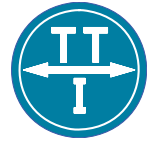
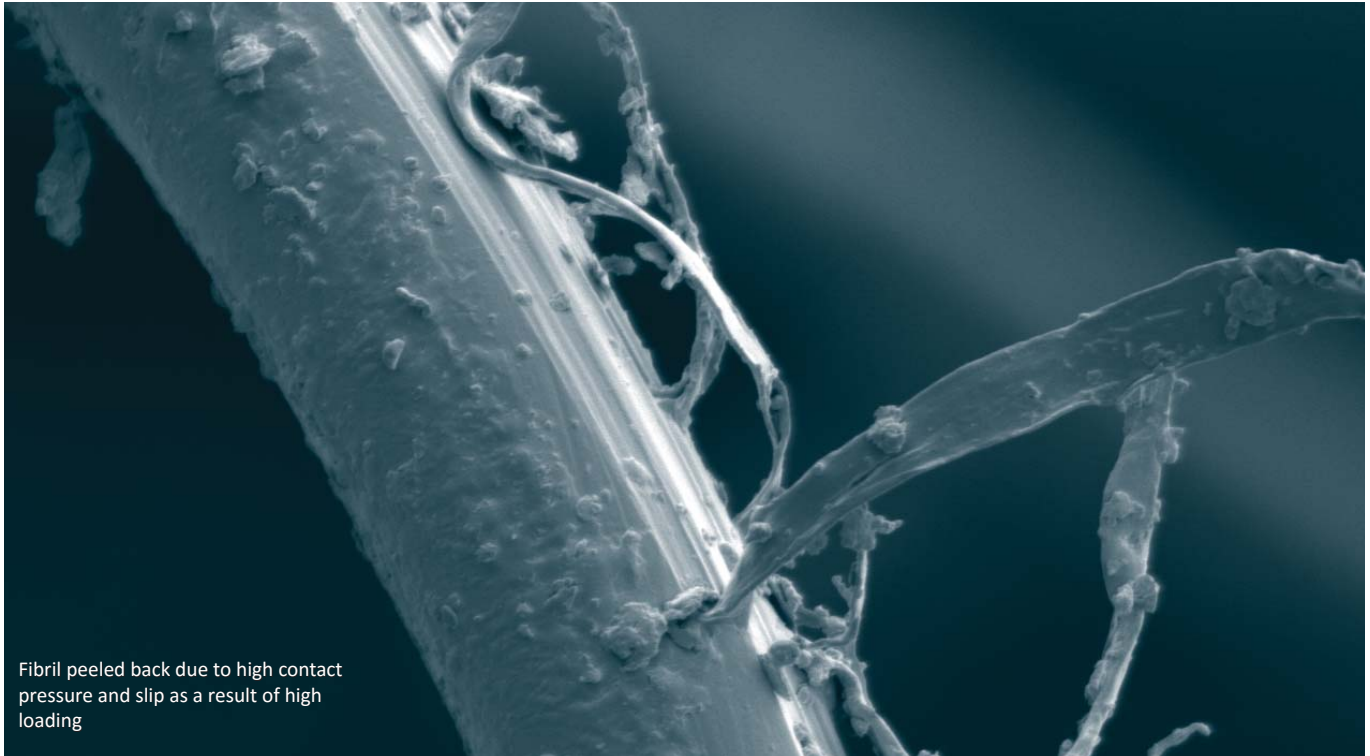


SPM & TANKER MOORING HAWSERS



Service Life Prediction,
Replacement Criteria and Testing Services

Technical Notes 07, April 2016



Fibril peeled back due to high contact pressure and slip as a result of high loading

SERVICE LIFE PREDICTION

Hawser durability is a prime concern to the operator. If the hawser is retired too early there is unnecessary waste, but if the hawser is not replaced on time there could be a catastrophic accident.

TTI has a considerable independent database on factors affecting hawser life including:

- **Surface Wear**
- **Internal Wear**
- **Tension-Tension Fatigue**
- **Flex Fatigue**
- **Axial Compression Fatigue**
- **Creep**
- **Hysteresis Heating**

In particular TTI has state of the art in house programs for the prediction of hawser life, validated against both laboratory and field data. These can be used to give guidance

on material and construction optimisation to maximise durability and performance of the mooring system.

TTI has also conducted pioneering work on the effects of the terminations upon fatigue performance and on the dependency of fatigue upon hawser length.

RETIREMENT CRITERIA

TTI is also experienced in the establishment of retirement criteria, backed by a considerable in house capability and extensive field experience. Hawser retirement criteria can be established in three ways:

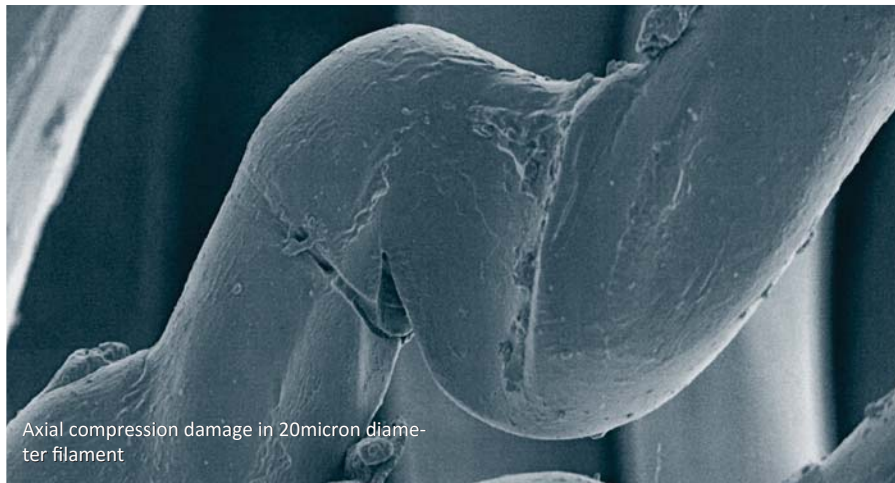
- By inspection and NDT analysis of the the rope structure
- From analysis of the loading spectrum by Miners Rule and exposure history
- By residual strength testing

TTI personnel prepared the fibre rope inspection and replacement guidelines which appear in the U.S. Coast Guard Guidelines for Deepwater Port SPM Design and the Oil Companies International Marine Forum (OCIMF) Mooring Equipment Guidelines. A wide range of SPM and tanker mooring hawsers, including parallel strand, braid-on-braid and 8-strand, have been inspected and examined in detail by TTI personnel in accordance with the OCIMF Guidelines. Effects of creep, axial compression, flex fatigue, hysteresis, internal and external abrasion can be assessed to provide guidance on rope life through use of our in-house Fibre Rope Modeller [FRM] program*.

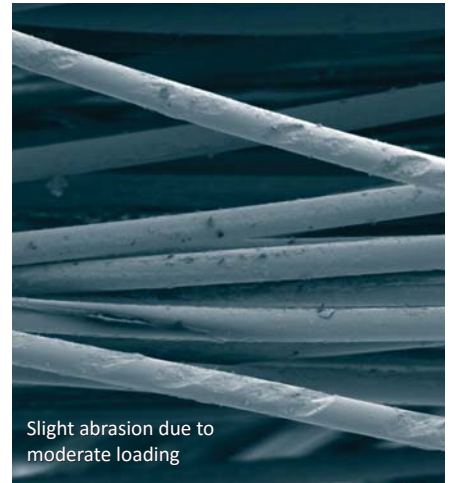
Using an extensive in-house database of rope fatigue life and from provision of hawser loading spectrums by the operator, TTI can conduct a Miner's summation to predict remaining or new hawser life.



SPM hawser broke in service after 8 months



Axial compression damage in 20micron diameter filament



Slight abrasion due to moderate loading

TESTING SERVICES

TTI offers comprehensive hawser residual strength testing and examination services. This includes yarn residual strength testing by realisation method in accordance

with ISO Standards. Scanning Electron Microscope [SEM] and optical microscopy analysis to look at yarn wear, fatigue and failure characteristics as shown above and Fourier Transform Infrared Spectroscopy (FTIR) analysis to confirm material type.

Alternatively, all types of rope, whatever condition, can be spliced by TTI and hawser residual strength determined by break testing.

* For details of FRM please see TTI Technical Note TN05

For further information and a demonstration, contact:

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