TOOLBOX of a

CERTIFIED PASSIVE HOUSE CONSULTANT

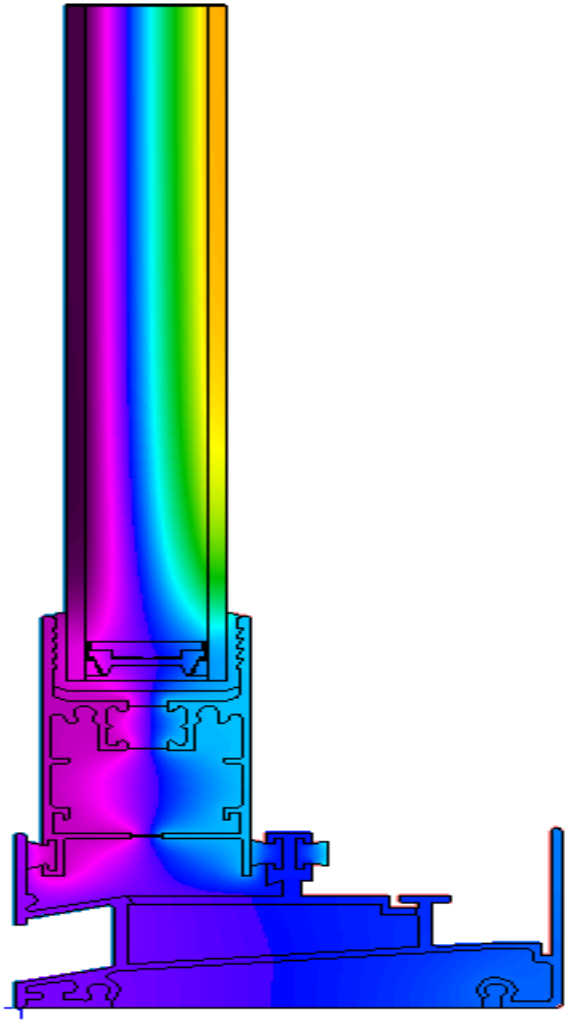
PHPP, Solar Pathfinder, WUFI, THERM

1) Energy Model, The Passive House Planning Package

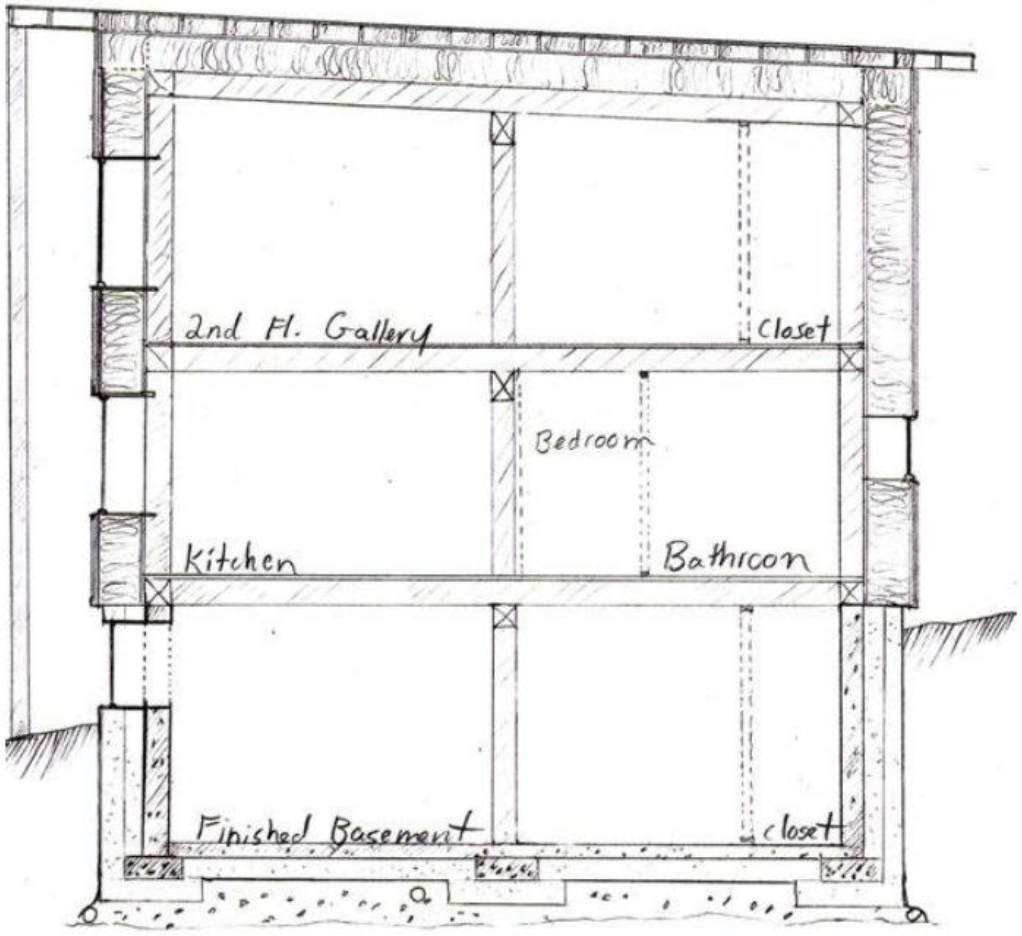
2) Shading Analysis, the Solar Pathfinder

3) Moisture/Mold Risk, WUFI-ORNL

4) Thermal Bridge Analysis, THERM



OUR PROJECT


2nd Fl. Gallery
Closet
Bedroom
Kitchen
Bathroom
Finished Basement
closet

A Passive House =

4.75

kBTU/ft.2/yr

1) The Whitchurch PH Cottage, 4.35 kBTU/ft.2/yr

Passive House Verification

Photo or Drawing

Building:	Lil' House in the Big Woods
Location and Climate:	Montpelier, VT
Street Address:	Brook Rd
City, State, Zip:	Middlesex
Country:	USA
Building Type:	Timber Frame
Home Owner(s) / Client(s):	Greg and Barb Whitchurch
Street Address:	Brook Rd
City, State, Zip:	Middlesex, VT
Architect:	Greg Whitchurch, Chris Miksic, Indigo Ruth-Davis
Street:	405 Camp Rd. PO box 32
City, State, Zip:	Calais, Vermont 05648
Mechanical System:	CERV, by Build Equinox
Street Address:	
City, State, Zip:	
Year of Construction:	2013
Number of Dwelling Units:	1
Gross Enclosed Volume V_e:	21130 ft^3
Number of Occupants:	3.7
Interior Temperature:	68.0 °F
Internal Heat Gains:	0.7 BTU/hr.ft²

No Standard Climate

Calculation Electricity / Internal Heat Ga

Building Type: Residential

Internal Heat Gains

Utilization Pattern: Dwelling

Type of Values Used: Standard

Planned Number of Occupants:

2 Verification

Verification: Monthly Method

Specific Space Heat Dema

Specific Space Heat Dema

Energy Demands with Reference to the Treated Floor Area

Treated Floor Area: 1400 ft^2

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	4.35	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	Yes
Pressurization Test Result:	0.60	ACH_{50}	0.6 ACH_{50}	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	29.1	kBTU/(ft²yr)	38.0 kBTU/(ft²yr)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	14.5	kBTU/(ft²yr)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:	0.0	kBTU/(ft²yr)		
Heating Load:	3.64	BTU/(ft²hr)		
Frequency of Overheating:		%	over 77.0 °F	
Specific Useful Cooling Energy Demand:	0.82	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	Yes
Cooling Load:	2.43	BTU/(ft²hr)		

We confirm that the values given herein have been **Issued on:**

Conventional Build, same design 90.94kBTU/ft.2/yr

Passive House Verification

Photo or Drawing

Building:	Lil' House in the Big Woods
Location and Climate:	Montpelier, VT
Street Address:	Brook Rd
City, State, Zip:	Middlesex
Country:	USA
Building Type:	Timber Frame
Home Owner(s) / Client(s):	Greg and Barb Whitchurch
Street Address:	
City, State, Zip:	
Architect:	Greg Whitchurch and Chris Miksic
Street:	
City, State, Zip:	
Mechanical System:	
Street Address:	
City, State, Zip:	
Year of Construction:	2013
Number of Dwelling Units:	1
Gross Enclosed Volume V_e:	21130 ft³
Number of Occupants:	3.7
Interior Temperature:	68.0 °F
Internal Heat Gains:	0.7 BTU/hr.ft²

No Standard Climate

Calculation Electricity / Internal Heat Ga

Building Type: Residential

Internal Heat Gains

Utilization Pattern: Dwelling

Type of Values Used: Standard

Planned Number of Occupants:

2 Verification

Energy Demands with Reference to the Treated Floor Area

Treated Floor Area: 1403 ft²

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	90.94	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	No
Pressurization Test Result:	3.00	ACH_{50}	0.6 ACH_{50}	No
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	40.0	kBTU/(ft²yr)	38.0 kBTU/(ft²yr)	No
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	20.8	kBTU/(ft²yr)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:	0.0	kBTU/(ft²yr)		
Heating Load:	26.01	BTU/(ft²hr)		
Frequency of Overheating:	0	%	over 77.0 °F	
Specific Useful Cooling Energy Demand:		kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	
Cooling Load:	0.00	BTU/(ft²hr)		

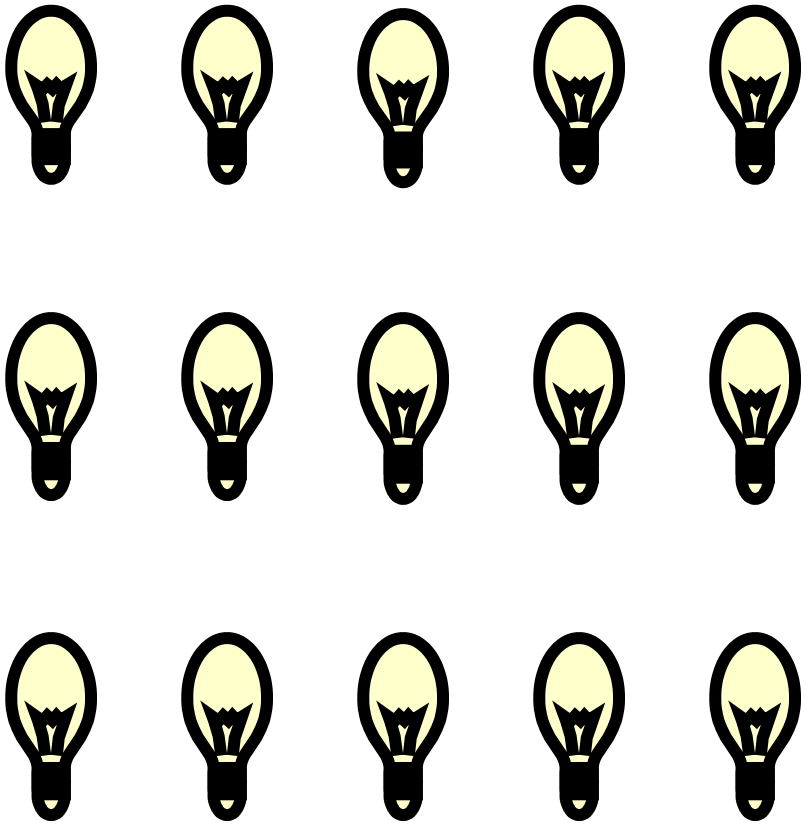
Verification: Monthly Method

Specific Space Heat Dema

Specific Space Heat Dema

We confirm that the values given herein have been **Issued on:**

Heating load on coldest days=
5,096BTU/hr=
1494 Watts=
Heating system equivalent to 15, 100W light bulbs

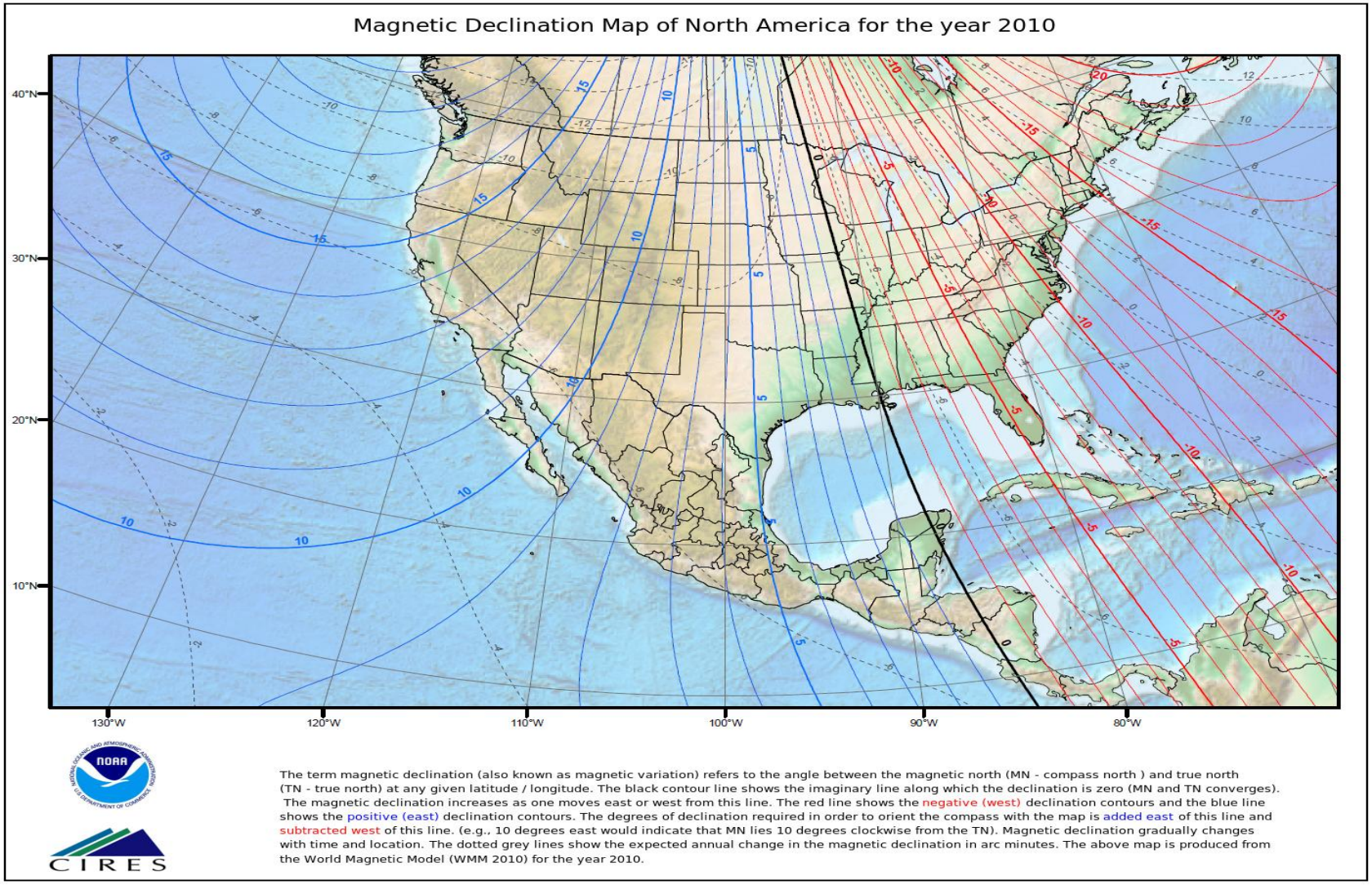


THE CERV

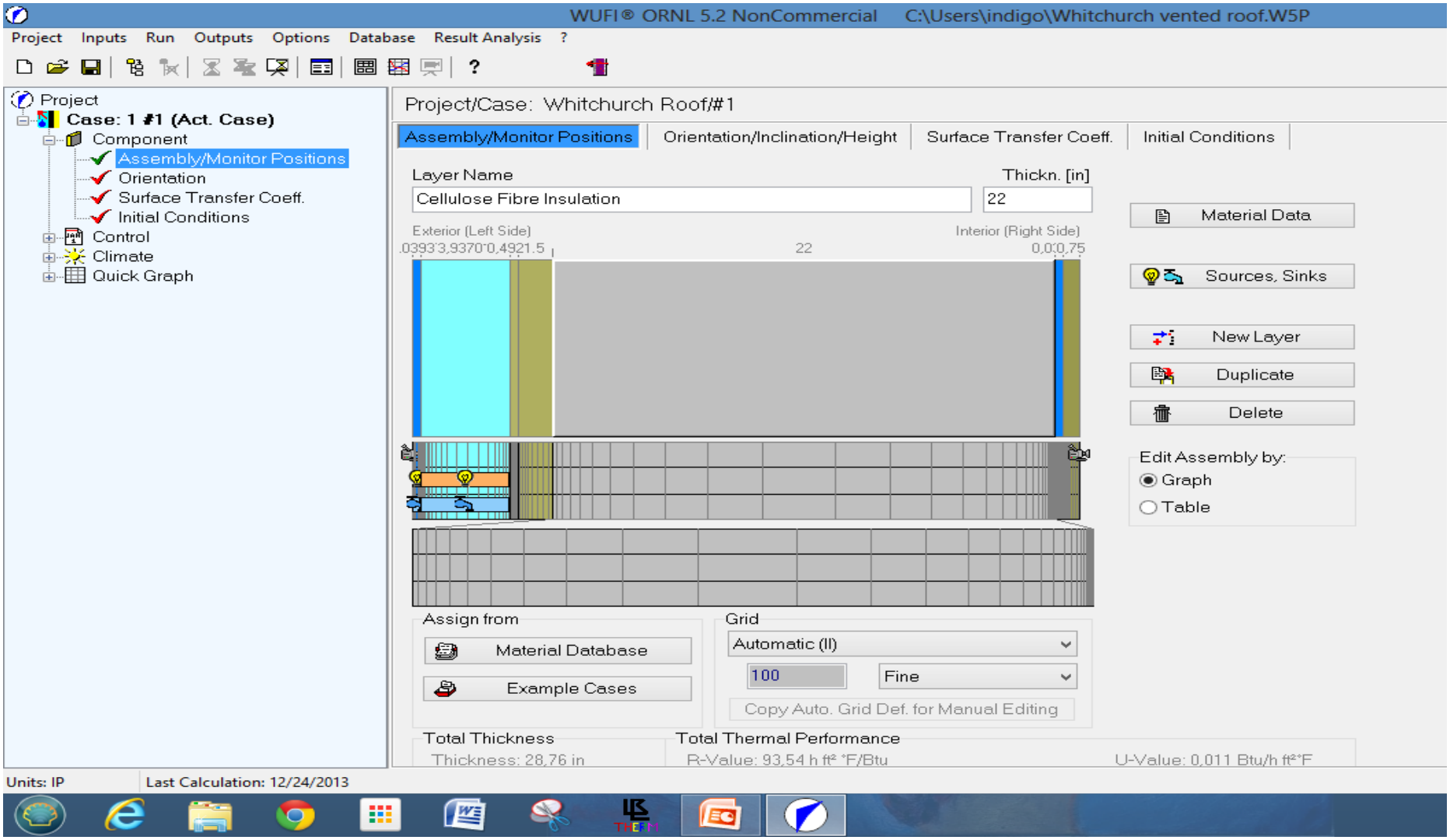
2) Use the solar pathfinder to determine shading conditions at future location of windows

Proper Orientation

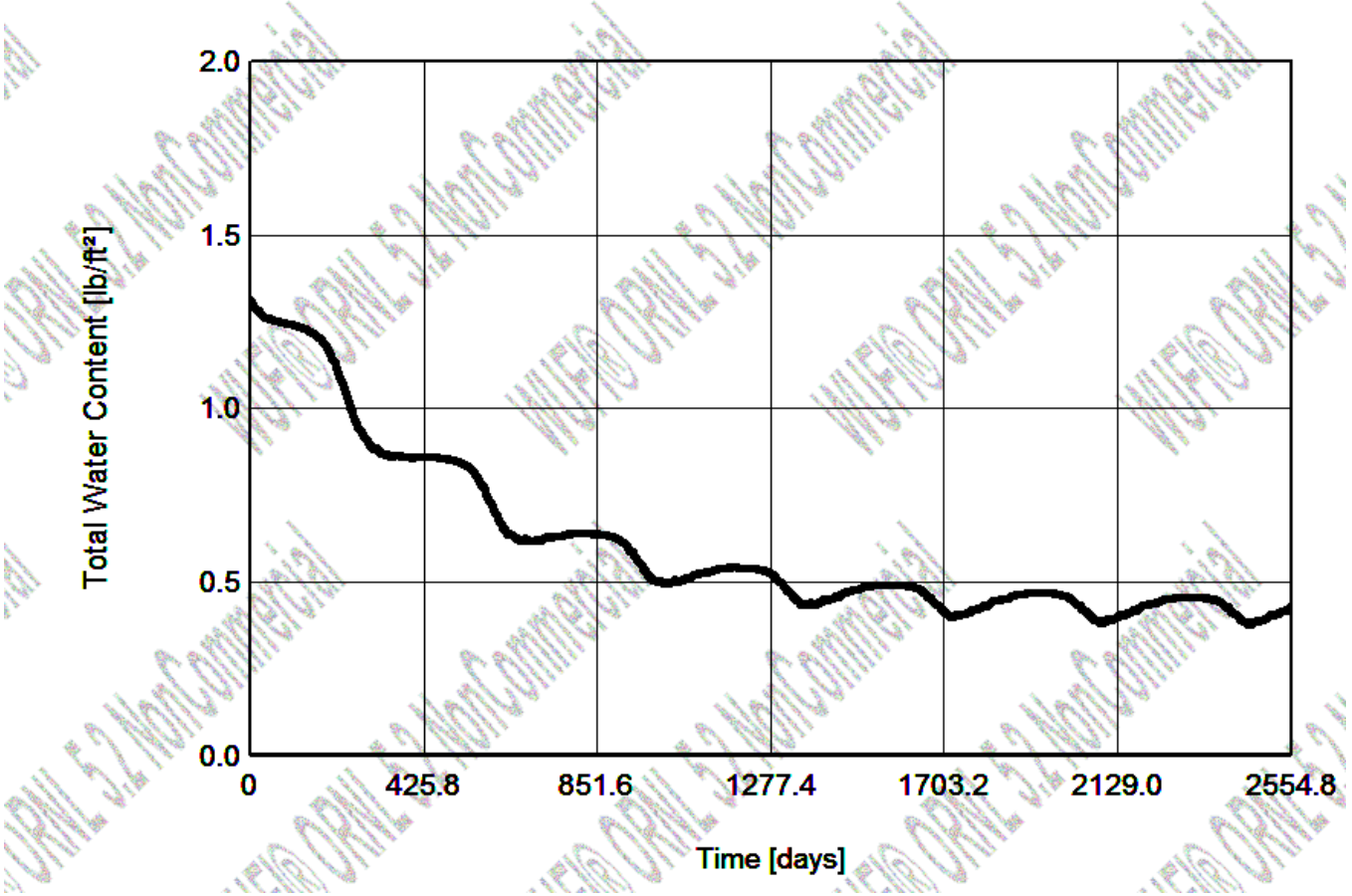
-16 Degrees from magnetic north



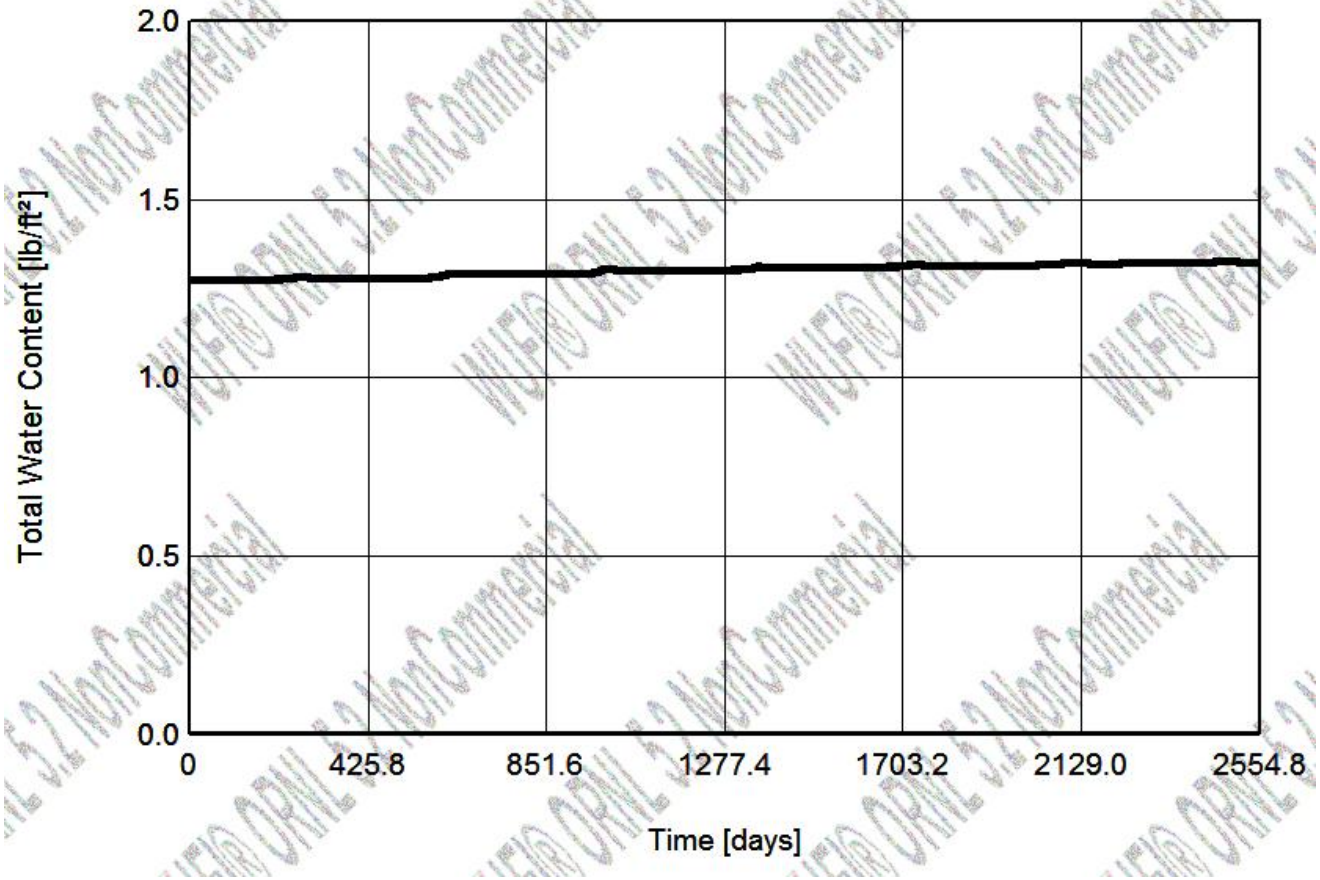
3) WUFI Hygrothermal Analysis



WUFI-ORNL, vented roof 7 yr.



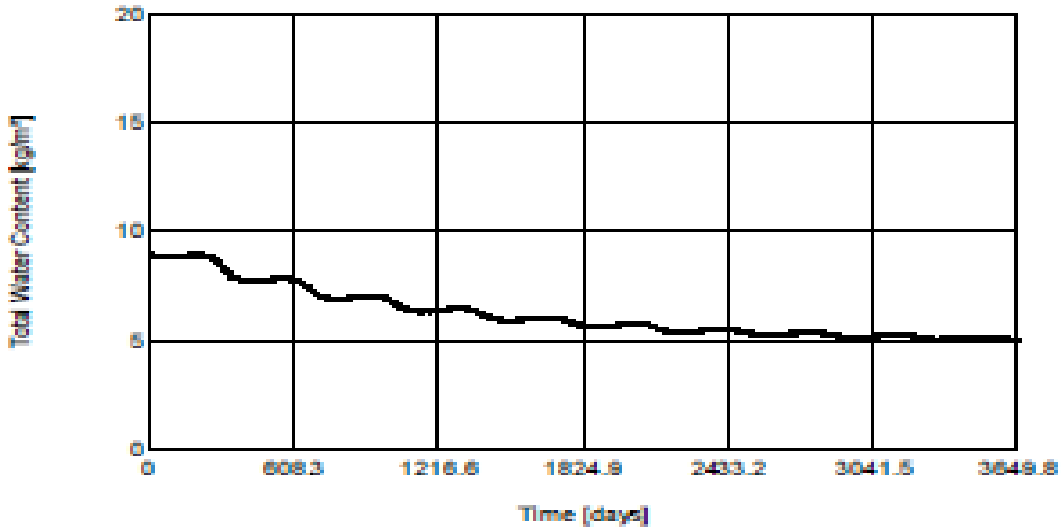
WUFI-ORNL, unvented 7 yr.



WUFI Pro
10-Year Initial Dry-out

WUFI® Pro 5.2 Fraunhofer IBP

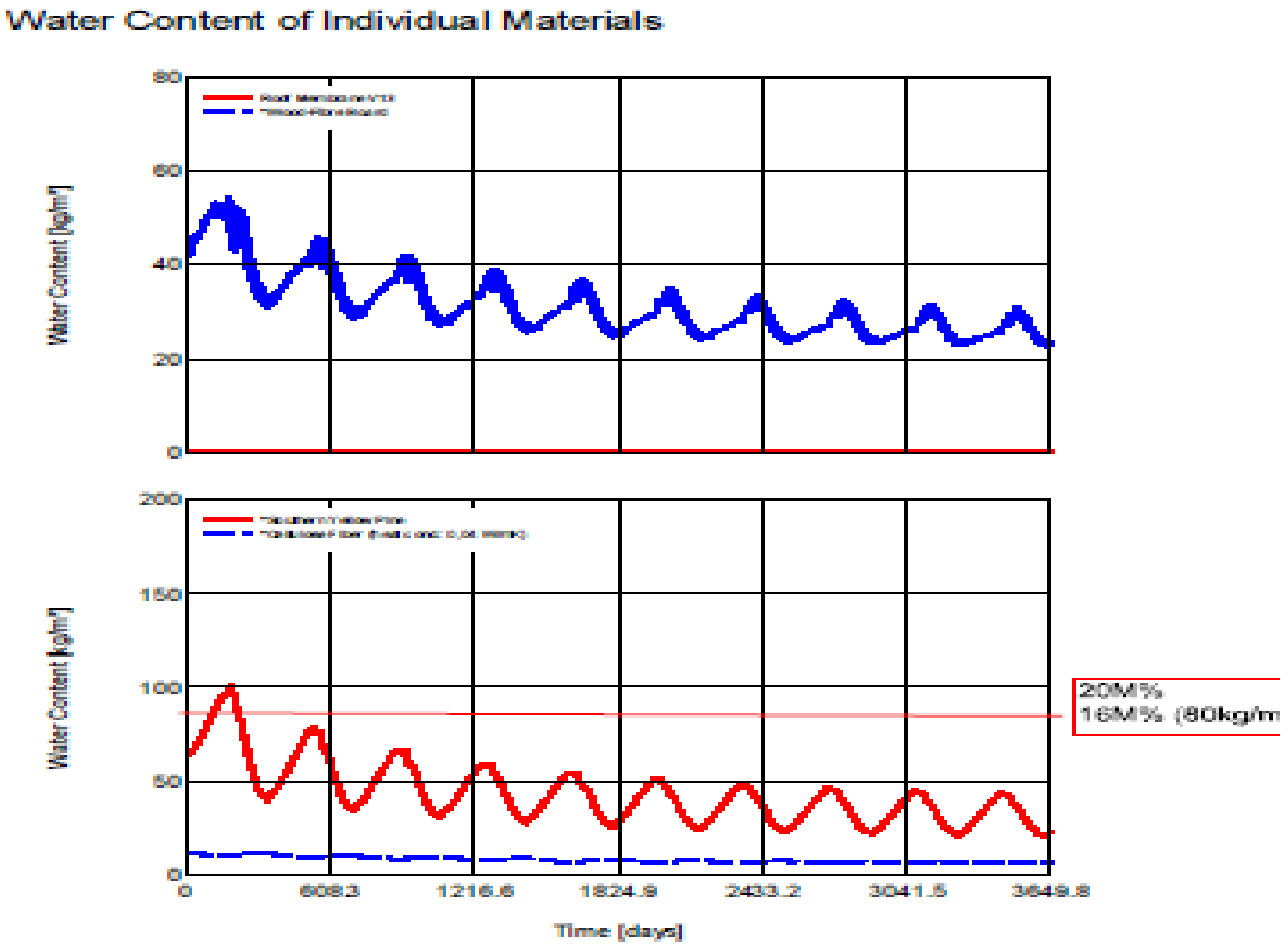
Total Water Content in Construction



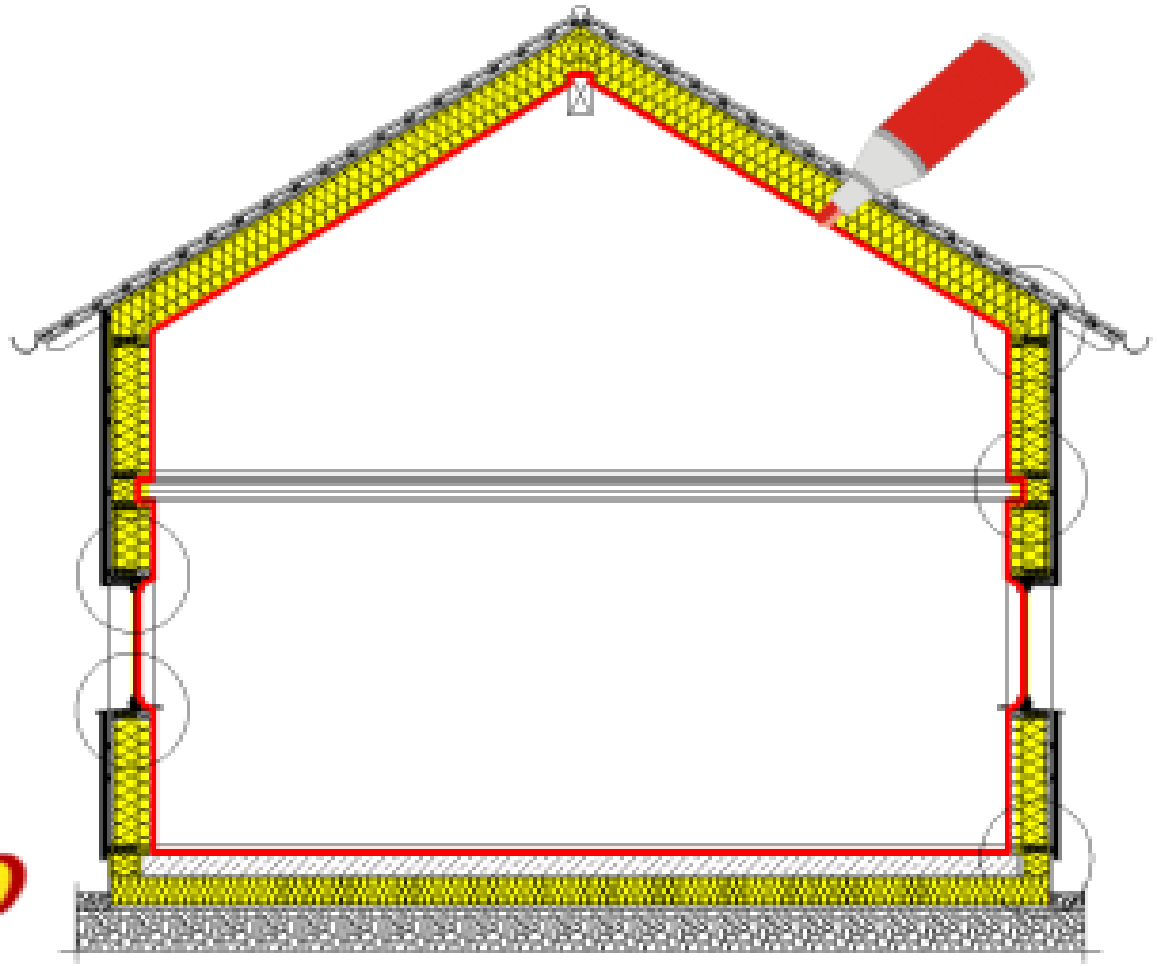
Shows Over 20% Moisture Content In Winter Of 1st Year

WUFI® Pro 5.2

Fraunhofer IBP



Thermal Bridge Free= <.006 BTU/hr.ft.F



Continuous thermal envelope

4) Thermal Bridge=

2D Thermal transmittance modeled in THERM

minus

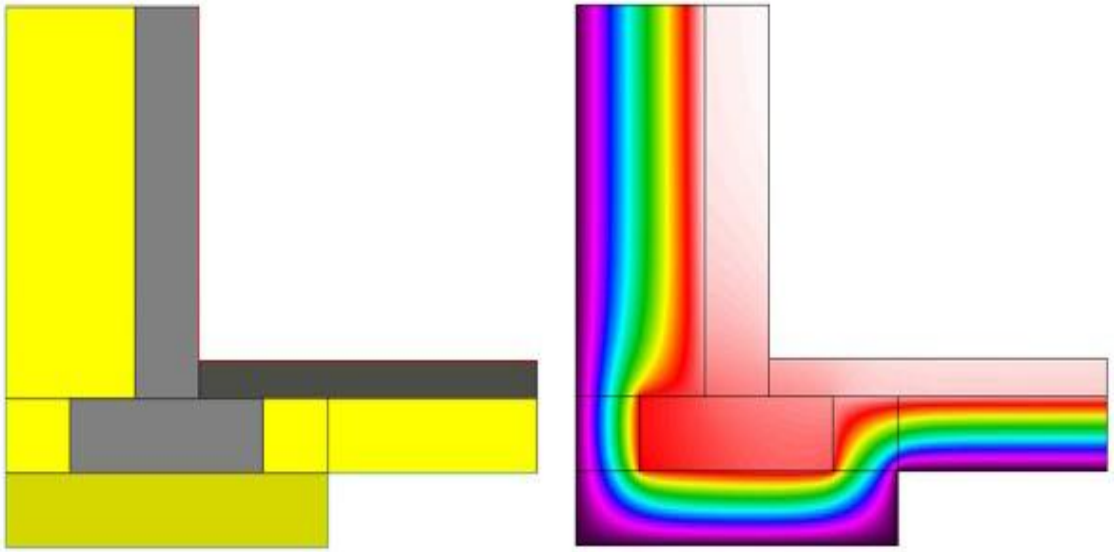
1D Thermal Transmittance as modeled in PHPP

Foundation Foam=TB?

Foundation Foam in THERM

Reduction Factor	0.60	Internal Temperature	68.0
		External Temperature	35.6
		Lowest Surface Temp	65.4
Ψ_e (for PHPP)	-0.003 Btu/hr*'f*F	f_{RSI} at 68 °F/ 23 °F	0.92

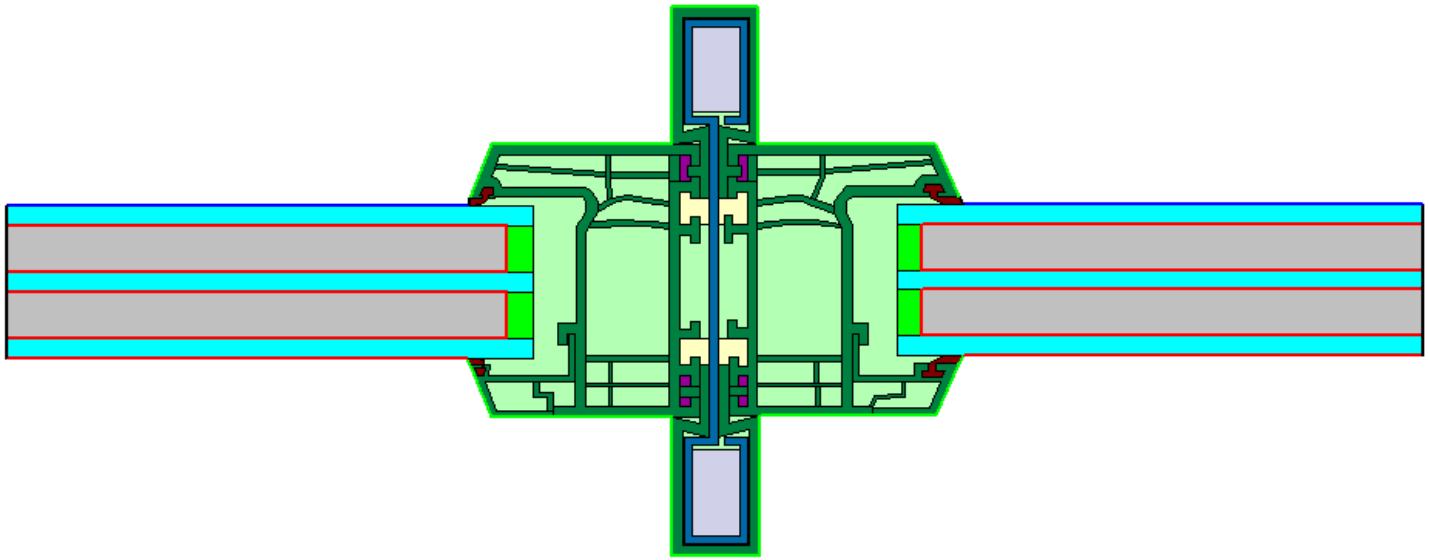
Images Of Detail



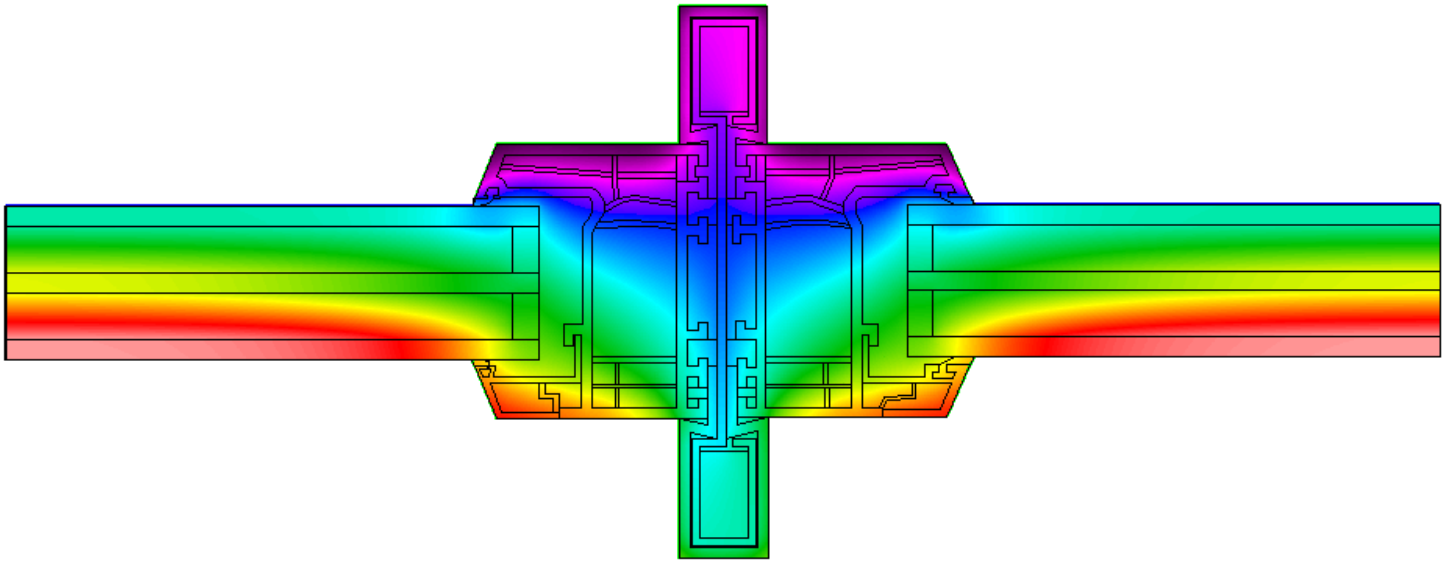
By Chris West, Eco Houses of Vermont

Window connection Mullion=
Giant piece of metal=
Giant thermal bridge

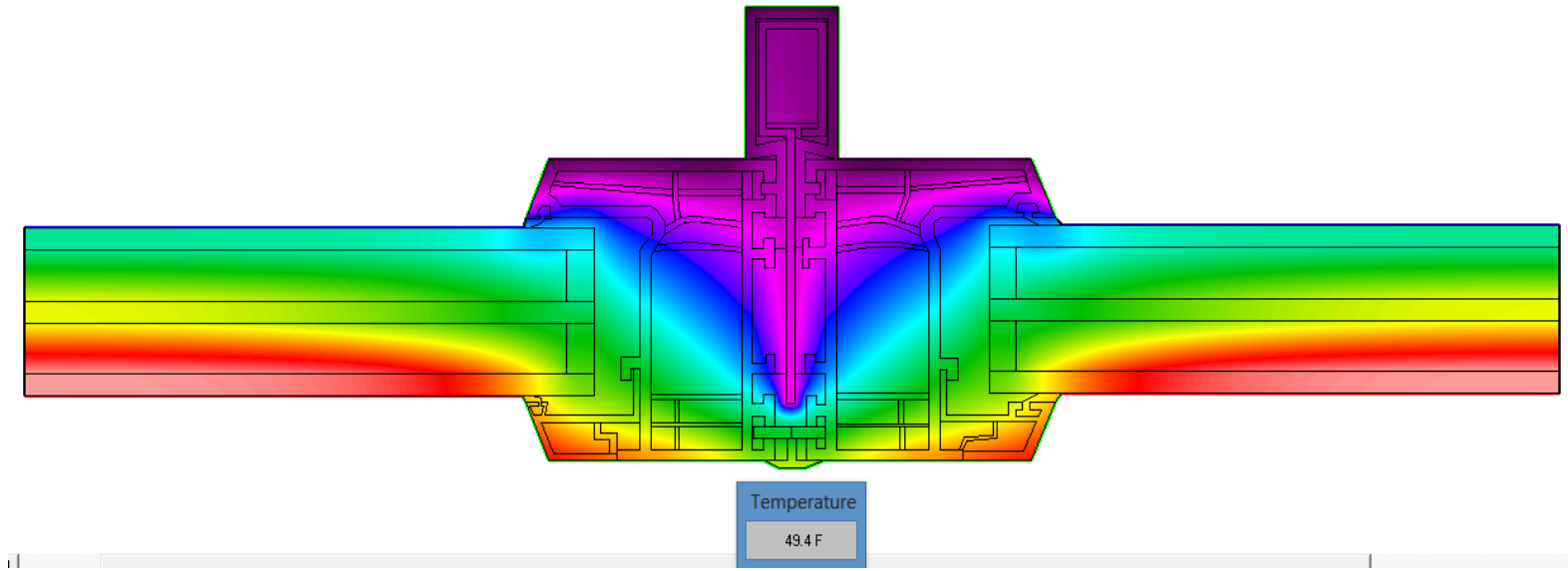
Plan View of Window Jointing Mullion In THERM



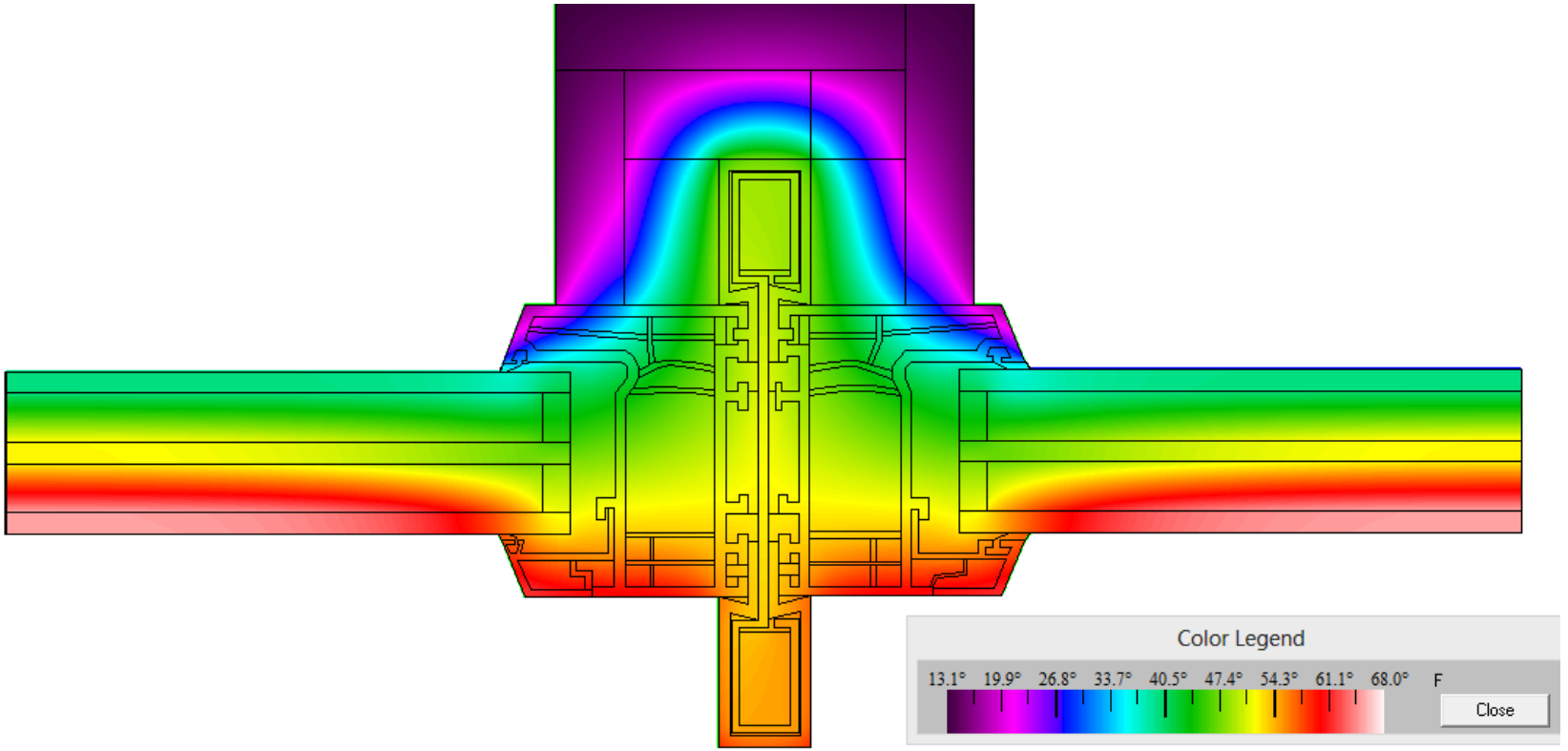
Thermal Bridge=0.16 BTU/hr.ft.F
Temperature=42.6 F



Thermal Bridge=.043 BTU/hr.ft.F
Temperature=49.4 F



Exterior Trim w/ EPS
Thermal Bridge=.039 BTU/hr.ft.F



Performance based design