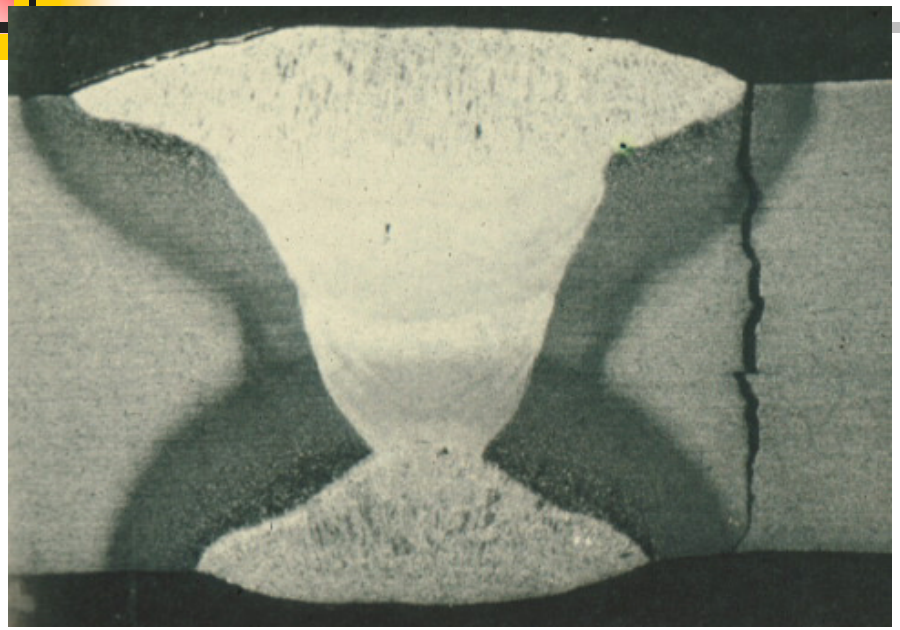
Overview of Weldment Fatigue Life Prediction

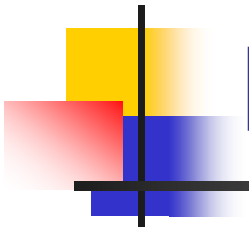


F. V. Lawrence

University of Illinois

At Urbana

The fatigue-prone machine



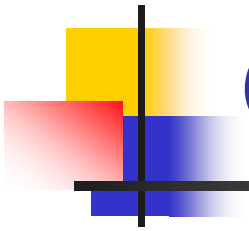
Lecturer

Professor Frederick Lawrence

Civil and Environmental Engineering

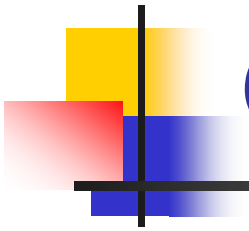
University of Illinois at Urbana

flawrenc@uiuc.edu



Outline

- I Introduction
- II Fatigue Fundamentals
- III Fatigue Models
- IV Modeling Weldment Fatigue Behavior
- V Predicted Weldment Fatigue Behavior
- VI Classifications of Weldments
- VII Improving the Fatigue Life of Weldments



Overall objective

- To understand the factors which control the fatigue life of weldments.

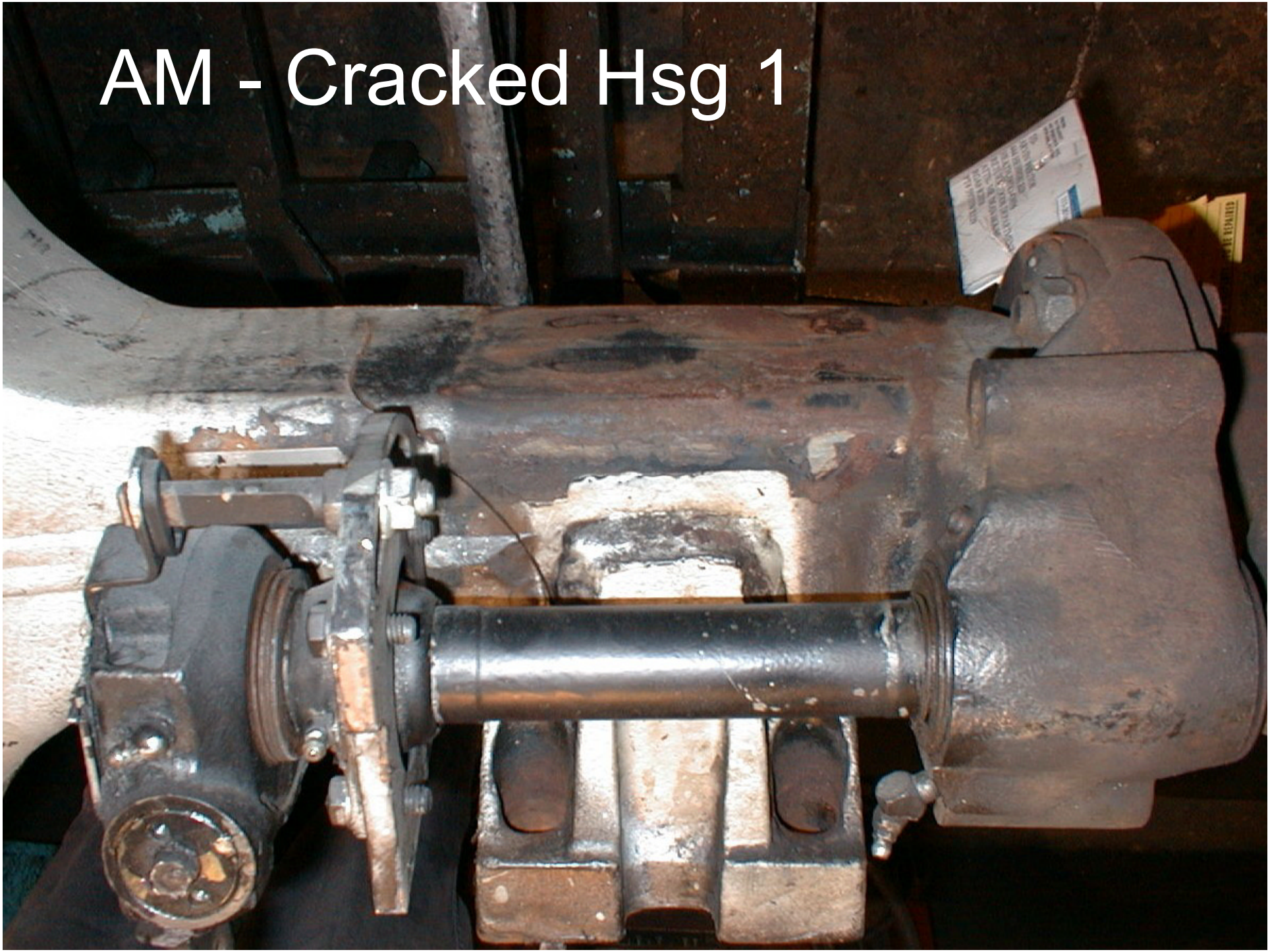
Underlying ideas…

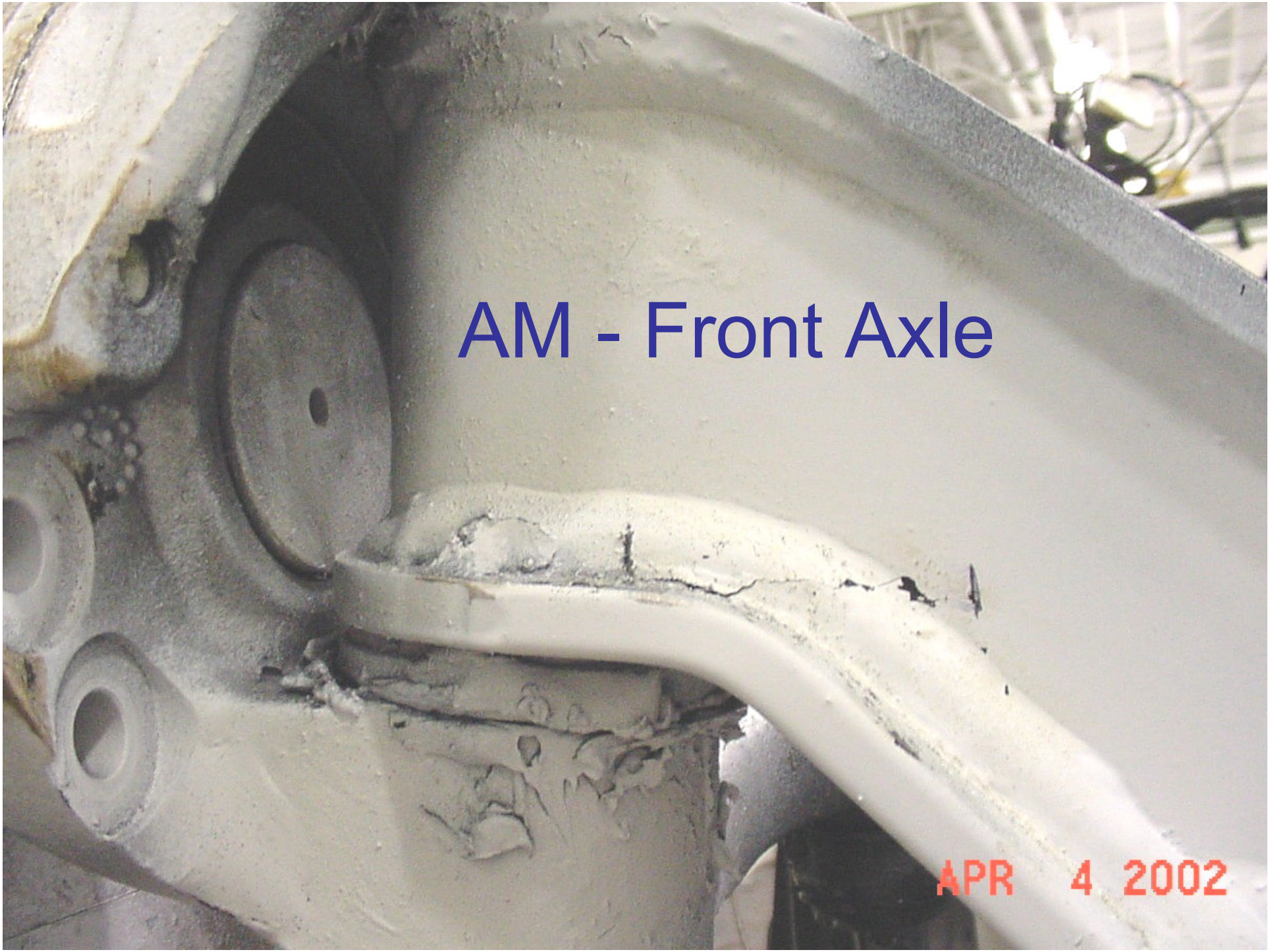
- No two weldments are **alike**!
- The fatigue of weldments is a complex, **non-linear** problem.
- Weldment fatigue life is strongly dependent upon **initial conditions**.
- Models help us understand what may happen and how to **control** it!
- Fatigue is caused by the fluctuation of **local** stresses and strains.
- There is nothing more practical than a good **theory**!

I Introduction

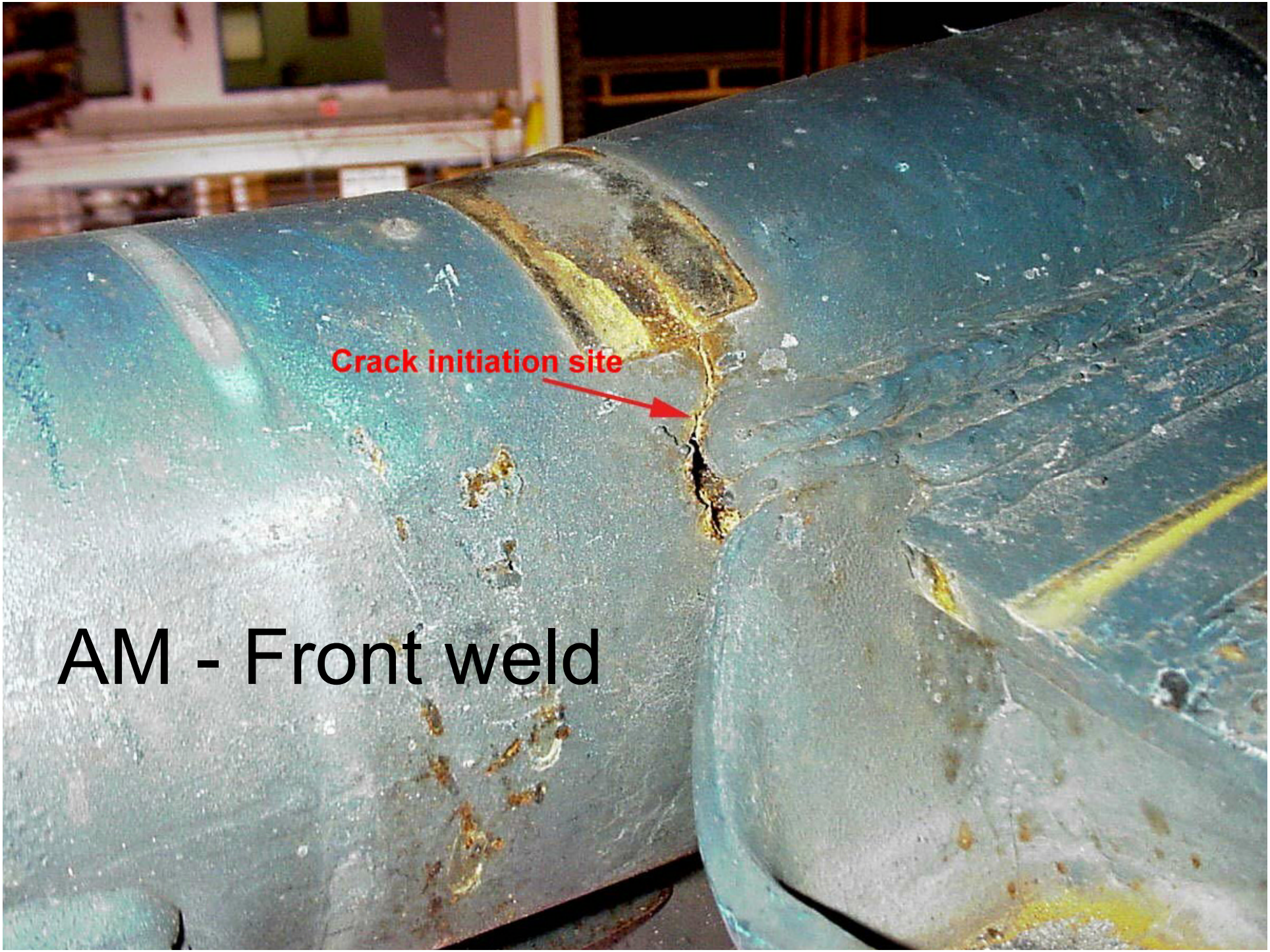
Fatigue of Weldments

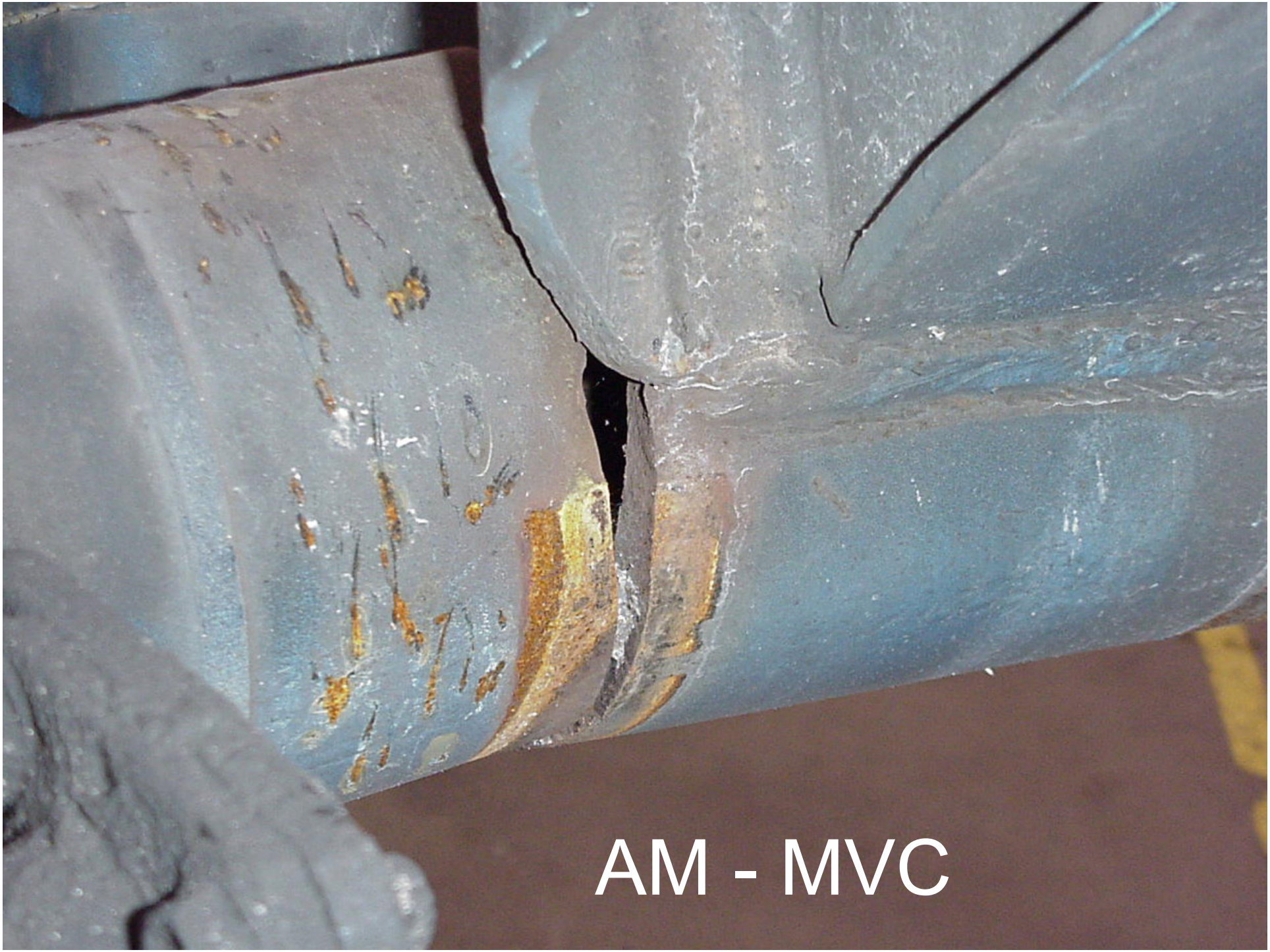
AM - Cracked Hsg 1

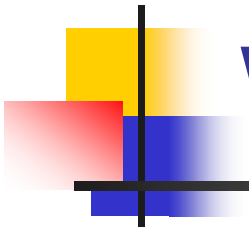



AM - Front Axle
APR 4 2002

AM - Rear weld overall


Crack initiation site
AM - Front weld


AM - MVC



What to do?

- Reduce the local stresses and strains.
  - Redesign component
  - Reduce stress concentrations.
    - Avoid lousy weld geometries.
    - Make the weld toes nice.
    - Control weld distortions.
- Avoid tensile residual stresses.
  - Avoid high strength materials.
- Calculate, don’t guess.
- Use fatigue life improvement techniques.