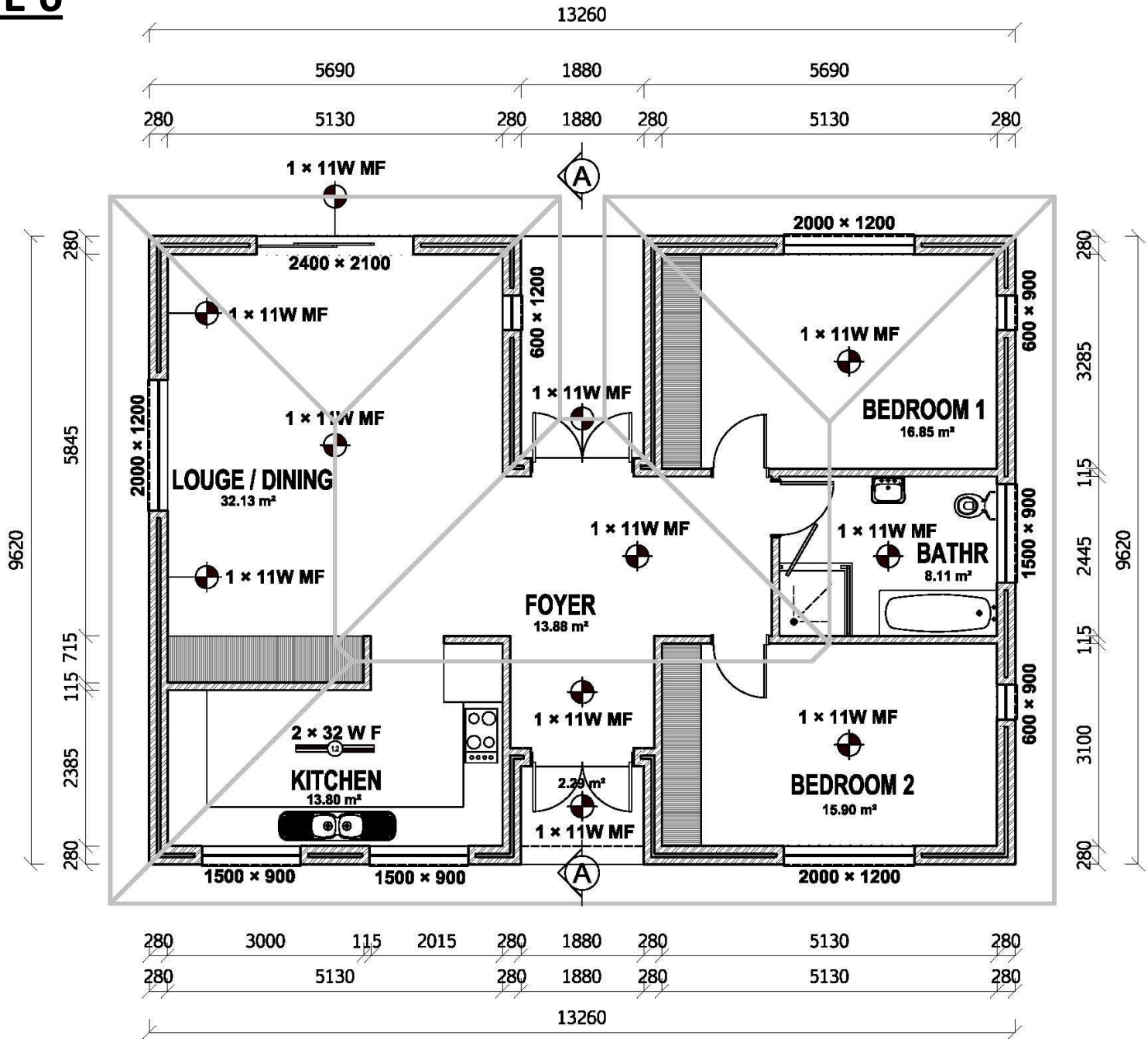
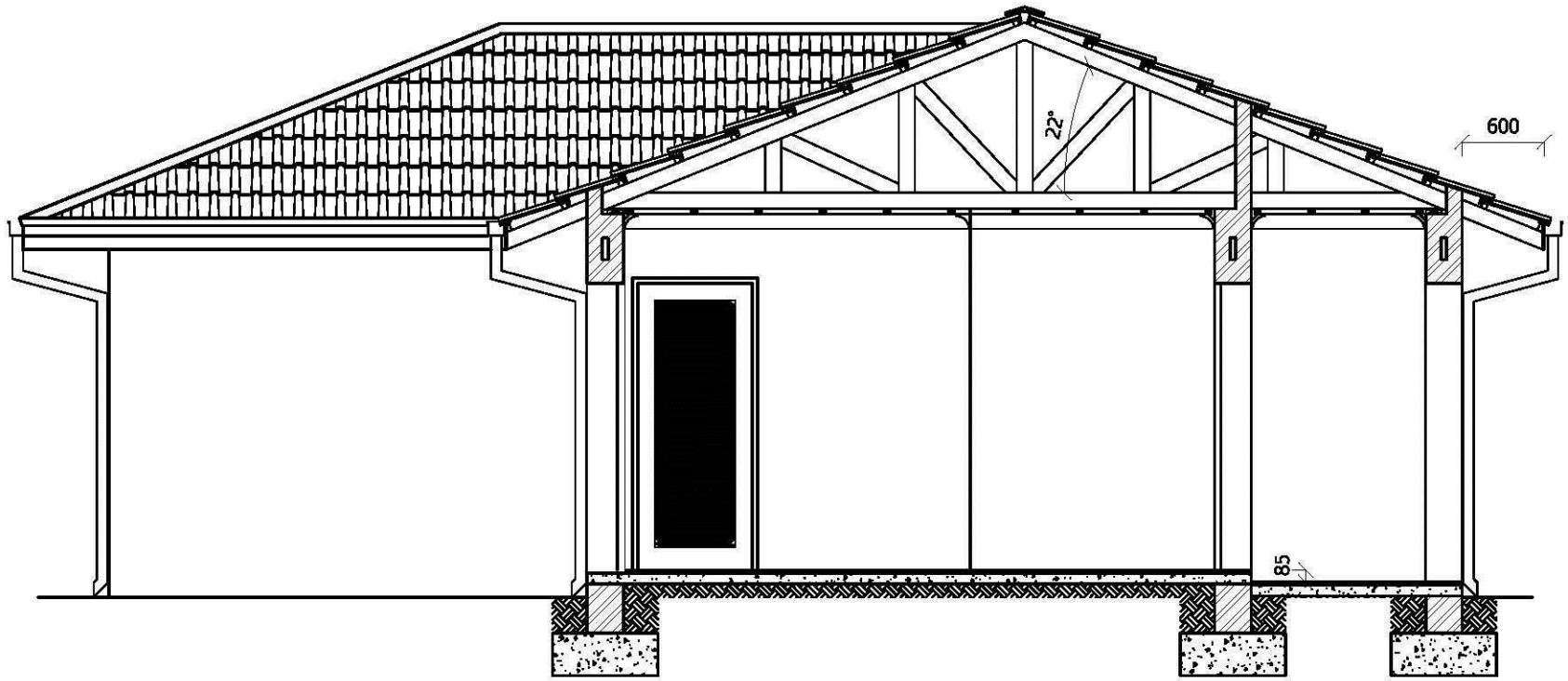


ZONE 6





2100
2550
2275

NATURAL VENTILATION

CONSTANTS:

$$\text{CONDUCTANCE:} \quad 100.67 \times 1.2 = 120.80$$

$$\text{SHG:} \quad 100.67 \times 0.13 = 13.09$$

CONDUCTANCE:

Use clear glass in aluminium split frame

$$\begin{aligned} A \times U &= 18.09 \times 5.6 \\ &= 101.30 \quad (< 140.94 \checkmark) \end{aligned}$$

SOLAR HEAT GAIN:

$$P = 600 + 115 = 715$$

$$G = 2275 - 2100 = 175 \quad (< 500)$$

2100 Door:	$P/H = 715/2275 = 0.31$
1200 Window:	$P/H = 715/1375 = 0.52$
900 Window:	$P/H = 715/1075 = 0.66$

NORTH:

$5.04 \times 0.77 \times 0.37$	$= 1.44$
$2.40 \times 0.77 \times 0.29$	$= 0.54$

EAST:

$(0.54 \times 0.77 \times 0.74) \times 2$	$= 0.62$
$1.35 \times 0.77 \times 0.74$	$= 0.77$
$0.72 \times 0.77 \times 0.83$	$= 0.46$

SOUTH:

$$2.40 \times 0.77 \times 0.31 = 0.57$$

$$(1.35 \times 0.77 \times 0.29) \times 2 = 0.60$$

WEST:

$$2.40 \times 0.77 \times 0.79 = \underline{1.46}$$

TOTAL = 6.46 (<13.09)

ARTIFICIAL VENTILATION:

ENERGY INDEX:

NORTHERN FAÇADE: $13.26 \times 2.550 = 33.81$
 $33.81 \times 0.227 = 7.67$

EASTERN FAÇADE: F1 $3.4 \times 2.550 = 8.67$
 $8.67 \times 0.227 = 1.97$

F2: $9.62 \times 2.550 = 24.53$
 $24.53 \times 0.227 = 5.57$

SOUTHERN FAÇADE: $13.26 \times 2.550 = 33.81$
 $33.81 \times 0.227 = 7.67$

WESTERN FAÇADE: $9.62 \times 2.550 = 24.53$
 $24.53 \times 0.227 = 5.57$

NORTHERN FAÇADE:

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 5.04[0.77(-0.16 \times 0.99 + 1.25 \times 0.93) + 0.00 \times 5.6] \\ &= 5.04[0.77(-0.16 + 1.16) + 0.00] \\ &= 5.04[0.77(1.00) + 0.00] \\ &= 5.04[0.77 + 0.00] \\ &= 5.04 \times 0.77 \\ &= 3.88 \end{aligned}$$

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 2.4[0.77(-0.16 \times 0.97 + 1.25 \times 0.77) + 0.00 \times 5.6] \\ &= 2.4[0.77(-0.16 + 0.96) + 0.00] \\ &= 2.4[0.77(0.80) + 0.00] \\ &= 2.4[0.62 + 0.00] \\ &= 2.4 \times 0.62 \\ &= 1.49 \end{aligned}$$

$$3.88 + 1.49 = 5.37 (<7.67 \checkmark)$$

EASTERN FAÇADE:

F1

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 0.72[0.77(-0.30 \times 0.92 + 1.18 \times 0.86) + 0.03 \times 5.6] \\ &= 1.35[0.77(-0.28 + 1.01) + 0.17] \\ &= 1.35[0.77(0.73) + 0.17] \\ &= 1.35(0.56 + 0.17) \\ &= 1.35 \times 0.73 \\ &= 0.99 (<1.97 \checkmark) \end{aligned}$$

F2

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 1.35[0.77(-0.30 \times 0.84 + 1.18 \times 0.74) + 0.03 \times 5.6] \\ &= 1.35[0.77(-0.25 + 0.87) + 0.17] \\ &= 1.35[0.77(0.62) + 0.17] \\ &= 1.35(0.48 + 0.17) \\ &= 1.35 \times 0.65 \\ &= 0.88 \end{aligned}$$

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 0.54[0.77(-0.30 \times 0.84 + 1.18 \times 0.74) + 0.03 \times 5.6] \\ &= 0.54[0.77(-0.25 + 0.87) + 0.17] \\ &= 0.54[0.77(0.62) + 0.17] \\ &= 0.54(0.48 + 0.17) \\ &= 0.54 \times 0.65 \\ &= 0.35 \end{aligned}$$

$$2 \text{ Windows} = 0.35 \times 2 = 0.70$$

$$0.88 + 0.70 = 1.58 \quad (< 5.57 \checkmark)$$

SOUTHERN FAÇADE:

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 2.4[0.77(-0.45 \times 0.93 + 0.35 \times 0.89) + 0.09 \times 5.6] \\ &= 2.4[0.77(-0.42 + 0.31) + 0.50] \\ &= 2.4[0.77(-0.08) + 0.39] \\ &= 2.4(-0.11 + 0.50) \\ &= 2.4 \times 0.39 \\ &= 0.94 \end{aligned}$$

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 1.35[0.77(-0.45 \times 0.88 + 0.35 \times 0.82) + 0.09 \times 5.6] \\ &= 1.35[0.77(-0.40 + 0.29) + 0.50] \\ &= 1.35[0.77(-0.07) + 0.50] \\ &= 1.35(-0.11 + 0.50) \\ &= 1.35 \times 0.39 \\ &= 0.53 \end{aligned}$$

$$2 \text{ Windows} = 0.53 \times 2 = 1.06$$

$$0.94 + 1.06 = 1.71 (< 7.67 \checkmark)$$

WESTERN FAÇADE:

$$\begin{aligned} A[S(C_A \times S_H + C_B \times S_C) + C_C \times U] &= 2.4[0.77(-0.40 \times 0.92 + 0.98 \times 0.85) + 0.04 \times 5.6] \\ &= 2.4[0.77(-0.37 + 0.83) + 0.22] \\ &= 2.4[0.77(0.46) + 0.22] \\ &= 2.4(0.35 + 0.22) \\ &= 2.4 \times 0.57 \\ &= 1.37 (<5.57 \checkmark) \end{aligned}$$

BUILDING SUITABLE FOR AIRCONDITIONING / MECHANICAL VENTILATION

LIGHTING

ENERGY DEMAND:

ALLOWED: $5\text{W}/\text{m}^2$

$$5\text{W}/\text{m}^2 \times 121.92\text{m}^2 = 609.60\text{W}$$

$$11 \times 11\text{W lamps} + 2 \times 32\text{W lamps} = 185\text{W} (< 609.60\text{W } \checkmark)$$

or

$$185\text{W} / 121.92\text{m}^2 = 1.52\text{W}/\text{m}^2 (< 5\text{W}/\text{m}^2)$$

ENERGY CONSUMPTION:

ALLOWED: $5\text{kWh/m}^2.\text{a}$ or 5kWh/m^2 [$a = 1$ (year)]

$$5\text{kWh/m}^2.\text{a} \times 121.92\text{m}^2 = 609.60\text{kWh.a}$$

Assume lights are on from 17:00 – 22:00 each day/year

That is 5h/day

$$52 \text{ (weeks)} \times 7 \text{ (days)} \times 5 \text{ (h)} = 1\,820\text{h.a}$$

$$\begin{aligned} \text{There are } 11 \times 11\text{W lamps, } 2 \times 32\text{W lamps} &= (11 \times 11\text{W}) + (2 \times 32\text{W}) \\ &= 121\text{W} + 64\text{W} \\ &= 185\text{W} \\ &= 0.185\text{kW} \end{aligned}$$

$$0.185\text{kW} \times 1\,820\text{h.a} = 336.7\text{kWh.a} (< 609.60\text{kWh.a} \checkmark)$$