FEATURE

CASE STUDY: STRUCTURAL EFFECTS OF WIND LOADING ON NETTING

A senior capstone project at the University of Hartford College of Engineering leads to a test program for a new safety solution developed by TUTUS LLC.

By Forrest Hester

A capstone project by a team of senior-year mechanical-engineering students, under the direction of Allan Penda, adjunct professor at The University of Hartford College of Engineering, developed a test program specifically for TUTUS LLC as a case study of the new Dropped Object Solutions (DOPS) safety system. DOPS, a tool and debris containment wrap used on aerial lift vehicles, is a one-piece safety product made from small mesh netting and designed for field assembly using loop fasteners and one zipper. The assembled DOPS creates a reusable five-sided enclosure that wraps around a work platform's existing steel framework. As expected, the netting is prone to some degree of wind loading, but how much was an unknown that needed to be solved. The purpose of the University of Hartford (UH) case study was to determine this unknown.

Background

As a trade worker in the gas and oil business of Texas and familiar with mobile aerial lift work platforms, Forrest Hester, founder and president of TUTUS, was aware of the unaddressed need to keep tools and material contained in a small and frequently congested work area. The DOPS began as an invention of necessity, with a fast-paced two-year time line of ideas, development, testing, and prototype deployment.

Sketching and designing from home, and with the feedback from a sail maker, Hester grew his idea into a series of workable prototypes. To bring the idea to production levels, he reached out to a northeast safety net manufacturer, InCord. Together, with a larger collaboration of ideas and assembly methods, the first production DOPS was assembled.

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CASE STUDY

The UH case study began with a simple outline:

- Understand the design requirements and the need for wind load testing.
- Research existing information regarding wind load on netting.
- Develop a test plan to evaluate wind-load induced forces on the sample product.
- Conduct wind-load testing and compare the results to expected results.
- Relate wind-load results as a cumulative to known limitations of a relevant aerial lift vehicle.
- Relate results to Industry Safety Standards.
- Present conclusions and recommendations based on results and analysis.

Research

Three different materials supplied by manufacturer InCord were first analyzed and then electronically modeled and tested using existing case studies regarding porosity and drag coefficient for screens. This analysis, modeling, and testing became the basis for later validating their test method as it related to synthetic netting.

Predications were made from calculated and available research to measure a pressure drop across the netting as it equates to an applied pressure, or wind load, calculated by multiplying the pressure drop by the netting area. Wind tunnel testing at the UH test lab was performed and compared to calculated data. The results were nearly the same, validating the test method within six percent.

Analysis and Summary

The wind load testing up to 90 mph on three different materials produced results that were within the design requirements for DOPS. Each material had distinct characteristics, and each was proven suitable for use as standard and alternative material with the DOPS design. With solid test analysis, safe working limits could be determined for each manufacturer's mobile aerial lift platform that might use a DOPS platform wrap.

To date, more than two-dozen mobile aerial lift platforms from three manufacturers have been studied and matched with a DOPS. Within 2017, the new aerial lift platform safety system will hopefully be deployed to worksites across the nation – saving lives and protecting property.

For more information on the study, visit www.tutusdropprevention.com. •

About the Author

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