Xcel Energy®

2019 ANSI/ASHRAE/IES STANDARD 90.1 COMMERCIAL BUILDING ENVELOPE VOCABULARY

SHUMS CODA ASSOCIATES

Group 14 ENGINEERING

BUILDTank inc.

Building Code Support Program
COLORADO
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It's hard enough to carefully plan review to the energy code, but, when you have a plan designed to a code you don't use every day it can be especially intimidating. This technical guide helps highlight some of the key differences in definitions between ASHRAE 90.1-2019 and the 2021 International Energy Conservation Code (IECC) so you can make sure you're speaking the same language when it comes to the codes and standards.

What is the Building Envelope?

A building envelope is the assembly of building elements that form the boundary between conditioned, semiheated, and unconditioned spaces. Its purpose is

- to control heat transfer,
- to maintain a stable indoor environment
- improve energy efficiency.

The complete building envelope can include foundation walls, below grade walls, slab on grade, floors, above grade walls (e.g. wood framed, metal framed, mass, concrete, etc.), doors, windows, skylights, attics, and roofs.

The building envelope must meet specific insulation, air leakage, and fenestration requirements depending on the energy compliance path that is chosen for the project.

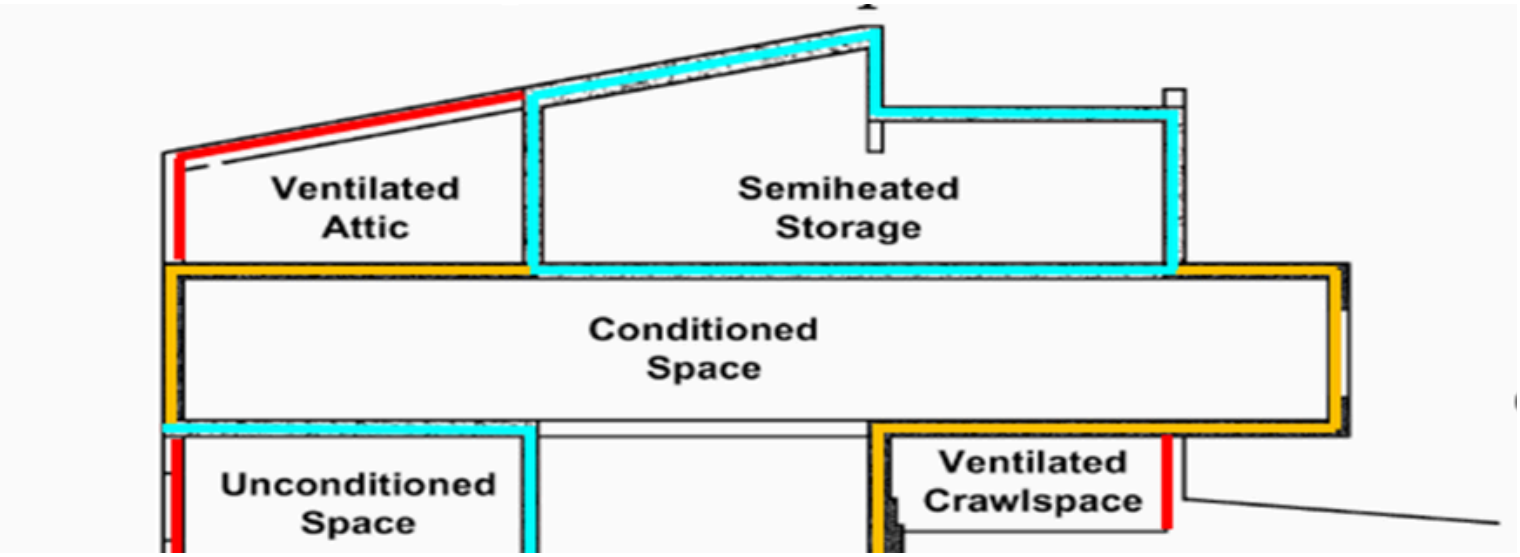
Key Definitions from Section 3.2

Exterior Building Envelope: the elements of a building that separate conditioned spaces from the exterior.

Semiexterior Building Envelope: the elements of a building that separate conditioned space from unconditioned space or that enclose semiheated spaces through which thermal energy may be transferred to or from the exterior, to or from unconditioned spaces.

Enclosed Space: a volume substantially surrounded by solid surfaces such as walls, floors, roofs, and openable devices such as doors, and operable windows.

Space: an eclosed space within a building. The classifications of spaces are as follows for the purpose of determining building envelope requirements.



Conditioned Space: a cooled space, heated space, or indirectly conditioned space.

a) Cooled Space: an enclosed space within a building that is cooled by a cooling system whose sensible output capacity exceeds 3.4 Btu/h*ft^2 of floor area.

b) Heated Space: an enclosed space within a building that is heated by a heating system whose output capacity relative to the floor area is greater than or equal to the criteria in table 3.2.

c) Indirectly Conditioned Space: an enclosed space within a building that is not a heated space or a cooled space, which is heated or cooled indirectly by being connected to adjacent space(s) provided:

1. The product of the U-factors and surface areas of the space adjacent to connected spaces exceeds the combined sum of the product of the U-factors and surface areas of the space adjoining the outdoors, unconditioned spaces, and to or from semiheated spaces (e.g. corridors) or
2. that air from heated or cooled spaces is intentionally transferred (naturally or mechanically) into the space at a rate exceeding 3 ach (e.g. atria).

d) Semiheated Space: an enclosed space within a building that is heated by a heating system whose output is greater than or equal to 3.4Btu/h*ft^2 of floor area but is not a conditioned space.

e) Unconditioned Space: an enclosed space within a building that is not conditioned space or a semiheated space. Crawlspaces, attics, and parking garages with natural or mechanical ventilation are not considered enclosed spaces.

Climate Zone	Heated Space Threshold	Semiheated Space Range
1	>5 Btu/h*sqft	3.4 to 5 Btu/h*sqft
2	>5 Btu/h*sqft	3.4 to 5 Btu/h*sqft
3A, 3B	>9 Btu/h*sqft	3.4 to 9 Btu/h*sqft
3C	>7 Btu/h*sqft	3.4 to 7 Btu/h*sqft
4A, 4B	>10 Btu/h*sqft	3.4 to 10 Btu/h*sqft
4C	>8 Btu/h*sqft	3.4 to 8 Btu/h*sqft
5	>12 Btu/h*sqft	3.4 to 12 Btu/h*sqft
6	>14 Btu/h*sqft	3.4 to14 Btu/h*sqft
7	>16 Btu/h*sqft	3.4 to 16 Btu/h*sqft
8	>19 Btu/h*sqft	3.4 to 19 Btu/h*sqft

Designers must consult Section 5.1.4.1 and Table B-1 from the AHSRAE 169 Standard to verify the zone for the specific county that the project is located.

Project designers must select and document one of the following four paths for the entire project. Path requirements cannot be mixed and matched. The selected path will govern the building envelope, and the electrical, mechanical, and plumbing systems for the project.

The options to choose from are:

1. **Section 5.5 Prescriptive path–** Strict adherence to specific R-values and U-factors for every component. The project must comply with the appropriate climate table 5.5-0 through 5.5-8

2. **Section 5.6 Building Envelope Trade-off Compliance Path–** Allows flexibility of the building envelope components (e.g. increasing U-factor of fenestration if compensating with higher insulation R-value elsewhere). This is calculated via COMcheck^{tm} or other similar software

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3. **Section 11 Energy Cost Budget–** A modeled approach comparing a proposed building design predicted energy costs against a “baseline” building (e.g. the same building built with the prescriptive path).

4. **Appendix G Performance Rating –** A comprehensive modeling path often used for LEED or high-performance certifications.

Just a note to remember that the specific details and requirements of Section 11 and Appendix G differ greatly from the requirements of the IECC, (e.g. Simulation program capabilities, Exceptional Calculation Methods, Mandatory Requirements, etc.).

Additional detailed information and path requirements can also be found on the Shums Coda Energy and Sustainability website.
Energy and Sustainability - Shums Coda

Technical Documents Page
Colorado Building Code Support Program - Shums Coda

The use of any compliance path must meet the mandatory requirements of section 5.4 which includes the following sections:

5.4.1 Insulation – A material of relatively low heat conductivity used to shield a volume against loss or entrance of heat by radiation, convection, or conduction.

- **Continuous Insulation –** Insulation that is uncompressed and continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior side, the exterior side, or is integral (e.g. SIPS panels), to the opaque surface of the exterior wall.
- **Cavity Insulation-** Insulation that is installed uncompressed filling the void between a building's inner and outer wall skins. It is installed between purlins and girts, wall studs, floor joists, roof rafters, and trusses as part of the building envelope.

5.4.2 Fenestration – An assembly, including the frame, in the building envelope that allows light to pass. Fenestration assemblies include but are not limited to, windows, plastic/composite panels, clere stories, roof monitors, skylights, glass block, and doors where more than one-half of the door area is glazed. Types of fenestrations include field fabricated, skylight, and vertical fenestration.

- **Solar heat gain coefficient (SHGC):** the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space.
- **U-factor (thermal transmittance):** heat transmission in unit time through unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on each side ($Btu/h \cdot ft^2 \cdot °F$).
- **Visible transmittance (VT):** the ratio of visible radiation entering the space through the fenestration product to the incident visible radiation, determined as the spectral transmittance of the total fenestration system, weighted by the photopic response of the eye and integrated into a single dimensionless value.

5.4.2 Doors – A hinged, sliding, rollup, or revolving barrier, at the entrance of a building or room. An opaque door is a solid, non-transparent door that blocks light and visibility, with less than 50% glazing.

5.4.3.1 Continuous Air Barrier – The combination of interconnected materials, assemblies, sealed joints, and components of the building envelope that minimize air leakage int or out of the building envelope.

5.4.3.2 Loading Dock Weatherseals – A barrier applied around the edges of a loading dock door to prevent air, water, dust, and insects, from entering a building. It enhances energy efficiency by reducing drafts, heat loss, and noise, and is made from materials like rubber, foam, felt, or metal.

5.4.3.3 Vestibules and Revolving Doors – Vestibules are a passage, hall, or room between the outer door and the interior of a building. Revolving doors are an entrance/egress element which has partitions that turn/revolve about a central axis. The partitions are equipped with weather seals that are in contact with the semi-circular door enclosure to limit the loss of energy through the opening.