds/sf) of carpet per year. Armstrong indicates that they are only accepting a small portion of the amount that they could recycle. They produce 1 million sf of ceiling tile per day (or 300 million sf/year) at their Pennsylvania plant.
5. There are many small and medium scale lumber salvage companies in New York City. Most such companies will come to a project site during demolition and remove the lumber, paying for any quality lumber. Securing this service generally does not require more than a phone call with a few days notice before demolition.

Local salvage companies include the following:

[M. Fine Lumber](#), Brooklyn NY
Sawkill Lumber Co., Bronx
Build It Green, Queens
Big Wood, Upstate NY

Notes

Two different approaches were considered to increase diversion rates. Initially a system similar to LEED was considered. That approach mandated required a Construction Waste Management Plan to be developed for each project and mandated high diversion requirements. It was felt this approach would place an undue burden on certain types of projects and not on others. (Due to the different conditions and materials that may be present on a site, some projects would be unduly burdened with trying to reclaim and recycle wastes of no value that would eventually be landfilled anyway.)

An alternate approach the committee investigated was to require recycling of all recyclable demolition and construction waste. This was also deemed too burdensome due to NYSDEC constraints on transfer facilities that limit some of the materials to be diverted.

The final proposal represents a compromise between these two options by targeting specific materials that are often not diverted due to damage caused by handling and/or co-mingling. Requiring site sorting of these materials will likely

push diversion rates to their highest practical point. Market forces will continue to encourage off-site sorting of the other construction and demolition waste.

This proposal sets a lower project size threshold for separation of large-dimension lumber than for separation of other materials. Consultations with local salvagers indicate that there is no lower limit on project scale when it comes to large-dimension lumber: a salvager will come to a site for just a few good quality boards. In addition, arranging for the salvage of such lumber only requires a telephone call, as compared with the training that maybe required for the separation of other materials addressed in this proposal.

ENDNOTES:

¹ HENNINGSON, DURHAM, AND RICHARDSON ARCHITECTURE AND ENGINEERING, P.C., COMMERCIAL WASTE MANAGEMENT STUDY, VOL. 4., EVALUATION OF WASTE DISPOSAL CAPACITY POTENTIALLY AVAILABLE TO NEW YORK CITY, (2004) <http://www.nyc.gov/html/dsny/downloads/pdf/swmp/swmp/cwms/cwms-ces/v4-ewdc.pdf>; See also U.S. EPA, WHAT'S IN A BUILDING? COMPOSITION ANALYSIS OF C&D DEBRIS, <http://www.epa.gov/region09/waste/solid/pdf/cd1.pdf> (last visited Jan. 12, 2010); and, Tom Napier, Construction Waste Management, U.S. Army Corps of Engineers, Engineer Research and Development Center / Construction Engineering Research Laboratory (2008) <http://www.wbdg.org/resources/cwmgmt.php>.

² City of Portland Bureau of Planning and Sustainability, Construction, Remodeling and Demolition Waste, <http://www.portlandonline.com/osd/index.cfm?c=41683> (last visited Jan. 12, 2010).

³ SFENVIRONMENT, SAN FRANCISCO, CALIFORNIA ORDINANCE NO. 27-06, <http://www.sfenvironment.org/downloads/library/ondemolitionordinancefinal.pdf> (last visited Jan. 12, 2010).

⁴ SFENVIRONMENT, CONSTRUCTION AND DEMOLITION DEBRIS RECYCLING, http://www.sfenvironment.org/our_programs/interests.html?ssi=3&ti=5&ii=125 (last visited Jan. 12, 2010).

RC 2: PROVIDE RECYCLING AREAS IN APARTMENT BUILDINGS

New York City Building Code

Proposal developed by the Materials & VOCs Committee

Summary

Issue:

In many buildings, the lack of a dedicated recycling space impedes recycling

Recommendation:

Require new multi-family residential buildings to provide adequate space to store and sort recyclable materials

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1213 as follows:

1213.1 General. Multiple dwellings shall comply with Section 81 of the New York State Multiple Dwelling Law and Section 27-2021 of the New York City Housing Maintenance Code. Where a room [is] or rooms are provided for the storage of refuse and/or recyclables in a building, such room or rooms shall be completely enclosed by construction that has a fire resistance rating of not less than 2 hours, with self-closing opening protectives having a fire protection rating of not less than 1 ½ hours. The location of such refuse storage room or rooms shall be identified on the construction documents.

1213.2 Compactor. A refuse compacting system shall be provided in multiple dwellings in a Group I-1 or R-2 occupancy that are four or more stories in height and contain 12 or more dwelling units, and in buildings of any size occupied as a Group R-1 multiple dwelling. Such system shall be located within a refuse storage room constructed in accordance with Section 1213.1 or in a refuse chute termination room constructed in accordance with Section 707.13.4. The floor within such room shall be constructed of concrete and shall be sloped to a floor drain connected to the building sewer. A hose connection shall be provided within such room.

1213.3 Refuse chute. A multiple dwelling that is five or more stories in height and that contains more than 12 dwelling units shall be provided with a refuse chute, refuse chute access rooms, and refuse chute termination room constructed in accordance with Section 707.13.

1213.4 Central Refuse Storage Room. Any building classified in occupancy groups R-1 or R-2 that contains 12 or more dwelling units shall contain at least one central refuse storage room. The central refuse storage room or rooms shall contain sufficient space for the storage of both refuse and recyclables, separated in accordance with the requirements of the Department of Sanitation, and shall comply with the minimum area requirements of Table 1213.4.

Table 1213.4

<u>Number of dwelling units</u>	<u>Minimum size of refuse storage room</u>
<u>12-23</u>	<u>65 square feet</u>
<u>24-49</u>	<u>100 square feet</u>
<u>50-99</u>	<u>150 square feet</u>
<u>100 or more</u>	<u>150 square feet plus 1 square foot per dwelling unit over 99 units up to a maximum of 250 square feet.</u>

1213.5 Secondary Storage Rooms for Refuse and Recyclables. Any building classified in occupancy groups R-1 or R-2 that contains 12 or more dwelling units shall contain a secondary storage room for refuse and recyclable material on any floor with main entries to 6 or more dwelling units. Secondary storage rooms shall be a minimum of 10 square feet and shall contain separate receptacles for refuse, for recyclable paper products, and for recyclable metal, glass, and plastic.

Exceptions:

1. Floors with separate trash chutes for refuse, for recyclable paper, and for recyclable metal, glass, and plastic. Chutes for recyclable material shall be constructed in accordance with Section 707.13.
2. Where a refuse access room is provided on a floor that is constructed in accordance with Section 707.13.3 and such refuse access room is at least 8 square feet in area.

Supporting Information

Issue – Expanded

Recycling is good for the environment because it takes less energy and resources to make new products out of recycled materials than from new materials. It also has the potential to save the city money as the cost of exporting waste to out-of-state landfills continues to rise.

About 33% of New York's total waste stream (and 16% of residential waste) is recycled, putting the city just above the average national recycling rate of 32%. Other large cities have managed to vastly exceed this average. Los Angeles recycled over 60% of its total waste and Chicago over 55%; almost 70% of San Francisco's waste is recycled.

One barrier to increasing recycling rates in multi-family residential buildings is that many lack a dedicated room to store and sort recycling and waste. Without this dedicated space, it is challenging for residents or superintendents to keep recycling separated. For this reason, many other cities and Battery Park City Authority require that residential buildings provide a waste/recycling room.

Environmental & Health Benefits

By increasing the allotted space for recycling bins and thus increasing awareness and accessibility for recycling measures, this proposal will in effect increase the recycling rates for multi-family residential facilities. By increasing the recycling rates, less solid waste goes to landfills.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

Many municipalities including San Francisco, Santa Monica¹, and Portland require that residential buildings provide space for recyclables.² Within New York City, Battery Park City also has a space requirement for recyclables.

LEED

This recommendation is in accordance with LEED NC provided that criteria for separation of materials, size & accessibility of designated recycling storage areas, and location of collection areas are met. This issue is addressed as a prerequisite under almost all of the rating systems. Therefore, code revisions under this proposal could significantly impact a project's ability to attain LEED certification.

LEED requires that adequate space is provided for the storage of paper, corrugated cardboard, glass, plastics, and metals. Projects adhering to the code revisions outlined in this proposal will only comply with LEED if all of these materials are accommodated and if they are collected separately.

LEED 2009 also specifies a minimum size for refuse storage rooms in commercial buildings. Buildings 50,000-20,000 square feet are required to provide a room that is 225-275 square feet. The maximum room size required is 500 square feet for buildings of 200,000 square feet or greater.

Implementation and Market Availability

There are no known implementation issues for this proposal.

Notes

1. The committee initially considered requiring trash compactors in commercial buildings in order to consolidate waste and recyclable materials, thus reducing air pollution from transportation from the building. Ultimately, the committee did not include this provision because these benefits were not sufficiently understood or quantifiable.

2. The Zoning Resolution will also need to be revised to add “recycling” to all references to refuse, and to credit chutes for recycling in the same manner as chutes for refuse.

ENDNOTES:

¹ SANTA MONICA MUNICIPAL CODE ART. 9 § 4.10.02.150 (1994), available at http://www.qcode.us/codes/santamonica/view.php?topic=9-9_04-9_04_10-9_04_10_02-9_04_10_02_150.

² ASHRAE 198.1 § 9.3.4.3 (requires central collection for recycling with separate storage for paper, corrugated cardboard, glass, plastics and metals); BATTERY PARK CITY RESIDENTIAL ENVIRONMENTAL GUIDELINES (require secondary storage room on each floor; either separate bins or separate chutes for refuse and recyclables, and centralized holding areas holding a volume of 2.9CF/dwelling unit); SANTA MONICA, CA., PLANNING AND ZONING REGULATIONS, art. 9.04 (require minimum areas for recycled materials storage); ALAMEDA COUNTY, CA. (aims to divert 75% waste from landfills; ties area requirements to frequency of pick-up); CITY OF MOUNTAIN VIEW, CALIFORNIA (requires one 3-yard bin and 3 recycling carts for every 15 units); PORTLAND, OR., CITY CODE ch. 17 (requires recycling systems sized to meet the goal of achieving 75% recycling by 2015); REDMOND, WA. STANDARDS FOR GARBAGE AND RECYCLING ENCLOSURES 20D.120.40 (requires 65 square foot minimum area and stipulates 1.5 square foot/dwelling); WASHINGTON DC. DPW (has adopted a single-stream recycling. Recyclables are taken to the materials recycling facility (MRF) where they are separated and prepared for market); and (numerous other municipalities require residential recycling without stipulating space requirements for recyclable collection.).

RC 3: USE RECYCLED AGGREGATE IN CONCRETE

NYC Building Code and Administrative Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Waste concrete, asphalt, and glass can be reused as bedding material or as aggregate in new concrete, reducing construction waste and the need for virgin materials.

Recommendation:

Require a minimum amount of recycled concrete, asphalt, or glass as bedding material and within new concrete.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1905 as follows:

1905.2 Selection of concrete proportions. Concrete proportions shall be determined in accordance with the provisions of Sections 1905.2.1 through [1905.2.3] 1905.2.5.

2. Add a new Section 1905.2.5 as follows:

1905.2.5 Minimum Recycled Content. In all concrete mixes for cast-in-place concrete, requiring a compressive strength of 4,000 psi or less, a minimum of 10% of the aggregate, as measured by weight, shall be recycled concrete. After July 1, 2013, this minimum shall be raised to 15% of the aggregate, as measured by weight. Concrete aggregate shall not exceed .75 inches in diameter, with no more than 1% deleterious material. The provisions of Section 1905.2.5 shall not apply to structures designed for the containment, storage, or conveyance of water, sewage, or other liquids.

3. Add a new Section 1911.2 as follows:

1911.2 Minimum Recycled Content in Base Course Materials. A minimum of 15% of all base course materials, measured by weight, shall consist of recycled concrete, recycled asphalt, or glass cullet. The recycled concrete materials shall have a maximum diameter of .75 inches, with no more than 5% deleterious material, and any glass shall have a maximum diameter of .375 inches. After July 1, 2013, this minimum shall increase to 25% of the base course, as measured by weight. Recycled asphalt shall not exceed 5% of the total weight.

4. Amend Tables 720.1(1), 720.1(2), 720.1(3), 721.2.1.1, 721.2.1.2(1), 721.2.1.4(1), 721.2.2.1, 721.2.3(1), 721.2.3(2), 721.2.3(3), 721.2.3(4), 721.2.3(5), 721.2.4 and 721.3.2, and Figures 721.2.2.2, 721.2.2.3(1) and 721.2.2.3(2) by adding a footnote as follows:

For the purposes of fire resistance, recycled concrete shall be considered siliceous aggregate, unless the aggregate in question can be documented, to the satisfaction of the building commissioner, to be of another type.

Amendments to the Administrative Code of the city of New York:

1. Add a new Section 6-308.1 as follows:

§ 6-308.1 Minimum recycled content in concrete and base course materials. a. No concrete mixes purchased by any agency that require a compressive strength of 4,000 psi or less shall contain concrete aggregate that is composed of no less than 10% recycled concrete, as measured by weight. After July 1, 2013, no such concrete mixes shall contain concrete aggregate that is composed of less than 15% recycled concrete, as measured by weight. All concrete aggregate shall not exceed .75 inches in diameter, with no more than 1% deleterious material. Notwithstanding the foregoing, the provisions of this subdivision (a) shall not apply to any concrete mixes intended to be used in structures

designed for the containment, storage or conveyance of water, sewage or other liquids.

b. No base course materials purchased by any agency shall contain less than 15% recycled concrete, recycled asphalt or glass cullet, as measured by weight. All such recycled concrete materials shall be a maximum of .75 inches, with no more than 5% deleterious material. All such glass cullet shall be a maximum of .375 inches in diameter. Recycled asphalt shall not exceed 5% of the total weight. After July 1, 2013, no such base course materials shall contain less than 25% recycled concrete, recycled asphalt or glass cullet, as measured by weight.

c. The department of transportation shall promulgate rules no later than July 1, 2011 that incorporate the standards for base course materials as set forth in subdivisions (a) and (b) in all specifications for sidewalk construction.

Supporting Information

Issue – Expanded

Each year in New York City, miles of concrete sidewalks and roadways are built or replaced, using thousands of tons of concrete. Much of the aggregate in this concrete is quarried gravel, as are much of the base courses below the streets and sidewalks, and the process of quarrying and shipping the gravel and shipping causes environmental degradation.

The need to quarry and transport gravel could be reduced by utilizing waste materials, which are plentiful in New York City, for some of the aggregate or in the base courses. This process could also save money by reducing the costs of disposing of these waste materials. Due to a lack of sufficient demand, the city's construction waste transfer stations generate excess concrete from demolition of buildings and infrastructure, which they pay to get rid of, driving up demolition costs. Similarly, the City is saddled with excess asphalt from resurfacing the roads and glass from the residential recycling program; disposing of the excess costs taxpayers money. Therefore, New Yorkers will experience multiple benefits by reusing waste concrete, asphalt, and glass as aggregate in new concrete or in base courses.

The use of recycled concrete as an aggregate and in base courses is well established technically. It is accepted by ASTM and AASHTO as a source of aggregate in new concrete and can meet or exceed all applicable state and federal specifications. It is currently being used in concrete and asphalt products with better performance over comparable virgin aggregates and it provides for superior compaction and constructability.

Recycled concrete also has the benefit of weighing 10%-15% less than quarry products, reducing material and hauling costs.

Environmental & Health Benefits

This proposal will reduce the use of virgin materials, the impacts of land disturbance from quarrying and the quantity of material sent to landfills. Because recycled concrete usually originates and is consumed in the same geographical area, fuel consumption for transporting quarried aggregate will also decrease.ⁱ

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

While exact savings are difficult to quantify, savings will be realized in the feedstock costs for concrete and material costs for base courses, which should be distributed to some degree from the concrete and stone suppliers up the supply chain to the customers/residents of the facility, or, in the case of civil works, the taxpayer. Additional savings will come from the reduction in transportation costs and landfill fees due to the reduced disposal of old concrete.

Precedents

Although no known precedents exist requiring the use of recycled concrete as an aggregate, this is allowed by several municipalities and required by many federal agencies. For example, California includes the use of both recycled concrete and blast furnace slag as recycled aggregates in concrete mixtures.ⁱⁱ

LEED

LEED credits are available for the use of recycled Concrete Aggregate.

These credits include:

- LEED NC- MR cr.4.1 & 4.2 Recycled Content;

- LEED CI-MR cr. 4.1 & 4.2 Recycled content;
- LEED EB-MR cr.2 Optimize use of Alternative Materials;
- LEED for Schools MR cr.4.1 & 4.2 Recycled Content;
- LEED for Homes MR cr. 2 Environmentally Preferable Products; and
- credits under the various pilot programs.

Additionally, for concrete recycled on site, LEED MR credits relating to Construction Waste Management are available for diverting waste from disposal.

Implementation & Market Availability

There are no known implementation issues for this proposal. Recycled concrete from demolition waste is readily available

Some smaller concrete batch plants may need to create new mix designs to document their successful use of recycled aggregates, but the American Concrete Institute will provide technical assistance in to such companies. Technology does not impose any upper limit on the percent recycled concrete used in bedding material.

Notes

Concrete standards may be specified in tables or figures other than those identified in the fourth proposed amendment to the Building Code above and should be amended likewise.

ENDNOTES:

ⁱ Construction Materials Recycling Ass'n, Materials Website, <http://www.cdrecycling.org/materials> (last visited July 21, 2009).

ⁱ Fed. Highway Admin., Summary of Texas Recycled Concrete Aggregate Review, <http://www.fhwa.dot.gov/pavement/recycling/rcatx.cfm> (last visited Jan. 19, 2010).

ⁱⁱ CAL. CODE, Tit. 24 § pt. 11 § 706, 36 (2008), available at <http://www.documents.dgs.ca.gov>.

RC 4: USE RECYCLED ASPHALT

New York City Building Code and Administrative Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Asphalt pavement diverted from the construction waste stream can be reused as aggregate in new asphalt, greatly reducing construction waste and the need for virgin materials.

Recommendation:

Require a minimum amount of recycled asphalt as the base material for new asphalt aggregate.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new Section 3403.1 as follows:

SECTION BC 3403 PAVED AREAS

3403 Recycled content in asphalt. Beginning July 1, 2010, a minimum of 20% of all asphalt mixtures shall be recycled asphalt pavement (RAP), measured by weight. That minimum shall increase to 25% beginning July 1, 2014, and to 30% beginning July 1, 2018.

Amendments to the Administrative Code of the City of New York:

1. Add a new Section 6-308.1 as follows:

§ 6-308.1 Minimum recycled content in asphalt. No asphalt mixtures purchased by any agency shall contain less than 20% of recycled asphalt pavement, measured by weight. After July 1, 2014, no such asphalt mixtures shall contain less than 25% of recycled asphalt pavement measured by weight. After July 1, 2018, no such asphalt mixtures shall contain less than 30% of recycled asphalt pavement measured by weight. Notwithstanding the foregoing, the provisions of this section shall not apply to any asphalt intended to be used in aeronautical uses, highway projects funded by the federal government, or where asphalt content is otherwise prescribed by federal or state laws, regulations or guidelines.

Supporting Information

Issue – Expanded

Each year roughly 5% of New York City's streets are resurfaced. In the process, the top layers of asphalt are removed, and new layers are applied. About one million tons of asphalt is removed each year, and another one million tons is reapplied. If properly run, asphalt plants can reuse a considerable amount of recycled asphalt pavement (RAP) in creating new pavement material. The New York City Department of Transportation (DOT) has been an industry leader in using a high percentage of RAP; after having gradually increased its rates over many years, its current mix includes roughly 40% RAP. New York's private sector asphalt plants, however, lag behind, achieving an average recycling rate of roughly 15%, according to DOT. These rates can be increased, and this proposal gives the industry 8 years to gradually improve its techniques and increase its recycling rate to a minimum of 30%.¹

Environmental & Health Benefits

The primary environmental advantage to using recycled asphalt pavement (RAP) is that it prevents asphalt from entering landfills. Secondary advantages from this also include decreasing carbons emitted from using and transporting virgin materials as well as removing and transporting existing asphalt.

The chart below shows the impact of this proposal under two scenarios. In the first scenario, DOT does not increase its plant capacity – it remains at 45% of the market. In the second scenario, DOT increases its capacity to 75% of the market.

MVOC13 - Use Recycled Asphalt						
Scenario 1 (One DOT plant, 45% of city capacity)	milled asphalt (thousands of tons)	% currently recycled	current recycled asphalt (thousands of tons)	2010 recycled asphalt - 20% recycled (thousands of tons)	2018 recycled asphalt - 30% recycled (thousands of tons)	Impact: additional recycled asphalt 2018 (thousands of tons)
DOT	450	40%	180	180	180	
Private Plants	550	15%	82.5	110	165	82.5
Scenario 2 (Additional DOT plants, 75% of city capacity)	milled asphalt (thousands of tons)	% currently recycled	current recycled asphalt (thousands of tons)	2010 recycled asphalt - 20% recycled (thousands of tons)	2018 recycled asphalt - 30% recycled (thousands of tons)	Impact: additional recycled asphalt 2018 (thousands of tons)
DOT	750	40%	300	300	300	
Private Plants	250	15%	37.5	50	75	37.5

In the first scenario, this proposal would increase the use of recycled asphalt by 82,500 tons annually. To put this in perspective, the Dept. of Sanitation collects 13,000 tons of waste and recyclables daily, with another 13,000 tons collected from the commercial sector by private haulers. Therefore, the first scenario would result in the recycling of an amount of waste that is equivalent to over three day's worth of residential and commercial collections from the entire city, on an annual basis.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

The use of recycled asphalt pavement (RAP) has been widely utilized since the 1970s. Many municipalities across the country allow for the use of RAP and even dictate its use, including Utah,¹ California² and Colorado³. The Colorado Department of Transportation (CDOT) developed a specification in 1999 allowing 25% RAP in asphalt mixes.⁴ In addition, Chattanooga, TN implemented a new process in 2007 incorporating up to 50% RAP.⁵

LEED

LEED credits are available for the use of recycled asphalt aggregate feedstock.

These credits include:

- LEED NC- MR cr.4.1 & 4.2 Recycled Content;
- LEED CI-MR cr. 4.1 & 4.2 Recycled content;
- LEED EB-MR cr.2 Optimize use of Alternative Materials;
- LEED for Schools MR cr.4.1 & 4.2 Recycled Content;
- LEED for Homes MR cr. 2 Environmentally Preferable Products; and
- credits under the various pilot programs.

Additionally, for asphalt recycled on site, LEED MR credits relating to Construction Waste Management are available for diverting waste from disposal.

Implementation & Market Availability

There are no known implementation issues for this proposal. Recycled asphalt is readily available.

Notes

Some form of pavement recycling has been documented back to 1915.⁶ Nevada and Texas conducted the first sustained

efforts starting in 1974.⁷ Between 1976 and 1982, over 40 states documented RAP projects, and currently nearly all 50 states routinely use RAP as an aggregate substitute and binder.⁸ “Substitution rates of 10 to 50 percent or more, depending on state specifications, are normally introduced in pavements, and recently developed technology has even made it possible to recycle 90 to 100 percent RAP in hot mix.”⁹

“Recycling asphalt pavements is currently the largest single recycling practice in the United States. In 2002, 30,000,000 tons of RAP was used in hot mix asphalt (HMA) with a savings of over \$300 million, accomplished by lowering material costs for the newly placed asphalt and eliminating the disposal cost of the RAP.”¹⁰

ENDNOTES:

¹ UTAH CODE ANN. § 72-6-106 (1998), available at http://law.justia.com/utah/codes/title72/72_06007.html.

² CAL. PUB. RES. § 42700-42703 (2009), available at <http://lawyers.wizards.pro/california/codes/prc/42700-42703.php>.

³ Colorado Asphalt Pavement Association, *The Benefit of Using Recycled Asphalt Pavement*, 1, http://www.co-asphalt.com/documents/RAP_Brochure_all.pdf

⁴ *Ibid.*, 4.

⁵ International Council for Local Environmental Initiatives, *Chattanooga, Tenn., Uses Recycled Asphalt on Streets*, <http://www.icleiusa.org/success-stories/cool-infrastructure/roads-and-pavement/chattanooga-tenn-uses-recycled-asphalt-on-streets> (last visited Apr. 7, 2009).

⁶ Turner-Fairbank Highway Resource Center, *Reclaimed Asphalt Pavement*, FEDERAL HIGHWAY ADMINISTRATION, <http://www.tfhr.gov/hnr20/recycle/waste/rap132.htm> (last visited Jan. 19, 2010).

⁷ *Ibid.*

⁸ *Ibid.*

⁹ *Ibid.*

¹⁰ Bradley J. Putnam, et al., *Recycled Asphalt Pavement used in Superpave Mixes Made with Rubberized Asphalt*, 1 (2002), <http://www.ces.clemson.edu/arts/Mairepav4%20-%20RAP%20in%20Rubberized%20Asphalt2.pdf>. (last visited Jan. 19, 2010).

RC 5: PROTECT FORESTS BY USING SUSTAINABLE WOOD

New York City Building Code & New York City Administrative Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:

Forests store carbon, and tropical forests provide a habitat for half of the world's animal and plant species. Conventional forestry practices degrade forests and are unsustainable.

Recommendation:

Require that a portion of wood used in construction be sustainably harvested or come from reclaimed sources. Require that all tropical wood used in construction be sustainably harvested.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend 2302.1 to include the following definitions:

CERTIFIED WOOD PRODUCT. A wood product that achieves the standards of a qualified forest certification program.

CHAIN OF CUSTODY CERTIFICATION. A process that provides documentary evidence verifying that a given wood product is derived from a certified forest of origin.

FOREST CERTIFIER. An independent, third-party organization that conducts comprehensive assessments of environmentally and socially responsible forest management practices and that is accredited by an independent, third-party accreditation body.

NON-TROPICAL WOOD SPECIES. Any wood species that is not listed in Table 2309.3.1.1 or rule promulgated by the department pursuant to such section.

QUALIFIED FOREST CERTIFICATION PROGRAM. An independent, third-party initiative that is deemed qualified by the department and provides, through one or more organizations, formal affiliates or contracted agents, an integrated package of services including, but not limited to: development and application of standards to assess and certify forest management; accreditation of certifiers; chain of custody certification; and awarding of certification by the program's accredited forest certifiers.

RECLAIMED WOOD PRODUCT. Wood that has been salvaged for reuse from an existing building or structure by a licensed wood reclamation business.

THIRD PARTY. Not having an ownership interest in the land or the management of the forests or chain of custody operation being evaluated, and independent from any forest trade association.

TROPICAL HARDWOOD SPECIES. A hardwood tree species typically found in tropical rainforests and listed in Table 2309.3.1.1 or rule promulgated by the department.

TROPICAL RAINFOREST. Forests that are usually found near the equator and typically characterized by high rainfall and biodiversity. Tropical rainforests are common in Asia, Australia, Africa, South America and Central America.

2. Add a new Section 2309 as follows:

2309.1 Non-tropical wood.

2309.1.1 Applicability. This section shall apply to any construction projects with a work area greater than five thousand (5,000) square feet.

2309.1.2 Certified Wood Products and Reclaimed Wood Products. A portion of any non-tropical wood used for dimensional lumber, construction-grade plywood or flooring, or used for any other purpose designated by the commissioner, shall be certified wood products or reclaimed wood products in accordance with the dates and percentages listed in Table 2309.1.1. Compliance with such percentages may be demonstrated in terms of the total weight, volume or cost of such non-tropical wood. Calculations may include wood products purchased for temporary use on the project, such as formwork, bracing, scaffolding, sidewalk protection and guard rails. If any such materials are included, all such materials must be included in the calculations.

Table 2309.1.1

<u>Date</u>	<u>Percentage Certified Or Reclaimed Wood Products</u>
<u>2010</u>	<u>10%</u>
<u>2013</u>	<u>15%</u>
<u>2016</u>	<u>20%</u>
<u>2019</u>	<u>25%</u>

2309.2 Qualified Forest Certification Programs.

2309.2.1 Standards. The mayor's office of long-term planning and sustainability shall determine, through rulemaking, standards for the qualification of forest certification programs.

2309.2.2 Qualifying Programs. The mayor's office of long-term planning and sustainability shall determine, through rulemaking, and list those forest certification programs that meet the standards of Section 2309.2.1.

2309.3 Tropical hardwood.

2309.3.1 Generally. At least once every two years, the commissioner shall review and, if necessary, update or revise Table 2309.3.1.1 to ensure it contains a complete list of tropical hardwood species used in New York city construction.

Table 2309.3.1.1
Tropical Hardwood Species

<u>Common Name</u>	<u>Scientific Name</u>
<u>African Mahogany</u>	<u>Kyaya ivorensis</u>
<u>African Padauk</u>	<u>Pterocarpus soyauxii</u>
<u>Afromosia</u>	<u>Pericopsis elata</u>

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<u>Almon</u>	<u>Shorea almon</u>
<u>Amaranth</u>	<u>Peltogyne spp.</u>
<u>Amazaque</u>	<u>Guibourtis ehie</u>
<u>Amer. Mahogany</u>	<u>Sweletenia macrophylla</u>
<u>Andiroba</u>	<u>Carapa guianensis</u>
<u>Angola Padauk</u>	<u>Pterocarpus angolensis</u>
<u>Aningeria</u>	<u>Aningeris spp.</u>
<u>Apilong</u>	<u>Dipterocarpus grandifloris</u>
<u>Balsa</u>	<u>Ochroma lagopus</u>
<u>Banak</u>	<u>Virola spp.</u>
<u>Bella Rose</u>	<u>Anisoptera thurifera</u>
<u>Benge</u>	<u>Guibourtis arnoldiana</u>
<u>Boire</u>	<u>Deterium senegalese</u>
<u>Cativo</u>	<u>Prioria copifera</u>
<u>Chenchen</u>	<u>Antiaris africana</u>
<u>Concobola</u>	<u>Dalbergis retusa</u>
<u>Corida</u>	<u>Cordia spp.</u>
<u>Cumaru</u>	<u>Dipteryx odorata</u>

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<u>Ebony</u>	<u>Diospyros spp.</u>
<u>Gaboon</u>	<u>Aucoumes kleineana</u>
<u>Greenheart</u>	<u>Chlorocardium rodiei</u>
<u>Ipe</u>	<u>Tabebuia</u>
<u>Iroko</u>	<u>Chlorophors excelsa</u>
<u>Koa</u>	<u>Acacia koa</u>
<u>Koto</u>	<u>Pterygota macrocarpa</u>
<u>Limba</u>	<u>Terminalia superba</u>
<u>Louro</u>	<u>Aniba duckei</u>
<u>Makora</u>	<u>Tieghemella leckellii</u>
<u>Merbau</u>	<u>Intsia</u>
<u>Movinqui</u>	<u>Distemonanthus benthamianis</u>
<u>Peroba</u>	<u>Aspidosperma spp.</u>
<u>Purpleheart</u>	<u>Peltogyne spp.</u>
<u>Ramin</u>	<u>Gonystylus spp.</u>
<u>Red Lauan</u>	<u>Shorea negrosensis</u>
<u>Rosewood</u>	<u>Dalbergia spp.</u>
<u>Sapela</u>	<u>Entandrophragma cylindricum</u>

<u>Sonora</u>	<u>Shorea philippinensis</u>
<u>Spanish Cedar (cedro)</u>	<u>Cedrela odorata</u>
<u>Tanguile</u>	<u>Shorea polysperma</u>
<u>Teak</u>	<u>Tectona grandis</u>
<u>Tigerwood</u>	<u>Lourea trichillodes</u>
<u>Wenge</u>	<u>Millettia laurentii</u>
<u>White Lauan</u>	<u>Pentacme contorta</u>
<u>Zebrawood</u>	<u>Microberlinia brazzavillensis</u>

2309.3.2 Certification requirement. Any wood product consisting of or containing any tropical hardwood species listed in Table 2309.3.1.1 may only be utilized if such material or product is a certified wood product.

Amendments to the New York City Administrative Code:

1. Amend Section 20-698 to include the following definition:

“Tropical hardwood species” shall mean a hardwood tree species found in tropical rainforests and listed in Table 2309.3.1.1 of the New York City Building Code or rule promulgated by the department of buildings pursuant to Section 2309.3.1 of such code.

2. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to Subchapter 12 (Endangered or Threatened Species) but contains the following prohibition language:

Tropical hardwoods. Any new building material or furniture composed of or containing any tropical hardwood species that is purchased, sold or offered for purchase or sale after July 1, 2010 shall be a certified wood product or reclaimed wood product pursuant to section BC 2309 of the New York city building code.

Supporting Information

Issue – Expanded

Forests stabilize the global climate, create oxygen, and provide critical habitat for plants and animals. In the 1990s, forests were estimated to remove 2.6 billion tons of carbon from the atmosphere annually, an amount equivalent to about 33% of current emissions from human activities.¹

While healthy forests store and sequester carbon,² deforestation releases massive amounts of carbon dioxide into the atmosphere through burning vegetation, decomposing trees,³ and cultivating cleared land.⁴ Combined, deforestation is responsible for about 20% of the world’s greenhouse gas emissions.⁵ Conventional forestry practices also typically involve large-scale clearcutting and cause water and air pollution, soil erosion, stream sedimentation, habitat destruction, and waste generation. While many deforested areas are later reforested through replanting or natural regrowth, those forests are often ecologically poorer than the ones they replaced with lower soil depth and reduced species diversity.

A large share of carbon dioxide emissions from forestry originates in tropical regions, which suffer from higher deforestation rates than other parts of the world. Tropical forests store approximately 25% of the world’s carbon and their deforestation contributes approximately 1.5 billion tons of carbon to the atmosphere each year.⁶ Tropical

deforestation is also a concern because these forests provide habitat for half of the world's animal and plant species. New York City utilizes these tropical hardwoods because of their strength and durability for outdoor use. They can be found in boardwalks, benches, ferry piers, marine transfer stations and even in the Brooklyn Bridge promenade.⁷

Wood that is certified through organizations such as the Forest Stewardship Council provides the same strength and durability as conventional products, but certification ensures the wood has been harvested sustainably. Depending on the specific certification, the forester may: limit clear cuts, consider aquatic and sensitive sites, protect endangered species, preserve critical habitat, prevent soil erosion, incorporate community and stakeholder input, address regeneration and reforestation, prohibit certain chemicals, employ pest management techniques and carefully plan for the future condition of forests.⁸

According to contractors, concern about delays – not about materials costs – is the major barrier to more widespread use of certified and reclaimed wood in construction. Builders are reluctant to specify any product that is not readily available from major building suppliers and that could potentially hold up a project. Since wood is only used in small quantities in most New York City buildings, the cost premium for certified or reclaimed wood is of much smaller concern. A code requirement for certified or reclaimed wood will remove the supply barrier, as all building supply companies will stock these environmentally superior materials (see Implementation and Market Availability for a discussion of the market availability of certified wood).

Environmental & Health Benefits

This proposal will reduce greenhouse gas emissions and the range of negative environmental affects from conventional forestry practices. The proposal will also improve the market for certified wood and increase the range of available certified wood products.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.2%, depending on building type. It was thus categorized as incurring no to a medium capital cost increment.

Precedents

There are no known precedents for this proposal.

LEED

Currently only wood products certified by the Forest Stewardship Council (FSC) meet the qualifications under LEED for certified wood. To the extent FSC wood is used to comply with this proposal in New York, such wood this proposal will assist in achieving the following LEED credits (including pilot programs under development):

- LEED NC-MR cr.7 Certified Wood
- LEED CI-MR cr.7 Certified Wood
- LEED EB-MR cr.2 Optimize Use of Alternative Materials
- LEED for Schools MR cr.7 Certified Wood
- LEED for Homes MR cr.2.1 FSC Certified Tropical Wood

Implementation and Market Availability

There are no known implementation issues for this proposal, as certified wood products are readily available. The most widely recognized wood certification body is the Forest Stewardship Council (FSC), the only such organization whose standards are recognized by LEED and endorsed by major environmental organizations. While other certification systems exist in North America, they are considered to be less protective of forests and influenced by industry concerns.

All 308,741 hectares (762,898 acres) of New York State-owned forest are FSC-certified,⁹ and there are over 11,751,598 hectares of FSC-certified forests in the United States.^{10 11} Marjam Supply Company and Green Depot, major local suppliers of building materials, report no difficulty in sourcing FSC wood products in New York City and that lumber companies quickly responded to changes in demand.¹² In particular, Marjam / Green Depot identified dimensional lumber, construction-grade plywood and flooring as the categories of wood products most easily available as FSC. Many other wood products are available as FSC, but are less readily available, including architectural grade plywood, veneers, particleboard, fiber board, windows and doors.

Notes

The committee limited the types of wood products covered by the certified / reclaimed requirement to dimensional lumber, construction-grade plywood and flooring. As discussed in Implementation and Market Availability, these are the categories of FSC-certified wood products most readily available from suppliers in New York City. It is probable that if the city required a wider list of wood products to be FSC-certified the market would respond to ensure availability. However, given this proposal may represent the first mandate for certified wood products by a major city, the committee opted for a conservative approach while granting the Commissioner of the Department of Buildings the authority to expand the scope of covered wood products in the future.

Table 2309.3.1.1 contains a list of tropical hardwood species known to be used in NYC construction at this time. However, fashions change quickly and new tropical hardwood species regularly enter the market. As required in Section 2309.3.1, it will be important for the city to keep Table 2309.3.1.1 up to date.

ENDNOTES:

¹ ENVIRONMENTAL DEFENSE FUND, REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION IN DEVELOPING COUNTRIES (REDD): IMPLICATIONS FOR THE CARBON MARKET 1 (2008) http://www.edf.org/documents/7975_REDDandCarbonMarketAnalysisReport_EDF_0508.pdf.

² Ibid.

³ PERVAZE A. SHEIKH, ET AL., CONGRESSIONAL RESEARCH SERVICE, CLIMATE CHANGE AND INTERNATIONAL DEFORESTATION: LEGISLATIVE ANALYSIS 1 (2008) <http://www.nationalaglawcenter.org/assets/crs/RL34634.pdf>.

⁴ Ibid.

⁵ ENVIRONMENTAL DEFENSE FUND, REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION IN DEVELOPING COUNTRIES (REDD): IMPLICATIONS FOR THE CARBON MARKET 3 (2008) http://www.edf.org/documents/7975_REDDandCarbonMarketAnalysisReport_EDF_0508.pdf.

⁶ Ibid. at 1.

⁷ MEMORANDUM FROM ROHIT T. AGGARWALA, DIRECTOR OF LONG-TERM PLANNING AND SUSTAINABILITY TO MAYOR MICHAEL R. BLOOMBERG ON THE TROPICAL HARDWOOD REDUCTION PLAN (February 11, 2008), http://www.nyc.gov/html/om/pdf/tropical_hardwoods_report.pdf.

⁸ DEANNA NEWSOM AND DAPHNE HEWITT, THE RAINFOREST ALLIANCE, THE GLOBAL IMPACTS OF SMARTWOOD CERTIFICATION (2005), http://www.rainforest-alliance.org/forestry/documents/sw_impacts.pdf.

⁹ New York Joins Elite Company with Certified "Green" Forests, NY DEP 2008 PRESS RELEASES, Mar. 10, 2008, <http://www.dec.ny.gov/press/42552.html>.

¹⁰ FOREST STEWARDSHIP COUNCIL, GLOBAL FSC CERTIFICATES: TYPE AND DISTRIBUTION 2-3 (2009), http://www.fsc.org/fileadmin/web-data/public/document_center/powerpoints_graphs/facts_figures/09-03-16_Global_FSC_certificates_-_type_and_distribution_-_FINAL.pdf.

¹¹ N.Y. Department of Environmental Conservation Achieves FSC Certification, INTERIORS & SOURCES, May 2008, available at <http://www.buildings.com/Magazine/ArticleDetails/tabid/3413/ArticleID/6048/Default.aspx>.

¹² Email from Jim Holiber, General Manager & Corporate Counsel, Green Depot, LLC (Feb. 13, 2009).

WE 1: ENHANCE WATER EFFICIENCY STANDARDS

New York City Plumbing Code and Administrative Code

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:

Although New York City receives substantial rainfall, the city is still vulnerable in dry years and has experienced seven droughts in the last 45 years. Fortunately, the need for water can be easily reduced with more-efficient plumbing fixtures.

Recommendation:

Enhance water efficiency standards for plumbing fixtures.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Add the following definitions to Section 202:

DUAL-FLUSH TOILET. A toilet that enables the user to select a high flush for solid waste or a reduced volume, low flush for liquid waste.

HIGH-EFFICIENCY TOILET (HET). A toilet that is authorized by the WaterSense Program of the United States Environmental Protection Agency to bear the WaterSense label.

NON-WATER URINAL. A urinal that discharges into the sanitary drainage system but is not supplied by a water distribution system.

WATERSENSE-LABELED FIXTURE. A plumbing fixture that has been tested by a third-party laboratory in accordance with the WaterSense Program of the United States Environmental Protection Agency, has been certified by such laboratory as meeting the performance and efficiency requirements of the program and has been authorized by the program to use its label.

2. Add a new Section 417.4.2 as follows:

417.4.2 Limitation on showerheads. The aggregate allowable flow rate from all shower head fixtures (including rain systems, waterfalls, bodysprays, and jets) that can operate simultaneously in a single shower compartment shall be limited to the flow rate in Table 604.4 for a single shower head.

Exception: Group showers, such as in athletic facilities, schools, or institutional occupancies, shall be permitted to have more than one showerhead.

3. Amend Section 419.1 as follows:

419.1 Approval. Urinals shall conform to ASME A112.19.2M, CSA B45.1 or CSA B45.5. Urinals shall conform to the water consumption requirements of Section 604.4. Urinals shall conform to the hydraulic performance requirements of ASME A112.19.6, CSA B45.1 or CSA B45.5. Non-water urinals shall conform to ANSI/ASME A112.19.19.

4. Amend Section 420.1 as follows:

420.1 Approval. Toilets shall conform to the water consumption requirements of Section 604.4 and shall conform to ANSI Z124.4, ASME A112.19.2M, CSA B45.1, CSA B45.4 or CSA B45.5. Toilets shall conform to the hydraulic performance requirements of ASME A112.19.6. Toilet tanks shall conform to ANSI Z124.4, ASME A112.19.2, ASME A112.19.9M, CSA B45.1, CSA B45.4 or CSA B45.5. Electro-hydraulic toilets shall comply with ASME A112.19.13. Dual-flush toilets shall comply with flush volume testing requirements in ASME A112.19.14.

5. Add new Sections 420.6, 420.7 and 420.8 as follows:

WE 1: ENHANCE WATER EFFICIENCY STANDARDS

420.6 Requirement for high-efficiency toilets. All toilets installed after July 1, 2010, shall be high-efficiency Watersense-labeled fixtures.

420.7 Requirement for dual-flush toilets. All toilets installed after January 1, 2013, shall be dual-flush. The commissioner may promulgate rules establishing signage explaining proper usage and water conservation benefits of dual-flush toilets.

Exception: Toilets with a flushometer valve and a sensor control device for automatic flushing.

420.8 Requirement for WaterSense lavatory faucets & showerheads. All residential lavatory faucet fixtures and shower head fixtures installed after July 1, 2010 shall be WaterSense-labeled fixtures.

6. Amend Section 604.4 as follows:

604.4 Maximum flow and water consumption. The maximum water consumption flow rates and quantities for all plumbing fixtures and fixture fittings shall be in accordance with Table 604.4.

Exceptions:

1. Blowout design toilets [3.5 gallons (13 L) per flushing cycle].
2. Vegetable sprays.
3. Clinical sinks [4.5 gallons (17 L) per flushing cycle].
4. Service sinks.
5. Emergency showers.

7. Amend Table 604.4 as follows:

TABLE 604.4

MAXIMUM FLOW RATES AND CONSUMPTION FOR PLUMBING FIXTURES AND FIXTURE FITTINGS

PLUMBING FIXTURE OR FIXTURE FITTING	MAXIMUM FLOW RATE OR QUANTITY ^b
Lavatory, private	[2.2] 1.5 gpm at 60 psi
Lavatory, public, (metering)	0.25 gallon per metering cycle
Lavatory, public (other than metering)	0.5 gpm at 60 psi
Shower head ^a	[2.5] 2.0 gpm at 80 psi
Sink faucet	[2.2] 1.5 gpm at 60 psi
Service sink	2.5 gpm at 60 psi
Urinal	[1.0] 0.2 gallon per flushing cycle
Toilet ^c	[1.6] 1.28 gallons per flushing cycle

For SI: 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m,
1 pound per square inch = 6.895 kPa.

a. A hand-held shower spray is a shower head.

b. Consumption tolerances shall be determined from referenced standards.

c. Dual-flush toilets installed between July 1, 2010 and July 1, 2013 shall have an effective flush volume that shall not exceed 1.28 gallons (4.8 liters). The effective flush volume is defined as the composite average flush volume of two reduced flushes and one full flush. Dual-flush toilets installed after July 1, 2013 shall comply with the maximum flush volume in Table 604.4, which shall not exceed a total of 1.28 gallons (4.8 liters) for any flush cycle.

8. Amend Chapter 13 as follows:

Add ASME standard A112.19.14 after standard A112.19.13 as follows:
A112.19.14-2006 Six-Liter Toilets Equipped with a Dual-flushing
Device.....420.1

Add ASME standard A112.19.19 after standard A112.19.14 as follows:

A112.19.19-2006 Vitreous China Nonwater Urinals.....419.1

9. Delete Section C102 (Waterless Urinals) in its entirety.

Amendments to the Administrative Code of the City of New York:

1. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to Subchapter 12 (Endangered or Threatened Species) but contains the following prohibition language:

Water efficient fixtures. a. It shall be unlawful to buy or sell, offer, or attempt to buy or sell, or cause any person to buy or sell any water fixture that does not comply with the water consumption requirements of section 604.4 of the New York city plumbing code.

Supporting Information

Issue – Expanded

New York City has experienced seven droughts over the last 45 years, two of which lasted for over a year.¹ Although there have not been serious droughts in two decades, repair of major system components, such as the Delaware Aqueduct leak, means that the City must either reduce consumption further or invest in expensive supply projects that are not required outside of emergencies and will be far less environmentally acceptable than the existing supply system. Improving water efficiency is the least expensive and most sustainable means to ensure there will be a sufficient supply of water to meet all of the City's needs. New Yorkers have been enormously successful in decreasing water consumption citywide from an average high of over 208 gallons per person per day in 1988 to approximately 137 gallons of water per person per day in 2003 (or 78 gallons per person per day when limited to residential water consumption).² This proposal builds upon this record of improving water efficiency.

Environmental & Health Benefits

This proposal is estimated to reduce water consumption by 5-7 gallons of water per person per day, or 3-4% over the next ten years. Using less water reduces wastewater flows, thus easing the burden on the City's already taxed wastewater treatment plants, reducing the energy spent on water treatment and distribution and reducing the incidence of combined sewer overflows. In addition, by removing impediments to the use of non-water urinals, we facilitate the use of water-efficient technologies.

This proposal was determined to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was determined to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For some buildings this proposal will result in no increase of capital costs and for others an increase of up to 0.08%. It was thus categorized as incurring no to a medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years or more than ten years depending on the building type.

Precedents

This proposal is largely consistent with the Environmental Protection Agency's WaterSense program, establishes voluntary standards for toilet and bath fixture flow rates.⁴ A number of municipalities have mandated lower flow rates in local codes, some of which also reference the WaterSense requirements.⁵ The International Code Council, which is adopted in 37 states plus Washington DC, is a partner with EPA's WaterSense guidelines.⁶ These standards also align with proposed flow rates in ASHRAE Standard 189.1P.⁷

California has reduced flow rate requirements for fixtures; the recommended flow rates in this proposal either equal or surpass California's recommendations.⁸ In addition, several California cities— including San Diego, Los Angeles, and San Francisco – have retrofit-on-resale ordinances, in which either the buyer or seller of a property is required to replace inefficient plumbing fixtures upon sale.⁹

Dual-flush toilets are common and often mandatory in developed countries that make water a priority, including Australia, Israel, Japan, and throughout Europe. For example, dual-flush toilets are mandatory in most parts of Australia and, as of 2001, 63% of Australian households have dual-flush toilets.¹⁰

LEED

This proposal will assist in achieving all Water Use Reduction & Innovative Wastewater Technology prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

LEED 2009 for New Construction will implement changes to the format of the WE section. The following revised credits are relevant to the measures outlined under this proposal:

- LEED NC-WE prerequisite 1, Water Use Reduction: 20% Reduction
- LEED NC-WE cr.2, Innovative Wastewater Technologies
- LEED NC-WE cr.3, Water Use Reduction

LEED requires compliance with the Energy Policy Act of 1992 fixture performance requirements. Since this proposal refers to another standard for performance criteria, the project team will need to evaluate potential LEED compliance for individual projects.

LEED Water Efficiency measures only apply to water closets, urinals, lavatory faucets, showers, and kitchen sinks. The reduction in water use calculates water savings for these fixture types, and factors in any greywater volume for additional reduction in potable water usage under this credit.

Implementation and Market Availability

The fixtures required by 2013 under this proposal are readily available.

Numerous manufacturers produce dual-flush toilets and some have dual-flush models that use a maximum of 1/28 gpf, including American Standard and Caroma,.

Notes

1. The committee had mixed views on limiting the flow rate of sink faucets to 1.5 gpm. To the extent kitchen faucets are used for filling basins, a lower flow rate will increase waiting time. On the other hand, kitchen sink faucets are often left running during dish washing, meaning a lower flow rate will save water. Understanding this issue completely would require a study on how humans behave with different flow kitchen faucets. The committee ultimately opted for the lower flow rate.

2. Some committee members expressed concern that the low flushing volume of .2 gpl urinals or non-water urinals could potentially lead to issues of drain line cleanliness. Nonetheless, there was consensus that this limited concern should not be a boundary to greater water efficiency. It was suggested that drain line cleanliness be taken into account when installing .2 gpf or non-water urinals by placing them first to the stack with water closets behind them.

3. The committee spent more time on the question of whether to require dual-flush toilets than any other issue in this proposal. Initially, the issue was considered as a choice between requiring 1.28 gpf toilets or dual-flush toilets. In that context, there was considerable debate whether, given the variances of use patterns, a dual-flush toilet would actually lead to lower consumption than a 1.28 gpf toilet. Ultimately, the committee recast the policy options to first require 1.28 gpf toilets in 2010, and then requiring that these toilets (with a maximum flush of 1.28 gpf) also be dual-flush by 2013.

This attention to toilets is apt since in a typical household, more water is used for toilet flushing than any other use. Studies have shown, with proper education, dual-flush toilets can lead to dramatic reductions in water use.

4. A comparison of five independent studies on dual-flush water usage found that dual-flush toilets result in 23%-32% less water usage than conventional fixtures and the average water savings from replacing existing plumbing fixtures with dual-flush fixtures was 10,600 gallons per year per home.¹¹ These reductions have held up with dual-flush toilets tested outside of homes. In a Canadian study, flush volumes were reduced by 68% in single-family homes, 56% in offices, and 52% in an average coffee shop.¹² This same study also showed dual-flush toilets to be consumer friendly - 66% of participants said they would definitely recommend dual-flush toilets to others.¹³

While dual-flush toilets dramatically reduce water usage and overall cost, the exact amount varies depending on the use of a building and whether or not urinals are also installed. Some commentators have noted that potential improvements from dual-flush toilets may not be realized without appropriate user education.¹⁴

5. Estimates of citywide savings are based on the calculations provided below:

How Enhanced Water Efficiency Standards for Plumbing Products Reduces Per Capita Residential Water Consumption (gcpd = Gallons per Capita per Day)		
End Use	Total Savings (Additional Savings)	Notes
Toilet Use at Home	13.2 gcpd (2.4 gcpd)	$4.5 \text{ gpf} - 1.2 \text{ gpf} = 3.3 \text{ gpf} * 4 \text{ flushes per day} = 13.2 \text{ gcpd savings}$
Showerheads	14 gcpd (3.5 gcpd)	$4 \text{ gpm} - 2 \text{ gpm} = 2 \text{ gpm} * 7 \text{ minutes per shower} = 14 \text{ gcpd}$
Faucets	6 gcpd (3 gcpd)	$2 \text{ gpm reduction} * 3 \text{ minutes per day} = 6 \text{ gcpd}$
Toilets and Urinals at Work	5.8 gcpd (3.6 gcpd)	Males: $(3.5 \text{ gpf} - 0.5 \text{ gpf}) * 2 \text{ uses} = 6 \text{ gcpd}$ Females: $(4 \text{ gpf} - 1.28 \text{ gpf}) * 2 \text{ uses} = 5.4 \text{ gcpd}$
Total at Home	33.2 gcpd (8.9 gcpd)	
Total at Work	5.8 gcpd (3.6 gcpd)	

Abbreviations and Acronyms:

gcpd = Gallons per capita per day

gpf = Gallons per flush

gpm = Gallons per minute

4.5 gpf = water use of pre-1980 toilets (some are 5 gpf or more)

1.2 gpf = water use of mix of single-flush High Efficiency Toilets and Dual-flush Toilets

4 gpm = Flow rate for pre-1990 showerheads (some are 5 gpm or more)

2 gpm = Proposed new showerhead flow rate (Current Code is 2.5 gpm)

Old faucets flow at anywhere from 3 gpm to 6 gpm

Existing fixture standards will already provide significant water savings over time. The proposed new standards will increase those savings significantly: About 27% increased saving in home water use and 62% savings in water use in the workplace compared to current standards alone.

Existing Residential Water Use: 78 gcpd average,

Fixture Replacement Rates: 20-30 years (toilets and faucets); 10 years (showerheads)

Toilets: 45% currently 1.6 gpf, 5% currently 3.5 gpf; 50% 5 gpf (oldest portion, mostly in 1-20 unit residential buildings)

After 10 years: All showerhead savings attained, 30% of toilet and faucet savings: Average $(13.2 \text{ gcpd} * 0.3) + 14 \text{ gcpd} + (6 \text{ gcpd} * 0.3) = 19.96 \text{ gcpd}$ (25.5% reduction in residential use, 18.6% reduction in citywide use)

After 20 and 30 years: Additional $(13.2 \text{ gcpd} * 0.3) + (6 \text{ gcpd} * 0.3) = 5.96 \text{ gcpd}$

After 30 years: $19.96 + 5.96 + 5.96 = 31.88 \text{ gcpd}$

Conservatism and other Notes:

4.5 gpf used for older toilets instead of nominal 5 gpf.

1.2 gpf reflects mix of HET single flush and dual-flush fixtures

4 gpm used for old showerheads based on field data rather than 5 gpm nominal

Additional savings in second and third decades may be less as the toilet being replaced is increasingly more likely to be 3.5 gpf or even 1.6 gpf.

ENDNOTES:

¹ New York City EPA, History of Drought and Water Consumption http://www.nyc.gov/html/dep/html/drinking_water/droughthist.shtml, (last visited Jan. 19, 2010).

² New York City EPA, History of New York City's Water Supply System, http://nyc.gov/html/dep/html/drinking_water/history.shtml (last visited Jan. 19, 2010).

⁴ U.S. EPA, NATIONAL EFFICIENCY STANDARDS AND SPECIFICATIONS FOR RESIDENTIAL AND COMMERCIAL WATER, ENVIRONMENTAL PROTECTION AGENCY: USING FIXTURES AND APPLIANCES, <http://www.epa.gov/WaterSense/docs/matrix508.pdf> (last visited April 9, 2009).

⁵ U.S. EPA, WaterSense: Meet our Partners, http://www.epa.gov/watersense/meet_our_partners.html (last visited Oct. 8, 2009).

⁶ Ibid.

⁷ AMERICAN SOCIETY OF HEATING, REFRIGERATORS, AND AIR-CONDITIONING ENGINEERS, PUBLIC REVIEW DRAFT: ASHRAE STANDARD, (2008) available at <http://www.sanantonio.gov/Mayor/EnvironmentalPolicy/attachments/ASHRAE%20189%20Public%20Review.pdf>.

⁸ CAL. CODE, Tit. 24 § pt. 11 § 603, 42-43 (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

⁹ Alex Wilson, Water Policies: Encouraging Conservation, ENVIRONMENTAL BUILDING NEWS, Sept. 1, 2008, available at <http://www.buildinggreen.com/auth/article.cfm/ID/4007>.

¹⁰ GEORGE WILKENFELD AND ASSOCIATES, A MANDATORY WATER EFFICIENCY LABELING SCHEME FOR AUSTRALIA, 29, 68 (2003), available at <http://www.waterrating.gov.au/publications/pubs/strategic-study.pdf>.

¹¹ John Koeller et. al., Dual-Flush Toilet Fixtures- Field Studies and Water Savings, KOELLER AND COMPANY (2003), <http://www.allianceforwaterefficiency.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=836>.

¹² CANADA MORTGAGE AND HOUSING CORPORATION, RESEARCH REPORT: HOUSING TECHNOLOGY SERIES: DUAL-FLUSH TOILET PROJECT (2002), <http://www.cmhc-schl.gc.ca/odpub/pdf/63042.pdf>.

¹³ Ibid.

¹⁴ U.S. EPA, WATER DEMAND BULLETIN, 91 (2008).

WE 2: UPGRADE INEFFICIENT TOILETS, SHOWERHEADS & FAUCETS DURING RENOVATIONS

New York City Building Code

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:

Older toilets and fixtures use three to five times as much water as today's standard fixtures.

Recommendation:

Require the replacement of any outdated plumbing fixtures when bathrooms are renovated.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new Section 2903 as follows:

SECTION BC 2903 **UPGRADE UPON MAJOR RENOVATION**

2903.1 Definitions. Definitions used in the New York City Plumbing Code shall apply in this section.

2903.2 Bathroom fixture replacement upon major renovation requiring a permit. Upon any alteration to any bathroom or restroom requiring a permit, any toilet, or showerhead that does not comply with the water consumption requirements of section 604.4 of the New York City Plumbing Code shall be replaced with a compliant model. Any sink or lavatory faucet that does not comply with the water consumption requirements of section 604.4 of the New York City Plumbing Code shall either be fitted with an aerator to bring such faucet into compliance or be replaced with a compliant faucet.

Exception: Any toilet that does not consume more than 1.6 gallons of water per flush.

Supporting Information

Issue – Expanded

Pre-1980 toilets can use as much as 7 gallons per flush (the equivalent of nearly 1½ water-cooler bottles), and other old plumbing fixtures use correspondingly large amounts of water. Although New York City has instituted incentive-based toilet replacement programs in the past and new toilets must comply with federal water efficiency requirements, there are still many wasteful plumbing fixtures in the city.

This proposal will only be triggered when plumbing fixtures are moved or added, not during simple replacements of fixtures or other standard bathroom renovation work.

Environmental & Health Benefits

Requiring more efficient fixtures will reduce water consumption, resulting in less wastewater treatment and reduced frequency of combined sewer overflows. This proposal will also generate business for plumbers and plumbing supply companies.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. This proposal was also estimated to generate financial savings that will pay for any capital costs in less than three years.

Precedents

New York City would not be the first major city to pass a law requiring the replacement of water-wasting fixtures during renovations.ⁱ A similar ordinance, for example, was proposed in San Francisco in February by Mayor Gavin Newsom and Supervisor Sophie Maxwell.ⁱⁱ Furthermore, a parallel San Francisco ordinance would require the replacement of outdated fixtures in all commercial buildings.ⁱⁱⁱ Both ordinances have the support of the Building Owners and Managers Association and San Francisco Apartments Association.^{iv}

Additionally, smaller municipalities have passed more extensive ordinances for outdated fixture replacement. The Marina Coast Water District (encompassing the City of Marina and Fort Ord in California), for example, requires upgrading to low-flow fixtures during new construction, any renovation that involves district review, any renovation that involves replacement of fixtures, and changes of ownership.^v Also, all hotels and apartment buildings were required to install at least low-flow showerheads within a specified period of time following the enactment of the ordinance.^{vi}

LEED

This proposal would help buildings to meet the LEED-EB 2009 Water Efficiency prerequisite WE1, Minimum Indoor Plumbing Fixture and Fitting Efficiency and WE Credit 2, Additional Indoor Plumbing Fixture and Fitting Efficiency.

Implementation & Market Availability

All plumbing fixtures required under this proposal are off-the-shelf products that are produced by all major manufacturers.

Notes

1. The proposal will only apply to a gut renovation of a bathroom in which fixtures are moved or added, since the requirement is tied to the issuance of a plumbing permit. A permit is not required for the vast majority of renovation work to bathroom, including the replacement of fixtures and retiling. A building permit is only required for work in a bathroom involving changes to the roughing (pipes leading to or from the drainage or supply plumbing).
2. Toilets that do not consume more than 1.6 gpf are exempted from the replacement requirement in this proposal because the committee's primary intent was to replace the truly water-guzzling toilets permitted prior to 1994. The committee felt that the water savings from replacing a 1.6 gpf toilet with a 1.28 gpf toilet would not justify the financial cost of doing so. Future studies of savings from dual-flush toilets may justify the repeal of this exception beginning 2013 when dual flush would be required in New York City under the *Enhance Water Efficiency Standards* proposal.

ENDNOTES:

ⁱ Joshua Sabatini, City Wants to Curb Flow of Water, SAN FRANCISCO EXAMINER, Feb. 25, 2009, available at <http://www.sfexaminer.com/local/40268922.html>; and San Francisco, CA., Residential Water Conservation Ordinance Amendments, File No. 090225 (2009), available at <http://www.sfgov.org/site/uploadedfiles/bdsupvrs/committees/materials/090225tdr.pdf>.

ⁱⁱ Joshua Sabatini, City Wants to Curb Flow of Water, SAN FRANCISCO EXAMINER, Feb. 25, 2009, available at <http://www.sfexaminer.com/local/40268922.html>;

ⁱⁱⁱ San Francisco, CA., Residential Water Conservation Ordinance Amendments, File No. 090225 (2009), available at <http://www.sfgov.org/site/uploadedfiles/bdsupvrs/committees/materials/090225tdr.pdf>.

^{iv} Ibid.

^v MARINA COAST, CA., WATER DISTRICT CODE, Tit. 3 § 3.36.030 (2001), available at http://www.mcwd.org/code_3_water_svc_system.html#336020.

^{vi} Ibid.

WE 3: CATCH LEAKS BY MEASURING WATER USE

New York City Plumbing Code

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:

Leaks and equipment malfunctions waste a tremendous amount of water in New York City buildings and they can persist undetected for years. Sub-meters attached to major water-using equipment can help detect these leaks.

Recommendation:

Require sub-meters for all major water-using equipment. These sub-meters will help building managers quickly detect leaks and malfunctions.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Amend Section 608.16.2 as follows:

608.16.2 Connections to boilers. The potable supply to the boiler shall be equipped with a backflow preventer with an intermediate atmospheric vent complying with ASSE 1012 or CAN/CSA B64.3. Where conditioning chemicals are introduced into the system, the potable water connection shall be protected by an air gap or a reduced pressure principle backflow preventer, complying with ASSE 1013, CAN/CSA B64.4 or AWWA C511. Makeup water supplies to boilers serving buildings with more than five stories shall be equipped with a water meter from a list promulgated by the department of environmental protection along with inlet and outlet isolation valves.

2. Amend Section 606.5.4.1 as follows:

606.5.4.1 Water piping control and location. Water inlets to gravity house tanks shall be controlled by a ball cock or other automatic supply valve or emergency electrical cut-off so installed as to prevent the overflow of the tank in the event that the pumps filling the tanks do not shut off at the predetermined level or the street pressure rises to a point where it can fill the tank. The water inlet to a suction tank shall be controlled by a ball cock or other automatic supply valve. The inlet shall be terminated so as to provide an accepted air gap but in no case shall it be less than 4 inches (102 mm) above the top of the overflow. The outlet from a gravity tank to the distribution system shall be equipped with a strainer located at least 2 inches (51 mm) above the tank bottom to prevent solids from entering the piping system. All down-feed supplies from a tank cross-connected in any manner with distribution supply piping in a building supplied by direct street or pump pressure, shall be equipped with a check valve on the main cold water down supply to prevent backflow of water into the roof tank. All roof tanks shall be provided with a high water level alarm at or slightly below the overflow.

3. Add a new subsection 606.7 to Section 606 as follows:

606.7. Equipment and area submeters. Water submeters from a list promulgated by the department of environmental protection shall be installed on the makeup water lines for each of the following: evaporative cooling towers, boilers serving buildings with more than five stories, and commercial tenants in food and laundry related businesses, gyms, spas, and swimming pools.

Supporting Information

Issue – Expanded

Sub-meters provide building owners and managers with the necessary information to make informed decisions regarding their water consumption. With sub-meters, an owner or manager can identify changes in water consumption that may be attributed to leaks or faulty equipment, directly bill tenants for water consumption, and identify areas of excessive water use. In addition, sub-meters enable building owners to provide the City with more detailed water consumption information, which may assist in making infrastructure decisions. It is particularly important to monitor

cooling towers, rooftop water supply tanks, and boilers given the quantity of water used and/or the potential for leaks or other waste.

In many office buildings, evaporative cooling towers use more water than domestic uses. Cooling towers work by rejecting heat from building air conditioning systems using a water spray that dissipates heat as the water evaporates into the atmosphere. The water level in a cooling tower basin is controlled by a simple float valve that turns off the supply of make up water when the basin is full. However, the float valve can fail, causing the water level to increase until it overflows into the sewer, wasting hundreds or thousands of gallons an hour.

The refill of a rooftop water supply tank operates in much the same way with the same potential for large-scale water loss. Without alarms to inform the building owner of possible leak conditions, large-scale waste may remain undetected for days or even months. Likewise, water flows into boilers to make up for evaporative or blow down losses as well as condensate leaks. Without a makeup water meter these losses will not be detected at all.

The alarms being recommended in this proposal would either make a sound or send a signal to a building management computer if the level of water in a cooling tower basin or roof tank rises above the overflow point.

Environmental & Health Benefits

Environmental benefits of efficient water use are directly related to the amount of freshwater available for human consumption. Less than 2.5% of the earth's water is freshwater, and most of this is locked up in ice caps and glaciers.¹

This proposal was determined to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For some buildings this proposal will result in no increase of capital costs and for others an increase of up to 0.03%. It was thus categorized as incurring no to a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years or more than ten years depending on the building type.

Precedents

Water submetering is required under the 2008 California Green Building Standards Code for both indoor and outdoor potable water outlets.² In addition, Texas requires submetering of water use for all new construction begun after January 1, 2003.³ The New York State Energy Code already requires submetering of electricity in new or renovated construction; the addition of water submetering as a means of allowing tenants to monitor their own water consumption would be consistent with this requirement.

There are no known precedents for requiring overflow alarms on roof tanks.

LEED

For existing buildings, water metering is addressed by LEED EB-EA cr.5.1-5.3, Performance Measurement, Enhanced Metering.

For other rating systems, LEED EA credits for Measurement & Verification require the implementation of a M&V Plan consistent with the International Performance Measurement & Verification Protocol (IPMVP) Volume III, April, 2003, which concerns energy conservation measures. However, the LEED credit expands upon typical IPMVP M&V objectives, and M&V activities should not necessarily be confined to energy systems. In fact, the case study presented in the LEED NC reference manual highlights the Frito-Lay Jim Rich Service Center in Rochester, NY, which monitored water through metering, along with other systems. Therefore, this proposal could also potentially contribute to earning the following credits:

- LEED NC-EA cr.5 Measurement & Verification
- LEED CI-EA cr.3 Energy Use, Measurement & Payment Accountability
- LEED for Schools EA cr.5 Measurement & Verification

Additionally, LEED 2009 encourages building owners to include water-using systems in their Commissioning plans, as

appropriate. While ongoing metering is not a component of Commissioning, LEED cites a synergy with this process as it also verifies performance of systems.

Implementation & Market Availability

There are no known implementation issues for this proposal. Water meters and overflow alarms are readily available.

Notes

1. A Submeter is a water meter owned, maintained and operated by the building owner for the purpose of monitoring water use by a specific end use, tenant or physical portion of a building. In this case, submeters are recommended for the makeup water lines of evaporative cooling towers to monitor for efficient operation of the tower, for makeup water lines for boilers, to help detect steam condensate system losses or excess boiler blow-down, for food- and laundry-related tenants because they are usually typically high water users and for large functional or physical portions of a building as well as gyms and spas containing water using equipment such as swimming pools, hydro-therapy pools, showers and toilet facilities, etc.
2. While not a requirement, it is strongly recommended that the requisite submeter be provided with a centrally located totalizing display or connected to a Building Automation System to allow building operators to more easily view water use profiles. Further, the committee strongly recommends that the DEP make available on line or via email water meter readings for total building water use.
3. The committee intended to include a provision in subsection 606.7 that would require a meter “for any tenant with a separate tap off the base building water system serving a single or multiple floors totaling 50,000 square feet or more.” Servicing tenants for water with a dedicated tap is nonconventional practice but does occur in NYC. The committee was unable to finalize this language and appropriate costing assumptions for a nonconventional practice in time for the publication of this report. One potential source of appropriate code language for this provision is section 409 of the IAPMO Uniform Plumbing Code.
4. Mechanical Code section 908.5 requires that the Plumbing Code be followed with respect to water supply.

ENDNOTES:

¹ Blue Egg, Potable Water: Our Global Drinking Problem, <http://www.blueegg.com/article/Potable-Water-Our-Global-Drinking-Problem.html> (last visited Apr. 8, 2009).

² CAL. CODE, Tit. 24 § pt. 11 § 603, 29 (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

³ TEXAS WATER CODE ANN. § 13.501 (2003), available at <http://www.tceq.state.tx.us/assets/public/permitting/watersupply/ud/forms/subchapm.pdf>.

WE 4: FACILITATE USE OF RECYCLED WATER

New York City Plumbing Code

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:

Using rainwater and recycled water can reduce stress on the city's water supply while simultaneously reducing the volume of combined sewer overflow. But the Plumbing Code currently discourages reuse by limiting applications and requiring all recycled water to follow the same stringent protocols, regardless of end use or incoming water quality.

Recommendation:

Facilitate the use of rainwater and recycled water by tailoring protocols according to incoming water quality and end use, and expand the permitted uses of such water.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Amend Section C101.1 as follows:

C101.1 General. This section provides standards for the recycling of greywater, blackwater and rainwater piped within a building. [Water recycling systems shall receive storm water captured from roofs and balconies, condensate reclamation systems, gray water discharge only of lavatories from public restrooms in commercial office buildings, and the treated effluent from an approved black water treatment system as regulated by Department of Health and Mental Hygiene.] Recycled water shall be utilized only for flushing water closets and urinals, cooling tower makeup, washing of sidewalks, streets or buildings, vehicle washing, laundry, irrigation systems that are located in the same lot as the water recycling system and any other uses permitted by the department. Recycled water shall be considered non-potable. Such systems shall comply with sections C101.2 through C101.1[2]4.

Exceptions.

1. Rainwater where all piping is exterior to the building and that is used solely for subsurface irrigation, drip irrigation or washing of sidewalks, streets, buildings or vehicles.
2. Commercial car washing facilities.

2. Amend Section C102.1 as follows:

BLACKWATER. Wastewater discharged from water closets, urinals, clothes washers and any other fixtures discharging animal or vegetable matter in suspension or solution.

GREYWATER. Wastewater discharged from lavatories, bathtubs, showers, [clothes washers] steam condensate and laundry sinks.

RAINWATER. Precipitation collected from roofs, roof setbacks or balconies.

3. Amend Section C101.6 as follows:

C101.6 Disinfection. Recycled water shall be disinfected by an approved method that employs ultraviolet or one or more disinfectants such as chlorine, iodine or ozone.

Exception. The following sources of water may be used for the following purposes without additional disinfection:

1. Steam condensate used for any purpose authorized in section C101.1; or
2. Rainwater used solely for subsurface irrigation, drip irrigation, or washing of sidewalks, streets, buildings or vehicles.

4. Amend C101.7 to add an exception as follows:

Exception: Rainwater used for subsurface irrigation, drip irrigation, and washing of sidewalks, streets, buildings or vehicles.

5. Section C101.11 is amended as follows:

C101.11 [Coloring. The recycled water shall be dyed blue or green with a food grade vegetable dye before such water is supplied to the fixtures.] Reserved.

6. Section C101.12 is amended as follows:

C101.12 Identification. All recycled water distribution piping and reservoirs shall be painted purple and identified in writing as containing nonpotable water. Piping identification shall be in accordance with Section 608.8. Any hose bibb supplied with recycled water shall be colored purple in accordance with the Uniform Plumbing Code (2009 edition) and identified with a sign stating, “Do Not Drink.” Any hose attached to such a hose bibb shall be colored purple.

7. Add new sections C101.13 and C101.14 as follows:

C101.13 Water closet-sink combinations. Notwithstanding any other provision of this appendix, a fixture that enables waste water from a lavatory sink to discharge directly into the flushing tank of a water closet may be utilized.

C101.14 First-flush diverters. All recycling systems for stormwater exempted from Section C101.6 shall include a first-flush diverter, which shall divert the first flow of water from the catchment service. First-flush diverters shall be sized so that the minimum volume of water diverted is equal to at least one (1) gallon (3.8 L) per each hundred (100) square foot (9.3 m²) of catchment area served.

Supporting Information

Environmental & Health Benefits

By facilitating water recycling, this proposal will decrease the use of potable water for non-drinking purposes and reduce the volume of stormwater entering New York’s sewer system, thus helping to reduce combined sewer overflows.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

Rainwater

Few U.S. jurisdictions regulate rainwater, in part due to an assumption of relatively high quality and part because rainwater collection and reuse is generally decentralized and used mainly for subsurface irrigation. That particular use may have limited utility in New York City. Neither the International Plumbing Code (IPC) nor the Universal Plumbing Code directly addresses using captured rainwater for flushing water closets and urinals. Although the NYC-PC is largely based on the IPC, it specifically mentions rainwater from certain sources as approved for certain end uses, if it is filtered and disinfected.

Some U.S. jurisdictions allow for limited, untreated uses. Massachusetts allows the use of runoff from non-metal roofs for toilet flushing, and also allows the re-use of stormwater runoff for irrigation without a permit if it is not exposed to land uses with higher potential for pollution than the runoff source.

Other U.S. jurisdictions that allow such uses have not done so through formal rules or statutes based upon scientific studies of water quality or public health. For example, in October 2008, San Francisco Mayor Gavin Newsom began a city initiative that promoted rainwater harvesting for “non-drinking purposes like outdoor irrigation and indoor toilet use.”¹ Mayor Newsom, the San Francisco Public Utilities Commission, the Department of Public Health, and the Department of Building Inspection signed a Memorandum of Understanding that allows for rainwater usage in toilets

without “requiring treatment to potable standards.”² San Francisco requires only a basic filtration of the rain water and a backflow prevention device.³

In January 2007, Seattle and King County Department of Public Health issued a “Policies and Procedures” memo that formally established rainwater harvesting guidelines in Seattle.⁴ The memo allows “harvested rainwater to supply certain types of plumbing fixtures in structures while maintaining the standards for adequate public health protection.”⁵ The allowable applications include “water closets, urinals, hose bibs, industrial applications, domestic clothes washing, irrigation and water features.”⁶ Seattle and King County require pre-storage treatment to “divert debris and/or ‘first flows’ prior to entering the storage system;” the CAM recommends using “leaf screens” and “self cleaning bug screens” for the Pacific Northwest.^{7,8} For final water quality treatment, “[s]creen systems and/or basic mechanical filtration are typically adequate for . . . toilet flushing.”⁹ All other installation and connection matters are governed by the Uniform Plumbing Code.¹⁰

In many international jurisdictions, rainwater is not required to be treated before being used for toilet flushing.¹¹ Generally, these jurisdictions require clearly marked pipes, a system to prevent cross-contamination (such as an airgap), and usually a roofwasher or some type of preliminary filter.¹² Rainwater is permitted (or in some cases required) for toilet flushing in France (pipes must be labeled),¹³ Belgium (rainwater harvesting required in new construction),¹⁴ Germany,¹⁵ and the UK.¹⁶ Furthermore, according to a UK report, in depth studies have been conducted in Germany, which have found that “if rainwater is collected properly, it can be used in toilets and washing machines without being disinfected.”¹⁷

Greywater

In the U.S., the arid states have pioneered reuse standards. California has had health, design, and operational requirements for reuse projects since 1978. California has a new statute (11/12/2008) that requires standard-setting for greywater systems for the first time. Arizona has a well-regarded code that has been copied in other states. New Mexico, Colorado, Texas, Florida, Massachusetts, Connecticut, Oregon, Utah, Vermont, Washington and other states have some variation of reuse standards.

In almost all of the state regulations, untreated greywater is limited to irrigation, and in many cases only subsurface irrigation, for non-food crops. Greywater regulation is almost exclusively aimed at small residential properties with sufficient unbuilt land area to absorb on-site flows. For example, Arizona’s code contains a general permit for such uses. California allows only subsurface irrigation onto zones of specific sizes and soils, but still requires a permit and operation and maintenance plan. The UPC, followed in many jurisdictions but not New York City, only allows greywater to be used in residential subsurface landscape irrigation. The use of untreated greywater in densely-populated urban areas without such areas, and for uses other than irrigation, is a largely untested proposition. For example, the IPC, followed in many jurisdictions including New York City, allows reuse only after disinfection and dyeing for subsurface irrigation and toilet flushing. (301.3, App. C 101). The Greywater Code of Queensland, Australia, generally considered to be one of the most progressive in the world, requires the treatment and disinfection of greywater before re-use in toilet flushing. New York State’s 2007 plumbing code specifies filtration, disinfection, and dyeing of greywater, and explicitly allows it only for toilet flushing. Other uses presumably require a variance. There are unconfirmed reports of untreated uses for toilet flushing in Germany, but the presence of sophisticated systems in that country for that application (e.g., Pontos Aquacycle¹⁸) suggests that some treatment is required there. (A similar system in the Netherlands is the Muiden Ecoplay.¹⁹) International reviews (Lazarova, 2003; Alkhatib, 2006) found that toilet flushing universally requires pre-treatment units of varying complexity.

Rather than mandating treatment, another approach is to regulate greywater along with reclaimed water or other sources through the application of source-neutral water quality standards that depend on end-uses, which presupposes a regulatory apparatus to permit, monitor, and enforce the limits. For example, the recently-adopted Massachusetts Reclaimed Water Code²⁰, requires a state permit, engineering report, and reuse management plan, unless greywater is used only for subsurface irrigation and disposal. The permit system provides for the following classes and uses of reclaimed water:

Class A water

- Uses: irrigation where contact likely; cooling where mist may make contact if chlorine or other biocide used to treat recirculating water; toilet and urinal flushing; food crop irrigation; industrial process water, commercial laundries and carwashes; snowmaking, fire protection
- Standards: pH of 6.5-8.5; BOD<10 mg/l; TSS<5 mg/l; Turbidity < 2 NTU; Total Nitrogen < 10 mg/l (exceptions allowed); median of no detectable fecal coliform / 100 ml over continuous 7 day samples, not to exceed 14/100 ml in any one sample

Class B water

- Uses: irrigation where contact unlikely; cooling water where mists and aerosols not created; irrigation for pasture and unprocessed food crops where there is no contact with edible portion of the crops; wetlands and recreational impoundments; dust control; soil compaction; mixing and washing concrete and aggregate; street cleaning

- Standards: pH of 6.5-8.5; BOD<30 mg/l; TSS<10 mg/l; Turbidity < 5 NTU; Total Nitrogen < 10 mg/l (exceptions allowed); median of 14 detectable fecal coliform / 100 ml over continuous 7 day samples, not to exceed 100/100 ml in any one sample

Class C water

- Uses: orchard and vineyard irrigation if no contact with edible portions; closed systems for industrial process water; industrial boiler feed; silviculture
- Standards: pH of 6.5-8.5; BOD<30 mg/l; TSS<30 mg/l; Turbidity < 10 NTU; Total Nitrogen < 10 mg/l (exceptions allowed); median of 200 detectable fecal coliform / 100 ml over continuous 7 day samples, not to exceed 800/100 ml in any one sample

The World Health Organization, Israel, Jordan and South Africa, among others, have developed specific regulatory requirements including maximum permissible levels of various contaminants. However, many of these guidance documents are directed towards irrigation of food and non-food crops. Exceptions are European Union countries and Australia, which has a federal system that is similar to ours, but with more developed national guidelines and binding state standards. Australia is in the midst of promulgating national guidelines to address health concerns in a comprehensive way.

LEED

This proposal will assist in achieving all prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

LEED 2009 for New Construction will implement changes to the format of the WE section. The following revised credits are relevant to the measures outlined under this proposal:

- LEED NC-WE prerequisite 1, Water Use Reduction: 20% Reduction
- LEED NC-WE cr. 1.1 & 1.2, Water Efficient Landscaping
- LEED NC-WE cr.2, Innovative Wastewater Technologies
- LEED NC-WE cr.3, Water Use Reduction

LEED also addresses the use of treated stormwater as one method of reducing the amount of wastewater going into the sewer system. For these purposes, this proposal will assist in achieving all stormwater design credits in LEED Sustainable Sites sections of the various rating systems

Implementation & Market Availability

There are no known implementation issues for this proposal.

Notes

To Wait or Not to Wait?

The New York State Legislature has mandated that New York State Department of Health publish a report on water reuse by February 2008 and adopt water quality and operational standards by February 2009.²¹ Little progress has been made on the report, let alone regulations, despite the publication of a second working draft report in February 2008.

A central discussion of the committee was whether to recommend that NYC convene a blue ribbon commission to develop water reuse standards in the absence of action by NYS DOH. One perspective is that regardless of delays at NYS DOH ultimately there will be statewide standards that will supersede any NYC standards. Even if NYC convened a commission immediately after publication of the task force report, it would probably take at least a year before the city promulgated standards. That time could be better spent encouraging NYS to enact standards. In addition, there are public policy advantages to having a single statewide standard, such as economies of scale in terms of expertise and equipment and ease of enforcement. The NYC DOH felt strongly that water reuse standards are better left to NYS.

Another perspective is that NYC cannot control NYS DOH, which thus far has not even complied with a state law that would lead to statewide standards. According to this perspective, it is better to have interim NYC standards than continue indefinitely without water reuse standards. One potential source for these interim standards is those used by The Solaire since 2004 and some other buildings in NYC under prior authorization from NYC DOH.

Ultimately, the committee was swayed by NYC DOH's views and decided against recommending the formation of an NYC blue ribbon commission on water reuse.

How Safe is Safe Enough?

The committee spent months discussing the degree to which variations in system design could be applied to different water sources or for different end uses.

One approach is, in the absence of comprehensive standards, to design systems so that recycled water is safe for all

potential uses other than drinking water.

Another perspective is that applying the same standard regardless of water source or end use is needlessly stringent and will impede water reuse. This perspective is informed by a desire to reduce potable water consumption and stormwater, recognizing that additional requirements will likely lead to greater costs and reduce water recycling. Smaller buildings are likely to be particularly price sensitive, whereas larger buildings will have greater capacity to absorb higher costs.

The committee attempted to strike a balance between these two approaches. Most water sources and end uses will be subject to the same standards with the following exceptions:

- Steam condensate, which comes from water heated to over 212 degrees Fahrenheit and is thus sterile, will be exempt from disinfection requirements.
- Rainwater also provides a reasonably clean source of water and is exempted from some requirements of Appendix C when used for limited purposes. Rainwater piped external to a building, such as rain barrels and cisterns, is entirely exempt from Appendix C. Rainwater piped inside a building must comply with most requirements of Appendix C, but not requirements for treatment and make-up water.
- Single unit sink-toilet combinations are also exempted from the requirements of Appendix C.

Clean Toilet Water?

The committee spent considerable time discussing whether to allow untreated but filtered rainwater for flushing toilets and urinals. In a typical building, toilet flushing is the largest water end use and also is a particularly unclean end use, meaning it offers significant potential for water reuse.

The potential for objective decision-making was limited by the absence of testing data on pathogens that may exist in rainwater (carried from a roof) and may pre-exist in toilets and urinals. One approach is water quality must be high because people can drop objects in toilets and, if untreated, pathogens may grow when water sits in storage or toilet tanks.

Another approach is that toilets and urinals are so inherently unclean and pathogen-laden that rainwater could not cause any appreciable increase in health risk. We should also avoid the unnecessary addition of chemicals to water that is eventually released into waterways. Moreover, the city does not require a large number of practices that would likely have a much more significant impact on the cleanliness of toilets, such as cleaning toilets and limiting the use of harsh chemicals or chlorine pucks inside toilets.

This issue proved to be more contentious than any other discussed by the committee. The final proposal would continue to subject flushing water to the same standards as other end uses. At the same time, the city is instructed to study the issue and determine whether an alternative standard is appropriate for toilet and urinal flushing water.

Blue Dye

The proposal eliminates the requirement that blue dye be added to recycled water. Dyeing diminishes the ability to reuse water for certain applications such as laundry, irrigation and, in some instances, cooling. Instead, all pipes handling recycling water must be colored purple, a practice that is common in other U.S. jurisdictions and required under the Uniform Plumbing Code (2009).

Steam Condensate

At the suggestion of representatives from the Department of Health, the proposal would add “steam condensate” to the list of sources of “greywater” in C102.1. Steam condensate comes from water heated to over 212 degrees Fahrenheit and is thus sterile. While it would not require disinfection, the condensate can include metals from piping and is not fit for drinking.

Clothes Washers

At the suggestion of representatives from the Department of Health, the proposal would move “clothes washers” from the definition of “greywater” in C102.1 to the definition of “blackwater” given the potential contamination from washing diapers or soiled clothing.

Commercial Car Washing Facilities

These facilities are currently regulated by the Department of Environmental Protection so have been exempted from Appendix C.

ENDNOTES:

- ¹ Press Release, Mayor's Office of Communications, Mayor Gavin Newsom Launches Rainwater Harvesting Initiative to Green the City, Conserve Water & Protect the Bay & Ocean (Oct. 9, 2008), available at <http://www.californiachronicle.com/articles/view/77115>.
- ² Memorandum from the San Francisco Public Utilities Commission to the Department of Public Health & Department of Building Inspection, Rainwater Harvesting Systems. 3 (June 11, 2008) (on file with author).
- ³ Ibid. at 5.
- ⁴ King County Department of Policies and Procedures, Rainwater Harvesting and Connection to Plumbing Fixtures, Product/Method #07-001 (2007), available at http://www.kingcounty.gov/healthServices/health/.../Rainwater_Harvesting.ashx.
- ⁵ Ibid. at §1.1.
- ⁶ Ibid. at § 6.6.
- ⁷ Memo from the San Francisco Public Utilities Commission to the Department of Public Health, 2.
- ⁸ Department of Planning and Development of Seattle, Client Assistance Memorandum 701: Rainwater Harvesting for Beneficial Use, 2 (Apr. 28, 2008), available at <http://www.seattle.gov/DPD/Publications/CAM/CAM701.pdf>.
- ⁹ Memo from the San Francisco Public Utilities Commission to the Department of Public Health, 4.
- ¹⁰ Ibid.
- ¹¹ CANADA MORTGAGE AND HOUSING CORPORATION, RAINWATER HARVESTING AND GREY WATER REUSE FACT SHEET, TECHNICAL SERIES 03-100, <http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/03-100-e.htm> (last visited Jan. 21, 2010).
- ¹² Ibid.
- ¹³ Ibid.
- ¹⁴ Ibid.
- ¹⁵ Ibid.
- ¹⁶ ENVIRONMENT AGENCY, CH. 7: REUSING GREYWATER AND HARVESTING RAINWATER, CONSERVING WATER IN BUILDINGS (2003), http://www.environment-agency.gov.uk/static/documents/Leisure/cwb_ch7_grey_rain_889316.pdf.
- ¹⁷ Canada Mortgage and Housing Corp., Rainwater Harvesting and Grey Water Reuse, Technical Series 03-100 <http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/03-100-e.htm> (last visited Jan. 26, 2010).
- ¹⁸ Hansgrohe International, Pontos GMBH, <http://www.pontos-aquacycle.com> (last visited Jan. 21, 2010).
- ¹⁹ Ecoplay, Home, <http://www.ecoplay-systems.com> (last visited Jan. 21, 2010).
- ²⁰ 314 MASS. CODE REGS. 20 (2009) available at <http://www.mass.gov/dep/service/regulations/314cmr20.pdf>.
- ²¹ N.Y. ENVTL. CONSERV. ART. 15, TIT. 6 § 5-0601 to 15-0607. NYSDOH was also directed to create a registry of recycled water systems. The U.S. Environmental Protection Agency (EPA) published water reuse guidelines in 2004, but these were focused on reclaimed water from utilities. In any event these are not binding on states, which have the primary responsibility in our federal system for setting water quality standards.

WE 5: REDUCE USE OF DRINKING WATER TO CLEAN SIDEWALKS

Administrative Code of the City of New York

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:

Clean drinking water is frequently used in New York City to wash sidewalks, parking lots, and streets.

Recommendation:

Require the use of either water-conserving equipment, such as water brooms, or recycled water for cleaning sidewalks, parking lots, and streets.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Amend Section 24-332 as follows:

§ 24-332 Use of water through hose. It shall be unlawful for any person to wash any street, parking area, sidewalk, areaway, steps, building or other place in the city by means of a hose or piping, or to use water through a hose or sprinkler for watering lawns or gardens, or to operate any outside shower where the water runs upon a street, sidewalk, or other public place between the first day of November and the last day of March following. Any person washing, by means of a hose or piping, any street, parking area, sidewalk, areaway, steps, or building, shall utilize one of the following:

- a. Water conserving equipment, as such term is defined by the department; or
- b. Recycled water for any such washing.

Supporting Information

Issue – Expanded

Sidewalk cleaning is necessary to maintain a clean and healthy urban space. Sidewalk cleaning removes animal feces, garbage, liquid residue, and other residue from the sidewalk. Buildings typically undertake this cleaning by spraying drinking water on the sidewalk through a hose with no control nozzle.

A primary strategy for resource conservation is to use all resources for their maximum benefit. For water, this implies matching water quality to the appropriate use. It is not necessary to use drinking-quality water to clean sidewalks given this water does not come in contact with humans and immediately flows into the storm sewer.

This proposal would require buildings to minimize the use of drinking water for sidewalk cleaning by requiring the use of water efficient pavement cleaning equipment, such as a “water broom” or other products. This type of equipment is already used by some buildings in the city, but is not a common practice. Alternatively, building could use recycled water, such as rainwater collected on a roof, for sidewalk cleaning.

Utilizing water efficient pavement cleaning strategies is important due to the public nature of the act. The sight of building staff washing down the sidewalk with drinking water sends a message to the public that water conservation is unimportant; water brooms would send the opposite message. Signage noting that a hose bib is for non-potable uses further communicates to the public the conservation measures of its citizens.

During periods of drought, these strategies will allow buildings to maintain clean streets and a healthy environment by removing unpleasant refuse from the sidewalk, without negatively impacting the available water resources.

Environmental & Health Benefits

This proposal would reduce the consumption of drinking water in New York City. If the proposal leads some buildings

to add on-site capacity for rainwater storage, it will shift the discharge of some water to post-storm event periods, reducing combined sewer overflows (CSOs). Reduction of CSOs reduces the risk of exposure to disease-causing viruses and bacteria. (See Stormwater proposals for more information on CSOs.)

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. This proposal was also estimated to generate financial savings that will pay for any capital costs in less than three years.

Precedents

Many municipalities in California forbid wash-water from entering the sewer system in order to prevent water contamination with hazardous materials. A few municipalities restrict surface cleaning as a means of water conservation. For example, under the City of Los Angeles' Water Conservation Plan - Phase I, all residents are prohibited from using a "water hose to wash any hard or paved surfaces including, but not limited to, sidewalks, walkways, driveways, and parking areas," unless using a "Department-approved water conserving spray cleaning devices." (Chapter XII: The Water Conservation Plan of the City of Los Angeles, § 121.08(A)(1).) Waterbrooms are currently the only approved sidewalk cleaning device.¹

LEED

Utilizing non-potable water for sidewalk cleaning is a strategy to reduce water consumption for all buildings and, in conjunction with other conservation strategies such as HET plumbing fixtures, drip irrigation, and/or water-efficient mechanical systems, meeting both water conservation points is possible.

Also, when utilizing stormwater for sidewalk cleaning, additional credits may be achieved as well. The development of a stormwater management plan includes mitigating runoff from the site. This can be accomplished by the capture of rainwater for reuse or other measures. LEED also addresses the use of treated stormwater. Therefore, this proposal will facilitate achieving LEED points under the following credits:

- NC SS 6.1 Stormwater Design: Quantity Control Option 1B
- LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control
- LEED ND-GCT cr.9 Stormwater Management
- LEED CI-SS cr.1B, Stormwater Management: Rate & Quantity
- LEED for Homes SS cr. 4 Surface Water Management.
- LEED EB-SS cr. 5 Stormwater Management

Additionally, LEED for New Development (pilot program) will address diverting wastewater generated by the project in: LEED ND-GCT cr.16, Wastewater Management.

Implementation & Market Availability

Water efficient pavement cleaning equipment is readily available.

ENDNOTES:

¹ Press Release, Los Angeles Department of Water and Power, Drought Busters, The City's Mobile Water Conservation Team, Take To The Street To 'Stop and Spot' Water Waste (Nov. 13, 2007), <http://www.ladwpnews.com/go/doc/1475/182533>.

WE 6: STOP WASTING DRINKING WATER FOR COOLING

New York City Plumbing Code

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:

"Once-through" cooling systems emit heat into potable water, which is then drained into the sewer. No other cooling systems waste water in this manner.

Recommendation:

Prohibit new installations from using "once through" cooling systems.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Amend Section 202 to include the following definitions:

SUBSTANTIAL REPAIR OR REPLACEMENT. Repair or replacement of an item of equipment or system costing 50% or more of the cost of replacing the entire existing item of equipment or system.

ONCE-THROUGH COOLING. The practice of using potable water to cool a condenser or other item of process or building equipment and then discarding the water to a sanitation drain. Once-through cooling also includes the use of potable water to temper hot water or steam before sending it to a sanitation drain.

2. Add a new Section 428 as follows:

SECTION PC 428 PROHIBITED WATER USES

428.1 Potable water prohibited for once-through cooling. Potable water shall not be used for in once-through cooling equipment or substantial repair or replacement of existing cooling equipment. Equipment such as ice-making machines, walk-in coolers, refrigerated walk-in boxes, or environmental air conditioning equipment shall be provided with air cooled condensers or recirculating condenser water systems, or supplied with non-potable water as permitted by Appendix C of this code.

PC 428.2 Approvals. If a proposed design includes the use of non-potable water for cooling, calculations shall be provided and approved by the department demonstrating that sufficient non-potable water is available at all times for the proposed cooling load. Potable water may be used as an emergency backup providing sufficient backflow equipment is provided and the emergency feature can be used no more than 24 hours consecutively and no more than 24 hours in any year.

Exception: The department may waive the requirements of this section in connection with the substantial repair and replacement of existing cooling equipment upon the submission of a cost and savings analysis prepared by a licensed professional that demonstrates that the elimination of once-through water-cooled equipment in accordance with this section has a payback longer than five years assuming a water/sewer cost escalation of 7% per year. In no case shall such equipment be used in sizes that exceed maximum sizes specified in RCNY Title 15 Chapter 20-08.

Supporting Information

Issue – Expanded

Most large building air conditioning and refrigeration systems operate with a recirculating system of cooling water. Throughout the city, however, there are small-to-medium size systems that pass potable water once through a piece of equipment to provide cooling and then dump the potable water into the sewer system. Examples include ice-making

machines in hotels, restaurants, taverns and similar occupancies, walk-in coolers in food business facilities, older medical x-ray and laser equipment and local cooling particularly for “back office” portions of an office building where people and computer heat loads exceed what was originally anticipated for the air conditioning system. The Department of Environmental Protection’s (DEP) water use rules currently limit the size of such equipment to no more than six tons of refrigeration capacity (1 ton = 12,000 BTUH) or two tons of air conditioning capacity.

Each “ton” of cooling uses about 250,000 gallons of single-pass cooling water each year, amounting to more than \$200 per year in water/sewer costs. This is 40 times more water than would be used in a recirculating system using an evaporative cooling tower operating at five cycles of concentration and 100% more than an air-cooled system.^{2 3}

Once-through water-cooled equipment is particularly susceptible to “silent leaks” that can waste an enormous amount of water and cost the customer a great deal of money. A small solenoid valve is meant to turn the cooling water supply “on” or “off” depending on whether the compressor needs cooling at that moment. To avoid damage to the expensive compressor from overheating, the solenoid valve is designed to fail in an open position, meaning water flowing full time. Under that circumstance, normal operation, which might mean 0.5 – 2.0 gpm water flow for 15-20 minutes each hour, escalates to continuously flow, 24 hours a day. The valve and equipment do not provide any indication of valve failure without a physically difficult inspection. According to Department of Environmental Protection water conservation officials, virtually every high water bill complaint from a food or medical business turns out to have to water-cooled equipment as the primary problem.

Environmental & Health Benefits

By conserving potable water, we are also reducing the amount of energy and resources spent on water treatment and distribution. Using less water also reduces the amount of sewage in our sewer systems and reduces the frequency of combined sewer overflows (CSOs).

This proposal was determined to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

Austin, Seattle, Phoenix, San Antonio, Denver, and Hawaii are among the jurisdictions that prohibit once-through equipment. The draft of Portland, OR’s new water conservation standards requires potable water used in once-through cooling systems to be reused.⁴

LEED

LEED addresses the use of condensate water as a water conservation strategy for irrigation and building sewage conveyance systems. For these purposes, this proposal will assist in achieving all prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

LEED also addresses the use of treated stormwater as condensate water as one method of reducing the amount of wastewater going into the sewer system. For these purposes, this proposal will assist in achieving all Stormwater Design credits in LEED Sustainable Sites sections of the various rating systems.

Implementation & Market Availability

There are no known implementation issues for this proposal. All replacement and substitute systems, such as high-efficiency (EnergyStar rated) air-cooled condensers for heat rejection or a connection to a recirculating cooling water system, are readily available.

Notes

RS 16 P107.16 of the 1968 building code and DEP regulations allow once through cooling systems. The 2008 building code no longer expressly allows once through cooling but instead references DEP or has removed references to these cooling systems.

ENDNOTES:

¹ R.C.N.Y., Tit. 15 § 20-06 (A)(2) AND (A)(3) (1991).

² U.S. Dep't. of Energy, Best Management Practice: Single-Pass Cooling Equipment, http://www1.eere.energy.gov/femp/program/waterefficiency_bmp9.html (last visited July 14, 2009).

³ California Urban Water Conservation Council, Resource Center: Commercial Food Services, <http://www.cuwcc.org/products/commercial-ice-makers.aspx> (last visited Oct. 20, 2009).

⁴ City of Portland, Water Conservation and Stormwater Management Requirements, available at <http://www.portlandonline.com/BDS/INDEX.CFM?c=48074&a=222101> (last visited Oct. 20, 2009).

WE 7: REUSE WATER FROM CONED STEAM

New York City Plumbing Code; New York City Mechanical Code

Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue: The water used by Con Edison to make steam is dumped into the sewers after it has been used by buildings. This wastes 5 million to 10 million gallons of clean water a day and stresses wastewater treatment plants.

Recommendation:

Require buildings that use utility steam for space heating and/or cooling to reuse at least 50% of the steam condensate produced, unless shown to be unfeasible.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Add a new Section 614.1 as follows:

SECTION PC 614 UTILIZATION OF STEAM CONDESATE

614.1 Applicability. Buildings that use utility steam for space heating and/or cooling shall reuse at least 50% of the steam condensate produced, averaged over one year, using one any means permitted in Appendix C of this code.

Exception. Any water remaining after use for the purposes permitted in Appendix C may be discarded; provided, however, that any such building shall report to the department the percentage of steam condensate discarded.

614.2 Restrictions. The systems for utilization of steam condensate shall be designed to ensure that:

1. Water utilized for toilet/urinal flushing shall not exceed 100°F at any time, unless combined with other sources of water to lower such temperature below 100°F; and
2. Water supplied to any outlet accessible by humans, including hose bibs and laundries, shall not exceed 140°F, unless combined with other sources of water to lower such temperature below 140°F.

Amendments to the New York City Mechanical Code:

1. Add a new Section 307.4 as follows:

307.4 Utility Steam Condensate. In buildings where utility steam condensate is used to provide space heating or cooling, provision shall be made to recover the condensate as required by Section 614 of the New York City Plumbing Code.

Supporting Information

Issue – Expanded

Approximately 2,000 large Manhattan buildings use Con Edison's steam system as a source of energy. When this steam cools into liquid water (steam condensate), it is still far hotter than permissible by the Department of

Environmental Protection for release into the sewers. Typically, this water is then cooled with potable water and disposed. Because of this, between five and ten million gallons of almost potable water (condensate mixed with potable water) is wasted annually.

Five and seven million gallons per day of steam condensate flow into the sewer system, ending up at the Newtown Creek, Wards Island and North River wastewater treatment plants. To the extent that steam condensate can substitute for potable water for certain non-potable uses, such as toilet/urinal flushing, cooling tower makeup water, and sidewalk washing, both potable water and wastewater flows can be reduced.

Some condensate reuse already occurs without any incentive or regulatory requirement due to cost effectiveness. The 100 largest steam consumers (who produce 40% of the system's total condensate) recovered 30% of their condensate in 2005, compared to about 20% recovery systemwide. A Con Edison-sponsored analysis that assumed far lower water/sewer costs than currently exist found that all but 10% of condensate could be recovered economically.

The intent of this recommendation is that it would only apply to new construction and gut rehabilitations.

Environmental & Health Benefits

This proposal will reduce wastewater flows to Newtown Creek and Wards Island plants. It will also reduce water use as condensate replaces potable water for these end uses.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For some buildings this proposal will result in no increase of capital costs and for others an increase of up to 0.03%. It was thus categorized as incurring no to a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years or in three to ten years depending on the building type.

Precedents

There are no known precedents for this proposal.

LEED

LEED addresses the use of condensate water as a water conservation strategy for irrigation and building sewage conveyance systems. For these purposes, this proposal will assist in achieving all prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

Implementation & Market Availability

The technology is readily available. There are no known implementation issues for this proposal.

Notes

A separate Task Force proposal, Use Waste Heat from ConEd Steam, requires that the thermal energy in condensate be used to the extent practical. (Added material in Section 6.8 of ASHRAE 90.1 2007.) When there is a use for this energy (e.g., during heating season), the condensate will be available at 100-130°F. However, in the summer, if steam cooling is operating, the condensate will be used only for service hot water heating and may be considerably hotter (180°F or more) when released for these applications. A water-to-air cooling coil (with freeze protection) will therefore be a necessary part of the installations called for in this measure in most cases.

The Committee had originally suggested adding this language to MC 1210.2.3, but that section refers to high pressure steam and is concerned with assuring reliability and safety. PC 614 seems a more natural fit. A reference has been included in the Mechanical Code.

SW 1: REDUCE EXCESSIVE PAVING OF SITES

New York City Building Code
Proposal developed by the Homes Committee

Summary

Issue:

Due to excess stormwater, 27 billion gallons of sewage are released directly into New York harbor each year.¹ Paving over the ground exacerbates this problem.

Recommendation:

In new construction projects, require that half of the non-built lot be permeable.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Chapter 34 to read as follows:

CHAPTER 34 SITE AND LANDSCAPING

3402.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

AREA, IMPERMEABLE. Any portion of a lot on which the soil is covered with impervious materials such as asphalt or concrete, or bricks or pavers over a concrete or asphalt sub-base

AREA, NON-BUILT SITE. Any area of a lot that is not covered by a building.

3403.1 Impermeable surfaces. Sites shall comply with the following standards on impermeable surfaces:

3403.2 For new buildings, a maximum of fifty percent of the non-built site area of the zoning lot may be impermeable area.

3403.3 For alterations, the impermeable area of the non-built site area of the zoning lot shall not be increased to greater than fifty percent.

3403.3.1 Where over fifty percent of the existing non-built site area of the zoning lot is impermeable area, any impermeable area that is removed shall be replaced only with pervious materials.

Exceptions:

1. Any building classified in occupancy groups F or H and motor fuel-dispensing facilities classified under occupancy group M.

2. Subject to approval of the Commissioner, where compliance would result in flooding within existing buildings.

Effective Date: July 1, 2010

Supporting Information

Issue – Expanded

Impervious pavement is common in urban environments because it is perceived as the lowest cost solution for parking,

plazas, and other hard surfaces. However, impervious surfaces cause hardship for cities by increasing local flooding, combined sewer overflows and other environmental degradation that could be avoided by through alternative paving techniques. An increasing number of design options, including pervious pavements of many sorts, can satisfy building functional needs without creating as much runoff and allowing for some re-establishment of natural process and hydrological cycles, such as infiltrations into soils, evaporation, and evapo-transpiration. Alternatives to pavement also often involve planted systems, which create habitat, and cool the city, along with restoring the hydrological cycles.

Environmental & Health Benefits

Greater surface permeability in New York City will reduce local flooding, combined sewer overflows, and allow for filtration and groundwater recharge. Permeable areas retain moisture, which evaporates during hot periods, reducing the urban heat island effect.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

Pollutants in stormwater runoff can have damaging effects on human health and aquatic ecosystems. Since New York City has a combined sewer system in many areas, and intense storms flood the system, which can result in the overflow of untreated stormwater and septic sewage (Combined Sewer Overflow) to be discharged directly into the rivers. Limiting the amount of water flowing directly into the system from intense storms can lessen the occurrences of CSOs.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents

Several cities require new and redeveloped sites to reduce impervious areas of sites and limit driveway paving.

The City of Philadelphia requires new developments and redevelopments over 10,000 square feet to reduce the impervious area of a site connected to sewers by 20% compared to preexisting conditions. Philadelphia offers the reduction of impervious areas on a lot as an option to meet criteria to reduce peak flow stormwater volumes that are led to sewers. Other structural stormwater management practices may be used that detain water and release it over a longer period of time than unabated runoff.

The City of Chicago requires redeveloped sites over 7,500 square feet that discharge to combined sewers to reduce impervious cover by 15% from previous conditions. Its stormwater management manual recommends landscaping and permeable pavement as ways to meet stricter regulation. Methods to reduce flooding on-site include vegetated filter strips, which are designed to receive stormwater runoff from impervious surfaces and disperse it over permeable areas, and bioinfiltration systems, which are depressed areas containing plants, mulch, and prepared soils.

Berkeley limits the amount of paved off-street parking allowed in a yard, and requires permeable surfaces and landscape strips surrounding paved parking.²

Toronto provides a maximum front yard driveway width and requires 50-60% of front yards to be landscaped.³

LEED

LEED for Homes SS cr.4.1 states lot must be designed such that at least 70% of the built environment, excluding the area under the roof, is permeable or designed to capture water runoff for infiltration on-site.

For existing homes seeking certification under the LEED EB rating system, this proposal will facilitate achieving SS cr. 5.1 & 5.2 Stormwater Management, Rate and Quantity Reduction.

Depending on the permeable surface that is utilized, project teams may also be eligible for LEED for Homes SS cr.3 Local Heat Island Effects or LEED EB-SS cr. 6.1 Heat Island Reduction, non-roof. These sections award points to projects for reducing irrigation, tempering the outdoor environment, and reducing cooling loads.

Implementation & Market Availability

Nearly any surface that is paved with a traditional impervious surface may be converted to a porous pavement system. Porous pavements are especially applicable to sites that are in high-density area where space is too limited for other methods of stormwater management including lawns or soil beds for infiltration. A simple option for permeable driveway alternatives is crushed gravel, but where this is undesirable there are an increasing number of options available, and several systems have histories of success.

Porous asphalt was developed in the 1970's and has been implemented where standard asphalt would otherwise be used. It is installed just as standard asphalt is, but uses larger aggregate so that water can pass through voids in the material. Thomas Cahill, P.E. has used porous asphalt for projects such as walking paths at Swarthmore College and many large-scale parking lots throughout Pennsylvania. Porous asphalt has proven to be at-least as durable as impermeable pavement.

Similar to porous asphalt is porous concrete, which likewise is made of larger sized aggregate so that water can trickle through. The Florida Concrete Association developed porous concrete and it has been used in Florida and other southern states.

Porous asphalt and concrete need regular maintenance; otherwise after time the pores tend to clog up. Vacuuming or power washing annually, or using a leaf blower more frequently all satisfactorily restore permeability. During the winter months sand should never be used to increase friction because the sand will obstruct voids in the pavement. Salts may still be used though they should be used sparingly because chlorides that pass through the pavement may corrode piping and damage plant life. Permeable pavements tend to require less salt anyway because precipitation passes through instead of ponding on top thus mitigating the formation of ice.

Reinforced turf is an especially appealing alternative to paving on sites which experience relatively infrequent traffic. Reinforced turf is comprised of a grid of either plastic or concrete with openings that can be filled with soil. Turf grass can take root in this soil and aid in retaining stormwater. A popular brand of reinforced turf called "Grasscrete", marketed by a UK based company, is a concrete, heavy-duty interlocking system that has been used for decades.

If the owner or designer deems turf unwanted then permeable pavers can be used. Permeable pavers are paving units, often made of concrete, with openings in between that can be filled with relatively pervious material such as gravel. They can be combined in a variety of patterns and are suited to areas such as patios and plazas.

One need not choose a single variety of permeable pavements over others. On large-scale projects a designer would be smart to apply different permeable pavement systems where they are most appropriate. This has been accomplished very successfully at the New Sunrise Yards in Queens, a light industrial facility for NYC DOT with a need for truck access, extensive parking, and fire code access. Here a varied palette of solutions, which included permeable pavers in the parking area and Grasscrete in the side yard where fire truck access was required, limited the impermeable paving to the truck loading dock areas.

ENDNOTES:

¹ State of New York, DEC, A Gathering Storm - New York Wastewater Infrastructure in Crisis, <http://www.dec.ny.gov/chemical/48803.html> (last visited January 14, 2010).

² BERKELEY MUN. CODE § 23D.12.080 (2006), *available at* <http://www.ci.berkeley.ca.us/citycouncil/2006citycouncil/packet/072506/2006-07-25%20Item%2003%20Ord%20>

%20Off%20Street%20Parking%20Yards.pdf.

³ City of Toronto, Front Yard Parking, <http://www.toronto.ca/zoning/frontyard.htm> (last visited Oct. 14, 2009).

SW 2: REDUCE STORMWATER RUNOFF FROM NEW DEVELOPMENTS

Rules of the City of New York (Department of Environmental Protection)
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

While wastewater discharged by the city into New York Harbor must meet increasingly stringent national and state standards, the city's own stormwater detention standards have not changed in 25 years. For this reason, DEP is considering increasing detention standards for properties with new or altered sewer connections.

Recommendation:

The Task Force supports more rigorous standards for new and altered sewer connections, which should be accompanied by model detention system designs that would meet these standards. Future permit applications and decisions should also be made publicly available. DEP began considering these measures through a process that was independent of the Task Force, prior to the issuance of this report.

Proposed Legislation, Rule or Study

Expression of Support for the New York City Department of Environmental Protection to increase storm-water detention requirements.

The New York City Department of Environmental Protection (DEP) is exploring changes to sewer regulations and codes to increase stormwater detention standards for new development. DEP is studying options to increase detention requirements because of the city's endemic problems with stormwater runoff that overwhelms sewage treatment plants, resulting in combined sewage overflows (CSOs) that pollute NYC's waterways. Detention at the source of stormwater runoff is generally more cost effective than collective detention downstream, so increasing site-based detention requirements is a good strategy.

Given these problems, the Committee supports the creation of more stringent standards, and the ones DEP is studying are in keeping with the current methodology for storm-water calculations, a methodology that is well understood by the industry. The Committee recommends that when DEP releases their proposal requirements, the agency to explain how it arrived at the specifics of its requirements and their expected impact over time. In particular, the Committee recommends that DEP analyze the impact of proposed new standards on a variety of prototypical sites. At a minimum, for each prototypical site, the analysis should assess how storage volumes would increase, how this could be accommodated on each site through one or more alternative designs, and the estimated cost. This explanatory material should be made available to the engineering and development community.

In addition, in order to promote better understanding of DEP detention requirements and means of compliance, the Committee recommends that future permit applications and DEP decisions be made available to the public.

Supporting Information

Issue - Expanded

During dry conditions, the city's sewage treatment plants can easily treat the volume of wastewater produced in New York City. When there are rainstorms, however, the addition of stormwater into pipes that carry both stormwater and sewage overwhelm the capacity of treatment plants, carrying partially treated sewage into New York Harbor – these incidents are called Combined Sewage Overflows (CSOs). CSOs undermine the ecology of the harbor and can cause illness as they contain human waste that can carry pathogenic organisms. Some of the common diseases include hepatitis, gastric disorders, dysentery, and swimmer's ear. Other forms of bacteria found in untreated waters can cause typhoid, cholera, and dysentery. Human health is also impacted when fish or shellfish that have been contaminated by combined-sewer discharges are consumed.

Increased stormwater runoff from excess paving not only increases CSOs but also flooding of some city neighborhoods. More than 75% of New York City is covered with impervious surfaces and buildings and developed lots account for 45% of the city's land area. The situation is exacerbated as runoff from low-density development (one- and two- family homes) has increased 50% since 1950 because residents have paved over their yards, often in order to obtain more parking spaces. An analysis conducted by the Department of City Planning and Department of Buildings, predicts over 52 million square feet of new development greater 10,000 square feet will be built between 2010 and 2030. Even if the

recent slowdown in construction in New York City is taken into account when interpreting these estimates, the projections for new development make it even more urgent to address the current stormwater problems.²

On-site detention regulations have been in place since the mid 1980s. Since then, water standards for New York Harbor have increased in order to allow for recreation and habitat. There has been no parallel change in on-site detention requirements to match the change in water standards and increased development and paving of yards. Therefore, the detention requirements should be updated to reflect these new regulations and city conditions.

Environmental & Health Benefits

Reduction of combined sewage overflow (CSO) reduces the risk of exposure to disease causing bacteria and viruses.

This proposal was found to have high positive environmental impact per building and to impact a small number of buildings. It was given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.02% to 0.3%, depending on building type. It was thus categorized as incurring a low to medium capital cost increment.

Precedents

Performance standards for new construction approaches have been adopted by Chicago, Philadelphia, Seattle, Portland, and other major cities.

LEED

LEED credits retention but does not reward detention. Retention removes stormwater permanently from the system through infiltration into the site or through productive use, a strategy that is more appropriate for suburban areas where the level of paving and development is not that high. In comparison, detention temporarily detains stormwater and slowly releases it to the system and thus decreases CSOs by slowing down the flow to sewage treatment plants. Detention is a more effective technique for reducing runoff in urban areas that should be credited under LEED.

Nevertheless, various LEED credits across all the rating systems refer to detention facilities as one possible implementation to mitigate stormwater runoff. These LEED credits include:

- NC SS 6.1 Stormwater Design: Quantity Control Option 1B
- LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control
- LEED ND-GCT cr.9 Stormwater Management
- LEED CI-SS cr.1B Site Selection
- LEED for Homes SS cr. 4 Surface Water Management.

Though the standards do not currently address existing building sites, LEED EB-SS cr. 5 Stormwater Management also makes reference to detention facilities. Should the standards change as a result of this proposal, these credits would be more attainable.

Should the standards be revised to implement alternative strategies such as vegetated roofs, rainwater collection, or on-site wastewater treatment, then the recommendation will also result in easier compliance with Water Efficiency credits across the various rating systems.

Implementation & Market Availability

There are no known implementation issues for this proposal.

The technology and materials required to support reductions in stormwater runoff are widely available.

ENDNOTES:

¹ CENTER FOR MARINE CONSERVATION, SEWAGE TREATMENT: AMERICA'S PIPE DREAM – A REPORT ON COMBINED-SEWER OVERFLOWS (1992).

² CITY OF NEW YORK, PLANYC, SUSTAINABLE STORMWATER MANAGEMENT PLAN 2008 (2008) *available at* http://www.nyc.gov/html/planyc2030/downloads/pdf/sustainable_stormwater_plan.pdf.

SW 3: REDUCE STORMWATER RUNOFF FROM CONSTRUCTION SITES

New York City Building Code

Proposal developed by Site & Site Stormwater Committee

Summary

Issue:

While state and federal regulations limit stormwater discharge from construction sites that are larger than an acre, smaller sites are unregulated. In New York City, many construction sites are well under an acre.

Recommendation:

Require construction sites of less than an acre to reduce runoff, soil loss, sedimentation, and the generation of dust and particulate matter.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new section BC 3321 to read as follows:

SECTION BC 3321

Construction Activity Pollution Prevention

3321.1 Erosion and sedimentation control plan. No permit shall be issued for the construction or demolition of a building until an erosion and sedimentation control plan in accordance with rules promulgated by the Commissioner has been approved by the department. The Commissioner shall promulgate rules establishing requirements for erosion and sedimentation control plans. In promulgating such rules, the Commissioner shall consider the standards of the 2003 EPA Construction General Permit and New York State Pollutant Discharge Elimination System and consider measures to accomplish the following objectives:

1. Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse;
2. Prevent sedimentation of storm sewer or receiving streams; and
3. Prevent polluting the air with dust and particulate matter.

Exception: Construction or demolition projects where a total of less than 2,000 square feet of the construction or demolition site is impacted by construction or demolition, or the siting or transportation of construction materials or equipment. Such projects shall submit a site plan clearly showing the total area in which construction or demolition, or the siting or transportation of construction materials or equipment, will occur.

Supporting Information

Issue - Expanded

In New York State, stormwater discharges from construction activities that disturb one acre or more of land must receive a New York State Pollution Discharge Elimination System (SPDES) permit. These permits require the contractor to prepare a stormwater pollution prevention plan. With certain exceptions (such as construction in the “East of Hudson” watershed), sites less than one acre do not require a SPDES permit.

While a one-acre minimum may make sense as the cut-off in rural areas, very few construction sites in New York City are this large. As a result, construction sites in New York City are not covered by NYS stormwater mitigation requirements. This proposal would fill the regulatory gap by requiring all construction sites in New York City that disturb more than 2,000 square feet to develop a stormwater pollution prevention plan.

Environmental & Health Benefits

Reduced runoff results in a reduction of combined sewage overflow (CSO) that in turn reduces the risk of exposure to

disease-causing bacteria and viruses.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.05% to 0.06%, depending on building type. It was thus categorized as incurring a low to a medium capital cost increment.

Precedents

The City and County of Denver¹ as well as the Virginia Department of Conservation & Recreation² have stormwater management plans in place that limit the runoff of stormwater from construction sites.

Note: One acre is the common trigger for Construction Activities Stormwater Management. General permits cover smaller sites. However, it is common for special situations to require permits for disturbances typically greater than 2,500 square feet. Special situations include historic districts, environmentally sensitive areas, etc.

LEED

All projects pursuing LEED certification must meet the requirements of the EPA Construction General Permit (CGP), as this is a prerequisite of the rating systems (with the exception of LEED CI). Since the code revisions outlined in this proposal reference the EPA guidelines directly, this proposal will have a significant positive impact on achieving LEED certification.

Although the CGP only applies to construction sites greater than 1 acre. The requirements are applied to all projects for the purposes of the LEED prerequisites. Therefore, these recommended code revisions are applicable.

The following LEED prerequisites apply: NC-SS prerequisite 1 Construction Activity Pollution Prevention; EB-SS prerequisite 1 Erosion & Sedimentation Control; LEED for Schools SS prerequisite 1 Construction Activity Pollution Prevention Required; LEED for Retail (pilot program) SS prerequisite 1 Construction Activity Pollution Prevention; LEED ND (pilot program) GCT prerequisite 1 Construction Activity Pollution Prevention.

Implementation & Market Availability

There are no known implementation issues associated with this proposal.

The technology and materials required to support the reduction in stormwater runoff are widely available.

ENDNOTES:

¹ CITY AND COUNTY OF DENVER, WASTEWATER MGMT. DIV., DEP'T OF PUB. WORKS, CONSTRUCTION ACTIVITIES STORMWATER MANAGEMENT PLANS: AN INFO. GUIDE (2006) available at www.denvergov.org/Portals/528/documents/DftGuide452007.pdf.

² Virginia Department of Conservation & Recreation, Virginia Stormwater Management Program, http://www.dcr.virginia.gov/soil_and_water/stormwat.shtml (last visited Jan 31, 2010).

SW 4: SEND RAINWATER TO WATERWAYS

Rules of the City of New York (Department of Environmental Protection)
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Most properties located on the waterfront direct their rainwater into the sewer system, which contributes to more frequent combined sewer overflows during storms.

Recommendation:

Require waterfront properties to treat and discharge rainwater into the adjacent water body, unless it is technically infeasible.

Proposed Legislation, Rule or Study

Amendments to the Rules of the City of New York:

1. Add a new paragraph (j) to Section 19-02 of Title 15 as follows:

(j) For properties located adjacent to tidal waterways, permits for the discharge of stormwater into public sewers shall require, at a minimum, a finding by the Commissioner that it is not feasible to discharge all or part of the site's stormwater into the adjacent waterbody in compliance with the requirements of the Army Corps of Engineers and New York State Department of Environmental Conservation and the New York State Department of Environmental Conservation.

Supporting Information

Issue - Expanded

Excess stormwater is an important environmental and health issue in New York City due to the incidence of combined sewer overflows. Sites situated next to water bodies could entirely eliminate their burden on the sewer system by discharging stormwater directly into the water body.

Sending stormwater directly to waterways is already a common practice with the Department of Environmental Protection, though it is not yet formalized in code.

Environmental & Health Benefits

Redirection of waterfront runoff results in a reduction of combined sewage overflow (CSO) that in turn reduces the risk of exposure to disease-causing bacteria and viruses.

This proposal was found to have a low positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to lower capital costs if implemented.

Precedents

As noted above, DEP has permitted many sites to discharge their stormwater directly into waterways. Projects where this has occurred include the following: 184 Kent Avenue (Brooklyn), 155 West Street (Brooklyn), Ferry Point Park (Bronx), Bronx River Greenway (Bronx), Silvercup (Queens), Fresh Kills (Staten Island) and Baker Field (Manhattan).

LEED

For existing buildings, projects must meet LEED EB-WE prerequisite 2 Discharge Water Compliance which concerns protecting natural habitat, waterways and water supply from pollutants carried by building discharge water. Under Option A, if regulated by EPA National Pollution Discharge Elimination System (NPDES) Clean Water Act requirements, a project must demonstrate NPDES permit compliance including use of any required oil separators, grease interceptors and other filtration for in-building generated discharges and proper disposal of any wastes collected. Under Option B, if the facility is not regulated by a NPDES Permit, this prerequisite is achieved.

Since this proposal requires that all discharges into waterbodies comply with the requirements of NYSDEC, the recommendations will assist in achieving LEED EB credits.

Implementation & Market Availability

There are no known implementation issues for this proposal. The technology and materials required to support the redirection of stormwater runoff are widely available.

Notes

The federal Clean Water Act requires all municipal, industrial and commercial facilities that discharge wastewater or stormwater directly from a point source into a water of the United States to obtain a National Pollutant Discharge Elimination System (NPDES) permit. All permits are written to ensure the receiving waters will achieve their Water Quality Standards. In order for this proposal to be implemented, the method of discharge must comply with existing NPDES permits.

SW 5

ENCOURAGE INNOVATIVE STORMWATER PRACTICES

Administrative Code of the City of New York

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Modern stormwater control systems incorporate both civil engineering strategies, such as underground detention tanks, and landscape-based strategies, such as green roofs and natural landscaping. New York City's regulations, however, do not properly account for the impact of landscape-based strategies.

Recommendation:

Revise stormwater regulations to account for landscape-based strategies.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Add a new Section 24-528 as follows:

§ 24-528.1 Stormwater flow control. a. On or before Jan. 1, 2013, the department shall promulgate rules establishing runoff coefficients for green roofs, woodlands, gravel, native vegetation with prepared soils, dry bottom detention basins and wetlands. Such rules shall exclude approved best management practice areas from site flow rate calculations.

b. The runoff coefficients provided under this section shall not permit a site to provide less detention storage volume than required under rules in place on July 1, 2009.

§ 24-528.2 Stormwater volume control. On or before Jan. 1, 2013, the department shall promulgate rules, which may incorporate by reference a design manual, establishing a comprehensive system for alternative stormwater detention strategies. Such rules shall include:

a. Detention storage values for alternative strategies that may be used to decrease the size of structural stormwater detention storage facilities that would otherwise be required by the department.

b. Standard designs to simplify compliance and streamline enforcement.

c. Standard designs and detention storage values for the following alternative strategies: green roofs, rooftop runoff BMPs (planter boxes, rain barrels and cisterns), permeable paving, natural landscaping, vegetated filter strips, bio-infiltration systems, drainage swales and infiltration vaults. Such detention storage values shall only apply with respect to reductions in permissible stormwater outflow the department may enact after July 1, 2009. The detention storage values provided under this section shall not permit a site to provide less structural detention storage volume than required under rules in place on July 1, 2009. Any project that utilizes the standard designs shall receive the established detention storage credit. Rooftop runoff BMPs may not contribute more than a ten percent (10%) of the site's required detention storage volume.

Supporting Information

Issue – Expanded

How Stormwater Became A Problem

When it rains in a natural area, like a forest or grassland, most rainwater soaks into the ground or is captured by leaves, with the remainder running into rivers and streams. Stormwater is a problem in cities because hard surfaces, such as roofs and streets, reduce the area where rain can infiltrate into the soil and reduce evapotranspiration from vegetation.

In New York and many other cities, proposed developments with excess stormwater must construct onsite detention tanks and sometimes replace sewer pipes downstream of the project site to avoid flooding and sewer surcharge. This traditional approach to stormwater management addresses a problem caused by interference with the hydrological cycle (paving of permeable surfaces) by further bypassing that natural system (instead of the ground absorbing water, constructed tanks now do so).

As a result of the green building movement, some cities are now revisiting their approach to stormwater management. Many cities now seek to mimic natural systems for capturing stormwater with approaches like permeable pavement and detention basins, rather than relying solely on structural solutions to stormwater. Indeed, Staten Island's "Bluebelt" is a famous and enormously successful effort to reduce stormwater through both structural and non-structural systems such as engineered ponds, wetlands, outlet silting basins and sand filters. Cities are also beginning to treat stormwater as a potential water resource, rather than a problem that must be removed from sites.

New York City's Approach to Stormwater

The New York City Department of Environmental Protection (DEP) regulates the amount of sanitary and stormwater inputs to the combined sewer system. Specifically, the Drainage Review Section of the Division of Sewer Regulation and Control reviews new and proposed redevelopment projects to ensure that flow rates are within the carrying capacity of existing sewer pipes. These flow rates are specified in the City's Drainage Plan. Developers must submit Site Connection applications to DEP, specifying the total developed site storm flow and the amount of detention and retention incorporated into the site design. If a proposed development produces flows that are above those specified in the Drainage Plan, the developer must also produce an Amended Drainage Plan. The Amended Drainage Plan may involve replacing sewer pipes downstream of the project site in order to avoid flooding and sewer surcharge. The developer is also required to provide a certain amount of onsite detention of stormwater runoff.

DEP determines the flow rate off a building site by multiplying the site area and rainfall intensity with a runoff coefficient.¹ This "runoff coefficient" represents the ability of a surface to absorb rainfall. For example, roof surfaces have a coefficient of 1.0, whereas grass has a coefficient of 0.20 (meaning 80% of the rain is assumed to be absorbed by the ground).²

The amount of required stormwater detention is determined by comparing the estimated flow rate off a site (based on the types of surfaces) with its permissible flow rate under the Drainage Plan. Developers are required to provide detention that is equal to the delta between the estimated and permissible flow rates.

DEP does not, however, provide runoff coefficients for green roofs and other permeable surfaces that are now widely used by green building projects to reduce stormwater rate. In addition, DEP provides coefficients for grass areas and undeveloped areas, but no further nuance according to types of plantings and soil. In comparison, the Chicago Stormwater Ordinance Manual distinguishes between 11 types of lawns and other vegetated surfaces.³ In addition, DEP does not credit many types of volume reduction systems such as green roofs, drainage swales and rooftop runoff BMPs (planter boxes, rain barrels and cisterns).

DEP is currently considering reducing the allowable stormwater runoff to 10% of current levels. This 900% reduction in runoff volume reflects the enormous uncertainty in calculations of sewer carrying capacity. The city's stormwater calculations evidently have sufficient uncertainty to tolerate some variability inherent in site-based stormwater management systems. Indeed, DEP is currently studying volume reduction strategies.

DEP's Upcoming Design Manual

DEP is developing a source control design manual that will contain approved designs and design considerations for use in New York City to comply with applicable codes and economic incentive packages. Many cities and states have recently published design manuals, but these do not describe New York City regulatory requirements and New York City-specific climate, geologic, hydrologic, and built conditions. The Design Manual will address different land use and building classifications; soil, bedrock, and groundwater conditions specific to different areas of New York City; climate conditions specific to New York City; and Administrative Code and permitting requirements for installing source controls, using examples from pilot and demonstration projects in New York City. The Design Manual will also include minimum maintenance requirements and procedures that will ensure effective source control performance over their design life. Maintenance requirements will take into consideration the sedimentation that can cause source controls to fail or perform less effectively over the years.

Task Force Proposal

This recommendation proposes that DEP build upon its existing efforts and enhance its own runoff coefficients by also using the nuanced coefficients developed by Chicago. It also proposes that DEP credit the detention storage capacity of site-based stormwater controls.

Environmental & Health Benefits

By facilitating the use of site-based stormwater management practices, this proposal will reduce combined sewage overflow (CSO). CSO events can expose swimmers to disease-causing bacteria and viruses, contaminate fish and shellfish and otherwise harm the New York Harbor.

This proposal was found to have no significant positive environmental impact.

This proposal was found to have no significant positive health impact.

Cost / Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

This proposal would bring New York City closer to Chicago's Chicago Stormwater Ordinance Manual. Under the proposal, NYC would align with Chicago in terms of the types of surfaces with runoff coefficients and the types of volume reduction strategies credited. Many other cities, such as Seattle, have stormwater plans similar to Chicago. For example, the Seattle Stormwater Facility Credit program:

- Gives credit for many BMPs including: green roofs, cisterns, bioretention, pervious pavement, etc.
- Developed to recognize that stormwater flowing through privately-owned flow control or treatment systems has less impact than stormwater that directly enters the City's stormwater system or area waterways.
http://www.seattle.gov/util/stellent/groups/public/@spu/@fom/documents/webcontent/spu01_003921.pdf

LEED

The effectiveness of this proposal relative to LEED certification will depend on the precise regulations that are adopted by the city when the program is implemented.

Various LEED credits across all the rating systems refer to detention facilities as one possible implementation to mitigate stormwater runoff. These LEED credits include

- NC SS 6.1 Stormwater Design: Quantity Control Option 1B
- LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control
- LEED CI-SS cr.1B Site Selection; LEED for Homes SS cr. 4 Surface Water Management
- LEED EB-SS cr. 5 Stormwater Management
- LEED ND-GCT cr.9 Stormwater Management (pilot program).

This proposal will assist in achieving credits which govern the reuse of treated wastewater, recycled wastewater and graywater, or captured rainwater for landscaping:

- LEED NC-WE cr. 1.1 & 1.2 Water Efficient Landscaping
- LEED for Schools-WE cr. 1.1 & 1.2 Water Efficient Landscaping
- LEED CI-SS cr.1 Options G&H Water Efficient Irrigation
- LEED EB-WE cr.1 Water Efficient Landscaping
- LEED ND-GCT cr. 16 Wastewater Management (pilot program).

For projects that reduce potable water use for building sewage conveyance through the use of water-conserving fixtures or non-potable water, the recommendation will result in easier compliance with:

- LEED NC-WE cr.2 OPTION 1 Innovative Wastewater Technologies
- LEED CI-SS cr.1 Option I Innovative Wastewater Technologies
- LEED for Schools-WE cr.2 OPTION 1 Innovative Wastewater Technologies
- LEED for Homes WE cr.1 Water Reuse
- LEED EB-WE cr.2 Innovative Wastewater Technologies.

Implementation & Market Availability

There are no known implementation issues associated with this proposal. The technology and materials required to support the reduction in stormwater runoff are widely available.

Notes

- The Department of Environmental Protection expressed concern about providing credit for alternative strategies that may have variable capacity for stormwater detention, such as cisterns or rain barrels. Rain barrels may not function following freezing periods, and water captured during one rainfall by rain barrels and cisterns may not be used prior to the next rainfall. On the other hand, rain barrels and cisterns offer the potential for reductions not only in stormwater, but also potable water use (by providing an alternative water source for landscaping). Other cities, such as Chicago, have approached the conflicting goals of predictability in stormwater retention and maximizing opportunity for reductions by limiting the credit that may be claimed by variable BMPs. This proposal follows this same approach by limiting the detention storage for cisterns and rain barrels to no more than 10% of the allowable flow rate.
- Definitions for terms used in the proposed code language can be found in the Chicago Stormwater Ordinance Manual.
- This proposal should be considered in the context of SS5, which establishes maintenance requirements for BMPs. As a result of the maintenance requirements, some of the alternative strategies in this proposal could only be utilized by larger sites with maintenance staff.

ENDNOTES:

¹ NYC DEP'T OF ENVIRONMENTAL PROTECTION, BUREAU OF WATER AND SEWER OPERATIONS, CRITERIA FOR DETERMINATION OF DETENTION FACILITY VOLUME, (2008) http://www.nyc.gov/html/dep/pdf/water_sewer/30.pdf.

² Ibid. (DEP's runoff coefficients are as follows: 1.0 roof areas; 0.85 pavement; 0.75 porous asphalt; 0.30 undeveloped areas; and 0.20 grass areas.).

³ CITY OF CHICAGO, IL., DEP'T OF ENVIRONMENT, STORMWATER MANAGEMENT ORDINANCE MANUAL, 23 (2008).

SW 6: MAINTAIN SITE-BASED STORMWATER DETENTION SYSTEMS

Administrative Code of the City of New York

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Site-based stormwater diversion and detention systems must be properly maintained to be a reliable component of the city's stormwater infrastructure.

Recommendation:

Establish maintenance standards for site-based stormwater systems, and require property owners to verify compliance.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Add a new Section as follows:

Maintenance and Performance Standards.

a. No later than July first, two thousand eleven, the department shall promulgate rules establishing maintenance and performance standards for stormwater detention systems constructed pursuant to a permit or requirement issued by the department. For the purposes of this section, "stormwater detention systems" shall include, but not be limited to, detention tanks, roofwater detention systems, drywells, gravel pits and any other stormwater detention systems allowed by the department.

b. No later than July first, two thousand eleven, the department shall promulgate rules requiring the owners of buildings that have received a permit pursuant to section 24-507 of the administrative code to submit an operations and maintenance plan for any stormwater detention systems included in such permit. Such rules shall require building owners to:

1. Include in the operations and management plan any activities required to keep the stormwater detention system in compliance with the rules promulgated pursuant to subdivision (a) of this section.
2. Maintain an inspection and maintenance logbook and make such logbook available for review by the department upon request.
3. Obtain certification no less than every five years from a third-party inspector authorized by the department to inspect stormwater detention systems. The department shall develop the documentation and performance standards and the testing protocols for such certification. The department shall establish an audit program, which will inspect no less than five percent of the certification reports submitted annually. The department shall be authorized to establish fines for failure to comply with the requirements of such certification program and fees for participation.

Supporting Information

Issue – Expanded

As a result of the green building movement, some cities are revisiting their approach to stormwater management. Many cities now seek to mimic natural systems for capturing stormwater, with approaches such as permeable pavement and detention basins, rather than relying solely on structural solutions to stormwater. Indeed, Staten Island's "Bluebelt" is a famous and enormously successful effort to reduce stormwater through both structural and non-structural, site-based systems such as engineered ponds, wetlands, outlet silting basins and sand filters.

Another proposal from the Task Force, *SW5: Encourage Innovative Stormwater Practices*, would require the NYC Department of Environmental Protection to develop regulations that will encourage site-based stormwater detention and diversion systems. These site-based systems, however, can only become a reliable part of the overall city stormwater system if they are maintained to ensure proper function. For example, permeable pavement requires periodic cleaning to remain porous, as do rooftop detentions systems and silting basins that can become clogged or silted up.

This proposal would require the department to develop maintenance standards to ensure that site-based stormwater systems can be reliable components of the citywide stormwater system.

Environmental & Health Benefits

Reduced runoff results in a reduction of combined sewer overflow (CSO) that in turn reduces the risk of exposure to disease-causing bacteria and viruses.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs.

Precedents

The City of Durham, North Carolina requires submittal of *BMP Annual Maintenance Certifications* (http://www.durhamnc.gov/departments/works/stormwater_bmp.cfm). Additionally, a certification is required of the person making the submittal (http://www.durhamnc.gov/departments/works/pdf/bmp2_maintenance_certifier.pdf).

LEED

The effectiveness of this proposal relative to LEED certification will depend on the precise regulations that are adopted by the city when the program is implemented.

This proposal may facilitate achieving the following credits that govern the reduction of stormwater volumes:

- LEED NC-SS cr. 6.1 Stormwater Design, Quantity Control
- LEED CI-SS cr.1B Stormwater Management, Rate and Quantity
- LEED EB-SS cr.5.1 & 5.2 Stormwater Management
- LEED for Schools SS cr. 6.1 Stormwater Design, Quantity Control
- LEED for Homes SS cr.4 Surface Water Management
- LEED ND-GCT cr.9 Stormwater Management (pilot program)
- other LEED pilot programs under development.

LEED for New Construction SS cr. 6.2 Stormwater Design, Quality Control requires the implementation of a stormwater management plan to reduce or eliminate water pollution. This plan must utilize acceptable Best Management Practices (BMPs). The BMP's are considered to meet with LEED if they are in accordance with standards and specifications from a state or local program that has adopted the LEED performance standards. Therefore, revisions to the code under this proposal may result in achieving LEED credits, provided that the standards comply with the criteria outlined in the reference guides.

Implementation & Market Availability

There are no known implementation issues associated for this proposal.

SW 7: ANALYZE STRATEGIES TO REDUCE STORMWATER RUNOFF FROM EXISTING DEVELOPMENTS

Study

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

To reduce combined sewer overflows, New York City must address already developed buildings and lots. These make up nearly 50% of the city's impervious surfaces, and they often release more runoff than permitted, largely due to new paving after initial construction.

Recommendation:

Undertake a study to assess the potential for reducing stormwater runoff from existing properties.

Proposed Legislation, Rule or Study

The City of New York should study options for increasing on-site stormwater management requirements for existing properties. The study should analyze and propose potential changes to the Building Code, Zoning Resolution, and sewer connection rules.

This study should focus on three specific areas:

1. **Upgrades During Reconstruction.** Evaluate the feasibility of requiring properties undergoing renovations to come into compliance with the requirements of the City Drainage Plan that were in effect at the time of the property's construction. Many existing properties release more runoff than their original allowance due to increased paving on-site or through a lack of maintenance for stormwater control systems. The study should determine the types, number, and location of properties that were subject to detention requirements at the time of their construction and analyze the ways that many properties have come out of compliance. The study should also evaluate methods to bring properties back into compliance and the costs associated with these actions. In addition, the study should analyze options for sites developed before any detention regulations were in place.
2. **Rooftop Detention.** Evaluate the feasibility of requiring buildings undergoing roof replacements to install rooftop detention systems (i.e. "blue roofs"). The study should evaluate the potential depth of water that could safely be detained on a rooftop both with and without requiring a full structural rooftop analysis. The study should analyze the effect that roof pitch and drainage configurations have on the performance of rooftop detention systems and develop recommendations for maximum allowable pitch. The study should propose a methodology to assess the storage and rate-of-flow impacts of rooftop detention. The study should also examine the effectiveness of rooftop detention systems at the time of freezing temperatures; analyze waterproofing and rooftop membrane surfacing; and offer recommendations for establishing a methodology for crediting rooftop detention systems by DEP for volume and rate of flow control.
3. **Rain Barrels.** Evaluate the feasibility of requiring residential properties undergoing renovations to install rain barrels on-site such that each rain barrel would be connected to the building downspout and equipped with an overflow mechanism that connects to the sewer system. The study should evaluate the size and quantity of rain barrels required by lot size; develop standards for overflow mechanisms; and examine the efficacy of rain barrels in both warm and cold weather.

For each of the three areas of investigation, the study should analyze the magnitude of renovation that could trigger a potential requirement; the threshold of property types and sizes that could be required to comply with potential new requirements; potential obstacles for adoption; and which exemptions might be necessary for adoption of these potential requirements.

The study should analyze the costs and benefits of any potential requirement. To analyze the costs of requiring on-site stormwater controls, the study should develop at least 5 scenarios showing the impact of how potential requirements could be implemented on prototypical sites. The study should also evaluate the costs for the City to review and enforce any new requirements.

This study should be a multi-agency effort, to include the Office of Long Term Planning and Sustainability (OLTPS), the Department of Buildings (DOB), and the Department of Environmental Protection (DEP).

Supporting Information

Issue – Expanded

While it is essential to reduce water runoff from new development, New York is an older and developed city so most stormwater comes from already developed sites. Buildings and developed lots account for 45% of New York City's land area. Therefore, it is essential to address runoff from existing sites and Part 1 of the study looks at how that can be achieved.

Part 2 of the study looks specifically at rooftop detention, which is a less expensive strategy for new development. Here a methodology must be developed to properly credit this detention technique. In addition, it could potentially be used as a central strategy for detention on existing sites. Because of a number of technical issues, including structural concerns, this technique needs to be studied in order to determine how and where it can be utilized.

Part 3 of the study relates to small sites. Currently, the method for controlling water runoff on small sites is too coarse. Adopting prescriptive rather than performance regulations may be the only feasible solution. The study should determine if rooftop detention and rain barrels are appropriate means to reduce runoff on small sites.

Environmental & Health Benefits

Reduced runoff results in a reduction of combined sewage overflow (CSO) that in turn reduces the risk of exposure to disease-causing bacteria and viruses.

This proposal was found to have a low, positive environmental indirect environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a study, which will have no direct impact on construction costs.

Precedents

Historically, stormwater regulations have applied to new developments. However, municipalities have started to place regulations on previously developed sites to reduce runoff. For example, within the City of Portland, Oregon, projects are subject to the requirements of their 2008 *Stormwater Management Manual*¹ if they:

- propose new offsite discharges or new connections to the public system, are required to comply with stormwater requirements for the impervious area draining to the discharge point, or
- develop or redevelop over 500 square feet of impervious surface.

The Maryland Department of the Environment composed the following stormwater management requirements for all redevelopment projects:

- reduce existing site imperviousness by 20%,
- provide water quality for 20% of the site's imperviousness,
- or a combination of both.

The Code of Maryland Regulations (COMAR 26.17.02.02) defines redevelopment as any construction, alteration, or improvement exceeding 5,000 square feet of land disturbance performed on sites where the existing land use is commercial, industrial, institutional, or multifamily residential.²

LEED

Under the LEED for Existing Buildings rating system, this proposal will facilitate achieving SS cr. 5.1 & 5.2 Stormwater Management, Rate and quantity reduction. This proposal requires that buildings achieve the site detention of their original permits, while LEED EB requires that measures be implemented to mitigate a percentage of the annual stormwater falling on the site. Project teams must determine for each individual project whether the code revisions result in the acquisition of LEED credits.

For any project with substantial improvement that is seeking certification under another rating system, this proposal will facilitate achieving similar LEED Sustainable Sites credits for Stormwater control by utilizing pervious site surfaces.

Depending on the permeable surface that is utilized, project teams may also be eligible for LEED credits relating to Heat Island Reduction as a result of this proposal. These Sustainable Sites subsections award points to projects for reducing irrigation, tempering the outdoor environment, and reducing cooling loads.

Implementation & Market Availability

The technology and materials required to support the reduction in stormwater runoff are widely available.

There are no known implementation issues for this proposal.

ENDNOTES:

¹ CITY OF PORTLAND, OR., 2008 STORMWATER MANAGEMENT MANUAL (2008), *available at* <http://www.portlandonline.com/BES/index.cfm?c=47952>.

² MD. CODE REGS. § 26.17.02.02 (2000) *available at* <http://www.dsd.state.md.us/comar/getfile.aspx?file=26.17.02.02.htm>.

UE 1: INCREASE BIODIVERSITY IN PUBLIC LANDSCAPES

Rules of the City of New York (New York City Department of Transportation and Department of Parks and Recreation)

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Historically, foreign species and monocultures have been widely used in landscaping to the detriment of the urban ecology. Native and diverse plants species tend to be hardy, require little water and fertilizer, and provide habitats for birds and other native animals.

Recommendation:

Promote diverse and native plant species by requiring their use on city-owned property, including buildings, parks and sidewalks.

Proposed Legislation, Rule or Study

City agencies should revise their planting rules, specifications and design manuals to conform to the standard below.

The following requirements shall apply to planting on city owned property.

1. No plant species shall be used if it is listed as invasive as defined and identified by the New York State Department of Environmental Conservation.
2. The following requirements shall pertain to various sites:

Type of Site	Native Species Requirement	Diversity Requirement
Green Streets Medians Sites ¹ < 0.5 acres	A minimum of 50% of all plant material ² shall be native species and drought and salt tolerant	N. A.
Sidewalks	A minimum of 75% of all trees proposed to be planted shall be drought and salt tolerant; minimum 30% shall be native.	Builder's Pavement Plan to include location and species of all trees, both existing and proposed, on each affected block. No single tree species shall be used for a length of more than four blocks. ¹
0.5 acres < Sites < 5 acres	A minimum of 60% of all plant material shall be native species and drought and salt tolerant	No single species shall comprise more than 30% and not more than 50% of any genus and not more than 70% of any family of the plant material.
Sites > 5 acres	A minimum of 75% of all plant material shall be native species and drought and salt tolerant	No single species shall comprise more than 10% and not more than 20% of any genus and not more than 30% of any family of the plant material.

Exemptions:

1. Historic parks that have significant stands or allees of viable, non-invasive, non-native trees.
2. Existing trees (or shrubs) shall not be removed to bring a project into compliance.

Supporting Information

Issue – Expanded

Landscaping has traditionally involved exotic plants and vast monocultures of turf grass. Non-native species are typically brought to North America without their predators and thus often outcompete native plant species. Many non-native species are prolific seed producers, escaping cultivation and colonizing new areas. Maintaining monocultures of turf grass requires the application of fertilizers and herbicides. Non-native species that have adapted to wetter conditions than New York, can also require regular watering.

Invasive species have caused millions of dollars in damage to agriculture, wetlands, water bodies and livestock. Ecologists estimate that invasive species overtake 3 million acres per year at a cost of \$123 billion annually: zebra mussel can shut down electrical utilities by clogging water intake pipes; leafy spurge causes \$144 million in livestock forage damage annually in Montana, North and South Dakotas and Wyoming; invading sea lampreys caused the collapse of the lake trout and other Great Lakes fisheries, costing the US and Canada approximately \$13 million annually to control; the Asian long-horned beetle required the destruction of 2000 trees in Brooklyn, costing the federal, state and city governments \$5 million (as of 1999).

In contrast, native species are already adapted to the local climate and ecosystem. They typically require less water than exotic plants and are hardier. When plantings are diverse, there is less need for pesticides and fertilizers. Native plants also provide habitats for local birds, insects and other animals.

Environmental & Health Benefits

Native and diverse plantings require less water and fertilization and are more likely to survive drought conditions and pathogens.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Prohibiting the use of invasive, non-native species reduces labor cost associated with grounds maintenance and reduces the cost of replanting after intended species have been overrun by invasive, non-native species.

Much greater savings are attributable to curtailing or suppressing the spread of invasive species and/or host pests that have destroyed natural areas such as forests, wetlands, water bodies, and economic resources such as fisheries, agriculture and timber production.

Precedents

The Federal Report of the National Performance Review, 1994, recommends "environmentally beneficial landscaping" at federal facilities and federally funded projects. The recommendations, which were incorporated into all federal programs and practices by February 1996, propose that federal agencies use regionally native plants for landscaping in a way that minimize adverse effects on the natural habitat.

Executive Order #13112 passed on February 3, 1999 promulgated during the Clinton administration states that a federal agency cannot authorize, fund or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States. This same Executive Order created the National Invasive Species Council that posts a list (updated every 2 years) of invasive species. Any state agency receiving federal funds, such as NYS DOT, must uphold the native planting requirement.⁵

The guidance highlights that using native plants and employing landscaping practices that conserve water and prevent pollution will minimize the adverse effects of landscaping on the environment.⁴

The current approved list of Street Trees published by NYCDPR 2009 contains 66% of native tree species.

New York State and New York City have a number of different groups focused on identifying invasive plant species. Unlike many other states, NYSDEC has yet to publish a list of invasive plants. Until such time, it is recommended to use the Brooklyn Botanic Garden list and the Cornell Cooperative Extension Invasive Species Clearinghouse.⁵

LEED

This recommendation may assist in achieving:

- LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat
- LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space
- LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat
- LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction.

These credits include options that require protecting a portion of the site area with native/adapted vegetation.

In addition, LEED EB-SS cr.1 Green Site and Building Exterior Management includes protecting natural areas among the possible measures to include in the management plan for obtaining this credit.

Implementation & Market Availability

There are no known implementation issues associated with this proposal.

Wholesale and retail nurseries and plant growers are greatly expanding the availability of native plant species.

Notes

A native species is:

- A species that reproduces in a region without human intervention;
- A species that co-evolves with and depends on other regional plants and animals for survival;
- A plant not transplanted to the region by humans accidentally or purposefully;
- A species that, with respect to a particular ecosystem, that historically occurred or currently occurs, other than as a result of human introduction, in that ecosystem.

ENDNOTES:

¹ Note: Site area is the unbuilt area of the site, and refers to both building sites and parks.

² Note: Plant material includes trees, hedges, shrubs, and perennial plants.

³ Press Release, US Dept. of Agriculture, President Clinton Expands Federal Effort to Combat Invasive Species (Feb. 3, 1999), available at <http://www.ladwpnews.com/go/doc/1475/182533/>. <http://www.nps.gov/plants/alien/pubs/eopress.htm>.

⁴ Dep't of Transp., Fed Highway Admin., Memorandum on Environmentally Beneficial Landscaping (Apr. 26, 1994) <http://www.fhwa.dot.gov/environment/042694em.htm>.

⁵ Brooklyn Botanic Garden, Pest Alert: Worst Invasives in the New York Metropolitan Area, available at http://www.bbg.org/gar2/pestalerts/invasives/worst_nym.html. (last visited Oct 20, 2009).

UE 2: INCREASE BIODIVERSITY IN SIDEWALK PLANTINGS

NYC Zoning Resolution

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Where groundcover is required under the Zoning Code, such as in sidewalk planting strips, standard practice is to use turfgrass. But, turfgrass is a water-intensive monoculture that requires pesticides and fertilizers.

Recommendation:

Prohibit the use of turfgrass within the sidewalk planting strips required in new developments.

Proposed Legislation, Rule or Study

Amendments to the New York City Zoning Resolution

1. Add the following definitions to Section 12-10 (Definitions):

Low Herbaceous plants

A “low herbaceous plant” is part of the family of plants that lack a permanent woody stem, are low-growing or creeping and include: grasses, native ground covers, “steppables” (herbaceous ground covers tolerant of limited foot traffic), herbs, perennials, annuals and vegetables. Both evergreen and deciduous plants may be herbaceous plants.

Native Meadow

A “native meadow” is a combination of native, warm-season grass types which may or may not contain perennials (flowers). Warm-season grasses have extensive root systems which make them far more drought tolerant than cool-season grasses that comprise turfgrass. Mature height ranges of the plants contained in a meadow typically vary from 8 inches to 36 inches depending on seed mix.

No-mow grass

“No-mow grass” is a spreading or stoloniferous grass (such as SR3100 Hard Fescue, Scaldis Hard Fescue, Dawson Red Fescue, Creeping Red Fescue or Sheep fescue) that ranges in mature height from 4 to 8 inches.

Turfgrass

“Turfgrass” is a spreading or stoloniferous grass that is comprised of cool-season grass seeds and requires regular mowing.

2. Amend Section 26-11 as follows:

26-11

General Purposes

The urban design guidelines are established to strengthen, at street level, the relationship of new developments with existing buildings and to improve the quality of the streetscape by:

- (a) maintaining the visual continuity of new developments at street level;
- (b) enhancing the visual character of the neighborhood; [and]
- (c) reducing conflict between pedestrian and vehicular circulation[.]; and
- (d) improving the environmental quality through sustainable landscape practices.

3. Amend Section 26-23 as follows:

26-23

Requirements for Planting Strips and Trees

A minimum three-foot wide planting strip shall be provided adjacent to and along the entire length of the required curb. Within the required planting strip, one tree of at least three inches in caliper shall be planted for every 25 feet of length of such planting strip. Driveways are permitted to traverse such planting strips, and utilities are permitted to be located within such planting strips. Within this planting strip, no #turf grass# shall be permitted.

4. Amend Section 26-42 as follows:

26-42

Planting Strips

In accordance with applicability requirements of underlying district regulations, the owner of the #development#, #enlargement# or converted #building# shall provide and maintain a planting strip. #Street# trees required pursuant to Section 26-41 shall be planted within such planting strip. In addition to such #street# trees, such strip shall be fully planted with [grass or groundcover] #native meadow# plantings, #no-mow grass#, #low herbaceous plants# or native ground covers, except that #street# trees within the planting strip shall have a minimum of a 3 foot diameter mulch bed at their base. #Native meadow# or other grasses shall be mowed once per year. Such planting strip shall be located adjacent to and extend along the entire length of the curb of the #street#.

Supporting Information

Issue – Expanded

32 million acres in the United States are planted in turfgrass, more than the acreage planted with crops. Although ubiquitous in private and public gardens across the country, turfgrass has many negative environmental attributes. It requires excessive amounts of water, causes water and air pollution, and has very low biodiversity.

Each day, approximately 7.9 billion gallons of potable water are used throughout the U.S. to irrigate landscapes that are largely comprised of turfgrass. In the Northeast, just 1000 square feet of turfgrass requires 624 gallons of water weekly and often more than 10,000 gallons over the course of the growing season. Almost 10% of the potable water in urban areas is used for landscaping.

Often, turfgrass is also fertilized with nitrogen and phosphorus. Both of these highly water soluble chemicals runoff into receiving waters with heavy rain or excessive irrigation. Phosphorus causes algal blooms that devastate fish and other organisms and upsets the ecology of aquatic systems. A 1000 square foot area of bluegrass requires 6 pounds of nitrogen fertilizer weekly. Pesticides used to treat turfgrass are also highly toxic and water soluble. About 7 million birds are estimated die annually throughout the US as a result of exposure to lawn pesticides.

In addition, lawnmowers are highly polluting and consume 58 million gallons of gasoline each year in the U.S. A typical lawn mower operating for one hour produces the same amount of air pollution as one new car running for 11 hours.

Finally, most turfgrass seed species are not native to the Northeast and as a result, insects do not feed on the grass blades. This reduces the presence of birds and other animals in New York City.

Environmental & Health Benefits

Reduced noise and air pollution from mowers and blowers; less damage to tree trunks from mowers; longer lifespans for street trees; greater habitat from diversified species.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

There are no known precedents for this proposal.

LEED

This recommendation may assist in achieving credit for:

- LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat;
- LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space;
- LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat; and
- LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction.

These credits include options that require protecting a portion of the site area with native/adapted vegetation.

For previously developed sites, LEED requires that a project utilize local and regional governmental agencies, consultants, educational facilities, and native plant societies as resources for the selection of appropriate native or adapted plant materials. LEED prohibits plant materials listed as invasive or noxious weed species. A project seeking these relevant LEED credits must support with research that turfgrass is in fact an invasive species.

This recommendation will also assist in achieving credit for:

- LEED NC-WE cr.1.1 & 1.2 Water Efficient Landscaping;
- LEED EB-WE cr.1.1 & 1.2 Water Efficient Landscaping;
- LEED for Schools-WE cr.1.1 & 1.2 Water Efficient Landscaping;
- LEED for Retail NC (pilot program) WE cr.1.1 & 1.2 Water Efficient Landscaping; and
- LEED ND (pilot program) GCT cr.3 Reduced Water Use.

These credits limit or eliminate the use of potable water for landscape irrigation, and include the selection of climate-tolerant plants.

Implementation and Market Availability

"No mow" grasses and native meadow grasses are readily available from multiple suppliers. Internet resources and botanical gardens offer extensive information on appropriate plant and seed selection, planting procedures, care and maintenance of turfgrass alternatives. University web sites such as University of Massachusetts, Rutgers University and University of Connecticut offer such resources.

Notes

Selection of the appropriate types of herbaceous plants depends on the soil type and sun and shade conditions but will typically survive without irrigation under normal annual rainfall in New York City. Selection of species should consider appropriate height, salt and drought tolerance and resistance to foot traffic.

For native meadows, annual mowing is required to prevent growth of woody plants. Mowing should be done in the fall and should retain between 6"-8" height of stems. Selection of the appropriate types or combinations of native grasses and wildflower perennials depends on the soil type and sun and shade conditions but will typically survive without irrigation or supplemental water under annual rainfall in New York City. Selection of species should consider appropriate height, salt tolerance, and resistance to foot traffic.

No-mow grass does requires mowing once or twice a year to prevent growth of woody plants. Selection of the appropriate type of no-mow grass depends on the soil type and sun and shade conditions but will typically survive without irrigation or supplemental water under annual rainfall in New York City. Select mixes that are appropriate for New York City's climatic zone (Zone 6) and use at least 3 seed types in the mix. Available and appropriate species are inherently salt and drought tolerant.

Turfgrass requires regular mowing, fertilizer and pest control-applications, and constant water application of at least 1" per week of supplemental water from a potable water source.

UE 3

CONSTRUCT SUSTAINABLE SIDEWALKS

Rules of the City of New York (New York City Department of Transportation and Department of Parks and Recreation)

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Sidewalks have the potential to reduce runoff, mitigate the urban heat island effect, promote the use of recycled materials and increase the longevity of trees. However, city rules and regulations for sidewalks are inconsistent and are, in some cases, impediments to green sidewalks

Recommendation:

Create a single consistent sidewalk standard that includes permeable strips, water storage capacity, increased planting and recycled materials.

Proposed Legislation, Rule or Study

The Department of Transportation and Department of Parks and Recreation should revise their sidewalk rules, specifications and details to conform to the standard below. In addition, information on agency websites should be coordinated and made consistent.

Proposed Sidewalk Standard:

1. Permeable Strip. Sidewalks shall include a continuous permeable strip at the curb side. The permeable strip shall conform to the following requirements:
 - i. Dimension shall be a minimum of 1/3 the sidewalk width (aka. the distance between the lot line and the curb) but not less than three feet wide along the curb side length of the sidewalk from lot line to lot line.
 - ii. Tree planting Zone within permeable strip: Planting zone shall be the minimum length and depth as defined by DRP in Tree Planting Standards: Sample Tree Pit Configurations, p. 20. Planting zone shall be backfilled with topsoil per same reference standard p.9-11. Planting may include single tree, grouped trees with or without shrubs or ground covers.
 - iii. Existing trees: Where existing trees are encountered in construction of a new permeable strip, the root mass shall be left undisturbed within the Critical Root Zone. Structural soil shall be placed outside of the Critical Root Zone.
 - iv. Tree Planting Spacing: Trees shall be planted either individually or in groups with a minimum distance of 10 feet on center to a maximum of 25 feet. Other spacing requirements shall be as defined by DOT, DPR, FDNY and MTA with the exception that a pattern book be developed to determine tree spacing from intersections based on sight lines, traffic direction and traffic control.
 - v. The Builder's Pavement Plan shall show all existing trees on the block, indicating the species, and show the proposed new trees, indicating the species.
 - vi. Requirements for non-planted permeable strips:
 - a. Surface material shall be permeable based on DOT material options applicable to neighborhood classification that are in the process of development by DOT.
 - b. Backfill Beyond Planting Zone within permeable strip: Between planting zones and within the full extent of the permeable strip, the backfill shall be Structural Soil as defined by DPR p. 4-7 with a depth no less than 24 inches from finished grade. The use of recycled concrete aggregate shall not be permitted due to its potential to alter the pH of the soil beyond the acceptable range for trees.
 - vii. Requirements for planted permeable strips:
 - a. Within this planting strip, no turf grass shall be permitted. Plants shall consist of: native meadow plantings, low herbaceous grasses or native ground covers, except that street trees within the planting strip shall have a 3 foot diameter/square mulch bed at their base.
 - b. Meadow or other grasses shall be mowed once per year.

Exceptions:

1. Sidewalk zones where the distance between the curb and the lot line is less than 9' - 0" wide.
2. Areas within any sidewalk which contain sub grade structures including but not limited to subway vents or

structures, critical utility infrastructure, sidewalk vaults, and electrical vaults.

3. Areas within curb cuts.

4. Historic sidewalks constructed of brick or granite or bluestone slabs.

5. Locations where rock is present within 3 feet below sidewalk grade.

2. Sidewalk zone beyond permeable strip shall conform to the following requirements:

i. Concrete shall consist of Type IIA Portland Cement, fly ash or blast furnace slag, size no.57 stone with recycled concrete, and Type 1A Natural sand. It shall achieve a compressive strength of 3,200 PSI 28 days after the pour. For weather ability, it is to be air entrained, having an air content of 6.5% give or take 1.5%. The concrete mixture shall contain a maximum of 400 lbs. of Portland cement per cubic yard of concrete. After July 1, 2013, this maximum shall be lowered to 300 lbs. of Portland cement per cubic yard of concrete. The aggregate mixture shall contain size no. 57 stone mixed with a minimum of 10% recycled concrete, measured by weight. The recycled concrete shall be no larger than .75 inches, with no more than 1% deleterious material.

ii. All unsatisfactory material shall be removed and replaced with suitable material. Organics such as grass and other plant material must be removed. The entire sub base must be compacted until firm. The sub grade should be wet down thoroughly and should be damp at the time of pouring.

iii. It is required that a minimum of six (6) inches of No. 3 (1/2") stone or gravel, with a minimum of 15% recycled concrete, recycled asphalt, or glass cullet, be placed under the sidewalk. After July 1, 2013, this minimum shall be raised to 25%. The recycled concrete shall be no larger than .75 inches, with no more than 5% deleterious material, and the glass shall be a maximum of .375 inches. Recycled asphalt shall not exceed 5% of the total weight, glass cullet shall be no more than 30% of the total weight, and there is no maximum for recycled concrete. The foundation must be sufficiently compacted.

iv. Alternatively, the foundation may be consist of a minimum of six (6) inches of Structural Soil as defined by the Department of Parks and Recreation.

Exception: The requirements for use of recycled materials shall be waived if recycled material cannot be obtained for less than a 10% premium over the cost of virgin material.

Supporting Information

Issue – Expanded

Sidewalks in NYC make up 8% of the city - over 24 square miles in total. This means that a small change related to the design and structure of sidewalk systems will have significant environmental, micro-climate, and health impacts. New sidewalks are regularly installed, while old ones are constantly being fixed, repaired, and replaced.

The Department of Transportation is responsible for regulating sidewalks, while the Department of Parks and Recreation is responsible for regulating the trees planted in those sidewalks. Their jurisdiction overlaps on issues such as the location of street trees, size of tree pits, materials within tree pits, and extent of structural soil within tree pits. Both agencies provide specifications and details (drawings) on tree pits and these documents are not consistent with each other.¹ In addition, the Department of Design and Construction has two sets of specifications for tree pit soil and plantings. The School Construction Authority uses details that are consistent with those of the Department of Transportation, and its own specifications for tree pits. All told, between the various city agencies and public authorities, there are at least 10 sets of inconsistent and sometimes conflicting specifications and drawings for sidewalk trees and tree pits.

This proposal would provide one standard sidewalk specification that would increase tree cover, reduce stormwater runoff, and decrease greenhouse gas emissions. It would require that the outer third of all sidewalks be permeable with at least 24" of structural soil below, referred to as "linear tree pit." As structural soil is 30% void, it can serve as a repository for storm water; almost all the rain in a 2" storm would be captured by a sidewalk designed to the proposed specification. By reducing stormwater runoff, the permeable strip will reduce flooding in sewers, subways, and roads, and reduce the pollution carried into waterways. It will also provide more root space for trees, ensuring a healthier tree canopy.

The specification also proposes that trees be planted closer together, increasing the number of trees in sidewalks. This will reduce urban heat island effect, increase natural shading and cooling through evapo-transpiration, and provide more pleasant sidewalks.

Finally, the proposal recommends that sidewalks use a concrete mixture with 50% less cement than typically used. Cement production is an energy intensive process that results in significant carbon dioxide emissions -1 ton of cement causes the release of 1 ton of CO2 emissions. Capping the amount of cement used in NYC sidewalks will reduce greenhouse gas emissions from cement manufacturing, while not decreasing performance. Using recycled material in sidewalks will also increase the amount of construction and demolition that is recycled, and reduce the amount of

environmental damage caused by quarrying.

Environmental & Health Benefits

This proposal will provide numerous environmental and health benefits, including reductions in greenhouse gas emissions, a decrease in stormwater, and a healthier, more widespread tree population.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.005%. It was thus categorized as incurring no capital cost increment.

Savings will ultimately be derived from reduced energy demand and reduced demand on sewage treatment plants.

Precedents

City of Los Angeles: Department of Public Works and Environmental Affairs jointly recommend investigation of technologies for permeable pavement systems and associated pilot projects, May 2008.²

US EPA: Advocates for permeable surfaces to control selected pollutants especially Total Suspended Solids, nutrients and metals in the National Management Measures to Control Nonpoint Source Pollution from Urban Areas, November 2005.³

FHWA: Provides diagrams and descriptions of permeable pavements, infiltration trenches and biofiltration in Stormwater Best Management Practices in Ultra urban Setting.⁴

Seattle: Currently revising its Stormwater Management Manual for Western Washington to account for advances in urban stormwater management. Anticipated to be passed in late 2009. Changes to the current code to include permeable pavement, bioretention and vegetated roofs.

http://seattle.gov/dpd/Planning/Stormwater_Grading_and_Drainage_Code_Revisions/Overview/default.asp

LEED

This recommendation may assist in achieving various LEED credits.

The following credits include options that require planting a portion of the site area with native/adapted vegetation:

LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat; LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space; LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat; and LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction.

Utilizing recycled concrete will assist in obtaining the following credits:

LEED NC- MR cr.4.1 & 4.2 Recycled Content; LEED CI-MR cr. 4.1 & 4.2 Recycled content; LEED EB-MR cr.2 Optimize use of Alternative Materials; LEED for Schools MR cr.4.1 & 4.2 Recycled Content; LEED for Homes MR cr. 2 Environmentally Preferable Products; and credits under the various pilot programs. Additionally, for concrete recycled on site, LEED MR credits relating to Construction Waste Management are available for diverting waste from disposal.

Various LEED credits refer to detention facilities to mitigate stormwater runoff. These LEED credits include:

NC SS 6.1 Stormwater Design: Quantity Control Option 1B; LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control; LEED ND-GCT cr.9 Stormwater Management; LEED CI-SS cr.1B Site Selection; and LEED for Homes SS cr. 4 Surface Water Management; and LEED EB-SS cr. 5 Stormwater Management.

The following LEED credits address mitigation of the heat-island effect through the use of permeable site surfaces:

LEED NC-SS cr. 7.1 Heat Island Effect, non-roof; LEED CI-SS cr.1D Heat Island Effect, non-roof; LEED EB-SS cr.6 Heat Island Reduction; LEED for Schools SS cr.7.1 Heat Island Effect, non-roof; LEED for Homes SS cr.4.1 Surface Water Management; LEED ND-GCT cr.10 Heat Island Reduction (pilot program).

Implementation and Market Availability

There are no known implementation issues for this proposal. Multiple local suppliers carry structural soil and there are many manufacturers of permeable pavements.

Notes

Mitigation Strategy for Locations Exhibiting Poorly Draining Soils

Proper tree planting methods recommend a percolation test in every proposed tree pit. In the condition of continuous tree trenches, percolation tests should be conducted every 50 feet if poorly drained soils are suspected. Poorly drained soils are those that percolate at less than 1 inch per hour. There are multiple mitigating measures that can be employed in this instance. One is the use of a vertical sump drain in which an approximately 8 inch diameter auger drills through the poorly draining soil until it reaches better draining soil. This column is then filled with sand to allow water to move from the poorly draining tree trench into free draining soil below. Another technique is to use underdrainage, or perforated plastic pipe wrapped in filter fabric. This method would use a continuous 4 to 6 inch diameter perforated plastic [HDPE] pipe wrapped in filter fabric with a connection to an outlet pipe or sewer line. A third option is to continuously slope the tree trench to a sump or to an area of better drained soils. A fourth option is to use tree species that are more adapted to periodically saturated soil conditions.

Evapotranspiration

One of the major benefits of more sidewalk trees is their ability to return moisture (rainfall) back into the atmosphere. A 6-8 inch caliper tree with a crown diameter of 20 feet can extract 6.21 inches of water in a 31 day period in July, or 0.2 inches per day, or 4.19 cubic feet of water per day or 30 gallons per day [Trees in the Urban Landscape, p. 80]. Evapotranspiration is a major mitigating factor in reducing concerns of soil saturation.

Rainfall Interception by Trees

The leaves, branches and trunks of trees intercept rainfall. Tests demonstrate that a 9 year old tree, 28 feet tall with a 19 foot canopy spread can intercept 68% [58 gallons per square foot] of a 0.5 inch storm event [86 gallons per square foot]. [<http://www.fs.fed.us/psw/programs/cufr/>]

Soil Volume Calculations

Current Department of Transportation (DOT) standards recommend that trees be planted in a tree pit of 5 feet by 5 feet by 3 feet depth. This is equivalent to a soil volume of 75 cubic feet. The Department of Parks and Recreation (DPR) recommends tree pits be as large as the sidewalk space permits, recognizing limitations of obstructions and required clearances. The current DPR/DOT recommended spacing of trees is 25'- 40'. Since there is no current provision for continuous trenches between trees, the tree root's ability to extend beyond the tree pit is highly compromised due to our heavily compacted and unsuitable urban soils. The calculation of appropriate soil volume is based on many criteria including the soil quality, water holding capacity, tree canopy at maturity, availability of adjacent soil into which tree roots can expand, microclimate and the like. Research has demonstrated that shade trees in NYC's climate will attain greater height and canopy spread, survive longer, and sustain drought better with more soil volume. This proposal provides the following:

Tree Trench Width/Depth	On center Tree Spacing	Soil Volume per Tree
4 feet x 24 inches	10' - 15'	80 - 120 cubic feet
4 feet x 24 inches	20' - 25'	160 - 200 cubic feet
5 feet x 24 inches	10' - 15'	100 - 150 cubic feet
5 feet x 24 inches	20' - 25'	200 - 250 cubic feet
6 feet x 24 inches	10' - 15'	120 - 180 cubic feet
6 feet x 24 inches	20' - 25'	240 - 300 cubic feet

The basic proposal is for a 24 inch deep continuous tree trench backfilled with structural soil beyond the immediate root ball zone. Trees planted initially at larger calipers (greater than 5 inches) will need deeper tree pits, however the trench beyond the root ball can remain 24 inches and retain effectiveness. This is due to the fact that the overwhelming majority of tree roots, particularly the feeder roots, are located within the top 6 to 24 inches of the soil. Roots only grow where the physical and chemical environment is correct in terms of temperature, moisture, aeration, pH, nutrient supply and soil moisture. Furthermore, a continuous trench between trees allows for shared root space so the actual available volume is greater. To date there is no conclusive research that allows a determination as to how much less soil volume can be specified if soil volumes are contiguous, but research shows that tree roots in natural settings extend 2 to 4 times the diameter of the crown.

Stormwater Catchment Area of Sidewalk Tree Trench

The stormwater catchment area used in the calculations in this proposal assumes a continuous and even cross slope on a sidewalk from the building face to the edge of the trench plus the water falling directly on the trench. Therefore, on a 15 foot wide sidewalk, there would be a 5 foot wide permeable tree trench and a 10 foot wide zone of impervious surface draining into the trench. This assumes in a typical 100 foot long trench a catchment area of 1000 SF of impermeable surface and 500 SF of permeable surface contributing water to the trench.

ENDNOTES:

¹ CITY OF NEW YORK ADC. LAW § 28-108 (2007) available at <http://codes.lp.findlaw.com/nycode/ADC/28/1/108/28-108.1> (requires a builders pavement plan for new construction or alteration, compliance with Department of Transportation regulations, and compliance with NYC ADC LAW §19-113 &19-115 (2007). The Department of Transportation has "Standard Specifications" dated 1986 and standard detail for tree pit, topsoil and granite block pavement (H-1046) dated 1981. These are inconsistent with Department of Parks and Recreation "Tree Planting Standards" dated April 2008.).

² CITY OF LOS ANGELES, INTER-DEPARTMENTAL CORRESPONDENCE (May 21, 2008) available at eng.lacity.org/.../2008%2F200805%2F20080521/.../20080521_ag_br_st_san_ce_1_tr1.pdf

³ U.S. EPA, Polluted Runoff ,Nonpoint Source Pollution, National Management Measures to Control Nonpoint Source Pollution from Urban Areas (November 2005), <http://www.epa.gov/owow/nps/urbanmm/index.html#08>

⁴ U.S. DEP'T OF TRANSP., FEDERAL HIGHWAY ADMINISTRATION , STORMWATER BEST MANAGEMENT PRACTICES IN AN ULTRA-URBAN SETTING: SELECTION AND MONITORING (2002) available at <http://www.fhwa.dot.gov/environment/ultraurb/index.htm> (last visited Oct. 20, 2009).

UE 4: PRESERVE “100-YEAR OLD” TREES

Study

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

Large, old trees offer significant benefits to the city by providing cooling, shade, habitat, and carbon sequestration, as well as significant aesthetic benefits.

Recommendation:

Establish a voluntary program whereby property owners can obtain plaques for their “100-year old” trees, which could also be added to a map of significant trees.

Proposed Legislation, Rule or Study

The Site & Site Stormwater Committee recommends that the Department of Parks and Recreation establish a voluntary program whereby:

1. The owner of a tree located on private property that, in the judgment of the department, is at least 100 years old may obtain a plaque recognizing the tree as a “historic tree,” including identification of the species type; and
2. The department publishes a map identifying the location of such historic trees.

Supporting Information

Issue – Expanded

Large trees make up much of New York City’s urban forest and provide extensive environmental, economic, social, aesthetic and recreational benefits. A recent study by the Department of Parks and Recreation estimated the annual financial benefit of the city’s street trees at about \$122 million.¹ Trees reduce the urban heat island effect, remove air pollutants and carbon dioxide, sequester runoff, alleviate flooding, provide wildlife habitat, lower energy use in buildings, and provide for more comfortable microclimates. Typically, these benefits are most evident in large trees since they have more biomass than smaller ones. Detailed information on the benefits of trees is discussed in the Notes section of this proposal.

Trees on public property fall under the jurisdiction of NYCDPR and are subject to that agency’s removal and restitution policies. Most of the city’s trees, however, are located on private property. Their care and any decision to remove them is exclusively the decision of property owners.

The voluntary program recommended in this proposal would foster community pride in the city’s oldest trees, encouraging their proper care and protection.

Environmental & Health Benefits

Any increase in tree cover retention from this proposal will provide the range of environmental and health benefits associated with trees.

This proposal was found to have a positive, indirect environmental impact.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is for a voluntary program and is therefore expected to not have any impact on capital costs.

Precedents

Tree ordinances that are based on the mature canopy size are currently being developed and tested throughout the United States. These canopy ordinances have several commonalities:

- Ordinance requirements are triggered by a development activity
- A pre-development tree inventory is required
- Trees being conserved must be protected throughout the construction project
- On-site inspections are made by the local government authority
- There is a maintenance requirement

As with any ordinance, the success of tree canopy preservation ordinances depends on community acceptance, compliance and enforcement. In addition, in order to facilitate successful implementation, these ordinances depend on detailed tree species lists that identify tree species worthy of preservation, expected canopy size at full maturity, and the replacement (penalty) if a tree is not protected. Example ordinances from other jurisdictions include the following:

- City of Charlotte (NC) Tree Ordinance of City Code, Chapter 21, Article III, Section 21-62
- City of Providence (RI) Code of Ordinances, Chapter 27 Zoning, Article IV Supplementary Regulations, Section 425 Landscape and Tree Preservation
- City of Pasadena (CA) Municipal Code, Title 8, Chapter 8.52 City Trees and Tree Protection Ordinance
- City of Austin (TX) Code, Title 25, Chapter 25-8, Subchapter B, Division 2. Protected Trees
- City of Thousand Oaks (CA) Municipal Code, Title 5, Chapter 24. Landmark Tree Preservation and Protection
- City of Palo Alto (CA), Municipal Code, Chapter 8.10.090, Designation of Heritage Trees.
- City of Seattle (WA), Heritage Tree Program, available at <http://www.seattle.gov/transportation/heritagetree.htm>²
- City of Johnston (IA), Code of Ordinances, Building and Property Regulations, Chapter 151, Tree Protection and Conservation.
- City of Chesapeake (VA), Landscape Ordinance, Section 19-602: Tree Preservation and canopy requirements <http://livepublish.municode.com>
- Athens-Clarke County (GA) Code of Ordinances, Part III, Chapter 8.7 Community Tree Management
- Prince George’s County (MD) Woodland Conservation and Tree Preservation Policy <http://www.pgplanning.org>

LEED

This recommendation may assist in achieving LEED NC-SS cr.5.1 Site Development, Protect or Restore Habitat; LEED EB-SS CR.4 Reduced Site Disturbance, Protect or Restore Open Space; LEED for Schools-SS cr. 5.2 Site Development, Protect or Restore Habitat; LEED for Homes-SS cr.1 Minimize Disturbed Area of Site; and LEED for Retail NC (pilot program)-SS cr.5.1 Site Development, Protect or Restore Habitat. These credits include protecting a portion of the site area with native/adapted vegetation.

LEED ND (pilot program)-GCT cr.7 Minimize Site Disturbance during Construction, will specifically address protection of trees based on type, condition, horticultural value, etc. This recommendation will be directly applicable to obtaining this LEED credit.

In addition, LEED EB-SS cr.1 Green Site and Building Exterior Management includes protecting natural areas among the possible measures to include in the management plan for obtaining this credit.

Implementation & Market Availability

There are no known impediments to this voluntary program proposal.

Notes

How Big is a “100 Year Old” Tree?

The size of a 100-year old tree varies greatly depending on its species, and estimating age is an inexact science. The most common method for estimating the age of a living tree is to measure its diameter, but this method can only ever be a rough estimate because:

- Growth rate is a function of the specific conditions under which a tree is growing
- There is a big difference in growth rate between hardwood and softwood trees
- Trees slow down in putting on caliper as they get older

Hardwood trees such as oak and ash may only increase in girth by ½ inch per year whereas softwood trees or faster growing species such as maple and pines can put on as much as ¾ inch per year. Below are some examples of the diameter (measured a 24” dBH – diameter at breast height – 4’-6”) of a 100 year old tree of various species:

- Oak: 24” caliper DBH
- Birch: 34” caliper DBH
- Basswood: 44” caliper DBH

What Are the Benefits of Large Trees?

Larger trees provide the following specific benefits at a greater capacity than smaller trees:

- Tree canopies reduce the fast rate at which rain falls to the ground. Water enters the ground more slowly under

trees and is better absorbed and filtered into the ground than when water runs off surfaces. One hundred percent of rainfall is intercepted at the beginning of a storm event and drops to 3% at maximum rain intensity. A 28 foot tall tree with a 19 foot spread can intercept 68% of a 0.5 inch storm event.

- Tree roots absorb soil water that contain both nutrients and pollutants. Some pollutants are transformed by plant roots through metabolic processes and others are trapped in woody tissues and are released only when a tree decomposes. In one growing season, a 24” caliper maple tree can remove 120 mg of cadmium, 280 mg of chromium, 1640 mg of nickel, 10,400 mg of lead from the environment.
- Trees absorb carbon dioxide and produce oxygen through photosynthesis. Trees therefore act as a carbon sink by removing carbon and storing it as cellulose in their trunks, branches, leaves and roots while releasing oxygen back into the atmosphere. A single, mature tree can absorb carbon dioxide at a rate of 48 lbs/year and release enough oxygen back into the atmosphere to support 2 people for a year. A small tree (3” caliper) produces 6 lbs of oxygen per year; a medium tree (9-12” caliper) produces 49 lbs of oxygen per year; a mature tree (27-30” caliper) produces 148 lbs of oxygen per year or 24 times the amount of a small tree and 3 times the amount of a medium tree. Each person in the United States generates approximately 2.3 tons of carbon dioxide each year. A mature tree stores about 13 pounds of carbon annually.³
- Trees also remove other gaseous pollutants by absorbing them through their leaf surface. Some of these pollutants are: sulfur dioxide, ozone, nitrogen oxides and chlorofluorocarbons.
- Trees evapotranspire; thereby contributing moisture and cooling into the atmosphere,⁴

ENDNOTES:

¹ David Randall, Maybe Only God Can Make a Tree, but Only People Can Put a Price on It, N.Y. TIMES, April 18, 2007, available at <http://www.nytimes.com/2007/04/18/nyregion/18trees.html>. (The estimate of the total value from trees includes an assessment of the increase in property values, reduced energy consumption from shading, and carbon dioxide absorption. According to another survey of trees in three NYC neighborhoods, the estimated environmental benefit of a NYC tree is \$3,225. During the summer of 2002 Citizen Pruners surveyed and mapped trees in three neighborhoods of New York City. The USDA Forest Service and SUNY used this tree data in their analysis to determine the environmental and economic benefits in each of the 3 neighborhoods surveyed. There were 322 trees surveyed in the three project sites: 50 in Hunts Point in the Bronx, 60 in the Lower East Side of Manhattan, and 212 in New Brighton on Staten Island. The value of the 50 trees surveyed in the Bronx was estimated at \$26,508.00, with a mean value of \$530.16. The total amount of carbon sequestration conducted by the 50 trees in the Bronx is 131.26 kg/year with a mean value of 2.63 kg/year. The total value of the 60 trees surveyed in Manhattan was \$35,981.00 with a mean value of \$599.68. The total amount of carbon sequestration conducted by the 60 trees in Manhattan is 182.77 kg/year with a mean value of 3.05 kg/year. The total value of the 212 trees on Staten Island was \$975,969.00 with a mean value of \$4,603.63. The total amount of carbon sequestration conducted by the 212 trees on Staten Island is 4,005.14 kg/year with a mean value of 18.89 kg/year. NYC Oasis Cooperative, Neighborhood Tree Survey, http://www.oasisnyc.net/resources/street_trees/default.asp) (last visited Jan. 26, 2010).

² CITY OF SEATTLE, WA., URBAN FOREST MANAGEMENT PLAN (2007), http://www.seattle.gov/environment/documents/Final_UFMP.pdf.

³ David J. Nowak, Atmospheric Carbon Reduction by Urban Trees, 37:3 JOURNAL OF ENVIRONMENTAL MANAGEMENT 207-217 (1993); and DAVID J. NOWAK, USDA FOREST SERVICE GENERAL TECHNICAL REPORT, BENEFITS OF COMMUNITY TREES, BROOKLYN TREES.

⁴ CENTER FOR URBAN FOREST RESEARCH, IS ALL YOUR RAIN GOING DOWN THE DRAIN? (2002), <http://www.fs.fed.us/psw/programs/cufr/products/newsletters/UF4.pdf>; and THE TRUST FOR PUBLIC LAND, ARGUMENTS FOR LAND CONSERVATION: DOCUMENTATION AND INFORMATION SOURCES FOR LAND RESOURCES PROTECTION (Mike McAlinney, ed. 1993).

UE 5

PROTECT STREET TREES FROM CONSTRUCTION ACTIVITIES

New York City Building Code

Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:

While sidewalk sheds protect pedestrians during the construction, maintenance and inspection of buildings, they can cause considerable damage to trees. Limbs are often damaged or removed, and the trees are cut off from access to sun and moisture, often resulting in the weakening or even death of the tree.

Recommendation:

During construction, require that street trees be protected and watered, and that any pruning be performed by a professional.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 3302 by adding the definition of “certified arborist”:

CERTIFIED ARBORIST. A person designated as a certified arborist in accordance with rules or guidelines established by the department of parks and recreation.

2. Amend Section 3307.6.3 as follows:

3307.6.3 Design of sidewalk sheds. All sidewalk sheds shall meet the following design requirements:

1. All sidewalk sheds shall be designed by an engineer.

Exception: Sidewalk sheds that follow a standard design approved by the department or the Board of Standards and Appeals.

2. If any tree trunk or tree canopy will be located within the area of a sidewalk shed, a certified arborist shall develop and submit a mitigation plan to the department prior to the construction of any sidewalk shed. Any required pruning or limb removal shall be performed by a certified arborist prior to construction of the sidewalk shed. Such mitigation plan shall:

a. include photographs of the existing street trees in accordance with the protocols of the department of parks and recreation for photographing trees;

b. describe the tree pruning and limb removal to be performed by a certified arborist along with adjustments to the design of the sidewalk shed necessary to protect and accommodate the existing street trees, including notching of any decks or railings; and

c. identify the appropriate times of year within the project schedule for any tree pruning or limb removal and a schedule/timeline for undertaking any such work.

3. Sidewalk sheds shall not extend over the crown of any tree, nor shall any tree leader be removed. No more than 20% of the limbs of any tree shall be removed during pruning.

3. Add a new paragraph 9 to Section 3307.6.4 as follows:

9. After the removal of the sidewalk shed, a certified arborist shall inspect the trees, perform any further compensatory pruning as required, and may order the removal or replacement of any trees that have been too damaged to survive. The caliper of any replacement trees shall be a minimum of 4 inches. Sign off for the project shall include documentation of any tree replacements specified by the certified arborist.

4. Add a new definition to Section 3302.1 as follows:

DRIP IRRIGATION BAG. A polyethelene plastic bag with nylon webbing that is placed around the base of a tree to provide water.

5. Add a new paragraph 3 to Section 3307.6.5 as follows:

3. Trees covered by sidewalk sheds shall be equipped with drip irrigation bags to provide water and shall be refilled weekly during the period for which the sidewalk shed is erected.

Supporting Information

Issue – Expanded

Sidewalk sheds are a regular feature of the New York City streetscape due to construction activity and façade inspections. Each year, the Department of Buildings issues tens of thousands of buildings permits for new construction and building renovations and Local Law 11 requires erection of scaffolding and sidewalk sheds to perform façade inspections and maintenance. As of February 2008 there were 4500 sidewalk sheds in place throughout the 5 boroughs.

Unfortunately, sidewalk sheds can damage and even kill trees. Sidewalk sheds cast shade over sidewalk trees, prevent rainwater from reaching tree roots and damage tree crowns. The installation of sidewalk sheds or construction activity sometimes damage tree leaders (main vertical limb), resulting in permanent deformation of trees so that the tree no longer grows vertically. Broken side branches that are not removed with clean cuts provide avenues for diseases and can eventually cause the demise of trees.

Environmental & Health Benefits

Tree survival and growth will increase shading around the city, lowering the street temperature in the summer and reducing the demand for air conditioning in buildings. Trees also absorb air pollutants and carbon (NYC trees absorb 42,300 tons per years), which helps to counteract the urban heat island effect.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost / Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.0% to 0.01%, depending on building type. It was thus categorized as incurring no to a low capital cost increment.

Precedents

The City of Hayward, California has a Tree Preservation Ordinance that requires a permit to disfigure or remove a protected tree.¹ The ordinance defines protected trees as certain species, trees of certain height and width, street trees, memorial trees, and trees that are planted to replace protected trees.² Several jurisdictions around the world also require protection of tree during construction, including the United Kingdom and the City of Sidney, Australia.³

LEED

For new construction projects, this proposal may facilitate achieving LEED NC-SS Cr.5.1 Protect or Restore Habitat. Though LEED pertains to the property itself, if adjacent sidewalks are deemed part of a "site", then street tree protection could become part of the 50% "protected" area under Option 2. LEED 2009 allows a 20% protected region for the total site (including building footprint) if that total site area exceeds the site area with the building footprint excluded.

For existing building projects, this proposal may facilitate achieving LEED EB-SS cr. 1.1 & 1.2 Green Site and Building Exterior Management. This credit requires developing a plan to preserve ecological integrity. Tree protection could be included as one component of such management plan.

This proposal may also facilitate achieving LEED for Homes SS cr. 1.2 Site Stewardship, which refers specifically to a tree or plant preservation plan; and LEED ND GCT cr.7 Option 3, Minimize Site Disturbance During Construction, which relates entirely to tree protection.

Implementation & Market Availability

The region has many ISA certified arborists that are very competitively priced. Hourly rates in the NYC area range from \$16.50 to \$23.50 per hour. Drip irrigation bags (gator bags) cost \$16.50 per 20-gallon bag and are manufactured by many companies

Notes

Drip irrigation bags must be sized according to tree caliper. A 20 gallon-capacity bag (standard size) is recommended for a 1" - 4" caliper tree; a 50 gallon-capacity bag is recommended for a 4" - 8" caliper tree.

ENDNOTES:

¹ HAYWARD MUNICIPAL CODE § 10-15.20, available at <http://www.hayward-ca.gov/municipal/HMCWEB/TreePreservation.pdf> (last visited Jan 3, 2010).

² ID. AT § 10-15.12 (defining "certified arborist," "cutting," "damage" and "disfigurement").

³ Town and Country Planning Act of 1990 § 8,1,1 U.K. OPSI § 197-214 (1990) available at http://www.opsi.gov.uk/acts/acts1990/Ukpga_19900008_en_1.htm (has rules and language on tree protection during construction.); (Scaffolding permits for the City of Sydney Australia also require documentation of street trees. See Application for Approval - Temporary Structures, available at www.cityofSydney.nsw.gov.au/Development/documents/forms/ApplicationForScaffolding-NewLegislation.pdf).