LESSON 3: STRENGTH OF MATERIALS REVIEW II – V&M DIAGRAMS AND BEAM SHEAR STRESSES

Fall 2016

If I owned both Hell and Texas, I’d live in Hell and rent out Texas” – William T. Sherman.

LESSON OBJECTIVES

1. Construct shear and moment diagrams for beams, using the Strength of Materials sign convention (e.g., plotting M on the compression side).
2. Construct moment diagrams for frames (plotting the diagram on the compression side of the members), computing and labeling min and max points.
3. Compute normal or shear stresses at any position within statically determinate beams or frames.

REVIEW MATERIAL: If you are weak in V & M Diagrams or in the computation of normal and shear stresses in beams, refer to those chapters in your Strength of Materials book.

IN-CLASS PROBLEMS:

1. Plot V & M, then determine the maximum \( \sigma \) and the \( \tau \) in the glue.

   ![Diagram showing shear and moment diagrams for beams]

   Key V & M Rules
   1. Area under w diagram between A and B equals the change in V from A to B.
   2. Area under V diagram between A and B equals the change in M from A to B.
   3. Slope magnitude of M at any point equals the V at that point.
   4. Slope magnitude of V at any point equals the w at that point.
   5. Concentrated force => “jump” on V
   6. Concentrated moment => “jump” on M
   7. Uniform loads => Linear V and Parabolic M
   8. Concentrated Loads => Jumps in V and Linear M.
   9. If an interval has no loads or concentrated moments, then M must be linear in this interval.
   10. If an interval has uniform loads but no concentrated moments, then M must be parabolic in this interval.

2. Plot M, then determine the maximum \( \sigma \). All shapes are W16x26.

   ![Diagram showing moment diagrams for frames]

   ![Diagram showing shear and moment diagrams for beams]
Homework (due Monday): Plot all moment diagrams “on the compression side” (the standard convention)

1. Plot V & M (specify all local Min and Max values), then determine the maximum $\sigma$ and the maximum $\tau$ in the beam.

2. Plot V & M (specify all local Min and Max values), then determine the maximum $\sigma$. Given: all members are W16x26, bent about the weak axis.

2’. For the previous, determine the maximum $\sigma$ if the W16x26 members are bent about their strong axis.

3. Plot M, then determine the maximum $\sigma$. All shapes are W16x26. Given: This structure is statically indeterminate; therefore, the horizontal base reactions of 5 kips each are given to you.

4. Plot V & M (specify all local Min and Max values). Given: concentrated moment $M=10$kip-ft applied at midspan of 10’ beam.