

**January 12,
2016 Lab 7b
Bridges
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Introduction:

Each part of the lab must be in an APA format (template available on Canvas). All lab report content must be written in your own words, no copy and paste or retyping of others work. Save your lab report as a Microsoft Word document with file name: LASTNAME_TECH10500_LAB#. You will then submit the lab report in the Modules section in Canvas. All submissions must be through the Canvas drop box. No submissions via email or messages will be accepted. The due date will be posted in Canvas (typically at the beginning of the next week's lecture). Late labs will not be accepted for any reason.

In this laboratory you will work together in a group to meet a design objective. Your ability to meet the objective will be assessed. As part of your experience, you will need to spend time brainstorming possible solutions to your problem.

Using the digital designs for the previous week's lab as inspiration, you will work in groups to build a similar bridge that will transport the K'nex tractor from desk1 to desk2.

Objectives for this lab include:

Explore fundamental design ideas, including stability and the use of a truss.

Complete a simple design using K'nex parts to meet a specific objective.

Explore and identify good testing practices.

Assess team performance and group work

Procedure and Course Work:

In this experience, you will be asked to design a structure made from KEX. To explore the concept of *stability*, think about a square made from KEX rods and corner connectors.



Stability is the ability to resist deformation or collapse, especially when under load. Characterize the stability of this structure:

One method to increase the strength of your structure would be to include rods and connectors that are not prepared from plastic (and have more stability, such as metal). Or, perhaps you could increase the thickness of the rods and connectors. Both approaches increase the materials needed to construct a structure.

A different approach would be to add something else to the structure to stabilize it. Use a longer rod to add a diagonal to the square.



Characterize the stability of the structure with this additional piece:

The use of the triangle shape is a very common approach to help create stability without changing materials. The diagonal is an excellent example of a *truss*.

We often think of trusses in bridges because we can see them – the trusses are visible. But this construction technique is commonly part of many designs.

Design Goals: Your group will create a structure of some shape and arrangement that will support weight placed upon the structure as the tractor drives across it.

Design constraints:

- The bridge cannot be held in place by members of the groups.
- The bridge must have sides high enough to prevent the cart from driving off the side.
- You are limited to the K'nex parts supplied in one zip-top plastic bag (no additional materials of any kind are permitted).
- The weights must remain in the trailer until the trailer clears the bridge. You should be sure your structure is designed to allow the platform to have weights placed upon it as the weights will be used in the testing of your structure.
- The bridge platform must also be constructed in a way that the wheels cannot become trapped between K'nex parts and stall the tractor.
- Each person must contribute to the design and construction. One person cannot conceive and build the structure.
- Once the tractor has started towards the bridge, group members are not allowed to move the bridge or touch the tractor at any point until the test is complete.

You will test the carrying capacity of your structure by allowing the tractor to drive across the bridge unguided. You will be allowed two attempts to successfully demonstrate your design. The lab instructor must approve the design before any testing/demonstration at the bridge site occurs.

Process: Follow the design process:

BEGIN HERE on your own!

1. Define the problem in one or two sentences:
2. Identify and categorize construction parts. Think about the possible pieces you will have in your K'nex kits. In other words, do not design beyond the available components. There are no 12" long K'nex rods.
3. *Brainstorm* some connections (elements) that will support weight and be part of your design (follow the guidelines offered at the beginning of this experience).

Document these connections, think about the various connections that are possible and evaluate their stability and strength.

STOP HERE – do you have a good plan? If so, show it to the instructor and then you will be put you're into groups.

NOW: discuss you design options based on what each individual has come up with.

Build your structure and continue the integration of brainstorming techniques. As you make connections, evaluate each to determine if you might find a different configuration or arrangement that would improve stability and strength. Look at each of the original concept designs and see if any revision needs to be implemented.

4. Begin the design process. Using the tools discussed in class, design the structure. Make sketches, charts and notes as needed.

5. Begin Construction

6. When you are ready the instructor will test the design. You can test a maximum of two times.

7. How close is your prediction to the actual test results?

8. What was the maximum weight/distance that your bridge supported?
_____. Include the number of weights and the distance the tractor traveled (in inches) for both tests.

9. Once you have witnessed the testing of the structures of your entire class, describe the lessons you learned and how you would have improved your structure.

10. Critically evaluate your teamwork using an Excel table. Put this in the appendices section of the lab report.

Each member of the team will create their own individual lab reports. While some information will be commonly used among team members, all writing must be your own.

For the lab report, include a detailed design process for both lab parts (7a the digital and 7b the physical group build).