

***RTTV Calculation report  
For  
Proposed House Development  
in Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.***

24 May 2021

**Thomas Anderson & Partners Consulting Engineers Limited  
Rm 1602/04, 16/F  
Leighton Centre  
77 Leighton Road  
Causeway Bay, Hong Kong  
Tel: (852) 2866 6778  
Fax: (852) 2529 3268**

## **RTTV Calculation Report**

## **INTRODUCTION**

1.1 The building is Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long

1.2 The General Building Plan has been submitted to Buildings Department under letter dated 2 Feb 2021.

This document is the Residential Thermal Transfer Value calculation.

## **DEMONSTRATION OF COMPLIANCE**

2.1 To improve the energy efficiency of residential buildings, the compliance with the following design and construction requirements is included as one of the pre-requisites for the granting of gross floor area (GFA) concessions for green / amenity features and non-mandatory / non-essential plant rooms and services in a residential building under Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) APP-151:-

(a) The RTTV of wall (RTTV Wall) and roof (RTTV Roof) should not exceed  $14\text{Watt/m}^2$  and  $4\text{Watt/m}^2$  respectively;

(d) Glass forming part of the building envelope such as curtain wall, cladding, skylight, window and door of the residential building and RRF should have a VL Glass of not less than 50% and an ER Glass of not more than 20%.

Support calculation, building information, glazing information and general building plan are submitted in the attached document.



## PERFORMANCE DATA

**Project:** Proposed Residential Development at Lot No 2115 in D.D.105, Ngau Tam Mei, Yuen Long, New Territories

**Date:** 21-Jun-18

**Prepared by:** Phoebe Hu

NO	COMPOSITION	Type	Visible Light (%)			Shading Coefficient	U-Value (W/m2 K)
			Transmittance	Reflectance			
				Outdoor	Indoor		
1	10mm SBTS61B #2 HS + 12A (BLK) + 12mm Clear glass	IGU	53%	17%	10%	0.43	1.74

<http://www.shenbo.hk>

Hong Kong Office:

Unit 14, 6/F., Leader Industrial Centre, 57 Au Pui Wan Street, Shatin, N.T., Hong Kong

Tel: (852)2117 3390 Fax: (852)2117 3391 E-mail: [phoebe.hu@shenbo.hk](mailto:phoebe.hu@shenbo.hk) / +86-13823284840

Shenzhen Production Base: Macau Industrial Zone, Zhangge Village, Guanlan Town, Shenzhen, China



## RTTV Calculation (House 1)

## Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

### Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

### West Elevations (House 1) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 0.24 + 8.10 )	x 4.20 x 1 =	8.34 x 4.20 x 1 =	35.02 m <sup>2</sup>
1/F	( 1.52 + 8.01 )	x 3.60 x 1 =	9.53 x 3.60 x 1 =	34.32 m <sup>2</sup>
R/F	( )	x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

---

**Gross Wall Areas 69.33 m<sup>2</sup>**

### North Elevations (House 1) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 2.35 )	x 4.20 x 1 =	2.35 x 4.20 x 1 =	9.87 m <sup>2</sup>
1/F	( 6.12 + 1.73 )	x 3.60 x 1 =	7.85 x 3.60 x 1 =	28.26 m <sup>2</sup>
R/F	( )	x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

---

**Gross Wall Areas 38.13 m<sup>2</sup>**

### East Elevations (House 1) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 2.32 )	x 4.20 x 1 =	2.32 x 4.20 x 1 =	9.74 m <sup>2</sup>
1/F	( 2.42 + 4.50 )	x 3.60 x 1 =	6.92 x 3.60 x 1 =	24.93 m <sup>2</sup>
R/F	( )	x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

---

**Gross Wall Areas 34.67 m<sup>2</sup>**

### South Elevations (House 1) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 3.53 + 0.90 )	x 4.20 x 1 =	4.43 x 4.20 x 1 =	18.61 m <sup>2</sup>
1/F	( 8.22 )	x 3.60 x 1 =	8.22 x 3.60 x 1 =	29.59 m <sup>2</sup>
R/F	( )	x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

---

**Gross Wall Areas 48.20 m<sup>2</sup>**

**Total Gross Wall Areas 190.33 m<sup>2</sup>**

# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
1/F (Window GL02) - B	=	2.64 m	( 1 storey)

### West Elevations (House 1) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 8.10	)x 3.05 x 1 =	8.10 x 3.05 x 1 =	24.66 m <sup>2</sup>
1/F (Window GL02) - B	( 8.01 +	)x 2.85 x 1 =	8.01 x 2.85 x 1 =	22.83 m <sup>2</sup>

**Gross Glazing Areas 47.49 m<sup>2</sup>**

### North Elevations (House 1) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

**Gross Glazing Areas 0.00 m<sup>2</sup>**

### East Elevations (House 1) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	(	)x 3.05 x 1 =	0.00 x 3.05 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - B	( 0.80 + 0.85 + 2.85	)x 2.64 x 1 =	4.50 x 2.64 x 1 =	11.86 m <sup>2</sup>

**Gross Glazing Areas 11.86 m<sup>2</sup>**

### South Elevations (House 1) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 3.53	)x 3.05 x 1 =	3.53 x 3.05 x 1 =	10.75 m <sup>2</sup>
1/F (Window GL02) - B	(	)x 2.64 x 1 =	0.00 x 2.64 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 10.75 m<sup>2</sup>**

**Total Gross Glazing Areas 70.10 m<sup>2</sup>**

# West Elevations (House 1)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 1) = 69.33 m²

Glazing Areas at West Elevations (House 1) = 47.49 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 27.15 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 10.90 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.58 x 3.05 = 10.90 m²

OPF 1.50 / 3.50 = 0.43 ECS = 0.755

Glazing Areas Shaded by Cover of Balcony ( W-F3 ) = 9.44 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 3.58 x 2.64 = 9.44 m²

OPF 1.50 / 3.00 = 0.50 ECS = 0.714

Opaque Wall Areas at West Elevations (House 1) = 21.84 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 21.84 m²

Window to Wall Ratio (WWf) = 47.49 / 69.33 = 0.68

Sheet no. 3

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 1)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	4	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)		
Facade Orientation Facing	West	Gross Wall Area (Ao) =	69.33
Window to Wall Ratio (WWR)	0.68	Wall Orientation Factor (Gw) =	1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material				
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	21.84		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		3.87		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 3.87 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	27.15	10.90	9.44
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.49	0.20	0.17

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.86 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	27.15	10.90	9.44
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.76	0.71
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		7.95	2.41	1.97

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 12.34 W/m²

Summary of RTTV at West Elevations (House 1)  
= 3.87 + 0.86 + 12.34  
= 17.07 W/m²

# North Elevations (House 1)

Sheet no. 5

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 1) = 38.13 m²

Glazing Areas at North Elevations (House 1) = 0.00 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 0.00 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 1) = 38.13 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 38.13 m²

Window to Wall Ratio (WWR) = 0.00 / 38.13 = 0.00

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 1)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	38.13
Window to Wall Ratio (WWR)	0.00	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.90		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.03		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material				
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	38.13		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.67		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.67 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.00		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		0.00		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Summary of RTTV at North Elevations (House 1)  
= 8.67 + 0.00 + 0.00  
= 8.67 W/m²

# East Elevations (House 1)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 1) = 34.67 m²

Glazing Areas at East Elevations (House 1) = 11.86 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 11.86 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 1) = 22.81 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 22.81 m²

Window to Wall Ratio (WWf) = 11.86 / 34.67 = 0.34

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 1)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	34.67
Window to Wall Ratio (WWR)	0.34	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	22.81		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		7.66		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 7.66 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	11.86		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.41		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.41 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	11.86		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.58		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 6.58 W/m²

Summary of RTTV at East Elevations (House 1)  
= 7.66 + 0.41 + 6.58  
= 14.65 W/m²

South Elevations (House 1)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 1)	=	48.20 m²
Glazing Areas at South Elevations (House 1)	=	10.75 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( S-F1 )	=	10.75 m²
ECS	=	1.000

Opaque Wall Areas at South Elevations (House 1)	=	37.45 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( S-W1 )	=	37.45 m²

Window to Wall Ratio (WWR) = 10.75 / 48.20 = 0.22

Wall Orientation Factor	Gw = 0.975	(Refer to Table 9)
Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 1)		

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	98.0%	0.9
AGT Tiles	2.0%	0.8

Average Absorptivity = 0.898

'U' value of Opaque Wall Areas		
U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 10 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)

Facade Orientation Facing South Gross Wall Area (Ao) = 48.20  
Window to Wall Ratio (WWR) 0.22 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1	S-W2	
External Finish Material		30mm Stone cladding	10mm AGT Tile	
Conductivity	W/mK	2.90	1.10	
Thickness	m	0.030	0.010	
Average Absorptivity (α <sub>wi</sub> )	(α)	0.90	0.80	
Intermediate component		12mm cement/ sand render	12mm cement/ sand render	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.012	0.012	
Intermediate component		200mm concrete wall	200mm concrete wall	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.20	0.20	
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material				
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.010	0.010	
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42	3.42	
Opaque Wall Area (A <sub>wi</sub> )	m²	37.08	0.37	
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.22	0.07	

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.29 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	10.75		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.24		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.24 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	10.75		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		3.90		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 3.90 W/m²

Summary of RTTV at South Elevations (House 1)  
= 8.29 + 0.24 + 3.90  
= 12.43 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No. 11 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)

Overall Gross Wall Area [a] 190.33 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	69.33	3.87	0.86	12.34	17.07	6.22
North	38.13	8.67	0.00	0.00	8.67	1.74
East	34.67	7.66	0.41	6.58	14.65	2.67
South	48.20	8.29	0.24	3.90	12.43	3.15

Overall RTTV<sub>wall</sub> = 13.77 W/m²

< 14 W/m² OK

Roof

Sheet no. 12

Gross Roof Areas  
(Opaque Walls + Skylight Areas) (Aro) at Roof = 194.65 m<sup>2</sup>

Skylight Areas at Roof = 0.00 m<sup>2</sup>

Breakdown of Skylight Areas  
Skylight Areas Unshaded ( S1 ) = 0.00 m<sup>2</sup>

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)
Unglazed Porcelain Tiles (Grey)	81%	0.9
AGT Tile (Brown)	9%	0.8
Concrete (Jacuzzi)	10%	0.7
Average Absorptivity =		0.871

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

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)

OpaqueAreas at Roof = 194.65 m<sup>2</sup>

Breakdown of Opaque Roof Areas  
RC Roof Areas ( R1 ) = 180.00 m<sup>2</sup>  
1/F = m<sup>2</sup>  
Roof = 115.30 m<sup>2</sup>  
Upper Roof = 64.70 m<sup>2</sup>

R1 Description: Roof Area	
Roof Material	
External surface film resistance	Ro = 0.055
Air space resistance	Ra = 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1 = 0.023
50mm cement/ sand screed	0.05 / 0.72 = 0.069
50mm expanded polystyrene	0.05 / 0.034 = 1.471
150mm concrete slab	0.15 / 2.16 = 0.069
Internal surface film resistance	Ri = 0.162
Total	1.849

$$Uw1 = \frac{1}{1.849} = 0.54 \text{ W/m}^2\text{K}$$

Breakdown of Opaque Roof Areas  
RC Roof Areas ( R2 ) = 6.75 m<sup>2</sup>  
1/F = m<sup>2</sup>  
Roof = 6.75 m<sup>2</sup>  
Upper Roof = m<sup>2</sup>

R2 Description: Roof Area	
Roof Material	
External surface film resistance	Ro = 0.055
Air space resistance	Ra = 0
50mm cement/ sand screed	0.05 / 0.72 = 0.069
50mm expanded polystyrene	0.05 / 0.034 = 1.471
150mm concrete slab	0.15 / 2.16 = 0.069
10mm AGT Tile (Brown)	0.01 / 1.1 = 0.009
Internal surface film resistance	Ri = 0.162
Total	1.836

$$Uw1 = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Breakdown of Opaque Roof Areas  
RC Roof Areas ( R3 ) = 7.90 m<sup>2</sup>  
1/F = m<sup>2</sup>  
Roof = 7.90 m<sup>2</sup>  
Upper Roof = m<sup>2</sup>

R3 Description: Roof Area	
Roof Material	
External surface film resistance	Ro = 0.055
Air space resistance	Ra = 0
50mm cement/ sand screed	0.05 / 0.72 = 0.069
150mm concrete slab	0.15 / 2.16 = 0.069
Internal surface film resistance	Ri = 0.162
Total	0.356

$$Uw1 = \frac{1}{0.356} = 2.81 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 194.65  
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	R2	R3
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	Concrete (Jacuzzi)
Conductivity	W/mK	1.10	1.10	2.16
Thickness	m	0.025	0.010	0.150
Average Absorptivity	(α)	0.9	0.8	0.7
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	50mm cement/ sand screed
Conductivity	W/mK	0.72	0.72	0.72
Thickness	m	0.050	0.050	0.050
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	50mm expanded polystyrene
Conductivity	W/mK	0.034	0.034	0.034
Thickness	m	0.05	0.05	0.05
Intermediate component		150mm concrete slab	150mm concrete slab	150mm concrete slab
Conductivity	W/mK	2.16	2.16	2.16
Thickness	m	0.15	0.15	0.15
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	0.38
Thickness	m	0.01	0.01	0.01
U-value of the Roof (Uri)	W/m²K	0.53	0.53	0.53
Opaque Roof Area (Ari)	m²	180.00	6.75	7.90
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		2.93	0.11	0.75

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs where i= 1, 2, ..., n  
= 3.79 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  
= 3.79 + 0.00 + 0.00  
= 3.79 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No. 14 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)

Overall Roof Area [a] 194.65 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	194.65	3.79	0.00	0.00	3.79	3.79

Overall RTTV<sub>roof</sub> = 3.79 W/m²

< 4 W/m² OK

## RTTV Summary Sheet

Address:	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 1)						BD Ref. No.
Building Type:	Residential						BD 2/9179/15
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-						
No. of Storeys (Residential Units)	2						

**Table 1**

Deemed to Satisfy RTTV <sub>Wall</sub>									
Facade Orientation Facing	West	North	East	South					
Average Absorptivity	0.795	0.795	0.795	0.795					
Average Window to Wall Ratio	0.62	0.00	0.40	0.46					
Shading Coefficient of Glazing	0.43		0.43	0.43					
Average Shading Coefficient of Facade	0.43		0.43	0.43					
Visible Light Transmittance	53 %	%	53 %	53 %	%	%	%	%	%
External Reflectance	17 %	%	17 %	17 %	%	%	%	%	%

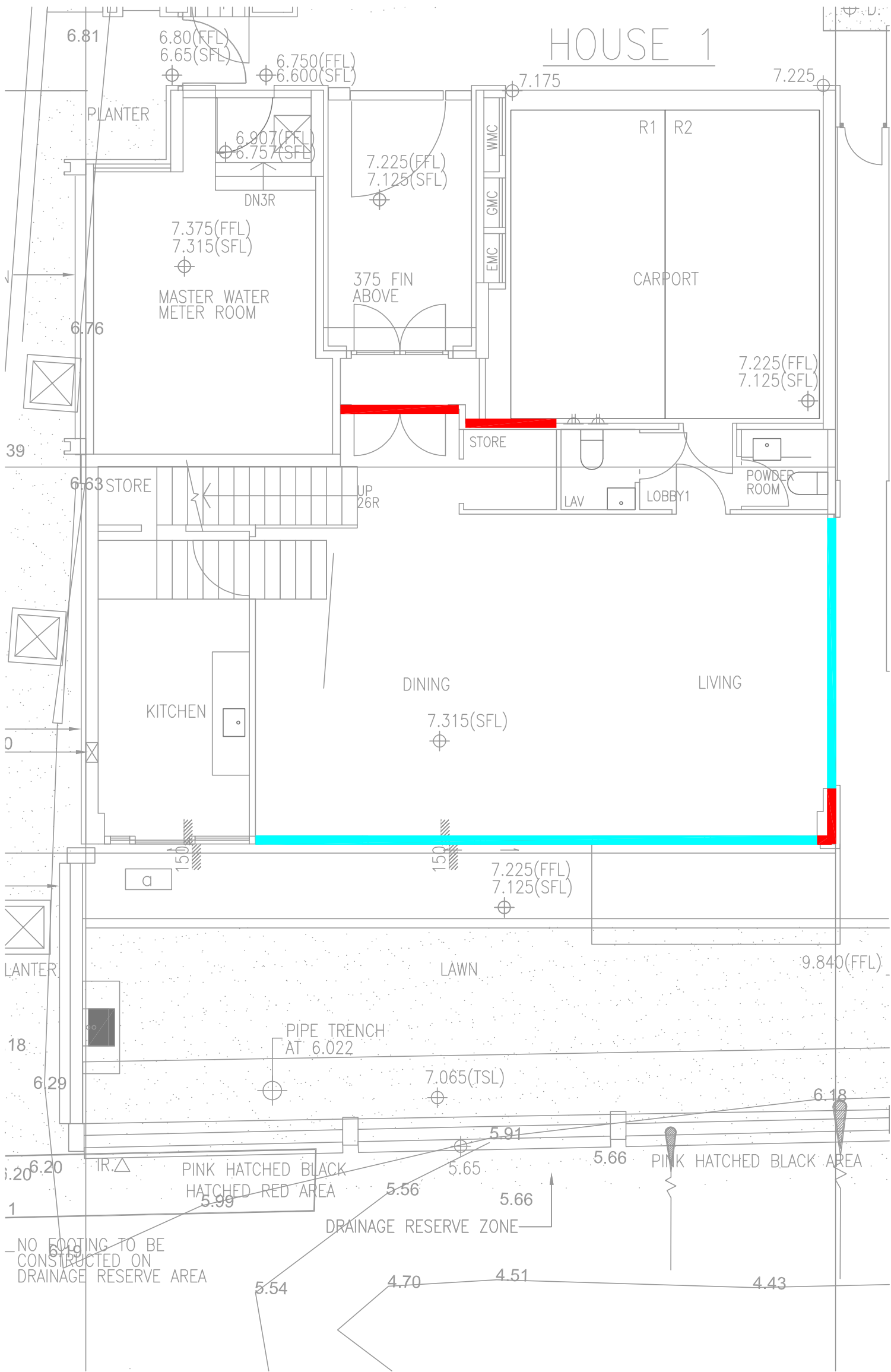
RTTV <sub>Wall</sub>																	
Facade Orientation Facing		West				North				East				South			
Wall Orientation Factor		1.131				0.79				1.072				0.975			
Total External Wall Area (Residential Units)		78.0 m <sup>2</sup>		Window to Wall Ratio		23.2 m <sup>2</sup>		Window to Wall Ratio		25.0 m <sup>2</sup>		Window to Wall Ratio		50.2 m <sup>2</sup>		Window to Wall Ratio	
Total Window Area		48.30 m <sup>2</sup>		= 0.62		0.00 m <sup>2</sup>		= 0.00		10.09 m <sup>2</sup>		= 0.04		23.19 m <sup>2</sup>		= 0.46	
Heat Conduction	Opaque Wall	3.87		W/m <sup>2</sup>		8.67		W/m <sup>2</sup>		7.66		W/m <sup>2</sup>		8.29		W/m <sup>2</sup>	
	Window	0.86		W/m <sup>2</sup>		0.00		W/m <sup>2</sup>		0.41		W/m <sup>2</sup>		0.41		W/m <sup>2</sup>	
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %
		<input checked="" type="checkbox"/> Tinted	Area = 48.3 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input type="checkbox"/> Tinted	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input checked="" type="checkbox"/> Tinted	Area = 14.23 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 13.09 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Sidefin		<input type="checkbox"/> Yes <input type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Solar Radiation through Gazing		12.34 W/m <sup>2</sup>				0.00 W/m <sup>2</sup>				6.58 W/m <sup>2</sup>				3.90 W/m <sup>2</sup>			
Average Absorptivity		0.795				0.795				0.795				0.795			
RTTV <sub>Wall</sub> at each Facade		17.07 W/m <sup>2</sup>				8.67 W/m <sup>2</sup>				14.65 W/m <sup>2</sup>				12.43 W/m <sup>2</sup>			
Overall RTTV <sub>Wall</sub>		13.77 W/m <sup>2</sup>															

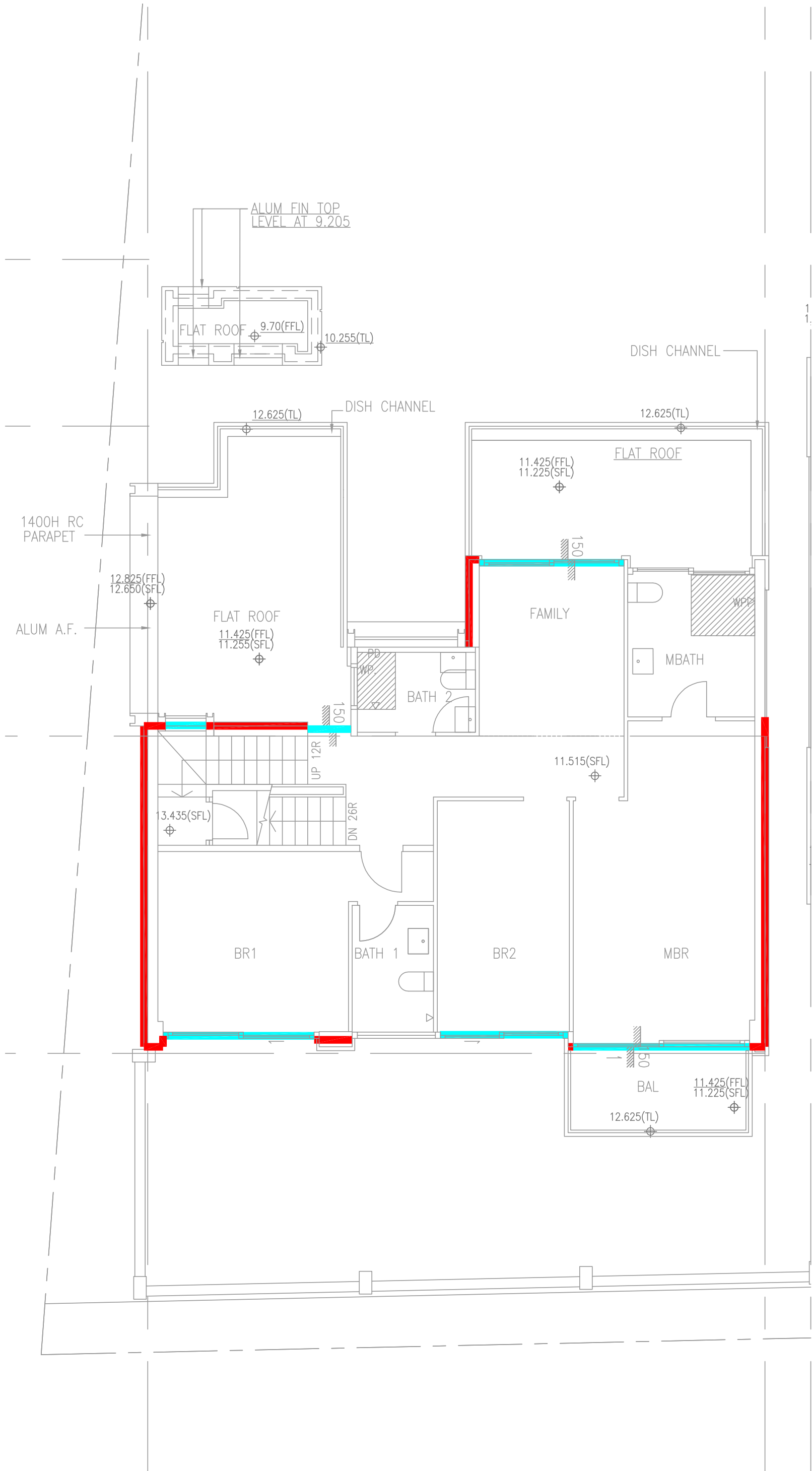
Table 3

RTTV <sub>Roof</sub>									
Roof Orientation Factor									
Total Roof Area (Residential Units)		2.16 194.65	m <sup>2</sup>						
Total Skylight Area		0	m <sup>2</sup>						
Heat Conduction	Roof	3.79	W/m <sup>2</sup>						
	Skylight	0	W/m <sup>2</sup>						
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No							
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No							
	Solar Radiation through Gazing		0	W/m <sup>2</sup>					
Average Absorptivity (Roof)		0.8							
Overall RTTV <sub>Roof</sub>		3.79	W/m <sup>2</sup>						

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



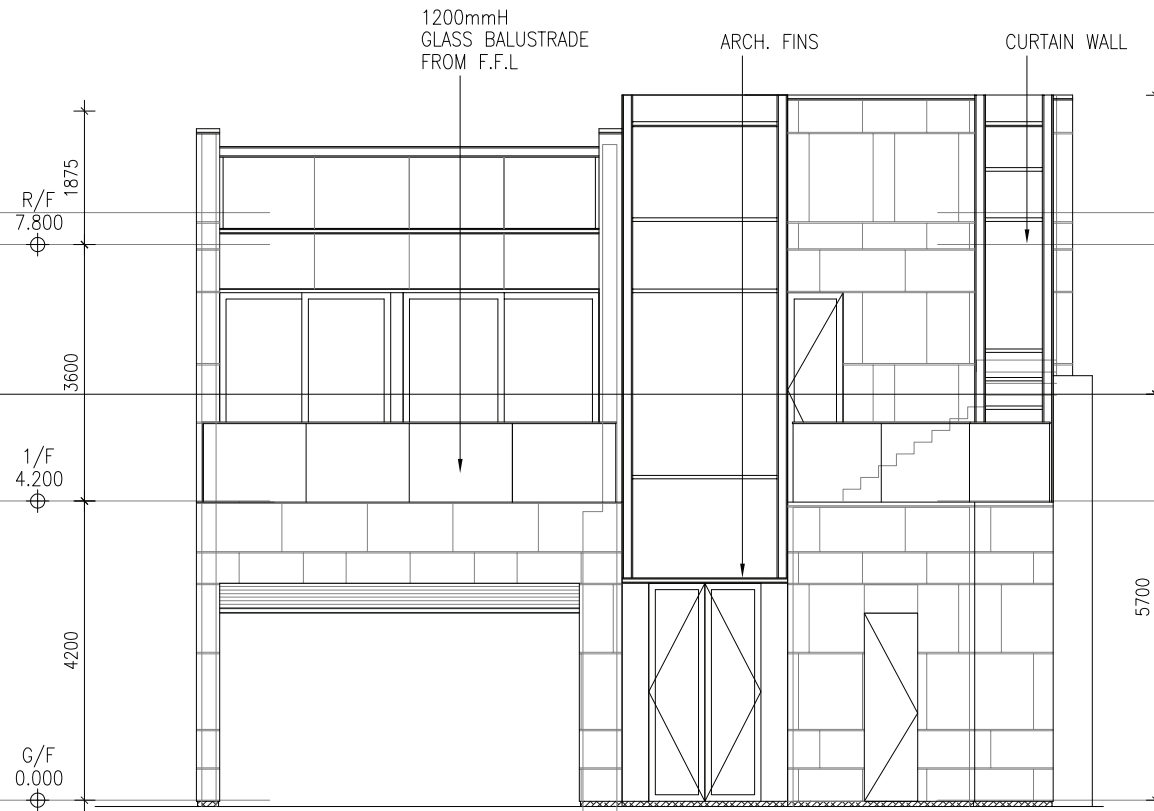




DRAWING TITLE: HOUSE 1 FIRST FLOOR PLAN

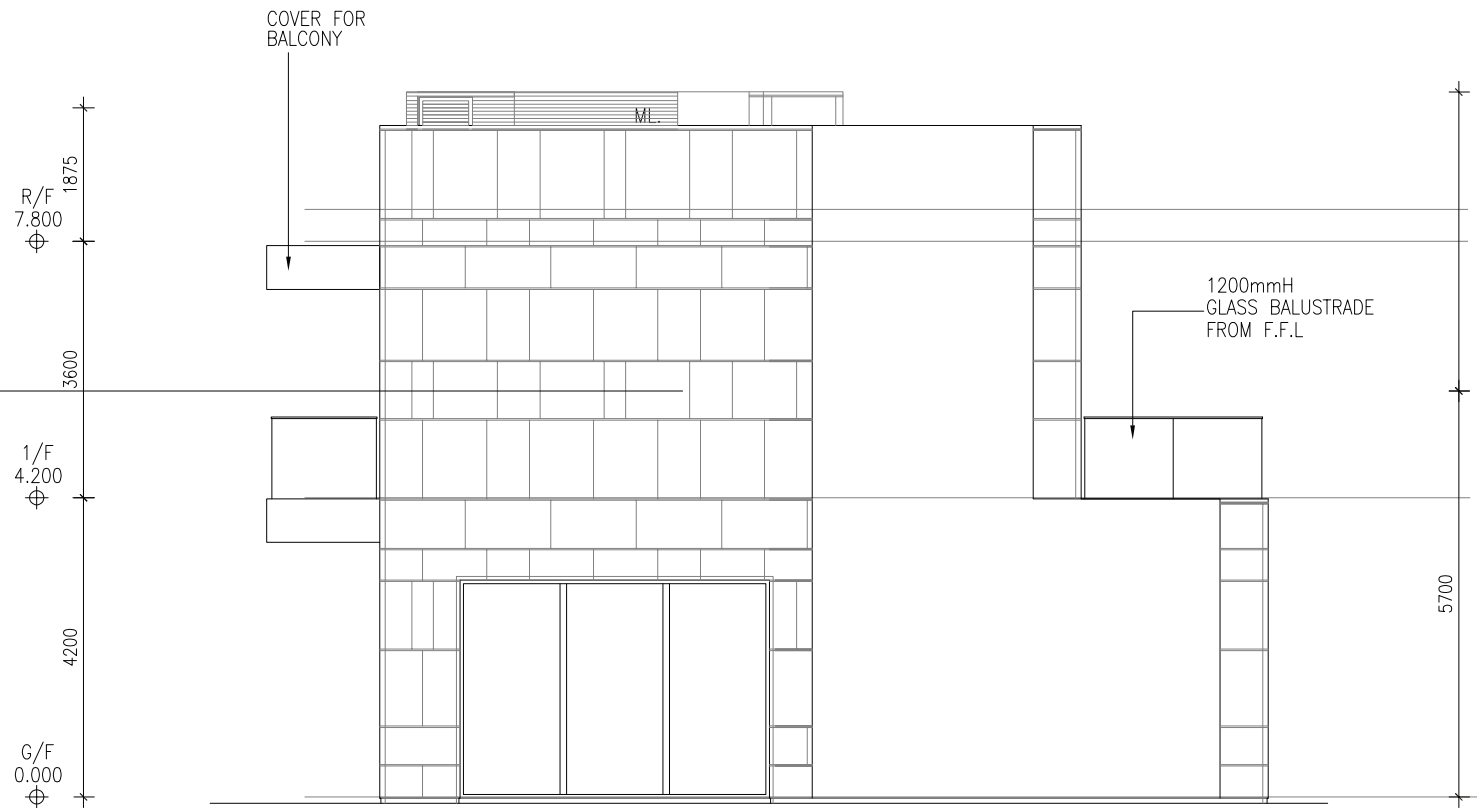
SCALE: 1:150@A4





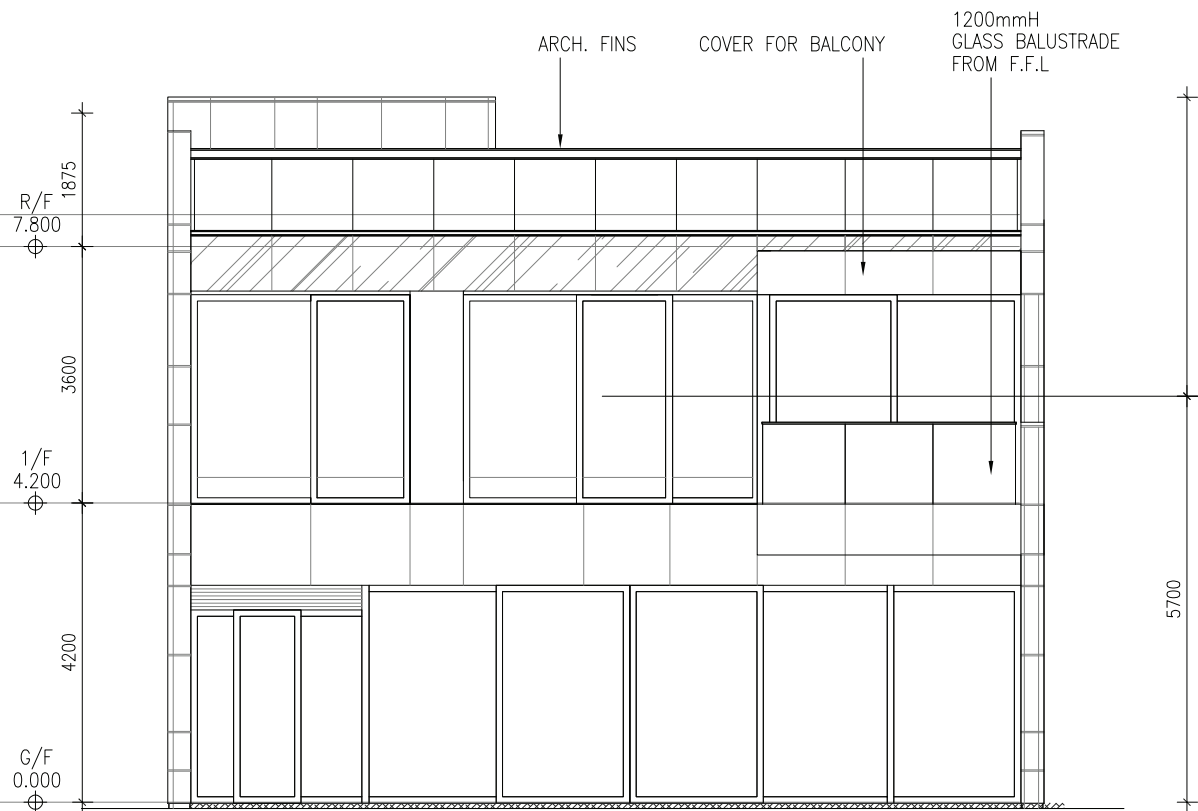
15 EAST ELEVATION 1:75  
HOUSE 1

CSK-1E1



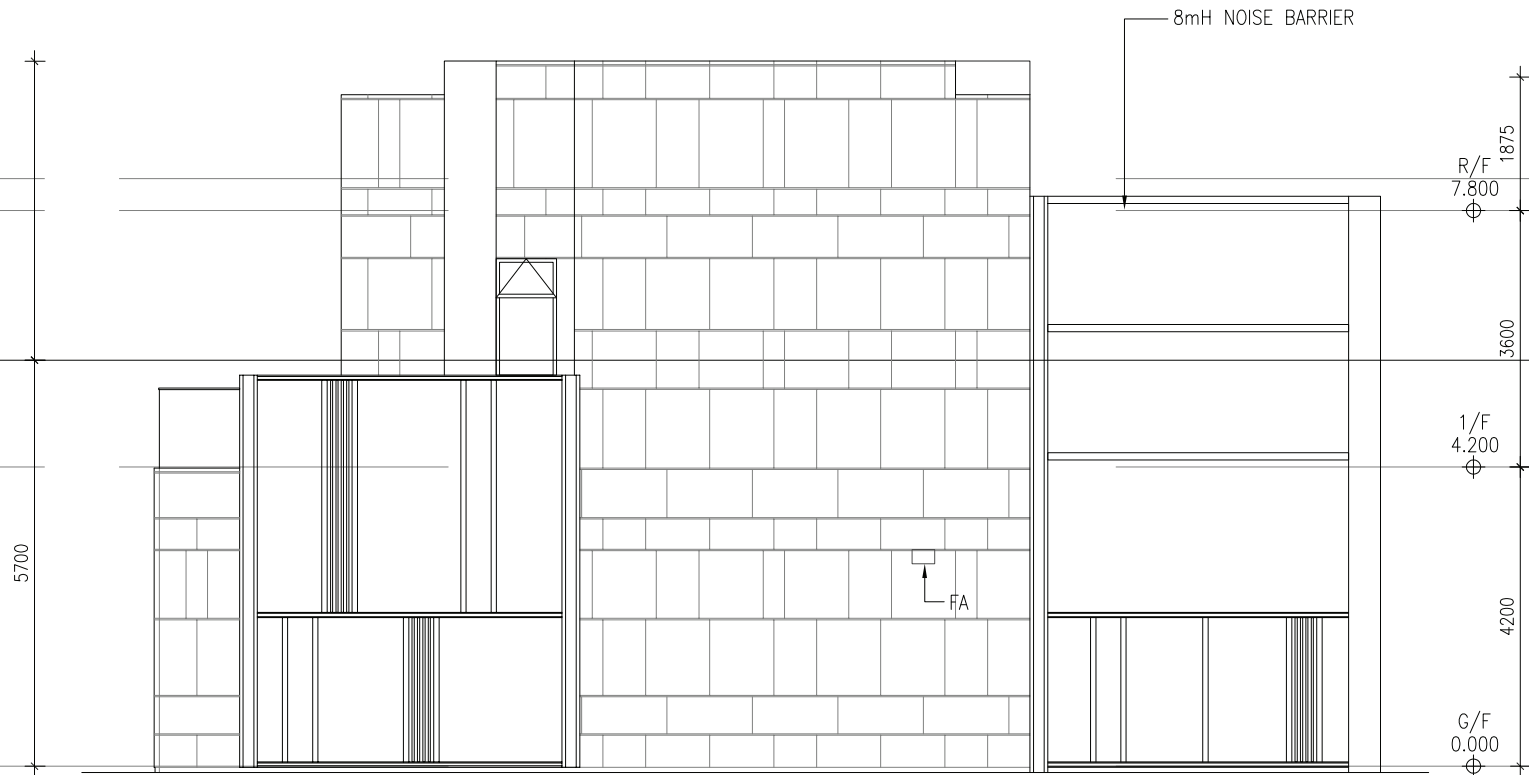
17 SOUTH ELEVATION 1:75  
— HOUSE 1

CSK-1E2



16 WEST ELEVATION 1:75  
— HOUSE 1

CSK-1E3



18 NORTH ELEVATION 1:75  
— HOUSE 1

CSK-1E4

## RTTV Calculation (House 2)



# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

### West Elevations (House 2) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 3.13 + ###)	)x 4.20 x 1 =	14.83	x 4.20 x 1 =	62.29 m <sup>2</sup>
1/F	( 4.90 + 0.64	)x 3.60 x 1 =	5.54	x 3.60 x 1 =	19.94 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00	x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 82.23 m<sup>2</sup>**

### North Elevations (House 2) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 0.59 + 0.35 + 5.57	)x 4.20 x 1 =	6.51	x 4.20 x 1 =	27.34 m <sup>2</sup>
1/F	( 6.50 + 1.40	)x 3.60 x 1 =	7.90	x 3.60 x 1 =	28.44 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00	x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 55.78 m<sup>2</sup>**

### East Elevations (House 2) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 5.40 + 0.50 + 2.00	)x 4.20 x 1 =	7.90	x 4.20 x 1 =	33.18 m <sup>2</sup>
1/F	( 5.50 + 0.80	)x 3.60 x 1 =	6.30	x 3.60 x 1 =	22.68 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00	x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 55.86 m<sup>2</sup>**

### South Elevations (House 2) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 7.88 + 4.07	)x 4.20 x 1 =	11.95	x 4.20 x 1 =	50.19 m <sup>2</sup>
1/F	( 8.50	)x 3.60 x 1 =	8.50	x 3.60 x 1 =	30.60 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00	x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 80.79 m<sup>2</sup>**

**Total Gross Wall Areas 274.66 m<sup>2</sup>**

## Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

### Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 2) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 8.30	)x 3.05 x 1 =	8.30 x 3.05 x 1 =	25.27 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 4.90	)x 2.66 x 1 =	4.90 x 2.66 x 1 =	13.01 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 38.28 m<sup>2</sup>**

### North Elevations (House 2) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 0.59 +	)x 3.05 x 1 =	0.59 x 3.05 x 1 =	1.80 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00 x 2.66 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 1.80 m<sup>2</sup>**

### East Elevations (House 2) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	(	)x 3.05 x 1 =	0.00 x 3.05 x 1 =	0.00 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
G/F (Window GL02)	(	)x 2.66 x 1 =	0.00 x 2.66 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02)	( 3.10 + 2.15 + 0.50	)x 2.64 x 1 =	5.25 x 2.64 x 1 =	13.86 m <sup>2</sup>

**Gross Glazing Areas 13.86 m<sup>2</sup>**

### South Elevations (House 2) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 2.63 + 4.25	)x 3.05 x 1 =	6.88 x 3.05 x 1 =	20.95 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00 x 2.66 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - D	( 5.50 + 2.50	)x 2.74 x 1 =	8.00 x 2.74 x 1 =	21.88 m <sup>2</sup>

**Gross Glazing Areas 42.83 m<sup>2</sup>**

**Total Gross Glazing Areas 96.77 m<sup>2</sup>**

# West Elevations (House 2)

Sheet no. 3

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 2) = 82.23 m²

Glazing Areas at West Elevations (House 2) = 38.28 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 16.80 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 2) = 43.95 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 43.95 m²

Window to Wall Ratio (WWR) = 38.28 / 82.23 = 0.47

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 2)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1

Description:

RC Wall Areas

Wall Material			
External surface film resistance	Ro	=	0.044
Air space resistance	Ra	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	Ri	=	0.12
Total	0.293		

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	4	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)		
Facade Orientation Facing	West	Gross Wall Area (Ao) =	82.23
Window to Wall Ratio (WWR)	0.47	Wall Orientation Factor (Gw) =	1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	43.95		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		6.56		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 6.56 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	38.28	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.59	0.15	0.18

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.92 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	16.80	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		4.15	1.58	2.90

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 8.63 W/m²

Summary of RTTV at West Elevations (House 2)  
= 6.56 + 0.92 + 8.63  
= 16.11 W/m²

# North Elevations (House 2)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 2)	=	55.78 m²
Glazing Areas at North Elevations (House 2)	=	1.80 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( N-F1 )	=	1.80 m²
ECS	=	1.000

Opaque Wall Areas at North Elevations (House 2)	=	53.99 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( N-W1 )	=	53.99 m²

Window to Wall Ratio (WWR) = 1.80 / 55.78 = 0.03

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 2)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	55.78
Window to Wall Ratio (WWR)	0.03	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	53.99		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.30		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.30 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	1.80		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.03		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.03 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	1.80		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		0.46		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 0.46 W/m²

Summary of RTTV at North Elevations (House 2)  
= 8.30 + 0.03 + 0.46  
= 8.78 W/m²

East Elevations (House 2)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 2)	=	55.86 m²
Glazing Areas at East Elevations (House 2)	=	13.86 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( E-F1 )	=	13.86 m²
ECS	=	1.000

Opaque Wall Areas at East Elevations (House 2)	=	42.00 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( E-W1 )	=	42.00 m²

Window to Wall Ratio (WWR) = 13.86 / 55.86 = 0.25

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 2)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/((Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	55.86
Window to Wall Ratio (WWR)	0.25	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (awi)	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (Uwi)	W/m²K	3.42		
Opaque Wall Area (Awi)	m²	42.00		
Heat Conduction = 3.57(Awi/Ao) Uwi awi Gw		8.75		

Heat Conduction through Opaque Walls = 3.57(Awi/Ao) Uwi awi Gw    where i= 1, 2, ..., n  
= 8.75    W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (Afi)	m²	13.86		
U-value of Glazing (Ufi)	W/m²K	1.74		
Heat Conduction = 0.64 (Afi/Ao) Uf Gw		0.30		

Heat Conduction through Glazing = 0.64 (Afi/Ao) Ufi Gw    where i= 1, 2, ..., n  
= 0.30    W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (Afi)	m²	13.86		
Shading Coefficient of Glazing (SCf)		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw		4.78		

Solar Radiation through Glazing = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw    where i= 1, 2, ..., n  
= 4.78    W/m²

Summary of RTTV at East Elevations (House 2)  
= 8.75    +    0.30    +    4.78  
= 13.82    W/m²



## South Elevations (House 2)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 2) = 80.79 m<sup>2</sup>

Glazing Areas at South Elevations (House 2) = 42.83 m<sup>2</sup>

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 42.83 m<sup>2</sup>  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 2) = 37.96 m<sup>2</sup>

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 37.96 m<sup>2</sup>

Window to Wall Ratio (WWR) = 42.83 / 80.79 = 0.53

Sheet no. 9

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 2)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

### 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)

R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)

R<sub>a</sub> Air space resistance (Refer to Table 3)

x Thickness of building materials

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

### S-W1

Description:

RC Wall Areas

Wall Material			
External surface film resistance	R <sub>o</sub>	=	0.044
Air space resistance	R <sub>a</sub>	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	R <sub>i</sub>	=	0.12
Total			0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 10 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)

Facade Orientation Facing South Gross Wall Area (Ao) = 80.79  
 Window to Wall Ratio (WWR) 0.53 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	37.96		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.97		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{4.97}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	42.83		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.58		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.58}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	42.83		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		9.28		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{9.28}} \quad \text{W/m}^2$$

**Summary of RTTV at South Elevations (House 2)**

$$= 4.97 + 0.58 + 9.28$$

$$= \underline{\underline{14.83}} \quad \text{W/m}^2$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)

Overall Gross Wall Area [a]274.66 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	82.23	6.56	0.92	8.63	16.11	4.82
North	55.78	8.30	0.03	0.46	8.78	1.78
East	55.86	8.75	0.30	4.78	13.82	2.81
South	80.79	4.97	0.58	9.28	14.83	4.36

Overall RTTV<sub>wall</sub> =13.78W/m²

<14W/m²OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 167.82 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 167.82 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 152.66 m²  
1/F = 25.16 m²  
Roof = 93.80 m²  
Upper Roof = 33.70 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 15.16 m²  
1/F = 5.56 m²  
Roof = 9.60 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
Internal surface film resistance	Ri	= 0.162
Total		1.849

$$U_{w1} = \frac{1}{1.849} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No.	13	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)		
Roof Orientation Facing	Flat	Gross Roof Area (Aro) =	167.82
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	152.66	15.16	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.25	0.29	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs

where i= 1, 2, ..., n

= 3.54 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

= 3.54 + 0.00 + 0.00

= 3.54 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.

Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)

Overall Roof Area [a]

167.82 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	167.82	3.54	0.00	0.00	3.54	3.54

Overall RTTV<sub>roof</sub> =

3.54

W/m²

<

4

W/m²

OK

RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 2)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>Wall</sub>								
Facade Orientation Facing	West	North	East	South				
Average Absorptivity	0.795	0.8	0.8	0.8				
Average Window to Wall Ratio	0.51	0.37	0.18	0.23				
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43				
Average Shading Coefficient of Facade	0.43	0.43	0.43	0.43				
Visible Light Transmittance	53 %	53 %	53 %	53 %	%	%	%	%
External Reflectance	17 %	17 %	17 %	17 %	%	%	%	%

Table 2

RTTV <sub>Wall</sub>																	
Facade Orientation Facing		West				North				East				South			
Wall Orientation Factor		1.131				0.79				1.072				0.975			
Total External Wall Area (Residential Units)		120.0	m <sup>2</sup>	Window to Wall Ratio		63.1	m <sup>2</sup>	Window to Wall Ratio		46.4	m <sup>2</sup>	Window to Wall Ratio		78.1	m <sup>2</sup>	Window to Wall Ratio	
Total Window Area		61.73	m <sup>2</sup>	= 0.51		23.37	m <sup>2</sup>	= 0.37		8.25	m <sup>2</sup>	= 0.18		18.12	m <sup>2</sup>	= 0.23	
Heat Conduction	Opaque Wall	6.56		W/m <sup>2</sup>		8.30		W/m <sup>2</sup>		8.75		W/m <sup>2</sup>		4.97		W/m <sup>2</sup>	
	Window	0.92		W/m <sup>2</sup>		0.03		W/m <sup>2</sup>		0.30		W/m <sup>2</sup>		0.58		W/m <sup>2</sup>	
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %
					ER = %				ER = %				ER = %				ER = %
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 %
				ER = 17 %				ER = 17 %				ER = 17 %				ER = 17 %	
	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	
					ER = %				ER = %				ER = %				ER = %
		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Solar Radiation through Gazing		8.63 W/m <sup>2</sup>				0.46 W/m <sup>2</sup>				4.78 W/m <sup>2</sup>				9.28 W/m <sup>2</sup>			
Average Absorptivity		0.795				0.795				0.795				0.795			
RTTV <sub>Wall</sub> at each Facade		16.11 W/m <sup>2</sup>				8.78 W/m <sup>2</sup>				13.82 W/m <sup>2</sup>				14.83 W/m <sup>2</sup>			
Overall RTTV <sub>Wall</sub>		13.78 W/m <sup>2</sup>															

Table 3										
RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		167.82 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.54 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>		SC =		VLT = %		ER = %	
		<input type="checkbox"/> Tinted	Area = m <sup>2</sup>		SC =		VLT = %		ER = %	
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>		SC =		VLT = %		ER = %	
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	Solar Radiation through Gazing		0 W/m <sup>2</sup>							
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.54 W/m <sup>2</sup>								

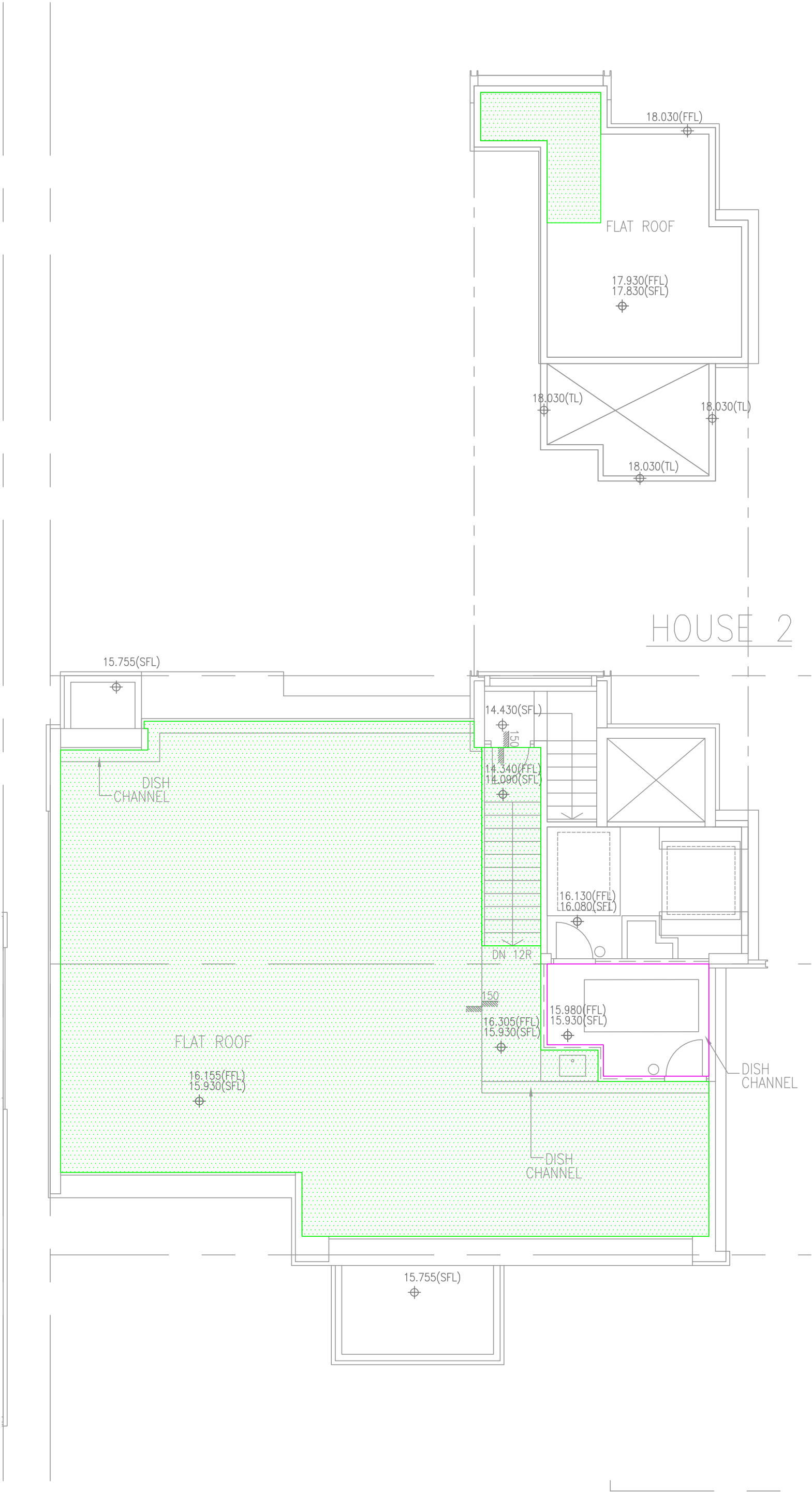
ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



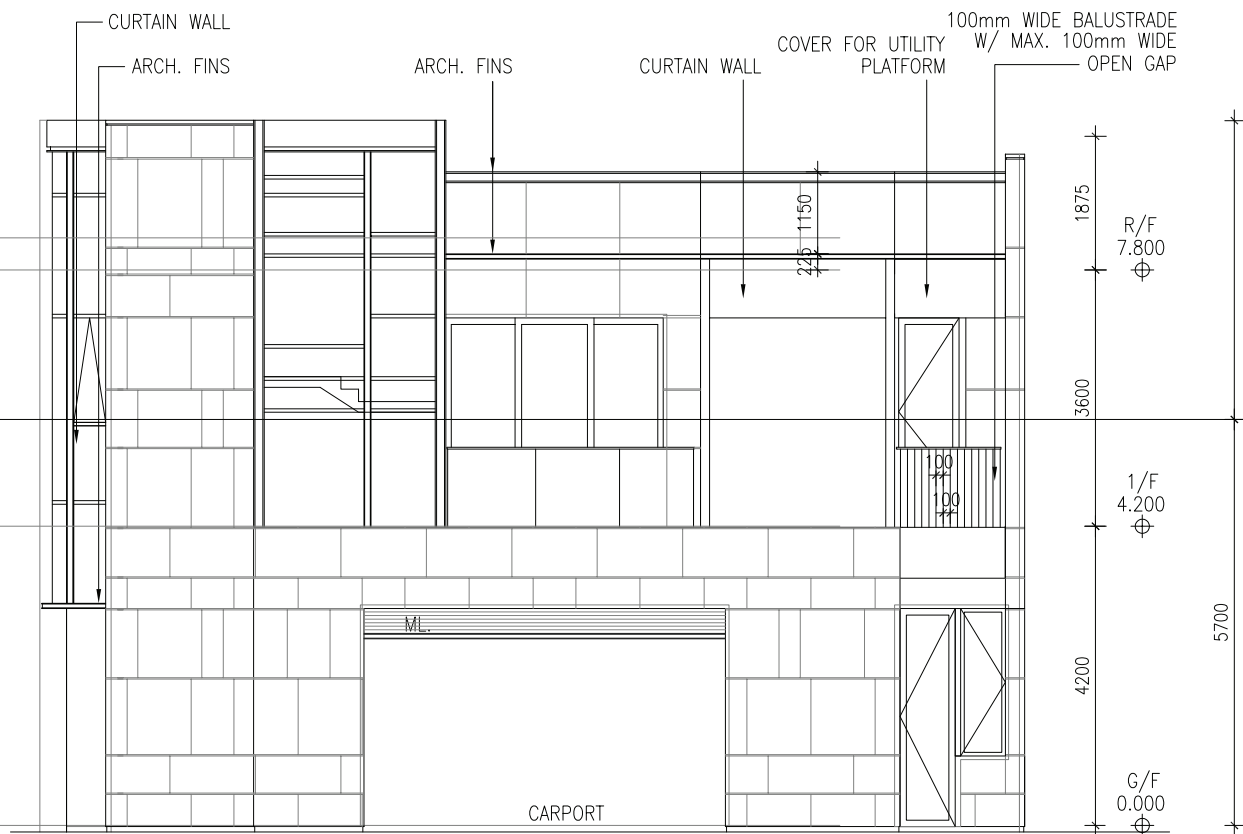




SCALE: 1:150@A4



DRAWING TITLE: HOUSE 2 ROOF FLOOR PLAN  
SCALE: 1:150@A4



1 EAST ELEVATION 1:75  
— HOUSE 2

CSK-2E1

R/F  
7.800  
1875  
3600  
1/F  
4.200  
4200  
G/F  
0.000

PARAPET WALL OF ADJACENT HOUSE

COVER FOR BALCONY

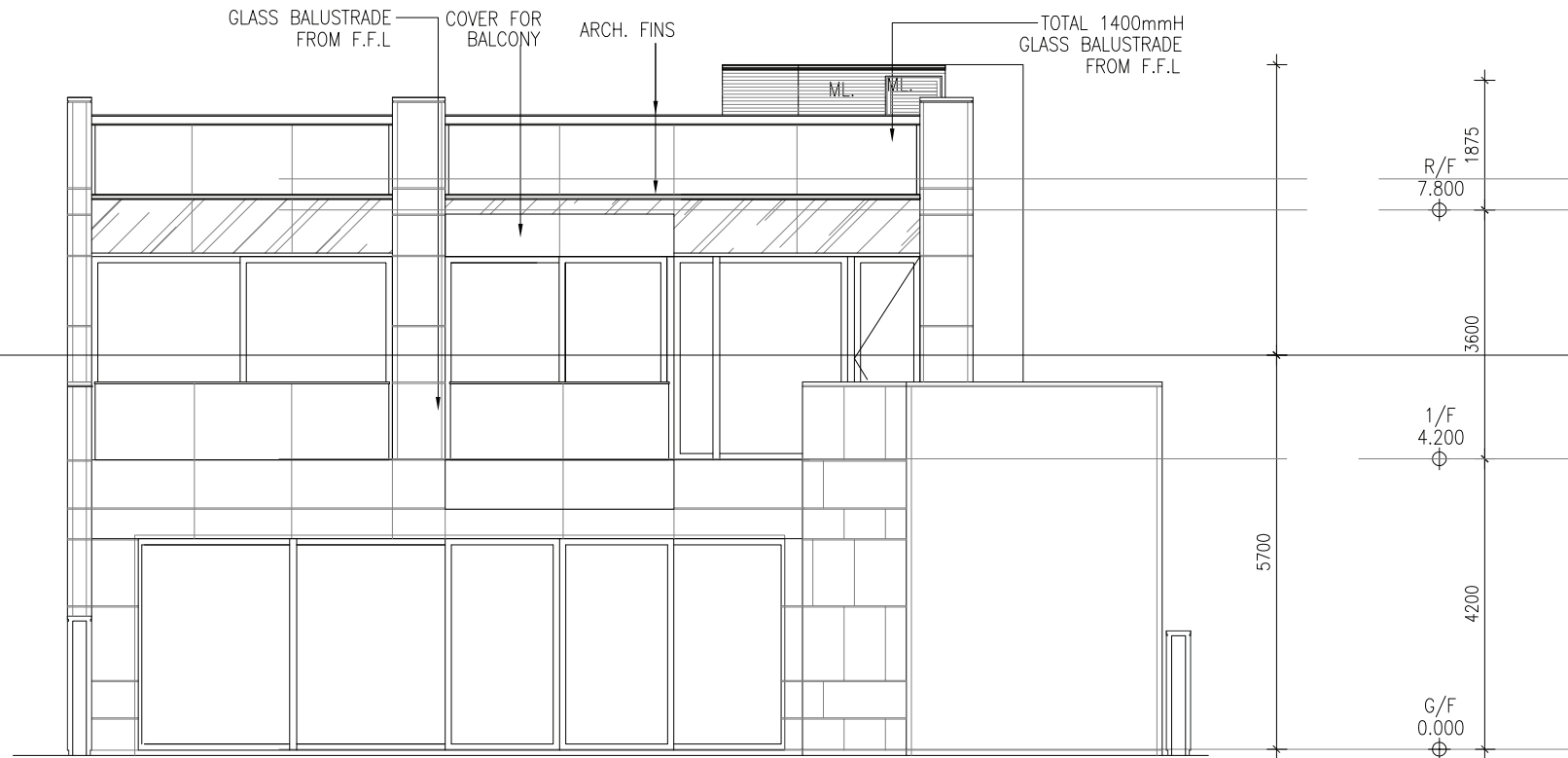
CURTAIN WALL

ARCH. FINS  
CURTAIN WALL

5700

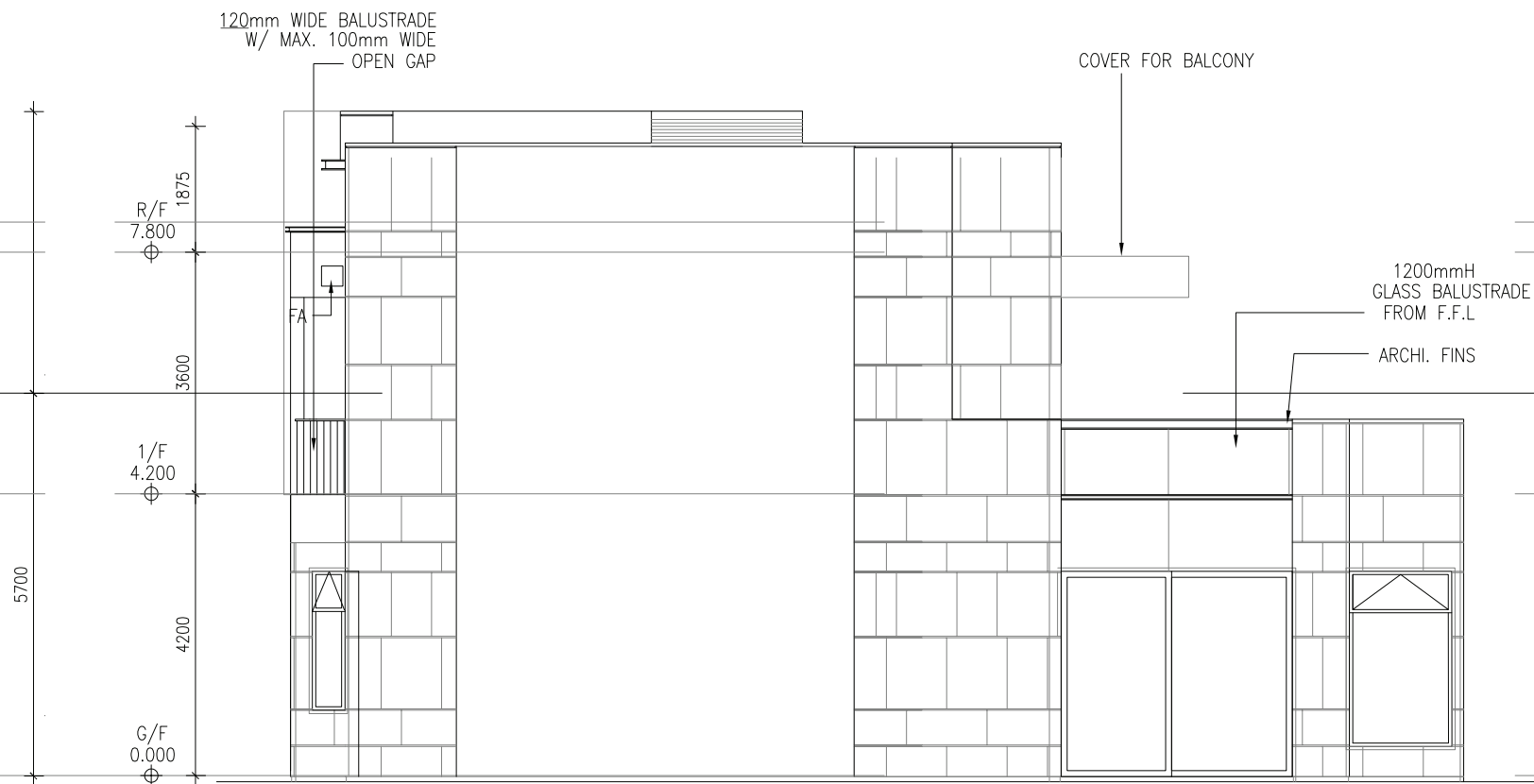
8 SOUTH ELEVATION 1:75  
HOUSE 2

CSK-2E2



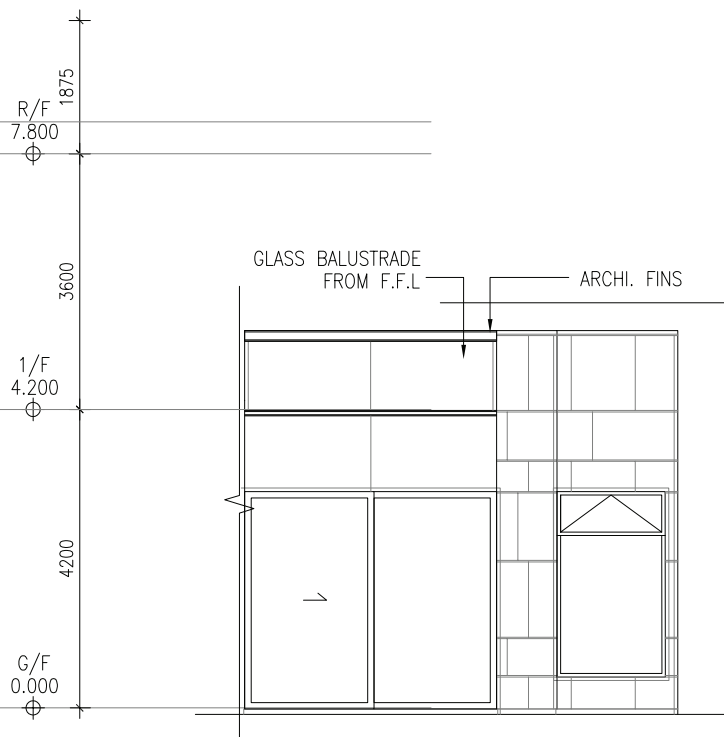
9 WEST ELEVATION 1:75  
— HOUSE 2

CSK-2E3

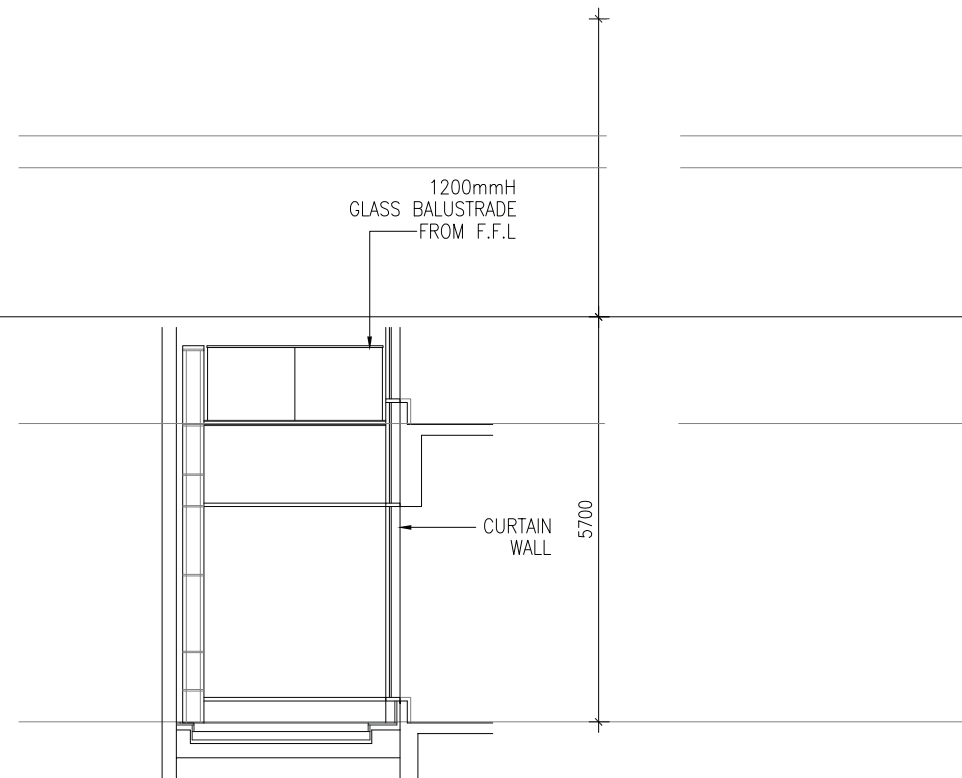


7 NORTH ELEVATION 1:75  
HOUSE 2

CSK-2E4



6 PART ELEVATION OF BR1 1:75  
HOUSE 2



2 PART ELEVATION OF BR1 1:75  
HOUSE 2

CSK-2E5

## RTTV Calculation (House 3)



# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

<b>West Elevations (House 3)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys	
G/F	( 10.20 + 4.10 )x 4.20 x 1 = 14.30 x 4.20 x 1 =	60.06 m <sup>2</sup>
1/F	( 4.50 + 8.30 )x 3.60 x 1 = 12.80 x 3.60 x 1 =	46.08 m <sup>2</sup>
R/F	( )x 1.90 x 1 = 0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 106.14 m<sup>2</sup>**

<b>North Elevations (House 3)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys	
G/F	( 5.60 + 3.65 + 3.80 + 1.50 )x 4.20 x 1 = 14.55 x 4.20 x 1 =	61.11 m <sup>2</sup>
1/F	( 1.00 + 6.65 + 1.56 )x 3.60 x 1 = 9.21 x 3.60 x 1 =	33.16 m <sup>2</sup>
R/F	( )x 1.90 x 1 = 0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 94.27 m<sup>2</sup>**

<b>East Elevations (House 3)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys	
G/F	( 5.40 + 2.00 + 3.20 + 2.00 )x 4.20 x 1 = 12.60 x 4.20 x 1 =	52.92 m <sup>2</sup>
1/F	( 3.20 + 2.10 + 2.10 )x 3.60 x 1 = 7.40 x 3.60 x 1 =	26.64 m <sup>2</sup>
R/F	( )x 1.90 x 1 = 0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 79.56 m<sup>2</sup>**

<b>South Elevations (House 3)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys	
G/F	( 5.20 + 2.37 + 1.25 )x 4.20 x 1 = 8.82 x 4.20 x 1 =	37.02 m <sup>2</sup>
1/F	( 0.80 + 5.40 )x 3.60 x 1 = 0.80 x 3.60 x 1 =	2.88 m <sup>2</sup>
R/F	( )x 1.90 x 1 = 0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 39.90 m<sup>2</sup>**

**Total Gross Wall Areas 319.87 m<sup>2</sup>**

## Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

### Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 3)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 9.54	)x 3.05 x 1 =	9.54	x	3.05	x	1	=	29.03 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 7.43 + 4.50	)x 2.66 x 1 =	11.93	x	2.66	x	1	=	31.66 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00	x	2.74	x	1	=	0.00 m <sup>2</sup>

**Gross Glazing Areas 60.69 m<sup>2</sup>**

### North Elevations (House 3)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 3.65 + 0.50	)x 3.05 x 1 =	4.15	x	3.05	x	1	=	12.62 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00	x	2.66	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00	x	2.74	x	1	=	0.00 m <sup>2</sup>

**Gross Glazing Areas 12.62 m<sup>2</sup>**

### East Elevations (House 3)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 1.50 + 2.00	)x 3.05 x 1 =	3.50	x	3.05	x	1	=	10.66 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
G/F (Window GL02)	(	)x 0.86 x 1 =	0.00	x	0.86	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02)	( 3.20 + 2.10 + 2.10	)x 2.64 x 1 =	5.30	x	2.64	x	1	=	13.99 m <sup>2</sup>

**Gross Glazing Areas 24.65 m<sup>2</sup>**

### South Elevations (House 3)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 5.10	)x 3.05 x 1 =	5.10	x	3.05	x	1	=	15.53 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00	x	2.66	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - D	( 0.80 + 5.40	)x 2.74 x 1 =	6.20	x	2.74	x	1	=	16.96 m <sup>2</sup>

**Gross Glazing Areas 32.49 m<sup>2</sup>**

**Total Gross Glazing Areas 130.45 m<sup>2</sup>**

# West Elevations (House 3)

Sheet no. 3

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 3) = 106.14 m²

Glazing Areas at West Elevations (House 3) = 60.69 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 39.21 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 3) = 45.45 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 45.45 m²

Window to Wall Ratio (WWR) = 60.69 / 106.14 = 0.57

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 3)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	4	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)		
Facade Orientation Facing	West	Gross Wall Area (Ao) =	106.14
Window to Wall Ratio (WWR)	0.57	Wall Orientation Factor (Gw) =	1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	45.45		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		5.26		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 5.26 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.008	0.008	0.008
Glazing Area (A <sub>fi</sub> )	m²	60.69	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.65	1.65	1.65
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.68	0.11	0.13

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.92 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.008	0.008	0.008
Glazing Area (A <sub>fi</sub> )	m²	39.21	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.40	0.40	0.40
Visible Light Transmittance (VLT)	%	57	57	57
External Reflectance (ER)	%	7	7	7
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.98	1.14	2.09

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 10.21 W/m²

Summary of RTTV at West Elevations (House 3)  
= 5.26 + 0.92 + 10.21  
= 16.39 W/m²

# North Elevations (House 3)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 3) = 94.27 m²

Glazing Areas at North Elevations (House 3) = 12.62 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 12.62 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 3) = 81.64 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 81.64 m²

Window to Wall Ratio (WWR) = 12.62 / 94.27 = 0.13

Sheet no. 5

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 3)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 6 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)

Facade Orientation Facing North Gross Wall Area (Ao) = 94.27  
 Window to Wall Ratio (WWR) 0.13 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	81.64		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		7.43		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{7.43} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.008		
Glazing Area (A <sub>fi</sub> )	m²	12.62		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.65		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.11		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.11} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.008		
Glazing Area (A <sub>fi</sub> )	m²	12.62		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.40		
Visible Light Transmittance (VLT)	%	57		
External Reflectance (ER)	%	7		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		1.77		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{1.77} \quad \text{W/m}^2$$

**Summary of RTTV at North Elevations (House 3)**

$$= 7.43 + 0.11 + 1.77$$

$$= \underline{9.31} \quad \text{W/m}^2$$

East Elevations (House 3)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 3)	=	79.56 m²
Glazing Areas at East Elevations (House 3)	=	24.65 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( E-F1 )	=	24.65 m²
ECS	=	1.000

Opaque Wall Areas at East Elevations (House 3)	=	54.91 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( E-W1 )	=	54.91 m²

Window to Wall Ratio (WWR)	=	24.65 / 79.56	=	0.31
----------------------------	---	---------------	---	------

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 3)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/((Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	79.56
Window to Wall Ratio (WWR)	0.31	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	54.91		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.03		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.03 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.008		
Glazing Area (A <sub>fi</sub> )	m²	24.65		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.65		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.35		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.35 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.008		
Glazing Area (A <sub>fi</sub> )	m²	24.65		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.40		
Visible Light Transmittance (VLT)	%	57		
External Reflectance (ER)	%	7		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.55		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 5.55 W/m²

Summary of RTTV at East Elevations (House 3)  
= 8.03 + 0.35 + 5.55  
= 13.93 W/m²



# South Elevations (House 3)

Sheet no. 9

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 3) = 39.90 m²

Glazing Areas at South Elevations (House 3) = 32.49 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 32.49 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 3) = 7.42 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 7.42 m²

Window to Wall Ratio (WWR) = 32.49 / 39.90 = 0.81

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 3)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 10 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)

Facade Orientation Facing South Gross Wall Area (Ao) = 39.90  
 Window to Wall Ratio (WWR) 0.81 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	7.42		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		1.97		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{1.97} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.008		
Glazing Area (A <sub>fi</sub> )	m²	32.49		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.65		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.84		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.84} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.008		
Glazing Area (A <sub>fi</sub> )	m²	32.49		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.40		
Visible Light Transmittance (VLT)	%	57		
External Reflectance (ER)	%	7		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		13.26		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{13.26} \quad \text{W/m}^2$$

**Summary of RTTV at South Elevations (House 3)**

$$= 1.97 + 0.84 + 13.26$$

$$= \underline{16.06} \quad \text{W/m}^2$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)

Overall Gross Wall Area [a]319.87 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	106.14	5.26	0.92	10.21	16.39	5.44
North	94.27	7.43	0.11	1.77	9.31	2.74
East	79.56	8.03	0.35	5.55	13.93	3.46
South	39.90	1.97	0.84	13.26	16.06	2.00

Overall RTTV<sub>wall</sub> =13.65W/m²

<14W/m²OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 131.58 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	95%	0.9
AGT Tile (Brown)	5%	0.8
Average Absorptivity =		0.895

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 131.58 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 120.42 m²  
1/F = 22.43 m²  
Roof = 94.30 m²  
Upper Roof = 3.69 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 11.16 m²  
1/F = 5.12 m²  
Roof = 6.04 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$U_{w1} = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No.	13	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)		
Roof Orientation Facing	Flat	Gross Roof Area (Aro) =	131.58
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	120.42	11.16	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.27	0.27	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs

where i= 1, 2, ..., n

= 3.54 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

= 3.54 + 0.00 + 0.00

= 3.54 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)

Overall Roof Area [a]131.58 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	131.58	3.54	0.00	0.00	3.54	3.54

Overall RTTV<sub>roof</sub> =3.54W/m²

<4W/m²OK

RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 3)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd.	
	<input type="checkbox"/> 2. Architect	
	<input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>Wall</sub>								
Facade Orientation Facing	West	North	East	South				
Average Absorptivity	0.795	0.8	0.8	0.8				
Average Window to Wall Ratio	0.51	0.37	0.18	0.23				
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43				
Average Shading Coefficient of Facade	0.43	0.43	0.43	0.43				
Visible Light Transmittance	53 %	53 %	53 %	53 %	%	%	%	%
External Reflectance	17 %	17 %	17 %	17 %	%	%	%	%

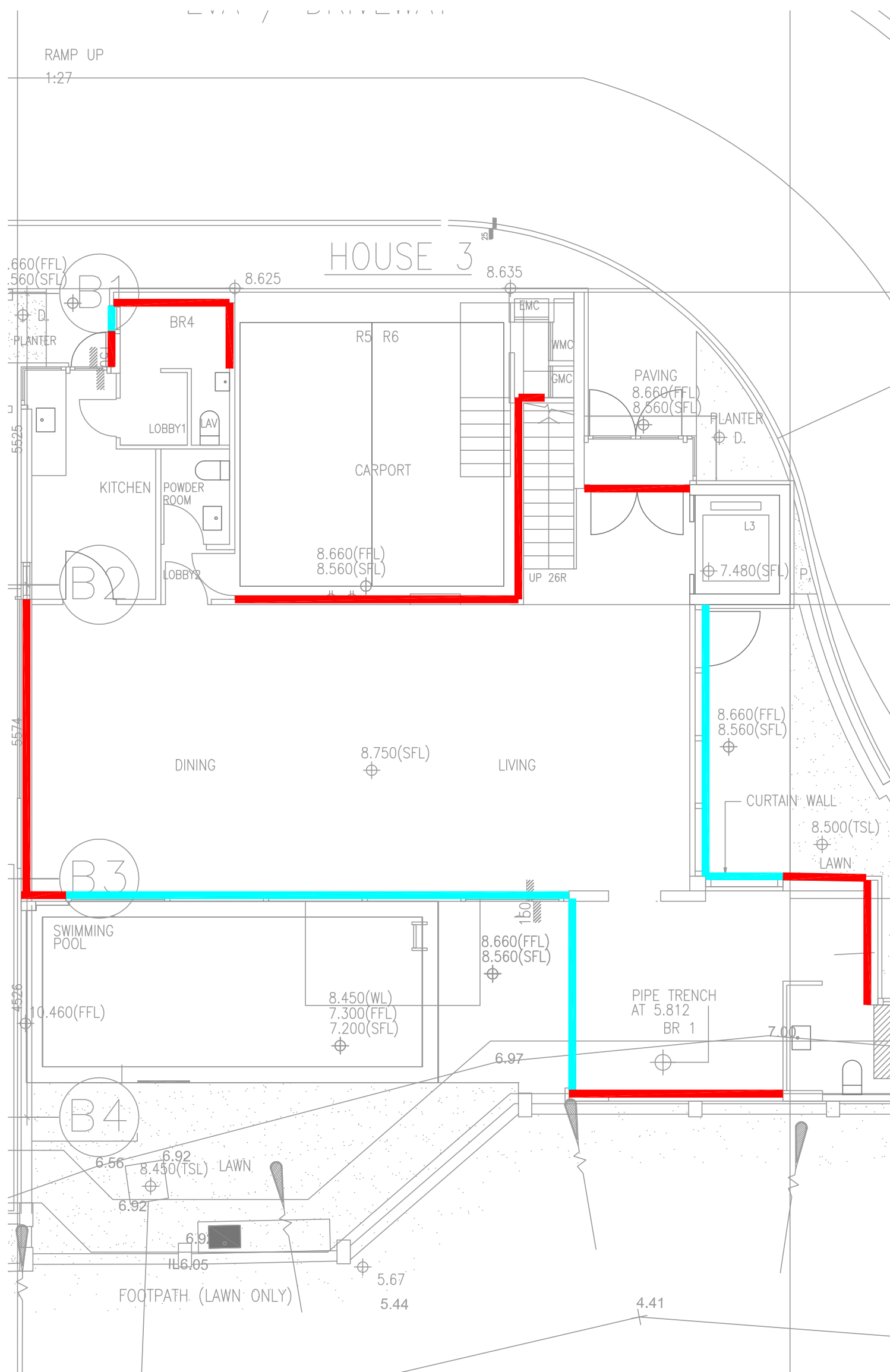
Table 2

RTTV <sub>Wall</sub>																						
Facade Orientation Facing		West				North				East				South								
Wall Orientation Factor		1.131				0.79				1.072				0.975								
Total External Wall Area (Residential Units)		120.0 m <sup>2</sup>		Window to Wall Ratio		63.1 m <sup>2</sup>		Window to Wall Ratio		46.4 m <sup>2</sup>		Window to Wall Ratio		78.1 m <sup>2</sup>		Window to Wall Ratio						
		61.73 m <sup>2</sup>		= 0.51		23.37 m <sup>2</sup>		= 0.37		8.25 m <sup>2</sup>		= 0.18		18.12 m <sup>2</sup>		= 0.23						
Heat Conduction	Opaque Wall	5.26 W/m <sup>2</sup>				7.43 W/m <sup>2</sup>				8.03 W/m <sup>2</sup>				1.97 W/m <sup>2</sup>								
	Window	0.92 W/m <sup>2</sup>				0.11 W/m <sup>2</sup>				0.35 W/m <sup>2</sup>				0.84 W/m <sup>2</sup>								
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %					
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.40	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %					
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %					
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No								
		External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
			Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Solar Radiation through Gazing		10.21 W/m <sup>2</sup>				1.77 W/m <sup>2</sup>				5.55 W/m <sup>2</sup>				13.26 W/m <sup>2</sup>								
Average Absorptivity		0.795				0.795				0.795				0.795								
RTTV <sub>Wall</sub> at each Facade		16.39 W/m <sup>2</sup>				9.31 W/m <sup>2</sup>				13.93 W/m <sup>2</sup>				16.06 W/m <sup>2</sup>								
Overall RTTV <sub>Wall</sub>						13.65 W/m <sup>2</sup>																

Table 3

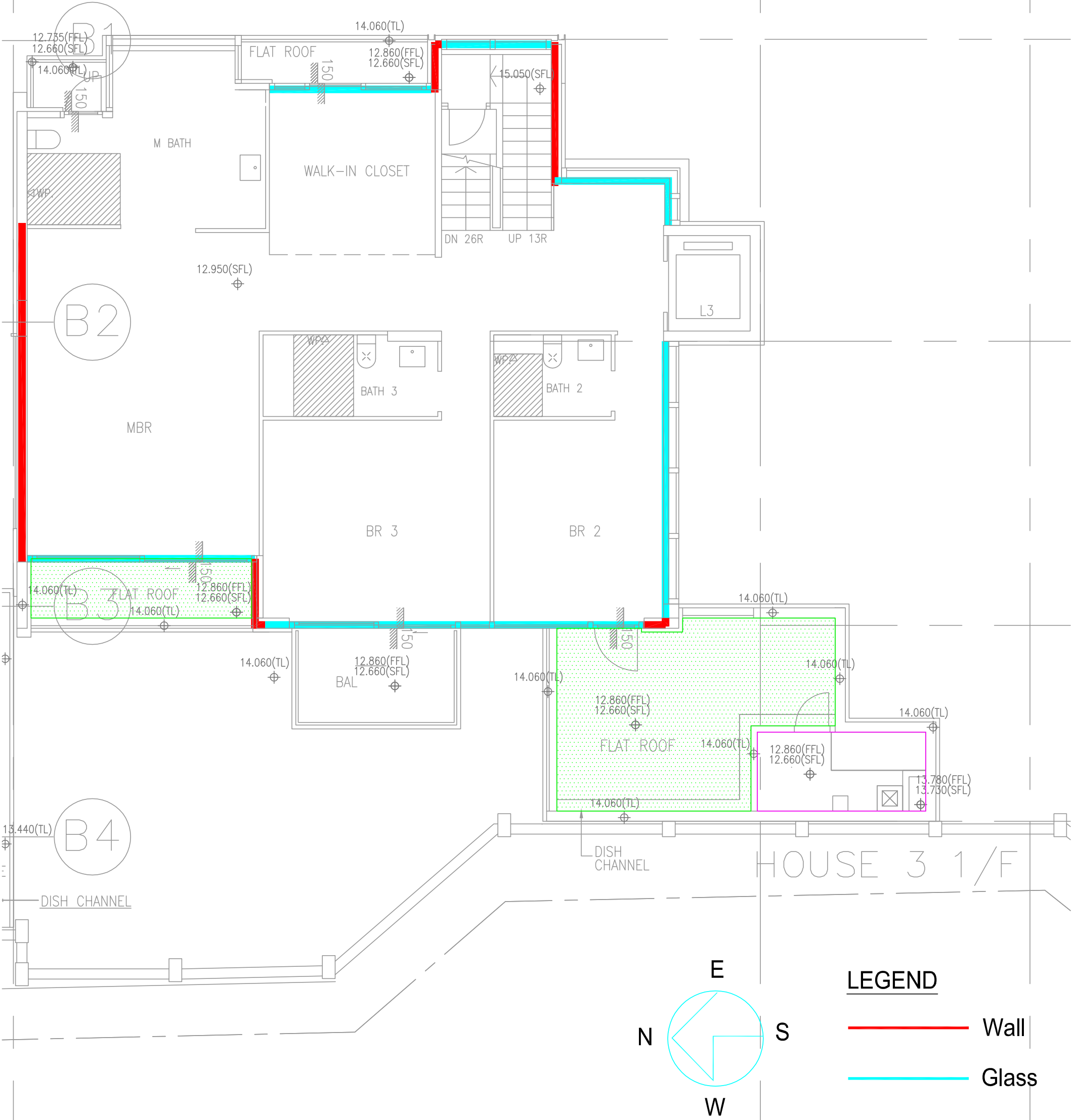
RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		131.58 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.54 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	Solar Radiation through Gazing		0 W/m <sup>2</sup>							
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.54 W/m <sup>2</sup>								

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



DRAWING TITLE: HOUSE 3 GROUND FLOOR PLAN  
SCALE: 1:150@A4

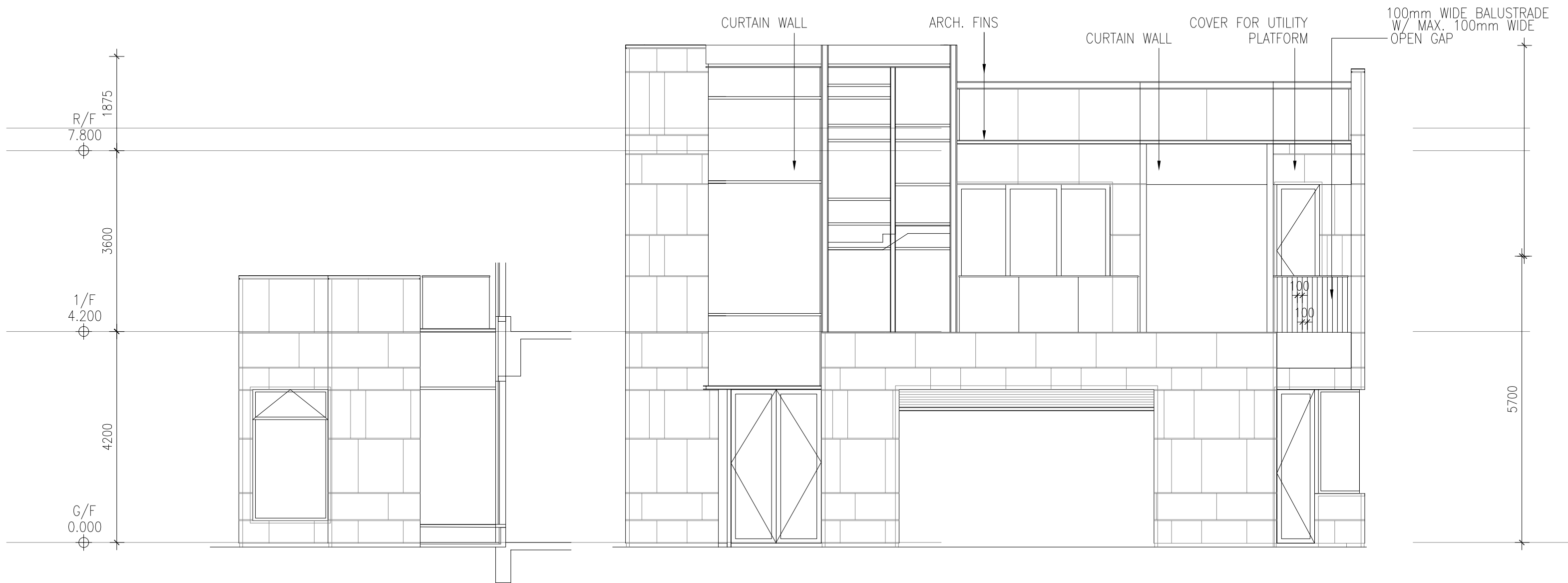




DRAWING TITLE: HOUSE 3 FIRST FLOOR PLAN

SCALE: 1:150@A4

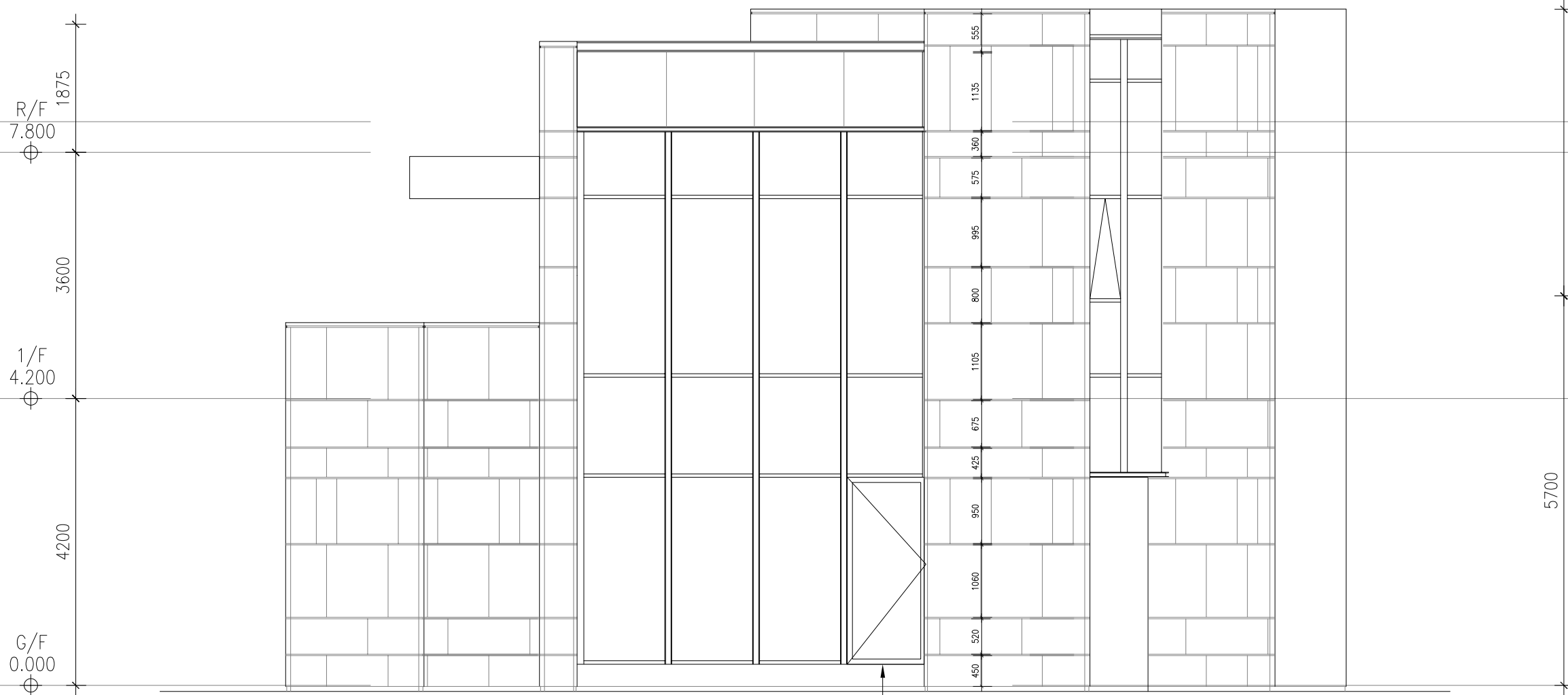




11 EAST ELEVATION 1:75  
HOUSE 3

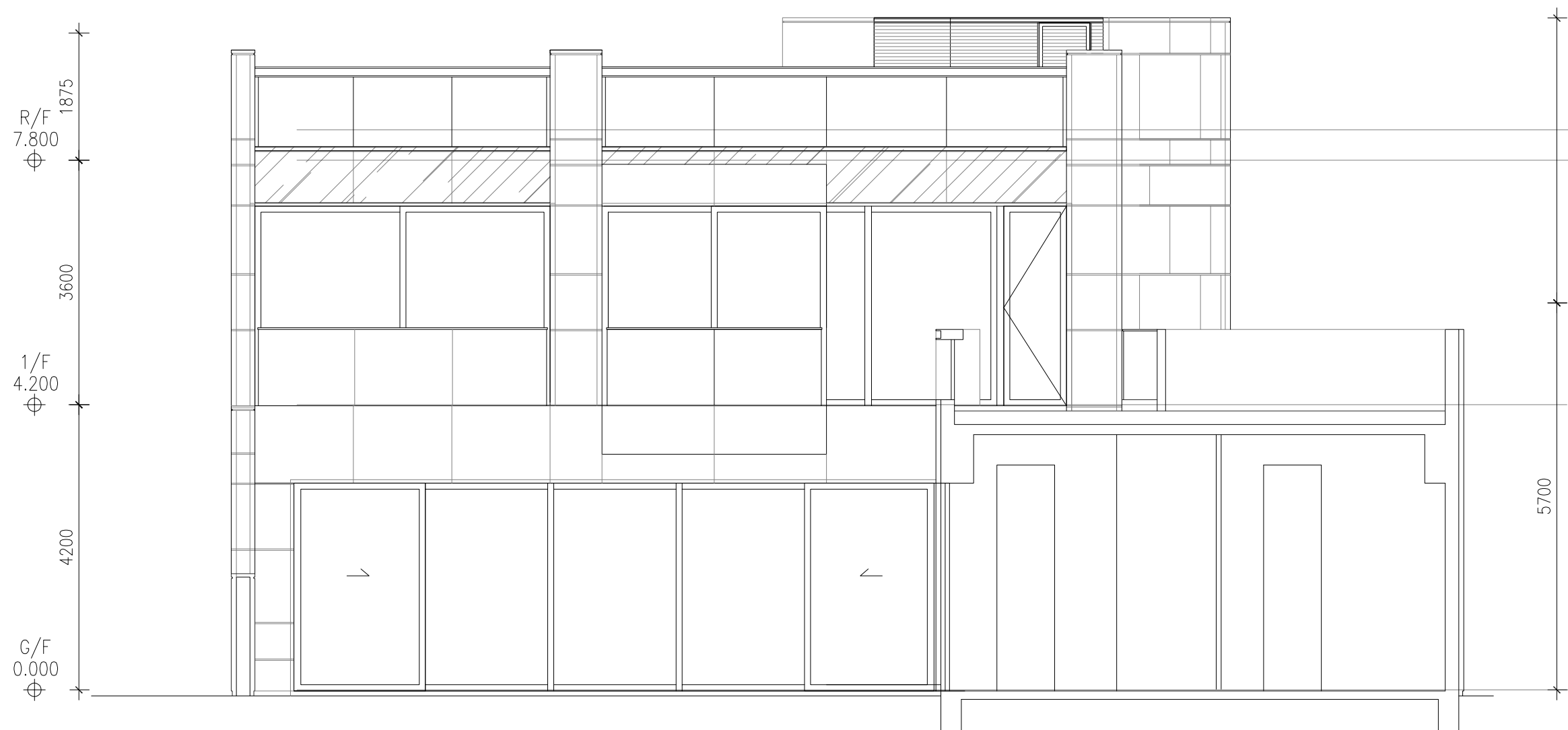
11 EAST ELEVATION 1:75  
HOUSE 3

CSK-3E1



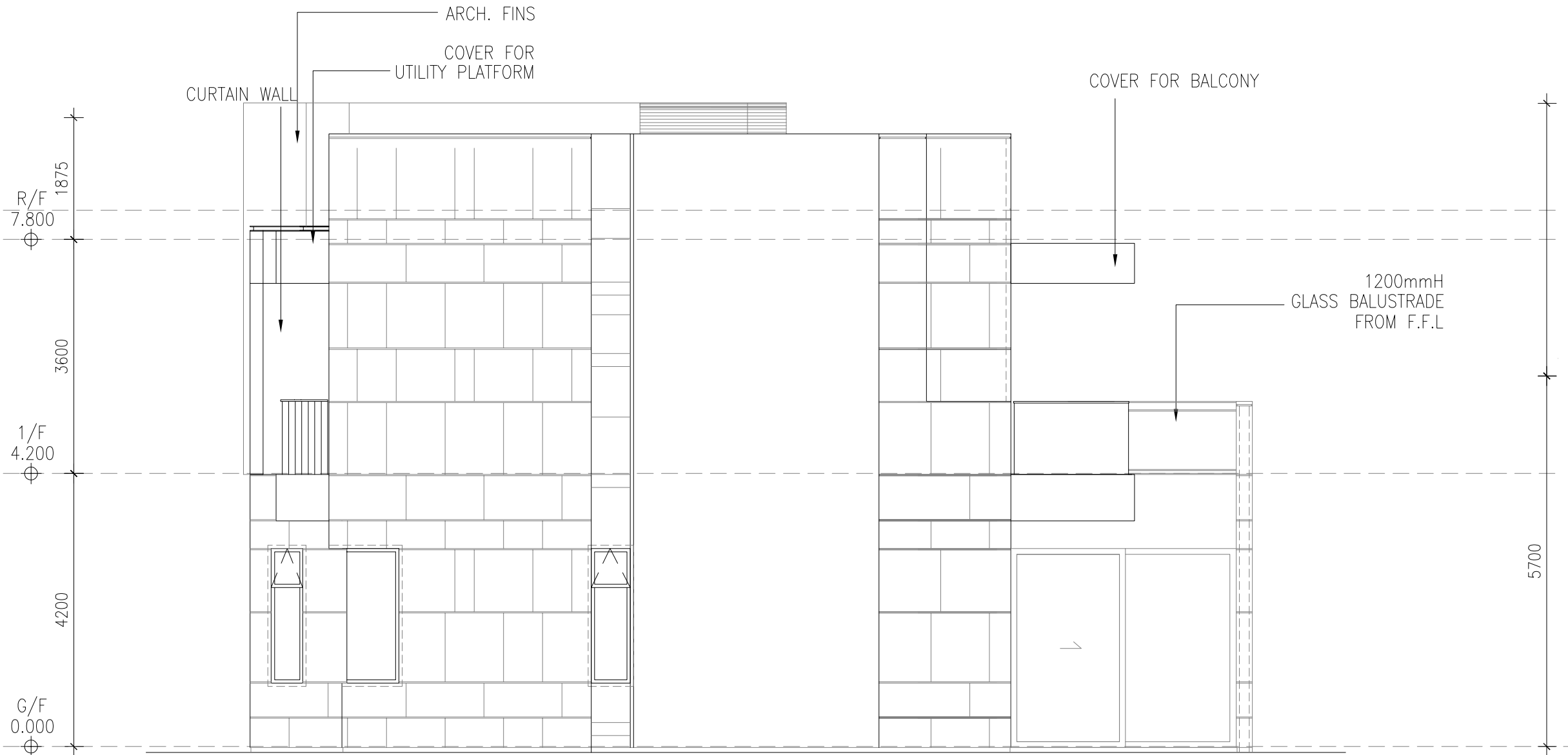
12 SOUTH ELEVATION 1:75  
HOUSE 3

CSK-3E2



12 WEST ELEVATION 1:75  
HOUSE 3

CSK-3E3



13 NORTH ELEVATION 1:75  
HOUSE 3

CSK-3E4

## RTTV Calculation (House 5)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

### West Elevations (House 5) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 13.40	)x 4.20 x 1 =	13.40 x 4.20 x 1 =	56.28 m <sup>2</sup>
1/F	( 10.70	)x 3.60 x 1 =	10.70 x 3.60 x 1 =	38.52 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 94.80 m<sup>2</sup>**

### North Elevations (House 5) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 8.00 + 1.50	)x 4.20 x 1 =	9.50 x 4.20 x 1 =	39.90 m <sup>2</sup>
1/F	( 3.60 + 5.90	)x 3.60 x 1 =	9.50 x 3.60 x 1 =	34.20 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 74.10 m<sup>2</sup>**

### East Elevations (House 5) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 4.55 + 8.20 + 2.00	)x 4.20 x 1 =	14.75 x 4.20 x 1 =	61.95 m <sup>2</sup>
1/F	( 8.05	)x 3.60 x 1 =	8.05 x 3.60 x 1 =	28.98 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 90.93 m<sup>2</sup>**

### South Elevations (House 5) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 12.00 + 1.50	)x 4.20 x 1 =	13.50 x 4.20 x 1 =	56.70 m <sup>2</sup>
1/F	( 6.70	)x 3.60 x 1 =	6.70 x 3.60 x 1 =	24.12 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 80.82 m<sup>2</sup>**

**Total Gross Wall Areas 340.65 m<sup>2</sup>**



## Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

### Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 5)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	9.90	)x	3.05	x	1	=	9.90	x 3.05 x 1 = 30.15 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	4.50	)x	2.66	x	1	=	4.50	x 2.66 x 1 = 11.95 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 42.09 m<sup>2</sup>**

### North Elevations (House 5)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	5.50 + 2.25	)x	3.05	x	1	=	7.75	x 3.05 x 1 = 23.60 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	1 + 5.40	)x	2.66	x	1	=	6.40	x 2.66 x 1 = 16.99 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 40.59 m<sup>2</sup>**

### East Elevations (House 5)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	2.60 + 2.00	)x	3.05	x	1	=	4.60	x 3.05 x 1 = 14.01 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	4.40	x 3.15 x 1 = 13.84 m <sup>2</sup>
G/F (Window GL02)	(		)x	0.86	x	1	=	0.00	x 0.86 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02)	(	2.20 + 2.20	)x	2.64	x	1	=	2.20	x 2.64 x 1 = 5.81 m <sup>2</sup>

**Gross Glazing Areas 33.65 m<sup>2</sup>**

### South Elevations (House 5)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	0.50 + 2.25 + 3.60	)x	3.05	x	1	=	6.35	x 3.05 x 1 = 19.34 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(		)x	2.66	x	1	=	0.00	x 2.66 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 19.34 m<sup>2</sup>**

**Total Gross Glazing Areas 135.67 m<sup>2</sup>**

# West Elevations (House 5)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 5) = 94.80 m<sup>2</sup>

Glazing Areas at West Elevations (House 5) = 42.09 m<sup>2</sup>

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 14.20 m<sup>2</sup>  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m<sup>2</sup>  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m<sup>2</sup>  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m<sup>2</sup>  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m<sup>2</sup>  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F4 ) = 6.41 m<sup>2</sup>  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 2.10 x 3.05 = 6.41 m<sup>2</sup>  
SPF 6.00 / 2.10 = 2.86 ECS = 0.955

Opaque Wall Areas at West Elevations (House 5) = 52.71 m<sup>2</sup>

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 52.71 m<sup>2</sup>

Window to Wall Ratio (WWR) = 42.09 / 94.80 = 0.44

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 5)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x<sub>1</sub>/k<sub>1</sub>+x<sub>2</sub>/k<sub>2</sub>+...+x<sub>n</sub>/k<sub>n</sub>+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-W1

Description:

RC Wall Areas

Wall Material			
External surface film resistance	Ro	=	0.044
Air space resistance	Ra	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	Ri	=	0.12
Total			0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m<sup>2</sup>K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)

Facade Orientation Facing West Gross Wall Area (Ao) = 94.80  
 Window to Wall Ratio (WWR) 0.44 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	52.71		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		6.83		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i = 1, 2, \dots, n$$

$$= \underline{\underline{6.83}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing					
Components / Details		Code No.			
Description	Units	W-F1	W-F2	W-F3	W-F4
Glazing Type		Tinted	Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	14.20	9.61	11.88	6.41
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.19	0.13	0.16	0.09

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i = 1, 2, \dots, n$$

$$= \underline{\underline{0.56}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing					
Components / Details		Code No.			
Description	Units	W-F1	W-F2	W-F3	W-F4
Glazing Type		Tinted	Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	14.20	9.61	11.88	6.41
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53	53
External Reflectance (ER)	%	17	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99	0.96
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		3.04	1.37	2.52	1.31

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i = 1, 2, \dots, n$$

$$= \underline{\underline{8.24}} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 5)**

$$= 6.83 + 0.56 + 8.24$$

$$= \underline{\underline{15.62}} \quad \text{W/m}^2$$

# North Elevations (House 5)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 5) = 74.10 m²

Glazing Areas at North Elevations (House 5) = 40.59 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 33.73 m²  
ECS = 1.000

Glazing Areas Shaded by Built-Fin (Projection on Left) ( N-F2 ) = 6.86 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 2.25 x 3.05 = 6.86 m²  
SPF 3.40 / 2.25 = 1.51 ECS = 0.977

Opaque Wall Areas at North Elevations (House 5) = 33.51 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 33.51 m²

Window to Wall Ratio (WWR) = 40.59 / 74.10 = 0.55

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 5)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	74.10
Window to Wall Ratio (WWR)	0.55	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	33.51		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		3.88		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 3.88 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1	N-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	33.73	6.86	
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.40	0.08	

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.48 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1	N-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	33.73	6.86	
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	
Visible Light Transmittance (VLT)	%	53	53	
External Reflectance (ER)	%	17	17	
External Shading Multiplier (ESC)		1.00	0.98	
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.46	1.28	

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 7.74 W/m²

Summary of RTTV at North Elevations (House 5)  
= 3.88 + 0.48 + 7.74  
= 12.10 W/m²

# East Elevations (House 5)

Sheet no. 7

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 5) = 90.93 m²

Glazing Areas at East Elevations (House 5) = 33.65 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 25.69 m²  
ECS = 1.000

Glazing Areas Shaded by Built-Fin (Projection on Right) ( N-F2 ) = 7.96 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 2.61 x 3.05 = 7.96 m²  
SPF 7.80 / 3.00 = 2.60 ECS = 0.795

Opaque Wall Areas at East Elevations (House 5) = 57.28 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 57.28 m²

Window to Wall Ratio (WWR) = 33.65 / 90.93 = 0.37

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 5)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	90.93
Window to Wall Ratio (WWR)	0.37	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	57.28		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		7.33		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 7.33 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1	N-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	25.69	7.96	
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.34	0.10	

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.44 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1	N-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	25.69	7.96	
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	
Visible Light Transmittance (VLT)	%	53	53	
External Reflectance (ER)	%	17	17	
External Shading Multiplier (ESC)		1.00	0.80	
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.44	1.34	

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 6.78 W/m²

Summary of RTTV at East Elevations (House 5)  
= 7.33 + 0.44 + 6.78  
= 14.55 W/m²

# South Elevations (House 5)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 5) = 80.82 m²

Glazing Areas at South Elevations (House 5) = 19.34 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 1.65 m²  
ECS = 1.000

Glazing Areas Shaded by Built-Fin (Projection on left) ( S-F2 ) = 17.69 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 5.80 x 3.05 = 17.69 m²  
SPF 10.70 / 6.00 = 1.78 ECS = 0.816

Opaque Wall Areas at South Elevations (House 5) = 61.48 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 61.48 m²

Window to Wall Ratio (WWR) = 19.34 / 80.82 = 0.24

Sheet no. 9

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 5)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 10 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)

Facade Orientation Facing South Gross Wall Area (Ao) = 80.82  
Window to Wall Ratio (WWR) 0.24 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	61.48		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.05		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.05 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1	S-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	1.65	17.69	
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.02	0.24	

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.26 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1	S-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	1.65	17.69	
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	
Visible Light Transmittance (VLT)	%	53	53	
External Reflectance (ER)	%	17	17	
External Shading Multiplier (ESC)		1.00	0.82	
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		0.36	3.13	

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 3.48 W/m²

Summary of RTTV at South Elevations (House 5)  
= 8.05 + 0.26 + 3.48  
= 11.79 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)

Overall Gross Wall Area [a]340.65 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	94.80	6.83	0.56	8.24	15.62	4.35
North	74.10	3.88	0.48	7.74	12.10	2.63
East	90.93	7.33	0.44	6.78	14.55	3.88
South	80.82	8.05	0.26	3.48	11.79	2.80

Overall RTTV<sub>wall</sub> =13.66W/m²

<14W/m²OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 169.39 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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)

OpaqueAreas at Roof = 169.39 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 157.71 m²  
1/F = 29.04 m²  
Roof = 93.57 m²  
Upper Roof = 35.10 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 11.68 m²  
1/F = 5.61 m²  
Roof = 6.07 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

Uw1 = 1 / 1.858 = 0.54 W/m²K

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

Uw1 = 1 / 1.836 = 0.54 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 169.39  
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (α <sub>wi</sub> )	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (U <sub>ri</sub> )	W/m²K	0.53	0.53	
Opaque Roof Area (A <sub>ri</sub> )	m²	157.71	11.68	
Heat Conduction = 3.47(A <sub>ri</sub> /A <sub>ro</sub> ) U <sub>ri</sub> a <sub>ri</sub> Gs		3.33	0.22	

Heat Conduction through Opaque Roof = 3.47(A<sub>ri</sub>/A<sub>ro</sub>) U<sub>ri</sub> a<sub>ri</sub> Gs where i= 1, 2, ..., n  
= 3.55 W/m²

Part 2 - Calculation of Heat Conduction through Skylight					
Components / Details		Code No.			
Description	Units	S1			
Skylight Glazing Type		-			
Thickness	m	-			
Skylight Area (A <sub>si</sub> )	m²	0.00			
U-value of Skylight Glazing (U <sub>si</sub> )	W/m²K	-			
Heat Conduction = 0.40 (A <sub>si</sub> /A <sub>ro</sub> ) U <sub>si</sub> G <sub>s</sub>		0.00			

Heat Conduction through Skylight = 0.40 (A<sub>si</sub>/A<sub>ro</sub>) U<sub>si</sub> G<sub>s</sub> 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 (A <sub>si</sub> )	m²	0.00			
Shading Coefficient of Skylight Glazing (SC <sub>r</sub> )		-			
Visible Light Transmittance (VLT)		-			
External Reflectance (ER)		-			
Solar Radiation = 41.10 (A <sub>si</sub> /A <sub>ro</sub> ) (SC <sub>ri</sub> ) G <sub>s</sub>		0.00			

Solar Radiation through Skylight = 41.10 (A<sub>si</sub>/A<sub>ro</sub>) (SC<sub>ri</sub>) G<sub>s</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Summary of RTTV at Roof  
= 3.55 + 0.00 + 0.00  
= 3.55 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)

Overall Roof Area [a]

169.39 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	169.39	3.55	0.00	0.00	3.55	3.55

Overall RTTV<sub>roof</sub> =

3.55

W/m²

<

4

W/m²

OK

RTTV Summary Sheet

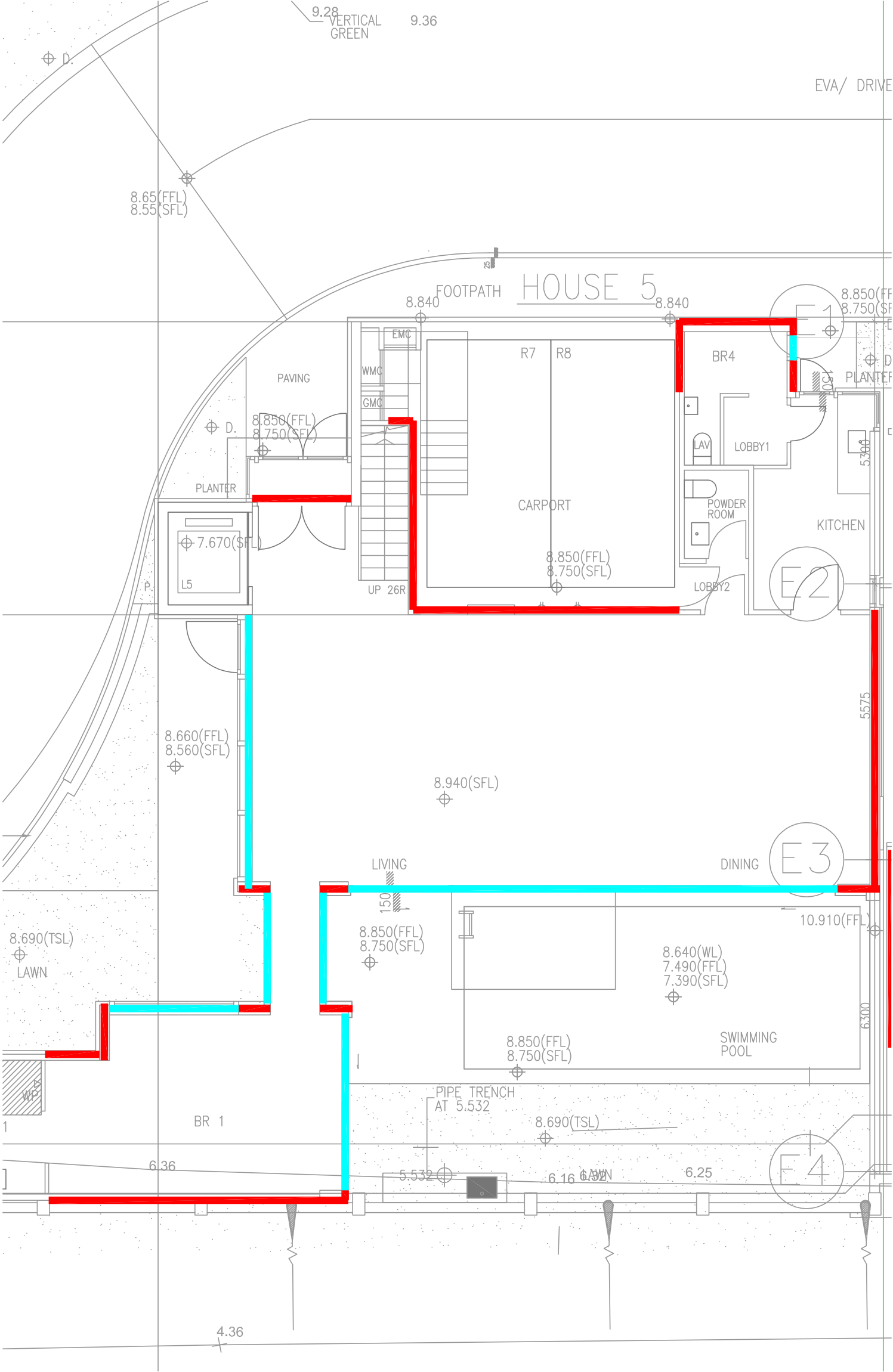
Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 5)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd.	
	<input type="checkbox"/> 2. Architect	
	<input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Deemed to Satisfy RTTV <sub>Wall</sub>									
Facade Orientation Facing	West		North		East		South		
Average Absorptivity	0.795		0.8		0.8		0.8		
Average Window to Wall Ratio	0.51		0.37		0.18		0.23		
Shading Coefficient of Glazing	0.43		0.43		0.43		0.43		
Average Shading Coefficient of Facade	0.43		0.43		0.43		0.43		
Visible Light Transmittance	53 %		53 %		53 %		53 %		
External Reflectance	17 %		17 %		17 %		17 %		

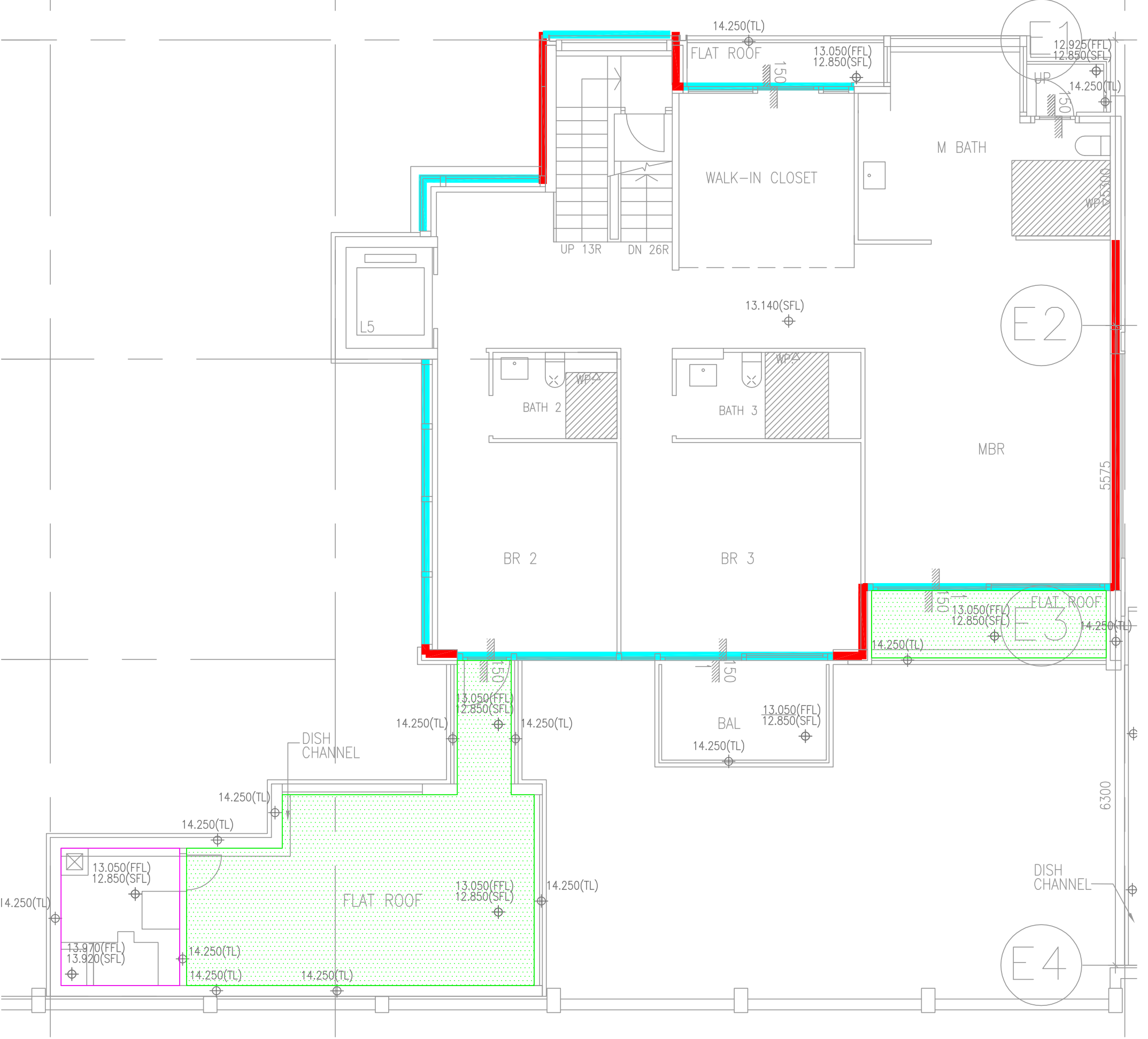
Table 2																									
Facade Orientation Facing		West						North						East				South							
Wall Orientation Factor		1.131						0.79						1.072				0.975							
Total External Wall Area (Residential Units)		120.0 m <sup>2</sup>		Window to Wall Ratio				63.1 m <sup>2</sup>		Window to Wall Ratio				46.4 m <sup>2</sup>		Window to Wall Ratio				78.1 m <sup>2</sup>		Window to Wall Ratio			
Total Window Area		61.73 m <sup>2</sup>		= 0.51				23.37 m <sup>2</sup>		= 0.37				8.25 m <sup>2</sup>		= 0.18				18.12 m <sup>2</sup>		= 0.23			
Heat Conduction	Opaque Wall	6.83 W/m <sup>2</sup>						3.88 W/m <sup>2</sup>						7.33 W/m <sup>2</sup>				8.05 W/m <sup>2</sup>							
	Window	0.56 W/m <sup>2</sup>						0.48 W/m <sup>2</sup>						0.44 W/m <sup>2</sup>				0.26 W/m <sup>2</sup>							
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %				
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %				
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %				
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No							
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No							
	Solar Radiation through Gazing		8.24 W/m <sup>2</sup>						7.74 W/m <sup>2</sup>						6.78 W/m <sup>2</sup>				3.48 W/m <sup>2</sup>						
	Average Absorptivity		0.795						0.795						0.795				0.795						
	RTTV <sub>Wall</sub> at each Facade		15.62 W/m <sup>2</sup>						12.10 W/m <sup>2</sup>						14.55 W/m <sup>2</sup>				11.79 W/m <sup>2</sup>						
Overall RTTV <sub>Wall</sub>		13.66 W/m <sup>2</sup>																							

Table 3										
RTTV <sub>Roof</sub>										
Roof Orientation Factor										
Total Roof Area (Residential Units)		2.16 169.39		m <sup>2</sup>						
Total Skylight Area		0		m <sup>2</sup>						
Heat Conduction	Roof	3.55		W/m <sup>2</sup>						
	Skylight	0		W/m <sup>2</sup>						
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes	<input type="checkbox"/> No							
	External Shading	<input type="checkbox"/> Yes	<input type="checkbox"/> No							
	Solar Radiation through Gazing		0		W/m <sup>2</sup>					
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.55		W/m <sup>2</sup>						

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



DRAWING TITLE: HOUSE 5 GROUND FLOOR PLAN  
SCALE: 1:150@A4



N

E

S

W

HOUSE 5 1/F

LEGEND

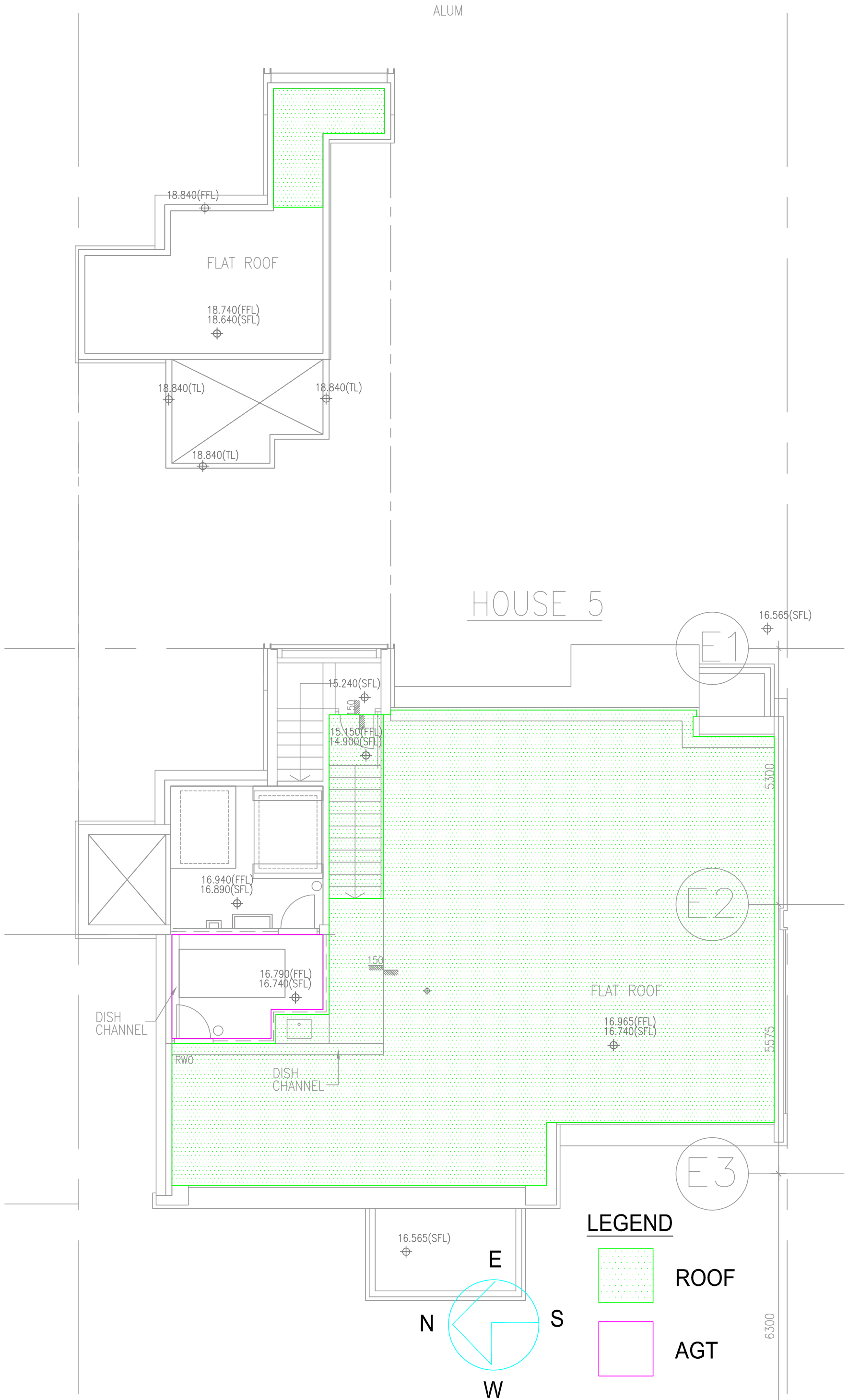
Wall

Glass

DRAWING TITLE: HOUSE 5 FIRST FLOOR PLAN

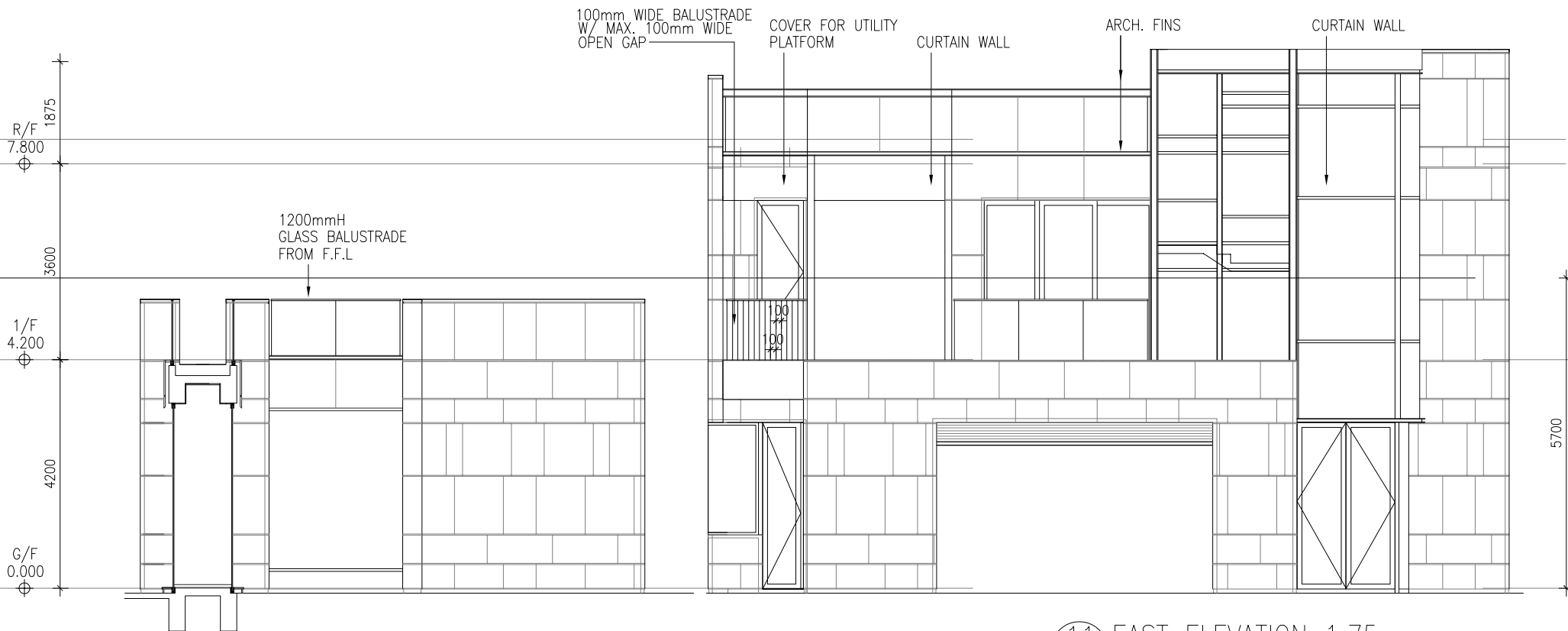
SCALE: 1:150@A4





DRAWING TITLE: HOUSE 5 ROOF FLOOR PLAN

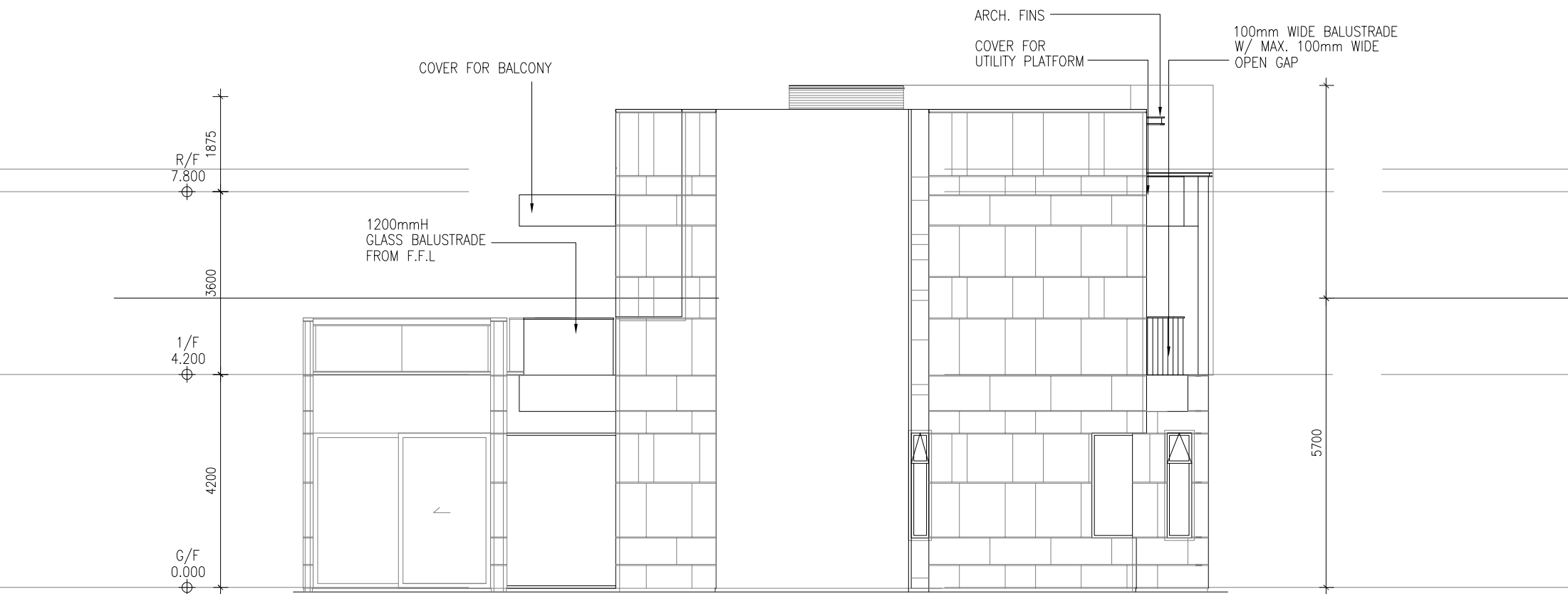
SCALE: 1:150@A4



10 EAST ELEVATION 1:75  
— HOUSE 5

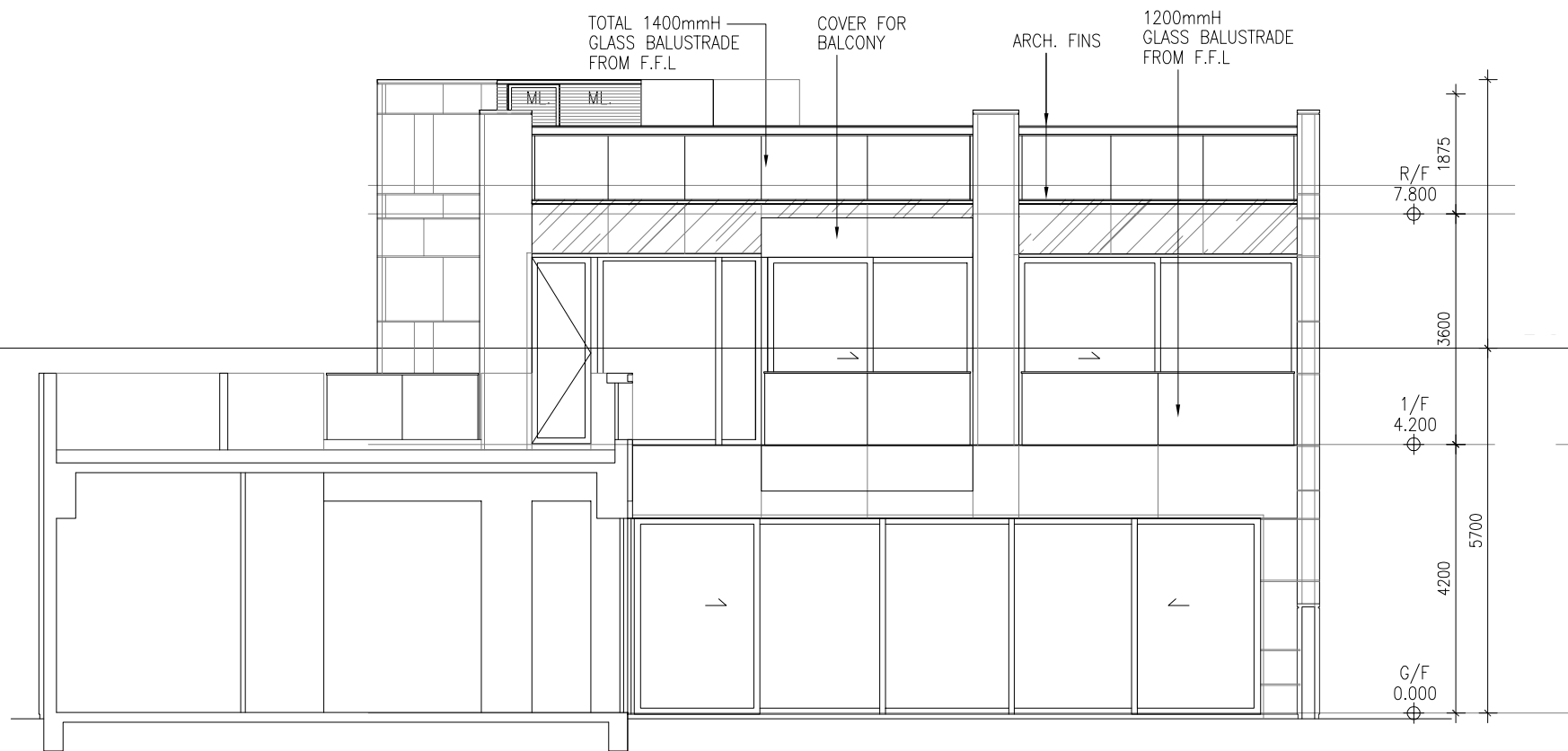
11 EAST ELEVATION 1:75  
— HOUSE 5

CSK-5E1



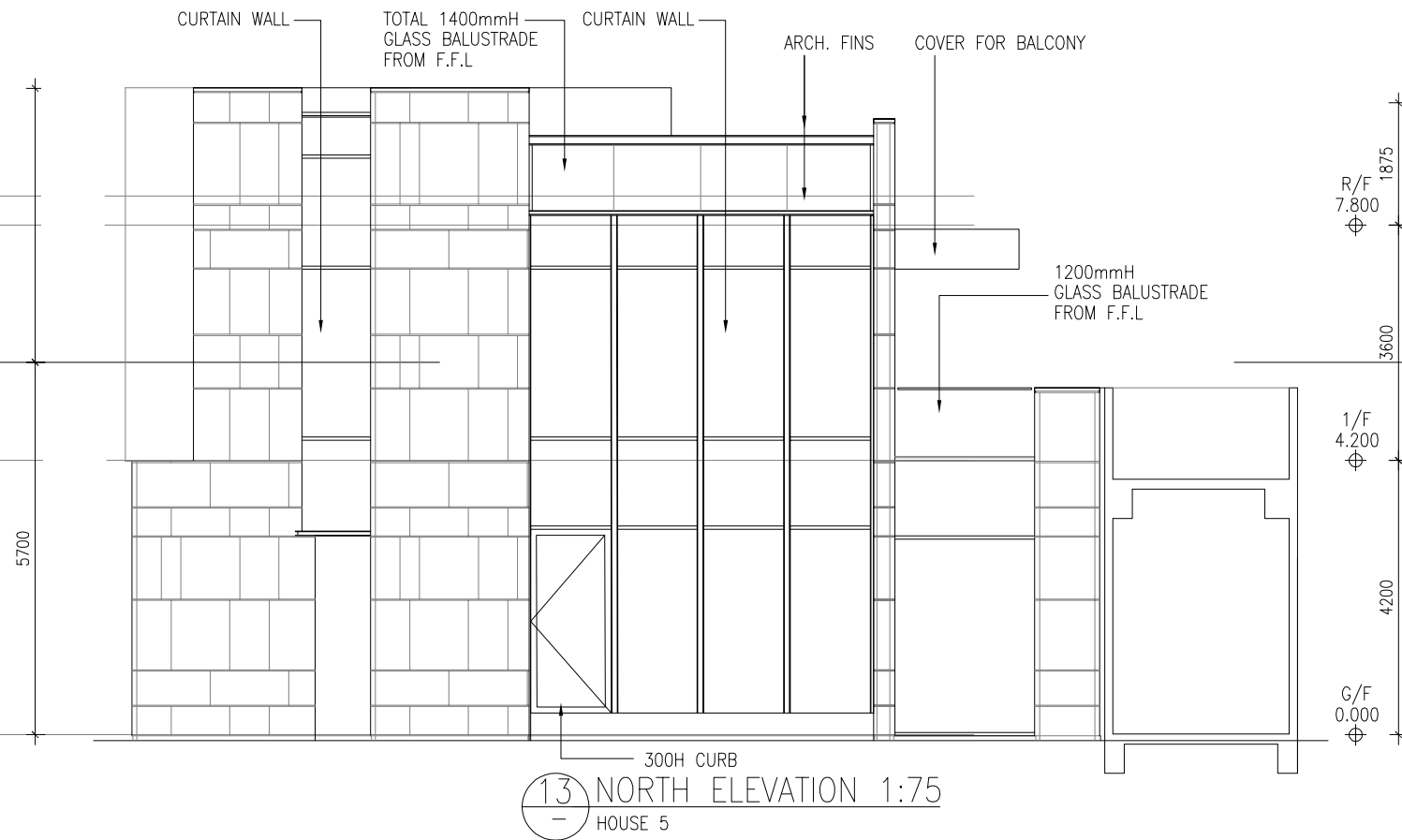
12 SOUTH ELEVATION 1:75  
HOUSE 5

CSK-5E2



14 WEST ELEVATION 1:75  
HOUSE 5

CSK-5E3



CSK-5E4

## RTTV Calculation (House 6)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

### West Elevations (House 6) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 12.00	)x 4.20 x 1 =	12.00 x 4.20 x 1 =	50.40 m <sup>2</sup>
1/F	( 12.70	)x 3.60 x 1 =	12.70 x 3.60 x 1 =	45.72 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 96.12 m<sup>2</sup>**

### North Elevations (House 6) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 1.50 + 9.50 + 2.60	)x 4.20 x 1 =	13.60 x 4.20 x 1 =	57.12 m <sup>2</sup>
1/F	( 8.60 + 0.90	)x 3.60 x 1 =	9.50 x 3.60 x 1 =	34.20 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 91.32 m<sup>2</sup>**

### East Elevations (House 6) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 8.20	)x 4.20 x 1 =	8.20 x 4.20 x 1 =	34.44 m <sup>2</sup>
1/F	( 5.80 + 0.80	)x 3.60 x 1 =	6.60 x 3.60 x 1 =	23.76 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 58.20 m<sup>2</sup>**

### South Elevations (House 6) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 13.50 + 1.10	)x 4.20 x 1 =	14.60 x 4.20 x 1 =	61.32 m <sup>2</sup>
1/F	( 6.50	)x 3.60 x 1 =	6.50 x 3.60 x 1 =	23.40 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 84.72 m<sup>2</sup>**

**Total Gross Wall Areas 330.36 m<sup>2</sup>**

## Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

### Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 6)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	9.90	)x	3.05	x	1	=	9.90	x 3.05 x 1 = 30.15 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	7.50	)x	2.66	x	1	=	7.50	x 2.66 x 1 = 19.91 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 50.06 m<sup>2</sup>**

### North Elevations (House 6)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	5.30 + 2.60	)x	3.05	x	1	=	7.90	x 3.05 x 1 = 24.06 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	2.80 + 5.40	)x	2.66	x	1	=	8.20	x 2.66 x 1 = 21.77 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 45.83 m<sup>2</sup>**

### East Elevations (House 6)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	2.90	)x	3.05	x	1	=	2.90	x 3.05 x 1 = 8.83 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
G/F (Window GL02)	(		)x	0.86	x	1	=	0.00	x 0.86 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02)	(	0.70 + 2.20 + 3.10	)x	2.64	x	1	=	2.90	x 2.64 x 1 = 7.66 m <sup>2</sup>

**Gross Glazing Areas 16.49 m<sup>2</sup>**

### South Elevations (House 6)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	0.55 + 3.80	)x	3.05	x	1	=	4.35	x 3.05 x 1 = 13.25 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(		)x	2.66	x	1	=	0.00	x 2.66 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 13.25 m<sup>2</sup>**

**Total Gross Glazing Areas 125.62 m<sup>2</sup>**



# West Elevations (House 6)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 6) = 96.12 m²

Glazing Areas at West Elevations (House 6) = 50.06 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 28.57 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 6) = 46.06 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 46.06 m²

Window to Wall Ratio (WWR) = 50.06 / 96.12 = 0.52

Sheet no. 3

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 6)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)

Facade Orientation Facing West Gross Wall Area (Ao) = 96.12  
 Window to Wall Ratio (WWR) 0.52 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	46.06		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> Gw		5.88		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{5.88} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	50.06	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> Gw		0.66	0.13	0.16

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.94} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	28.57	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>fi</sub> )(ESC <sub>wi</sub> )Gw		6.04	1.35	2.48

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{9.87} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 6)**

$$= 5.88 + 0.94 + 9.87$$

$$= \underline{16.69} \quad \text{W/m}^2$$

North Elevations (House 6)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 6)	=	91.32 m²
Glazing Areas at North Elevations (House 6)	=	45.83 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( N-F1 )	=	45.83 m²
ECS	=	1.000

Opaque Wall Areas at North Elevations (House 6)	=	45.49 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( N-W1 )	=	45.49 m²

Window to Wall Ratio (WWR) = 45.83 / 91.32 = 0.50

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 6)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	91.32
Window to Wall Ratio (WWR)	0.50	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	45.49		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.27		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 4.27 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.83		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.44		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.44 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.83		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		7.12		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 7.12 W/m²

Summary of RTTV at North Elevations (House 6)  
= 4.27 + 0.44 + 7.12  
= 11.83 W/m²

# East Elevations (House 6)

Sheet no. 7

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 6) = 58.20 m²

Glazing Areas at East Elevations (House 6) = 16.49 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 16.49 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 6) = 41.71 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 41.71 m²

Window to Wall Ratio (WWR) = 16.49 / 58.20 = 0.28

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 6)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	58.20
Window to Wall Ratio (WWR)	0.28	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	41.71		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.34		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.34 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	16.49		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.34		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.34 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	16.49		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.45		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 5.45 W/m²

Summary of RTTV at East Elevations (House 6)  
= 8.34 + 0.34 + 5.45  
= 14.13 W/m²

## South Elevations (House 6)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 6) = 84.72 m<sup>2</sup>

Glazing Areas at South Elevations (House 6) = 13.25 m<sup>2</sup>

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 13.25 m<sup>2</sup>  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 6) = 71.47 m<sup>2</sup>

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 71.47 m<sup>2</sup>

Window to Wall Ratio (WWR) = 13.25 / 84.72 = 0.16

Sheet no. 9

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 6)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

### 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)

R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)

R<sub>a</sub> Air space resistance (Refer to Table 3)

x Thickness of building materials

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

### S-W1

Description:

RC Wall Areas

Wall Material			
External surface film resistance	R <sub>o</sub>	=	0.044
Air space resistance	R <sub>a</sub>	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	R <sub>i</sub>	=	0.12
Total			0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	10	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)		
Facade Orientation Facing	South	Gross Wall Area (Ao) =	84.72
Window to Wall Ratio (WWR)	0.16	Wall Orientation Factor (Gw) =	0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	71.47		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.93		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.93 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	13.25		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.17		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.17 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	13.25		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		2.74		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 2.74 W/m²

Summary of RTTV at South Elevations (House 6)  
= 8.93 + 0.17 + 2.74  
= 11.84 W/m²



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)

Overall Gross Wall Area [a]330.36 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	96.12	5.88	0.94	9.87	16.69	4.86
North	91.32	4.27	0.44	7.12	11.83	3.27
East	58.20	8.34	0.34	5.45	14.13	2.49
South	84.72	8.93	0.17	2.74	11.84	3.04

Overall RTTV<sub>wall</sub> =13.65W/m²

<14W/m²OK

Roof

Sheet no. 12

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 165.63 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 165.63 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 153.97 m²  
1/F = 25.11 m²  
Roof = 93.76 m²  
Upper Roof = 35.10 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 11.66 m²  
1/F = 5.59 m²  
Roof = 6.07 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$U_{w1} = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 165.63  
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(a)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	153.97	11.66	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.32	0.22	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs where i= 1, 2, ..., n  
= 3.55 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  
= 3.55 + 0.00 + 0.00  
= 3.55 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)

Overall Roof Area [a]

165.63 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	165.63	3.55	0.00	0.00	3.55	3.55

Overall RTTV<sub>roof</sub> =

3.55

W/m²

<

4

W/m²

OK

RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 6)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd.	
	<input type="checkbox"/> 2. Architect	
	<input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>wall</sub>								
Facade Orientation Facing	West	North	East	South				
Average Absorptivity	0.795	0.8	0.8	0.8				
Average Window to Wall Ratio	0.51	0.37	0.18	0.23				
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43				
Average Shading Coefficient of Facade	0.43	0.43	0.43	0.43				
Visible Light Transmittance	53 %	53 %	53 %	53 %	%	%	%	%
External Reflectance	17 %	17 %	17 %	17 %	%	%	%	%

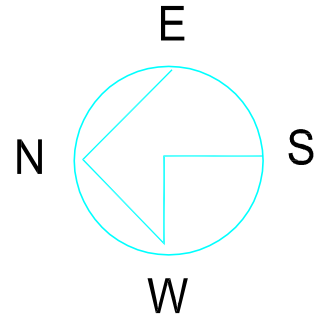
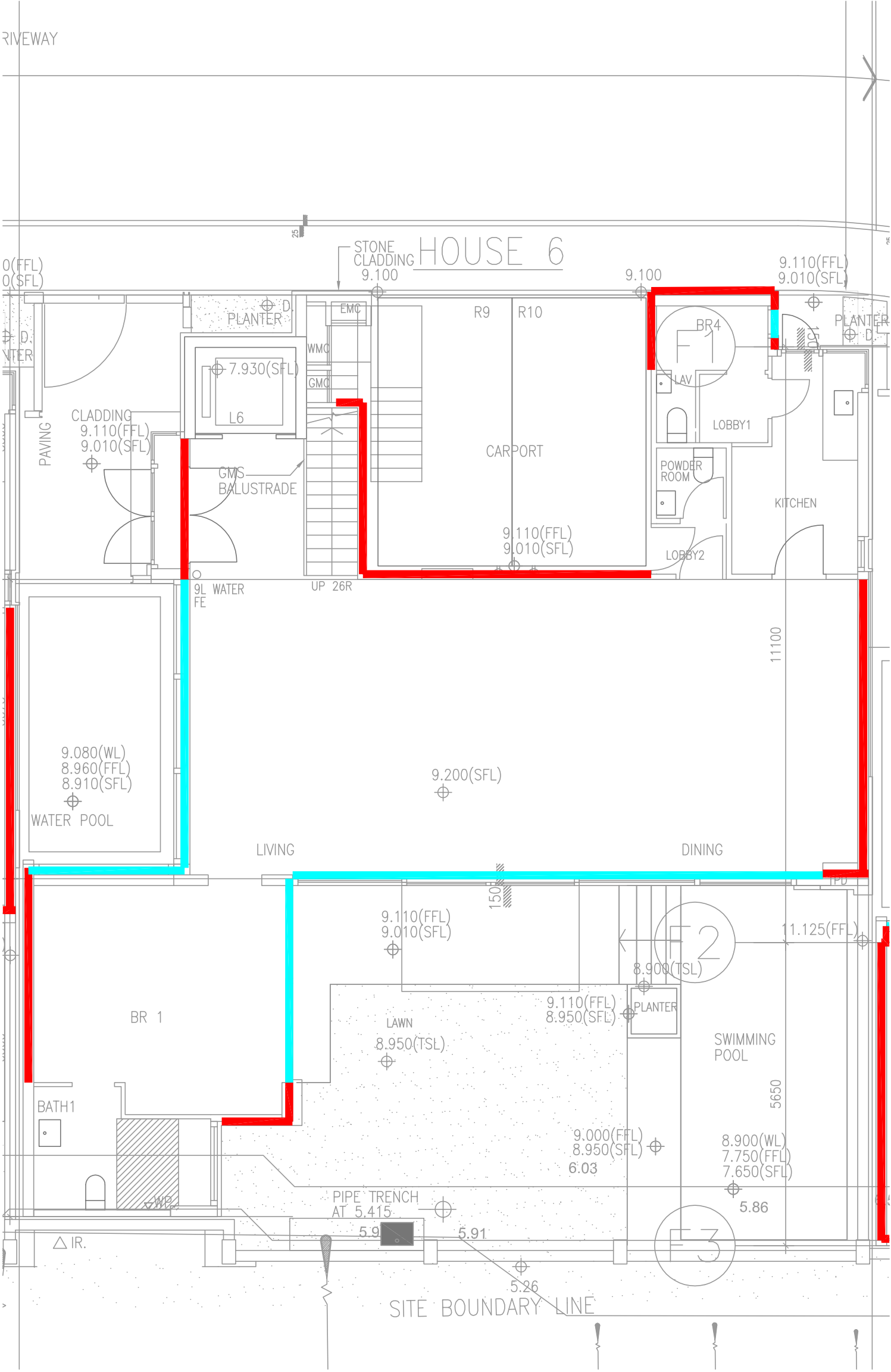
Table 2

RTTV <sub>Wall</sub>																		
Facade Orientation Facing		West				North				East				South				
Wall Orientation Factor		1.131				0.79				1.072				0.975				
Total External Wall Area (Residential Units)		120.0 m <sup>2</sup>		Window to Wall Ratio		63.1 m <sup>2</sup>		Window to Wall Ratio		46.4 m <sup>2</sup>		Window to Wall Ratio		78.1 m <sup>2</sup>		Window to Wall Ratio		
		Total Window Area				61.73 m <sup>2</sup>				23.37 m <sup>2</sup>				8.25 m <sup>2</sup>				18.12 m <sup>2</sup>
Total Window Area		61.73 m <sup>2</sup>		= 0.51		23.37 m <sup>2</sup>		= 0.37		8.25 m <sup>2</sup>		= 0.18		18.12 m <sup>2</sup>		= 0.23		
Heat Conduction	Opaque Wall	5.88 W/m <sup>2</sup>				4.27 W/m <sup>2</sup>				8.34 W/m <sup>2</sup>				8.93 W/m <sup>2</sup>				
	Window	0.94 W/m <sup>2</sup>				0.44 W/m <sup>2</sup>				0.34 W/m <sup>2</sup>				0.17 W/m <sup>2</sup>				
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
	Solar Radiation through Gazing		9.87 W/m <sup>2</sup>				7.12 W/m <sup>2</sup>				5.45 W/m <sup>2</sup>				2.74 W/m <sup>2</sup>			
Average Absorptivity		0.795				0.795				0.795				0.795				
RTTV <sub>Wall</sub> at each Facade		16.69 W/m <sup>2</sup>				11.83 W/m <sup>2</sup>				14.13 W/m <sup>2</sup>				11.84 W/m <sup>2</sup>				
Overall RTTV <sub>Wall</sub>		13.65 W/m <sup>2</sup>																

Table 3

RTTV <sub>Roof</sub>									
Roof Orientation Factor		2.16							
Total Roof Area (Residential Units)		165.53 m <sup>2</sup>							
Total Skylight Area		0 m <sup>2</sup>							
Heat Conduction	Roof	3.55 W/m <sup>2</sup>							
	Skylight	0 W/m <sup>2</sup>							
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No							
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No							
	Solar Radiation through Gazing		0 W/m <sup>2</sup>						
Average Absorptivity (Roof)		0.8							
Overall RTTV <sub>Roof</sub>		3.55 W/m <sup>2</sup>							

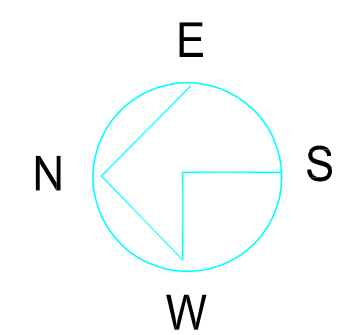
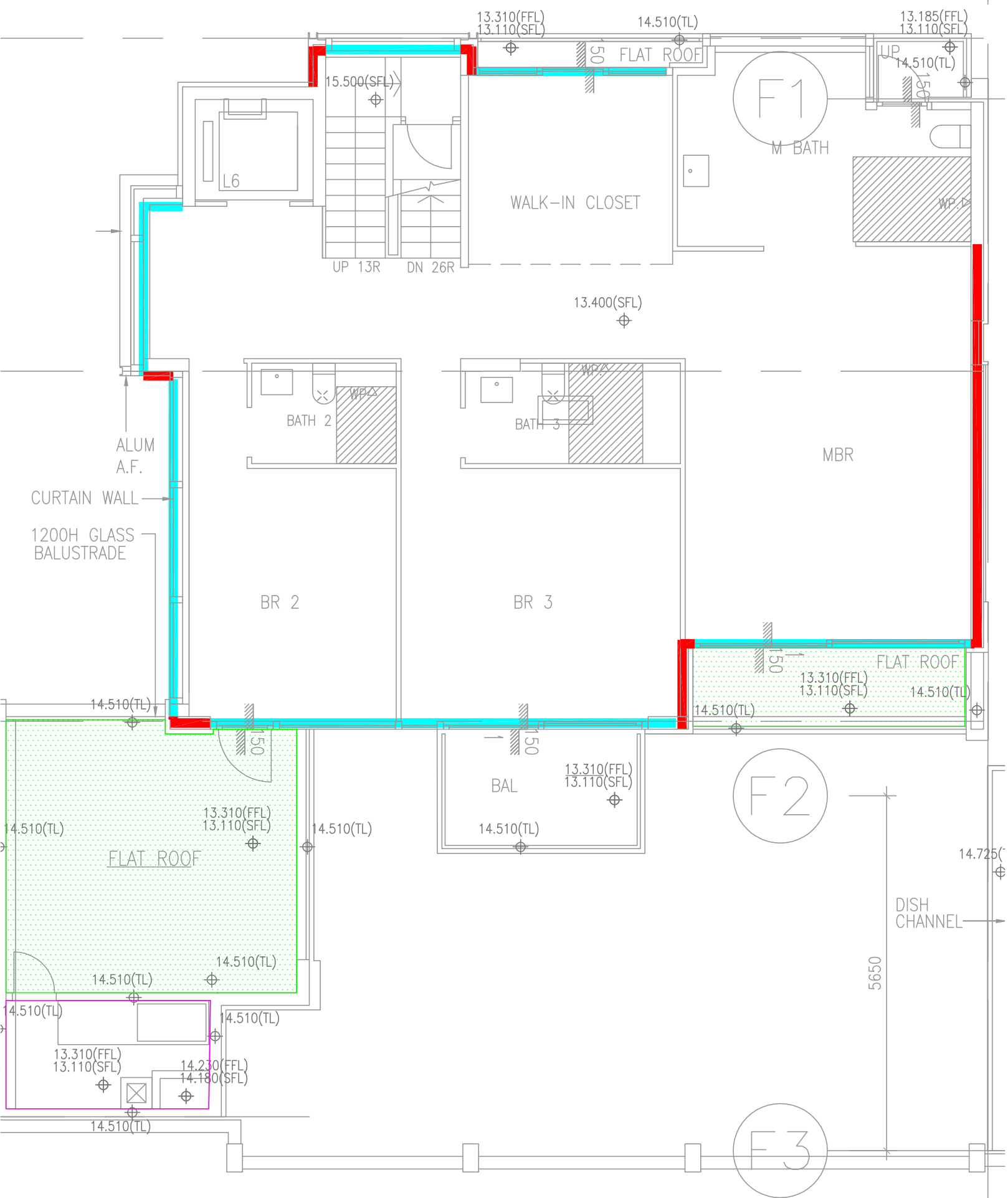
ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



**LEGEND**

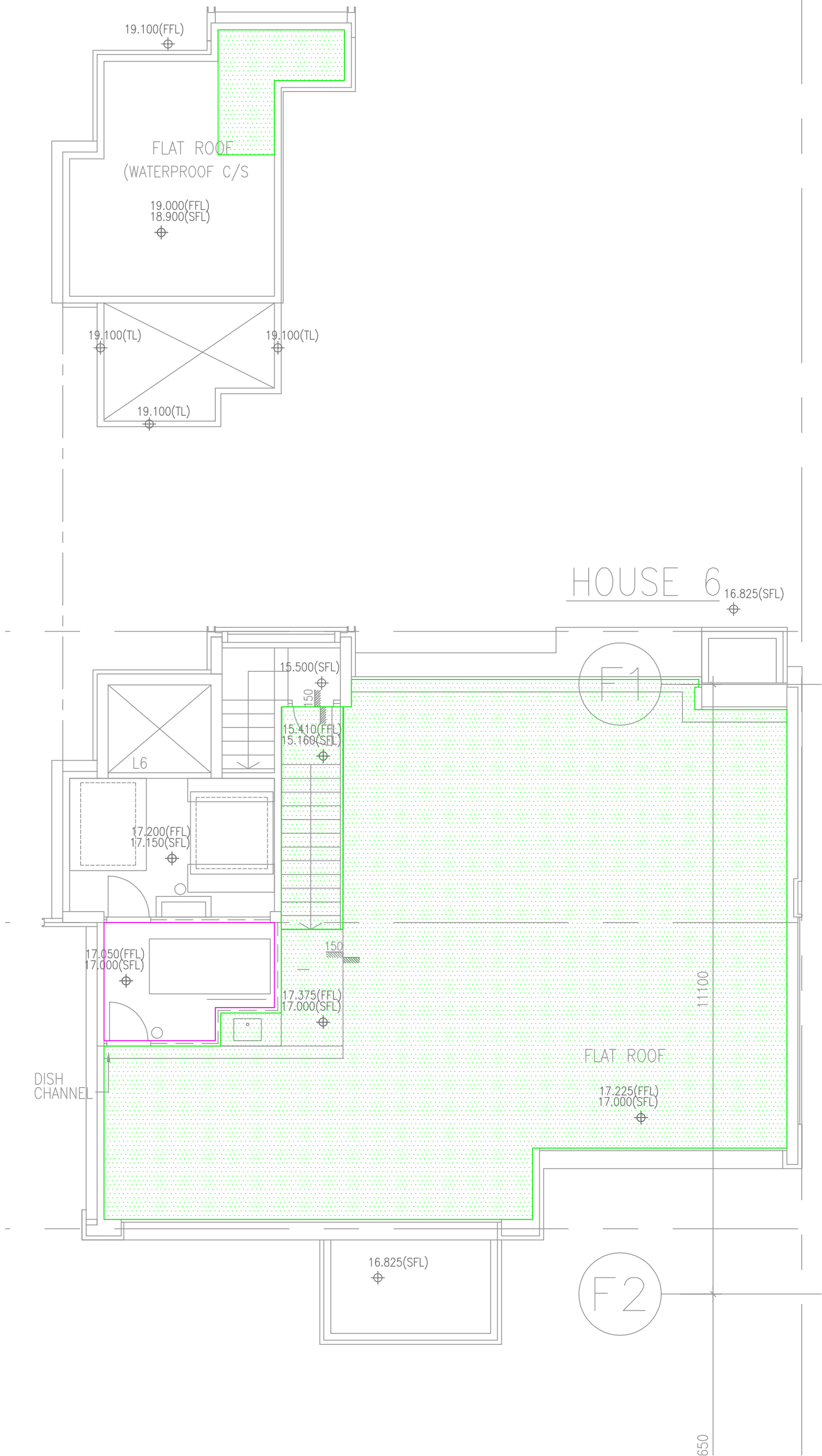
- Wall
- Glass

**DRAWING TITLE: HOUSE 6 GROUND FLOOR PLAN**  
SCALE: 1:150@A4



- LEGEND**
- Wall
  - Glass

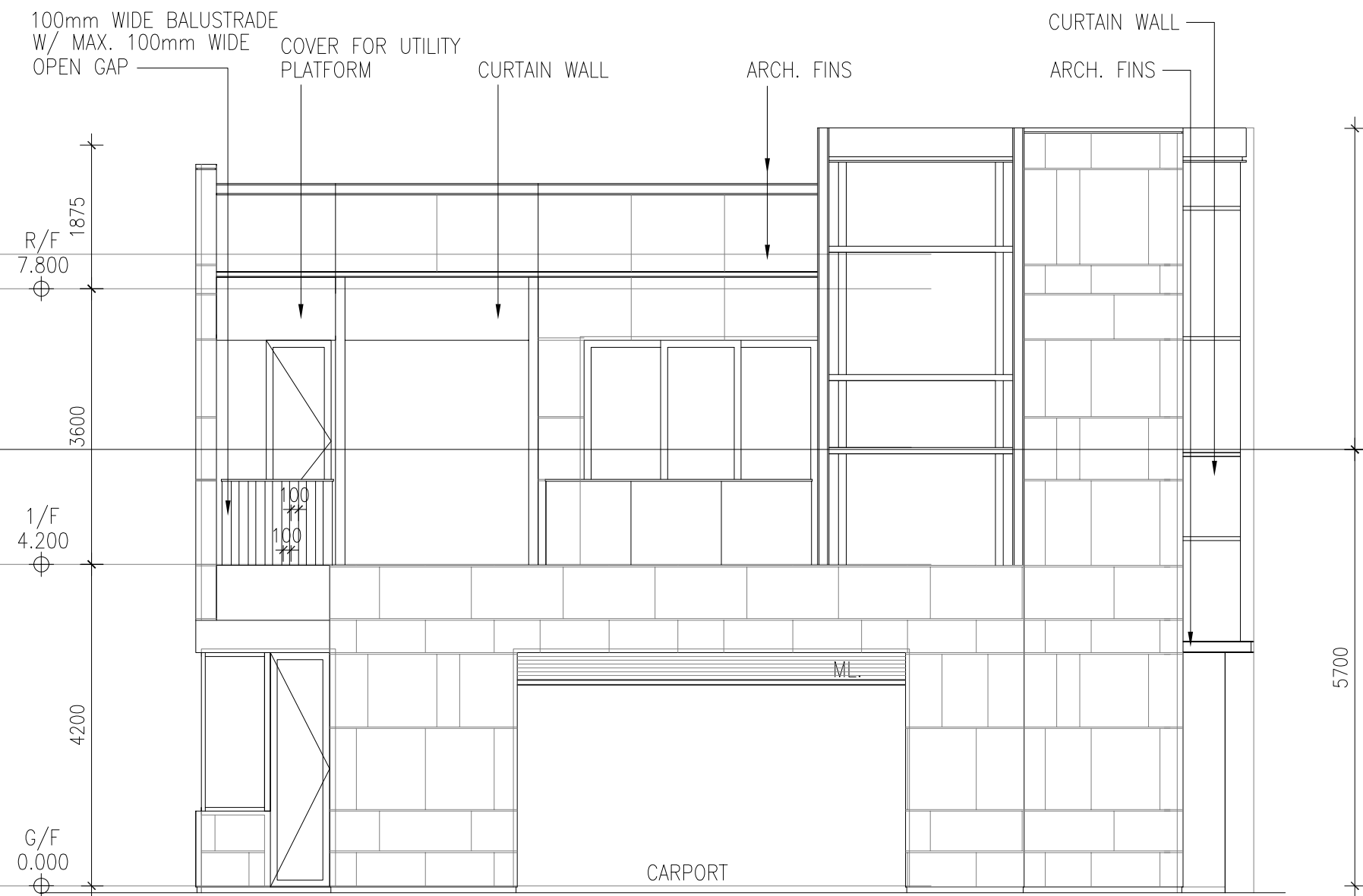
**DRAWING TITLE: HOUSE 6 FIRST FLOOR PLAN**  
SCALE: 1:150@A4



DRAWING TITLE: HOUSE 6 ROOF FLOOR PLAN

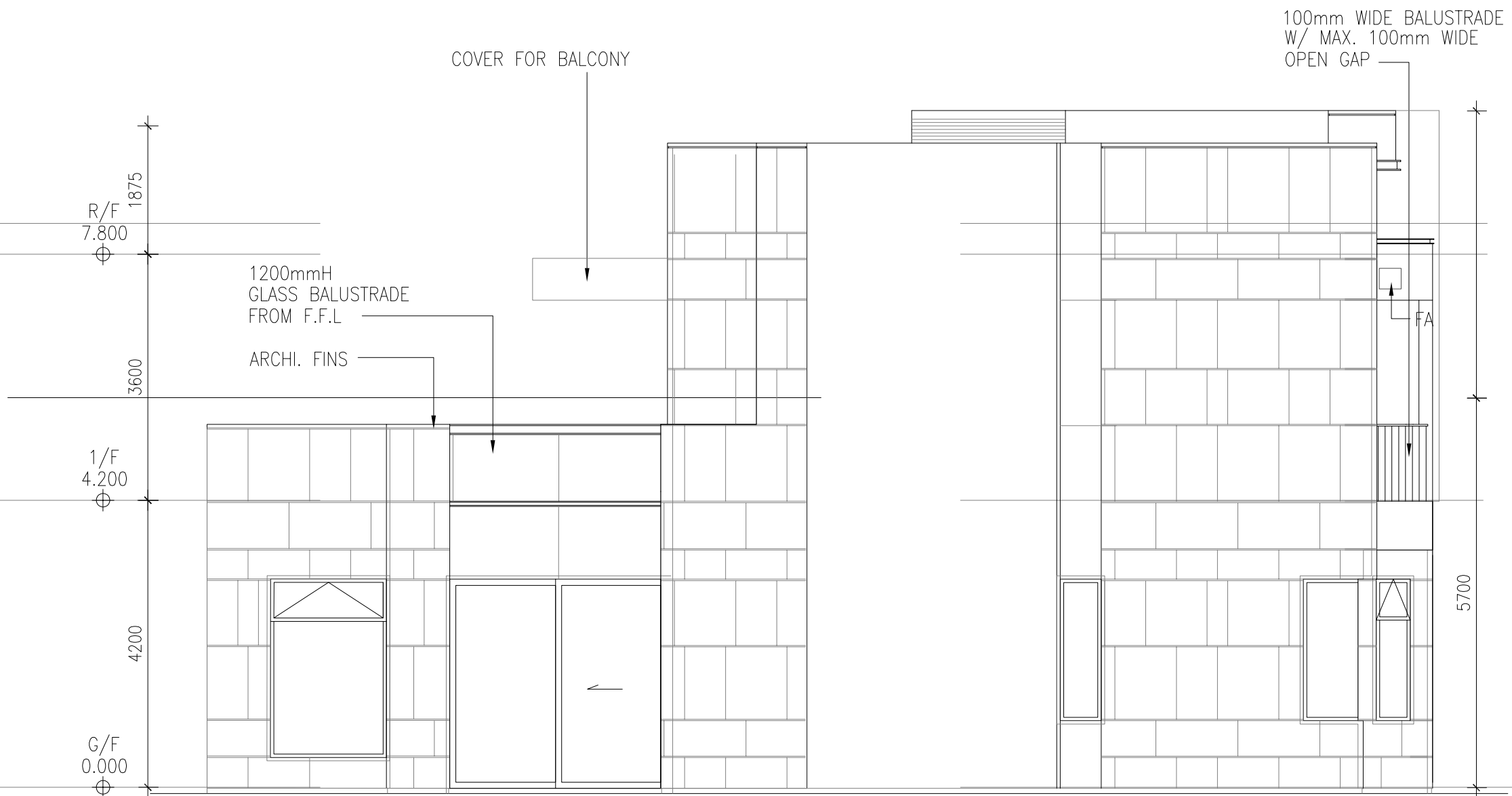
SCALE: 1:150@A4





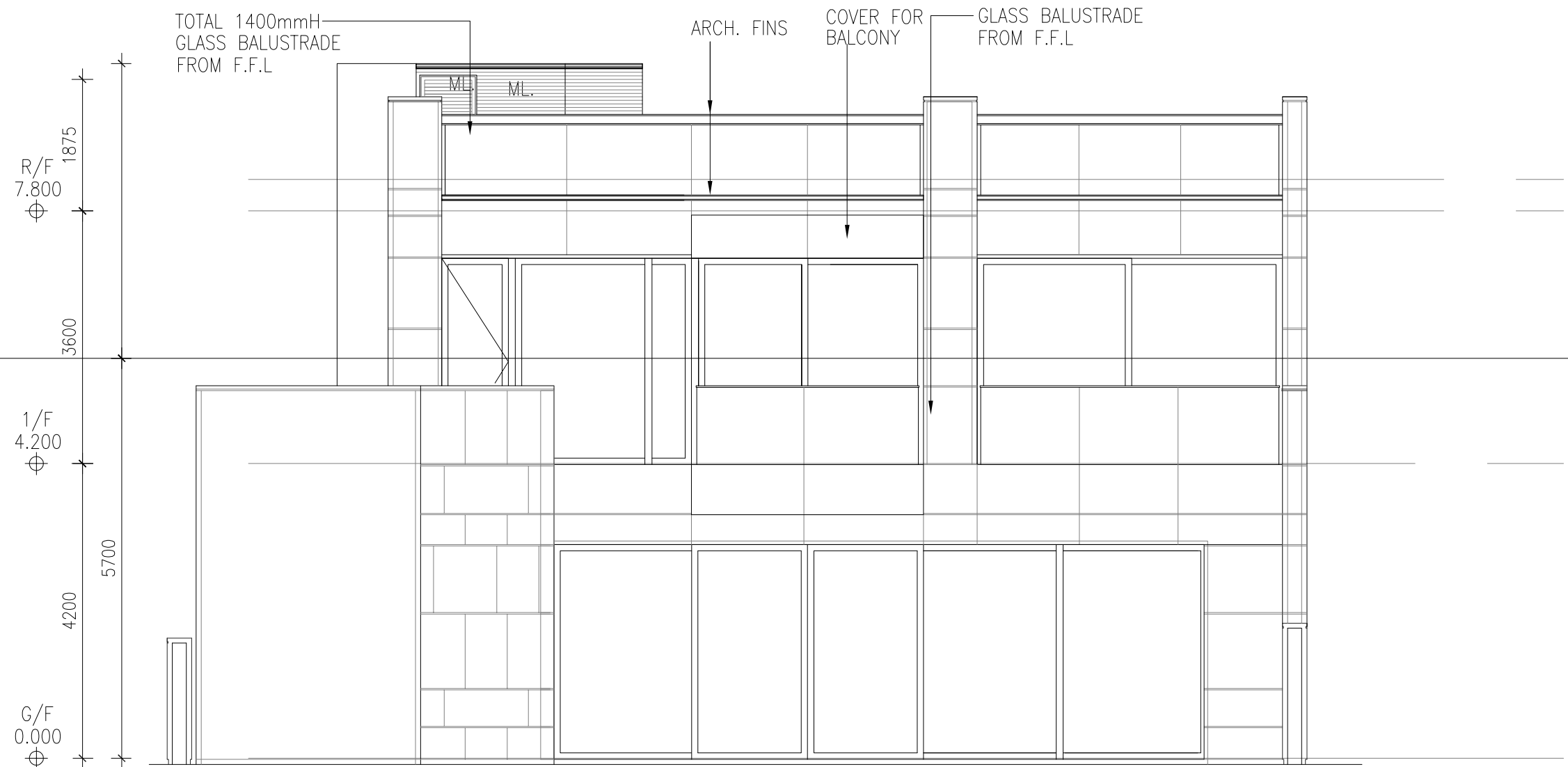
1 EAST ELEVATION 1:75  
— HOUSE 6

CSK-6E1



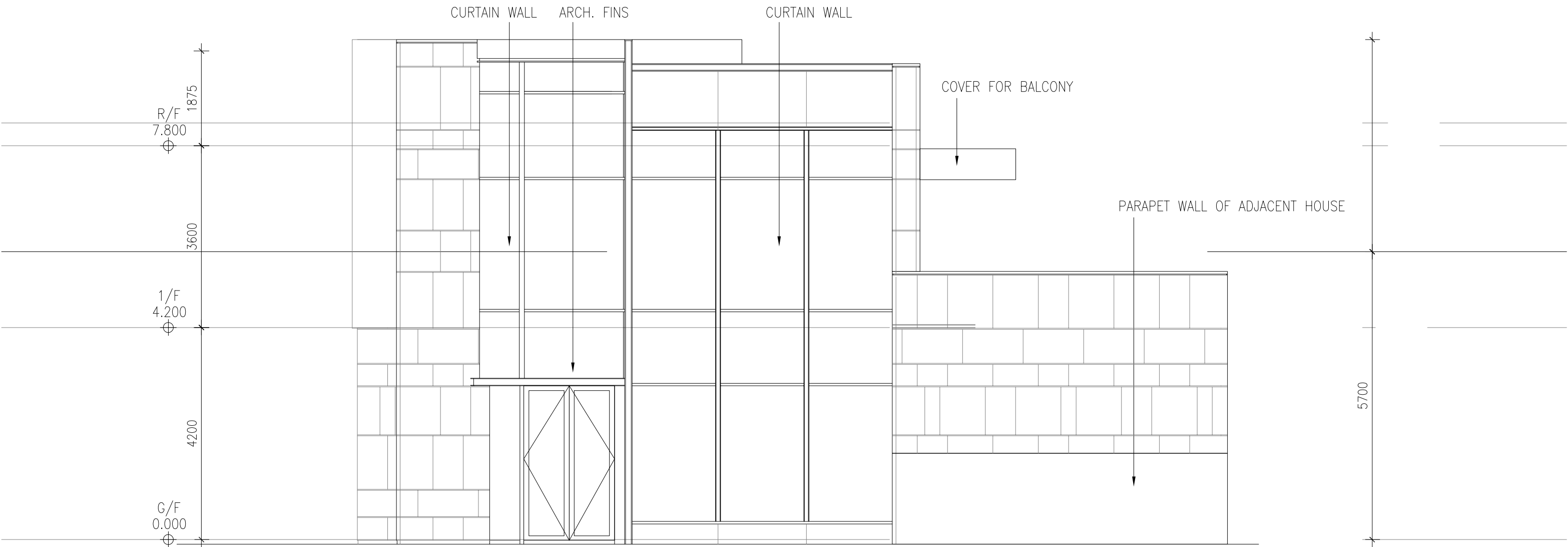
7 SOUTH ELEVATION 1:75  
HOUSE 6

CSK-6E2



9 WEST ELEVATION 1:75  
— HOUSE 6

CSK-6E3



8 NORTH ELEVATION 1:75  
— HOUSE 6

CSK-6E4

## RTTV Calculation (House 7)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

### West Elevations (House 7) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 12.00	)x 4.20 x 1 =	12.00 x 4.20 x 1 =	50.40 m <sup>2</sup>
1/F	( 12.70	)x 3.60 x 1 =	12.70 x 3.60 x 1 =	45.72 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 96.12 m<sup>2</sup>**

### North Elevations (House 7) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 13.70 + 1.50	)x 4.20 x 1 =	15.20 x 4.20 x 1 =	63.84 m <sup>2</sup>
1/F	( 8.60 + 0.90	)x 3.60 x 1 =	9.50 x 3.60 x 1 =	34.20 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 98.04 m<sup>2</sup>**

### East Elevations (House 7) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 8.50	)x 4.20 x 1 =	8.50 x 4.20 x 1 =	35.70 m <sup>2</sup>
1/F	( 5.80 + 0.80	)x 3.60 x 1 =	6.60 x 3.60 x 1 =	23.76 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 59.46 m<sup>2</sup>**

### South Elevations (House 7) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 1.10 + 13.50	)x 4.20 x 1 =	14.60 x 4.20 x 1 =	61.32 m <sup>2</sup>
1/F	( 6.50	)x 3.60 x 1 =	6.50 x 3.60 x 1 =	23.40 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 84.72 m<sup>2</sup>**

**Total Gross Wall Areas 338.34 m<sup>2</sup>**

## Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

### Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 7)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 10.00	)x 3.05 x 1 =	10.00 x	3.05 x	1 =	30.45 m <sup>2</sup>			
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x	3.15 x	1 =	0.00 m <sup>2</sup>			
1/F (Window GL02) - C	( 7.50 + 4.50	)x 2.66 x 1 =	12.00 x	2.66 x	1 =	31.86 m <sup>2</sup>			
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x	2.74 x	1 =	0.00 m <sup>2</sup>			

**Gross Glazing Areas 62.31 m<sup>2</sup>**

### North Elevations (House 7)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 8.00	)x 3.05 x 1 =	8.00 x	3.05 x	1 =	24.36 m <sup>2</sup>			
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x	3.15 x	1 =	0.00 m <sup>2</sup>			
1/F (Window GL02) - C	( 2.80 + 4.40	)x 2.66 x 1 =	7.20 x	2.66 x	1 =	19.12 m <sup>2</sup>			
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x	2.74 x	1 =	0.00 m <sup>2</sup>			

**Gross Glazing Areas 43.48 m<sup>2</sup>**

### East Elevations (House 7)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 2.60	)x 3.05 x 1 =	2.60 x	3.05 x	1 =	7.92 m <sup>2</sup>			
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x	3.15 x	1 =	0.00 m <sup>2</sup>			
G/F (Window GL02)	(	)x 0.86 x 1 =	0.00 x	0.86 x	1 =	0.00 m <sup>2</sup>			
1/F (Window GL02)	( 0.70 + 2.20 + 3.10	)x 2.64 x 1 =	2.90 x	2.64 x	1 =	7.66 m <sup>2</sup>			

**Gross Glazing Areas 15.57 m<sup>2</sup>**

### South Elevations (House 7)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 0.50 + 2.80	)x 3.05 x 1 =	3.30 x	3.05 x	1 =	10.05 m <sup>2</sup>			
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x	3.15 x	1 =	0.00 m <sup>2</sup>			
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00 x	2.66 x	1 =	0.00 m <sup>2</sup>			
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x	2.74 x	1 =	0.00 m <sup>2</sup>			

**Gross Glazing Areas 10.05 m<sup>2</sup>**

**Total Gross Glazing Areas 131.41 m<sup>2</sup>**

# West Elevations (House 7)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 7) = 96.12 m²

Glazing Areas at West Elevations (House 7) = 62.31 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 40.82 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 7) = 33.81 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 33.81 m²

Window to Wall Ratio (WWR) = 62.31 / 96.12 = 0.65

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 7)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1

Description:

RC Wall Areas

Wall Material			
External surface film resistance	Ro	=	0.044
Air space resistance	Ra	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	Ri	=	0.12
Total	0.293		

Uw1 = 1 / 0.293 = 3.42 W/m²K



**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)

Facade Orientation Facing West Gross Wall Area (Ao) = 96.12  
 Window to Wall Ratio (WWR) 0.65 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	33.81		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.32		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{4.32} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	62.31	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.82	0.13	0.16

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{1.10} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	40.82	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		8.62	1.35	2.48

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{12.46} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 7)**

$$= 4.32 + 1.10 + 12.46$$

$$= \underline{17.87} \quad \text{W/m}^2$$

# North Elevations (House 7)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 7) = 98.04 m²

Glazing Areas at North Elevations (House 7) = 43.48 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 43.48 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 7) = 54.56 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 54.56 m²

Window to Wall Ratio (WWR) = 43.48 / 98.04 = 0.44

Sheet no. 5

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 7)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	98.04
Window to Wall Ratio (WWR)	0.44	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	54.56		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.77		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 4.77 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	43.48		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.39		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.39 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	43.48		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.29		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 6.29 W/m²

Summary of RTTV at North Elevations (House 7)  
= 4.77 + 0.39 + 6.29  
= 11.45 W/m²

# East Elevations (House 7)

Sheet no. 7

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 7) = 59.46 m²

Glazing Areas at East Elevations (House 7) = 15.57 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 15.57 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 7) = 43.89 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 43.89 m²

Window to Wall Ratio (WWR) = 15.57 / 59.46 = 0.26

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 7)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	59.46
Window to Wall Ratio (WWR)	0.26	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	43.89		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.59		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.59 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.57		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.31		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.31 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.57		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.04		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 5.04 W/m²

Summary of RTTV at East Elevations (House 7)  
= 8.59 + 0.31 + 5.04  
= 13.94 W/m²

# South Elevations (House 7)

Sheet no. 9

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 7) = 84.72 m²

Glazing Areas at South Elevations (House 7) = 10.05 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 10.05 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 7) = 74.67 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 74.67 m²

Window to Wall Ratio (WWR) = 10.05 / 84.72 = 0.12

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 7)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 10 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)

Facade Orientation Facing South Gross Wall Area (Ao) = 84.72  
Window to Wall Ratio (WWR) 0.12 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	74.67		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		9.33		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 9.33 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	10.05		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.13		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.13 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	10.05		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		2.08		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 2.08 W/m²

Summary of RTTV at South Elevations (House 7)  
= 9.33 + 0.13 + 2.08  
= 11.53 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)

Overall Gross Wall Area [a]338.34 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	96.12	4.32	1.10	12.46	17.87	5.08
North	98.04	4.77	0.39	6.29	11.45	3.32
East	59.46	8.59	0.31	5.04	13.94	2.45
South	84.72	9.33	0.13	2.08	11.53	2.89

Overall RTTV<sub>wall</sub> =13.73W/m²

<14W/m²OK



Roof

Sheet no. 12

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 165.06 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 165.06 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 154.38 m²  
1/F = 35.50 m²  
Roof = 92.78 m²  
Upper Roof = 26.10 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 10.68 m²  
1/F = 4.66 m²  
Roof = 6.02 m²  
Upper Roof = m²

R1 Description: Roof Area	
Roof Material	
External surface film resistance	Ro = 0.055
Air space resistance	Ra = 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1 = 0.023
50mm cement/ sand screed	0.05 / 0.72 = 0.069
50mm expanded polystyrene	0.05 / 0.034 = 1.471
150mm concrete slab	0.15 / 2.16 = 0.069
10mm AGT Tile (Brown)	0.01 / 1.1 = 0.009
Internal surface film resistance	Ri = 0.162
Total	1.858

$$Uw1 = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2 Description: Roof Area	
Roof Material	
External surface film resistance	Ro = 0.055
Air space resistance	Ra = 0
50mm cement/ sand screed	0.05 / 0.72 = 0.069
50mm expanded polystyrene	0.05 / 0.034 = 1.471
150mm concrete slab	0.15 / 2.16 = 0.069
10mm AGT Tile (Brown)	0.01 / 1.1 = 0.009
Internal surface film resistance	Ri = 0.162
Total	1.836

$$Uw1 = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 165.06  
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (α <sub>i</sub> )	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	154.38	10.68	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.34	0.21	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs where i= 1, 2, ..., n  
= 3.55 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 (U <sub>si</sub> )	W/m²K	-			
Heat Conduction = 0.40 (Asi/Aro) U <sub>si</sub> Gs		0.00			

Heat Conduction through Skylight = 0.40 (Asi/Aro) U<sub>si</sub> 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 (SC <sub>r</sub> )		-			
Visible Light Transmittance (VLT)		-			
External Reflectance (ER)		-			
Solar Radiation = 41.10 (Asi/Aro) (SC <sub>ri</sub> ) Gs		0.00			

Solar Radiation through Skylight = 41.10 (Asi/Aro) (SC<sub>ri</sub>) Gs where i= 1, 2, ..., n  
= 0.00 W/m²

Summary of RTTV at Roof  
= 3.55 + 0.00 + 0.00  
= 3.55 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)

Overall Roof Area [a]

165.06 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	165.06	3.55	0.00	0.00	3.55	3.55

Overall RTTV<sub>roof</sub> =

3.55

W/m²

<

4

W/m²

OK

## RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 7)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>Wall</sub>								
Facade Orientation Facing	West	North	East	South				
Average Absorptivity	0.795	0.8	0.8	0.8				
Average Window to Wall Ratio	0.51	0.37	0.18	0.23				
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43				
Average Shading Coefficient of Facade	0.43	0.43	0.43	0.43				
Visible Light Transmittance	53 %	53 %	53 %	53 %	%	%	%	%
External Reflectance	17 %	17 %	17 %	17 %	%	%	%	%

Table 2

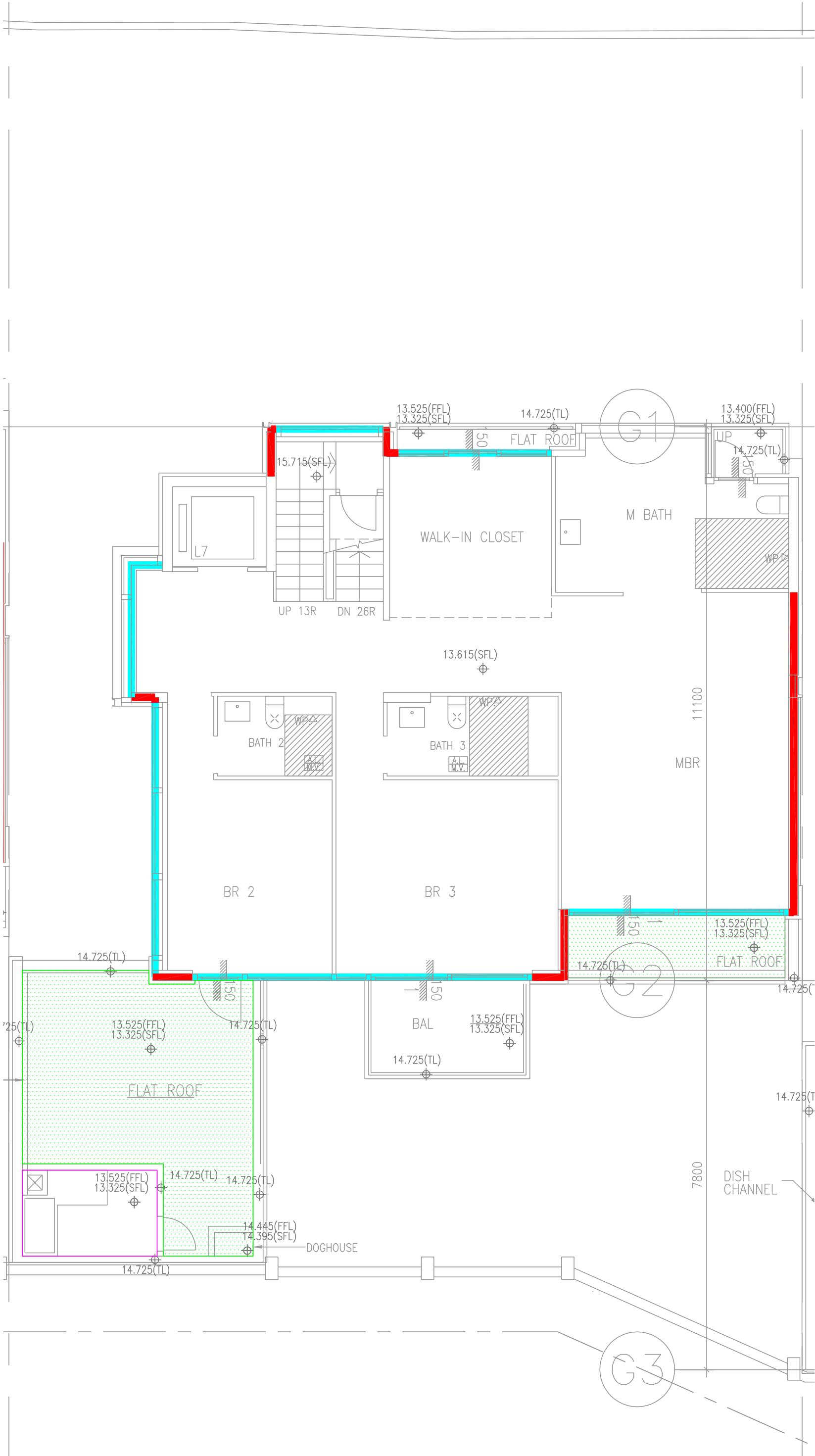
RTTV <sub>Wall</sub>																		
Facade Orientation Facing		West				North				East				South				
Wall Orientation Factor		1.131				0.79				1.072				0.975				
Total External Wall Area (Residential Units)		120.0	m <sup>2</sup>	Window to Wall Ratio		63.1	m <sup>2</sup>	Window to Wall Ratio		46.4	m <sup>2</sup>	Window to Wall Ratio		78.1	m <sup>2</sup>	Window to Wall Ratio		
Total Window Area		61.73	m <sup>2</sup>	= 0.51		23.37	m <sup>2</sup>	= 0.37		8.25	m <sup>2</sup>	= 0.18		18.12	m <sup>2</sup>	= 0.23		
Heat Conduction	Opaque Wall	4.32 W/m <sup>2</sup>				4.77 W/m <sup>2</sup>				8.59 W/m <sup>2</sup>				9.33 W/m <sup>2</sup>				
	Window	1.10 W/m <sup>2</sup>				0.39 W/m <sup>2</sup>				0.31 W/m <sup>2</sup>				0.13 W/m <sup>2</sup>				
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No						<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No						
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No						Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No						Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
Solar Radiation through Gazing		12.46 W/m <sup>2</sup>				6.29 W/m <sup>2</sup>				5.04 W/m <sup>2</sup>				2.08 W/m <sup>2</sup>				
Average Absorptivity		0.795				0.795				0.795				0.795				
RTTV <sub>Wall</sub> at each Facade		17.87 W/m <sup>2</sup>				11.45 W/m <sup>2</sup>				13.94 W/m <sup>2</sup>				11.53 W/m <sup>2</sup>				
Overall RTTV <sub>Wall</sub>		13.73 W/m <sup>2</sup>																

Table 3

RTTV <sub>Roof</sub>									
Roof Orientation Factor									
Total Roof Area (Residential Units)		2.16 165.06 m <sup>2</sup>							
Total Skylight Area		0 m <sup>2</sup>							
Heat Conduction	Roof	3.55 W/m <sup>2</sup>							
	Skylight	W/m <sup>2</sup>							
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =	VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No							
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No							
	Solar Radiation through Gazing		0 W/m <sup>2</sup>						
Average Absorptivity (Roof)		0.8							
Overall RTTV <sub>Roof</sub>		3.55 W/m <sup>2</sup>							

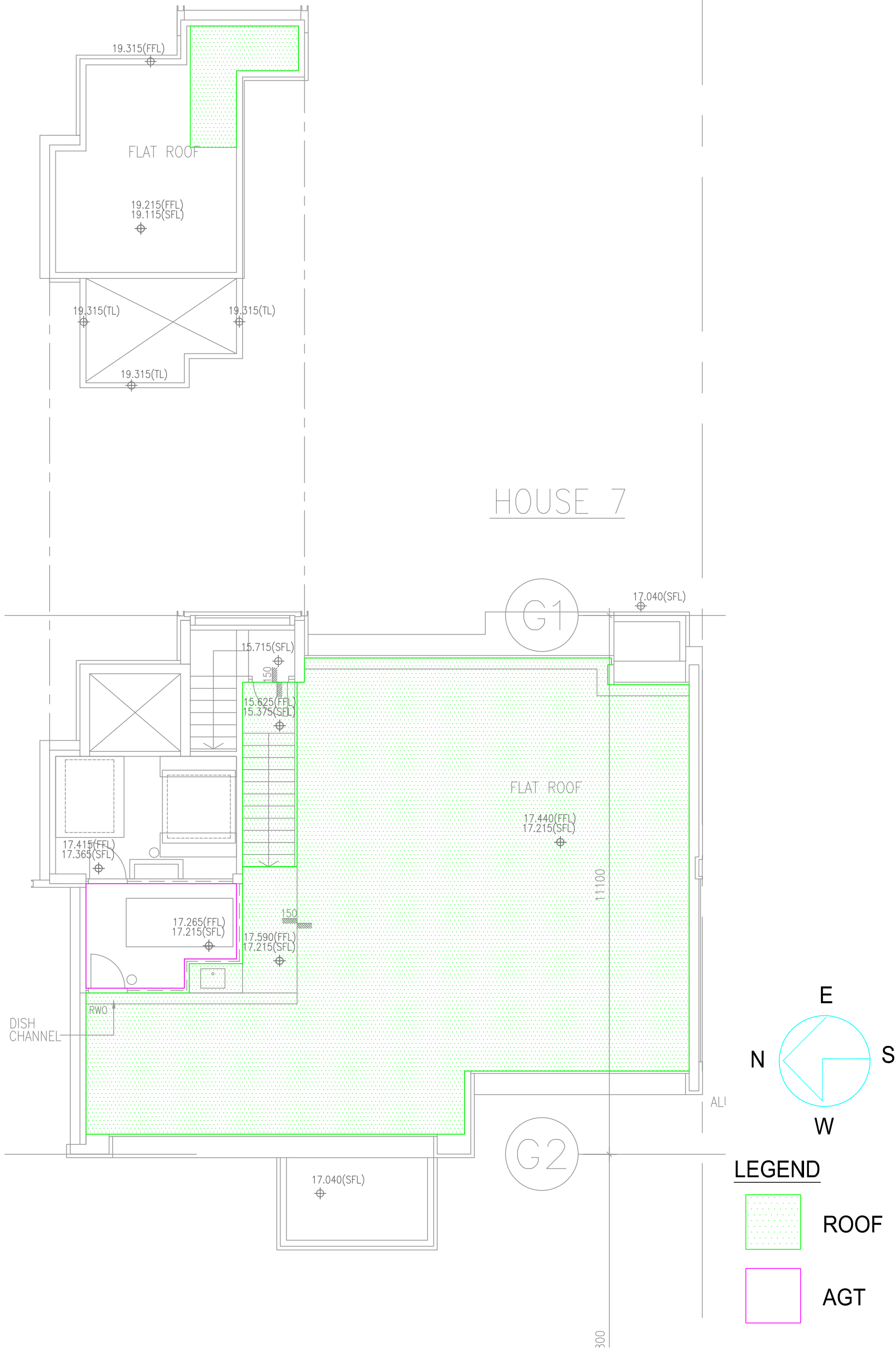
ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance





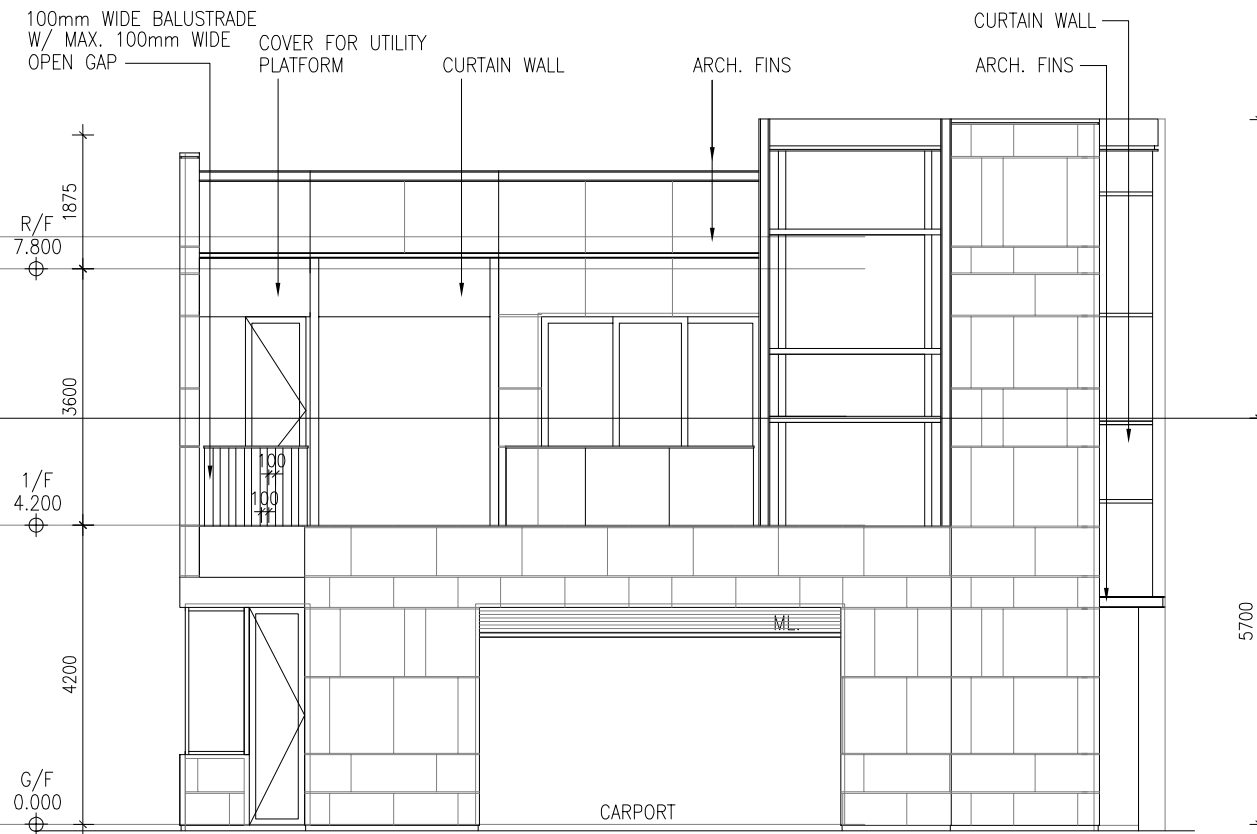
DRAWING TITLE: HOUSE 7 FIRST FLOOR PLAN

SCALE: 1:150@A4



DRAWING TITLE: HOUSE 7 ROOF FLOOR PLAN

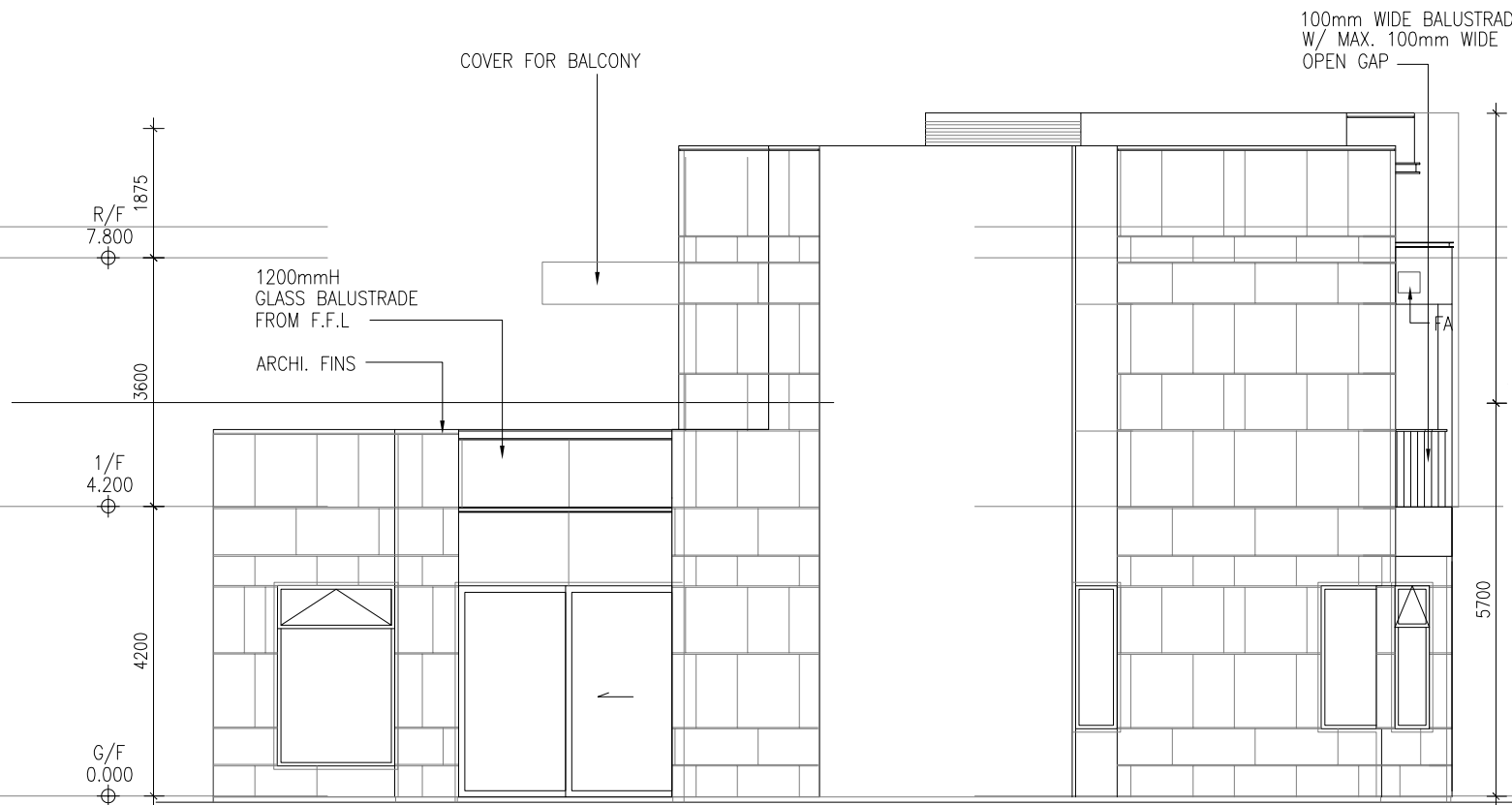
SCALE: 1:150@A4



1 EAST ELEVATION 1:75  
HOUSE 6

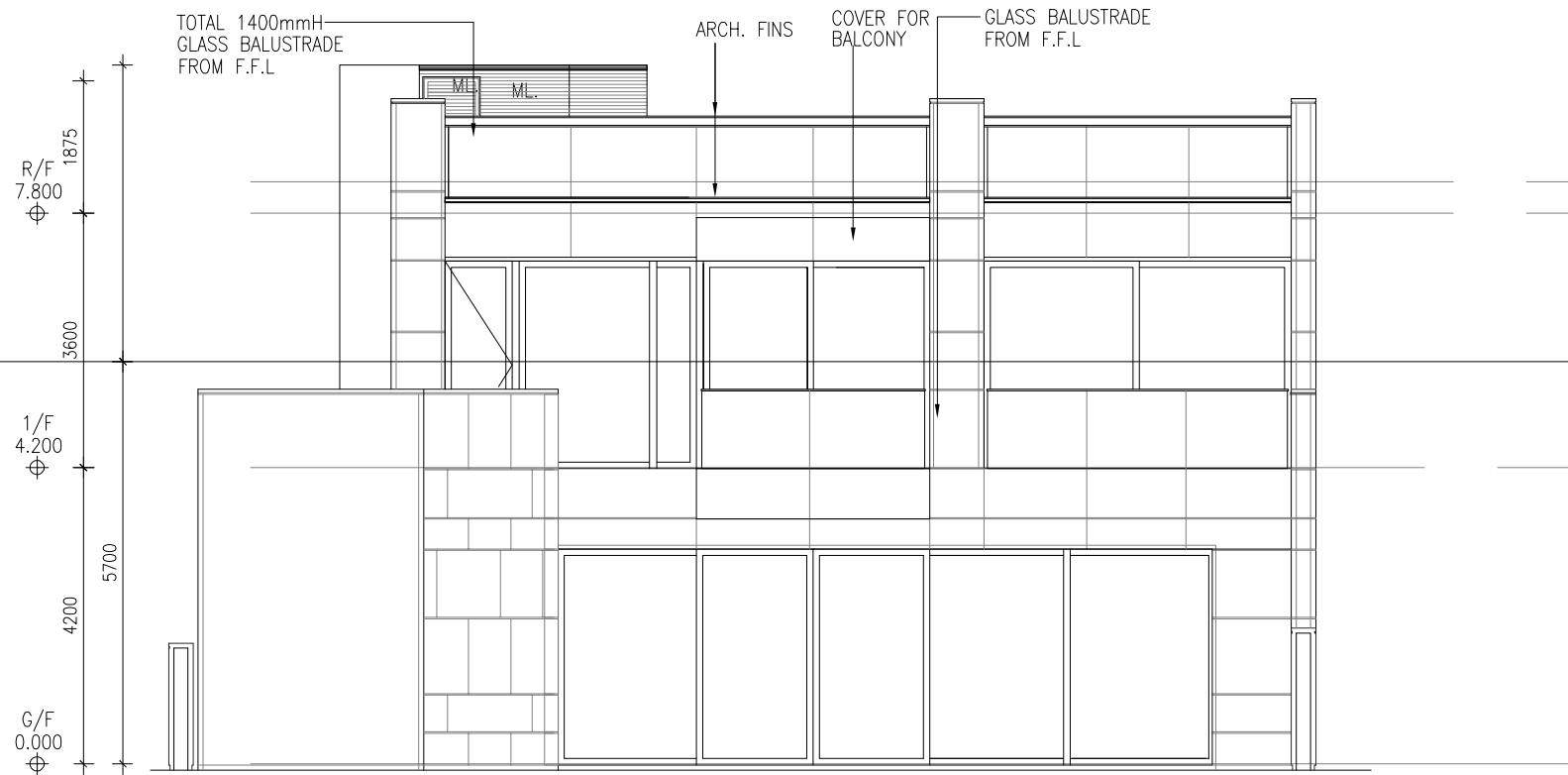
CSK-6E1





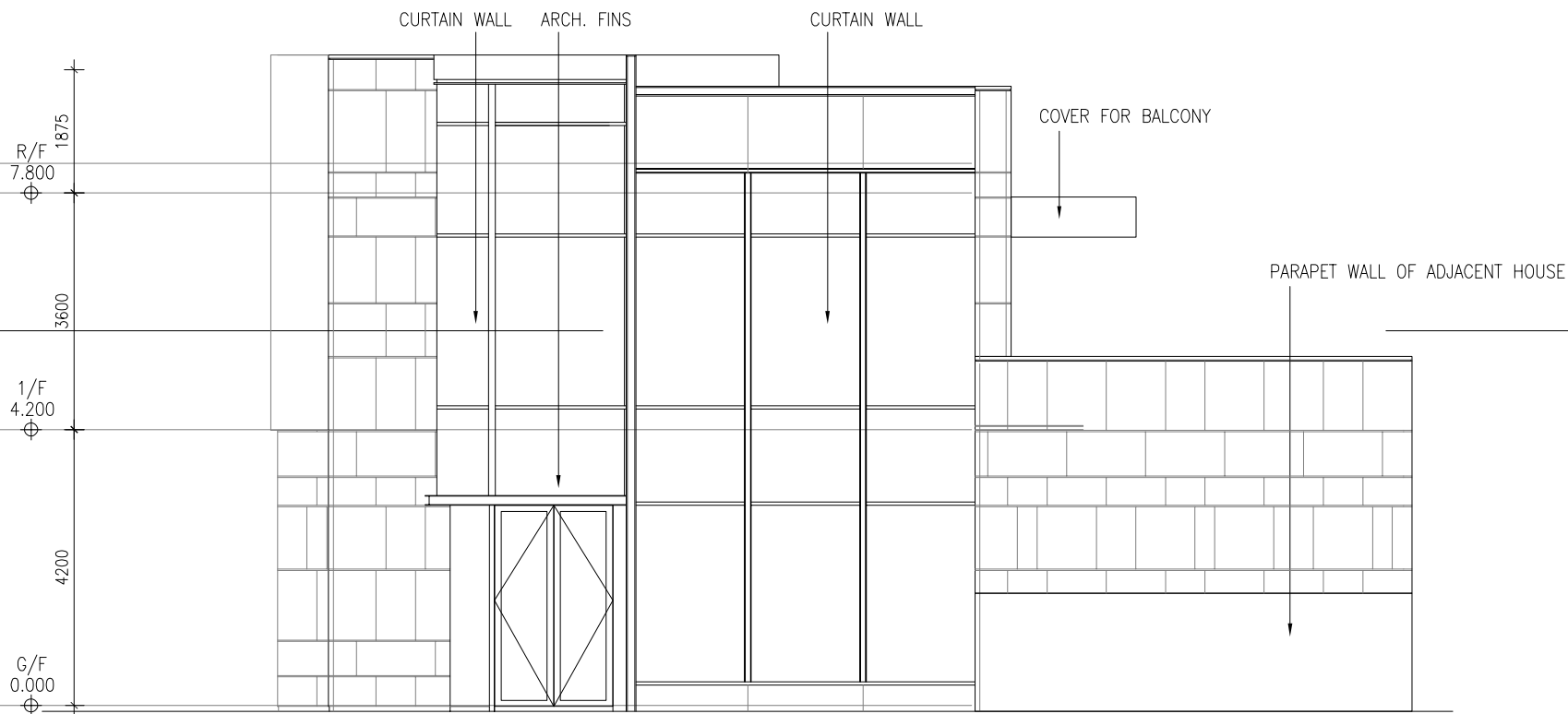
7 SOUTH ELEVATION 1:75  
— HOUSE 6

CSK-6E2



9 WEST ELEVATION 1:75  
— HOUSE 6

CSK-6E3



8 NORTH ELEVATION 1:75  
— HOUSE 6

CSK-6E4

## RTTV Calculation (House 8)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

<b>West Elevations (House 8)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 11.00 + 1.50 + 0.50	)x 4.20 x 1 =	13.00 x	4.20 x	1 =	54.60 m <sup>2</sup>				
1/F	( 12.70	)x 3.60 x 1 =	12.70 x	3.60 x	1 =	45.72 m <sup>2</sup>				
R/F	(	)x 1.90 x 1 =	0.00 x	1.90 x	1 =	0.00 m <sup>2</sup>				

**Gross Wall Areas 100.32 m<sup>2</sup>**

<b>North Elevations (House 8)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 13.50 + 1.60	)x 4.20 x 1 =	15.10 x	4.20 x	1 =	63.42 m <sup>2</sup>				
1/F	( 8.60 + 0.90	)x 3.60 x 1 =	9.50 x	3.60 x	1 =	34.20 m <sup>2</sup>				
R/F	(	)x 1.90 x 1 =	0.00 x	1.90 x	1 =	0.00 m <sup>2</sup>				

**Gross Wall Areas 97.62 m<sup>2</sup>**

<b>East Elevations (House 8)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 8.50	)x 4.20 x 1 =	8.50 x	4.20 x	1 =	35.70 m <sup>2</sup>				
1/F	( 5.80 + 0.80	)x 3.60 x 1 =	6.60 x	3.60 x	1 =	23.76 m <sup>2</sup>				
R/F	(	)x 1.90 x 1 =	0.00 x	1.90 x	1 =	0.00 m <sup>2</sup>				

**Gross Wall Areas 59.46 m<sup>2</sup>**

<b>South Elevations (House 8)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 15.00	)x 4.20 x 1 =	15.00 x	4.20 x	1 =	63.00 m <sup>2</sup>				
1/F	( 6.50	)x 3.60 x 1 =	6.50 x	3.60 x	1 =	23.40 m <sup>2</sup>				
R/F	(	)x 1.90 x 1 =	0.00 x	1.90 x	1 =	0.00 m <sup>2</sup>				

**Gross Wall Areas 86.40 m<sup>2</sup>**

**Total Gross Wall Areas 343.80 m<sup>2</sup>**

# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 8)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	7.90	)	x	3.05	x	1	=	7.90 x 3.05 x 1 = 24.06 m <sup>2</sup>
G/F (Window GL02) - B	(		)	x	3.15	x	1	=	0.00 x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	7.50 + 3.50	)	x	2.66	x	1	=	11.00 x 2.66 x 1 = 29.21 m <sup>2</sup>
1/F (Window GL02) - D	(		)	x	2.74	x	1	=	0.00 x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 53.26 m<sup>2</sup>**

### North Elevations (House 8)

North Elevations (House 8)																
Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys																
G/F (Window GL02) - A	(	8.20	1.30	)	x	3.05	x	1	=	9.50	x	3.05	x	1	=	28.93 m <sup>2</sup>
G/F (Window GL02) - B	(			)	x	3.15	x	1	=	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	2.80 +	4.40	)	x	2.66	x	1	=	7.20	x	2.66	x	1	=	19.12 m <sup>2</sup>
1/F (Window GL02) - D	(			)	x	2.74	x	1	=	0.00	x	2.74	x	1	=	0.00 m <sup>2</sup>

**Gross Glazing Areas 48.04 m<sup>2</sup>**

### East Elevations (House 8)

East Elevations (House 8)									
Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	2.70		)	x	3.05	x	1	= 2.70 x 3.05 x 1 = 8.22 m <sup>2</sup>
G/F (Window GL02) - B	(			)	x	3.15	x	1	= 0.00 x 3.15 x 1 = 0.00 m <sup>2</sup>
G/F (Window GL02)	(			)	x	0.86	x	1	= 0.00 x 0.86 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02)	(	0.70 + 2.20 + 3.10		)	x	2.64	x	1	= 2.90 x 2.64 x 1 = 7.66 m <sup>2</sup>

**Gross Glazing Areas 15.88 m<sup>2</sup>**

### South Elevations (House 8)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	0.50	1.30	3.80	)	x	3.05	x	1 = 5.60 x 3.05 x 1 = 17.05 m <sup>2</sup>
G/F (Window GL02) - B	(				)	x	3.15	x	1 = 0.00 x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(				)	x	2.66	x	1 = 0.00 x 2.66 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - D	(				)	x	2.74	x	1 = 0.00 x 2.74 x 1 = 0.00 m <sup>2</sup>

**Gross Glazing Areas 17.05 m<sup>2</sup>**

**Total Gross Glazing Areas 134.23 m<sup>2</sup>**

# West Elevations (House 8)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 8) = 100.32 m²

Glazing Areas at West Elevations (House 8) = 53.26 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 31.77 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 8) = 47.06 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 47.06 m²

Window to Wall Ratio (WWR) = 53.26 / 100.32 = 0.53

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 8)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)

Facade Orientation Facing West Gross Wall Area (Ao) = 100.32  
 Window to Wall Ratio (WWR) 0.53 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	47.06		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		5.76		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{5.76}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	53.26	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.67	0.12	0.15

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.94}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	31.77	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.43	1.30	2.38

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{10.10}} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 8)**

$$= 5.76 + 0.94 + 10.10$$

$$= \underline{\underline{16.80}} \quad \text{W/m}^2$$



North Elevations (House 8)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 8)	=	97.62 m²
Glazing Areas at North Elevations (House 8)	=	48.04 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( N-F1 )	=	48.04 m²
ECS	=	1.000

Opaque Wall Areas at North Elevations (House 8)	=	49.58 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( N-W1 )	=	49.58 m²

Window to Wall Ratio (WWR) = 48.04 / 97.62 = 0.49

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 8)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/((Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	97.62
Window to Wall Ratio (WWR)	0.49	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	49.58		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.36		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 4.36 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	48.04		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.43		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.43 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	48.04		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.98		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 6.98 W/m²

Summary of RTTV at North Elevations (House 8)  
= 4.36 + 0.43 + 6.98  
= 11.77 W/m²

## East Elevations (House 8)

Sheet no. 7

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 8) = 59.46 m<sup>2</sup>

Glazing Areas at East Elevations (House 8) = 15.88 m<sup>2</sup>

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 15.88 m<sup>2</sup>  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 8) = 43.58 m<sup>2</sup>

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 43.58 m<sup>2</sup>

Window to Wall Ratio (WWR) = 15.88 / 59.46 = 0.27

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 8)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

### 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)

R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)

R<sub>a</sub> Air space resistance (Refer to Table 3)

x Thickness of building materials

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

E-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	R <sub>o</sub>	= 0.044
Air space resistance	R <sub>a</sub>	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	R <sub>i</sub>	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	59.46
Window to Wall Ratio (WWR)	0.27	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	43.58		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.53		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.53 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.88		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.32		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.32 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.88		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.14		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 5.14 W/m²

Summary of RTTV at East Elevations (House 8)  
= 8.53 + 0.32 + 5.14  
= 13.99 W/m²

# South Elevations (House 8)

Sheet no. 9

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 8) = 86.40 m²

Glazing Areas at South Elevations (House 8) = 17.05 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 17.05 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 8) = 69.35 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 69.35 m²

Window to Wall Ratio (WWR) = 17.05 / 86.40 = 0.20

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 8)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas	
Wall Material			
External surface film resistance	Ro	=	0.044
Air space resistance	Ra	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	Ri	=	0.12
Total			0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	10	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)		
Facade Orientation Facing	South	Gross Wall Area (Ao) =	86.40
Window to Wall Ratio (WWR)	0.20	Wall Orientation Factor (Gw) =	0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	69.35		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.50		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.50 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	17.05		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.21		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.21 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	17.05		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		3.45		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 3.45 W/m²

Summary of RTTV at South Elevations (House 8)  
= 8.50 + 0.21 + 3.45  
= 12.16 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)

Overall Gross Wall Area [a]343.80 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	100.32	5.76	0.94	10.10	16.80	4.90
North	97.62	4.36	0.43	6.98	11.77	3.34
East	59.46	8.53	0.32	5.14	13.99	2.42
South	86.40	8.50	0.21	3.45	12.16	3.06

Overall RTTV<sub>wall</sub> =13.72W/m²

<14W/m²OK

Roof

Sheet no. 12

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 169.76 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 169.76 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 158.18 m²  
1/F = 26.84 m²  
Roof = 93.94 m²  
Upper Roof = 37.40 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 11.58 m²  
1/F = 5.56 m²  
Roof = 6.02 m²  
Upper Roof = m²

R1 Description: Roof Area	
Roof Material	
External surface film resistance	Ro = 0.055
Air space resistance	Ra = 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1 = 0.023
50mm cement/ sand screed	0.05 / 0.72 = 0.069
50mm expanded polystyrene	0.05 / 0.034 = 1.471
150mm concrete slab	0.15 / 2.16 = 0.069
10mm AGT Tile (Brown)	0.01 / 1.1 = 0.009
Internal surface film resistance	Ri = 0.162
Total	1.858

$$Uw1 = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2 Description: Roof Area	
Roof Material	
External surface film resistance	Ro = 0.055
Air space resistance	Ra = 0
50mm cement/ sand screed	0.05 / 0.72 = 0.069
50mm expanded polystyrene	0.05 / 0.034 = 1.471
150mm concrete slab	0.15 / 2.16 = 0.069
10mm AGT Tile (Brown)	0.01 / 1.1 = 0.009
Internal surface film resistance	Ri = 0.162
Total	1.836

$$Uw1 = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 169.76  
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(a)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	158.18	11.58	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.33	0.22	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs where i= 1, 2, ..., n  
= 3.55 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  
= 3.55 + 0.00 + 0.00  
= 3.55 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)

Overall Roof Area [a]

169.76 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	169.76	3.55	0.00	0.00	3.55	3.55

Overall RTTV<sub>roof</sub> =

3.55

W/m²

<

4

W/m²

OK

RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 8)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd.	
	<input type="checkbox"/> 2. Architect	
	<input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

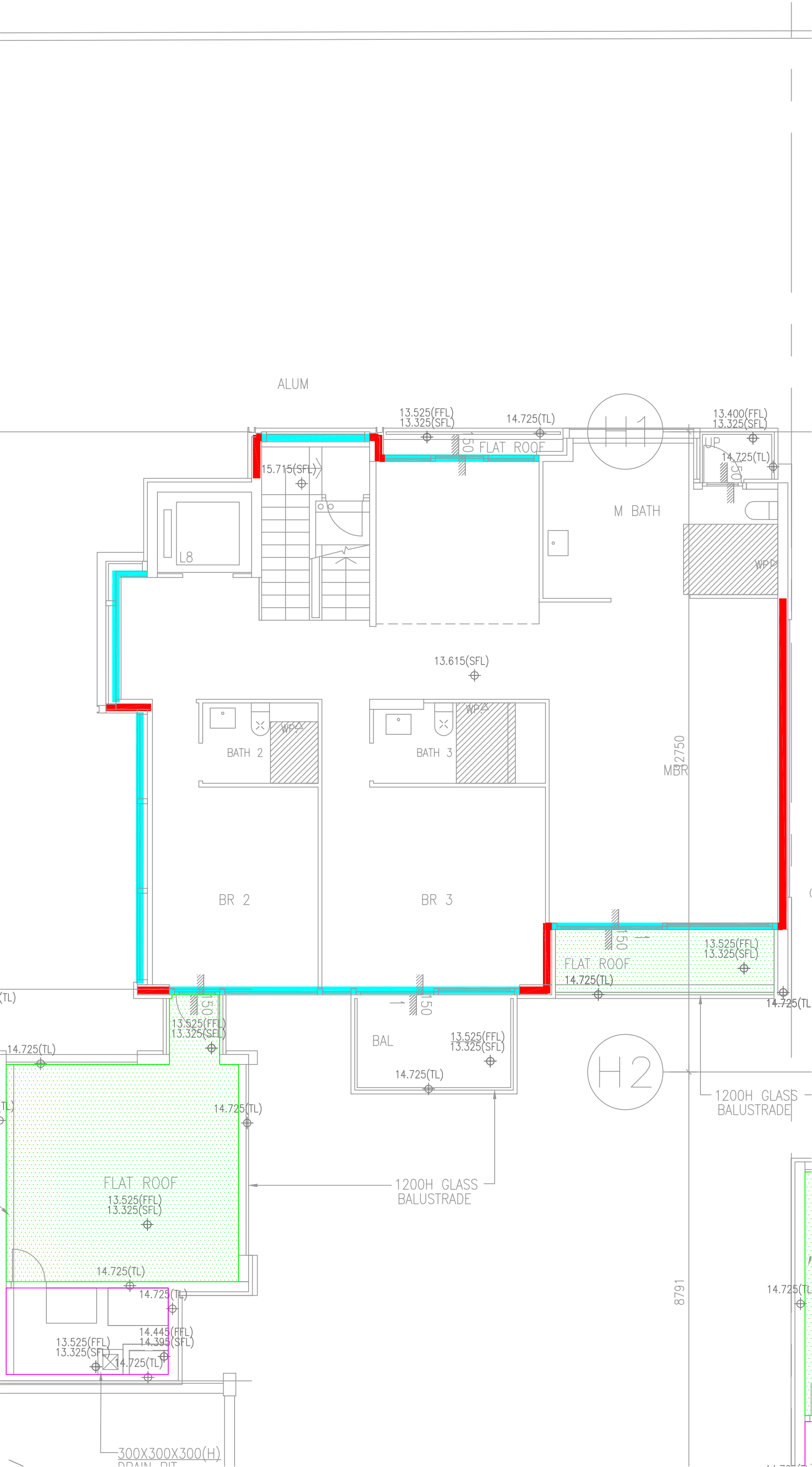
Deemed to Satisfy RTTV <sub>Wall</sub>									
Facade Orientation Facing	West		North		East		South		
Average Absorptivity	0.795		0.8		0.8		0.8		
Average Window to Wall Ratio	0.51		0.37		0.18		0.23		
Shading Coefficient of Glazing	0.43		0.43		0.43		0.43		
Average Shading Coefficient of Facade	0.43		0.43		0.43		0.43		
Visible Light Transmittance	53	%	53	%	53	%	53	%	%
External Reflectance	17	%	17	%	17	%	17	%	%

Table 2																			
		RTTV <sub>Wall</sub>																	
Facade Orientation Facing		West				North				East				South					
Wall Orientation Factor		1.131				0.79				1.072				0.975					
Total External Wall Area (Residential Units)		120.0	m <sup>2</sup>	Window to Wall Ratio		63.1	m <sup>2</sup>	Window to Wall Ratio		46.4	m <sup>2</sup>	Window to Wall Ratio		78.1	m <sup>2</sup>	Window to Wall Ratio			
Total Window Area		61.73	m <sup>2</sup>	= 0.51		23.37	m <sup>2</sup>	= 0.37		8.25	m <sup>2</sup>	= 0.18		18.12	m <sup>2</sup>	= 0.23			
Heat Conduction	Opaque Wall	5.76 W/m <sup>2</sup>				4.36 W/m <sup>2</sup>				8.53 W/m <sup>2</sup>				8.50 W/m <sup>2</sup>					
	Window	0.94 W/m <sup>2</sup>				0.43 W/m <sup>2</sup>				0.32 W/m <sup>2</sup>				0.21 W/m <sup>2</sup>					
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %		
					ER = %				ER = %				ER = %				ER = %		
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 %		
					ER = 17 %				ER = 17 %				ER = 17 %				ER = 17 %		
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %		
					ER = %				ER = %				ER = %				ER = %		
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Solar Radiation through Gazing		10.10 W/m <sup>2</sup>				6.98 W/m <sup>2</sup>				5.14 W/m <sup>2</sup>				3.45 W/m <sup>2</sup>					
Average Absorptivity		0.795				0.795				0.795				0.795					
RTTV <sub>Wall</sub> at each Facade		16.80 W/m <sup>2</sup>				11.77 W/m <sup>2</sup>				13.99 W/m <sup>2</sup>				12.16 W/m <sup>2</sup>					
Overall RTTV <sub>Wall</sub>		13.72 W/m <sup>2</sup>																	

Table 3										
RTTV <sub>Roof</sub>										
Roof Orientation Factor										
Total Roof Area (Residential Units)		2.16 169.76 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.55 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
Solar Radiation through Gazing		0 W/m <sup>2</sup>								
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.55 W/m <sup>2</sup>								

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance

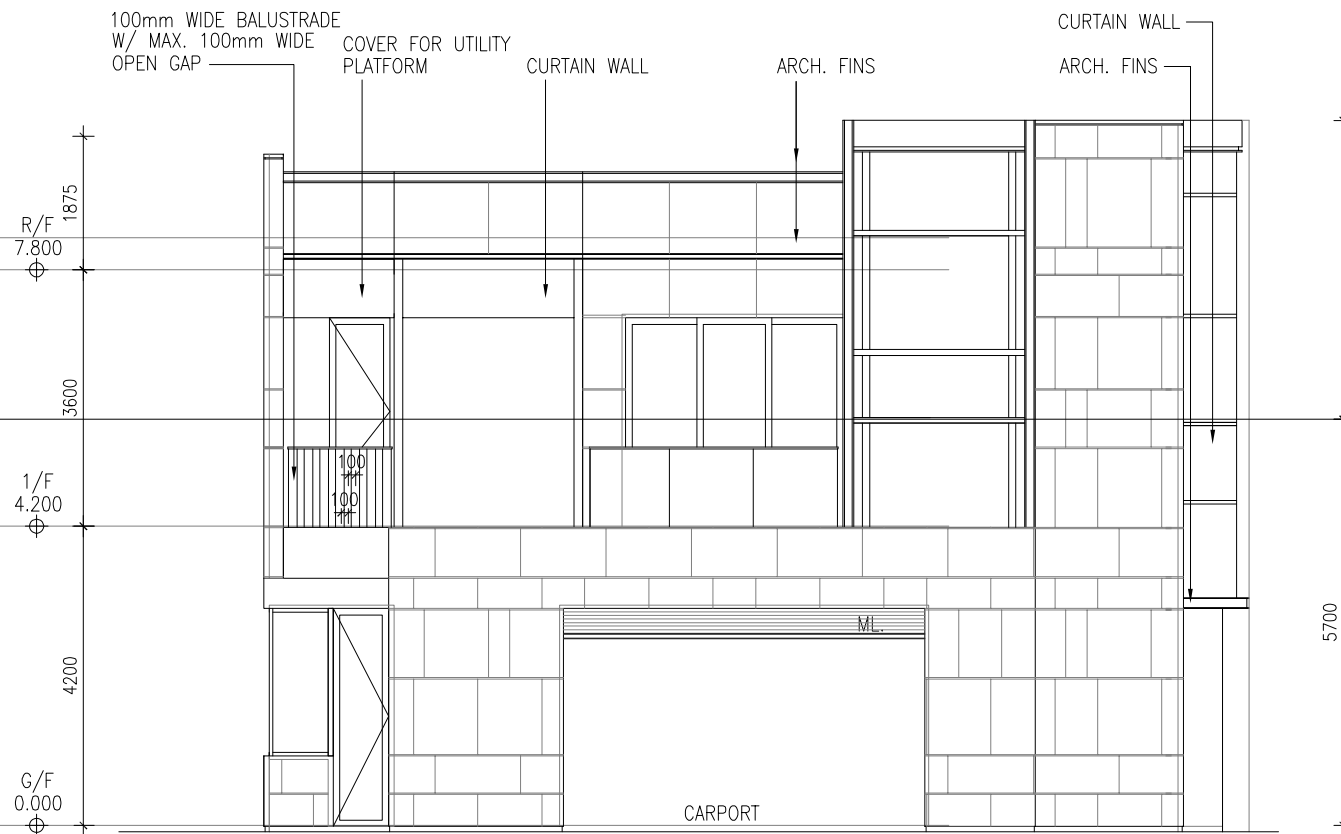




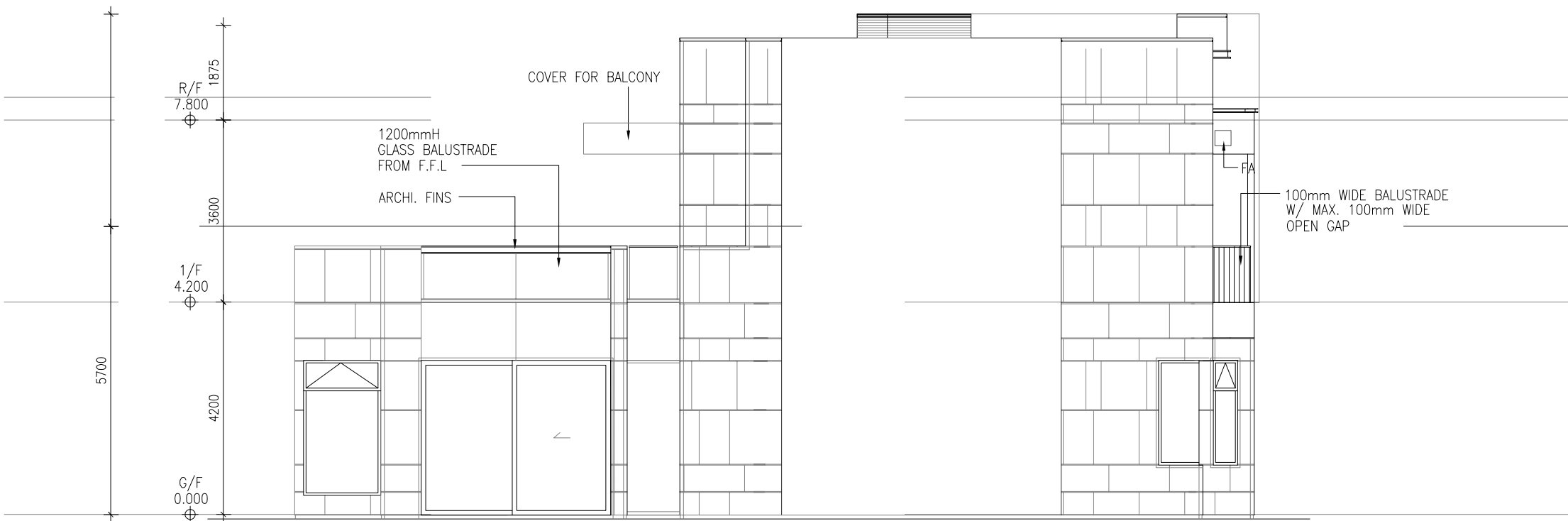
DRAWING TITLE: HOUSE 8 FIRST FLOOR PLAN

SCALE: 1:150@A4





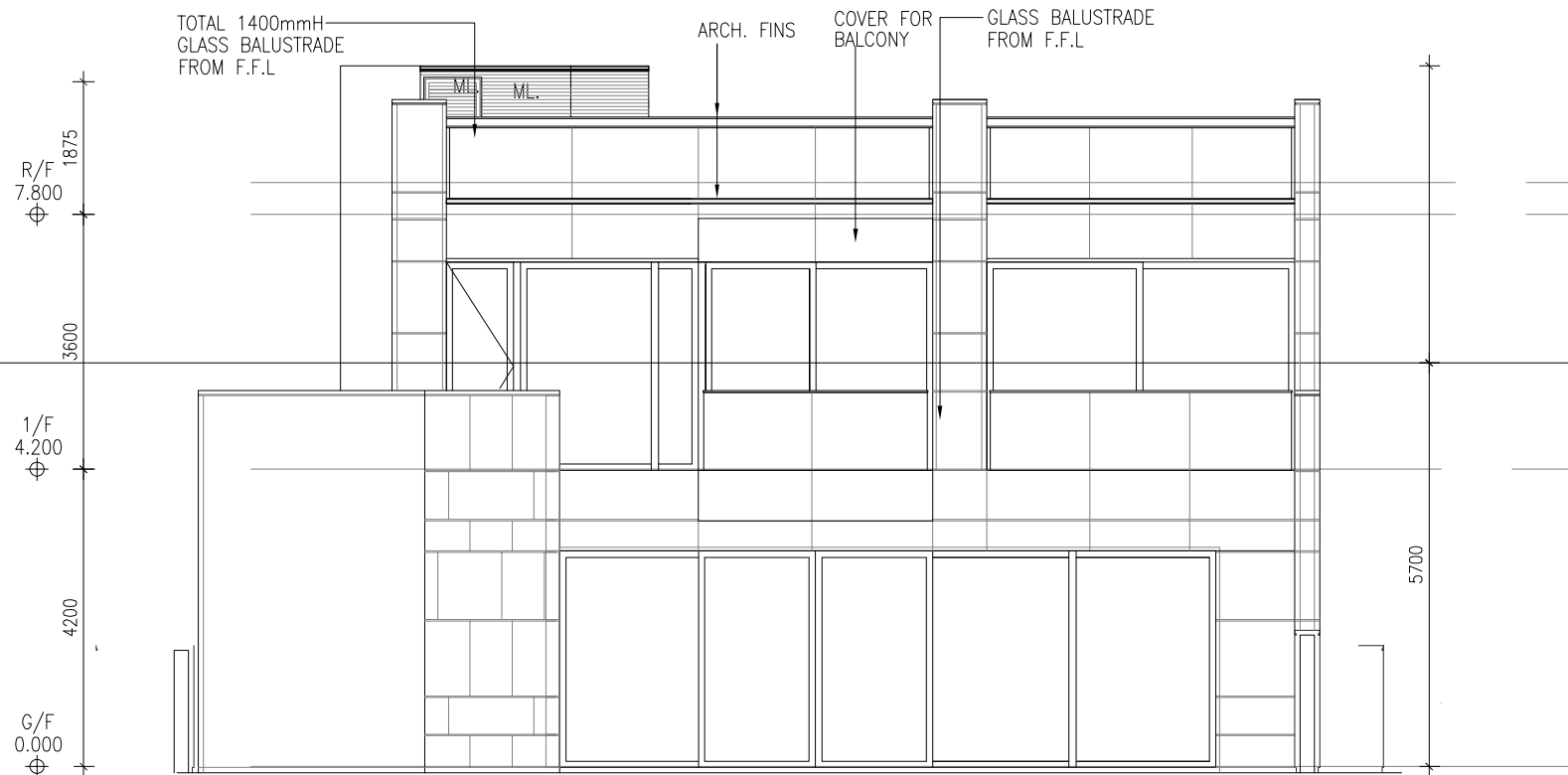
CSK-8E1



7 SOUTH ELEVATION 1:75  
HOUSE 8

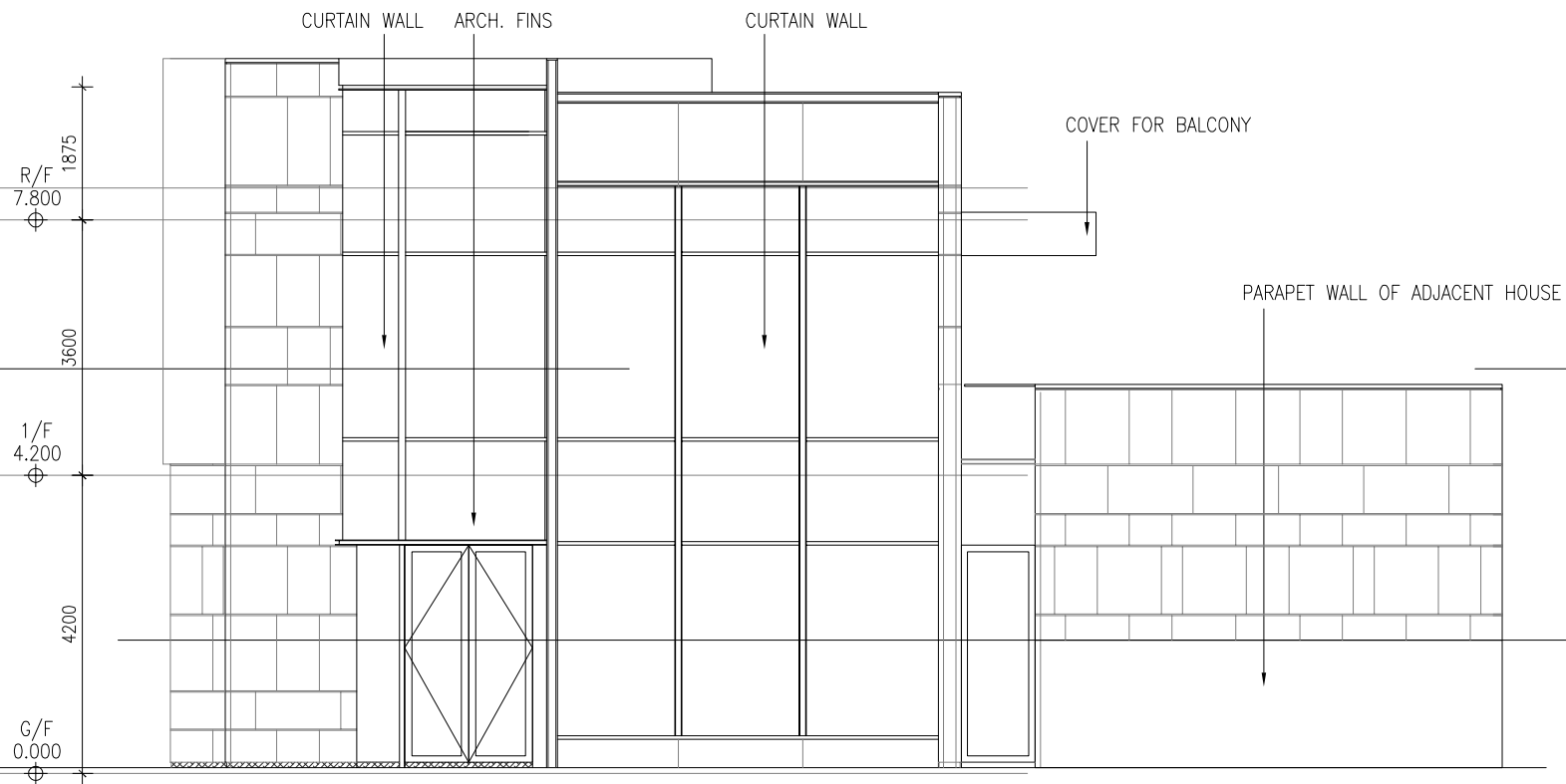
CSK-8E2





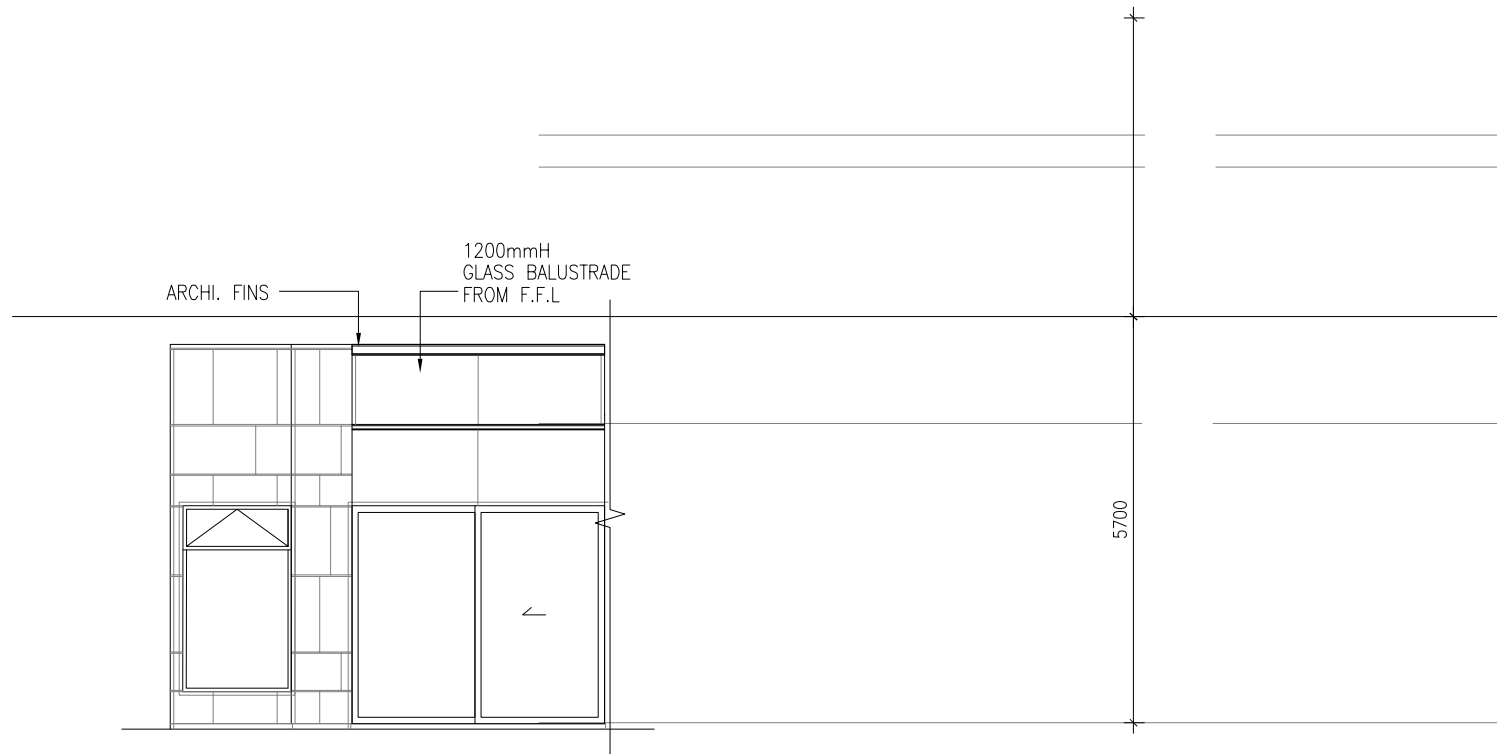
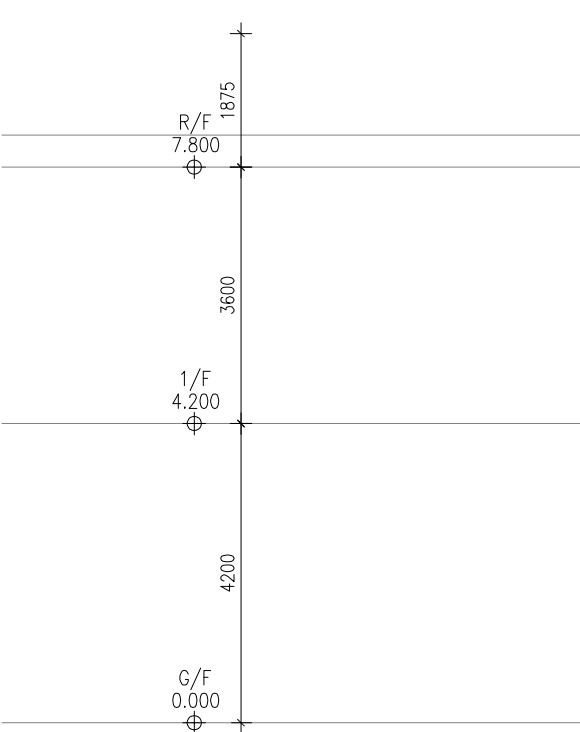
9 WEST ELEVATION 1:75  
— HOUSE 8

CSK-8E3



8 NORTH ELEVATION 1:75  
— HOUSE 8

CSK-8E4



6 PART ELEVATION OF BR1 1:75  
— HOUSE 8

CSK-8E5

## RTTV Calculation (House 9)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

West Elevations (House 9)		Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 0.60 + ####	)x 4.20 x 1 =	11.60	x	4.20	x	1	=	48.72	m <sup>2</sup>	
1/F	( 12.70	)x 3.60 x 1 =	12.70	x	3.60	x	1	=	45.72	m <sup>2</sup>	
R/F	(	)x 1.90 x 1 =	0.00	x	1.90	x	1	=	0.00	m <sup>2</sup>	

**Gross Wall Areas 94.44 m<sup>2</sup>**

North Elevations (House 9)		Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 14.50 + 0.80	)x 4.20 x 1 =	15.30	x	4.20	x	1	=	64.26	m <sup>2</sup>	
1/F	( 3.60 + 5.90	)x 3.60 x 1 =	9.50	x	3.60	x	1	=	34.20	m <sup>2</sup>	
R/F	(	)x 1.90 x 1 =	0.00	x	1.90	x	1	=	0.00	m <sup>2</sup>	

**Gross Wall Areas 98.46 m<sup>2</sup>**

East Elevations (House 9)		Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 2.50 + 1.10 + 2.80	)x 4.20 x 1 =	6.40	x	4.20	x	1	=	26.88	m <sup>2</sup>	
1/F	( 8.05	)x 3.60 x 1 =	8.05	x	3.60	x	1	=	28.98	m <sup>2</sup>	
R/F	(	)x 1.90 x 1 =	0.00	x	1.90	x	1	=	0.00	m <sup>2</sup>	

**Gross Wall Areas 55.86 m<sup>2</sup>**

South Elevations (House 9)		Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys									
G/F	( 2.80 + ####	)x 4.20 x 1 =	14.40	x	4.20	x	1	=	60.48	m <sup>2</sup>	
1/F	( 6.70	)x 3.60 x 1 =	6.70	x	3.60	x	1	=	24.12	m <sup>2</sup>	
R/F	(	)x 1.90 x 1 =	0.00	x	1.90	x	1	=	0.00	m <sup>2</sup>	

**Gross Wall Areas 84.60 m<sup>2</sup>**

**Total Gross Wall Areas 333.36 m<sup>2</sup>**

Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

West Elevations (House 9)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 6.90	)x 3.05 x 1 =	6.90	x	3.05	x	1	=	21.01 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 4.50 + 7.50	)x 2.66 x 1 =	12.00	x	2.66	x	1	=	31.86 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00	x	2.74	x	1	=	0.00 m <sup>2</sup>
									<b>Gross Glazing Areas 52.87 m<sup>2</sup></b>

North Elevations (House 9)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 3.70 + 0.90 + 1.80	)x 3.05 x 1 =	6.40	x	3.05	x	1	=	19.49 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 2 + 5.40	)x 2.66 x 1 =	7.40	x	2.66	x	1	=	19.65 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00	x	2.74	x	1	=	0.00 m <sup>2</sup>
									<b>Gross Glazing Areas 39.14 m<sup>2</sup></b>

East Elevations (House 9)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 2.10 + 1.85	)x 3.05 x 1 =	3.95	x	3.05	x	1	=	12.03 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
G/F (Window GL02)	(	)x 0.86 x 1 =	0.00	x	0.86	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02)	( 2.20 + 2.20 + 3.20	)x 2.64 x 1 =	4.40	x	2.64	x	1	=	11.62 m <sup>2</sup>
									<b>Gross Glazing Areas 23.64 m<sup>2</sup></b>

South Elevations (House 9)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 1.75 + 2.85	)x 3.05 x 1 =	4.60	x	3.05	x	1	=	14.01 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00	x	2.66	x	1	=	0.00 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00	x	2.74	x	1	=	0.00 m <sup>2</sup>
									<b>Gross Glazing Areas 14.01 m<sup>2</sup></b>

Total Gross Glazing Areas 129.66 m<sup>2</sup>

# West Elevations (House 9)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 9) = 94.44 m²

Glazing Areas at West Elevations (House 9) = 52.87 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( W-F1 ) = 31.98 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.29 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.28 x 2.64 = 11.29 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 9) = 41.57 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( W-W1 ) = 41.57 m²

Window to Wall Ratio (WWR) = 52.87 / 94.44 = 0.56

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 9)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 4 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)

Facade Orientation Facing West Gross Wall Area (Ao) = 94.44  
Window to Wall Ratio (WWR) 0.56 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	41.57		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		5.40		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 5.40 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	52.87	9.61	11.29
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.71	0.13	0.15

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.98 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	31.98	9.61	11.29
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.87	1.38	2.40

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 10.65 W/m²

Summary of RTTV at West Elevations (House 9)  
= 5.40 + 0.98 + 10.65  
= 17.04 W/m²



# North Elevations (House 9)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 9) = 98.46 m²

Glazing Areas at North Elevations (House 9) = 39.14 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 39.14 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 9) = 59.33 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 59.33 m²

Window to Wall Ratio (WWR) = 39.14 / 98.46 = 0.40

Sheet no. 5

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 9)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 6 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)

Facade Orientation Facing North Gross Wall Area (Ao) = 98.46  
 Window to Wall Ratio (WWR) 0.40 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	59.33		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> Gw		5.17		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{5.17} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	39.14		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> Gw		0.35		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.35} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	39.14		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )Gw		5.64		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{5.64} \quad \text{W/m}^2$$

**Summary of RTTV at North Elevations (House 9)**

$$= 5.17 + 0.35 + 5.64$$

$$= \underline{11.15} \quad \text{W/m}^2$$

# East Elevations (House 9)

Sheet no. 7

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 9) = 55.86 m²

Glazing Areas at East Elevations (House 9) = 23.64 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 23.64 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 9) = 32.22 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 32.22 m²

Window to Wall Ratio (WWR) = 23.64 / 55.86 = 0.42

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 9)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)

R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)

R<sub>a</sub> Air space resistance (Refer to Table 3)

x Thickness of building materials

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

E-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	R <sub>o</sub>	= 0.044
Air space resistance	R <sub>a</sub>	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	R <sub>i</sub>	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 8 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)

Facade Orientation Facing East Gross Wall Area (Ao) = 55.86  
 Window to Wall Ratio (WWR) 0.42 Wall Orientation Factor (Gw) = 1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	32.22		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> Gw		6.71		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{6.71} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	23.64		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> Gw		0.51		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.51} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	23.64		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )Gw		8.15		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{8.15} \quad \text{W/m}^2$$

**Summary of RTTV at East Elevations (House 9)**

$$= 6.71 + 0.51 + 8.15$$

$$= \underline{15.36} \quad \text{W/m}^2$$

# South Elevations (House 9)

Sheet no. 9

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 9) = 84.60 m²

Glazing Areas at South Elevations (House 9) = 14.01 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 14.01 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 9) = 70.59 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 70.59 m²

Window to Wall Ratio (WWR) = 14.01 / 84.60 = 0.17

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 9)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 10 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)

Facade Orientation Facing South Gross Wall Area (Ao) = 84.60  
 Window to Wall Ratio (WWR) 0.17 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	70.59		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> Gw		8.83		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{8.83} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	14.01		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.73		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> Gw		0.18		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.18} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	14.01		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )Gw		2.90		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{2.90} \quad \text{W/m}^2$$

**Summary of RTTV at South Elevations (House 9)**

$$= 8.83 + 0.18 + 2.90$$

$$= \underline{11.91} \quad \text{W/m}^2$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No. 11 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)

Overall Gross Wall Area [a] 333.36 m<sup>2</sup>

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	94.44	5.40	0.98	10.65	17.04	4.83
North	98.46	5.17	0.35	5.64	11.15	3.29
East	55.86	6.71	0.51	8.15	15.36	2.57
South	84.60	8.83	0.18	2.90	11.91	3.02

Overall RTTV<sub>wall</sub> = 13.72 W/m<sup>2</sup>

< 14 W/m<sup>2</sup> OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 167.62 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	90%	0.9
AGT Tile (Brown)	10%	0.8
Average Absorptivity =		0.89

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 167.62 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 154.57 m²  
1/F = 34.60 m²  
Roof = 95.57 m²  
Upper Roof = 24.40 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 13.05 m²  
1/F = 7.14 m²  
Roof = 5.91 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$Uw1 = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$Uw1 = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$



**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>**

Sheet No. 13 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 167.62  
 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	R2	
External Finish Material		25mm Unglazed	10mm	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (α <sub>wi</sub> )	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	154.57	13.05	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.30	0.25	

$$\text{Heat Conduction through Opaque Roof} = 3.47(\text{Ari}/\text{Aro}) \text{ Uri ari Gs} \quad \text{where } i = 1, 2, \dots, n$$

$$= \underline{\underline{3.54}} \quad \text{W/m}^2$$

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			

$$\text{Heat Conduction through Skylight} = 0.40 (\text{Asi}/\text{Aro}) \text{ Usi Gs} \quad \text{where } i = 1, 2, \dots, n$$

$$= \underline{\underline{0.00}} \quad \text{W/m}^2$$

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			

$$\text{Solar Radiation through Skylight} = 41.10 (\text{Asi}/\text{Aro}) (\text{SCri}) \text{ Gs} \quad \text{where } i = 1, 2, \dots, n$$

$$= \underline{\underline{0.00}} \quad \text{W/m}^2$$

Summary of RTTV at Roof

$$= 3.54 + 0.00 + 0.00$$

$$= \underline{\underline{3.54}} \quad \text{W/m}^2$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No. 14 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)

Overall Roof Area [a] 167.62 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	167.62	3.54	0.00	0.00	3.54	3.54

Overall RTTV<sub>roof</sub> = 3.54 W/m²

< 4 W/m² OK

RTTV Summary Sheet

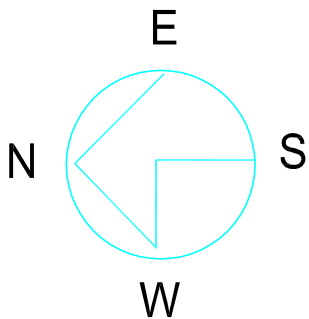
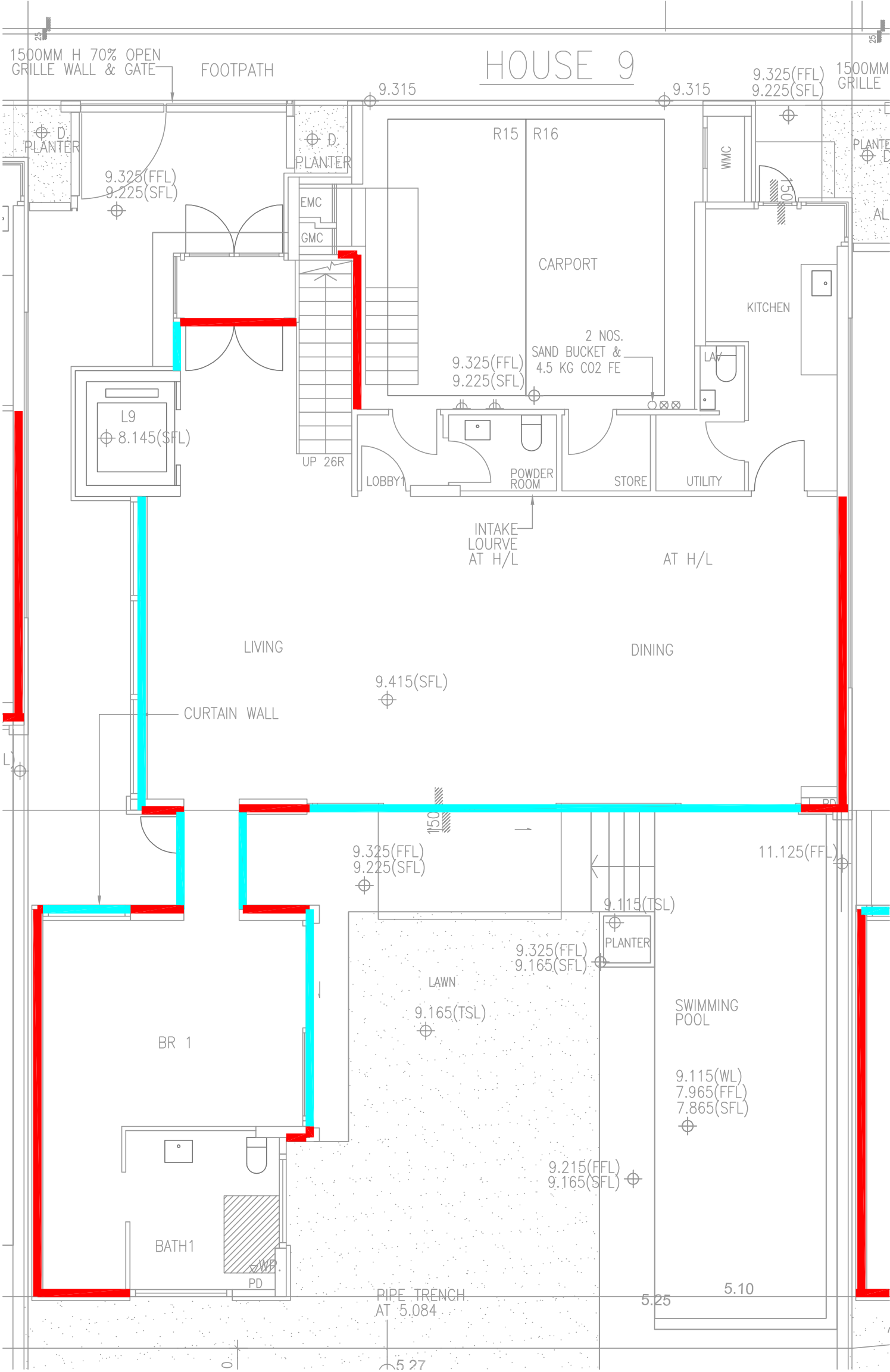
Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 9)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd.	
	<input type="checkbox"/> 2. Architect	
	<input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Deemed to Satisfy RTTV <sub>Wall</sub>									
Facade Orientation Facing	West	North	East	South					
Average Absorptivity	0.795	0.795	0.795	0.795					
Average Window to Wall Ratio	0.59	0.33	0.19	0.73					
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43					
Average Shading Coefficient of Facade	0.43	0.43	0.43	0.43					
Visible Light Transmittance	53 %	53 %	53 %	53 %					
External Reflectance	17 %	17 %	17 %	17 %					

Table 2																					
RTTV <sub>Wall</sub>																					
Facade Orientation Facing		West					North					East					South				
Wall Orientation Factor		1.131					0.79					1.072					0.975				
Total External Wall Area (Residential Units)		101.7 m <sup>2</sup>		Window to Wall Ratio			90.93 m <sup>2</sup>		Window to Wall Ratio			35.2 m <sup>2</sup>		Window to Wall Ratio			15.8 m <sup>2</sup>		Window to Wall Ratio		
Total Window Area		59.81 m <sup>2</sup>		= 0.59			29.63 m <sup>2</sup>		= 0.33			6.80 m <sup>2</sup>		= 0.19			11.42 m <sup>2</sup>		= 0.73		
Heat Conduction	Opaque Wall	5.40 W/m <sup>2</sup>					5.17 W/m <sup>2</sup>					6.71 W/m <sup>2</sup>					8.83 W/m <sup>2</sup>				
	Window	0.98 W/m <sup>2</sup>					0.35 W/m <sup>2</sup>					0.51 W/m <sup>2</sup>					0.18 W/m <sup>2</sup>				
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %
		<input checked="" type="checkbox"/> Tinted	Area = 59.81 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 29.63 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 6.8 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 11.42 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
	Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Solar Radiation through Gazing		10.65 W/m <sup>2</sup>					5.64 W/m <sup>2</sup>					8.15 W/m <sup>2</sup>					2.90 W/m <sup>2</sup>				
Average Absorptivity		0.795					0.795					0.795					0.795				
RTTV <sub>Wall</sub> at each Facade		17.04 W/m <sup>2</sup>					11.15 W/m <sup>2</sup>					15.36 W/m <sup>2</sup>					11.91 W/m <sup>2</sup>				
Overall RTTV <sub>Wall</sub>							13.72 W/m <sup>2</sup>														

Table 3										
RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		167.62 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.54 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
Solar Radiation through Gazing		0 W/m <sup>2</sup>								
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.54 W/m <sup>2</sup>								

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



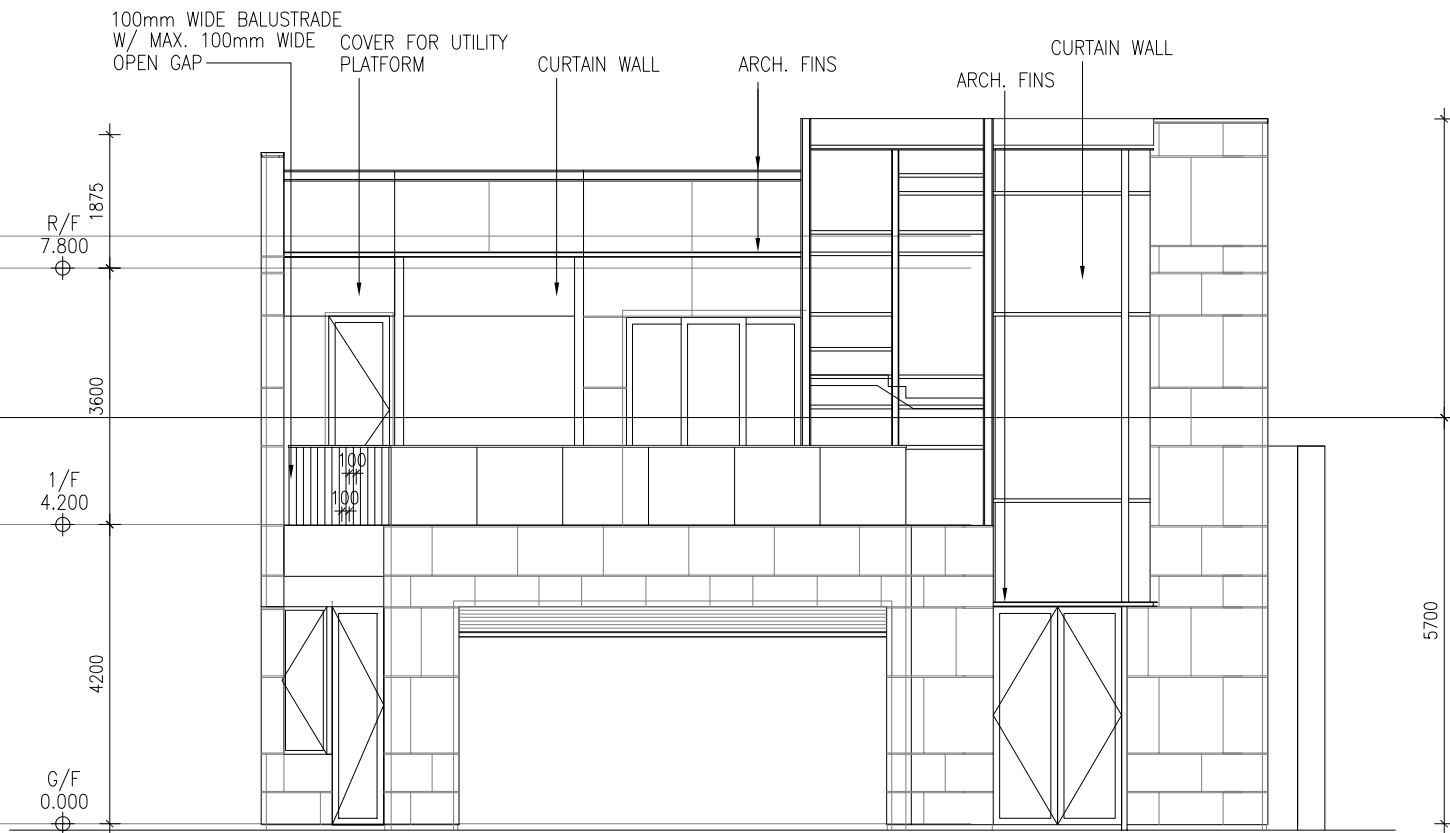
**LEGEND**

- Wall
- Glass

**DRAWING TITLE: HOUSE 9 GROUND FLOOR PLAN**  
SCALE: 1:150@A4

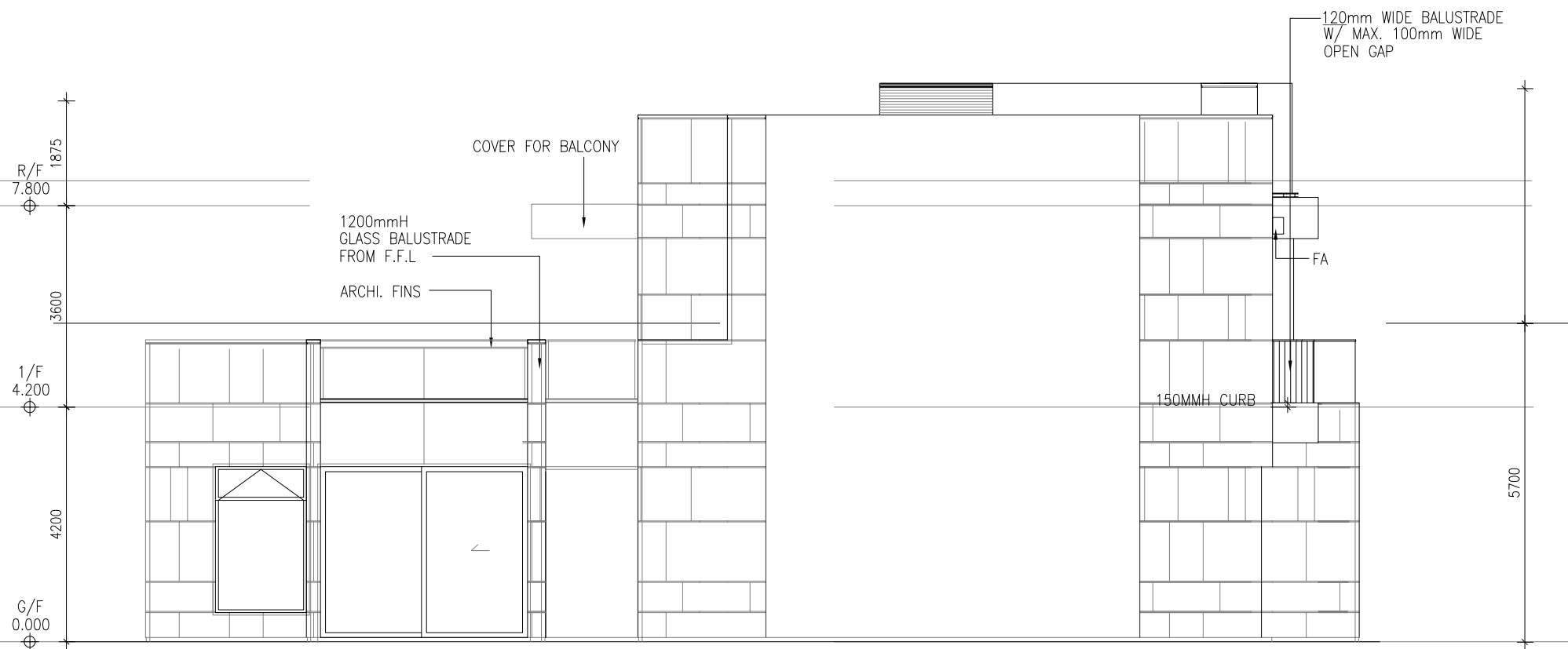






1A EAST ELEVATION 1:75  
HOUSE 9

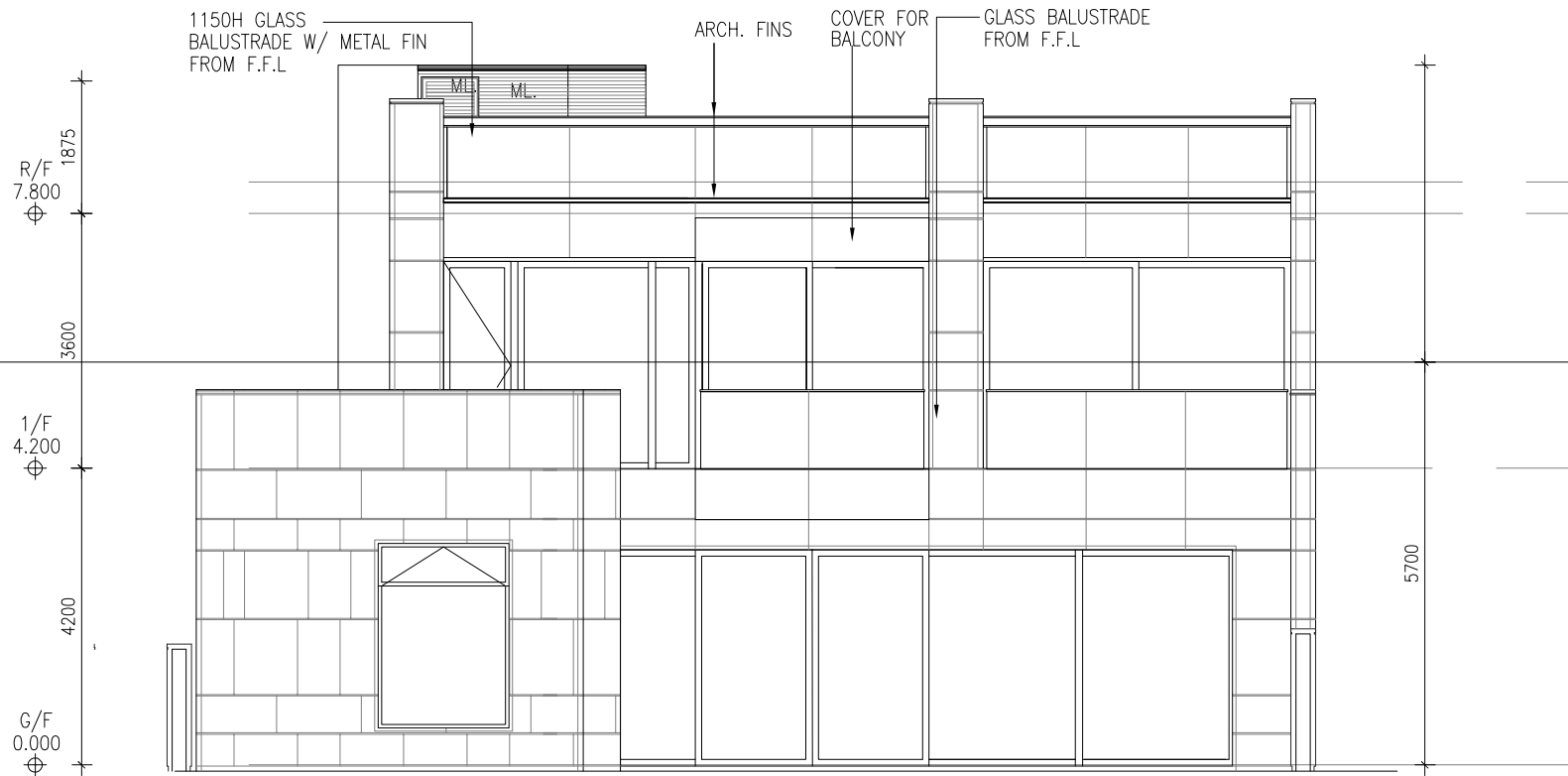
CSK-9E1



7 SOUTH ELEVATION 1:75  
HOUSE 9

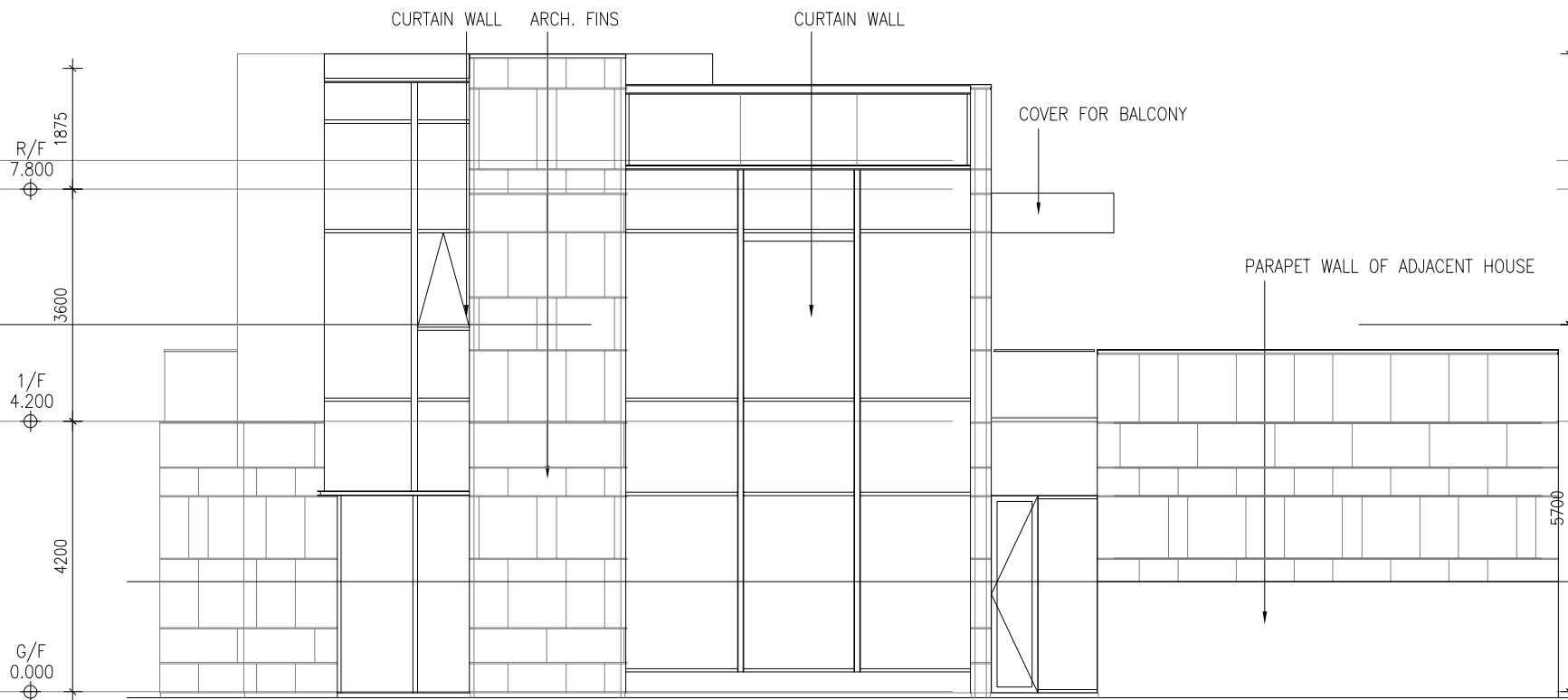
CSK-9E2





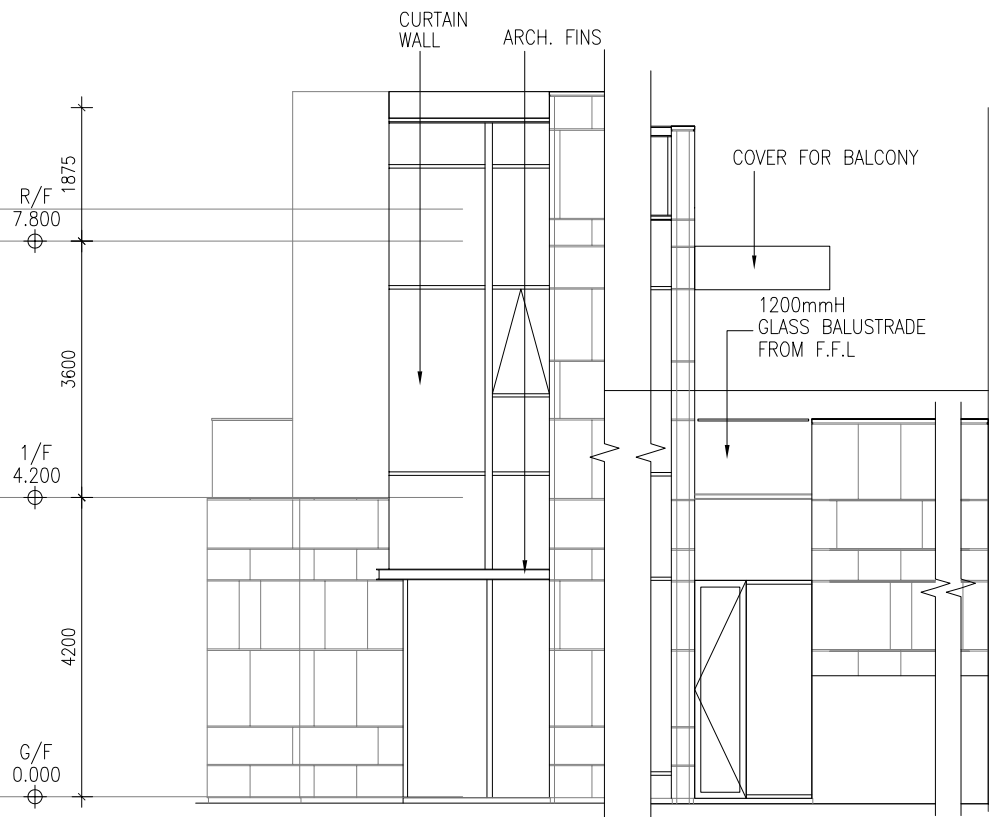
9 WEST ELEVATION 1:75  
— HOUSE 9

CSK-9E3

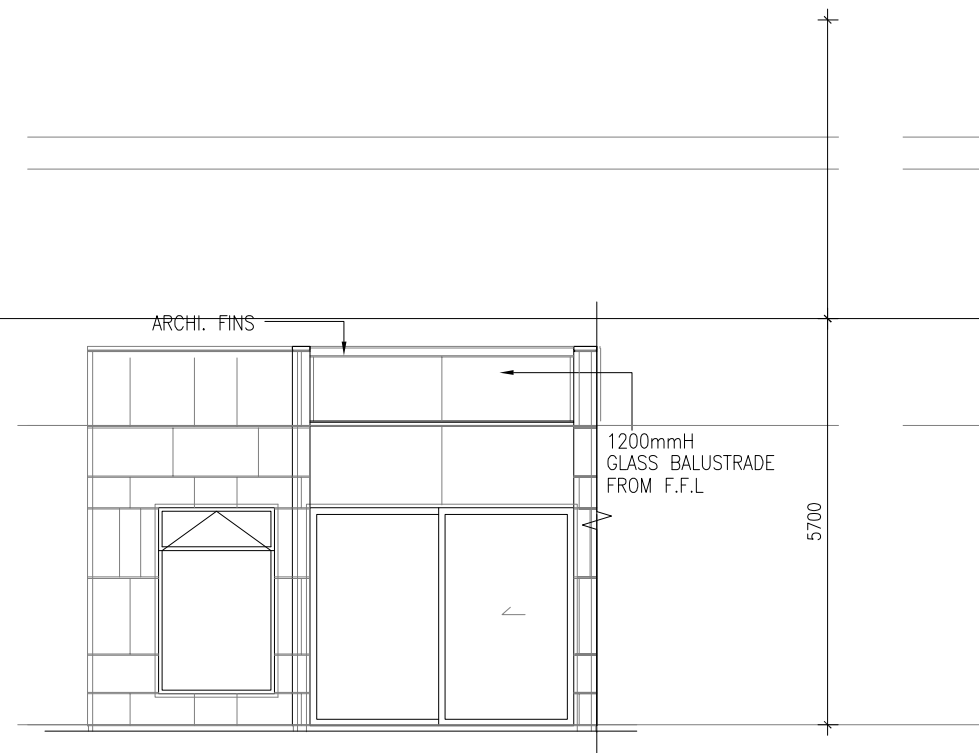


8 NORTH ELEVATION 1:75  
— HOUSE 9

CSK-9E4



8A PART ELEVATION 1:75  
HOUSE 9



3 PART ELEVATION OF BR1 1:75  
HOUSE 9

CSK-9E5

## RTTV Calculation (House 10)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

<b>West Elevations (House 10)</b>	Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys														
G/F	(	12.00 +	2.00	)x	4.20	x	1	=	14.00	x	4.20	x	1	=	58.80 m²
1/F	(	12.70	)x	3.60	x	1	=	12.70	x	3.60	x	1	=	45.72 m²	
R/F	(		)x	1.90	x	1	=	0.00	x	1.90	x	1	=	0.00 m²	

**Gross Wall Areas 104.52 m<sup>2</sup>**

<b>North Elevations (House 10)</b>		Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys													
G/F	(	14.50 +	0.90	)x	4.20	x	1	=	15.40	x	4.20	x	1	=	64.68 m²
1/F	(	3.60 +	5.90	)x	3.60	x	1	=	9.50	x	3.60	x	1	=	34.20 m²
R/F	(			)x	1.90	x	1	=	0.00	x	1.90	x	1	=	0.00 m²

**Gross Wall Areas 98.88 m<sup>2</sup>**

<b>East Elevations (House 10)</b>		Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys													
G/F	(	2.80 +	3.60	)x	4.20	x	1	=	6.40	x	4.20	x	1	=	26.88 m²
1/F	(	8.05	)x	3.60	x	1	=	8.05	x	3.60	x	1	=	28.98 m²	
R/F	(		)x	1.90	x	1	=	0.00	x	1.90	x	1	=	0.00 m²	

**Gross Wall Areas 55.86 m<sup>2</sup>**

<b>South Elevations (House 10)</b>		Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys													
G/F	(	11.60 +	2.60	)x	4.20	x	1	=	14.20	x	4.20	x	1	=	59.64 m²
1/F	(	6.70	)x	3.60	x	1	=	6.70	x	3.60	x	1	=	24.12 m²	
R/F	(		)x	1.90	x	1	=	0.00	x	1.90	x	1	=	0.00 m²	

**Gross Wall Areas 83.76 m<sup>2</sup>**

**Total Gross Wall Areas 343.02 m<sup>2</sup>**

## Sheet no. 2

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

South Elevations (House 10)		Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	( 1.50 + 4.00	)x 3.05 x 1 =	5.50	x	3.05	x	1	=	16.75	m²	
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00	x	3.15	x	1	=	0.00	m²	
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00	x	2.66	x	1	=	0.00	m²	
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00	x	2.74	x	1	=	0.00	m²	
									<b>Gross Glazing Areas</b>	<b>16.75 m²</b>	

**Total Gross Glazing Areas**      **134.16 m<sup>2</sup>**

# West Elevations (House 10)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 10) = 104.52 m²

Glazing Areas at West Elevations (House 10) = 55.92 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 35.02 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.29 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.28 x 2.64 = 11.29 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 10) = 48.60 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 48.60 m²

Window to Wall Ratio (WWR) = 55.92 / 104.52 = 0.53

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 10)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1

Description:

RC Wall Areas

Wall Material			
External surface film resistance	Ro	=	0.044
Air space resistance	Ra	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	Ri	=	0.12
Total	0.293		

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	4	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)		
Facade Orientation Facing	West	Gross Wall Area (Ao) =	104.52
Window to Wall Ratio (WWR)	0.53	Wall Orientation Factor (Gw) =	1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	48.60		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		5.71		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 5.71 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	55.92	9.61	11.29
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.67	0.12	0.14

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.93 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	35.02	9.61	11.29
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.80	1.24	2.17

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 10.21 W/m²

Summary of RTTV at West Elevations (House 10)  
= 5.71 + 0.93 + 10.21  
= 16.85 W/m²



# North Elevations (House 10)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 10) = 98.88 m²

Glazing Areas at North Elevations (House 10) = 38.00 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 38.00 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 10) = 60.88 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 60.88 m²

Window to Wall Ratio (WWR) = 38.00 / 98.88 = 0.38

Sheet no. 5

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 10)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 6 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)

Facade Orientation Facing North Gross Wall Area (Ao) = 98.88  
 Window to Wall Ratio (WWR) 0.38 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	60.88		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		5.28		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{5.28} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	38.00		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.34		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.34} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	38.00		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.45		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{5.45} \quad \text{W/m}^2$$

**Summary of RTTV at North Elevations (House 10)**

$$= 5.28 + 0.34 + 5.45$$

$$= \underline{11.07} \quad \text{W/m}^2$$

East Elevations (House 10)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 10)	=	55.86 m²
Glazing Areas at East Elevations (House 10)	=	23.49 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( E-F1 )	=	23.49 m²
ECS	=	1.000

Opaque Wall Areas at East Elevations (House 10)	=	32.37 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( E-W1 )	=	32.37 m²

Window to Wall Ratio (WWR) = 23.49 / 55.86 = 0.42

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 10)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 8 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)

Facade Orientation Facing East Gross Wall Area (Ao) = 55.86  
Window to Wall Ratio (WWR) 0.42 Wall Orientation Factor (Gw) = 1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	32.37		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		6.74		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 6.74 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	23.49		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.50		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.50 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	23.49		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		8.09		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 8.09 W/m²

Summary of RTTV at East Elevations (House 10)  
= 6.74 + 0.50 + 8.09  
= 15.34 W/m²

South Elevations (House 10)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 10)	=	83.76 m²
Glazing Areas at South Elevations (House 10)	=	16.75 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( S-F1 )	=	16.75 m²
ECS	=	1.000

Opaque Wall Areas at South Elevations (House 10)	=	67.01 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( S-W1 )	=	67.01 m²

Window to Wall Ratio (WWR)	=	16.75 / 83.76	=	0.20
----------------------------	---	---------------	---	------

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 10)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 10 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)

Facade Orientation Facing South Gross Wall Area (Ao) = 83.76  
Window to Wall Ratio (WWR) 0.20 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (awi)	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (Uwi)	W/m²K	3.42		
Opaque Wall Area (Awi)	m²	67.01		
Heat Conduction = 3.57(Awi/Ao) Uwi awi Gw		8.47		

Heat Conduction through Opaque Walls = 3.57(Awi/Ao) Uwi awi Gw where i= 1, 2, ..., n  
= 8.47 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (Afi)	m²	16.75		
U-value of Glazing (Ufi)	W/m²K	1.74		
Heat Conduction = 0.64 (Afi/Ao) Uf Gw		0.22		

Heat Conduction through Glazing = 0.64 (Afi/Ao) Ufi Gw where i= 1, 2, ..., n  
= 0.22 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (Afi)	m²	16.75		
Shading Coefficient of Glazing (SCf)		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw		3.50		

Solar Radiation through Glazing = 41.75 (Afi/Ao)(SCfi)(ESCwi)Gw where i= 1, 2, ..., n  
= 3.50 W/m²

Summary of RTTV at South Elevations (House 10)  
= 8.47 + 0.22 + 3.50  
= 12.18 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No. 11 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)

Overall Gross Wall Area [a] 343.02 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	104.52	5.71	0.93	10.21	16.85	5.13
North	98.88	5.28	0.34	5.45	11.07	3.19
East	55.86	6.74	0.50	8.09	15.34	2.50
South	83.76	8.47	0.22	3.50	12.18	2.98

Overall RTTV<sub>wall</sub> = 13.80 W/m²

< 14 W/m² OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 168.05 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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)

OpaqueAreas at Roof = 168.05 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 154.87 m²  
1/F = 34.60 m²  
Roof = 95.87 m²  
Upper Roof = 24.40 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 13.18 m²  
1/F = 7.27 m²  
Roof = 5.91 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

Uw1 = 1 / 1.858 = 0.54 W/m²K

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

Uw1 = 1 / 1.836 = 0.54 W/m²K



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No.	13	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)		
Roof Orientation Facing	Flat	Gross Roof Area (Aro) =	168.05
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	154.87	13.18	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.29	0.25	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs

where i= 1, 2, ..., n

= 3.54 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

= 3.54 + 0.00 + 0.00

= 3.54 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No. 14 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)

Overall Roof Area [a] 168.05 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	168.05	3.54	0.00	0.00	3.54	3.54

Overall RTTV<sub>roof</sub> = 3.54 W/m²

< 4 W/m² OK

## RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 10)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy $RTTV_{Wall}$									
Facade Orientation Facing	West		North		East		South		
Average Absorptivity	0.795		0.795		0.795		0.795		
Average Window to Wall Ratio	0.59		0.33		0.19		0.73		
Shading Coefficient of Glazing	0.43		0.43		0.43		0.43		
Average Shading Coefficient of Facade	0.43		0.43		0.43		0.43		
Visible Light Transmittance	53 %		53 %		53 %		53 %		
External Reflectance	17 %		17 %		17 %		17 %		

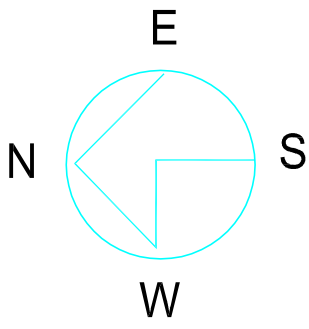
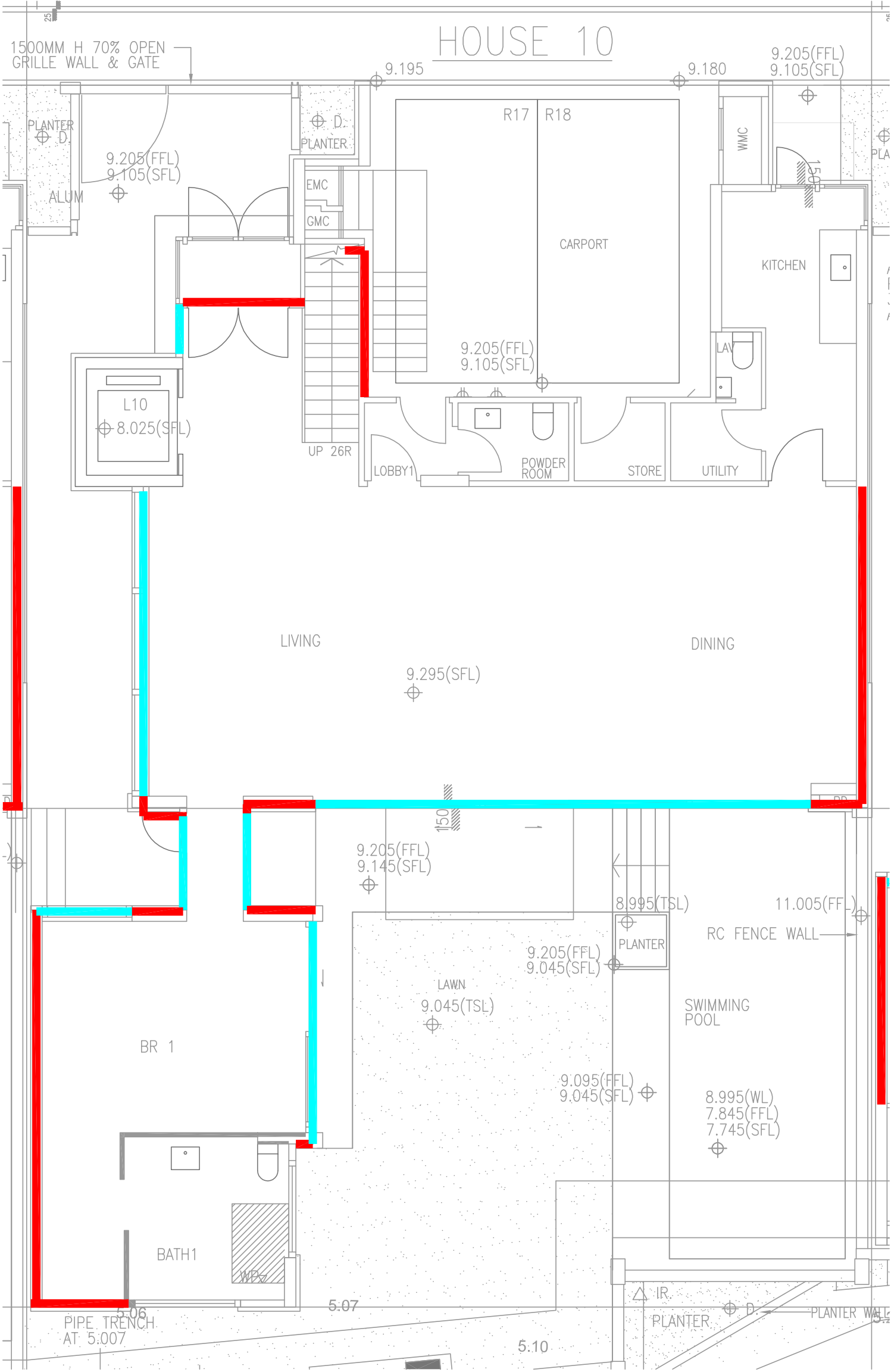
Table 2

RTTV <sub>Wall</sub>																		
Facade Orientation Facing		West				North				East				South				
Wall Orientation Factor		1.131				0.79				1.072				0.975				
Total External Wall Area (Residential Units)		101.7	m <sup>2</sup>	Window to Wall Ratio		90.93	m <sup>2</sup>	Window to Wall Ratio		35.2	m <sup>2</sup>	Window to Wall Ratio		15.8	m <sup>2</sup>	Window to Wall Ratio		
Total Window Area		59.81	m <sup>2</sup>			=	0.59			29.63	m <sup>2</sup>			=	0.33			6.80
Heat Conduction	Opaque Wall	5.71 W/m <sup>2</sup>				5.28 W/m <sup>2</sup>				6.74 W/m <sup>2</sup>				8.47 W/m <sup>2</sup>				
	Window	0.93 W/m <sup>2</sup>				0.34 W/m <sup>2</sup>				0.50 W/m <sup>2</sup>				0.22 W/m <sup>2</sup>				
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
		<input checked="" type="checkbox"/> Tinted	Area = 59.81 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 29.63 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 6.8 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 11.42 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
	Solar Radiation through Gazing		10.21 W/m <sup>2</sup>				5.45 W/m <sup>2</sup>				8.09 W/m <sup>2</sup>				3.50 W/m <sup>2</sup>			
	Average Absorptivity		0.795				0.795				0.795				0.795			
RTTV <sub>Wall</sub> at each Facade		16.85	W/m <sup>2</sup>		11.07	W/m <sup>2</sup>		15.34	W/m <sup>2</sup>		12.18	W/m <sup>2</sup>						
Overall RTTV <sub>Wall</sub>		13.80 W/m <sup>2</sup>																

Table 3

RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		168.05 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.54 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
Solar Radiation through Gazing		0 W/m <sup>2</sup>								
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.54 W/m <sup>2</sup>								

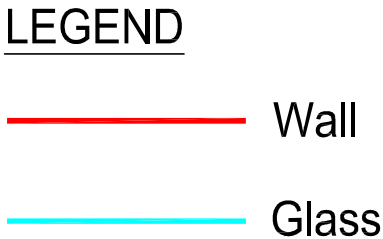
ER = External Reflectance; SC = Shading Coefficient &amp; VLT = Visible Light Transmittance



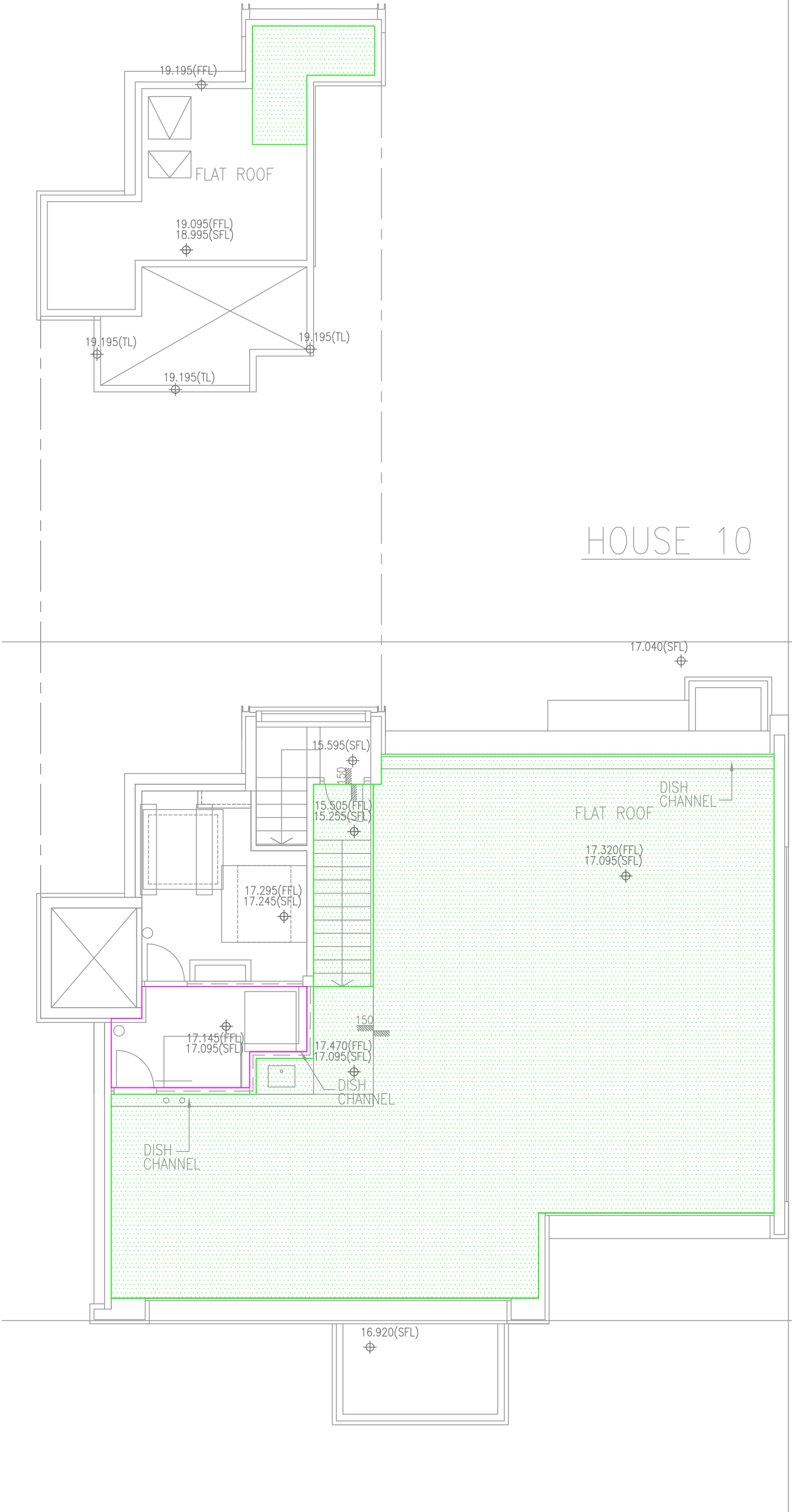
**LEGEND**

- Wall
- Glass

**DRAWING TITLE: HOUSE 10 GROUND FLOOR PLAN**  
SCALE: 1:150@A4

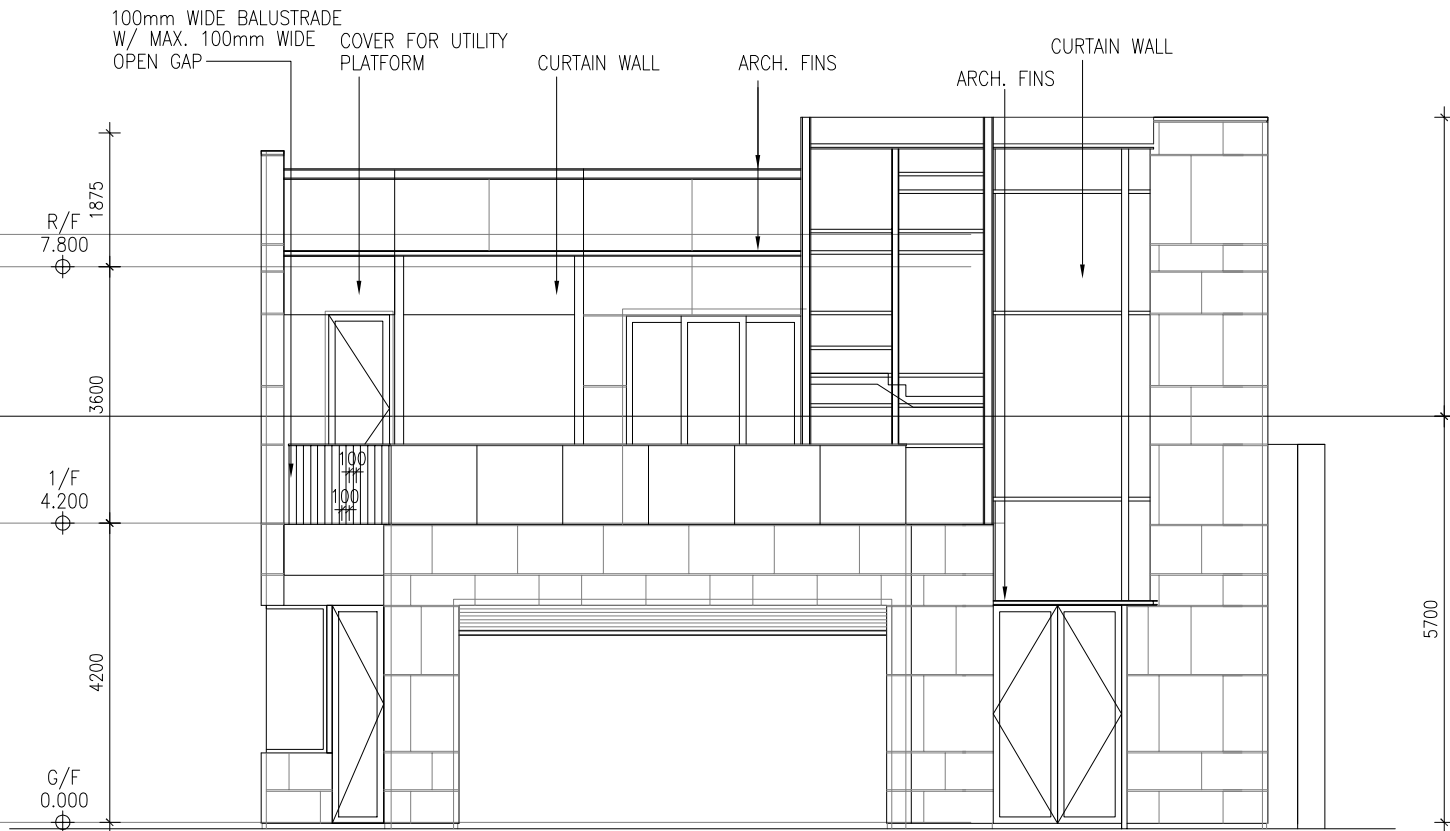


DRAWING TITLE: HOUSE 10 FIRST FLOOR PLAN  
SCALE: 1:150@A4



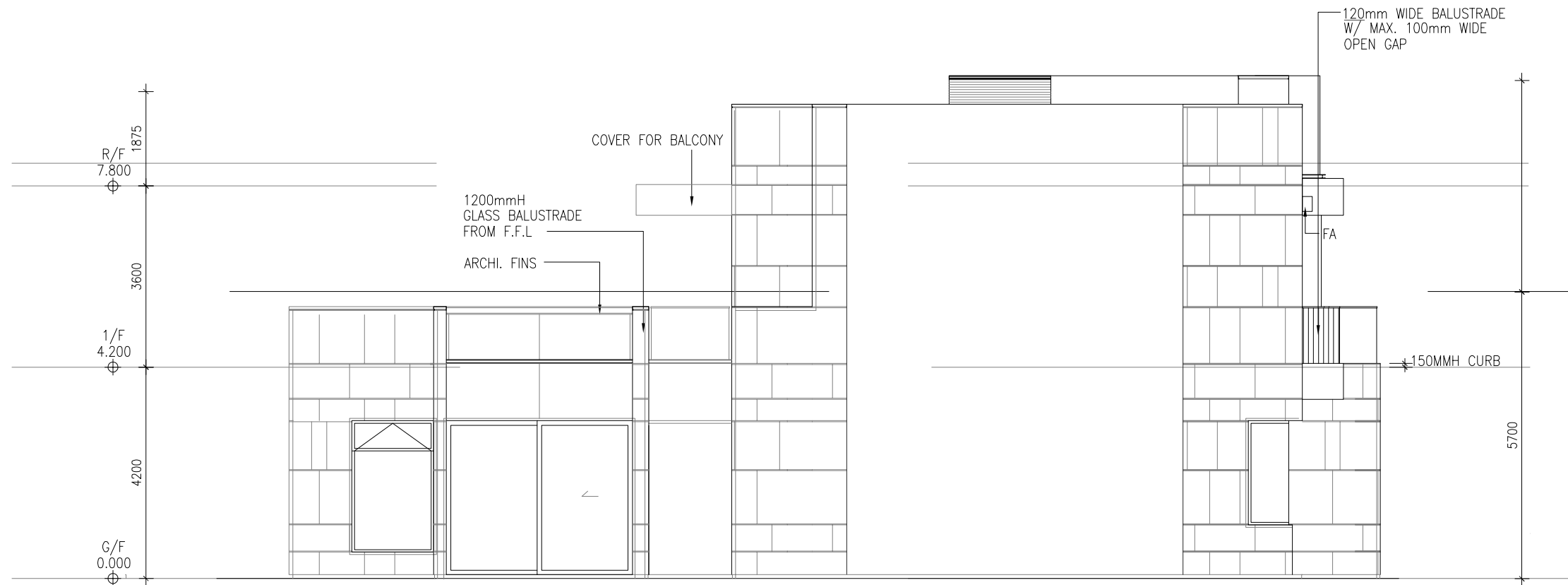
DRAWING TITLE: HOUSE 10 ROOF FLOOR PLAN

SCALE: 1:150@A4



1A EAST ELEVATION 1:75  
— HOUSE 10

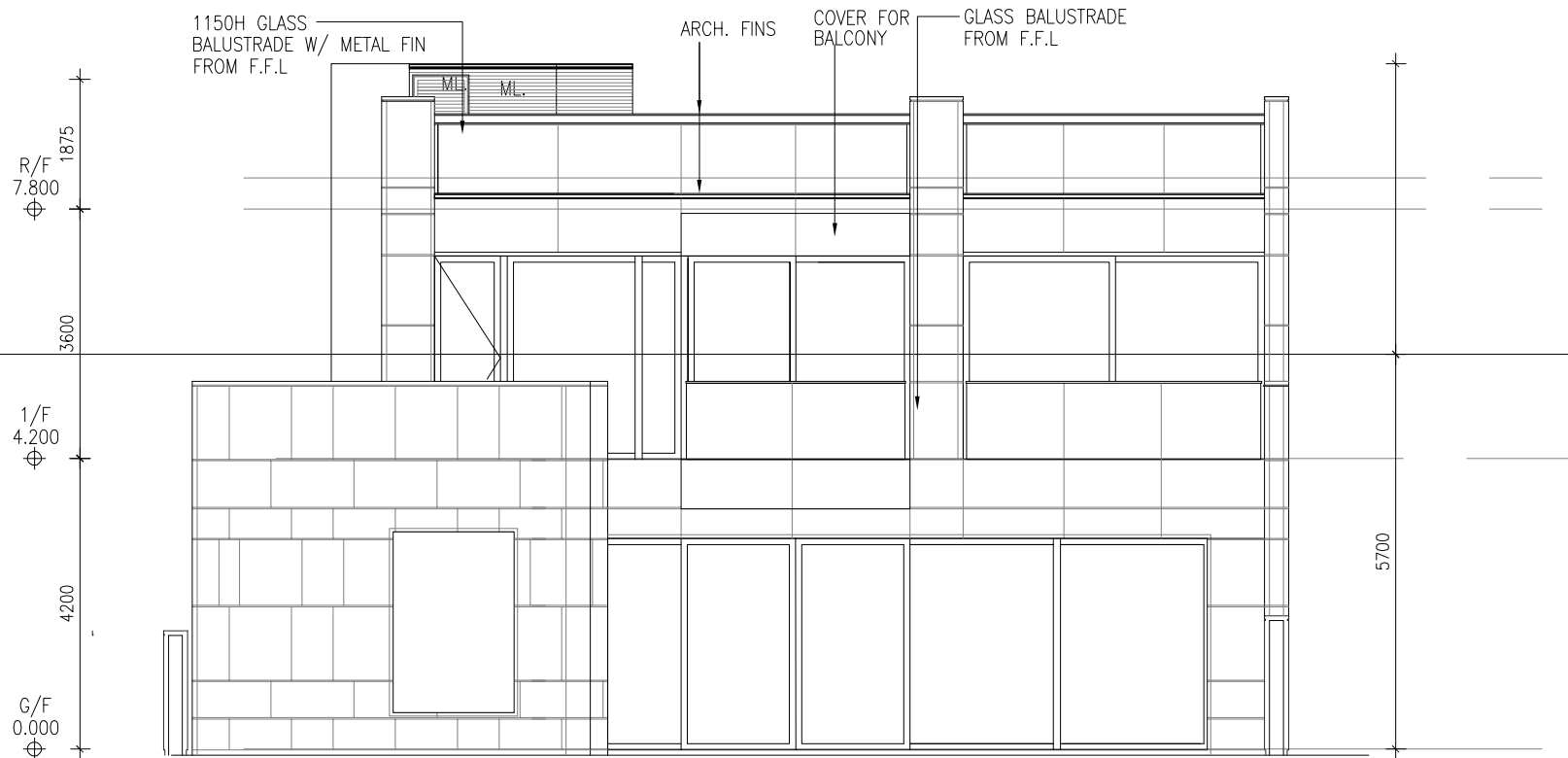
CSK-10E1



7 SOUTH ELEVATION 1:75  
— HOUSE 10

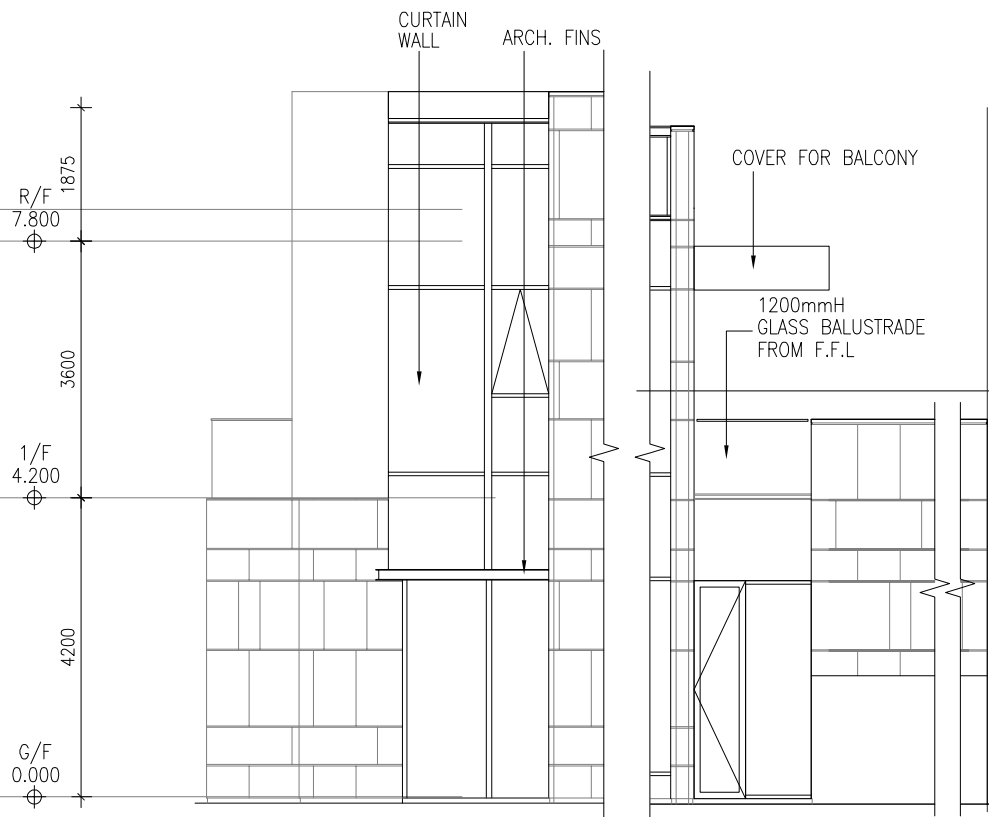
CSK-10E2



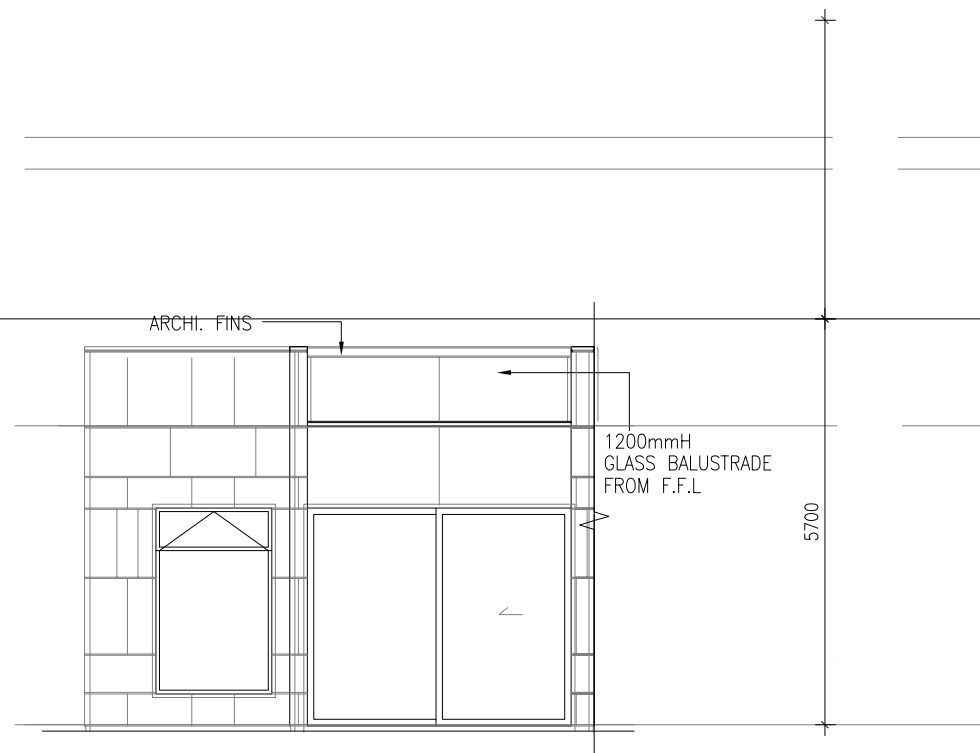


9 WEST ELEVATION 1:75  
— HOUSE 10

CSK-10E3

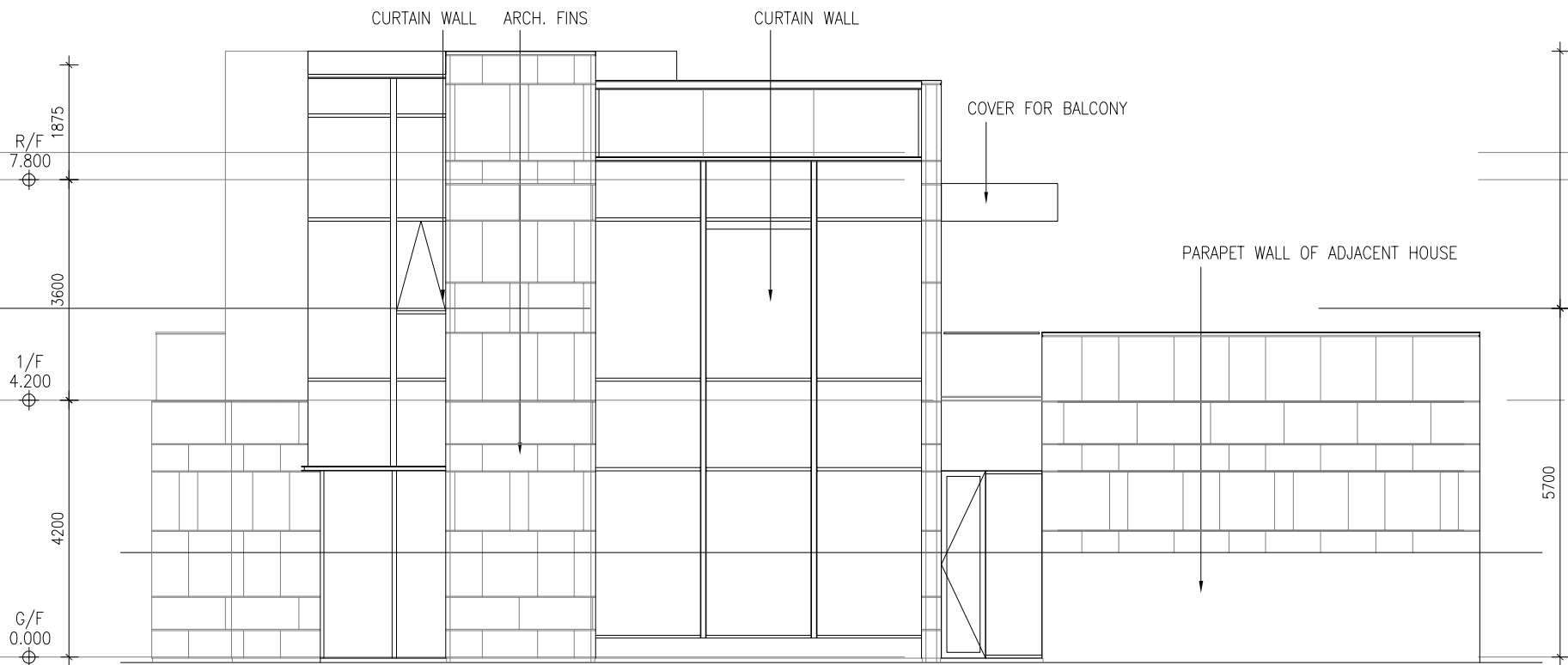


8A PART ELEVATION 1:75  
HOUSE 10



3 PART ELEVATION OF BR1 1:75  
HOUSE 10

# CSK-10E5



8 NORTH ELEVATION 1:75  
— HOUSE 10

CSK-10E4

## RTTV Calculation (House 11)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

### West Elevations (House 11) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 1.00 + #### + 1.50	)x 4.20 x 1 =	14.50 x 4.20 x 1 =	60.90 m <sup>2</sup>
1/F	( 12.70	)x 3.60 x 1 =	12.70 x 3.60 x 1 =	45.72 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 106.62 m<sup>2</sup>**

### North Elevations (House 11) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 10.90 + 0.90	)x 4.20 x 1 =	11.80 x 4.20 x 1 =	49.56 m <sup>2</sup>
1/F	( 3.60 + 5.90	)x 3.60 x 1 =	9.50 x 3.60 x 1 =	34.20 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 83.76 m<sup>2</sup>**

### East Elevations (House 11) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 2.80 + 3.80	)x 4.20 x 1 =	6.60 x 4.20 x 1 =	27.72 m <sup>2</sup>
1/F	( 8.05	)x 3.60 x 1 =	8.05 x 3.60 x 1 =	28.98 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 56.70 m<sup>2</sup>**

### South Elevations (House 11) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 11.80 + 3.00	)x 4.20 x 1 =	14.80 x 4.20 x 1 =	62.16 m <sup>2</sup>
1/F	( 6.70	)x 3.60 x 1 =	6.70 x 3.60 x 1 =	24.12 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 86.28 m<sup>2</sup>**

**Total Gross Wall Areas 333.36 m<sup>2</sup>**

# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 11)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	8.90	)x	3.05	x	1	=	8.90	x 3.05 x 1 = 27.10 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	4.50 + 5.50	)x	2.66	x	1	=	10.00	x 2.66 x 1 = 26.55 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>
<b>Gross Glazing Areas</b>									<b>53.65 m<sup>2</sup></b>

### North Elevations (House 11)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	0.90 + 4.50	)x	3.05	x	1	=	5.40	x 3.05 x 1 = 16.44 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	1 + 5.40	)x	2.66	x	1	=	6.40	x 2.66 x 1 = 16.99 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>
<b>Gross Glazing Areas</b>									<b>33.44 m<sup>2</sup></b>

### East Elevations (House 11)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	2.20 + 1.50	)x	3.05	x	1	=	3.70	x 3.05 x 1 = 11.27 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
G/F (Window GL02)	(		)x	0.86	x	1	=	0.00	x 0.86 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02)	(	2.20 + 2.20	)x	2.64	x	1	=	4.40	x 2.64 x 1 = 11.62 m <sup>2</sup>
<b>Gross Glazing Areas</b>									<b>22.88 m<sup>2</sup></b>

### South Elevations (House 11)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys									
G/F (Window GL02) - A	(	1.20 + 3.80	)x	3.05	x	1	=	5.00	x 3.05 x 1 = 15.23 m <sup>2</sup>
G/F (Window GL02) - B	(		)x	3.15	x	1	=	0.00	x 3.15 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - C	(		)x	2.66	x	1	=	0.00	x 2.66 x 1 = 0.00 m <sup>2</sup>
1/F (Window GL02) - D	(		)x	2.74	x	1	=	0.00	x 2.74 x 1 = 0.00 m <sup>2</sup>
<b>Gross Glazing Areas</b>									<b>15.23 m<sup>2</sup></b>

**Total Gross Glazing Areas 125.19 m<sup>2</sup>**

# West Elevations (House 11)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 11) = 106.62 m²

Glazing Areas at West Elevations (House 11) = 53.65 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 32.76 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.29 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.28 x 2.64 = 11.29 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 11) = 52.97 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 52.97 m²

Window to Wall Ratio (WWR) = 53.65 / 106.62 = 0.50

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 11)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	4	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)		
Facade Orientation Facing	West	Gross Wall Area (Ao) =	106.62
Window to Wall Ratio (WWR)	0.50	Wall Orientation Factor (Gw) =	1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	52.97		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		6.10		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 6.10 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	53.65	9.61	11.29
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.63	0.11	0.13

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.88 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	32.76	9.61	11.29
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.24	1.22	2.13

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 9.58 W/m²

Summary of RTTV at West Elevations (House 11)  
= 6.10 + 0.88 + 9.58  
= 16.56 W/m²



# North Elevations (House 11)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 11) = 83.76 m²

Glazing Areas at North Elevations (House 11) = 33.44 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 33.44 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 11) = 50.33 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 50.33 m²

Window to Wall Ratio (WWR) = 33.44 / 83.76 = 0.40

Sheet no. 5

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 11)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 6 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)

Facade Orientation Facing North Gross Wall Area (Ao) = 83.76  
 Window to Wall Ratio (WWR) 0.40 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	50.33		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		5.15		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{5.15}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	33.44		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.35		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.35}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	33.44		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.66		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{5.66}} \quad \text{W/m}^2$$

**Summary of RTTV at North Elevations (House 11)**

$$= 5.15 + 0.35 = \underline{\underline{11.16}} \quad \text{W/m}^2$$

# East Elevations (House 11)

Sheet no. 7

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 11) = 56.70 m²

Glazing Areas at East Elevations (House 11) = 22.88 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 22.88 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 11) = 33.82 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 33.82 m²

Window to Wall Ratio (WWR) = 22.88 / 56.70 = 0.40

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 11)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)

R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)

R<sub>a</sub> Air space resistance (Refer to Table 3)

x Thickness of building materials

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

E-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	R <sub>o</sub>	= 0.044
Air space resistance	R <sub>a</sub>	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	R <sub>i</sub>	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 8 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)

Facade Orientation Facing East Gross Wall Area (Ao) = 56.70  
 Window to Wall Ratio (WWR) 0.40 Wall Orientation Factor (Gw) = 1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	33.82		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		6.94		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{6.94}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	22.88		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.48		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.48}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	22.88		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		7.77		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{7.77}} \quad \text{W/m}^2$$

**Summary of RTTV at East Elevations (House 11)**

$$= 6.94 + 0.48 + 7.77$$

$$= \underline{\underline{15.19}} \quad \text{W/m}^2$$

South Elevations (House 11)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 11)	=	86.28 m²
Glazing Areas at South Elevations (House 11)	=	15.23 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( S-F1 )	=	15.23 m²
ECS	=	1.000

Opaque Wall Areas at South Elevations (House 11)	=	71.06 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( S-W1 )	=	71.06 m²

Window to Wall Ratio (WWR)	=	15.23 / 86.28	=	0.18
----------------------------	---	---------------	---	------

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 11)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 10 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)

Facade Orientation Facing South Gross Wall Area (Ao) = 86.28  
 Window to Wall Ratio (WWR) 0.18 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
<b>External Finish Material</b>		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
<b>Intermediate component</b>		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
<b>Intermediate component</b>		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Internal Finish Material</b>		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	71.06		
<b>Heat Conduction = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub></b>		<b>8.72</b>		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{8.72}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.23		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
<b>Heat Conduction = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub></b>		<b>0.19</b>		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.19}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.23		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
<b>Solar Radiation = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub></b>		<b>3.09</b>		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{3.09}} \quad \text{W/m}^2$$

**Summary of RTTV at South Elevations (House 11)**

$$= 8.72 + 0.19 + 3.09$$

$$= \underline{\underline{12.00}} \quad \text{W/m}^2$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No. 11 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)

Overall Gross Wall Area [a] 333.36 m<sup>2</sup>

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )	(W/m <sup>2</sup> )
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	106.62	6.10	0.88	9.58	16.56	5.30
North	83.76	5.15	0.35	5.66	11.16	2.81
East	56.70	6.94	0.48	7.77	15.19	2.58
South	86.28	8.72	0.19	3.09	12.00	3.10

Overall RTTV<sub>wall</sub> = 13.79 W/m<sup>2</sup>

< 14 W/m<sup>2</sup> OK

Roof

Sheet no. 12

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 170.33 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 170.33 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 158.97 m²  
1/F = 26.80 m²  
Roof = 97.57 m²  
Upper Roof = 34.60 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 11.36 m²  
1/F = 5.56 m²  
Roof = 5.80 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$U_{w1} = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No.	13	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)		
Roof Orientation Facing	Flat	Gross Roof Area (Aro) =	170.33
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	158.97	11.36	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.34	0.21	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs

where i= 1, 2, ..., n

= 3.55 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

= 3.55 + 0.00 + 0.00

= 3.55 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No. 14 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)

Overall Roof Area [a] 170.33 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	170.33	3.55	0.00	0.00	3.55	3.55

Overall RTTV<sub>roof</sub> = 3.55 W/m²

< 4 W/m² OK

RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 11)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd.	
	<input type="checkbox"/> 2. Architect	
	<input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

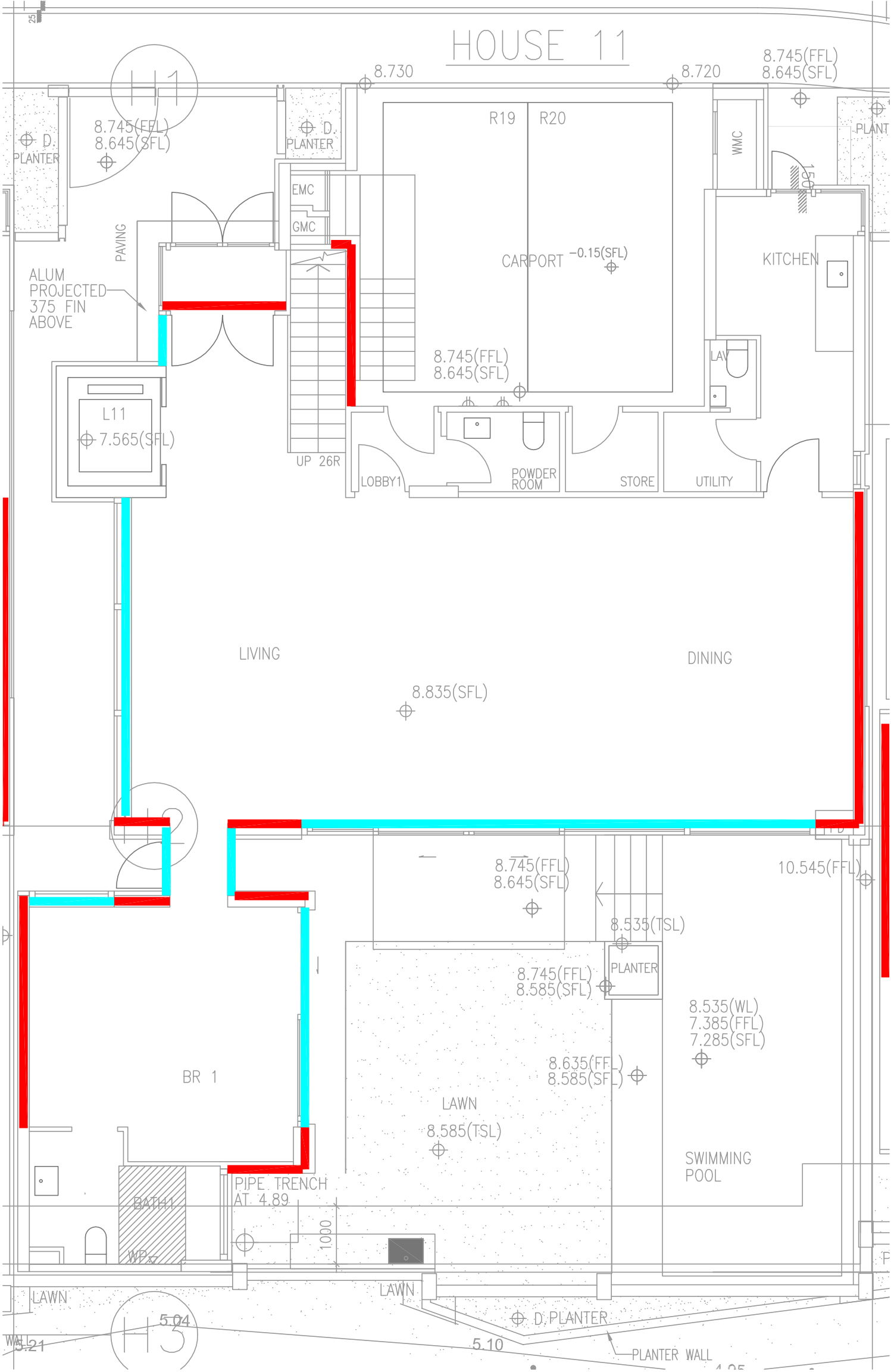
Deemed to Satisfy RTTV <sub>wall</sub>								
Facade Orientation Facing	West		North		East		South	
Average Absorptivity	0.795		0.795		0.795		0.795	
Average Window to Wall Ratio	0.59		0.33		0.19		0.73	
Shading Coefficient of Glazing	0.43		0.43		0.43		0.43	
Average Shading Coefficient of Facade	0.43		0.43		0.43		0.43	
Visible Light Transmittance	53	%	53	%	53	%	53	%
External Reflectance	17	%	17	%	17	%	17	%

Table 2																									
Facade Orientation Facing		West						North						East						South					
Wall Orientation Factor		1.131						0.79						1.072						0.975					
Total External Wall Area (Residential Units)		101.7 m <sup>2</sup>		Window to Wall Ratio				90.93 m <sup>2</sup>		Window to Wall Ratio				35.2 m <sup>2</sup>		Window to Wall Ratio				15.8 m <sup>2</sup>		Window to Wall Ratio			
Total Window Area		59.81 m <sup>2</sup>		= 0.59				29.63 m <sup>2</sup>		= 0.33				6.80 m <sup>2</sup>		= 0.19				11.42 m <sup>2</sup>		= 0.73			
Heat Conduction	Opaque Wall	6.10 W/m <sup>2</sup>						5.15 W/m <sup>2</sup>						6.94 W/m <sup>2</sup>						8.72 W/m <sup>2</sup>					
	Window	0.88 W/m <sup>2</sup>						0.35 W/m <sup>2</sup>						0.48 W/m <sup>2</sup>						0.19 W/m <sup>2</sup>					
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %				
		<input checked="" type="checkbox"/> Tinted	Area = 59.81 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 29.63 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 6.8 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 11.42 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %				
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %				
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
	Solar Radiation through Gazing		9.58 W/m <sup>2</sup>						5.66 W/m <sup>2</sup>						7.77 W/m <sup>2</sup>						3.09 W/m <sup>2</sup>				
Average Absorptivity		0.795						0.795						0.795						0.795					
RTTV <sub>Wall</sub> at each Facade		16.56 W/m <sup>2</sup>						11.16 W/m <sup>2</sup>						15.19 W/m <sup>2</sup>						12.00 W/m <sup>2</sup>					
Overall RTTV <sub>Wall</sub>		13.79 W/m <sup>2</sup>																							

Table 3

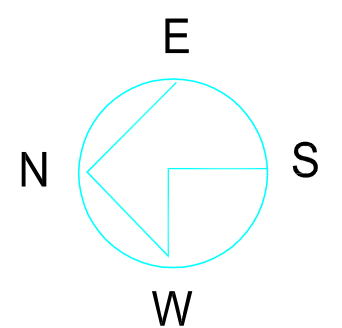
RTTV <sub>Roof</sub>										
Roof Orientation Factor										
Total Roof Area (Residential Units)		2.16 170.33		m <sup>2</sup>						
Total Skylight Area		0		m <sup>2</sup>						
Heat Conduction	Roof	3.55		W/m <sup>2</sup>						
	Skylight	0		W/m <sup>2</sup>						
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	Solar Radiation through Gazing		0		W/m <sup>2</sup>					
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.55		W/m <sup>2</sup>						

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



DRAWING TITLE: HOUSE 11 GROUND FLOOR PLAN

SCALE: 1:150@A4

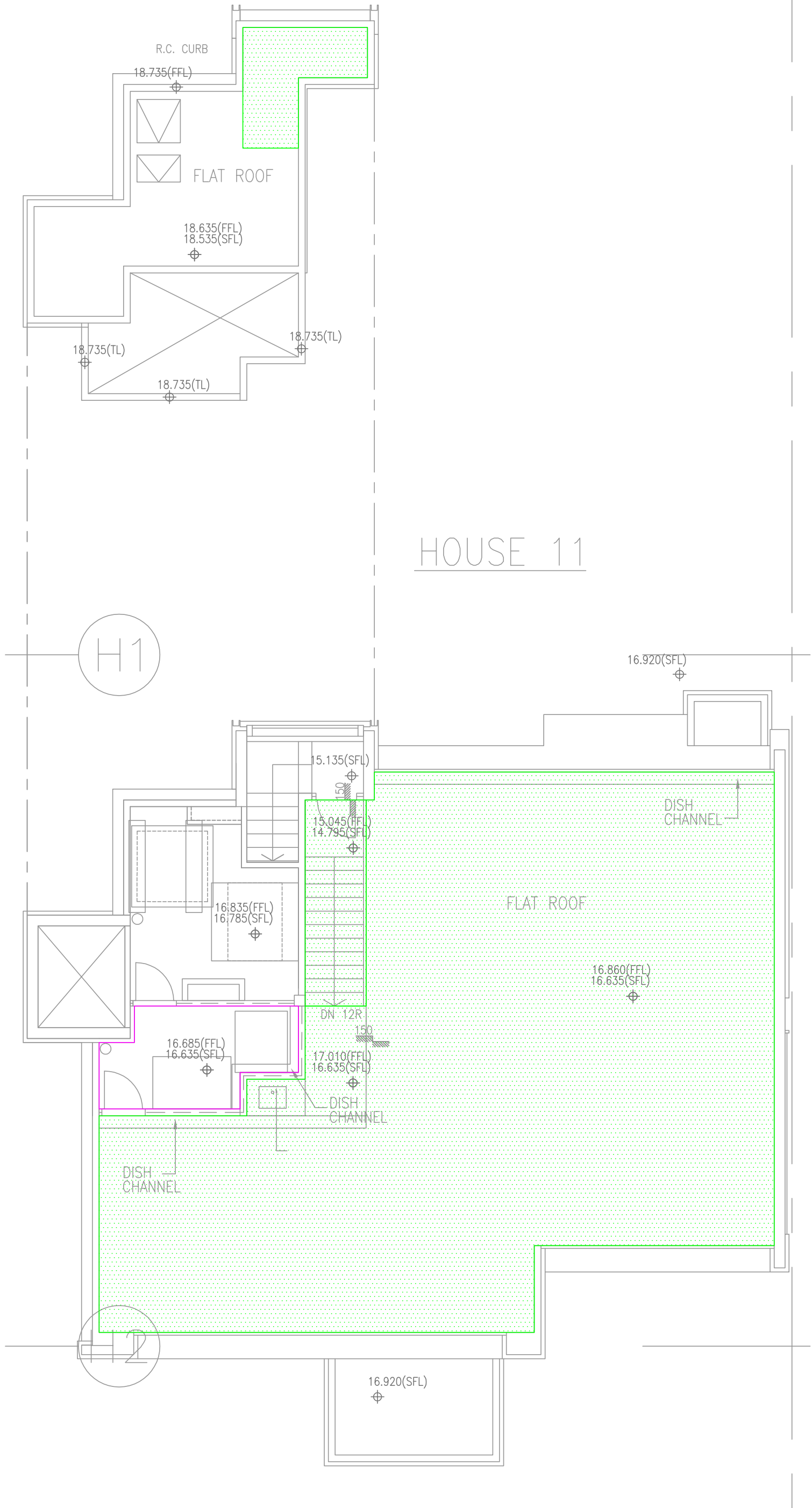


— Wall

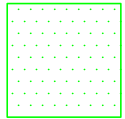
— Glass

# DRAWING TITLE: HOUSE 11 FIRST FLOOR PLAN

SCALE: 1:150@A4



LEGEND



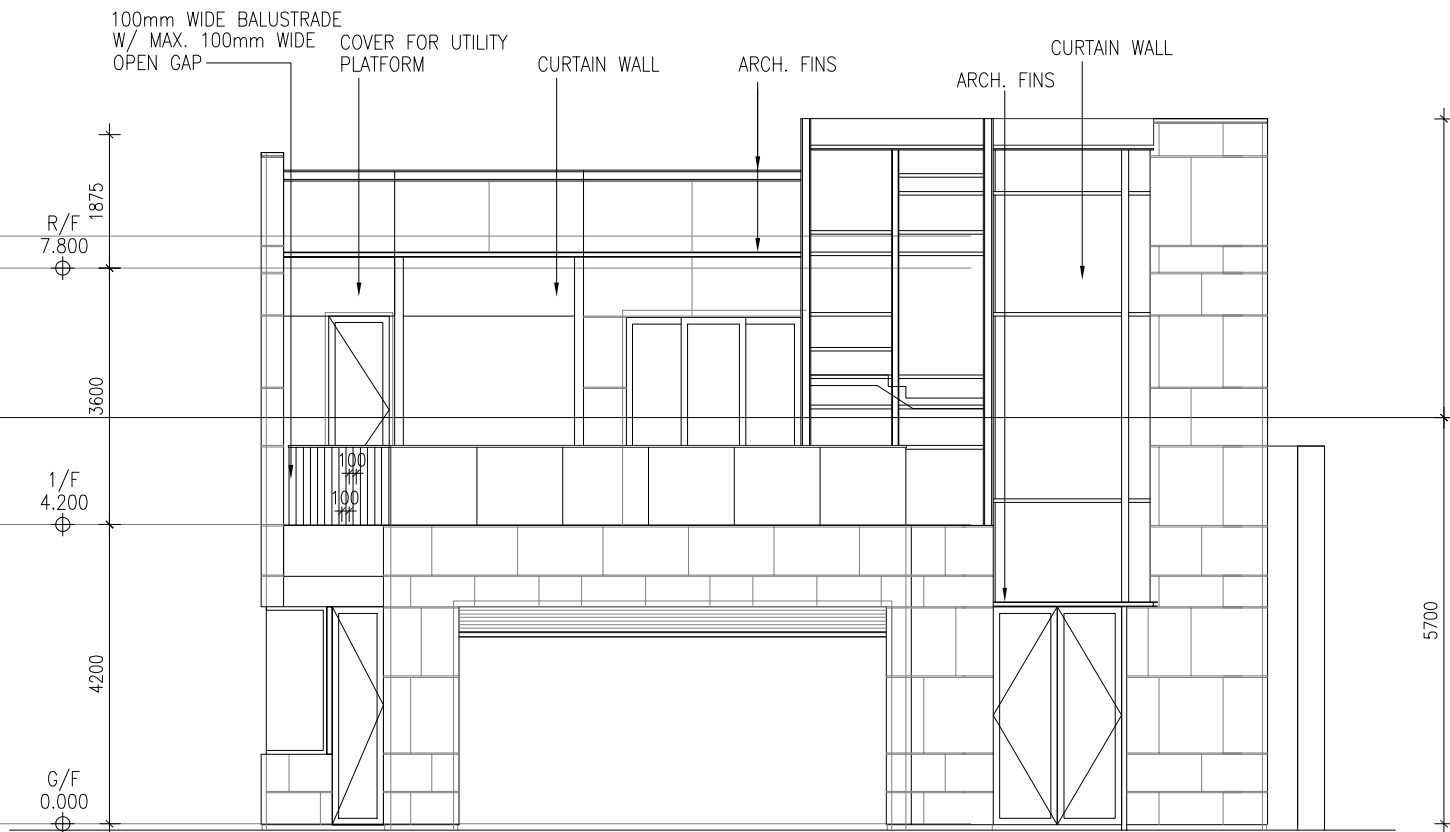
ROOF



AGT

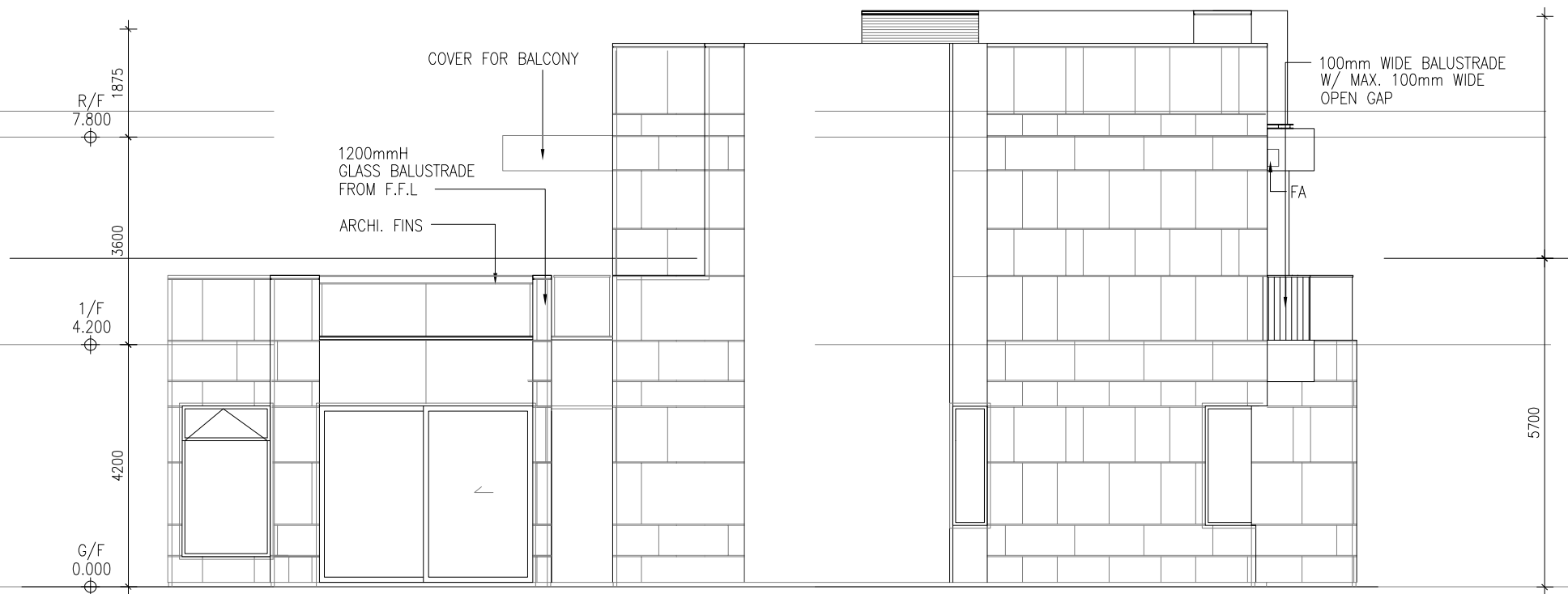
DRAWING TITLE: HOUSE 11 ROOF FLOOR PLAN

SCALE: 1:150@A4



1A EAST ELEVATION 1:75  
— HOUSE 11

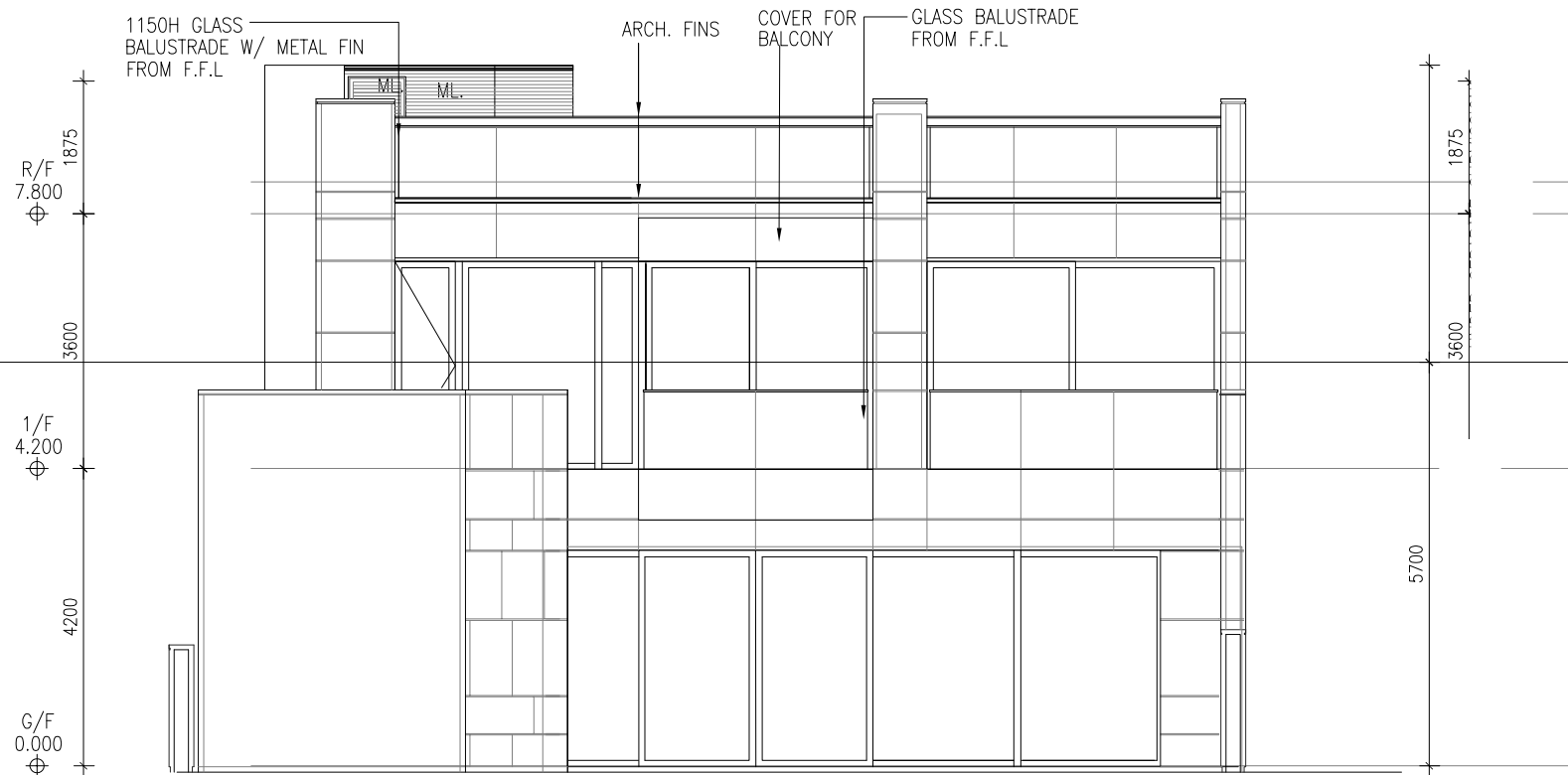
CSK-11E1



7 SOUTH ELEVATION 1:75  
HOUSE 11

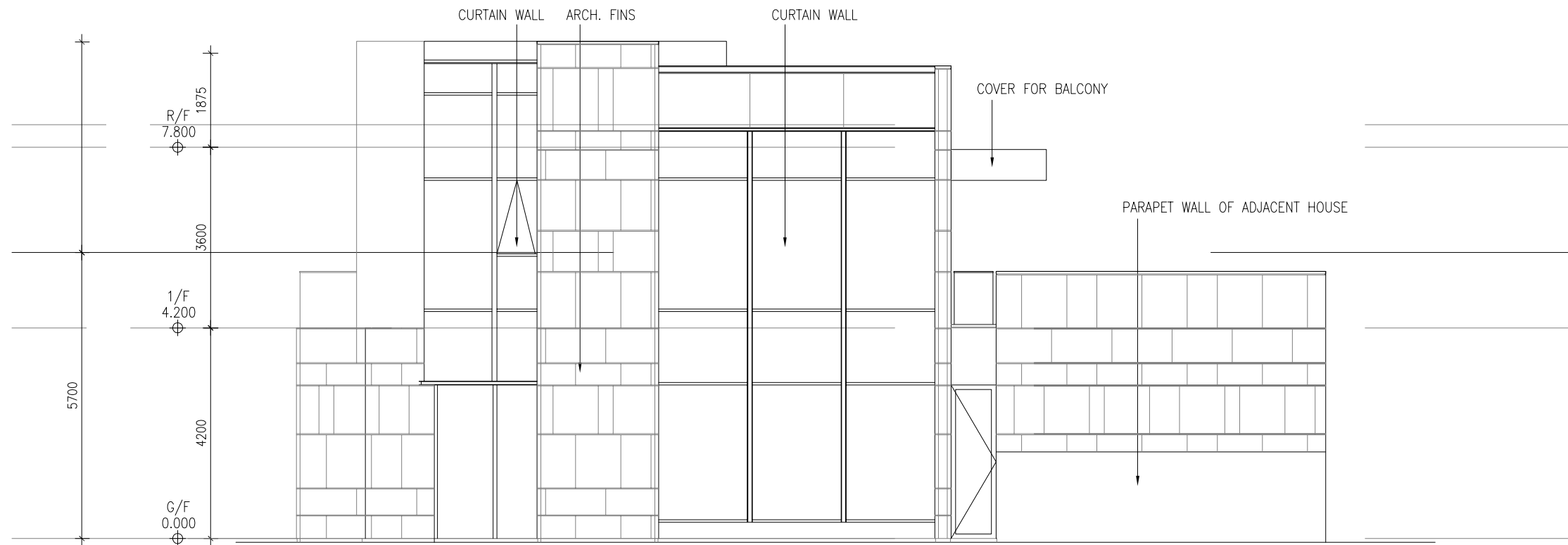
CSK-11E2





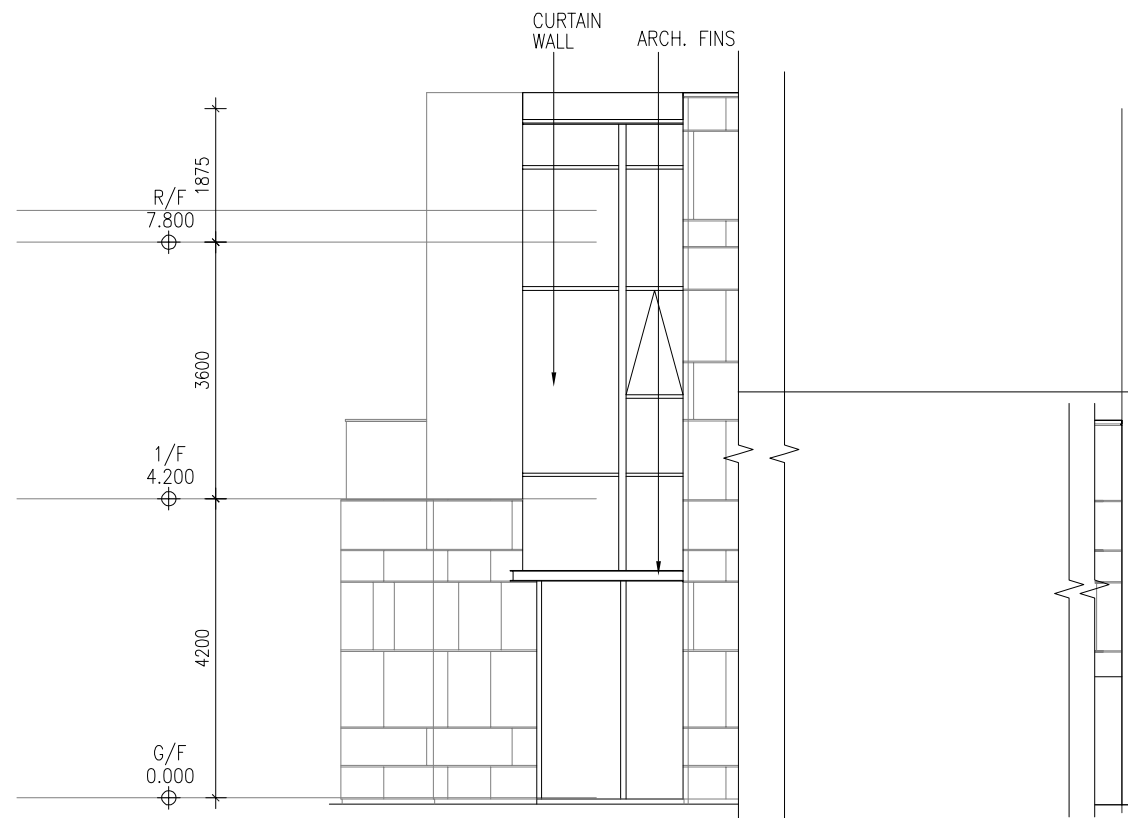
9 WEST ELEVATION 1:75  
— HOUSE 11

CSK-11E3

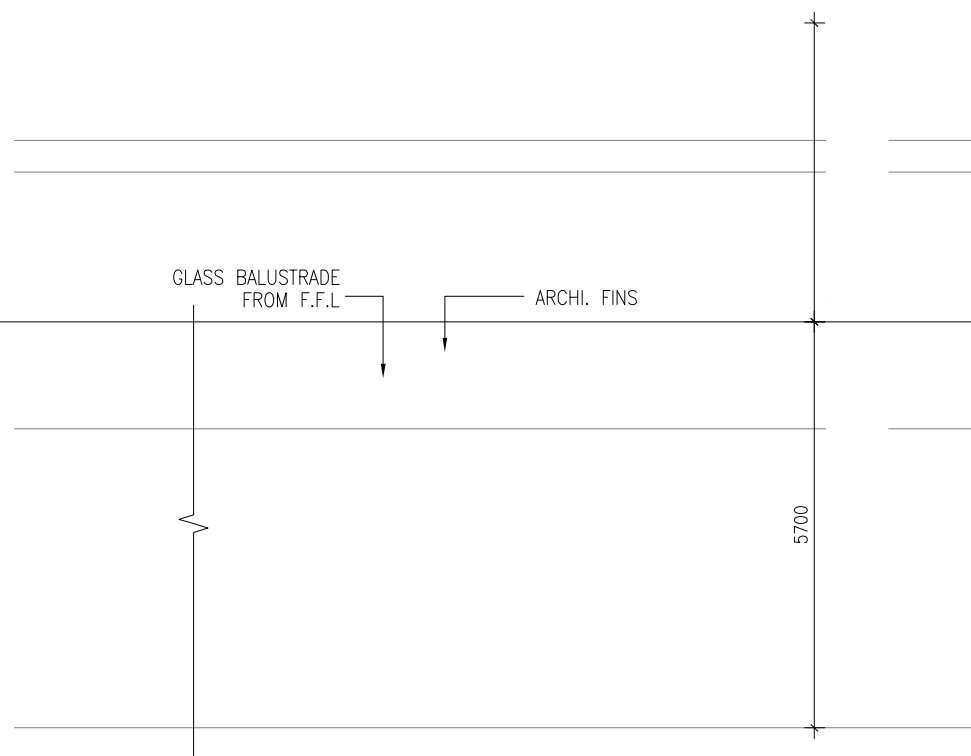


8 NORTH ELEVATION 1:75  
— HOUSE 11

CSK-11E4



8A PART ELEVATION 1:75  
HOUSE 11



6 PART ELEVATION OF BR1 1:75  
HOUSE 11

CSK-11E5

## RTTV Calculation (House 12)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

## West Elevations (House 12) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 13.50	)x 4.20 x 1 =	13.50 x 4.20 x 1 =	56.70 m <sup>2</sup>
1/F	( 12.70	)x 3.60 x 1 =	12.70 x 3.60 x 1 =	45.72 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 102.42 m<sup>2</sup>**

## North Elevations (House 12) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 12.30 + 1.50	)x 4.20 x 1 =	13.80 x 4.20 x 1 =	57.96 m <sup>2</sup>
1/F	( 8.60 + 0.90	)x 3.60 x 1 =	9.50 x 3.60 x 1 =	34.20 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 92.16 m<sup>2</sup>**

## East Elevations (House 12) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 3.50 + 8.60	)x 4.20 x 1 =	12.10 x 4.20 x 1 =	50.82 m <sup>2</sup>
1/F	( 5.80 + 0.80	)x 3.60 x 1 =	6.60 x 3.60 x 1 =	23.76 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 74.58 m<sup>2</sup>**

## South Elevations (House 12) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 14.00	)x 4.20 x 1 =	14.00 x 4.20 x 1 =	58.80 m <sup>2</sup>
1/F	( 6.50	)x 3.60 x 1 =	6.50 x 3.60 x 1 =	23.40 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 82.20 m<sup>2</sup>**

**Total Gross Wall Areas 351.36 m<sup>2</sup>**

# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 12) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 9.90	)x 3.05 x 1 =	9.90 x 3.05 x 1 =	30.15 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 7.50 + 4.50	)x 2.66 x 1 =	12.00 x 2.66 x 1 =	31.86 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 62.01 m<sup>2</sup>**

### North Elevations (House 12) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 7.70	)x 3.05 x 1 =	7.70 x 3.05 x 1 =	23.45 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 2.80 + 5.40	)x 2.66 x 1 =	8.20 x 2.66 x 1 =	21.77 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 45.22 m<sup>2</sup>**

### East Elevations (House 12) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 2.60	)x 3.05 x 1 =	2.60 x 3.05 x 1 =	7.92 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
G/F (Window GL02)	(	)x 0.86 x 1 =	0.00 x 0.86 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02)	( 0.70 + 2.20 + 3.10	)x 2.64 x 1 =	2.90 x 2.64 x 1 =	7.66 m <sup>2</sup>

**Gross Glazing Areas 15.57 m<sup>2</sup>**

### South Elevations (House 12) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 3.05 1.90	)x 3.05 x 1 =	4.95 x 3.05 x 1 =	15.07 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00 x 2.66 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 15.07 m<sup>2</sup>**

**Total Gross Glazing Areas 137.87 m<sup>2</sup>**

# West Elevations (House 12)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 12) = 102.42 m²

Glazing Areas at West Elevations (House 12) = 62.01 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 40.52 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 12) = 40.41 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 40.41 m²

Window to Wall Ratio (WWR) = 62.01 / 102.42 = 0.61

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 12)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)

Facade Orientation Facing West Gross Wall Area (Ao) = 102.42  
 Window to Wall Ratio (WWR) 0.61 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	40.41		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.84		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{4.84} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	62.01	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.76	0.12	0.15

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{1.03} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	40.52	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		8.03	1.27	2.33

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{11.63} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 12)**

$$= 4.84 + 1.03 + 11.63$$

$$= \underline{17.50} \quad \text{W/m}^2$$



# North Elevations (House 12)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 12)	=	92.16 m²
Glazing Areas at North Elevations (House 12)	=	45.22 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( N-F1 )	=	45.22 m²
ECS	=	1.000

Opaque Wall Areas at North Elevations (House 12)	=	46.94 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( N-W1 )	=	46.94 m²

Window to Wall Ratio (WWR)	=	45.22 / 92.16	=	0.49
----------------------------	---	---------------	---	------

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 12)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

- R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)
- R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)
- R<sub>a</sub> Air space resistance (Refer to Table 3)
- x Thickness of building materials
- k Thermal conductivity of building materials (Refer to Table 1)

N-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	R <sub>o</sub>	= 0.044
Air space resistance	R <sub>a</sub>	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	R <sub>i</sub>	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 6 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)

Facade Orientation Facing North Gross Wall Area (Ao) = 92.16  
 Window to Wall Ratio (WWR) 0.49 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	46.94		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.37		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{4.37} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.22		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.43		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.43} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.22		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.40		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.47		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{6.47} \quad \text{W/m}^2$$

**Summary of RTTV at North Elevations (House 12)**

$$= 4.37 + 0.43 + 6.47$$

$$= \underline{11.27} \quad \text{W/m}^2$$

# East Elevations (House 12)

Sheet no. 7

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 12) = 74.58 m²

Glazing Areas at East Elevations (House 12) = 15.57 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 15.57 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 12) = 59.01 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 59.01 m²

Window to Wall Ratio (WWR) = 15.57 / 74.58 = 0.21

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 12)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)

R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)

R<sub>a</sub> Air space resistance (Refer to Table 3)

x Thickness of building materials

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

E-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	R <sub>o</sub>	= 0.044
Air space resistance	R <sub>a</sub>	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	R <sub>i</sub>	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	74.58
Window to Wall Ratio (WWR)	0.21	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	59.01		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		9.21		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/Ao) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 9.21 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.57		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.25		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/Ao) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.25 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.57		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		4.02		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/Ao)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 4.02 W/m²

Summary of RTTV at East Elevations (House 12)  
= 9.21 + 0.25 + 4.02  
= 13.47 W/m²

# South Elevations (House 12)

Sheet no. 9

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 12) = 82.20 m²

Glazing Areas at South Elevations (House 12) = 15.07 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 15.07 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 12) = 67.13 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 67.13 m²

Window to Wall Ratio (WWR) = 15.07 / 82.20 = 0.18

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 12)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	10	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)		
Facade Orientation Facing	South	Gross Wall Area (Ao) =	82.20
Window to Wall Ratio (WWR)	0.18	Wall Orientation Factor (Gw) =	0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	67.13		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.64		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.64 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.07		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.20		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.20 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.07		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		3.21		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 3.21 W/m²

Summary of RTTV at South Elevations (House 12)  
= 8.64 + 0.20 + 3.21  
= 12.05 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)

Overall Gross Wall Area [a]351.36 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	102.42	4.84	1.03	11.63	17.50	5.10
North	92.16	4.37	0.43	6.47	11.27	2.96
East	74.58	9.21	0.25	4.02	13.47	2.86
South	82.20	8.64	0.20	3.21	12.05	2.82

Overall RTTV<sub>wall</sub> =13.74W/m²

<14W/m²OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 163.59 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 163.59 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 151.61 m²  
1/F = 34.80 m²  
Roof = 92.21 m²  
Upper Roof = 24.60 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 11.98 m²  
1/F = 5.78 m²  
Roof = 6.20 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$U_{w1} = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)

Roof Orientation Facing Flat Gross Roof Area (A<sub>ro</sub>) = 163.59  
Skylight to Roof Ratio (SRR) = 0 Roof Orientation Factor (G<sub>s</sub>) = 2.16

Part 1 - Calculation of Heat Conduction through Opaque Roof				
Components / Details		Code No.		
Description	Units	R1	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (α <sub>wi</sub> )	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (U <sub>ri</sub> )	W/m²K	0.53	0.53	
Opaque Roof Area (A <sub>ri</sub> )	m²	151.61	11.98	
Heat Conduction = 3.47(A <sub>ri</sub> /A <sub>ro</sub> ) U <sub>ri</sub> ari Gs		3.31	0.23	

Heat Conduction through Opaque Roof = 3.47(A<sub>ri</sub>/A<sub>ro</sub>) U<sub>ri</sub> ari Gs where i= 1, 2, ..., n  
= 3.55 W/m²

Part 2 - Calculation of Heat Conduction through Skylight					
Components / Details		Code No.			
Description	Units	S1			
Skylight Glazing Type		-			
Thickness	m	-			
Skylight Area (A <sub>si</sub> )	m²	0.00			
U-value of Skylight Glazing (U <sub>si</sub> )	W/m²K	-			
Heat Conduction = 0.40 (A <sub>si</sub> /A <sub>ro</sub> ) U <sub>si</sub> Gs		0.00			

Heat Conduction through Skylight = 0.40 (A<sub>si</sub>/A<sub>ro</sub>) U<sub>si</sub> 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 (A <sub>si</sub> )	m²	0.00			
Shading Coefficient of Skylight Glazing (SC <sub>ri</sub> )		-			
Visible Light Transmittance (VLT)		-			
External Reflectance (ER)		-			
Solar Radiation = 41.10 (A <sub>si</sub> /A <sub>ro</sub> ) (SC <sub>ri</sub> ) Gs		0.00			

Solar Radiation through Skylight = 41.10 (A<sub>si</sub>/A<sub>ro</sub>) (SC<sub>ri</sub>) Gs where i= 1, 2, ..., n  
= 0.00 W/m²

Summary of RTTV at Roof  
= 3.55 + 0.00 + 0.00  
= 3.55 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.

Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)

Overall Roof Area [a]163.59 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	163.59	3.55	0.00	0.00	3.55	3.55

Overall RTTV<sub>roof</sub> =3.55W/m²

<4W/m²OK

## RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 12)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

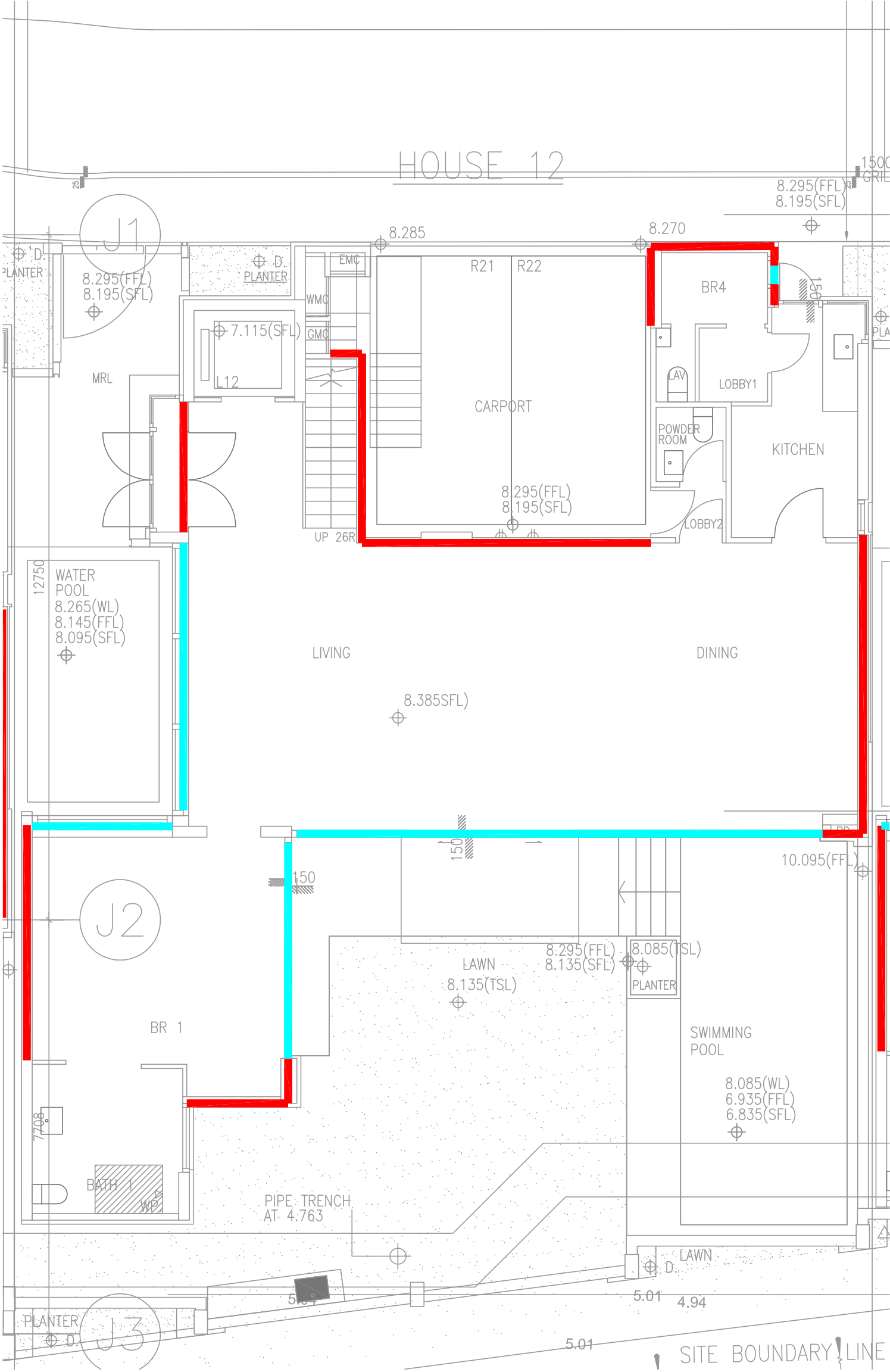
**Table 1**

Deemed to Satisfy RTTV <sub>Wall</sub>								
Facade Orientation Facing	West	North	East	South				
Average Absorptivity	0.795	0.8	0.8	0.8				
Average Window to Wall Ratio	0.51	0.37	0.18	0.23				
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43				
Average Shading Coefficient of Facade	0.43	0.43	0.43	0.43				
Visible Light Transmittance	53 %	53 %	53 %	53 %	%	%	%	%
External Reflectance	17 %	17 %	17 %	17 %	%	%	%	%

RTTV <sub>Wall</sub>																	
Facade Orientation Facing		West				North				East				South			
Wall Orientation Factor		1.131				0.79				1.072				0.975			
Total External Wall Area (Residential Units)		120.0 m <sup>2</sup>		Window to Wall Ratio		63.1 m <sup>2</sup>		Window to Wall Ratio		46.4 m <sup>2</sup>		Window to Wall Ratio		78.1 m <sup>2</sup>		Window to Wall Ratio	
Total Window Area		61.73 m <sup>2</sup>		= 0.51		23.37 m <sup>2</sup>		= 0.37		8.25 m <sup>2</sup>		= 0.18		18.12 m <sup>2</sup>		= 0.23	
Heat Conduction	Opaque Wall	4.84 W/m <sup>2</sup>				4.37 W/m <sup>2</sup>				9.21 W/m <sup>2</sup>				8.64 W/m <sup>2</sup>			
	Window	1.03 W/m <sup>2</sup>				0.43 W/m <sup>2</sup>				0.25 W/m <sup>2</sup>				0.20 W/m <sup>2</sup>			
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 %
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %
			ER = %				ER = %				ER = %				ER = %		
			ER = 17 %				ER = 17 %				ER = 17 %				ER = 17 %		
			ER = %				ER = %				ER = %				ER = %		
Double Glazing		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
External Shading		Overhang <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
		Sidefin <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Solar Radiation through Gazing		11.63 W/m <sup>2</sup>				6.47 W/m <sup>2</sup>				4.02 W/m <sup>2</sup>				3.21 W/m <sup>2</sup>			
Average Absorptivity		0.795				0.795				0.795				0.795			
RTTV <sub>Wall</sub> at each Facade		17.50 W/m <sup>2</sup>				11.27 W/m <sup>2</sup>				13.47 W/m <sup>2</sup>				12.05 W/m <sup>2</sup>			
Overall RTTV <sub>Wall</sub>		13.74 W/m <sup>2</sup>															

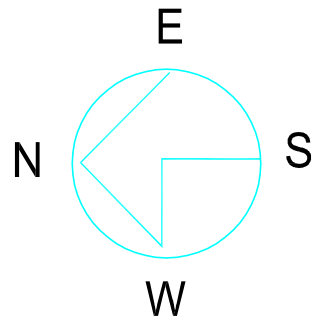
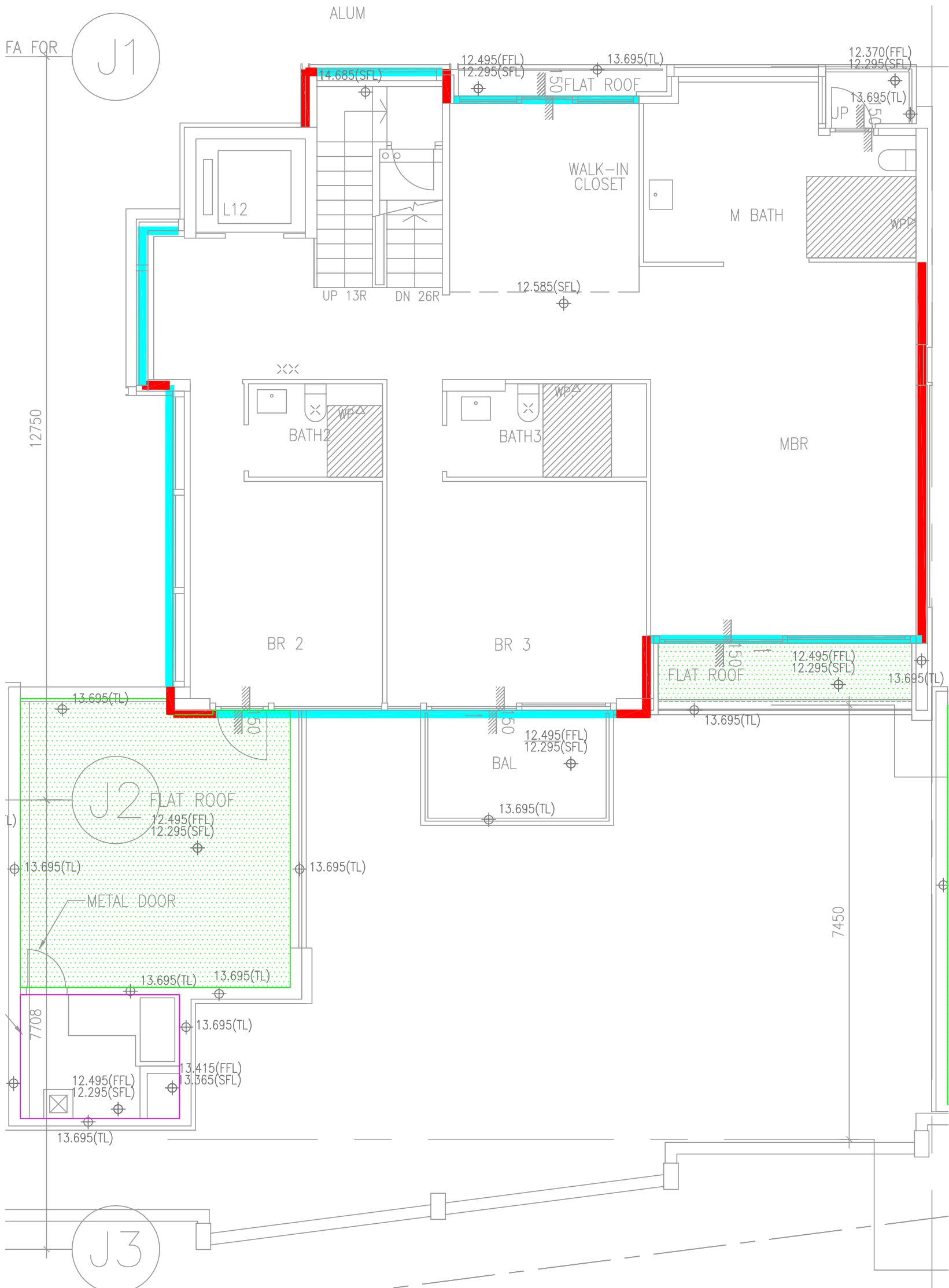
RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		163.59 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.55 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>		SC =		VLT = %		ER = %	
		<input type="checkbox"/> Tinted	Area = m <sup>2</sup>		SC =		VLT = %		ER = %	
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>		SC =		VLT = %		ER = %	
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	Solar Radiation through Gazing		0 W/m <sup>2</sup>							
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>Roof</sub>		3.55 W/m <sup>2</sup>								

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



DRAWING TITLE: HOUSE 12 GROUND FLOOR PLAN

SCALE: 1:150@A4

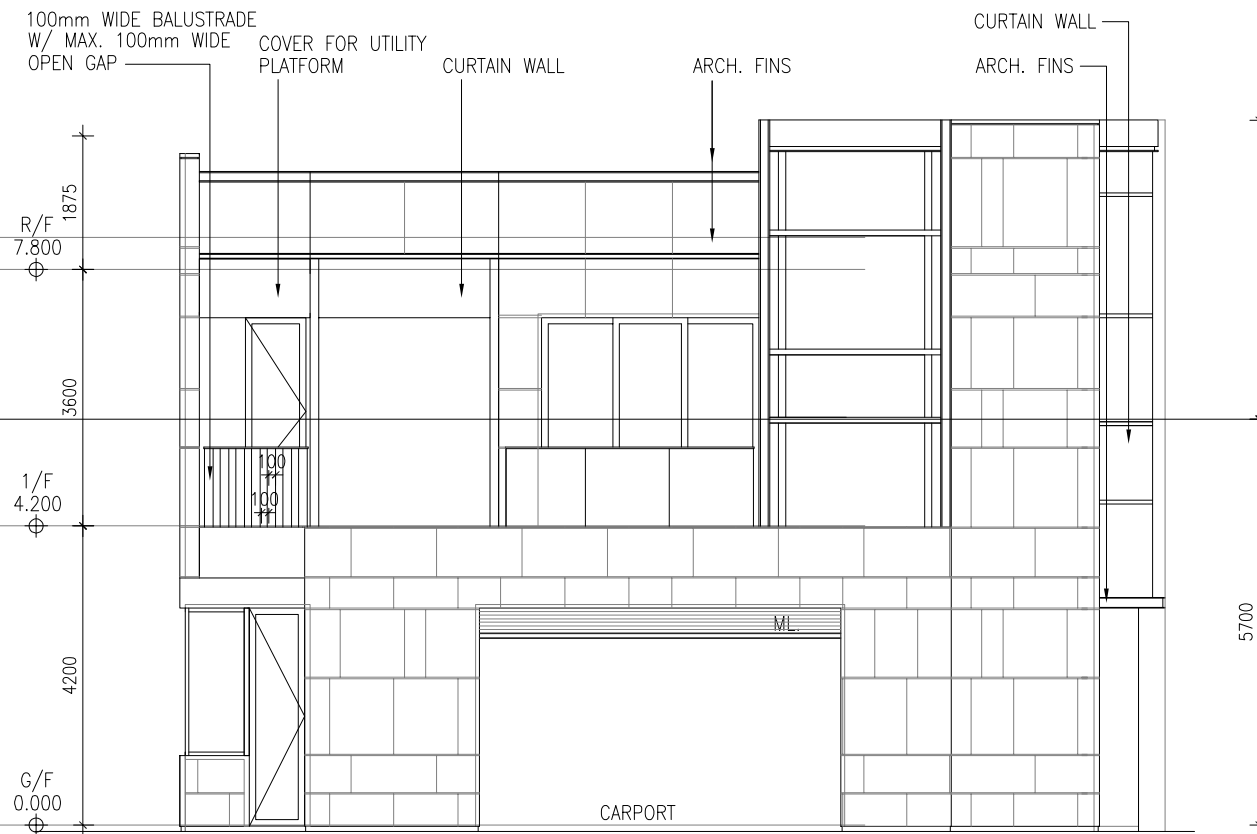


LEGEND

- Wall
- Glass

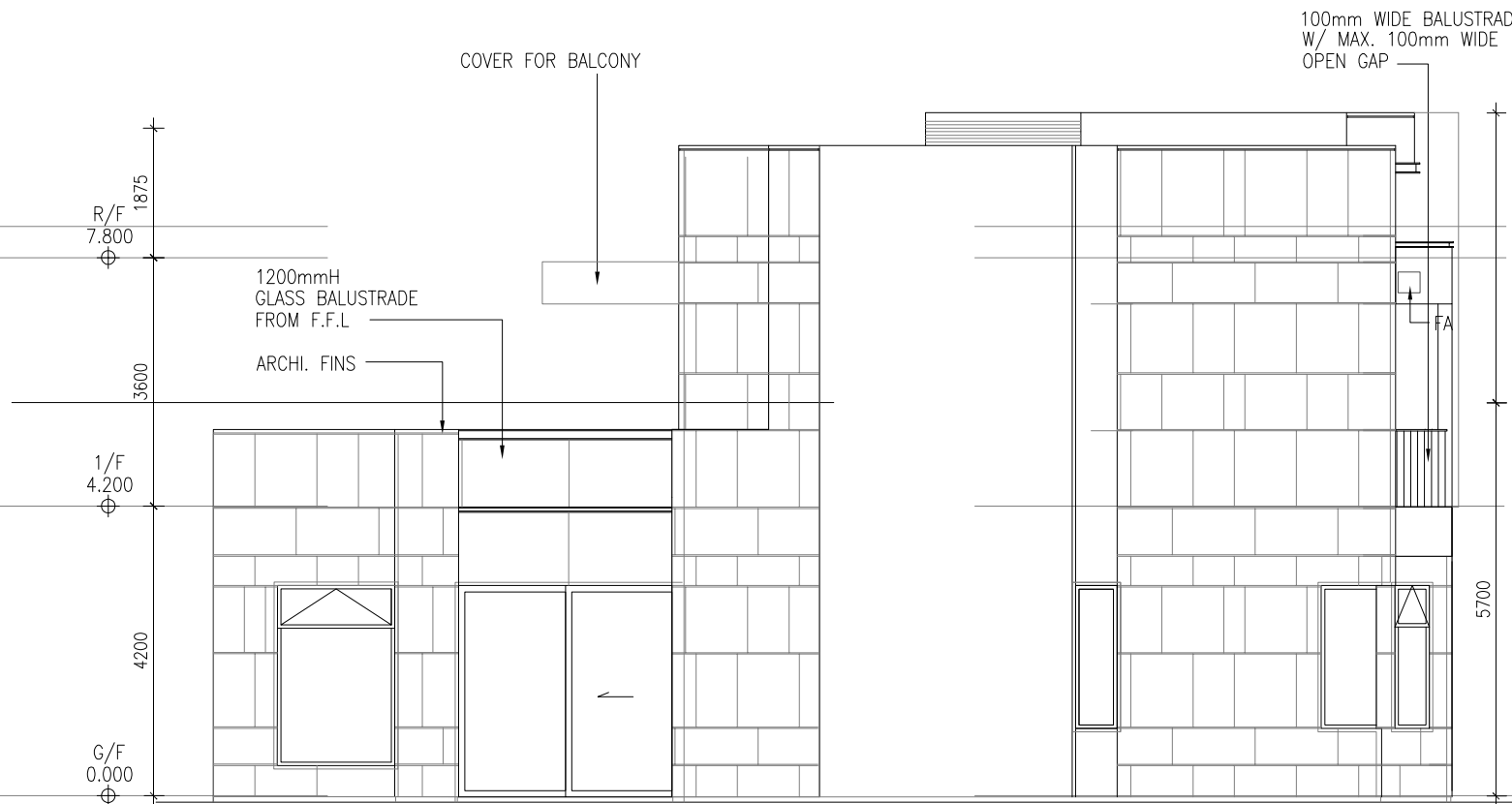
DRAWING TITLE: HOUSE 12 FIRST FLOOR PLAN  
SCALE: 1:150@A4





1 EAST ELEVATION 1:75  
HOUSE 12

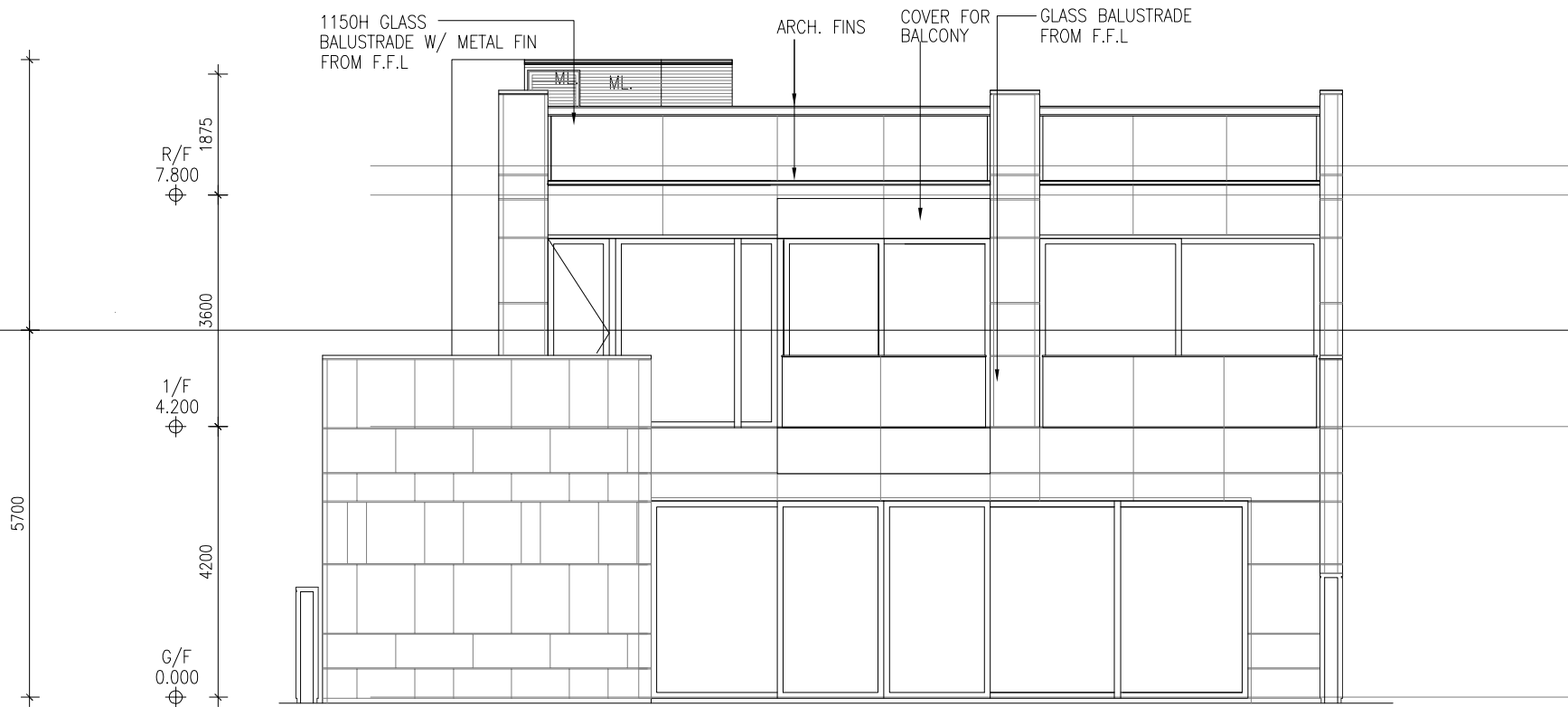
CSK-12E1



7 SOUTH ELEVATION 1:75  
— HOUSE 12

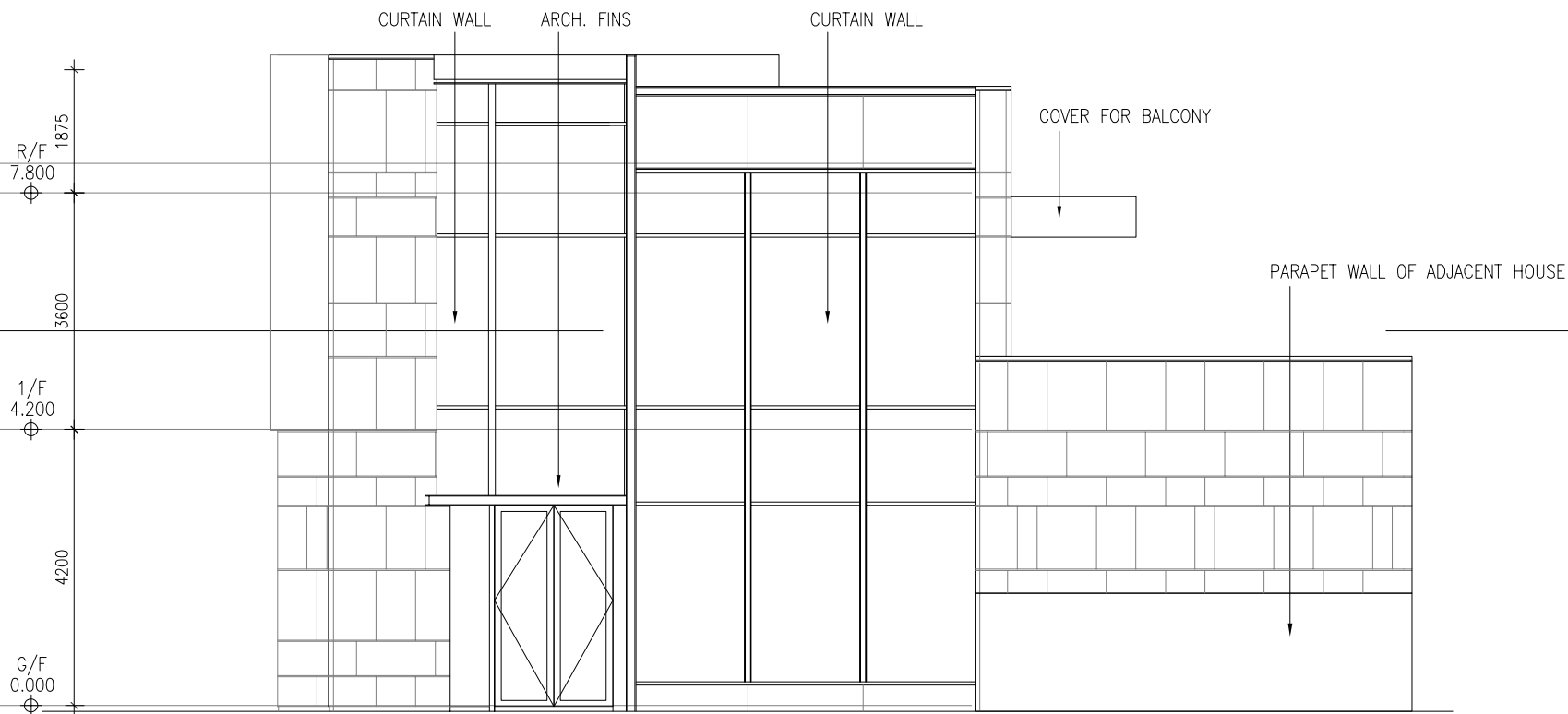
CSK-12E2





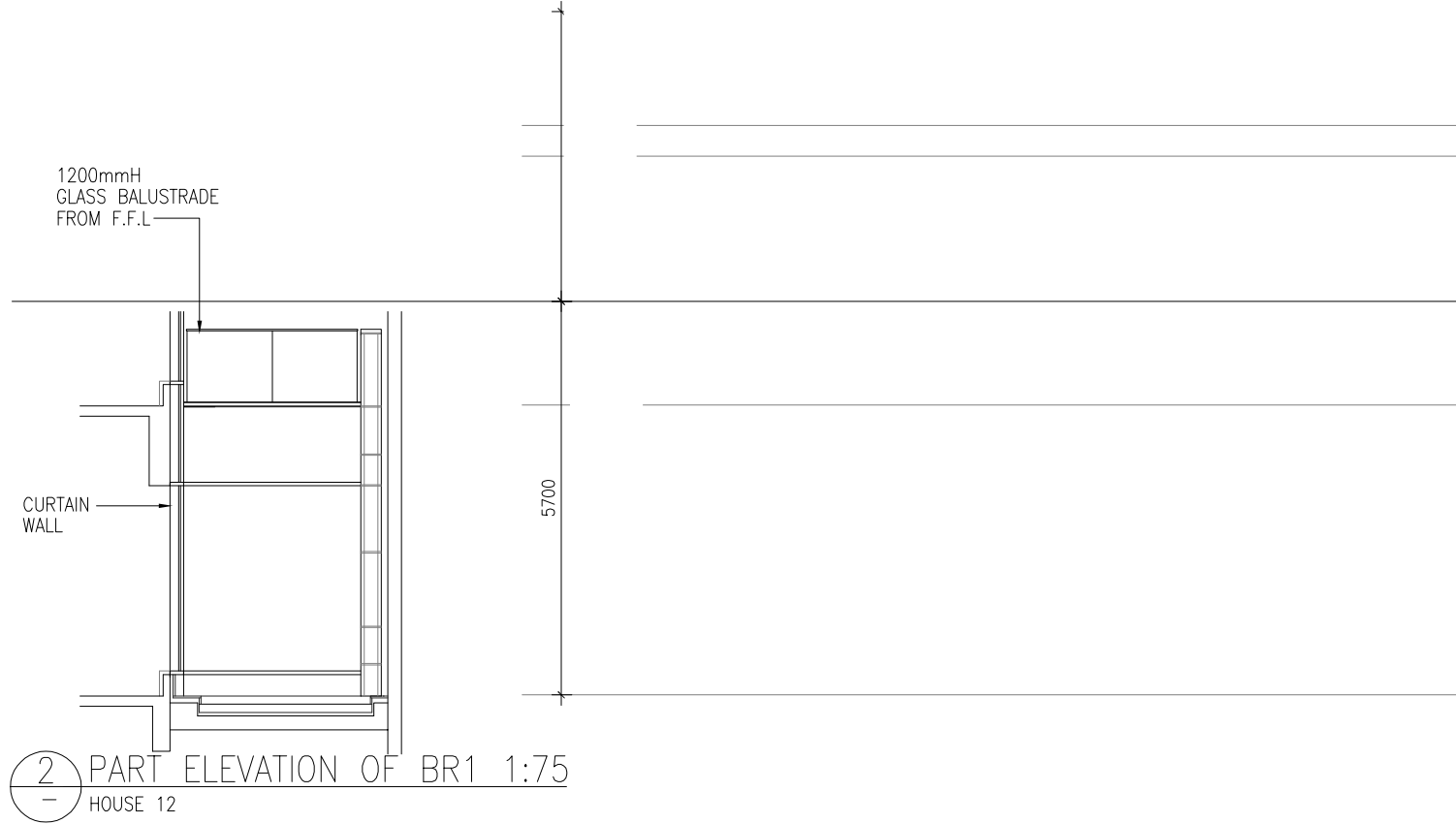
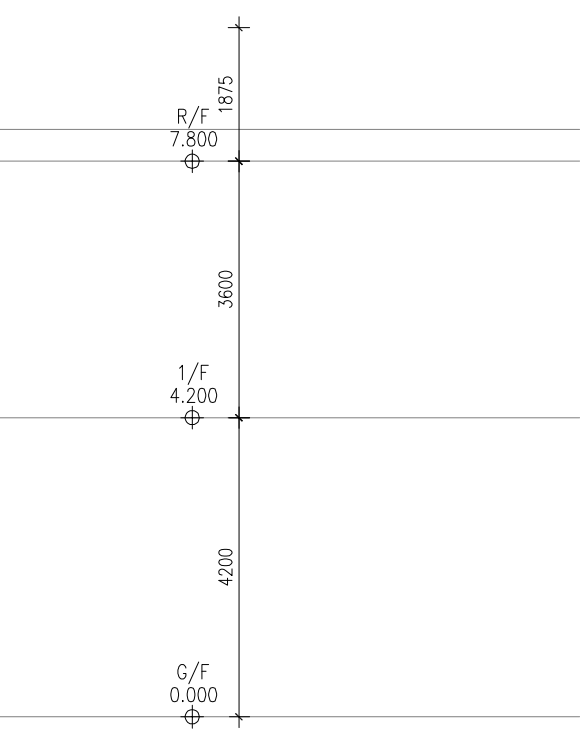
9 WEST ELEVATION 1:75  
— HOUSE 12

CSK-12E3



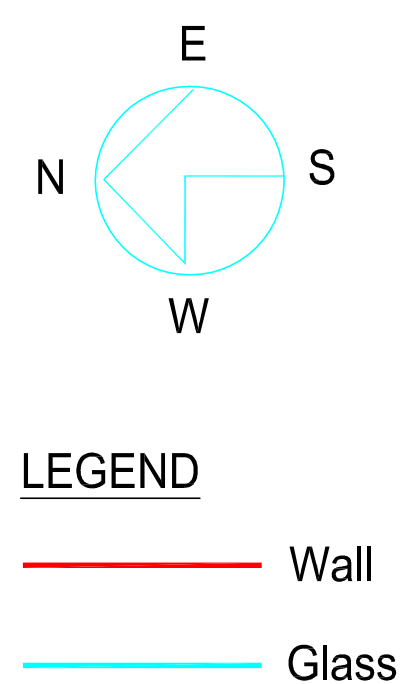
8 NORTH ELEVATION 1:75  
— HOUSE 12

CSK-12E4

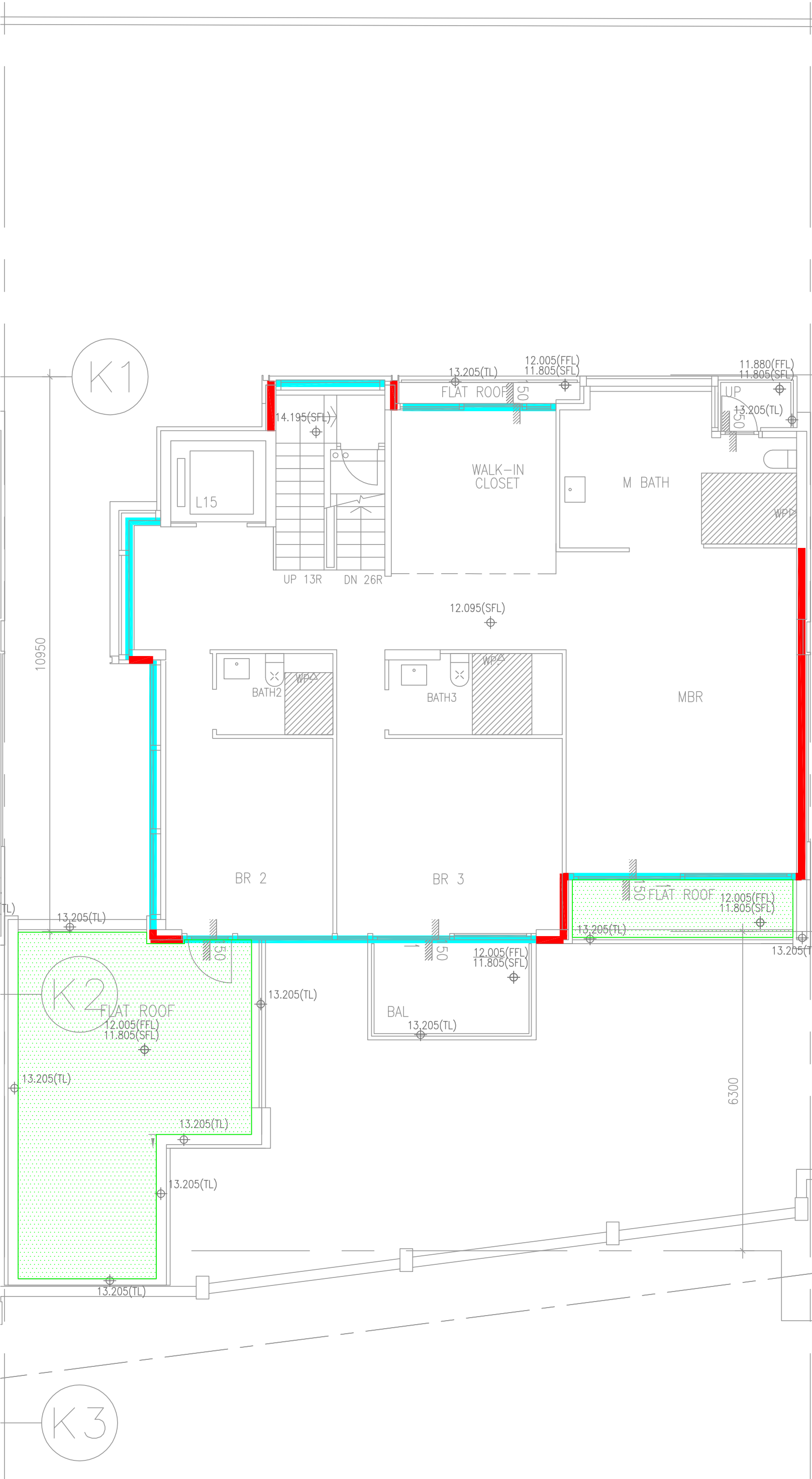


CSK-12E5

## RTTV Calculation (House 15)

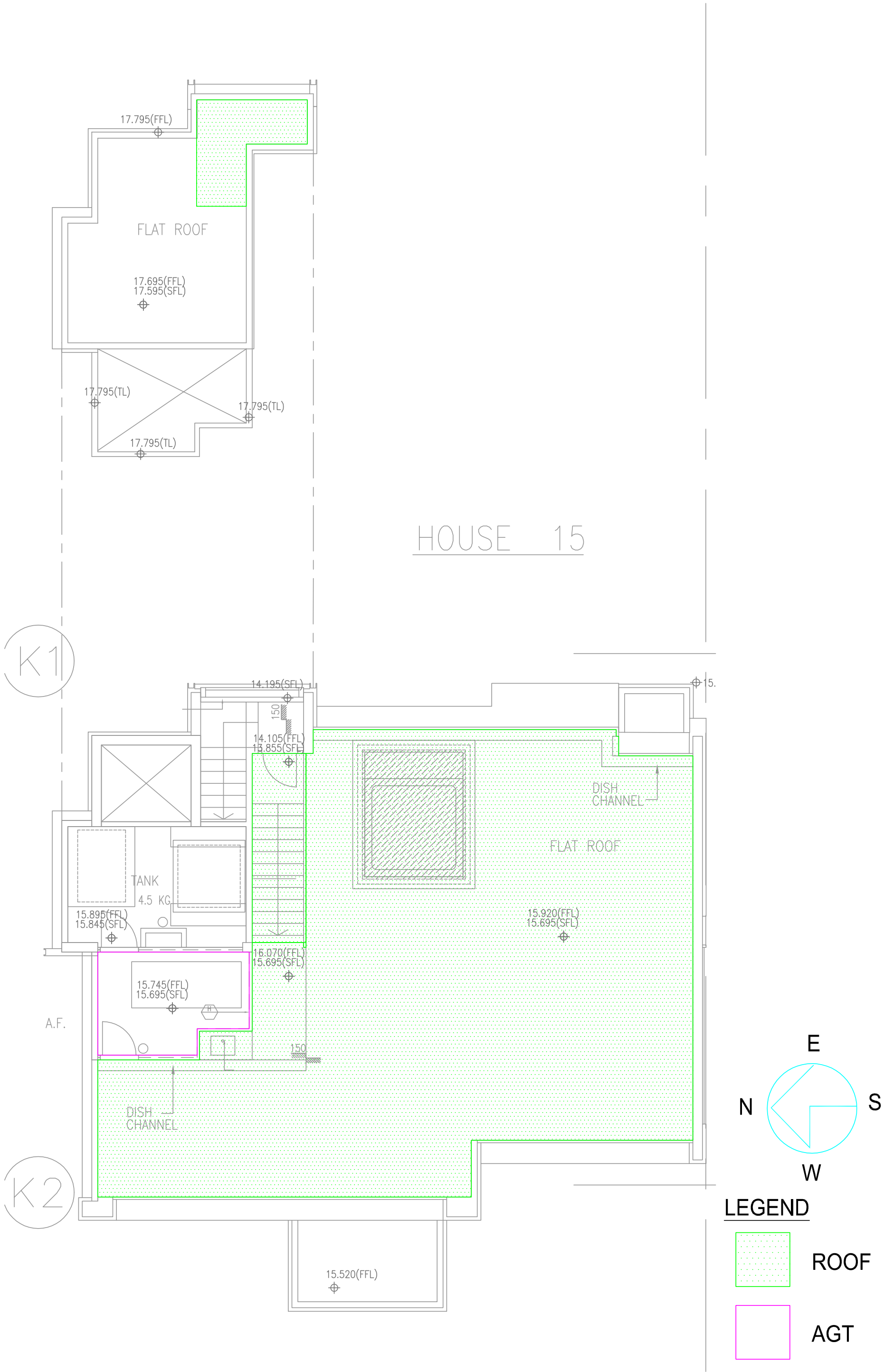


DRAWING TITLE: HOUSE 15 GROUND FLOOR PLAN  
SCALE: 1:150@A4



DRAWING TITLE: HOUSE 15 FIRST FLOOR PLAN

SCALE: 1:150@A4



DRAWING TITLE: HOUSE 15 ROOF FLOOR PLAN

SCALE: 1:150@A4

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

## West Elevations (House 15) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 23.50	)x 4.20 x 1 =	23.50 x 4.20 x 1 =	98.70 m <sup>2</sup>
1/F	( 12.70	)x 3.60 x 1 =	12.70 x 3.60 x 1 =	45.72 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 144.42 m<sup>2</sup>**

## North Elevations (House 15) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 13.00 1.50	)x 4.20 x 1 =	14.50 x 4.20 x 1 =	60.90 m <sup>2</sup>
1/F	( 8.60 + 0.90	)x 3.60 x 1 =	9.50 x 3.60 x 1 =	34.20 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 95.10 m<sup>2</sup>**

## East Elevations (House 15) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 2.70 8.70	)x 4.20 x 1 =	11.40 x 4.20 x 1 =	47.88 m <sup>2</sup>
1/F	( 5.80 + 0.80	)x 3.60 x 1 =	6.60 x 3.60 x 1 =	23.76 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 71.64 m<sup>2</sup>**

## South Elevations (House 15) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 13.00	)x 4.20 x 1 =	13.00 x 4.20 x 1 =	54.60 m <sup>2</sup>
1/F	( 6.50	)x 3.60 x 1 =	6.50 x 3.60 x 1 =	23.40 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 78.00 m<sup>2</sup>**

**Total Gross Wall Areas 389.16 m<sup>2</sup>**



# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 15) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 9.90	)x 3.05 x 1 =	9.90 x 3.05 x 1 =	30.15 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 7.50 + 4.50	)x 2.66 x 1 =	12.00 x 2.66 x 1 =	31.86 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 62.01 m<sup>2</sup>**

### North Elevations (House 15) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 7.80	)x 3.05 x 1 =	7.80 x 3.05 x 1 =	23.75 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 2.80 + 5.40	)x 2.66 x 1 =	8.20 x 2.66 x 1 =	21.77 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 45.52 m<sup>2</sup>**

### East Elevations (House 15) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 2.70	)x 3.05 x 1 =	2.70 x 3.05 x 1 =	8.22 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
G/F (Window GL02)	(	)x 0.86 x 1 =	0.00 x 0.86 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02)	( 0.70 + 2.20 + 3.10	)x 2.64 x 1 =	2.90 x 2.64 x 1 =	7.66 m <sup>2</sup>

**Gross Glazing Areas 15.88 m<sup>2</sup>**

### South Elevations (House 15) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 0.50 + 3.30	)x 3.05 x 1 =	3.80 x 3.05 x 1 =	11.57 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00 x 2.66 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 11.57 m<sup>2</sup>**

**Total Gross Glazing Areas 134.98 m<sup>2</sup>**

# West Elevations (House 15)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 15) = 144.42 m²

Glazing Areas at West Elevations (House 15) = 62.01 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 40.52 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 15) = 82.41 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 82.41 m²

Window to Wall Ratio (WWR) = 62.01 / 144.42 = 0.43

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 15)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)

Facade Orientation Facing West Gross Wall Area (Ao) = 144.42  
 Window to Wall Ratio (WWR) 0.43 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	82.41		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		7.01		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{7.01} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	62.01	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.54	0.08	0.10

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.73} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	40.52	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		5.70	0.90	1.65

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{8.25} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 15)**

$$= 7.01 + 0.73 + 8.25$$

$$= \underline{15.98} \quad \text{W/m}^2$$

North Elevations (House 15)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 15)	=	95.10 m²
Glazing Areas at North Elevations (House 15)	=	45.52 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( N-F1 )	=	45.52 m²
ECS	=	1.000

Opaque Wall Areas at North Elevations (House 15)	=	49.58 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( N-W1 )	=	49.58 m²

Window to Wall Ratio (WWR)	=	45.52 / 95.10	=	0.48
----------------------------	---	---------------	---	------

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 15)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	95.10
Window to Wall Ratio (WWR)	0.48	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	49.58		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.47		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 4.47 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.52		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.42		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.42 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.52		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.79		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 6.79 W/m²

Summary of RTTV at North Elevations (House 15)  
= 4.47 + 0.42 + 6.79  
= 11.68 W/m²

East Elevations (House 15)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 15)	=	71.64 m²
Glazing Areas at East Elevations (House 15)	=	15.88 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( E-F1 )	=	15.88 m²
ECS	=	1.000

Opaque Wall Areas at East Elevations (House 15)	=	55.76 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( E-W1 )	=	55.76 m²

Window to Wall Ratio (WWR) = 15.88 / 71.64 = 0.22

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 15)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	71.64
Window to Wall Ratio (WWR)	0.22	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	55.76		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		9.06		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/Ao) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 9.06 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.88		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.26		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/Ao) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.26 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	15.88		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		4.27		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/Ao)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 4.27 W/m²

Summary of RTTV at East Elevations (House 15)  
= 9.06 + 0.26 + 4.27  
= 13.59 W/m²

# South Elevations (House 15)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 15)	=	78.00 m²
Glazing Areas at South Elevations (House 15)	=	11.57 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( S-F1 )	=	11.57 m²
ECS	=	1.000

Opaque Wall Areas at South Elevations (House 15)	=	66.43 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( S-W1 )	=	66.43 m²

Window to Wall Ratio (WWR)	=	11.57 / 78.00	=	0.15
----------------------------	---	---------------	---	------

Sheet no. 9

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 15)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	10	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)		
Facade Orientation Facing	South	Gross Wall Area (Ao) =	78.00
Window to Wall Ratio (WWR)	0.15	Wall Orientation Factor (Gw) =	0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	66.43		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		9.01		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/Ao) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 9.01 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	11.57		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.16		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/Ao) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.16 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	11.57		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		2.60		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/Ao)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 2.60 W/m²

Summary of RTTV at South Elevations (House 15)  
= 9.01 + 0.16 + 2.60  
= 11.77 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)

Overall Gross Wall Area [a]389.16 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	144.42	7.01	0.73	8.25	15.98	5.93
North	95.10	4.47	0.42	6.79	11.68	2.85
East	71.64	9.06	0.26	4.27	13.59	2.50
South	78.00	9.01	0.16	2.60	11.77	2.36

Overall RTTV<sub>wall</sub> =13.65W/m²

<14W/m²OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 164.30 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 164.30 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 158.28 m²  
1/F = 30.74 m²  
Roof = 92.74 m²  
Upper Roof = 34.80 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 6.02 m²  
1/F = m²  
Roof = 6.02 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$U_{w1} = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 164.30  
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(a)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	158.28	6.02	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.44	0.12	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs where i= 1, 2, ..., n  
= 3.56 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  
= 3.56 + 0.00 + 0.00  
= 3.56 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)

Overall Roof Area [a]164.30 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	164.30	3.56	0.00	0.00	3.56	3.56

Overall RTTV<sub>roof</sub> =3.56W/m²

<4W/m²OK

## RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 15)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd.	
	<input type="checkbox"/> 2. Architect	
	<input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>wall</sub>									
Facade Orientation Facing	West		North		East		South		
Average Absorptivity	0.795		0.795		0.795		0.795		
Average Window to Wall Ratio	0.51		0.37		0.18		0.23		
Shading Coefficient of Glazing	0.43		0.43		0.43		0.43		
Average Shading Coefficient of Facade	0.43		0.43		0.43		0.43		
Visible Light Transmittance	53	%	53	%	53	%	53	%	%
External Reflectance	17	%	17	%	17	%	17	%	%

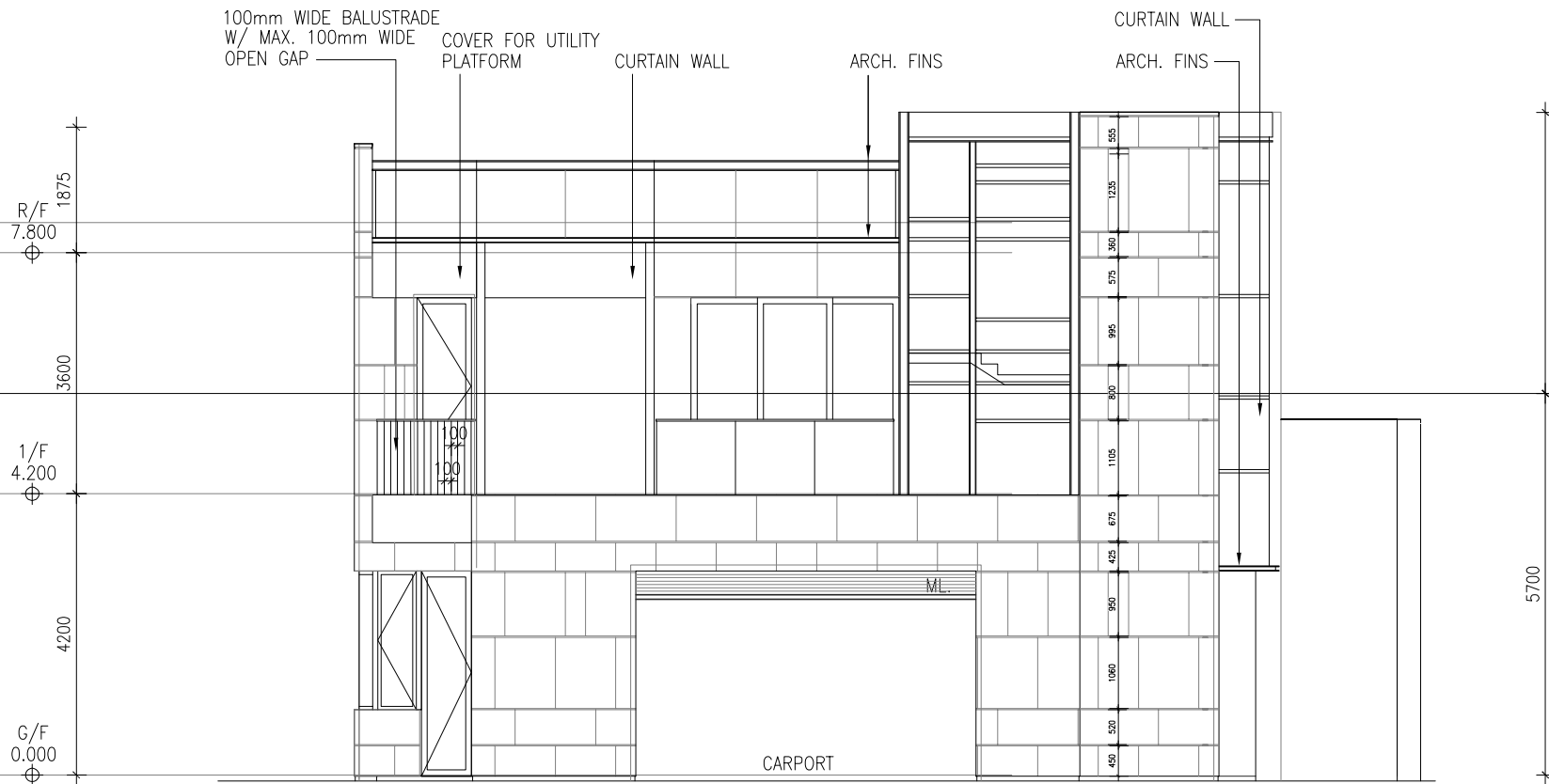
Table 2

RTTV <sub>wall</sub>																	
Facade Orientation Facing		West				North				East				South			
Wall Orientation Factor		1.131				0.79				1.072				0.975			
Total External Wall Area (Residential Units)		120.0 m <sup>2</sup>		Window to Wall Ratio		63.1 m <sup>2</sup>		Window to Wall Ratio		46.4 m <sup>2</sup>		Window to Wall Ratio		78.1 m <sup>2</sup>		Window to Wall Ratio	
Total Window Area		61.73 m <sup>2</sup>		= 0.51		23.37 m <sup>2</sup>		= 0.37		8.25 m <sup>2</sup>		= 0.18		18.12 m <sup>2</sup>		= 0.23	
Heat Conduction	Opaque Wall	7.01 W/m <sup>2</sup>				4.47 W/m <sup>2</sup>				9.06 W/m <sup>2</sup>				9.01 W/m <sup>2</sup>			
	Window	0.73 W/m <sup>2</sup>				0.42 W/m <sup>2</sup>				0.26 W/m <sup>2</sup>				0.16 W/m <sup>2</sup>			
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 18.12 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %
		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Solar Radiation through Gazing		8.25 W/m <sup>2</sup>				6.79 W/m <sup>2</sup>				4.27 W/m <sup>2</sup>				2.60 W/m <sup>2</sup>			
Average Absorptivity		0.795				0.795				0.795				0.795			
RTTV <sub>wall</sub> at each Facade		15.98 W/m <sup>2</sup>				11.68 W/m <sup>2</sup>				13.59 W/m <sup>2</sup>				11.77 W/m <sup>2</sup>			
Overall RTTV <sub>wall</sub>		13.65 W/m <sup>2</sup>															

Table 3

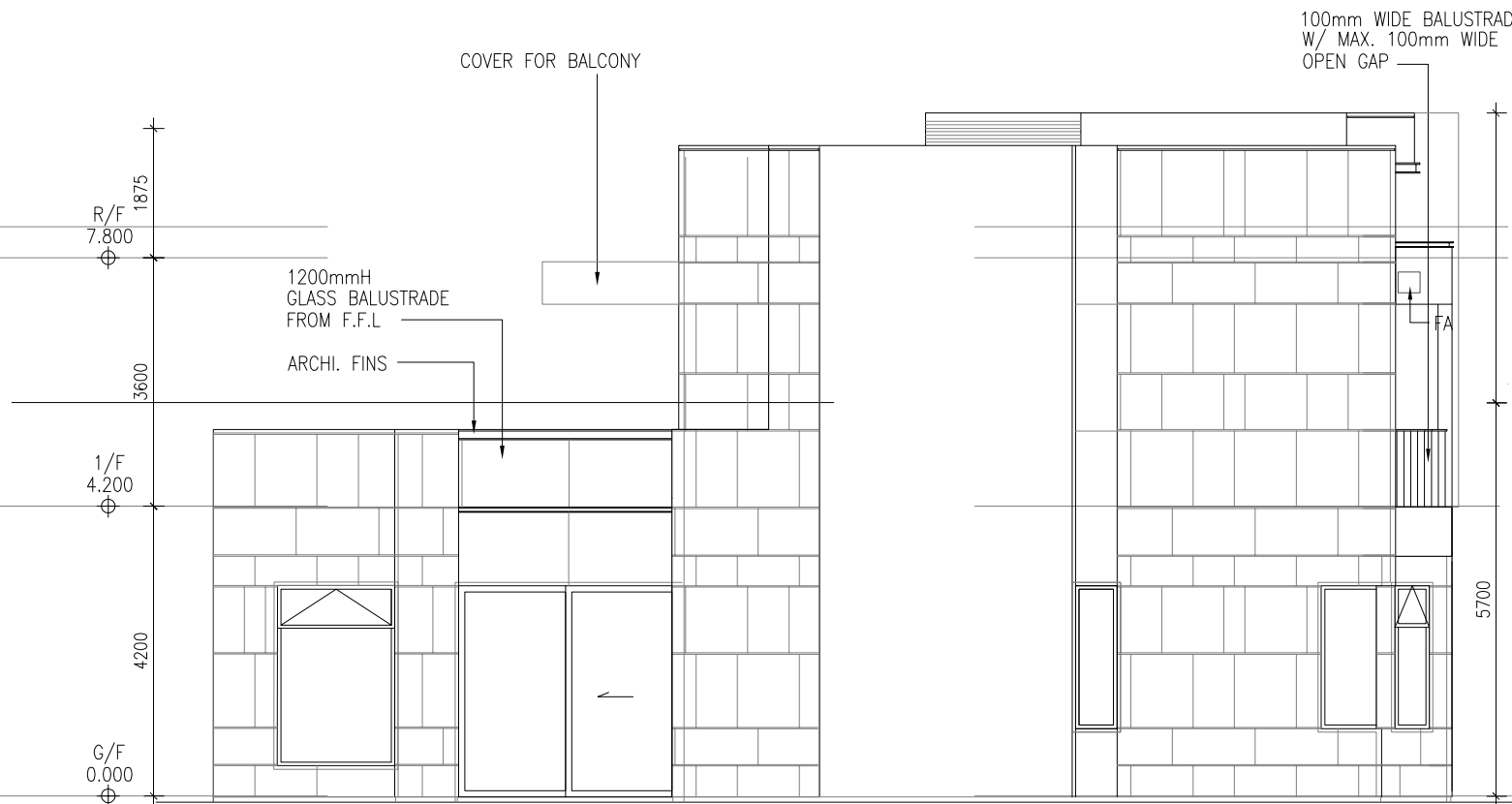
RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		164.30 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.56 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	Solar Radiation through Gazing		0 W/m <sup>2</sup>							
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>ROOF</sub>		3.56 W/m <sup>2</sup>								

ER = External Reflectance; SC = Shading Coefficient &amp; VLT = Visible Light Transmittance



1 EAST ELEVATION 1:75  
HOUSE 15

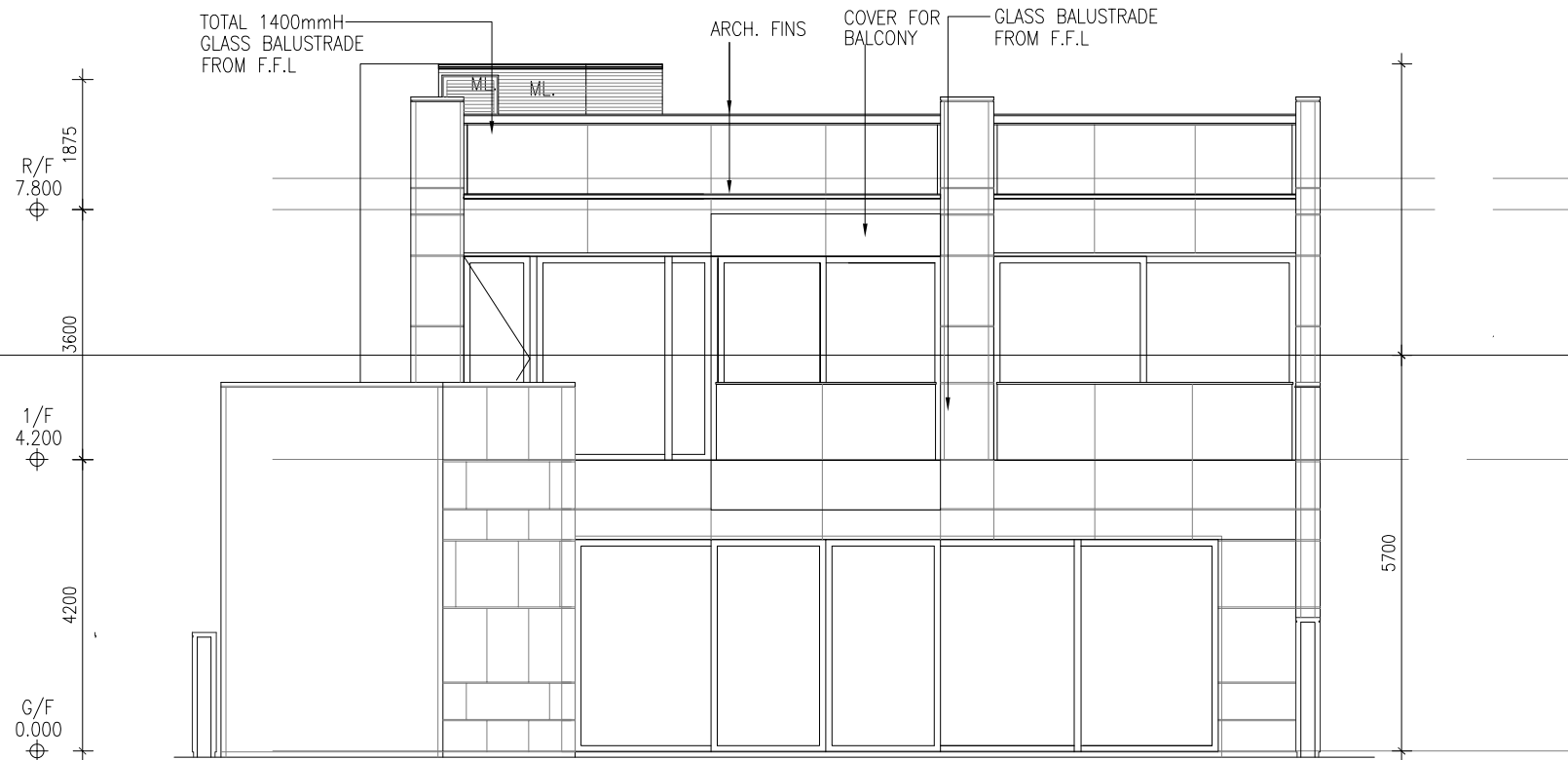
CSK-15E1



7 SOUTH ELEVATION 1:75  
— HOUSE 15

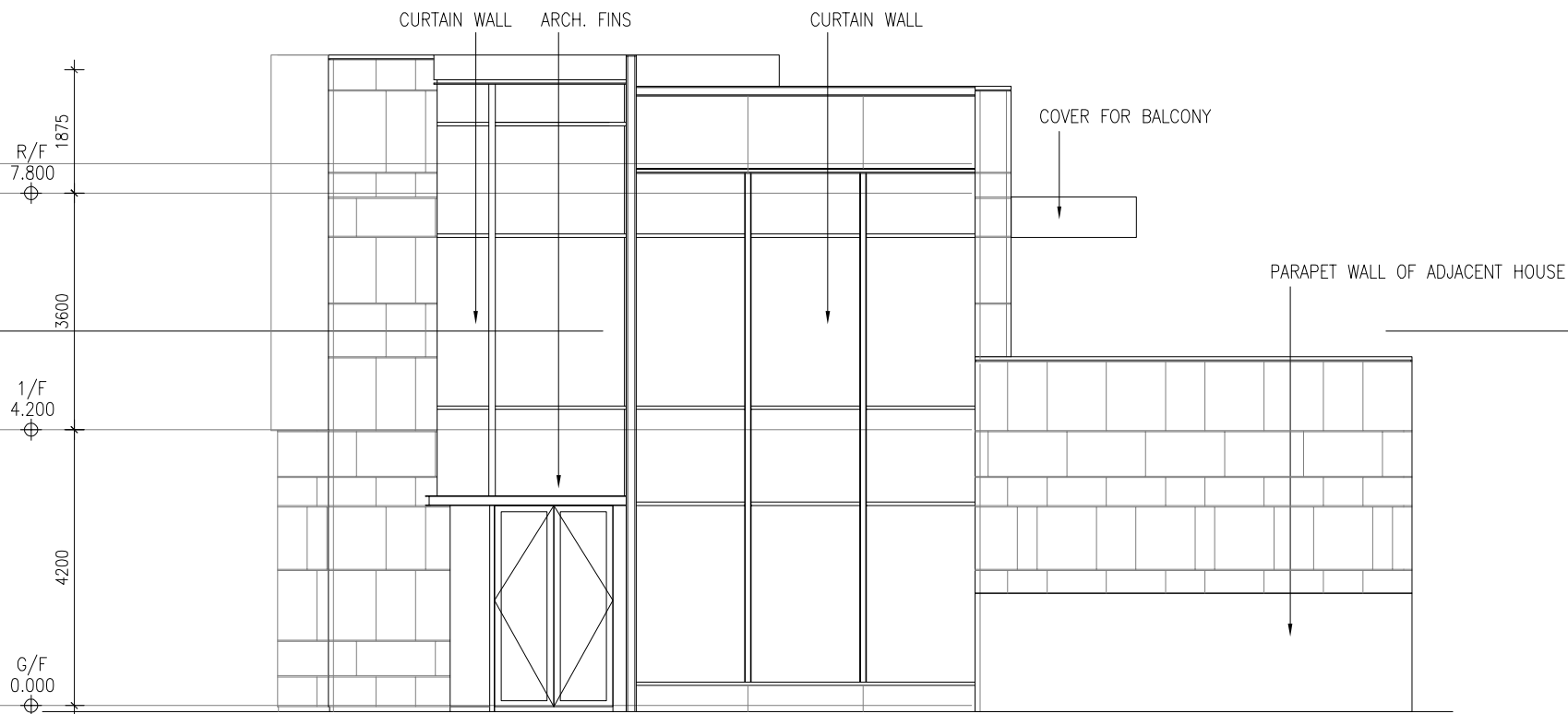
CSK-15E2





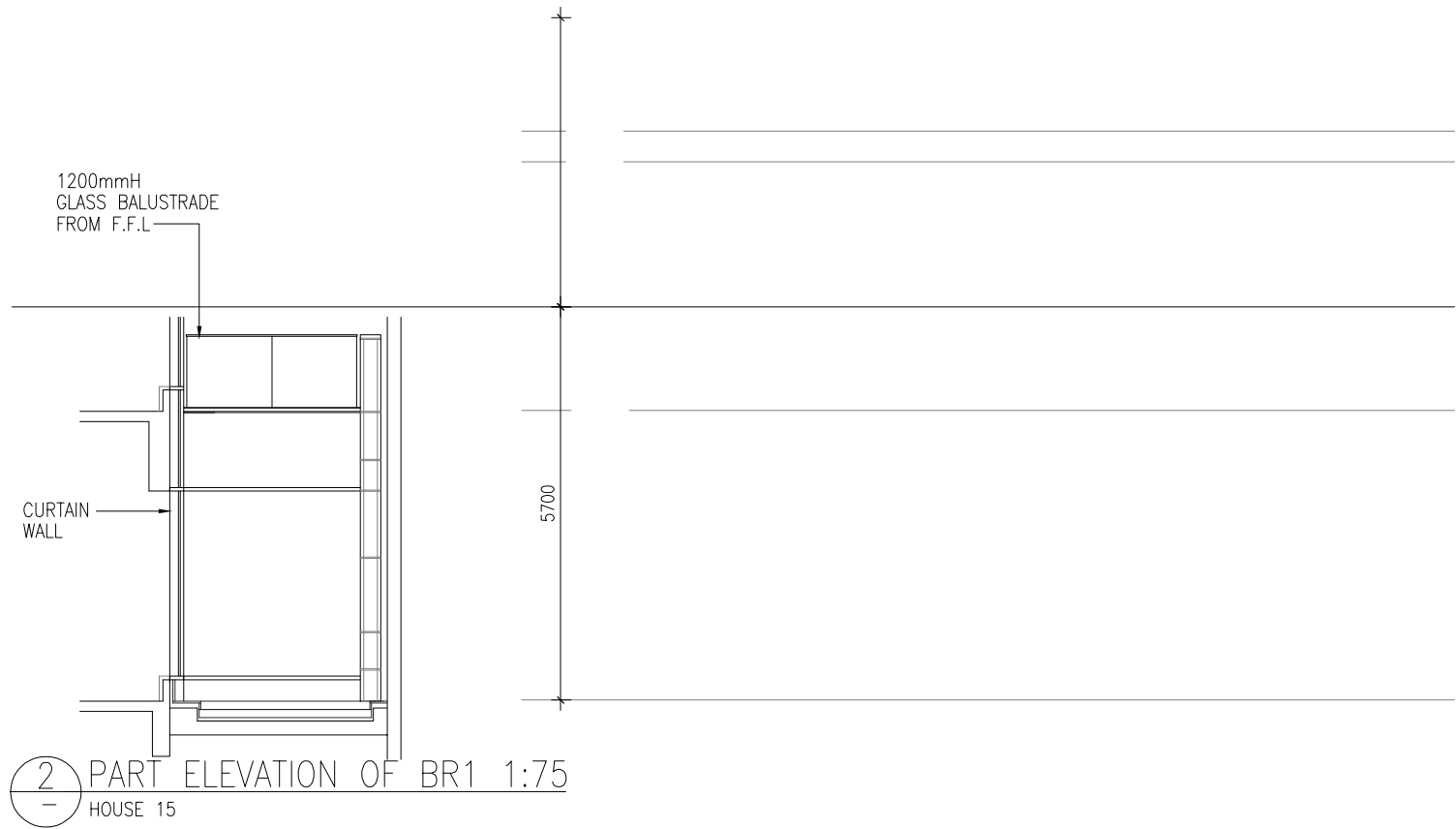
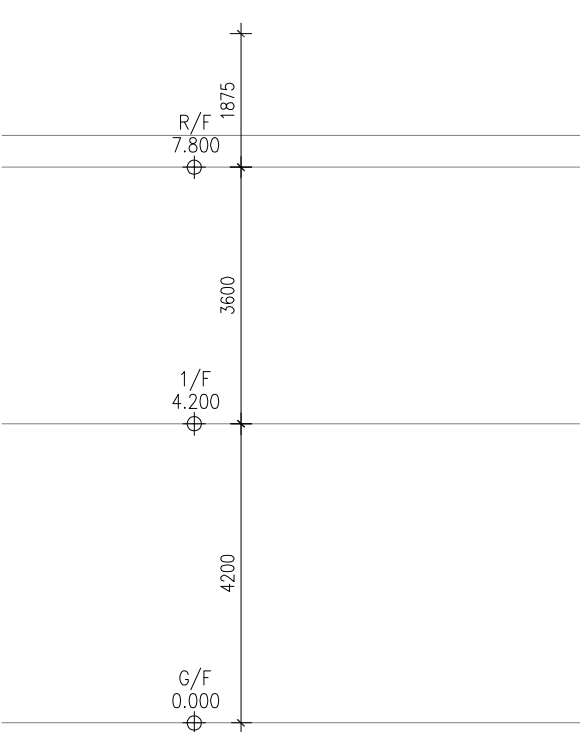
9 WEST ELEVATION 1:75  
— HOUSE 15

CSK-15E3



8 NORTH ELEVATION 1:75  
— HOUSE 6

CSK-16E4



CSK-15E5

## RTTV Calculation (House 16)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	2.25 m	( 1 storey)

## West Elevations (House 16) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 10.50 + 1.65	)x 4.20 x 1 =	12.15 x 4.20 x 1 =	51.03 m <sup>2</sup>
1/F	( 12.70	)x 3.60 x 1 =	12.70 x 3.60 x 1 =	45.72 m <sup>2</sup>
R/F	(	)x 2.25 x 1 =	0.00 x 2.25 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 96.75 m<sup>2</sup>**

## North Elevations (House 16) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 13.00 + 1.50	)x 4.20 x 1 =	14.50 x 4.20 x 1 =	60.90 m <sup>2</sup>
1/F	( 8.60 + 0.90	)x 3.60 x 1 =	9.50 x 3.60 x 1 =	34.20 m <sup>2</sup>
R/F	(	)x 2.25 x 1 =	0.00 x 2.25 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 95.10 m<sup>2</sup>**

## East Elevations (House 16) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 9.00 + 2.90	)x 4.20 x 1 =	11.90 x 4.20 x 1 =	49.98 m <sup>2</sup>
1/F	( 5.80 + 0.80	)x 3.60 x 1 =	6.60 x 3.60 x 1 =	23.76 m <sup>2</sup>
R/F	(	)x 2.25 x 1 =	0.00 x 2.25 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 73.74 m<sup>2</sup>**

## South Elevations (House 16) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 11.50	)x 4.20 x 1 =	11.50 x 4.20 x 1 =	48.30 m <sup>2</sup>
1/F	( 6.50	)x 3.60 x 1 =	6.50 x 3.60 x 1 =	23.40 m <sup>2</sup>
R/F	(	)x 2.25 x 1 =	0.00 x 2.25 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 71.70 m<sup>2</sup>**

**Total Gross Wall Areas 337.29 m<sup>2</sup>**

## Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

### Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 16) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 8.50	)x 3.05 x 1 =	8.50 x 3.05 x 1 =	25.88 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 7.50 + 4.50	)x 2.66 x 1 =	12.00 x 2.66 x 1 =	31.86 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 57.74 m<sup>2</sup>**

### North Elevations (House 16) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 7.70	)x 3.05 x 1 =	7.70 x 3.05 x 1 =	23.45 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 2.80 + 5.40	)x 2.66 x 1 =	8.20 x 2.66 x 1 =	21.77 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 45.22 m<sup>2</sup>**

### East Elevations (House 16) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 2.80	)x 3.05 x 1 =	2.80 x 3.05 x 1 =	8.53 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
G/F (Window GL02)	(	)x 0.86 x 1 =	0.00 x 0.86 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02)	( 0.70 + 2.20 + 3.10	)x 2.64 x 1 =	2.90 x 2.64 x 1 =	7.66 m <sup>2</sup>

**Gross Glazing Areas 16.18 m<sup>2</sup>**

### South Elevations (House 16) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 0.50 + 2.60	)x 3.05 x 1 =	3.10 x 3.05 x 1 =	9.44 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	(	)x 2.66 x 1 =	0.00 x 2.66 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 9.44 m<sup>2</sup>**

**Total Gross Glazing Areas 128.58 m<sup>2</sup>**

# West Elevations (House 16)

Sheet no. 3

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 16) = 96.75 m²

Glazing Areas at West Elevations (House 16) = 57.74 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( W-F1 ) = 36.26 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.61 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.15 x 3.05 = 9.61 m²  
OPF 1.90 / 3.05 = 0.62 ECS = 0.666

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 11.88 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 4.50 x 2.64 = 11.88 m²  
SPF 1.60 / 4.28 = 0.37 ECS = 0.989

Opaque Wall Areas at West Elevations (House 16) = 39.01 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( W-W1 ) = 39.01 m²

Window to Wall Ratio (WWR) = 57.74 / 96.75 = 0.60

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 16)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)

Facade Orientation Facing West Gross Wall Area (Ao) = 96.75  
 Window to Wall Ratio (WWR) 0.60 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	39.01		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.95		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{4.95} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	57.74	9.61	11.88
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.75	0.13	0.15

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{1.03} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	36.26	9.61	11.88
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.67	0.99
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		7.61	1.34	2.47

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{11.42} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 16)**

$$= 4.95 + 1.03 + 11.42$$

$$= \underline{17.40} \quad \text{W/m}^2$$



# North Elevations (House 16)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 16) = 95.10 m²

Glazing Areas at North Elevations (House 16) = 45.22 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 45.22 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 16) = 49.88 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 49.88 m²

Window to Wall Ratio (WWR) = 45.22 / 95.10 = 0.48

Sheet no. 5

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 16)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  where

R<sub>i</sub> Surface film resistance of internal surface (Refer to Table 2)

R<sub>o</sub> Surface film resistance of external surface (Refer to Table 2)

R<sub>a</sub> Air space resistance (Refer to Table 3)

x Thickness of building materials

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

N-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	R <sub>o</sub>	= 0.044
Air space resistance	R <sub>a</sub>	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	R <sub>i</sub>	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 6 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)

Facade Orientation Facing North Gross Wall Area (Ao) = 95.10  
 Window to Wall Ratio (WWR) 0.48 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	49.88		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.50		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{4.50} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.22		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.42		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.42} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	45.22		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		6.74		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{6.74} \quad \text{W/m}^2$$

**Summary of RTTV at North Elevations (House 16)**

$$= 4.50 + 0.42 + 6.74$$

$$= \underline{11.66} \quad \text{W/m}^2$$

East Elevations (House 16)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 16) = 73.74 m²

Glazing Areas at East Elevations (House 16) = 16.18 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 16.18 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 16) = 57.56 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 57.56 m²

Window to Wall Ratio (WWR) = 16.18 / 73.74 = 0.22

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 16)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	73.74
Window to Wall Ratio (WWR)	0.22	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	57.56		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		9.08		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/Ao) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 9.08 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	16.18		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.26		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/Ao) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.26 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	16.18		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		4.22		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/Ao)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 4.22 W/m²

Summary of RTTV at East Elevations (House 16)  
= 9.08 + 0.26 + 4.22  
= 13.57 W/m²

# South Elevations (House 16)

Sheet no. 9

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 16) = 71.70 m²

Glazing Areas at South Elevations (House 16) = 9.44 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 9.44 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 16) = 62.26 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 62.26 m²

Window to Wall Ratio (WWR) = 9.44 / 71.70 = 0.13

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 16)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8
Average Absorptivity =		0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas	
Wall Material			
External surface film resistance	Ro	=	0.044
Air space resistance	Ra	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	Ri	=	0.12
Total			0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 10 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)

Facade Orientation Facing South Gross Wall Area (Ao) = 71.70  
Window to Wall Ratio (WWR) 0.13 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	62.26		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		9.19		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/Ao) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 9.19 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	9.44		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.14		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/Ao) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.14 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	9.44		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		2.30		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/Ao)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 2.30 W/m²

Summary of RTTV at South Elevations (House 16)  
= 9.19 + 0.14 + 2.30  
= 11.64 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)

Overall Gross Wall Area [a]337.29 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	96.75	4.95	1.03	11.42	17.40	4.99
North	95.10	4.50	0.42	6.74	11.66	3.29
East	73.74	9.08	0.26	4.22	13.57	2.97
South	71.70	9.19	0.14	2.30	11.64	2.47

Overall RTTV<sub>wall</sub> =13.72W/m²

<14W/m²OK

Roof

Sheet no. 12

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 162.62 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 162.62 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 156.50 m²  
1/F = 34.63 m²  
Roof = 87.07 m²  
Upper Roof = 34.80 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 6.12 m²  
1/F = m²  
Roof = 6.12 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$U_{w1} = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No.	13	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)		
Roof Orientation Facing	Flat	Gross Roof Area (Aro) =	162.62
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	R2	
External Finish Material		25mm Unglazed	10mm	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (α <sub>wi</sub> )	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	156.50	6.12	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.44	0.12	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs

where i= 1, 2, ..., n

= 3.56 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

= 3.56 + 0.00 + 0.00

= 3.56 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14

BD Ref No.BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)

Overall Roof Area [a]

162.62 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	162.62	3.56	0.00	0.00	3.56	3.56

Overall RTTV<sub>roof</sub> =

3.56

W/m²

<

4

W/m²

OK

## RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 16)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

**Table 1**

Deemed to Satisfy RTTV <sub>Wall</sub>								
Facade Orientation Facing	West	North	East	South				
Average Absorptivity	0.795	0.8	0.8	0.8				
Average Window to Wall Ratio	0.51	0.37	0.18	0.23				
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43				
Average Shading Coefficient of Facade	0.43	0.43	0.43	0.43				
Visible Light Transmittance	53 %	53 %	53 %	53 %	%	%	%	%
External Reflectance	17 %	17 %	17 %	17 %	%	%	%	%

**Table 2**

RTTV <sub>Wall</sub>																
Facade Orientation Facing		West			North			East			South					
Wall Orientation Factor		1.131			0.79			1.072			0.975					
Total External Wall Area (Residential Units)		120.0 m <sup>2</sup>		Window to Wall Ratio	63.1 m <sup>2</sup>		Window to Wall Ratio	46.4 m <sup>2</sup>		Window to Wall Ratio	78.1 m <sup>2</sup>		Window to Wall Ratio			
Total Window Area		61.73 m <sup>2</sup>		= 0.51	23.37 m <sup>2</sup>		= 0.37	8.25 m <sup>2</sup>		= 0.18	18.12 m <sup>2</sup>		= 0.23			
Heat Conduction	Opaque Wall	4.95 W/m <sup>2</sup>			4.50 W/m <sup>2</sup>			9.08 W/m <sup>2</sup>			9.19 W/m <sup>2</sup>					
	Window	1.03 W/m <sup>2</sup>			0.42 W/m <sup>2</sup>			0.26 W/m <sup>2</sup>			0.14 W/m <sup>2</sup>					
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %
		<input checked="" type="checkbox"/> Tinted	Area = 61.73 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 23.37 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 8.25 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %
	Double Glazing <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
	External Shading				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Overhang <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
	Sidefin <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Sidefin <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
	Solar Radiation through Gazing 11.42 W/m <sup>2</sup>				6.74 W/m <sup>2</sup>				4.22 W/m <sup>2</sup>				2.30 W/m <sup>2</sup>			
	Average Absorptivity 0.795				0.795				0.795				0.795			
	RTTV <sub>Wall</sub> at each Facade 17.40 W/m <sup>2</sup>				11.66 W/m <sup>2</sup>				13.57 W/m <sup>2</sup>				11.64 W/m <sup>2</sup>			
	Overall RTTV <sub>Wall</sub>				13.72 W/m <sup>2</sup>											

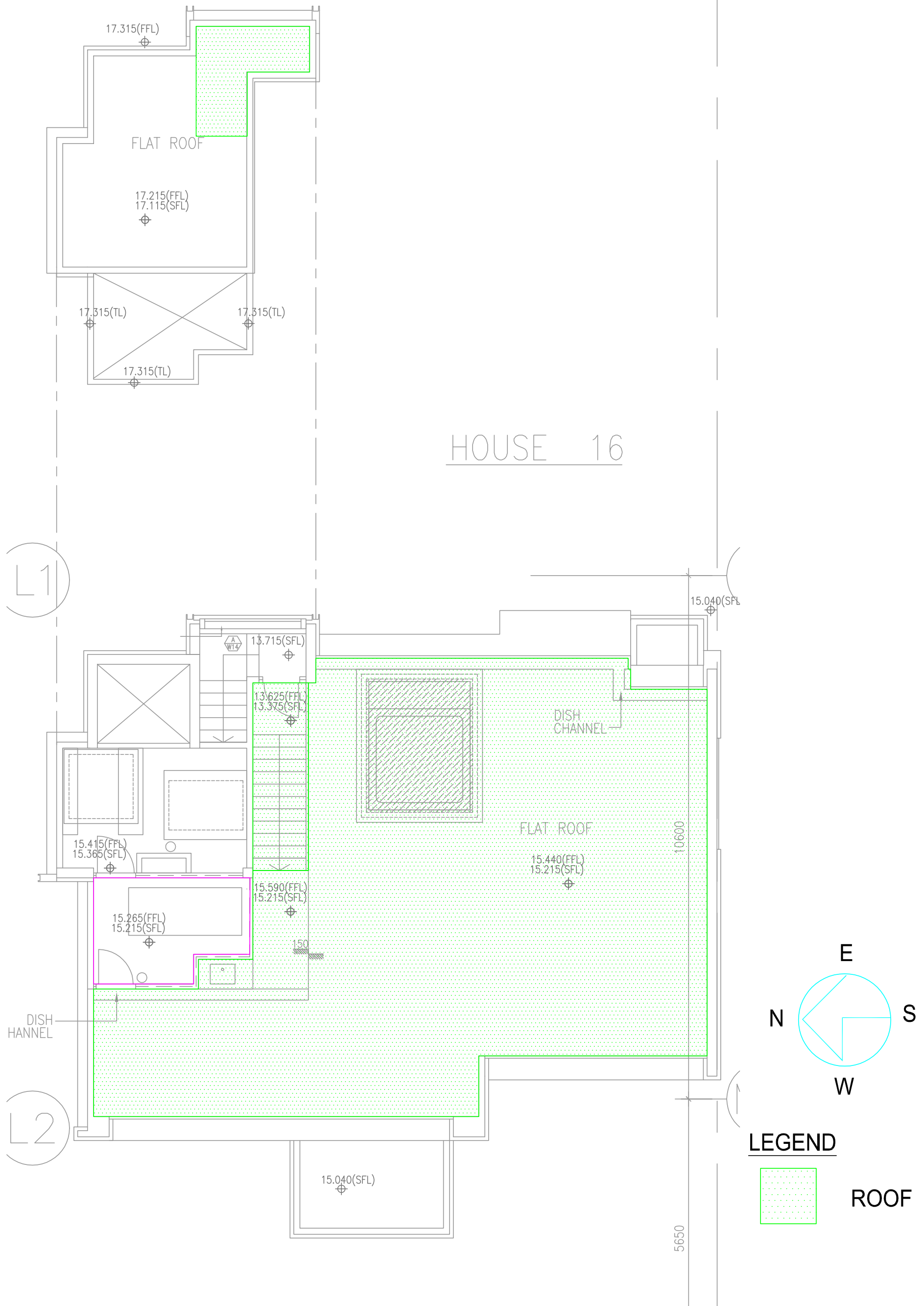
RTTV <sub>Roof</sub>												
Roof Orientation Factor		2.16										
Total Roof Area (Residential Units)		162.62		m <sup>2</sup>								
Total Skylight Area		0		m <sup>2</sup>								
Heat Conduction	Roof	3.56		W/m <sup>2</sup>								
	Skylight	W/m <sup>2</sup>										
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =		m <sup>2</sup>		SC =		VLT = %		ER = %	
		<input type="checkbox"/> Tinted	Area =		m <sup>2</sup>		SC =		VLT = %		ER = %	
		<input type="checkbox"/> Clear	Area =		m <sup>2</sup>		SC =		VLT = %		ER = %	
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No										
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No										
	Solar Radiation through Gazing		0		W/m <sup>2</sup>							
Average Absorptivity (Roof)		0.8										
Overall RTTV <sub>Roof</sub>		3.56		W/m <sup>2</sup>								

ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



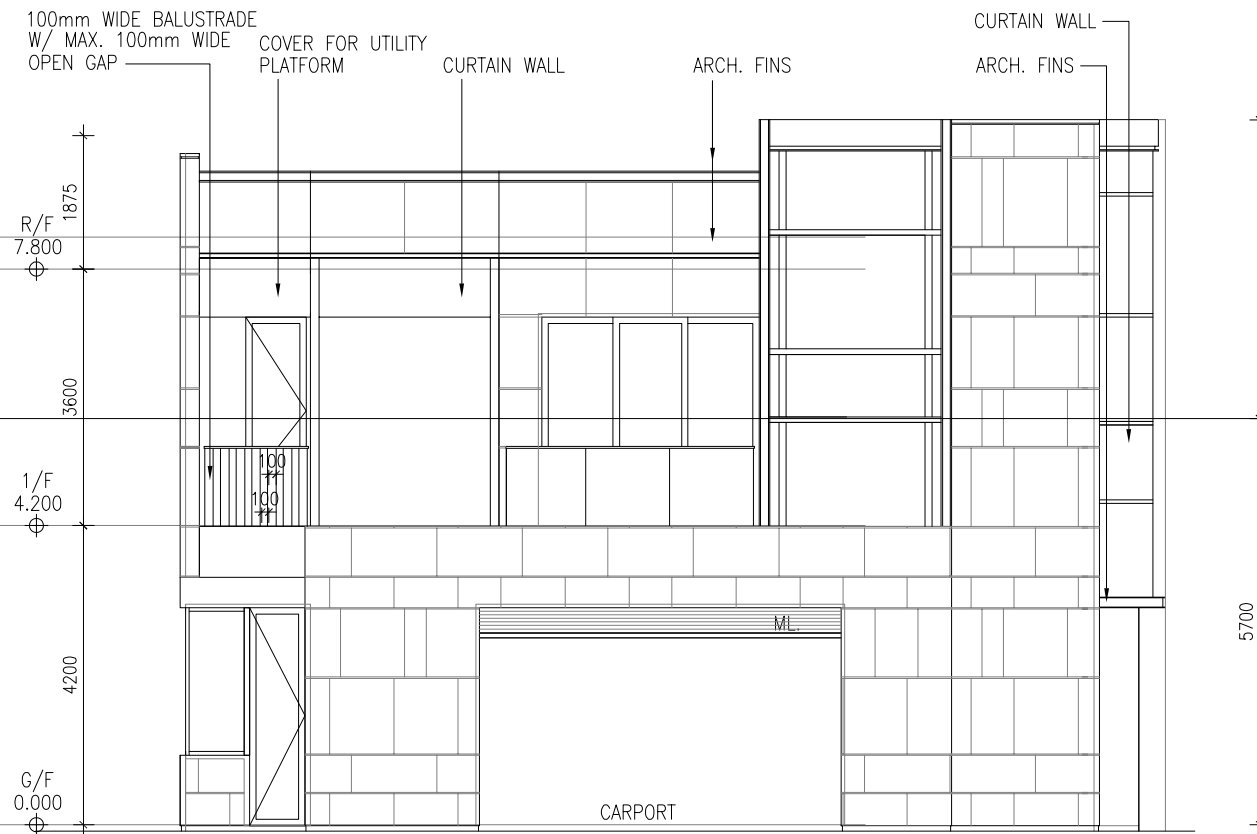


SCALE: 1:150@A4



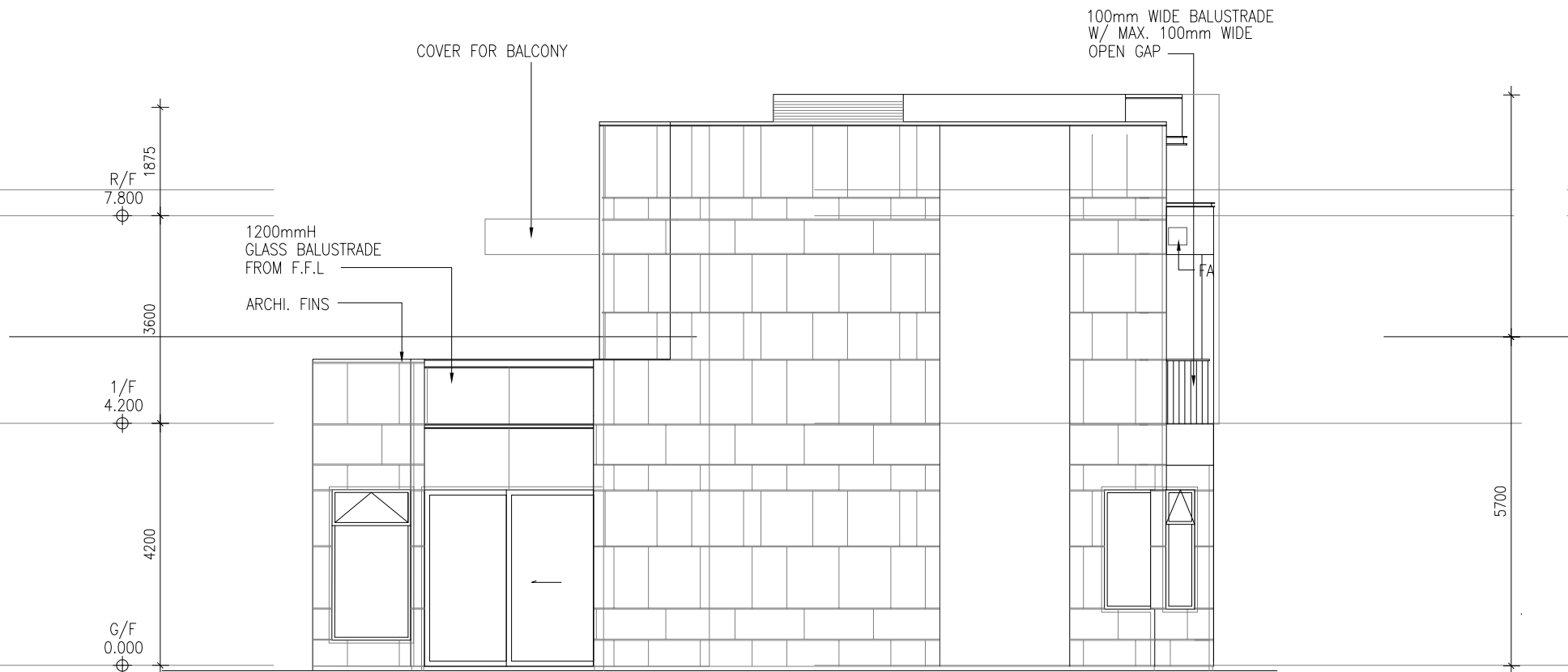
DRAWING TITLE: HOUSE 16 ROOF FLOOR PLAN

SCALE: 1:150@A4



1 EAST ELEVATION 1:75  
HOUSE 16

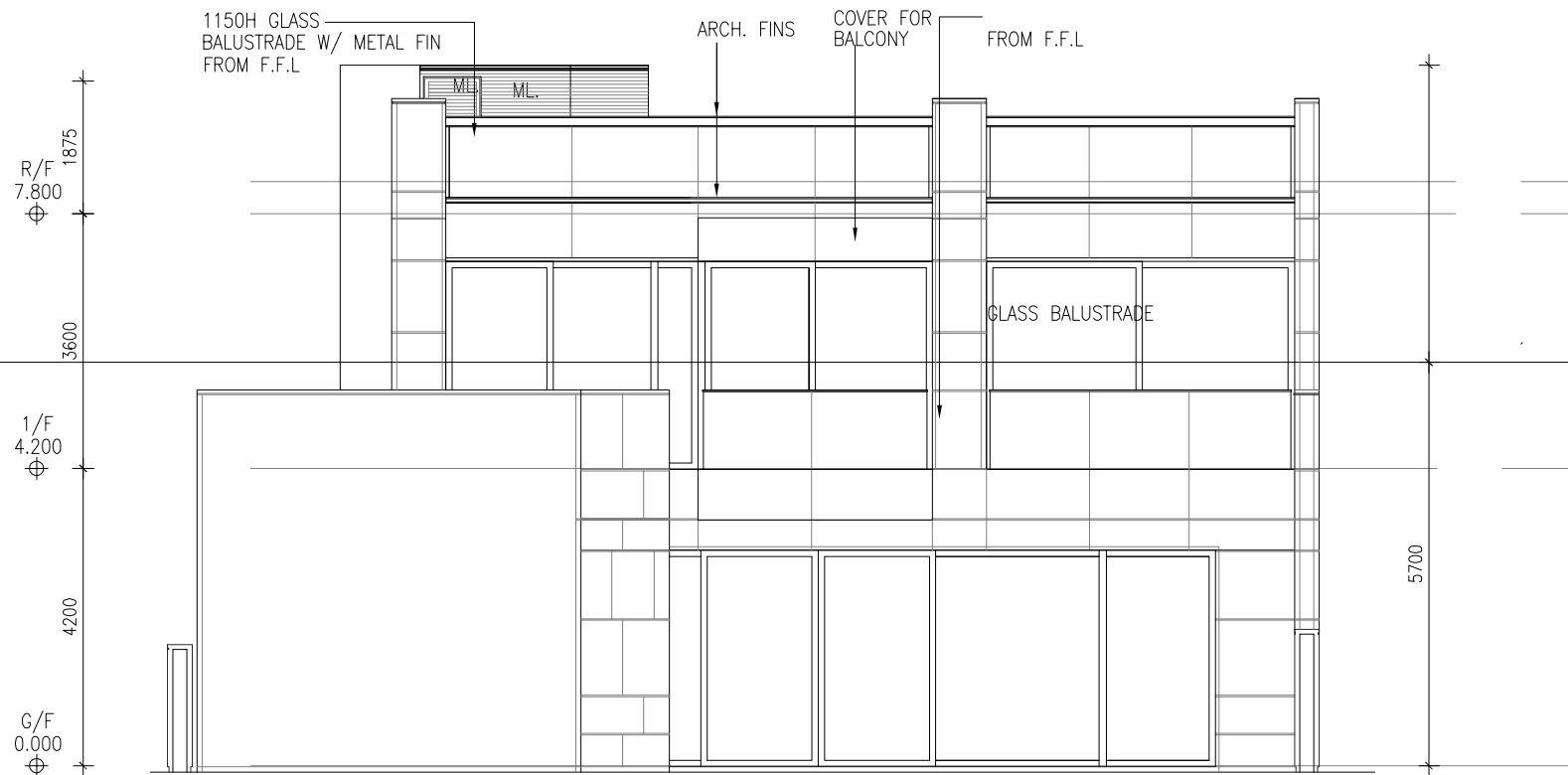
CSK-16E1



7 SOUTH ELEVATION 1:75  
— HOUSE 16

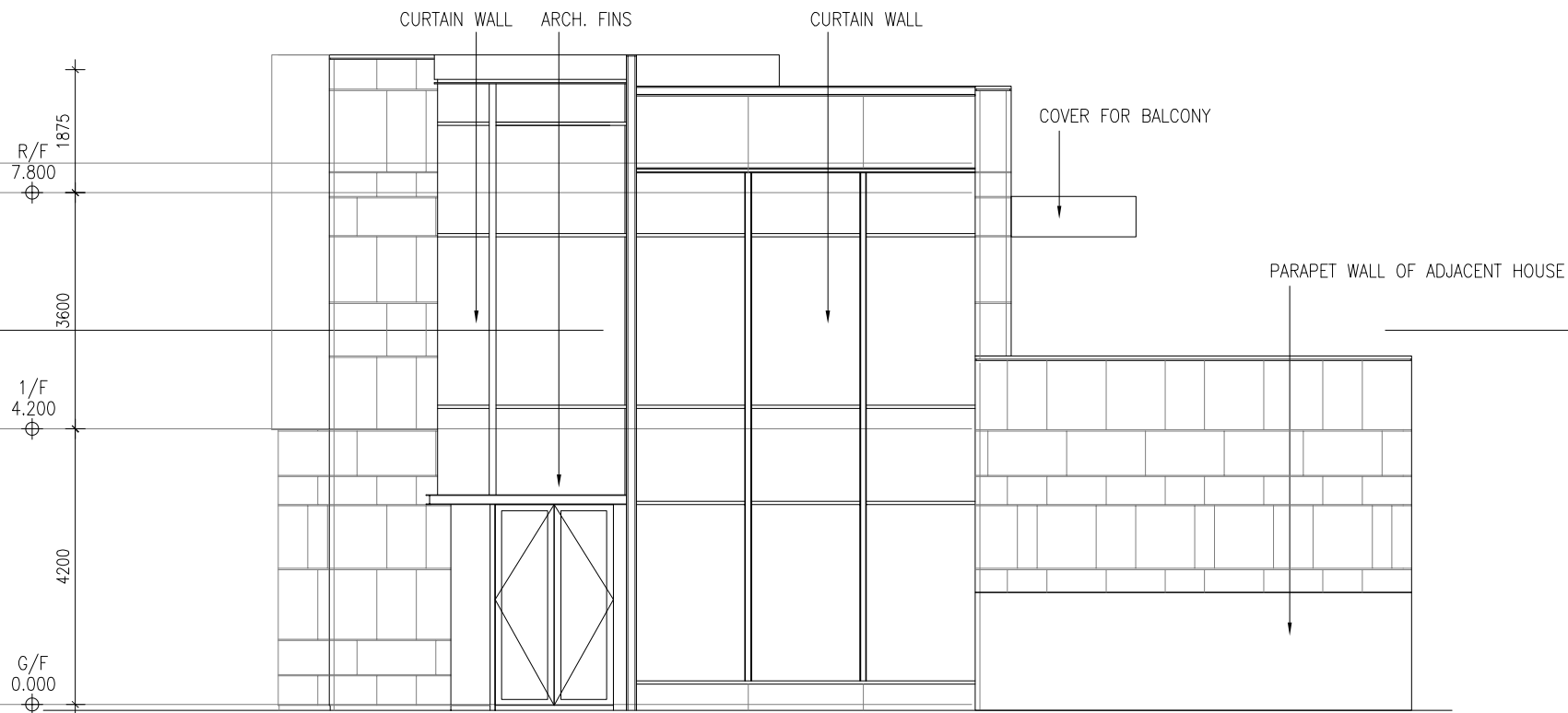
CSK-16E2





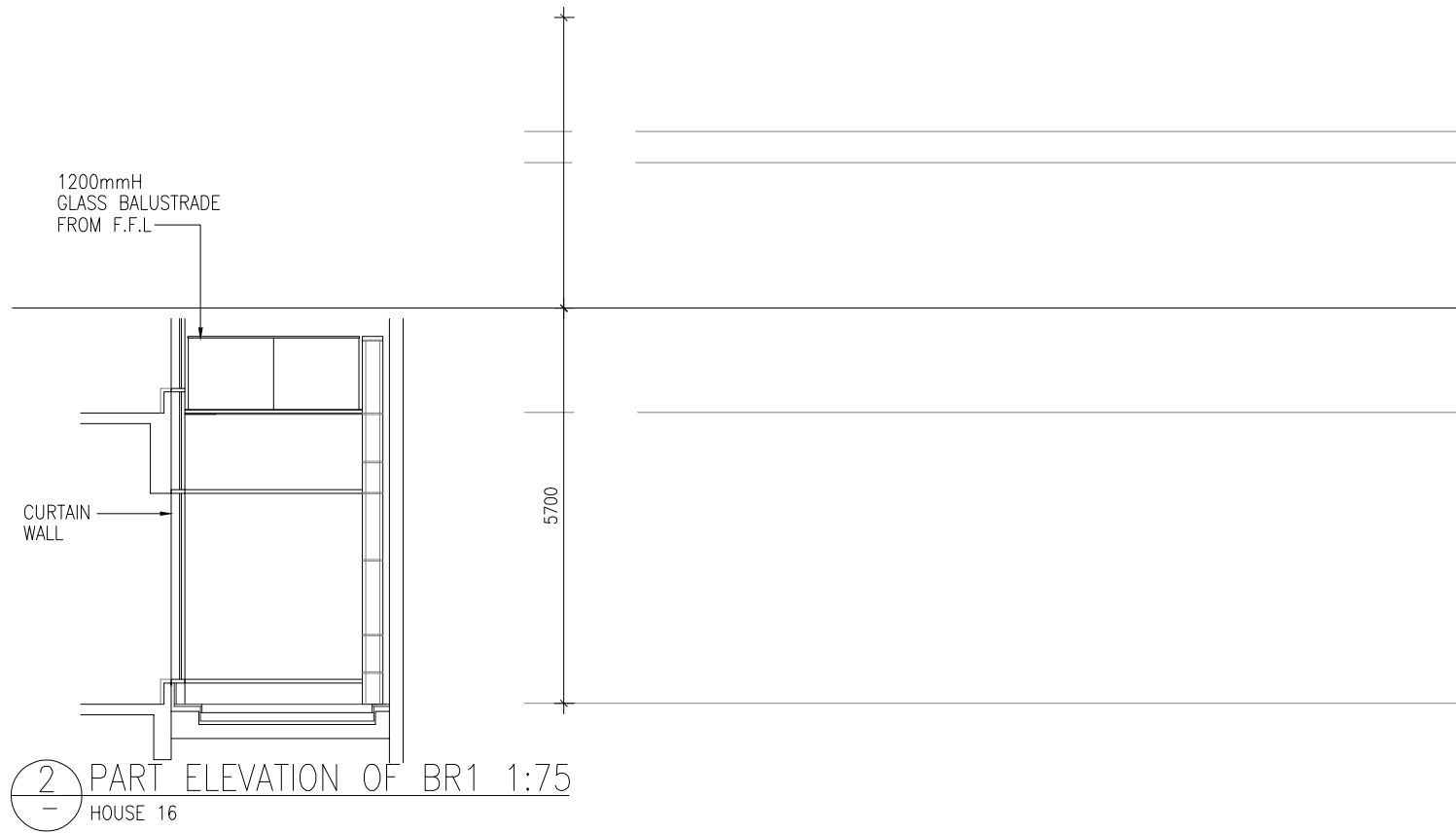
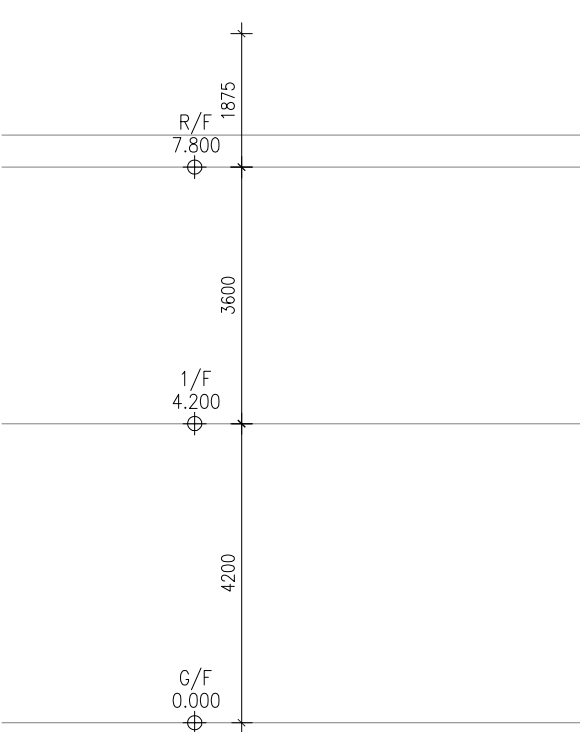
9 WEST ELEVATION 1:75  
— HOUSE 16

CSK-16E3



8 NORTH ELEVATION 1:75  
— HOUSE 6

CSK-16E4



CSK-16E5

## RTTV Calculation (House 17)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

## West Elevations (House 17) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 8.40	)x 4.20 x 1 =	8.40 x 4.20 x 1 =	35.28 m <sup>2</sup>
1/F	( 2.50 + 3.70	)x 3.60 x 1 =	6.20 x 3.60 x 1 =	22.32 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 57.60 m<sup>2</sup>**

## North Elevations (House 17) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 4.80	)x 4.20 x 1 =	4.80 x 4.20 x 1 =	20.16 m <sup>2</sup>
1/F	( 3.50 + 1.00	)x 3.60 x 1 =	4.50 x 3.60 x 1 =	16.20 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 36.36 m<sup>2</sup>**

## East Elevations (House 17) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 1.10 + 1.90	)x 4.20 x 1 =	3.00 x 4.20 x 1 =	12.60 m <sup>2</sup>
1/F	( 2.50 + 2.15	)x 3.60 x 1 =	4.65 x 3.60 x 1 =	16.74 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 29.34 m<sup>2</sup>**

## South Elevations (House 17) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 6.25 + 2.00	)x 4.20 x 1 =	8.25 x 4.20 x 1 =	34.65 m <sup>2</sup>
1/F	( 1.80 + 4.00	)x 3.60 x 1 =	5.80 x 3.60 x 1 =	20.88 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 55.53 m<sup>2</sup>**

**Total Gross Wall Areas 178.83 m<sup>2</sup>**

# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
1/F (Window GL02) - B	=	2.64 m	( 1 storey)

### West Elevations (House 17) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 8.00	)x 3.05 x 1 =	8.00 x 3.05 x 1 =	24.36 m²
1/F (Window GL02) - B	( 2.45 + 2.15	)x 2.64 x 1 =	4.60 x 2.64 x 1 =	12.12 m²

**Gross Glazing Areas 36.48 m²**

### North Elevations (House 17) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

**Gross Glazing Areas 0.00 m²**

### East Elevations (House 17) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 1.80	)x 3.05 x 1 =	1.80 x 3.05 x 1 =	5.48 m²
1/F (Window GL02) - B	( 2.50 + 2.10	)x 2.64 x 1 =	4.60 x 2.64 x 1 =	12.12 m²

**Gross Glazing Areas 17.60 m²**

### South Elevations (House 17) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

**Gross Glazing Areas 0.00 m²**

**Total Gross Glazing Areas 54.08 m²**

# West Elevations (House 17)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 17) = 57.60 m²

Glazing Areas at West Elevations (House 17) = 36.48 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 19.46 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.76 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.20 x 3.05 = 9.76 m²  
OPF 1.50 / 3.05 = 0.49 ECS = 0.714

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 7.26 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 2.75 x 2.64 = 7.26 m²  
SPF 2.13 / 2.28 = 0.94 ECS = 0.971

Opaque Wall Areas at West Elevations (House 17) = 21.12 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 21.12 m²

Window to Wall Ratio (WWf) = 36.48 / 57.60 = 0.63

Sheet no. 3

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 17)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)

Facade Orientation Facing West Gross Wall Area (Ao) = 57.60  
 Window to Wall Ratio (WWR) 0.63 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
<b>External Finish Material</b>		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.890		
<b>Intermediate component</b>		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
<b>Intermediate component</b>		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Internal Finish Material</b>		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	21.12		
<b>Heat Conduction = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub></b>		<b>4.50</b>		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{4.50}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	19.46	9.76	7.26
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
<b>Heat Conduction = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub></b>		<b>0.43</b>	<b>0.21</b>	<b>0.16</b>

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.80}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	19.46	9.76	7.26
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.71	0.97
<b>Solar Radiation = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub></b>		<b>6.86</b>	<b>2.46</b>	<b>2.48</b>

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{11.80}} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 17)**

$$= 4.50 + 0.80 + 11.80$$

$$= \underline{\underline{17.10}} \quad \text{W/m}^2$$



North Elevations (House 17)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 17) = 36.36 m²

Glazing Areas at North Elevations (House 17) = 0.00 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 0.00 m²  
ECS = 1.000

Opaque Wall Areas at North Elevations (House 17) = 36.36 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 36.36 m²

Window to Wall Ratio (WWR) = 0.00 / 36.36 = 0.00

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 17)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	36.36
Window to Wall Ratio (WWR)	0.00	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	36.36		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		8.58		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 8.58 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.00		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		0.00		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Summary of RTTV at North Elevations (House 17)  
= 8.58 + 0.00 + 0.00  
= 8.58 W/m²

East Elevations (House 17)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 17) = 29.34 m²

Glazing Areas at East Elevations (House 17) = 17.60 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 17.60 m²  
ECS = 1.000

Opaque Wall Areas at East Elevations (House 17) = 11.74 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 11.74 m²

Window to Wall Ratio (WWf) = 17.60 / 29.34 = 0.60

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 17)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	29.34
Window to Wall Ratio (WWR)	0.60	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	11.74		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.66		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 4.66 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	17.60		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.72		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.72 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	17.60		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		11.55		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 11.55 W/m²

Summary of RTTV at East Elevations (House 17)  
= 4.66 + 0.72 + 11.55  
= 16.92 W/m²

# South Elevations (House 17)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 17) = 55.53 m²

Glazing Areas at South Elevations (House 17) = 0.00 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 0.00 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 17) = 55.53 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 55.53 m²

Window to Wall Ratio (WWR) = 0.00 / 55.53 = 0.00

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 17)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1

Description:

RC Wall Areas

Wall Material				
External surface film resistance		Ro	=	0.044
Air space resistance		Ra	=	0
30mm Stone cladding	0.03	/ 2.9	=	0.010
12mm cement/ sand render	0.012	/ 0.72	=	0.017
200mm concrete wall	0.2	/ 2.16	=	0.093
10mm AGT Tile	0.01	/ 1.1	=	0.009
Internal surface film resistance		Ri	=	0.12
Total				0.293

Uw1 =  $\frac{1}{0.293}$  = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 10 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)

Facade Orientation Facing South Gross Wall Area (Ao) = 55.53  
Window to Wall Ratio (WWR) 0.00 Wall Orientation Factor (Gw) = 0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	55.53		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		10.58		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 10.58 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.65		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.00		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		0.00		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Summary of RTTV at South Elevations (House 17)  
= 10.58 + 0.00 + 0.00  
= 10.58 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)

Overall Gross Wall Area [a]178.83 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	57.60	4.50	0.80	11.80	17.10	5.51
North	36.36	8.58	0.00	0.00	8.58	1.74
East	29.34	4.66	0.72	11.55	16.92	2.78
South	55.53	10.58	0.00	0.00	10.58	3.29

Overall RTTV<sub>wall</sub> =13.31W/m²

<14W/m²OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 84.37 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

U = 1/(Ri+x1/k1+x2/k2+...+xn/kn+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)

OpaqueAreas at Roof = 84.37 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 77.77 m²  
1/F = m²  
Roof = 47.87 m²  
Upper Roof = 29.90 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 6.60 m²  
1/F = m²  
Roof = 6.60 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

Uw1 = 1 / 1.858 = 0.54 W/m²K

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

Uw1 = 1 / 1.836 = 0.54 W/m²K



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No.	13	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)		
Roof Orientation Facing	Flat	Gross Roof Area (Aro) =	84.37
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	77.77	6.60	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.30	0.25	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs

where i= 1, 2, ..., n

= 3.54 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

= 3.54 + 0.00 + 0.00

= 3.54 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)

Overall Roof Area [a]84.37 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	84.37	3.54	0.00	0.00	3.54	3.54

Overall RTTV<sub>roof</sub> =3.54W/m²

<4W/m²OK

RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 17)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>wall</sub>									
Facade Orientation Facing	West		North		East		South		
Average Absorptivity	0.795		0.795		0.795		0.795		
Average Window to Wall Ratio	0.71		0		0.15		0		
Shading Coefficient of Glazing	0.43				0.43				
Average Shading Coefficient of Facade	0.43				0.43				
Visable Light Transmittance	53	%		%	53	%		%	%
External Reflectance	17	%		%	17	%		%	%

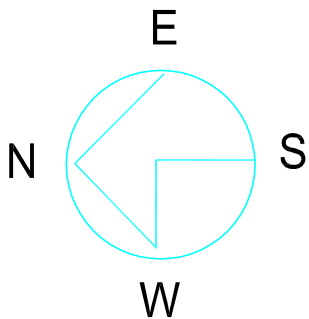
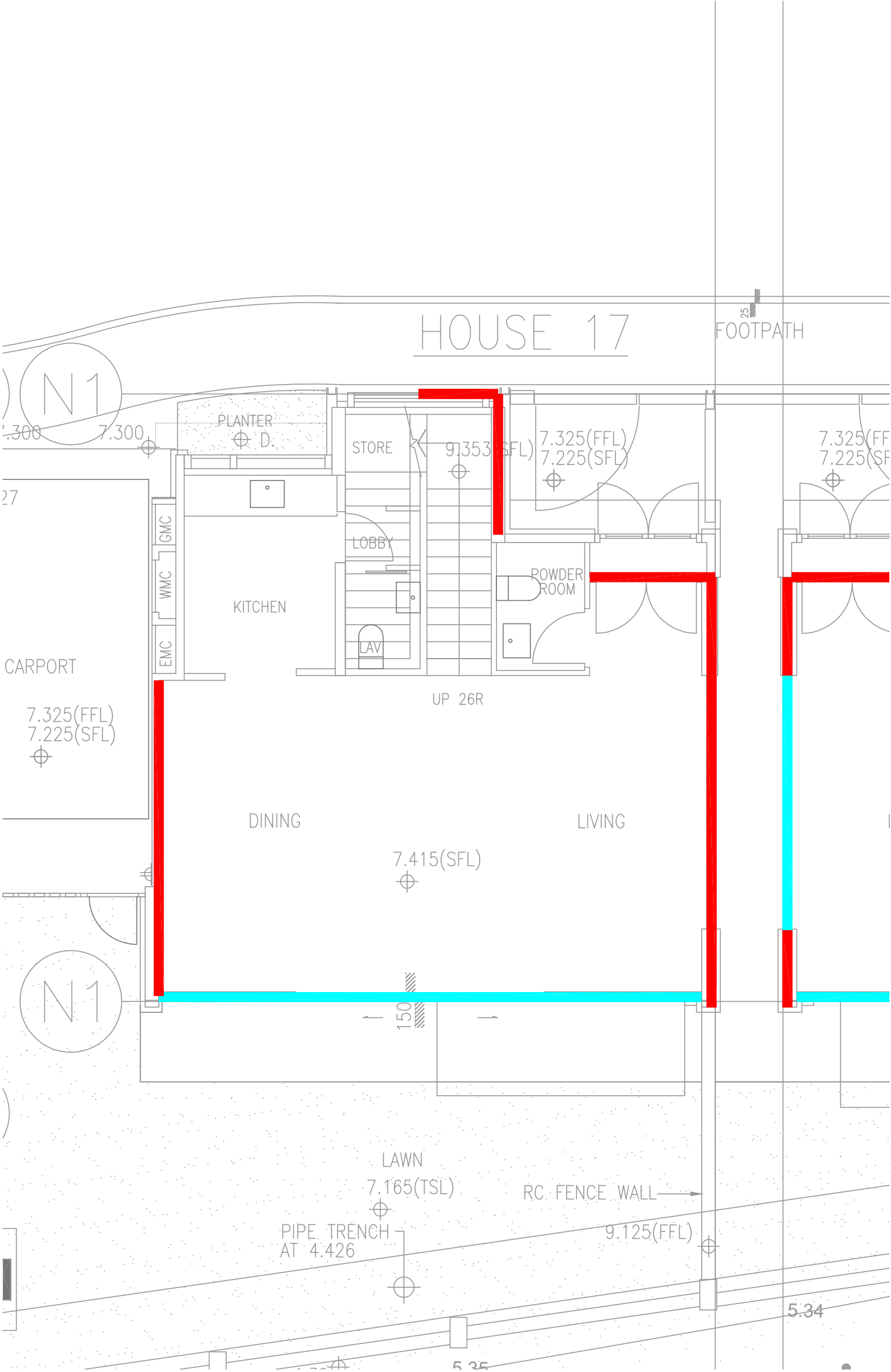
Table 2

RTTV <sub>Wall</sub>																									
Facade Orientation Facing		West						North						East						South					
Wall Orientation Factor		1.131						0.79						1.072						0.975					
Total External Wall Area (Residential Units)		67.0 m <sup>2</sup>		Window to Wall Ratio				49.2 m <sup>2</sup>		Window to Wall Ratio				42.6 m <sup>2</sup>		Window to Wall Ratio				33.2 m <sup>2</sup>		Window to Wall Ratio			
Total Window Area		47.61 m <sup>2</sup>		= 0.71				0.00 m <sup>2</sup>		= 0.00				6.59 m <sup>2</sup>		= 0.03				0.00 m <sup>2</sup>		= 0.00			
Heat Conduction	Opaque Wall	4.50 W/m <sup>2</sup>						8.58 W/m <sup>2</sup>						4.66 W/m <sup>2</sup>						10.58 W/m <sup>2</sup>					
	Window	0.80 W/m <sup>2</sup>						0.00 W/m <sup>2</sup>						0.72 W/m <sup>2</sup>						0.00 W/m <sup>2</sup>					
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %				
		<input checked="" type="checkbox"/> Tinted	Area = 47.61 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input type="checkbox"/> Tinted	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input checked="" type="checkbox"/> Tinted	Area = 6.59 m <sup>2</sup>	SC = 0.43	VLT = 53 %	ER = 17 %	<input type="checkbox"/> Tinted	Area = m <sup>2</sup>	SC =	VLT = %	ER = %				
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %				
		Double Glazing		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No									
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					Overhang	<input type="checkbox"/> Yes <input type="checkbox"/> No					Overhang	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Overhang	<input type="checkbox"/> Yes <input type="checkbox"/> No				
		Sidefin	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					Sidefin	<input type="checkbox"/> Yes <input type="checkbox"/> No					Sidefin	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Sidefin	<input type="checkbox"/> Yes <input type="checkbox"/> No				
	Solar Radiation through Gazing		11.80 W/m <sup>2</sup>						0.00 W/m <sup>2</sup>						11.55 W/m <sup>2</sup>						0.00 W/m <sup>2</sup>				
Average Absorptivity		0.795						0.8						0.8						0.8					
RTTV <sub>Wall</sub> at each Facade		17.10 W/m <sup>2</sup>						8.58 W/m <sup>2</sup>						16.92 W/m <sup>2</sup>						10.58 W/m <sup>2</sup>					
Overall RTTV <sub>Wall</sub>		13.31 W/m <sup>2</sup>																							

Table 3

RTTV <sub>Roof</sub>									
Roof Orientation Factor		2.16							
Total Roof Area (Residential Units)		84.37 m <sup>2</sup>							
Total Skylight Area		0 m <sup>2</sup>							
Heat Conduction	Roof	3.54 W/m <sup>2</sup>							
	Skylight	0 W/m <sup>2</sup>							
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	ER = %			
		<input type="checkbox"/> Tinted	Area = m <sup>2</sup>	SC =	VLT = %	ER = %			
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	ER = %			
	Double Glazing	<input type="checkbox"/> Yes	<input type="checkbox"/> No						
	External Shading	<input type="checkbox"/> Yes	<input type="checkbox"/> No						
Solar Radiation through Gazing		0 W/m <sup>2</sup>							
Average Absorptivity (Roof)		0.8							
Overall RTTV <sub>Roof</sub>		3.54 W/m <sup>2</sup>							

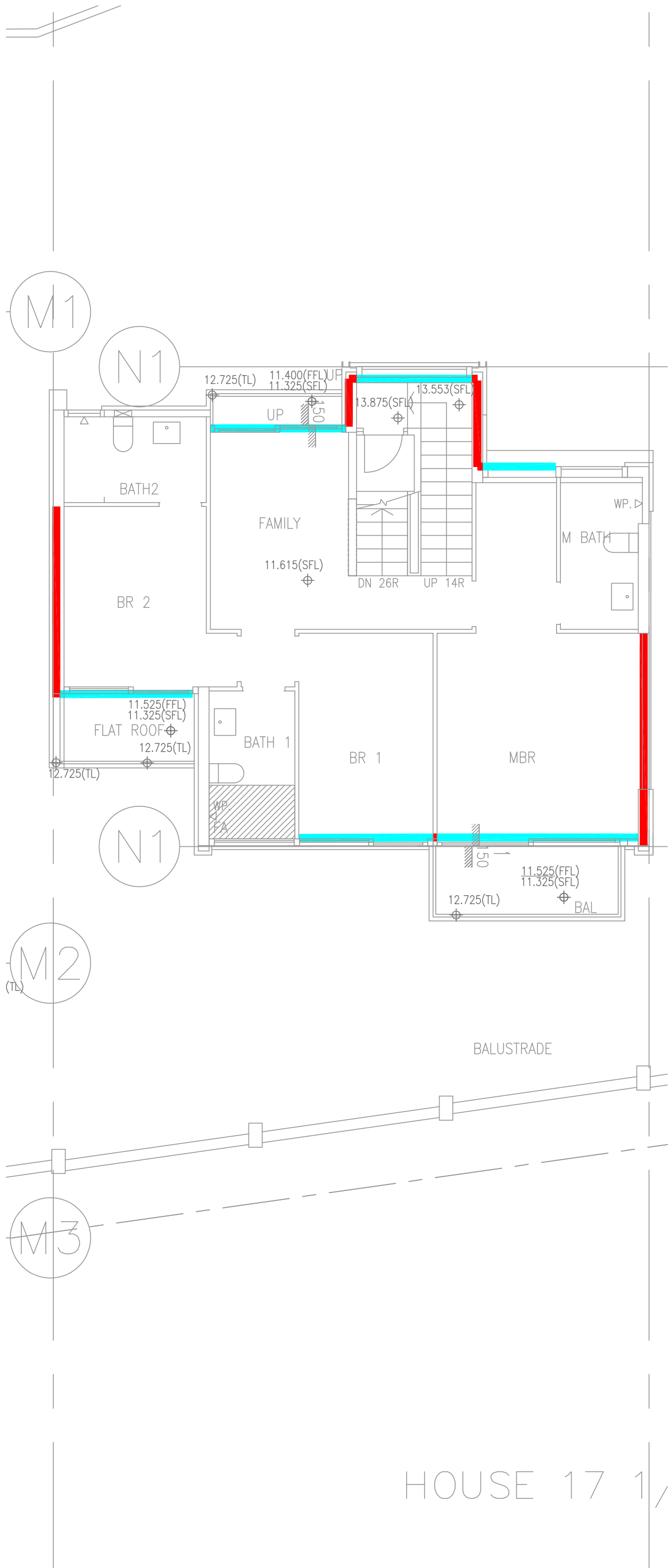
ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



**LEGEND**

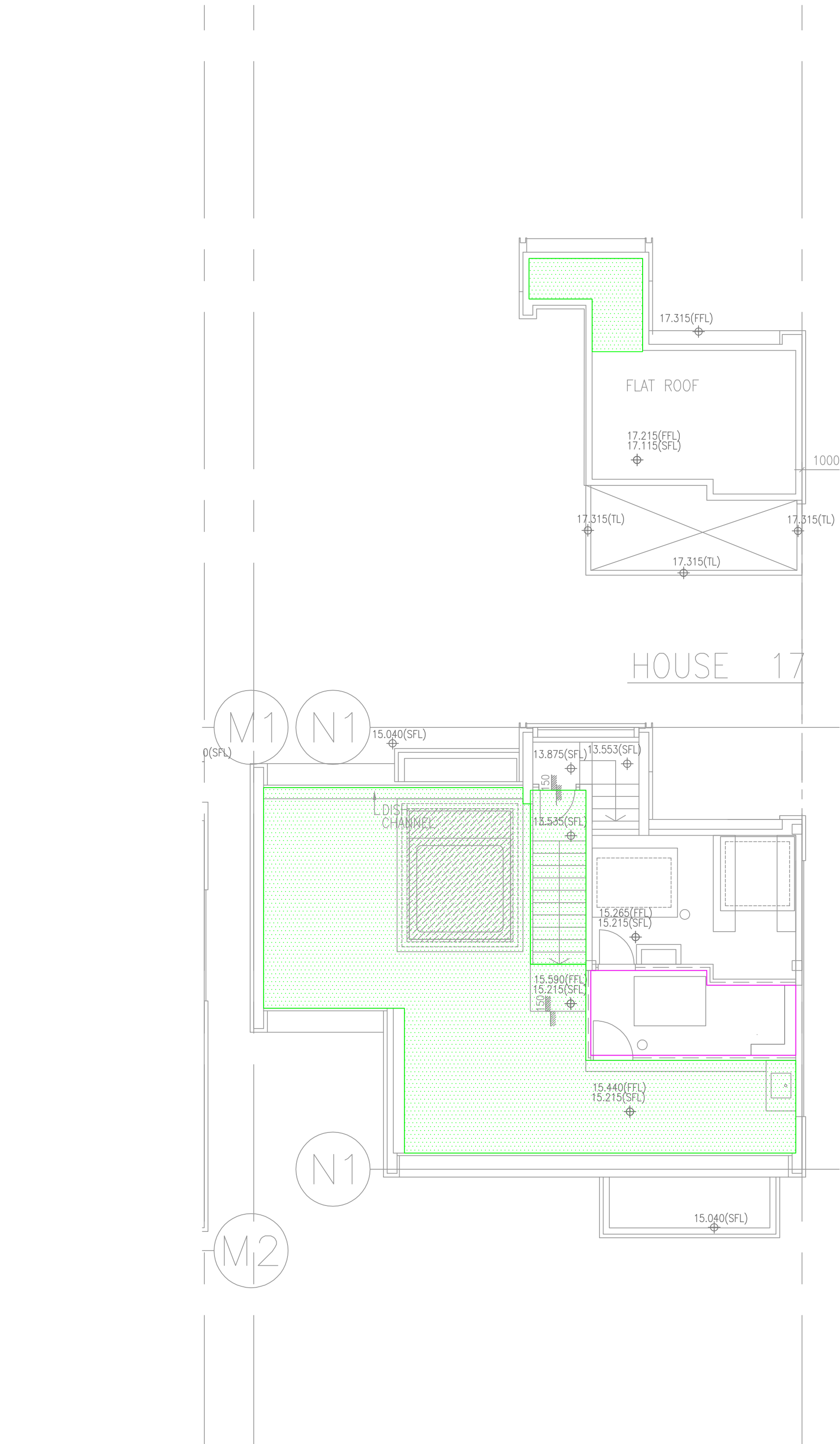
- Wall
- Glass

**DRAWING TITLE: HOUSE 17 GROUND FLOOR PLAN**  
SCALE: 1:150@A4



DRAWING TITLE: HOUSE 17 FIRST FLOOR PLAN

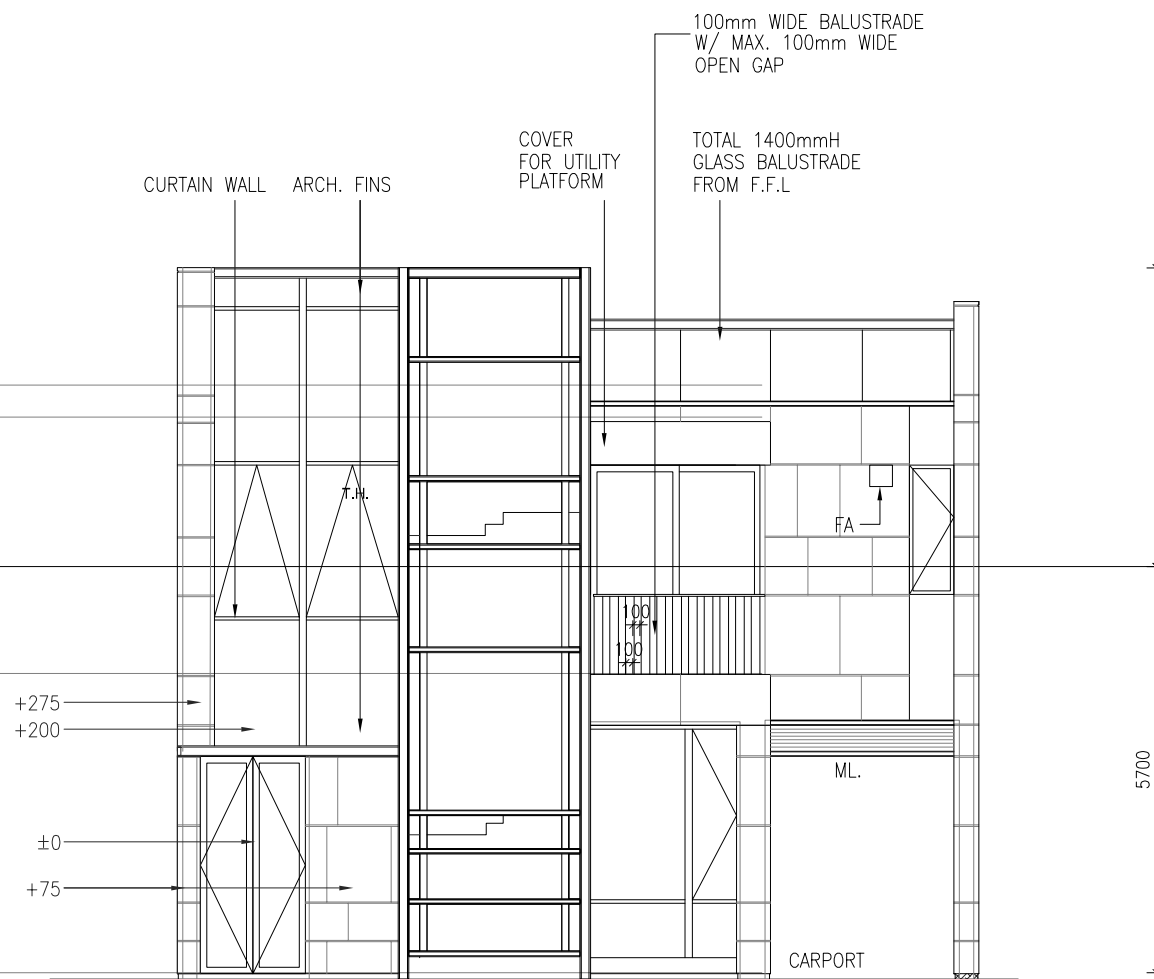
SCALE: 1:150@A4



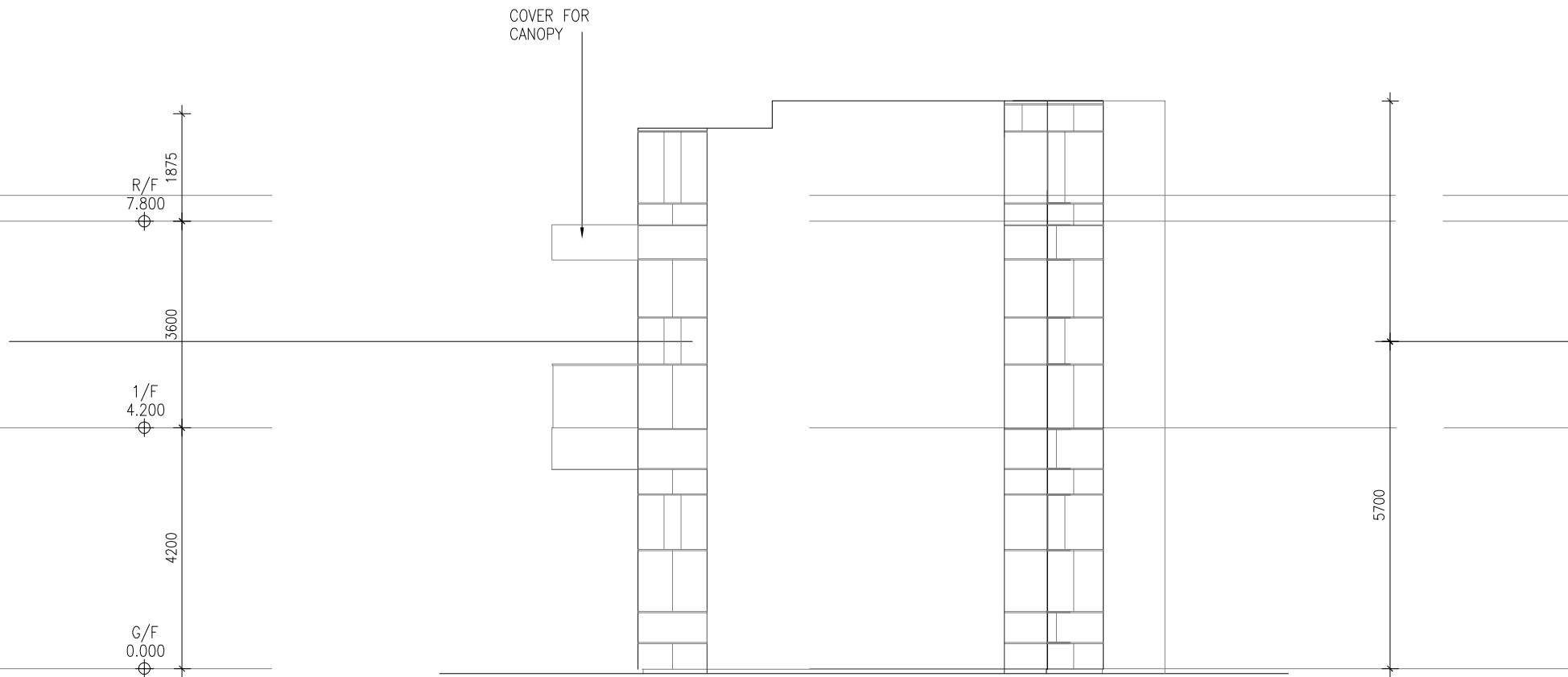
#### LEGEND

- ROOF
- AGT

**DRAWING TITLE: HOUSE 17 ROOF FLOOR PLAN**  
SCALE: 1:150@A4



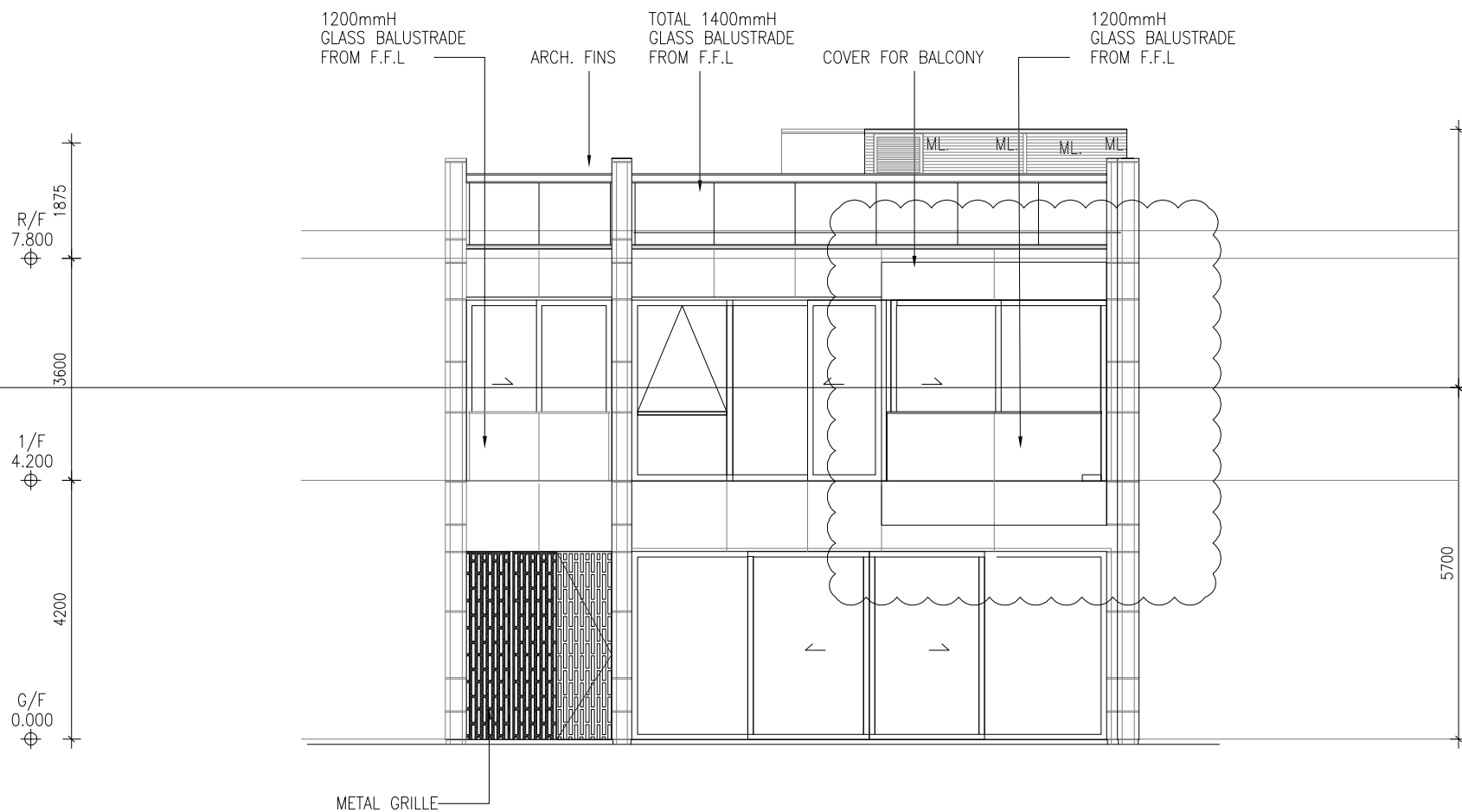
25 EAST ELEVATION 1:75  
— HOUSE 17



26 SOUTH ELEVATION 1:75  
— HOUSE 17

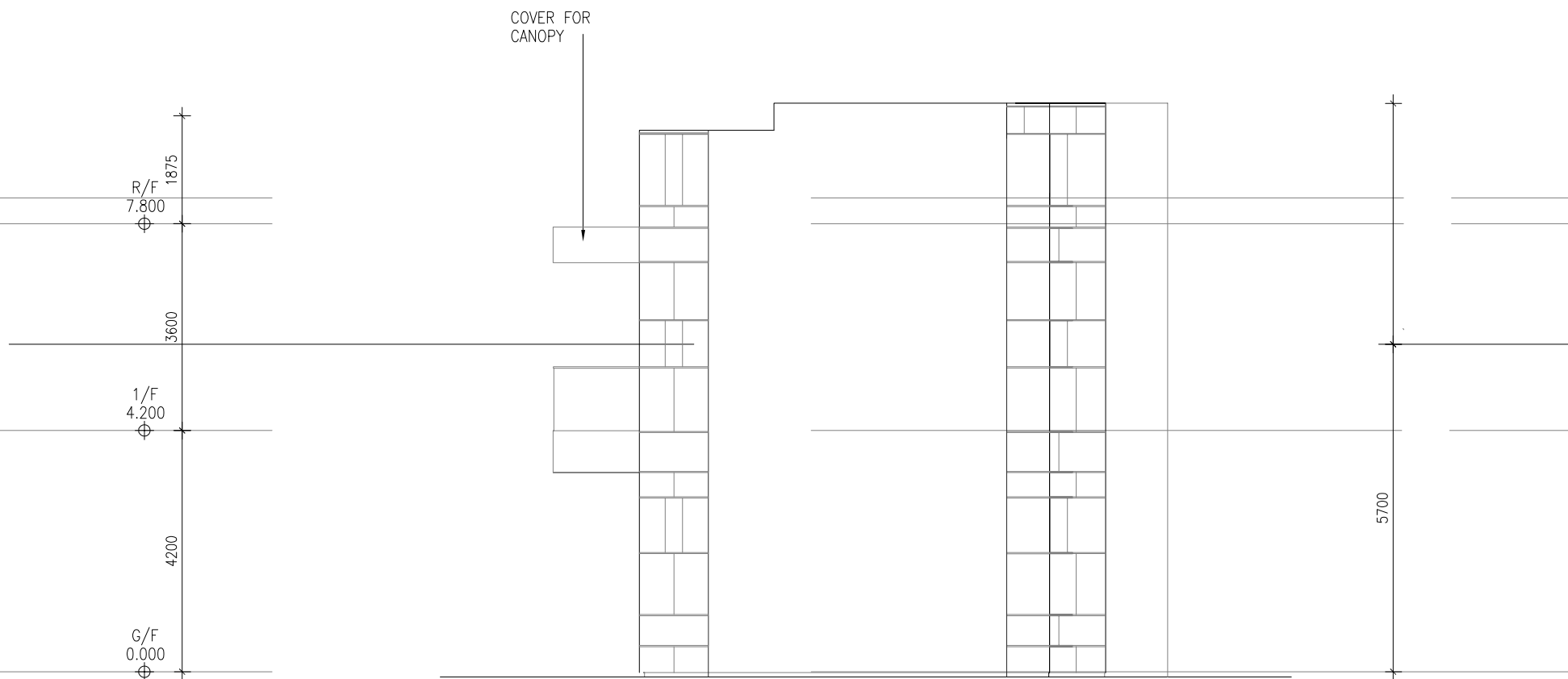
CSK-17E2





24 WEST ELEVATION 1:75  
— HOUSE 17

CSK-17E3A



26 SOUTH ELEVATION 1:75  
— HOUSE 17

CSK-17E2

## RTTV Calculation (House 18)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

### West Elevations (House 18) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 8.00	)x 4.20 x 1 =	8.00 x 4.20 x 1 =	33.60 m <sup>2</sup>
1/F	( 6.35 + 2.50	)x 3.60 x 1 =	8.85 x 3.60 x 1 =	31.86 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 65.46 m<sup>2</sup>**

### North Elevations (House 18) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 2.10 + 6.20	)x 4.20 x 1 =	8.30 x 4.20 x 1 =	34.86 m <sup>2</sup>
1/F	( 1.90 + 4.00	)x 3.60 x 1 =	5.90 x 3.60 x 1 =	21.24 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 56.10 m<sup>2</sup>**

### East Elevations (House 18) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 2.20 + 1.70	)x 4.20 x 1 =	3.90 x 4.20 x 1 =	16.38 m <sup>2</sup>
1/F	( 2.15 + 2.50	)x 3.60 x 1 =	4.65 x 3.60 x 1 =	16.74 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 33.12 m<sup>2</sup>**

### South Elevations (House 18) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 4.70	)x 4.20 x 1 =	4.70 x 4.20 x 1 =	19.74 m <sup>2</sup>
1/F	( 3.45	)x 3.60 x 1 =	3.45 x 3.60 x 1 =	12.42 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 32.16 m<sup>2</sup>**

**Total Gross Wall Areas 186.84 m<sup>2</sup>**

# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
1/F (Window GL02) - B	=	2.64 m	( 1 storey)

### West Elevations (House 18) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 8.00	)x 3.05 x 1 =	8.00 x 3.05 x 1 =	24.36 m²
1/F (Window GL02) - B	( 3.70 + 2.50	)x 2.64 x 1 =	6.20 x 2.64 x 1 =	16.34 m²

**Gross Glazing Areas 40.70 m²**

### North Elevations (House 18) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 3.75	)x 3.05 x 1 =	3.75 x 3.05 x 1 =	11.42 m²
-----------------------	--------	---------------	-------------------	----------

**Gross Glazing Areas 11.42 m²**

### East Elevations (House 18) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	(	)x 3.05 x 1 =	0.00 x 3.05 x 1 =	0.00 m²
1/F (Window GL02) - B	( 2.15	)x 2.64 x 1 =	2.15 x 2.64 x 1 =	5.67 m²

**Gross Glazing Areas 5.67 m²**

### South Elevations (House 18) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

**Gross Glazing Areas 0.00 m²**

**Total Gross Glazing Areas 57.78 m²**

# West Elevations (House 18)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 18) = 65.46 m²

Glazing Areas at West Elevations (House 18) = 40.70 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( W-F1 ) = 23.68 m²  
ECS = 1.000

Glazing Areas Shaded by Cover of Balcony ( W-F2 ) = 9.76 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.20 x 3.05 = 9.76 m²  
OPF 1.50 / 3.05 = 0.49 ECS = 0.714

Glazing Areas Shaded by Built-Fin (Projection on Right) ( W-F3 ) = 7.26 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 2.75 x 2.64 = 7.26 m²  
SPF 2.13 / 2.28 = 0.94 ECS = 0.971

Opaque Wall Areas at West Elevations (House 18) = 24.76 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( W-W1 ) = 24.76 m²

Window to Wall Ratio (WWf) = 40.70 / 65.46 = 0.62

Sheet no. 3

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 18)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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-W1 Description: RC Wall Areas

Wall Material			
External surface film resistance	Ro	=	0.044
Air space resistance	Ra	=	0
30mm Stone cladding	0.03 / 2.9	=	0.010
12mm cement/ sand render	0.012 / 0.72	=	0.017
200mm concrete wall	0.2 / 2.16	=	0.093
10mm AGT Tile	0.01 / 1.1	=	0.009
Internal surface film resistance	Ri	=	0.12
Total			0.293

$U_{w1} = \frac{1}{0.293} = 3.42 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	4	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)		
Facade Orientation Facing	West	Gross Wall Area (Ao) =	65.46
Window to Wall Ratio (WWR)	0.62	Wall Orientation Factor (Gw) =	1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.890		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	24.76		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		4.64		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 4.64 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	23.68	9.76	7.26
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.46	0.19	0.14

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.78 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	W-F3
Glazing Type		Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	23.68	9.76	7.26
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53
External Reflectance (ER)	%	17	17	17
External Shading Multiplier (ESC)		1.00	0.71	0.97
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		7.34	2.16	2.19

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 11.69 W/m²

Summary of RTTV at West Elevations (House 18)  
= 4.64 + 0.78 + 11.69  
= 17.12 W/m²

# North Elevations (House 18)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 18)	=	56.10 m²
Glazing Areas at North Elevations (House 18)	=	11.42 m²
Breakdown of Glazing Areas Glazing Areas Unshaded ( N-F1 )	=	11.42 m²
ECS	=	1.000

Opaque Wall Areas at North Elevations (House 18)	=	44.68 m²
Breakdown of Opaque Wall Areas RC Wall Areas ( N-W1 )	=	44.68 m²

Window to Wall Ratio (WWR)	=	11.42 / 56.10	=	0.00
----------------------------	---	---------------	---	------

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 18)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K



**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 6 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)

Facade Orientation Facing North Gross Wall Area (Ao) = 56.10  
 Window to Wall Ratio (WWR) 0.00 Wall Orientation Factor (Gw) = 0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
<b>External Finish Material</b>		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
<b>Intermediate component</b>		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
<b>Intermediate component</b>		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Internal Finish Material</b>		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	44.68		
<b>Heat Conduction = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub></b>		<b>6.83</b>		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{6.83}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	11.42		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
<b>Heat Conduction = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub></b>		<b>0.18</b>		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.18}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	11.42		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
<b>Solar Radiation = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub></b>		<b>2.89</b>		

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_f)(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{2.89}} \quad \text{W/m}^2$$

**Summary of RTTV at North Elevations (House 18)**

$$= 6.83 + 0.18 + 2.89$$

$$= \underline{\underline{9.90}} \quad \text{W/m}^2$$

East Elevations (House 18)

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 18) = 33.12 m²

Glazing Areas at East Elevations (House 18) = 5.67 m²

Breakdown of Glazing Areas

Glazing Areas Unshaded ( E-F1 ) = 5.67 m²

ECS = 1.000

Opaque Wall Areas at East Elevations (House 18) = 27.45 m²

Breakdown of Opaque Wall Areas

RC Wall Areas ( E-W1 ) = 27.45 m²

Window to Wall Ratio (WWf) = 5.67 / 33.12 = 0.17

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 18)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	8	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)		
Facade Orientation Facing	East	Gross Wall Area (Ao) =	33.12
Window to Wall Ratio (WWR)	0.17	Wall Orientation Factor (Gw) =	1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	27.45		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		9.65		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 9.65 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	5.67		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.20		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.20 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	5.67		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.53		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		4.06		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 4.06 W/m²

Summary of RTTV at East Elevations (House 18)  
= 9.65 + 0.20 + 4.06  
= 13.91 W/m²

# South Elevations (House 18)

Sheet no. 9

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 18) = 32.16 m²

Glazing Areas at South Elevations (House 18) = 0.00 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( S-F1 ) = 0.00 m²  
ECS = 1.000

Opaque Wall Areas at South Elevations (House 18) = 32.16 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( S-W1 ) = 32.16 m²

Window to Wall Ratio (WWR) = 0.00 / 32.16 = 0.00

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 18)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1

Description:

RC Wall Areas

Wall Material				
External surface film resistance		Ro	=	0.044
Air space resistance		Ra	=	0
30mm Stone cladding	0.03	/ 2.9	=	0.010
12mm cement/ sand render	0.012	/ 0.72	=	0.017
200mm concrete wall	0.2	/ 2.16	=	0.093
10mm AGT Tile	0.01	/ 1.1	=	0.009
Internal surface film resistance		Ri	=	0.12
Total				0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	10	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)		
Facade Orientation Facing	South	Gross Wall Area (Ao) =	32.16
Window to Wall Ratio (WWR)	0.00	Wall Orientation Factor (Gw) =	0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	S-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	32.16		
Heat Conduction = 3.57(A <sub>wi</sub> /Ao) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		10.58		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/Ao) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 10.58 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
Heat Conduction = 0.64 (A <sub>fi</sub> /Ao) U <sub>fi</sub> G <sub>w</sub>		0.00		

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/Ao) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	S-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	0.00		
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43		
Visible Light Transmittance (VLT)	%	53		
External Reflectance (ER)	%	17		
External Shading Multiplier (ESC)		1.00		
Solar Radiation = 41.75 (A <sub>fi</sub> /Ao)(SC <sub>f</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		0.00		

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/Ao)(SC<sub>f</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 0.00 W/m²

Summary of RTTV at South Elevations (House 18)  
= 10.58 + 0.00 + 0.00  
= 10.58 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)

Overall Gross Wall Area [a]186.84 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	65.46	4.64	0.78	11.69	17.12	6.00
North	56.10	6.83	0.18	2.89	9.90	2.97
East	33.12	9.65	0.20	4.06	13.91	2.47
South	32.16	10.58	0.00	0.00	10.58	1.82

Overall RTTV<sub>wall</sub> =13.26W/m²

<14W/m²OK

Roof

Sheet no. 12

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 100.57 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	96%	0.9
AGT Tile (Brown)	4%	0.8
Average Absorptivity =		0.896

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 100.57 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 93.97 m²  
1/F = 27.30 m²  
Roof = 47.87 m²  
Upper Roof = 18.80 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 6.60 m²  
1/F = m²  
Roof = 6.60 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
25mm Unglazed Porcelain Tiles (Grey)	0.025 / 1.1	= 0.023
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.858

$$U_{w1} = \frac{1}{1.858} = 0.54 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro	= 0.055
Air space resistance	Ra	= 0
50mm cement/ sand screed	0.05 / 0.72	= 0.069
50mm expanded polystyrene	0.05 / 0.034	= 1.471
150mm concrete slab	0.15 / 2.16	= 0.069
10mm AGT Tile (Brown)	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 100.57  
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	R2	
External Finish Material		25mm Unglazed Porcelain Tiles (Grey)	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity	(α)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.53	0.53	
Opaque Roof Area (Ari)	m²	93.97	6.60	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.34	0.21	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs where i= 1, 2, ..., n  
= 3.34 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  
= 3.34 + 0.00 + 0.00  
= 3.34 W/m²



Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)

Overall Roof Area [a]100.57 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	100.57	3.34	0.00	0.00	3.34	3.34

Overall RTTV<sub>roof</sub> =3.34W/m²

<4W/m²OK

## RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 18)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>Wall</sub>								
Facade Orientation Facing	West		North		East		South	
Average Absorptivity	0.795		0.795		0.795		0.795	
Average Window to Wall Ratio	0.71		0		0.15		0	
Shading Coefficient of Glazing	0.43				0.43			
Average Shading Coefficient of Facade	0.43				0.43			
Visible Light Transmittance	53	%		%	53	%		%
External Reflectance	17	%		%	17	%		%

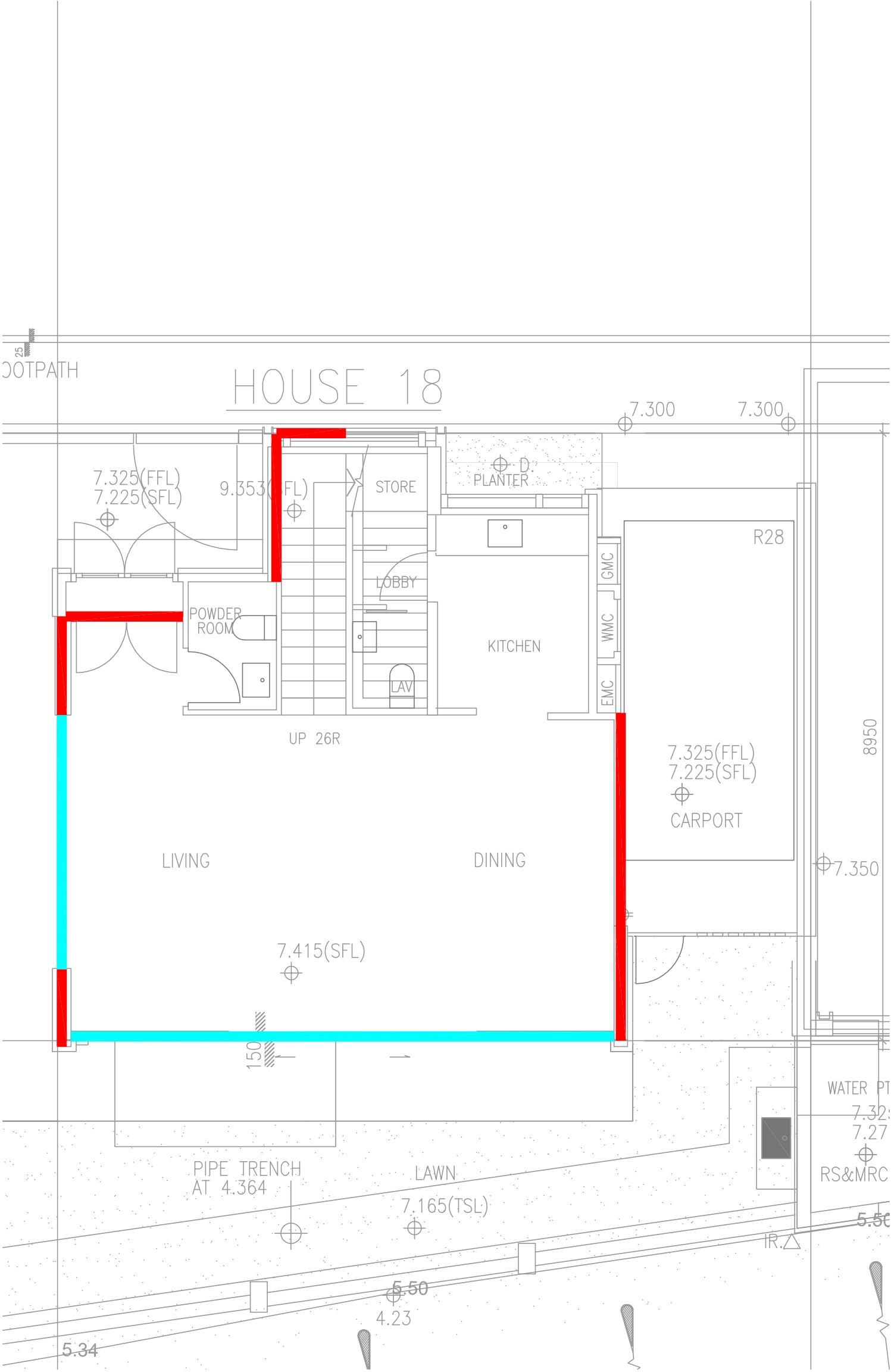
Table 2

RTTV <sub>Wall</sub>																	
Facade Orientation Facing		West				North				East				South			
Wall Orientation Factor		1.131				0.79				1.072				0.975			
Total External Wall Area (Residential Units)		67.0 m <sup>2</sup>		Window to Wall Ratio		49.2 m <sup>2</sup>		Window to Wall Ratio		42.6 m <sup>2</sup>		Window to Wall Ratio		33.2 m <sup>2</sup>		Window to Wall Ratio	
Total Window Area		47.61 m <sup>2</sup> = 0.71				0.00 m <sup>2</sup> = 0.00				6.59 m <sup>2</sup> = 0.03				0.00 m <sup>2</sup> = 0.00			
Heat Conduction	Opaque Wall	4.64 W/m <sup>2</sup>				6.83 W/m <sup>2</sup>				9.65 W/m <sup>2</sup>				10.58 W/m <sup>2</sup>			
	Window	0.78 W/m <sup>2</sup>				0.18 W/m <sup>2</sup>				0.20 W/m <sup>2</sup>				0.00 W/m <sup>2</sup>			
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = %
					ER = %				ER = %				ER = %				ER = %
		<input checked="" type="checkbox"/> Tinted	Area = 47.61 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input type="checkbox"/> Tinted	Area = m <sup>2</sup>	SC =	VLT = %	<input checked="" type="checkbox"/> Tinted	Area = 6.59 m <sup>2</sup>	SC = 0.43	VLT = 53 %	<input type="checkbox"/> Tinted	Area = m <sup>2</sup>	SC =	VLT = %
					ER = 17 %				ER = %				ER = 17 %				ER = %
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = %
					ER = %				ER = %				ER = %				ER = %
	Double Glazing	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
	External Shading	Overhang	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No		Overhang	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Overhang	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No		Overhang	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Sidefin		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No		Sidefin	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Sidefin	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No		Sidefin	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
Solar Radiation through Gazing		11.69 W/m <sup>2</sup>				2.89 W/m <sup>2</sup>				4.06 W/m <sup>2</sup>				0.00 W/m <sup>2</sup>			
Average Absorptivity		0.795				0.795				0.795				0.795			
RTTV <sub>Wall</sub> at each Facade		17.12 W/m <sup>2</sup>				9.90 W/m <sup>2</sup>				13.91 W/m <sup>2</sup>				10.58 W/m <sup>2</sup>			
Overall RTTV <sub>Wall</sub>		13.26 W/m <sup>2</sup>															

Table 3

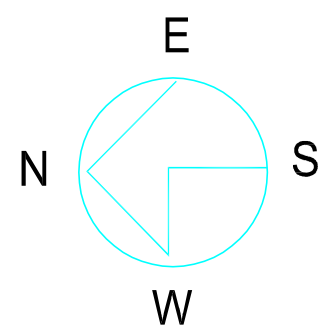
RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		100.57 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.34 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
Solar Radiation through Gazing		0 W/m <sup>2</sup>								
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>ROOF</sub>		3.34 W/m <sup>2</sup>								

ER = External Reflectance; SC = Shading Coefficient &amp; VLT = Visible Light Transmittance



DRAWING TITLE: HOUSE 18 GROUND FLOOR PLAN

SCALE: 1:150@A4

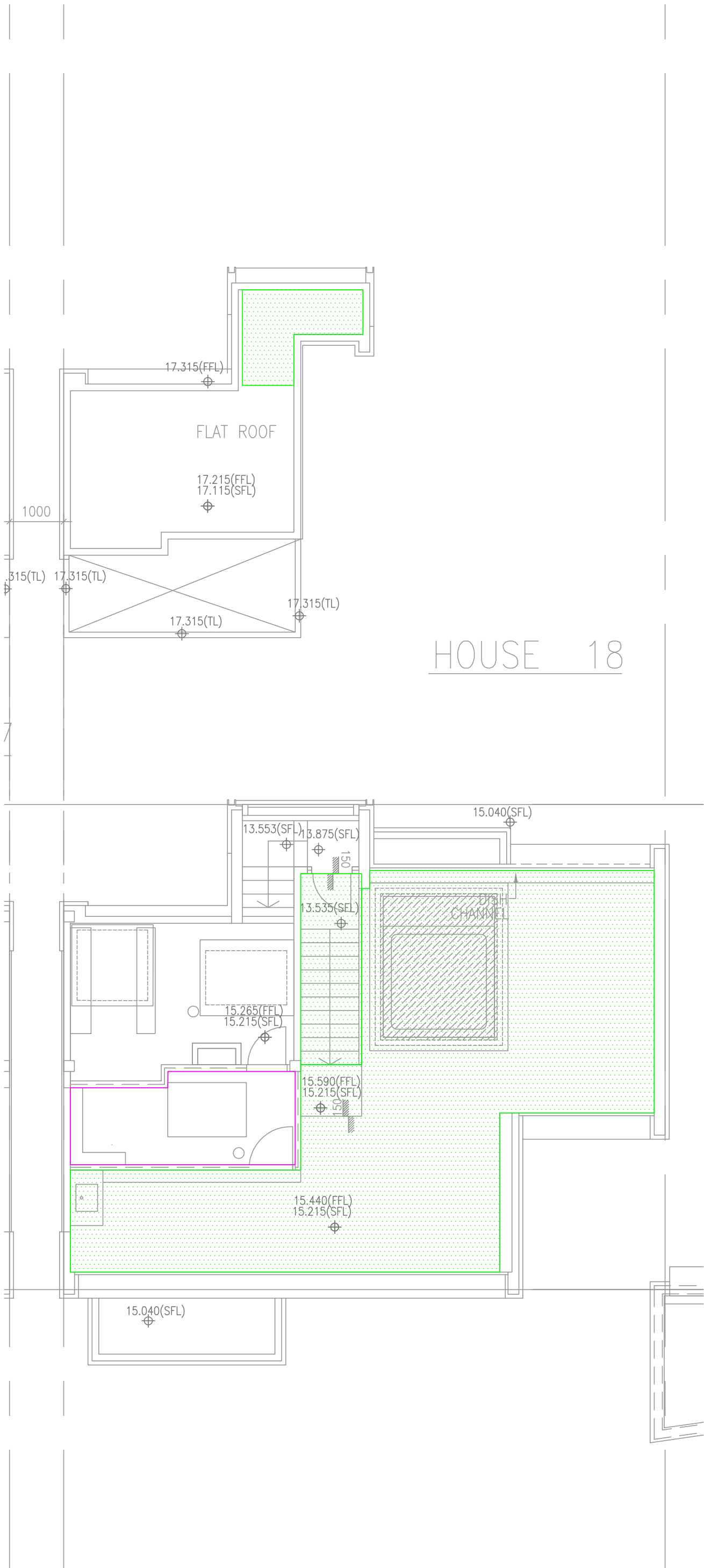


— Wall

— Glass

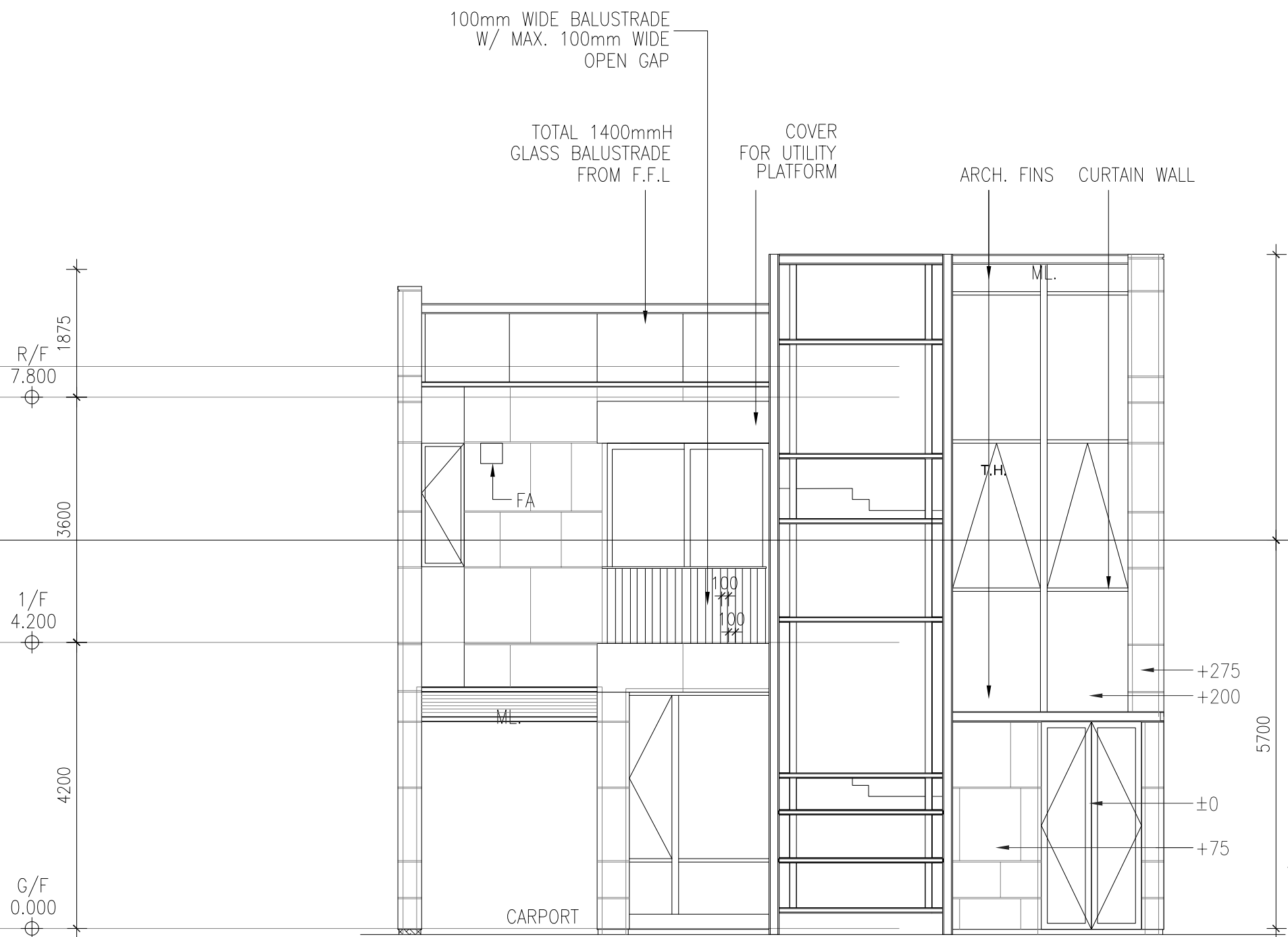
HOUSE 18 1/F

SCALE: 1:150@A4

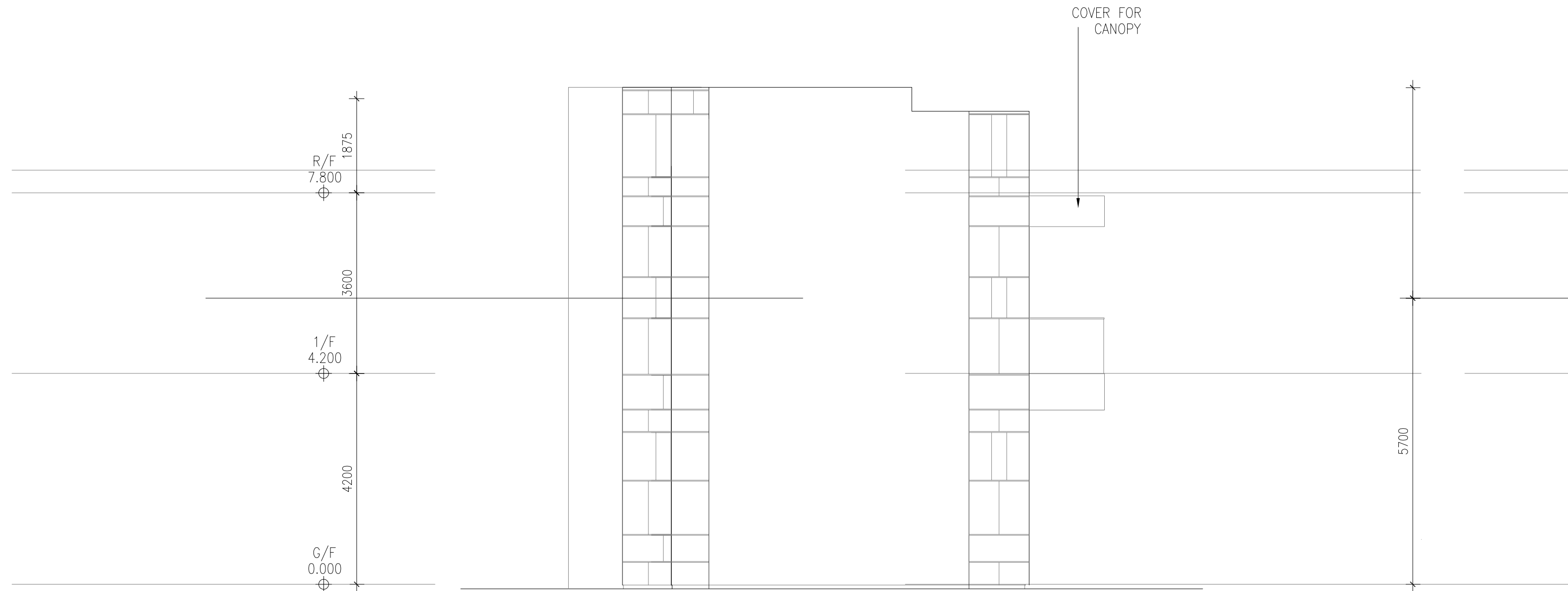


DRAWING TITLE: HOUSE 18 ROOF FLOOR PLAN

SCALE: 1:150@A4

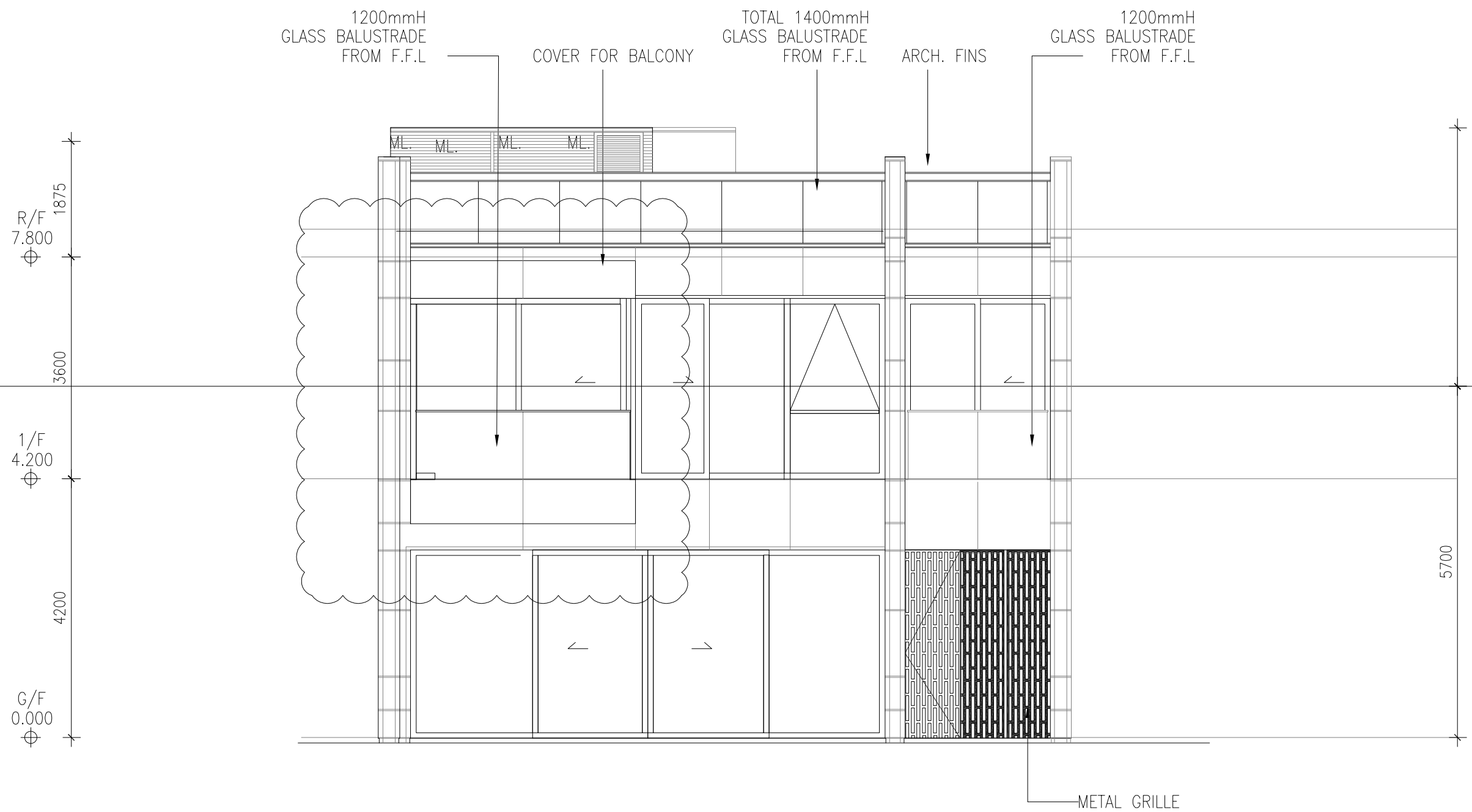


25 EAST ELEVATION 1:75  
— HOUSE 18



26 SOUTH ELEVATION 1:75  
— HOUSE 18

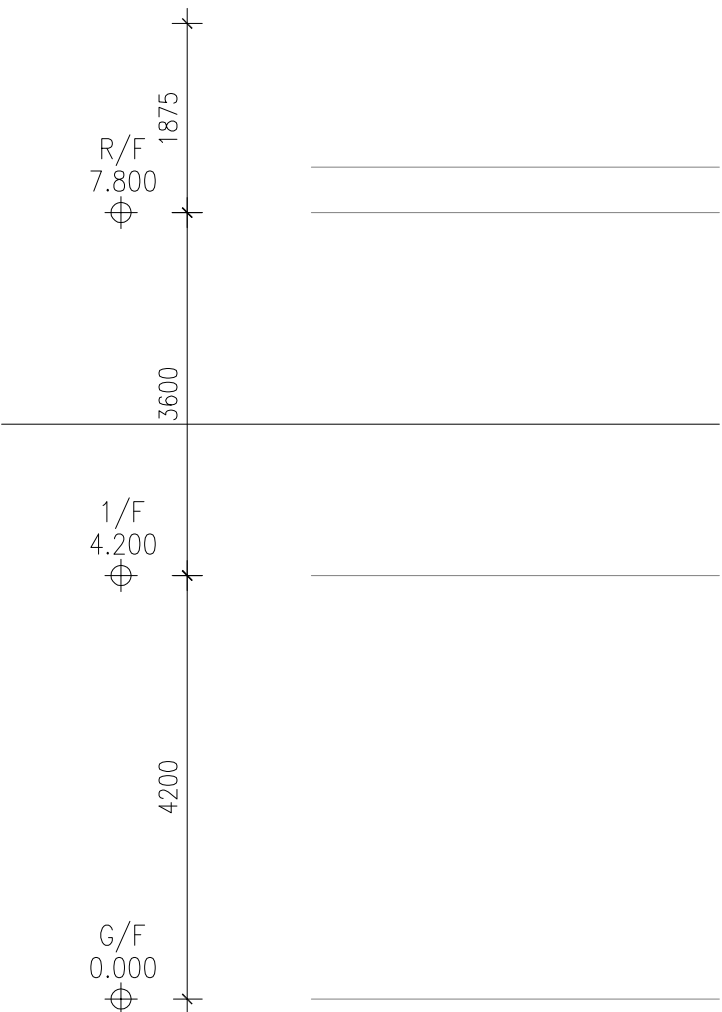
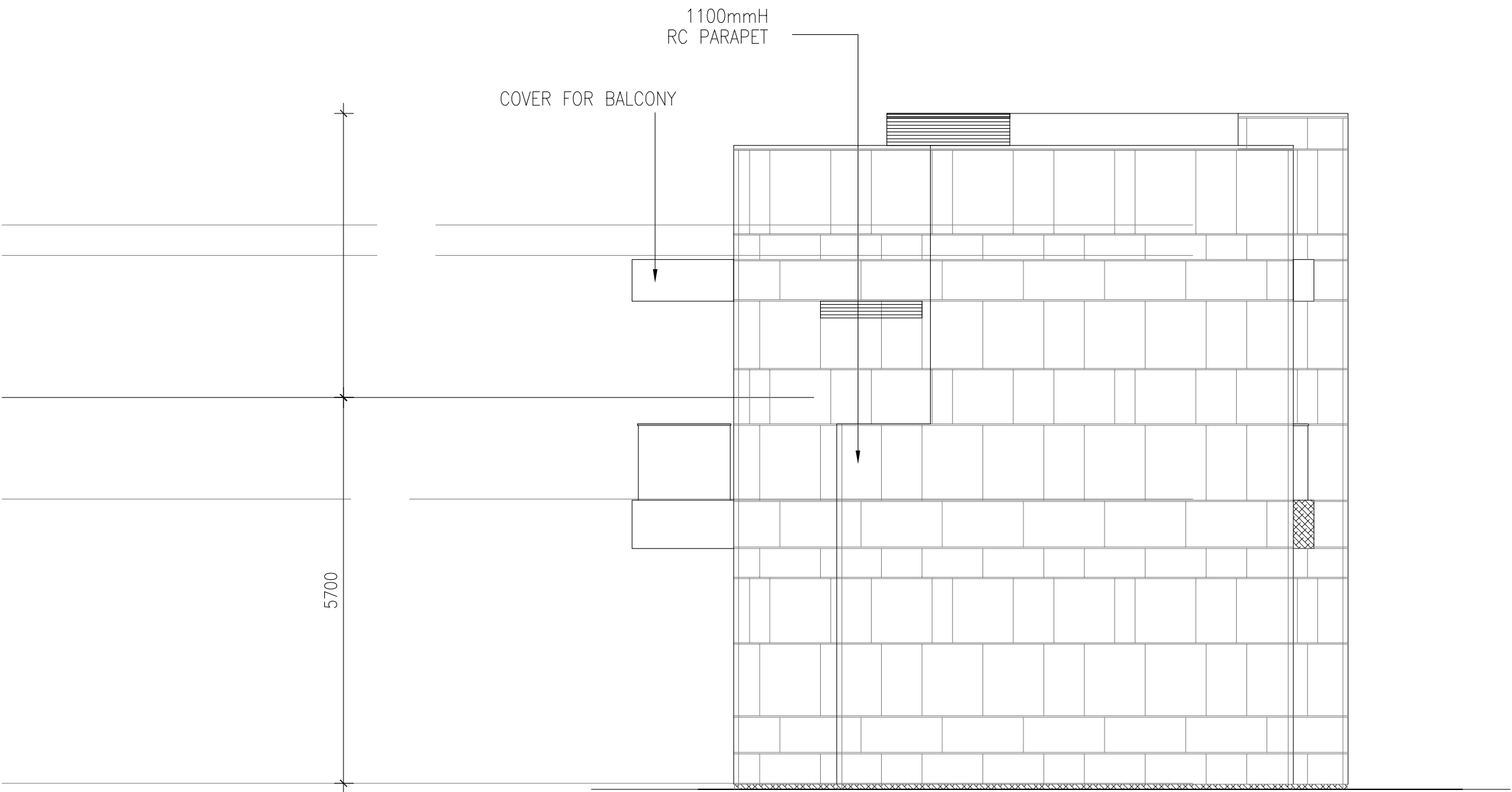
CSK-18E2



24 WEST ELEVATION 1:75  
HOUSE 18

CSK-18E3A





27 NORTH ELEVATION 1:75  
— HOUSE 18

CSK-18E4

## RTTV Calculation (House 19)

# Gross Wall Area (Opaque walls + Glazing Areas) Calculation

Sheet no. 1

## Storey heights (Residential Units) :

G/F	=	4.20 m	( 1 storey)
1/F	=	3.60 m	( 1 storey)
R/F	=	1.90 m	( 1 storey)

## West Elevations (House19) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 31.00	)x 4.20 x 1 =	31.00 x 4.20 x 1 =	130.20 m <sup>2</sup>
1/F	( 18.50	)x 3.60 x 1 =	18.50 x 3.60 x 1 =	66.60 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 196.80 m<sup>2</sup>**

## North Elevations (House 19) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 2.10 + 2.90 + 1.00 + 3.90	)x 4.20 x 1 =	9.90 x 4.20 x 1 =	41.58 m <sup>2</sup>
1/F	( 9.00	)x 3.60 x 1 =	9.00 x 3.60 x 1 =	32.40 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 73.98 m<sup>2</sup>**

## East Elevations (House 19) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 1.85 + 4.50 + 16.50	)x 4.20 x 1 =	22.85 x 4.20 x 1 =	95.97 m <sup>2</sup>
1/F	( 6.50 + 7.80	)x 3.60 x 1 =	14.30 x 3.60 x 1 =	51.48 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 147.45 m<sup>2</sup>**

## South Elevations (House 19) Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys

G/F	( 3.30 + 4.30	)x 4.20 x 1 =	7.60 x 4.20 x 1 =	31.92 m <sup>2</sup>
1/F	( 5.90	)x 3.60 x 1 =	5.90 x 3.60 x 1 =	21.24 m <sup>2</sup>
R/F	(	)x 1.90 x 1 =	0.00 x 1.90 x 1 =	0.00 m <sup>2</sup>

**Gross Wall Areas 53.16 m<sup>2</sup>**

**Total Gross Wall Areas 471.39 m<sup>2</sup>**

# Total Glazing Area (Window + Balcony) Calculation

Sheet no. 2

## Glazing heights (Residential Units) :

G/F (Window GL02) - A	=	3.05 m	( 1 storey)
G/F (Window GL02) - B	=	3.15 m	( 1 storey)
1/F (Window GL02) - C	=	2.66 m	( 1 storey)
1/F (Window GL02) - D	=	2.74 m	( 1 storey)

### West Elevations (House 19) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 4.40 + 7.30	)x 3.05 x 1 =	11.70 x 3.05 x 1 =	35.63 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 11.50 + 4.30	)x 2.66 x 1 =	15.80 x 2.66 x 1 =	41.95 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 77.58 m<sup>2</sup>**

### North Elevations (House 19) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 3.00	)x 3.05 x 1 =	3.00 x 3.05 x 1 =	9.14 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 6.25 + 2.40	)x 2.66 x 1 =	6.25 x 2.66 x 1 =	16.59 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 25.73 m<sup>2</sup>**

### East Elevations (House 19) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 1.40 + 3.10 + 4.50 + 1.40	)x 3.05 x 1 =	10.40 x 3.05 x 1 =	31.67 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 1.60 + 2.00	)x 2.66 x 1 =	1.60 x 2.66 x 1 =	4.25 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 35.92 m<sup>2</sup>**

### South Elevations (House 19) Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys

G/F (Window GL02) - A	( 4.30 + 2.20	)x 3.05 x 1 =	6.50 x 3.05 x 1 =	19.79 m <sup>2</sup>
G/F (Window GL02) - B	(	)x 3.15 x 1 =	0.00 x 3.15 x 1 =	0.00 m <sup>2</sup>
1/F (Window GL02) - C	( 5.90	)x 2.66 x 1 =	5.90 x 2.66 x 1 =	15.66 m <sup>2</sup>
1/F (Window GL02) - D	(	)x 2.74 x 1 =	0.00 x 2.74 x 1 =	0.00 m <sup>2</sup>

**Gross Glazing Areas 35.46 m<sup>2</sup>**

**Total Gross Glazing Areas 174.68 m<sup>2</sup>**

# West Elevations (House 19)

Sheet no. 3

Gross Wall Areas (Opaque Walls + Glazing Areas) (Ao) at West Elevations (House 19) = 196.80 m²

Glazing Areas at West Elevations (House 19) = 77.58 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( W-F1 ) = 49.52 m²

ECS = 1.000

Glazing Areas Shaded by 2 side-fin projection ( W-F2 ) = 28.06 m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 9.20 x 3.05 = 28.06 m²

Left SPF 4.30 / 9.20 = 0.47 ECS = 0.985  
Right SPF 3.70 / 9.20 = 0.40 ECS = 0.988  
ESC (total) = 0.973

Opaque Wall Areas at West Elevations (House 19) = 119.22 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( W-W1 ) = 119.22 m²

Window to Wall Ratio (WWR) = 77.58 / 196.80 = 0.39

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

Average Absorptivity (α) of the External Opaque Wall at West Elevations (House 19)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro =	0.044
Air space resistance	Ra =	0
30mm Stone cladding	0.03 / 2.9 =	0.010
12mm cement/ sand render	0.012 / 0.72 =	0.017
200mm concrete wall	0.2 / 2.16 =	0.093
10mm AGT Tile	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 4 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)

Facade Orientation Facing West Gross Wall Area (Ao) = 196.80  
 Window to Wall Ratio (WWR) 0.39 Wall Orientation Factor (Gw) = 1.131

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	W-W1		
<b>External Finish Material</b>		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
<b>Intermediate component</b>		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
<b>Intermediate component</b>		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Internal Finish Material</b>		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	119.22		
<b>Heat Conduction = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub></b>		<b>7.44</b>		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{7.44} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	49.52	28.06	
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	
<b>Heat Conduction = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub></b>		<b>0.32</b>	<b>0.18</b>	

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{0.50} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	W-F1	W-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	49.52	28.06	
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	
Visible Light Transmittance (VLT)	%	53	53	
External Reflectance (ER)	%	17	17	
External Shading Multiplier (ESC)		1.00	0.97	
<b>Solar Radiation = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub></b>		<b>5.11</b>	<b>2.82</b>	

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{7.93} \quad \text{W/m}^2$$

**Summary of RTTV at West Elevations (House 19)**

$$= 7.44 + 0.50 + 7.93$$

$$= \underline{15.86} \quad \text{W/m}^2$$

# North Elevations (House 19)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at North Elevations (House 19) = 73.98 m²

Glazing Areas at North Elevations (House 19) = 25.73 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( N-F1 ) = 16.58 m²  
ECS = 1.000

Glazing Areas Shaded by side-fin projection on right ( N-F2 ) = 9.15 m²  
G/F Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
3.00 x 3.05 = 9.15 m²  
SPF 9.20 / 3.70 = 2.49 ECS = 0.977

Opaque Wall Areas at North Elevations (House 19) = 48.25 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( N-W1 ) = 48.25 m²

Window to Wall Ratio (WWR) = 25.73 / 73.98 = 0.35

Sheet no. 5

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

Average Absorptivity (α) of the External Opaque Wall at North Elevations (House 19)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	6	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)		
Facade Orientation Facing	North	Gross Wall Area (Ao) =	73.98
Window to Wall Ratio (WWR)	0.35	Wall Orientation Factor (Gw) =	0.79

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	N-W1		
External Finish Material		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	48.25		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		5.59		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 5.59 W/m²

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	N-F1	N-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	16.58	9.15	
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.20	0.11	

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.31 W/m²

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	N-F1	N-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	16.58	9.15	
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	
Visible Light Transmittance (VLT)	%	53	53	
External Reflectance (ER)	%	17	17	
External Shading Multiplier (ESC)		1.00	0.98	
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		3.18	1.71	

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 4.89 W/m²

Summary of RTTV at North Elevations (House 19)  
= 5.59 + 0.31 + 4.89  
= 10.79 W/m²



# East Elevations (House 19)

Sheet no. 7

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at East Elevations (House 19) = 147.45 m²

Glazing Areas at East Elevations (House 19) = 35.92 m²

Breakdown of Glazing Areas  
Glazing Areas Unshaded ( E-F1 ) = 26.46 m²

ECS = 1.000

Glazing Areas Shaded by 2 side-fin projection ( W-F2 ) = 9.46 m²

Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 3.10 x 3.05 = 9.46 m²

Left SPF 3.40 / 3.10 = 1.10 ECS = 0.970  
Right SPF 1.00 / 3.10 = 0.32 ECS = 0.938  
ESC (total) = 0.908

Opaque Wall Areas at East Elevations (House 19) = 111.53 m²

Breakdown of Opaque Wall Areas  
RC Wall Areas ( E-W1 ) = 111.53 m²

Window to Wall Ratio (WWR) = 35.92 / 147.45 = 0.24

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

Average Absorptivity (α) of the External Opaque Wall at East Elevations (House 19)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

'U' value of Opaque Wall Areas

U = 1/(Ri+x₁/k₁+x₂/k₂+...+xₙ/kₙ+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-W1	Description:	RC Wall Areas
Wall Material		
External surface film resistance	Ro	= 0.044
Air space resistance	Ra	= 0
30mm Stone cladding	0.03 / 2.9	= 0.010
12mm cement/ sand render	0.012 / 0.72	= 0.017
200mm concrete wall	0.2 / 2.16	= 0.093
10mm AGT Tile	0.01 / 1.1	= 0.009
Internal surface film resistance	Ri	= 0.12
Total		0.293

Uw1 = 1 / 0.293 = 3.42 W/m²K

**Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 8 BD Ref No. BD 2/9179/15  
 Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)

Facade Orientation Facing East Gross Wall Area (Ao) = 147.45  
 Window to Wall Ratio (WWR) 0.24 Wall Orientation Factor (Gw) = 1.072

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	E-W1		
<b>External Finish Material</b>		30mm Stone cladding		
Conductivity	W/mK	2.90		
Thickness	m	0.030		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
<b>Intermediate component</b>		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.01		
<b>Intermediate component</b>		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Intermediate component</b>				
Conductivity				
Thickness				
<b>Internal Finish Material</b>		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	3.42		
Opaque Wall Area (A <sub>wi</sub> )	m²	111.53		
<b>Heat Conduction = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub></b>		<b>8.80</b>		

$$\text{Heat Conduction through Opaque Walls} = 3.57(A_{wi}/A_o) U_{wi} \alpha_{wi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{8.80}} \quad \text{W/m}^2$$

Part 2 - Calculation of Heat Conduction through Glazing				
Components / Details		Code No.		
Description	Units	E-F1		
Glazing Type		Tinted		
Thickness	m	0.01		
Glazing Area (A <sub>fi</sub> )	m²	35.92		
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74		
<b>Heat Conduction = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub></b>		<b>0.29</b>		

$$\text{Heat Conduction through Glazing} = 0.64 (A_{fi}/A_o) U_{fi} G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{0.29}} \quad \text{W/m}^2$$

Part 3 - Calculation of Solar Radiation through Glazing				
Components / Details		Code No.		
Description	Units	E-F1	W-F2	
Glazing Type		Tinted	Tinted	
Thickness	m	0.01	0.01	
Glazing Area (A <sub>fi</sub> )	m²	26.46	9.46	
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	
Visible Light Transmittance (VLT)	%	53	53	
External Reflectance (ER)	%	17	17	
External Shading Multiplier (ESC)		1.00	0.91	
<b>Solar Radiation = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub></b>		<b>3.45</b>	<b>1.12</b>	

$$\text{Solar Radiation through Glazing} = 41.75 (A_{fi}/A_o)(SC_{fi})(ESC_{wi})G_w \quad \text{where } i=1, 2, \dots, n$$

$$= \underline{\underline{4.57}} \quad \text{W/m}^2$$

**Summary of RTTV at East Elevations (House 19)**

$$= 8.80 + 0.29 + 4.57$$

$$= \underline{\underline{13.67}} \quad \text{W/m}^2$$

# South Elevations (House 19)

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at South Elevations (House 19) = 53.16 m²

Glazing Areas at South Elevations (House 19) = 35.46 m²

## Breakdown of Glazing Areas

Glazing Areas Unshaded ( S-F1 ) = 2.38 m²  
ECS = 1.000

Glazing Areas Shaded by overhang and projection on left ( S-F2 ) = 13.12 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 4.30 x 3.05 = 13.12 m²  
SPF 9.30 / 4.40 = 2.11 ECS = 0.816  
OPF 1.50 / 4.20 = 0.36 ECS = 0.711  
ECS (total) = 0.580

Glazing Areas Shaded by overhang and projection on left ( S-F3 ) = 15.69 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
1/F 5.90 x 2.66 = 15.69 m²  
SPF 5.90 / 5.90 = 1.00 ECS = 0.837  
OPF 1.60 / 3.60 = 0.44 ECS = 0.671  
ECS (total) = 0.562

Glazing Areas Shaded by Cover of Balcony ( S-F4 ) = 4.27 m²  
Glazing Area = Length of Glazing x Glazing Height x No. of Storeys  
G/F 1.40 x 3.05 = 4.27 m²  
OPF 1.10 / 3.05 = 0.36 ECS = 0.711

Opaque Wall Areas at South Elevations (House 19) = 17.70 m²

## Breakdown of Opaque Wall Areas

RC Wall Areas ( S-W1 ) = 17.70 m²

Window to Wall Ratio (WWR) = 35.46 / 53.16 = 0.67

Sheet no. 9

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

Average Absorptivity (α) of the External Opaque Wall at South Elevations (House 19)

External Wall Material (Colour/Finish)	% of wall area	α Absorptivity (Refer to Table 5)
Stone cladding	90.0%	0.9
Wall Tiles	10.0%	0.8

Average Absorptivity = 0.89

## 'U' value of Opaque Wall Areas

$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$  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)

0 Description:	0
Wall Material	
External surface film resistance	Ro = 0.044
Air space resistance	Ra = 0
30mm Stone cladding	0.03 / 2.9 = 0.010
12mm cement/ sand render	0.012 / 0.72 = 0.017
200mm concrete wall	0.2 / 2.16 = 0.093
10mm AGT Tile	0.01 / 1.1 = 0.009
Internal surface film resistance	Ri = 0.12
Internal surface film resistance	Ri = 0.12
Total	0.369

$U_{w1} = \frac{1}{0.369} = 2.71 \text{ W/m}^2\text{K}$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.	10	BD Ref No.	BD 2/9179/15
Building Address	Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)		
Facade Orientation Facing	South	Gross Wall Area (Ao) =	53.16
Window to Wall Ratio (WWR)	0.67	Wall Orientation Factor (Gw) =	0.975

Part 1 - Calculation of Heat Conduction through Opaque Walls				
Components / Details		Code No.		
Description	Units	Wall Material		
External Finish Material		12mm cement/ sand render		
Conductivity	W/mK	0.72		
Thickness	m	0.012		
Average Absorptivity (α <sub>wi</sub> )	(α)	0.89		
Intermediate component		200mm concrete wall		
Conductivity	W/mK	2.16		
Thickness	m	0.20		
Intermediate component		10mm AGT Tile		
Conductivity	W/mK	1.10		
Thickness	m	0.01		
Intermediate component				
Conductivity				
Thickness				
Intermediate component				
Conductivity				
Thickness				
Internal Finish Material		Internal surface film resistance		
Conductivity	W/mK	R <sub>i</sub>		
Thickness	m	0.00		
U-value of Opaque Area (U <sub>wi</sub> )	W/m²K	2.71		
Opaque Wall Area (A <sub>wi</sub> )	m²	17.70		
Heat Conduction = 3.57(A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> α <sub>wi</sub> G <sub>w</sub>		2.80		

Heat Conduction through Opaque Walls = 3.57(A<sub>wi</sub>/A<sub>o</sub>) U<sub>wi</sub> α<sub>wi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 2.80 W/m²

Part 2 - Calculation of Heat Conduction through Glazing					
Components / Details		Code No.			
Description	Units	S-F1	S-F2	S-F3	S-F4
Glazing Type		Tinted	Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	2.38	13.12	15.69	4.27
U-value of Glazing (U <sub>fi</sub> )	W/m²K	1.74	1.74	1.74	1.74
Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub>		0.05	0.27	0.32	0.09

Heat Conduction through Glazing = 0.64 (A<sub>fi</sub>/A<sub>o</sub>) U<sub>fi</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.72 W/m²

Part 3 - Calculation of Solar Radiation through Glazing					
Components / Details		Code No.			
Description	Units	S-F1	S-F2	S-F3	S-F4
Glazing Type		Tinted	Tinted	Tinted	Tinted
Thickness	m	0.01	0.01	0.01	0.01
Glazing Area (A <sub>fi</sub> )	m²	2.38	13.12	15.69	4.27
Shading Coefficient of Glazing (SC <sub>f</sub> )		0.43	0.43	0.43	0.43
Visible Light Transmittance (VLT)	%	53	53	53	53
External Reflectance (ER)	%	17	17	17	17
External Shading Multiplier (ESC)		1.00	0.58	0.56	0.71
Solar Radiation = 41.75 (A <sub>fi</sub> /A <sub>o</sub> )(SC <sub>fi</sub> )(ESC <sub>wi</sub> )G <sub>w</sub>		0.78	2.51	2.90	1.00

Solar Radiation through Glazing = 41.75 (A<sub>fi</sub>/A<sub>o</sub>)(SC<sub>fi</sub>)(ESC<sub>wi</sub>)G<sub>w</sub> where i= 1, 2, ..., n  
= 6.19 W/m²

Summary of RTTV at South Elevations (House 19)  
= 2.80 + 0.72 + 6.19  
= 9.71 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No.11

BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)

Overall Gross Wall Area [a]471.39 m²

Facade Orientation Facing	Gross Wall Area	Heat Conduction through Opaque Walls	Heat Conduction through Glazing	Solar Radiation through Glazing	RTTV <sub>wall</sub> at Each Facade	Area-weighted RTTV <sub>wall</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
West	196.80	7.44	0.50	7.93	15.86	6.62
North	73.98	5.59	0.31	4.89	10.79	1.69
East	147.45	8.80	0.29	4.57	13.67	4.28
South	53.16	2.80	0.72	6.19	9.71	1.10

Overall RTTV<sub>wall</sub> =13.69W/m²

<14W/m²OK

Roof

Gross Roof Areas (Opaque Walls + Skylight Areas) (Aro) at Roof = 250.02 m²

Skylight Areas at Roof = 0.00 m²

Breakdown of Skylight Areas

Skylight Areas Unshaded ( S1 ) = 0.00 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)
Unglazed Porcelain Tiles (Grey)	100%	0.9

Average Absorptivity = 0.9

'U' value of Opaque Roof Areas

$$U = 1 / (R_i + x_1/k_1 + x_2/k_2 + \dots + x_n/k_n + R_a + R_o)$$

- 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)

OpaqueAreas at Roof = 250.02 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 243.88 m²  
1/F = 49.30 m²  
Roof = 132.66 m²  
Upper Roof = 61.92 m²

Breakdown of Opaque Roof Areas

RC Roof Areas ( R2 ) = 6.14 m²  
1/F = m²  
Roof = 6.14 m²  
Upper Roof = m²

R1	Description:	Roof Area
Roof Material		
External surface film resistance	Ro =	0.055
Air space resistance	Ra =	0
25mm Tiles	0.025 / 1.1 =	0.023
50mm cement/ sand screed	0.05 / 0.72 =	0.069
50mm expanded polystyrene	0.05 / 0.034 =	1.471
150mm concrete slab	0.15 / 2.16 =	0.069
10mm gypsum plaster	0.01 / 0.38 =	0.026
Internal surface film resistance	Ri =	0.162
Total		1.876

$$U_{w1} = \frac{1}{1.876} = 0.53 \text{ W/m}^2\text{K}$$

R2	Description:	Roof Area
Roof Material		
External surface film resistance	Ro =	0.055
Air space resistance	Ra =	0
50mm cement/ sand screed	0.05 / 0.72 =	0.069
50mm expanded polystyrene	0.05 / 0.034 =	1.471
150mm concrete slab	0.15 / 2.16 =	0.069
10mm AGT Tile (Brown)	0.01 / 1.1 =	0.009
Internal surface film resistance	Ri =	0.162
Total		1.836

$$U_{w1} = \frac{1}{1.836} = 0.54 \text{ W/m}^2\text{K}$$

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>

Sheet No. 13 BD Ref No. BD 2/9179/15  
Building Address Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)

Roof Orientation Facing Flat Gross Roof Area (Aro) = 250.02  
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	R2	
External Finish Material		25mm concrete tile	10mm AGT Tile (Brown)	
Conductivity	W/mK	1.10	1.10	
Thickness	m	0.025	0.010	
Average Absorptivity (awi)	(a)	0.9	0.8	
Intermediate component		50mm cement/ sand screed	50mm cement/ sand screed	
Conductivity	W/mK	0.72	0.72	
Thickness	m	0.050	0.050	
Intermediate component		50mm expanded polystyrene	50mm expanded polystyrene	
Conductivity	W/mK	0.034	0.034	
Thickness	m	0.05	0.05	
Intermediate component		150mm concrete slab	150mm concrete slab	
Conductivity	W/mK	2.16	2.16	
Thickness	m	0.15	0.15	
Intermediate component				
Conductivity	W/mK			
Thickness	m			
Internal Finish Material				
Conductivity	W/mK	0.38	0.38	
Thickness	m	0.01	0.01	
U-value of the Roof (Uri)	W/m²K	0.55	0.53	
Opaque Roof Area (Ari)	m²	243.88	6.02	
Heat Conduction = 3.47(Ari/Aro) Uri ari Gs		3.62	0.08	

Heat Conduction through Opaque Roof = 3.47(Ari/Aro) Uri ari Gs where i= 1, 2, ..., n  
= 3.70 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  
= 3.70 + 0.00 + 0.00  
= 3.70 W/m²

Project: Demarcation District No. 105 Ngau Tam Mei, Yuen Long, N.T.  
Form RTTV (Roof) 2 - Summary of RTTV<sub>roof</sub> of Building Envelopes

Sheet No.14BD Ref No. BD 2/9179/15

Building AddressLot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)

Overall Roof Area [a]250.02 m²

Roof	Gross Roof Area	Heat Conduction through Opaque Roof	Heat Conduction through Skylight	Solar Radiation through Skylight	RTTV <sub>roof</sub> at Each Type of Roof	Area-weighted RTTV <sub>roof</sub>
	(m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)	(W/m²)
	[b]	[c]	[d]	[e]	[f]=[c]+[d]+[e]	[g]=[f]x[b]/[a]
Flat Roof	250.02	3.70	0.00	0.00	3.70	3.70

Overall RTTV<sub>roof</sub> =3.70W/m²

<4W/m²OK



## RTTV Summary Sheet

Address: Lot 2115, D.D. 105, Ngau Tam Mei, Yuen Long (House 19)		BD Ref. No. BD 2/9179/15
Building Type:	Residential	
RTTV Calculated by:	<input checked="" type="checkbox"/> 1. Registered Professional Thomas Anderson & Partners Consulting Engineers Ltd. <input type="checkbox"/> 2. Architect <input type="checkbox"/> 3. Others, please specify:-	
No. of Storeys (Residential Units)	2	

Table 1

Deemed to Satisfy RTTV <sub>wall</sub>								
Facade Orientation Facing	West	North	East	South				
Average Absorptivity	0.795	0.8	0.8	0.8				
Average Window to Wall Ratio	0.36	0.36	0.03	0.52				
Shading Coefficient of Glazing	0.43	0.43	0.43	0.43				
Average Shading Coefficient of Facade	0.40	0.40	0.40	0.40				
Visible Light Transmittance	57 %	57 %	57 %	57 %	%	%	%	%
External Reflectance	7 %	7 %	7 %	7 %	%	%	%	%

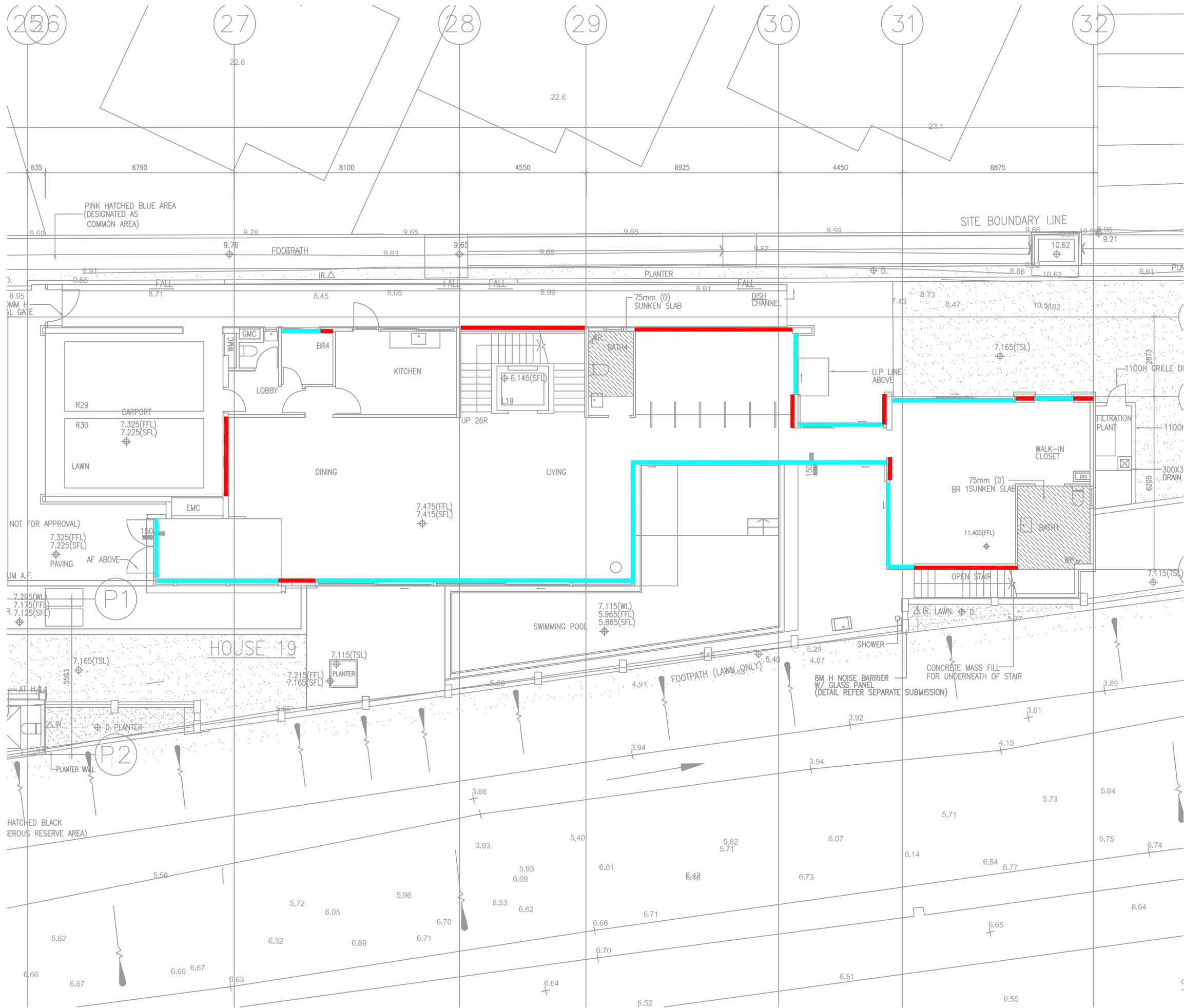
Table 2

RTTV <sub>Wall</sub>																		
Facade Orientation Facing		West				North				East				South				
Wall Orientation Factor		1.131				0.79				1.072				0.975				
Total External Wall Area (Residential Units)		199.8 m <sup>2</sup>		Window to Wall Ratio		75.4 m <sup>2</sup>		Window to Wall Ratio		126.1 m <sup>2</sup>		Window to Wall Ratio		62.5 m <sup>2</sup>		Window to Wall Ratio		
		72.17 m <sup>2</sup> = 0.36				27.22 m <sup>2</sup> = 0.36				4.31 m <sup>2</sup> = 0.03				32.67 m <sup>2</sup> = 0.52				
Heat Conduction	Opaque Wall	7.44 W/m <sup>2</sup>				5.59 W/m <sup>2</sup>				8.80 W/m <sup>2</sup>				2.80 W/m <sup>2</sup>				
	Window	0.50 W/m <sup>2</sup>				0.31 W/m <sup>2</sup>				0.29 W/m <sup>2</sup>				0.72 W/m <sup>2</sup>				
Window	Glass Type	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Reflective	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
		<input checked="" type="checkbox"/> Tinted	Area = 72.17 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 27.22 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 4.31 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	<input checked="" type="checkbox"/> Tinted	Area = 32.67 m <sup>2</sup>	SC = 0.43	VLT = 53 % ER = 17 %	
		<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	<input type="checkbox"/> Clear	Area = m <sup>2</sup>	SC =	VLT = % ER = %	
		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
	Solar Radiation through Gazing		7.93 W/m <sup>2</sup>				4.89 W/m <sup>2</sup>				4.57 W/m <sup>2</sup>				6.19 W/m <sup>2</sup>			
Average Absorptivity		0.795				0.8				0.8				0.8				
RTTV <sub>Wall</sub> at each Facade		15.86 W/m <sup>2</sup>				10.79 W/m <sup>2</sup>				13.67 W/m <sup>2</sup>				9.71 W/m <sup>2</sup>				
Overall RTTV <sub>Wall</sub>		13.69 W/m <sup>2</sup>																

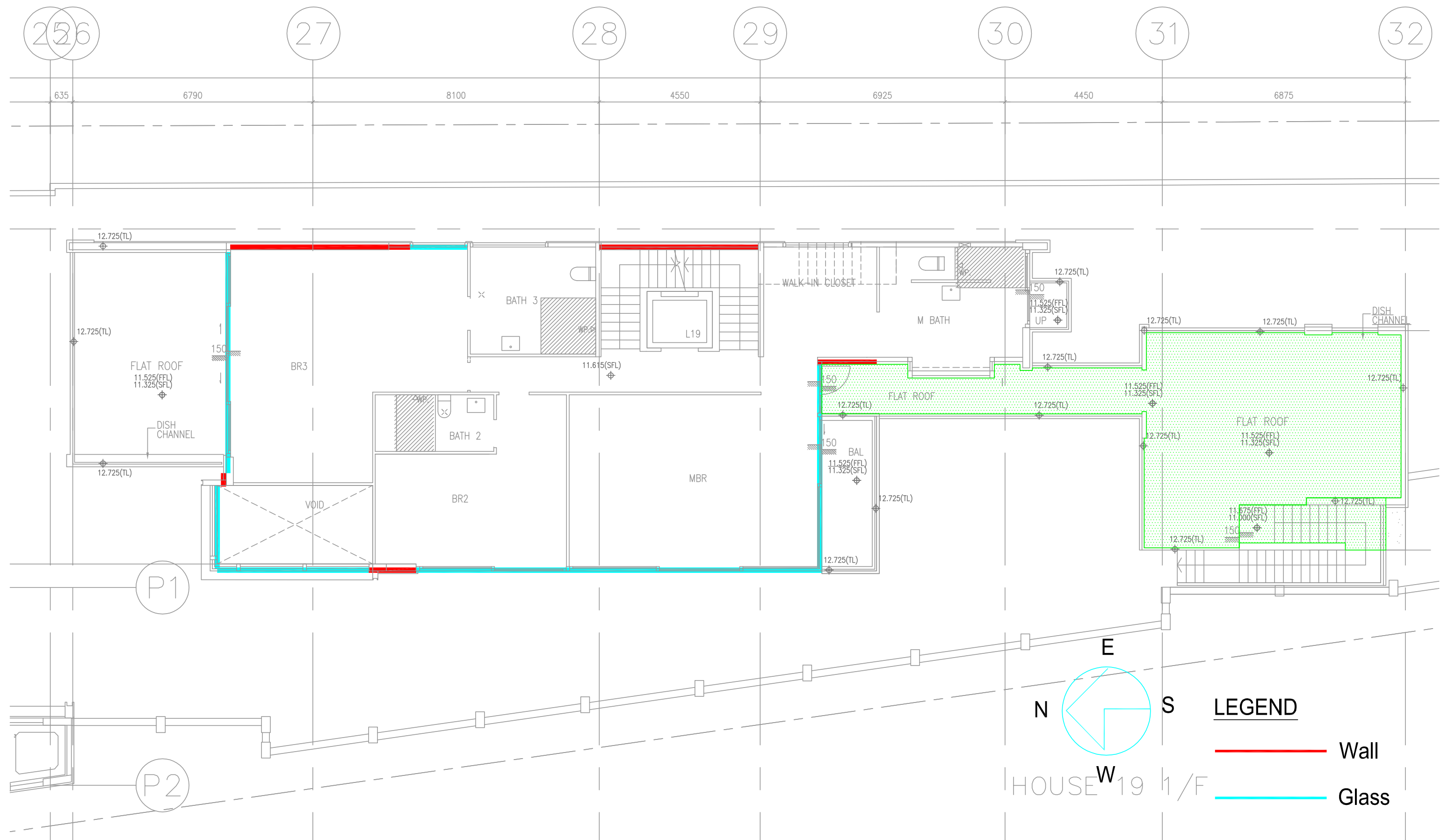
Table 3

RTTV <sub>Roof</sub>										
Roof Orientation Factor		2.16								
Total Roof Area (Residential Units)		250.02 m <sup>2</sup>								
Total Skylight Area		0 m <sup>2</sup>								
Heat Conduction	Roof	3.70 W/m <sup>2</sup>								
	Skylight	0 W/m <sup>2</sup>								
Skylight	Glass Type	<input type="checkbox"/> Reflective	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Tinted	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
		<input type="checkbox"/> Clear	Area =	m <sup>2</sup>	SC =		VLT =	%	ER =	%
	Double Glazing	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	External Shading	<input type="checkbox"/> Yes <input type="checkbox"/> No								
	Solar Radiation through Gazing		0 W/m <sup>2</sup>							
Average Absorptivity (Roof)		0.8								
Overall RTTV <sub>ROOF</sub>		3.70 W/m <sup>2</sup>								

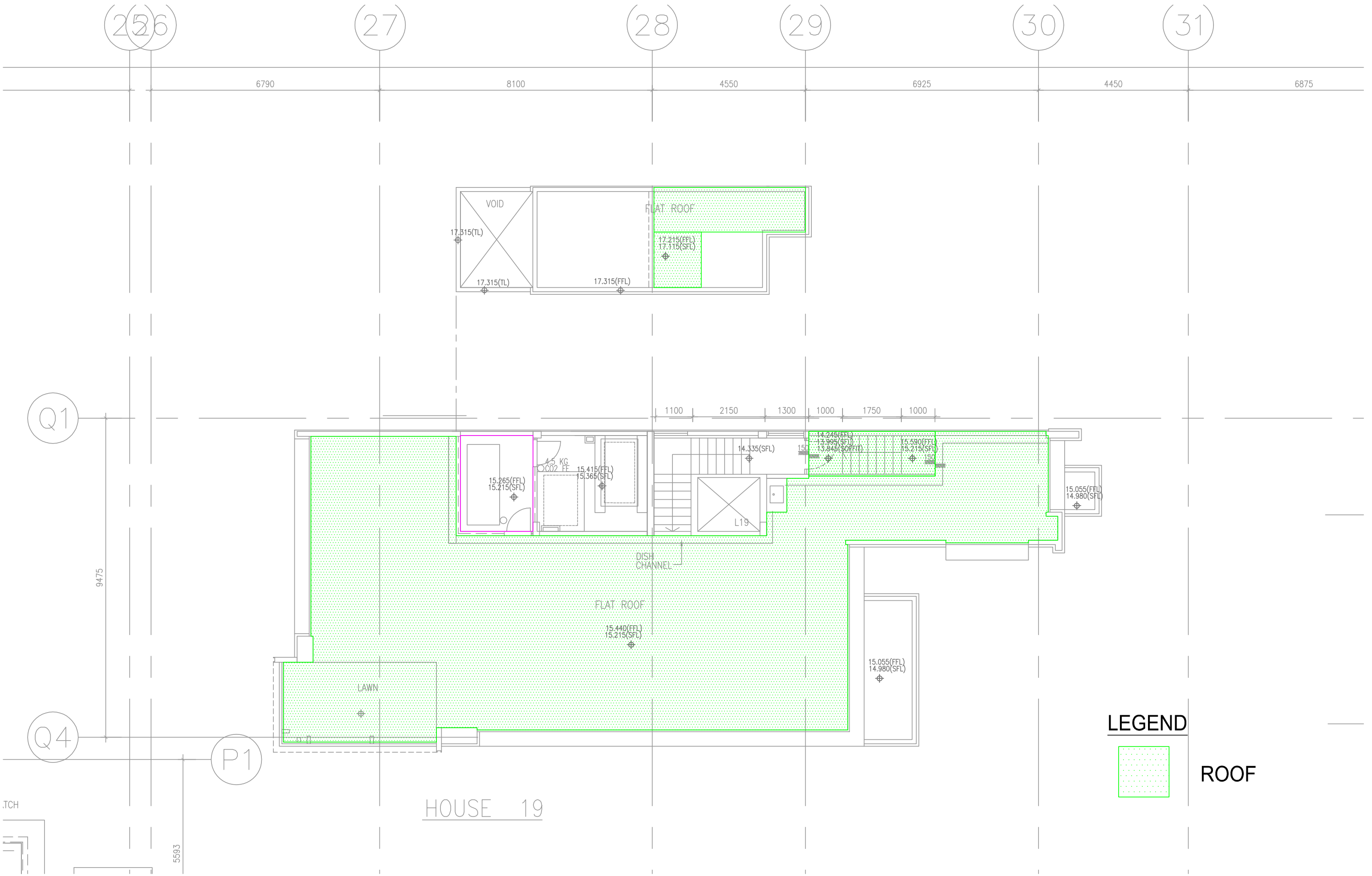
ER = External Reflectance; SC = Shading Coefficient & VLT = Visible Light Transmittance



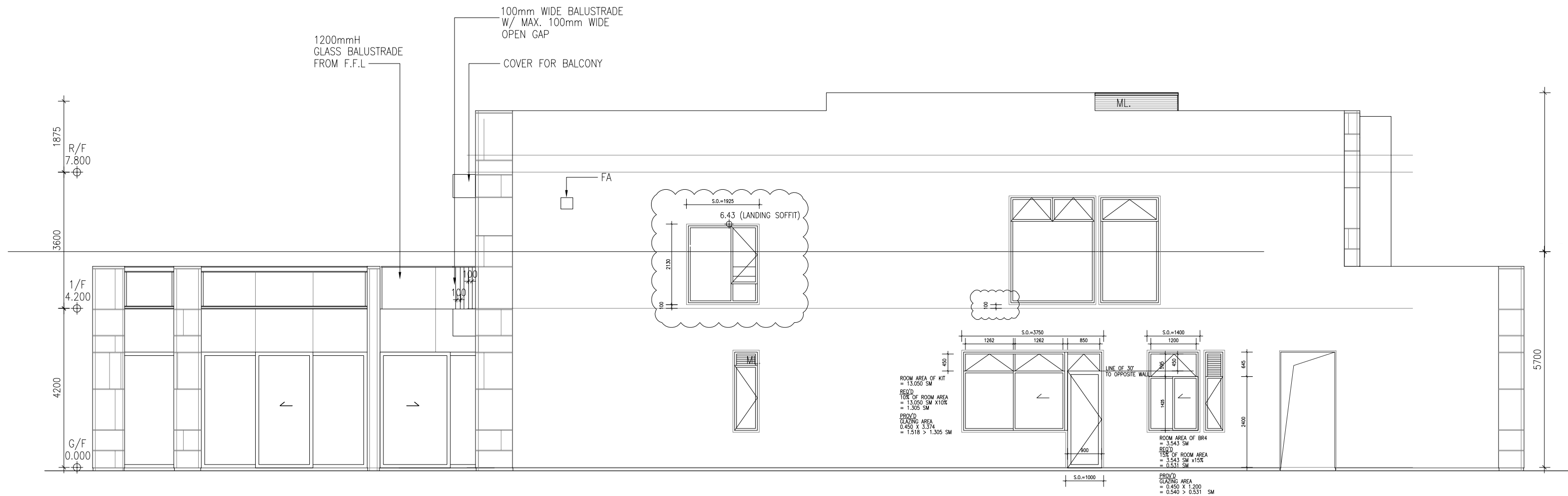
**DRAWING TITLE: HOUSE 19 GROUND FLOOR PLAN**  
SCALE: 1:150@A4



**DRAWING TITLE: HOUSE 19 FIRST FLOOR PLAN**  
SCALE: 1:100@A3

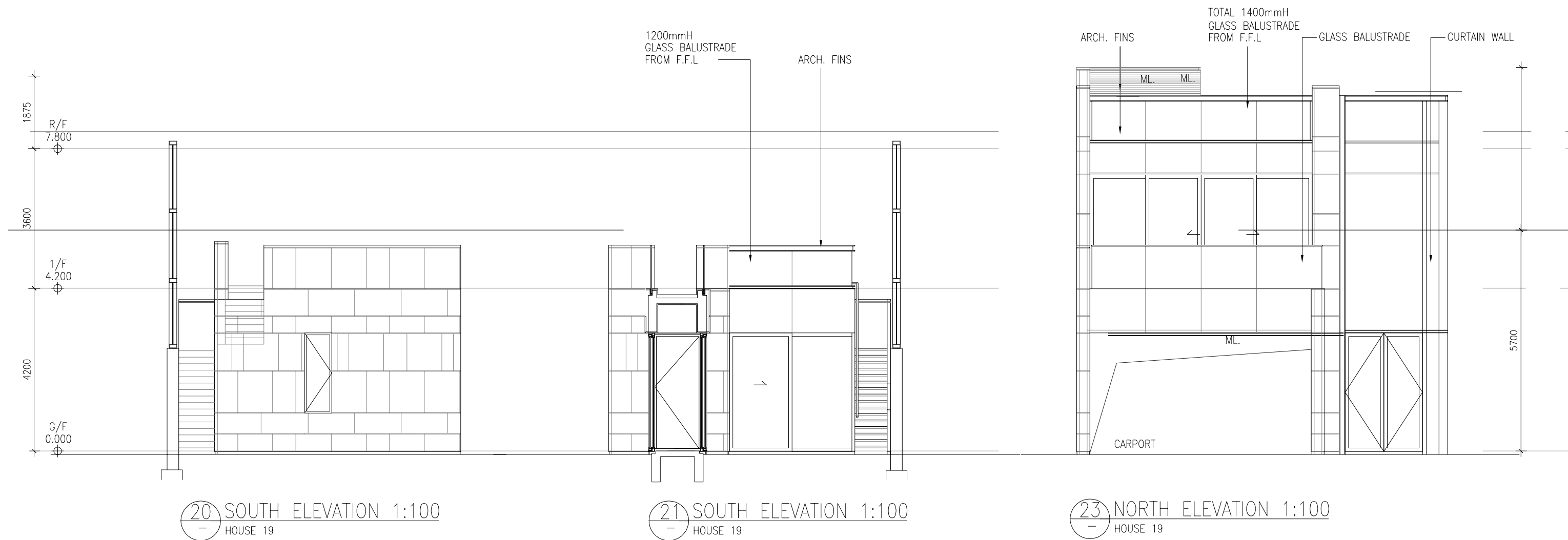


**DRAWING TITLE: HOUSE 19 ROOF FLOOR PLAN**  
SCALE: 1:100@A3

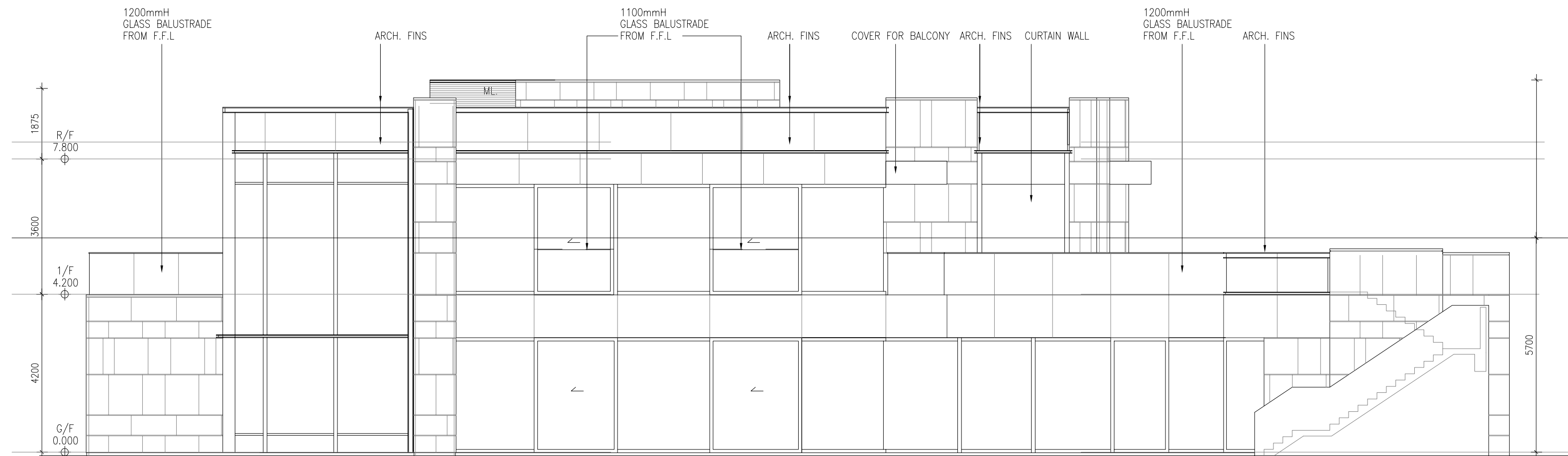


22 EAST ELEVATION 1:100  
HOUSE 19

CSK-19E1B



# CSK-19E2



19 WEST ELEVATION 1:100  
— HOUSE 19

CSK-19E3