Lab #10: *Civil Engineering* (Chapter 6)

Mortise and Tenon Joint vs. Butt Joint

INTRODUCTION:

The objective of this lab is to illustrate to the student the effectiveness of the mortise and tenon joint in comparison to a basic butt joint in resisting a twisting motion, applying the concept to the potential design of the Ark.

MATERIALS

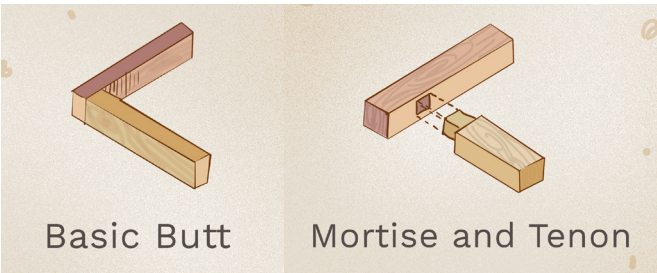
- Sharp knife or box cutter
- (2) dense styrofoam blocks, 1.5 inches thick, 8x8 inches (e.g., from Lowe's)
- Glue
- Images of a basic butt joint and a mortise and tenon joint

METHODS

1	2	3
4	5	6

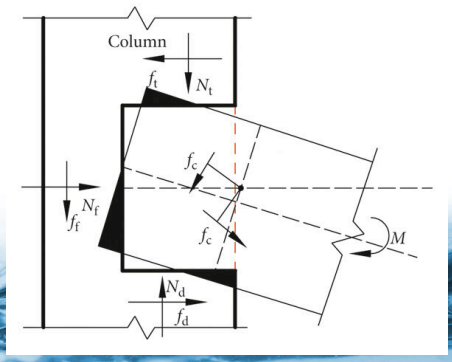
1. Use the knife to cut both styrofoam blocks to the pattern on the right
2. Using one of the styrofoam blocks, make 2 basic butt joints:
   - Glue piece #2 to the center of piece #1.
   - Glue piece #5 to the center of piece #4.

   [Piece #3 and #6 are to be used as back-up.]
3. After the glue dries, twist piece #2 and piece #5, assessing how easily the blocks twist.
4. Using the other styrofoam block, make 2 mortise and tenon joints:
   - Use a knife/box cutter to cut a **tenon** on piece #2 and piece #5. [**Be sure** to keep the **tenon** as **wide** as possible.]
   - Use a knife/box cutter to cut in the center of piece #1 and piece #4 **mortises** that match the **tenon** from above. [**Make sure** that the **mortise** is small enough to allow a **tight fit** for the **tenon**.]
   - Add glue to the mortise holes and lips and insert the tenons.
5. After the glue dries, twist piece #2 and piece #5, assessing how easily the blocks twist relative to the basic butt joints



[From www.thesprucecrafts.com]

Example Mortise and Tenon Forces



[Hua Ma, et al., "Seismic Performance of Damaged...."]

RESULTS/DISCUSSION

1. Was one of the joint types more resistant to twisting? If so, which one? _____
_____

2. Flood critics argue that a wooden vessel as large as the Ark, with extremely long planks, would not be seaworthy because such long planks would be susceptible to twisting, causing leakage.

   - What, exactly, is keeping the long blocks from twisting on each of the joint types? [Hint: on the butt joint, for example, there are two primary things keeping the plank from twisting.] _____
   _____
   _____

   - Why, do you suppose, a mortise/tenon joint would be more resistant to twisting than a butt joint? _____
   _____
   _____

   - If the tenon was a cylindrical shape instead of a rectangular shape (with the diameter of the cylinder equal to the length of one of the rectangle's sides), would it be expected to be more resistant to twisting? Explain. _____
   _____

   - Would a cylindrical tenon be more resistant to twisting than a butt joint? Explain. _____
   _____
   _____

3. Is it reasonable to suggest that pre-Flood humans could have known about and made mortise and tenon joints? _____ Why? _____

   - If so, **how** could they have come to know about them? _____
   _____

   - How exactly could they have **made** them (e.g., with what; Genesis 4)? _____
   _____