Research project: **Spatial analysis of measured snow load data in five districts and their comparison to snow load zone data of DIN 1055-5: 2005 as a pilot study for the revision of the snow load zone map**

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Summary: All available measurements of snow water equivalent and snow depth in five Bavarian districts were analyzed by extreme value statistics and by spatial interpolation as a thorough pilot study for a survey of the snow load zone map of DIN 1055-5:2005. The investigations aimed at an increase of the spatial resolution of the snow load information with appropriate data. The spatial distribution of snow depth measurement sites is more dense than that of snow water equivalent sites in the meteorological network of German Weather Service (DWD). In order to achieve a spatially higher resolution of snow load data out from snow depth measurements, information on the corresponding density of snow is required. Representative values of snow density in the test areas were derived from regression analysis between snow depth and snow water equivalent data, taken from sites where both parameters have simultaneously been measured. The investigations show that the regression relationship between the annual maxima of water equivalent and the associated snow depths leads to snow densities, which correspond to the upper envelope of the snow densities determined for annual maxima of snow depths. Thus the relationship leads to relevant snow water equivalents in terms of standardization with regard to a safe design of structures.

Regression relationships for snow density were applied to data of all snow depth measurement sites in order to calculate snow water equivalents. Characteristic snow loads and the associated snow load zones were subsequently determined by means of extreme value analysis. The comparison of the newly ascertained site-related snow load zone assignment with the snow load zones of DIN 1055-5:2005 leads to results that suggest changes to the snow load zone classification for many locations. The deviations from the current snow load zone assignments depend on the region. Site-related assignments to smaller snow load zones predominate in the district of Miesbach. In the district of Rottal-Inn, the majority of the site-related results are in line with the current zone assignments, whereas more deviations to higher snow load zones were found in the districts of Traunstein, Berchtesgadener Land and Passau.

The obtained snow load data with a more dense spatial resolution were interpolated using a geostatistical method. Snow load zone grids were derived from the resulting snow load grids. Afterwards the snow load zone grids were compared to snow load zones of DIN 1055-5:2005. The results indicate that height dependencies of snow loads in the test areas often differ from those that are defined in the corresponding equations of DIN 1055-5:2005. These height dependencies of snow loads arise from the topography and the associated meteorological conditions. The current results show that the interpolated snow loads mainly lead to snow load zone assignments that are smaller in higher altitudes than in lower altitudes. In other words: The snow loads are overestimated with increasing elevation on the basis of the present zone assignments of DIN 1055-5:2005. The main reason for the current overestimation of snow loads seems to be the distinctive elevation gradients in the test regions. Therefore, the results of the study may be an argument for the introduction of a special regional zoning (e.g. an "alpine region").

Snow load zones for community areas were assigned on the basis of interpolated snow load grids by application of an objective generalization procedure for grid data with elevation greater than 1000 m above sea level. A comparison between community-remapped snow load zones and the currently valid zone assignments of DIN 1055-5:2005 substantiated the results of the station-related snow load zone assignments within the test areas: 32 communities (17 %, out of 195 communities) are associated with a higher snow load zone, for 59 communities (30 %) the newly determined snow load zone corresponds to the currently applicable one and 104 communities (53 %) are allocated to a smaller snow load zone.