PROKON Support Portal

Enormous wind pressures when using BS EN 1991-1-4:2005 + A1:2010 outside the UK

Johan - 2019-11-29 - 0 Comments - in G02: Wind pressure analysis

Users should be cautious when using the UK National Annex to Eurocode 1 outside of the United Kingdom.

The procedure for determining the peak wind speed pressure (q_p) differs between SANS 10160-3-2011 and BS EN 1991-1-4:2005+A1:2010. A brief discussion of both procedures follow.

SANS 10160-3:2011

$$q_p(z) = \frac{1}{2} \times \rho \times v_p^2(z)$$

where:

- q_p - peak wind speed pressure
- ρ - air density, which is a function of site elevation. Air density decreases as elevation increases.
- v_p - peak wind speed
- z - height of the structure

It is expected that an increase in site elevation will result in a reduction of peak wind speed pressure.

BS EN 1991-1-4:2005+A1:2010

This code uses a diffferent approach. First, an altitude factor c_{alt} is determined:

$$c_{alt} = 1 + 0{,}001 \cdot A \qquad \text{for } z \leqslant 10 \text{ m)}$$
$$c_{alt} = 1 + 0{,}001 \cdot A \cdot (10/z)^{0.2} \qquad \text{for } z > 10 \text{ m}$$

where:

- A - altitude of the site above sea-level
- z - height of the building

Paragraph NA.2.18 states that the air density should be taken as 1.226 kg/m^3. This is a constant value, regardless of site elevation. The basic wind speed should then be calculated

and ultimately the peak wind speed pressure. It is expected that an increase in site elevation will result in an increase of peak wind speed pressure.

Summary of the influence of site elevation on peak wind speed pressure

Using the SA code: peak wind speed pressure should decrease as site elevation increases.

Using Eurocode (with the UK annex): peak wind speed pressure should increase as site elevation increases.

The problem with using BS EN 1991-1-4:2005+A1:2010 outside the UK

Figure NA.1 gives the value of fundamental basic wind velocity before the altitude correction is applied. These wind speeds are measured at 10 m above ground at sea level and need to be adjusted for site elevation. The wind speeds in Figure NA.1 are lower than the actual speeds one would measure with an anemometer, hence the adjustment.

Note 1 states that the map is intended for sites in the United Kingdom, Isle of Man and the Channel Islands only. (The typical elevations are much lower than in South Africa)

In order to determine the fundamental basic wind velocity, you have to first calculate the altitude factor with equation NA.2. (c_{alt} will always be greater than 1)

Figure 1 in SANS 10160-3:2011 shows a map of measured wind speeds at much higher elevations than in the United Kingdom - no altitude factor is required. Applying the altitude factor to sites located in South Africa (especially inland sites) will most likely result in enormous wind pressures.