**5.8.1 Cálculo estructural**

**Comprobación secciones de acero**

1. VIGAS

VIGA tipo 1 (Ventanas pequeñas) (2IPE-270) l/lb: 220,00cm cm

Acero estructural: S275

Límite elástico: 275,0 MPa

Tensión de rotura: 430,0 MPa

La sección es agrupada: 2 "I"

Cálculo de 2º orden:

Factor reductor de pandeo por flexión: = 0,94

Esbeltez: = (0,24;0,37)

Factor de longitud de pandeo: = (1,000;1,000)

Clase de las alas: 1; Clase del alma: 1 (Combinación n=6)

| Flecha(cm) | Vertical | | Horizontal | | fAdm | Cumple |
| --- | --- | --- | --- | --- | --- | --- |
| Flecha por confort | +0,00 | +0,00 | +0,00 | +0,00 |  +0,68 | Sí |
| Flecha por integridad | +0,00 | -0,00 | +0,00 | +0,00 |  +0,59 | Sí |
| Flecha por apariencia | +0,00 | -0,00 | +0,00 | +0,00 |  +0,79 | Sí |

COMBINACIONES PRINCIPALES

| N | TIPO | COMB. | X(cm) | Fx kN | Mx kNm | My kNm | (My1) | Mz kNm | (Mz1) | Vy kN | Vz kN | % |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Tr | 0(2) | 0 | 0,8 | 0,0 | 0,0 | (0,0) | -0,1 | (-0,6) | -0,9 | 0,0 | 0,1% |
| 4 | Mz | 0(2) | 237 | 0,8 | 0,0 | 0,0 | (0,0) | -0,6 | (-0,6) | 1,3 | 0,0 | 0,2% |
| 5 | V | 0(2) | 237 | 0,8 | 0,0 | 0,0 | (0,0) | -0,6 | (-0,6) | 1,3 | 0,0 | 0,2% |
| 6 | Sm | 0(2) | 237 | 0,8 | 0,0 | 0,0 | (0,0) | -0,6 | (-0,6) | 1,3 | 0,0 | 0,2% |

APROVECHAMIENTO 0,00 (0,2%)

ESFUERZOS ULTIMOS - COEFICIENTES (kN)(kNm)

| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TÉRMINOS DE SECCIÓN | | | | | | | |
| Alas clase | --- | 1 | --- | --- | 1 | 1 | 1 |
| Alma clase | --- | 1 | --- | --- | 1 | 1 | 1 |
| ESFUERZOS SIMPLES | | | | | | | |
| Nt,Rd | --- | 2404,3 | --- | --- | 2404,3 | 2404,3 | 2404,3 |
| Nc,Rd | --- | 2404,3 | --- | --- | 2404,3 | 2404,3 | 2404,3 |
| Fx / N,Rd | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Vc,Rd,y | --- | 669,6 | --- | --- | 669,6 | 669,6 | 669,6 |
| Vy / Vc,Rd,y | --- | 0,1% | --- | --- | 0,2% | 0,2% | 0,2% |
| Vc,Rd,z | --- | 832,9 | --- | --- | 832,9 | 832,9 | 832,9 |
| Vz / Vc,Rd,z | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Mc,Rd,y | --- | 162,3 | --- | --- | 162,3 | 162,3 | 162,3 |
| My / Mc,Rd,y | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Mc,Rd,z | --- | 253,5 | --- | --- | 253,5 | 253,5 | 253,5 |
| Mz / Mc,Rd,z | --- | 0,1% | --- | --- | 0,2% | 0,2% | 0,2% |
| TRd | --- | 693,4 | --- | --- | 693,4 | 693,4 | 693,4 |
| Mx / TRd | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| ESFUERZOS COMBINADOS | | | | | | | |
| Mv,Rd,y | --- | 0,0 | --- | --- | 0,0 | 0,0 | 0,0 |
| My / Mv,Rd,y | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Mv,Rd,z | --- | 0,0 | --- | --- | 0,0 | 0,0 | 0,0 |
| Mz / Mv,Rd,z | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| N + M | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| N + M + V | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Vpl,T,Rd,y | --- | 669,6 | --- | --- | 669,6 | 669,6 | 669,6 |
| T + Vy | --- | 0,1% | --- | --- | 0,2% | 0,2% | 0,2% |
| Vpl,T,Rd,z | --- | 832,9 | --- | --- | 832,9 | 832,9 | 832,9 |
| T + Vz | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| PANDEO LATERAL | | | | | | | |
| LT | --- | 1,000 | --- | --- | 1,000 | 1,000 | 1,000 |
| red,LT | --- | 0,000 | --- | --- | 0,000 | 0,000 | 0,000 |
| Mcr | --- | 0,3 | --- | --- | 1,2 | 1,2 | 1,2 |

VIGA tipo 2 (Ventanas grandes) (2IPE-270) l/lb: 320cm

Acero estructural: S275

Límite elástico: 275,0 MPa

Tensión de rotura: 430,0 MPa

La sección es agrupada: 2 "I"

Cálculo de 2º orden:

Factor reductor de pandeo por flexión: = 0,89

Esbeltez: = (0,33;0,49)

Factor de longitud de pandeo: = (1,000;1,000)

Clase de las alas: 1; Clase del alma: 1 (Combinación n=6)

| Flecha(cm) | Vertical | | Horizontal | | fAdm | Cumple |
| --- | --- | --- | --- | --- | --- | --- |
| Flecha por confort | +0,00 | +0,00 | +0,00 | +0,00 |  +0,91 | Sí |
| Flecha por integridad | +0,00 | +0,00 | +0,00 | +0,00 |  +0,79 | Sí |
| Flecha por apariencia | +0,00 | +0,00 | +0,00 | +0,00 |  +1,06 | Sí |

COMBINACIONES PRINCIPALES

| N | TIPO | COMB. | X(cm) | Fx kN | Mx kNm | My kNm | (My1) | Mz kNm | (Mz1) | Vy kN | Vz kN | % |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Tr | 0(2) | 0 | 3,3 | 0,0 | 0,0 | (0,0) | -0,5 | (0,7) | -1,5 | 0,0 | 0,2% |
| 4 | Mz | 0(2) | 150 | 3,3 | 0,0 | 0,0 | (0,0) | 0,7 | (0,7) | -0,1 | 0,0 | 0,3% |
| 5 | V | 0(2) | 0 | 3,3 | 0,0 | 0,0 | (0,0) | -0,5 | (0,7) | -1,5 | 0,0 | 0,2% |
| 6 | Sm | 0(2) | 150 | 3,3 | 0,0 | 0,0 | (0,0) | 0,7 | (0,7) | -0,1 | 0,0 | 0,3% |

APROVECHAMIENTO 0,00 (0,3%)

ESFUERZOS ULTIMOS - COEFICIENTES (kN)(kNm)

| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TÉRMINOS DE SECCIÓN | | | | | | | |
| Alas clase | --- | 1 | --- | --- | 1 | 1 | 1 |
| Alma clase | --- | 1 | --- | --- | 1 | 1 | 1 |
| ESFUERZOS SIMPLES | | | | | | | |
| Nt,Rd | --- | 2404,3 | --- | --- | 2404,3 | 2404,3 | 2404,3 |
| Nc,Rd | --- | 2404,3 | --- | --- | 2404,3 | 2404,3 | 2404,3 |
| Fx / N,Rd | --- | 0,1% | --- | --- | 0,1% | 0,1% | 0,1% |
| Vc,Rd,y | --- | 669,6 | --- | --- | 669,6 | 669,6 | 669,6 |
| Vy / Vc,Rd,y | --- | 0,2% | --- | --- | 0,0% | 0,2% | 0,0% |
| Vc,Rd,z | --- | 832,9 | --- | --- | 832,9 | 832,9 | 832,9 |
| Vz / Vc,Rd,z | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Mc,Rd,y | --- | 162,3 | --- | --- | 162,3 | 162,3 | 162,3 |
| My / Mc,Rd,y | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Mc,Rd,z | --- | 253,5 | --- | --- | 253,5 | 253,5 | 253,5 |
| Mz / Mc,Rd,z | --- | 0,2% | --- | --- | 0,3% | 0,2% | 0,3% |
| TRd | --- | 693,4 | --- | --- | 693,4 | 693,4 | 693,4 |
| Mx / TRd | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| ESFUERZOS COMBINADOS | | | | | | | |
| Mv,Rd,y | --- | 0,0 | --- | --- | 0,0 | 0,0 | 0,0 |
| My / Mv,Rd,y | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Mv,Rd,z | --- | 0,0 | --- | --- | 0,0 | 0,0 | 0,0 |
| Mz / Mv,Rd,z | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| N + M | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| N + M + V | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| Vpl,T,Rd,y | --- | 669,6 | --- | --- | 669,6 | 669,6 | 669,6 |
| T + Vy | --- | 0,2% | --- | --- | 0,0% | 0,2% | 0,0% |
| Vpl,T,Rd,z | --- | 832,9 | --- | --- | 832,9 | 832,9 | 832,9 |
| T + Vz | --- | 0,0% | --- | --- | 0,0% | 0,0% | 0,0% |
| PANDEO LATERAL | | | | | | | |
| LT | --- | 1,000 | --- | --- | 1,000 | 1,000 | 1,000 |
| red,LT | --- | 0,000 | --- | --- | 0,000 | 0,000 | 0,000 |
| Mcr | --- | 1,0 | --- | --- | 1,4 | 1,0 | 1,4 |

2. PILARES

PILAR tipo (ventana grande) (2UPN-140) l/lb: 378,0 cm / 357,5 cm

Acero estructural: S275

Límite elástico: 275,0 MPa

Tensión de rotura: 430,0 MPa

La sección es agrupada: 2 "U" Enfrentados

Cálculo de 2º orden:

Factor reductor de pandeo por flexión: = 0,58

Esbeltez: = (0,76;0,93)

Factor de longitud de pandeo: = (1,000;1,000)

Clase de las alas: 1; Clase del alma: 1 (Combinación n=6)

COMBINACIONES PRINCIPALES

| N | TIPO | COMB. | X(cm) | Fx kN | Mx kNm | My kNm | (My1) | Mz kNm | (Mz1) | Vy kN | Vz kN | % |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | Co | 0(2) | 0 | -0,8 | 0,0 | -0,0 | (0,0) | 0,0 | (0,0) | 0,0 | -0,0 | 0,1% |
| 1 | Tr | 0(2) | 358 | 0,8 | 0,0 | 0,0 | (0,0) | 0,0 | (0,0) | 0,0 | -0,0 | 0,1% |
| 3 | My | 0(2) | 358 | 0,8 | 0,0 | 0,0 | (0,0) | 0,0 | (0,0) | 0,0 | -0,0 | 0,1% |
| 5 | V | 0(2) | 0 | -0,8 | 0,0 | -0,0 | (0,0) | 0,0 | (0,0) | 0,0 | -0,0 | 0,1% |
| 6 | Sm | 0(2) | 0 | -0,8 | 0,0 | -0,0 | (0,0) | 0,0 | (0,0) | 0,0 | -0,0 | 0,1% |

APROVECHAMIENTO 0,00 (0,1%)

ESFUERZOS ULTIMOS - COEFICIENTES (kN)(kNm)

| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| TÉRMINOS DE SECCIÓN | | | | | | | |
| Alas clase | 1 | 0 | --- | 0 | --- | 1 | 1 |
| Alma clase | 1 | 0 | --- | 0 | --- | 1 | 1 |
| ESFUERZOS SIMPLES | | | | | | | |
| Nt,Rd | 1068,6 | 1068,6 | --- | 1068,6 | --- | 1068,6 | 1068,6 |
| Nc,Rd | 1068,6 | 1068,6 | --- | 1068,6 | --- | 1068,6 | 1068,6 |
| Fx / N,Rd | 0,1% | 0,1% | --- | 0,1% | --- | 0,1% | 0,1% |
| Vc,Rd,y | 314,8 | 314,8 | --- | 314,8 | --- | 314,8 | 314,8 |
| Vy / Vc,Rd,y | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| Vc,Rd,z | 362,9 | 362,9 | --- | 362,9 | --- | 362,9 | 362,9 |
| Vz / Vc,Rd,z | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| Mc,Rd,y | 43,7 | 43,7 | --- | 43,7 | --- | 43,7 | 43,7 |
| My / Mc,Rd,y | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| Mc,Rd,z | 54,0 | 54,0 | --- | 54,0 | --- | 54,0 | 54,0 |
| Mz / Mc,Rd,z | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| TRd | 218,5 | 218,5 | --- | 218,5 | --- | 218,5 | 218,5 |
| Mx / TRd | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| ESFUERZOS COMBINADOS | | | | | | | |
| Mv,Rd,y | 0,0 | 0,0 | --- | 0,0 | --- | 0,0 | 0,0 |
| My / Mv,Rd,y | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| Mv,Rd,z | 0,0 | 0,0 | --- | 0,0 | --- | 0,0 | 0,0 |
| Mz / Mv,Rd,z | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| N + M | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| N + M + V | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| Vpl,T,Rd,y | 314,8 | 314,8 | --- | 314,8 | --- | 314,8 | 314,8 |
| T + Vy | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| Vpl,T,Rd,z | 362,9 | 362,9 | --- | 362,9 | --- | 362,9 | 362,9 |
| T + Vz | 0,0% | 0,0% | --- | 0,0% | --- | 0,0% | 0,0% |
| INESTABILIDAD - PANDEO | | | | | | | |
| Nb,Rd | 1068,6 | --- | --- | --- | --- | 1068,6 | 1068,6 |
| Fx / Nb,Rd | 0,1% | --- | --- | --- | --- | 0,1% | 0,1% |
| red,y | 0,925 | --- | --- | --- | --- | 0,925 | 0,925 |
| red,z | 0,756 | --- | --- | --- | --- | 0,756 | 0,756 |
| y | 1,000 | --- | --- | --- | --- | 1,000 | 1,000 |
| z | 1,000 | --- | --- | --- | --- | 1,000 | 1,000 |
| Ncr,y | 1310,7 | --- | --- | --- | --- | 1310,7 | 1310,7 |
| Ncr,z | 1962,2 | --- | --- | --- | --- | 1962,2 | 1962,2 |
| PANDEO LATERAL | | | | | | | |
| LT | 1,000 | 1,000 | --- | 1,000 | --- | 1,000 | 1,000 |
| red,LT | 0,000 | 0,000 | --- | 0,000 | --- | 0,000 | 0,000 |
| Mcr | 0,0 | 0,0 | --- | 0,0 | --- | 0,0 | 0,0 |
| COMPRESIÓN Y FLEXIÓN CON PANDEO | | | | | | | |
| CE (6.61) | 0,1% | --- | --- | --- | --- | 0,1% | 0,1% |
| CE (6.62) | 0,1% | --- | --- | --- | --- | 0,1% | 0,1% |
| kyy | 0,400 | --- | --- | --- | --- | 0,400 | 0,400 |
| kzz | 1,000 | --- | --- | --- | --- | 1,000 | 1,000 |
| kyz | 0,600 | --- | --- | --- | --- | 0,600 | 0,600 |
| kzy | 0,240 | --- | --- | --- | --- | 0,240 | 0,240 |
| cmy | 0,400 | --- | --- | --- | --- | 0,400 | 0,400 |
| cmz | 1,000 | --- | --- | --- | --- | 1,000 | 1,000 |
| cmLT | 1,000 | --- | --- | --- | --- | 1,000 | 1,000 |
| NEd | 0,8 | --- | --- | --- | --- | 0,8 | 0,8 |
| MEd,y | -0,0 | --- | --- | --- | --- | -0,0 | -0,0 |
| MEd,z | 0,0 | --- | --- | --- | --- | 0,0 | 0,0 |