# 53:134 Structural Design II (Steel Structures)

## Spring 2006 (Lecture Summary)

## Week 11 (3/27 – 3/31/06)

### 3/27/06

- Design of tension members: Review of specifications.
  - Tension limit states – yielding of the section.
  - Fracture of the net section.
  - Slenderness ratio.
  - Effective area for fracture limit state – shear lag factor, reduction factor.
  - Block Shear, Section J4 of the Specs.
- AISC web-enhanced teaching animations; basics, tributary area, block shear, lateral loads.
- Design for tension – Examples. Calculations for U. Use of Tables: Part 1 - Section properties, Part 3 – design strength for yielding limit state and fracture limit state.
- **Read**:. Chapters B and D of the AISC LRFD Specifications and Part 3 of the Manual, Design of Tension Members.

### 3/29/06

- Design of tension members – material from the textbook, Chapter 9, Section 9.1.1. Member failure modes:
  - Yielding failure of the gross cross-section.

- Fracture rupture of the net section.
- Shear rupture.
- Tension rupture.
- Shear-tension rupture.

♦ AISC animations:
- Block shear rupture failure modes. Block shear capacity is the combined shear and tensile capacity of the failure mode (smallest capacity governs).
- Block shear areas: Failure can happen in either yielding or fracture in all the modes. We calculate the yield capacity on the gross area and fracture capacity on the net area.

♦ Design of compression members – buckling failure is predominant and must be considered.

♦ AISC animations:
- Slenderness ratio: KL/r; effective length (braced, unbraced length).
- Global buckling of members; Buckling happens when a member in compression becomes unstable due to its slenderness and load; elastic buckling (larger slenderness ratio, inelastic buckling smaller slenderness ratio).
- Local buckling: instability is due to the plates of a member becoming unstable.

♦ **Midterm Exam 2** – Design of an Indeterminate Truss; Due April 5, 2006.

## 3/31/06

- Design of compression members – buckling failure is predominant and must be considered.
- Design for compression: Global buckling of members; Euler buckling theory, buckling critical stress, slenderness ratio.
- Slenderness ratio: KL/r; effective length (braced, unbraced length). Buckling happens when a member in compression becomes unstable due to its slenderness and load; elastic buckling (larger slenderness ratio, inelastic buckling smaller slenderness ratio).
- Local buckling: instability is due to the plates of a member becoming unstable; cross-sectional element slenderness is defined as b/t ratio; compact sections have small b/t and do not buckle locally; noncompact section can buckle locally; slender sections have a large b/t that require use LRFD Specifications Appendix E3. Limits for compact and noncompact sections, refer to Table B5.1.
- **Read**:
  - LRFD Specifications: Chapters B, E, Appendix B.
  - LRFD Manual: Part 4 Design of Compression Members.
- **Midterm Exam 2** – Due date extended to April 7, 2006.