Building Physics

LEVEL: **1 YEAR BACHELOR**

SPECIALTY: **COP**

COURS 03

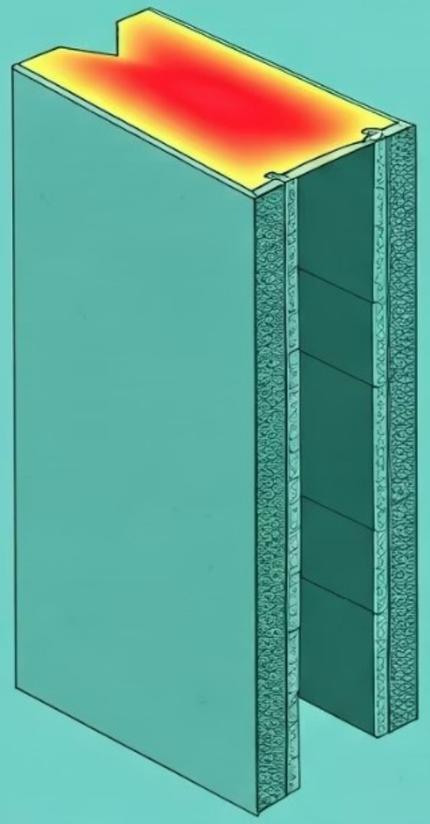
HEAT LOSS

University of Biskra

2024-2025

Thermal Bridges and Heat Loss in Buildings

This cours explores thermal bridges in buildings, their types, and impact on heat loss. We'll examine how to calculate thermal losses and strategies to mitigate their effects.



Understanding Thermal Bridges

Definition

Areas where building elements connect, causing heat loss through the envelope.

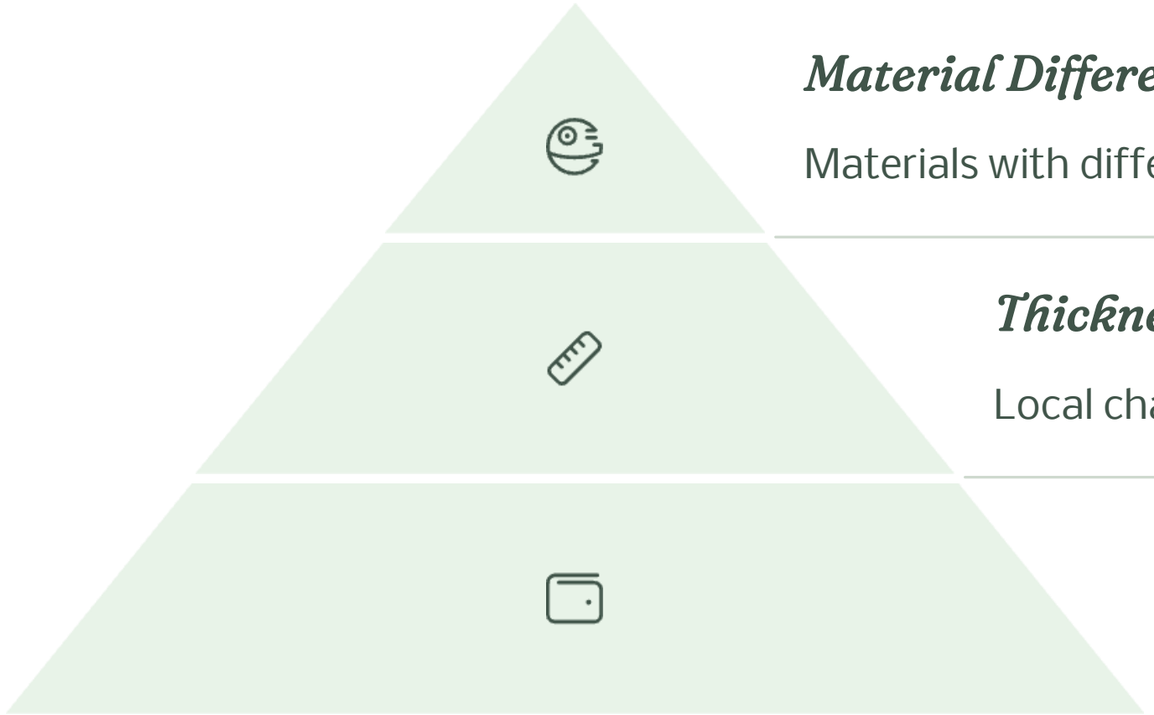
Thermal Resistance

hermal exchange with the Parts where insulation is deficient.

Significant Impact

Can exceed 40% of total thermal losses through the building envelope.

Causes of Thermal Bridges



Material Differences

Materials with different thermal conductivity

Thickness Changes

Local changes in material thickness

Structural Junctions

Connections between walls, floors, and other elements

Thermal bridges occur where the insulation layer is discontinuous. According to Roulet (2016), avoiding thermal bridges is imperative but not always possible.

Types of Thermal Bridges

Linear Thermal Bridges (2D)

Characterised by a linear coefficient (Ψ) expressed in W/(m.K).

Example: Junction between a floor and exterior wall.

Heat loss calculated by multiplying the linear coefficient by length in metres.

Point Thermal Bridges (3D)

Characterised by a point coefficient (χ) expressed in W/K.

Example: Junction between a floor and two perpendicular façade walls.

The coefficient directly expresses the heat loss in W/K.

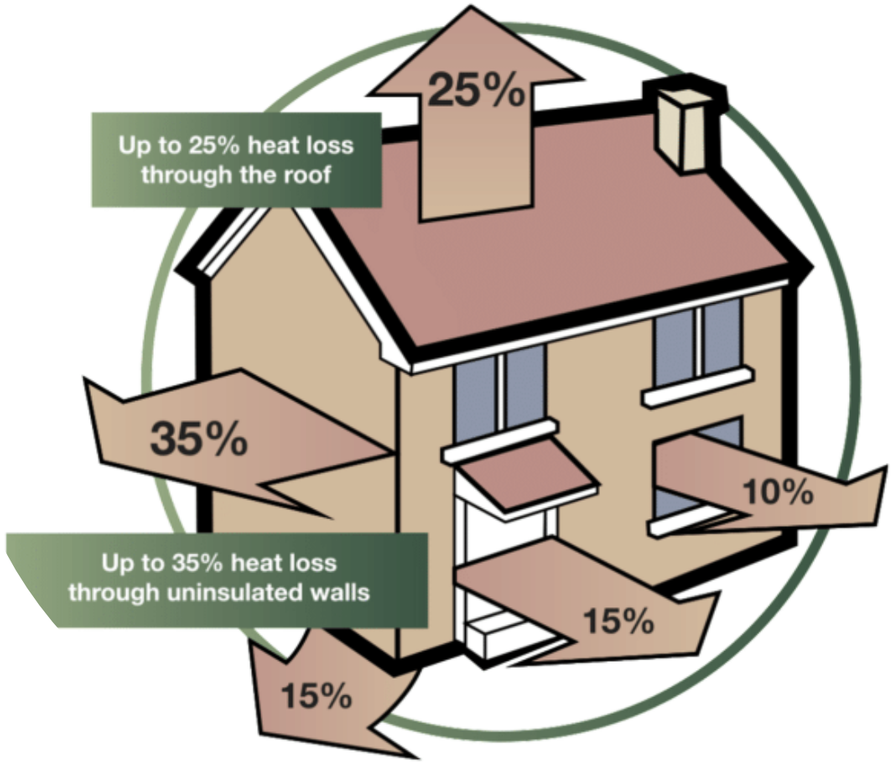
Heat Loss in Heated Spaces

Roof

Heat loss through roofing in contact with exterior

Air Renewal

Heat loss through ventilation and air leakage



Walls

Thermal transfer through exterior walls

Floors

Heat loss through ground floors

Windows & Doors

Significant heat transfer through openings

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Heat loss through roofing in contact with exterior

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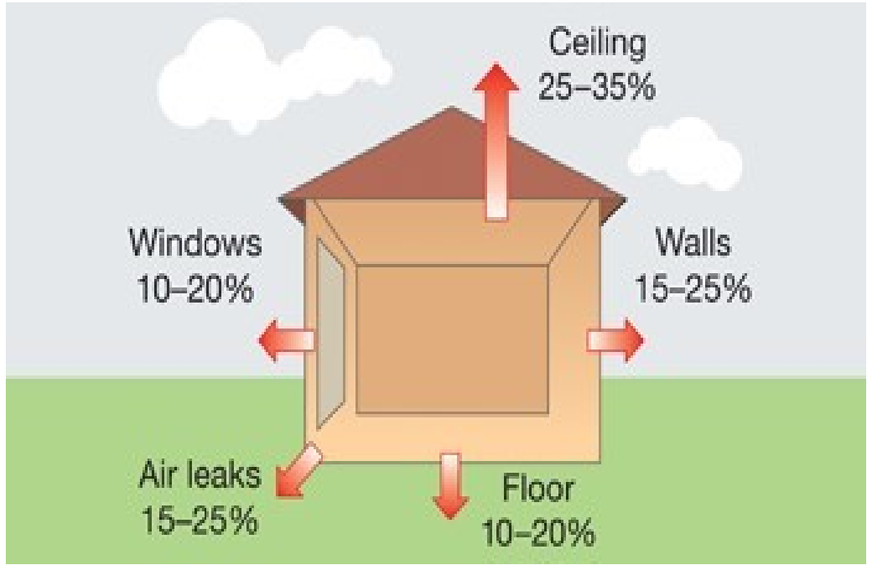
Heat loss through ventilation and air leakage



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Heat Loss ways

1

Surface Heat Loss

Through walls, ceilings, floors, doors, and windows

2

Point Thermal Bridges

Through junctions and discontinuities in insulation

3

Air Renewal Heat Loss

Through ventilation and air leakage

Thermal transmittance -U value

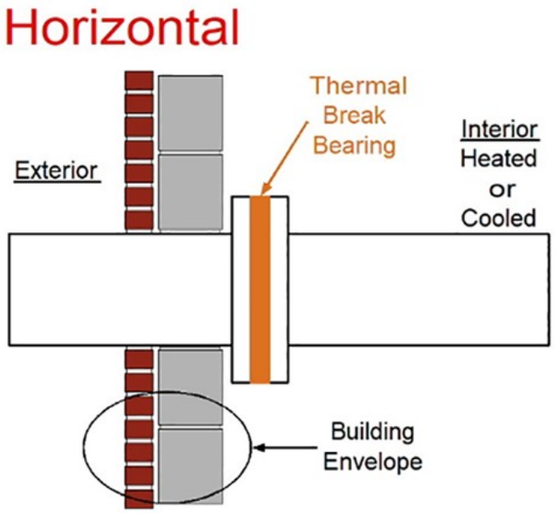
The U-value serves as a metric quantifying the thermal efficiency of a structural element within a building, such as a wall, roof, or window.

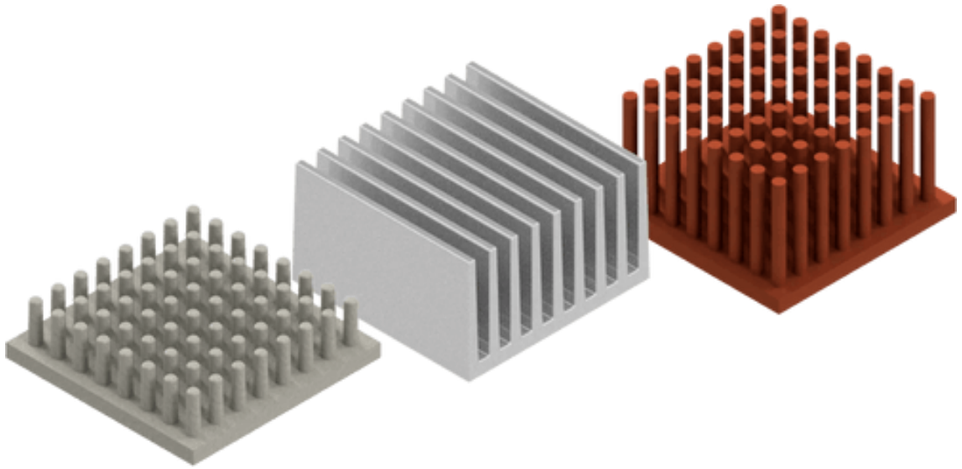
The U-value is the amount of energy lost per second, through 1 square meter of the building material, at a temperature difference of 1 Kelvin K (=1ºC).

The unit for U-values is W/(m²K).

$$U=1/R$$

Mitigating Thermal Bridge Effects





Continuous Insulation

Ensuring insulation continuity across junctions reduces thermal bridging significantly.

Thermal Breaks

Installing specific materials to interrupt thermal conductivity at critical junctions.

Optimized Design

Careful planning of structural elements to minimize thermal bridge effects.

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Merci pour votre Attention