MINNESOTA RULES, CHAPTER 1323

Presented by

Presented by: Don Sivigny Minnesota Department of Labor and Industry

Construction Codes and Licensing Division

MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY
CONSTRUCTION CODES AND LICENSING

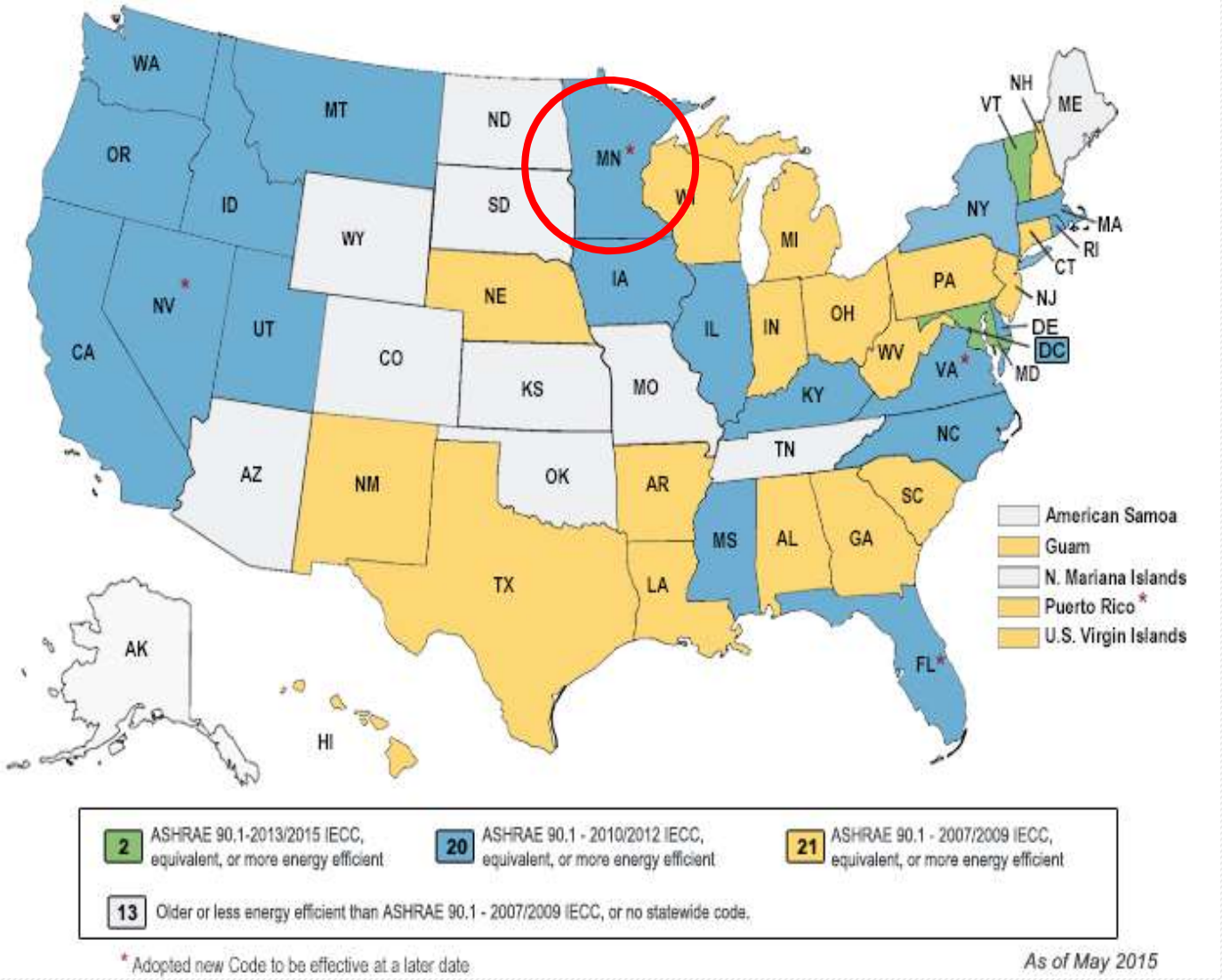
The 2012 IECC or the AHHREA Standard 90.1-2010

An introduction to the Basics and the Key Differences.

Comparing the 2012 IECC to ASHRAE Standard 90.1-2010

Status of Code Adoption: Commercial

Overview of the currently adopted commercial energy code in each state



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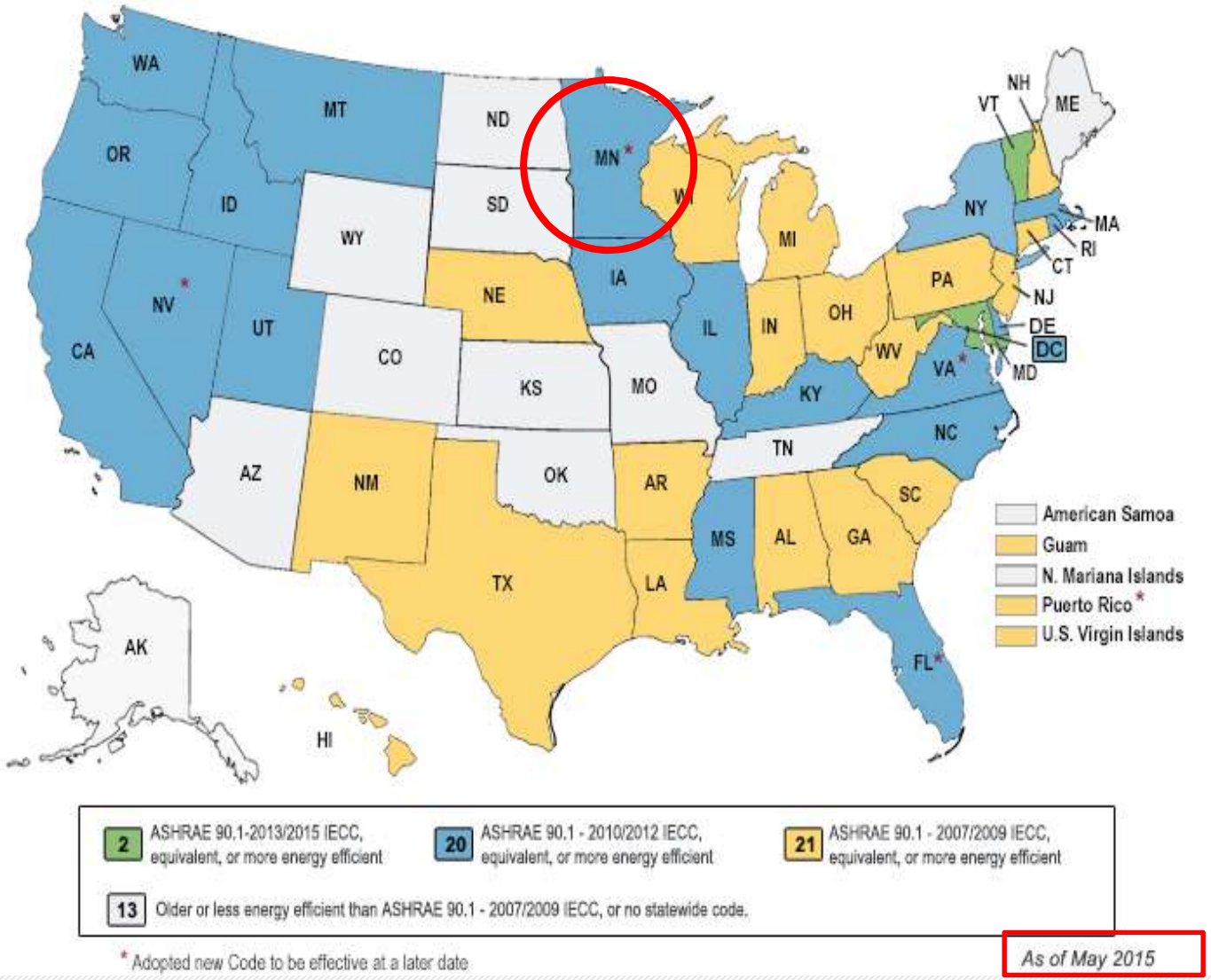

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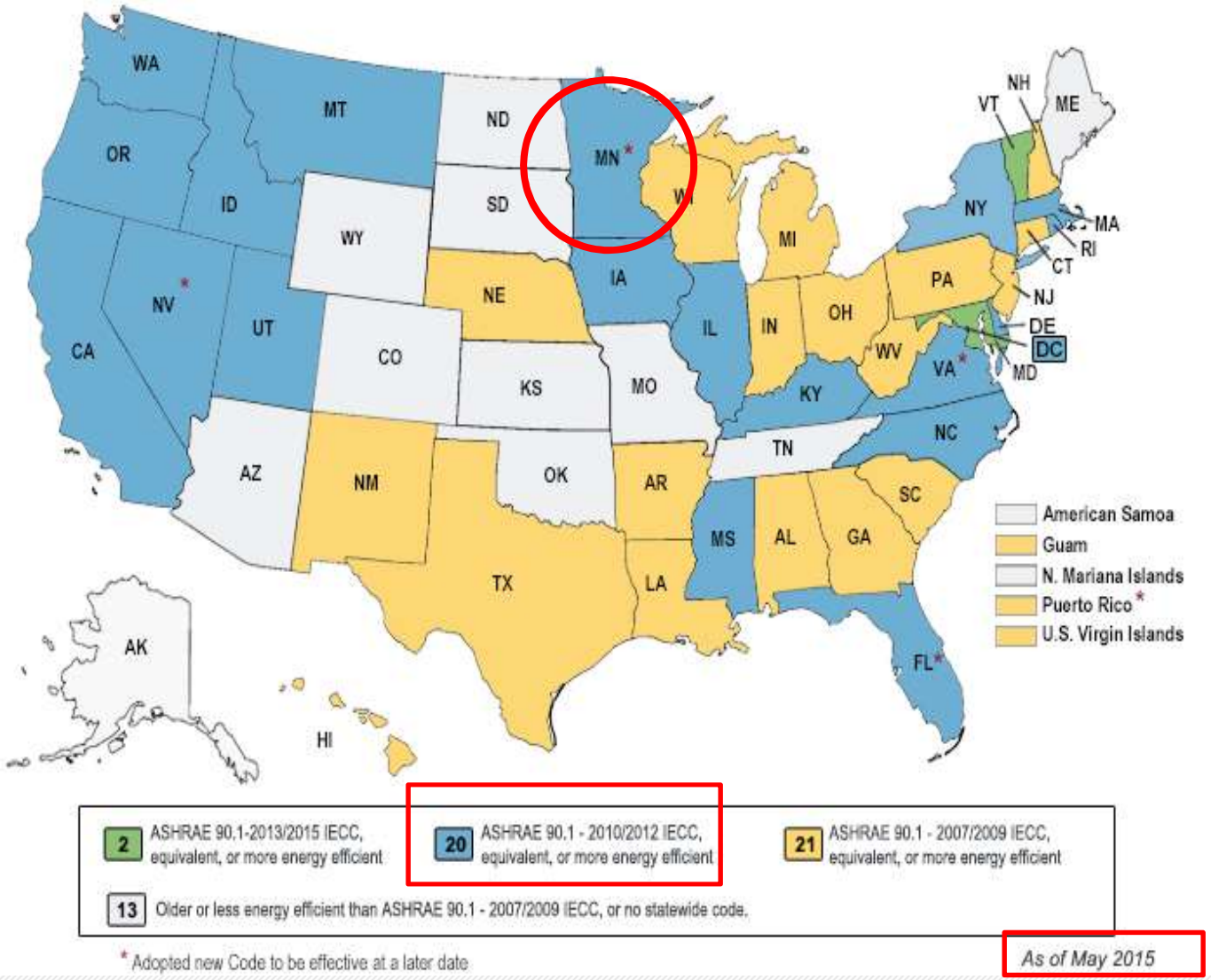
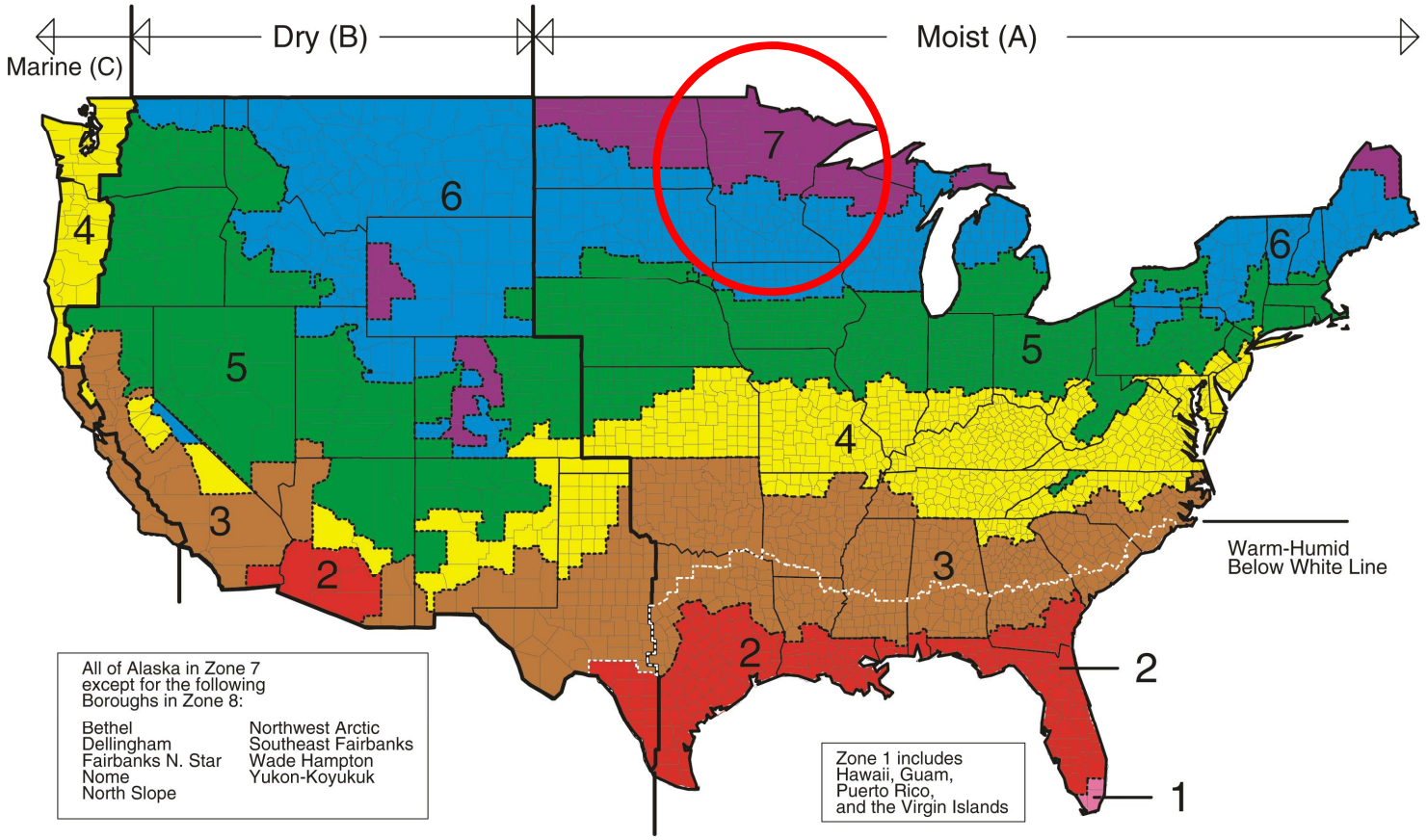


Climate Zones

- **Three separate moisture regimes overlay the eight climate zones.**



Definition of a Residential Building

- **Residential buildings (IECC)**: Includes detached on- and two- family dwellings and multiple single family dwelling buildings (townhouses) as well as Group R-2, R-3, and R-4 Buildings, **three stories or less in height.**

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- **Residential buildings (ASHRAE):** Spaces in building used primarily for living and sleeping, including but not limited to, dwelling units, **hotel/motel guest rooms,** dormitories, nursing homes, **patient rooms in hospitals,** lodging houses, fraternity/sorority houses, hostels, prisons and fire stations.

Example

- **ASHRAE defines patient rooms in hospitals and hotel/motels as residential where as the 2012 IECC would consider these rooms as commercial.**

Example

- ASHRAE defines patient rooms in hospitals and hotel/motels as residential where as the 2012 IECC would consider these rooms as commercial.

- **Thus in some instances (like these) a building built to the 2012 IECC would have more rigorous thermal envelope requirements than one built to ASHREA**

Definition of a Commercial Building

- **Commercial buildings (IECC)** : All buildings not included in the definition of a residential building.

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- **Commercial buildings (IECC)**: All buildings not included in the definition of a residential building.

- **Commercial Buildings (ASHRAE):** ASHRAE does not give a definition of commercial buildings. **(See Scoping provisions Section 2.2)** for what this standard does not apply to.

Section 2 – Scope Exception

What does not apply:

- ✓Too little heating or cooling
- ✓**Single-family, multifamily of three stories or less, manufactured or modular homes**
- ✓Buildings that don't use electricity or fossil fuel

ASHREA Section 5 – 5.5.1

TABLE 5.5-6 Building Envelope Requirements For Climate Zone 6

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.093	R-[illegible] c.i.
Metal Buildings	U-0.049	R-13.0 + R-19.0	U-0.049	R-13.0 + R-19.0	U-0.072	R-16.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mass	U-0.064	R-12.5 c.i.	U-0.057	R-14.6 c.i.	U-0.137	R-4.2 c.i.
Steel-Joist	U-0.038	R-30.0	U-0.032	R-38.0	U-0.052	R-19.0
Wood-Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-0.051	R-19.0
Slab-On-Grade Floors						
Unheated	F-0.540	R-10 for 24 in.	F-0.520	R-15 for 24 in.	F-0.730	NR
Heated	F-0.860	R-15 for 24 in.	F-0.688	R-20 for 48 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-0.500		U-0.500		U-1.450	

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value

Reference Table 5.5-6

Determining energy use by defining the space.

- **Conditioned Space: Greater than 3.5 Btu's or 1 watt of energy use per square foot for space conditioning purposes.**

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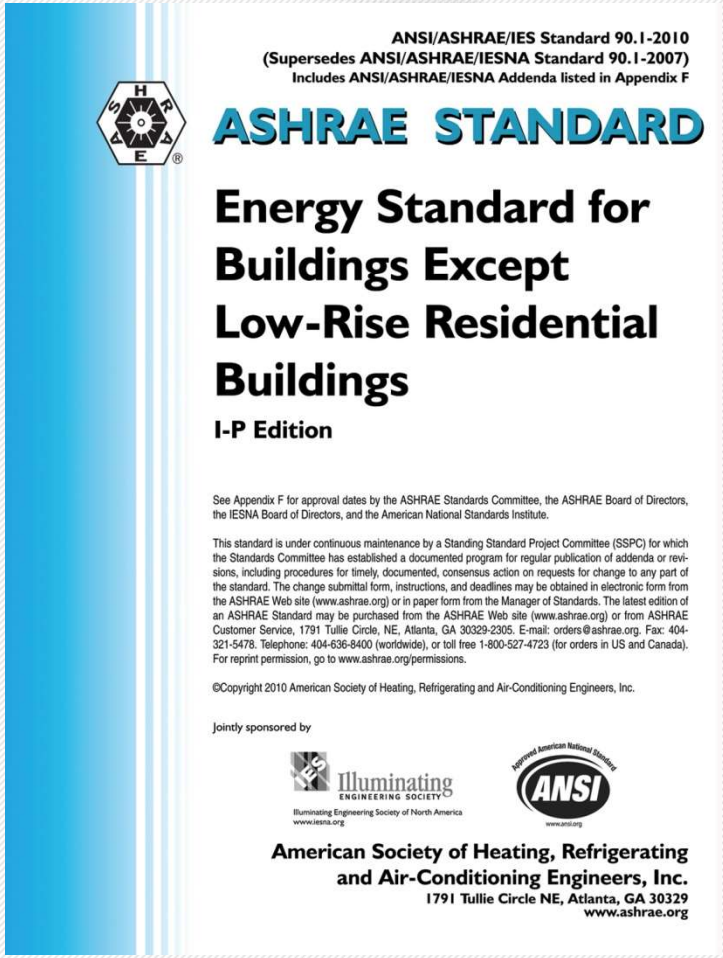
- **Unconditioned space: Uses less then 3.4 Btu's or 1 watt per Square foot for space conditioning purposes**
- **Semi Conditioned Space: (ASHREA only) is energy use of between 3.4- Btu's and 20 Btu's of energy use for Space conditioning purposes**

Arrangement and format of the 2012 IECC

- **IECC Commercial Provisions, Chapters CE 1-5, contain provisions for residential buildings four stories or greater in height.**

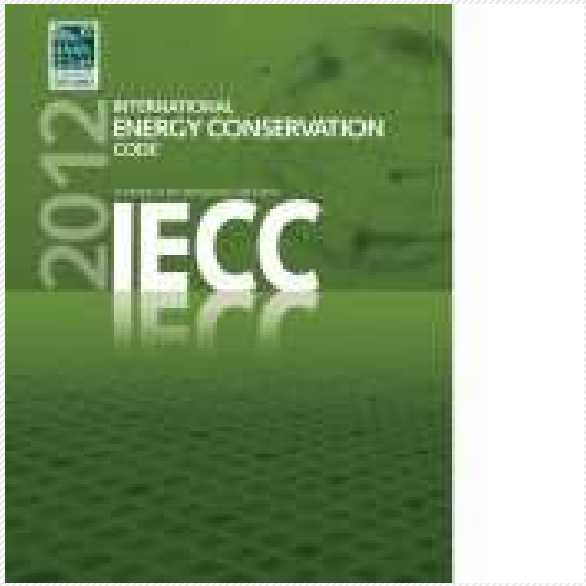
IECC section C401 General

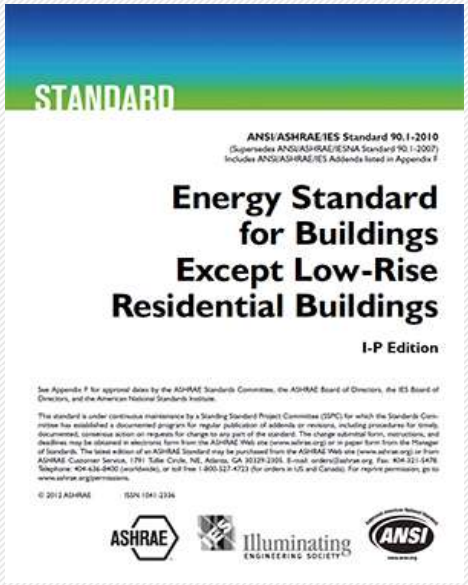
- The section has been revised for clarity. **Compliance with ANSI/ASHRAE/IESNA 90.1 is still an acceptable alternative.**



Intent

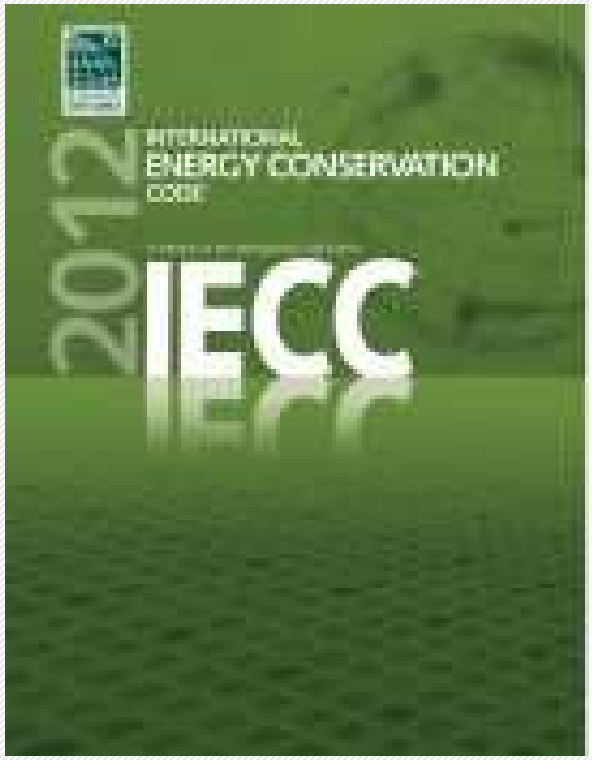
- **Life safety, health and environmental requirements take precedence over energy provisions.**



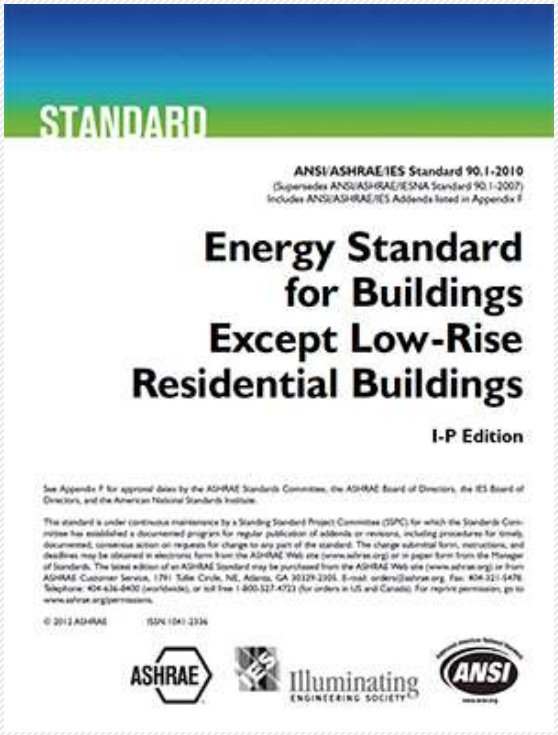


Which choice will they make?

2012 IECC

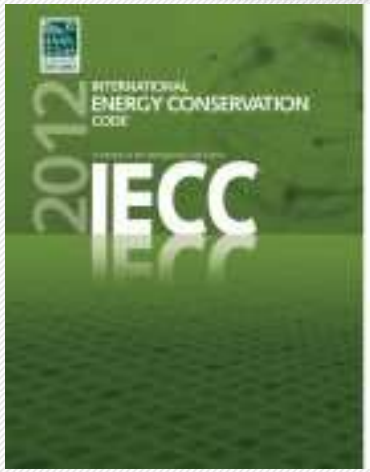


2010 ASHRAE Standard 90.1

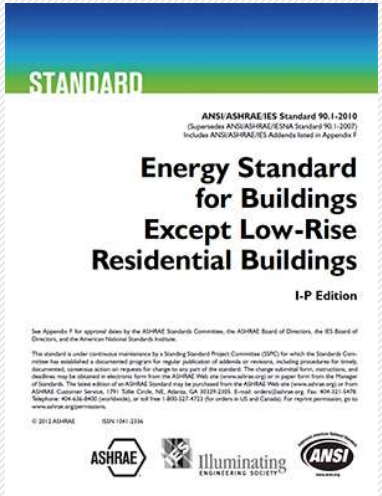


Which commercial code did they use for their Building

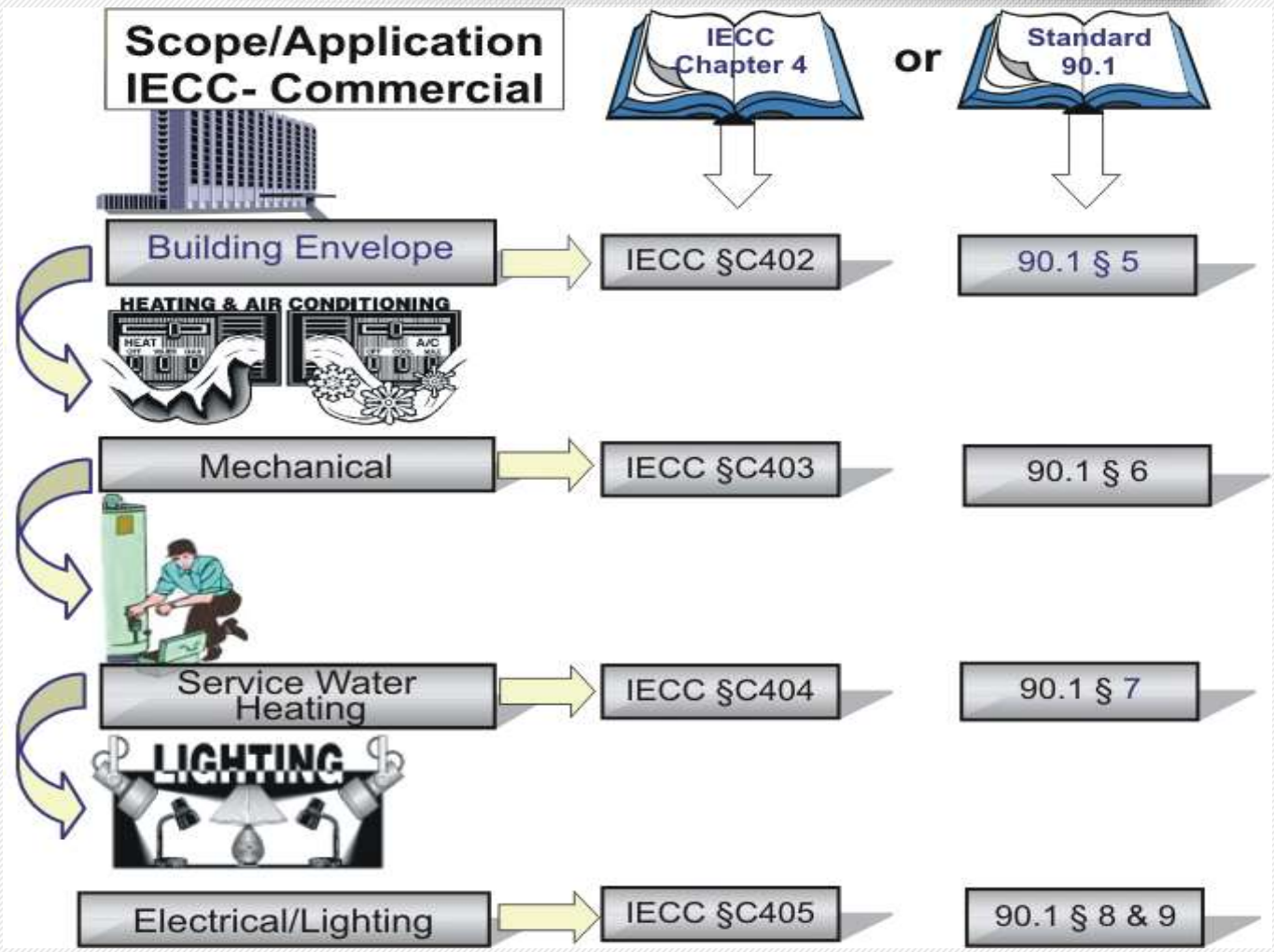
- **2012 IECC chapters CE1-CE5:**
  - **Prescriptive approach, or;**
  - **Performance approach**



- **ASHREA Standard 90.1-2010**



Highlighting the Key differences



Choose a Commercial Path *"All-In!"*

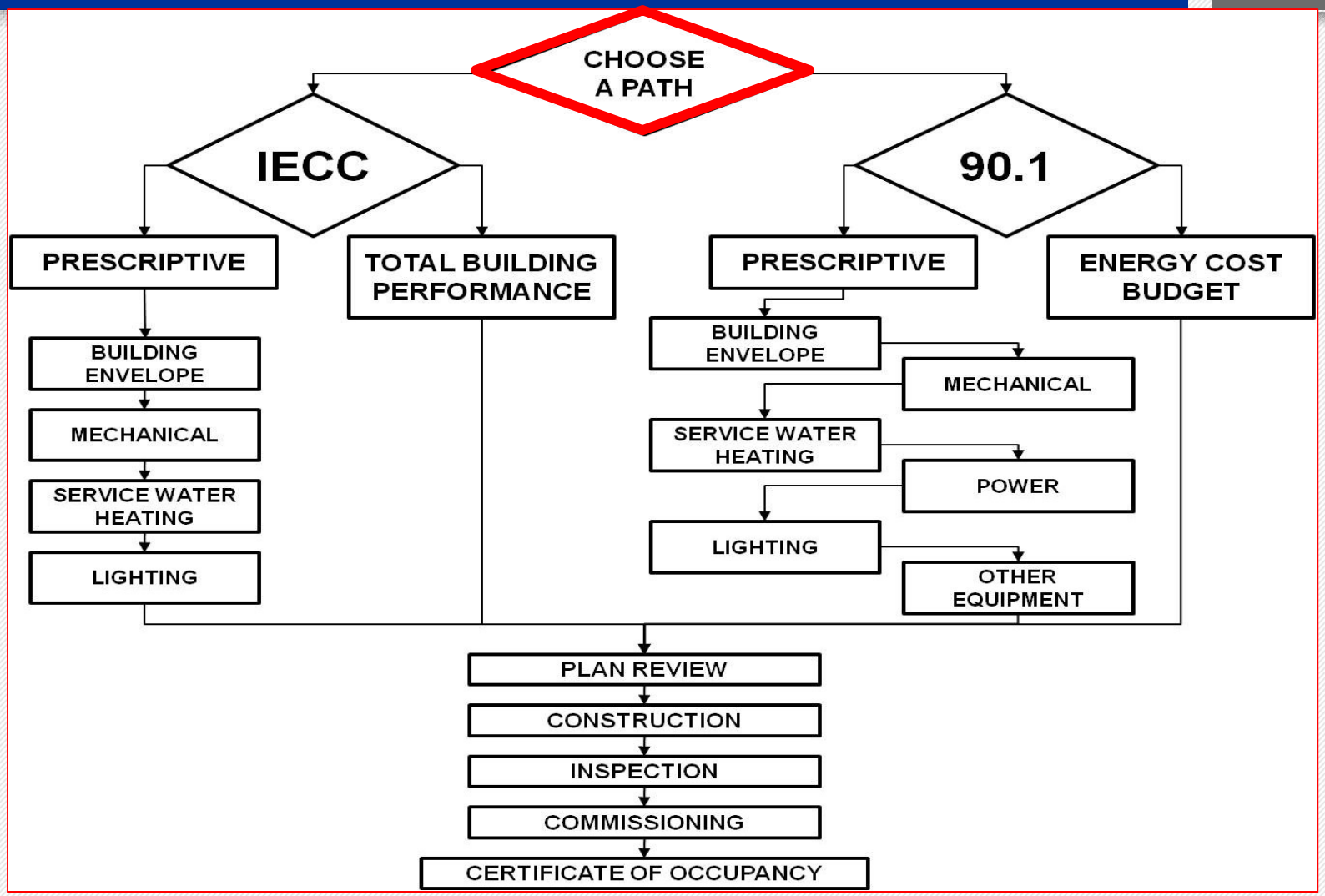
2012 IECC

1. Scope & Administration
2. Definitions
3. General Requirements
4. Commercial
   - 402) ENV
   - 403) MECH
   - 404) SWH
   - 405) LTG
   - 406) HIGH EFF MEASURES
   - 407) PERFORMANCE
   - 408) Cx
5. Referenced Standards

ASHRAE 90.1-2010

1. Purpose
2. Scope
3. Definitions & Abbreviations
4. Administration & Enforcement
5. ENV
6. HVAC
7. SWH
8. PWR
9. LTG
10. EQUIPMENT
11. ECB
12. Normative References

Commercial Energy Code Compliance Process 2012 IECC vs. ASHRAE 90.1-2010



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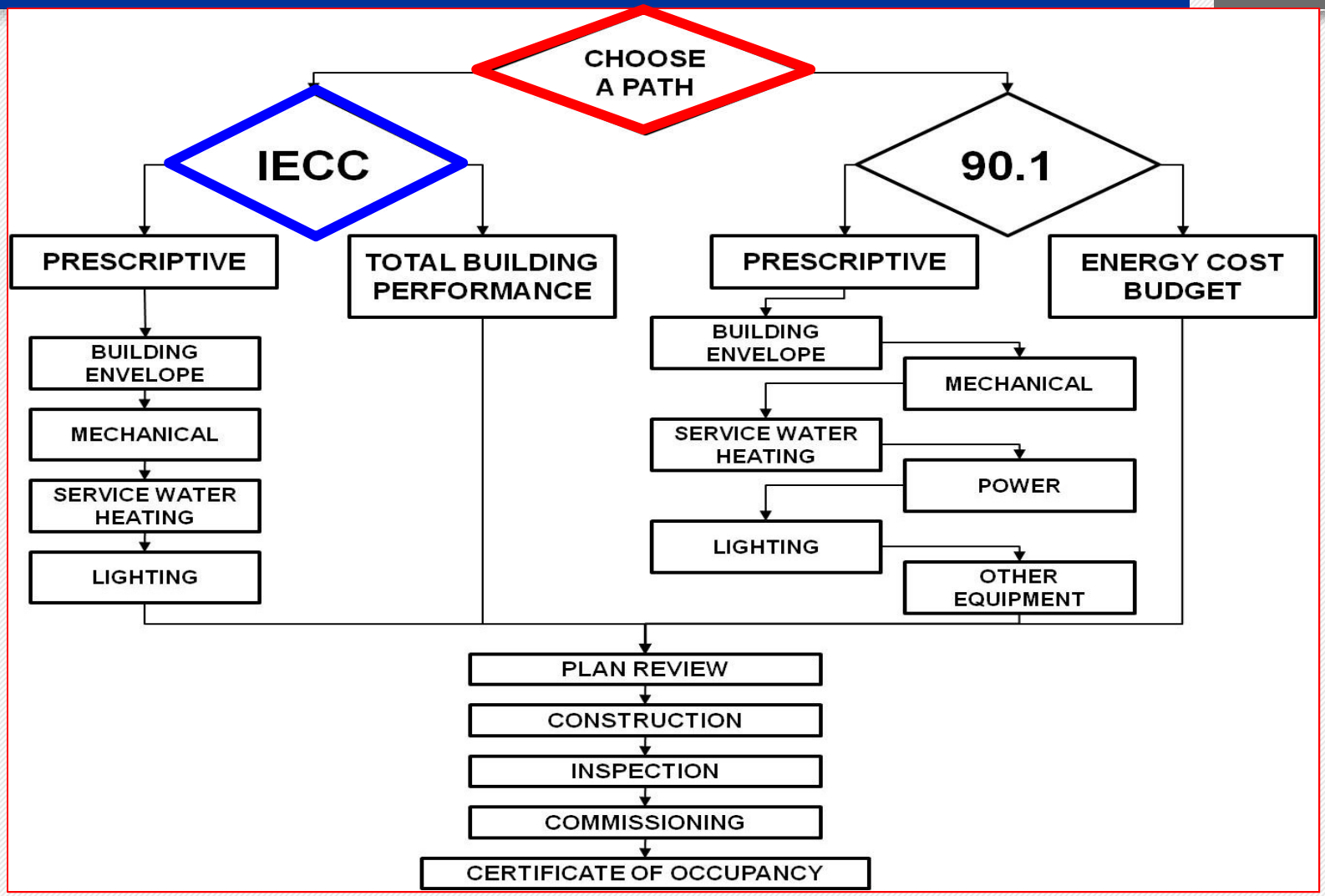

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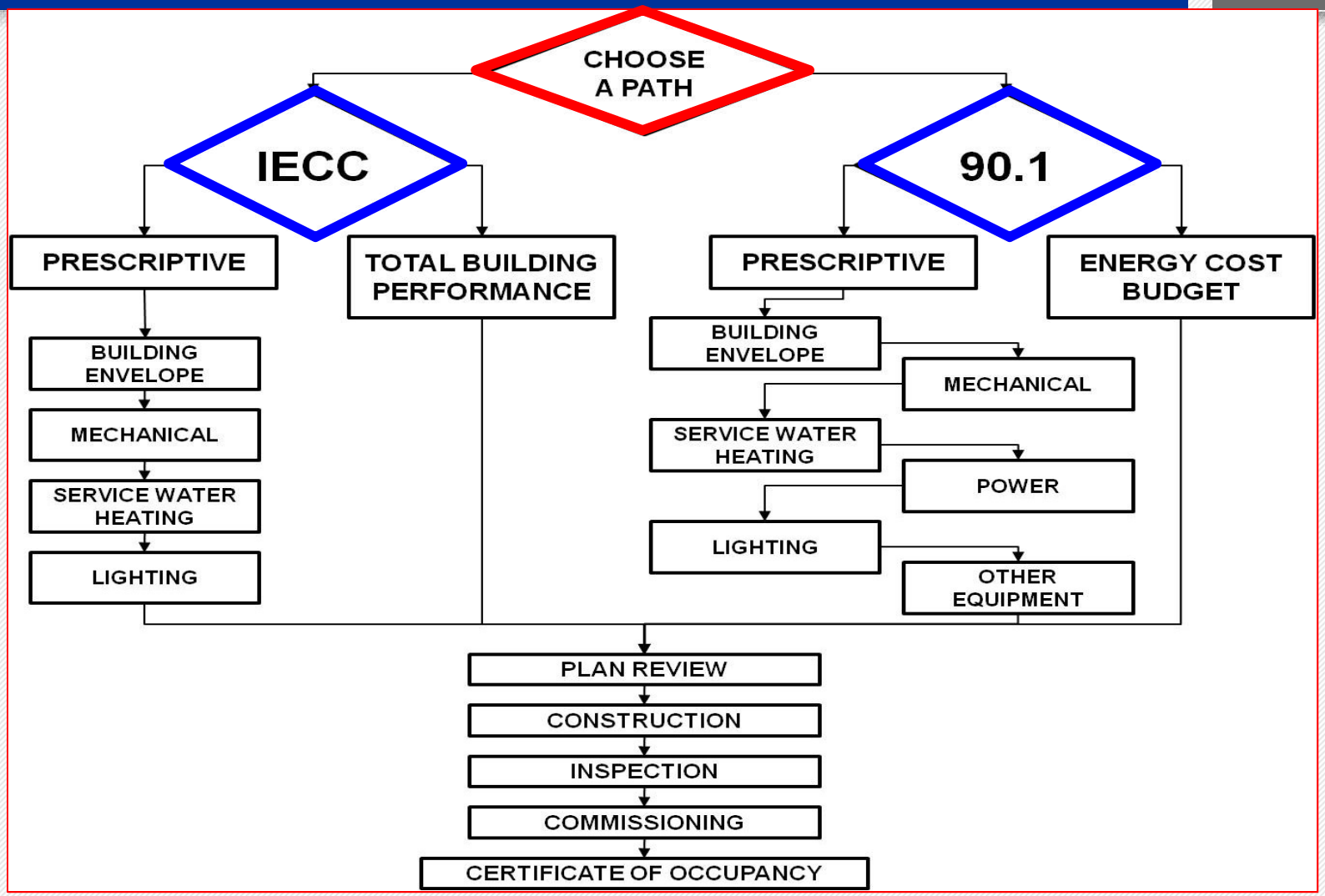

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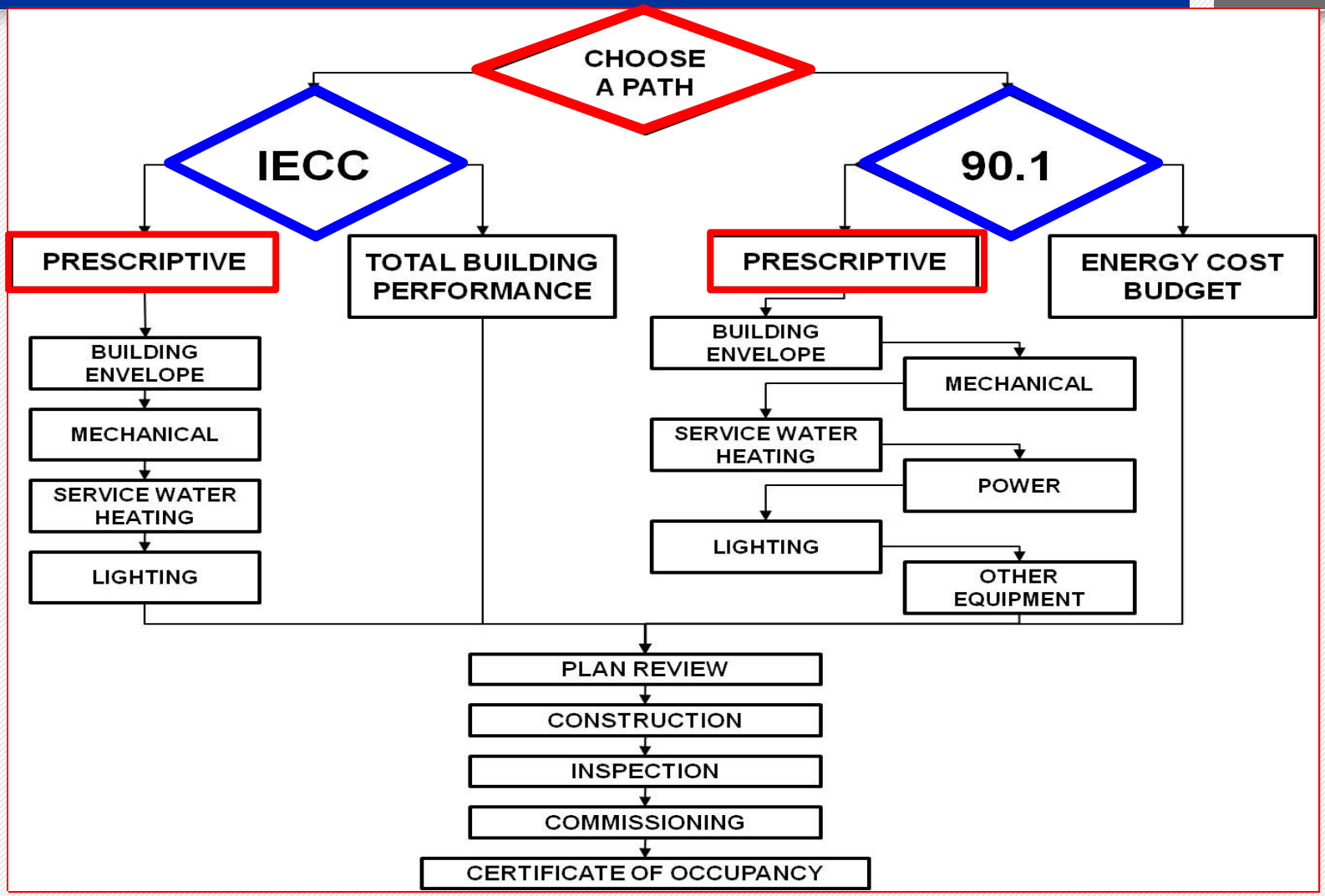

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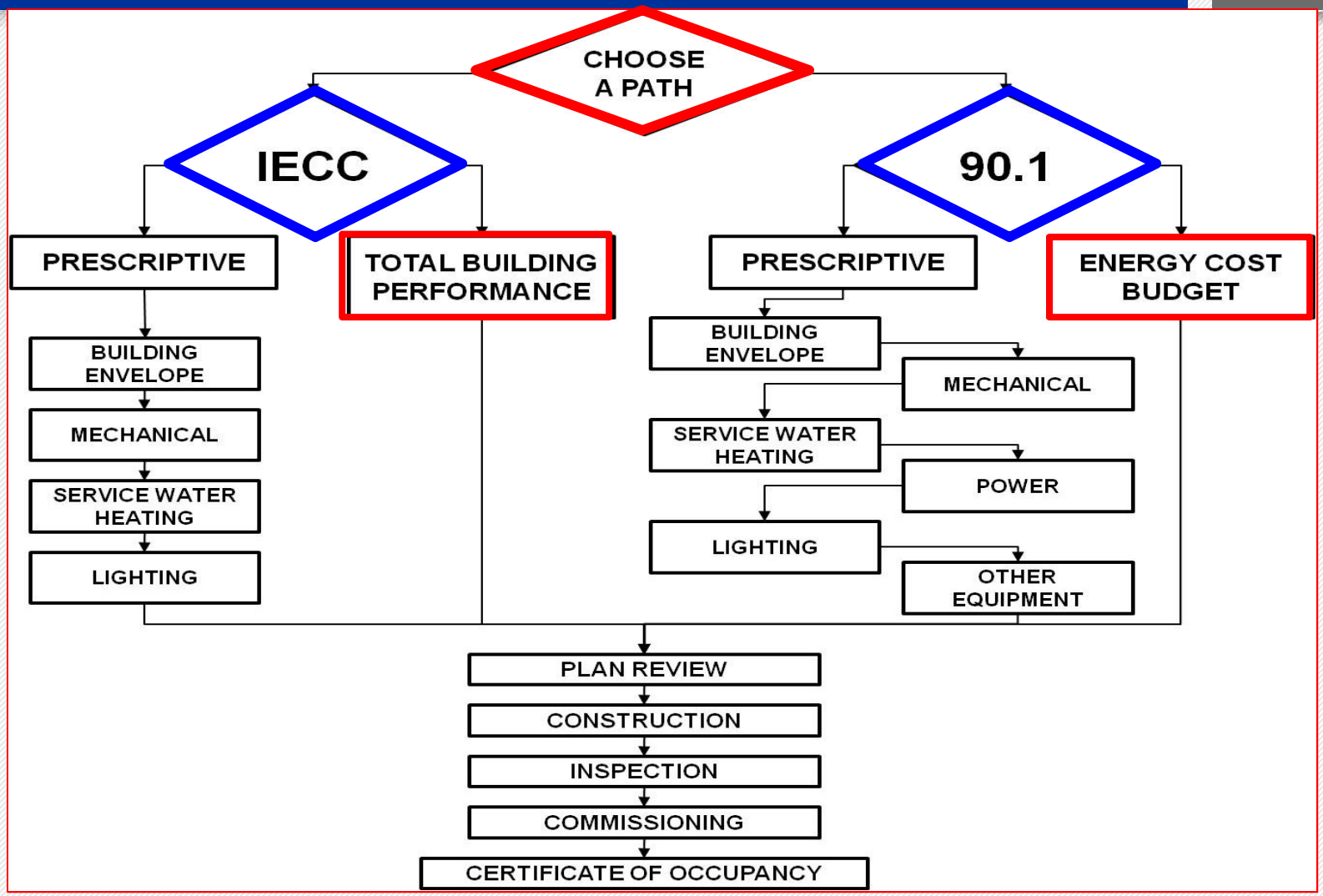

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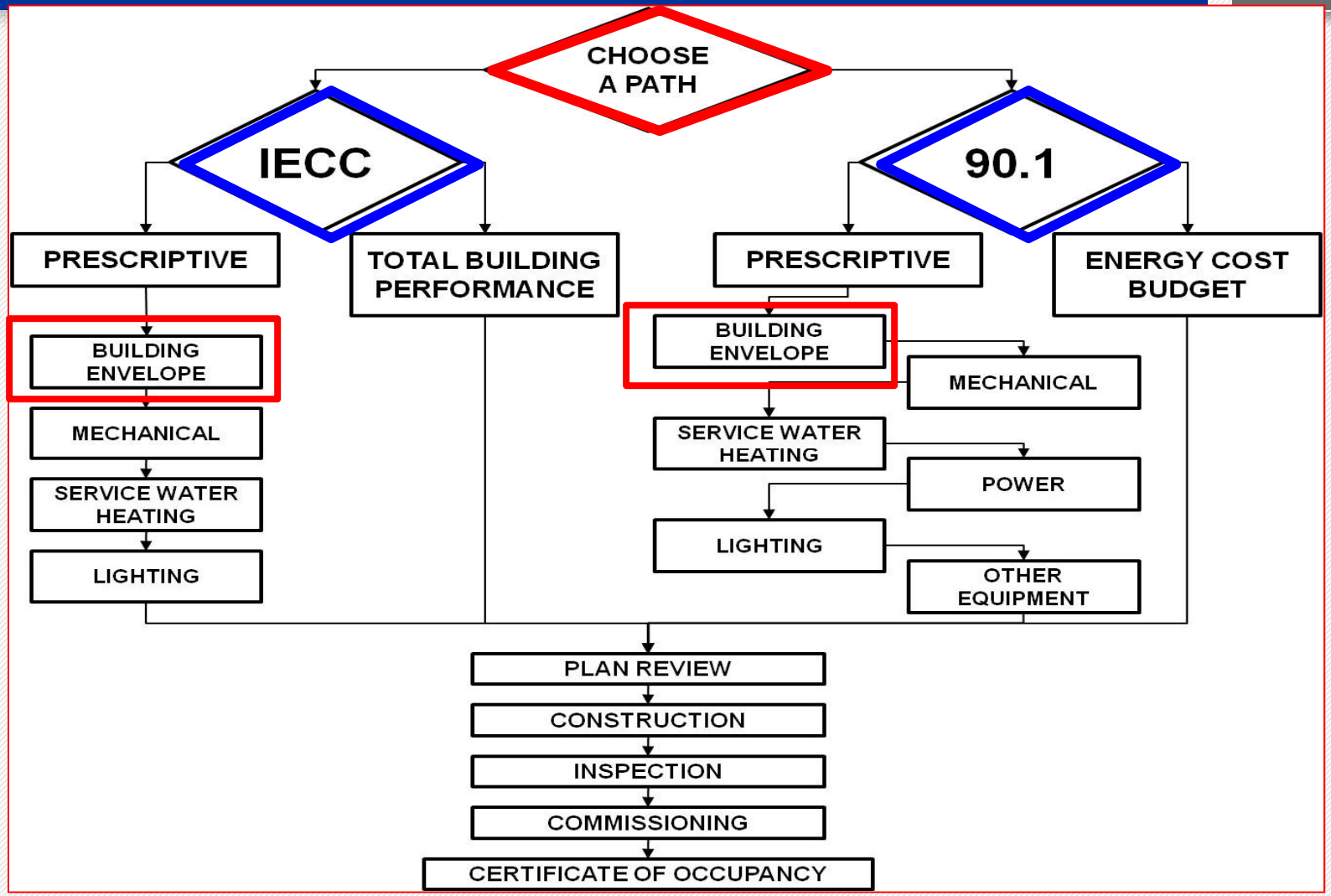

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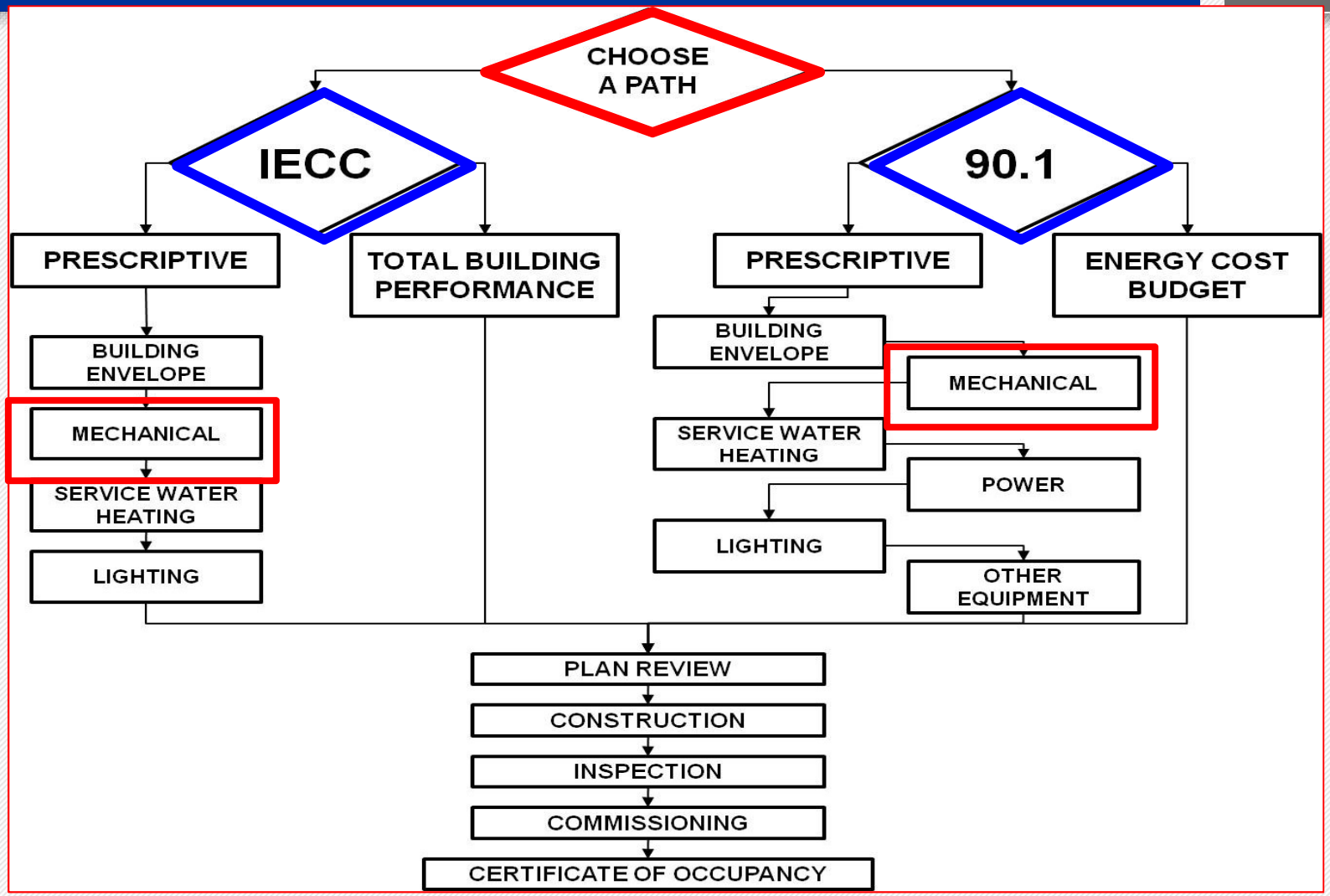

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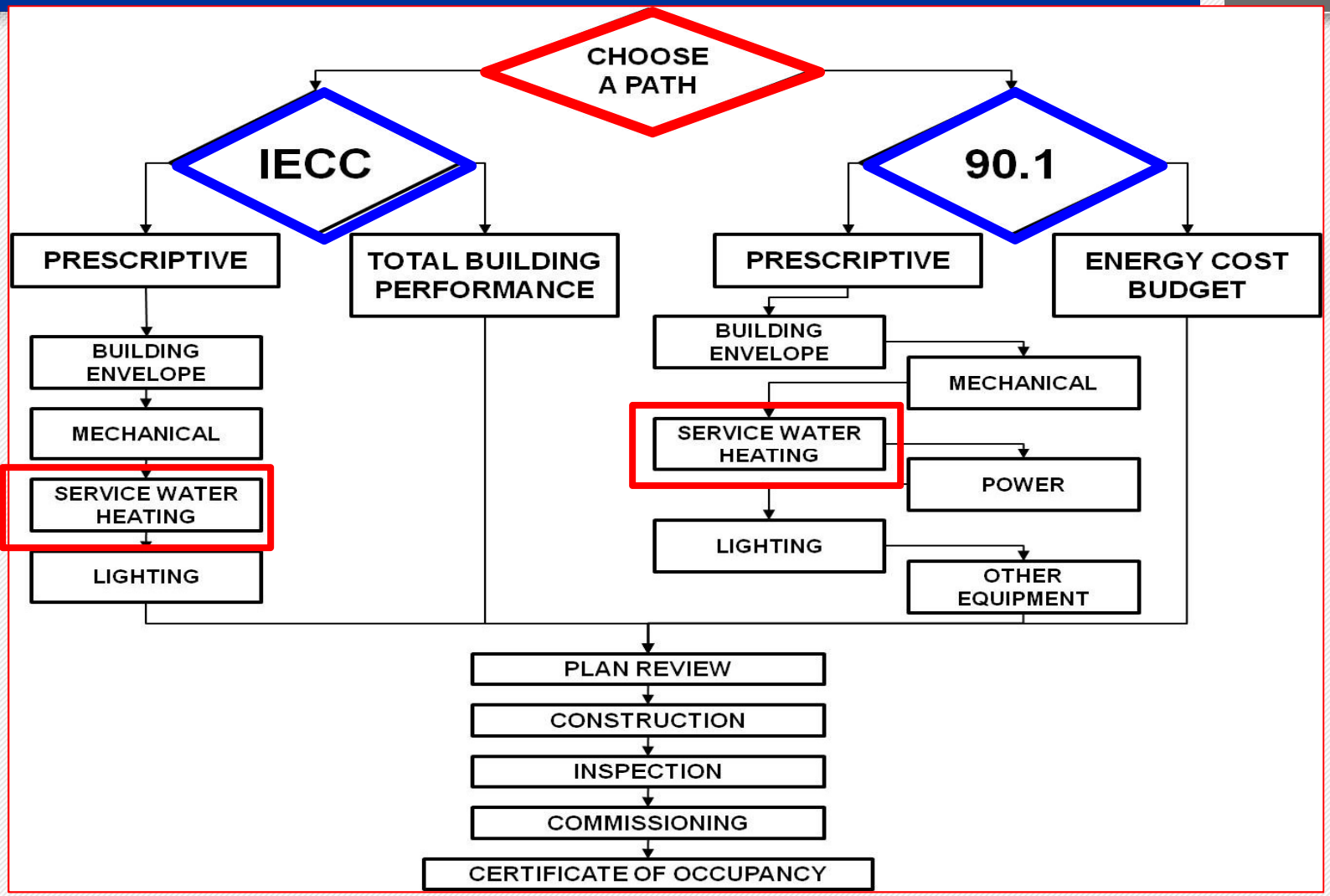

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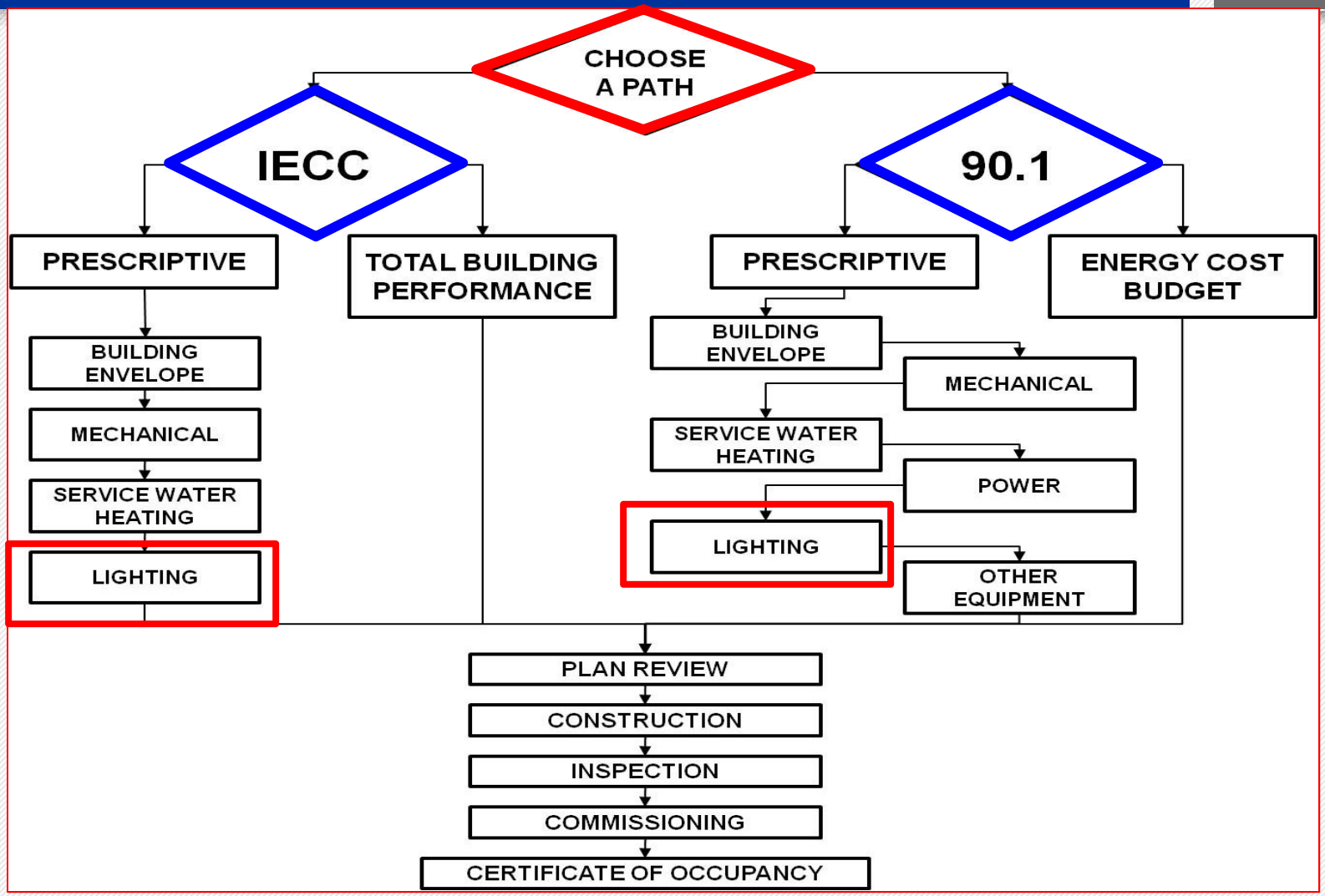

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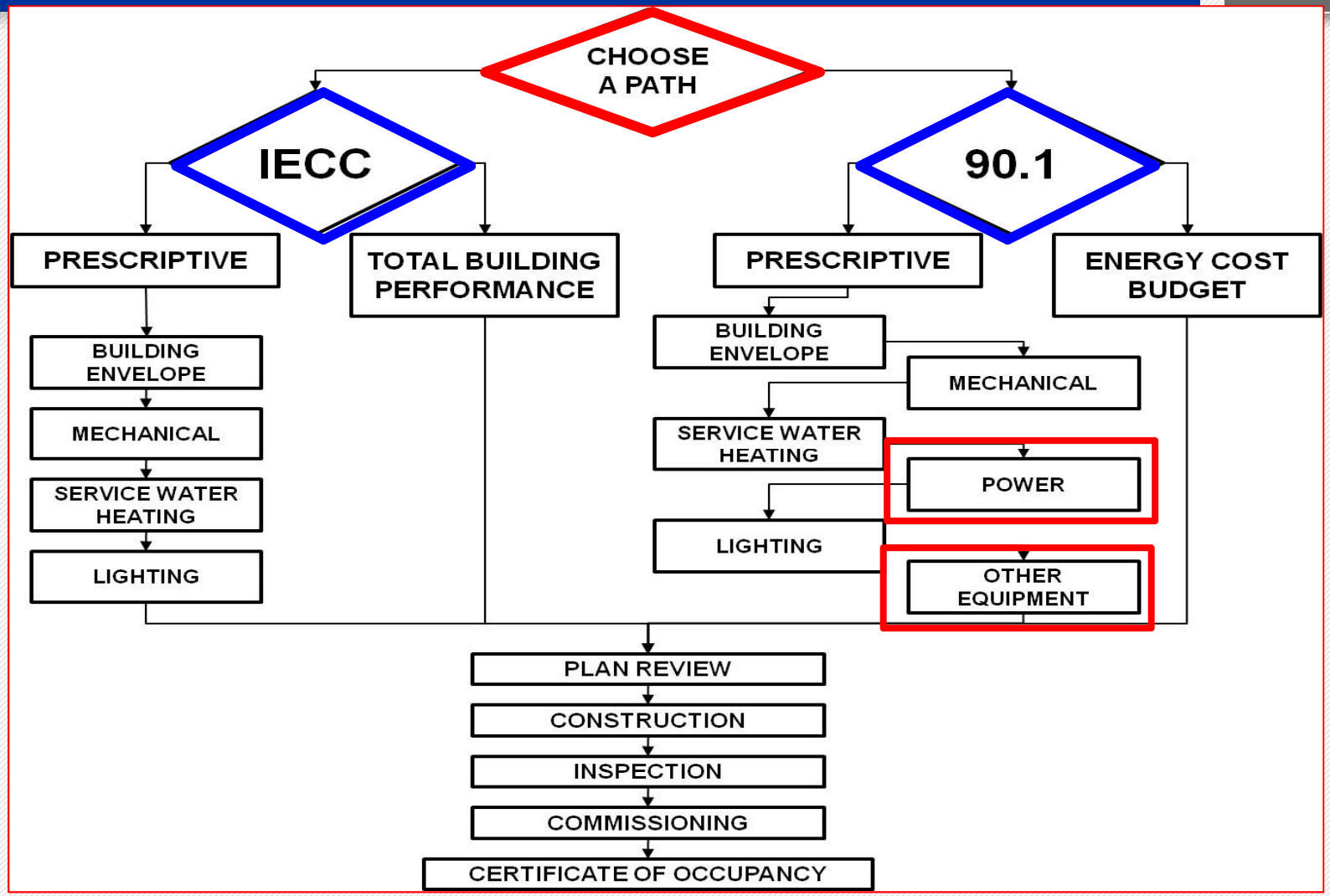

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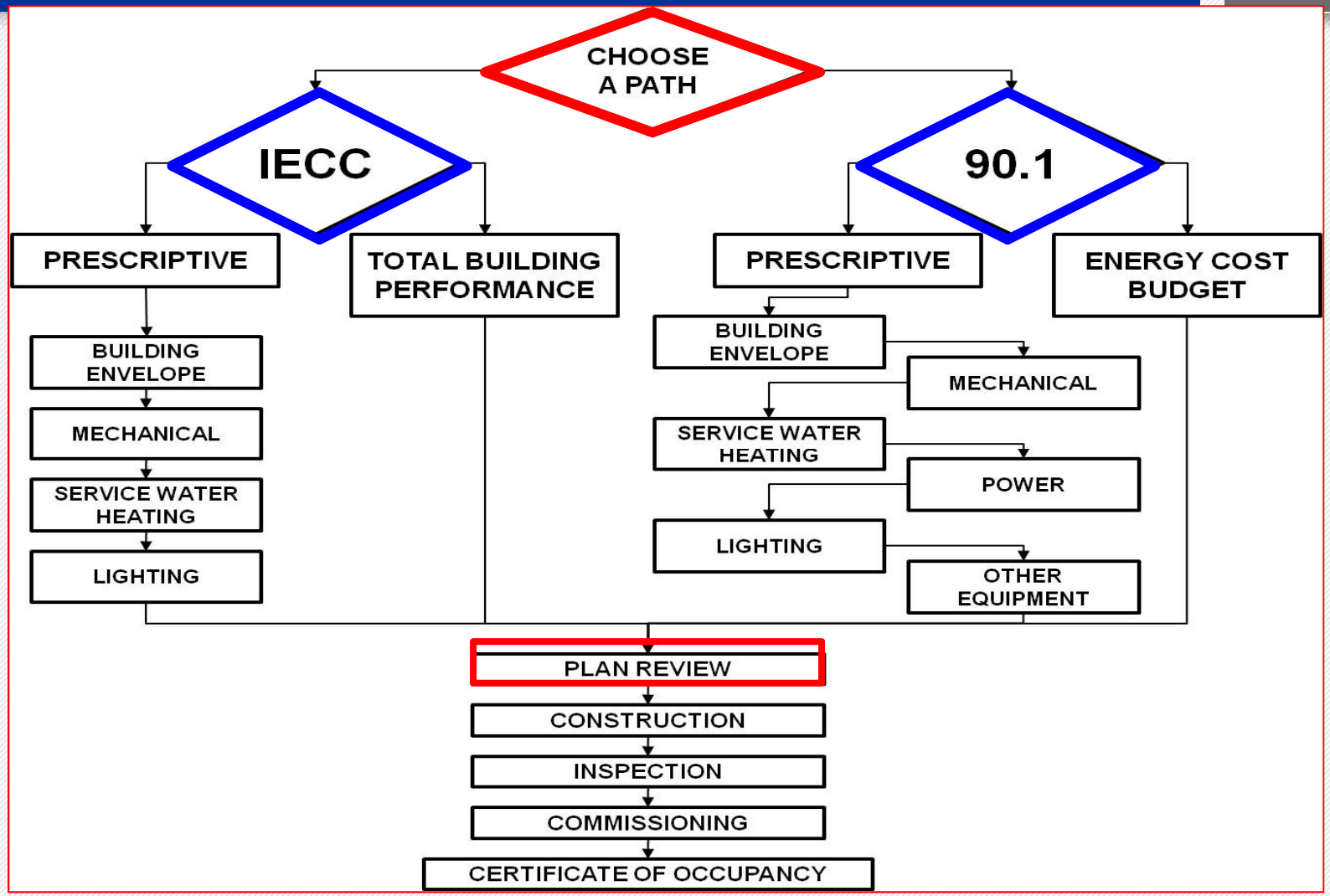

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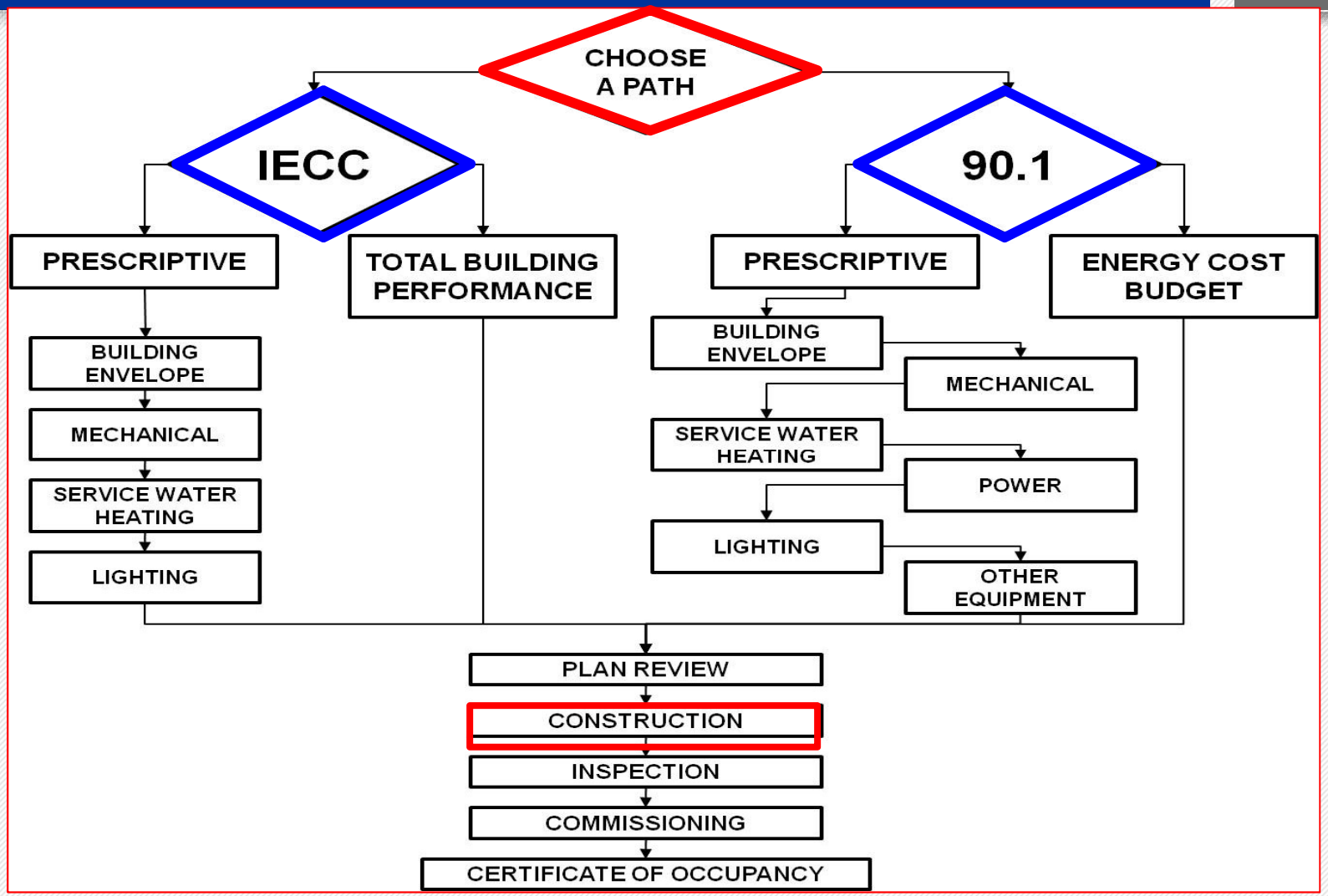

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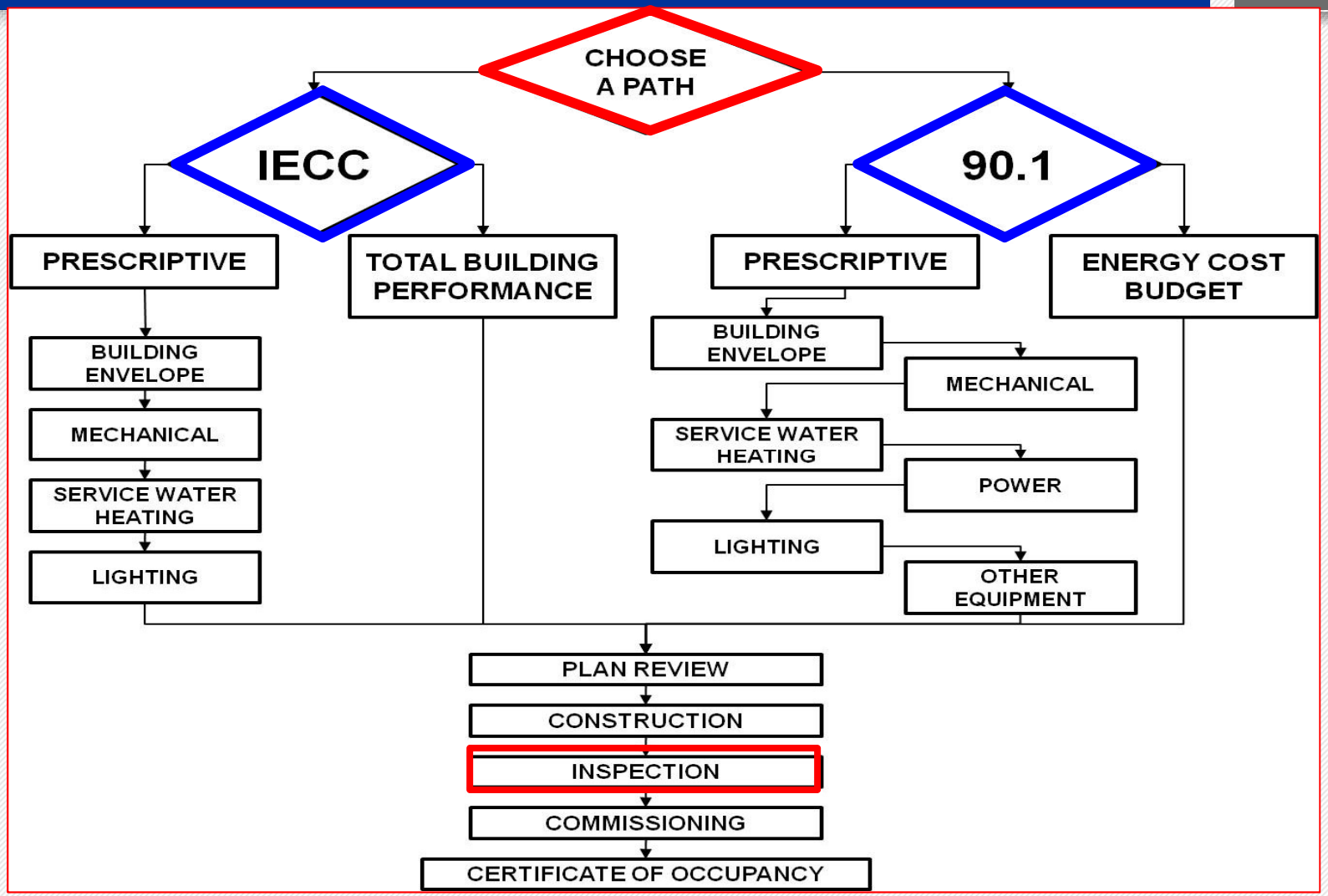

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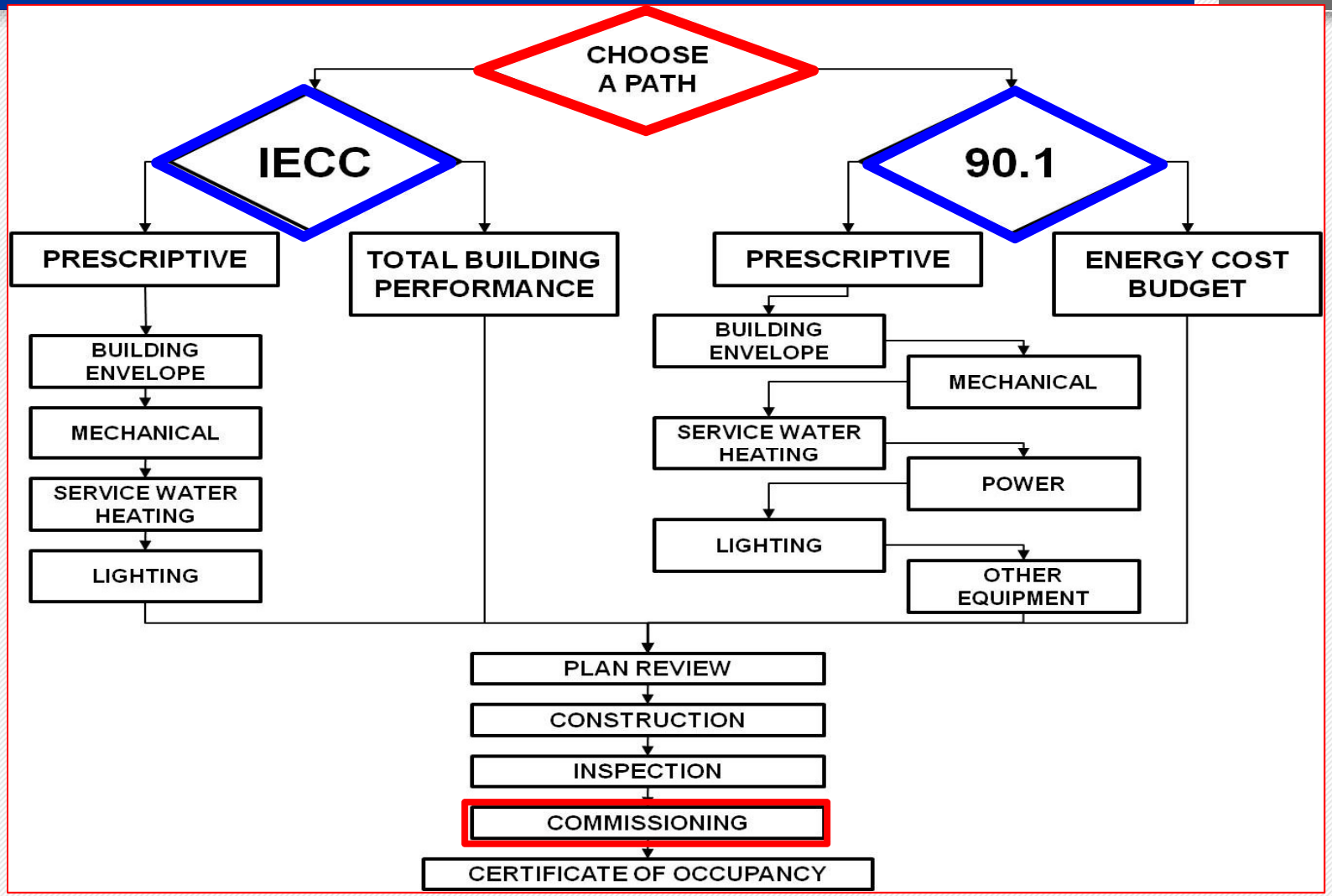

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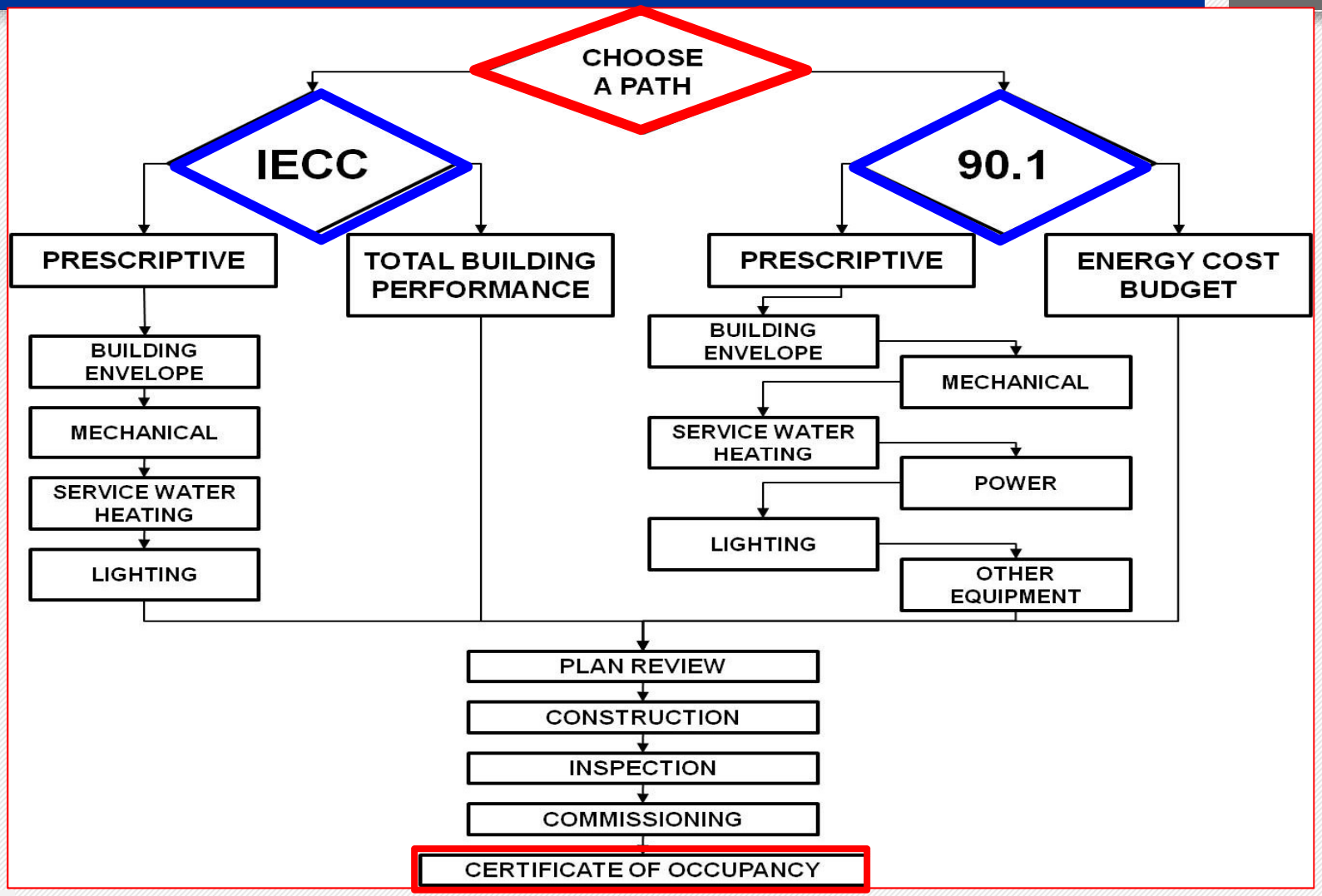


Compliance Options – IECC

1

- 90.1-2010

OR

2

2012 IECC

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

OR

- COMcheck™

AND

- Pick One:
  - C406.2 – Eff. HVAC Performance

  or
  - C406.3 – Eff. Lighting Systems

  or
  - C406.4 – On-site Renewable Energy

OR

3

2012 IECC

- C407 – Total Building Performance
- C402.4 – Air Leakage
- C403.2 – Provisions applicable to all mechanical systems
- C404 – SWH
- Lighting Mandatory Sections
  - C405.2, C405.3, C405.4
  - C405.6, C405.7
- Energy cost to be ≤ 85% of Reference Building

Compliance Options – 90.1-2010

4

- 2012 IECC

OR

5

90.1-2010

- § 5 - Envelope
- § 6 - Mechanical
- § 7 - SWH
- § 8 - Power
- § 9 - Lighting
- § 10 - Elevators & Motors

OR

- COMcheck™

OR

- Normative Appendix 'G'

OR

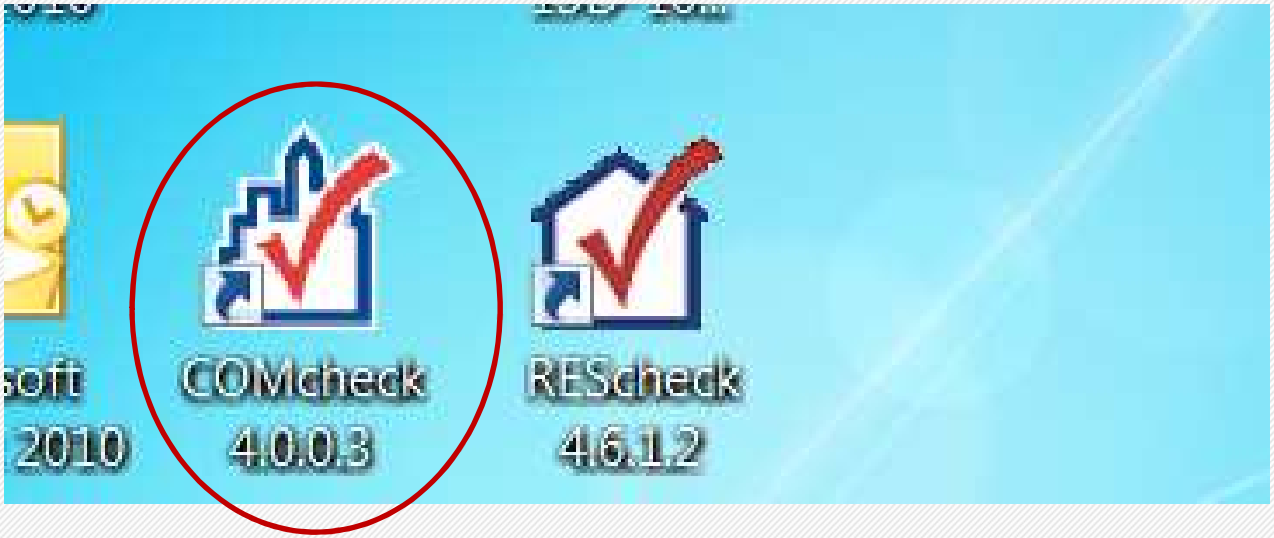
6

90.1-2010

- § 11 - Energy Cost Budget
- § 5.4 - Air Leakage
- § 6.4 - Provisions applicable to all mechanical systems
- § 7.4 - SWH
- § 8.4 - Power
- § 9.4 - Lighting Mandatory Provisions
- § 10 - Elevators & Motors
- Energy cost of Proposed to be ≤ of Reference Building

As Promised, Com-Check is back

- **Download COMcheck from Doe website: Energycodes.gov**



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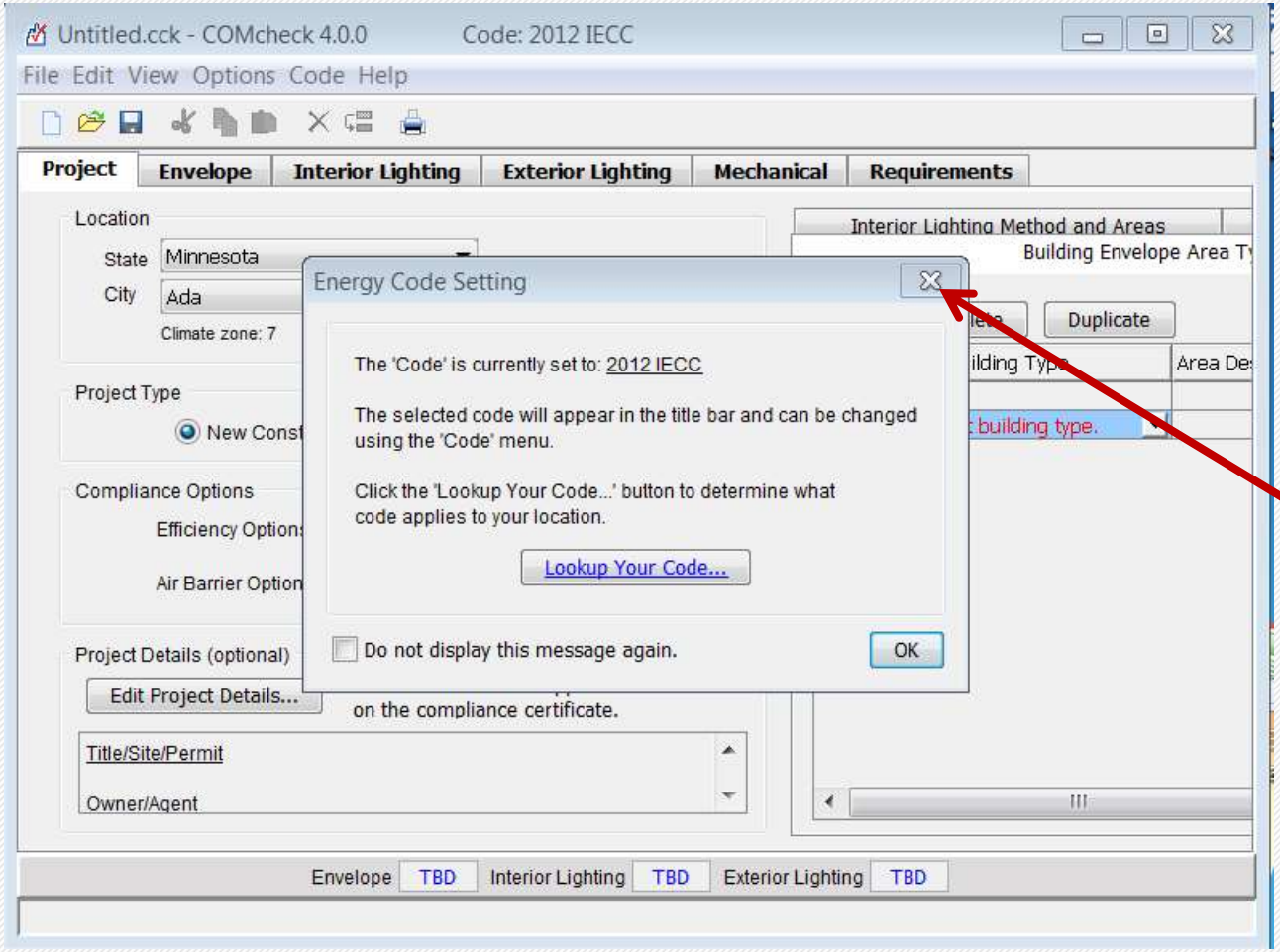

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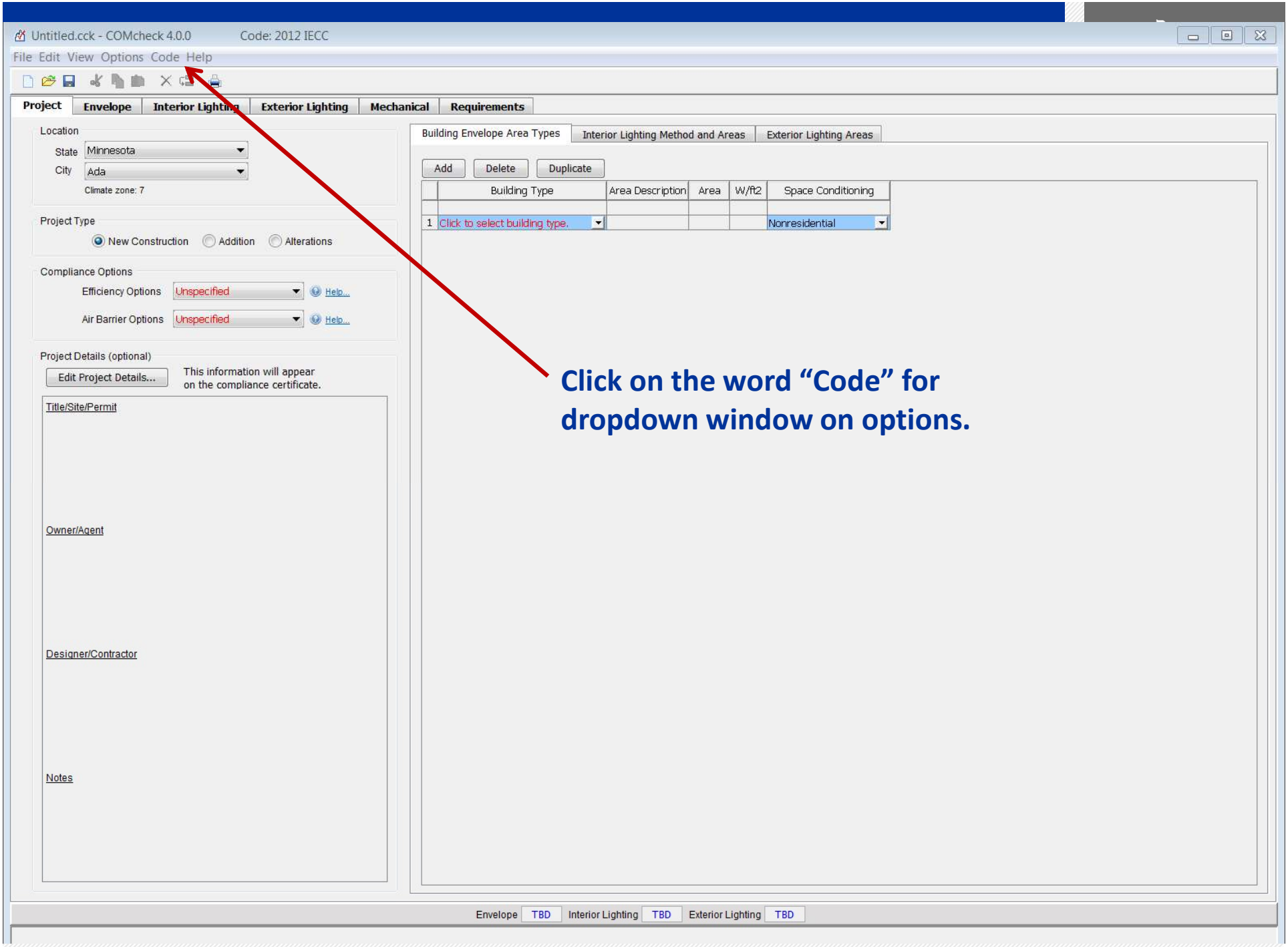
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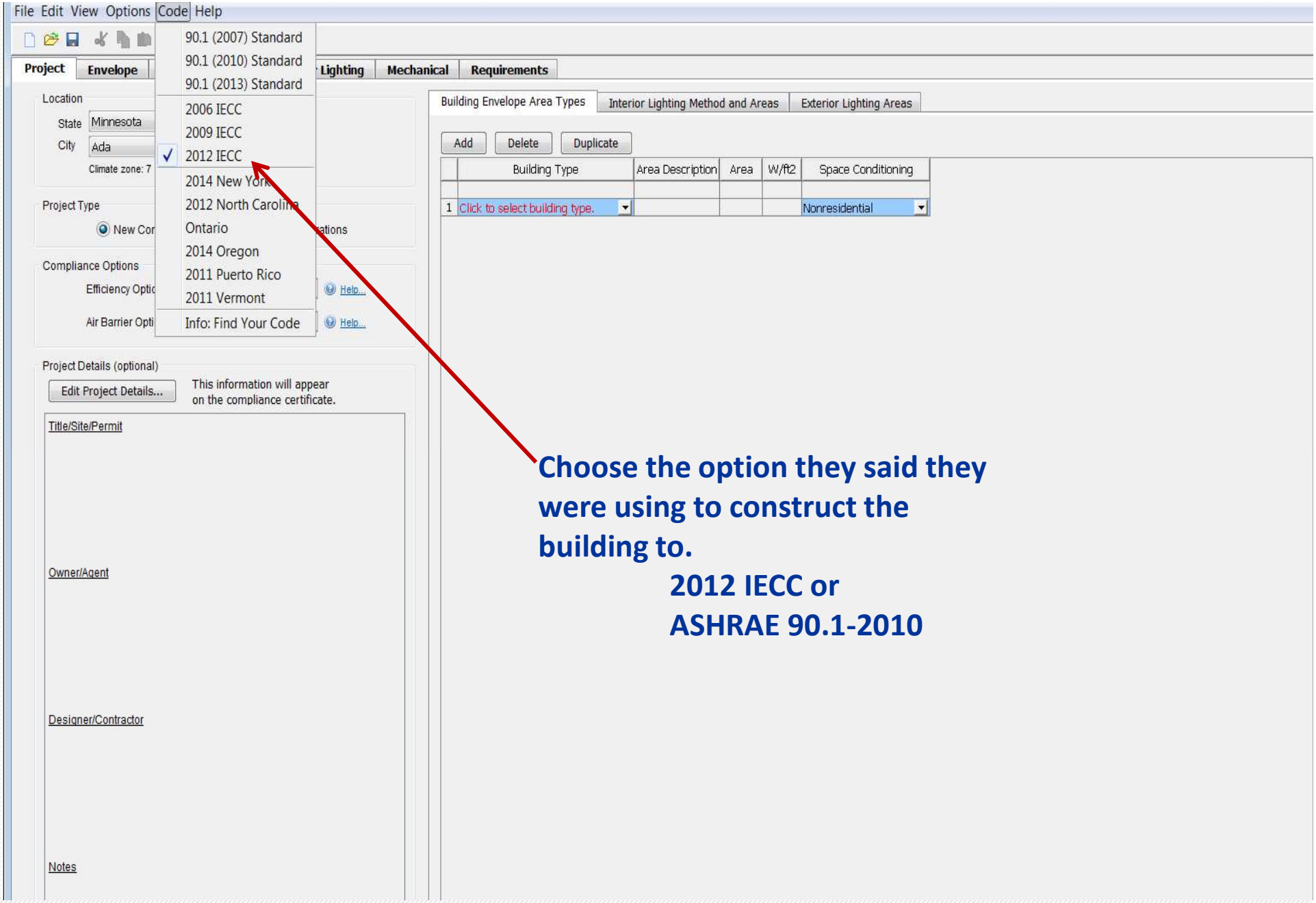
Code: 2012 IECC
File Edit View Options Code Help
Project
Envelope
Interior Lighting
Exterior Lighting
Mechanical
Requirements
Location
State Minnesota
City Ada
Climate zone: 7
Project Type
New Construction
Addition
Alterations
Compliance Options
Efficiency Options Unspecified Help...
Air Barrier Options Unspecified Help...
Project Details (optional)
Edit Project Details...
This information will appear on the compliance certificate.
Title/Site/Permit
Owner/Agent
Designer/Contractor
Notes
Building Envelope Area Types
Interior Lighting Method and Areas
Exterior Lighting Areas
Add
Delete
Duplicate
Building Type
Area Description
Area
W/ft2
Space Conditioning
1 Click to select building type.
Nonresidential
Envelope TBD
Interior Lighting TBD
Exterior Lighting TBD
Click on the word “Code” for dropdown window on options.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90.1 (2007) Standard
90.1 (2010) Standard
90.1 (2013) Standard
2006 IECC
2009 IECC
2012 IECC
2014 New York
2012 North Carolina
Ontario
2014 Oregon
2011 Puerto Rico
2011 Vermont
Info: Find Your Code
Project
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Help...
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Add
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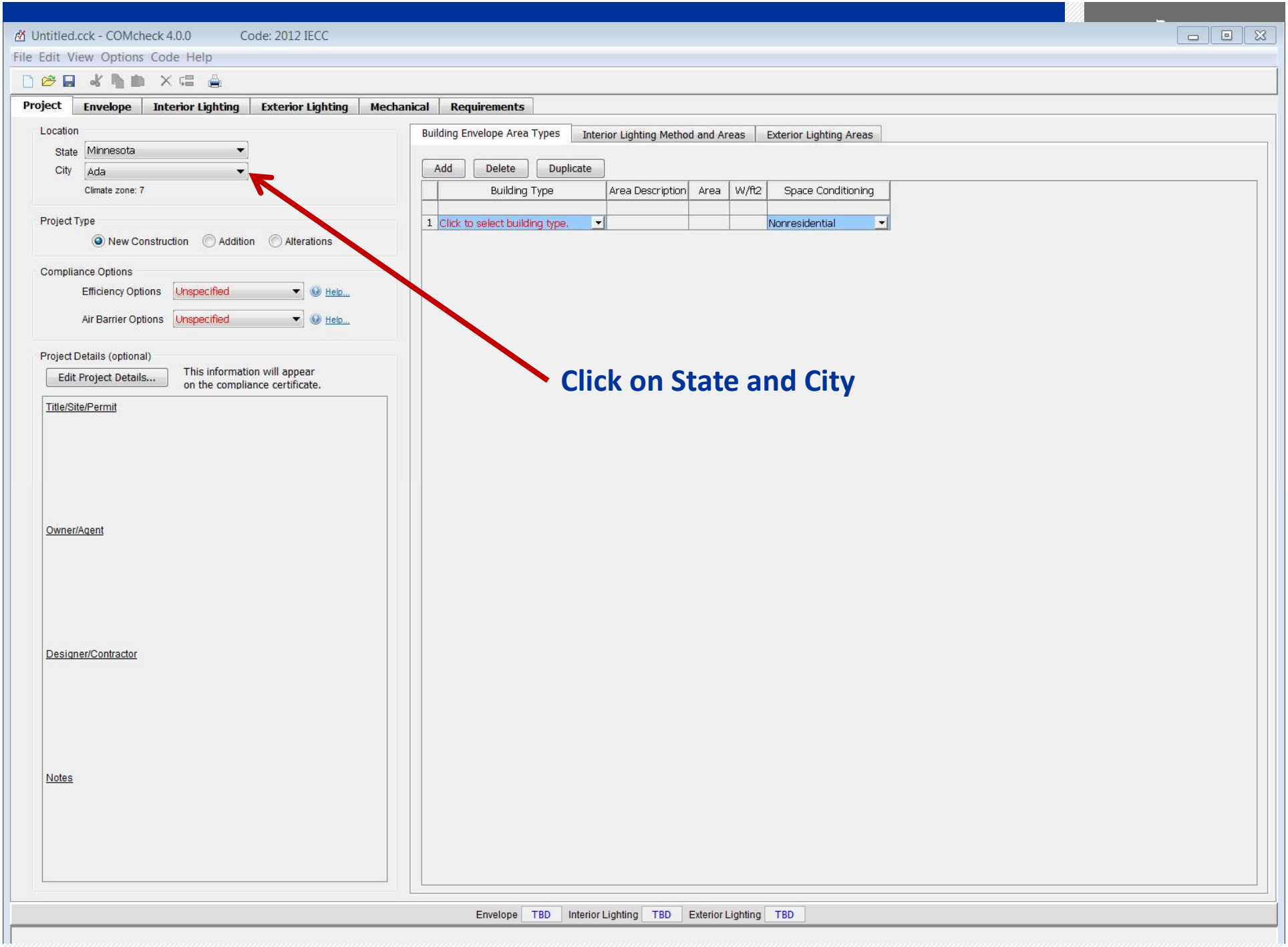
Duplicate
Building Type
Area Description
Area
W/ft2
Space Conditioning
1 Click to select building type.
Nonresidential
Choose the option they said they were using to construct the building to.
2012 IECC or
ASHRAE 90.1-2010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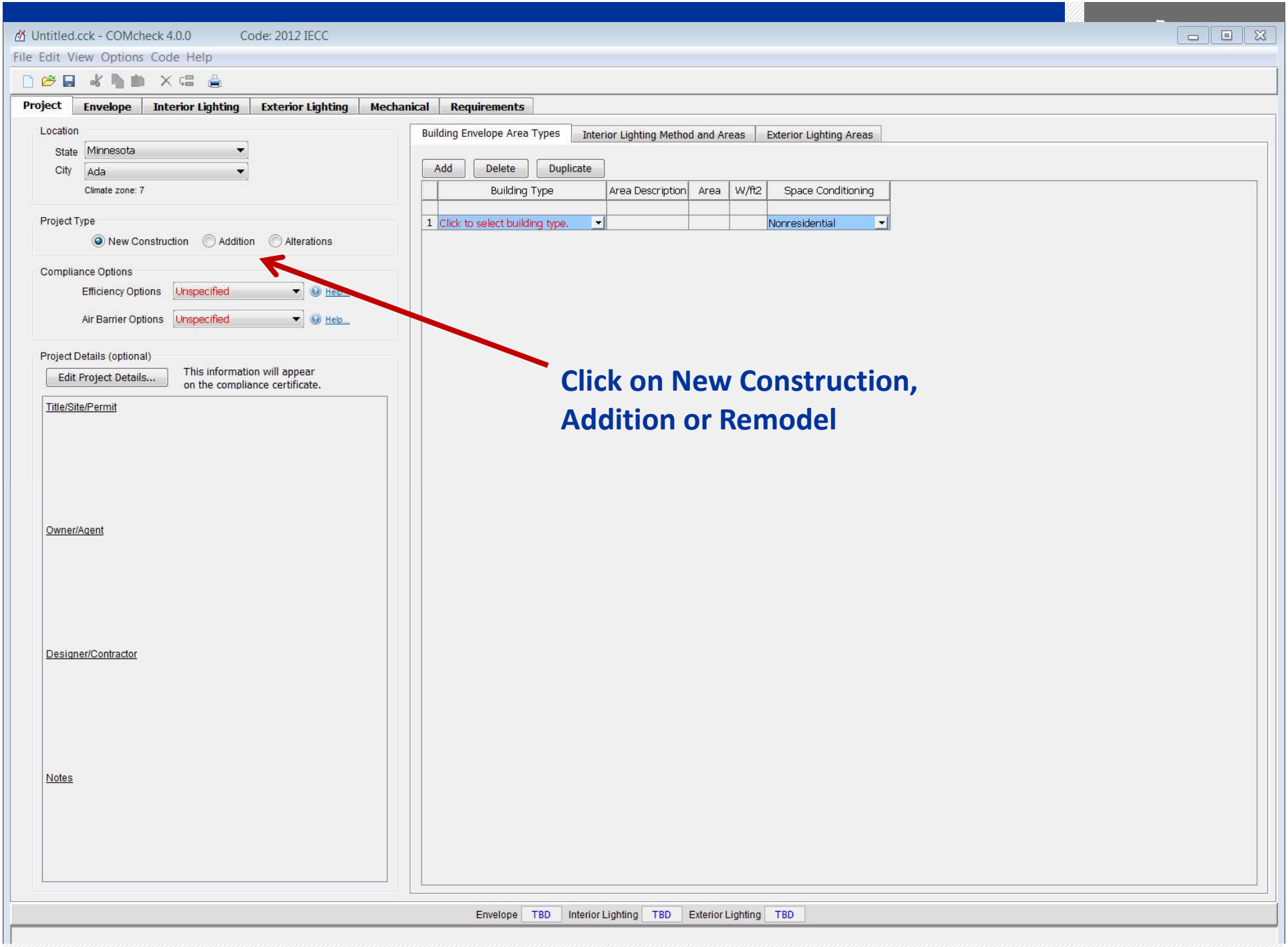
Add
Delete
Duplicate
Building Type
Area Description
Area
W/ft2
Space Conditioning
1 Click to select building type.
Nonresidential
Click on State and City
Envelope TBD
Interior Lighting TBD
Exterior Lighting TBD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Efficiency Options Unspecified
Air Barrier Options Unspecified
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Interior Lighting Method and Areas
Exterior Lighting Areas
Add
Delete
Duplicate
Building Type
Area Description
Area
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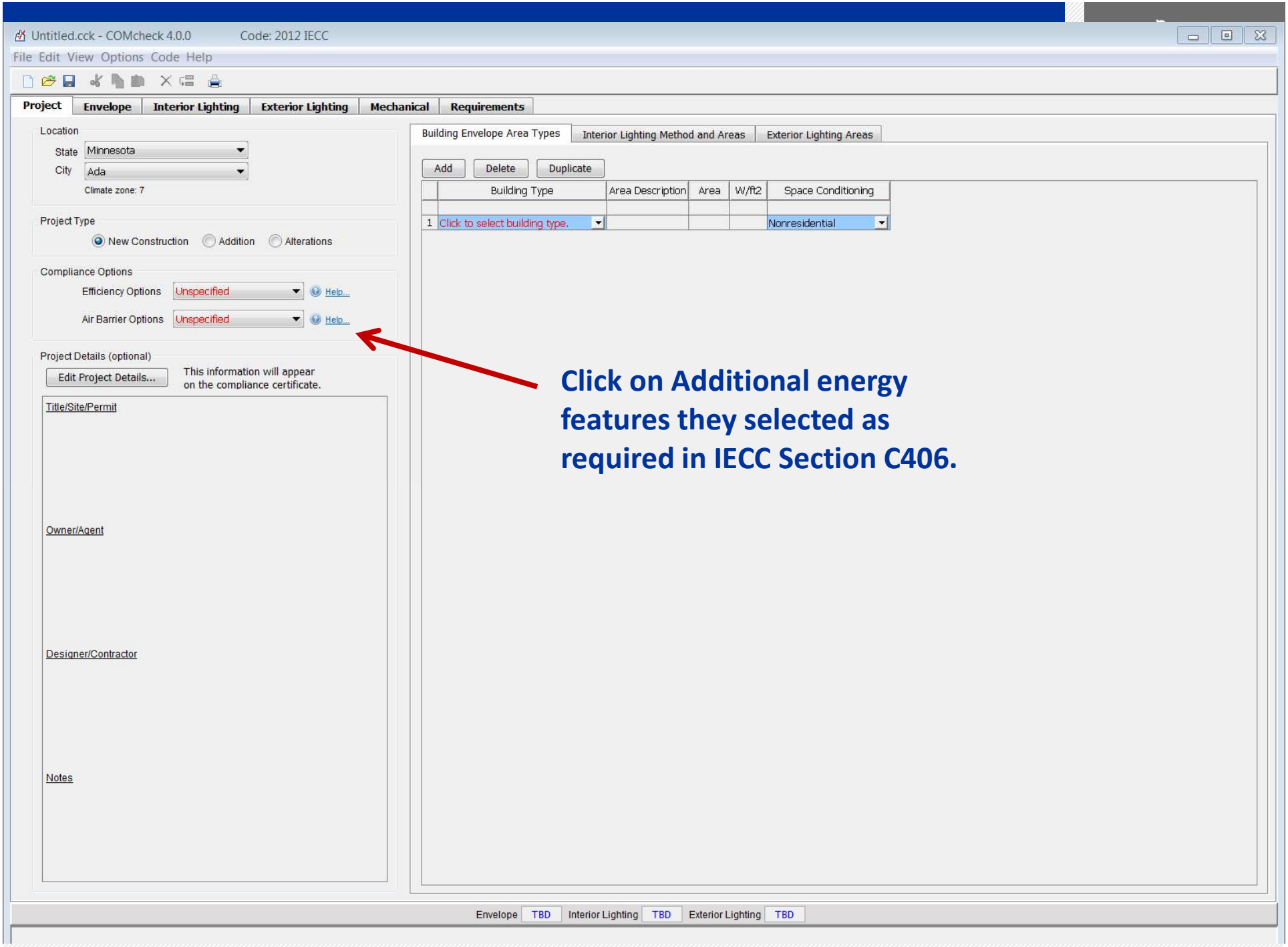
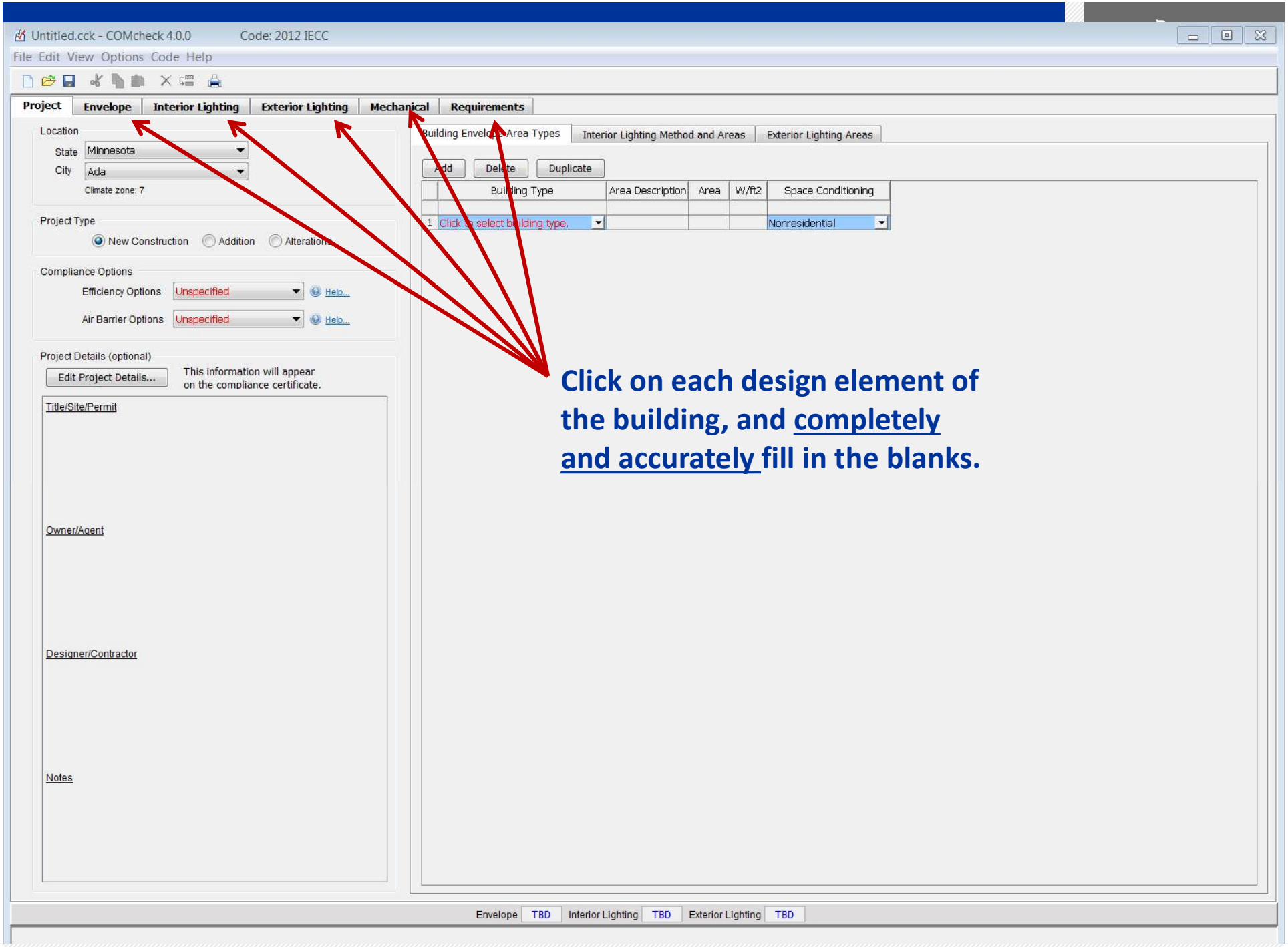
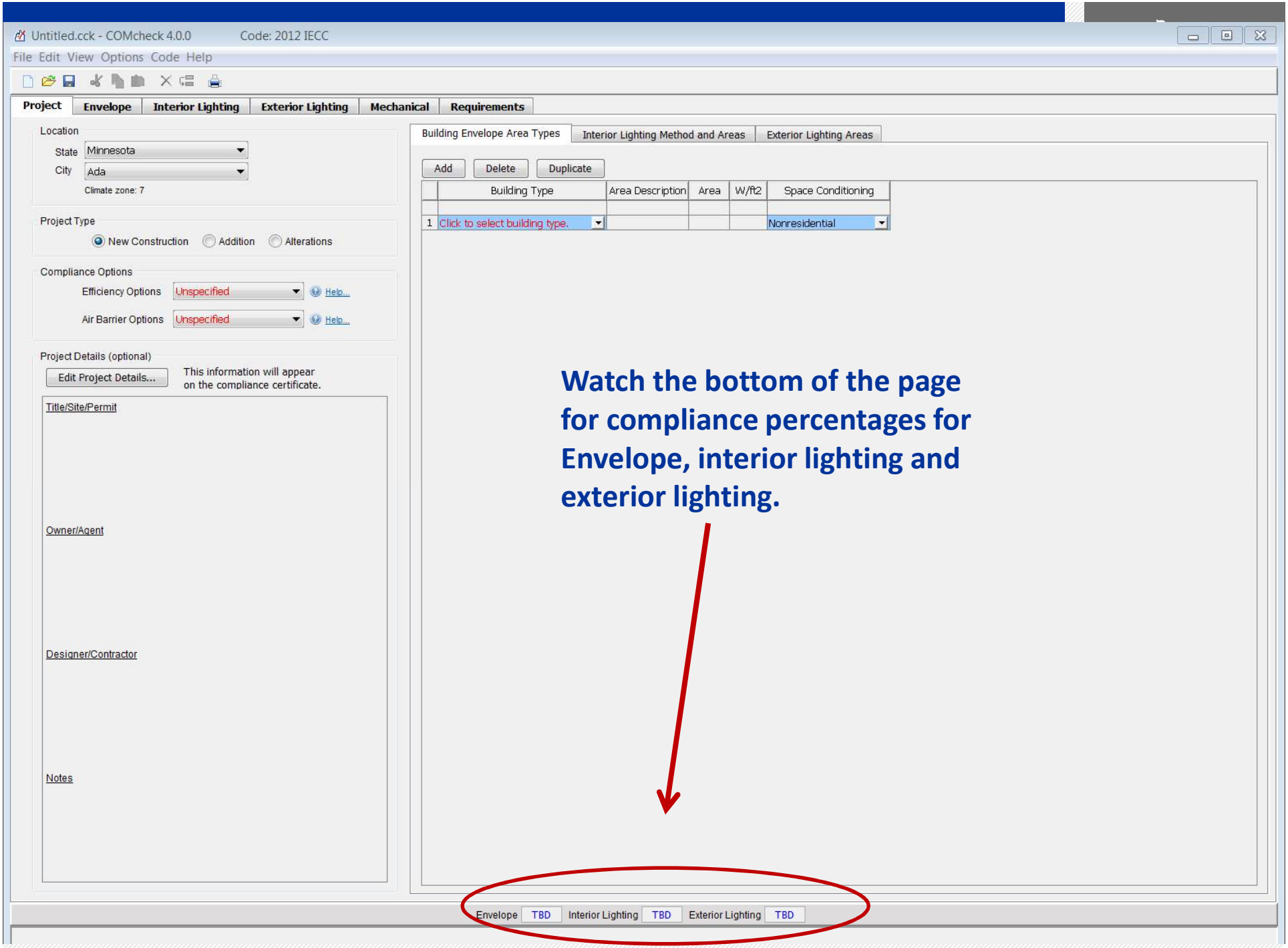
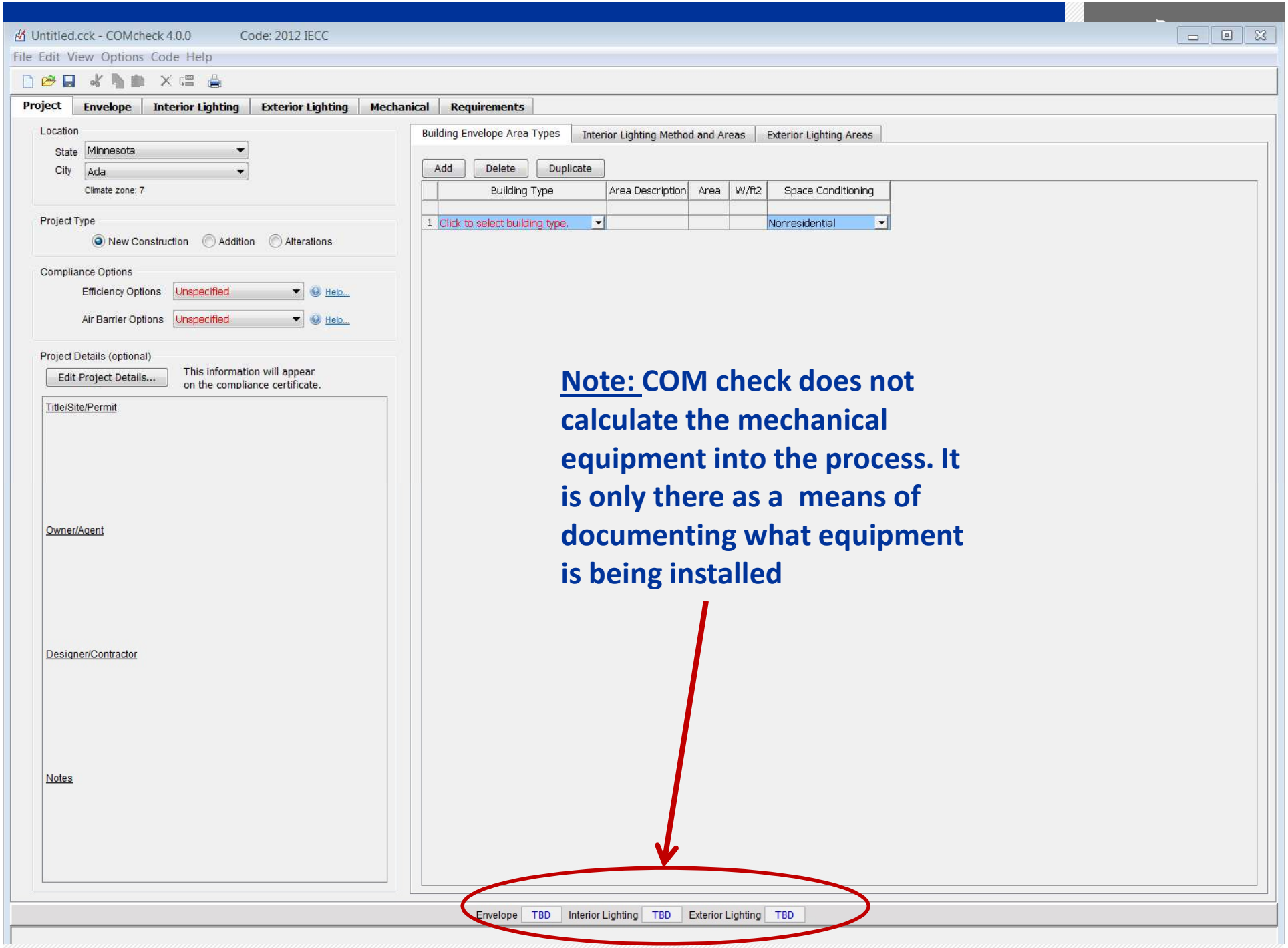
Space Conditioning
1 Click to select building type.
Nonresidential
Click on New Construction, Addition or Remodel
Envelope TBD
Interior Lighting TBD
Exterior Lighting TBD



Click on Additional energy features they selected as required in IECC Section C406.


Untitled.cck - COMcheck 4.0.0
Code: 2012 IECC
File Edit View Options Code Help
Project
Envelope
Interior Lighting
Exterior Lighting
Mechanical
Requirements
Location
State Minnesota
City Ada
Climate zone: 7
Project Type
New Construction
Addition
Alteration
Compliance Options
Efficiency Options Unspecified Help...
Air Barrier Options Unspecified Help...
Project Details (optional)
Edit Project Details...
This information will appear on the compliance certificate.
Title/Site/Permit
Owner/Agent
Designer/Contractor
Notes
Building Envelope Area Types
Interior Lighting Method and Areas
Exterior Lighting Areas
Add
Delete
Duplicate
Building Type
Area Description
Area
W/ft2
Space Conditioning
1 Click to select building type.
Nonresidential
Click on each design element of the building, and completely and accurately fill in the blanks.
Envelope TBD
Interior Lighting TBD
Exterior Lighting TBD


Untitled.cck - COMcheck 4.0.0
Code: 2012 IECC
File Edit View Options Code Help
Project
Envelope
Interior Lighting
Exterior Lighting
Mechanical
Requirements
Location
State Minnesota
City Ada
Climate zone: 7
Project Type
New Construction
Addition
Alterations
Compliance Options
Efficiency Options Unspecified Help...
Air Barrier Options Unspecified Help...
Project Details (optional)
Edit Project Details...
This information will appear on the compliance certificate.
Title/Site/Permit
Owner/Agent
Designer/Contractor
Notes
Building Envelope Area Types
Interior Lighting Method and Areas
Exterior Lighting Areas
Add
Delete
Duplicate
Building Type
Area Description
Area
W/ft2
Space Conditioning
1 Click to select building type.
Nonresidential
Watch the bottom of the page for compliance percentages for Envelope, interior lighting and exterior lighting.
Envelope TBD
Interior Lighting TBD
Exterior Lighting TBD


Untitled.cck - COMcheck 4.0.0
Code: 2012 IECC
File Edit View Options Code Help
Project
Envelope
Interior Lighting
Exterior Lighting
Mechanical
Requirements
Location
State Minnesota
City Ada
Climate zone: 7
Project Type
New Construction
Addition
Alterations
Compliance Options
Efficiency Options Unspecified Help...
Air Barrier Options Unspecified Help...
Project Details (optional)
Edit Project Details...
This information will appear on the compliance certificate.
Title/Site/Permit
Owner/Agent
Designer/Contractor
Notes
Building Envelope Area Types
Interior Lighting Method and Areas
Exterior Lighting Areas
Add
Delete
Duplicate
Building Type
Area Description
Area
W/ft2
Space Conditioning
1 Click to select building type.
Nonresidential
Note: COM check does not calculate the mechanical equipment into the process. It is only there as a means of documenting what equipment is being installed
Envelope TBD
Interior Lighting TBD
Exterior Lighting TBD

Key Differences

MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY
CONSTRUCTION CODES AND LICENSING

Building Envelope- Walls

ASHREA Standard 90.1-2010

- Specific designation for semi-heated spaces that are less vigorous than those for heated spaces

Building Envelope- Walls

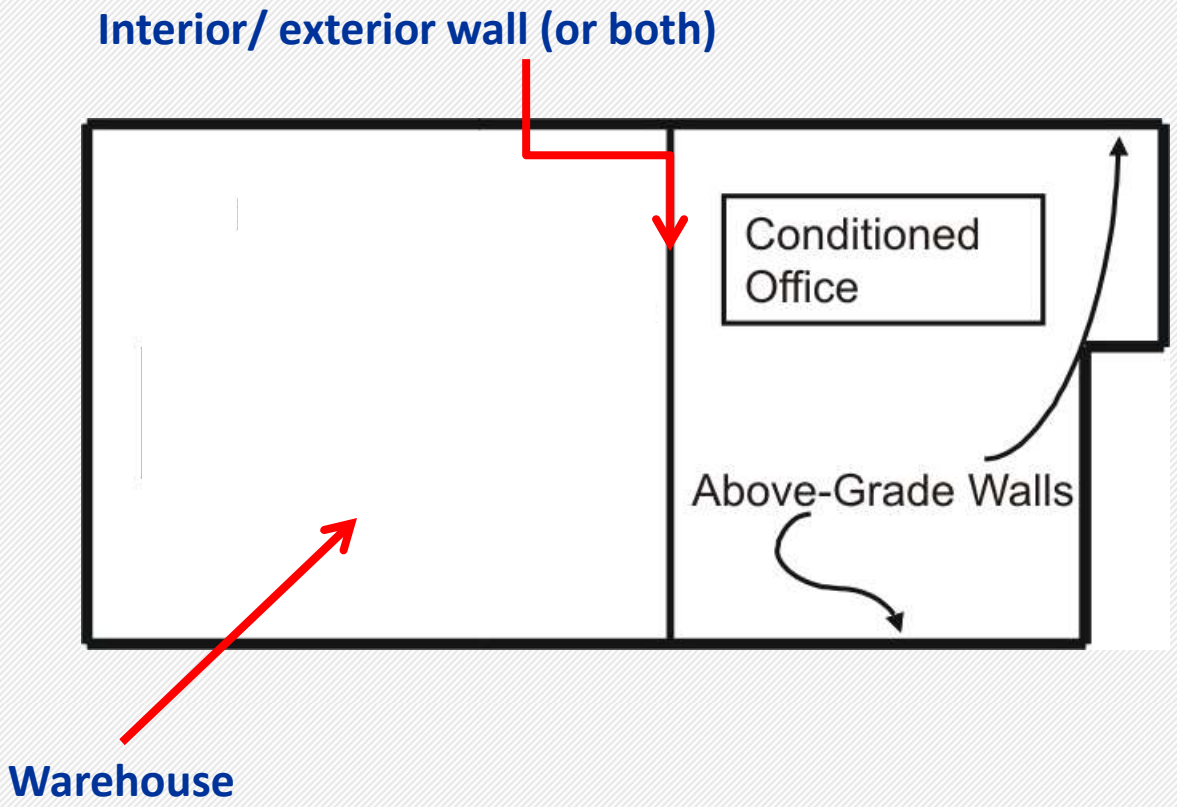
2012 IECC

- **No such designation and therefore treats all semi heated spaces as heated spaces**

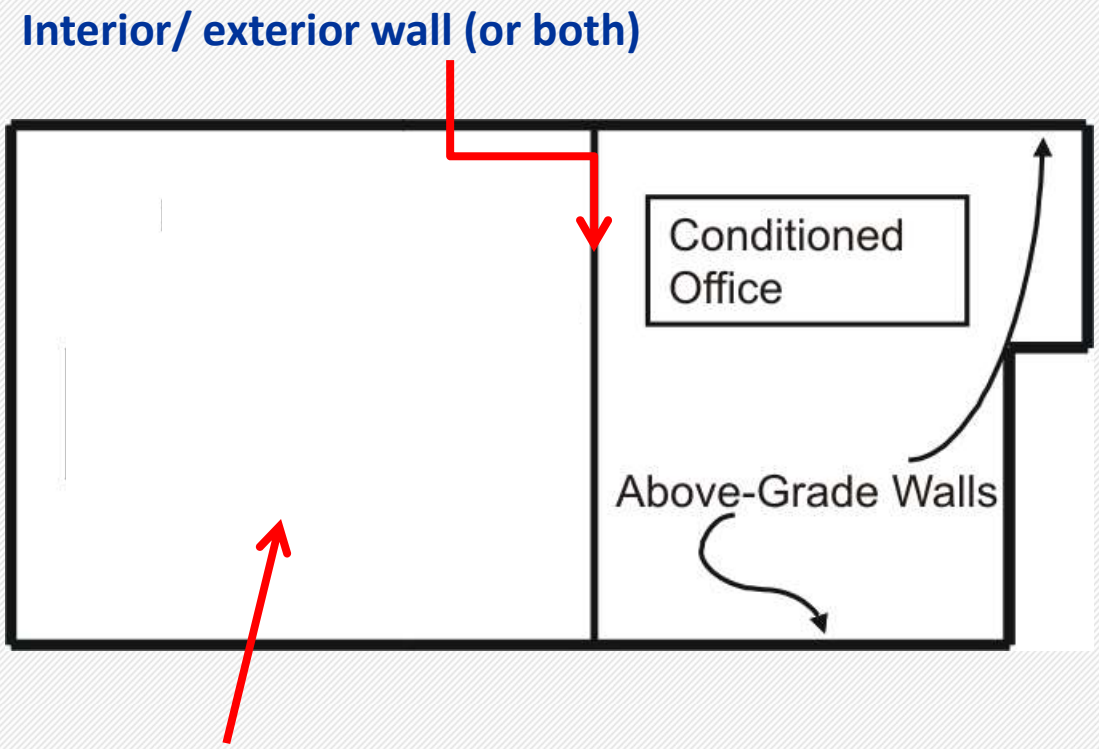
ASHREA Standard 90.1-2010

- Specific designation for semi-heated spaces that are less vigorous than those for heated spaces

Example


Interior/ exterior wall (or both)
Conditioned Office
Above-Grade Walls
Warehouse

Example


Interior/ exterior wall (or both)
Conditioned Office
Above-Grade Walls
Semi conditioned Warehouse

Building envelope- Fenestration

ASHREA Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights as roof area

Building envelope- Fenestration

2012 IECC

- **Allows up to 30% window to wall ratio.**
  - **Wall is defined as above grade only**
- **Allows up to 3% skylights to roof ratio.**

ASHREA Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights to roof ratio.

Building envelope- Fenestration

2012 IECC

- **Allows up to 30% window to wall ratio.**
  - **Wall is defined as above grade only**
- **Allows up to 3% skylights to roof ratio.**
- **Because of the wall consideration for above grade only, the IECC is more likely to reach these limitations then one built to ASHREA 90.1**
- **Maybe……**

ASHREA Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights to roof ratio.

Building envelope- Fenestration

2012 IECC

- **Allows up to 30% window to wall ratio.**
  - **Wall is defined as above grade only**
- **Allows up to 3% skylights to roof ratio.**
- **However, the IECC will allow up to 40% of vertical fenestration in no less than 50% of the conditioned floor areas in a zone dedicated as using daylighting features and controls. (C 402.3.1.1)**
- **AHSREA does not have this provision**

ASHREA Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights to roof ratio.

Building envelope- Fenestration

2012 IECC

ASHREA Standard 90.1-2010

- **Limits the fenestration area** on the **east and West sides** of the building **by requireing the southern most side to have a greater fenestration area** than that of the East or West sides

Building envelope- Fenestration

2012 IECC

- **No provisions as these appear in the IECC**

ASHREA Standard 90.1-2010

- Limits the fenestration area on the east and West sides of the building by requiring the southern most side to have a greater fenestration area than that of the East or West sides

Inspection of specific items

ASHREA Standard 9.01-2010

- This document is more specific in the details and what needs to be inspected

Inspection of specific items

2012 IECC

- Not as many details to inspect

ASHREA Standard 9.01-2010

- This document is more specific in the details and what needs to be inspected

Building Envelope
Inspection of specific items

ASHREA Standard 90.1-2010

- ✓ **Wall insulation after the insulation and vapor retarder are in place but before concealment**

Building Envelope
Inspection of specific items

ASHREA Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ **Roof/ceiling insulation after roof/insulation is in place but before concealment**

Building Envelope
Inspection of specific items

ASHREA Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ **Slab/foundation wall after slab/foundation insulation is in place but before concealment**

Building Envelope
Inspection of specific items

ASHREA Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ **Fenestration after all glazing materials are in place**

Building Envelope
Inspection of specific items

ASHREA Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ Fenestration after all glazing materials are in place
- ✓ **Continuous air barrier after installation but before concealment**

Building Envelope
Inspection of specific items

ASHREA Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ Fenestration after all glazing materials are in place
- ✓ Continuous air barrier after installation but before concealment
- ✓ **Mechanical systems and equipment and insulation after installation but before concealment**

Building Envelope
Inspection of specific items

ASHREA Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ Fenestration after all glazing materials are in place
- ✓ Continuous air barrier after installation but before concealment
- ✓ Mechanical systems and equipment and insulation after installation but before concealment
- ✓ **Electrical equipment and systems after installation but before concealment**

- **Sometimes the opaque assemblies are not consistent between the two documents even though the climate zone remains the same.**

- **Here are some examples:**

IECC- Roof insulation entirely above deck

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)[b,c]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, Below Grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-20 for 24″ below
Heated slabs[d]	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 36″ below	R-15 for 36″ below	R-15 for 36″ below	R-20 for 48″ below	R-20 for 24″ below	R-20 for 48″ below	R-20 for 48″ below	R-20 for 48″ below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

IECC Roofs

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)[b,c]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, Below Grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-20 for 24″ below
Heated slabs[d]	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 36″ below	R-15 for 36″ below	R-15 for 36″ below	R-20 for 48″ below	R-20 for 24″ below	R-20 for 48″ below	R-20 for 48″ below	R-20 for 48″ below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

ASHREA Section 5 – 5.5.1

TABLE 5.5-6 Building Envelope Requirements For Climate Zone 6

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.093	R-10.0 c.i.
Metal Buildings	U-0.049	R-13.0 + R-19.0	U-0.049	R-13.0 + R-19.0	U-0.072	R-16.0
Attic and Other	U-0.027	R-38.0	U-0.027	R-38.0	U-0.034	R-30.0
Mass	U-0.064	R-12.5 c.i.	U-0.057	R-14.6 c.i.	U-0.137	R-4.2 c.i.
Steel-Joist	U-0.038	R-30.0	U-0.032	R-38.0	U-0.052	R-19.0
Wood-Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-0.051	R-19.0
Slab-On-Grade Floors						
Unheated	F-0.540	R-10 for 24 in.	F-0.520	R-15 for 24 in.	F-0.730	NR
Heated	F-0.860	R-15 for 24 in.	F-0.688	R-20 for 48 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-0.500		U-0.500		U-1.450	

Reference Table 5.5-6 on page 31 in 90.1-2010

IECC Roofs

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roofs																
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)[b,c]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, Below Grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-20 for 24″ below
Heated slabs[d]	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 36″ below	R-15 for 36″ below	R-15 for 36″ below	R-20 for 48″ below	R-20 for 24″ below	R-20 for 48″ below	R-20 for 48″ below	R-20 for 48″ below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-ft^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

ASHREA Section 5 – 5.5.1

TABLE 5.5-7 Building Envelope Requirements For Climate Zone 7

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.093	R-10.0 c.i.
Metal Building	U-0.049	R-13.0+R-19.0	U-0.049	R-13.0+R-19.0	U-0.072	R-16.0
Attic and Other	U-0.027	R-38.0	U-0.027	R-38.0	U-0.034	R-30.0

Reference Table 5.5-7 on page 32 in 90.1-2010

Building envelope- Above Grade Wall Insulation

2012 IECC

- Does not define wall types in the document. We need to look to ASHREAE Standard 90.1 for those definitions.

ASHREA Standard 90.1-2010

- Four types of walls are defined

Building envelope- Above Grade Wall Insulation

ASHREA Standard 90.1-2010

- **Four types of walls are defined**
  - ✓ **Mass walls**
    - **heat capacity determined from Table A3.1B or A3.1C**

Building envelope- Above Grade Wall Insulation

ASHREA Standard 90.1-2010

- **Four types of walls are defined**
  - ✓ **Mass walls**
    - heat capacity determined from Table A3.1B or A3.1C
    - **R-value is for continuous insulation or when uninterrupted by framing other than metal clips no closer than 24 in. o.c. horizontally and 16 in. o.c. vertically**

Building envelope- Above Grade Wall Insulation

ASHREA Standard 90.1-2010

- **Four types of walls are defined (cont.)**
  - ✓ **Metal building** wall R-value
    - for insulation compressed between metal wall panels and the steel structure

Building envelope- Above Grade Wall Insulation

ASHREA Standard 90.1-2010

- **Four types of walls are defined (cont.)**
  - ✓ **Metal building** wall R-value
    - for insulation compressed between metal wall panels and the steel structure
  - ✓ **Steel-framed** wall R-value
    - for uncompressed insulation installed in the cavity between steel studs

Building envelope- Above Grade Wall Insulation

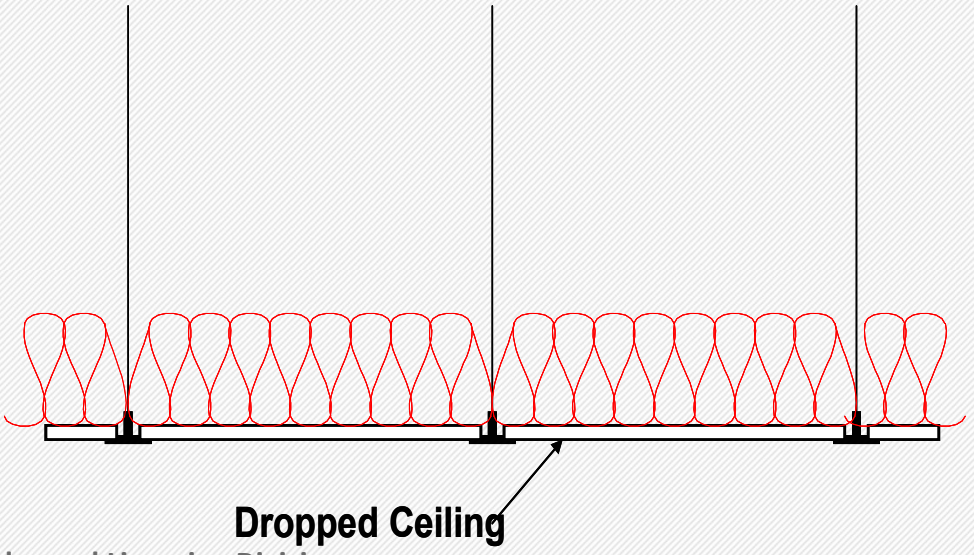
ASHREA Standard 90.1-2010

- **Four types of walls are defined (cont.)**
  - ✓ **Metal building** wall R-value
    - for insulation compressed between metal wall panels and the steel structure
  - ✓ **Steel-framed** wall R-value
    - for uncompressed insulation installed in the cavity between steel studs
  - ✓ **Wood-framed and other** R-value

    for uncompressed insulation installed in the cavity between wood studs; also acceptable to be continuous insulation uninterrupted by studs

C402.2.1 – Insulating Suspended Ceilings with Removable Ceiling Tiles

- **Will not count for code compliance**
- **Not considered part of the minimum thermal resistance of the roof insulation**



C303.1.3 -Fenestration product rating

Fenestration product rating:

"Label or Table"

NFRC

National Fenestration Rating Council

CERTIFIED

World's Best Window Co.

Millennium 2000+ Casement

Vinyl-Clad Wood Frame
Double Glaze • Argon Fill • Low E

ENERGY Performance

- Energy savings will depend on your specific climate, house and lifestyle
- For more information, call [manufacturer's phone number] or visit NFRC's web site at www.nfrc.org

Technical Information

	U-Factor	Solar Heat Gain Coefficient	Visible Transmittance	Air Leakage
Res	.32	.45	.58	.3
Non-Res	.31	.45	.60	.3

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product energy performance. NFRC ratings are determined for a fixed set of environmental conditions and specific product sizes.

Default table C 303.1.3(1)

Fenestration product rating:

"Label or Table"

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

C402.3 – Fenestration Prescriptive Compliance

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \le PF < 0.5$	1.1	1.2
$PF \le 0.5$	1.2	1.6

C402.3 – Fenestration Prescriptive Compliance

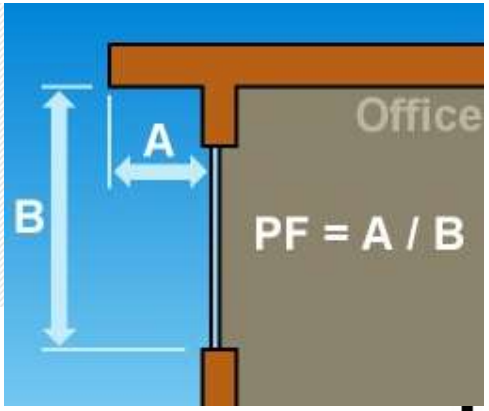


TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

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Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \le PF < 0.5$	1.1	1.2
$PF \le 0.5$	1.2	1.6

C402.3 – Fenestration Prescriptive Compliance

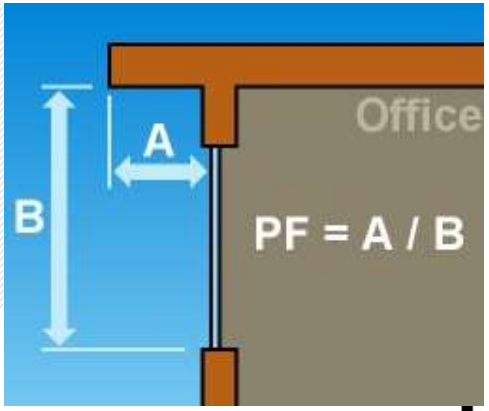

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
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Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \le PF < 0.5$	1.1	1.2
$PF \le 0.5$	1.2	1.6

C402.3 – Fenestration Prescriptive Compliance

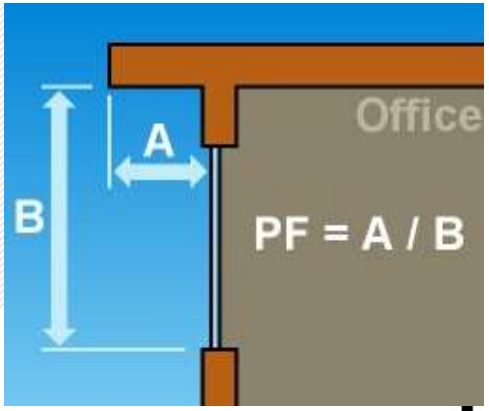


TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \le PF < 0.5$	1.1	1.2
$PF \le 0.5$	1.2	1.6

Current SHGC requirement = 0.40 (or) 0.45
South-Facing Fenestration (PF = 0.33) (2/6)

C402.3 – Fenestration Prescriptive Compliance

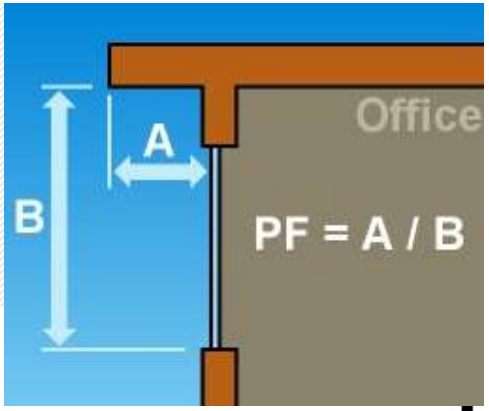


TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

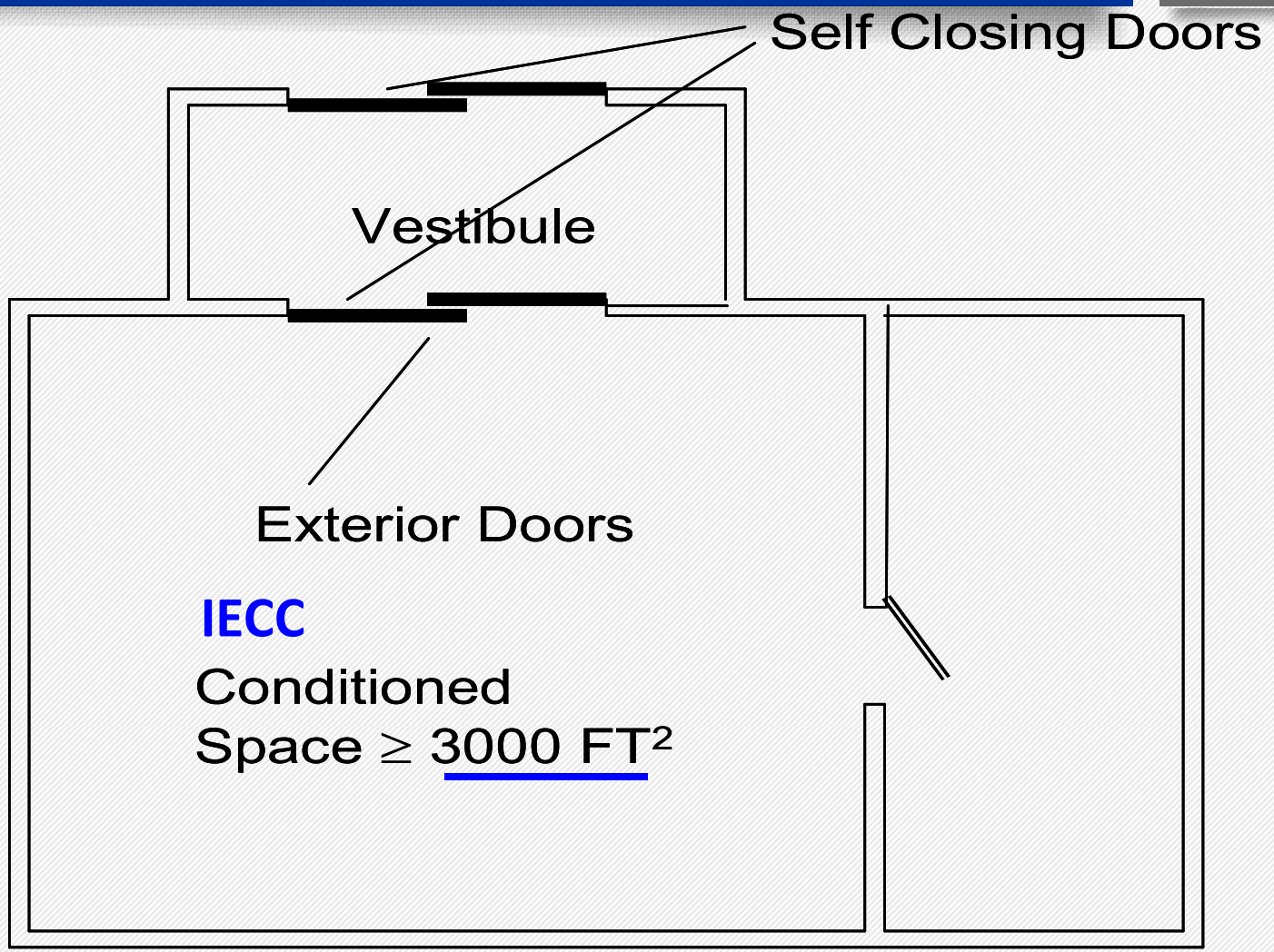
NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

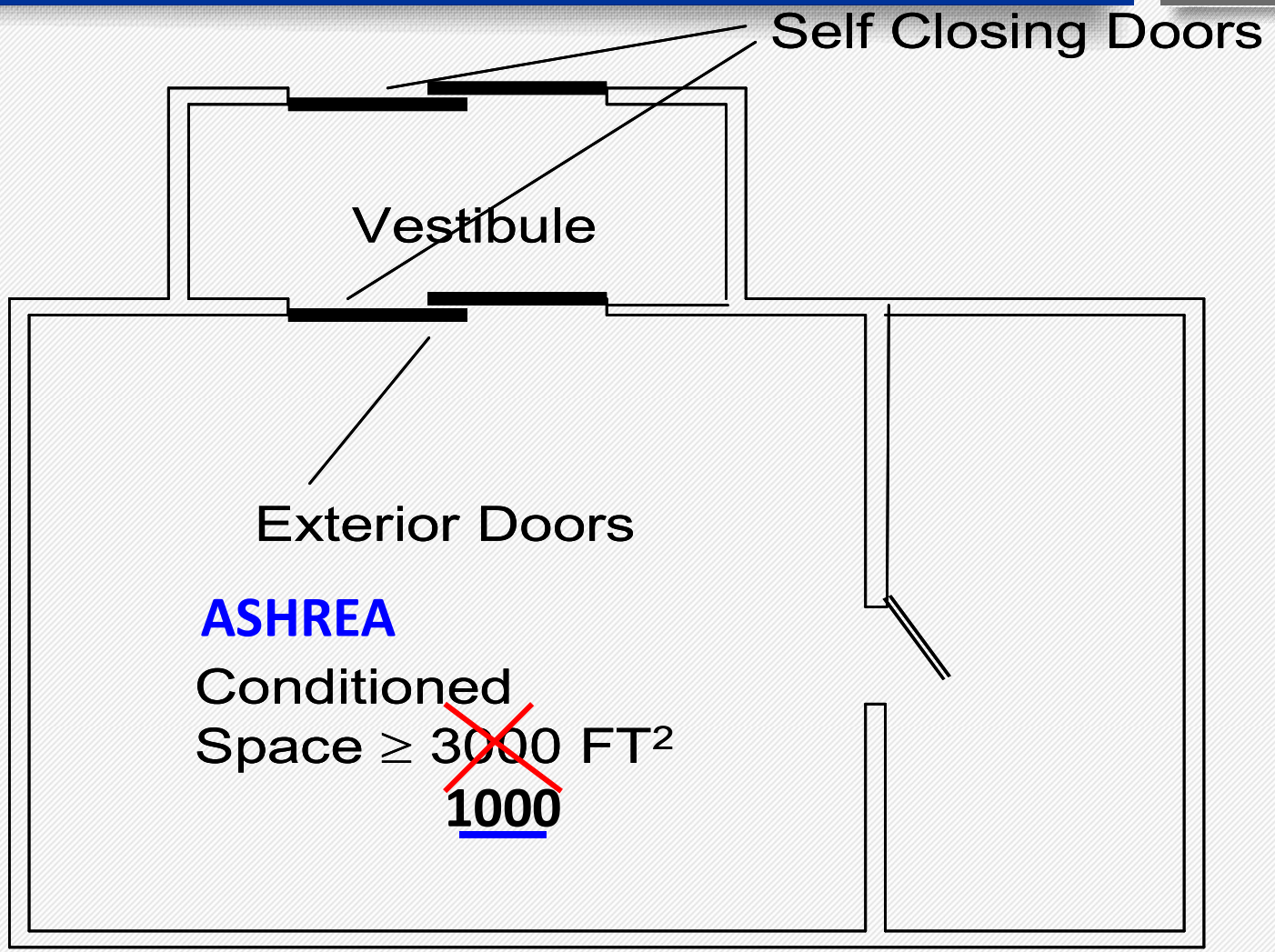
PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \le PF < 0.5$	1.1	1.2
$PF \le 0.5$	1.2	1.6

Current SHGC requirement = 0.40 (or) 0.45
South-Facing Fenestration (PF = 0.33) (2/6)
Adjustment = 0.40 x 1.2 = 0.48 (Zone 6)
(or)
= 0.45 x 1.2 = 0.54 (Zone 7)

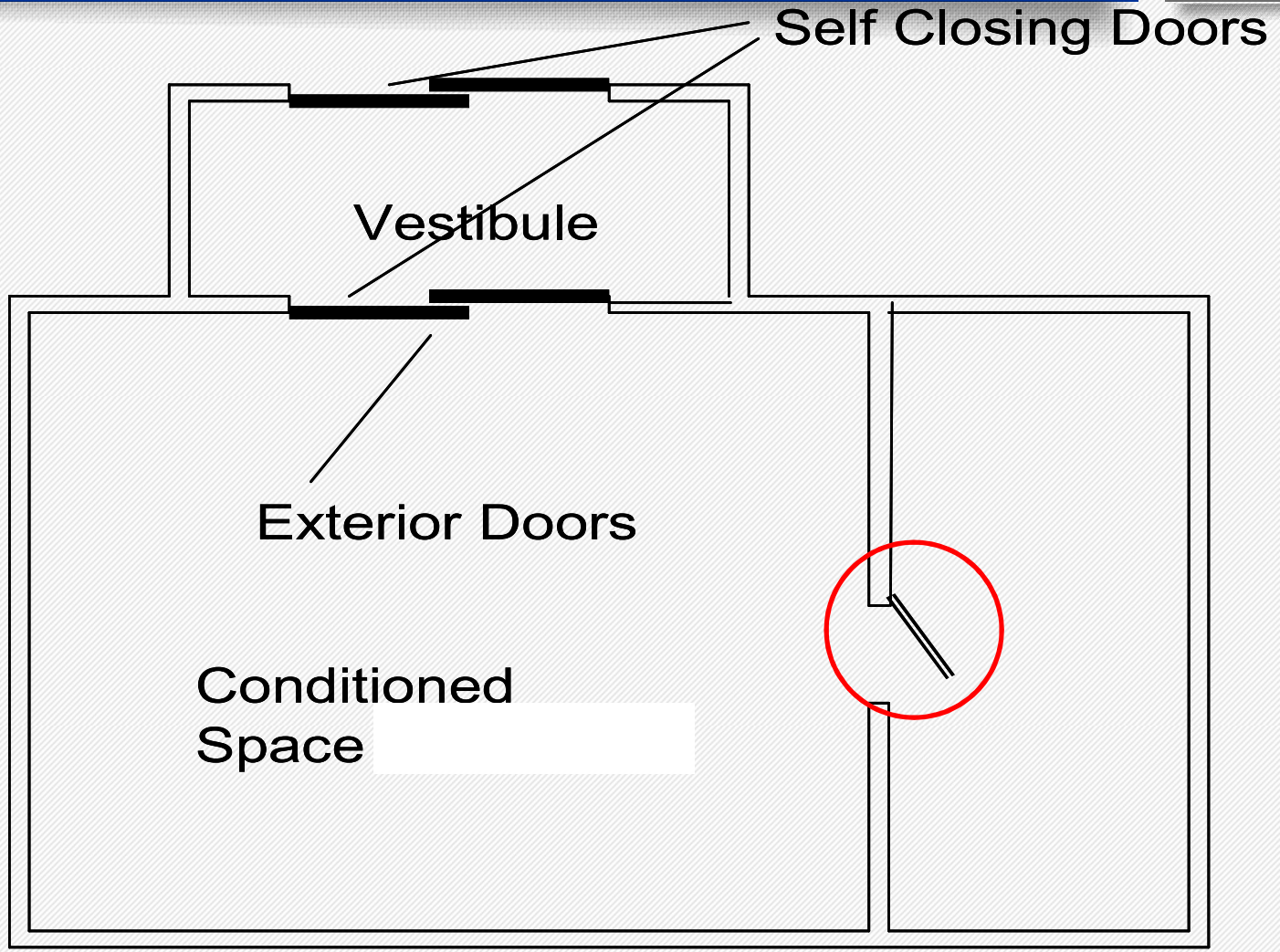
Vestibules


Self Closing Doors
Vestibule
Exterior Doors
IECC
Conditioned
Space ≥ 3000 FT²

Vestibules


Self Closing Doors
Vestibule
Exterior Doors
ASHREA
Conditioned
Space ≥ 3000 FT²
1000

Space and storage area. Do I keep a door or an opening?



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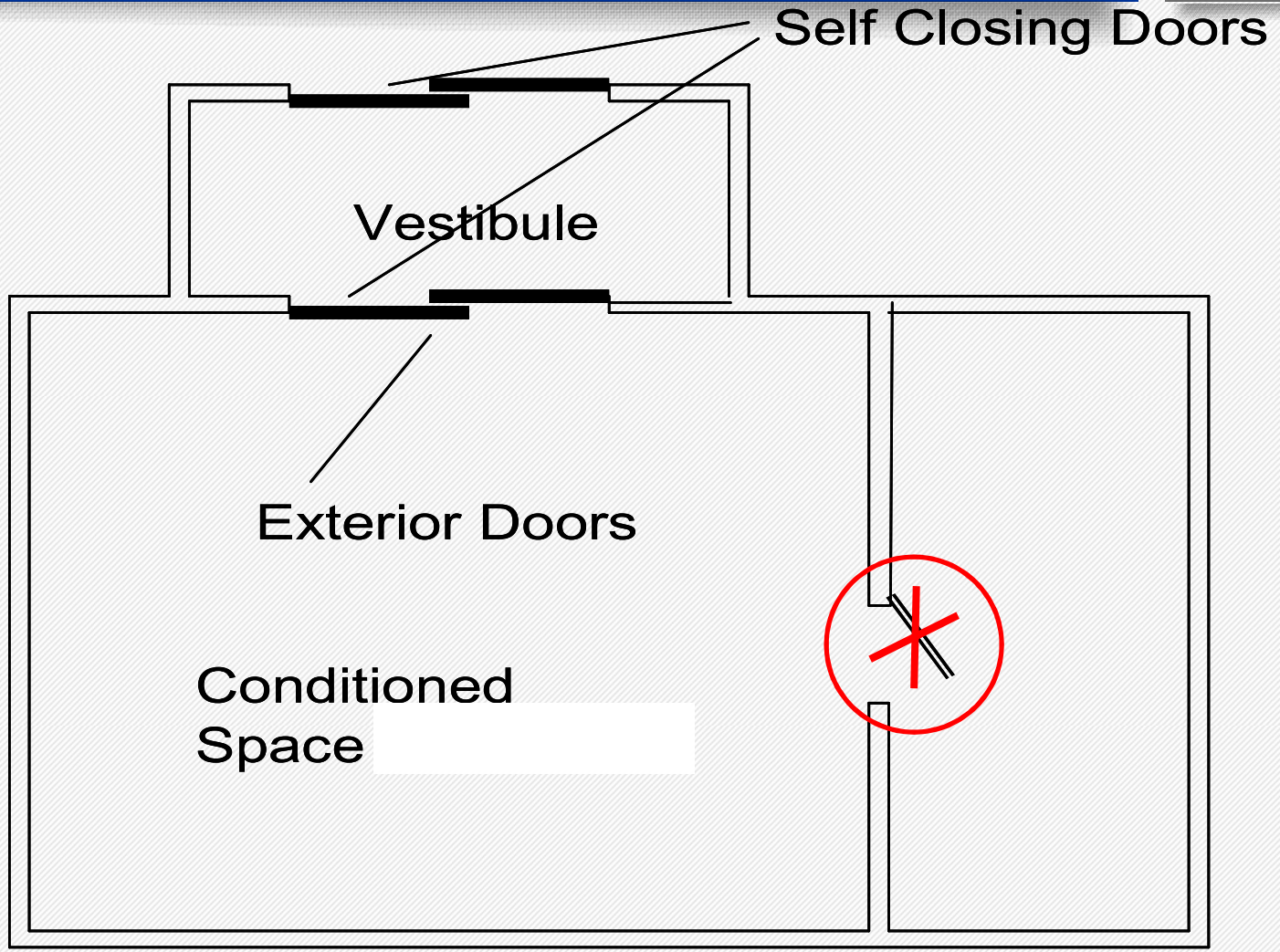

IECC/ ASHRAE Sections we have not discussed today

- **Lighting (includes)**
  - Building area method
  - Space by space method
  - Interior lighting & controls
    - Tradeable surfaces
  - Exterior lighting & controls
    - Exterior lighting Zones
  - Daylighting (natural light)
  - Controls
    - Including daylight areas
- **Power (includes)**
  - Voltage drop
  - Transformer regulations
- **Mechanical (includes)**
  - Simple system
  - Complex systems
  - Commissioning
    - Commissioning reports
  - Functional performance testing
  - Economizers
  - Heating systems
  - Cooling systems
  - System controls
  - System designs
- **Service Water Heating**


THE END