
Cordage Institute 2025 Annual Conference Technical Paper Abstracts

The Influence of Different D/d Ratios on the Bending Strength of HMPE Fiber Rope Slings

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In this study, we systematically examine the influence of various D/d ratios on the bending strength of high-modulus polyethylene (HMPE) fiber rope slings, drawing comparisons with industry standards that provide guidelines for such assessments. Our research involves conducting comprehensive direct tension and basket-type tests on single-leg and grommet samples fabricated from 12-strand HMPE ropes with a nominal diameter of 24mm. The results reveal that, while the qualitative outcomes align with industry standards, there are notable discrepancies in the estimated strengths, particularly in complex configurations involving two different D/d ratios.

This presentation will share our findings, providing valuable insights into the bending strength of HMPE fiber rope slings in various configurations. By presenting these results, we aim to establish a robust foundation for comparing and benchmarking our findings against industry standards.

Dynamic Behavior of Aramids: Implications for Rope and Cable Applications

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In this work, the authors present an in-depth analysis of the mechanical hysteresis behavior of para-aramid yarns, critical materials for dynamically loaded constructions in the rope and cable industry. This paper provides insights for engineers and researchers aiming to optimize the performance of rope and cable systems under varying dynamic loads and temperatures.

Twaron® and Technora® yarns, known for their high tensile strength and robustness, were evaluated under a range of temperatures from -75 °C to +150 °C. The study focuses on the intrinsic dynamic behavior of the yarn, highlighting the influence of temperature, load mean level, and load amplitude on key mechanical properties such as storage modulus (E'), loss modulus (E''), and damping factor ($\tan \delta$).

The study includes a detailed explanation of dynamic analysis techniques, like the calculation methods for complex, storage, and loss moduli. The complex modulus represents the combined elastic and viscous response of the material, while the storage and loss moduli denote the reversible and dissipative components, respectively.

Key findings reveal that the storage modulus increases with load mean level monotonically, while the loss modulus slightly varies with the applied load amplitude. Damping behavior, represented by $\tan \delta$, shows a direct correlation with the load mean levels and amplitudes. On the other hand, the

temperature has a modest effect on the damping coefficient. A direct dynamic behavior comparison of aramids with other synthetic fibers is part of this paper as well.

The findings have significant implications for the design and engineering of high-performance ropes and cables, where dynamic loading conditions are critical.

Considerations For Total Mooring System Energy and Testing Opportunities

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Mooring mainlines advertised as reduced recoil risk (RRR) ropes can be tested in accordance with CI-1502, which ensures that the energy released during a parting event can successfully be captured or accurately controlled. Unfortunately, the variety of real world mooring arrangements adds a significant amount of total system energy that can easily overwhelm individual components designed as RRR. While it is true that winch brakes are set as a first line of defense to reduce system loads, poor line inspection techniques, equipment maintenance, and environmental impacts can still lead to dangerous situations if operators are lulled into a false sense of security that a RRR line will keep them safe.

To increase overall mooring safety for all hands working on or near a moored ship, a more detailed approach to account for mooring arrangement energy must be enacted. Samson has an accurate model of mooring arrangement system energy that factors both mainline and tail material and deployment length to optimize energy-capturing capabilities for RRR components. This model was tested using large-scale testing facilities and validated through field trials to ensure a high level of predictive accuracy and robustness of safety features for operators. This model can be applied to any product with a set of measurable parameters for each component. Samson advocates that testing methods be developed to account for full system energy to improve safety within the industry.

Tanker Mooring Line Failure Trends and Analysis

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Whitehill Manufacturing

Synthetic ropes are successfully used as mooring lines on a broad range of oil and gas carrier vessels. High-performance mooring lines are reliable and considered best practice when deployed alone or with mooring tails made of compliant fibers depending on the terminal exposure and weather patterns. However, a number of undamaged mooring line failures have been reported. Several Whitehill mooring lines that were in service for 10+ years on US flagged oil tankers parted while in service between 2019 and 2024. The failed lines and intact lines from the same vessels were returned to the manufacturer for testing and analysis. Similarities among the parted lines and patterns in the residual testing suggest potential causes of the failures. Line management plans and practices should be adjusted so that future incidents can be avoided.