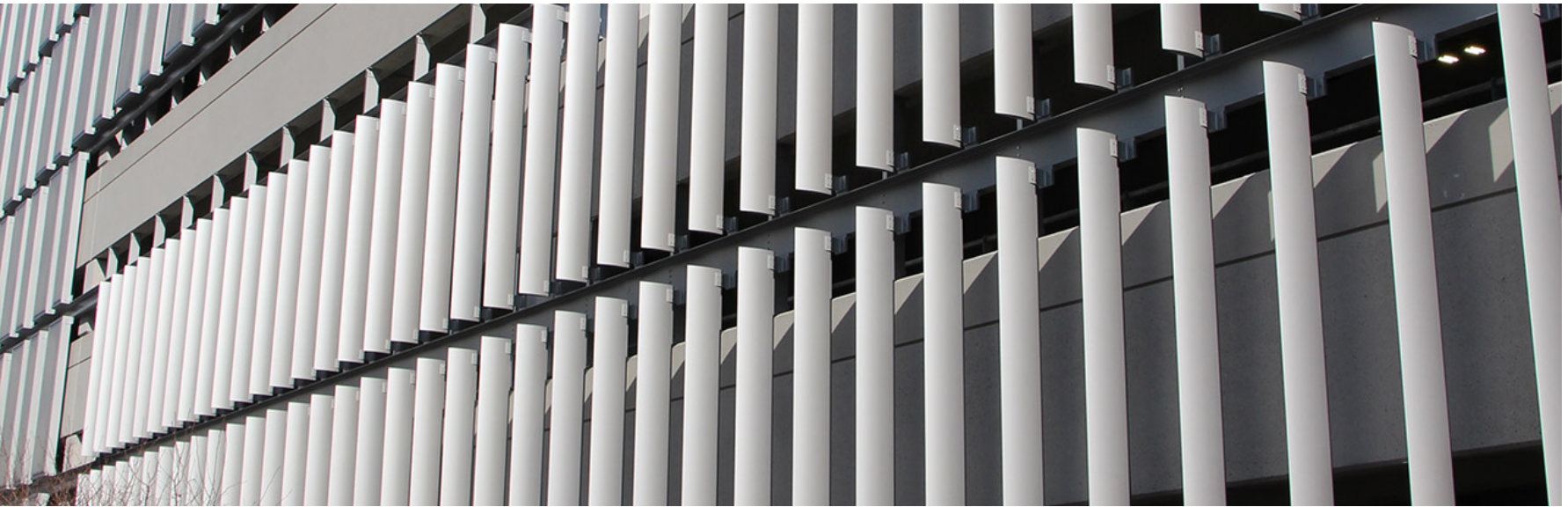


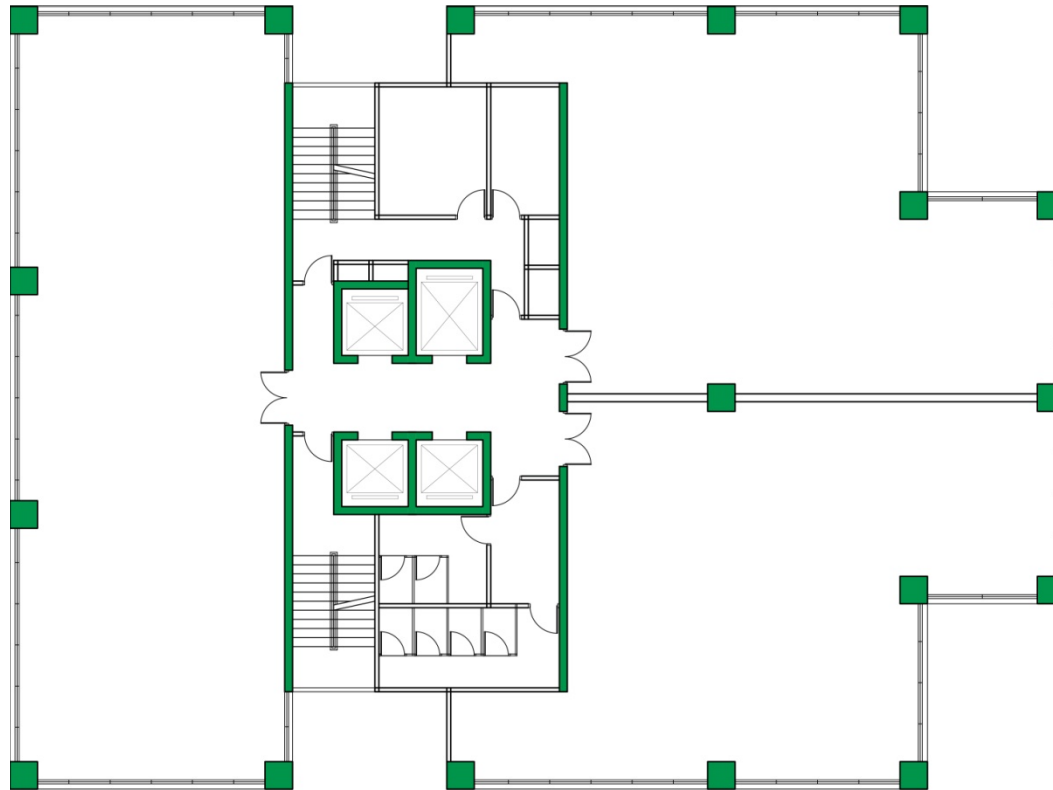
topic 2 **OTTV Calculation**



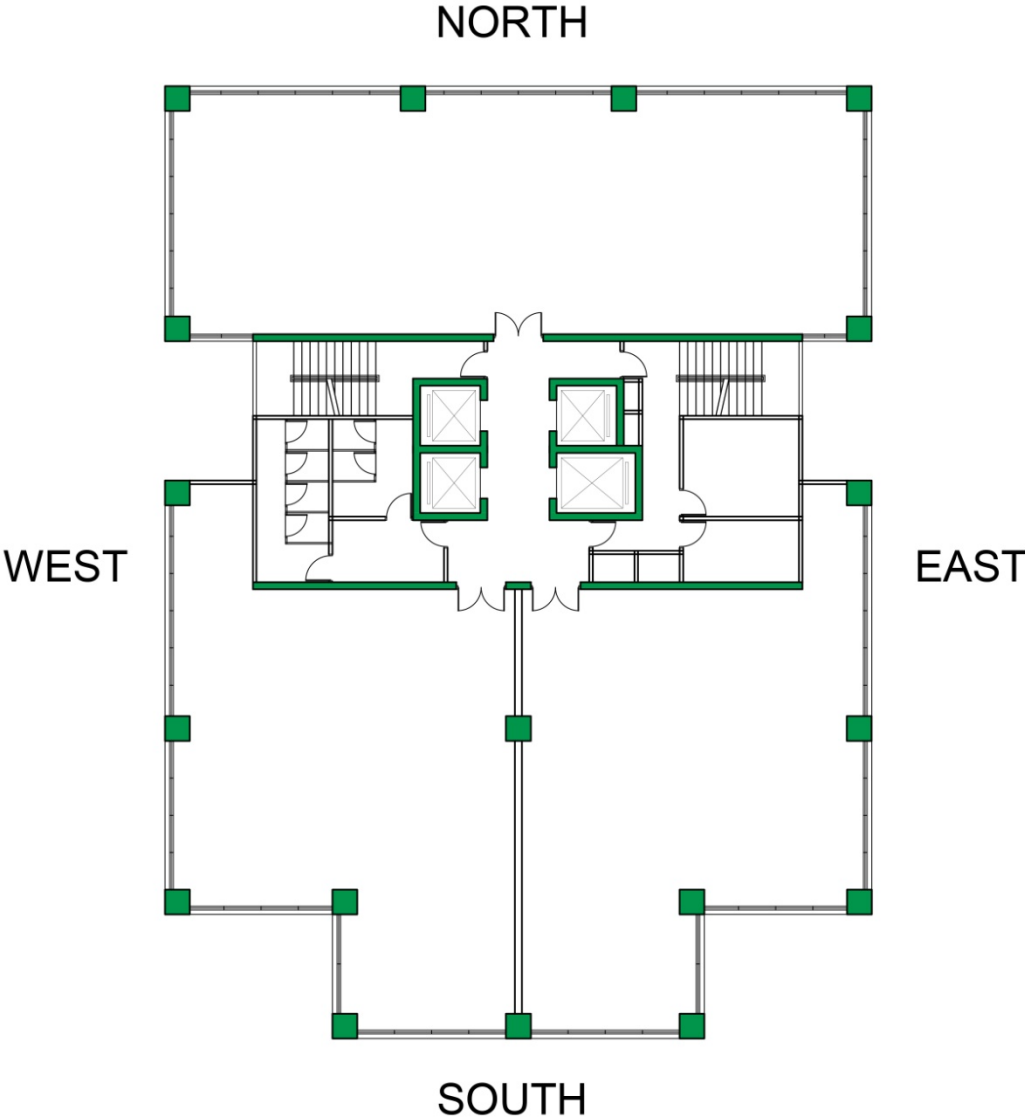
OTTV Calculation Template

OTTV COMPONENT		A	B	C	D	E	F	G	H	I	J	K	L	
	Wall Location	Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	% of OTTV
HEAT CONDUCTION THROUGH WALLS	Wall 1		15					N/A	N/A	N/A	N/A	N/A		
	Wall 2		15					N/A	N/A	N/A	N/A	N/A		
	Wall 3		15					N/A	N/A	N/A	N/A	N/A		
	Wall 4		15					N/A	N/A	N/A	N/A	N/A		
	Wall 5		15					N/A	N/A	N/A	N/A	N/A		
		Σ Wall Area	y	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U_w									Σ	
HEAT CONDUCTION THROUGH WINDOWS	Wall 1		6	N/A		N/A	N/A		N/A	N/A	N/A	N/A		
	Wall 2		6	N/A		N/A	N/A		N/A	N/A	N/A	N/A		
	Wall 3		6	N/A		N/A	N/A		N/A	N/A	N/A	N/A		
	Wall 4		6	N/A		N/A	N/A		N/A	N/A	N/A	N/A		
	Wall 5		6	N/A		N/A	N/A		N/A	N/A	N/A	N/A		
				Equation for Heat Conduction Through Windows = 6 x WWR x U_f									Σ	
SOLAR HEAT GAIN THROUGH WINDOWS	Wall 1		194	N/A		N/A	N/A	N/A						
	Wall 2		194	N/A		N/A	N/A	N/A						
	Wall 3		194	N/A		N/A	N/A	N/A						
	Wall 4		194	N/A		N/A	N/A	N/A						
	Wall 5		194	N/A		N/A	N/A	N/A						
				Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC									Σ	
												Σ WALL OTTV =	x	
												Σ WALL AREA =	y	
												OTTV =	x/y	

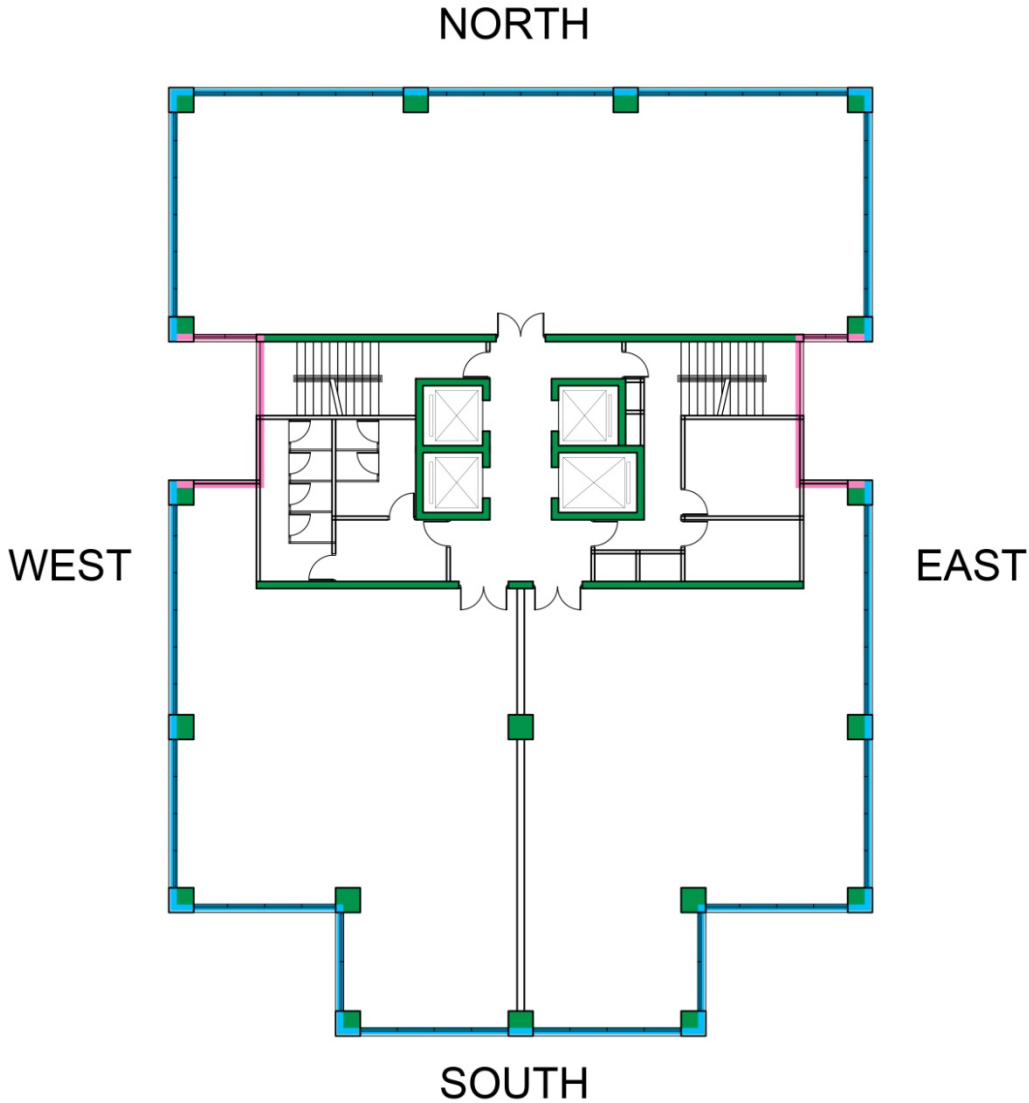
Case Study Office Tower



1. Determine the orientation of each elevation.



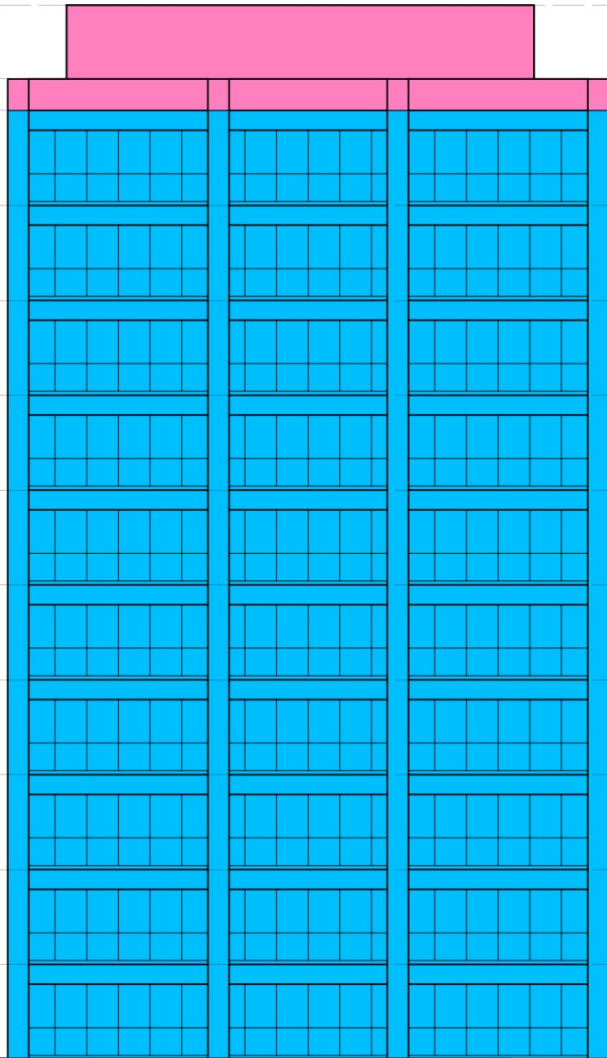
1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.



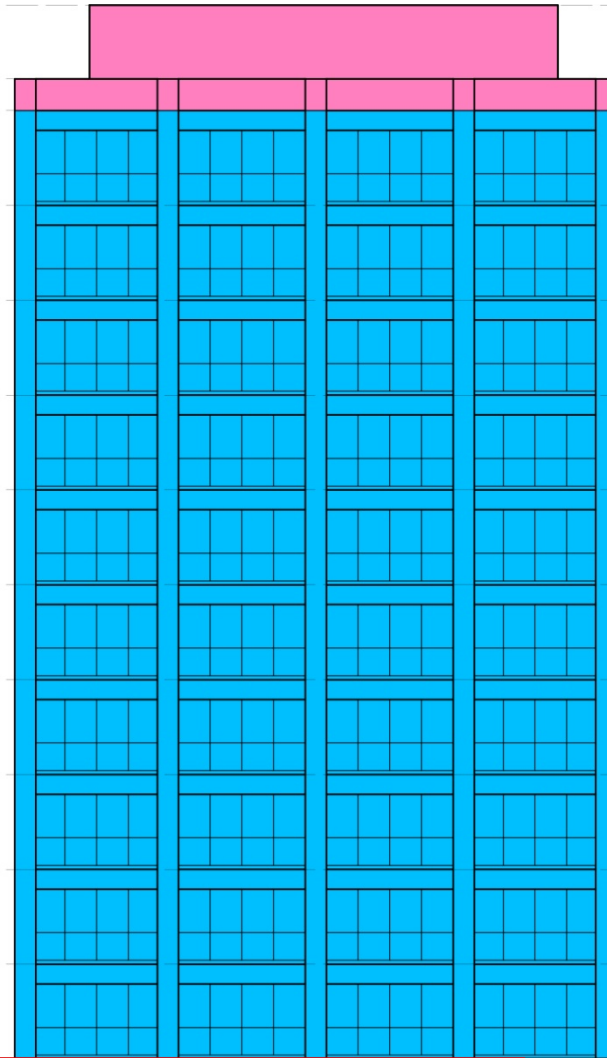
Walls & Apertures used for OTTV calculation

Walls & Apertures not used for OTTV calculation

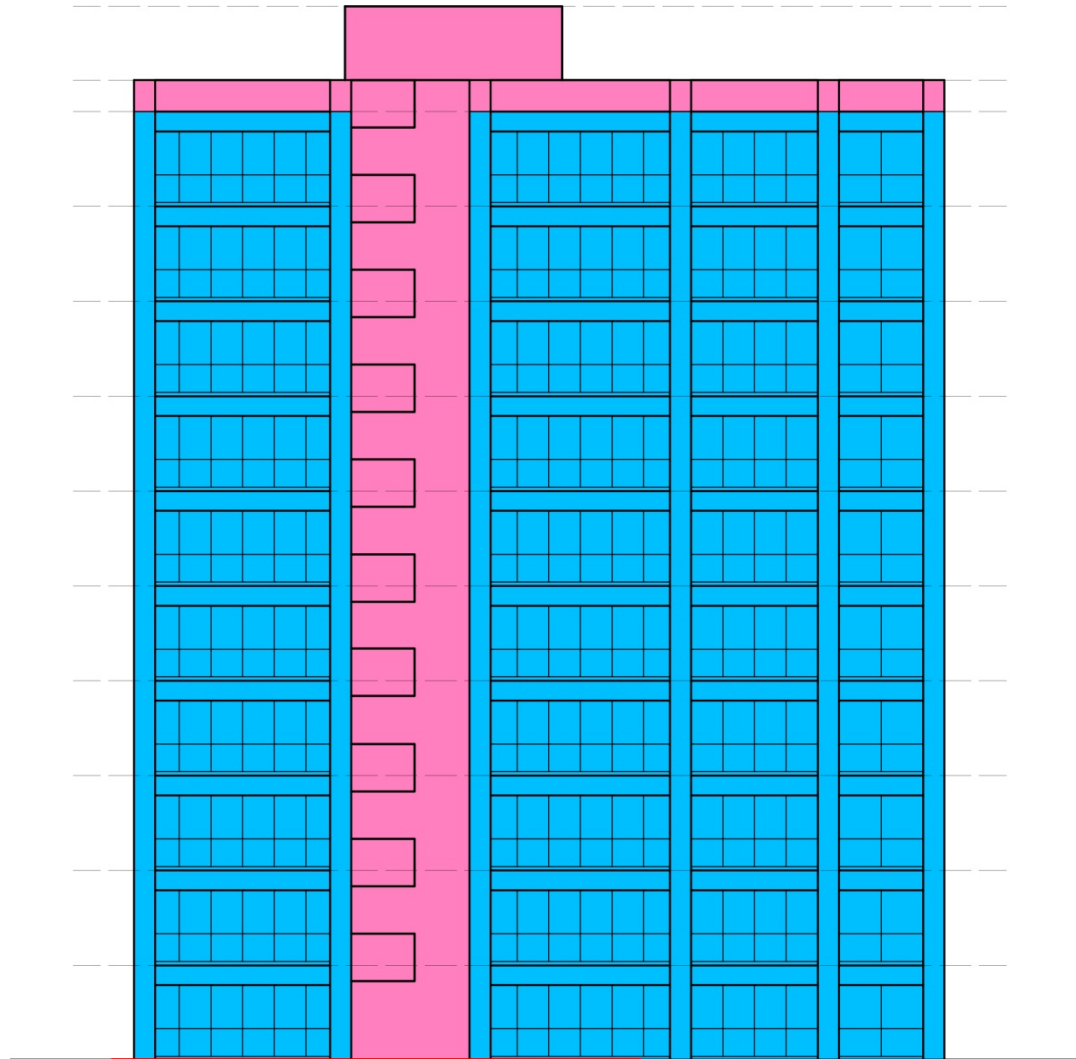
1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas.



NORTH ELEVATION
Total Wall Area = 820.80 sqm



SOUTH ELEVATION
Total Wall Area = 820.80 sqm



EAST / WEST ELEVATION
Total Wall Area = 944.28 sqm

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. **[Fill in the wall areas into OTTV template]**

OTTV Calculation Example

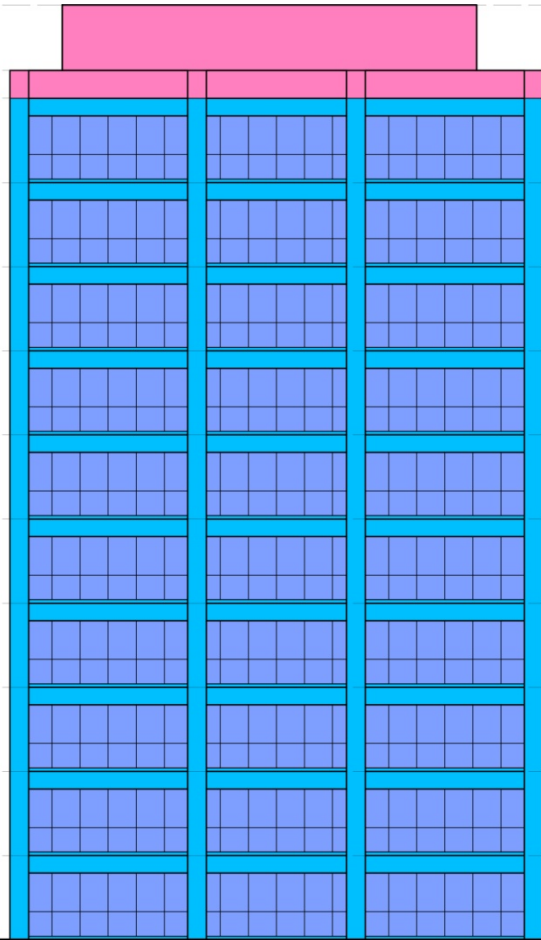
OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.00	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	South Wall	820.80	15	0.00	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	East Wall	944.28	15	0.00	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	West Wall	944.28	15	0.00	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U _w										Σ	0.00
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	South Window	820.80	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	East Window	944.28	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	West Window	944.28	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
			Equation for Heat Conduction Through Windows = 6 x WWR x U _f										Σ	0.00
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	South Window	820.80	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	East Window	944.28	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	West Window	944.28	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC										Σ	0.00
												Σ WALL OTTV =	0.00	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	0.00	

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. **Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]**

OTTV Calculation Example

OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	South Wall	820.80	15	0.15	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	East Wall	944.28	15	0.15	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	West Wall	944.28	15	0.15	0.00	1.00	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U _w										Σ	0.00
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	South Window	820.80	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	East Window	944.28	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	West Window	944.28	6	N/A	0.00	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
			Equation for Heat Conduction Through Windows = 6 x WWR x U _f										Σ	0.00
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	South Window	820.80	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	East Window	944.28	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	West Window	944.28	194	N/A	0.00	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC										Σ	0.00
												Σ WALL OTTV =	0.00	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	0.00	

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. **Calculate the Window-to-Wall Ratio (WWR).**



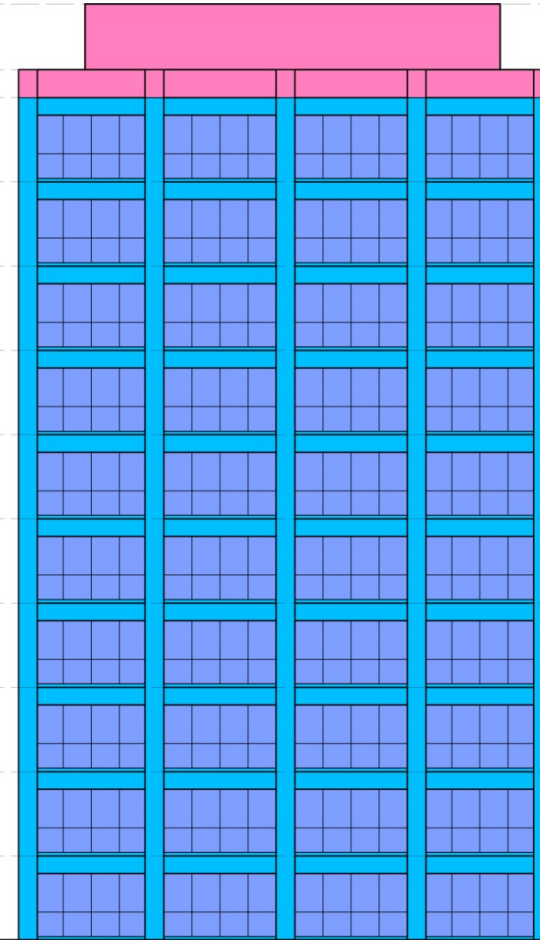
NORTH ELEVATION

Total Wall Area (y) = 820.80 sqm

Total Window Area (x) = 529.00 sqm

WWR = $x / y = 529.00 / 820.80$

WWR = 0.64



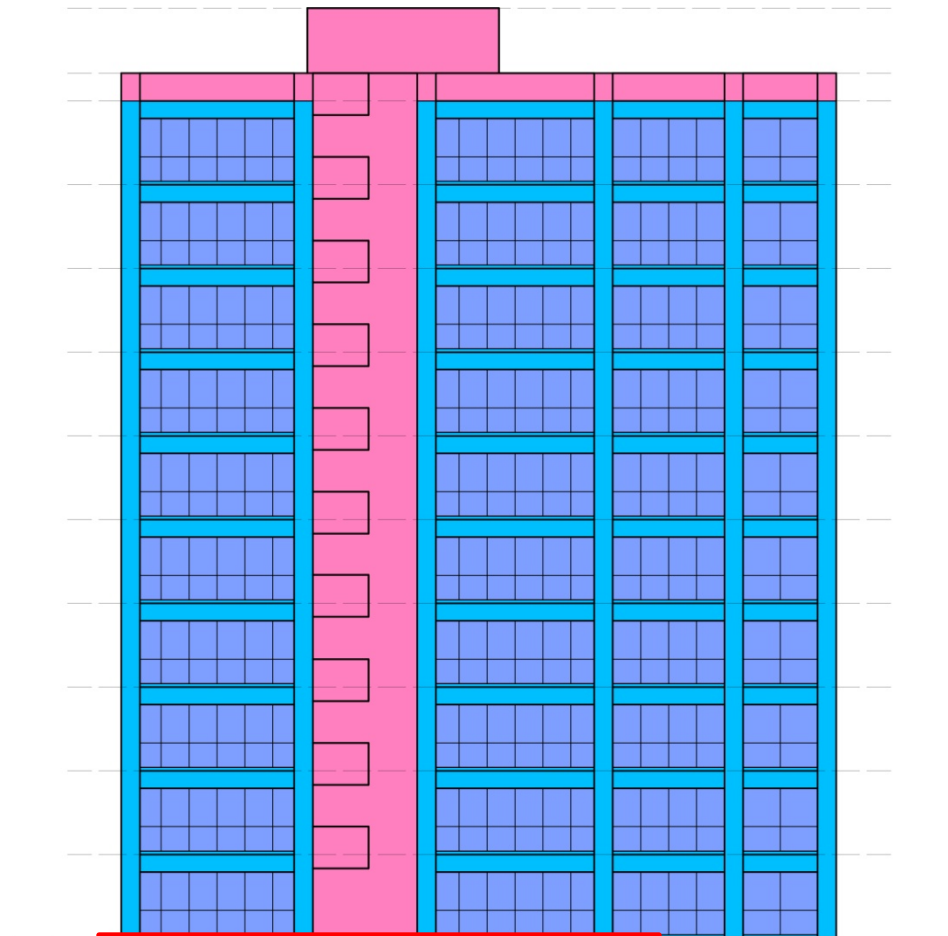
SOUTH ELEVATION

Total Wall Area (y) = 820.80 sqm

Total Window Area (x) = 507.60 sqm

WWR = $x / y = 507.60 / 820.60$

WWR = 0.62



EAST / WEST ELEVATION
Total Wall Area (y) = 944.28 sqm
Total Window Area (x) = 578.60 sqm
 $WWR = x / y = 578.60 / 944.28$
WWR = 0.61

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]

OTTV Calculation Example

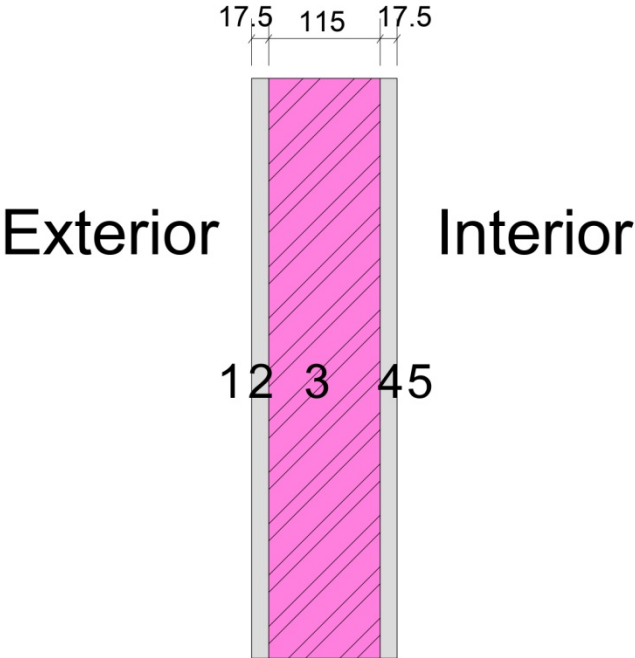
OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	South Wall	820.80	15	0.15	0.62	0.38	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	East Wall	944.28	15	0.15	0.61	0.39	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	West Wall	944.28	15	0.15	0.61	0.39	0.00	N/A	N/A	N/A	N/A	N/A	0.00	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U_w										Σ	0.00
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	South Window	820.80	6	N/A	0.62	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	East Window	944.28	6	N/A	0.61	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	West Window	944.28	6	N/A	0.61	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
			Equation for Heat Conduction Through Windows = 6 x WWR x U_f										Σ	0.00
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC										Σ	0.00
												Σ WALL OTTV =	0.00	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	0.00	

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. **Calculate the Wall U-value.**

Wall U-value

Item	Material	Thickness (mm)	Thermal Conductivity (W/mk)	Thermal Resistance, R (m2k/W)
1	External Surface	-	-	0.040
2	External Wall Plaster	17.5	0.570	0.0307
3	Bricks Wall	115.0	0.77	0.149
4	Internal Wall Plaster	17.5	0.570	0.031
5	Internal Surface	-	-	0.130
Total		150	Total R	0.381

Wall U-Value = $\frac{1}{R}$ = $\frac{1}{0.381}$ = **2.63** W/m2k



1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. **Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]**

OTTV Calculation Example

OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	2.63	N/A	N/A	N/A	N/A	N/A	1,748.55	
	South Wall	820.80	15	0.15	0.62	0.38	2.63	N/A	N/A	N/A	N/A	N/A	1,845.69	
	East Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	West Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U_w										Σ	7,952.71
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	South Window	820.80	6	N/A	0.62	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	East Window	944.28	6	N/A	0.61	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
	West Window	944.28	6	N/A	0.61	N/A	N/A	0.00	N/A	N/A	N/A	N/A	0.00	
			Equation for Heat Conduction Through Windows = 6 x WWR x U_f										Σ	0.00
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC										Σ	0.00
												Σ WALL OTTV =	7,952.71	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	2.25	

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
- 7. DONE for HEAT CONDUCTION THROUGH WALLS**

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. **Determine the U-value for glazing. Obtained from glass manufacturers.**

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. Determine the U-value for glazing. [Fill in Glazing U-value 5.7 into OTTV template]

OTTV Calculation Example

OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	2.63	N/A	N/A	N/A	N/A	N/A	1,748.55	
	South Wall	820.80	15	0.15	0.62	0.38	2.63	N/A	N/A	N/A	N/A	N/A	1,845.69	
	East Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	West Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = $15 \times \alpha \times (1 - WWR) U_w$										Σ	7,952.71
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,965.67	
	South Window	820.80	6	N/A	0.62	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,404.24	
	East Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
	West Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
			Equation for Heat Conduction Through Windows = $6 \times WWR \times U_f$										Σ	74,769.05
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.00	0.00	0.00	0.00	0.00	
			Equation for Solar Heat Gain Through Windows = $194 \times WWR \times OF \times SC$										Σ	0.00
												Σ WALL OTTV =	82,721.76	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	23.43	

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. Determine the U-value for glazing. [Fill in Glazing U-value 5.7 into OTTV template]
9. **DONE for HEAT CONDUCTION THROUGH WINDOWS.**

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. Determine the U-value for glazing. [Fill in Glazing U-value 5.7 into OTTV template]
9. DONE for HEAT CONDUCTION THROUGH WINDOWS.
10. **Fill in the Orientation Factor according Table 4 [Solar Correction Factors] in MS1525:2007.**

Table 4. Solar correction factors

Orientation	CF
North	0.90
Northeast	1.09
East	1.23
Southeast	1.13
South	0.92
Southwest	0.90
West	0.94
Northwest	0.90

NOTES:

1. Table 4 specifies CF for the various orientation of the fenestration. For the calculation of CF, it is recommended that the nearest predominant orientation be selected.
2. A fenestration system may consist of a glazing material such as glass, a shading device and a combination of both.

NOTE. Table 4 is based on updated (2006) data to match with the current test reference year (TRY) weather data for Kuala Lumpur. Data collected indicates that the average vertical East surface solar radiation is significantly higher than the vertical West surface. This trend is seen to be caused by the normally clear sky in the morning and cloudy sky in the afternoon.

OTTV Calculation Example

OTTV COMPONENT		A	B	C	D	E	F	G	H	I	J	K	L	
	Wall Location	Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	% of OTTV
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	2.63	N/A	N/A	N/A	N/A	N/A	1,748.55	
	South Wall	820.80	15	0.15	0.62	0.38	2.63	N/A	N/A	N/A	N/A	N/A	1,845.69	
	East Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	West Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U_w									Σ	7,952.71	9.6%
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,965.67	
	South Window	820.80	6	N/A	0.62	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,404.24	
	East Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
	West Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
			Equation for Heat Conduction Through Windows = 6 x WWR x U_f									Σ	74,769.05	90.4%
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.90	0.00	0.00	0.00	0.00	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.92	0.00	0.00	0.00	0.00	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	1.23	0.00	0.00	0.00	0.00	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.94	0.00	0.00	0.00	0.00	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC									Σ	0.00	0.0%
Σ WALL OTTV =												82,721.76	100%	
Σ WALL AREA =												3,530.16		
OTTV =												23.43		

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. Determine the U-value for glazing. [Fill in Glazing U-value 5.7 into OTTV template]
9. DONE for HEAT CONDUCTION THROUGH WINDOWS.
10. Fill in the Orientation Factor according Table 4 [Solar Correction Factors] in MS1525:2007.
- 11. Determine the SC value for glazing. Obtained from glass manufacturers.**

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. Determine the U-value for glazing. [Fill in Glazing U-value 5.7 into OTTV template]
9. DONE for HEAT CONDUCTION THROUGH WINDOWS.
10. Fill in the Orientation Factor according Table 4 [Solar Correction Factors] in MS1525:2007.
11. Determine the SC value for glazing. Obtained from glass manufacturers. [Fill in the SC value 0.51 into OTTV template]

OTTV Calculation Example

OTTV COMPONENT		A	B	C	D	E	F	G	H	I	J	K	L	
	Wall Location	Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	% of OTTV
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	2.63	N/A	N/A	N/A	N/A	N/A	1,748.55	
	South Wall	820.80	15	0.15	0.62	0.38	2.63	N/A	N/A	N/A	N/A	N/A	1,845.69	
	East Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	West Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U_w									Σ	7,952.71	9.6%
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,965.67	
	South Window	820.80	6	N/A	0.62	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,404.24	
	East Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
	West Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
			Equation for Heat Conduction Through Windows = 6 x WWR x U_f									Σ	74,769.05	90.4%
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.90	0.51	0.00	0.00	0.00	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.92	0.51	0.00	0.00	0.00	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	1.23	0.51	0.00	0.00	0.00	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.94	0.51	0.00	0.00	0.00	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC									Σ	0.00	0.0%
Σ WALL OTTV =												82,721.76	100%	
Σ WALL AREA =												3,530.16		
OTTV =												23.43		

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. Determine the U-value for glazing. [Fill in Glazing U-value 5.7 into OTTV template]
9. DONE for HEAT CONDUCTION THROUGH WINDOWS.
10. Fill in the Orientation Factor according Table 4 [Solar Correction Factors] in MS1525:2007.
11. Determine the SC value for glazing. Obtained from glass manufacturers. [Fill in the SC value 0.51 into OTTV template]
12. **Determine the SC2 Shading Devices according sun shading design and refer to Table 5, 6 & 7 in MS1525:2007.**

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5.3.3 The shading coefficient of external shading devices can be obtained from Table 5, Table 6 and Table 7.

Table 5. Shading coefficient of horizontal projections

Ratio	Orientation				
	North/South	East	West	Northeast/Southeast	Northwest / Southwest
0.30 - 0.40	0.77	0.77	0.79	0.77	0.79
0.50 - 0.70	0.71	0.68	0.71	0.69	0.72
0.80 - 1.20	0.67	0.60	0.65	0.63	0.66
1.30 - 2.00	0.65	0.55	0.61	0.60	0.63

NOTE:
R1 is the ratio: Width of horizontal projection/ Height of fenestration

Table 6. Shading coefficient of vertical projections

Ratio	Orientation				
	North/South	East	West	Northeast/Southeast	Northwest / Southwest
0.30 - 0.40	0.82	0.87	0.86	0.83	0.84
0.50 - 0.70	0.77	0.82	0.81	0.77	0.79
0.80 - 1.20	0.73	0.78	0.77	0.72	0.74
1.30 - 2.00	0.70	0.75	0.74	0.69	0.71

NOTE:
R2 is the ratio: Width of vertical projection/ Length of fenestration

Table 7. Shading coefficient of egg-crate louvres

Ratios		Orientation				
R1	R2	North/South	East	West	Northeast/Southeast	Northwest/Southwest
0.20	0.20	0.71	0.77	0.77	0.73	0.75
	0.40 - 0.60	0.62	0.69	0.69	0.63	0.66
	0.60 - 1.80	0.56	0.62	0.61	0.55	0.58
0.40	0.20 - 0.40	0.59	0.63	0.64	0.60	0.63
	0.60 - 1.20	0.49	0.54	0.54	0.48	0.52
	1.40 - 1.80	0.46	0.50	0.51	0.44	0.48
0.60	0.20 - 0.60	0.52	0.54	0.56	0.51	0.55
	0.80 - 1.80	0.43	0.44	0.46	0.39	0.44
0.80	0.20 - 0.60	0.50	0.49	0.52	0.47	0.52
	0.80 - 1.80	0.40	0.39	0.42	0.36	0.41
1.00	0.20 - 0.40	0.51	0.48	0.52	0.48	0.52
	0.60 - 1.20	0.41	0.39	0.42	0.36	0.42
	1.40 - 1.80	0.38	0.35	0.38	0.32	0.38
1.20 - 1.80	0.20 - 1.80	0.38	0.33	0.38	0.32	0.38

NOTES:
R1 is the ratio: Width of horizontal projection / Height of fenestration
R2 is the ratio: Width of vertical projection / Length of fenestration

1. Determine the orientation each of elevation.
2. Determine the wall for OTTV calculation.
3. Calculate the wall areas. [Fill in the wall areas into OTTV template]
4. Determine the Solar Absorption Factor (α). Wall to be white painted [$\alpha = 0.15$]
5. Calculate the Window-to-Wall Ratio (WWR). [Fill in the WWR into OTTV template]
6. Calculate the Wall U-value. [Fill in the Wall U-value 2.63 into OTTV template]
7. DONE for HEAT CONDUCTION THROUGH WALLS
8. Determine the U-value for glazing. [Fill in Glazing U-value 5.7 into OTTV template]
9. DONE for HEAT CONDUCTION THROUGH WINDOWS.
10. Fill in the Orientation Factor according Table 4 [Solar Correction Factors] in MS1525:2007.
11. Determine the SC value for glazing. Obtained from glass manufacturers. [Fill in the SC value 0.51 into OTTV template]
12. Determine the SC2 Shading Devices according sun shading design and refer to Table 5, 6 & 7 in MS1525:2007. **[SC2 = 1, no sun shading devices]**

OTTV Calculation Example

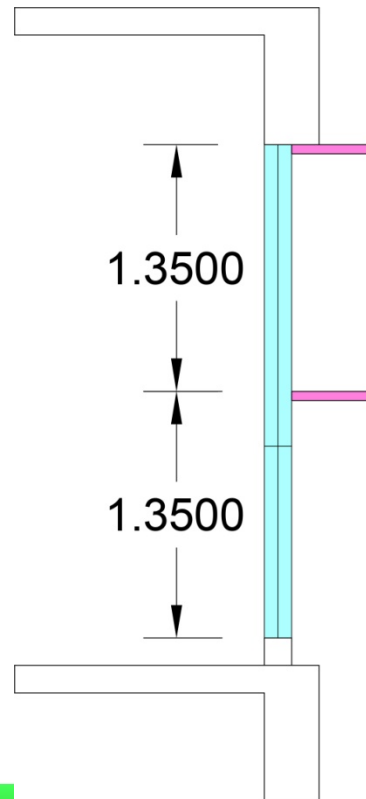
OTTV COMPONENT		A	B	C	D	E	F	G	H	I	J	K	L	
	Wall Location	Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	% of OTTV
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	2.63	N/A	N/A	N/A	N/A	N/A	1,748.55	
	South Wall	820.80	15	0.15	0.62	0.38	2.63	N/A	N/A	N/A	N/A	N/A	1,845.69	
	East Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	West Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U_w										Σ	7,952.71
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,965.67	
	South Window	820.80	6	N/A	0.62	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,404.24	
	East Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
	West Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
			Equation for Heat Conduction Through Windows = 6 x WWR x U_f										Σ	74,769.05
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.90	0.51	1.00	0.51	46,776.93	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.92	0.51	1.00	0.51	46,322.16	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	1.23	0.51	1.00	0.51	70,098.33	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.94	0.51	1.00	0.51	53,571.08	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC										Σ	216,768.49
Σ WALL OTTV =												299,490.25	100%	
Σ WALL AREA =												3,530.16		
OTTV =												84.84		

WAYS TO IMPROVE OTTV

1. Review sunshades and its Shading Coefficient (SC) in Table 5, 6 and 7.

Proposal: Provision of two layer of horizontal sun shading (450mm) as per diagram below.

[R = 0.33], refer SC2 in Table 5.



$$\begin{aligned}
 R &= X/Y \\
 &= 450/1350 \\
 &= 0.33
 \end{aligned}$$

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5.3.3 The shading coefficient of external shading devices can be obtained from Table 5, Table 6 and Table 7.

Table 5. Shading coefficient of horizontal projections

Ratio	Orientation				
R1	North/South	East	West	Northeast/Southeast	Northwest/Southwest
0.30 - 0.40	0.77	0.77	0.79	0.77	0.79
0.50 - 0.70	0.71	0.68	0.71	0.69	0.72
0.80 - 1.20	0.67	0.60	0.65	0.63	0.66
1.30 - 2.00	0.65	0.55	0.61	0.60	0.63

NOTE.
R1 is the ratio: Width of horizontal projection/ Height of fenestration

Table 6. Shading coefficient of vertical projections

Ratio	Orientation				
R2	North/South	East	West	Northeast/Southeast	Northwest/Southwest
0.30 - 0.40	0.82	0.87	0.86	0.83	0.84
0.50 - 0.70	0.77	0.82	0.81	0.77	0.79
0.80 - 1.20	0.73	0.78	0.77	0.72	0.74
1.30 - 2.00	0.70	0.75	0.74	0.69	0.71

NOTE.
R2 is the ratio: Width of vertical projection/ Length of fenestration

OTTV Calculation Example

OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	2.63	N/A	N/A	N/A	N/A	N/A	1,748.55	
	South Wall	820.80	15	0.15	0.62	0.38	2.63	N/A	N/A	N/A	N/A	N/A	1,845.69	
	East Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	West Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = $15 \times \alpha \times (1 - WWR) U_w$										Σ	7,952.71
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,965.67	
	South Window	820.80	6	N/A	0.62	N/A	N/A	5.70	N/A	N/A	N/A	N/A	17,404.24	
	East Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
	West Window	944.28	6	N/A	0.61	N/A	N/A	5.70	N/A	N/A	N/A	N/A	19,699.57	
			Equation for Heat Conduction Through Windows = $6 \times WWR \times U_f$										Σ	74,769.05
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.90	0.51	0.77	0.39	36,018.24	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.92	0.51	0.77	0.39	35,668.06	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	1.23	0.51	0.77	0.39	53,975.71	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.94	0.51	0.79	0.40	42,321.15	
			Equation for Solar Heat Gain Through Windows = $194 \times WWR \times OF \times SC$										Σ	167,983.16
												Σ WALL OTTV =	250,704.92	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	71.02	

WAYS TO IMPROVE OTTV

- 1. Review sunshades and its Shading Coefficient (SC) in Table 5, 6 and 7.
- 2. Review glass selection and its Shading Coefficient (SC).

Proposal: Changing the glass to laminated low E glass [U-value = 3.6; SC = 0.49].

GLASS PERFORMANCE DATA

No.	Glass Item	Thk (mm)	Visible Light		Solar Radiation			U-Value (W/m2.K)		S.C.	RHG W/m2	
			Trn %	Ref % (Out)	Ref % (In)	Trn %	Ref %	Abs %	W			S
a.	5mm ASG Dark Green Annealed Float + 0.38mm Clear PVB	10.38	65.00	8.00	11.00	33.00	6.00	61.00	-	3.60	0.49	337
	+ 5mm ASG Clear Annealed Hard Coated Low-E #4											

Remark:

- * Above datas are just an indicative figures with no pre-judice and actual performance may slightly vary.
- * The data provided is intended solely as a guide. No responsibility is accepted or implied by ASG for its use.
- * It is advisable for the user to conduct an independent lab test before confirmation of item and order to us to avoid any future misunderstanding or argument as each user's expectation is differs from case t
- * The tolerance of published data with respect to photometric properties is +/- 3 points normally.
- * Please proceed glass thermal stress analysis while finalising glass selection at your end.

Abbreviations :

- Trn : Transmittance
- Ref : Reflectance
- Abs : Absorption
- SC : Shading Coefficient
- RHG : Relative Heat Gain

The data are calculated using spectral measurements that are conform to standards EN410 (1998), ISO 9050 (1990) and WIS/WINDAT. The tolerance of published data with respect to photometric properties is +/- 3 points.

The U-value (formerly k-value) is calculated according to standard EN673. The emissivity measurement complies with standard EN673 (Annex A) and EN 12898. The U-value tolerance is +/-0.1W/m2.K

This document is no evaluation of the risk of glass breakage due to thermal stress. For tempered glass: the risk of spontaneous breakage due to Nickle-Sulfide is not covered by raw glass supplier.

Specifications, technical and other data are based on information available at the time of preparation of this document and are subject to change without notice. Raw glass supplier can not be held responsible for any deviation between the data introduced and the conditions on site.

This document is only informative, in no way it implies an acceptance of the order by raw glass supplier.

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OTTV Calculation Example

OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.64	0.36	2.63	N/A	N/A	N/A	N/A	N/A	1,748.55	
	South Wall	820.80	15	0.15	0.62	0.38	2.63	N/A	N/A	N/A	N/A	N/A	1,845.69	
	East Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	West Wall	944.28	15	0.15	0.61	0.39	2.63	N/A	N/A	N/A	N/A	N/A	2,179.23	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = $15 \times \alpha \times (1 - WWR) U_w$										Σ	7,952.71
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.64	N/A	N/A	3.60	N/A	N/A	N/A	N/A	11,346.74	
	South Window	820.80	6	N/A	0.62	N/A	N/A	3.60	N/A	N/A	N/A	N/A	10,992.15	
	East Window	944.28	6	N/A	0.61	N/A	N/A	3.60	N/A	N/A	N/A	N/A	12,441.83	
	West Window	944.28	6	N/A	0.61	N/A	N/A	3.60	N/A	N/A	N/A	N/A	12,441.83	
			Equation for Heat Conduction Through Windows = $6 \times WWR \times U_f$										Σ	47,222.56
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.64	N/A	N/A	N/A	0.90	0.49	0.77	0.38	34,605.76	
	South Window	820.80	194	N/A	0.62	N/A	N/A	N/A	0.92	0.49	0.77	0.38	34,269.31	
	East Window	944.28	194	N/A	0.61	N/A	N/A	N/A	1.23	0.49	0.77	0.38	51,859.02	
	West Window	944.28	194	N/A	0.61	N/A	N/A	N/A	0.94	0.49	0.79	0.39	40,661.50	
			Equation for Solar Heat Gain Through Windows = $194 \times WWR \times OF \times SC$										Σ	161,395.59
												Σ WALL OTTV =	216,570.85	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	61.35	

WAYS TO IMPROVE OTTV

1. Review sunshades and its Shading Coefficient (SC) in Table 5, 6 and 7.
2. Review glass selection and its Shading Coefficient (SC).
3. Review WWR.

Existing WWR

East – 0.64

West – 0.62

North – 0.61

South – 0.61

Proposed New WWR

East – 0.45

West – 0.45

North – 0.50

South – 0.50

OTTV Calculation Example

OTTV COMPONENT	Wall Location	A	B	C	D	E	F	G	H	I	J	K	L	% of OTTV
		Wall Area (m ²)	Constant	Solar Absorption Factor (α)	Window to Wall Ratio (WWR)	(1-WWR)	Wall Constr U-Value (U _w)	Glass U-Value (U _f)	Orientation Factor (OF)	Glass Shading Coeff (SC1)	Device Shading Coeff (SC2)	Shading Coefficient SC1 x SC2 (ie columns I x J)	Wall OTTV (ie multiply all shaded cells in the same row)	
HEAT CONDUCTION THROUGH WALLS	North Wall	820.80	15	0.15	0.45	0.55	2.63	N/A	N/A	N/A	N/A	N/A	2,671.40	
	South Wall	820.80	15	0.15	0.45	0.55	2.63	N/A	N/A	N/A	N/A	N/A	2,671.40	
	East Wall	944.28	15	0.15	0.50	0.50	2.63	N/A	N/A	N/A	N/A	N/A	2,793.89	
	West Wall	944.28	15	0.15	0.50	0.50	2.63	N/A	N/A	N/A	N/A	N/A	2,793.89	
	Σ Wall Area	3,530.16	Equation for Heat Conduction Through Walls = 15 x α x (1 - WWR) U_w										Σ	10,930.57
HEAT CONDUCTION THROUGH WINDOWS	North Window	820.80	6	N/A	0.45	N/A	N/A	3.60	N/A	N/A	N/A	N/A	7,978.18	
	South Window	820.80	6	N/A	0.45	N/A	N/A	3.60	N/A	N/A	N/A	N/A	7,978.18	
	East Window	944.28	6	N/A	0.50	N/A	N/A	3.60	N/A	N/A	N/A	N/A	10,198.22	
	West Window	944.28	6	N/A	0.50	N/A	N/A	3.60	N/A	N/A	N/A	N/A	10,198.22	
			Equation for Heat Conduction Through Windows = 6 x WWR x U_f										Σ	36,352.80
SOLAR HEAT GAIN THROUGH WINDOWS	North Window	820.80	194	N/A	0.45	N/A	N/A	N/A	0.90	0.49	0.77	0.38	24,332.17	
	South Window	820.80	194	N/A	0.45	N/A	N/A	N/A	0.92	0.49	0.77	0.38	24,872.89	
	East Window	944.28	194	N/A	0.50	N/A	N/A	N/A	1.23	0.49	0.77	0.38	42,507.39	
	West Window	944.28	194	N/A	0.50	N/A	N/A	N/A	0.94	0.49	0.79	0.39	33,329.10	
			Equation for Solar Heat Gain Through Windows = 194 x WWR x OF x SC										Σ	125,041.55
												Σ WALL OTTV =	172,324.92	100%
												Σ WALL AREA =	3,530.16	
												OTTV =	48.82	

WAYS TO IMPROVE OTTV

1. Review sunshades and its Shading Coefficient (SC) in Table 5, 6 and 7.
2. Review glass selection and its Shading Coefficient (SC).
3. Review WWR.

Complied UBBL 38A (1)(a) where OTTV < 50 W/m²

Thank You

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