This course explores the engineering issues associated with common types of derailments, including track, equipment and operator derailments. The specific failure mechanisms associated with key classes of derailments will be examined with the technologies available for reducing these types of derailments.

This course is intended for civil and mechanical engineering majors, working engineers and railroad engineering professionals who have a degree in civil, mechanical or industrial engineering (or equivalent). Students are expected to have knowledge of strength of materials, basic structural analysis and math through linear algebra with a basic understanding of differential equations.

**Topics Covered**

- Intro to railroad and railroad systems
- Overview of railroad safety
- Rail-related derailments - 1
  - Rail fatigue (Hatfield), defect failure rates, risk and UT
- Rail-related derailments - 2
  - Wear, bolted rail derailments, welded failures (MoPac Amtrak)
- CWR-related derailments
  - Track buckles, buckling theory, installation temp
  - CSX Amtrak buckle, Phoenix Light rail
- Track Geometry related derailments-1
  - Track standards, inspection, and safety
  - Dynamic wheel rail forces
  - Combined causes and vehicle/track interaction related derailments
- Track Geometry related derailments-2
  - Dynamic wheel/rail forces continued
  - Wheel climb and derailments; L/V Nadal and related safety limits
  - High c.g. loads (ATS&F)

- Non-uniform - uneven loading
- Turnout-related Derailments - DH
- Other track-related derailment, causes, mechanisms and prevention
  - Ties and fasteners, GRMS; other
- Wheel-related derailments
  - Overheated wheel and thermal cracks (LIRR)
  - Fracture of wheel; US, ICE-DB
  - Wheel inspection
- Other mechanical caused derailments; causes, mechanisms and prevention
  - Axles and bearings (hot box and acoustic bearing detection)
  - Trucks and truck components
  - Brakes; other
- Operating-related accidents & derailments
  - Human factors (Amtrak NEC)
  - Train makeup and operations
- Signal and other accidents
- Grade crossing accidents and personal protection

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**About the Instructor**

Dr. Allan M. Zarembski is an internationally recognized authority in the fields of track and vehicle/track system analysis, railway component failure analysis, track strength, and maintenance planning. Research Professor and Director of UD’s Railroad Engineering and Safety Program, Zarembski served as vice president and general manager of Zeta-Tech, a railway technical consulting and applied technology company that is an independent business unit of Harsco Rail. He previously held positions with Pandrol Inc., Speno Rail Services Company and the Association of American Railroads. He received the ASME’s Rail Transportation Award in 1992 and the U.S. Federal Railroad Administration’s Special Act Award in 2001.