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COMPARISON OF THE WIND LOADS INFLUENCES TO THE STEEL CHIMNEYS IN ACCORDANCE OF STANDARD STN AND ENV

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Summary: *This paper describes the static and dynamic analyses used for welded steel chimneys expertises according to national standard STN 73 0035 and European standard EN 1991 1-4. More details are concerned with wind loading determination and its using for static analysis and lateral resonance analysis. On the base of the three VEAB chimney models with and without the mechanical dampers the wind load effect is presented.*

1. Introduction

The frameless welded steel chimneys are modern and economic solution for the transmition of the smoke gas from the plants. The steel chimneys are constructed in dependency on the plant powers with diameter more than 5m and 150m of the height. The steel chimney consist two pipes – the structural pipe and the inner pipe. Furthermore there is the thermal insulation. The structural pipe can be constructed from one or more segments connected by the flanges and bolts. The chimney is anchored in the concrete block. The design of the chimney can be optimised by static and dynamic analysis considered various load effects. The critical load of the chimneys is the wind impact. For slender structures subjected to wind loading there are three main actions to consider, gust wind, vortex shedding and ring oscillation ovalling. Assessment of the design chimney due to wind effect is defined in standard ENV 1991-2-4. The previous standard was STN 730035 in Slovakia. In the case of the design of the chimneys the german standard DIN 4133 is recommended.

Figure 1 VEAB steel chimney

In this paper the VEAB steel chimney (Travnik, 2002) of the height 90m is considered. The behaviour of the steel chimney was investigated in the real plant. The experimental and numerical analyses were published in report of the Sweden Company (Travnik, 2002).

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2. Static and dynamic calculation of the chimney

The most importance parameters for the static design of the steel chimneys by EN 1991-1-4 is the mean wind velocity v_m. The mean wind velocity depends of the roughness factor $c_r(z)$ and the orography factor $c_o(z)$, $v_m = c_r(z).c_o.v_b$,where v_b is the basic wind velocity. The dynamic analysis of the steel chimneys must be realized in accordance of the ENV considering the across resonance vibration due to buffering effects, galloping, divergence and fluttering. The base of the dynamic analysis is the calculation of the first mode of the chimney.

3. Wind load in accordance of the STN and ENV standards

The numerical analysis of the steel stack due to along-wind turbulence according to EN has been compared with procedures according to STN 73 0035. The comparison of the STN and ENV definition of the wind pressure along the chimney is presented in the fig.2.

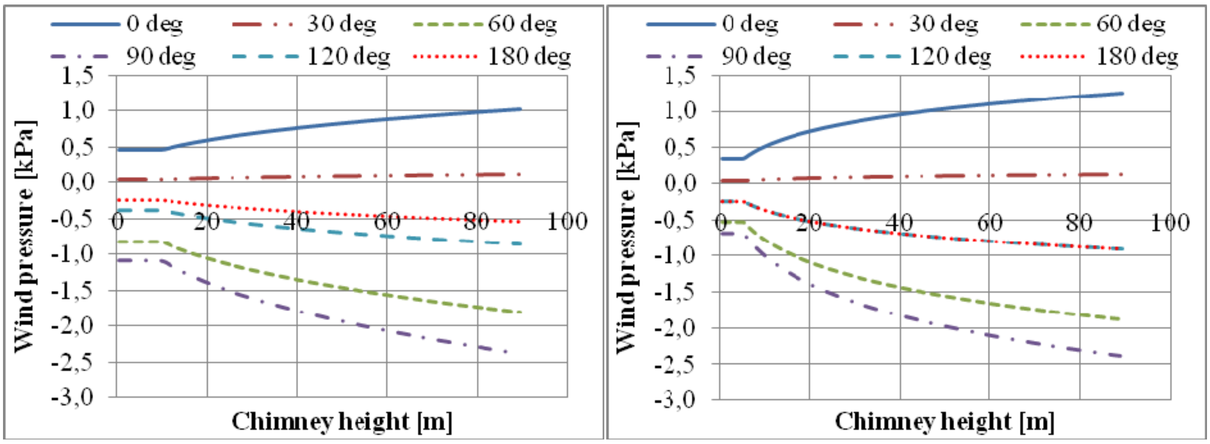

Figure 2 Wind pressure on the steel chimney by a) STN standard and b) ENV standard

4. Conclusion

This paper presents that a detailed analysis of peak velocity pressures according to different codes gives us different wind load. The fluctuating part of pressure – dynamic nature, depends on the atmospheric turbulence. The resultant of these pressures gives rise to a system of different distribution of the forces. Differences between EN and STN are more than 22,9% (or 59,7%) for design (or normal) pressure values on the chimney surface.

4. Acknowledgement

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