AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Structural Engineering

Analysis of Green House Systems Using Fiber Reinforced Polymer Cables

A Thesis submitted in partial fulfilment of the requirements of the Master of Science in Civil Engineering
(Structural Engineering)

by

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Statement

This thesis is submitted as a partial fulfillment of Master of Science in Civil Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Abstract

Ahmad Mohammed Ashraf Mohammed Alaa El-Din Eliwa ElGammal "Analysis of Green House Using Fiber Reinforced Polymer Cables", Master of Science dissertation, Ain Shams University, 2016.

This thesis presents a biconcave cable truss as a roofing system for green houses by using non-traditional cable materials. Not only traditional steel cables were used but also FRP cables namely: high-strength carbon FRP (CFRP), hybrid FRP cables such as basalt mixed with carbon with two different volume proportions 25% and 50% of carbon fiber called B/CFRP 25% and B/CFRP 50%, respectively. Also, another newly developed hybrid FRP cable formed by the hybridization of basalt and steel cables together with two volume proportions 20% and 30% called B/SFRP 20% and B/SFRP 30%, respectively. These hybrid cables have been tested for large scale cable stayed bridges and were deemed appropriate. Up to the author's knowledge using FRP cables in cable trusses as roofing structure has never been studied.

Several parameters have been tested in this study to get a better understanding of the cable truss behavior. The output of each parameter was added to the next as an input. An excel based program was developed that linked excel with SAP2000 FE model this helped reduce the time needed for analysis and thus simplifying creating large number of analysis models and storing the results.

The parameters studied here are the effect of varying: the cable pretension as a function of yield strain, distributed loads (w), span-to-depth ratio with constant cable area, span-to-sag (L/s) ratio with span-to-camber (L/c) ratio, the optimum spacing between hangers and the number of elements between hangers, tieback angle with roller supports used instead of columns and finally tieback angle with vertical columns provided.

The major conclusions drawn from this study are as follows: (1) Cable truss stiffness is directly proportional to the pretension. (2) Cable truss stiffness is inversely proportional to the increase of w and (L/s). (3) Cable truss stiffness is inversely proportional to the