

Building Sustainable Information Models

in collaboration with:



funded by:



research team:

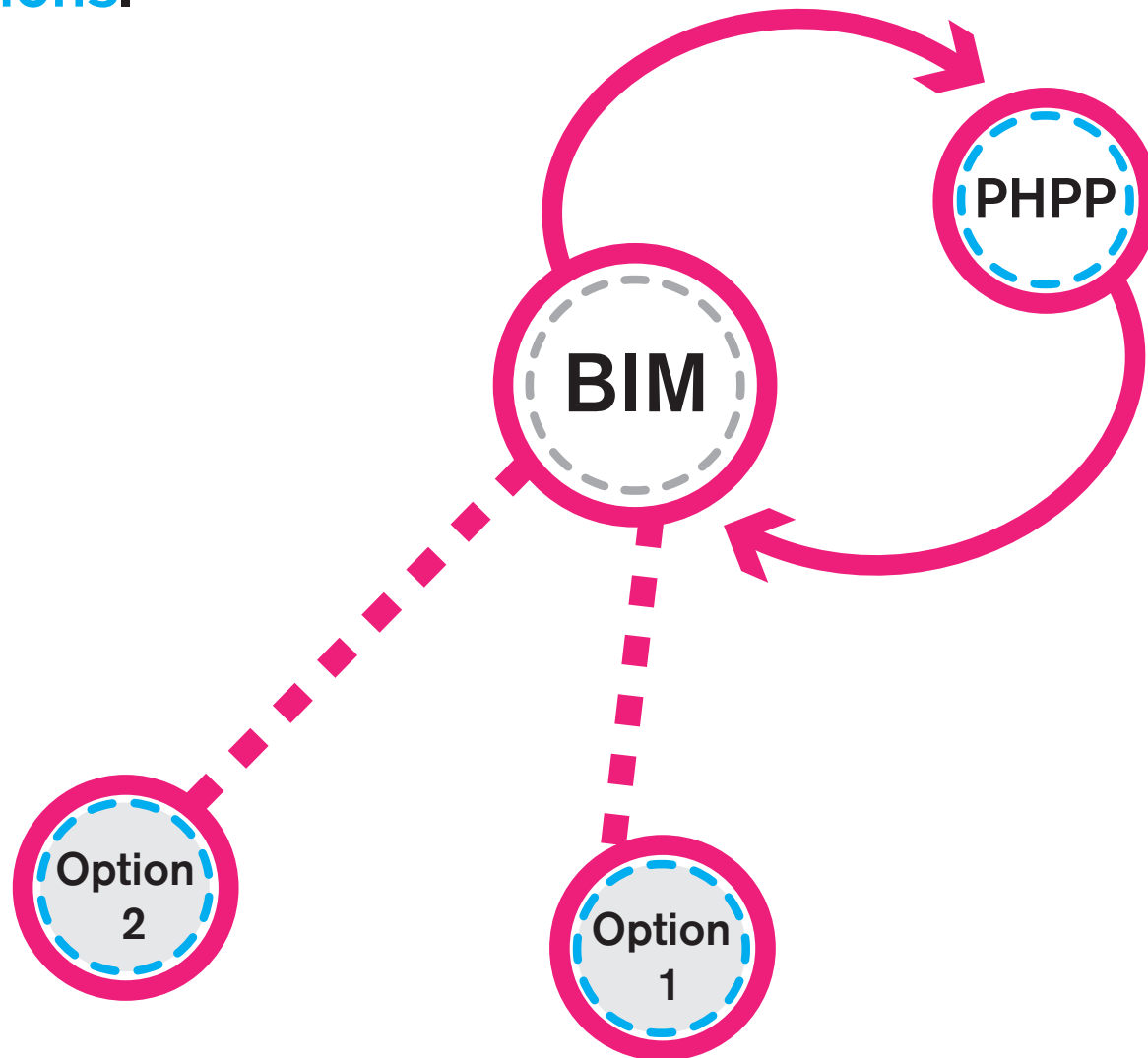
Jason Andersen, Case Design Inc.

Christopher Steffens, Adjunct Faculty, School of Constructed Environments

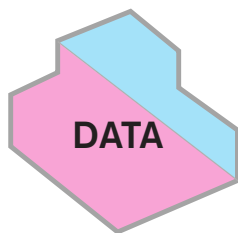
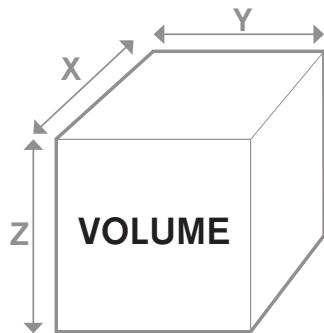
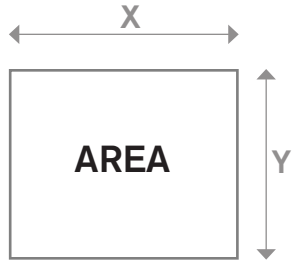
Steve Sanderson, Adjunct Faculty, School of Constructed Environments

Our **objective** was to assist students in **leveraging** their existing use of the Solar Decathlon's **Revit Model** for Environmental Analysis. This was achieved through creating a better workflow from the model to the **Passive House Planning Package**

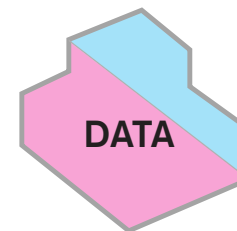
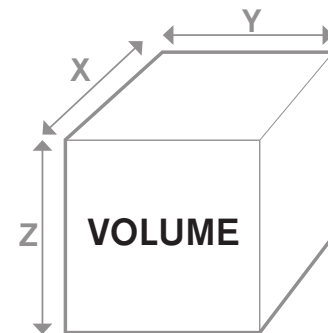
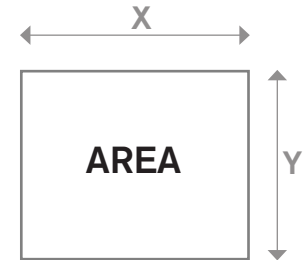
The **challenge** was how to **design a system** to expedite the extraction of useful data to inform the performance of multiple design **iterations**.



BIM Attributes



PHPP Inputs



Translation

The Potential:

Efficient Mechanics

Data about Efficiency and pertinent information aligned with geometry.

Super-insulation

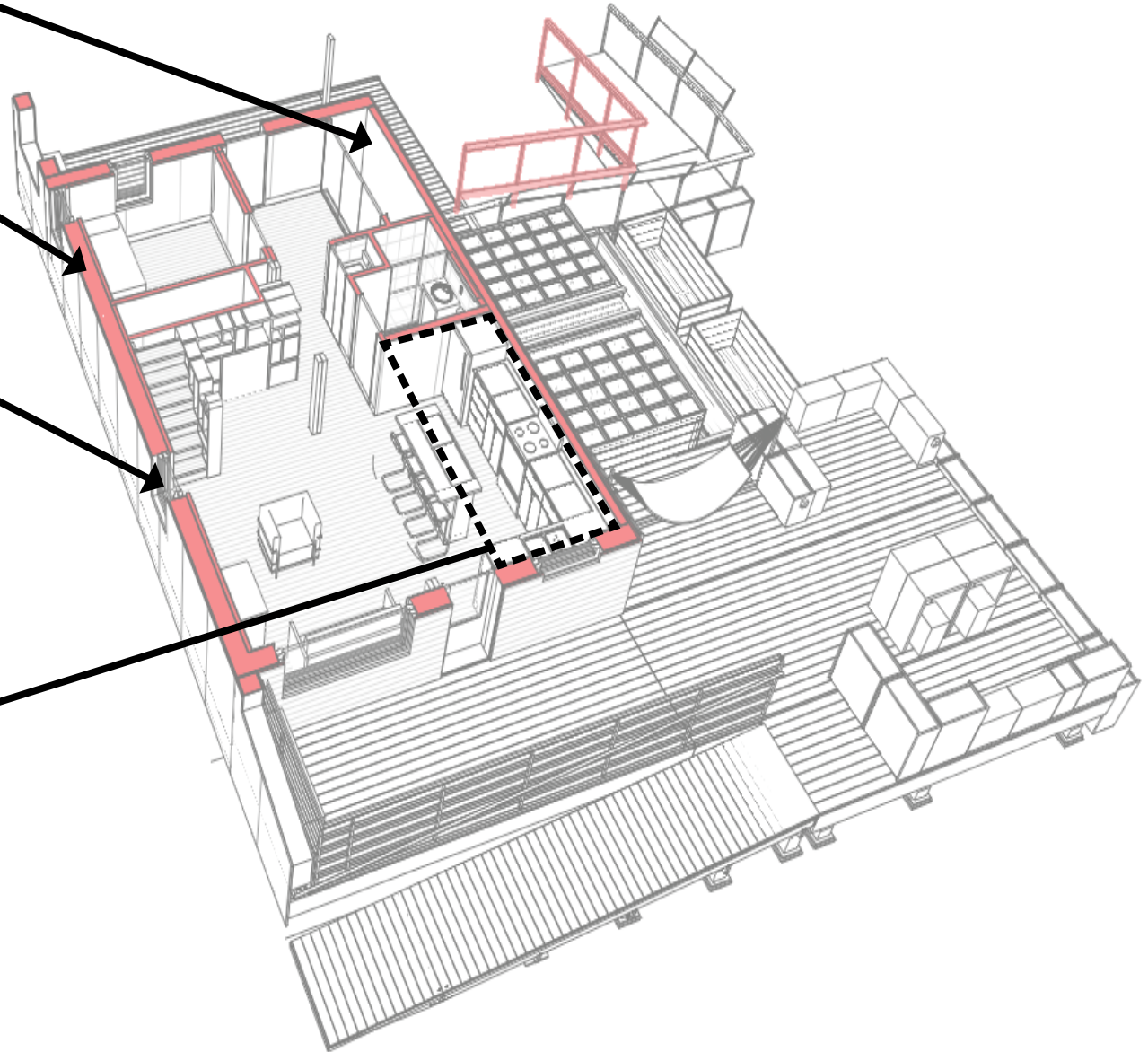
Dynamic material listings with U-values associated with geometry.

Efficient Windows

Dynamic material listings with U-values associated with geometry. In addition to real-time understanding of material usage through schedules.

Accounting of Space

Dynamic Room schedules to organize and represent that space as needed in PHPP.



The Need:

Information

Filling out the PHPP is the first step to Designing to the standard and then to Certification

Passive House Planning

REDUCTION FACTOR SOLAR RADIATION, WINDOW U-VALUE

Building: Annual Heat Demand: Heating Degree Days:

Climate:

Window Area Orientation	Global Radiation (Cardinal Points)	Shading	Dirt	Non-Perpendicular Incident Radiation	Glazing Fraction	SHGC	Reduction Factor for Solar Radiation	Window Area	Window U-Value	Window R-Value	Glazing Area	Glazing Area as % of Gross Floor Area	Average Global Radiation
maximum:	1800000	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%	42
North	102	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%	102
East	202	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%	202
South	109	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%	109
West	166	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%	166
Horizontal													
Total or Average Value for All Windows:						0.00	0.00	0.0	0.00	0.0	0.0		

Transmission Losses		Heat Gains Solar Radiation	
kBTU/hp	kBTU/hp	kBTU/hp	kBTU/hp
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Position	Qty	Window Unit	#	Deviation from North	Angle of Inclination from the Horizontal	Orientation	Window Rough Openings		Installed		Glazing		Frame		SHGC	U-Value		R-Value		Window Frame Dimensions				Insta	
							Width	Height	in Area in the Areas worksheet	Select glazing from the WinType worksheet	Select window from the WinType worksheet	Perpendicular Radiation	Glazing	Frames		Glazing	Frames	Width - Left	Width - Right	Width - Below	Width - Above	Left VR	Right VR		
1	1	W1	1	180	90	South	8	1/2	5	6 1/2	0	0	0	0	0	0	0	0	0	0	0	0	0		
3	3	W2	2	270	90	West	4	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0			
2	2	W3	3	90	90	East	4	3	4	6	0	0	0	0	0	0	0	0	0	0	0	0			

PHPP I-P 2007 unpopulated - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View PowerPivot

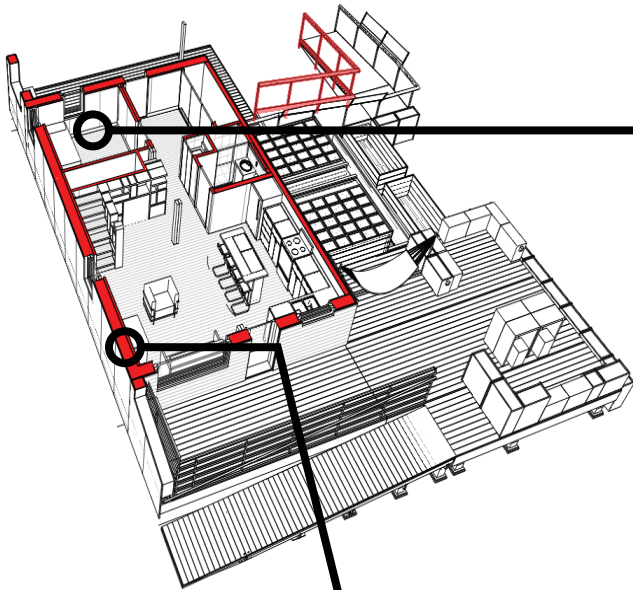
Clipboard Font Alignment Number Styles Cells Editing

Passive House Planning

Envelope Area Input										Selection of the Corresponding Envelope Assembly		R-Value		Exterior Absorptivity	
Area #	Building Element Description	Group #	Assigned to Group	Qty	Length	Width	Additional Area	Subtracted Area	Subtracted Window Areas	Area	#	R-Value	Exterior Absorptivity	Input For consideration	
	Treated Floor Area	1	Treated Floor Area							0.0					
	North Windows	2	North Windows							0.0					
	East Windows	3	East Windows							0.0					
	South Windows	4	South Windows							0.0					
	West Windows	5	West Windows							0.0					
	Horizontal Windows	6	Horizontal Windows							0.0					
	Exterior Door	7	Exterior Door							0.0					
1										0.0					
2										0.0					
3										0.0					
4										0.0					
5										0.0					
6										0.0					
7										0.0					
8										0.0					
9										0.0					
10										0.0					
11										0.0					
12										0.0					
13										0.0					
14										0.0					
15										0.0					
16										0.0					
17										0.0					
18										0.0					
19										0.0					
20										0.0					
21										0.0					

Please complete in Windows worksheet only

The **alignment** of the Building Information Models, which are rich with **data**, to PHPP that requires data provides an opportunity for the designer to organize and **output** information in a way that is helpful to a larger **process**.



Areas

PHPP-RefDims TFA				
Treated Floor Area	Name	Level	Unbounded Height	Perimeter
Primary Spaces	LOFT	T.O. Loft 8'-0" A2G	9'-7 3/16"	29'-11 1/4"
Primary Spaces	BATHROOM	T.O. FIRST FLOOR	8'-11 1/4"	28'-5 15/16"
Primary Spaces	BEDROOM	GROUND LEVEL	9'-0 7/16"	40'-4 5/16"
Primary Spaces	KITCHEN	GROUND LEVEL	8'-11 7/16"	45'-8"
Primary Spaces	LIVING ROOM	GROUND LEVEL	8'-11 1/16"	78'-7 7/8"
Secondary 50%	Bedroom Closet	GROUND LEVEL	8'-11 1/4"	22'-5 5/8"
Secondary 50%	MECH	T.O. FIRST FLOOR	8'-11 3/16"	26'-8 7/16"
Secondary 50%	Storage Under Stair	GROUND LEVEL	4'-9 11/16"	43'-3 1/4"
Secondary 60%	LAUNDRY	GROUND LEVEL	8'-0"	9'-9 1/2"
Secondary 60%	ENTRYWAY	GROUND LEVEL	8'-11 3/4"	36'-2 7/16"

Walls

PHPP-R_Values Wall						
Area Group	Type	Material: Name	Area	Thermal Performance		
				Material: Thic	Material: R Value per Inch	
8	+SD 11 7/8 I Joist	+SD 5/8 Gypsum - Wall Board	330.96 SF	0' - 0 5/8"	1	0.63
8	+SD 11 7/8 I Joist	+SD 1/2 Wood - Sheating Plywood	330.96 SF	0' - 0 1/2"	1	0.5
8	+SD 11 7/8 I Joist	+SD 11 7/8 Stud Layer 01	330.96 SF	0' - 11 7/8"	3	35.63
8	+SD 11 7/8 I Joist	+SD 5/8 Wood - Sheating OSB	330.96 SF	0' - 0 5/8"	1	0.63
8	+SD 11 7/8 I Joist	+01 Generic Membrane	330.96 SF	0' - 0 1/32"	0	0
						37.38
8	+SD 11 7/8 I Joist	+SD 5/8 Gypsum - Wall Board	210.00 SF	0' - 0 5/8"	1	0.63
8	+SD 11 7/8 I Joist	+SD 1/2 Wood - Sheating Plywood	210.00 SF	0' - 0 1/2"	1	0.5
8	+SD 11 7/8 I Joist	+SD 11 7/8 Stud Layer 01	210.00 SF	0' - 11 7/8"	3	35.63
8	+SD 11 7/8 I Joist	+SD 5/8 Wood - Sheating OSB	210.00 SF	0' - 0 5/8"	1	0.63
8	+SD 11 7/8 I Joist	+01 Generic Membrane	210.00 SF	0' - 0 1/32"	0	0
						37.38

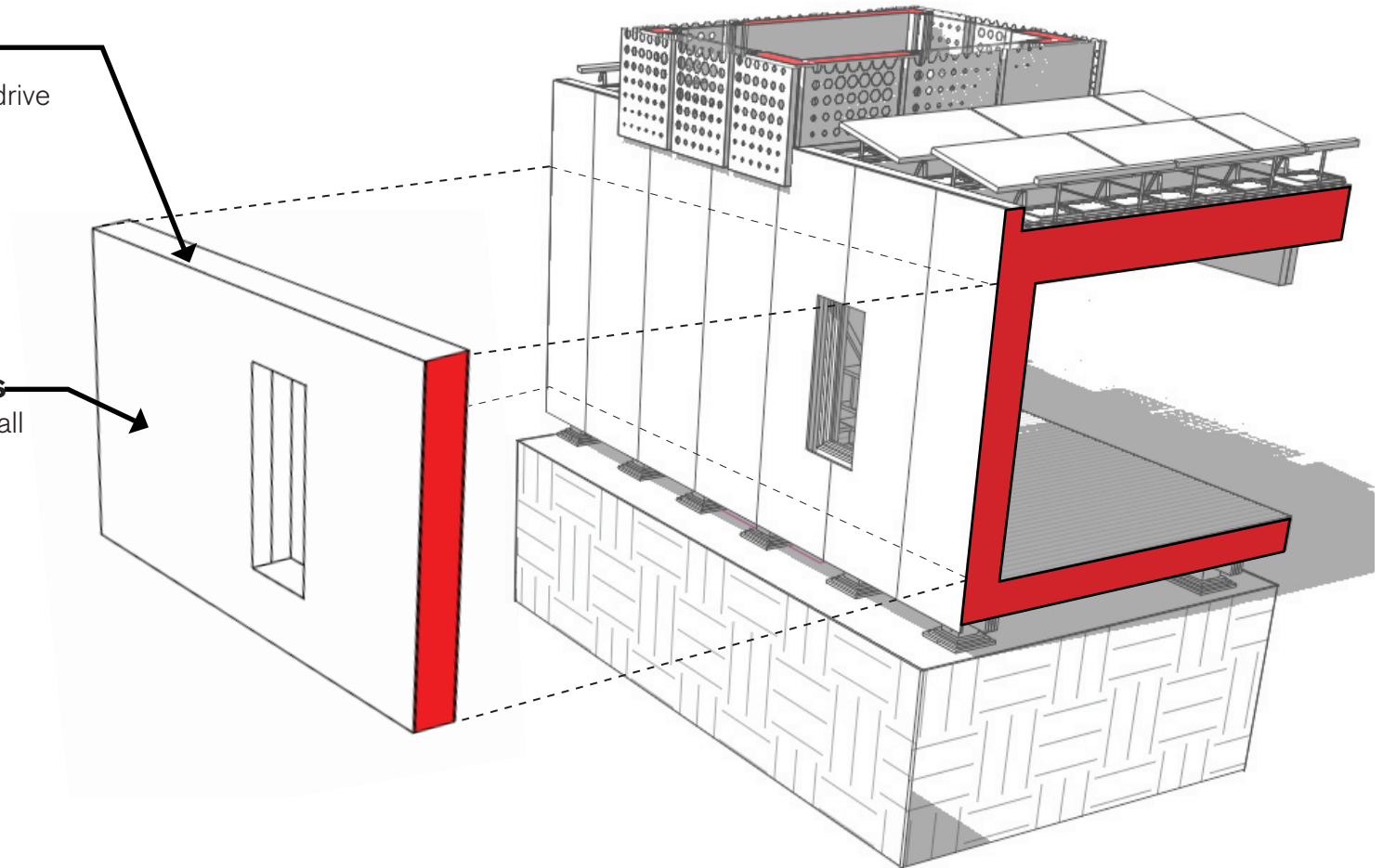
While aligning the information is **important** it is also required to **embed information** into the model geometry.

Thermal Envelope Walls

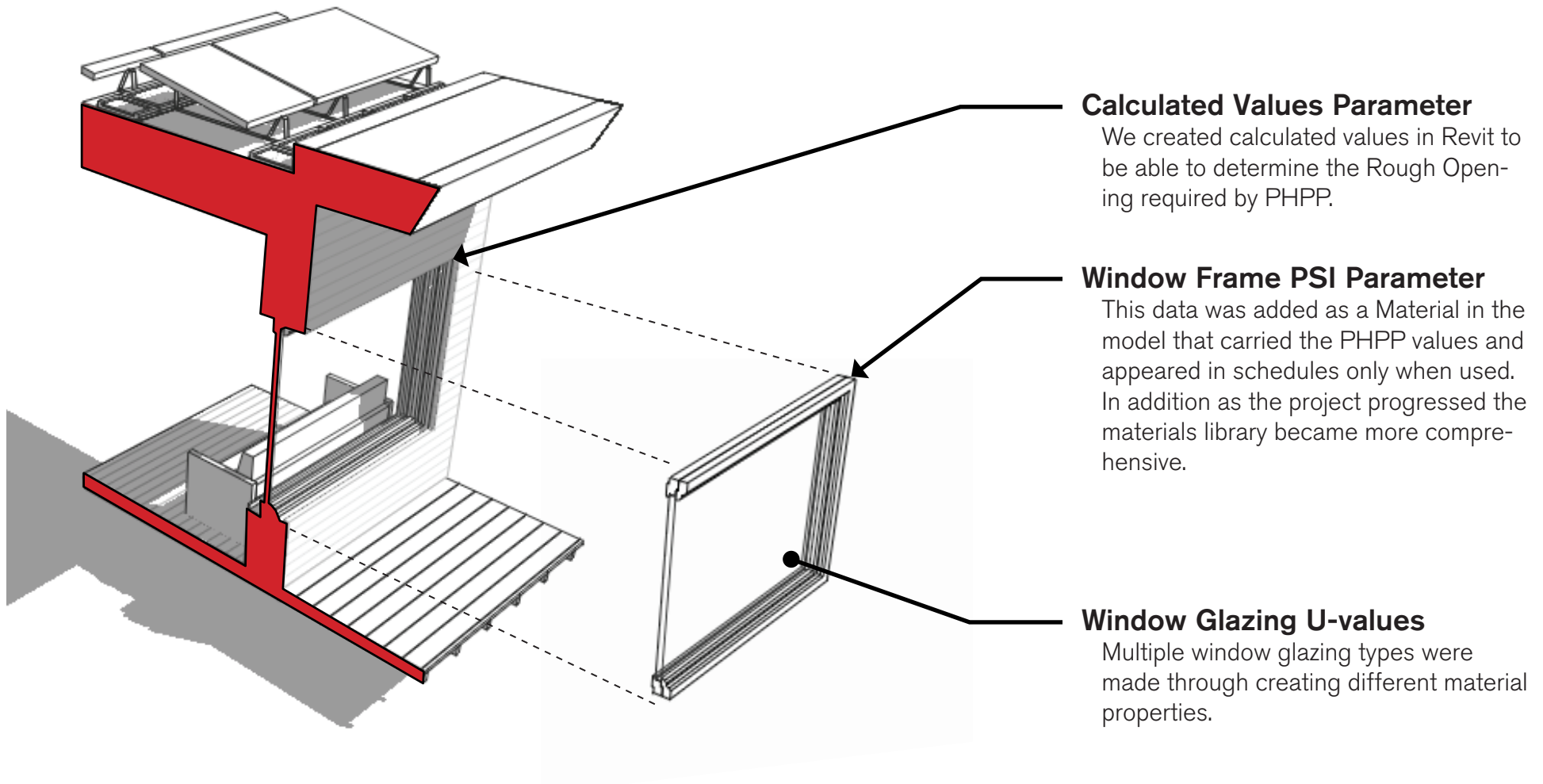
We created separate walls to drive all parameters associated with PHPP values

PHPP Parameters in Walls

Materials were used to 'contain' all pertinent value for analysis.



We worked closely with the team to **strategically model** and associate data in order to **facilitate information transfer** to PHPP



Grand total: 6

[illegible]

Passive House Planning

REDUCTION FACTOR SOLAR RADIATION, WITH SHADING

Building: Chicago IL*

Annual Heat Demand: 1 kBTU/(h*°y)

Climate:	Chicago IL*											
Window Area Orientation	Global Radiation (Cardinal Points)	Shading	Dirt	Non-Perpendicular Incident Radiation	Glazing Fraction	SHGC	Reduction Factor for Solar Radiation	Window Area	Window U-Value	Window R-Value	Glazing Area	Glazing Area as % of Gross Floor Area
maximum:	kBTU/h*°y	0.75	0.95	0.85				ft²	BTU/hr.ft².F	hr.ft².F/BTU	ft²	
North	42	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%
East	102	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%
South	202	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%
West	109	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%
Horizontal	166	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%
Total or Average Value for All Windows.						0.00	0.00	0.0	0.00	0.0	0.0	

Description	Qty	Window Unit	#	Deviation from North	Angle of Inclination from the Horizontal	Orientation	Window Rough Openings				Installed	Glazing		Frame	SHGC	U-Value		R-Value			
							Width		x	Height		#	#	#	#	#	#	#	#	#	#
							ft	in		ft	in										
Main Window	1	W1	1	180	90	South	8	ft 1/2	in x	5	ft 6 1/2	in	Select:	Select:	Select:	-	BTU/hr.ft².F	BTU/hr.ft².F	hr.ft².F/BTU	hr.ft².F/BTU	
Bedrooms	3	W2	2	270	90	West	4	ft 3	in x	3	ft 2	in	Select:	Select:	Select:						
Kitchen	2	W3	3	90	90	East	4	ft 3	in x	4	ft 6	in	Select:	Select:	Select:						
			0				ft		in x		ft	in	Select:	Select:	Select:						



For **future studies** the **exchange** of data from one context / discipline / software to another will happen with increasing speed. There is an immense **need** for **people** to be facile with multiple **tools** to expedite this process.

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Learning

[illegible]

Everything



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New DesignByMany Challenge! - Pop-Up Retail Store

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 O-Cubes Description For...

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