



Bridge Track Insulation & Windows

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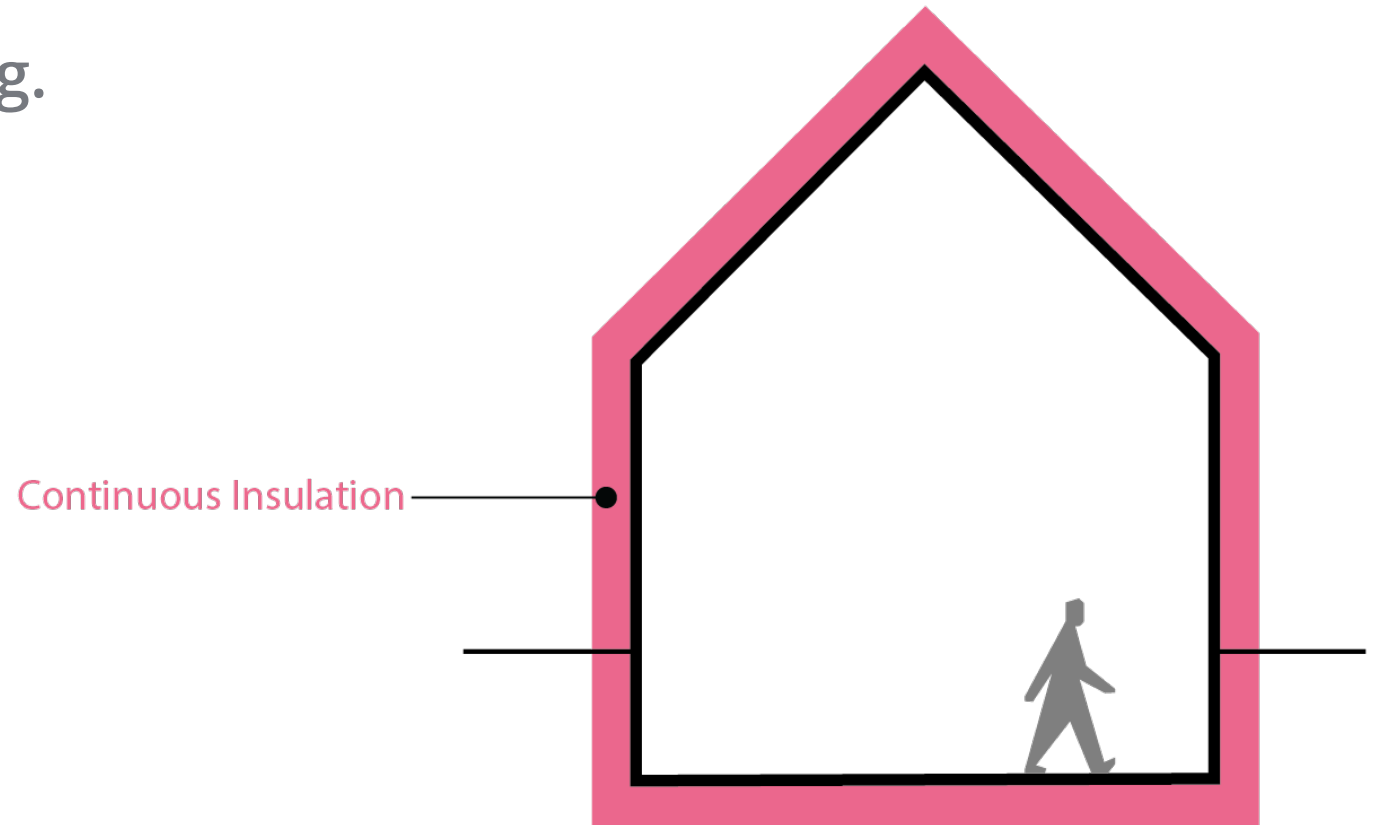


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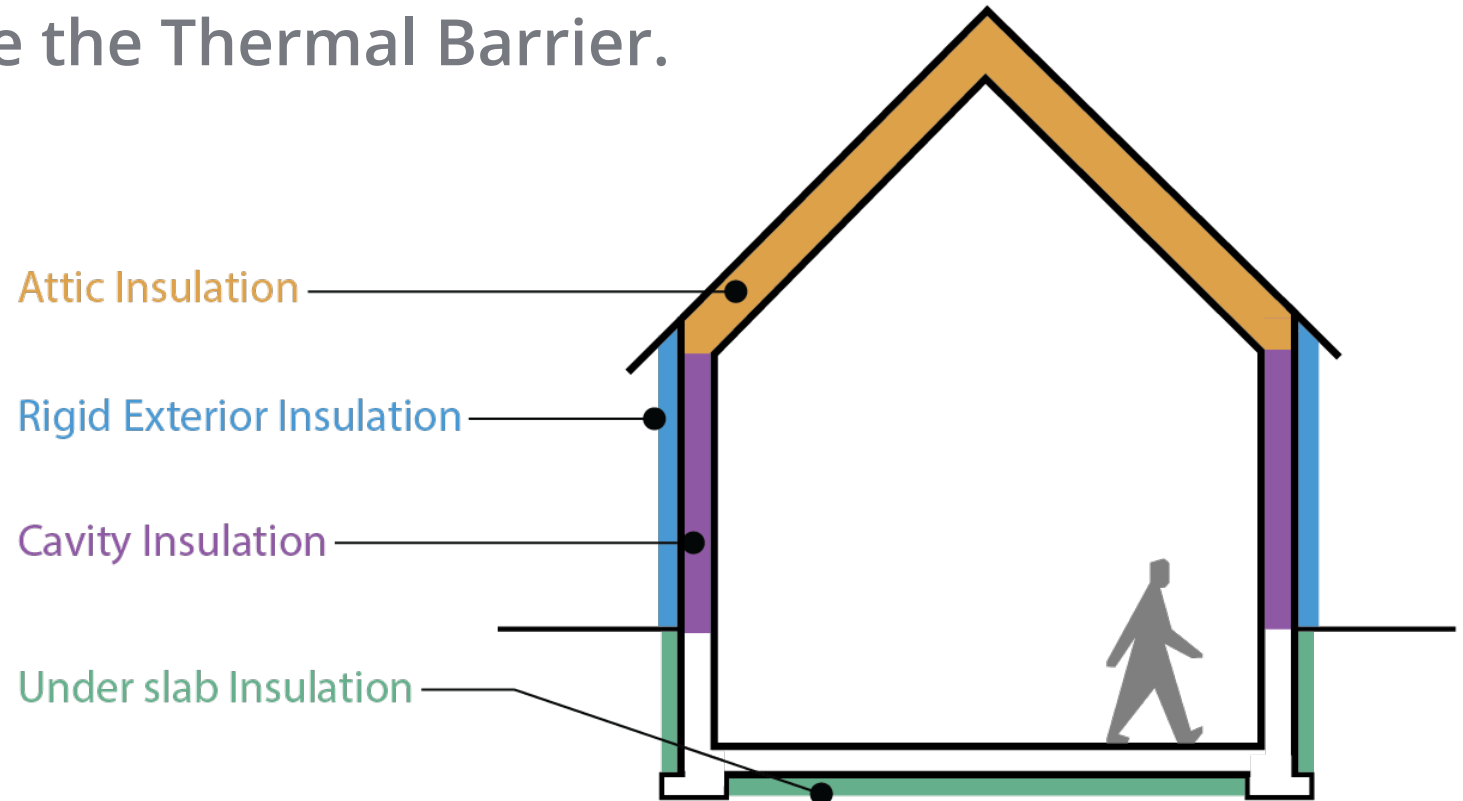
What you know

1. Passive House design requires Continuous Insulation on all sides of a building.



What you might not know

1. The average home has about (4) types of insulation which together constitute the Thermal Barrier.



Insulation



So many types!!

Rigid Roof



Attic Fill



Blown Cavity / Cathedral



Rigid Wall



Spray Foam



Foam Board



Considerations:

1. Application: Cavity v. Exterior
2. Cost

Climate Zone	Rigid Board or Air Impermeable Insulation	Total Cavity Insulation	Total Wall Assembly Insulation	Ratio of Rigid Board Insulation or Air Impermeable R-Value to Total Insulation R-Value
4C	R-2.5	R-13	R-15.5	15%
	R-3.75	R-20	R-23.75	15%
4A, 4B	R-3.5	R-13	R-16.5	20%
	R-5	R-20	R-25	20%
5	R-5	R-13	R-18	30%
	R-7.5	R-20	R-27.5	30%
6	R-7.5	R-13	R-20.5	35%
	R-11.25	R-20	R-31.25	35%
7	R-10	R-13	R-28	45%
	R-15	R-20	R-35	45%
8	R-15	R-13	R-28	50%
	R-20	R-20	R-40	50%

source: buildingscience.com

Insulation

More considerations:

3. R-value per inch

4. Ease of installation

TYPE	MATERIAL	WHERE APPLICABLE	INSTALLATION METHODS	ADVANTAGES
Blanket: batts and rolls	Fiberglass	Unfinished walls, including foundation walls	Fitted between studs, joists, and beams.	Do-it-yourself. Suited for standard stud and joist spacing that is relatively free from obstructions. Relatively inexpensive.
	Mineral (rock or slag) wool			
	Plastic fibers	Floors and ceilings		
	Natural fibers			
Foam board or rigid foam	Polystyrene	Unfinished walls, including foundation walls	Interior applications: must be covered with 1/2-inch gypsum board or other building-code approved material for fire safety.	High insulating value for relatively little thickness. Can block thermal short circuits when installed continuously over frames or joists.
	Polyisocyanurate	Floors and ceilings		
	Polyurethane		Unvented low-slope roofs	
	Phenolic			
Rigid fibrous or fiber insulation	Fiberglass	Ducts in unconditioned spaces	HVAC contractors fabricate the insulation into ducts either at their shops or at the job sites.	Can withstand high temperatures.
	Mineral (rock or slag) wool	Other places requiring insulation that can withstand high temperatures		
Sprayed foam and foamed-in-place	Cementitious	Enclosed existing wall	Applied using small spray containers or in larger quantities as a pressure sprayed (foamed-in-place) product.	Good for adding insulation to existing finished areas, irregularly shaped areas, and around obstructions.
	Phenolic	Open new wall cavities		
	Polyisocyanurate	Unfinished attic floors		
	Polyurethane			
Loose-fill and blown-in	Cellulose	Enclosed existing wall or open new wall cavities	Blown into place using special equipment and, although not recommended, sometimes poured in.	Good for adding insulation to existing finished areas, irregularly shaped areas, and around obstructions.
	Fiberglass	Unfinished attic floors		
	Mineral (rock or slag) wool	Other hard-to-reach places		

source: energy.gov

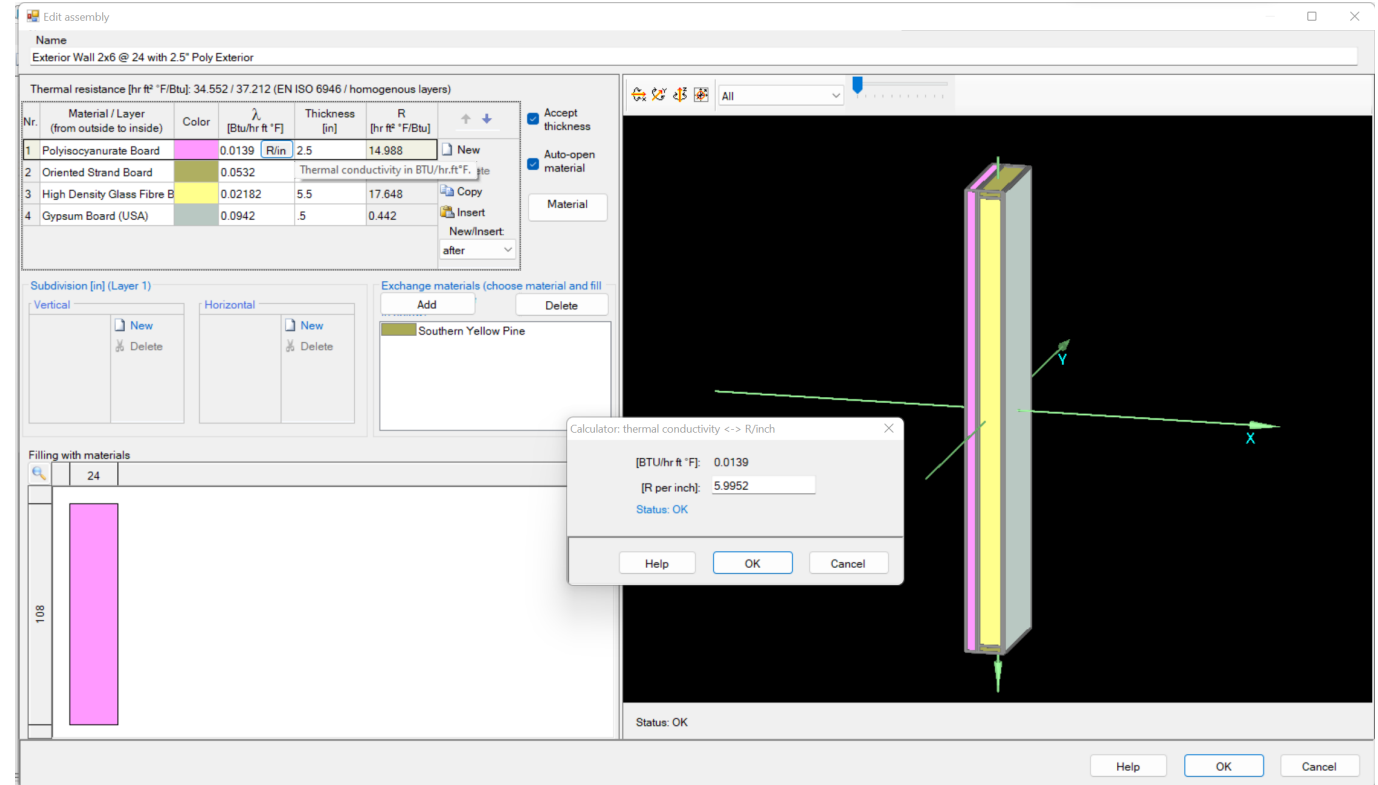
Still more:

4. Global Warming Potential (GWP)
5. Moisture Management
6. VOC Content

Insulation

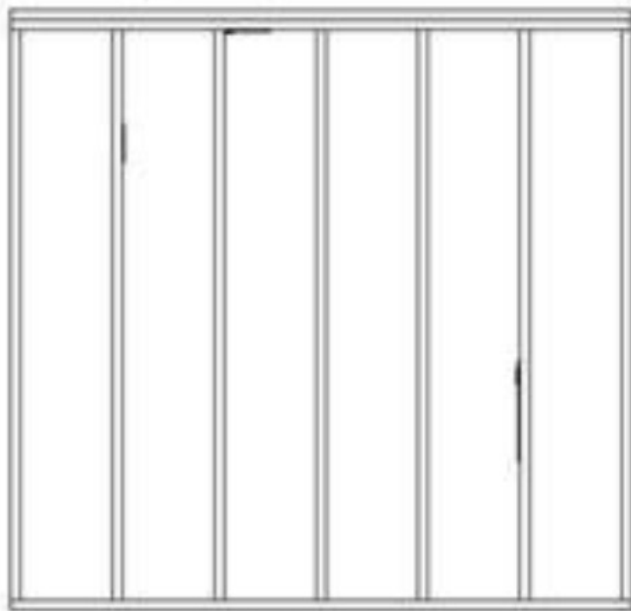
Modeling the insulation is easy, for each layer in an assembly just need:

1. R-value / inch
2. Thickness

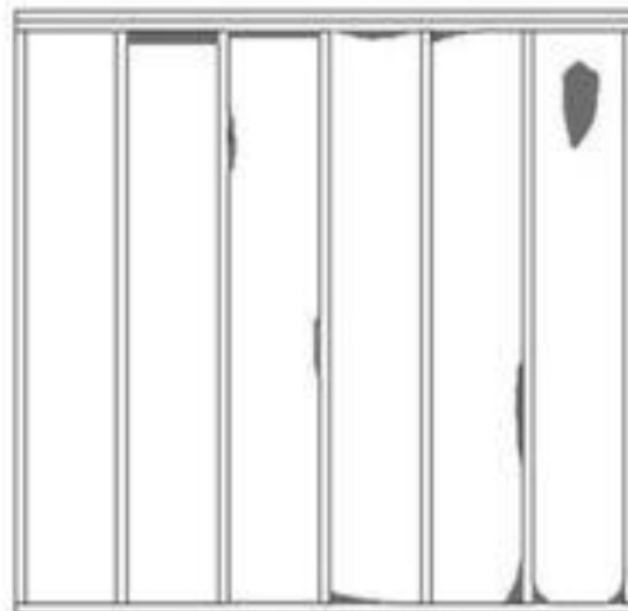


Insulation

QA/QC on Site:



Grade I: Almost no gaps



Grade II: Up to 2%



Grade III: 2% - 5%

RESNET protocol for the effect of missing insulation on installation grade

Diagrams from the HERS Standards

Insulation



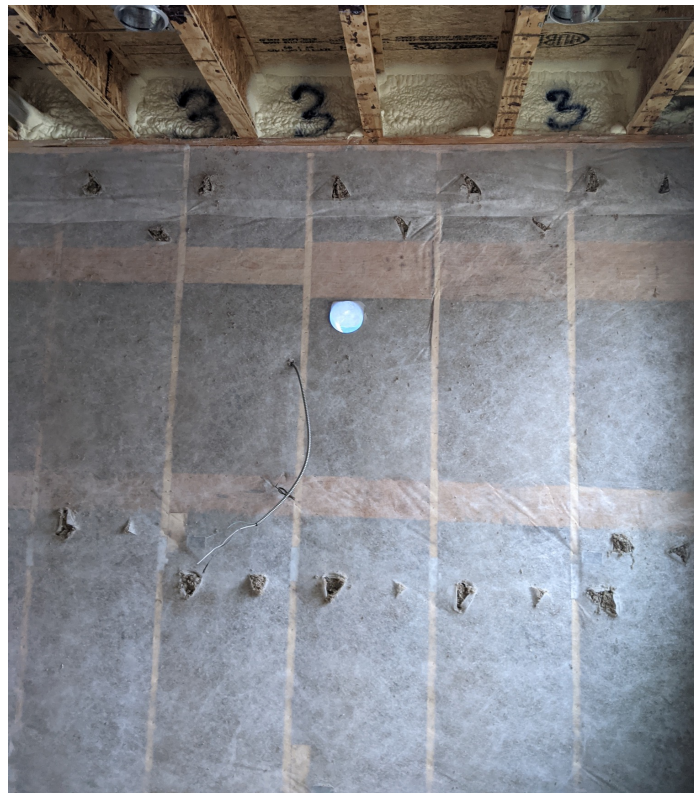
QA/QC on Site – The Good:



Insulation

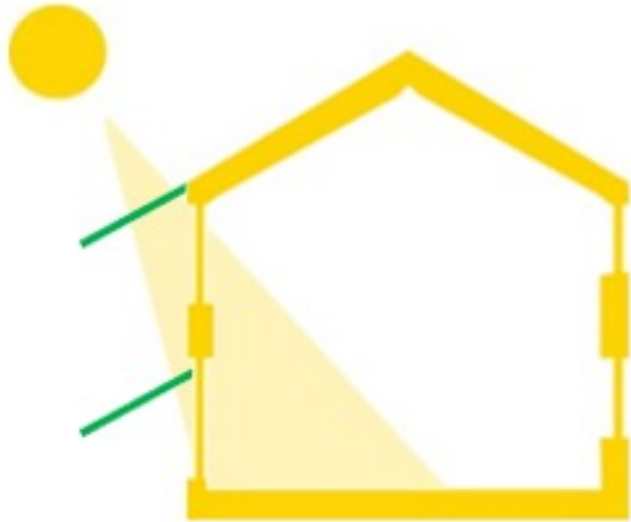


QA/QC on Site – The Bad & The Ugly:



Windows are dual function

1. Are part of the Thermal Barrier
2. Allow Natural Light and Wanted (or Unwanted) Solar Heat Gain

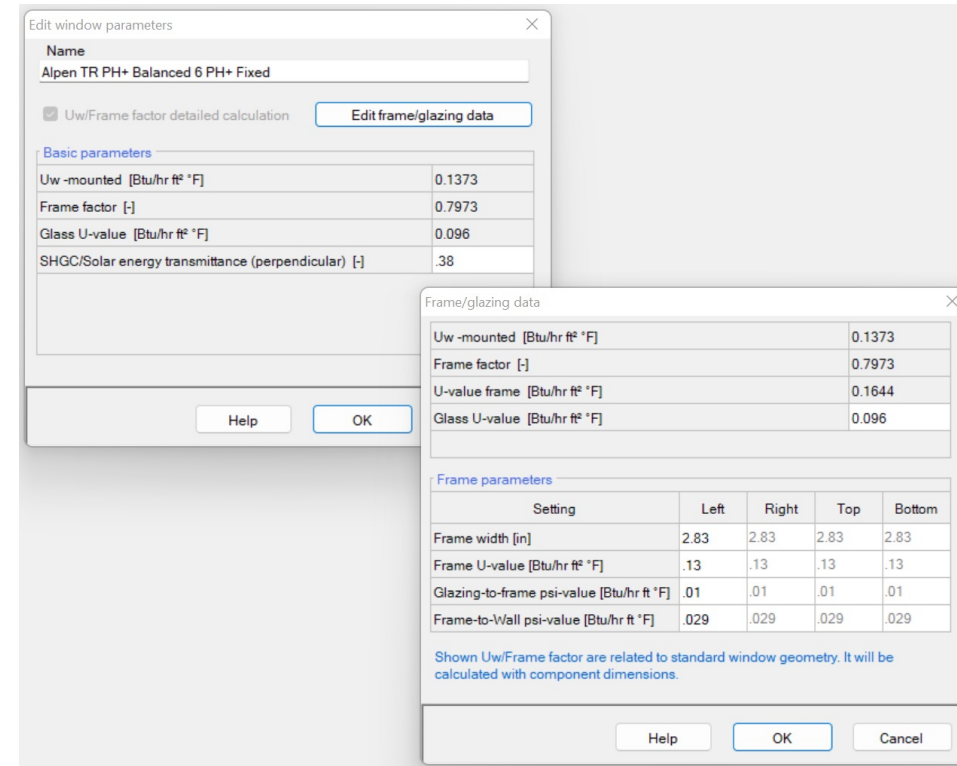


In the planning phase:

1. Control Exposure.
2. Control Ratio of window to wall.
3. Provide shading on southern exposures.

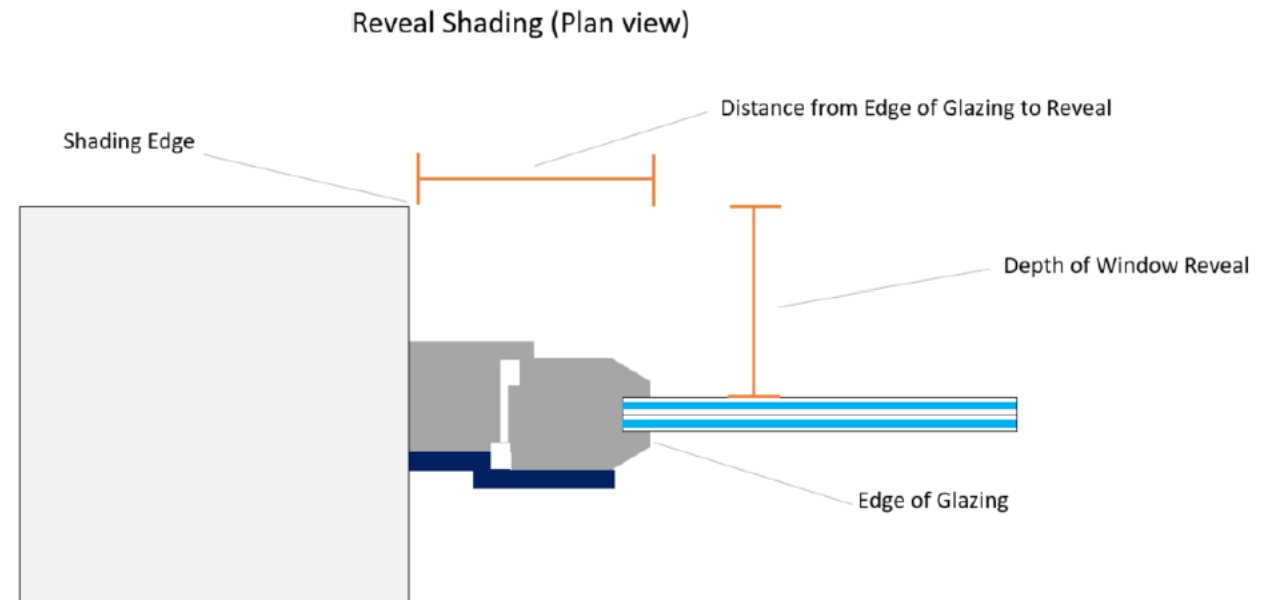
Modeling Windows Thermal Performance is easy, just need the size and shape and:

1. U_{cog}
2. U_{frame}
3. PSI_{spacer}



Modeling Windows Shading Performance is easy too, just need:

1. SHGC
2. Reveal Depth
3. Distance from edge of glazing to reveal
4. Shading Devices



But.....Choosing the right product can be daunting

Frame and Sash

1. Clad Wood
2. Aluminum
3. Vinyl
4. Fiberglass
5. New Hybrid Frames

Glazing

1. Double vs Triple glazed
2. Gas Options Air, Argon, Krypton
3. Low E coatings
4. Spacer Selections

Other things to consider:

1. Cost
2. Durablility
3. Air Tightness
4. Strength
5. Appearance
6. Availabilty
7. Foreign or Domestic?
8. Service and Maintenance

The Phius Windows database can help....




Phius Certified Windows

View our current listings of Phius-certified windows, doors,
and skylights with the link below:

→ [Phius Certified Window Database](#)

.... But these reflect a very narrow set of the possible combinations of Window and glazing.

Calculation based on ISO 10077-2, EN 673, EN 410

Product name: Alpen Tyrol TR-9 PH+ Tilt Turn		Center-of-glass properties				
ASHRAE/IECC /DOE North American Climate Zone	North, East, West - facing			Alpen Balanced-9 PH+ No Grids		
		Whole-window installed U-value		Ucog-Value		
Climate specific recommendations:		W/m2K	BTU/hr.ft2.F	SHGC	W/m2K	BTU/hr.ft2.F
8		0.75	0.13	0.333	0.417	0.074
7		0.74	0.13	0.333	0.397	0.070
6	<input checked="" type="checkbox"/>	0.72	0.13	0.333	0.376	0.066
5	<input checked="" type="checkbox"/>	0.72	0.13	0.333	0.373	0.066
4	<input checked="" type="checkbox"/>	0.72	0.13	0.333	0.376	0.066
Marine North	<input checked="" type="checkbox"/>	0.72	0.13	0.333	0.378	0.067
Marine South	<input checked="" type="checkbox"/>	0.72	0.13	0.333	0.381	0.067
3	<input checked="" type="checkbox"/>	0.72	0.13	0.333	0.379	0.067
2 West		0.73	0.13	0.333	0.388	0.068
2 East		0.73	0.13	0.333	0.388	0.068
Alpen Tyrol TR-9 PH+ Tilt Tur		FRAME		Psi-spacer		Psi-opaque
SS-D		U-frame		Ψ		
		W/m2K	BTU/hr.ft2.F	W/mK	BTU/hr.ft.F	W/mK
Head	117 mm	4.61 in	0.86	0.15	0.047	0.027
Sill	117	4.61	0.86	0.15	0.047	0.027
left jamb	117	4.61	0.85	0.15	0.047	0.027
right jamb	117	4.61	0.85	0.15	0.047	0.027

Valid through April 2022

Common Pitfalls....

1. Windows are an integral part of the home but are often treated as a commodity product.
2. The industry is filled with salesmen trying to get orders but often lacks in “installation specialists”.
3. Installers often not trained in proper air sealing.
4. Industry seems to push for trained service technicians over well trained installers.
5. “Europeans do it better” mindset.

Take Away.....

There is no “Silver Bullet” Solution.