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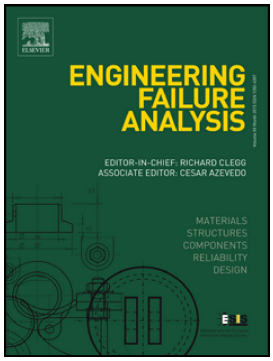

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Failure Analysis of Steel Silos Subject to Wind Load

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Abstract

Steel constructed are made of thin-walled cylindrical shells. They are widely used in various food and agriculture industries for storing granular solids, liquids, and bulk food. The present research study was completed to determine the structural behavior of thin-walled silo when subjected to wind load. The study included determination of deformational behavior of a large field silo and development of a finite element model. This experimental part of the study comprises a challenging full-scale test on 14.55 m diameter and 23.27 m high steel silo located in the open farm land near Bothwell in the province of Ontario, Canada. The finite element model was then developed for undertaking wind analysis to study the effect of different parameters such as different geometric dimensions, stiffener patterns, and wind girders on the wind-induced buckling strength of steel silos made of corrugated steel. Both linear and geometrically nonlinear buckling analyses were carried out to determine the critical wind speed for corrugated steel silos. The study found that the wind girders, also known as wind rings, significantly increase the buckling strength of the silo. This study found that the critical buckling wind speeds of the field silo specimen have increased by about 44%. Further, the optimum location for the addition of wind rings was found to be near the roof of the silo.

Keywords: Test on a field silo, finite element modeling, wind analysis, buckling