Product Requirement Document

Software Title:

Comprehensive U-value calculator

Background Introduction:

For the engineers related to the building, calculate the values related to the performance of construction material is the necessary process. All of the calculation steps, engineers need to calculate the U-value of the building elements which demonstrated the thermal resistance property. The Comprehensive U-value calculator is designed for the building engineers to quickly calculated the U-values of the building elements.
This software was designed for the two simple building structure U-value calculation which are ground floor and the wall structure.

Implement Theory:

The building elements U–value calculation methods are different.
For the wall structure, the U–value is calculated by the equation given:

$$U = \frac{1}{R_{total}}$$

R value is calculated by add all the insulations up.

$$R_{total} = R_1 + R_2 + R_3 + R_n$$

Consider the

And the thermal resistance R–value is given by

$$R = \frac{\lambda}{d}$$

Where λ is the thermal conductivity value, the d is the thickness of the insulation material.

For the Ground-Floor U-value calculation,
firstly determinate the perimeter to area ratio,

$$ratio = \frac{perimeter}{area} m/m^2$$

And then determine the thermal resistance of the insulation layer by:

$$R_{insulation} = \frac{\lambda}{d}$$

Table C1 **U-values (W/m^2K) for solid ground floors**

	Thermal resistance of all-over insulation (m^2K/W)					
perimeter/ area (m/m^2)	0	0.5	1	1.5	2	2.5
0.05	0.13	0.11	0.10	0.09	0.08	0.08
0.10	0.22	0.18	0.16	0.14	0.13	0.12
0.15	0.30	0.24	0.21	0.18	0.17	0.15
0.20	0.37	0.29	0.25	0.22	0.19	0.18
0.25	0.44	0.34	0.28	0.24	0.22	0.19
0.30	0.49	0.38	0.31	0.27	0.23	0.21
0.35	0.55	0.41	0.34	0.29	0.25	0.22
0.40	0.60	0.44	0.36	0.30	0.26	0.23
0.45	0.65	0.47	0.38	0.32	0.27	0.23
0.50	0.70	0.50	0.40	0.33	0.28	0.24
0.55	0.74	0.52	0.41	0.34	0.28	0.25
0.60	0.78	0.55	0.43	0.35	0.29	0.25
0.65	0.82	0.57	0.44	0.35	0.30	0.26
0.70	0.86	0.59	0.45	0.36	0.30	0.26
0.75	0.89	0.61	0.46	0.37	0.31	0.27
0.80	0.93	0.62	0.47	0.37	0.32	0.27
0.85	0.96	0.64	0.47	0.38	0.32	0.28
0.90	0.99	0.65	0.48	0.39	0.32	0.28
0.95	1.02	0.66	0.49	0.39	0.33	0.28
1.00	1.05	0.68	0.50	0.40	0.33	0.28

Where the lambda is the thermal conductivity of the insulation layer and the d is the thickness of the insulation layer.

Finally, find out the final R-value by the Bilinear-Interpolation method from the Table given above.

For example the insulation layer of the ground floor has the P/A ratio 0.28, and the thermal resistance 0.385, finally the U-value equals:

$$U_floor = \frac{(0.0289 - 0)(0.34 - 0.44)}{(0.5 - 0)} + 0.44 = 0.43422 W/m^2K$$

Similar Products:

THS CONCEPTS:

https://www.ths-concepts.co.uk/how-to-calculate-u-values/

One online free U-value calculator with the detail calculation theory, but the insulation material layer number is limited.

Mannok U-Value Calculator:

https://uvaluecalculator.mannokbuild.com/

Free, online U-value calculator with various types of structures, but the material types are limited.