# DESIGN NOTE 4: Wall ties – checking the capacity of a tie to transfer loads between the leaves of a cavity wall.

Whilst the requirements for wall ties are covered in BS EN 1996-1-1there is no classification system for ties indicating their suitability for different end uses. PD 6697, however, does provide, in Table 10, a suitable classification system based on that previously contained in BS 5628. The minimum spacing of wall ties is a Nationally Determined Parameter and may be found in the UK National Annex to BS EN 1996-1-1 Clause N.A. 2.17 where it is required to be 2,5 per $m^2$.

The purpose of this design note is to demonstrate how the ability of a tie to transfer design wind loads between the two leaves of a cavity wall may be checked by calculation. The value for the characteristic tensile and compressive strength of the tie has been taken as the minimum values given in PD 6697 Table 12 but in practice these values will be declared by the manufacturer of the tie. Typical values have been selected for the wind loading.

## Example Calculation

| | |
|---|---|
| Description of tie | Type 2 to PD 6697 |
| Minimum mortar designation | M2 (designation iv) as required by PD 6697[1] |
| Tensile characteristic load capacity | 1800 N (PD 6697 Table 12) |
| Compressive characteristic load capacity | 1300 N (PD 6697 Table 12) |
| Material partial factor ($\gamma$m) | 3,0 (N.A.to BS EN 1996-1-1 Table N.A.1) |
| Wall tie density | 2,5 per $m^2$ |
| Tie tensile design resistance | 1,50 kN/$m^2$ |
| Tie compressive design resistance | 1,08 kN/$m^2$ |
| Wind characteristic load | 1,19 kN/$m^2$ |
| Cpe + Cpi for wind load | 1,12 (as +0,82 and -0,30) |
| Wind characteristic load across wall | 1,33 kN/$m^2$ |
| Load partial factor ($\gamma$f) | 1,35 |

[1] In practice M4 would be the typical specification for the mortar.

Design wind load across wall 1,796 kN/m$^2$

Design load into each leaf 0,898 kN/m$^2$ (on 50% basis)

Out of balance design compressive load in ties $= \frac{(0,82-0,30)}{1,12} \times 0,898 = 0,42$ kN/m$^2$

$$\frac{Tie\ resistance}{Applied\ load\ in\ compression} = \frac{1,08}{0,42} = 2,56 > 1 \therefore O.K.$$

Alternative Cpe + Cpi Situation:

Wind characteristic load 1,19 kN/m$^2$ as before

Cpe + Cpi for wind load 0,62 (as +0,82 and +0,20)

Wind characteristic load across wall 0,738 kN/m$^2$

Design wind load across wall 0,996 kN/m$^2$

Design load into each leaf 0,498 kN/m$^2$ (on 50% basis)

Out of balance design compressive load in ties $= \frac{(0,82+0,20)}{0,62} \times 0,498 = 0,82$ kN/m$^2$

$$\frac{Tie\ resistance}{Applied\ load\ in\ compression} = \frac{1,08}{0,82} = 1,32 > 1 \therefore O.K.$$

**Therefore a Type 2 tie at a spacing of 2,5 per m$^2$ will satisfactorily transfer the design lateral loads between the leaves.**