RTTV Summary Sheet

Notes:
ER = External Reflectance
SC = Shading Coefficient
VLT = Visible Light Transmittance
Window and skylight data should represent the major proportion of its use in the development.

PNAP APP-156 Appendix A

Address: Redevelopment of Tai Po Town Lot No.233, Nos.2, 4 and 6, Wai Yi Street, Tai Po, N.T.	BD Ref. No. BD2/9046/18

Building Type:	Residential
RTTV calculated by	☐ 1. Registered Professional Engineers
	☑ 2. Architect
	☐ 3. Others, please specify:
No. of Storeys (Residential Units)	10

Table 1

Deemed to Satisfy $RTTV_{Wall}$								
Facade Orientation Facing								
Average Absorptivity								
Average Window to Wall Ratio								
Shading Coefficient of Glazing								
Average Shading Coefficient of Facade								
Visible Light Transmittance	%	%	%	%	%	%	%	%
External Reflectance	%	%	%	%	%	%	%	%

Table 2

$RTTV_{Wall}$																
Facade Orientation Facing		E				N				W				S			
Wall Orientation Factor		1.072				0.79				1.131				0.975			
Total External Wall Area (Residential Units)		357.24 m²	Window to Wall Ratio = 0.01			381.62 m²	Window to Wall Ratio = 0.76			359.76 m²	Window to Wall Ratio = 0			376.61 m²	Window to Wall Ratio = 0.04		
Total Window area		4.03 m²				289.72 m²				0 m²				14.08 m²			
Heat Conduction	Opaque Wall	9.30 W/m²				0.64 W/m²				3.83 W/m²				3.18 W/m²			
	Window	0.03 W/m²				1.50 W/m²				0 W/m²				0.09 W/m²			
Window	Glass Type	☐ Reflective	Area= m²	SC=	VLT= % ER= %	☐ Reflective	Area= m²	SC=	VLT= % ER= %	☐ Reflective	Area= m²	SC=	VLT= % ER= %	☐ Reflective	Area= m²	SC=	VLT= % ER= %
		☐ Tinted	Area= m²	SC=	VLT= % ER= %	☐ Tinted	Area= m²	SC=	VLT= % ER= %	☐ Tinted	Area= m²	SC=	VLT= % ER= %	☐ Tinted	Area= m²	SC=	VLT= % ER= %
		☑ Clear	Area= 4.03 m²	SC= 0.69	VLT= 80 % ER= 11 %	☑ Clear	Area= 289.72 m²	SC= 0.69	VLT= 80 % ER= 11 %	☐ Clear	Area= m²	SC=	VLT= % ER= %	☑ Clear	Area= 14.08 m²	SC= 0.69	VLT= 80 % ER= 11 %
	Double Glazing	☐ Yes ☑ No				☐ Yes ☑ No				☐ Yes ☐ No				☐ Yes ☑ No			
	External Shading	Overhang ☐ Yes ☑ No				Overhang ☐ Yes ☑ No				Overhang ☐ Yes ☐ No				Overhang ☐ Yes ☑ No			
		Sidefin ☐ Yes ☑ No				Sidefin ☐ Yes ☑ No				Sidefin ☐ Yes ☐ No				Sidefin ☐ Yes ☑ No			
Solar Radiation through Glazing		0.35 W/m²				17.28 W/m²				0 W/m²				1.05 W/m²			
Average Absorptivity		0.78				0.61				0.78				0.9			
$RTTV_{Wall}$ at each facade		9.67 W/m²				20.09 W/m²				9.97 W/m²				10.69 W/m²			
Overall $RTTV_{Wall}$		12.70 W/m²															

Table 3

$RTTV_{Roof}$						
Roof Orientation Factor		2.16				
Total Roof Area (Residential Units)		86.41 m²				
Total Skylight Area		0 m²				
Heat Conduction	Roof	3.48 W/m²				
	Skylight	0 W/m²				
Skylight	Glass Type	☐ Reflective	Area= m²	SC=	VLT= %	ER= %
		☐ Tinted	Area= m²	SC=	VLT= %	ER= %
		☐ Clear	Area= m²	SC=	VLT= %	ER= %
	Double Glazing	☐ Yes ☐ No				
	External Shading	☐ Yes ☐ No				
Solar Radiation through Glazing		0 W/m²				
Average Absorptivity (roof)		0.9				
Overall $RTTV_{Roof}$		3.48 W/m²				

Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

Storey heights (Residential Units) :

2/F - 12/F	=	2.80 m	(10	storeys)
R/F to UR/F	=	5.75 m	(1	storey)
TR/F	=	0.00 m	(1	storey)

E Elevations

Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

2/F - 12/F	(	11.28	)x	2.80	x	10	=	11.28	x	2.80	x	10	= 315.84 m²
R/F to UR/F	(	7.20	)x	5.75	x	1	=	7.20	x	5.75	x	1	= 41.40 m²
TR/F													

Gross Wall Areas 357.24 m²

N Elevations

Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

2/F - 12/F	(	12.13	)x	2.80	x	10	=	12.13	x	2.80	x	10	= 339.64 m²
R/F to UR/F	(	7.30	)x	5.75	x	1	=	7.30	x	5.75	x	1	= 41.98 m²
TR/F													

Gross Wall Areas 381.62 m²

W Elevations

Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

2/F - 12/F	(	11.37	)x	2.80	x	10	=	11.37	x	2.80	x	10	= 318.36 m²
R/F to UR/F	(	7.20	)x	5.75	x	1	=	7.20	x	5.75	x	1	= 41.40 m²
TR/F													

Gross Wall Areas 359.76 m²

S Elevations

Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

2/F - 12/F	(	12.14	)x	2.80	x	10	=	12.14	x	2.80	x	10	= 339.92 m²
R/F to UR/F	(	6.38	)x	5.75	x	1	=	6.38	x	5.75	x	1	= 36.69 m²
TR/F													

Gross Wall Areas 376.61 m²

Total Gross Wall Areas 1475.22 m²

Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

Glazing heights (Residential Units) :

2/F - 12/F (Window 8)	=	1.15 m	(10.00 storeys)
2/F- 12/F (Window 4)	=	2.15 m	(10.00 storeys)
2/F- 12/F (Window 7)	=	2.10 m	(10.00 storeys)
2/F- 12/F (Window 4a)	=	1.15 m	(10.00 storeys)
2/F- 12/F (Window 5)	=	1.00 m	(10.00 storeys)
2/F- 12/F (Window 6)	=	1.80 m	(10.00 storeys)
2/F- 12/F (Window 9)	=	0.85 m	(10.00 storeys)
2/F- 12/F (Window 10)	=	0.65 m	(10.00 storeys)
2/F- 12/F (Window 2)	=	1.00 m	(10.00 storeys)
R/F to TR/F	=	5.75 m	(1.00 storey)

E Elevations

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8)	(0.35	)x	1.15	x	10	=	0.35	x	1.15	x	10	=	4.03 m²
R/F to TR/F	(0.00	)x	5.75	x	1	=	0.00	x	5.75	x	1	=	0.00 m²

Gross Glazing Areas 4.03 m²

N Elevations

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

2/F- 12/F (Window 4)	(2.40	)x	2.15	x	10	=	2.40	x	2.15	x	10	=	51.60 m²
2/F- 12/F (Window 7)	(2.65	)x	2.10	x	10	=	2.65	x	2.10	x	10	=	55.65 m²
2/F- 12/F (Window 4a)	(0.65	)x	1.15	x	10	=	0.65	x	1.15	x	10	=	7.48 m²
2/F- 12/F (Window 5)	(0.80	)x	1.00	x	10	=	0.80	x	1.00	x	10	=	8.00 m²
2/F- 12/F (Window 6)	(1.25	)x	1.80	x	10	=	1.25	x	1.80	x	10	=	22.50 m²
R/F to TR/F	(0.00	)x	5.75	x	1	=	0.00	x	5.75	x	1	=	0.00 m²

Gross Glazing Areas 289.72 m²

W Elevations

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8)	(0.00	)x	1.15	x	10	=	0.00	x	1.15	x	10	=	0.00 m²
R/F to TR/F	(0.00	)x	5.75	x	1	=	0.00	x	0.00	x	1	=	0.00 m²

Gross Glazing Areas 0.00 m²

S Elevations

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

2/F- 12/F (Window 9)	(0.85	)x	0.30	x	10	=	0.85	x	0.30	x	10	=	2.55 m²
2/F- 12/F (Window 10)	(0.65	)x	0.85	x	10	=	0.65	x	0.85	x	10	=	5.53 m²
2/F- 12/F (Window 2)	(0.60	)x	1.00	x	10	=	0.60	x	1.00	x	10	=	6.00 m²
R/F to TR/F	(0.00	)x	5.75	x	1	=	0.00	x	5.75	x	1	=	0.00 m²

Gross Glazing Areas 14.08 m²

Total Gross Glazing Areas 307.82 m²

E Elevations

Gross Wall Areas = 357.24 m²
(Opaque Walls + Glazing Areas) (Ao) at E Elevations

Glazing Areas at E Elevations = 4.03 m²

Breakdown of Glazing Areas

Glazing Areas Unshaded (E-F) = 4.03 m²

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (E) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	1.15	=	0.00						ESC1	=			
	SPF	=	0.00	/(	0.40	+				)=	0.00		ESC2	=			
	ECS	=	0.000		x		0.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (E) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	1.15	=	0.00						ESC1	=			
	SPF	=	0.00	/(	0.40	+				)=	0.00		ESC2	=			
	ECS	=	0.000		x		0.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (E) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	1.15	=	0.00						ESC1	=			
	SPF_R	=	0.00	/(	0.40	+				)=	0.00		ECS_R	=			
	SPF_L	=	0.00	/(	0.40	+				)=	0.00		ESC_L	=			
	ESC2	=	1.00	-	[(	1-	ECS_R	)	+(	1-	ESC_L	)]					
		=	1.00	-	[(	1-		)	+(	1-	0	)]	=	-1			
	ESC	=	0.000		x		-1.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (E) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	1.15	=	0.00						ESC1	=			
	SPF_R	=	0.00	/(	0.40	+				)=	0.00		ESC_R	=			
	SPF_L	=	0.00	/(	0.40	+				)=	0.00		ESC_L	=			
	ESC2	=	1.00	-	[(	1-	ESC_R	)	+(	1-	ESC_L	)]					
		=	1.00	-	[(	1-		)	+(	1-	0	)]	=	-1			
	ESC	=	0.000		x		-1.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right) (E) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	1.15	=	0.00						ESC1	=			
	SPF	=	0.00	/(	0.40	+				)=	0.00		ESC2	=			
	ESC	=	0.000		x		0.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (E) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	1.15	=	0.00						ESC1	=			
	SPF_R	=	0.00	/(	0.40	+				)=	0.00		ESC_R	=			
	SPF_L	=	0.00	/(	0.40	+				)=	0.00		ESC_L	=			
	ESC2	=	1.00	-	[(	1-	ESC_R	)	+(	1-	ESC_L	)]					
		=	1.00	-	[(	1-	0	)	+(	1-	0.00	)]	=	-1			
	ESC	=	0.000		x		-1.000							=	0.000		

Window to Wall Ratio (WWR) = 4.03 / 357.24 = 0.01

Deemed to Satisfy RTTVwall
Compliance Check

N Elevations

Sheet no. 3

Gross Wall Areas = 381.62 m²
(Opaque Walls + Glazing Areas) (Ao) at N Elevations

Glazing Areas at N Elevations = 289.72 m²

Breakdown of Glazing Areas

Glazing Areas Unshaded (N-F) = 289.72 m²

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (N) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	2.50	=	0.00						ESC1	=			
	SPF	=	0.00	/(	3.20	+				)=	0.00		ESC2	=			
	ESC	=	0.000		x		0.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (N) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	2.50	=	0.00						ESC1	=			
	SPF	=	0.00	/(	3.20	+				)=	0.00		ESC2	=			
	ESC	=	0.000		x		0.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (N) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	2.50	=	0.00						ESC1	=			
	SPF_R	=	0.00	/(	3.20	+				)=	0.00		ESC_R	=			
	SPF_L	=	0.00	/(	3.20	+				)=	0.00		ESC_L	=			
	ESC2	=	1.00	-	[(	1-	ESC_R	)	+(	1-	ESC_L	)]					
		=	1.00	-	[(	1-	0	)	+(	1-	0	)]	=	-1			
	ESC	=	0.000		x		-1.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right) (N) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	2.50	=	0.00						ESC1	=			
	SPF	=	0.00	/(	3.20	+				)=	0.00		ESC2	=			
	ESC	=	0.000		x		0.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (N) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	2.50	=	0.00						ESC1	=			
	SPF_R	=	0.00	/(	3.20	+				)=	0.00		ESC_R	=			
	SPF_L	=	0.00	/(	3.20	+				)=	0.00		ESC_L	=			
	ESC2	=	1.00	-	[(	1-	ESC_R	)	+(	1-	ESC_L	)]					
		=	1.00	-	[(	1-	0.000	)	+(	1-	0	)]	=	-1			
	ESC	=	0.000		x		-1.000							=	0.000		

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (N) = 0.00 m²

	Glazing Area	=	Length of Glazing			x	Glazing Height			x	No. of Storeys						
2/F - 12/F (Window 8)			(0.00							)x	0.00	x	10	=	0.00	m²	
	OPF	=	0.00	/	2.50	=	0.00						ESC1	=			
	SPF_R	=	0.00	/(	3.20	+				)=	0.00		ESC_R	=			
	SPF_L	=	0.00	/(	3.20	+				)=	0.00		ESC_L	=			
	ESC2	=	1.00	-	[(	1-	ESC_R	)	+(	1-	ESC_L	)]					
		=	1.00	-	[(	1-	0.000	)	+(	1-	0	)]	=	-1			
	ESC	=	0.000		x		-1.000							=	0.000		

Window to Wall Ratio (WWR) = 289.72 / 381.62 = 0.76

W Elevations

Gross Wall Areas = 359.76 m²
(Opaque Walls + Glazing Areas) (Ao) at W Elevations

Glazing Areas at W Elevations = 0.00 m²

Breakdown of Glazing Areas

Glazing Areas Unshaded (W-F) = 0.00 m²

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ESC2 =		
ESC = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ESC2 =		
ESC = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(			)x	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 +				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 +				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ESC2 =		
ESC = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ESC2 =		
ESC = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 +				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (W) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 +				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Window to Wall Ratio (WWR) = 0.00 / 359.76 = 0.00

Deemed to Satisfy RTTVwall
Compliance Check

S Elevations

Sheet no. 4

Gross Wall Areas = 376.61 m²
(Opaque Walls + Glazing Areas) (Ao) at S Elevations

Glazing Areas at S Elevations = 14.08 m²

Breakdown of Glazing Areas

Glazing Areas Unshaded (S-F) = 14.08 m²

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ESC2 =		
ESC = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ECS1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ECS2 =		
ECS = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 #				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 +				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ESC2 =		
ESC = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Left) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF = 0.00 /(0.40 +				)= 0.00	ECS2 =		
ESC = 0.000	x	0.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 +				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Glazing Areas Shaded by Overhang Fin & Built-Fin (Projection on Right & Left) (S) = 0.00 m²

	Glazing Area = Length of Glazing	x	Glazing Height	x	No. of Storeys		
2/F - 12/F (Window 8)	(0.00			)x 0.00	x 10	=	0.00 m²
OPF = 0.00 / 1.15 = 0.00					ESC1 =		
SPF_R = 0.00 /(0.40 +				)= 0.00	ESC_R =		
SPF_L = 0.00 /(0.40 +				)= 0.00	ESC_L =		
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]							
= 1.00 - [(1- 0) +(1- 0)]						=	-1
ESC = 0.000	x	-1.000				=	0.000

Window to Wall Ratio (WWR) = 14.08 / 376.61 = 0.04

E Elevations

Gross Wall Areas = **357.24** m²
(Opaque Walls + Glazing Areas) (Ao) at **E Elevations**

Glazing Areas at **E Elevations** = **4.03** m²

Breakdown of Glazing Areas

Glazing Areas **Unshaded** (**E-F**) = **4.03** m²

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0) +(1- 0)] = -1

ECS = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0.000) +(1- 0)] = -1

ECS = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0) +(1- 0)] = -1

ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**E**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0.000) +(1- 0)] = -1

ECS = 0.000 x -1.000 = **0.000**

Opaque Wall Areas at **E Elevations** = **353.22** m²

Breakdown of Opaque Wall Areas

RC Wall Areas (**E-C**) = **353.22** m²

RC Column Areas (E-W12,E-W14,E-W3,E-W6) (**E-C**) = **0.00** m²

2/F - 12/F 0 x 2.80 x 10 = 0.00 m²

2/F - 12/F (E-W1,E-W2,E-W4,E-W5) (**E-C**) = **0.00** m²

0 x 2.80 x 10 = 0.00 m²

Window to Wall Ratio (WWR) = 4.03 / 357.24 = **0.01**

Wall Orientation Factor Gw = 1.072 (Refer to **Table 9**)

Average Absorptivity (α) of the External Opaque Wall at **E Elevations**

External Wall Material (Colour/Finish)	% of wall/roof area	α Absorptivity (Refer to **Table 5**)
Tile (matt) Dark grey	69%	0.9
Aluminium	31%	0.5
	Average Absorptivity =	**0.78**

0.78

'U' value of Opaque Wall Areas

$U = 1/(Ri+x_1/k_1+x_2/k_2+\ldots+x_n/k_n+Ra+Ro)$

where Ri Surface film resistance of internal surface (Refer to **Table 2**)
Ro Surface film resistance of external surface (Refer to **Table 2**)
Ra Air space resistance (Refer to **Table 3**)
x Thickness of building materials
k Thermal conductivity of building materials (Refer to **Table 1**)

E-C Description: RC Wall Areas

Wall Material			
External surface film resistance	Ro =	0.044	
Air space resistanace	Ra =	0	
External tiles	0.025 / 1.5 =	0.017	
Concrete	0.15 / 2.16 =	0.069	
	/ 0.38 =	0.000	
Gypsum plaster	0.025 / 0.38 =	0.066	
Internal surface film resistance	Ri =	0.12	
Total		**0.316**	

Uc1 = 1 / 0.316 = 3.17 W/m²K

E-C Description: (E-W12,E-W14,E-W3,E-W6)

Wall Material			
external surface film	Ro =	0.044	
Air space resistanace	Ra =	0	
	0 / 1.5 =	0.000	
	0 / 2.16 =	0.000	
	0 / 0.38 =	0.000	
	0 / 0.38 =	0.000	
Internal surface film resistamce	Ri =	0.12	
Total		**0.164**	

Uc2 = 1 / 0.164 = 6.10 W/m²K

E-C Description: (E-W1,E-W2,E-W4,E-W5)

Wall Material			
external surface film	Ro =	0.044	
Air space resistanace	Ra =	0	
	0 / 1.5 =	0.000	
	0 / 2.16 =	0.000	
	0 / 0.38 =	0.000	
	0 / 0.38 =	0.000	
Internal surface film resistamce	Ri =	0.12	
Total		**0.164**	

Uc2 = 1 / 0.164 = 6.10 W/m²K

Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014

Form RTTV (Wall) 1 - Calculation of $RTTV_{wall}$ of E Facade

Sheet No. 6 BD Ref No. BD 2/9046/18

Building Address REDEVELOPMENT OF TAI PO TOWN LOT NO.233, NOS. 2,4 AND 6 WAI YI STREET, TAI PO, N.T.

Facade Orientation Facing E Gross Wall Area (Ao) = 357.24

Window to Wall Ratio (WWR) 0.01 Wall Orientation Factor (Gw) = 1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls

Components / Details		Code No.		
Description	Units	E-C	E-C	E-C
External Finish Material		External tiles	0	0
Conductivity	W/mK	1.50	1.50	1.50
Thickness	m	0.025	0.000	0.000
Average Absorptivity	(α)	0.78	0.78	0.78
Intermediate component		Concrete	0.00	0.00
Conductivity	W/mK	2.16	2.16	2.16
Thickness	m	0.15	0.00	0.00
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material		Gypsum plaster	0.00	0.00
Conductivity	W/mK	0.38	0.38	0.38
Thickness	m	0.03	0.00	0.00
U-value of Opaque Area (Uwi)	W/m²K	3.17	6.10	6.10
Opaque Wall Area (Awi)	m²	353.22	0.00	0.00
Heat Conduction = 3.57(Awi/Ao) Uwi αwi Gw		9.30	0.00	0.00

Heat Conduction through Opaque Walls = 3.57(Awi/Ao) Uwi αwi Gw where i= 1, 2, …, n

= 9.30 W/m²

Part 2 - Calculation of Heat Conduction through Glazing

Components / Details		Code No.								
Description	Units	E-F	E-W	E-W	E-W	E-W	E-W	E-W	E-W	E-W
Glazing Type		Clear glass								
Thickness	m	0.006								
Glazing Area (Afi)	m²	4.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
U-value of Glazing (Ufi)	W/m²K	3.9								
Heat Conduction = 0.64 (Afi/Ao) Uf Gw		0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Heat Conduction through Glazing = 0.64 (Afi/Ao) Ufi Gw where i= 1, 2, …, n

= 0.03 W/m²

Part 3 - Calculation of Solar Radiation through Glazing

Components / Details		Code No.								
Description	Units	E-F	E-W	E-W	E-W	E-W	E-W	E-W	E-W	E-W
Glazing Type		Clear glass								
Thickness	m	0.006								
Glazing Area (Afi)	m²	4.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shading Coefficient of Glazing (SCf)		0.69								
Visible Light Transmittance (VLT)	%	71								
External Reflectance (ER)	%	9								
External Shading Miltiplier (ESC)		1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Solar Radiation = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw		0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Solar Radiation through Glazing = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw where i= 1, 2, …, n

= 0.35 W/m²

Summary of RTTV at E Elevations

= 9.30 + 0.03 + 0.35

= 9.67 W/m²

N Elevations

Gross Wall Areas = **381.62** m²
(Opaque Walls + Glazing Areas) (Ao) at **N Elevations**

Glazing Areas at **N Elevations** = **289.72** m²

Breakdown of Glazing Areas

Glazing Areas **Unshaded** (**N-F**) = **289.72** m²

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**N**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF = 0.00 /(3.20 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**N**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF = 0.00 /(3.20 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**N**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF_R = 0.00 /(3.20 +)= 0.00 ESC_R =

SPF_L = 0.00 /(3.20 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0) +(1- 0)] = -1

ECS = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**N**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF_R = 0.00 /(3.20 +)= 0.00 ESC_R =

SPF_L = 0.00 /(3.20 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0) +(1- 0)] = -1

ECS = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**N**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF = 0.00 /(3.20 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**N**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF = 0.00 /(3.20 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**N**) = m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF_R = 0.00 /(3.20 +)= 0.00 ESC_R =

SPF_L = 0.00 /(3.20 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0) +(1- 0)] = -1

ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**N**) = m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 2.50 = 0.00 ESC1 =

SPF_R = 0.00 /(3.20 +)= 0.00 ESC_R =

SPF_L = 0.00 /(3.20 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0.000) +(1- 0)] = -1

ESC = 0.000 x -1.000 = **0.000**

Opaque Wall Areas at **N Elevations** = **91.90** m²

Breakdown of Opaque Wall Areas

RC Wall Areas (**N-C**) = **91.90** m²

RC Column Areas (**N-C**) = **0.00** m²

2/F - 12/F 0 x 2.80 x 10 = 0.00 m²

2/F - 12/F (**N-C**) = **0.00** m²

0 x 2.80 x 10 = 0.00 m²

Window to Wall Ratio (WWR) = 289.72 / 381.62 = **0.76**

Wall Orientation Factor Gw = 0.79 (Refer to **Table 9**)

Average Absorptivity (α) of the External Opaque Wall at **N Elevations**

External Wall Material (Colour/Finish)	% of wall/roof area	α Absorptivity (Refer to **Table 5**)
Tile (matt) Dark grey	28%	0.9
Aluminium	72%	0.5
	Average Absorptivity =	**0.61**

'U' value of Opaque Wall Areas

$U = 1/(Ri+x_1/k_1+x_2/k_2+\ldots+x_n/k_n+Ra+Ro)$

where Ri Surface film resistance of internal surface (Refer to **Table 2**)

Ro Surface film resistance of external surface (Refer to **Table 2**)

Ra Air space resistance (Refer to **Table 3**)

x Thickness of building materials

k Thermal conductivity of building materials (Refer to **Table 1**)

N-C Description: RC Wall Areas

Wall Material				
External surface film resistance		Ro	=	0.044
Air space resistanace		Ra	=	0
External tiles	0.025 / 1.5		=	0.017
Concrete	0.15 / 2.16		=	0.069
	/ 0.38		=	0.000
Gypsum plaster	0.025 / 0.38		=	0.066
Internal surface film resistance		Ri	=	0.12
Total				**0.316**

Uc1 = 1 / 0.316 = 3.17 W/m²K

N-C Description: 0

Wall Material				
external surface film		Ro	=	0.044
Air space resistanace		Ra	=	0
	0 / 1.5		=	0.000
	0 / 2.16		=	0.000
	0 / 0.38		=	0.000
	0 / 0.38		=	0.000
Internal surface film resistamce		Ri	=	0.12
Total				**0.164**

Uc2 = 1 / 0.164 = 6.10 W/m²K

N-C Description: 0

Wall Material				
external surface film		Ro	=	0.044
Air space resistanace		Ra	=	0
	0 / 1.5		=	0.000
	0 / 2.16		=	0.000
	0 / 0.38		=	0.000
	0 / 0.38		=	0.000
Internal surface film resistamce		Ri	=	0.12
Total				**0.164**

Uc2 = 1 / 0.164 = 6.10 W/m²K

Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014

Form RTTV (Wall) 1 - Calculation of $RTTV_{wall}$ of N Facade

Sheet No. 8 BD Ref No. BD 2/9046/18

Building Address REDEVELOPMENT OF TAI PO TOWN LOT NO.233, NOS. 2,4 AND 6 WAI YI STREET, TAI PO, N.T.

Facade Orientation Facing N Gross Wall Area (Ao) = 381.62

Window to Wall Ratio (WWR) 0.76 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls

Components / Details		Code No.		
Description	Units	N-C	N-C	N-C
External Finish Material		External tiles	0	0
Conductivity	W/mK	1.50	1.50	1.50
Thickness	m	0.025	0.000	0.000
Average Absorptivity	(α)	0.61	0.61	0.61
Intermediate component		Concrete	0.00	0.00
Conductivity	W/mK	2.16	2.16	2.16
Thickness	m	0.15	0.00	0.00
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material		Gypsum plaster	0.00	0.00
Conductivity	W/mK	0.38	0.38	0.38
Thickness	m	0.03	0.00	0.00
U-value of Opaque Area (Uwi)	W/m²K	3.17	6.10	6.10
Opaque Wall Area (Awi)	m²	91.90	0.00	0.00
Heat Conduction = 3.57(Awi/Ao) Uwi αwi Gw		1.32	0.00	0.00

Heat Conduction through Opaque Walls = 3.57(Awi/Ao) Uwi αwi Gw where i= 1, 2, …, n

= 1.32 W/m²

Part 2 - Calculation of Heat Conduction through Glazing

Components / Details		Code No.								
Description	Units	N-F1	N-W1	N-W2	N-W3	N-W4	N-W9	N-W10	N-W11	N-W12
Glazing Type		Clear glass								
Thickness	m	0.006								
Glazing Area (Afi)	m²	289.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
U-value of Glazing (Ufi)	W/m²K	3.9								
Heat Conduction = 0.64 (Afi/Ao) Uf Gw		1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Heat Conduction through Glazing = 0.64 (Afi/Ao) Ufi Gw where i= 1, 2, …, n

= 1.50 W/m²

Part 3 - Calculation of Solar Radiation through Glazing

Components / Details		Code No.								
Description	Units	N-F1	N-W1	N-W2	N-W3	N-W4	N-W9	N-W10	N-W11	N-W12
Glazing Type		Clear glass								
Thickness	m	0.006								
Glazing Area (Afi)	m²	289.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shading Coefficient of Glazing (SCf)		0.69								
Visible Light Transmittance (VLT)	%	71								
External Reflectance (ER)	%	9								
External Shading Miltiplier (ESC)		1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Solar Radiation = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw		17.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Solar Radiation through Glazing = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw where i= 1, 2, …, n

= 17.28 W/m²

Summary of RTTV at North Elevations

= 1.32 + 1.50 + 17.28

= 20.09 W/m²

W Elevations

Gross Wall Areas = **359.76** m²
(Opaque Walls + Glazing Areas) (Ao) at **W Elevations**

Glazing Areas at **W Elevations** = **0.00** m²

Breakdown of Glazing Areas

Glazing Areas **Unshaded** (**W-F**) = **0.00** m²

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**W**) = **0.00** m²
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys
2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²
OPF = 0.00 / 1.15 = 0.00 ESC1 =
SPF = 0.00 /(0.40 +)= 0.00 ESC2 =
ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**W**) = **0.00** m²
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys
2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²
OPF = 0.00 / 1.15 = 0.00 ESC1 =
SPF = 0.00 /(0.40 +)= 0.00 ESC2 =
ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**W**) = **0.00** m²
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys
2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²
OPF = 0.00 / 1.15 = 0.00 ESC1 =
SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =
SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]
= 1.00 - [(1- 0) +(1- 0)] = -1
ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**W**) = **0.00** m²
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys
2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²
OPF = 0.00 / 1.15 = 0.00 ESC1 =
SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =
SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]
= 1.00 - [(1- 0.000) +(1- 0)] = -1
ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**W**) = **0.00** m²
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys
2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²
OPF = 0.00 / 1.15 = 0.00 ESC1 =
SPF = 0.00 /(0.40 +)= 0.00 ESC2 =
ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**W**) = **0.00** m²
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys
2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²
OPF = 0.00 / 1.15 = 0.00 ESC1 =
SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =
SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]
= 1.00 - [(1- 0) +(1- 0)] = -1
ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**W**) = **0.00** m²
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys
2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²
OPF = 0.00 / 1.15 = 0.00 ESC1 =
SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =
SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =
ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]
= 1.00 - [(1- 0.000) +(1- 0)] = -1
ESC = 0.000 x -1.000 = **0.000**

Opaque Wall Areas at **W Elevations** = **359.76** m²

Breakdown of Opaque Wall Areas

RC Wall Areas (**W-C**) = **359.76** m²

RC Column Areas (**W-C**) = **0.00** m²
2/F - 12/F 0 x 2.80 x 10 = 0.00 m²

2/F - 12/F (**W-C**) = **0.00** m²
0 x 2.80 x 10 = 0.00 m²

Window to Wall Ratio (WWR) = 0.00 / 359.76 = **0.00**

Wall Orientation Factor Gw = 1.131 (Refer to **Table 9**)

Average Absorptivity (α) of the External Opaque Wall at **W Elevations**

External Wall Material (Colour/Finish)	% of wall/roof area	α Absorptivity (Refer to **Table 5**)
Tile (matt) Dark grey	70%	0.9
Aluminium	30%	0.5
	Average Absorptivity =	**0.78**

0.78

'U' value of Opaque Wall Areas

$U = 1/(Ri+x_1/k_1+x_2/k_2+\ldots+x_n/k_n+Ra+Ro)$

where Ri Surface film resistance of internal surface (Refer to **Table 2**)
Ro Surface film resistance of external surface (Refer to **Table 2**)
Ra Air space resistance (Refer to **Table 3**)
x Thickness of building materials
k Thermal conductivity of building materials (Refer to **Table 1**)

W-C Description: RC Wall Areas

Wall Material				
External surface film resistance		Ro	=	0.044
Air space resistanace		Ra	=	0
External tiles	0.025 /	1.5	=	0.017
Concrete	0.15 /	2.16	=	0.069
	/	0.38	=	0.000
Gypsum plaster	0.025 /	0.38	=	0.066
Internal surface film resistance		Ri	=	0.12
Total				**0.316**

Uc1 = 1 / 0.316 = 3.17 W/m²K

W-C Description: 0

Wall Material				
external surface film		Ro	=	0.044
Air space resistanace		Ra	=	0
	0 /	1.5	=	0.000
	0 /	2.16	=	0.000
	0 /	0.38	=	0.000
	0 /	0.38	=	0.000
Internal surface film resistamce		Ri	=	0.12
Total				**0.164**

Uc2 = 1 / 0.164 = 6.10 W/m²K

W-C Description: 0

Wall Material				
external surface film		Ro	=	0.044
Air space resistanace		Ra	=	0
	0 /	1.5	=	0.000
	0 /	2.16	=	0.000
	0 /	0.38	=	0.000
	0 /	0.38	=	0.000
Internal surface film resistamce		Ri	=	0.12
Total				**0.164**

Uc2 = 1 / 0.164 = 6.10 W/m²K

Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014
Form RTTV (Wall) 1 - Calculation of $RTTV_{wall}$ of W Facade

Sheet No. 10 BD Ref No. BD 2/9046/18

Building Address REDEVELOPMENT OF TAI PO TOWN LOT NO.233, NOS. 2,4 AND 6 WAI YI STREET, TAI PO, N.T.

Facade Orientation Facing W Gross Wall Area (Ao) = 359.76

Window to Wall Ratio (WWR) 0.00 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls

Components / Details		Code No.		
Description	Units	W-C	W-C	W-C
External Finish Material		External tiles	0	0
Conductivity	W/mK	1.50	1.50	1.50
Thickness	m	0.025	0.000	0.000
Average Absorptivity	(α)	0.78	0.78	0.78
Intermediate component		Concrete	0.00	0.00
Conductivity	W/mK	2.16	2.16	2.16
Thickness	m	0.15	0.00	0.00
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material		Gypsum plaster	0.00	0.00
Conductivity	W/mK	0.38	0.38	0.38
Thickness	m	0.03	0.00	0.00
U-value of Opaque Area (Uwi)	W/m^2K	3.17	6.10	6.10
Opaque Wall Area (Awi)	m^2	359.76	0.00	0.00
Heat Conduction = 3.57(Awi/Ao) Uwi αwi Gw		9.97	0.00	0.00

Heat Conduction through Opaque Walls = 3.57(Awi/Ao) Uwi αwi Gw where i= 1, 2, …, n

= 9.97 W/m^2

Part 2 - Calculation of Heat Conduction through Glazing

Components / Details		Code No.								
Description	Units	W-F1	W-W5	W-W6	W-W7	W-W8	W-W15	W-W16	W-W17	W-W18
Glazing Type		Clear glass								
Thickness	m	0.006								
Glazing Area (Afi)	m^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
U-value of Glazing (Ufi)	W/m^2K	3.9								
Heat Conduction = 0.64 (Afi/Ao) Uf Gw		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Heat Conduction through Glazing = 0.64 (Afi/Ao) Ufi Gw where i= 1, 2, …, n

= 0.00 W/m^2

Part 3 - Calculation of Solar Radiation through Glazing

Components / Details		Code No.								
Description	Units	W-F1	W-W5	W-W6	W-W7	W-W8	W-W15	W-W16	W-W17	W-W18
Glazing Type		Clear glass								
Thickness	m	0.006								
Glazing Area (Afi)	m^2	0.00								
Shading Coefficient of Glazing (SCf)		0.69								
Visible Light Transmittance (VLT)	%	71								
External Reflectance (ER)	%	9								
External Shading Miltiplier (ESC)		1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Solar Radiation = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Solar Radiation through Glazing = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw where i= 1, 2, …, n

= 0.00 W/m^2

Summary of RTTV at W Elevations

= 9.97 + 0.00 + 0.00

= 9.97 W/m^2

S Elevations

Gross Wall Areas = **376.61** m²
(Opaque Walls + Glazing Areas) (Ao) at **S Elevations**

Glazing Areas at **S Elevations** = **14.08** m²

Breakdown of Glazing Areas

Glazing Areas **Unshaded** (**S-F**) = **14.08** m²

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0) +(1- 0)] = -1

ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0.000) +(1- 0)] = -1

ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Left)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF = 0.00 /(0.40 +)= 0.00 ESC2 =

ESC = 0.000 x 0.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0) +(1- 0)] = -1

ESC = 0.000 x -1.000 = **0.000**

Glazing Areas **Shaded by Overhang Fin & Built-Fin (Projection on Right & Left)** (**S**) = **0.00** m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys

2/F - 12/F (Window 8) (0.00)x 0.00 x 10 = 0.00 m²

OPF = 0.00 / 1.15 = 0.00 ESC1 =

SPF_R = 0.00 /(0.40 +)= 0.00 ESC_R =

SPF_L = 0.00 /(0.40 +)= 0.00 ESC_L =

ESC2 = 1.00 - [(1- ESC_R) +(1- ESC_L)]

= 1.00 - [(1- 0.000) +(1- 0)] = -1

ECS = 0.000 x -1.000 = **0.000**

Opaque Wall Areas at **S Elevations** = **362.53** m²

Breakdown of Opaque Wall Areas

RC Wall Areas (**S-C**) = **362.53** m²

RC Column Areas (**S-C**) = **0.00** m²

2/F - 12/F 0 x 2.80 x 10 = 0.00 m²

2/F - 12/F (**S-C**) = **0.00** m²

0 x 2.80 x 10 = 0.00 m²

Window to Wall Ratio (WWR) = 14.08 / 376.61 = **0.04**

Wall Orientation Factor Gw = 0.975 (Refer to **Table 9**)

Average Absorptivity (α) of the External Opaque Wall at **S Elevations**

External Wall Material (Colour/Finish)	% of wall/roof area	α Absorptivity (Refer to **Table 5**)
Tile (matt) Dark grey	100%	0.9
	Average Absorptivity =	**0.90**

'U' value of Opaque Wall Areas

$U = 1/(Ri+x_1/k_1+x_2/k_2+\ldots+x_n/k_n+Ra+Ro)$

where Ri Surface film resistance of internal surface (Refer to **Table 2**)
Ro Surface film resistance of external surface (Refer to **Table 2**)
Ra Air space resistance (Refer to **Table 3**)
x Thickness of building materials
k Thermal conductivity of building materials (Refer to **Table 1**)

S-C Description: RC Wall Areas

Wall Material				
External surface film resistance		Ro	=	0.044
Air space resistanace		Ra	=	0
External tiles	0.025 /	1.5	=	0.017
Concrete	0.15 /	2.16	=	0.069
	/	0.38	=	0.000
Gypsum plaster	0.025 /	0.38	=	0.066
Internal surface film resistance		Ri	=	0.12
Total				**0.316**

Uc1 = 1 / 0.316 = 3.17 W/m²K

S-C Description: 0

Wall Material				
external surface film		Ro	=	0.044
Air space resistanace		Ra	=	0
	0 /	1.5	=	0.000
	0 /	2.16	=	0.000
	0 /	0.38	=	0.000
	0 /	0.38	=	0.000
Internal surface film resistamce		Ri	=	0.12
Total				**0.164**

Uc2 = 1 / 0.164 = 6.10 W/m²K

S-C Description: 0

Wall Material				
external surface film		Ro	=	0.044
Air space resistanace		Ra	=	0
	0 /	1.5	=	0.000
	0 /	2.16	=	0.000
	0 /	0.38	=	0.000
	0 /	0.38	=	0.000
Internal surface film resistamce		Ri	=	0.12
Total				**0.164**

Uc2 = 1 / 0.164 = 6.10 W/m²K

Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014
Form RTTV (Wall) 1 - Calculation of $RTTV_{wall}$ of S Facade

Sheet No. 12 BD Ref No. BD 2/9046/18

Building Address REDEVELOPMENT OF TAI PO TOWN LOT NO.233, NOS. 2,4 AND 6 WAI YI STREET, TAI PO, N.T.

Facade Orientation Facing S Gross Wall Area (Ao) = 376.61

Window to Wall Ratio (WWR) 0.04 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls

Components / Details		Code No.		
Description	Units	S-C	S-C	S-C
External Finish Material		External tiles	0	0
Conductivity	W/mK	1.50	1.50	1.50
Thickness	m	0.025	0.000	0.000
Average Absorptivity	(α)	0.90	0.90	0.90
Intermediate component		Concrete	0.00	0.00
Conductivity	W/mK	2.16	2.16	2.16
Thickness	m	0.15	0.00	0.00
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material		Gypsum plaster	0.00	0.00
Conductivity	W/mK	0.38	0.38	0.38
Thickness	m	0.03	0.00	0.00
U-value of Opaque Area (Uwi)	W/m^2K	3.17	6.10	6.10
Opaque Wall Area (Awi)	m^2	362.53	0.00	0.00
Heat Conduction = 3.57(Awi/Ao) Uwi αwi Gw		9.55	0.00	0.00

Heat Conduction through Opaque Walls = 3.57(Awi/Ao) Uwi αwi Gw where i= 1, 2, …, n

= 9.55 W/m^2

Part 2 - Calculation of Heat Conduction through Glazing

Components / Details		Code No.								
Description	Units	S-F1	S-W7	S-W8	S-W9	S-W10	S-W15	S-W16	S-W17	S-W18
Glazing Type		Clear Glas								
Thickness	m	0.006								
Glazing Area (Afi)	m^2	14.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
U-value of Glazing (Ufi)	W/m^2K	3.9								
Heat Conduction = 0.64 (Afi/Ao) Uf Gw		0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Heat Conduction through Glazing = 0.64 (Afi/Ao) Ufi Gw where i= 1, 2, …, n

= 0.09 W/m^2

Part 3 - Calculation of Solar Radiation through Glazing

Components / Details		Code No.								
Description	Units	S-F1	S-W7	S-W8	S-W9	S-W10	S-W15	S-W16	S-W17	S-W18
Glazing Type		Clear Glas								
Thickness	m	0.006								
Glazing Area (Afi)	m^2	14.08								
Shading Coefficient of Glazing (SCf)		0.69								
Visible Light Transmittance (VLT)	%	71								
External Reflectance (ER)	%	9								
External Shading Miltiplier (ESC)		1.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Solar Radiation = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw		1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Solar Radiation through Glazing = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw where i= 1, 2, …, n

= 1.05 W/m^2

Summary of RTTV at S Elevations

= 9.55 + 0.09 + 1.05

= 10.69 W/m^2

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Form RTTV (Wall) 2 - Summary of Overall $RTTV_{wall}$ of Building

Sheet No. 13 BD Ref No. BD 2/9046/18

Building Address REDEVELOPMENT OF TAI PO TOWN LOT NO.233, NOS. 2,4 AND 6 WAI YI STREET, TAI PO, N.T.

Overall Gross Wall Area [a] 1475.22 m^2

Facade Orientation Facing	Gross Wall Area (m^2) [b]	Heat Conduction through Opaque Walls (W/m^2) [c]	Heat Conduction through Glazing (W/m^2) [d]	Solar Radiation through Glazing (W/m^2) [e]	RTTVwall at Each Facade (W/m^2) [f]=[c]+[d]+[e]	Area-weighted RTTVwall (W/m^2) [g]=[f]x[b]/[a]
East	357.24	9.30	0.03	0.35	9.67	2.34
North	381.62	1.32	1.50	17.28	20.09	5.20
West	359.76	9.97	0.00	0.00	9.97	2.43
South	376.61	9.55	0.09	1.05	10.69	2.73

Overall RTTVwall = 12.70 W/m^2

< 14 W/m^2 ok.

Roof

Gross Roof Areas = **86.41** m²
(Opaque Walls + Skylight Areas) (Aro) at Roof

Skylight Areas at Roof = **0.00** m²

Breakdown of Skylight Areas

Skylight Areas Unshaded (**0**) = **0.00** m²

OpaqueAreas at Roof = **86.41** m²

Breakdown of Opaque Roof Areas

RC Roof Areas (**87.41**) = **86.41** m²

Roof (43.38)= 43.38 m²

Upper Roof (43.03)= 43.03 m²

Roof Orientation Factor Gs = 2.16 (Refer to **Table 9**)

Average Absorptivity (α) of the External Opaque Wall at Roof

External Roof Material (Colour/Finish)	% of roof area	α Absorptivity (Refer to **Table 5**)
Tile (matt) Dark grey	100%	0.9
	Average Absorptivity =	**0.9**

'U' value of Opaque Roof Areas

$U = 1/(Ri+x_1/k_1+x_2/k_2+\ldots+x_n/k_n+Ra+Ro)$

where Ri Surface film resistance of internal surface (Refer to **Table 2**)
Ro Surface film resistance of external surface (Refer to **Table 2**)
Ra Air space resistance (Refer to **Table 3**)
x Thickness of building materials
k Thermal conductivity of building materials (Refer to **Table 1**)

R1 Description: Roof Area

Roof Material						
External surface film resistance			Ro	=	0.055	
Air space resistanace			Ra	=	0	
10mm concrete tiles	0.01	/ 1.1		=	0.009	
15mm asphalt	0.015	/ 1.15		=	0.013	
75mm cement/sand screed	0.075	/ 0.72		=	0.104	
50mm polystyrene insulation	0.05	/ 0.034		=	1.471	
150mm concrete	0.15	/ 2.16		=	0.069	
20mm gypsum plaster	0.02	/ 0.38		=	0.053	
Internal surface film resistance			Ri	=	0.162	
Total				=	**1.936**	**W/m²K**
Ur1 =		**1 / 1.936**		=	**0.517**	

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Form RTTV (Roof) 1 - Calculation of $RTTV_{roof}$

Sheet No. 15 BD Ref No. BD 2/9046/18

Building Address REDEVELOPMENT OF TAI PO TOWN LOT NO.233, NOS. 2,4 AND 6 WAI YI STREET, TAI PO, N.T.

Roof Orientation Facing Flat Gross Roof Area (Aro) = 86.41

Skylight to Roof Ratio (SRR) = 0 Roof Orientation Factor (Gs) = 2.16

Part 1 - Calculation of Heat Conduction through Opaque Roof

Components / Details		Code No.		
Description	Units	R1		
External Finish Material		10mm concrete tiles		
Conductivity	W/mK	1.10		
Thickness	m	0.010		
Average Absorptivity	(α)	0.9		
Intermediate component		15mm asphalt		
Conductivity	W/mK	1.15		
Thickness	m	0.015		
Intermediate component		75mm cement/sand screed		
Conductivity	W/mK	0.720		
Thickness	m	0.08		
Intermediate component		50mm polystyrene insulation		
Conductivity	W/mK	0.03		
Thickness	m	0.05		
Internal Finish Material		20mm gypsum plaster		
Conductivity	W/mK	0.38		
Thickness	m	0.02		
U-value of the Roof (Uri)	W/m²K	0.52		
Opaque Roof Area (Ari)	m²	86.41		
Heat Conduction = 3.47(Ari/Aro) Uri αri Gs		3.48		

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri αri Gs where i= 1, 2, …, n

= 3.48 W/m²

Part 2 - Calculation of Heat Conduction through Skylight

Components / Details		Code No.			
Description	Units	S1			
Skylight Glazing Type		-			
Thickness	m	-			
Skylight Area (Asi)	m²	0.00			
U-value of Skylight Glazing (Usi)	W/m²K	-			
Heat Conduction = 0.40 (Asi/Aro) Usi Gs		0.00			

Heat Conduction through Skylight = 0.40 (Asi/Aro) Usi Gs where i= 1, 2, …, n

= 0.00 W/m²

Part 3 - Calculation of Solar Radiation through Skylight

Components / Details		Code No.			
Description	Units	S1			
Skylight Glazing Type		-			
Thickness	m	-			
Skylight Area (Asi)	m²	0.00			
Shading Coefficient of Skylight Glazing (SCr)		-			
Visible Light Transmittance (VLT)		-			
External Reflectance (ER)		-			
Solar Radiation = 41.10 (Asi/Aro) (SCri) Gs		0.00			

Solar Radiation through Skylight = 41.10 (Asi/Aro) (SCri) Gs where i= 1, 2, …, n

= 0.00 W/m²

Summary of RTTV at Roof

= 3.48 + 0.00 + 0.00

= 3.48 W/m²

Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014
Form RTTV (Roof) 2 - Summary of $RTTV_{roof}$ of Building Envelopes

Sheet No. 16 BD Ref No. BD 2/9046/18

Building Address REDEVELOPMENT OF TAI PO TOWN LOT NO.233, NOS. 2,4 AND 6 WAI YI STREET, TAI PO, N.T.

Overall Roof Area [a] 86.41 m^2

Roof	Gross Roof Area (m^2) [b]	Heat Conduction through Opaque Roof (W/m^2) [c]	Heat Conduction through Skylight (W/m^2) [d]	Solar Radiation through Skylight (W/m^2) [e]	RTTVroof at Each Type of Roof (W/m^2) [f]=[c]+[d]+[e]	Area-weighted RTTVroof (W/m^2) [g]=[f]x[b]/[a]
Flat Roof	86.41	3.48	0.00	0.00	3.48	3.48

Overall RTTVroof = 3.48 W/m^2

< 4 W/m^2 ok.