



# RTTV Summary Sheet

## Notes:

ER = External Reflectance

SC = Shading Coefficient

VLT = Visible Light Transmittance

Window and skylight data should represent the major proportion of its use in the development.

PNAP  
APP-156  
Appendix A

|                                                                                                  |                                                                                                                                                                          |             |
|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Address: Proposed Residential and Commercial Development at 5, 7-17 Western Street, Sai Ying Pun |                                                                                                                                                                          | ID Ref. No. |
| Building Type:                                                                                   | Residential                                                                                                                                                              |             |
| RTTV calculated by                                                                               | <input checked="" type="checkbox"/> 1. Registered Professional Engineers<br><input type="checkbox"/> 2. Architect<br><input type="checkbox"/> 3. Others, please specify: |             |
| No. of Storeys (Residential Units)                                                               | 24                                                                                                                                                                       |             |

Table 1

| Deemed to Satisfy RTTV <sub>Wall</sub> |   |   |   |   |   |   |   |   |
|----------------------------------------|---|---|---|---|---|---|---|---|
| Facade Orientation Facing              |   |   |   |   |   |   |   |   |
| Average Absorptivity                   |   |   |   |   |   |   |   |   |
| Average Window to Wall Ratio           |   |   |   |   |   |   |   |   |
| Shading Coefficient of Glazing         |   |   |   |   |   |   |   |   |
| Average Shading Coefficient of Facade  |   |   |   |   |   |   |   |   |
| Visible Light Transmittance            | % | % | % | % | % | % | % | % |
| External Reflectance                   | % | % | % | % | % | % | % | % |

Table 2

| RTTV <sub>Wall</sub>                         |                  |                                                                     |                                                                     |                            |                       |                                                          |                                                                   |                |                          |                                                                     |                                                                              |                        |                       |                                                                     |                                                                              |          |                        |                |                             |  |  |
|----------------------------------------------|------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------|-----------------------|----------------------------------------------------------|-------------------------------------------------------------------|----------------|--------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------|-----------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------|----------|------------------------|----------------|-----------------------------|--|--|
| Facade Orientation Facing                    |                  | N                                                                   |                                                                     |                            |                       |                                                          | S                                                                 |                |                          |                                                                     |                                                                              | W                      |                       |                                                                     |                                                                              |          | E                      |                |                             |  |  |
| Wall Orientation Factor                      |                  | 0.79                                                                |                                                                     |                            |                       |                                                          | 0.975                                                             |                |                          |                                                                     |                                                                              | 1.131                  |                       |                                                                     |                                                                              |          | 1.072                  |                |                             |  |  |
| Total External Wall Area (Residential Units) |                  | 625.46                                                              | m <sup>2</sup>                                                      | Window to Wall Ratio = 0.5 |                       |                                                          | 288.18                                                            | m <sup>2</sup> | Window to Wall Ratio = 0 |                                                                     |                                                                              | 430.99                 | m <sup>2</sup>        | Window to Wall Ratio = 0.12                                         |                                                                              |          | 1311.32                | m <sup>2</sup> | Window to Wall Ratio = 0.61 |  |  |
| Total Window Factor                          |                  | 312.13                                                              | m <sup>2</sup>                                                      |                            |                       |                                                          | 0                                                                 | m <sup>2</sup> |                          |                                                                     |                                                                              | 51.35                  | m <sup>2</sup>        |                                                                     |                                                                              |          | 799.05                 | m <sup>2</sup> |                             |  |  |
| Heat Conduction                              | Opaque Wall      | 4.7 W/m <sup>2</sup>                                                |                                                                     |                            |                       |                                                          | 11.12 W/m <sup>2</sup>                                            |                |                          |                                                                     |                                                                              | 11.37 W/m <sup>2</sup> |                       |                                                                     |                                                                              |          | 5.09 W/m <sup>2</sup>  |                |                             |  |  |
|                                              | Window           | 0.68 W/m <sup>2</sup>                                               |                                                                     |                            |                       |                                                          | 0 W/m <sup>2</sup>                                                |                |                          |                                                                     |                                                                              | 0.12 W/m <sup>2</sup>  |                       |                                                                     |                                                                              |          | 0.46 W/m <sup>2</sup>  |                |                             |  |  |
| Window                                       | Glass Type       | <input checked="" type="checkbox"/> GL-1                            | Area= 132.81 m <sup>2</sup>                                         | SC= 0.34                   | VLT= 50 %<br>ER= 19 % | <input type="checkbox"/> GL-1                            | Area= m <sup>2</sup>                                              | SC=            | VLT= %<br>ER= %          | <input type="checkbox"/> GL-1                                       | Area= m <sup>2</sup>                                                         | SC=                    | VLT= %<br>ER= %       | <input checked="" type="checkbox"/> GL-1                            | Area= 226.84 m <sup>2</sup>                                                  | SC= 0.34 | VLT= 50 %<br>ER= 19 %  |                |                             |  |  |
|                                              |                  | <input checked="" type="checkbox"/> GL-1A                           | Area= 24.64 m <sup>2</sup>                                          | SC= 0.32                   | VLT= 50 %<br>ER= 19 % | <input type="checkbox"/> GL-1A                           | Area= m <sup>2</sup>                                              | SC=            | VLT= %<br>ER= %          | <input type="checkbox"/> GL-1A                                      | Area= m <sup>2</sup>                                                         | SC=                    | VLT= %<br>ER= %       | <input checked="" type="checkbox"/> GL-1A                           | Area= 77.15 m <sup>2</sup>                                                   | SC= 0.32 | VLT= 50 %<br>ER= 19 %  |                |                             |  |  |
|                                              |                  | <input checked="" type="checkbox"/> GL-7                            | Area= 154.67 m <sup>2</sup>                                         | SC= 0.31                   | VLT= 51 %<br>ER= 19 % | <input type="checkbox"/> GL-7                            | Area= m <sup>2</sup>                                              | SC=            | VLT= %<br>ER= %          | <input checked="" type="checkbox"/> GL-7                            | Area= 51.35 m <sup>2</sup>                                                   | SC= 0.31               | VLT= 51 %<br>ER= 19 % | <input checked="" type="checkbox"/> GL-7                            | Area= 493.34 m <sup>2</sup>                                                  | SC= 0.31 | VLT= 51 %<br>ER= 19 %  |                |                             |  |  |
|                                              | 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 checked="" type="checkbox"/> Yes <input type="checkbox"/> No |                        |                       |                                                                     | Overhang <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 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 Glazing              |                  | 5.2 W/m <sup>2</sup>                                                |                                                                     |                            |                       |                                                          | 0 W/m <sup>2</sup>                                                |                |                          |                                                                     |                                                                              | 1.45 W/m <sup>2</sup>  |                       |                                                                     |                                                                              |          | 6.17 W/m <sup>2</sup>  |                |                             |  |  |
| Average Absorptivity                         |                  | 0.9                                                                 |                                                                     |                            |                       |                                                          | 0.9                                                               |                |                          |                                                                     |                                                                              | 0.89                   |                       |                                                                     |                                                                              |          | 0.9                    |                |                             |  |  |
| RTTV <sub>Wall</sub> at each facade          |                  | 10.24 W/m <sup>2</sup>                                              |                                                                     |                            |                       |                                                          | 11.12 W/m <sup>2</sup>                                            |                |                          |                                                                     |                                                                              | 12.94 W/m <sup>2</sup> |                       |                                                                     |                                                                              |          | 11.73 W/m <sup>2</sup> |                |                             |  |  |
| Overall RTTV <sub>Wall</sub>                 |                  | 11.51 W/m <sup>2</sup>                                              |                                                                     |                            |                       |                                                          |                                                                   |                |                          |                                                                     |                                                                              |                        |                       |                                                                     |                                                                              |          |                        |                |                             |  |  |

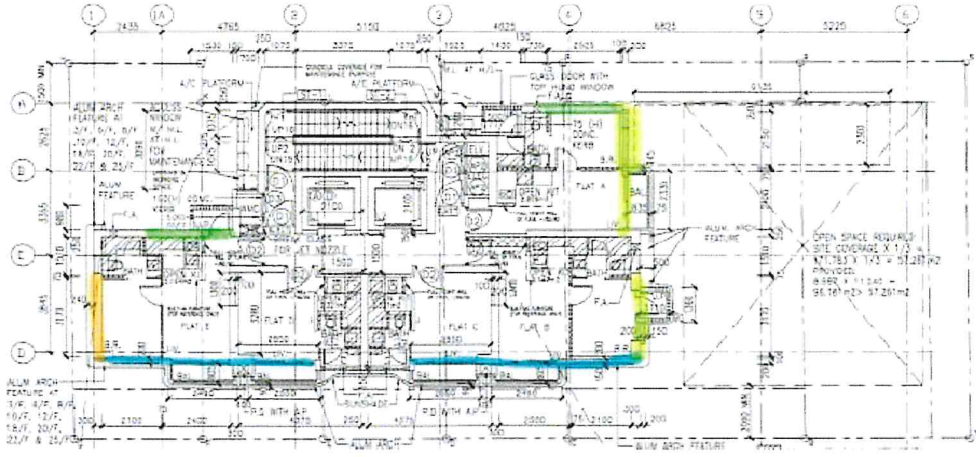
Table 3

| RTTV <sub>Roof</sub>                |                                 |                                                          |                    |                |     |      |   |     |   |
|-------------------------------------|---------------------------------|----------------------------------------------------------|--------------------|----------------|-----|------|---|-----|---|
| Roof Orientation Factor             |                                 | 2.16                                                     |                    |                |     |      |   |     |   |
| Total Roof Area (Residential Units) |                                 | 89.92 m <sup>2</sup>                                     |                    |                |     |      |   |     |   |
| Total Skylight Area                 |                                 | 0 m <sup>2</sup>                                         |                    |                |     |      |   |     |   |
| Heat Conduction                     | Roof                            | 3.62 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 Glazing |                                                          | 0 W/m <sup>2</sup> |                |     |      |   |     |   |
| Average Absorptivity (roof)         |                                 | 0.9                                                      |                    |                |     |      |   |     |   |
| Overall RTTV <sub>Roof</sub>        |                                 | 3.62 W/m <sup>2</sup>                                    |                    |                |     |      |   |     |   |

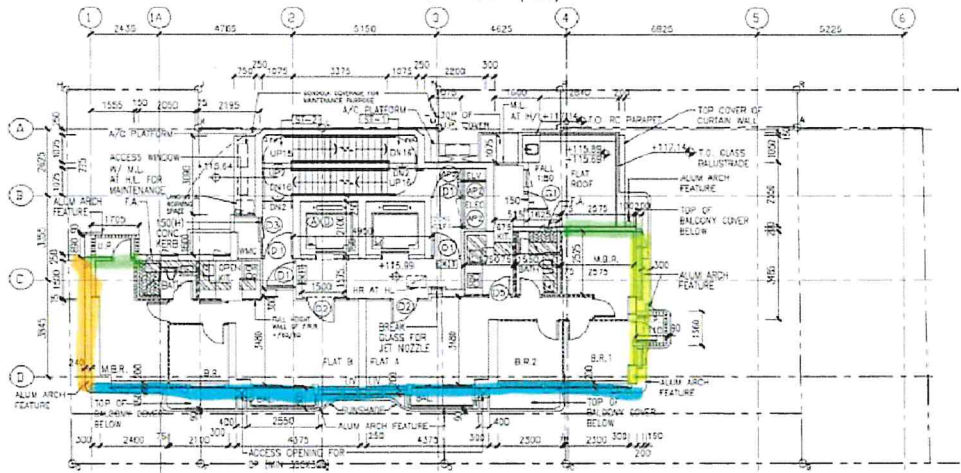
Layout Plan

Legend

- South
- West
- North
- East

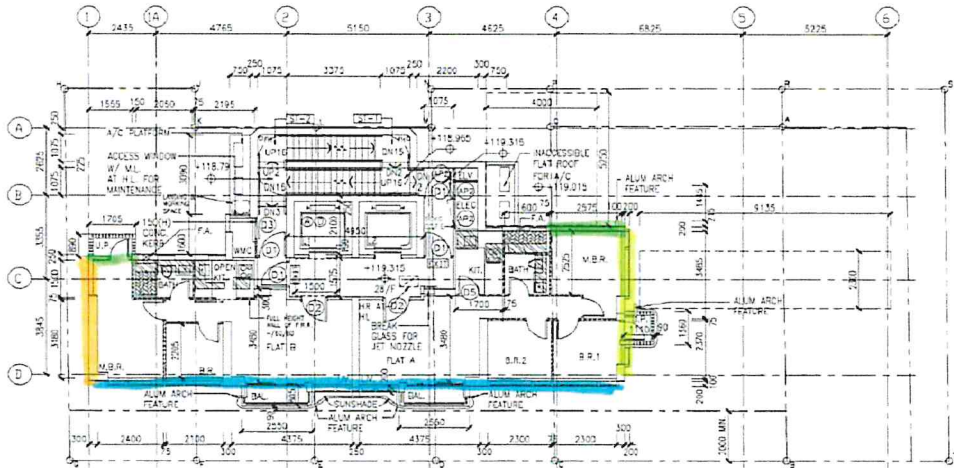


3-15/F, 17-26/F



27/F

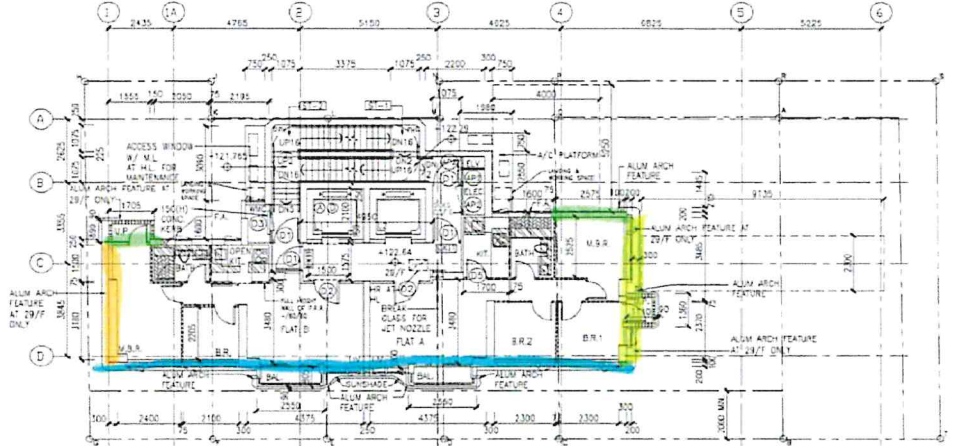
Layout Plan



Legend

- South
- West
- North
- East

28/F



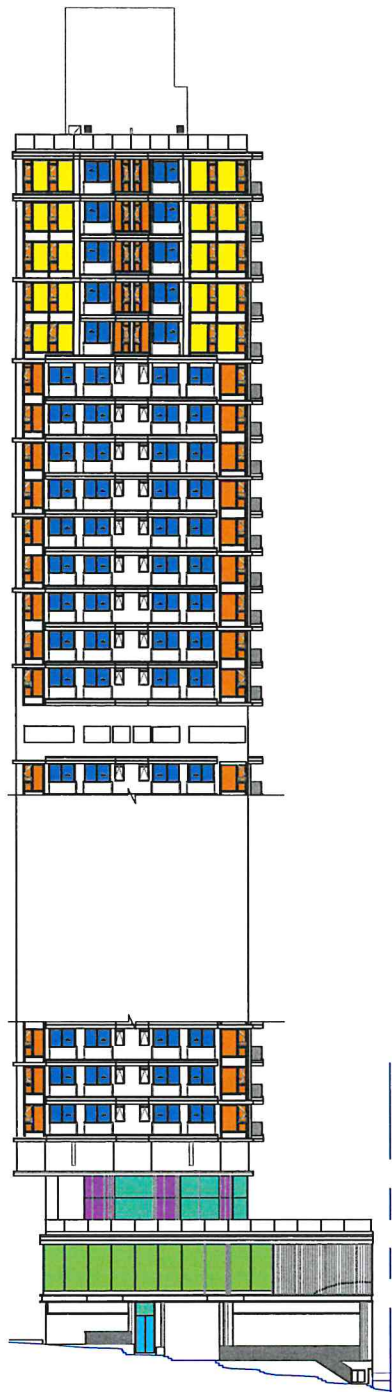
29-31/F



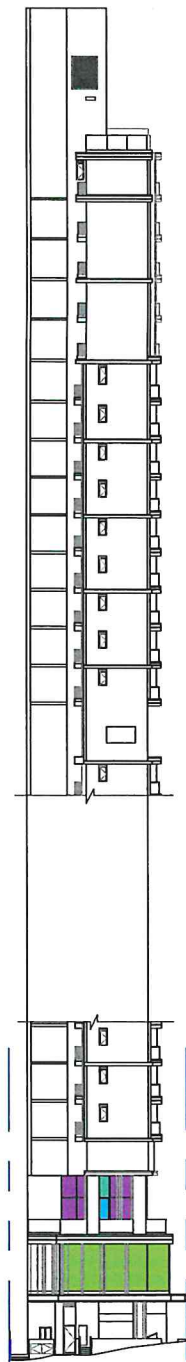
Elevation

Sheet no.

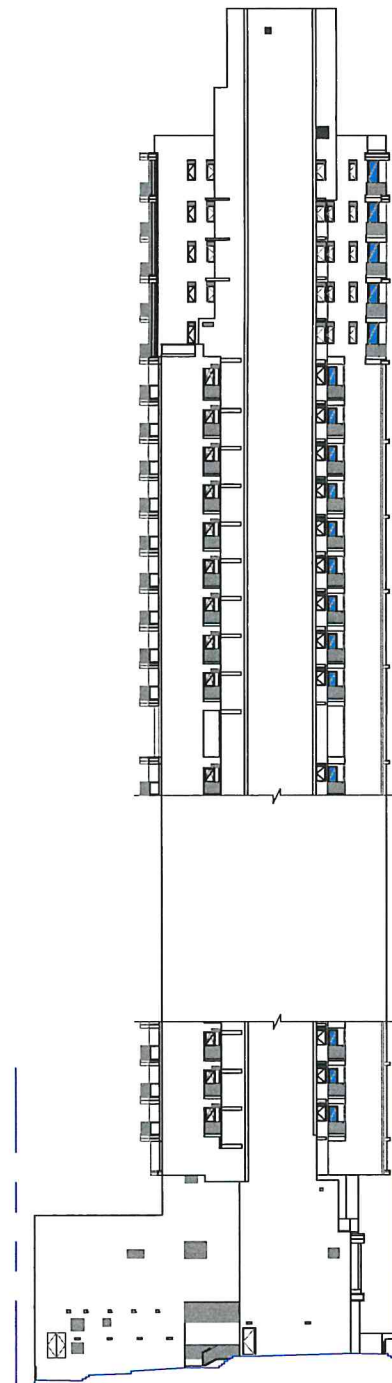
3



Front Elevation  
(Facing Western Street)



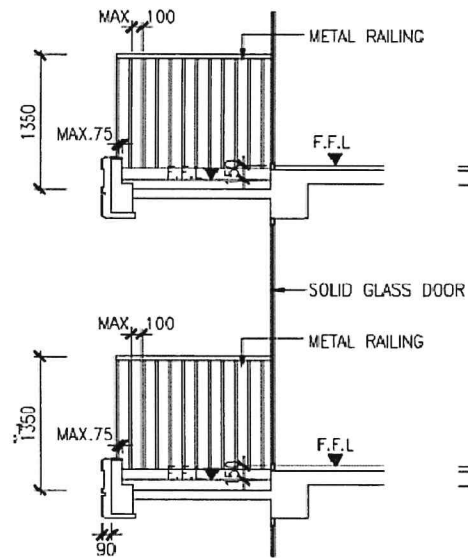
Side Elevation  
(Facing Third Street)



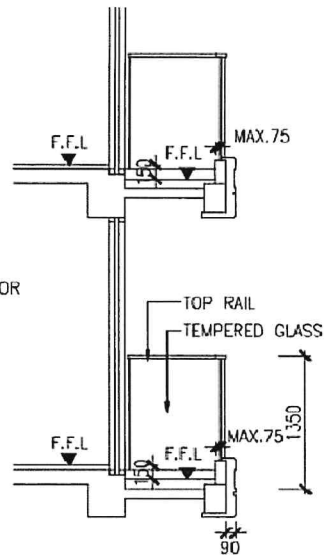
Rear Elevation  
(Facing Service Lane)



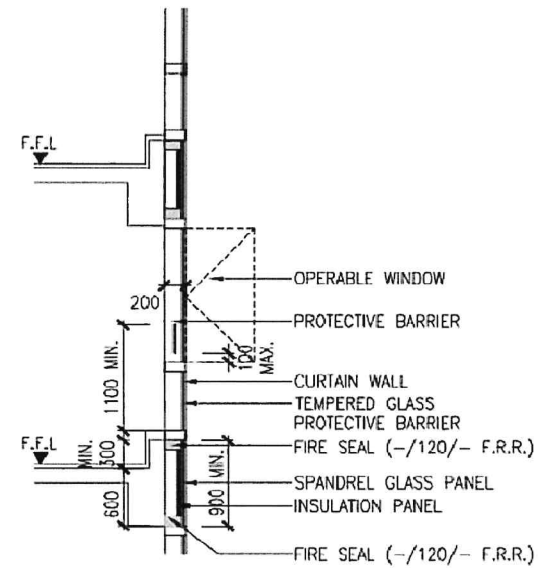
Side Elevation



TYPICAL DETAIL  
FOR UTILITY PLATFORM  
(1:50)



TYPICAL DETAIL  
FOR BALCONY  
(1:50)



TYPICAL DETAIL  
FOR CURTAIN WALL  
(1:50)

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

Sheet no. 5

### Storey heights (Residential Units) :

|                                          |   |        |               |
|------------------------------------------|---|--------|---------------|
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F | = | 3.15 m | ( 18 storeys) |
| 26/F                                     | = | 3.50 m | ( 1 storey)   |
| 27/F - 30/F                              | = | 3.33 m | ( 4 storeys)  |
| 31/F                                     | = | 3.50 m | ( 1 storey)   |

|                                          |                                                                                           |
|------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>North</b>                             | Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F | ( 5.13 + 3.47                                                                             |
| 26/F                                     | ( 5.13 + 3.47                                                                             |
| 27/F - 30/F                              | ( 6.43                                                                                    |
| 31/F                                     | ( 6.43                                                                                    |

|                                          |                                                                                           |
|------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>East</b>                              | Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F | ( 8.20 + 8.10                                                                             |
| 26/F                                     | ( 8.20 + 8.10                                                                             |
| 27/F - 30/F                              | ( 19.65                                                                                   |
| 31/F                                     | ( 19.65                                                                                   |

|                                          |                                                                                           |
|------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>South</b>                             | Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F | ( 3.39                                                                                    |
| 26/F                                     | ( 3.39                                                                                    |
| 27/F - 30/F                              | ( 5.01                                                                                    |
| 31/F                                     | ( 5.01                                                                                    |

|                                          |                                                                                           |
|------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>West</b>                              | Gross Wall Area = Total Length of Opaque Walls & Glazing x Storey Height x No. of Storeys |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F | ( 3.10 + 2.82                                                                             |
| 26/F                                     | ( 3.10 + 2.82                                                                             |
| 27/F - 30/F                              | ( 1.56 + 2.88                                                                             |
| 31/F                                     | ( 1.56 + 2.88                                                                             |

|                |                    |           |
|----------------|--------------------|-----------|
| )x 3.15 x 18 = | 8.60 x 3.15 x 18 = | 487.34 m² |
| )x 3.50 x 1 =  | 8.60 x 3.50 x 1 =  | 30.10 m²  |
| )x 3.33 x 4 =  | 6.43 x 3.33 x 4 =  | 85.52 m²  |
| )x 3.50 x 1 =  | 6.43 x 3.50 x 1 =  | 22.51 m²  |

Gross Wall Areas 625.46 m²

|                |                     |           |
|----------------|---------------------|-----------|
| )x 3.15 x 18 = | 16.30 x 3.15 x 18 = | 924.15 m² |
| )x 3.50 x 1 =  | 16.30 x 3.50 x 1 =  | 57.05 m²  |
| )x 3.33 x 4 =  | 19.65 x 3.33 x 4 =  | 261.35 m² |
| )x 3.50 x 1 =  | 19.65 x 3.50 x 1 =  | 68.78 m²  |

Gross Wall Areas 1311.32 m²

|                |                    |           |
|----------------|--------------------|-----------|
| )x 3.15 x 18 = | 3.39 x 3.15 x 18 = | 192.21 m² |
| )x 3.50 x 1 =  | 3.39 x 3.50 x 1 =  | 11.87 m²  |
| )x 3.33 x 4 =  | 5.01 x 3.33 x 4 =  | 66.57 m²  |
| )x 3.50 x 1 =  | 5.01 x 3.50 x 1 =  | 17.54 m²  |

Gross Wall Areas 288.18 m²

|                |                    |           |
|----------------|--------------------|-----------|
| )x 3.15 x 18 = | 5.92 x 3.15 x 18 = | 335.83 m² |
| )x 3.50 x 1 =  | 5.92 x 3.50 x 1 =  | 20.73 m²  |
| )x 3.33 x 4 =  | 4.43 x 3.33 x 4 =  | 58.92 m²  |
| )x 3.50 x 1 =  | 4.43 x 3.50 x 1 =  | 15.51 m²  |

Gross Wall Areas 430.99 m²

Total Gross Wall Areas 2655.95 m²

**Total Glazing Area (Window + Balcony) Calculation**

Sheet no. 6

**North**

3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Curtain Wall)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Balcony)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (U.P.)  
26/F (Curtain Wall)  
26/F (Balcony)  
26/F (U.P.)  
27/F - 30/F (Curtain Wall)  
27/F - 30/F (Balcony)  
27/F - 30/F (U.P.)  
31/F (Curtain Wall)  
31/F (Balcony)  
31/F (U.P.)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys  
( 2.05 + 0.87  
( 1.02 + 1.01  
( 0.79  
( 2.05 + 0.67  
( 1.02 + 1.01  
( 0.79  
( 2.60 + 0.67  
( 0.00  
( 0.85  
( 2.6 + 0.67  
( 0  
( 0.85

x 2.25 x 18 = 2.72 x 2.25 x 18 = 110.16 m²  
x 2.65 x 18 = 2.02 x 2.65 x 18 = 96.40 m²  
x 2.65 x 18 = 0.79 x 2.65 x 18 = 37.68 m²  
x 2.60 x 1 = 2.72 x 2.60 x 1 = 7.07 m²  
x 3.00 x 1 = 2.02 x 3.00 x 1 = 6.06 m²  
x 3.00 x 1 = 0.79 x 3.00 x 1 = 2.37 m²  
x 2.43 x 4 = 3.27 x 2.43 x 4 = 31.72 m²  
x 2.83 x 4 = 0.00 x 2.83 x 4 = 0.00 m²  
x 2.83 x 4 = 0.85 x 2.83 x 4 = 9.61 m²  
x 2.60 x 1 = 3.27 x 2.60 x 1 = 8.50 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²  
x 3.00 x 1 = 0.85 x 3.00 x 1 = 2.55 m²

Gross Glazing Areas 312.13 m²

**East**

3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Curtain Wall)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Balcony)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (U.P.)  
26/F (Curtain Wall)  
26/F (Balcony)  
26/F (U.P.)  
27/F - 30/F (Curtain Wall)  
27/F - 30/F (Balcony)  
27/F - 30/F (U.P.)  
31/F (Curtain Wall)  
31/F (Balcony)  
31/F (U.P.)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys  
( 1.70 + 2.10  
( 1.05 + 0.99 + 1.11 + 1.11 + 1.11 + 1.11 + 1.05 + 1.02  
( 0.00  
( 1.70 + 2.10  
( 1.05 + 0.99 + 1.11 + 1.11 + 1.11 + 1.11 + 1.05 + 1.02  
( 0.00  
( 1.99 + 2.09 + 2.30 + 2.29 + 1.45 + 1.45  
( 1.04 + 1.04 + 1.04 + 1.04  
( 0  
( 1.99 + 2.09 + 2.30 + 2.29 + 1.45 + 1.45  
( 1.04 + 1.04 + 1.04 + 1.04  
( 0

x 2.25 x 18 = 3.80 x 2.25 x 18 = 153.90 m²  
x 2.65 x 18 = 8.55 x 2.65 x 18 = 408.03 m²  
x 2.65 x 18 = 0.00 x 2.65 x 18 = 0.00 m²  
x 2.60 x 1 = 3.80 x 2.60 x 1 = 9.88 m²  
x 3.00 x 1 = 8.55 x 3.00 x 1 = 25.66 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²  
x 2.43 x 4 = 11.56 x 2.43 x 4 = 112.15 m²  
x 2.83 x 4 = 4.15 x 2.83 x 4 = 46.92 m²  
x 2.83 x 4 = 0.00 x 2.83 x 4 = 0.00 m²  
x 2.60 x 1 = 11.56 x 2.60 x 1 = 30.06 m²  
x 3.00 x 1 = 4.15 x 3.00 x 1 = 12.46 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²

Gross Glazing Areas 799.05 m²

**South**

3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Curtain Wall)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Balcony)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (U.P.)  
26/F (Curtain Wall)  
26/F (Balcony)  
26/F (U.P.)  
27/F - 30/F (Curtain Wall)  
27/F - 30/F (Balcony)  
27/F - 30/F (U.P.)  
31/F (Curtain Wall)  
31/F (Balcony)  
31/F (U.P.)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00  
( 0.00

x 2.25 x 18 = 0.00 x 2.25 x 18 = 0.00 m²  
x 2.65 x 18 = 0.00 x 2.65 x 18 = 0.00 m²  
x 2.65 x 18 = 0.00 x 2.65 x 18 = 0.00 m²  
x 2.60 x 1 = 0.00 x 2.60 x 1 = 0.00 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²  
x 2.43 x 4 = 0.00 x 2.43 x 4 = 0.00 m²  
x 2.83 x 4 = 0.00 x 2.83 x 4 = 0.00 m²  
x 2.83 x 4 = 0.00 x 2.83 x 4 = 0.00 m²  
x 2.60 x 1 = 0.00 x 2.60 x 1 = 0.00 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²

Gross Glazing Areas 0.00 m²

**West**

3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Curtain Wall)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Balcony)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (U.P.)  
26/F (Curtain Wall)  
26/F (Balcony)  
26/F (U.P.)  
27/F - 30/F (Curtain Wall)  
27/F - 30/F (Balcony)  
27/F - 30/F (U.P.)  
31/F (Curtain Wall)  
31/F (Balcony)  
31/F (U.P.)

Gross Glazing Area = Total Length of Glazing x Glazing Height x No. of Storeys  
( 0  
( 0  
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x 2.25 x 18 = 0.00 x 2.25 x 18 = 0.00 m²  
x 2.65 x 18 = 0.00 x 2.65 x 18 = 0.00 m²  
x 2.65 x 18 = 0.79 x 2.65 x 18 = 37.68 m²  
x 2.60 x 1 = 0.00 x 2.60 x 1 = 0.00 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²  
x 3.00 x 1 = 0.79 x 3.00 x 1 = 2.37 m²  
x 2.43 x 4 = 0.00 x 2.43 x 4 = 0.00 m²  
x 2.83 x 4 = 0.00 x 2.83 x 4 = 0.00 m²  
x 2.83 x 4 = 0.79 x 2.83 x 4 = 8.93 m²  
x 2.60 x 1 = 0.00 x 2.60 x 1 = 0.00 m²  
x 3.00 x 1 = 0.00 x 3.00 x 1 = 0.00 m²  
x 3.00 x 1 = 0.79 x 3.00 x 1 = 2.37 m²

Gross Glazing Areas 51.35 m²

Total Gross Glazing Areas 1162.53 m²

**Glazing heights (Residential Units) :**

3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Curtain Wall) = 2.25 m ( 18 storeys)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Balcony) = 2.65 m ( 18 storeys)  
3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (U.P.) = 2.65 m ( 18 storeys)  
26/F (Curtain Wall) = 2.60 m ( 1 storey)  
26/F (Balcony) = 3.00 m ( 1 storey)  
26/F (U.P.) = 3.00 m ( 1 storey)  
27/F - 30/F (Curtain Wall) = 2.43 m ( 4 storeys)  
27/F - 30/F (Balcony) = 2.83 m ( 4 storeys)  
27/F - 30/F (U.P.) = 2.83 m ( 4 storeys)  
31/F (Curtain Wall) = 2.60 m ( 1 storey)  
31/F (Balcony) = 3.00 m ( 1 storey)  
31/F (U.P.) = 3.00 m ( 1 storey)

North Elevations

|                                                                    |                            |               |                       |
|--------------------------------------------------------------------|----------------------------|---------------|-----------------------|
| Gross Wall Areas<br>(Opaque Walls + Glazing Areas) (Ao) at         | North Elevations           | =             | 625.46 m <sup>2</sup> |
| Glazing Areas at                                                   | North Elevations           | =             | 312.13 m <sup>2</sup> |
| <b>Breakdown of Glazing Areas</b>                                  |                            |               |                       |
| Glazing Areas                                                      | Unshaded                   | ( N-GL1 ) =   | 132.81 m <sup>2</sup> |
|                                                                    |                            | ( N-GL1A ) =  | 24.64                 |
|                                                                    |                            | ( N-GL7 ) =   | 0.00                  |
| Glazing Areas                                                      | Shaded by Balcony          | ( N-GL7-1 ) = | 96.40 m <sup>2</sup>  |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                            |               |                       |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (Balcony)                 | ( 1.02 + 1.01 )x 2.65 x 18 | =             | 96.40 m <sup>2</sup>  |
|                                                                    | OPF = 0.80 / 3.00 = 0.27   | ECS =         | 0.965                 |
| Glazing Areas                                                      | Shaded by U.P.             | ( N-GL7-2 ) = | 6.06 m <sup>2</sup>   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                            |               |                       |
| 26/F (Balcony)                                                     | ( 1.02 + 1.01 )x 3.00 x 1  | =             | 6.06 m <sup>2</sup>   |
|                                                                    | OPF = 0.89 / 3.35 = 0.27   | ECS =         | 0.965                 |
| Glazing Areas                                                      | Shaded by Balcony & U.P.   | ( N-GL7-3 ) = | 37.68 m <sup>2</sup>  |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                            |               |                       |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F                           | ( 0.79 )x 2.65 x 18        | =             | 37.68 m <sup>2</sup>  |
|                                                                    | OPF = 0.96 / 3.00 = 0.32   | ECS =         | 0.964                 |
| Glazing Areas                                                      | Shaded by Balcony & U.P.   | ( N-GL7-4 ) = | 2.37 m <sup>2</sup>   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                            |               |                       |
| 26/F                                                               | ( 0.79 )x 3.00 x 1         | =             | 2.37 m <sup>2</sup>   |
|                                                                    | OPF = 0.96 / 3.35 = 0.29   | ECS =         | 0.965                 |
| Glazing Areas                                                      | Shaded by U.P.             | ( N-F2-5 ) =  | 9.61 m <sup>2</sup>   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                            |               |                       |
| 27/F - 30/F                                                        | ( 0.85 )x 2.83 x 4         | =             | 9.61 m <sup>2</sup>   |
|                                                                    | OPF = 0.96 / 3.18 = 0.30   | ECS =         | 0.964                 |
| Glazing Areas                                                      | Shaded by U.P.             | ( N-F2-6 ) =  | 2.55 m <sup>2</sup>   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                            |               |                       |
| 31/F                                                               | ( 0.85 )x 3.00 x 1         | =             | 2.55 m <sup>2</sup>   |
|                                                                    | OPF = 0.96 / 3.35 = 0.29   | ECS =         | 0.965                 |
| Opaque Wall Areas at                                               | North Elevations           | =             | 313.33 m <sup>2</sup> |
| <b>Breakdown of Opaque Wall Areas</b>                              |                            |               |                       |
| RC Wall Areas                                                      | ( N-W1 ) =                 |               | 275.43 m <sup>2</sup> |
| Aluminium Cladding                                                 | ( N-W2 ) =                 |               | 37.90 m <sup>2</sup>  |
| Window to Wall Ratio (WWR)                                         | = 312.13 / 625.46          | =             | 0.50                  |

Sheet no. Z

|                                                         |                     |                          |
|---------------------------------------------------------|---------------------|--------------------------|
| Wall Orientation Factor                                 | Gw = 0.79           | (Refer to Table 9)       |
| Average Absorptivity (α) of the External Opaque Wall at | North Elevations    |                          |
| External Wall Material (Colour/Finish)                  | % of wall/roof area | α Absorptivity (Refer to |
| Dark Grey                                               | 100%                | 0.9                      |
|                                                         |                     |                          |
|                                                         |                     |                          |
|                                                         |                     |                          |
|                                                         |                     |                          |
|                                                         |                     |                          |
| Average Absorptivity =                                  |                     | 0.90                     |

|                                                                                                                      |                                                                |  |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|--|
| <b>'U' value of Opaque Wall Areas</b>                                                                                |                                                                |  |
| 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)  |  |

|                                  |              |                           |
|----------------------------------|--------------|---------------------------|
| N-W1                             | Description: | N-W1                      |
| Wall Material                    |              |                           |
| External surface film resistance | Ro =         | 0.044                     |
| Air space resistance             | Ra =         | 0                         |
| 12mm mosaic tiles                | 0.012 / 1.5  | = 0.008                   |
| 10mm cement/ sand render         | 0.01 / 0.72  | = 0.014                   |
| 150mm concrete wall              | 0.15 / 2.16  | = 0.069                   |
| 10mm gypsum plaster              | 0.01 / 0.38  | = 0.026                   |
| Internal surface film resistance | Ri =         | 0.12                      |
| Total                            |              | 0.282                     |
| Uw1 = $\frac{1}{0.282}$          |              | = 3.55 W/m <sup>2</sup> K |

|                                  |              |                           |
|----------------------------------|--------------|---------------------------|
| N-W2                             | Description: | N-W2                      |
| Wall Material                    |              |                           |
| external surface film            | Ro =         | 0.044                     |
| Air space resistance             | Ra =         | 0                         |
| 5mm aluminium cladding           | 0.005 / 160  | = 0.000                   |
| 10mm cement/ sand render         | 0.01 / 0.72  | = 0.014                   |
| 150mm concrete wall              | 0.012 / 2.16 | = 0.006                   |
| 10mm gypsum plaster              | 0.01 / 0.38  | = 0.026                   |
| Internal surface film resistance | Ri =         | 0.12                      |
| Total                            |              | 0.210                     |
| Uw2 = $\frac{1}{0.210}$          |              | = 4.77 W/m <sup>2</sup> K |



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

Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 8 BD Ref No. Residential & Commercial Development at 5-17 Western Street, Sai Ying Pun, Hong Kong

Facade Orientation Facing North Elevations Gross Wall Area (A<sub>o</sub>) = 625.46

Window to Wall Ratio (WWR) 0.50 Wall Orientation Factor (G<sub>w</sub>) = 0.79

| Part 1 - Calculation of Heat Conduction through Opaque Walls                                             |       |                          |                          |  |
|----------------------------------------------------------------------------------------------------------|-------|--------------------------|--------------------------|--|
| Components / Details                                                                                     |       | Code No.                 |                          |  |
| Description                                                                                              | Units | N-W1                     | N-W2                     |  |
| External Finish Material                                                                                 |       | 5mm mosaic tiles         | 5mm caldding             |  |
| Conductivity                                                                                             | W/mK  | 1.50                     | 160.00                   |  |
| Thickness                                                                                                | m     | 0.012                    | 0.005                    |  |
| Average Absorptivity                                                                                     | (α)   | 0.90                     | 0.90                     |  |
| Intermediate component                                                                                   |       | 10mm cement/ sand render | 10mm cement/ sand render |  |
| Conductivity                                                                                             | W/mK  | 0.72                     | 0.72                     |  |
| Thickness                                                                                                | m     | 0.01                     | 0.01                     |  |
| Intermediate component                                                                                   |       |                          |                          |  |
| Conductivity                                                                                             | W/mK  |                          |                          |  |
| Thickness                                                                                                | m     |                          |                          |  |
| Intermediate component                                                                                   |       |                          |                          |  |
| Conductivity                                                                                             | W/mK  |                          |                          |  |
| Thickness                                                                                                | m     |                          |                          |  |
| Intermediate component                                                                                   |       | 150mm concrete wall      | 150mm concrete wall      |  |
| Conductivity                                                                                             | W/mK  | 2.16                     | 2.16                     |  |
| Thickness                                                                                                | m     | 0.15                     | 0.01                     |  |
| Internal Finish Material                                                                                 |       | 10mm gypsum plaster      | 10mm gypsum plaster      |  |
| Conductivity                                                                                             | W/mK  | 0.38                     | 0.38                     |  |
| Thickness                                                                                                | m     | 0.01                     | 0.01                     |  |
| U-value of Opaque Area (U <sub>wi</sub> )                                                                | W/m²K | 3.55                     | 4.77                     |  |
| Opaque Wall Area (A <sub>wi</sub> )                                                                      | m²    | 275.43                   | 37.90                    |  |
| Heat Conduction = 3.57 (A <sub>wi</sub> /A <sub>o</sub> ) U <sub>wi</sub> a <sub>wi</sub> G <sub>w</sub> |       | 3.97                     | 0.73                     |  |

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

= 4.70 W/m²

| Part 2 - Calculation of Heat Conduction through Glazing                                  |       |          |        |       |         |         |         |         |        |        |  |
|------------------------------------------------------------------------------------------|-------|----------|--------|-------|---------|---------|---------|---------|--------|--------|--|
| Components / Details                                                                     |       | Code No. |        |       |         |         |         |         |        |        |  |
| Description                                                                              | Units | N-GL1    | N-GL1A | N-GL7 | N-GL7-1 | N-GL7-2 | N-GL7-3 | N-GL7-4 | N-F2-5 | N-F2-6 |  |
| Glazing Type                                                                             |       | IGU      | IGU    | IGU   | IGU     | IGU     | IGU     | IGU     | IGU    | IGU    |  |
| Thickness                                                                                | m     | 0.03     | 0.032  | 0.028 | 0.028   | 0.028   | 0.028   | 0.028   | 0.028  | 0.028  |  |
| Glazing Area (A <sub>fi</sub> )                                                          | m²    | 132.81   | 24.64  | 0.00  | 96.40   | 6.06    | 37.68   | 2.37    | 9.61   | 2.55   |  |
| U-value of Glazing (U <sub>fi</sub> )                                                    | W/m²K | 1.4      | 1.37   | 1.35  | 1.35    | 1.35    | 1.35    | 1.35    | 1.35   | 1.35   |  |
| Heat Conduction = 0.64 (A <sub>fi</sub> /A <sub>o</sub> ) U <sub>fi</sub> G <sub>w</sub> |       | 0.150    | 0.027  | 0.000 | 0.105   | 0.007   | 0.041   | 0.003   | 0.010  | 0.003  |  |

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

| Part 3 - Calculation of Solar Radiation through Glazing                                                          |       |          |        |       |         |         |         |         |        |        |  |
|------------------------------------------------------------------------------------------------------------------|-------|----------|--------|-------|---------|---------|---------|---------|--------|--------|--|
| Components / Details                                                                                             |       | Code No. |        |       |         |         |         |         |        |        |  |
| Description                                                                                                      | Units | N-GL1    | N-GL1A | N-GL7 | N-GL7-1 | N-GL7-2 | N-GL7-3 | N-GL7-4 | N-F2-5 | N-F2-6 |  |
| Glazing Type                                                                                                     |       | IGU      | IGU    | IGU   | IGU     | IGU     | IGU     | IGU     | IGU    | IGU    |  |
| Thickness                                                                                                        | m     | 0.03     | 0.032  | 0.028 | 0.028   | 0.028   | 0.028   | 0.028   | 0.028  | 0.028  |  |
| Glazing Area (A <sub>fi</sub> )                                                                                  | m²    | 132.81   | 24.64  | 0.00  | 96.40   | 6.06    | 37.68   | 2.37    | 9.61   | 2.55   |  |
| Shading Coefficient of Glazing (SC <sub>fi</sub> )                                                               |       | 0.34     | 0.32   | 0.31  | 0.31    | 0.31    | 0.31    | 0.31    | 0.31   | 0.31   |  |
| Visible Light Transmittance (VLT)                                                                                | %     | 50.00    | 50.00  | 51.00 | 51.00   | 51.00   | 51.00   | 51.00   | 51.00  | 51.00  |  |
| External Reflectance (ER)                                                                                        |       | 19.00    | 19.00  | 19.00 | 19.00   | 19.00   | 19.00   | 19.00   | 19.00  | 19.00  |  |
| External Shading Multiplier (ESC)                                                                                |       | 1.00     | 1.00   | 1.00  | 0.97    | 0.97    | 0.96    | 0.97    | 0.96   | 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> |       | 2.38     | 0.42   | 0.00  | 1.52    | 0.10    | 0.59    | 0.04    | 0.15   | 0.04   |  |

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

= 5.20 W/m²

Summary of RTTV at North Elevations

= 4.70 + 0.34 + 5.20

= 10.24 W/m²

East Elevations

|                                                                    |                   |               |            |
|--------------------------------------------------------------------|-------------------|---------------|------------|
| Gross Wall Areas<br>(Opaque Walls + Glazing Areas) (Ao) at         | East Elevations   | =             | 1311.32 m² |
| Glazing Areas at                                                   | East Elevations   | =             | 799.05 m²  |
| <b>Breakdown of Glazing Areas</b>                                  |                   |               |            |
| Glazing Areas                                                      | Unshaded          | ( E-GL1 ) =   | 228.84 m²  |
|                                                                    |                   | ( E-GL1A ) =  | 77.15      |
|                                                                    |                   | ( E-GL7 ) =   | 0.00       |
| Glazing Areas                                                      | Shaded by Balcony | ( E-GL7-1 ) = | 408.03 m²  |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                   |               |            |
| ( 8.55 ) x 2.65 x 18 = 408.03 m²                                   |                   |               |            |
| OPF = 0.80 / 3.00 = 0.27 ECS = 0.834                               |                   |               |            |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F                           |                   |               |            |
| <b>Glazing Areas</b>                                               |                   |               |            |
| 26/F                                                               | Shaded by Balcony | ( E-GL7-2 ) = | 25.66 m²   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                   |               |            |
| ( 8.55 ) x 3.00 x 1 = 25.66 m²                                     |                   |               |            |
| OPF = 0.80 / 3.35 = 0.24 ECS = 0.864                               |                   |               |            |
| <b>Glazing Areas</b>                                               |                   |               |            |
| 27-30/F                                                            | Shaded by Balcony | ( E-GL7-3 ) = | 46.92 m²   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                   |               |            |
| ( 4.15 ) x 2.83 x 4 = 46.92 m²                                     |                   |               |            |
| OPF = 0.80 / 3.18 = 0.25 ECS = 0.834                               |                   |               |            |
| <b>Glazing Areas</b>                                               |                   |               |            |
| 31/F                                                               | Shaded by Balcony | ( E-GL7-4 ) = | 12.46 m²   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys |                   |               |            |
| ( 4.15 ) x 3.00 x 1 = 12.46 m²                                     |                   |               |            |
| OPF = 0.80 / 3.35 = 0.24 ECS = 0.864                               |                   |               |            |
| <b>Opaque Wall Areas at</b>                                        |                   |               |            |
| East Elevations                                                    |                   | =             | 512.27 m²  |
| <b>Breakdown of Opaque Wall Areas</b>                              |                   |               |            |
| RC Wall Areas                                                      |                   | ( E-W1 ) =    | 414.07 m²  |
| Aluminium Cladding                                                 |                   | ( E-W2 ) =    | 98.20 m²   |
| <b>Window to Wall Ratio (WWR)</b>                                  |                   |               |            |
| = 799.05 / 1311.32 = 0.61                                          |                   |               |            |

Sheet no. 9

Wall Orientation Factor

Gw = 1.072 (Refer to Table 9)

Average Absorptivity ( $\alpha$ ) of the External Opaque Wall at

0

| External Wall Material (Colour/Finish) | % of wall/roof area | $\alpha$ |
|----------------------------------------|---------------------|----------|
| Dark Grey                              | 100%                | 0.9      |
|                                        |                     |          |
|                                        |                     |          |
|                                        |                     |          |
|                                        |                     |          |
|                                        |                     |          |

Average Absorptivity = 0.90

'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  $R_i$  Surface film resistance of internal surface (Refer to Table 2)

$R_o$  Surface film resistance of external surface (Refer to Table 2)

$R_a$  Air space resistance (Refer to Table 3)

$x$  Thickness of building materials

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

|                                  |  |               |            |
|----------------------------------|--|---------------|------------|
| <b>E-W1</b>                      |  | Description:  | E-W1       |
| Wall Material                    |  |               |            |
| External surface film resistance |  | Ro =          | 0.044      |
| Air space resistance             |  | Ra =          | 0          |
| 12mm mosaic tiles                |  | 0.012 / 1.5 = | 0.008      |
| 10mm cement/sand render          |  | 0.01 / 0.72 = | 0.014      |
| 150mm concrete wall              |  | 0.15 / 2.16 = | 0.069      |
| 10mm gypsum plaster              |  | 0.01 / 0.38 = | 0.026      |
| Internal surface film resistance |  | Ri =          | 0.12       |
| Total                            |  |               | 0.282      |
| Uw1 =                            |  | 1 / 0.282 =   | 3.55 W/m²K |
| <b>E-W2</b>                      |  | Description:  | E-W2       |
| Wall Material                    |  |               |            |
| external surface film            |  | Ro =          | 0.044      |
| Air space resistance             |  | Ra =          | 0          |
| 5mm aluminium cladding           |  | 0.005 / 160 = | 0.000      |
| 10mm cement/sand render          |  | 0.01 / 0.72 = | 0.014      |
| 600mm concrete column            |  | 0.6 / 2.16 =  | 0.278      |
| 10mm gypsum plaster              |  | 0.01 / 0.38 = | 0.026      |
| Internal surface film resistance |  | Ri =          | 0.12       |
| Total                            |  |               | 0.482      |
| Uw2 =                            |  | 1 / 0.482 =   | 2.07 W/m²K |

Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014  
Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No.

10

BD Ref No.

Building Address

Residential & Commercial Development at 5-17 Western Street, Sai Ying Pun, Hong Kong

Facade Orientation Facing

East Elevations

Gross Wall Area (A<sub>o</sub>) =

1311.32

Window to Wall Ratio (WWR)

0.61

Wall Orientation Factor (G<sub>w</sub>) =

1.072

| Part 1 - Calculation of Heat Conduction through Opaque Walls                                         |       |                          |                          |  |
|------------------------------------------------------------------------------------------------------|-------|--------------------------|--------------------------|--|
| Components / Details                                                                                 |       | Code No.                 |                          |  |
| Description                                                                                          | Units | E-W1                     | E-W2                     |  |
| External Finish Material                                                                             |       | 5mm mosaic tiles         | 5mm caldding             |  |
| Conductivity                                                                                         | W/mK  | 1.50                     | 160.00                   |  |
| Thickness                                                                                            | m     | 0.012                    | 0.005                    |  |
| Average Absorptivity                                                                                 | (α)   | 0.90                     | 0.90                     |  |
| Intermediate component                                                                               |       | 10mm cement/ sand render | 10mm cement/ sand render |  |
| Conductivity                                                                                         | W/mK  | 0.72                     | 0.72                     |  |
| Thickness                                                                                            | m     | 0.01                     | 0.01                     |  |
| Intermediate component                                                                               |       |                          |                          |  |
| Conductivity                                                                                         | W/mK  |                          |                          |  |
| Thickness                                                                                            | m     |                          |                          |  |
| Intermediate component                                                                               |       |                          |                          |  |
| Conductivity                                                                                         | W/mK  |                          |                          |  |
| Thickness                                                                                            | m     |                          |                          |  |
| Intermediate component                                                                               |       | 150mm concrete wall      | 150mm concrete wall      |  |
| Conductivity                                                                                         | W/mK  | 2.16                     | 2.16                     |  |
| Thickness                                                                                            | m     | 0.15                     | 0.01                     |  |
| Internal Finish Material                                                                             |       | 10mm gypsum plaster      | 10mm gypsum plaster      |  |
| Conductivity                                                                                         | W/mK  | 0.38                     | 0.38                     |  |
| Thickness                                                                                            | m     | 0.01                     | 0.01                     |  |
| U-value of Opaque Area (U <sub>w</sub> )                                                             | W/m²K | 3.55                     | 4.77                     |  |
| Opaque Wall Area (A <sub>w</sub> )                                                                   | m²    | 414.07                   | 98.20                    |  |
| Heat Conduction = 3.57(A <sub>w</sub> /A <sub>o</sub> ) U <sub>w</sub> α <sub>w</sub> G <sub>w</sub> |       | 3.86                     | 1.23                     |  |

Heat Conduction through Opaque Walls = 3.57(A<sub>w</sub>/A<sub>o</sub>) U<sub>w</sub> α<sub>w</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 5.09 W/m²

| Part 2 - Calculation of Heat Conduction through Glazing                                |       |          |        |       |         |         |         |         |  |  |  |
|----------------------------------------------------------------------------------------|-------|----------|--------|-------|---------|---------|---------|---------|--|--|--|
| Components / Details                                                                   |       | Code No. |        |       |         |         |         |         |  |  |  |
| Description                                                                            | Units | E-GL1    | E-GL1A | E-GL7 | E-GL7-1 | E-GL7-2 | E-GL7-3 | E-GL7-4 |  |  |  |
| Glazing Type                                                                           |       | IGU      | IGU    | IGU   | IGU     | IGU     | IGU     | IGU     |  |  |  |
| Thickness                                                                              | m     | 0.03     | 0.032  | 0.028 | 0.028   | 0.028   | 0.028   | 0.028   |  |  |  |
| Glazing Area (A <sub>g</sub> )                                                         | m²    | 132.81   | 24.64  | 0.00  | 408.03  | 25.66   | 46.92   | 12.46   |  |  |  |
| U-value of Glazing (U <sub>g</sub> )                                                   | W/m²K | 1.4      | 1.37   | 1.35  | 1.35    | 1.35    | 1.35    | 1.35    |  |  |  |
| Heat Conduction = 0.64 (A <sub>g</sub> /A <sub>o</sub> ) U <sub>g</sub> G <sub>w</sub> |       | 0.997    | 0.018  | 0.000 | 0.288   | 0.018   | 0.033   | 0.009   |  |  |  |

Heat Conduction through Glazing = 0.64 (A<sub>g</sub>/A<sub>o</sub>) U<sub>g</sub> G<sub>w</sub> where i= 1, 2, ..., n  
= 0.46

| Part 3 - Calculation of Solar Radiation through Glazing                                                        |       |          |        |       |         |         |         |         |  |  |  |
|----------------------------------------------------------------------------------------------------------------|-------|----------|--------|-------|---------|---------|---------|---------|--|--|--|
| Components / Details                                                                                           |       | Code No. |        |       |         |         |         |         |  |  |  |
| Description                                                                                                    | Units | E-GL1    | E-GL1A | E-GL7 | E-GL7-1 | E-GL7-2 | E-GL7-3 | E-GL7-4 |  |  |  |
| Glazing Type                                                                                                   |       | IGU      | IGU    | IGU   | IGU     | IGU     | IGU     | IGU     |  |  |  |
| Thickness                                                                                                      | m     | 0.03     | 0.032  | 0.028 | 0.028   | 0.028   | 0.028   | 0.028   |  |  |  |
| Glazing Area (A <sub>g</sub> )                                                                                 | m²    | 132.81   | 24.64  | 0.00  | 408.03  | 25.66   | 46.92   | 12.46   |  |  |  |
| Shading Coefficient of Glazing (SC <sub>g</sub> )                                                              |       | 0.34     | 0.32   | 0.31  | 0.31    | 0.31    | 0.31    | 0.31    |  |  |  |
| Visible Light Transmittance (VLT)                                                                              | %     | 50.00    | 50.00  | 51.00 | 51.00   | 51.00   | 51.00   | 51.00   |  |  |  |
| External Reflectance (E <sub>r</sub> )                                                                         |       | 19.00    | 19.00  | 19.00 | 19.00   | 19.00   | 19.00   | 19.00   |  |  |  |
| External Shading Multiplier (ESC)                                                                              |       | 1.00     | 1.00   | 1.00  | 0.83    | 0.86    | 0.83    | 0.86    |  |  |  |
| Solar Radiation = 41.75 (A <sub>g</sub> /A <sub>o</sub> ) (SC <sub>g</sub> )(ESC <sub>w</sub> ) G <sub>w</sub> |       | 1.54     | 0.27   | 0.00  | 3.60    | 0.23    | 0.41    | 0.11    |  |  |  |

Solar Radiation through Glazing = 41.75 (A<sub>g</sub>/A<sub>o</sub>) (SC<sub>g</sub>)(ESC<sub>w</sub>) G<sub>w</sub> where i= 1, 2, ..., n  
= 6.17 W/m²

Summary of RTTV at North Elevations  
= 5.09 + 0.46 + 6.17  
= 11.73 W/m²

South Elevations

Gross Wall Areas  
(Opaque Walls + Glazing Areas) (Ao) at

South Elevations

= 288.18 m²

Glazing Areas at South Elevations

= 0.00 m²

Breakdown of Glazing Areas

Glazing Areas

= 0.00 m²

Opaque Wall Areas at South Elevations

= 288.18 m²

Breakdown of Opaque Wall Areas

RC Wall Areas

( S-W1 ) = 288.18 m²

Aluminium Cladding

( S-W2 ) = 0.00 m²

Window to Wall Ratio (WWR)

= 0.00 / 288.18

= 0.00

Deemed to Satisfy RTTVwall

Compliance Check

Sheet no. 11

Wall Orientation Factor

Gw = 0.975 (Refer to Table 9)

Average Absorptivity (α) of the External Opaque Wall at

East Elevations

| External Wall Material (Colour/Finish) | % of wall/roof area | α Absorptivity |
|----------------------------------------|---------------------|----------------|
| Dark Grey                              | 100%                | 0.9            |
|                                        |                     |                |
|                                        |                     |                |

Average Absorptivity = 0.90

'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: S-W1

| Wall Material                    |                     |
|----------------------------------|---------------------|
| External surface film resistance | Ro = 0.044          |
| Air space resistance             | Ra = 0              |
| 12mm mosaic tiles                | 0.012 / 1.5 = 0.008 |
| 10mm cement/ sand render         | 0.01 / 0.72 = 0.014 |
| 150mm concrete wall              | 0.15 / 2.16 = 0.069 |
| 10mm gypsum plaster              | 0.01 / 0.38 = 0.026 |
| Internal surface film resistance | Ri = 0.12           |
| Total                            | 0.282               |

$$U_{w1} = \frac{1}{0.282} = 3.55 \text{ W/m}^2\text{K}$$

S-W2

Description: S-W2

| Wall Material                    |                     |
|----------------------------------|---------------------|
| external surface film            | Ro = 0.044          |
| Air space resistance             | Ra = 0              |
| 5mm aluminium cladding           | 0.005 / 160 = 0.000 |
| 10mm cement/ sand render         | 0.01 / 0.72 = 0.014 |
| 600mm concrete column            | 0.6 / 2.16 = 0.278  |
| 10mm gypsum plaster              | 0.01 / 0.38 = 0.026 |
| Internal surface film resistance | Ri = 0.12           |
| Total                            | 0.482               |

$$U_{w2} = \frac{1}{0.482} = 2.07 \text{ W/m}^2\text{K}$$

# Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014 Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade

Sheet No. 12 BD Ref No. \_\_\_\_\_

Building Address Residential & Commercial Development at 5-17 Western Street, Sai Ying Pun, Hong Kong

Facade Orientation Facing South Elevations Gross Wall Area (Ao) = 288.18

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                     | S-W2                     |  |
| External Finish Material                                     |       | 5mm mosaic tiles         | 5mm caldding             |  |
| Conductivity                                                 | W/mK  | 1.50                     | 160.00                   |  |
| Thickness                                                    | m     | 0.012                    | 0.005                    |  |
| Average Absorptivity                                         | (α)   | 0.90                     | 0.90                     |  |
| Intermediate component                                       |       | 10mm cement/ sand render | 10mm cement/ sand render |  |
| Conductivity                                                 | W/mK  | 0.72                     | 0.72                     |  |
| Thickness                                                    | m     | 0.01                     | 0.01                     |  |
| Intermediate component                                       |       |                          |                          |  |
| Conductivity                                                 | W/mK  |                          |                          |  |
| Thickness                                                    | m     |                          |                          |  |
| Intermediate component                                       |       |                          |                          |  |
| Conductivity                                                 | W/mK  |                          |                          |  |
| Thickness                                                    | m     |                          |                          |  |
| Intermediate component                                       |       | 150mm concrete wall      | 150mm concrete wall      |  |
| Conductivity                                                 | W/mK  | 2.16                     | 2.16                     |  |
| Thickness                                                    | m     | 0.15                     | 0.01                     |  |
| Internal Finish Material                                     |       | 10mm gypsum plaster      | 10mm gypsum plaster      |  |
| Conductivity                                                 | W/mK  | 0.38                     | 0.38                     |  |
| Thickness                                                    | m     | 0.01                     | 0.01                     |  |
| U-value of Opaque Area (Uwi)                                 | W/m²K | 3.55                     | 4.77                     |  |
| Opaque Wall Area (Aw)                                        | m²    | 288.18                   | 0.00                     |  |
| Heat Conduction = 3.57(Awi/Ao) Uwi awi Gw                    |       | 11.12                    | 0.00                     |  |

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

$$= \underline{11.12} \quad \text{W/m}^2$$

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

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

$$= \underline{0.00}$$

| Part 3 - Calculation of Solar Radiation through Glazing |       |          |
|---------------------------------------------------------|-------|----------|
| Components / Details                                    |       | Code No. |
| Description                                             | Units |          |
| Glazing Type                                            |       |          |
| Thickness                                               | m     |          |
| Glazing Area (Afi)                                      | m²    |          |
| Shading Coefficient of Glazing (SCf)                    |       |          |
| Visible Light Transmittance (VLT)                       | %     |          |
| External Reflectance (ER)                               |       |          |
| External Shading Multiplier (ESC)                       |       |          |
| Solar Radiation = 41.75 (Afi/Ao)(SCf)(ESCwi)Gw          |       |          |

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

$$= \underline{0.00} \quad \text{W/m}^2$$

Summary of RTTV at North Elevations

$$= 11.12 \quad + \quad 0.00 \quad + \quad 0.00$$

$$= \underline{11.12} \quad \text{W/m}^2$$



West Elevations

|                                                                                |                                                  |                  |   |           |
|--------------------------------------------------------------------------------|--------------------------------------------------|------------------|---|-----------|
| Gross Wall Areas<br>(Opaque Walls + Glazing Areas) (Ao) at                     |                                                  | West Elevations  | = | 430.99 m² |
| Glazing Areas at                                                               | West Elevations                                  |                  | = | 51.35 m²  |
| <b>Breakdown of Glazing Areas</b>                                              |                                                  |                  |   |           |
| Glazing Areas                                                                  | Unshaded                                         | ( W-GL7 )        | = | 0.00 m²   |
| Glazing Areas                                                                  | Shaded by U.P.                                   | ( W-GL7-1 )      | = | 37.68 m²  |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys             |                                                  |                  |   |           |
| 3/F, 5/F - 12/F, 15/F, 17/F - 23/F, 25/F (U.P.) ( 0.79 )x 2.65 x 18 = 37.68 m² |                                                  |                  |   |           |
| OPF = 0.83 / 3.00 = 0.28 ECS = 0.834                                           |                                                  |                  |   |           |
| Glazing Areas                                                                  | Shaded by U.P.                                   | ( W-GL7-2 )      | = | 2.37 m²   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys             |                                                  |                  |   |           |
| 26/F (U.P.) ( 0.79 )x 3.00 x 1 = 2.37 m²                                       |                                                  |                  |   |           |
| OPF = 0.83 / 3.35 = 0.25 ECS1 = 0.834                                          |                                                  |                  |   |           |
| Glazing Areas                                                                  | Shaded by U.P. & Built-Fin (Projection on Right) | ( W-GL7-3 )      | = | 8.93 m²   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys             |                                                  |                  |   |           |
| 27/F - 30/F (U.P.) ( 0.79 )x 2.83 x 4 = 8.93 m²                                |                                                  |                  |   |           |
| OPF = 0.83 / 3.18 = 0.26 ECS1 = 0.806                                          |                                                  |                  |   |           |
| Glazing Areas                                                                  | Shaded by U.P. & Built-Fin (Projection on Right) | ( W-GL7-4 )      | = | 2.37 m²   |
| Glazing Area = Length of Glazing x Glazing Height x No. of Storeys             |                                                  |                  |   |           |
| 31/F (U.P.) ( 0.79 )x 3.00 x 1 = 2.37 m²                                       |                                                  |                  |   |           |
| OPF = 0.83 / 3.35 = 0.25 ECS1 = 0.834                                          |                                                  |                  |   |           |
| Opaque Wall Areas at                                                           |                                                  | Glazing Areas at | = | 379.64 m² |
| <b>Breakdown of Opaque Wall Areas</b>                                          |                                                  |                  |   |           |
| RC Wall Areas                                                                  |                                                  | ( W-W1 )         | = | 378.86 m² |
| Aluminium Cladding                                                             |                                                  | ( W-W2 )         | = | 0.78 m²   |
| Window to Wall Ratio (WWR)                                                     |                                                  |                  |   |           |
| = 51.35 / 430.99 = 0.12                                                        |                                                  |                  |   |           |

Sheet no. 13

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

Average Absorptivity (α) of the External Opaque Wall at 0

| External Wall Material (Colour/Finish) | % of wall/roof area | α Absorptivity (Refer to |
|----------------------------------------|---------------------|--------------------------|
| Dark Grey                              | 91%                 | 0.9                      |
| Light Grey                             | 9%                  | 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: | W-W1       |
|----------------------------------|--|--------------|------------|
| Wall Material                    |  |              |            |
| External surface film resistance |  | Ro           | = 0.044    |
| Air space resistance             |  | Ra           | = 0        |
| 12mm mosaic tiles                |  | 0.012 / 1.5  | = 0.008    |
| 10mm cement/ sand render         |  | 0.01 / 0.72  | = 0.014    |
| 150mm concrete wall              |  | 0.15 / 2.16  | = 0.069    |
| 10mm gypsum plaster              |  | 0.01 / 0.38  | = 0.026    |
| Internal surface film resistance |  | Ri           | = 0.12     |
| Total                            |  |              | 0.282      |
| Uw1 = $\frac{1}{0.282}$ =        |  |              | 3.55 W/m²K |

| W-W2                             |  | Description: | W-W2       |
|----------------------------------|--|--------------|------------|
| Wall Material                    |  |              |            |
| external surface film            |  | Ro           | = 0.044    |
| Air space resistance             |  | Ra           | = 0        |
| 5mm aluminium cladding           |  | 0.005 / 160  | = 0.000    |
| 10mm cement/ sand render         |  | 0.01 / 0.72  | = 0.014    |
| 600mm concrete column            |  | 0.6 / 2.16   | = 0.278    |
| 10mm gypsum plaster              |  | 0.01 / 0.38  | = 0.026    |
| Internal surface film resistance |  | Ri           | = 0.12     |
| Total                            |  |              | 0.482      |
| Uw2 = $\frac{1}{0.482}$ =        |  |              | 2.07 W/m²K |

**Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014**  
**Form RTTV (Wall) 1 - Calculation of RTTV<sub>wall</sub> of Each Facade**

Sheet No. 14 BD Ref No. \_\_\_\_\_  
Building Address Residential & Commercial Development at 5-17 Western Street, Sai Ying Pun, Hong Kong

Facade Orientation Facing West Elevations Gross Wall Area (Ao) = 430.99  
Window to Wall Ratio (WWR) 0.12 Wall Orientation Factor (Gw) = 1.131

| Part 1 - Calculation of Heat Conduction through Opaque Walls |       |                          |                          |  |
|--------------------------------------------------------------|-------|--------------------------|--------------------------|--|
| Components / Details                                         |       | Code No.                 |                          |  |
| Description                                                  | Units | W-W1                     | W-W2                     |  |
| External Finish Material                                     |       | 5mm mosaic tiles         | 5mm caldding             |  |
| Conductivity                                                 | W/mK  | 1.50                     | 160.00                   |  |
| Thickness                                                    | m     | 0.012                    | 0.005                    |  |
| Average Absorptivity                                         | (α)   | 0.90                     | 0.90                     |  |
| Intermediate component                                       |       | 10mm cement/ sand render | 10mm cement/ sand render |  |
| Conductivity                                                 | W/mK  | 0.72                     | 0.72                     |  |
| Thickness                                                    | m     | 0.01                     | 0.01                     |  |
| Intermediate component                                       |       |                          |                          |  |
| Conductivity                                                 | W/mK  |                          |                          |  |
| Thickness                                                    | m     |                          |                          |  |
| Intermediate component                                       |       |                          |                          |  |
| Conductivity                                                 | W/mK  |                          |                          |  |
| Thickness                                                    | m     |                          |                          |  |
| Intermediate component                                       |       | 150mm concrete wall      | 150mm concrete wall      |  |
| Conductivity                                                 | W/mK  | 2.16                     | 2.16                     |  |
| Thickness                                                    | m     | 0.15                     | 0.01                     |  |
| Internal Finish Material                                     |       | 10mm gypsum plaster      | 10mm gypsum plaster      |  |
| Conductivity                                                 | W/mK  | 0.38                     | 0.38                     |  |
| Thickness                                                    | m     | 0.01                     | 0.01                     |  |
| U-value of Opaque Area (Uwi)                                 | W/m²K | 3.55                     | 4.77                     |  |
| Opaque Wall Area (Aw)                                        | m²    | 378.86                   | 0.78                     |  |
| Heat Conduction = 3.57(Awi/Ao) Uwi awi Gw                    |       | 11.34                    | 0.03                     |  |

Heat Conduction through Opaque Walls = 3.57(Awi/Ao) Uwi awi Gw where i= 1, 2, ..., n  
= 11.37 W/m²

| Part 2 - Calculation of Heat Conduction through Glazing |       |          |         |         |         |         |  |
|---------------------------------------------------------|-------|----------|---------|---------|---------|---------|--|
| Components / Details                                    |       | Code No. |         |         |         |         |  |
| Description                                             | Units | W-GL7    | W-GL7-1 | W-GL7-2 | W-GL7-3 | W-GL7-4 |  |
| Glazing Type                                            |       | IGU      | IGU     | IGU     | IGU     | IGU     |  |
| Thickness                                               | m     | 0.028    | 0.028   | 0.028   | 0.028   | 0.028   |  |
| Glazing Area (Afi)                                      | m²    | 0.00     | 37.68   | 2.37    | 8.93    | 2.37    |  |
| U-value of Glazing (Ufi)                                | W/m²K | 1.35     | 1.35    | 1.35    | 1.35    | 1.35    |  |
| Heat Conduction = 0.64 (Afi/Ao) Ufi Gw                  |       | 0.000    | 0.085   | 0.005   | 0.020   | 0.005   |  |

Heat Conduction through Glazing = 0.64 (Afi/Ao) Ufi Gw where i= 1, 2, ..., n  
= 0.12

| Part 3 - Calculation of Solar Radiation through Glazing |       |          |         |         |         |         |  |
|---------------------------------------------------------|-------|----------|---------|---------|---------|---------|--|
| Components / Details                                    |       | Code No. |         |         |         |         |  |
| Description                                             | Units | W-GL7    | W-GL7-1 | W-GL7-2 | W-GL7-3 | W-GL7-4 |  |
| Glazing Type                                            |       | IGU      | IGU     | IGU     | IGU     | IGU     |  |
| Thickness                                               | m     | 0.028    | 0.028   | 0.028   | 0.028   | 0.028   |  |
| Glazing Area (Afi)                                      | m²    | 0.00     | 37.68   | 2.37    | 8.93    | 2.37    |  |
| Shading Coefficient of Glazing (SCf)                    |       | 0.31     | 0.31    | 0.31    | 0.31    | 0.31    |  |
| Visible Light Transmittance (VLT)                       | %     | 51.00    | 51.00   | 51.00   | 51.00   | 51.00   |  |
| External Reflectance (ER)                               |       | 19.00    | 19.00   | 19.00   | 19.00   | 19.00   |  |
| External Shading Multiplier (ESC)                       |       | 1.00     | 0.83    | 0.83    | 0.81    | 0.83    |  |
| Solar Radiation = 41.75 (Afi/Ao)(SCf)(ESCwi)Gw          |       | 0.00     | 1.07    | 0.07    | 0.24    | 0.07    |  |

Solar Radiation through Glazing = 41.75 (Afi/Ao)(SCf)(ESCwi)Gw where i= 1, 2, ..., n  
= 1.45 W/m²

Summary of RTTV at North Elevations  
= 11.37 + 0.12 + 1.45  
= 12.94 W/m²

Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014  
Form RTTV (Wall) 2 - Summary of Overall RTTV<sub>wall</sub> of Building

Sheet No. 15 BD Ref No.  
Building Address Residential & Commercial Development at 5-17 Western Street, Sai Ying Pun, Hong Kong

Overall Gross Wall Area [a] 2655.95 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]                    |
| North                     | 625.46          | 4.70                                 | 0.34                            | 5.20                            | 10.24                               | 2.41                               |
| East                      | 1311.32         | 5.09                                 | 0.46                            | 6.17                            | 11.73                               | 5.79                               |
| South                     | 288.18          | 11.12                                | 0.00                            | 0.00                            | 11.12                               | 1.21                               |
| West                      | 430.99          | 11.37                                | 0.12                            | 1.45                            | 12.94                               | 2.10                               |
|                           |                 |                                      |                                 |                                 |                                     |                                    |
|                           |                 |                                      |                                 |                                 |                                     |                                    |
|                           |                 |                                      |                                 |                                 |                                     |                                    |
|                           |                 |                                      |                                 |                                 |                                     |                                    |
|                           |                 |                                      |                                 |                                 |                                     |                                    |

Overall RTTV<sub>wall</sub> = 11.51 W/m²

## Roof

Sheet no. 16

Gross Roof Areas  
(Opaque Walls + Skylight Areas) (Aro) at Roof = 67.27 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<br>(Refer to Table 5) |
|----------------------------------------|----------------|--------------------------------------|
| Dark Grey                              | 100%           | 0.9                                  |
|                                        |                |                                      |
|                                        |                |                                      |

Average Absorptivity = 0.9

### 'U' value of Opaque Roof Areas

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

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)

Opaque Areas at Roof = 67.27 m<sup>2</sup>

### Breakdown of Opaque Roof Areas

RC Roof Areas ( R1 ) = 67.27 m<sup>2</sup>

Roof 67.27 = 67.27 m<sup>2</sup>

Green Roof Areas ( R2 ) = 0.00 m<sup>2</sup>

Green roof 0 = 0 m<sup>2</sup>

| R1                               | Description: | Roof Area |
|----------------------------------|--------------|-----------|
| Roof Material                    |              |           |
| External surface film resistance | Ro =         | 0.055     |
| Air space resistance             | Ra =         | 0         |
| 25mm concrete 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   |
| 125mm concrete slab              | 0.125 / 2.16 | = 0.058   |
| 10mm gypsum plaster              | 0.01 / 0.38  | = 0.026   |
| Internal surface film resistance | Ri =         | 0.162     |
| Total                            |              | 1.864     |

$$Uw1 = \frac{1}{1.864} = 0.54 \text{ W/m}^2\text{K}$$

| R2            | Description: | Green roof  |
|---------------|--------------|-------------|
| Roof Material |              |             |
| Grass roof    | 1 / 2.75     | = 0.3636364 |
|               |              |             |
|               |              |             |
| Total         |              | 0.364       |

$$Uw2 = \frac{1}{0.364} = 2.75 \text{ W/m}^2\text{K}$$

**Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014**  
**Form RTTV (Roof) 1 - Calculation of RTTV<sub>roof</sub>**

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 Building Address Residential & Commercial Development at 5-17 Western Street, Sai Ying Pun, Hong Kong

Roof Orientation Facing Flat Gross Roof Area (A<sub>ro</sub>) = 67.27  
 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 concrete tiles       | Grass roof |  |
| Conductivity                                                                                             | W/mK  | 1.10                      | 2.75       |  |
| Thickness                                                                                                | m     | 0.025                     | 1.000      |  |
| Average Absorptivity                                                                                     | (α)   | 0.9                       | 0.2        |  |
| Intermediate component                                                                                   |       | 50mm cement/ sand screed  |            |  |
| Conductivity                                                                                             | W/mK  | 0.72                      |            |  |
| Thickness                                                                                                | m     | 0.050                     |            |  |
| Intermediate component                                                                                   |       | 50mm expanded polystyrene |            |  |
| Conductivity                                                                                             | W/mK  | 0.034                     |            |  |
| Thickness                                                                                                | m     | 0.05                      |            |  |
| Intermediate component                                                                                   |       | 125mm concrete slab       |            |  |
| Conductivity                                                                                             | W/mK  | 2.16                      |            |  |
| Thickness                                                                                                | m     | 0.13                      |            |  |
| Intermediate component                                                                                   |       |                           |            |  |
| Conductivity                                                                                             | W/mK  |                           |            |  |
| Thickness                                                                                                | m     |                           |            |  |
| Internal Finish Material                                                                                 |       | 10mm gypsum plaster       |            |  |
| Conductivity                                                                                             | W/mK  | 0.38                      |            |  |
| Thickness                                                                                                | m     | 0.01                      |            |  |
| U-value of the Roof (U <sub>ri</sub> )                                                                   | W/m²K | 0.54                      | 2.75       |  |
| Opaque Roof Area (A <sub>ri</sub> )                                                                      | m²    | 67.27                     | 0.00       |  |
| Heat Conduction = 3.47(A <sub>ri</sub> /A <sub>ro</sub> ) U <sub>ri</sub> a <sub>ri</sub> G <sub>s</sub> |       | 3.62                      | 0.00       |  |

Heat Conduction through Opaque Roof = 3.47(A<sub>ri</sub>/A<sub>ro</sub>) U<sub>ri</sub> a<sub>ri</sub> G<sub>s</sub> where i= 1, 2, ..., n  
 = 3.62 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>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> ) 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  
 = 3.62 + 0.00 + 0.00  
 = 3.62 W/m²

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

Sheet No.

18

BD Ref No.

Building Address

Residential & Commercial Development at 5-17 Western Street, Sai Ying Pun, Hong Kong

Overall Roof Area [a]

67.27 m<sup>2</sup>

| 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> |
|-----------|-------------------|-------------------------------------|----------------------------------|----------------------------------|-------------------------------------------|------------------------------------|
|           | (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]                    |
| Flat Roof | 67.27             | 3.62                                | 0.00                             | 0.00                             | 3.62                                      | 3.62                               |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |
|           |                   |                                     |                                  |                                  |                                           |                                    |

Overall RTTV<sub>roof</sub> =

3.62

W/m<sup>2</sup>

<

4

W/m<sup>2</sup>