High Performance Glazing & Windows

Your Buildings….
Your Windows….
Your Energy & Maintenance Bills

Agenda

- The impact of your choices
- Important terms related to glazing and windows
- Glazing choices
- Uncloaking the mystery of Low E Glass
- Shading
- Window Frame Construction
- Window performance standards

Windows affect the…..

- **Exterior**……. of your building.
- **Interior**……. of your building.
- **Operating & maintenance cost**……. of your building.
- **HVAC, operating systems, & comfort**…....of your building.
- **Weather & energy performance**……. of your building.
- **Structural integrity**……. of your building
- **Sound levels**……. of your building
- **Indoor air quality**……. of your building
- **Health**…….of the users of your building.
- **Performance**……. of the users of your building.

What other material has this much impact on your building…..

during both construction and use?

Important Terms

U Value (or Factor)

Measurement of heat transmission. (Btu/hr/ft²/ºF). The lower the number the better. Range from .20 to .70. Typical for windows is .45-.65.

Solar Heat Gain Coefficient (SHGC)

Measurement of heat entering a building from solar radiation. The lower the number the better. Range from 0 to 1. Typical for windows is .50 to .87.

Sound Transmission Class Rating (STC)

Sound control rating for interior panels. The higher the better. Typical for windows is 15 to 30 with standard glazings. 30-50 possible with special glazings and window construction. STC is inadequate for exterior noise measurement but is most widely used rating system.

Why are these terms important?

U Value:

Helps predict how much you will be spending on heating costs and how comfortable the space will be.

Solar Heat Gain Coefficient (SHGC):

Helps predict how much you will be spending cooling costs and how stable the temperature will remain within the building throughout the occupied time period.

Sound Transmission Class (STC):

Helps predict how quiet the interior spaces will be and how conducive to to a productive indoor environment.

Glazing Choices Sample Categories and Examples

- Single Pane (SP)
  - 1/8”, 1/4”, 3mm, 6mm, Single Strength, Double Strength
- Dual Pane (DP)
  - Single pane plus a storm window system
- Insulated (IG)
  - Sealed double or triple pane, Thermopane®
- Safety
  - Tempered, Laminated, Polycarbonate (Lexan®)
- Coated
  - Low E, hard coat, soft coat, pyrolytic, Low E^2
- Tinted
  - Grey, Bronze, Green, Azurlite ®, Evergreen ®
- Spectrally Selective
  - Low E^2, Heat Mirror ®

Low E: Uncloaking the mystery

Low Emissivity

- Emissivity: measure of a surface's ability to emit long-wave infrared radiation or room temperature radiant heat energy
  - Varies from 0 (no emitted infrared) to 1 (100% emitted infrared
- The lower the emissivity the lower the resultant U value.

Hard Coat/Soft Coat Differences

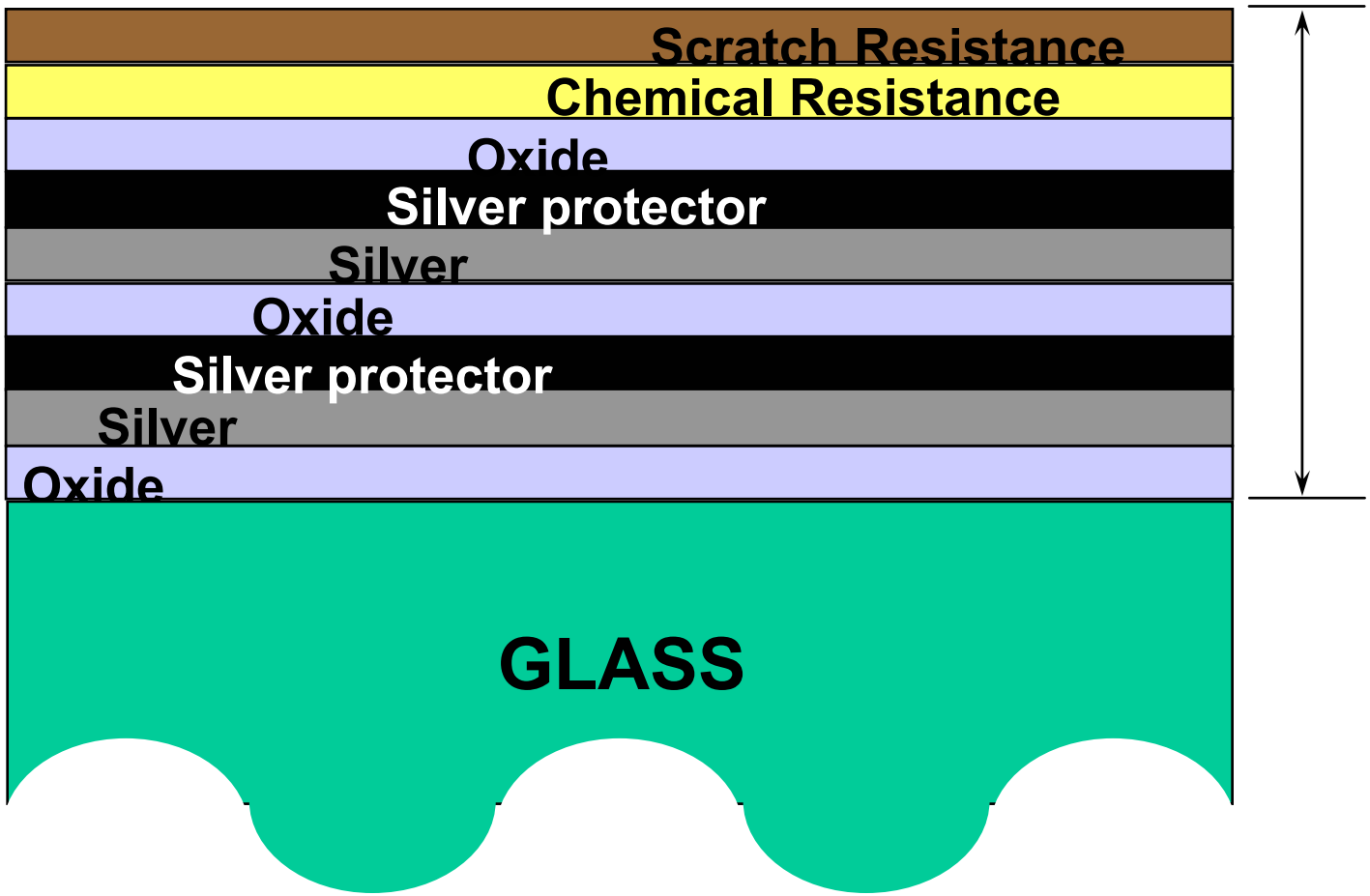
Hard Coat Low E (Pyrolytic)

- Designed to recognize long wave energy
- Reduces heat loss

Soft Coat Low E (Vacuum Deposition)

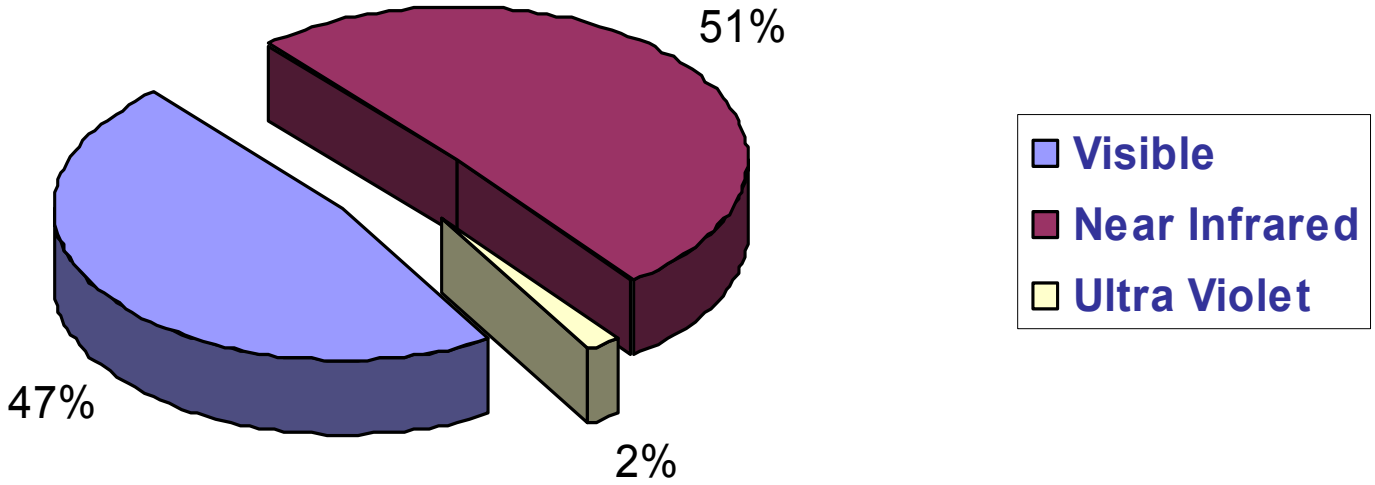
- Designed to recognize short and long wave energy
- Reduces heat gain and heat loss while maintaining high visible light transmission

What does LowE Look Like Up Close?



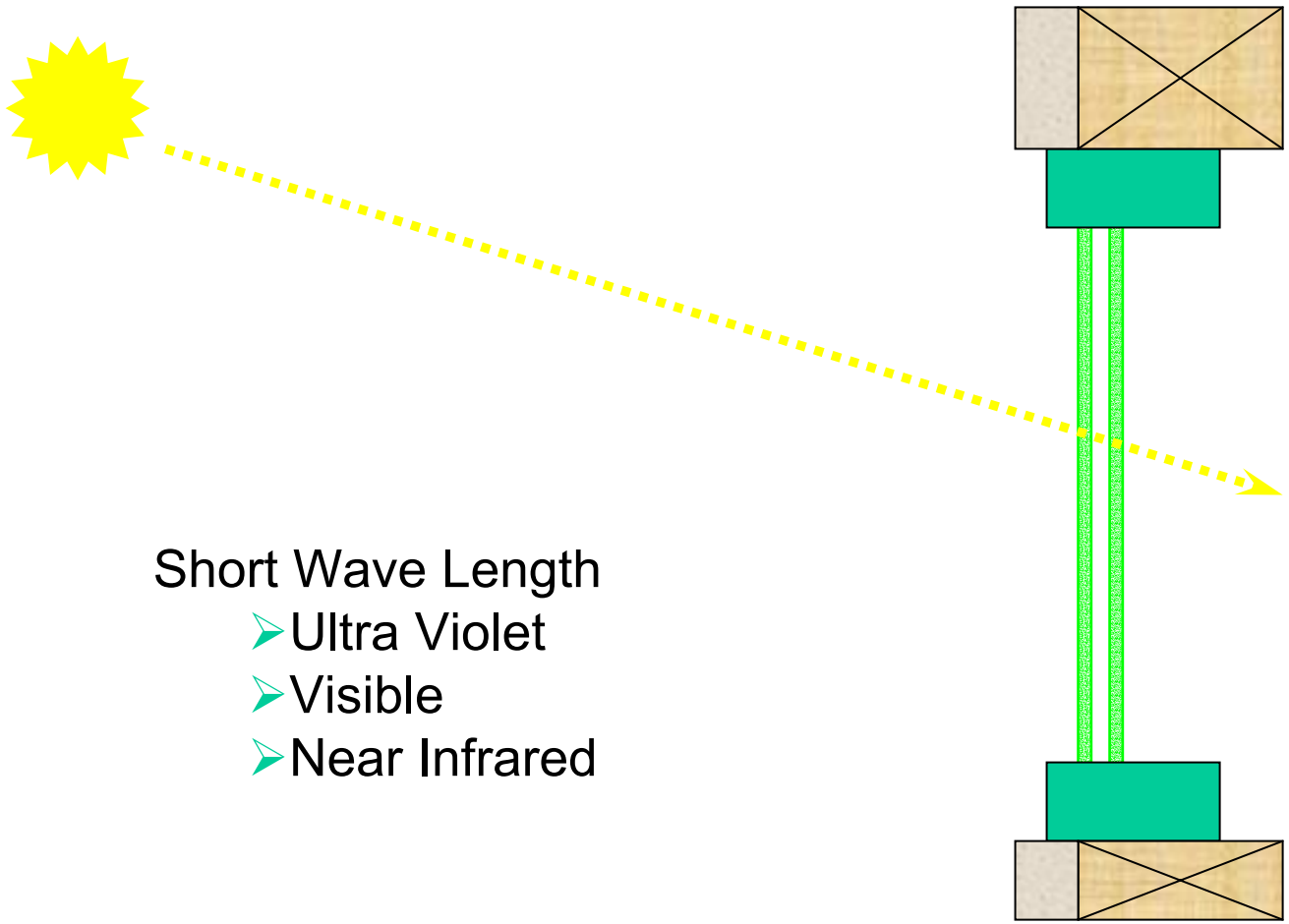
Why is this important?

Solar Spectrum
Heat We See & Feel



How Does LowE Work In the Real World?

Short Wavelength Energy

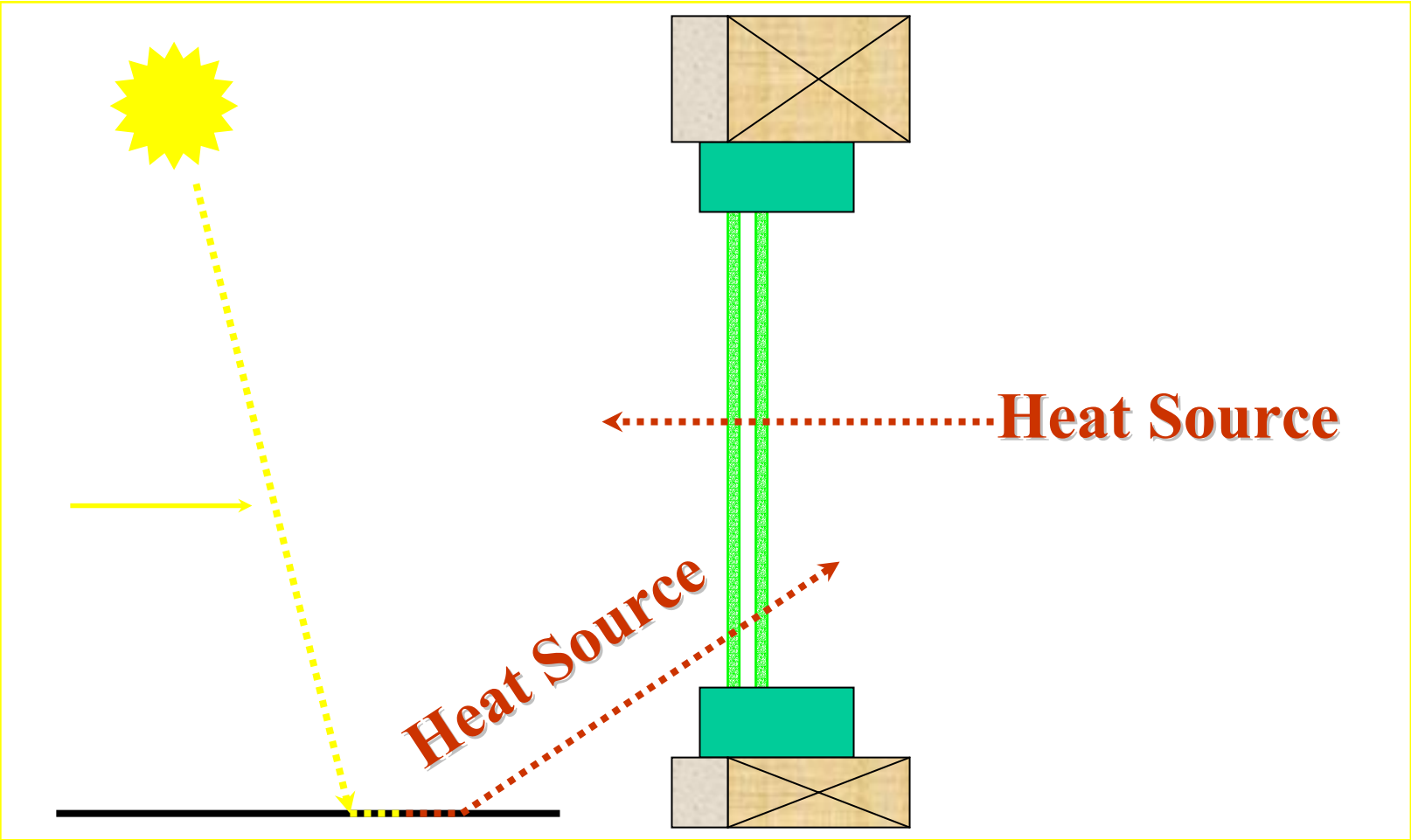


Short Wave Length

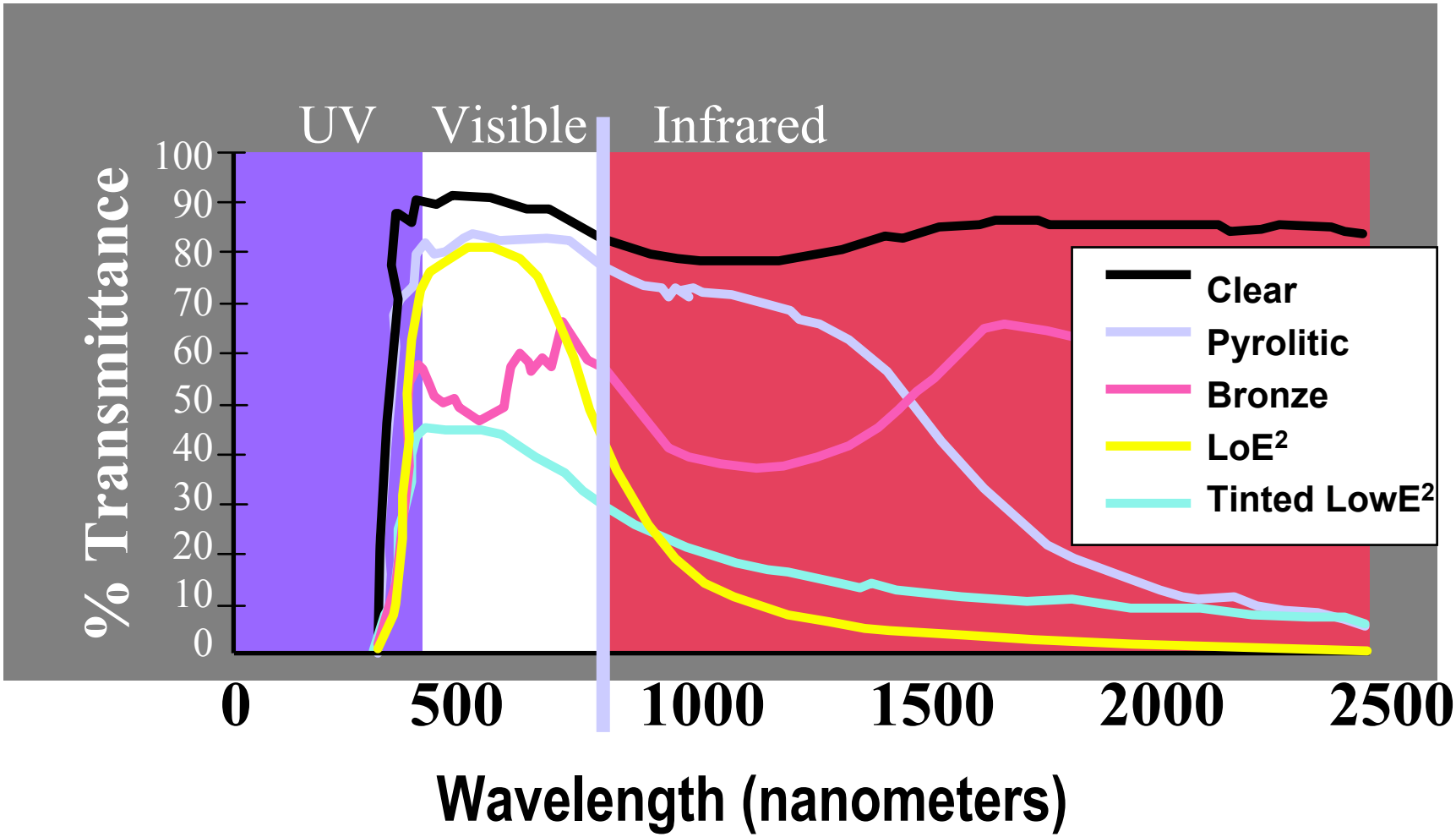
- Ultra Violet
- Visible
- Near Infrared

Long Wavelength Radiation

Far-infrared



Low E- Spectrally Selective



Guidelines for Choosing Glazing

- Determine life safety requirements
  - Safety Glazing
- Determine energy requirements
  - Heat Gain
  - Heat Loss
  - U Value
  - Solar Heat Gain Coefficient
- Address other issues
  - Sound, glare
- Determine short and long term costs
- Select appropriate glazing

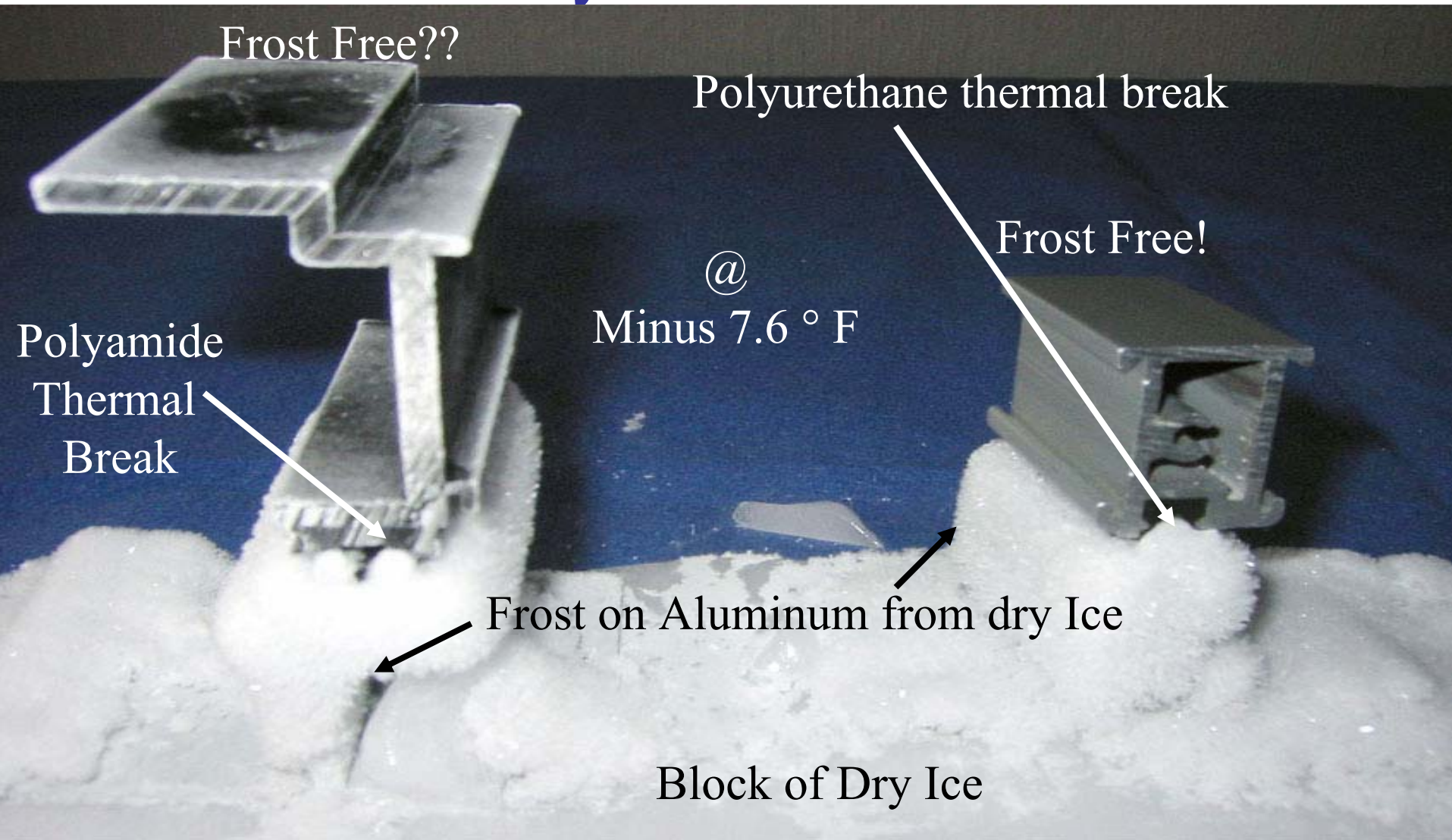
Shading

- Internal
  - Drapes, Shades
  - Blinds
- External
  - Mechanical
  - Fixed shade shelves
  - Canopy

Window Frame Materials

- Wood
  - Clad wood
- Vinyl
- Fiberglass
- Composite
- Steel and other metals (bronze, etc.)
- Aluminum
  - Non-thermal break
  - Thermally improved
  - Thermally broken

Thermally Broken Windows



Window Performance Standards

- American Architectural Manufacturer's Association (AAMA)
- Window and Door Manufacturer's Association (WDMA)
  - Formerly National Wood Window and Door Manufacturer's Association
- American National Standard Institute (ANSI)
- North American Fenestration Standard 101/IS2/NAFS-02
  - Voluntary Performance Specification for Windows, Skylights, and Glass Doors
- Approved by ANSI February 2003.

AAMA Performance Ratings

- R= Residential
- LC= Light Commercial
- C= Commercial
- HC= Heavy Commercial
- AW= Architectural

AAMA Performance Ratings

- **<u>Gateway Performance Requirements</u>**
- Establish minimums for each class and grade
  - Design Pressure
  - Structural Test Pressure
  - Water Resistance
  - Air Leakage

Minimum Test Pressures

Class	Design Pressure	Structural Test Pressure	Water Test Pressure
R	15	22.5	2.86
LC	25	37.5	3.75
C	30	45	4.50
HC	40	60	6.00
AW	40	60	8.00

All numbers are in pounds per square foot (PSF)

Using AAMA Standards

- Standards provide benchmark for comparison between windows from same manufacturer and from competing manufacturers, regardless of material.
- R, LC, C and HC grades provide progressively higher performance.
- AW grade provides added benefit of Life Cycle Testing

AAMA Architectural Grade (AW) Life Cycle Testing

- Life Cycle Testing performed after test for
  - Air, Water, and Structural Performance
- Life Cycle Testing simulates normal wear and tear on window system
  - Weather-strip, hardware, locks, balances, frame, sash
- Test simulates seven years of use.
- Units re-tested for Air, Water and Structural after Life Cycle tests.

Why specify and use AW Grade Windows?

- Ensures better performing windows
- Predicts performance over the long term
- Eliminates use of inferior, short lived products
- Reduces liability
- Minimizes maintenance costs
- Lengthens life cycle of building and window components
- Reduces cost of windows over life of building

Solar Heat Gain Challenge

Solar Heat Gain Challenge

Akard Elementary Interior-
Painted glass to reduce heat gain

Solar Heat Gain Solution

Heat Gain and Heat Loss Challenge

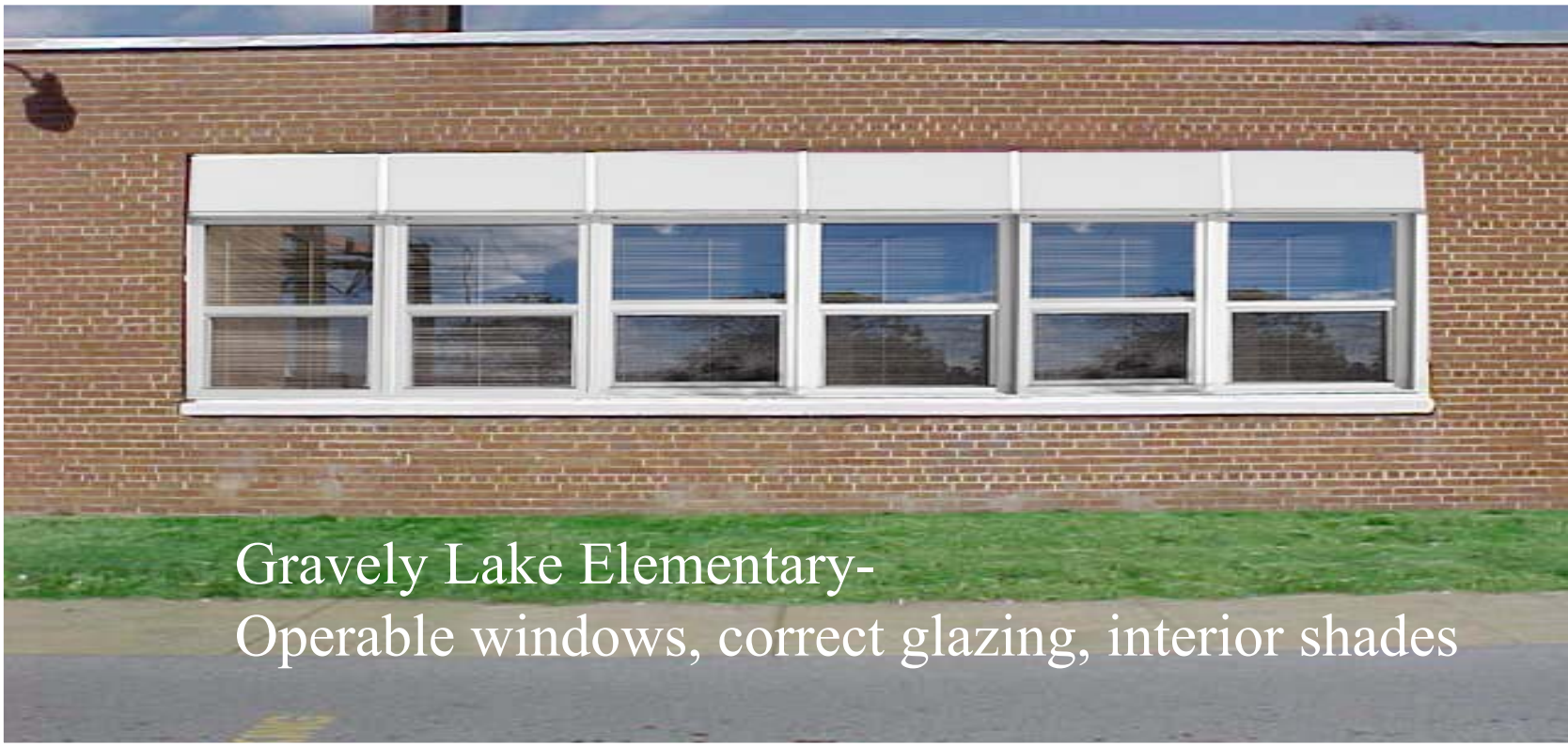
Heat Gain & Heat Loss Solution

Holston Valley Middle School-
Operable windows with correct glazing

Glare & Heat Gain Challenge

Gravely Lake Elementary

Glare & Heat Gain Solution



The Goal

- Lower costs for construction and maintenance
- Lower operating costs
- Lower energy bills
- Healthier buildings
- Better looking buildings
- Better performing buildings
- Improved working and living environment
- Increased productivity by users of the building

Choosing the correct glazing and window systems can make a difference.

Thank You