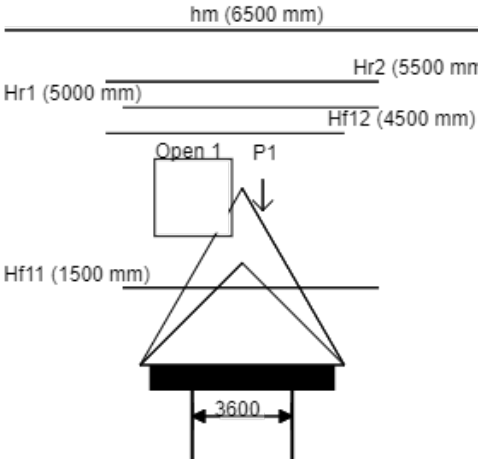
# 1.0 INPUT

## 1.1 Dimensions

| | | |
|---|---|---|
| Height of Masonry | $h_m$ | = **6500** mm |
| Leaf 1 Thickness | $t_{m1}$ | = **100** mm |
| Clear Span of Lintel | $L_c$ | = **3600** mm |




## 1.2 Material Property

| | | |
|---|---|---|
| Masonry Type | | **Solid** |
| Masonry Unit Weight Leaf 1 | $\Upsilon_{m1}$ | = **20** kN/m³ |

## 1.3 Loads

| | | |
|---|---|---|
| Selfweight of Lintel | $W_{s1}$ | = **0.15** kN/m |
| Dead Load Factor | $\Upsilon_d$ | = **1.4** |
| Imposed Load Factor | $\Upsilon_i$ | = **1.6** |

| Opening | Position (mm) | | Dimensions (mm) | |
|---|---|---|---|---|
| | Along Lintel ($OP_x$) | Above Lintel ($OP_y$) | Width ($W_{op}$) | Height ($H_{op}$) |
| 1 | 100 | 2500 | 1500 | 1500 |

| Point Load | Position (mm) | | Load (kN) | |
|---|---|---|---|---|
| | $P_x$ | $P_y$ | $P_d$ | $P_i$ |
| 1 | 2200 | 3000 | 10 | 20 |

| Floor Load 1 | Height above Lintel (mm) | Dead Load (kN/m) | Imposed Load (kN/m) |
|---|---|---|---|
| | $H_f$ | $W_{fd}$ | $W_{fi}$ |
| Side 1 | 1500 | 2 | 5 |
| Side 2 | 4500 | 5 | 8 |

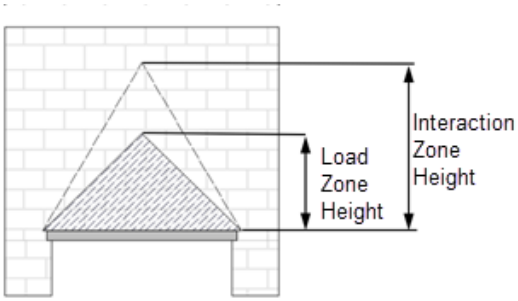
| Roof Load | Height above Lintel (mm) | Dead Load (kN/m) | Imposed Load (kN/m) |
|---|---|---|---|
| | $H_r$ | $W_{rd}$ | $W_{ri}$ |
| Side 1 | 5000 | 10 | 15 |
| Side 2 | 5500 | 10 | 20 |

# 2.0 OUTPUT

Ref: BS 5977

## 2.1 Bearing Pressure Check

| | | |
|---|---|---|
| Lintel Load Application Length | L | = $L_c$ * 1.1 = **3960** mm |
| Load Zone Height | $h_{lz}$ | = tan(45°) * L / 2 = **1980** mm |
| Interaction Zone Height | $h_{iz}$ | = tan(60°) * L / 2 = **3429.5** mm |




### 2.1.1 Load of Masonry Dispersed on Lintel

| | | |
|---|---|---|
| Area of Load Zone | $A_t$ | = $h_{iz}$ * L / 2 = **3.9** $m^2$ |
| Masonry Load from Load Zone | $W_{uvl}$ | = $A_t$ * ($t_{m1}$ * $\gamma_{m1}$ + $t_{m2}$ * $\gamma_{m2}$ + $t_{mc}$ * $\gamma_{mi}$) = **7.8** kN |
| Equ. Masonry Load from Load Zone | $W_{euvl}$ | = 1.33 * $W_{uvl}$ * $\gamma_d$ / L = **3.7** kN/m |

### 2.1.2 Dimensions of Lowest Opening Interacting with the Interaction Zone (I.Z)

| | | |
|---|---|---|
| Position of Opening along Lintel | $OP_x$ | = **100** mm |
| Position of Opening above Lintel | $OP_y$ | = **2500** mm |
| Width of Opening | $W_{op}$ | = **1500** mm |
| Height of Opening | $H_{op}$ | = **1500** mm |

### 2.1.3 Additional Weight of Masonry

| | | |
|---|---|---|
| Length of Load at the Level of Opening | $L_o$ | = **1073.2** mm |
| Length of Load in Load Zone | $L_{ot}$ | = **0** mm |
| Length of Load - Other Side I.Z. | $L_{oiother}$ | = **736.6** mm |
| Length of Load - Opening Side I.Z. | $L_{oiopening}$ | = **0** mm |
| Add. Area due to Interaction of Opening | $A_a$ | = **4.8** $m^2$ |
| Additional Weight of Masonry | $W_a$ | = $\gamma_d$ * $A_a$* ($t_{m1}$ * $\gamma_{m1}$ + $t_{m2}$ * $\gamma_{m2}$ + $t_{mc}$ * $\gamma_{mi}$) |
| | | = **13.5** kN |

### 2.1.4 Equivalent Load due to Additional Weight of Masonry

| | | |
|---|---|---|
| Masonry Load as UDL at Opening Level | $W_{madd}$ | = $W_a$ * 0.5 = **6.8** kN |
| Total Length of Spread | $UDL_{mspread}$ | = 2 * $OP_y$ + $L_{oiother}$ = **5736.6** mm |
| Total Load on Lintel | $W_{total}$ | = $W_{madd}$ / $UDL_{mspread}$ = **1.2** kN/m |
| Equivalent UDL | $W_{me}$ | = $W_{total}$ = **1.2** kN/m |

## 2.2 Equivalent Load due to Floor Load 1 Side 1

### 2.2.1 Floor Load on Load Zone

| | | |
|---|---|---|
| Distance of Floor from Load Zone Top | $Y_{f11T}$ | = $h_{lz}$ - $H_{f11}$ = **480** mm |
| Half the Length of Floor in Load Zone | $X_{f11T}$ | = Yf11T * (L / 2) / $h_{lz}$ = **480** mm |
| Length of Floor in Load Zone | $U_{DLf11spread1}$ | = (2 * $H_{f11}$ + 2 * $X_{f11}$T) = **3960** mm |
| Total Load Acting at the Load Zone | $F_{11T}$ | = ($W_{fd11}$ * $\gamma_d$ + $W_{fi11}$ * $\gamma_i$) * 2 * $X_{f11}$T = **10.4** kN |
| Load Distributed at the Level of Lintel | $W_{f11T}$ | = $F_{11T}$ / $UDL_{f11spread1}$ = **2.6** kN/m |

### 2.2.2 Floor Load at the Interaction Zone (I.Z.)

| | | |
|---|---|---|
| Total Load Acting | $F_{11}$ | = 0.5 * ($W_{fd11}$ * $\gamma_d$ + $W_{fi11}$ * $\gamma_i$) = **5.4** kN/m |
| Distance of Floor from I.Z. Top | $Y_{f11i}$ | = $h_{iz}$ - $H_{f11}$ = **1929.5** mm |
| Half the Length of Floor in Load and I.Z. | $X_{f11i}$ | = $Y_{f11i}$ * (L / 2) / $h_{iz}$ = **1114** mm |
| Length of Floor in per Side of the I.Z. | $X_{interf11}$ | = $X_{f11i}$ - $X_{f11T}$ = **634** mm |
| Total Length of Spread at Lintel Level | $UDL_{f11spread2}$ | = 2 * $H_{f11}$ + $X_{interf11}$ = **3634** mm |
| Total Load Acting at the I.Z. | $F_{11i}$ | = $F_{11}$ * $X_{interf11}$ = **3.4** kN |

| | | | |
|---|---|---|---|
| Assessed UDL at Lintel Level | $W_{f11i}$ | = $F_{11i}$ / $UDL_{f11spread2}$ = **0.9** kN/m | |
| Length of Load on Lintel | $UDL_{partf11}$ | = **3** mm | |
| Total Load on Lintel | $W_{f11iP}$ | = $W_{f11i}$ * $UDL_{partf11}$ = **2.8** kN | |
| Ratio of UDL Length to Lintel | n | = **0.8** | |
| K Factor | K | = **1.2** | *Table 1* |
| Total Equ. Load due to Roof Load 1 Side 1 | $W_{ef11}$ | = 2 * ((K * $W_{f11iP}$) / L) + $W_{f11T}$ = **4.3** kN/m | |

## 2.3 Equivalent Load due to Floor Load 1 Side 2

| | | |
|---|---|---|
| Length of Floor in Opening Zone | $L_{of}$ | = **1486.6** mm |
| Total Load Acting | $F_{12}$ | = ($W_{fd12}$ * $\gamma_d$ + $W_{fi12}$ * $\gamma_i$) * $L_{of}$ = **29.4** kN |
| Total Load Acting at the I.Z. | $F_{12/m}$ | = 0.5 * $F_{12}$ / $UDL_{mspread}$ = **2.6** kN/m |
| Total Equ. Load due to Roof Load 1 Side 2 | $W_{ef12}$ | = $F_{12}$/m = **2.6** kN/m |

## 2.4 Equivalent Load due to Roof Load Side 1

| | | |
|---|---|---|
| Length of Floor in Opening Zone | $L_{of}$ | = **1486.6** mm |
| Total Load Acting | $P_{DL+IL1}$ | = ($W_{rd1}$ * $\gamma_d$ + $W_{ri1}$ * $\gamma_i$) * $L_{of}$ = **56.5** kN |
| Total Load Acting at the I.Z. | $P_{DL+IL1/m}$ | = 0.5 * $P_{DL+IL1}$ / $UDL_{mspread}$ = **4.9** kN/m |
| Total Equ. Load due to Roof Load 1 Side 1 | $W_{er1}$ | = $P_{DL+IL1/m}$ = **4.9** kN/m |

## 2.5 Equivalent Load due to Roof Load Side 2

| | | |
|---|---|---|
| Length of Floor in Opening Zone | $L_{of}$ | = **1486.6** mm |
| Total Load Acting | $P_{DL+IL2}$ | = ($W_{rd2}$ * $\gamma_d$ + $W_{rd2}$ * $\gamma_i$) * $L_{of}$ = **68.4** kN |
| Total Load Acting at the I.Z. | $P_{DL+IL2/m}$ | = 0.5 * $P_{DL+IL2}$ / $UDL_{mspread}$ = **6** kN/m |
| Total Equivalent Load due to Roof Load Side 2 | $W_{er2}$ | = $P_{DL+IL2/m}$ = **6** kN/m |

## 2.6 Equivalent Load due to Point Load 1

| | | |
|---|---|---|
| Total Applied Load | $P_{con1}$ | = ($P_{d1}$ * $\gamma_d$) + ($P_{i1}$ * $\gamma_i$) = **46** kN |
| Total Load on Lintel | $P_{con1/m}$ | = $P_{con1}$ / $UDL_{mspread}$ = **8** kN/m |
| Total Equivalent Load due to Point Load 1 | $W_{ep1}$ | = $W_{ep1}$ = $P_{con1}$/m = **8** kN/m |

## 2.7 Analysis Results

| | | |
|---|---|---|
| Total Equivalent Load (Floor, Roof, Point Load, Opening, Lintel Self Weight) | $W_e$ | = $W_{euvl}$ + $W_{sl}$ * $\gamma_d$+ $W_{ef11}$ + $W_{ef12}$+ $W_{er1}$ + $W_{er2}$+ $W_{ep1}$<br>= **30.8** kN/m |
| Maximum Bending Moment | $M_{max}$ | = ($W_e$ * $L^2$) / 8 = **60.4** kN.m |
| Maximum Shear Force | $SF_{max}$ | = ($\gamma_d$ * $W_{uvl}$ + ($W_{ef11}$ + $W_{ef12}$ + $W_{er1}$ + $W_{er2}$ + $W_{ep1}$ + $\gamma_d$ * $W_{sl}$) * L)/2<br>= **59.2** kN |

# 3.0 SUMMARY

| Description | Notation | Results |
|---|---|---|
| Total Equivalent Factored Load (kN/m) | **$W_e$ =** | **30.8** |
| Maximum Bending Moment (kNm) | **$M_{max}$ =** | **60.4** |
| Maximum Shear Force (kN) | **$SF_{max}$ =** | **59.2** |