| PROJECT NAME: PROPOSED RESIDENTIAL UNITS | | | |
|---|---|---|---|
| CLIENT: | MADE BY: S.M | DATE: | |
| | CHECKED BY: B.O | DRAWING NO. | |

| REF | CALCULATION | OUTPUT |
|---|---|---|
| | **Design Properties and Parameters** | |
| | Building Location: Juja<br>Site Location: Site in Town<br>Aprox. Distance from sea (km): 8<br>Floor to floor heights: Typical h (m): 2.7; Ground h (m): 3<br>Building Use: Residential<br>No. of suspended floors: 14<br>Lateral Load resisting system: Moment resisting concrete space frame | |
| | Size and location of lift core: **Size** / **Location**<br>**x (m)**: 4 / 10<br>**y (m)**: 1 / 5 | |
| | Type of structure: Unbraced Frame | |
| | **Building dimension and Layout** | |
| | **Column arrangement**<br>dir. x: Nos. 6; Spacing (m) 5<br>dir. y: Nos. 2; Spacing (m) 3<br>Total No. of **columns**: 20<br>Section: h 450; b 400<br>**Plan dimension**<br>Length (m): 25<br>Width (m): 3<br>Height (m): 40.8 | **75m2** |
| | **Dynamic Classification** | |
| | **Type of bulding**: Framed buildings with structural walls around lifts and stairs with additional masonry subdivision walls (e.g. apartment buildings), buildings of masonry construction and timber-framed housing<br>For which:<br>Kb= 0.5 | **0.5** |
| | Height (m) 40.8<br>Cr= 0.023 | **0.023** |
| | 0.023 < 0.25 and;<br>40.8 < 300 m<br>**Therefore, BS6399-Part2 is applicable to wind load** | |
| | **Wind Characteristics** | |
| | Baic wind speed for Juja area: $V_b$ (m/s)= 10 | **10** |
| | Site Wind Speed: $V_s = V_b * S_a * S_s * S_d * S_p$<br>Altitude Factor, $S_a = 1+0.001*\Delta s$<br>$\Delta s$ (mm)= 1550 | **1550** |
| | $S_a = 1+0.001*1550$<br>$S_a = 2.55$ | **2.55** |
| | Direction factor, $S_d$= 1.0 | **1.0** |
| | Seasonal factor, $S_s$= 1.0 | **1.0** |
| | Probability factor, $S_p$= 1.0 | **1.0** |
| | Site wind Speed, $V_s = 10*2.55*1*1*1$<br>$V_s$ (m/s)= 25.5 | **25.5** |
| | **Site Exposure** | |
| | He = Hr = 40.8m<br>For the overal height, He =Hr and Site in Town and approximately 8 km closest distance to sea upwind<br>The bulding is type; **A**<br>**Choice of method**<br>Standard Method | |
| | **Determination of $S_b$- terrain and building factor** | |
| | **x- direction building dimensions**<br>D (m)= 25<br>B (m)= 3<br>Dividing the building into parts: 3 | |

| Ref | H1 | H2 | H3 |
|---|---|---|---|
| **Zone** | 0-3 | 3-37.8 | 37.8-40.8 |
| **Hr** | 3 | 37.8 | 40.8 |

| | | | | |
|---|---|---|---|---|
| $S_b$ | 1.81 | 1.94 | 2.00 | |

**y- direction building dimensions**

D (m)= 3

B (m)= 25

Dividing the building into parts 2

| Ref | H1 | H2 |
|---|---|---|
| Zone | 0-25 | 25-40.8 |
| Hr | 25 | 40.8 |
| $S_b$ | 1.95 | 2.00 |

**Standard effective wind speed**

$V_e=V_s*S_b$

For the overal height, He =40.8 and Site in Town and approximately 8 km closest distance to sea upwind

$S_b$= 2.00 **2**

Ve = 25.5*2 **51**

Ve = 51 kN/m$^2$

**Dynamic wind pressure, $q_s$**

$q_s=0.613V_s^2$

qs(40.8)= 0.613*51^2

qs= 1.594413 kN/m$^2$ **1.594413**

**Pressure Coefficient**

Re-entrant corner is ignored, and Cpe values are applied as if the wall is vertical

Funneling is not considered, the assumption that there is no adjacent building has been made

Pnet= Pe-Pi

Pe= qs*Cpe*Ca

Pi= qs*Cpi*Ca

Pnet= qsCa(Cpe-Cpi) qsCaCpnet

**Type of walls**

Four walls equally permeable; roof impermeable Cpi= -0.3 **-0.3**

**External pressure coeficient**

**x- direction building dimensions**

D (m)= 25

B (m)= 3

Dividing the building into parts 3

| Ref | H1 | H2 | H3 |
|---|---|---|---|
| Zone | 0-3 | 3-37.8 | 37.8-40.8 |
| Hr | 3 | 37.8 | 40.8 |
| D/H | 8.333 | 0.661 | 0.613 |
| Cpe | 0.24 | 0.85 | 0.85 |

**0.85**

**y- direction building dimensions**

D (m)= 3

B (m)= 25

Dividing the building into parts 2

| Ref | H1 | H2 |
|---|---|---|
| Zone | 0-25 | 25-40.8 |
| Hr | 25 | 40.8 |
| D/H | 0.120 | 0.074 |
| Cpe | 0.85 | 0.85 |

**0.85**

The external coeficient for the leeward side were ignored as wind force computed will be applied in both directions of the modelled frame

**Size effect factor**

For buildings of type A the size effect factor, Ca, of the building is given by;

Wind in x-dir, a=√40.8^2+3^2= **40.91** Ca= 0.86

Wind in z-dir, a=√40.8^2+25^2= **47.85** Ca= 0.86

Net wind pressure on walls x-dir, Pe= (0.85--0.3)*1.594413*0.86 1.5769 kN/m$^2$ **1.5769**

z-dir, Pe= (0.85--0.3)*1.594413*0.86 1.5769 kN/m$^2$ **1.5769**

**Horizontal wind loads**

| | | | | | |
|---|---|---|---|---|---|
| **Roof level** | -dir, Ax (m$^2$)= | 0.5*2.7*25 | **33.75** | Fx=1.576874457*33.75 | **53.2195** |
| | -dir, Az (m$^2$)= | 0.5*2.7*3 | **4.05** | Fx=1.576874457*4.05 | **6.3863** |
| **Other typical floors** | -dir, Ax (m$^2$)= | 2.7*25 | **67.50** | Fx=67.5*1.576874457 | **106.4390** |
| | -dir, Az (m$^2$)= | 2.7*3 | **8.10** | Fx=8.1*1.576874457 | **12.7727** |
| **Ground floor** | -dir, Ax (m$^2$)= | 3*25 | **75.00** | Fx=75*1.576874457 | **118.2656** |
| | -dir, Az (m$^2$)= | 3*3 | **9.00** | Fx=9*1.576874457 | **14.1919** |

**Tabulated summary of lateral forces and moments in direction**

| Level | Floor elevation | Vs | Sb | Ve | qs(kN/m$^2$) | Net qs(kN/m$^2$) | Force (kN) | Mj (kNm) *10$^3$ |
|---|---|---|---|---|---|---|---|---|
| 15th | 40.8 | 25.5 | 2 | 51 | 1.59 | 1.58 | 53.22 | 2.1714 |
| 14th | 38.1 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 4.0553 |
| 13th | 35.4 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 3.7679 |
| 12th | 32.7 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 3.4806 |
| 11th | 30 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 3.1932 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10th | 27.3 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 2.9058 | |
| 9th | 24.6 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 2.6184 | |
| 8th | 21.9 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 2.3310 | |
| 7th | 19.2 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 2.0436 | |
| 6th | 16.5 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 1.7562 | |
| 5th | 13.8 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 1.4689 | |
| 4th | 11.1 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 1.1815 | |
| 3rd | 8.4 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 0.8941 | |
| 2nd | 5.7 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 0.6067 | |
| 1st | 3 | 25.5 | 2 | 51 | 1.59 | 1.58 | 106.44 | 0.3193 | |
| 0 | 0 | 25.5 | 2 | 51 | 1.59 | 1.58 | 118.27 | 0 | |
| | | | | | | | | **32.7938638636147 kNm** | **32.7938638636147 kNm** |