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## Ashfall hazard: modelling volcanic ash roof loading and revisions to European Building Codes

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This paper presents a numerical procedure for testing the effects of both static and dynamic loading of volcanic ash deposition on concrete roofs. The study aims to propose, a revision to the building regulations to make existing and future European buildings more resilient. The investigation uses a multi-physics simulation approach. Mathematical modelling is developed to investigate the volcanic ash effects in the context of the EN1991 code. A numerical modelling tool (EDEM software) for the Discrete Element Method (DEM) and structural analysis tool (ANSYS) for the Finite Element Method (FEM) is used to investigate 1 m x 1 m x 0.0154 m concrete slab plate subjected to pressure load considering the wind and no-wind effects. The modelled wind velocity was held constant at 0.2 m/s. The density of the volcanic ash is low compared to natural systems but can be changed to reflect a range of relevant (measured) eruptive products. The key parameters and the results are illustrated as follows. With the initial results only, it is clear that our modelling technique has the potential to explore the loading effects of ash over a range of geological and environmental conditions during deposition.

The number of simulated volcanic particle loads is 80000, Volcanic ash particle density of 1000 (kg/m<sup>3</sup>). The simulated particle variables results for wind effects in the horizontal direction of (0.2 m/s) are as follows: The maximum pressures as 220042(Pa), the maximum deformation as 0.177 (mm) and the maximum stress as 10.3 (MPa). The no wind effect (controlled condition) simulations particle variable results are as follows: the maximum pressures as 6411.3 (Pa), the maximum deformation as 0.061 (mm) and the maximum stress as 3.44 (MPa).

As expected, the wind effect resulted in an uneven distribution of the ash on the roof surface, which in turn produced areas of high-pressure load and stress levels. These results will have a possible impact on the designs of buildings on flat roof considerations. We aim to continue with further investigations to determine the stress impact and collapse failure due to loading over a wide range of relevant volcanic ash particle size compositions.