



# Nebraska's Commercial Energy Code: *COMcheck Walk-through*

Nebraska Energy Code Training Program

Instructor: Matt Belcher

July 19, 2023: 10:00 am – 12:00 pm CST





# Housekeeping

- Attendees are muted upon entry
- Enter questions in the chat box
- This training is being recorded
- Slides and recording will be emailed to attendees and posted on the MEEA website
- CEUs are provided (ICC and AIA)
- Email John at [jgossman@mwalliance](mailto:jgossman@mwalliance) with any questions

# About MEEA

- MEEA is a nonprofit membership organization with 160+ members, including:
  - Utilities
  - Research institutions
  - State and local governments
  - Energy efficiency-related businesses
- MEEA helps stakeholders understand and implement cost-effective energy efficiency strategies



# About the Nebraska Training Program

- Goal: prepare the Nebraska workforce for upcoming changes in construction best practices
  - Residential and Commercial Energy Code
  - Building Science
  - Practical Solutions
- Focused on providing training to builders, code officials, design professionals, public officials and students
- For more information, visit:  
<https://www.mwalliance.org/nebraska-energy-codes-training-program>



# About Matt Belcher



- 40+ Years in the Building Industry
- Served as a Top Building Codes official in the St. Louis area
- Director of University of Missouri Columbia High Performance Buildings Research Center - Created and Instructed Curriculum for Students and Industry Professionals
- Currently Assisting University of Missouri Science & Technology in Building and Energy Code Curriculum and Policy
- ICC Member serving on 2012, 2015, 2018 and 2024 Energy Code Development Committee and 2021 Building Code-General Committee
- NAHB Approved Instructor for Advanced Building Science,
- Advanced Business Management





# Upcoming Events

## Nebraska Energy Codes Collaborative Meeting

- In-person in Lincoln, NE on **Tuesday, August 15**
- 9:30am - 12pm CT, lunch provided

## Nebraska Energy Code: All About the 2018 IECC, 2021 IECC, and Beyond

- Online, **Thursday September 7**, 1 - 2:30pm CT

## MCC Course: Foundations for Residential and Commercial Energy Code Compliance in Nebraska

- Online, Tuesdays 6 - 8pm CT
- **September 13 - October 3**





**14TH ANNUAL**

# **MIDWEST BUILDING ENERGY CODES CONFERENCE**

**Indianapolis, IN**  
**September 13-14**





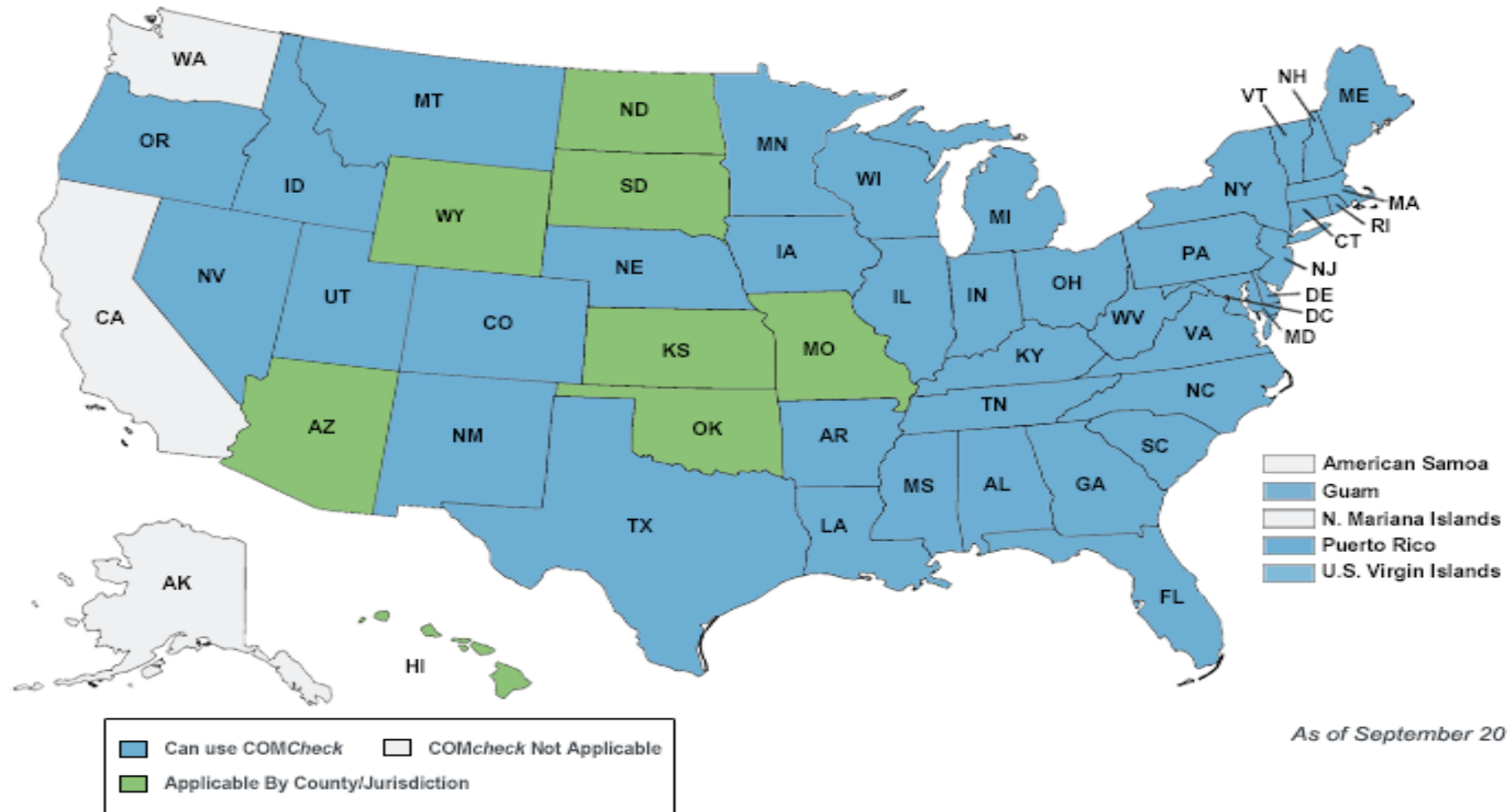
# COMcheck Learning Objectives:

Basics of using the COMcheck software, reviewing generated compliance reports, and the latest and greatest new features.

1. Obtain an overview of the basic functions and how COMcheck calculates compliance for the building envelope, interior and exterior lighting.
2. Be able to identify the construction specifications needed to complete a compliance calculation in the software.
3. Learn how to enter the building envelope, lighting, and mechanical components into the software.
4. Understand how the compliance reports are created and what they entail.



# States that allow COMcheck





- COMcheck-Web simplifies commercial and high-rise residential energy code compliance.
- It performs just like [COMcheck](#), the desktop version, but you don't need to download or install any software on your computer.
- *Can exchange files between desktop and web*



# COMcheck/COMcheck Web

The *COMcheck* software product group makes it easy to determine whether new commercial or high-rise residential buildings, additions, and alterations meet the requirements of the IECC and ASHRAE Standard 90.1,

*COMcheck* also simplifies compliance for building officials, plan checkers, and inspectors by allowing them to quickly determine if a building project meets the code.



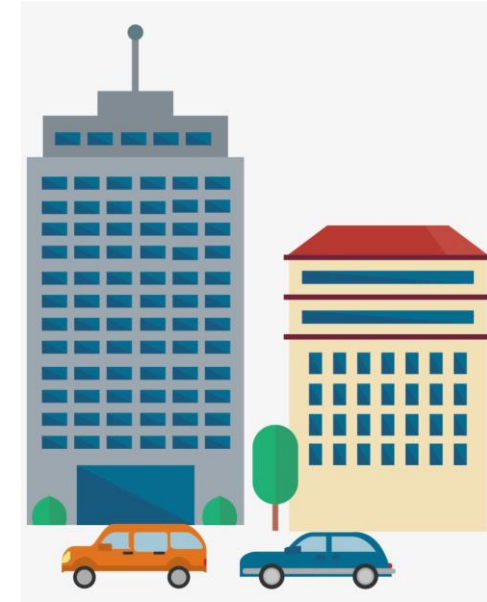
# Commercial Buildings in the IECC

Under the Purview of the Commercial Code

- ✓ Buildings with commercial use
- ✓ Multifamily residential buildings four stories or greater in height

**Not** Under the Purview of the Commercial Code

- x One- and two-family residential
- x R-2, R-3, R-4 three stories or less in height



# What About Mixed Use? – C101.4.1

- Treat the residential building portion under the applicable residential code
- Treat the commercial building portion under the commercial code
- Code Official has final authority

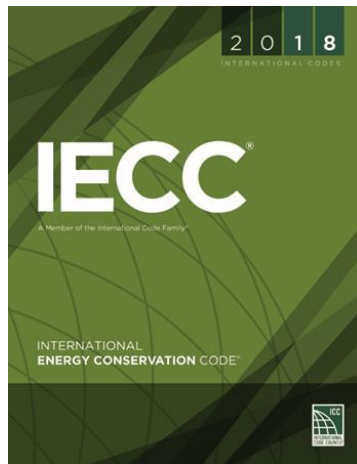


Image: agarch.com

# Commercial Compliance Options

**ASHRAE 90.1-2016**

OR



## **2018 IECC – Prescriptive**

- ✓ C402 – Envelope
- ✓ C403 – Mechanical
- ✓ C404 – SWH
- ✓ C405 – Lighting

**AND Pick at Least One C406:**

- C406.2 – Eff. HVAC Performance
- C406.3 – Reduced Lighting Power
- C406.4 – Enhanced Lighting Controls
- C406.5 – On-site Supply of Renewable Energy
- C406.6 – Dedicated Outdoor Air System
- C406.7 – High Eff. Service Water Heating
- C406.8 – Enhanced Envelope Performance
- C406.9 – Reduced Air Infiltration

OR

## **2018 IECC – Performance**

- C407 – Total Building Performance
- C402.5 – Air Leakage
- C403– Mandatory Mechanical Provisions
- C404 – SWH
- C405 - Lighting
- Building energy cost to be < 85% of standard reference design building

# 90.1 Simplified Approach Option for HVAC Systems

The simplified approach is an optional path for buildings that meet these criteria:

- Building is two stories or fewer in height.
- Gross floor area is less than 25,000 sq. ft.
- System serving single HVAC zone
- Each HVAC system in the building must comply with all 19 requirements.



# COMcheck Who may submit:

- The commercial energy code requires that a registered professional submit compliance documentation (construction documents and compliance verification).
- In the IECC, Section C103.1 Construction Documents, General, the wording states that construction documentation and other supporting data shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the code official is authorized to require necessary construction documents to be prepared by a registered design professional.





# Landing Page

**COMcheck-Web™**

Project title: 2009 IECC

Email Address | Password | Log In

Register | Forgotten Password?

New Project

PROJECT | ENVELOPE | INT. LIGHTING | EXT. LIGHTING | MECHANICAL

Reports

Code/Location

Code: 2009 IECC

State: Alabama

City: Abbeville

If your location is not included here, choose a nearby location with similar weather conditions.

Project Type

New Construction  Addition  Alterations

Project Details (optional)

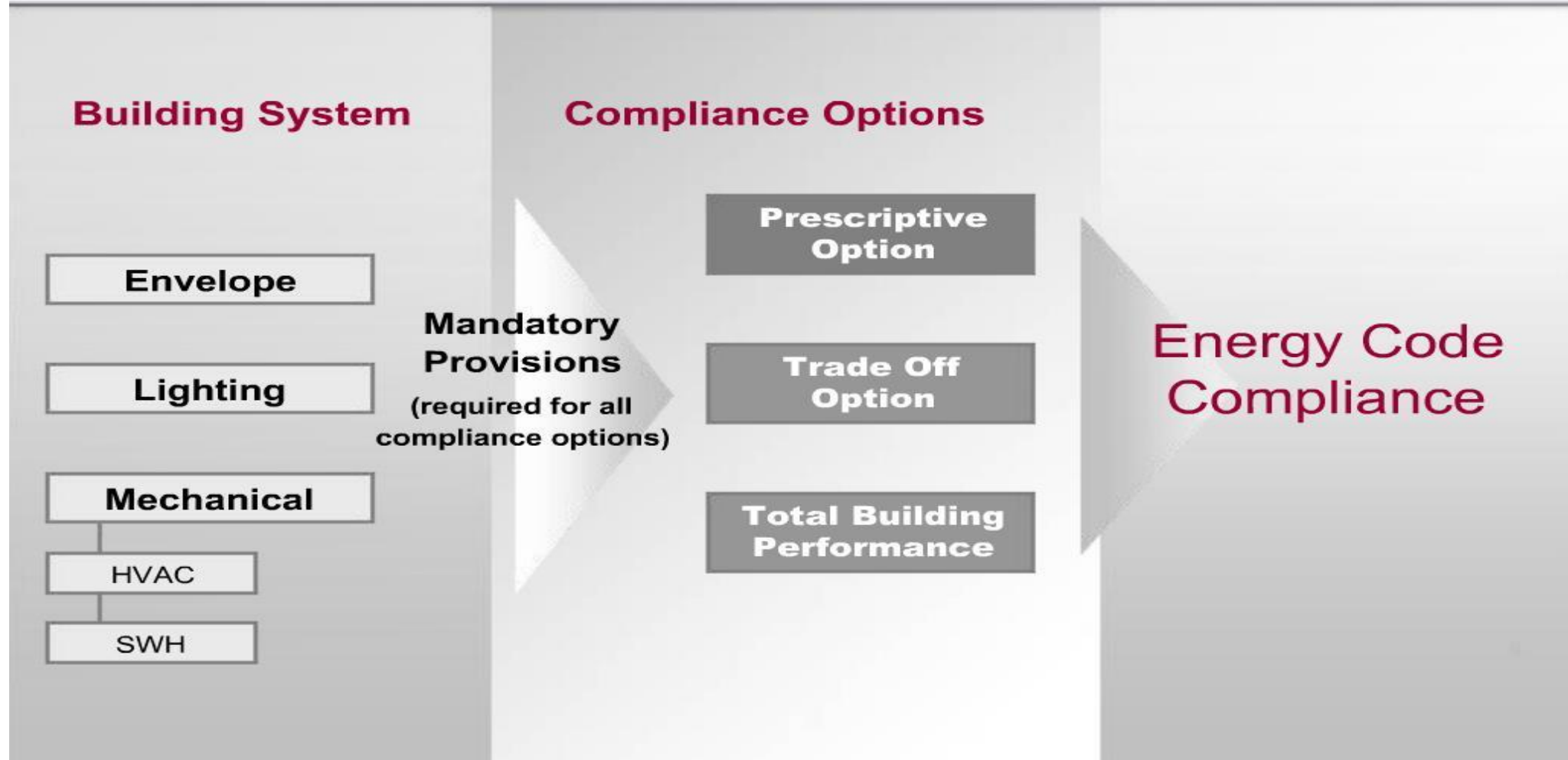
This information will appear on the compliance report. [Edit Project Details...](#)

Building Envelope and Interior Lighting Areas | Exterior Lighting Areas

Add Building Area Duplicate Delete

	Building Area	Area Description	Space Conditioning	Area	W/ft <sup>2</sup>
1	Select Area Category...				

# Commercial Buildings



# Mandatory Requirements Include:

- Air Leakage
- Air barriers
- Fenestration air leakage
- Rooms Containing Fuel-burning Appliances
- Air intakes, exhaust openings, stairways and shafts
- Loading dock weatherseals
- Vestibules
- Recessed lighting
- Commissioning



# What is COMcheck?

- Envelope
  - trade-off calculations are based on envelope loads only
  - defines a proposed design and a budget design
- Lighting
  - Watts/square foot (LPDs)
- Mechanical
  - short wizard to customize a list of requirements applicable to the system identified

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# Envelope Trade off methods:

- ASHRAE 90.1 (Pre-2013) Normative Appendix C Methodology for Building Envelope Trade-Off Option
  - 90.1-2007/2010
  - 2009/2012 IECC
- ASHRAE 90.1-2013 Appendix C has limited performance method (EnergyPlus) *(New)*
- 2015 IECC Component Performance Alternative (Total UA) *(New)*



# Project Types:

- New Construction: Trade-off compliance method
- Addition Trade-off compliance method
- Alteration Prescriptive compliance

# Commercial Building Envelope Requirements

## ➤ Mandatory Requirements:

- Moisture Control
- Air Leakage

## ➤ Climate Specific Requirements:

- Roof
- Above Grade Walls
- Below Grade Walls
- Floor
- Slab
- Skylights, Windows, and Doors



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# Mechanical/Service Hot Water Requirements

- Efficiency requirements
- Economizer requirements
- Fan Power Limitation
- Mandatory requirements
- No compliance metric available



# Lighting Requirements

- Mandatory requirements: Controls, Switching
- Interior/Exterior lighting power requirements

Complies if total connected power  $\leq$  lighting power allowance



# When do Lighting and Power Requirements Apply?

- Original Installed Lighting System in a New Building, Addition, or Tenant Build-out
- Existing Lighting System that is Altered
- Change in Occupancy that Increases Energy
- Change in Occupancy that requires less LPD as shown in the LPD tables

## **Exceptions:**

- Alterations where less than 10% of the luminaires in a space are replaced and installed interior power lighting is not increased
- Lighting within dwelling units
  - Where  $\geq 75\%$  of permanently installed fixtures (except low-voltage) are fitted for and include high-efficacy lamps

# Electrical Lighting and Power Systems Requirements

- Mandatory Interior Lighting requirements
  - Required Controls
  - Wattage/Efficiency Limits
- Interior Lighting Power Allowances (watts/ft<sup>2</sup>)
- Exterior Lighting Controls
  - Required Controls
  - Lamp Efficiency
- Exterior Lighting Power Allowances (watts/ft<sup>2</sup>)
- Dwelling Electric Meters
- Electrical Transformers and Motors
- Vertical and Horizontal Transportation Systems and Equipment



Image: U.S. Dept of Energy



# COMcheck Basics

- COMcheck is a reflection of the difference between a 'design' building energy performance factor (EPF) and a 'code' or budget building EPF.
- The methodology used to determine EPF is provided in ASHRAE 90.1 Normative Appendix C: Methodology for Building Envelope Trade-off Option.



# COMcheck Project Specification Steps

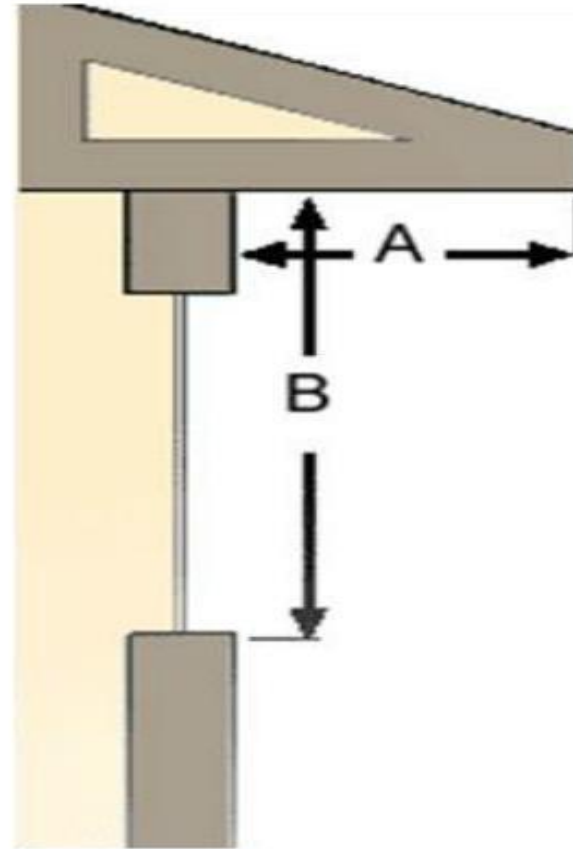
- Project
- Building Envelope Components
- Lighting
- Mechanical
- Requirements/ View/Print/ Save

# Information You will need:

- Energy Code
- Builder and project location
- Area take-offs for envelope assemblies
- Insulation R-values, fenestration performance data
- Lighting fixture details
- Heating and cooling system details
- Service water heating details



## Overhang/Projection Factor (PF)



$$\text{PF} = A/B$$
$$\text{PF} = 0.5$$



# Questions so far?

Please type in chat or unmute







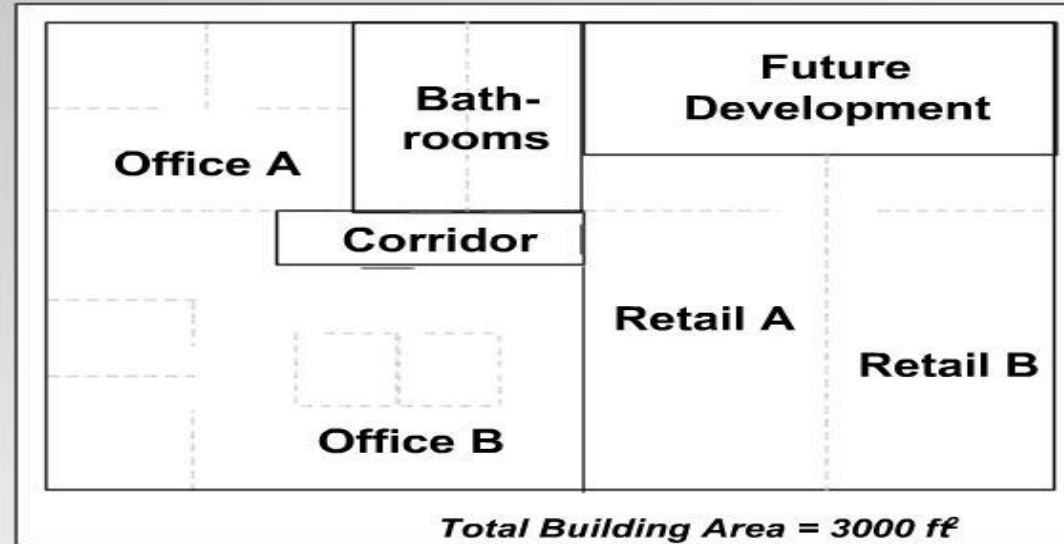
# Functional Testing of Lighting Controls

## Section C408.3.1

- Prior to passing final inspection, registered design professional to provide evidence that lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working order per construction documents and manufacturer's installation instructions

## Lighting Using Space-by-Space

<b>Office A:</b>	<b>400 ft<sup>2</sup></b>
<b>Office B:</b>	<b>850 ft<sup>2</sup></b>
<b>Bathrooms:</b>	<b>350 ft<sup>2</sup></b>
<b>Corridor:</b>	<b>50 ft<sup>2</sup></b>
<b>Retail A:</b>	<b>500 ft<sup>2</sup></b>
<b>Retail B:</b>	<b>500 ft<sup>2</sup></b>
<b>Future:</b>	<b>350 ft<sup>2</sup></b>



# Mechanical Systems and SWH Commissioning

## Section C408.2

- Prior to the final mechanical and plumbing sections, the registered design professional or approved agency shall provide evidence of mechanical systems commissioning and completion in accordance with section C408.2
- Mechanical Systems exempt from commissioning requirements (all other systems must comply)
  - In buildings where total mechanical equipment capacity is < 480,000 Btu/h (40 tons) cooling capacity **and** < 600,000 Btu/h combined service water heating and space-heating capacity
  - Included in Section C403.3 that serve individual dwelling units and sleeping units

# Alteration type project:

- Projects involve changes to or replacement of
  - Existing building components that are part of building envelope
  - Lighting, heating, ventilating, air conditioning, and water-heating equipment
- Specify only those envelope components, lighting fixtures, or mechanical systems/equipment that will exist upon completion of the project
- Alteration detail dialogs
  - Specify exemptions if applicable
  - Additional qualifications may be required (e.g., Window/wall ratio)
- Compliance shown as Pass/Fail for Envelope and Lighting

# Existing Buildings

## Section C503 - Alterations

- Code applies to any new construction
  - Additions or new work in existing structures
- Unaltered portion(s) may not need to comply
- When complying via ASHRAE 90.1-2016, alterations do not need to comply with C402-C405
- Where existing building exceeds fenestration area limitations of Section C402.4.1 prior to alteration, building is exempt from C402.4.1 provided there is no increase in fenestration area



Image: montgomerycountymd.gov





# Existing Buildings

## Section C503 - Alterations

- Heating and Cooling
  - New HVAC systems and duct systems that are part of the alteration to comply with Section C403
- Service hot water systems
  - New SWH systems that are part of the alteration to comply with C404
- Lighting Systems
  - New Lighting systems that are part of the alteration to comply with C405
    - **Exception** – alteration that replace <10% of the luminaires in a space provided such alteration does not increase the installed interior lighting power

# Existing Buildings - Lighting Power and Systems

## Section C502.2.6

New lighting systems installed as part of an addition to comply with C405

- Total interior lighting power to comply C405.3.2
  - Stand alone addition
  - Addition + existing building as a single building
- Total exterior lighting power to comply C405.4.2
  - Stand alone addition
  - Addition + existing building as a single building
- Repairs – C504.2
  - Repairs exempt where only the bulb, ballast or both within the existing luminaires in a space are replaced, provided that the replacement does not increase the installed interior lighting power

# Building Controls are Complicated

- Since 2004, about 30% of all new requirements have been related to building controls
- Control requirements can be difficult to implement and verification is beyond the expertise of most building code officials
- Assumption is that they are implemented and working correctly
- Source:  
[https://www.pnnl.gov/main/publications/external/technical\\_reports/PNNL-26348.pdf](https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-26348.pdf)



# Systems Commissioning and Completion Requirements

## Section C408

- Commissioning is critical to ensure that buildings are **working as designed**
- Preliminary and final reports required
- Mechanical and lighting commissioning detailed in section C408

### Benefits of Commissioning





# Functional Testing of Lighting Controls

## *Section C408.3.1*

- Prior to passing final inspection, registered design professional to provide evidence that lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working order per construction documents and manufacturer's installation instructions

# Compliance Certificate for Permit



**COMcheck Software Version COMcheck-Web**  
**Envelope Compliance Certificate**

**Project Information**

Energy Code: 2012 Ontario Building Code and Chapter 2 of Division 3 of SB-10(2017)  
 Project Title: OAA Festival Project 44%  
 Location: Toronto / Downtown, Ontario  
 Climate Zone: 5a  
 Project Type: New Construction  
 Vertical Glazing / Wall Area: 43%  
 Performance Sim. Specs: EnergyPlus 8.1.0.009 (EPW: CAN\_ON\_Toronto.716240\_CWEC.epw)

Construction Site: 666 Park Ave.  
 Toronto, Ontario M4M 4M4

Owner/Agent: Ima Driven  
 CanDo Developments  
 666 Park Ave  
 Toronto, Ontario M4M 4M4  
 6136015689  
 Ima.Driven@CanDo.ca

Designer/Contractor: Gerry Conway  
 Conway Architect Inc  
 185 Mafeking Ave  
 Ottawa K1K2V4  
 6136015689  
 ConwayArchitect@gmail.com

Building Area	Floor Area
1-Gnd Fl. Retail (Retail) : Nonresidential	10000
2-2nd - 10th (Office) : Nonresidential	90000
3-Bsmt. (Warehouse) : Nonresidential	10000

# EAZEE building COMcheck

## Envelope HW problem

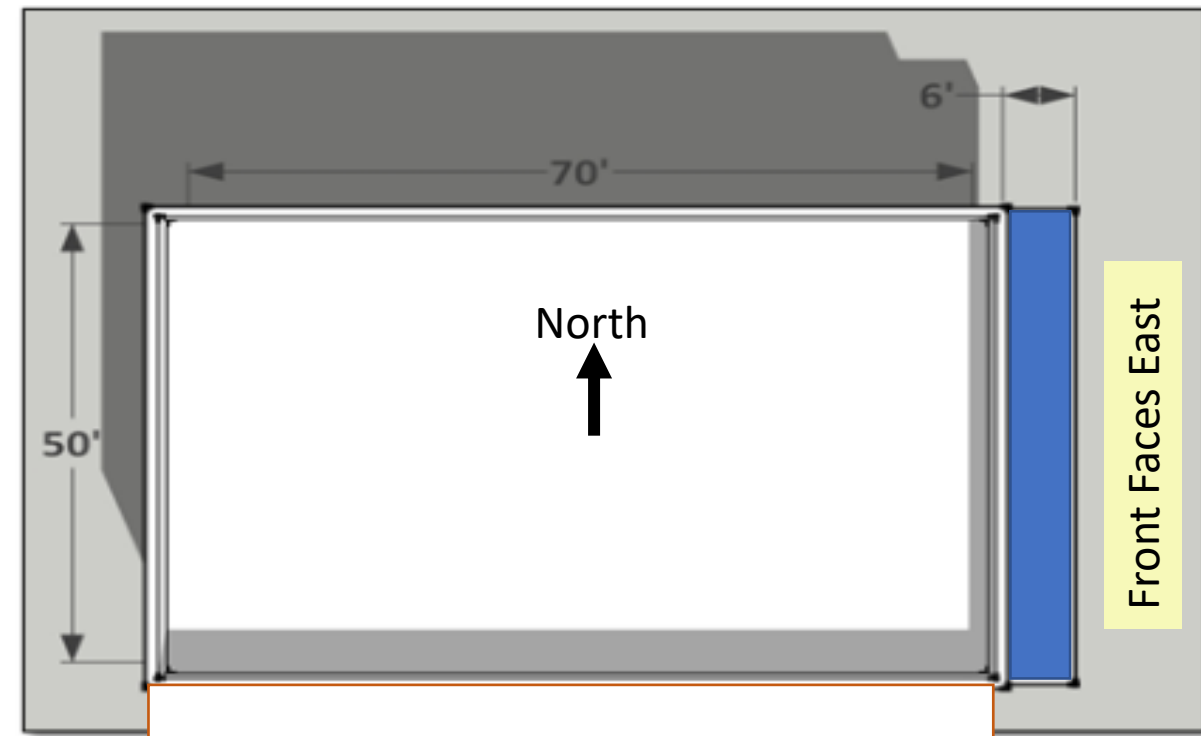
### • Small 10' Strip Retail Building

- East Wall: R-19 2x6, 16" o.c. all metal curtain-wall glazing is on the Front (East) façade and shaded by a 6' overhang (500 s.f.)
  - East Glazing 410 s.f. U-0.36, SHGC-0.44, VT-0.50
  - East Glass Entry 40 s.f. U-0.31, SHGC-0.38, VT-0.50
- South Wall: 8" CMU's - adjacent "interior" (700 s.f.)
- North Wall: 8" CMU's with R-10 c.i. (700 s.f.)
- West Wall: 8" CMU's with R-10 c.i. (500 s.f.)
  - Rear Opaque Doors 80 s.f. U-0.32

*Enter Building dimensions into COMcheck and locate it in your city in NE.*

*Slab on grade, R-10, Ceiling R-30 continuous above roof decking. Select/adjust insulation values that will make it pass IECC-21 or 90.1-2019*

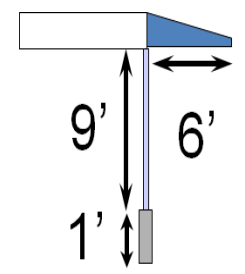
<https://www.energycodes.gov/comcheck>



Adjacent Retail (conditioned space)

### INSTRUCTIONS

Enter all envelope surfaces into COMCheck  
Use 90.1-2019 or IECC 2021 as code.  
Account for overhang shading front glass  
Adjust wall R-values, etc. until design passes



# Thank you! Questions?

Matt Belcher, Verdatek Solutions

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John Gossman, MEEA

[jgossman@mwalliance.org](mailto:jgossman@mwalliance.org)

[www.mwalliance.org/nebraska-energy-codes-training-program](http://www.mwalliance.org/nebraska-energy-codes-training-program)

