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An Experimental and Numerical Study into the Development of FRP Guyed Towers

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Abstract

A research project has been carried out at the University of Manitoba, Canada, to develop fibre-reinforced polymer (FRP) meteorological guyed towers. Both theoretical and experimental results are presented in this paper. The theoretical work involved the development of finite element models to analyze the structural behavior of an 81m tower. The experimental work involved the testing of an 8.6 m long segment, representing the bottom segment of the 81 m guyed tower used in the analysis, under static and dynamic loading. This segment was constructed from three cells bonded together with epoxy resin to form an equilateral triangle shape. Each cell was fabricated using four layers of glass fibre matting for a total thickness of 5 mm with a sequence of $[90^{\circ}/0^{\circ}/0^{\circ}/90^{\circ}]$ impregnated in epoxy resin. An extensive material testing program was also carried out to define the material properties for finite element analysis. The numerical results are compared with the experimental results to confirm the validity of the finite element models.

Keywords: Fibre-reinforced polymers; Composite; Meteorological towers; FEA; Testing

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