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1995 年

樓宇的總熱傳送值守則

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香港

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香港  
建築事務監督

**1995 年 4 月**

## 前 言

政府在 1991 年委託顧問公司進行的一項研究發現，如果樓宇外殼在建造上具有適當的總熱傳送值，便可減少樓宇在空調方面的電力需求，從而減少在發電時排出的溫室氣體。由於政府的目標是制訂一套全面的樓宇能源守則，以管制樓宇的能源總消耗量，而管制總熱傳送值將會是其中的一環，故此作為管制的第一步，政府在《建築物(能源效率)規例》(第 123 章附屬法例)中引入了對總熱傳送值的立法管制。

本守則為認可人士、註冊結構工程師及其他負責設計和建造樓宇的人士提供技術指引。凡已符合本守則的規定，可當作為已符合《建築物(能源效率)規例》中對樓宇須具有的適當總熱傳送值所訂的要求。

本守則將會定期予以檢討。建築事務監督歡迎大家提出建議，俾能改善本守則的不足之處或在整體上提升樓宇的能源效率。

除本守則所述的方法外，還有其他能達致同等或更佳能源效能標準的方法可供選擇。當局必然會獨立考慮又或合併考慮這些方法，以確定這些方法是否可以接受。

## 目 錄

| 段數                      | 頁次 |
|-------------------------|----|
| 1. 有關管制總熱傳送值的總則.....    | 1  |
| 2. 定義.....              | 2  |
| 3. 適當的總熱傳送值.....        | 3  |
| 4. 訂定總熱傳送值計算資料的原則.....  | 4  |
| 5. 外牆的總熱傳送值.....        | 5  |
| 6. 屋頂的總熱傳送值.....        | 6  |
| 7. 計算總熱傳送值的組件系數及參數..... | 7  |
| 8. 門窗.....              | 18 |
| 9. 提交資料.....            | 18 |

附表一 標準表格

附錄一 標準商業樓宇的總熱傳送值計算資料樣本

## 1. **General Principles of Control of Overall Thermal Transfer Value**

1.1 For the design and planning of energy - efficient buildings, Government is developing a comprehensive energy code to cover inter alia lighting and air-conditioning. Overall thermal transfer value (OTTV) is one aspect of energy conservation.

### **General approach**

1.2 An OTTV is a measure of the energy consumption of a building envelope. Its formulation allows authorized persons, registered structural engineers and other persons responsible for the design and construction of buildings freedom to innovate and vary important envelope components such as type of glazing, window size, external shading to windows, wall colour and wall type to meet the maximum OTTV criteria. Any measure to improve energy efficiency or to save energy should be considered in planning a building.

1.3 Siting a building to avoid extensive glazed facades with a southerly aspect or introducing shades to window areas can reduce solar heat gain. Appropriate choice of windows with a low thermal transmittance characteristic will also minimize solar heat transmission.

1.4 Artificial lighting consumes electricity and creates heat. This increases the cooling load of a building and in turn increases energy consumption. Consequently, when determining the size and location of windows as well as choice of glass in the envelope of a building, efforts should be made to provide as much natural lighting into the building as possible. For example, with glazing, the visible lighting transmittance should be acknowledged in addition to its thermal transmittance properties; daylight can supplement artificial lighting and consequently reduce the cooling load.

1.5 Other measures include more extensive use of energy-efficient building services equipment and appliances, e.g. energy-saving lamps, low-loss luminaries and high-efficiency air-conditioning and more sophisticated building services control systems.

## **Scope**

1.6 The provisions in this Code apply to all hotels and commercial buildings as defined in the Building (Energy Efficiency) Regulation. They aim at reducing heat transfer through the building envelope and thus the electricity required for air-conditioning.

1.7 The concept of OTTV is based on the assumption that the envelope of a building is completely enclosed.

1.8 In the OTTV formulation, the following factors are not addressed or allowed for :

- (a) Internal shading devices, such as draperies and blinds.
- (b) Solar reflection or shading from adjacent buildings.

## **2. Definitions**

In this Code, unless otherwise stated, words and expressions have the meaning attributed to them by the Building (Energy Efficiency) Regulation. It should also be noted that :

"building tower" means that part of a building above the podium of the building;

"fenestration" means any glazed aperture in the building envelope;

"lightwell" means a vertical shaft of open air enclosed on all sides by parts of a building;

"opaque" wall or roof means that solid part of the wall or roof which is not part of the fenestration;

"podium" means that part of a building which,

- (a) if having a site coverage exceeding the permitted percentage site coverage, is -
  - (i) within 15 m above ground level as permitted under Building (Planning) Regulation 20(3); or
  - (ii) within such height as is permitted by the Building Authority by way of a modification of that regulation granted under section 42 of the Buildings Ordinance; and
- (b) if having a site coverage within the permitted percentage site coverage, is within 15 m above ground level.

"refuge floor" has the meaning assigned to it in the Code of Practice for Means of Escape and means a protected floor that serves as a refuge for the occupants of the building to assemble in case of fire.

### 3. **Suitable OTTV**

3.1 The external walls and roofs of a building to which the Building (Energy Efficiency) Regulation applies should be designed and constructed to have the following OTTV :

- (a) in the case of a building tower; the OTTV should not exceed 35 W/m<sup>2</sup>; and
- (b) in the case of a podium; the OTTV should not exceed 80 W/m<sup>2</sup>.

3.2 The maximum OTTV specified in paragraph 3.1 should apply to the overall building envelope, i.e. all the external walls and roofs, as the case may be, in average and do not apply to the individual wall or roof.



3.3 The OTTV of the external walls and roofs of a building tower or podium should be assessed in accordance with methods set out in this Code. A sample of OTTV calculations for a typical commercial building is set out in Appendix for illustration.

#### 4. Principles of OTTV Calculations

##### **External walls and roofs not included in OTTV calculations**

4.1 All external walls and roofs of a building should be included in OTTV calculations except -

- (a) an external wall of a refuge floor;
- (b) an external wall or roof of a carparking floor;
- (c) an external wall of a lightwell having an area on plan not exceeding 21 m<sup>2</sup>; and
- (d) any wall on any roof.

##### **Party wall**

4.2 An external wall of a building which is a party wall should be included in OTTV calculations whether an adjoining building exists or not. Shading to the party wall from adjoining buildings should not be considered in calculating the OTTV.

## 5. OTTV of External Walls

The OTTV of the external walls of a building tower or a podium,  $OTTV_w$ , should be calculated using the following formula -

$$OTTV_w = \frac{(A_w \times U \times \alpha \times TDEQ_w) + (A_{f_w} \times SC \times ESM \times SF)}{Ao_w}$$

where

- $A_w$  = Area of opaque wall,  $m^2$
- $U$  = Thermal transmittance of opaque wall,  $W/m^2\text{°C}$  (See para 7.1)
- $\alpha$  = Absorptivity of the opaque wall (Table 4)
- $TDEQ_w$  = Equivalent temperature difference for wall,  $\text{°C}$  (Table 5)
- $A_{f_w}$  = Area of fenestration in wall,  $m^2$
- $SC$  = Shading coefficient of fenestration in wall (See para 7.5)
- $ESM$  = External shading multiplier (Table 6 and 7)
- $SF$  = Solar factor for the vertical surface,  $W/m^2$  (Table 8)
- $Ao_w$  = Gross area of external walls, i.e.  $A_w + A_{f_w}$ ,  $m^2$

## 6. OTTV of Roofs

The OTTV of the roofs of a building tower or a podium,  $OTTV_r$ , should be calculated using the following formula :-

$$OTTV_r = \frac{(A_r \times U \times \alpha \times TDEQ_r) + (A_{f_r} \times SC \times SF)}{Ao_r}$$

Where

- $A_r$  = Area of opaque roof,  $m^2$
- $U$  = Thermal transmittance of opaque roof,  $W/m^2\text{°C}$  (See para 7.1)
- $\alpha$  = Absorptivity of the opaque roof (Table 4)
- $TDEQ_r$  = Equivalent temperature difference for roof,  $\text{°C}$  (Table 9)
- $A_{f_r}$  = Area of fenestration in roof,  $m^2$
- $SC$  = Shading coefficient of fenestration in roof (See para 7.5)
- $SF$  = Solar factor for horizontal surface,  $W/m^2$  (Table 8)
- $Ao_r$  = Gross area of roof, i.e.  $A_r + A_{f_r}$ ,  $m^2$

7. **Calculation of Component Coefficients and Parameters of OTTV**

**Thermal transmittance of opaque construction (U)**

7.1 Opaque walls and roofs usually involve a composite of materials. The thermal transmittance of an opaque wall or roof should be derived by the following formula :

$$U = \frac{1}{R_i + \frac{x_1}{k_1} + \frac{x_2}{k_2} + \dots + \frac{x_n}{k_n} + R_a + R_o}$$

x = Thickness of building material of the wall or roof or part thereof, m

k = Thermal conductivity of the building material, W/m°C  
(Table 1)

R<sub>i</sub> = Surface film resistance of internal surface of the wall or roof, m<sup>2</sup>C/W  
(Table 2)

R<sub>o</sub> = Surface film resistance of external surface of the wall or roof, m<sup>2</sup>C/W  
(Table 2)

R<sub>a</sub> = Air space resistance, m<sup>2</sup>C/W (Table 3)

**Component coefficients and parameters of thermal transmittance**

7.2 The component coefficients and parameters used in calculating the thermal transmittance of opaque construction should be assessed as follows :

- (a) Thermal conductivity of building materials (k)

The thermal conductivity of the building materials of walls and roofs should be obtained from Table 1.

**Table 1 Thermal Conductivity of Building Materials**

| Material                      | Density<br>kg/m <sup>3</sup> | Thermal<br>Conductivity (k)<br>W/m°C |
|-------------------------------|------------------------------|--------------------------------------|
| Asphalt, mastic with 20% grit | 2350                         | 1.15                                 |
| Boards                        |                              |                                      |
| a) cork                       | 145                          | 0.042                                |
| b) hardboard high density     | 1010                         | 0.144                                |
| c) mineral fibre              | 265                          | 0.053                                |
| d) plasterboard               | 950                          | 0.16                                 |
| Brick (common)                | 1900                         | 0.95                                 |
| Concrete                      |                              |                                      |
| a) normal weight aggregate    | 2400                         | 2.16                                 |
| b) lightweight aggregate      | 1300                         | 0.44                                 |
| c) flat roof tiles or slabs   | 2100                         | 1.10                                 |
| Glass                         | 2500                         | 1.05                                 |
| Mosaic tile cladding          | 2500                         | 1.50                                 |
| Insulating materials          |                              |                                      |
| a) glass fibre mat or quilt   | 32                           | 0.035                                |
| b) mineral wool felt          | 50                           | 0.039                                |
| c) polystyrene expanded       | 25                           | 0.034                                |
| d) polyurethane foam          | 30                           | 0.026                                |
| Metals                        |                              |                                      |
| a) aluminium alloy typical    | 2800                         | 160                                  |
| b) copper commercial          | 8900                         | 200                                  |
| c) steel, carbon              | 7800                         | 50                                   |
| Plaster/render                |                              |                                      |
| a) gypsum                     | 1120                         | 0.38                                 |
| b) gypsum, sand aggregate     | 1570                         | 0.53                                 |
| c) cement/sand                | 1860                         | 0.72                                 |
| Screeding                     |                              |                                      |
| a) cement sand                | 1860                         | 0.72                                 |
| b) terrazzo                   | 2435                         | 1.59                                 |
| Stone                         |                              |                                      |
| a) granite                    | 2650                         | 2.9                                  |
| b) marble                     | 2500                         | 2.0                                  |

Note :

If other materials are used the thermal conductivity values should be subject to the acceptance of the Building Authority and the source of the information from which the thermal conductivity values are obtained should be submitted for his consideration for this purpose.

(b) Surface film resistance for walls and roofs ( $R_i$ ,  $R_o$ )

The surface film resistance for walls and roofs should be obtained from Table 2.

**Table 2 Surface Film Resistance for Walls and Roofs**

| Type of surface                        | Surface film resistance<br>$m^2\text{C/W}$ |
|--|--|
| Surface film resistance for walls      |  |
| 1. Internal surface ( $R_i$ )          |  |
| (a) Absorptivity (0.5 and above)       | 0.120                                      |
| (b) Absorptivity (below 0.5)           | 0.299                                      |
| 2. External surface ( $R_o$ )          | 0.044                                      |
| Surface film resistance for roofs      |  |
| 1. Internal surface ( $R_i$ )          |  |
| (a) Absorptivity (0.5 and above)       |  |
| (i) Flat roof                          | 0.162                                      |
| (ii) Sloped roof $22\frac{1}{2}^\circ$ | 0.148                                      |
| (iii) Sloped roof $45^\circ$           | 0.133                                      |
| (b) Absorptivity (below 0.5)           |  |
| (i) Flat roof                          | 0.801                                      |
| (ii) Sloped roof $22\frac{1}{2}^\circ$ | 0.595                                      |
| (iii) Sloped roof $45^\circ$           | 0.391                                      |
| 2. External surface ( $R_o$ )          | 0.055                                      |

(c) Air space resistance for walls and roofs ( $R_a$ )

The air space resistance for walls and roofs should be obtained from Table 3.

**Table 3 Air Space Resistance for Walls and Roofs**

| Type of air space                                     | Air space resistance ( $R_a$ ) $m^2\text{°C/W}$ |       |       |       |       |        |
|---|---|-------|-------|-------|-------|--------|
|   | 5 mm  | 10 mm | 20 mm | 50 mm | 75 mm | 100 mm |
| Air space resistance for walls                        |   |       |       |       |       |        |
| Vertical air space (heat flows horizontally)          |   |       |       |       |       |        |
| (a) Absorptivity (0.5 and above)                      | 0.110   | 0.123 | 0.148 | 0.153 | 0.156 | 0.160  |
| (b) Absorptivity (below 0.5)                          | 0.250   | 0.359 | 0.578 | 0.589 | 0.597 | 0.606  |
| Air space resistance for roofs                        |   |       |       |       |       |        |
| Horizontal or sloping air space (heat flows downward) |   |       |       |       |       |        |
| (a) Absorptivity (0.5 and above)                      |   |       |       |       |       |        |
| (i) horizontal air space                              | 0.110   | 0.123 | 0.148 | 0.158 | 0.166 | 0.174  |
| (ii) sloped air space $22\frac{1}{2}^\circ$           | 0.110   | 0.123 | 0.148 | 0.154 | 0.160 | 0.165  |
| (iii) sloped air space $45^\circ$                     | 0.110   | 0.123 | 0.148 | 0.152 | 0.155 | 0.158  |
| (b) Absorptivity (below 0.5)                          |   |       |       |       |       |        |
| (i) horizontal air space                              | 0.250   | 0.357 | 0.572 | 0.891 | 1.157 | 1.423  |
| (ii) sloped air space $22\frac{1}{2}^\circ$           | 0.250   | 0.357 | 0.571 | 0.768 | 0.931 | 1.095  |
| (iii) sloped air space $45^\circ$                     | 0.250   | 0.357 | 0.570 | 0.644 | 0.706 | 0.768  |

**Absorptivity ( $\alpha$ )**

7.3 Energy simulation studies for Hong Kong have shown that the external surface and colour of walls and roofs, and therefore their absorptivity, have a significant effect on chiller energy used. This should be included in the heat gain calculation as a multiplication constant to the equivalent temperature difference. The absorptivity for wall and roof surfaces should be obtained from Table 4.

**Table 4 Absorptivity for wall and roof surfaces**

| Material                           | Absorptivity<br>$\alpha$ | Paint                                | Absorptivity<br>$\alpha$ |
|------------------------------------|--------------------------|--------------------------------------|--------------------------|
| Black glass                        | 1.0                      | Optical flat black paint             | 0.98                     |
| Black concrete                     | 0.91                     | Flat black paint                     | 0.95                     |
| Stafford blue brick                | 0.89                     | Black lacquer                        | 0.92                     |
| Red brick                          | 0.88                     | Dark grey paint                      | 0.91                     |
| Bituminous felt                    | 0.88                     | Dark blue lacquer                    | 0.91                     |
| Blue grey slate                    | 0.87                     | Black oil paint                      | 0.90                     |
| Roofing, green                     | 0.86                     | Dark olive drab paint                | 0.89                     |
| Brown concrete                     | 0.85                     | Azure blue or dark green lacquer     | 0.88                     |
| Asphalt pavement, weathered        | 0.82                     | Dark brown paint                     | 0.88                     |
| Wood, smooth                       | 0.78                     | Dark blue-grey paint                 | 0.88                     |
| Uncoloured concrete                | 0.65                     | Medium brown paint                   | 0.84                     |
| White marble                       | 0.58                     | Medium light brown paint             | 0.80                     |
| White mosaic tiles                 | 0.58                     | Brown or green lacquer               | 0.79                     |
| Light buff brick                   | 0.55                     | Medium rust paint                    | 0.78                     |
| Built-up roof, white               | 0.50                     | Light grey oil paint                 | 0.75                     |
| Bituminous felt, aluminized        | 0.40                     | Red oil paint                        | 0.74                     |
| Gravel                             | 0.29                     | Medium dull green paint              | 0.59                     |
| White on galvanized iron           | 0.26                     | Medium orange paint                  | 0.58                     |
| White glazed brick                 | 0.25                     | Medium yellow paint                  | 0.57                     |
| Polished aluminium reflector sheet | 0.12                     | Medium blue paint                    | 0.51                     |
| Aluminized mylar film              | 0.10                     | Medium kelly green paint             | 0.51                     |
| Tinned surface                     | 0.05                     | Light green paint                    | 0.47                     |
|                                    |                          | Aluminium paint                      | 0.40                     |
|                                    |                          | White semi-gloss paint               | 0.30                     |
|                                    |                          | White gloss paint                    | 0.25                     |
|                                    |                          | Silver paint                         | 0.25                     |
|                                    |                          | White lacquer                        | 0.21                     |
|                                    |                          | Laboratory vapour deposited coatings | 0.02                     |

Note :

Absorptivity for other materials or surfaces should be subject to the acceptance of the Building Authority and the source of the information from which the absorptivity values are obtained should be submitted for his consideration.

**Equivalent temperature difference for walls (TDEQ<sub>w</sub>)**

7.4 Energy simulation studies for Hong Kong have indicated that thermal mass affects the total heat flow through walls sufficiently to warrant its inclusion in the formulation of an OTTV. The equivalent temperature difference for walls should take into account the wall mass, density and orientation. Heavyweight construction gives a better performance than lightweight construction because it resists the passage of heat. The equivalent temperature difference for walls should be obtained from Table 5.

**Table 5 Equivalent Temperature Difference for Walls**

| Orientation | Density of wall construction      |                             |                              |                              |                                     |
|-------------|-----------------------------------|-----------------------------|------------------------------|------------------------------|-------------------------------------|
|             | less than<br>22 kg/m <sup>2</sup> | 23-199<br>kg/m <sup>2</sup> | 200-379<br>kg/m <sup>2</sup> | 380-569<br>kg/m <sup>2</sup> | 570 kg/m <sup>2</sup><br>or greater |
| N           | 3.70                              | 3.38                        | 2.72                         | 2.05                         | 1.70                                |
| NNE         | 4.65                              | 4.21                        | 3.30                         | 2.36                         | 1.88                                |
| NE          | 5.60                              | 5.03                        | 3.86                         | 2.67                         | 2.05                                |
| ENE         | 6.55                              | 5.86                        | 4.44                         | 2.98                         | 2.23                                |
| E           | 7.50                              | 6.68                        | 5.01                         | 3.28                         | 2.40                                |
| ESE         | 7.05                              | 6.26                        | 4.65                         | 3.00                         | 2.15                                |
| SE          | 6.60                              | 5.85                        | 4.30                         | 2.71                         | 1.90                                |
| SSE         | 6.15                              | 5.43                        | 3.95                         | 2.43                         | 1.65                                |
| S           | 5.70                              | 5.01                        | 3.60                         | 2.15                         | 1.40                                |
| SSW         | 6.15                              | 5.42                        | 3.92                         | 2.37                         | 1.58                                |
| SW          | 6.60                              | 5.82                        | 4.23                         | 2.59                         | 1.75                                |
| WSW         | 6.55                              | 5.81                        | 4.29                         | 2.73                         | 1.93                                |
| W           | 6.50                              | 5.79                        | 4.35                         | 2.86                         | 2.10                                |
| WNW         | 5.80                              | 5.19                        | 3.94                         | 2.66                         | 2.00                                |
| NW          | 5.10                              | 4.59                        | 3.54                         | 2.45                         | 1.90                                |
| NNW         | 4.40                              | 3.98                        | 3.13                         | 2.25                         | 1.80                                |



### Shading coefficient of fenestration (SC)

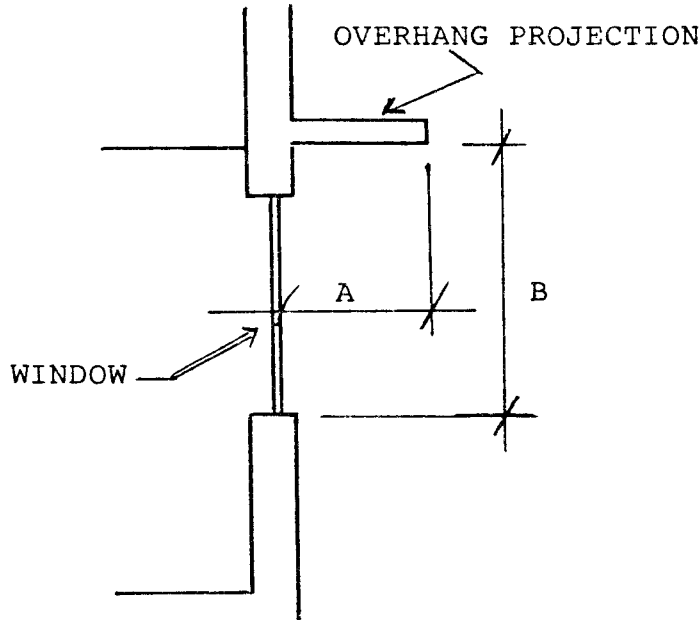
7.5 The shading coefficient of fenestration is the ratio of the solar heat gain through a particular type of glass under a specific set of conditions to the solar heat gain through double strength sheet clear glass under the same conditions. Allowances for Hong Kong's latitude and solar effects have been taken into account in the solar factor and therefore the shading coefficient of glass published by glass manufacturers in Hong Kong or overseas can be used without modification provided that the calculations have been based on a normal angle of incidence.

### External shading multiplier (ESM)

7.6 Shading of windows is of paramount importance in reducing solar heat gain to the building. This shading can be provided by projections over the window, at the side of the window, or a combination of both. For the purpose of simplicity in OTTV calculations this shading effect is taken into account as an external shading multiplier which should be assessed as follows :

(a) Overhang projections to windows

The external shading multiplier for overhang projections to windows should be obtained from Table 6 according to the overhang projection factor (OPF) and the orientation of the window. The OPF should be calculated as follows :



$$OPF = \frac{A}{B}$$

**Table 6 External Shading Multiplier for Overhang Projections to Windows**

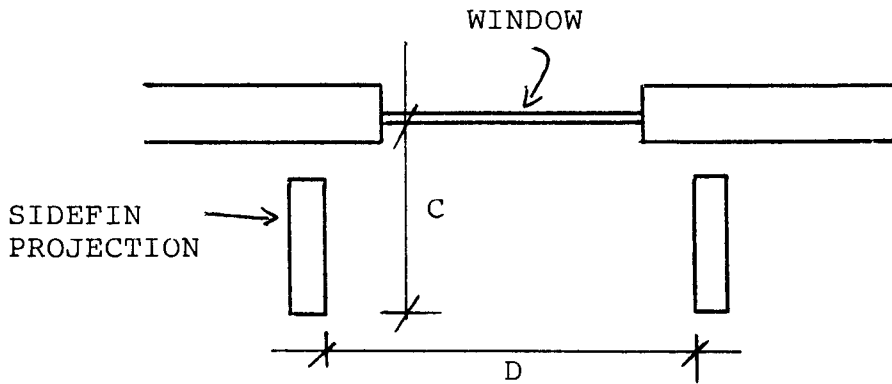
| OPF  | ESM   |       |       |       |
|------|-------|-------|-------|-------|
|      | N     | NE/NW | S/E/W | SE/SW |
| 0.00 | 1.000 | 1.000 | 1.000 | 1.000 |
| 0.05 | 0.975 | 0.969 | 0.962 | 0.962 |
| 0.10 | 0.951 | 0.939 | 0.926 | 0.926 |
| 0.15 | 0.928 | 0.909 | 0.890 | 0.890 |
| 0.20 | 0.905 | 0.880 | 0.856 | 0.856 |
| 0.25 | 0.883 | 0.853 | 0.823 | 0.823 |
| 0.30 | 0.861 | 0.826 | 0.790 | 0.790 |
| 0.35 | 0.840 | 0.800 | 0.759 | 0.759 |
| 0.40 | 0.820 | 0.774 | 0.729 | 0.729 |
| 0.45 | 0.800 | 0.750 | 0.700 | 0.700 |
| 0.50 | 0.781 | 0.726 | 0.672 | 0.672 |
| 0.55 | 0.762 | 0.704 | 0.645 | 0.645 |
| 0.60 | 0.744 | 0.682 | 0.620 | 0.620 |
| 0.65 | 0.726 | 0.661 | 0.595 | 0.595 |
| 0.70 | 0.710 | 0.641 | 0.572 | 0.572 |
| 0.75 | 0.693 | 0.621 | 0.549 | 0.549 |
| 0.80 | 0.678 | 0.603 | 0.528 | 0.528 |
| 0.85 | 0.663 | 0.585 | 0.507 | 0.507 |
| 0.90 | 0.648 | 0.568 | 0.488 | 0.488 |
| 0.95 | 0.634 | 0.552 | 0.470 | 0.470 |
| 1.00 | 0.621 | 0.537 | 0.453 | 0.453 |

Notes :

- (i) Should the OPF value fall in between increments, adopt the multiplier related to the next larger OPF value.
- (ii) OPF values above 1.0 are considered to produce too great an error in estimation.
- (iii) ESM for South, East and West orientations are combined since the figures are very similar.

(b) Sidefin projections to windows

The external shading multiplier for sidefin projections to windows should be obtained from Table 7 according to the sidefin projection factor (SPF) and the orientation of the window. The SPF should be calculated as follows :



$$SPF = \frac{C}{D}$$

**Table 7 External Shading Multiplier for Sidefin Projections to Windows**

| SPF  | ESM   |       |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
|      | N     | NE    | E     | SE    | S     | SW    | W     | NW    |
| 0.00 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 0.05 | 0.955 | 0.964 | 0.974 | 0.968 | 0.962 | 0.968 | 0.968 | 0.964 |
| 0.10 | 0.911 | 0.929 | 0.948 | 0.937 | 0.925 | 0.936 | 0.947 | 0.929 |
| 0.15 | 0.869 | 0.896 | 0.923 | 0.906 | 0.890 | 0.906 | 0.922 | 0.895 |
| 0.20 | 0.828 | 0.863 | 0.898 | 0.877 | 0.855 | 0.876 | 0.897 | 0.863 |
| 0.25 | 0.789 | 0.832 | 0.875 | 0.848 | 0.822 | 0.848 | 0.873 | 0.831 |
| 0.30 | 0.751 | 0.801 | 0.852 | 0.821 | 0.790 | 0.820 | 0.850 | 0.800 |
| 0.35 | 0.714 | 0.772 | 0.829 | 0.794 | 0.759 | 0.793 | 0.828 | 0.771 |

(Cont'd)

**Table 7 External Shading Multiplier for Sidefin Projections to Windows (Cont'd)**

| SPF  | ESM   |       |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
|      | N     | NE    | E     | SE    | S     | SW    | W     | NW    |
| 0.40 | 0.679 | 0.743 | 0.807 | 0.768 | 0.729 | 0.767 | 0.806 | 0.742 |
| 0.45 | 0.645 | 0.716 | 0.786 | 0.743 | 0.700 | 0.743 | 0.785 | 0.715 |
| 0.50 | 0.613 | 0.690 | 0.766 | 0.719 | 0.673 | 0.719 | 0.765 | 0.689 |
| 0.55 | 0.582 | 0.664 | 0.746 | 0.696 | 0.646 | 0.696 | 0.746 | 0.664 |
| 0.60 | 0.553 | 0.640 | 0.727 | 0.674 | 0.621 | 0.674 | 0.727 | 0.640 |
| 0.65 | 0.525 | 0.617 | 0.709 | 0.653 | 0.596 | 0.653 | 0.709 | 0.617 |
| 0.70 | 0.499 | 0.595 | 0.691 | 0.632 | 0.573 | 0.633 | 0.692 | 0.595 |
| 0.75 | 0.473 | 0.574 | 0.674 | 0.613 | 0.551 | 0.613 | 0.675 | 0.574 |
| 0.80 | 0.450 | 0.554 | 0.658 | 0.594 | 0.531 | 0.595 | 0.660 | 0.555 |
| 0.85 | 0.428 | 0.535 | 0.642 | 0.577 | 0.511 | 0.578 | 0.645 | 0.536 |
| 0.90 | 0.407 | 0.517 | 0.627 | 0.560 | 0.493 | 0.561 | 0.630 | 0.519 |
| 0.95 | 0.388 | 0.500 | 0.613 | 0.544 | 0.475 | 0.546 | 0.617 | 0.502 |
| 1.00 | 0.370 | 0.484 | 0.599 | 0.529 | 0.459 | 0.531 | 0.604 | 0.487 |
| 1.05 | 0.354 | 0.470 | 0.586 | 0.515 | 0.444 | 0.518 | 0.592 | 0.473 |
| 1.10 | 0.339 | 0.456 | 0.574 | 0.502 | 0.430 | 0.505 | 0.581 | 0.460 |
| 1.15 | 0.325 | 0.444 | 0.562 | 0.490 | 0.417 | 0.494 | 0.570 | 0.448 |
| 1.20 | 0.313 | 0.432 | 0.551 | 0.478 | 0.406 | 0.483 | 0.560 | 0.437 |
| 1.25 | 0.302 | 0.422 | 0.541 | 0.468 | 0.395 | 0.473 | 0.551 | 0.427 |
| 1.30 | 0.293 | 0.412 | 0.531 | 0.458 | 0.386 | 0.464 | 0.543 | 0.418 |
| 1.35 | 0.286 | 0.404 | 0.522 | 0.450 | 0.377 | 0.456 | 0.535 | 0.410 |
| 1.40 | 0.279 | 0.396 | 0.514 | 0.442 | 0.370 | 0.449 | 0.528 | 0.404 |
| 1.45 | 0.274 | 0.390 | 0.506 | 0.435 | 0.364 | 0.443 | 0.522 | 0.398 |
| 1.50 | 0.271 | 0.385 | 0.499 | 0.429 | 0.359 | 0.438 | 0.517 | 0.394 |

Notes :

- (i) SPF values above 1.5 are considered to produce too great an error in estimation.
- (ii) Should the SPF value fall in between increments, adopt the multiplier related to the next larger SPF value.

(c) Combination of overhang and sidefin projections

For windows with both overhang and sidefin projections each external shading multiplier should be calculated separately as described in (a) and (b) and the smaller of the two values obtained should be used as the external shading multiplier in the OTTV calculations.

**Solar factor (SF)**

7.7 The solar factor for vertical surfaces at various orientations and that for horizontal surfaces should be obtained from Table 8. The solar factors have been calculated for the Hong Kong climate. Any sloping or angled wall or roof can be resolved into vertical and horizontal components. The vertical components of the sloping or angled wall or roof can be treated as a vertical surface with a solar factor at that respective orientation; whereas the horizontal component can be treated as a horizontal surface.

**Table 8 Solar Factor**

|                           |     |     |     |     |     |     |     |     |
|---------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| orientation               | N   | NE  | E   | SE  | S   | SW  | W   | NW  |
| SF for vertical surface   | 104 | 138 | 168 | 197 | 191 | 202 | 175 | 138 |
| orientation               | NNE | ENE | ESE | SSE | SSW | WSW | WNW | NNW |
| SF for vertical surface   | 121 | 153 | 183 | 194 | 197 | 189 | 157 | 121 |
| SF for horizontal surface | 264 |     |     |     |     |     |     |     |

**Equivalent temperature difference for roofs ( $TD_{EQr}$ )**

7.8 The equivalent temperature difference for roofs should take into account the roof mass and density and should be obtained from Table 9.

**Table 9 Equivalent Temperature Difference for Roofs**

| Density of roof construction | less than 22 kg/m <sup>2</sup> | 23-199 kg/m <sup>2</sup> | 200-379 kg/m <sup>2</sup> | 380-569 kg/m <sup>2</sup> | 570 kg/m <sup>2</sup> or above |
|------------------------------|--------------------------------|--------------------------|---------------------------|---------------------------|--------------------------------|
| TDE <sub>Qr</sub>            | 18.60                          | 16.88                    | 13.37                     | 9.75                      | 7.90                           |

**8. Windows and doors**

Buildings should not have unenclosed doorways and entrances. For commercial buildings where heavy traffic of people is anticipated, self-closing doors without restrainers, revolving doors or other similar means of minimizing heat gain should be employed. Careful attention should also be paid to the sealing of windows to guard against leakage during service.

**9. Submission of Information**

9.1 Information and calculations required by the Building Authority are specified in the Building (Energy Efficiency) Regulation. Simplified version of OTTV calculations can be included in the first submission of building plans, provided that detailed calculations have to be submitted before consent to commence works will be granted. The following information and calculations should be submitted on the standard forms set out in the schedule to this Code :

- (a) Calculation of 'U' value of composite wall and roof and details of other component coefficients and parameters of OTTV on Form OTTV 1.
- (b) Window and rooflight schedule on Form OTTV 2.
- (c) OTTV calculations on Form OTTV 3 and Form OTTV 4.

9.2 OTTV calculations should be made to two places of decimals.

## Schedule of Standard Forms

Form OTTV 1

Form OTTV 2

Form OTTV 3

Form OTTV 4

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A \_\_\_\_\_

BD Ref 2/\_\_\_\_/\_\_\_\_/\_\_\_\_

Building address \_\_\_\_\_

Physical data of Opaque \*Wall/Roof

Facade Orientation facing \_\_\_\_\_ Solar Factor (SF) is \_\_\_\_\_

| *Wall/Roof Code No.                                   | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>2</sub> /R <sub>2</sub> | *W <sub>3</sub> /R <sub>3</sub> | *W <sub>4</sub> /R <sub>4</sub> |
|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Location of Wall/Roof                                 |                                 |                                 |                                 |                                 |
| External Finish Material                              |                                 |                                 |                                 |                                 |
| Conductivity      W/m°C                               |                                 |                                 |                                 |                                 |
| Density              kg/m <sup>3</sup>                |                                 |                                 |                                 |                                 |
| Thickness            m                                |                                 |                                 |                                 |                                 |
| Absorptivity        (α)                               |                                 |                                 |                                 |                                 |
| Intermediate component                                |                                 |                                 |                                 |                                 |
| Conductivity      W/m°C                               |                                 |                                 |                                 |                                 |
| Density              kg/m <sup>3</sup>                |                                 |                                 |                                 |                                 |
| Thickness            m                                |                                 |                                 |                                 |                                 |
| Intermediate component                                |                                 |                                 |                                 |                                 |
| Conductivity      W/m°C                               |                                 |                                 |                                 |                                 |
| Density              kg/m <sup>3</sup>                |                                 |                                 |                                 |                                 |
| Thickness            m                                |                                 |                                 |                                 |                                 |
| Intermediate component                                |                                 |                                 |                                 |                                 |
| Conductivity      W/m°C                               |                                 |                                 |                                 |                                 |
| Density              kg/m <sup>3</sup>                |                                 |                                 |                                 |                                 |
| Thickness            m                                |                                 |                                 |                                 |                                 |
| Intermediate component                                |                                 |                                 |                                 |                                 |
| Conductivity      W/m°C                               |                                 |                                 |                                 |                                 |
| Density              kg/m <sup>3</sup>                |                                 |                                 |                                 |                                 |
| Thickness            m                                |                                 |                                 |                                 |                                 |
| Internal Finish Material                              |                                 |                                 |                                 |                                 |
| Conductivity      W/m°C                               |                                 |                                 |                                 |                                 |
| Density              kg/m <sup>3</sup>                |                                 |                                 |                                 |                                 |
| Thickness            m                                |                                 |                                 |                                 |                                 |
| Absorptivity        α                                 |                                 |                                 |                                 |                                 |
| 'U' value of composite *Wall/Roof                     |                                 |                                 |                                 |                                 |
| Area of *Wall/Roof    m <sup>2</sup>                  |                                 |                                 |                                 |                                 |
| Density of composite *Wall/Roof    kg/m <sup>2</sup>  |                                 |                                 |                                 |                                 |
| Equivalent temperature difference (TD <sub>EQ</sub> ) |                                 |                                 |                                 |                                 |



Building (Energy Efficiency) Regulation  
Form OTTV 2

Window/Rooflight Schedule

Sheet No. B \_\_\_\_\_

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address \_\_\_\_\_

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_

Solar Factor (SF) is \_\_\_\_\_

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    |                                  |                                  |                                  |                                  |
| Glazing type                         |                                  |                                  |                                  |                                  |
| Thickness m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)             |                                  |                                  |                                  |                                  |
| Type of shading device               |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       |                                  |                                  |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_

Solar Factor is \_\_\_\_\_

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    |                                  |                                  |                                  |                                  |
| Glazing type                         |                                  |                                  |                                  |                                  |
| Thickness m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)             |                                  |                                  |                                  |                                  |
| Type of shading device               |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       |                                  |                                  |                                  |                                  |

\* Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C \_\_\_\_\_

BD Ref 2/\_\_\_\_/\_\_\_\_/\_\_\_\_

Building address \_\_\_\_\_

Facade Orientation facing \_\_\_\_\_.

Opaque \*Walls/Roofs

| Code No.  | Description | *A <sub>w</sub> /A <sub>r</sub> | U   | α         | TD <sub>EQ</sub> | Sum |
|-----------|-------------|---------------------------------|-----|-----------|------------------|-----|
|           |             |                                 |     |           |                  |     |
| Subtotals |             |                                 | (A) | Heat Gain |                  | (C) |

Fenestration

| Code No.  | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC  | ESM       | SF | Sum |
|-----------|-------------|-----------------------------------|-----|-----------|----|-----|
|           |             |                                   |     |           |    |     |
| Subtotals |             |                                   | (B) | Heat Gain |    | (D) |

Gross Heat Gain (C + D) \_\_\_\_\_

Gross Area (A + B) \_\_\_\_\_

$$OTTV = \frac{C + D}{A + B} = \text{_____ W/m}^2$$

\* Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 4

---

Summary of OTTV of Building Envelope

Sheet No. D \_\_\_\_\_

BD Ref. 2/\_\_\_\_/\_\_\_\_/\_\_\_\_

Building address \_\_\_\_\_

Total Envelope Heat Gain (\* Tower/Podium)

| Facade Orientation | Gross Area from Form OTTV 3 | Gross Heat Gain from Form OTTV3 |
|--------------------|-----------------------------|---------------------------------|
| a.                 |                             |                                 |
| b.                 |                             |                                 |
| c.                 |                             |                                 |
| d.                 |                             |                                 |
| e.                 |                             |                                 |
| f.                 |                             |                                 |
| Subtotal           | (E)                         | (G)                             |
| Roof               |                             |                                 |
| a.                 |                             |                                 |
| b.                 |                             |                                 |
| Subtotal           | (F)                         | (H)                             |

$$* \text{ Tower/Podium Walls OTTV} = \frac{G}{E} = \text{_____ W/m}^2$$

$$* \text{ Tower/Podium Roofs OTTV} = \frac{H}{F} = \text{_____ W/m}^2$$

$$* \text{ Tower/Podium OTTV} = \frac{G + H}{E + F} = \text{_____ W/m}^2$$

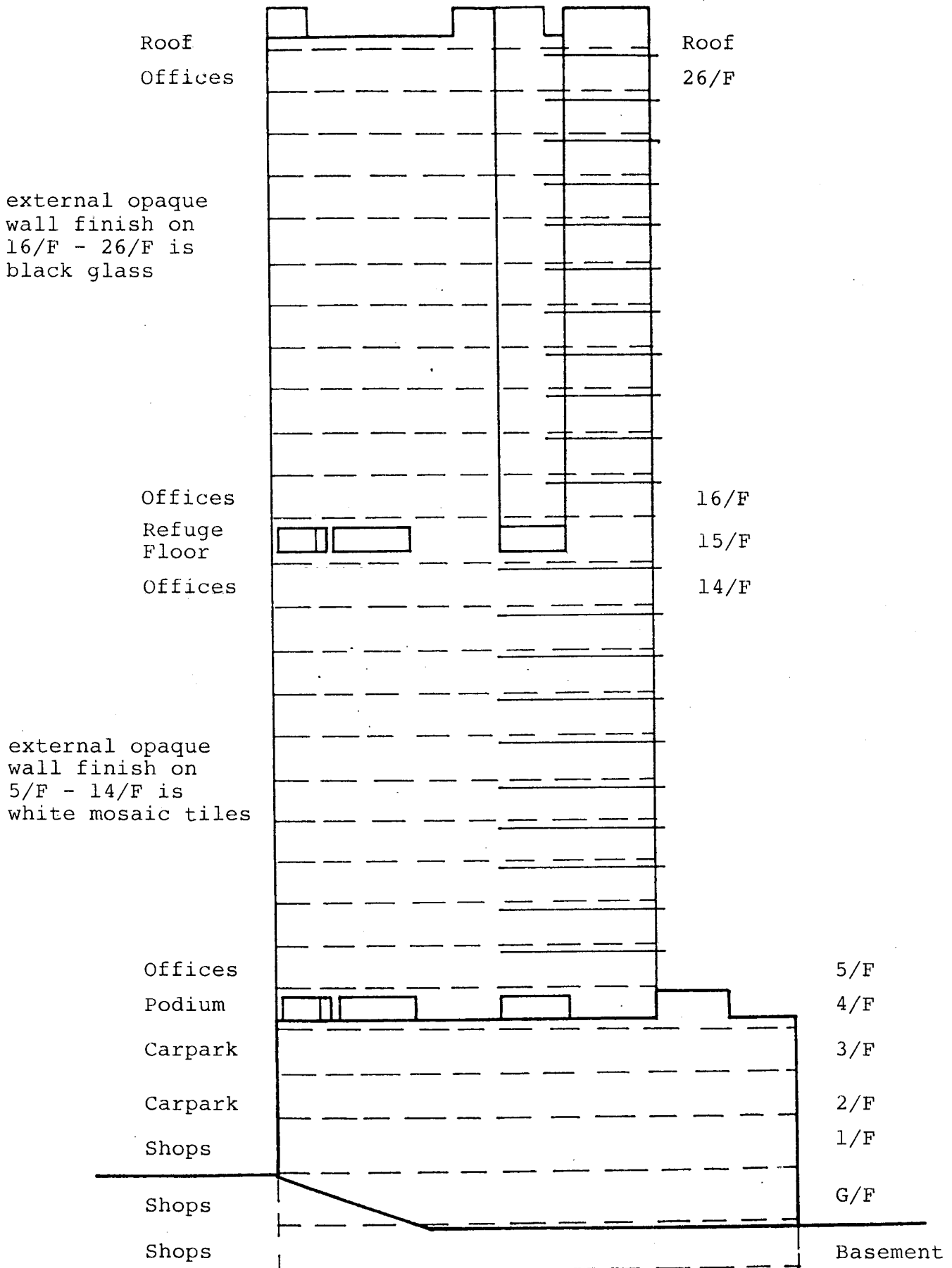
\* Delete as appropriate

First issue April 1995

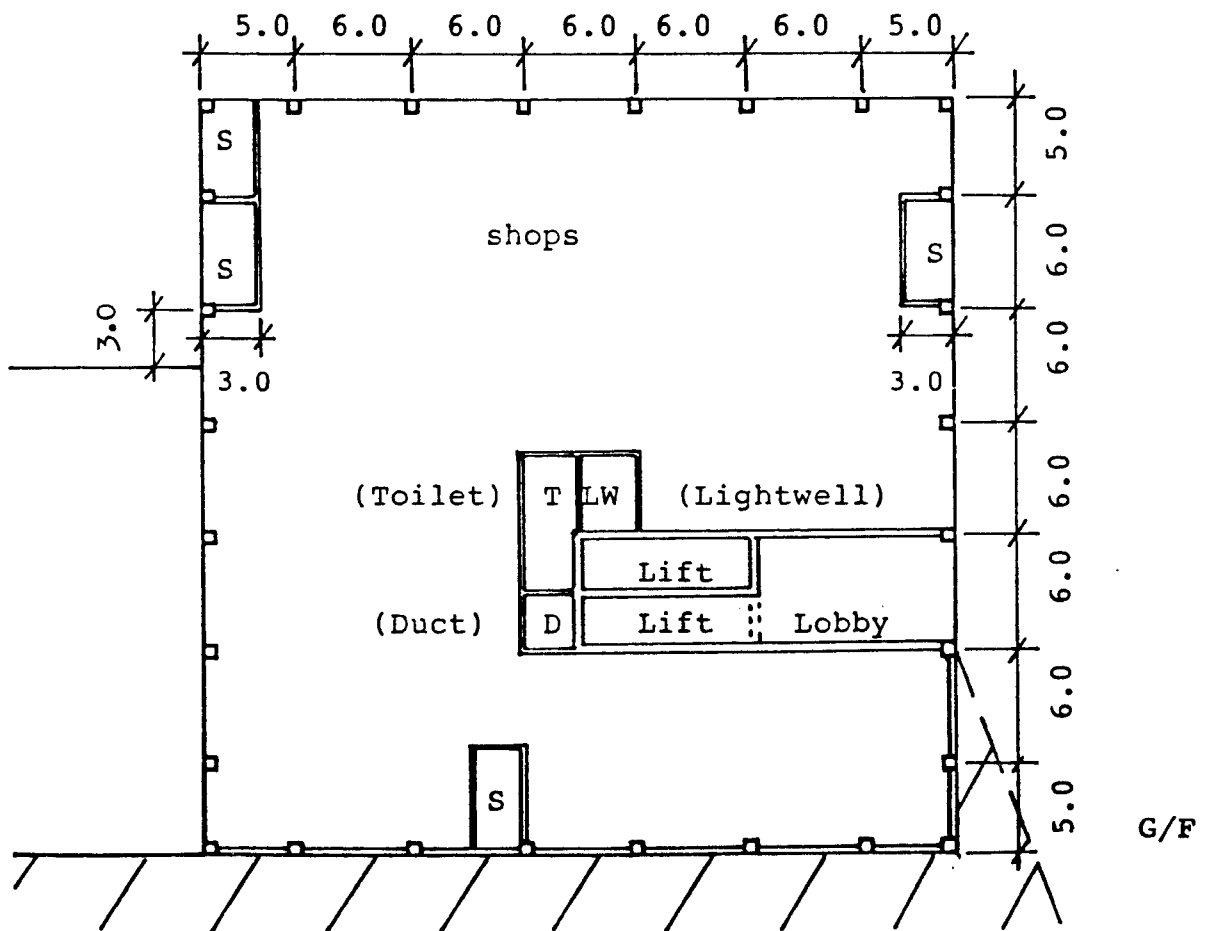
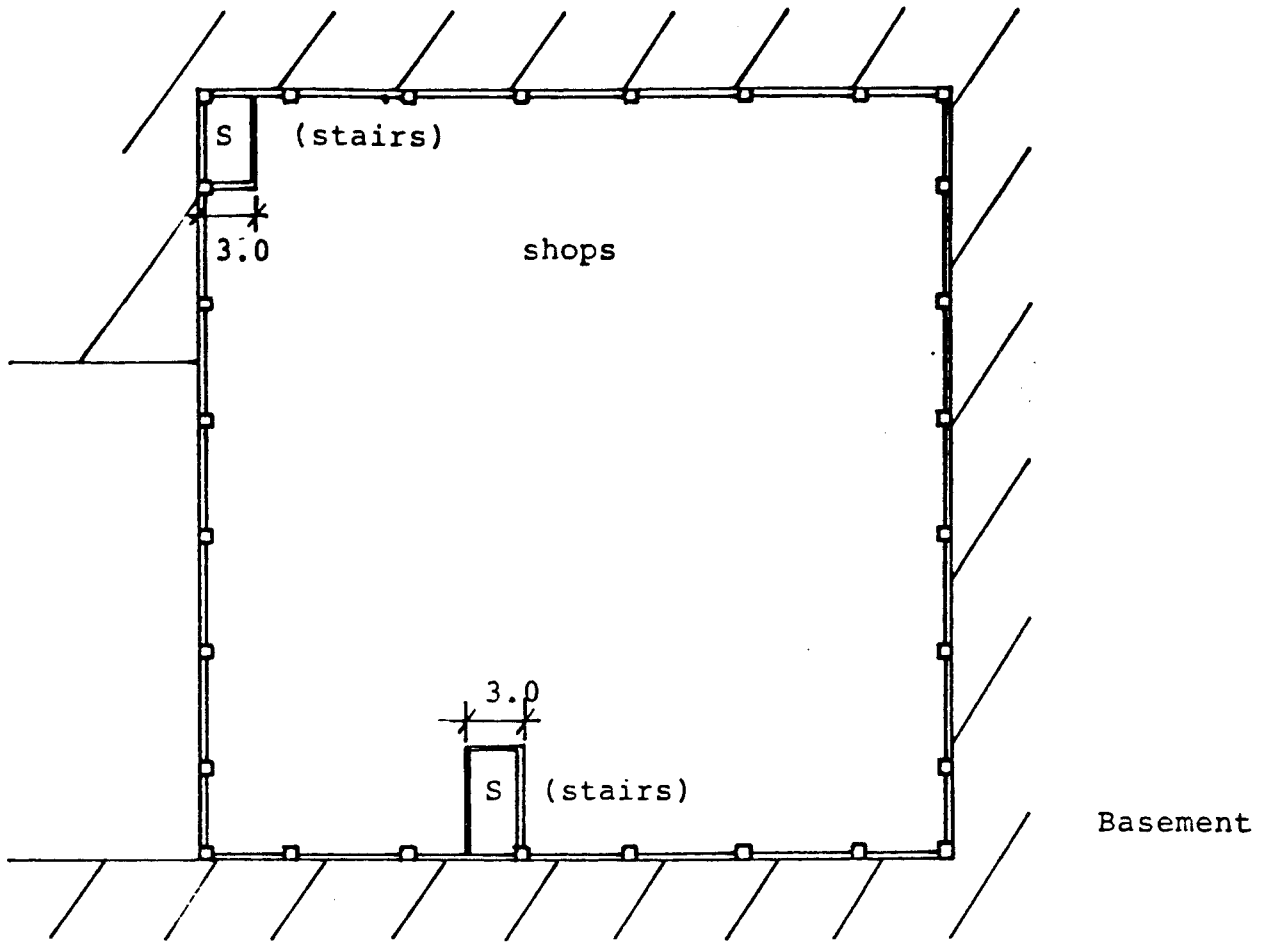
## Appendix A

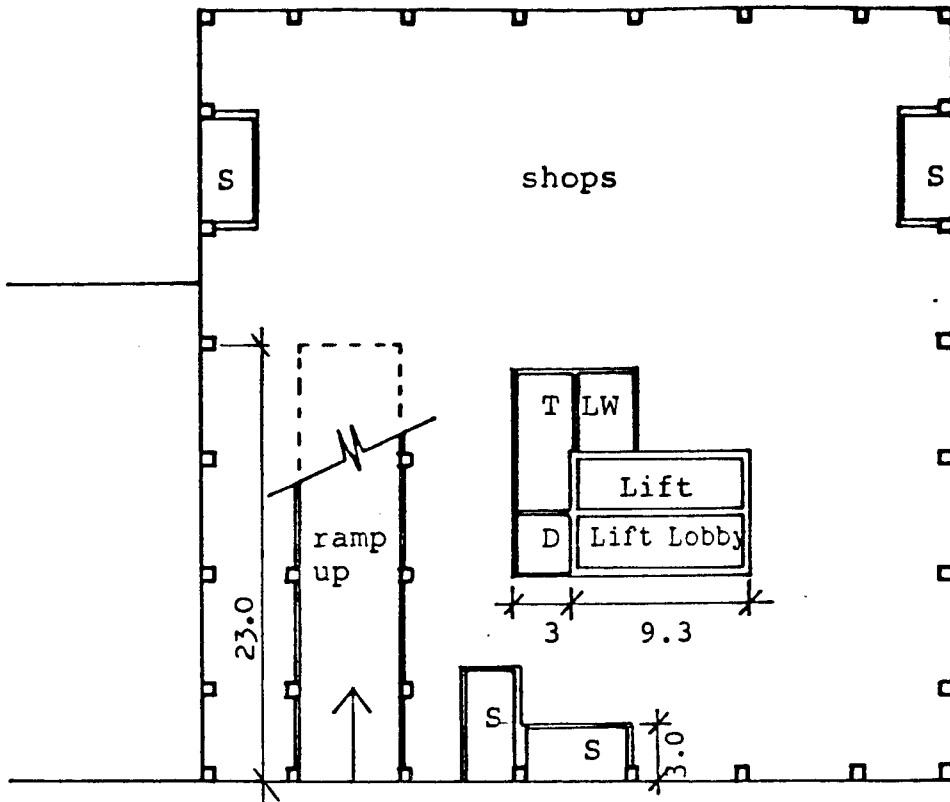
A sample of OTTV calculation for  
a typical commercial building

# Plans and Elevation of a Typical Commercial Building

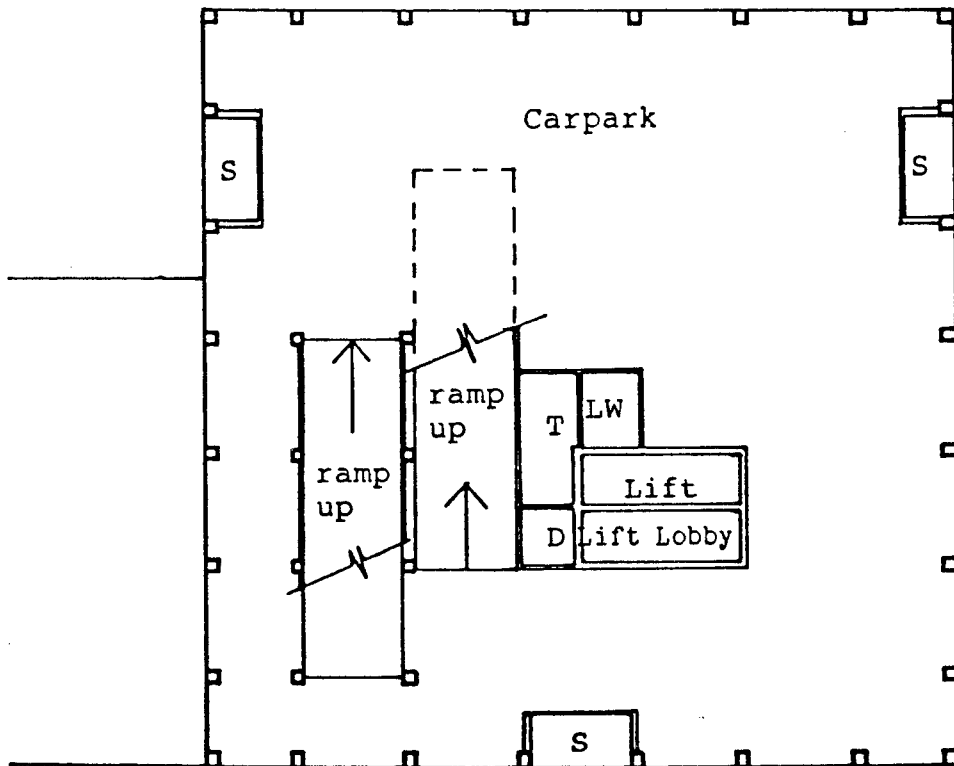


**East Elevation**

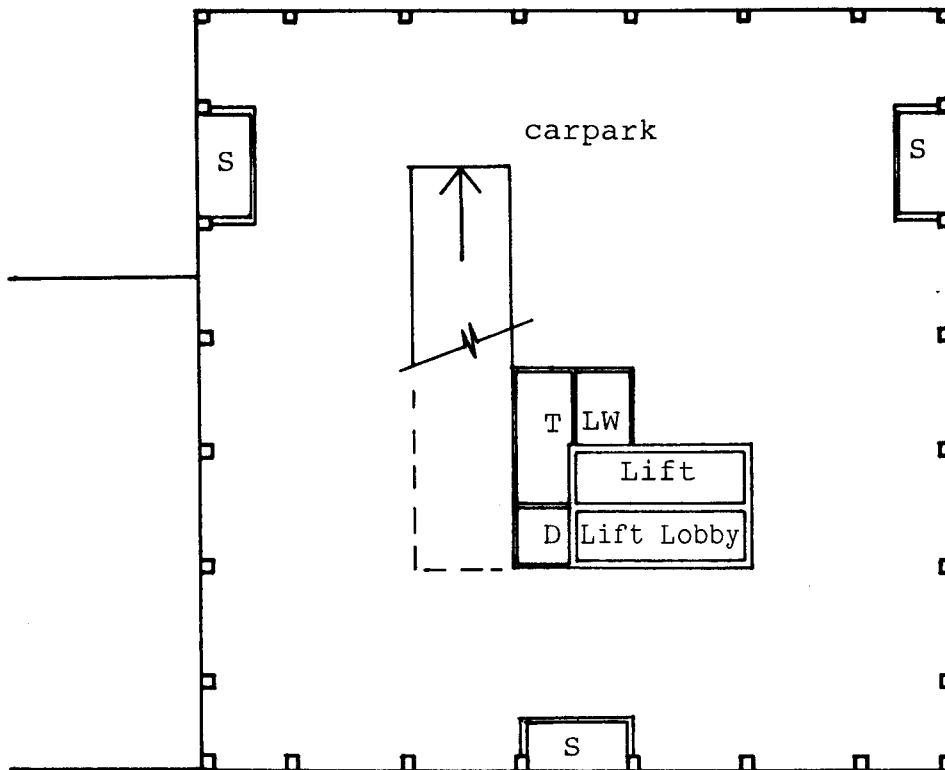




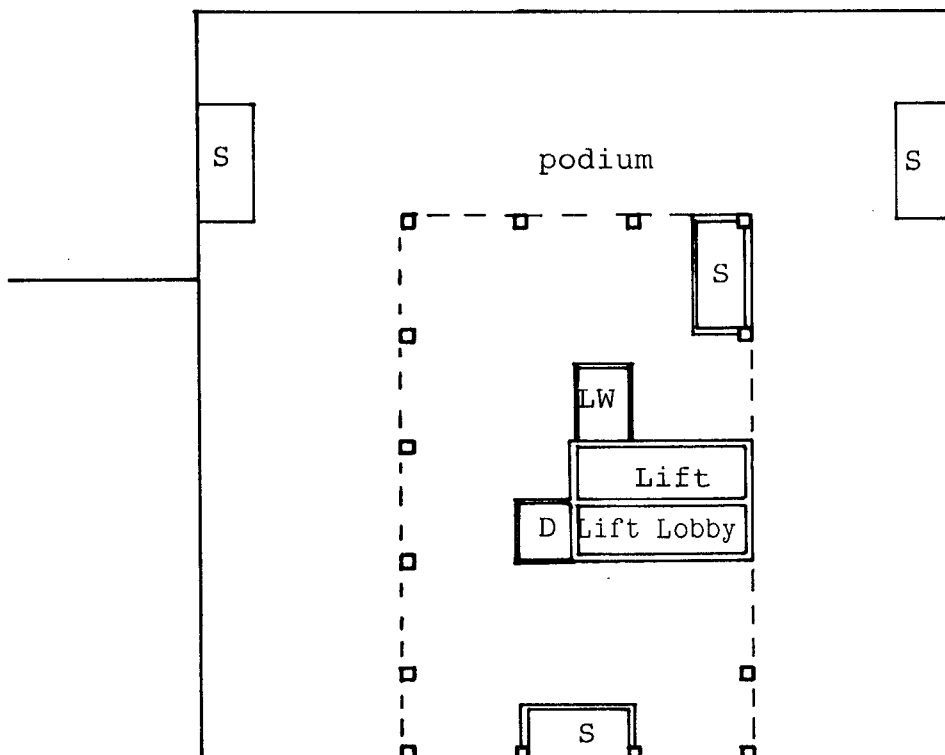
1/F



2/F

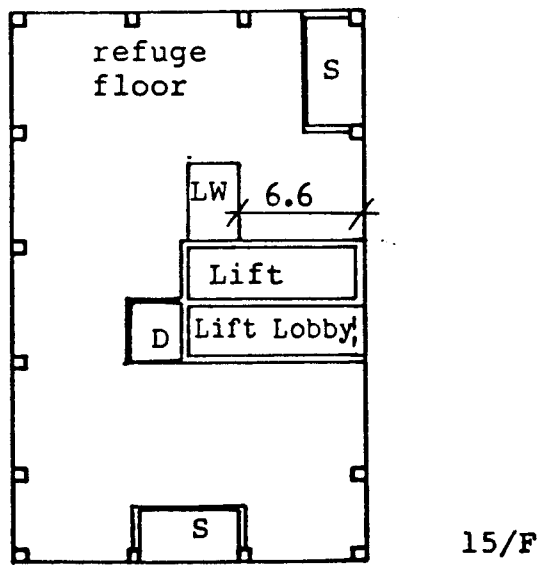
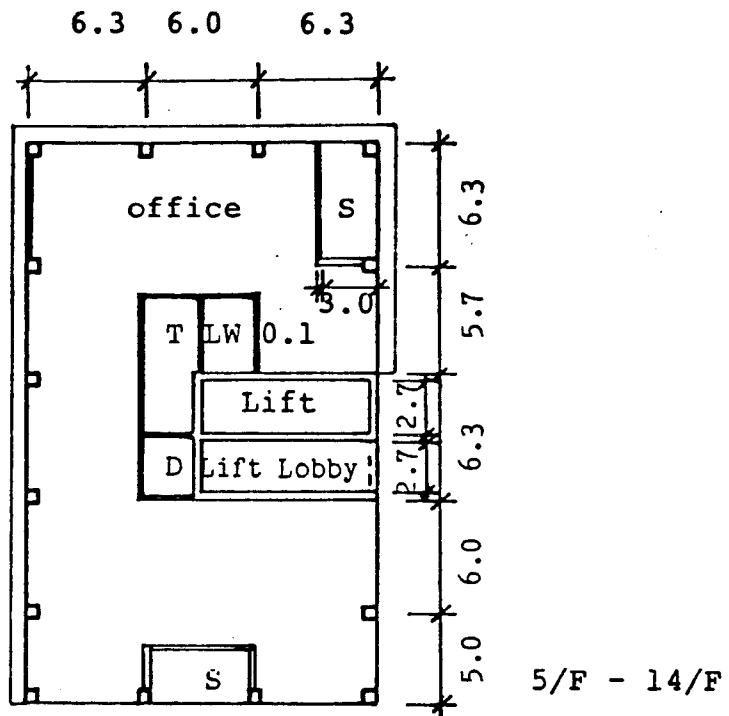


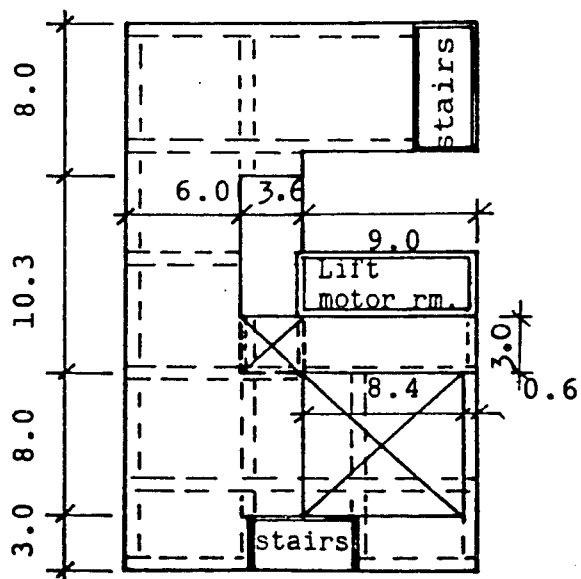
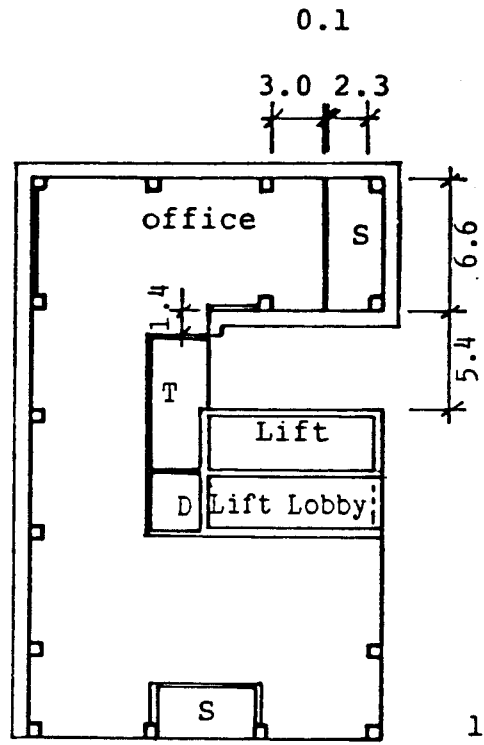
3/F



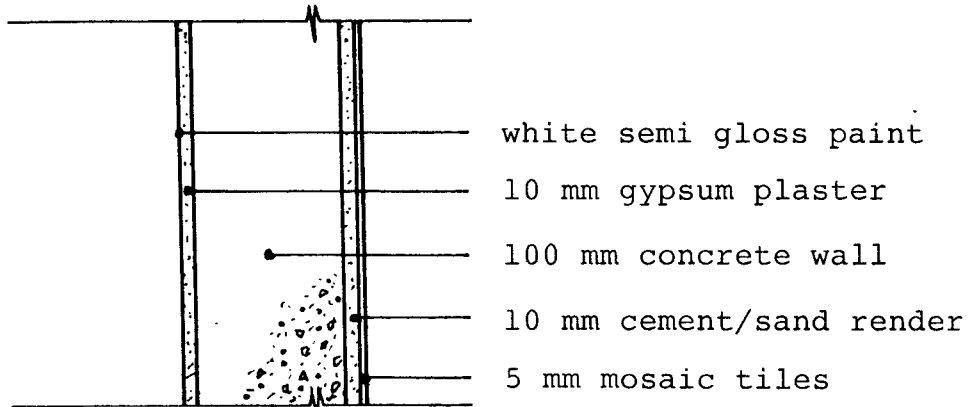
4/F



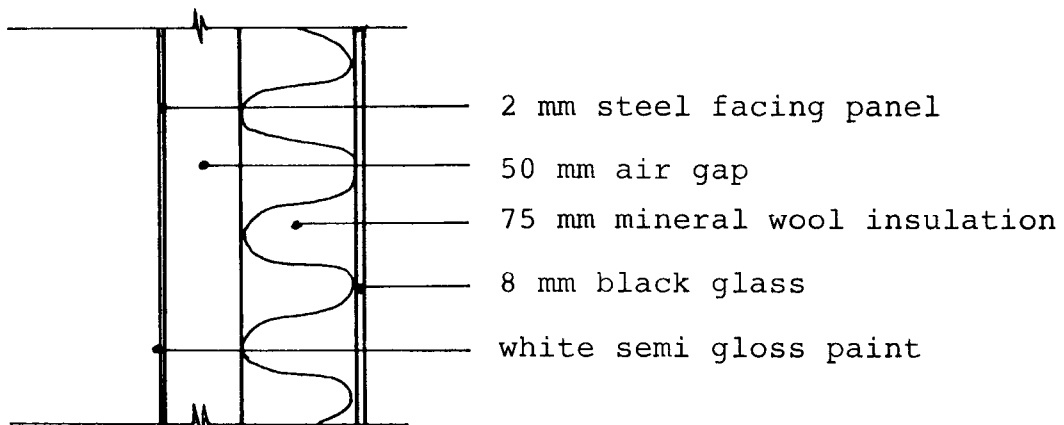




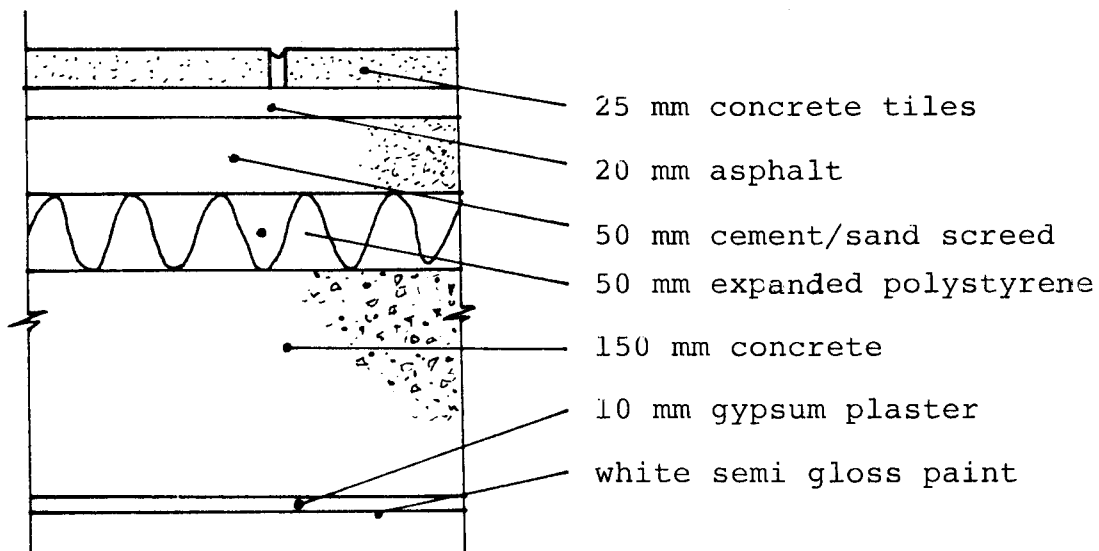
## Construction of Walls and Roof



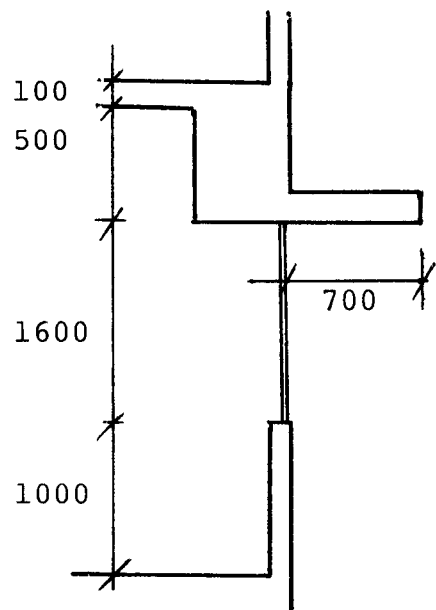
PANEL WALLS  
GROUND - 15TH FLOOR



CURTAIN WALL  
16TH FLOOR - 26TH FLOOR



ROOF



TYPICAL SECTION  
5TH FLOOR - 26TH FLOOR

Gross Wall Calculations

Storey heights :

|                          |                        |
|--------------------------|------------------------|
| Ground and First Floors  | 4.0 m                  |
| 2nd & 3rd floors         | 3.5 m                  |
| 4th to 26th floors       | 3.2 m                  |
| All columns 600 x 600 mm | All beams 600 x 600 mm |

East Elevation

|       |           |  |   |                       |                         |
|-------|-----------|--|---|-----------------------|-------------------------|
| P     | G/F       | $11.0 \times 4.0 \div 2 + 29 \times 4.0$ | = | 138.00 m <sup>2</sup> |                         |
|       | 1/F       | $40 \times 4.0 + 23 \times 4 \times 0.5$ | = | 206.00 m <sup>2</sup> | 344.00 m <sup>2</sup>   |
| <hr/> |           |  |   |                       |                         |
| T     | 5/F-14/F  | $23.0 \times 3.2 \times 10$              | = | 736.00 m <sup>2</sup> |                         |
|       | 16/F-26/F | $23.0 \times 3.2 \times 11$              | = | 809.60 m <sup>2</sup> | 1,545.60 m <sup>2</sup> |
| <hr/> |           |  |   |                       |                         |
|       | 5/F-14/F  | $6.3 \times 3.2 \times 10$               | = | 201.60 m <sup>2</sup> |                         |
|       | 16-26/F   | $6.3 \times 3.2 \times 11$               | = | 221.76 m <sup>2</sup> | 423.36 m <sup>2</sup>   |
| <hr/> |           |  |   |                       |                         |

North Elevation

|       |         |                                   |   |                       |                         |
|-------|---------|-----------------------------------|---|-----------------------|-------------------------|
| P     | G/F     | $40.0 \times 4.0$                 | = | 160.00 m <sup>2</sup> |                         |
|       | 1/F     | $40.0 \times 4.0$                 | = | 160.00 m <sup>2</sup> | 320.00 m <sup>2</sup>   |
| <hr/> |         |                                   |   |                       |                         |
| T     | 5-14/F  | $18.6 \times 3.2 \times 10$       | = | 595.20 m <sup>2</sup> |                         |
|       | 16-26/F | $(18.6 + 9) \times 3.2 \times 11$ | = | 971.52 m <sup>2</sup> | 1,566.72 m <sup>2</sup> |
| <hr/> |         |                                   |   |                       |                         |

West Elevation

|       |           |  |   |                         |                         |
|-------|-----------|--|---|-------------------------|-------------------------|
| P     | G/F       | $40 \times 4.0$                          | = | 160.00 m <sup>2</sup>   |                         |
|       | 1/F       | $40 \times 4.0 + 23 \times 4 \times 0.5$ | = | 206.00 m <sup>2</sup>   | 366.00 m <sup>2</sup>   |
| <hr/> |           |  |   |                         |                         |
| T     | 5/F-14/F  | $29.3 \times 3.2 \times 10$              | = | 937.60 m <sup>2</sup>   |                         |
|       | 16/F-26/F | $29.3 \times 3.2 \times 11$              | = | 1,031.36 m <sup>2</sup> | 1,968.96 m <sup>2</sup> |
| <hr/> |           |  |   |                         |                         |

South Elevation

|       |           |   |   |                       |                         |
|-------|-----------|---|---|-----------------------|-------------------------|
| P     | G/F       | Nil   | = | -                     |                         |
|       | 1/F       | $40 \times 4.0 + (5.4 \times 23.35 - 5.4 \times 4.0)$ | = | 264.49 m <sup>2</sup> | 264.49 m <sup>2</sup>   |
| <hr/> |           |   |   |                       |                         |
| T     | 5/F-14/F  | $18.6 \times 3.2 \times 10$                           | = | 595.20 m <sup>2</sup> |                         |
|       | 16/F-26/F | $(18.6 + 9) \times 3.2 \times 11$                     | = | 971.52 m <sup>2</sup> | 1,566.72 m <sup>2</sup> |
| <hr/> |           |   |   |                       |                         |

Window Schedule

Building Address

Typical Commercial Building

| Orientation of Facade | Floor   | Class Thickness<br>m | Type       | Sizes and no./floor<br>m          | Total area per floor<br>m <sup>2</sup> |
|-----------------------|---------|----------------------|------------|-----------------------------------|--|
| East                  | G/F     | 0.012                | plain      | (5.4 x 4 + 4.1) 3.4               | 87.38                                  |
|                       | 1/F     | 0.012                | plain      | (4.1x2 + 5.4x5) 3.4               | 119.68                                 |
|                       | 2-4/F   | Nil                  | Nil        | -                                 | -                                      |
|                       | 5-14/F  | 0.008                | tinted     | (4.1+5.7+5.4x2) 1.6               | 32.96                                  |
|                       | 5-14/F  | 0.008                | tinted     | 2.7 x 1.6                         | 4.32                                   |
|                       | 15/F    | Nil                  | tinted     | -                                 | -                                      |
|                       | 16-26/F | 0.008                | tinted     | (4.1+5.7+1.4+5.4) 1.6<br>+3.9x0.8 | 29.68                                  |
|                       | 16-26/F | 0.008                | tinted     | 2.7 x 1.6                         | 4.32                                   |
| North                 | G/F     | 0.012                | plain      | (4.1+5.4x5+1.7+2.3) 3.4           | 119.34                                 |
|                       | 1/F     | 0.012                | plain      | (4.1x2+5.4x5) 3.4                 | 119.68                                 |
|                       | 2-4/F   | Nil                  | Nil        | -                                 | -                                      |
|                       | 5-14/F  | 0.008                | tinted     | (2.3+3.0+5.4x2) 1.6               | 25.76                                  |
|                       | 15/F    | Nil                  | Nil        | -                                 | -                                      |
|                       | 16-26/F | 0.008                | tinted     | (2.3+3.0+5.4x2) 1.6               | 25.76                                  |
| West                  | G/F     | 0.012                | plain      | (4.1+5.4+2.7) 3.4                 | 41.48                                  |
|                       | 1/F     | 0.012                | plain      | (4.1+5.4+2.7) 3.4                 | 41.48                                  |
|                       | 2-4/F   | Nil                  | Nil        | -                                 | -                                      |
|                       | 5-14/F  | 0.008                | tinted     | (5.4x3+4.1) 1.6                   | 32.48                                  |
|                       | 15/F    | Nil                  | Nil        | -                                 | -                                      |
|                       | 16-26/F | 0.008                | tinted     | (5.4x3+4.1) 1.6                   | 32.48                                  |
| South                 | G/F     | Nil                  | Nil        | -                                 | -                                      |
|                       | 1/F     | 0.012                | plain      | (4.1x2+2.7+2.6+5.4x3) 3.4         | 100.98                                 |
|                       | 2-4/F   | Nil                  | Nil        | -                                 | -                                      |
|                       | 5-14/F  | 0.008                | tinted     | (5.4x3) 1.6                       | 25.92                                  |
|                       | 15/F    | Nil                  | Nil        | -                                 | -                                      |
|                       | 16-26/F | 0.006                | reflective | (5.4x3) 1.6                       | 25.92                                  |
|                       | 16-26/F | 0.008                | tinted     | (3.0 + 2.3) 1.6                   | 8.48                                   |

East Elevation (Tower) Gross Wall Area  $1,545.60 + 423.36 = 1,968.96 \text{ m}^2$

Wall composite areas

Beams and Column Areas

5/F - 14/F  $[0.6 (11.0+5.7+6.3)+(0.6 \times 2.6 \times 4)] \times 10 = 200.40 \text{ m}^2$   
 15/F Nil  
 16/F - 26/F  $[0.6 (11.0+5.4+6.6)+(0.6 \times 2.6 \times 4)] \times 11 = 220.44 \text{ m}^2 \quad 420.84 \text{ m}^2$

Glazing Areas in 100 mm panel/curtain wall from Window Schedule

5/F - 14/F  $32.96 \times 10 = 329.60 \text{ m}^2$   
 15/F Nil  
 16/F - 26/F  $29.68 \times 11 = 326.48 \text{ m}^2 \quad 656.08 \text{ m}^2$

Glazing Area in 300 mm Structural Walls from Window Schedule

5/F - 14/F  $4.32 \times 10 = 43.20 \text{ m}^2$   
 15/F  $4.32 \times 11 = 47.52 \text{ m}^2 \quad 90.72 \text{ m}^2$

100 mm Panel/Curtain Wall Areas

5/F - 14/F  $736.00 - (200.40 + 329.60) = 206.00 \text{ m}^2$   
 15/F Nil  
 16/F - 26/F  $809.60 - (220.44 + 326.48) = 262.68 \text{ m}^2 \quad 468.68 \text{ m}^2$

300 mm Structural Walls to Lift & Lift Lobby

5/F - 14/F  $0.3 \times 3.2 \times 3 \times 10 = 28.80 \text{ m}^2$   
 16/F - 26/F  $0.3 \times 3.2 \times 3 \times 11 = 31.68 \text{ m}^2 \quad 60.48 \text{ m}^2$

300 mm Panel Walls to Lift & Lift Lobby

5/F - 14/F  $201.60 - (43.20 + 28.80) = 129.60$   
 16/F - 26/F  $221.76 - (47.52 + 31.68) = 142.56 \text{ m}^2 \quad 272.16 \text{ m}^2$

Lift shaft walls without gypsum plaster

5/F - 14/F  $2.7 \times 3.2 \times 10 = 86.40 \text{ m}^2$   
 16/F - 26/F  $2.7 \times 3.2 \times 11 = 95.04 \text{ m}^2 \quad 181.44 \text{ m}^2$

Fenestration between 5/F - 14/F

Total Glazing in 100 mm panel walls = 329.60  
 $(4.1 + 5.7) 1.6 \times 10 = 156.80$  unshaded  
 172.80 shaded

Fenestration between 16/F - 26/F

Total Glazing in curtain wall = 326.48  
 $[(4.1+5.7)1.6+(3.9 \times 0.8)] \times 11 = 206.80$  unshaded  
 119.68 shaded

'U' value of composite wall of columns and beams :-

G/F, 1/F, 5/F-14/F

| W <sub>1</sub> for beam and column                |                             | Weight                    |
|---|-----------------------------|---------------------------|
| external surface film                             | R <sub>o</sub> = 0.044      |                           |
| 5 mm white mosaic tiles                           | $\frac{0.005}{1.5} = 0.003$ | 0.005 x 2500 = 12.50      |
| 10 mm cement/sand render                          | $\frac{0.01}{0.72} = 0.014$ | 0.01 x 1860 = 18.60       |
| 600 mm concrete beam & column                     | $\frac{0.60}{2.16} = 0.278$ | 0.60 x 2400 = 1440.00     |
| 10 mm gypsum plaster                              | $\frac{0.01}{0.38} = 0.026$ | 0.01 x 1120 = 11.20       |
| Internal surface film<br>(absorptivity below 0.5) | R <sub>i</sub> = 0.299      |                           |
| Totals  | 0.664                       | 1482.30 kg/m <sup>2</sup> |

$$U_w = \frac{1}{0.664} = 1.51 \text{ W/m}^2\text{°C}$$

(for west podium wall without tiles or render 'U' value is 1.55 W/m<sup>2</sup>°C)

'U' value of composite wall panels :-

G/F, 1/F, 5/F-14/F

| W <sub>3</sub> for wall panel |                            | Weight                   |
|-------------------------------|----------------------------|--------------------------|
| external surface film         | R <sub>o</sub> = 0.044     |                          |
| 5 mm white mosaic tiles       | = 0.003                    | 0.005 x 2500 = 12.50     |
| 10 mm cement/sand render      | = 0.014                    | 0.01 x 1860 = 18.60      |
| 100 mm concrete panel         | $\frac{0.1}{2.16} = 0.046$ | 0.10 x 2400 = 240.00     |
| 10 mm gypsum plaster          | = 0.026                    | 0.01 x 1120 = 11.20      |
| Internal surface film         | R <sub>i</sub> = 0.299     |                          |
| Totals                        | 0.432                      | 282.30 kg/m <sup>2</sup> |

$$U_w = \frac{1}{0.432} = 2.32 \text{ W/m}^2\text{°C}$$

(for west podium wall without tiles and render 'U' value is 2.41 W/m<sup>2</sup>°C)



'U' value of composite columns and beams :-

16/F - 26/F

| W <sub>2</sub> for beam and column                     |                               | Weight                    |
|--|-------------------------------|---------------------------|
| External surface film                                  | R <sub>o</sub> = 0.044        |                           |
| 8 mm black glass                                       | $\frac{0.008}{1.05} = 0.0076$ | 0.008 x 2500 = 20.00      |
| 50 mm Air space resistance<br>(absorptivity above 0.5) | R <sub>a</sub> = 0.153        |                           |
| 600 mm concrete beam<br>and column                     | $\frac{0.60}{2.16} = 0.278$   | 0.6 x 2400 = 1440.00      |
| 10 mm gypsum plaster                                   | $\frac{0.01}{0.38} = 0.026$   | 0.01 x 1120 = 11.20       |
| Internal surface film                                  | R <sub>i</sub> = 0.299        |                           |
| Totals   | 0.808                         | 1471.20 kg/m <sup>2</sup> |

$$U_w = \frac{1}{0.808} = 1.24 \text{ W/m}^2\text{°C}$$

'U' value of composite curtain wall panels :-

16/F - 26/F

| W <sub>4</sub> for panel wall                          |                               | Weight                  |
|--|-------------------------------|-------------------------|
| External surface film                                  | R <sub>o</sub> = 0.044        |                         |
| 8 mm black glass                                       | $\frac{0.008}{1.05} = 0.0076$ | 0.008 x 2500 = 20.00    |
| 75 mm mineral wool felt<br>insulation                  | $\frac{0.075}{0.039} = 1.923$ | 0.075 x 50 = 3.75       |
| 50 mm Air space resistance<br>(absorptivity above 0.5) | R <sub>a</sub> = 0.153        | -                       |
| 2 mm pressed steel panel                               | $\frac{0.002}{50} = 0.00004$  | 0.002 x 7800 = 15.60    |
| Internal surface film                                  | R <sub>i</sub> = 0.299        |                         |
| Totals   | 2.427                         | 39.35 kg/m <sup>2</sup> |

$$U_w = \frac{1}{2.427} = 0.41 \text{ W/m}^2\text{°C}$$

'U' value of structural walls :-

G/F, 1/F, 5/F-14/F

| W <sub>5</sub> for wall panel                     |                             | Weight                  |
|---|-----------------------------|-------------------------|
| external surface film                             | Ro = 0.044                  |                         |
| 5 mm white mosaic tiles                           | $\frac{0.005}{1.5} = 0.003$ | 0.005 x 2500 = 12.50    |
| 10 mm cement/sand render                          | $\frac{0.01}{0.72} = 0.014$ | 0.01 x 1860 = 18.60     |
| 300 mm concrete wall                              | $\frac{0.30}{2.16} = 0.139$ | 0.30 x 2400 = 720.00    |
| 10 mm gypsum plaster                              | $\frac{0.01}{0.38} = 0.026$ | 0.01 x 1120 = 11.20     |
| Internal surface film<br>(absorptivity below 0.5) | Ri = 0.299                  |                         |
| Totals  | 0.525                       | 762.3 kg/m <sup>2</sup> |

$$U_w = \frac{1}{0.525} = 1.91 \text{ W/m}^2\text{°C}$$

(for carpark ramp and walls without tiles or render 'U' value is 1.97 W/m<sup>2</sup>°C)  
(for lift wall without gypsum plaster 'U' value is 3.13 W/m<sup>2</sup>°C)

'U' value of structural walls :-

16/F-26/F

| W <sub>6</sub> for beam and column                     |                               | Weight                   |
|--|-------------------------------|--------------------------|
| external surface film                                  | Ro = 0.044                    |                          |
| 8 mm black glass                                       | $\frac{0.008}{1.05} = 0.0076$ | 0.008 x 2500 = 20.00     |
| 50 mm Air space resistance<br>(absorptivity above 0.5) | Ra = 0.153                    |                          |
| 300 mm concrete wall                                   | $\frac{0.30}{2.16} = 0.139$   | 0.3 x 2400 = 720.00      |
| 10 mm gypsum plaster                                   | $\frac{0.01}{0.38} = 0.026$   | 0.01 x 1120 = 11.20      |
| Internal surface film                                  | Ri = 0.299                    |                          |
| Totals   | 0.669                         | 751.20 kg/m <sup>2</sup> |

$$U_w = \frac{1}{0.669} = 1.50 \text{ W/m}^2\text{°C}$$

(for lift wall without gypsum plaster 'U' value is 2.16 W/m<sup>2</sup>°C)

'U' value of Lift Lobby wall :-

5/F - 14/F

| W7 for beam and column     |                             | Weight                    |
|----------------------------|-----------------------------|---------------------------|
| External surface film      | Ro = 0.044                  |                           |
| 5 mm white mosaic tiles    | = 0.003                     | 0.005 x 2500 = 12.50      |
| 10 mm cement/sand render   | = 0.014                     | 0.01 x 1860 = 18.60       |
| *3.0 m concrete lobby wall | $\frac{3.00}{2.16} = 1.389$ | 3.00 x 2400 = 7200.00     |
| Totals                     | 1.450                       | 7231.10 kg/m <sup>2</sup> |

$$U_w = \frac{1}{1.45} = 0.69 \text{ W/m}^2\text{°C} \quad * 3.0 \text{ m length assumed for simplicity}$$

'U' value of Lift Lobby wall :-

16/F - 26/F

| W8 for beam and column                              |            | Weight                    |
|---|------------|---------------------------|
| External surface film                               | Ro = 0.044 |                           |
| 8 mm black glass                                    | = 0.0076   | 0.008 x 2500 = 20.00      |
| 50 mm Air space resistance (absorptivity above 0.5) | Ra = 0.153 |                           |
| *3.0 m concrete lobby wall                          | = 1.389    | 3.00 x 2400 = 7200.00     |
| Totals  | = 1.594    | 7220.00 kg/m <sup>2</sup> |

$$U_w = \frac{1}{1.594} = 0.63 \text{ W/m}^2\text{°C}$$

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 1

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing East (Tower)Solar Factor (SF) is 168

| *Wall/Roof Code No.                                      | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>2</sub> /R <sub>2</sub>             | *W <sub>3</sub> /R <sub>3</sub> | *W <sub>4</sub> /R <sub>4</sub>             |
|--|---------------------------------|---|---------------------------------|---|
| Location of Wall/Roof                                    | Beams & Cols<br>5/F-14/F        | Beams & Cols<br>16/F-26/F                   | Panel Curtain<br>Walls 5/F-14/F | Panel Curtain<br>Wall 16/F-26/F             |
| External Finish Material                                 |                                 |   |                                 |   |
| Conductivity W/m°C                                       | 1.50                            | 1.05  | 1.50                            | 1.05  |
| Density kg/m <sup>3</sup>                                | 2500                            | 2500  | 2500                            | 2500  |
| Thickness m  | 0.005                           | 0.008                                       | 0.005                           | 0.008                                       |
| Absorptivity (α)   | 0.58                            | 1.00  | 0.58                            | 1.00  |
| Intermediate component                                   | cement render                   | air gap                                     | cement render                   | mineral wool                                |
| Conductivity W/m°C                                       | 0.72                            |   | 0.72                            | 0.039                                       |
| Density kg/m <sup>3</sup>                                | 1860                            |   | 1860                            | 50  |
| Thickness m  | 0.01                            | 0.05  | 0.01                            | 0.075                                       |
| Intermediate component                                   | r. concrete                     | r. concrete                                 | r. concrete                     | air gap                                     |
| Conductivity W/m°C                                       | 2.16                            | 2.16  | 2.16                            |   |
| Density kg/m <sup>3</sup>                                | 2400                            | 2400  | 2400                            |   |
| Thickness m  | 0.60                            | 0.60  | 0.10                            | 0.05  |
| Intermediate component                                   |                                 |   |                                 |   |
| Conductivity W/m°C                                       |                                 |   |                                 |   |
| Density kg/m <sup>3</sup>                                |                                 |   |                                 |   |
| Thickness m  |                                 |   |                                 |   |
| Intermediate component                                   |                                 |   |                                 |   |
| Conductivity W/m°C                                       |                                 |   |                                 |   |
| Density kg/m <sup>3</sup>                                |                                 |   |                                 |   |
| Thickness m  |                                 |   |                                 |   |
| Internal Finish Material                                 |                                 | white semi gloss paint<br>on gypsum plaster |                                 | white semi<br>gloss paint on<br>steel panel |
| Conductivity W/m°C                                       | 0.38                            | 0.38  | 0.38                            | 50  |
| Density kg/m <sup>3</sup>                                | 1120                            | 1120  | 1120                            | 7800  |
| Thickness m  | 0.01                            | 0.01  | 0.01                            | 0.002                                       |
| Absorptivity α   | 0.30                            | 0.30  | 0.30                            | 0.30  |
| 'U' value of composite<br>*Wall/Roof                     | 1.51                            | 1.24  | 2.32                            | 0.41  |
| Area of *Wall/Roof m <sup>2</sup>                        | 200.40                          | 220.44                                      | 206.00                          | 262.68                                      |
| Density of composite<br>*Wall/Roof kg/m <sup>2</sup>     | 1482                            | 1471  | 282                             | 39  |
| Equivalent temperature<br>difference (TD <sub>EQ</sub> ) | 2.40                            | 2.40  | 5.01                            | 6.68  |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 1(A)

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing East (Tower)Solar Factor (SF) is 168

| *Wall/Roof Code No.                                      | *W <sub>5</sub> /R <sub>5</sub>             | *W <sub>6</sub> /R <sub>6</sub> | *W <sub>7</sub> /R <sub>7</sub> | *W <sub>8</sub> /R <sub>8</sub> |
|--|---|---------------------------------|---------------------------------|---------------------------------|
| Location of Wall/Roof                                    | 300 Panel Walls<br>5/F-14/F                 | 300 Panel Walls<br>16/F-26/F    | Lift Lobby Wall<br>5/F-14/F     | Lift Lobby Wall<br>16/F-26/F    |
| External Finish Material                                 | white mosaic<br>tiles                       | black glass                     | white mosaic<br>tiles           | black glass                     |
| Conductivity W/m°C                                       | 1.50  | 1.05                            | 1.50                            | 1.05                            |
| Density kg/m <sup>3</sup>                                | 2500  | 2500                            | 2500                            | 2500                            |
| Thickness m  | 0.005                                       | 0.008                           | 0.005                           | 0.008                           |
| Absorptivity (α)   | 0.58  | 1.00                            | 0.58                            | 1.00                            |
| Intermediate component                                   | cement render                               | air gap                         | cement render                   | air gap                         |
| Conductivity W/m°C                                       | 0.72  |                                 | 0.72                            |                                 |
| Density kg/m <sup>3</sup>                                | 1860  |                                 | 1860                            |                                 |
| Thickness m  | 0.01  | 0.05                            | 0.01                            | 0.05                            |
| Intermediate component                                   | r. concrete                                 | r. concrete                     | r. concrete                     | r. concrete                     |
| Conductivity W/m°C                                       | 2.16  | 2.16                            | 2.16                            | 2.16                            |
| Density kg/m <sup>3</sup>                                | 2400  | 2400                            | 2400                            | 2400                            |
| Thickness m  | 0.30  | 0.30                            | 3.00                            | 3.00                            |
| Intermediate component                                   |   |                                 |                                 |                                 |
| Conductivity W/m°C                                       |   |                                 |                                 |                                 |
| Density kg/m <sup>3</sup>                                |   |                                 |                                 |                                 |
| Thickness m  |   |                                 |                                 |                                 |
| Intermediate component                                   |   |                                 |                                 |                                 |
| Conductivity W/m°C                                       |   |                                 |                                 |                                 |
| Density kg/m <sup>3</sup>                                |   |                                 |                                 |                                 |
| Thickness m  |   |                                 |                                 |                                 |
| Internal Finish Material                                 | white semi gloss paint<br>on gypsum plaster |                                 |                                 |                                 |
| Conductivity W/m°C                                       | 0.38  | 0.38                            |                                 |                                 |
| Density kg/m <sup>3</sup>                                | 1120  | 1120                            |                                 |                                 |
| Thickness m  | 0.01  | 0.01                            |                                 |                                 |
| Absorptivity α   | 0.30  | 0.30                            |                                 |                                 |
| 'U' value of composite<br>*Wall/Roof                     | 1.91(3.13)                                  | 1.50(2.16)                      | 0.69                            | 0.63                            |
| Area of *Wall/Roof m <sup>2</sup>                        | 43.20(86.4)                                 | 47.52(95.04)                    | 28.80                           | 31.68                           |
| Density of composite<br>*Wall/Roof kg/m <sup>2</sup>     | 762(751)                                    | 751(740)                        | 7231                            | 7220                            |
| Equivalent temperature<br>difference (TD <sub>EQ</sub> ) | 2.40  | 2.40                            | 2.40                            | 2.40                            |

( ) Lift shaft walls without gypsum plaster

\*Delete as appropriate

Building (Energy Efficiency) Regulation  
Form OTTV 2

Window/Rooflight Schedule

Sheet No. B 1

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing East (Tower)Solar Factor (SF) is 168

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    | 5/F-14/F<br>shaded               | 5/F-14/F<br>unshaded             | 16/F-26/F<br>shaded              | 16/F-26/F<br>unshaded            |
| Glazing type                         | tinted                           | tinted                           | tinted                           | tinted                           |
| Thickness m                          | 0.008                            | 0.008                            | 0.008                            | 0.008                            |
| Shading Coefficient (SC)             | 0.70                             | 0.70                             | 0.70                             | 0.70                             |
| Type of shading device               | solid<br>overhang                | -                                | aluminium<br>foils               | -                                |
| External Shading<br>Multiplier (ESM) | 0.7                              | -                                | 0.7                              | -                                |
| Area of glazing m <sup>2</sup>       | 172.80                           | 156.80                           | 119.68                           | 206.80                           |

Physical data on \*window/rooflight

Facade Orientation facing East (Tower)Solar Factor is 168

| Window/Rooflight Code No.            | *F <sub>5</sub> /RL <sub>5</sub> | *F <sub>6</sub> /RL <sub>6</sub> | *F <sub>7</sub> /RL <sub>7</sub> | *F <sub>8</sub> /RL <sub>8</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    | 5/F-14/F<br>unshaded             | 16/F-26/F<br>unshaded            |                                  |                                  |
| Glazing type                         | tinted                           | tinted                           |                                  |                                  |
| Thickness m                          | 0.008                            | 0.008                            |                                  |                                  |
| Shading Coefficient (SC)             | 0.70                             | 0.70                             |                                  |                                  |
| Type of shading device               | -                                | -                                |                                  |                                  |
| External Shading<br>Multiplier (ESM) | -                                | -                                |                                  |                                  |
| Area of glazing m <sup>2</sup>       | 43.20                            | 47.52                            |                                  |                                  |

\* Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 1

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingFacade Orientation facing East (Tower).

Opaque \*Walls/Roofs

| Code No.  | Description                      | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum          |
|-----------|----------------------------------|---------------------------------|------|-----------|------------------|--------------|
| W1        | Beams & Cols 5/F-14/F            | 200.40                          | 1.51 | 0.58      | 2.40             | 421.22       |
| W2        | Beams & Cols 16/F-26/F           | 220.44                          | 1.24 | 1.00      | 2.40             | 656.03       |
| W3        | Panel Curtain Walls<br>5/F-14/F  | 206.00                          | 2.32 | 0.58      | 5.01             | 1,388.74     |
| W4        | Panel Curtain Walls<br>16/F-26/F | 262.68                          | 0.41 | 1.00      | 6.68             | 719.43       |
| W5        | 300 Panel Walls<br>5/F-14/F      | 43.20                           | 1.91 | 0.58      | 2.40             | 114.86       |
| W5A       | 300 Lift Walls                   | 86.40                           | 3.13 | 0.58      | 2.40             | 376.44       |
| W6        | 300 Panel Walls<br>16/F-26/F     | 47.52                           | 1.50 | 1.00      | 2.40             | 171.07       |
| W6A       | 300 Lift Walls                   | 95.04                           | 2.16 | 1.00      | 2.40             | 492.69       |
| W7        | Lift/Lobby wall<br>5/F-14/F      | 28.80                           | 0.69 | 0.58      | 2.40             | 27.66        |
| W8        | Lift/Lobby wall<br>16/F-26/F     | 31.68                           | 0.63 | 1.00      | 2.40             | 47.90        |
| Subtotals |                                  | 1,222.16                        | (A)  | Heat Gain |                  | 4,416.04 (C) |

Fenestration

| Code No.  | Description          | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|----------------------|-----------------------------------|------|-----------|-----|---------------|
| F1        | 5/F - 14/F shaded    | 172.80                            | 0.70 | 0.7       | 168 | 14,224.90     |
| F2        | 5/F - 14/F unshaded  | 156.80                            | 0.70 | -         | 168 | 18,439.68     |
| F3        | 16/F - 26/F shaded   | 119.68                            | 0.70 | 0.7       | 168 | 9,852.06      |
| F4        | 16/F - 26/F unshaded | 206.80                            | 0.70 | -         | 168 | 24,319.68     |
| F5        | 5/F-14/F unshaded    | 43.20                             | 0.70 | -         | 168 | 5,080.32      |
| F6        | 16/F - 26/F unshaded | 47.52                             | 0.70 | -         | 168 | 5,588.35      |
| Subtotals |                      | 746.80                            | (B)  | Heat Gain |     | 77,504.99 (D) |

Gross Heat Gain (C + D) 81,921.03Gross Area (A + B) 1,968.96

$$\text{OTTV} = \frac{C + D}{A + B} = \underline{41.61} \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

North Elevation (Tower)

Gross Wall Area

1,566.72 m<sup>2</sup>Wall composite areasBeams and Column Areas

|             |                                 |   |                       |                       |
|-------------|---------------------------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | (0.6 x 18.6 + 0.6 x 2.6 x 4) 10 | = | 174.00 m <sup>2</sup> |                       |
| 15/F        | Nil                             | = | -                     |                       |
| 16/F - 26/F | (0.6 x 18.6 + 0.6 x 2.6 x 4) 11 | = | 191.40 m <sup>2</sup> | 365.40 m <sup>2</sup> |
|             |                                 |   |                       | <hr/>                 |

300 mm Structural Wall to Lift

|           |                |   |                      |  |
|-----------|----------------|---|----------------------|--|
| 16/F-26/F | 0.3 x 3.2 x 11 | = | 10.56 m <sup>2</sup> |  |
|-----------|----------------|---|----------------------|--|

300 mm Structural Panel Walls to Lift

|           |                        |   |                       |                       |
|-----------|------------------------|---|-----------------------|-----------------------|
| 16/F-26/F | 9.0 x 3.2 x 11 - 10.56 | = | 306.24 m <sup>2</sup> | 316.80 m <sup>2</sup> |
|           |                        |   |                       | <hr/>                 |

Glazing Areas

|             |            |   |                       |                       |
|-------------|------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | 25.76 x 10 | = | 257.60 m <sup>2</sup> |                       |
| 15/F        | Nil        | = | -                     |                       |
| 16/F - 26/F | 25.76 x 11 | = | 283.36 m <sup>2</sup> | 540.96 m <sup>2</sup> |
|             |            |   |                       | <hr/>                 |

100 mm Staircase Wall

|             |                |   |                     |                     |
|-------------|----------------|---|---------------------|---------------------|
| 5/F - 14/F  | 0.1 x 2.6 x 10 | = | 2.60 m <sup>2</sup> |                     |
| 16/F - 26/F | 0.1 x 2.6 x 11 | = | 2.86 m <sup>2</sup> | 5.46 m <sup>2</sup> |
|             |                |   |                     | <hr/>               |

100 mm Wall Panel Areas

|             |  |   |                       |                       |
|-------------|--|---|-----------------------|-----------------------|
| 5/F - 14/F  | 595.20 - (174.00 + 257.60 + 2.60)          | = | 161.00 m <sup>2</sup> |                       |
| 15/F        | Nil  | = | -                     |                       |
| 16/F - 26/F | 971.52 - (191.40 + 316.80 + 283.36 + 2.86) | = | 177.10 m <sup>2</sup> | 338.10 m <sup>2</sup> |
|             |  |   |                       | <hr/>                 |



Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 2

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing North (Tower)Solar Factor (SF) is 104

| *Wall/Roof Code No.                                      |                   | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>2</sub> /R <sub>2</sub>             | *W <sub>3</sub> /R <sub>3</sub> | *W <sub>4</sub> /R <sub>4</sub>             |
|--|-------------------|---------------------------------|---|---------------------------------|---|
| Location of Wall/Roof                                    |                   | Beams & Coils<br>5/F-14/F       | Beams & Coils<br>16/F-26/F                  | Panel Walls<br>5/F-14/F         | Curtain wall<br>panel 16/F-26/F             |
| External Finish Material                                 |                   | white mosaic<br>tiles           | black glass                                 | white mosaic<br>tiles           | black glass                                 |
| Conductivity   | W/m°C             | 1.50                            | 1.05  | 1.50                            | 1.05  |
| Density  | kg/m <sup>3</sup> | 2500                            | 2500  | 2500                            | 2500  |
| Thickness  | m                 | 0.005                           | 0.008                                       | 0.005                           | 0.008                                       |
| Absorptivity   | (α)               | 0.58                            | 1.00  | 0.58                            | 1.00  |
| Intermediate component                                   |                   | cement render                   | air gap                                     | cement render                   | air gap                                     |
| Conductivity   | W/m°C             | 0.72                            |   | 0.72                            | 0.039                                       |
| Density  | kg/m <sup>3</sup> | 1860                            |   | 1860                            | 50  |
| Thickness  | m                 | 0.01                            | 0.05  | 0.01                            | 0.075                                       |
| Intermediate component                                   |                   | r. concrete                     | r. concrete                                 | r. concrete                     | air gap                                     |
| Conductivity   | W/m°C             | 2.16                            | 2.16  | 2.16                            |   |
| Density  | kg/m <sup>3</sup> | 2400                            | 2400  | 2400                            |   |
| Thickness  | m                 | 0.60                            | 0.60  | 0.10                            | 0.05  |
| Intermediate component                                   |                   |                                 |   |                                 |   |
| Conductivity   | W/m°C             |                                 |   |                                 |   |
| Density  | kg/m <sup>3</sup> |                                 |   |                                 |   |
| Thickness  | m                 |                                 |   |                                 |   |
| Intermediate component                                   |                   |                                 |   |                                 |   |
| Conductivity   | W/m°C             |                                 |   |                                 |   |
| Density  | kg/m <sup>3</sup> |                                 |   |                                 |   |
| Thickness  | m                 |                                 |   |                                 |   |
| Intermediate component                                   |                   |                                 |   |                                 |   |
| Conductivity   | W/m°C             |                                 |   |                                 |   |
| Density  | kg/m <sup>3</sup> |                                 |   |                                 |   |
| Thickness  | m                 |                                 |   |                                 |   |
| Internal Finish Material                                 |                   |                                 | white semi gloss paint on<br>gypsum plaster |                                 | white semi<br>gloss paint on<br>steel panel |
| Conductivity   | W/m°C             | 0.38                            | 0.38  | 0.38                            | 50  |
| Density  | kg/m <sup>3</sup> | 1120                            | 1120  | 1120                            | 7800  |
| Thickness  | m                 | 0.01                            | 0.01  | 0.01                            | 0.002                                       |
| Absorptivity   | α                 | 0.30                            | 0.30  | 0.30                            | 0.30  |
| 'U' value of composite<br>*Wall/Roof                     |                   | 1.51                            | 1.24  | 2.32                            | 0.41  |
| Area of *Wall/Roof                                       | m <sup>2</sup>    | 174.00                          | 191.40                                      | 161.00                          | 177.10                                      |
| Density of composite<br>*Wall/Roof                       | kg/m <sup>2</sup> | 1482                            | 1471  | 282                             | 39  |
| Equivalent temperature<br>difference (TD <sub>EQ</sub> ) |                   | 1.70                            | 1.70  | 2.72                            | 3.38  |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 3

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing North (Tower)Solar Factor (SF) is 104

| *Wall/Roof Code No.                                   | *W <sub>6</sub> /R <sub>6</sub>        | *W <sub>7</sub> /R <sub>7</sub> | *W <sub>8</sub> /R <sub>8</sub> | *W <sub>8A</sub> /R <sub>8A</sub>     |
|---|--|---------------------------------|---------------------------------|---------------------------------------|
| Location of Wall/Roof                                 | 300mm Structural Panel Walls 16/F-26/F | 100mm Staircase wall 5/F-14/F   | 100mm Stair wall 16/F-26/F      | 300mm Structural Lift Walls 16/F-26/F |
| External Finish Material                              | black glass                            | white mosaic tiles              | black glass                     | black glass                           |
| Conductivity W/m°C                                    | 1.05                                   | 1.50                            | 1.05                            | 1.05                                  |
| Density kg/m <sup>3</sup>                             | 2500                                   | 2500                            | 2500                            | 2500                                  |
| Thickness m   | 0.008                                  | 0.005                           | 0.008                           | 0.008                                 |
| Absorptivity (α)                                      | 1.00                                   | 0.58                            | 1.00                            | 1.00                                  |
| Intermediate component                                | air gap                                | cement render                   | air gap                         | air gap                               |
| Conductivity W/m°C                                    |  | 0.72                            |                                 |                                       |
| Density kg/m <sup>3</sup>                             |  | 1860                            |                                 |                                       |
| Thickness m   | 0.05                                   | 0.01                            | 0.05                            | 0.05                                  |
| Intermediate component                                | r. concrete                            | r. concrete                     | r. concrete                     | r. concrete                           |
| Conductivity W/m°C                                    | 2.16                                   | 2.16                            | 2.16                            | 2.16                                  |
| Density kg/m <sup>3</sup>                             | 2400                                   | 2400                            | 2400                            | 2400                                  |
| Thickness m   | 0.30                                   | 3.00                            | 3.00                            | 3.00                                  |
| Intermediate component                                |  |                                 |                                 |                                       |
| Conductivity W/m°C                                    |  |                                 |                                 |                                       |
| Density kg/m <sup>3</sup>                             |  |                                 |                                 |                                       |
| Thickness m   |  |                                 |                                 |                                       |
| Intermediate component                                |  |                                 |                                 |                                       |
| Conductivity W/m°C                                    |  |                                 |                                 |                                       |
| Density kg/m <sup>3</sup>                             |  |                                 |                                 |                                       |
| Thickness m   |  |                                 |                                 |                                       |
| Internal Finish Material                              |  |                                 |                                 |                                       |
| Conductivity W/m°C                                    |  |                                 |                                 |                                       |
| Density kg/m <sup>3</sup>                             |  |                                 |                                 |                                       |
| Thickness m   |  |                                 |                                 |                                       |
| Absorptivity α  |  |                                 |                                 |                                       |
| 'U' value of composite *Wall/Roof                     | 2.16                                   | 0.69                            | 0.63                            | 0.63                                  |
| Area of *Wall/Roof m <sup>2</sup>                     | 306.24                                 | 2.60                            | 2.86                            | 10.56                                 |
| Density of composite *Wall/Roof kg/m <sup>2</sup>     | 740                                    | 7231                            | 7220                            | 7220                                  |
| Equivalent temperature difference (TD <sub>EQ</sub> ) | 1.70                                   | 1.70                            | 1.70                            | 1.70                                  |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 2

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Window/Rooflight Schedule

Sheet No. B 2

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing North (Tower) Solar Factor (SF) is 104

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    | 5/F-14/F<br>shaded               | 16/F-26/F<br>shaded              |                                  |                                  |
| Glazing type                         | tinted                           | tinted                           |                                  |                                  |
| Thickness m                          | 0.008                            | 0.008                            |                                  |                                  |
| Shading Coefficient (SC)             | 0.70                             | 0.70                             |                                  |                                  |
| Type of shading device               | solid<br>overhang                | aluminium<br>foils               |                                  |                                  |
| External Shading<br>Multiplier (ESM) | 0.80                             | 0.80                             |                                  |                                  |
| Area of glazing m <sup>2</sup>       | 257.60                           | 283.36                           |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_ Solar Factor is \_\_\_\_\_

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    |                                  |                                  |                                  |                                  |
| Glazing type                         |                                  |                                  |                                  |                                  |
| Thickness m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)             |                                  |                                  |                                  |                                  |
| Type of shading device               |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       |                                  |                                  |                                  |                                  |

\* Delete as appropriate

Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 2

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingFacade Orientation facing North (Tower).

Opaque \*Walls/Roofs

| Code No.  | Description                       | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum          |
|-----------|-----------------------------------|---------------------------------|------|-----------|------------------|--------------|
| W1        | Beams & Col. 5/F-14/F             | 174.00                          | 1.51 | 0.58      | 1.70             | 259.06       |
| W2        | Beams & Col. 16/F-26/F            | 191.40                          | 1.24 | 1.00      | 1.70             | 403.47       |
| W3        | Panels Walls 5/F-14/F             | 161.00                          | 2.32 | 0.58      | 2.72             | 589.27       |
| W4        | Panels Walls 16/F-26/F            | 177.10                          | 0.41 | 1.00      | 3.38             | 245.43       |
| W6        | 300 mm Structural Panel 16/F-26/F | 306.24                          | 2.16 | 1.00      | 1.70             | 1,124.51     |
| W7        | 100 mm Stair wall 5/F-14/F        | 2.60                            | 0.69 | 0.58      | 1.70             | 1.77         |
| W8        | 100 mm Stair wall 16/F-26/F       | 2.86                            | 0.63 | 1.00      | 1.70             | 3.06         |
| W8A       | 300 mm Lift wall 16/F-26/F        | 10.56                           | 0.63 | 1.00      | 1.70             | 11.31        |
| Subtotals |                                   | 1,025.76                        | (A)  | Heat Gain |                  | 2,637.88 (C) |

Fenestration

| Code No.  | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|-------------|-----------------------------------|------|-----------|-----|---------------|
| F1        | 5/F - 14/F  | 257.60                            | 0.70 | 0.80      | 104 | 15,002.62     |
| F2        | 16/F - 26/F | 283.36                            | 0.70 | 0.80      | 104 | 16,502.89     |
| Subtotals |             | 540.96                            | (B)  | Heat Gain |     | 31,505.51 (D) |

Gross Heat Gain (C + D) 34,143.39Gross Area (A + B) 1,566.72

$$\text{OTTV} = \frac{C + D}{A + B} = \underline{21.79} \text{ W/m}^2$$

\* Delete as appropriate

West Elevation (Tower)                      Gross Wall Area                      1,968.96 m<sup>2</sup>

Wall composite areas

Beams and Column Areas

|             |                                 |   |                       |                       |
|-------------|---------------------------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | (0.6 x 29.3 + 0.6 x 2.6 x 6) 10 | = | 269.40 m <sup>2</sup> |                       |
| 15/F        | Nil                             | = | -                     |                       |
| 16/F - 26/F | (0.6 x 29.3 + 0.6 x 2.6 x 6) 11 | = | 296.34 m <sup>2</sup> | 565.74 m <sup>2</sup> |
|             |                                 |   |                       | <hr/>                 |

Glazing Areas

|             |            |   |                       |                       |
|-------------|------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | 32.48 x 10 | = | 324.80 m <sup>2</sup> |                       |
| 15/F        | Nil        | = | -                     |                       |
| 16/F - 26/F | 32.48 x 11 | = | 357.28 m <sup>2</sup> | 682.08 m <sup>2</sup> |
|             |            |   |                       | <hr/>                 |

Wall Panel Areas

|             |                              |   |                       |                       |
|-------------|------------------------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | 937.60 - (269.40 + 324.80)   | = | 343.40 m <sup>2</sup> |                       |
| 15/F        | Nil                          | = | -                     |                       |
| 16/F - 26/F | 1,031.36 - (296.34 + 357.28) | = | 377.74 m <sup>2</sup> | 721.14 m <sup>2</sup> |
|             |                              |   |                       | <hr/>                 |

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 3

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing West (Tower)Solar Factor (SF) is 175

| *Wall/Roof Code No.                                      | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>2</sub> /R <sub>2</sub>             | *W <sub>3</sub> /R <sub>3</sub> | *W <sub>4</sub> /R <sub>4</sub>             |
|--|---------------------------------|---|---------------------------------|---|
| Location of Wall/Roof                                    | Beams & Cols<br>5/F-14/F        | Beams & Cols<br>16/F-26/F                   | Panel Walls<br>5/F-14/F         | Curtain Wall<br>panel 16/F-26/F             |
| External Finish Material                                 | white mosaic<br>tiles           | black glass                                 | white mosaic<br>tiles           | black glass                                 |
| Conductivity W/m°C                                       | 1.50                            | 1.05  | 1.50                            | 1.05  |
| Density kg/m <sup>3</sup>                                | 2500                            | 2500  | 2500                            | 2500  |
| Thickness m  | 0.005                           | 0.008                                       | 0.005                           | 0.008                                       |
| Absorptivity (α)   | 0.58                            | 1.00  | 0.58                            | 1.00  |
| Intermediate component                                   | cement render                   | air gap                                     | cement render                   | mineral felt                                |
| Conductivity W/m°C                                       | 0.72                            |   | 0.72                            | 0.039                                       |
| Density kg/m <sup>3</sup>                                | 1860                            |   | 1860                            | 50  |
| Thickness m  | 0.01                            | 0.05  | 0.01                            | 0.075                                       |
| Intermediate component                                   | r. concrete                     | r. concrete                                 | r. concrete                     | air gap                                     |
| Conductivity W/m°C                                       | 2.16                            | 2.16  | 2.16                            |   |
| Density kg/m <sup>3</sup>                                | 2400                            | 2400  | 2400                            |   |
| Thickness m  | 0.60                            | 0.60  | 0.10                            | 0.05  |
| Intermediate component                                   |                                 |   |                                 |   |
| Conductivity W/m°C                                       |                                 |   |                                 |   |
| Density kg/m <sup>3</sup>                                |                                 |   |                                 |   |
| Thickness m  |                                 |   |                                 |   |
| Intermediate component                                   |                                 |   |                                 |   |
| Conductivity W/m°C                                       |                                 |   |                                 |   |
| Density kg/m <sup>3</sup>                                |                                 |   |                                 |   |
| Thickness m  |                                 |   |                                 |   |
| Internal Finish Material                                 |                                 | white semi gloss paint on<br>gypsum plaster |                                 | white semi<br>gloss paint on<br>steel panel |
| Conductivity W/m°C                                       | 0.38                            | 0.38  | 0.38                            | 50  |
| Density kg/m <sup>3</sup>                                | 1120                            | 1120  | 1120                            | 7800  |
| Thickness m  | 0.01                            | 0.01  | 0.01                            | 0.002                                       |
| Absorptivity α   | 0.30                            | 0.30  | 0.30                            | 0.30  |
| 'U' value of composite<br>*Wall/Roof                     | 1.51                            | 1.24  | 2.32                            | 0.41  |
| Area of *Wall/Roof m <sup>2</sup>                        | 269.40                          | 296.34                                      | 343.40                          | 377.74                                      |
| Density of composite<br>*Wall/Roof kg/m <sup>2</sup>     | 1482                            | 1471  | 282                             | 39  |
| Equivalent temperature<br>difference (TD <sub>EQ</sub> ) | 2.10                            | 2.10  | 4.35                            | 5.79  |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 2

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Window/Rooflight Schedule

Sheet No. B     3    BD Ref 2/      /      /     Building address     Typical Commercial Building    

Physical data on \*window/rooflight

Facade Orientation facing     West (Tower)     Solar Factor (SF) is     175    

| Window/Rooflight Code No.                       | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight               | 5/F-14/F<br>shaded               | 16/F-26/F<br>shaded              |                                  |                                  |
| Glazing type                                    | tinted                           | tinted                           |                                  |                                  |
| Thickness            m                          | 0.008                            | 0.008                            |                                  |                                  |
| Shading Coefficient (SC)                        | 0.70                             | 0.70                             |                                  |                                  |
| Type of shading device                          | solid<br>overhang                | aluminium<br>foils               |                                  |                                  |
| External Shading<br>Multiplier            (ESM) | 0.70                             | 0.70                             |                                  |                                  |
| Area of glazing        m <sup>2</sup>           | 324.80                           | 357.28                           |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing                      Solar Factor is                     

| Window/Rooflight Code No.                       | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight               |                                  |                                  |                                  |                                  |
| Glazing type                                    |                                  |                                  |                                  |                                  |
| Thickness            m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)                        |                                  |                                  |                                  |                                  |
| Type of shading device                          |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier            (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing        m <sup>2</sup>           |                                  |                                  |                                  |                                  |

\* Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 3

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Facade Orientation facing West (Tower)

Opaque \*Walls/Roofs

| Code No.  | Description                      | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum          |
|-----------|----------------------------------|---------------------------------|------|-----------|------------------|--------------|
| W1        | Beams & Col. 5/F-14/F            | 269.40                          | 1.51 | 0.58      | 2.10             | 495.48       |
| W2        | Beams & Col. 16/F-26/F           | 296.34                          | 1.24 | 1.00      | 2.10             | 771.67       |
| W3        | Panels Walls 5/F-14/F            | 343.40                          | 2.32 | 0.58      | 4.35             | 2,010.04     |
| W4        | Curtain Wall Panels<br>16/F-26/F | 377.74                          | 0.41 | 1.00      | 5.79             | 896.72       |
| Subtotals |                                  | 1,286.88                        | (A)  | Heat Gain |                  | 4,173.91 (C) |

Fenestration

| Code No.  | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|-------------|-----------------------------------|------|-----------|-----|---------------|
| F1        | 5/F - 14/F  | 324.80                            | 0.70 | 0.70      | 175 | 27,851.60     |
| F2        | 16/F - 26/F | 357.28                            | 0.70 | 0.70      | 175 | 30,636.76     |
| Subtotals |             | 682.08                            | (B)  | Heat Gain |     | 58,488.36 (D) |

Gross Heat Gain (C + D) 62,662.27

Gross Area (A + B) 1,968.96

$$\text{OTTV} = \frac{C + D}{A + B} = \underline{31.83} \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995



South Elevation (Tower)

Gross Wall Area

1,566.72 m<sup>2</sup>Wall composite areasBeam and Column Areas

|             |                                     |   |                       |                       |
|-------------|-------------------------------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | (0.6 x 18.6 + 0.6 x 2.6 x 4) 10     | = | 174.00 m <sup>2</sup> |                       |
| 15/F        | Nil                                 |   |                       |                       |
| 16/F - 26/F | [(0.6 x (18.6+9)+0.6 x 2.6 x 6)] 11 | = | 285.12 m <sup>2</sup> | 459.12 m <sup>2</sup> |

---

Glazing Areas

|             |            |   |                       |                       |
|-------------|------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | 25.92 x 10 | = | 259.20 m <sup>2</sup> |                       |
| 15/F        | Nil        |   |                       |                       |
| 16/F - 26/F | 25.92 x 11 | = | 285.12 m <sup>2</sup> |                       |
| 16/F - 26/F | 8.48 x 11  | = | 93.28 m <sup>2</sup>  | 637.60 m <sup>2</sup> |

---

100 mm Stair case wall

|             |                |   |                     |                     |
|-------------|----------------|---|---------------------|---------------------|
| 16/F - 26/F | 0.1 x 2.6 x 11 | = | 2.86 m <sup>2</sup> | 2.86 m <sup>2</sup> |
|-------------|----------------|---|---------------------|---------------------|

---

Wall Panel Areas

|             |                                     |   |                       |                       |
|-------------|-------------------------------------|---|-----------------------|-----------------------|
| 5/F - 14/F  | 595.20 - (174.00 + 259.20)          | = | 162.00 m <sup>2</sup> |                       |
| 15/F        | Nil                                 |   |                       |                       |
| 16/F - 26/F | 971.52 - (285.12+285.12+93.28+2.86) | = | 305.14 m <sup>2</sup> | 467.14 m <sup>2</sup> |

---

Fenestration between 16/F - 26/F

|               |                        |                       |          |
|---------------|------------------------|-----------------------|----------|
| Total Glazing | 285.12 + 93.28 =       | 378.40 m <sup>2</sup> |          |
|               | (5.4 x 3) x 1.6 x 11 = | 285.12 m <sup>2</sup> | Unshaded |
|               |                        | 93.28 m <sup>2</sup>  | Shaded   |

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Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 4

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing South (Tower)Solar Factor (SF) is 191

| *Wall/Roof Code No.                                      | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>2</sub> /R <sub>2</sub>             | *W <sub>3</sub> /R <sub>3</sub> | *W <sub>4</sub> /R <sub>4</sub>             |
|--|---------------------------------|---|---------------------------------|---|
| Location of Wall/Roof                                    | Beams & Col<br>5/F-14/F         | Beams & Col<br>16/F-26/F                    | Panel Walls<br>5/F-14/F         | Curtain Wall<br>panel 16/F-26/F             |
| External Finish Material                                 | white mosaic<br>tiles           | black glass                                 | white mosaic<br>tiles           | black glass                                 |
| Conductivity W/m°C                                       | 1.50                            | 1.05  | 1.50                            | 1.05  |
| Density kg/m <sup>3</sup>                                | 2500                            | 2500  | 2500                            | 2500  |
| Thickness m  | 0.005                           | 0.008                                       | 0.005                           | 0.008                                       |
| Absorptivity (α)   | 0.58                            | 1.00  | 0.58                            | 1.00  |
| Intermediate component                                   | cement render                   | air gap                                     | cement render                   | mineral felt                                |
| Conductivity W/m°C                                       | 0.72                            |   | 0.72                            | 0.039                                       |
| Density kg/m <sup>3</sup>                                | 1860                            |   | 1860                            | 50  |
| Thickness m  | 0.01                            | 0.05  | 0.01                            | 0.075                                       |
| Intermediate component                                   | r. concrete                     | r. concrete                                 | r. concrete                     | air gap                                     |
| Conductivity W/m°C                                       | 2.16                            | 2.16  | 2.16                            |   |
| Density kg/m <sup>3</sup>                                | 2400                            | 2400  | 2400                            |   |
| Thickness m  | 0.60                            | 0.60  | 0.10                            | 0.05  |
| Intermediate component                                   |                                 |   |                                 |   |
| Conductivity W/m°C                                       |                                 |   |                                 |   |
| Density kg/m <sup>3</sup>                                |                                 |   |                                 |   |
| Thickness m  |                                 |   |                                 |   |
| Intermediate component                                   |                                 |   |                                 |   |
| Conductivity W/m°C                                       |                                 |   |                                 |   |
| Density kg/m <sup>3</sup>                                |                                 |   |                                 |   |
| Thickness m  |                                 |   |                                 |   |
| Internal Finish Material                                 |                                 | white semi gloss paint on<br>gypsum plaster |                                 | white semi<br>gloss paint on<br>steel panel |
| Conductivity W/m°C                                       | 0.38                            | 0.38  | 0.38                            | 50  |
| Density kg/m <sup>3</sup>                                | 1120                            | 1120  | 1120                            | 7800  |
| Thickness m  | 0.01                            | 0.01  | 0.01                            | 0.002                                       |
| Absorptivity α   | 0.30                            | 0.30  | 0.30                            | 0.30  |
| 'U' value of composite<br>*Wall/Roof                     | 1.51                            | 1.24  | 2.32                            | 0.41  |
| Area of *Wall/Roof m <sup>2</sup>                        | 174.00                          | 285.12                                      | 162.00                          | 305.14                                      |
| Density of composite<br>*Wall/Roof kg/m <sup>2</sup>     | 1482                            | 1471  | 282                             | 39  |
| Equivalent temperature<br>difference (TD <sub>EQ</sub> ) | 1.40                            | 1.40  | 3.60                            | 5.01  |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 4

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing South (Tower)Solar Factor (SF) is 191

|   |                   |                                 |
|---|-------------------|---------------------------------|
| *Wall/Roof Code No.   |                   | *W <sub>g</sub> /R <sub>g</sub> |
| Location of Wall/Roof                                       |                   | 16/F-26/F                       |
| External Finish Material                                    |                   | Staircase wall<br>black glass   |
| Conductivity  | W/m°C             | 1.05                            |
| Density   | kg/m <sup>3</sup> | 2500                            |
| Thickness   | m                 | 0.008                           |
| Absorptivity  | (α)               | 1.00                            |
| Intermediate component                                      |                   | air gap                         |
| Conductivity  | W/m°C             |                                 |
| Density   | kg/m <sup>3</sup> |                                 |
| Thickness   | m                 | 0.05                            |
| Intermediate component                                      |                   | r. concrete                     |
| Conductivity  | W/m°C             | 2.16                            |
| Density   | kg/m <sup>3</sup> | 2400                            |
| Thickness   | m                 | 3.00                            |
| Intermediate component                                      |                   |                                 |
| Conductivity  | W/m°C             |                                 |
| Density   | kg/m <sup>3</sup> |                                 |
| Thickness   | m                 |                                 |
| Intermediate component                                      |                   |                                 |
| Conductivity  | W/m°C             |                                 |
| Density   | kg/m <sup>3</sup> |                                 |
| Thickness   | m                 |                                 |
| Internal Finish Material                                    |                   |                                 |
| Conductivity  | W/m°C             |                                 |
| Density   | kg/m <sup>3</sup> |                                 |
| Thickness   | m                 |                                 |
| Absorptivity  | α                 |                                 |
| 'U' value of composite<br>*Wall/Roof                        |                   | 0.63                            |
| Area of *Wall/Roof  | m <sup>2</sup>    | 2.86                            |
| Density of composite<br>*Wall/Roof                          | kg/m <sup>2</sup> | 7220                            |
| Equivalent temperature<br>difference<br>(TD <sub>EQ</sub> ) |                   | 1.40                            |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 2

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Window/Rooflight Schedule

Sheet No. B 4

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing South (Tower)Solar Factor (SF) is 191

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    | 5/F-14/F<br>unshaded             | 16/F-26/F<br>unshaded            | 16/F-26/F<br>shaded              |                                  |
| Glazing type                         | tinted                           | reflective                       | tinted                           |                                  |
| Thickness m                          | 0.008                            | 0.006                            | 0.008                            |                                  |
| Shading Coefficient (SC)             | 0.70                             | 0.40                             | 0.70                             |                                  |
| Type of shading device               |                                  |                                  | aluminium<br>foils               |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  | 0.70                             |                                  |
| Area of glazing m <sup>2</sup>       | 259.20                           | 285.12                           | 93.28                            |                                  |

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_

Solar Factor is \_\_\_\_\_

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    |                                  |                                  |                                  |                                  |
| Glazing type                         |                                  |                                  |                                  |                                  |
| Thickness m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)             |                                  |                                  |                                  |                                  |
| Type of shading device               |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       |                                  |                                  |                                  |                                  |

\* Delete as appropriate

Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 4

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingFacade Orientation facing South (Tower).

Opaque \*Walls/Roofs

| Code No.  | Description            | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum          |
|-----------|------------------------|---------------------------------|------|-----------|------------------|--------------|
| W1        | Beams & Col. 5/F-14/F  | 174.00                          | 1.51 | 0.58      | 1.40             | 213.34       |
| W2        | Beams & Col. 16/F-26/F | 285.12                          | 1.24 | 1.00      | 1.40             | 494.97       |
| W3        | Panels Walls 5/F-14/F  | 162.00                          | 2.32 | 0.58      | 3.60             | 784.75       |
| W4        | Panels Walls 16/F-26/F | 305.14                          | 0.41 | 1.00      | 5.01             | 626.79       |
| W8        | Stair Walls 16/F-26/F  | 2.86                            | 0.63 | 1.00      | 1.40             | 2.52         |
| Subtotals |                        | 929.12                          | (A)  | Heat Gain |                  | 2,122.37 (C) |

Fenestration

| Code No.  | Description          | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|----------------------|-----------------------------------|------|-----------|-----|---------------|
| F1        | 5/F - 14/F unshaded  | 259.20                            | 0.70 |           | 191 | 34,655.04     |
| F2        | 16/F - 26/F unshaded | 285.12                            | 0.40 |           | 191 | 21,783.17     |
| F3        | 16/F - 26/F shaded   | 93.28                             | 0.70 | 0.70      | 191 | 8,730.08      |
| Subtotals |                      | 637.60                            | (B)  | Heat Gain |     | 65,168.29 (D) |

Gross Heat Gain (C + D) 67,290.66Gross Area (A + B) 1,566.72

$$\text{OTTV} = \frac{C + D}{A + B} = \underline{42.95} \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

**Building (Energy Efficiency) Regulation**  
**Form OTTV 4**

**Summary of OTTV of Building Envelope**

Sheet No. D \_\_\_\_\_

BD Ref. 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingTotal Envelope Heat Gain (\*Tower/Podium)

| Facade Orientation | Gross Area from Form OTTV 3 | Gross Heat Gain from Form OTTV 3 |
|--------------------|-----------------------------|----------------------------------|
| a. East            | 1,968.96                    | 81,921.03                        |
| b. North           | 1,566.72                    | 34,143.39                        |
| c. West            | 1,968.96                    | 62,662.27                        |
| d. South           | 1,566.72                    | 67,290.66                        |
| e.                 |                             |                                  |
| f.                 |                             |                                  |
| Subtotal           | 7,071.36 (E)                | 246,017.35 (G)                   |
| Roof               |                             |                                  |
| a.                 | 391.80                      | 13,185.05                        |
| b.                 |                             |                                  |
| Subtotal           | (F)                         | (H)                              |

$$\text{Tower/Podium Walls OTTV} = \frac{G}{E} = \underline{34.79} \text{ W/m}^2$$

$$\text{Tower/Podium Roofs OTTV} = \frac{H}{F} = \underline{33.65} \text{ W/m}^2$$

$$\text{Tower/Podium OTTV} = \frac{G + H}{E + F} = \underline{34.73} \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

Accountable Roof AreasRoof

$$\text{Gross Area} = 6.0 \times 6.6 + 9.6 \times 8.0 + 6 \times 10.3 + 9.0 \times 3.0 + 18.6 \times 8.0 + (6.3 \times 3.0 \times 2) = 391.80 \text{ m}^2$$

$$\text{Glazed area} = 8.4 \times 8.0 = 67.20 \text{ m}^2$$

$$\text{Beam area} = [(15.6 \times 2) + (6.0 \times 2) + 18.6 + (6.3 \times 2) + (5.4 \times 9) + 1.4 + (4.1 \times 2) + (1.7 \times 2) + (2.4 \times 2 \times 0.5) + (3.6 \times 0.5)] \times 0.6 = 84.12 \text{ m}^2$$

$$\text{Lift Lobby walls} = 0.3 (9+2.7) = 3.51 \text{ m}^2$$

$$\text{Panel area} = 391.80 - 67.2 - 84.12 - 3.51 = 236.97 \text{ m}^2$$

15/F

$$\text{Gross Area} = 6.6 \times 5.4 + 2.4 \times 1.4 = 39.00 \text{ m}^2$$

$$\text{Glazed area} = \text{Nil}$$

$$\text{Beam area} = 0.6 (5.4 \times 2) = 6.48 \text{ m}^2$$

$$\text{Panel area} = 39.00 - 6.48 = 32.52 \text{ m}^2$$

Podium Roof

Carpark under non-accountable Nil

'U' value of composite roof beams (and panels) :-

15/F and Roof

| R <sub>1</sub> (R <sub>2</sub> ) for beams (panels) | r                            | Weight               |
|---|------------------------------|----------------------|
| External surface film                               | R <sub>o</sub> = 0.055       |                      |
| 25 mm concrete tiles                                | $\frac{0.025}{1.10} = 0.023$ | 0.025 x 2100 = 52.50 |
| 20 mm asphalt                                       | $\frac{0.02}{1.15} = 0.017$  | 0.02 x 2350 = 47.00  |
| 50 mm cement/sand screed                            | $\frac{0.05}{0.72} = 0.069$  | 0.05 x 1860 = 93.00  |
| 50 mm polystyrene insulation                        | $\frac{0.05}{0.034} = 1.471$ | 0.05 x 25 = 1.25     |
| 600 mm r. concrete                                  | = 0.278                      | 0.6 x 2400 = 1440.00 |
| 10 mm gypsum plaster                                | = 0.026                      | 0.01 x 1120 = 11.20  |
| Internal surface film                               | R <sub>i</sub> = 0.801       |                      |
| Totals  | 2.740                        | 1644.95 kg/m         |

$$U_R = \frac{1}{2.740} = 0.37 \text{ W/m}^2\text{°C}$$

for 150 mm slab 'U' value is 0.40 W/m<sup>2</sup>°C and weight = 564.95 kg/m

for lift lobby walls say 3.0 m deep for ease of calculation,  
'U' value is 0.33 W/m<sup>2</sup>°C and weight = 7,393.75 kg/m



Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 5

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing Roof (Tower)Solar Factor (SF) is 264

| *Wall/Roof Code No.                                   | *W <sub>1</sub> /R <sub>1</sub>          | *W <sub>2</sub> /R <sub>2</sub> | *W <sub>3</sub> /R <sub>3</sub> |
|---|--|---------------------------------|---------------------------------|
| Location of Wall/Roof                                 | Tower Roof Beam                          | Tower Roof Panels               | Tower Roof Lift Walls           |
| External Finish Material                              | concrete tiles                           | concrete tiles                  | concrete tiles                  |
| Conductivity W/m°C                                    | 1.10                                     | 1.10                            | 1.10                            |
| Density kg/m <sup>3</sup>                             | 2100                                     | 2100                            | 2100                            |
| Thickness m   | 0.025                                    | 0.025                           | 0.025                           |
| Absorptivity (α)                                      | 0.65                                     | 0.65                            | 0.65                            |
| Intermediate component                                | asphalt                                  | asphalt                         | asphalt                         |
| Conductivity W/m°C                                    | 1.15                                     | 1.15                            | 1.15                            |
| Density kg/m <sup>3</sup>                             | 2350                                     | 2350                            | 2350                            |
| Thickness m   | 0.02                                     | 0.02                            | 0.02                            |
| Intermediate component                                | cement/sand screed                       |                                 |                                 |
| Conductivity W/m°C                                    | 0.72                                     | 0.72                            | 0.72                            |
| Density kg/m <sup>3</sup>                             | 1860                                     | 1860                            | 1860                            |
| Thickness m   | 0.05                                     | 0.05                            | 0.05                            |
| Intermediate component                                | expanded polystyrene                     |                                 |                                 |
| Conductivity W/m°C                                    | 0.034                                    | 0.034                           | 0.034                           |
| Density kg/m <sup>3</sup>                             | 25                                       | 25                              | 25                              |
| Thickness m   | 0.05                                     | 0.05                            | 0.05                            |
| Intermediate component                                | r. concrete                              | r. concrete                     | r. concrete                     |
| Conductivity W/m°C                                    | 2.16                                     | 2.16                            | 2.16                            |
| Density kg/m <sup>3</sup>                             | 2400                                     | 2400                            | 2400                            |
| Thickness m   | 0.60                                     | 0.15                            | 3.00                            |
| Internal Finish Material                              | white semi gloss paint on gypsum plaster |                                 |                                 |
| Conductivity W/m°C                                    | 0.38                                     | 0.38                            |                                 |
| Density kg/m <sup>3</sup>                             | 1120                                     | 1120                            |                                 |
| Thickness m   | 0.01                                     | 0.01                            |                                 |
| Absorptivity α  | 0.30                                     | 0.30                            |                                 |
| 'U' value of composite *Wall/Roof                     | 0.37                                     | 0.40                            | 0.33                            |
| Area of *Wall/Roof m <sup>2</sup>                     | 84.12                                    | 236.97                          | 3.51                            |
| Density of composite *Wall/Roof kg/m <sup>2</sup>     | 1645                                     | 565                             | 7394                            |
| Equivalent temperature difference (TD <sub>EQ</sub> ) | 7.90                                     | 9.75                            | 7.90                            |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 2

Window/Rooflight Schedule

Sheet No. B 5BD Ref 2/     /     /    Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing Roof (Tower)Solar Factor (SF) is 264

| Window/Rooflight Code No.                       | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight               | Roof                             |                                  |                                  |                                  |
| Glazing type                                    | tinted                           |                                  |                                  |                                  |
| Thickness            m                          | 0.008                            |                                  |                                  |                                  |
| Shading Coefficient (SC)                        | 0.70                             |                                  |                                  |                                  |
| Type of shading device                          | -                                |                                  |                                  |                                  |
| External Shading<br>Multiplier            (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing        m <sup>2</sup>           | 67.20                            |                                  |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing                     Solar Factor is                     

| Window/Rooflight Code No.                       | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight               |                                  |                                  |                                  |                                  |
| Glazing type                                    |                                  |                                  |                                  |                                  |
| Thickness            m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)                        |                                  |                                  |                                  |                                  |
| Type of shading device                          |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier            (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing        m <sup>2</sup>           |                                  |                                  |                                  |                                  |

\* Delete as appropriate

Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 5

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Facade Orientation facing Roof (Tower).

Opaque \*Walls/Roofs

| Code No.       | Description                   | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum        |
|----------------|-------------------------------|---------------------------------|------|-----------|------------------|------------|
| R <sub>1</sub> | Tower Roof Beams              | 84.12                           | 0.37 | 0.65      | 7.90             | 159.82     |
| R <sub>2</sub> | Tower Roof Panels             | 236.97                          | 0.40 | 0.65      | 9.75             | 600.72     |
| R <sub>3</sub> | Tower Roof Stair & Lift Walls | 3.51                            | 0.33 | 0.65      | 7.90             | 5.95       |
| Subtotals      |                               | 324.60                          | (A)  | Heat Gain |                  | 766.49 (C) |

Fenestration

| Code No.        | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------------|-------------|-----------------------------------|------|-----------|-----|---------------|
| RL <sub>1</sub> | Rooflight   | 67.20                             | 0.70 | -         | 264 | 12,418.56     |
| Subtotals       |             | 67.20                             | (B)  | Heat Gain |     | 12,418.56 (D) |

Gross Heat Gain (C + D) 13,185.05

Gross Area (A + B) 391.80

$$\text{OTTV} = \frac{C + D}{A + B} = \frac{13,185.05}{391.80} = 33.65 \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 5(A)

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing Roof (15/F)Solar Factor (SF) is 264

| *Wall/Roof Code No.                                   |                   | *W <sub>1</sub> /R <sub>1</sub>          | *W <sub>2</sub> /R <sub>2</sub> |
|---|-------------------|--|---------------------------------|
| Location of Wall/Roof                                 |                   | 15/F Beams                               | 15/F Panels                     |
| External Finish Material                              |                   | concrete tiles                           | concrete tiles                  |
| Conductivity  | W/m°C             | 1.10                                     | 1.10                            |
| Density   | kg/m <sup>3</sup> | 2100                                     | 2100                            |
| Thickness   | m                 | 0.025                                    | 0.025                           |
| Absorptivity  | (α)               | 0.65                                     | 0.65                            |
| Intermediate component                                |                   | asphalt                                  | asphalt                         |
| Conductivity  | W/m°C             | 1.15                                     | 1.15                            |
| Density   | kg/m <sup>3</sup> | 2350                                     | 2350                            |
| Thickness   | m                 | 0.02                                     | 0.02                            |
| Intermediate component                                |                   | cement/sand screed                       |                                 |
| Conductivity  | W/m°C             | 0.72                                     | 0.72                            |
| Density   | kg/m <sup>3</sup> | 1860                                     | 1860                            |
| Thickness   | m                 | 0.05                                     | 0.05                            |
| Intermediate component                                |                   | expanded polystyrene                     |                                 |
| Conductivity  | W/m°C             | 0.034                                    | 0.034                           |
| Density   | kg/m <sup>3</sup> | 25                                       | 25                              |
| Thickness   | m                 | 0.05                                     | 0.05                            |
| Intermediate component                                |                   | r. concrete                              | r. concrete                     |
| Conductivity  | W/m°C             | 2.16                                     | 2.16                            |
| Density   | kg/m <sup>3</sup> | 2400                                     | 2400                            |
| Thickness   | m                 | 0.60                                     | 0.15                            |
| Internal Finish Material                              |                   | white semi gloss paint on gypsum plaster |                                 |
| Conductivity  | W/m°C             | 0.38                                     | 0.38                            |
| Density   | kg/m <sup>3</sup> | 1120                                     | 1120                            |
| Thickness   | m                 | 0.01                                     | 0.01                            |
| Absorptivity  | α                 | 0.30                                     | 0.30                            |
| 'U' value of composite *Wall/Roof                     |                   | 0.37                                     | 0.40                            |
| Area of *Wall/Roof                                    | m <sup>2</sup>    | 6.48                                     | 32.52                           |
| Density of composite *Wall/Roof                       | kg/m <sup>2</sup> | 1645                                     | 565                             |
| Equivalent temperature difference (TD <sub>EQ</sub> ) |                   | 7.90                                     | 9.75                            |

\*Delete as appropriate

First issue April 1995

**Building (Energy Efficiency) Regulation**  
**Form OTTV 3**

**Calculation of OTTV of Individual Facade in Building Envelope**

Sheet No. C 5(A)

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingFacade Orientation facing Roof (15/F).

Opaque \*Walls/Roofs

| Code No.       | Description | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum       |
|----------------|-------------|---------------------------------|------|-----------|------------------|-----------|
| R <sub>3</sub> | 15/F Beams  | 6.48                            | 0.37 | 0.65      | 7.90             | 12.31     |
| R <sub>4</sub> | 15/F Panels | 32.52                           | 0.40 | 0.65      | 9.75             | 82.44     |
| Subtotals      |             | 39.00                           | (A)  | Heat Gain |                  | 94.75 (C) |

Fenestration

| Code No.  | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC  | ESM       | SF | Sum |
|-----------|-------------|-----------------------------------|-----|-----------|----|-----|
| Subtotals |             |                                   | (B) | Heat Gain |    | (D) |

Gross Heat Gain (C + D) 94.75Gross Area (A + B) 39.00

$$\text{OTTV} = \frac{C + D}{A + B} = \underline{2.43} \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

East Elevation (Podium)                      Gross Wall Area                      344.00 m<sup>2</sup>

Wall Composite Areas

Beam and Column Areas

|            |   |   |                      |
|------------|---|---|----------------------|
| G/F        | $0.6 \times 40.0 + 0.6 (3.4 \times 6 + 3.4 \times 0.5^*)$ | = | 37.26 m <sup>2</sup> |
| 1/F        | $0.6 \times 40.0 + 0.6 (3.4 \times 8)$                    | = | 40.32 m <sup>2</sup> |
| 1/F (Ramp) | $0.6 \times 23.0 + 0.6 (3.4 \times 5 \times 0.5)$         | = | 18.90 m <sup>2</sup> |
| 2/F - 4/F  | Nil   | = | -                    |
|            |   |   | 96.48 m <sup>2</sup> |

Glazing Areas

|           |                       |   |                       |
|-----------|-----------------------|---|-----------------------|
| G/F       | 87.38 m <sup>2</sup>  | = | 87.38 m <sup>2</sup>  |
| 1/F       | 119.68 m <sup>2</sup> | = | 119.68 m <sup>2</sup> |
| 2/F - 4/F | Nil                   | = | -                     |
|           |                       |   | 207.06 m <sup>2</sup> |

300 mm Retaining Wall

|     |                            |   |                      |
|-----|----------------------------|---|----------------------|
| G/F | $138.00 - (37.26 + 87.38)$ | = | 13.36 m <sup>2</sup> |
|-----|----------------------------|---|----------------------|

300 mm Ramp Wall

|     |                                  |   |                     |
|-----|----------------------------------|---|---------------------|
| 1/F | $23 \times 4 \times 0.5 - 18.90$ | = | 27.1 m <sup>2</sup> |
|-----|----------------------------------|---|---------------------|

\* Only half column considered to contribute

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 6

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing East (Podium)Solar Factor (SF) is 168

| *Wall/Roof Code No.                                   |                   | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>5</sub> /R <sub>5</sub> | *W <sub>5A</sub> /R <sub>5A</sub> | *W /R |
|---|-------------------|---------------------------------|---------------------------------|-----------------------------------|-------|
| Location of Wall/Roof                                 |                   | Beams & Cols<br>G/F & 1/F       | Retaining Wall<br>G/F           | Ramp Wall<br>1/F                  |       |
| External Finish Material                              |                   | white mosaic tiles              |                                 |                                   |       |
| Conductivity  | W/m°C             | 1.50                            | 1.50                            | 2.16                              |       |
| Density   | kg/m <sup>3</sup> | 2500                            | 2500                            | 2400                              |       |
| Thickness   | m                 | 0.005                           | 0.005                           | 0.30                              |       |
| Absorptivity  | (α)               | 0.58                            | 0.58                            | 0.65                              |       |
| Intermediate component                                |                   | cement render                   |                                 |                                   |       |
| Conductivity  | W/m°C             | 0.72                            | 0.72                            |                                   |       |
| Density   | kg/m <sup>3</sup> | 1860                            | 1860                            |                                   |       |
| Thickness   | m                 | 0.01                            | 0.01                            |                                   |       |
| Intermediate component                                |                   | Reinforced concrete             |                                 |                                   |       |
| Conductivity  | W/m°C             | 2.16                            | 2.16                            |                                   |       |
| Density   | kg/m <sup>3</sup> | 2400                            | 2400                            |                                   |       |
| Thickness   | m                 | 0.60                            | 0.30                            |                                   |       |
| Intermediate component                                |                   |                                 |                                 |                                   |       |
| Conductivity  | W/m°C             |                                 |                                 |                                   |       |
| Density   | kg/m <sup>3</sup> |                                 |                                 |                                   |       |
| Thickness   | m                 |                                 |                                 |                                   |       |
| Intermediate component                                |                   |                                 |                                 |                                   |       |
| Conductivity  | W/m°C             |                                 |                                 |                                   |       |
| Density   | kg/m <sup>3</sup> |                                 |                                 |                                   |       |
| Thickness   | m                 |                                 |                                 |                                   |       |
| Internal Finish Material                              |                   | white semi gloss paint          |                                 |                                   |       |
| Internal Finish Material                              |                   | on gypsum plaster               |                                 |                                   |       |
| Conductivity  | W/m°C             | 0.38                            | 0.38                            | 0.38                              |       |
| Density   | kg/m <sup>3</sup> | 1120                            | 1120                            | 1120                              |       |
| Thickness   | m                 | 0.01                            | 0.01                            | 0.01                              |       |
| Absorptivity  | α                 | 0.30                            | 0.30                            | 0.30                              |       |
| 'U' value of composite *Wall/Roof                     |                   | 1.51                            | 1.91                            | 1.97                              |       |
| Area of *Wall/Roof                                    | m <sup>2</sup>    | 96.48                           | 13.36                           | 27.1                              |       |
| Density of composite *Wall/Roof                       | kg/m <sup>2</sup> | 1482                            | 762                             | 731                               |       |
| Equivalent temperature difference (TD <sub>EQ</sub> ) |                   | 2.40                            | 2.40                            | 2.40                              |       |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 2

Window/Rooflight Schedule

Sheet No. B 6

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing East (Podium)Solar Factor (SF) is 168

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    | G/F&l/F<br>unshaded              |                                  |                                  |                                  |
| Glazing type                         | plain                            |                                  |                                  |                                  |
| Thickness m                          | 0.012                            |                                  |                                  |                                  |
| Shading Coefficient (SC)             | 0.90                             |                                  |                                  |                                  |
| Type of shading device               | -                                |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) | -                                |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       | 207.06                           |                                  |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_

Solar Factor is \_\_\_\_\_

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    |                                  |                                  |                                  |                                  |
| Glazing type                         |                                  |                                  |                                  |                                  |
| Thickness m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)             |                                  |                                  |                                  |                                  |
| Type of shading device               |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       |                                  |                                  |                                  |                                  |

\* Delete as appropriate

First issue April 1995



Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 6

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingFacade Orientation facing East (Podium).

Opaque \*Walls/Roofs

| Code No.  | Description          | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum        |
|-----------|----------------------|---------------------------------|------|-----------|------------------|------------|
| W1        | Beams & Col. G/F&1/F | 96.48                           | 1.51 | 0.58      | 2.40             | 202.79     |
| W5        | Panels G/F&1/F       | 13.36                           | 1.91 | 0.58      | 2.40             | 35.52      |
| W5        | Ramp Wall 1/F        | 27.10                           | 1.97 | 0.65      | 2.40             | 83.28      |
| Subtotals |                      | 136.94                          | (A)  | Heat Gain |                  | 321.59 (C) |

Fenestration

| Code No.  | Description | *A <sub>f</sub> <sub>w</sub> /A <sub>f</sub> <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|-------------|---|------|-----------|-----|---------------|
| F1        | G/F & 1/F   | 207.06  | 0.90 | -         | 168 | 31,307.47     |
| Subtotals |             | 207.06  | (B)  | Heat Gain |     | 31,307.47 (D) |

Gross Heat Gain (C + D) 31,629.06Gross Area (A + B) 344.00

$$\text{OTTV} = \frac{C + D}{A + B} = \underline{91.95} \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

North Elevation (Podium)

Gross Wall Area

320.00 m<sup>2</sup>Wall Composite AreasBeam and Column Areas

|     |   |   |                      |                      |
|-----|---|---|----------------------|----------------------|
| G/F | $0.6 \times 40 + 0.6 \times 3.4 \times 8$ | = | 40.32 m <sup>2</sup> |                      |
| 1/F | $0.6 \times 40 + 0.6 \times 3.4 \times 8$ | = | 40.32 m <sup>2</sup> | 80.64 m <sup>2</sup> |
|     |   |   | <hr/>                |                      |

100 mm Stair Wall

|                |                  |   |                     |
|----------------|------------------|---|---------------------|
| G/F Stair Wall | $0.1 \times 3.4$ | = | 0.34 m <sup>2</sup> |
|----------------|------------------|---|---------------------|

Glazing Areas

|     |        |   |                       |                       |
|-----|--------|---|-----------------------|-----------------------|
| G/F | 119.34 | = | 119.34 m <sup>2</sup> |                       |
| 1/F | 119.68 | = | 119.68 m <sup>2</sup> | 239.02 m <sup>2</sup> |
|     |        |   | <hr/>                 |                       |

Panel Areas

|     |                                    |   |       |   |
|-----|------------------------------------|---|-------|---|
| G/F | $160.00 - (40.32 + 119.34 + 0.34)$ | = | 0     |   |
| 1/F | $160.00 - (40.32 + 119.68)$        | = | 0     | 0 |
|     |                                    |   | <hr/> |   |

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 7

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing North (Podium)Solar Factor (SF) is 104

| *Wall/Roof Code No.                                     |                   | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>7</sub> /R <sub>7</sub> | *W <sub>3</sub> /R <sub>3</sub> | *W <sub>4</sub> /R <sub>4</sub> |
|---|-------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Location of Wall/Roof                                   |                   | Beams & Cols<br>G/F & 1/F       | Stair Wall<br>G/F               |                                 |                                 |
| External Finish Material                                |                   | white mosaic tiles              |                                 |                                 |                                 |
| Conductivity  | W/m°C             | 1.50                            | 1.50                            |                                 |                                 |
| Density   | kg/m <sup>3</sup> | 2500                            | 2500                            |                                 |                                 |
| Thickness   | m                 | 0.005                           | 0.005                           |                                 |                                 |
| Absorptivity  | (α)               | 0.58                            | 0.58                            |                                 |                                 |
| Intermediate component                                  |                   | cement render                   |                                 |                                 |                                 |
| Conductivity  | W/m°C             | 0.72                            | 0.72                            |                                 |                                 |
| Density   | kg/m <sup>3</sup> | 1860                            | 1860                            |                                 |                                 |
| Thickness   | m                 | 0.01                            | 0.01                            |                                 |                                 |
| Intermediate component                                  |                   | Reinforced concrete             |                                 |                                 |                                 |
| Conductivity  | W/m°C             | 2.16                            | 2.16                            |                                 |                                 |
| Density   | kg/m <sup>3</sup> | 2400                            | 2400                            |                                 |                                 |
| Thickness   | m                 | 0.60                            | 3.00                            |                                 |                                 |
| Intermediate component                                  |                   |                                 |                                 |                                 |                                 |
| Conductivity  | W/m°C             |                                 |                                 |                                 |                                 |
| Density   | kg/m <sup>3</sup> |                                 |                                 |                                 |                                 |
| Thickness   | m                 |                                 |                                 |                                 |                                 |
| Intermediate component                                  |                   |                                 |                                 |                                 |                                 |
| Conductivity  | W/m°C             |                                 |                                 |                                 |                                 |
| Density   | kg/m <sup>3</sup> |                                 |                                 |                                 |                                 |
| Thickness   | m                 | white semi gloss paint          |                                 |                                 |                                 |
| Internal Finish Material                                |                   | on gypsum plaster               |                                 |                                 |                                 |
| Conductivity  | W/m°C             | 0.38                            |                                 |                                 |                                 |
| Density   | kg/m <sup>3</sup> | 1120                            |                                 |                                 |                                 |
| Thickness   | m                 | 0.01                            |                                 |                                 |                                 |
| Absorptivity  | α                 | 0.30                            |                                 |                                 |                                 |
| 'U' value of composite<br>*Wall/Roof                    |                   | 1.51                            | 0.69                            |                                 |                                 |
| Area of *Wall/Roof                                      | m <sup>2</sup>    | 80.64                           | 0.34                            |                                 |                                 |
| Density of composite<br>*Wall/Roof                      | kg/m <sup>2</sup> | 1482                            | 7231                            |                                 |                                 |
| Equivalent temperature<br>difference (T <sub>EQ</sub> ) |                   | 1.70                            | 1.70                            |                                 |                                 |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 2

Window/Rooflight Schedule

Sheet No. B 7

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing North (Podium) Solar Factor (SF) is 104

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    | G/F&l/F<br>unshaded              |                                  |                                  |                                  |
| Glazing type                         | plain                            |                                  |                                  |                                  |
| Thickness m                          | 0.012                            |                                  |                                  |                                  |
| Shading Coefficient (SC)             | 0.90                             |                                  |                                  |                                  |
| Type of shading device               | -                                |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) | -                                |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       | 239.02                           |                                  |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_ Solar Factor is \_\_\_\_\_

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    |                                  |                                  |                                  |                                  |
| Glazing type                         |                                  |                                  |                                  |                                  |
| Thickness m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)             |                                  |                                  |                                  |                                  |
| Type of shading device               |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       |                                  |                                  |                                  |                                  |

\* Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 7

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Facade Orientation facing North (Podium).

Opaque \*Walls/Roofs

| Code No.  | Description           | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum        |
|-----------|-----------------------|---------------------------------|------|-----------|------------------|------------|
| W1        | Beams & Cols. G/F&l/F | 80.64                           | 1.51 | 0.58      | 1.70             | 120.06     |
| W7        | Stair Wall G/F        | 0.34                            | 0.69 | 0.58      | 1.70             | 0.23       |
| Subtotals |                       | 80.98                           | (A)  | Heat Gain |                  | 120.29 (C) |

Fenestration

| Code No.  | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|-------------|-----------------------------------|------|-----------|-----|---------------|
| F1        | G/F & l/F   | 239.02                            | 0.90 | -         | 104 | 22,372.27     |
| Subtotals |             | 239.02                            | (B)  | Heat Gain |     | 22,372.27 (D) |

Gross Heat Gain (C + D) 22,492.56

Gross Area (A + B) 320.00

$$OTTV = \frac{C + D}{A + B} = \frac{22,492.56}{320.00} = 70.29 \text{ W/m}^2$$

\* Delete as appropriate

|                                |                 |                                    |                       |
|--------------------------------|-----------------|------------------------------------|-----------------------|
| <u>West Elevation (Podium)</u> | Gross Wall Area |                                    | 366.00 m <sup>2</sup> |
|                                |                 | (With tiles = 112 m <sup>2</sup> ) |                       |
|                                |                 | (Party wall = 208 m <sup>2</sup> ) |                       |

Wall Composite AreasBeam and Column Areas (with tiles)

|     |                          |   |                      |                      |
|-----|--------------------------|---|----------------------|----------------------|
| G/F | 0.6 x 14 + 0.6 (3.4 x 3) | = | 14.52 m <sup>2</sup> |                      |
| 1/F | 0.6 x 14 + 0.6 (3.4 x 3) | = | 14.52 m <sup>2</sup> | 29.04 m <sup>2</sup> |

---

300 mm Ramp Wall

|     |                     |   |                     |
|-----|---------------------|---|---------------------|
| 1/F | 23 x 4 x 0.5 - 18.9 | = | 27.1 m <sup>2</sup> |
|-----|---------------------|---|---------------------|

Glazing Areas

|     |       |   |                      |                      |
|-----|-------|---|----------------------|----------------------|
| G/F | 41.48 | = | 41.48 m <sup>2</sup> |                      |
| 1/F | 41.48 | = | 41.48 m <sup>2</sup> | 82.96 m <sup>2</sup> |

---

Beam and Column Areas (Party Wall and Ramp)

|          |                                |   |                      |                      |
|----------|--------------------------------|---|----------------------|----------------------|
| G/F      | 0.6 x 26 + 0.6 (3.4 x 5)       | = | 25.80 m <sup>2</sup> |                      |
| 1/F      | 0.6 x 26 + 0.6 (3.4 x 5)       | = | 25.80 m <sup>2</sup> |                      |
| 1/F Ramp | 0.6 x 23 + 0.6 (3.4 x 5 x 0.5) | = | 18.90 m <sup>2</sup> | 70.50 m <sup>2</sup> |

---

Panel Areas (with tiles)

|             |                          |   |   |
|-------------|--------------------------|---|---|
| G/F and 1/F | 112.00 - (29.04 + 82.96) | = | - |
|-------------|--------------------------|---|---|

Panel Areas in Party Wall

|             |             |   |                       |                       |
|-------------|-------------|---|-----------------------|-----------------------|
| G/F and 1/F | 208 - 51.60 | = | 156.40 m <sup>2</sup> | 156.40 m <sup>2</sup> |
|-------------|-------------|---|-----------------------|-----------------------|

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Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 8

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing West (Podium)Solar Factor (SF) is 175

| *Wall/Roof Code No.                                   | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>1A</sub> /R <sub>1A</sub> | *W <sub>3</sub> /R <sub>3</sub> | *W <sub>5</sub> /R <sub>5</sub> |
|---|---------------------------------|-----------------------------------|---------------------------------|---------------------------------|
| Location of Wall/Roof                                 | Beams & Cols<br>G/F & 1/F       | Beams & Cols<br>G/F & 1/F         | Panels<br>G/F & 1/F             | Ramp Wall<br>1/F                |
| External Finish Material                              | white mosaic<br>tiles           | Reinforced                        | Concrete                        | Reinforced<br>Concrete          |
| Conductivity W/m°C                                    | 1.50                            | 2.16                              | 2.16                            | 2.16                            |
| Density kg/m <sup>3</sup>                             | 2500                            | 2400                              | 2400                            | 2400                            |
| Thickness m   | 0.005                           | 0.60                              | 0.10                            | 0.30                            |
| Absorptivity (α)                                      | 0.58                            | 0.65                              | 0.65                            | 0.65                            |
| Intermediate component                                | cement render                   |                                   |                                 |                                 |
| Conductivity W/m°C                                    | 0.72                            |                                   |                                 |                                 |
| Density kg/m <sup>3</sup>                             | 1860                            |                                   |                                 |                                 |
| Thickness m   | 0.01                            |                                   |                                 |                                 |
| Intermediate component                                | Reinforced concrete             |                                   |                                 |                                 |
| Conductivity W/m°C                                    | 2.16                            |                                   |                                 |                                 |
| Density kg/m <sup>3</sup>                             | 2400                            |                                   |                                 |                                 |
| Thickness m   | 0.60                            |                                   |                                 |                                 |
| Intermediate component                                |                                 |                                   |                                 |                                 |
| Conductivity W/m°C                                    |                                 |                                   |                                 |                                 |
| Density kg/m <sup>3</sup>                             |                                 |                                   |                                 |                                 |
| Thickness m   |                                 |                                   |                                 |                                 |
| Intermediate component                                |                                 |                                   |                                 |                                 |
| Conductivity W/m°C                                    |                                 |                                   |                                 |                                 |
| Density kg/m <sup>3</sup>                             |                                 |                                   |                                 |                                 |
| Thickness m   |                                 |                                   |                                 |                                 |
| Intermediate component                                |                                 |                                   |                                 |                                 |
| Conductivity W/m°C                                    |                                 |                                   |                                 |                                 |
| Density kg/m <sup>3</sup>                             |                                 |                                   |                                 |                                 |
| Thickness m   |                                 |                                   |                                 |                                 |
| Internal Finish Material                              | white semi gloss paint          |                                   |                                 |                                 |
| Internal Finish Material                              | on gypsum plaster               |                                   |                                 |                                 |
| Conductivity W/m°C                                    | 0.38                            | 0.38                              | 0.38                            | 0.38                            |
| Density kg/m <sup>3</sup>                             | 1120                            | 1120                              | 1120                            | 1120                            |
| Thickness m   | 0.01                            | 0.01                              | 0.01                            | 0.01                            |
| Absorptivity α  | 0.30                            | 0.30                              | 0.30                            | 0.30                            |
| 'U' value of composite *Wall/Roof                     | 1.51                            | 1.55                              | 2.41                            | 1.97                            |
| Area of *Wall/Roof m <sup>2</sup>                     | 29.04                           | 70.50                             | 156.40                          | 27.1                            |
| Density of composite *Wall/Roof kg/m <sup>2</sup>     | 1482                            | 1451                              | 250                             | 731                             |
| Equivalent temperature difference (TD <sub>EQ</sub> ) | 2.10                            | 2.10                              | 4.35                            | 2.10                            |

\*Delete as appropriate

First issue April 1995

**Building (Energy Efficiency) Regulation  
Form OTTV 2**

**Window/Rooflight Schedule**

Sheet No. B 8

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing West (Podium) Solar Factor (SF) is 175

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    | G/F&l/F<br>unshaded              |                                  |                                  |                                  |
| Glazing type                         | plain                            |                                  |                                  |                                  |
| Thickness m                          | 0.012                            |                                  |                                  |                                  |
| Shading Coefficient (SC)             | 0.90                             |                                  |                                  |                                  |
| Type of shading device               | -                                |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) | -                                |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       | 82.96                            |                                  |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_ Solar Factor is \_\_\_\_\_

| Window/Rooflight Code No.            | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|--------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight    |                                  |                                  |                                  |                                  |
| Glazing type                         |                                  |                                  |                                  |                                  |
| Thickness m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)             |                                  |                                  |                                  |                                  |
| Type of shading device               |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing m <sup>2</sup>       |                                  |                                  |                                  |                                  |

\* Delete as appropriate



Building (Energy Efficiency) Regulation  
Form OTTV 3

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 8

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Facade Orientation facing West (Podium).

Opaque \*Walls/Roofs

| Code No.  | Description           | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum          |
|-----------|-----------------------|---------------------------------|------|-----------|------------------|--------------|
| W1        | Beams & Cols. G/F&l/F | 29.04                           | 1.51 | 0.58      | 2.10             | 53.41        |
| W1A       | Beams & Cols. G/F&l/F | 70.50                           | 1.55 | 0.65      | 2.10             | 149.16       |
| W3        | Panels G/F&l/F        | 156.40                          | 2.41 | 0.65      | 4.35             | 1,065.75     |
| W5        | Ramp Wall l/F         | 27.10                           | 1.97 | 0.65      | 2.10             | 72.87        |
| Subtotals |                       | 283.04                          | (A)  | Heat Gain |                  | 1,341.19 (C) |

Fenestration

| Code No.  | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|-------------|-----------------------------------|------|-----------|-----|---------------|
| F1        | G/F & l/F   | 82.96                             | 0.90 | -         | 175 | 13,066.20     |
| Subtotals |             | 82.96                             | (B)  | Heat Gain |     | 13,066.20 (D) |

Gross Heat Gain (C + D) 14,407.39

Gross Area (A + B) 366.00

$$\text{OTTV} = \frac{C + D}{A + B} = \frac{14,407.39}{366.00} = 39.36 \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

South Elevation (Podium)

Gross Wall Area

264.49 m<sup>2</sup>Wall Composite AreasBeam and Column Areas

|                |  |   |                      |                      |
|----------------|--|---|----------------------|----------------------|
| G/F            | -                                      | = | -                    |                      |
| 1/F            | $0.6 \times 34.6 + 0.6 (3.4 \times 8)$ | = | 37.08 m <sup>2</sup> | 37.08 m <sup>2</sup> |
| 1/F Stair Wall | $0.1 \times 3.4$                       | = | 0.34 m <sup>2</sup>  | 0.34 m <sup>2</sup>  |

Glazing Areas

|     |        |   |                       |                       |
|-----|--------|---|-----------------------|-----------------------|
| G/F | -      | = | -                     |                       |
| 1/F | 100.98 | = | 100.98 m <sup>2</sup> | 100.98 m <sup>2</sup> |

Ramp

|                               |                    |   |                       |                       |
|-------------------------------|--------------------|---|-----------------------|-----------------------|
| 1/F                           | $5.4 \times 23.35$ | = | 126.09 m <sup>2</sup> | 126.09 m <sup>2</sup> |
| External wall at ramp omitted | $5.4 \times 40$    | = | 21.60 m <sup>2</sup>  |                       |

Panel Areas

|     |  |   |   |   |
|-----|--|---|---|---|
| G/F | -  | = | - |   |
| 1/F | $160.00 - (37.08 + 0.34 + 100.98 + 21.60)$ | = | - | - |

Building (Energy Efficiency) Regulation  
Form OTTV 1

Calculation of 'U' Value of Composite Wall/Roof  
and Details of Other Values

Sheet No. A 9BD Ref 2/     /     /    Building address Typical Commercial Building

Physical data of Opaque \*Wall/Roof

Facade Orientation facing South (Podium)Solar Factor (SF) is 191

| *Wall/Roof Code No.                                   | *W <sub>1</sub> /R <sub>1</sub> | *W <sub>5</sub> /R <sub>5</sub> | *W <sub>7</sub> /R <sub>7</sub> | *W /R |
|---|---------------------------------|---------------------------------|---------------------------------|-------|
| Location of Wall/Roof                                 | Beams & Cols<br>1/F             | Ramp 1/F                        | Stair Wall<br>1/F               |       |
| External Finish Material                              | white mosaic<br>tiles           | r. concrete                     | white mosaic<br>tiles           |       |
| Conductivity W/m°C                                    | 1.50                            | 2.16                            | 1.50                            |       |
| Density kg/m <sup>3</sup>                             | 2500                            | 2400                            | 2500                            |       |
| Thickness m   | 0.005                           | 0.30                            | 0.005                           |       |
| Absorptivity (α)                                      | 0.58                            | 0.65                            | 0.58                            |       |
| Intermediate component                                | cement render                   |                                 | cement render                   |       |
| Conductivity W/m°C                                    | 0.72                            |                                 | 0.72                            |       |
| Density kg/m <sup>3</sup>                             | 1860                            |                                 | 1860                            |       |
| Thickness m   | 0.01                            |                                 | 0.01                            |       |
| Intermediate component                                | Reinforced<br>Concrete          |                                 | Reinforced<br>Concrete          |       |
| Conductivity W/m°C                                    | 2.16                            |                                 | 2.16                            |       |
| Density kg/m <sup>3</sup>                             | 2400                            |                                 | 2400                            |       |
| Thickness m   | 0.60                            |                                 | 3.00                            |       |
| Intermediate component                                |                                 |                                 |                                 |       |
| Conductivity W/m°C                                    |                                 |                                 |                                 |       |
| Density kg/m <sup>3</sup>                             |                                 |                                 |                                 |       |
| Thickness m   |                                 |                                 |                                 |       |
| Intermediate component                                |                                 |                                 |                                 |       |
| Conductivity W/m°C                                    |                                 |                                 |                                 |       |
| Density kg/m <sup>3</sup>                             |                                 |                                 |                                 |       |
| Thickness m   |                                 |                                 |                                 |       |
| Internal Finish Material                              | white semi gloss paint          |                                 |                                 |       |
| Internal Finish Material                              | on gypsum plaster               |                                 |                                 |       |
| Conductivity W/m°C                                    | 0.38                            | 0.38                            |                                 |       |
| Density kg/m <sup>3</sup>                             | 1120                            | 1120                            |                                 |       |
| Thickness m   | 0.01                            | 0.01                            |                                 |       |
| Absorptivity α  | 0.30                            | 0.30                            |                                 |       |
| 'U' value of composite *Wall/Roof                     | 1.51                            | 1.97                            | 0.69                            |       |
| Area of *Wall/Roof m <sup>2</sup>                     | 37.08                           | 126.09                          | 0.34                            |       |
| Density of composite *Wall/Roof kg/m <sup>2</sup>     | 1482                            | 731                             | 7231                            |       |
| Equivalent temperature difference (TD <sub>EQ</sub> ) | 1.40                            | 4.10                            | 1.40                            |       |

\*Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 2

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Window/Rooflight Schedule

Sheet No. B 9

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial Building

Physical data on \*window/rooflight

Facade Orientation facing South (Podium)Solar Factor (SF) is 191

| Window/Rooflight Code No.                       | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight               | l/F<br>unshaded                  |                                  |                                  |                                  |
| Glazing type                                    | plain                            |                                  |                                  |                                  |
| Thickness            m                          | 0.012                            |                                  |                                  |                                  |
| Shading Coefficient (SC)                        | 0.90                             |                                  |                                  |                                  |
| Type of shading device                          | -                                |                                  |                                  |                                  |
| External Shading<br>Multiplier            (ESM) | -                                |                                  |                                  |                                  |
| Area of glazing        m <sup>2</sup>           | 100.98                           |                                  |                                  |                                  |

Physical data on \*window/rooflight

Facade Orientation facing \_\_\_\_\_

Solar Factor is \_\_\_\_\_

| Window/Rooflight Code No.                       | *F <sub>1</sub> /RL <sub>1</sub> | *F <sub>2</sub> /RL <sub>2</sub> | *F <sub>3</sub> /RL <sub>3</sub> | *F <sub>4</sub> /RL <sub>4</sub> |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Location of *Window/<br>Rooflight               |                                  |                                  |                                  |                                  |
| Glazing type                                    |                                  |                                  |                                  |                                  |
| Thickness            m                          |                                  |                                  |                                  |                                  |
| Shading Coefficient (SC)                        |                                  |                                  |                                  |                                  |
| Type of shading device                          |                                  |                                  |                                  |                                  |
| External Shading<br>Multiplier            (ESM) |                                  |                                  |                                  |                                  |
| Area of glazing        m <sup>2</sup>           |                                  |                                  |                                  |                                  |

\* Delete as appropriate

First issue April 1995

**Building (Energy Efficiency) Regulation**  
**Form OTTV 3**

Calculation of OTTV of Individual Facade in Building Envelope

Sheet No. C 9

BD Ref 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingFacade Orientation facing South (Podium).

Opaque \*Walls/Roofs

| Code No.  | Description            | *A <sub>w</sub> /A <sub>r</sub> | U    | α         | TD <sub>EQ</sub> | Sum        |
|-----------|------------------------|---------------------------------|------|-----------|------------------|------------|
| W1        | Beams and Cols G/F&1/F | 37.08                           | 1.51 | 0.58      | 1.40             | 45.46      |
| W2        | Stair Wall 1/F         | 0.34                            | 0.69 | 0.58      | 1.40             | 0.19       |
| W3        | Ramp 1/F               | 126.09                          | 1.97 | 0.65      | 4.10*            | 611.98     |
| Subtotals |                        | 163.51                          | (A)  | Heat Gain |                  | 657.63 (C) |

\* Value interpolated from vert. and horizontal components.

Fenestration

| Code No.  | Description | *Af <sub>w</sub> /Af <sub>r</sub> | SC   | ESM       | SF  | Sum           |
|-----------|-------------|-----------------------------------|------|-----------|-----|---------------|
| F1        | 1/F         | 100.98                            | 0.90 | -         | 191 | 17,358.46     |
| Subtotals |             | 100.98                            | (B)  | Heat Gain |     | 17,358.46 (D) |

Gross Heat Gain (C + D) 18,016.09Gross Area (A + B) 264.49

$$\text{OTTV} = \frac{C + D}{A + B} = \frac{18,016.09}{264.49} = 68.12 \text{ W/m}^2$$

\* Delete as appropriate

First issue April 1995

Building (Energy Efficiency) Regulation  
Form OTTV 4

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Summary of OTTV of Building Envelope

Sheet No. D 1

BD Ref. 2/\_\_\_/\_\_\_/\_\_\_

Building address Typical Commercial BuildingTotal Envelope Heat Gain (\*Tower/Podium)

| Facade Orientation | Gross Area from Form OTTV3      | Gross Heat Gain from Form OTTV3 |
|--------------------|---------------------------------|---------------------------------|
| a. East            | 344.00                          | 31,629.06                       |
| b. North           | 320.00                          | 22,492.56                       |
| c. West            | 366.00                          | 14,407.39                       |
| d. South           | 264.49                          | 18,016.09                       |
| e.                 |                                 |                                 |
| f.                 |                                 |                                 |
| Subtotal           | 1,294.49 (E)                    | 86,545.10 (G)                   |
| Roof               | Carpark under - non accountable |                                 |
| a. Main            |                                 |                                 |
| b. 15/F            |                                 |                                 |
| Subtotal           | (F)                             | (H)                             |

$$\text{*Tower/Podium Walls OTTV} = \frac{G}{E} = \underline{66.86} \text{ W/m}^2$$

$$\text{*Tower/Podium Roofs OTTV} = \frac{H}{F} = \underline{\quad\quad\quad} \text{ W/m}^2$$

$$\text{*Tower/Podium OTTV} = \frac{G + H}{E + F} = \underline{\quad\quad\quad} \text{ W/m}^2$$

\* Delete as appropriate