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 turn 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 straightforward process is necessary to ensure proper performance.

Section 1513.7 Commissioning Requirements in Seattle’s energy code carries supporting data in a Client Assistant Memo 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 owner (2).

LEED

LEED requires Fundamental Commissioning of the Building Energy Systems as an Energy & Atmosphere Prerequisite 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 designs, 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:**
