



FAILURE ANALYSIS & PREVENTION

homework 2

engr 3820

ASTM STANDARDS READINGS

The American Society for Testing and Materials (ASTM) publishes quite a bit of information on failure analysis methodologies. Please take a **quick** look at the following ASTM standard, which is available in full-text through the link on the Resources page of the course web site.

- ASTM E 2332-04 Standard Practice for Investigation and Analysis of Physical Component Failures

The ASTM standards provide a brief introduction to physical component failure analysis.

- Is this useful for your planning of failure analysis investigations, or would you have arrived at the same procedures on your own?
- You may notice that many other ASTM standards are referenced within this document. Which of these other standards may be useful in your failure analysis investigations?

CASE STUDY READINGS

Here are a couple case studies for your reading pleasure. Last week we looked at some automobile-related failures. This week we have airplanes (well, maybe "aircraft" is more accurate). Does that mean that we'll read about trains next week? We'll see. A link to the *Engineering Failure Analysis* full-text journal is available on the course web site.

- J. McEvily, "Reverse engineering gone wrong: A case study," *Engineering Failure Analysis*, Volume 12, Issue 5, October 2005, Pages 834-838. This article presents an attempt at reverse engineering a load-bearing component.

As you read this case study, consider these questions:

- How common is this type of reverse engineering mistake?

- How could the reverse engineering process be better implemented, i.e., what evidence could have been collected, or what analyses should have been conducted to complete the reverse engineering process? Make some specific recommendations.
 - What costs would your suggested changes in (b) add to the reverse engineering process?
 - Are there any ethical implications with this type of engineering practice? Think about it, and we'll discuss it in class.
- N. J. Lourenço, C. F. A. Von Dollinger, M. L. A. Graça and P. P. de Campos, "Failure analysis of the main rotor grip of a civil helicopter," *Engineering Failure Analysis* **12** (2005) 43-47. This is a pretty interesting and pleasantly short article.

As you read this case study, consider these questions:

- What type of **physical** and **contextual** evidence did the authors collect, analyze, and report?
- How do the authors use the evidence?
- Are there missing pieces, i.e., evidence, laboratory analyses, or arguments that should have been used but were not? If so, what recommendations would you make to fill in these holes?
- Let's say you don't know much about fatigue, but you'd like to learn. Where would you go to find more information on fatigue loading, fatigue failure, and fatigue fracture surface characteristics?
- What do the fracture surface features tell us about the particular type of loading on the rotor grip? How would these features change with different types of loading?
- What could be done to prevent this particular failure from occurring in the future?