



First Lego League Curriculum - Ontario

Activity Sheet	
Gr 7 - Lesson #3	Medium Motor – Bridge Crossing
Date:	Name(s):

Check That I'm Done <input checked="" type="checkbox"/>		
<input type="checkbox"/> Commented on my code	<input type="checkbox"/> Modify it task	<input type="checkbox"/> Coding Challenge

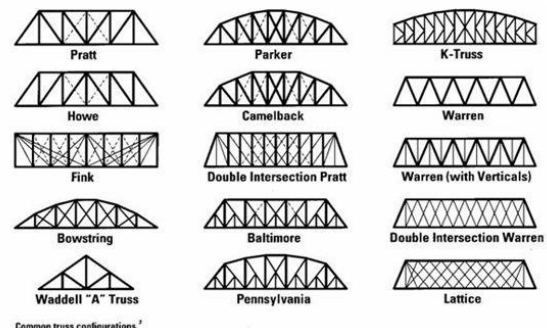
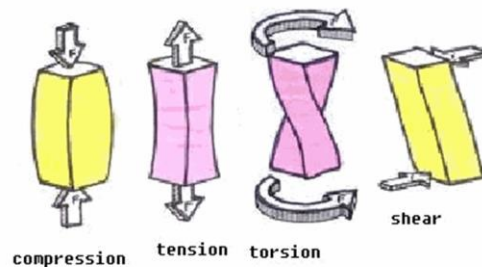
Learn	
<p>In the army exist a mobile bridge laying vehicle. It is capable of carrying a light weight bridge that can support both tanks, armored vehicles, and itself.</p> <p>The designers of this vehicle had to make some very hard decisions to make sure this worked properly. Many of their decisions centered on their understanding of internal and external forces, form, and function.</p> <p>The form of any object is its physical appearance. Appearance is usually an important design feature. Not so much in a radio tower, but definitely in clothing for example so that it looks good, or army vehicles which are camouflaged. You can't ignore function when thinking about form though also.</p>	 

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The **function** of any object is what it is capable of doing. This is determined by its features, materials, geometry and many other factors. The function of a bridge is to support all of the loads it needs to carry and allow vehicles to traverse from one place to another.

In order to create a good design with the desired form and function, you must take careful consideration of the internal forces within the structure itself. The internal forces are put into 5 categories: **tension, compression, torsion, and shear.**

To manage these forces affectively engineers have learned some useful tricks. Examples include struts, braces, supports, and stiff materials or flexible materials.



Note that all of these diagrams depict through trusses. Many of these configurations are also used in deck trusses and pony trusses as well.

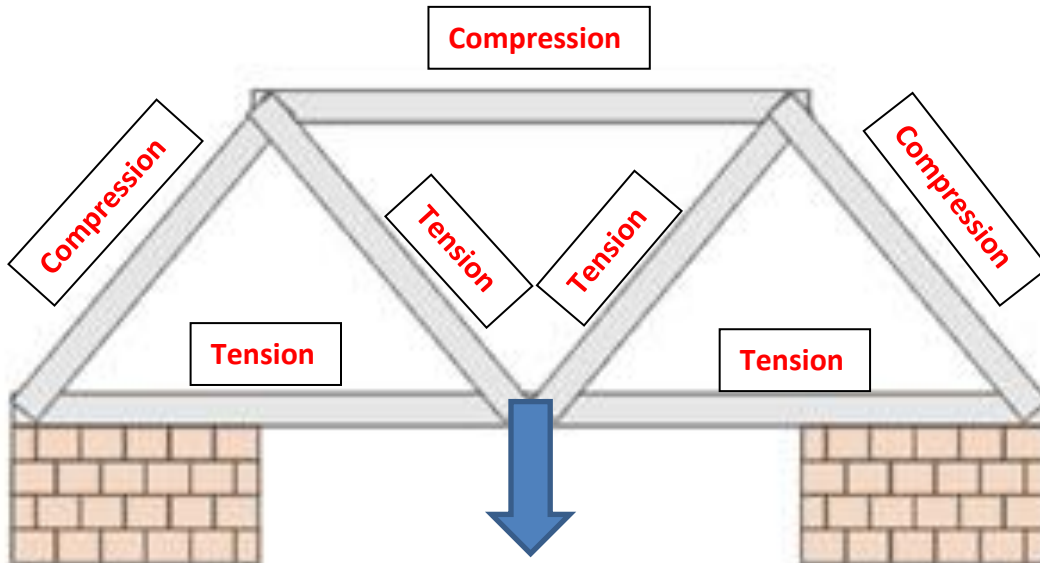
Predict and Plan

What are some of the key features of a portable bridge?

What are some of the biggest challenges in creating such a bridge?

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On the bridge below, clearly indicate whether each beam is in tension or compression. It can be helpful to picture pulling where the blue arrow is and imagine the beams being either strings or popsicle sticks, and asking yourself, would it collapse.



Demonstrate/Design/Discover

This challenge consists of three parts. 1) Designing a lifter, 2) Designing a bridge, and finally 3) Programming your sequence that uses that bridge

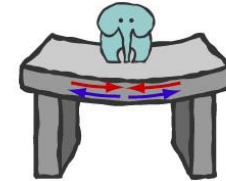
- ✓ Change your front lifter arm so it has two prongs shooting straight out. This can be done with Lego or everyday materials like popsicle sticks and masking tape.
- ✓ Using what you know about forces, structures, braces, and materials, design a light weight bridge that can be carried and laid down by your robot. Your bridge must i) Support the full weight of your robot and carry it without it falling off ii) be able to be carried and laid down by

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your robot arm iii) Span a minimum distance of 25cm.

- ✓ Create a program that approaches the gap, lays down your bridge, aligns the robot, and the traverses the gap.

Tips:



#1 The top of a bridge tends to be in compression. As the bending forces the material towards itself. At the bottom however, the material spreads apart and is in tension. Select your shape and materials to handle this effect.

#2 Deploying your bridge may take some trial and error. Remember that controlling your motors with seconds will allow a motor to move on after hitting something, where rotations will keep struggling until the motor has completed its turns.

Record

What are the final **dimensions** of your bridge? Length _____ cm

Width _____ cm Height _____ cm.

(If possible) How much does your bridge weigh? _____ Kg



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Sketch your bridge in the 'down' position below. Use a red coloured pen/pencil to signify where the bridge is in compression, and a blue line to signify where you believe the bridge is in tension.