

**Bridge Construction Projects****STEAM: Engineering**

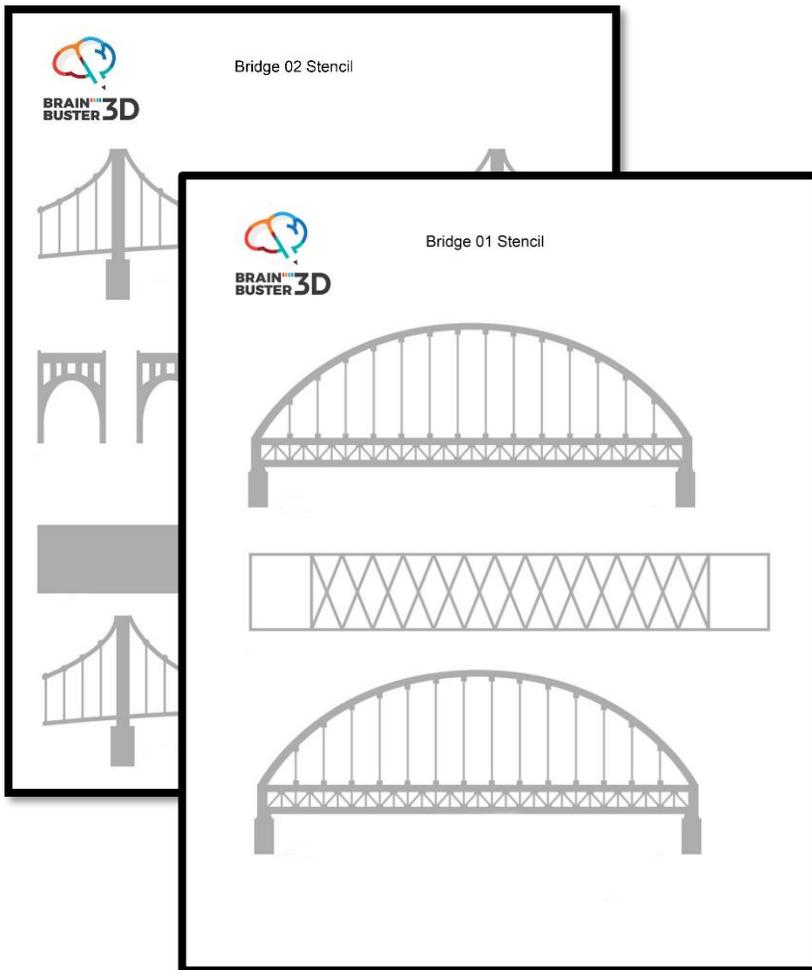
The engineering design process is a series of steps engineers use as they work to solve problems. There are five main engineering steps: **ASK IMAGINE PLAN CREATE IMPROVE**

**Constructing Bridge Models will help you learn Engineering Skills. How?**

- You will be using the stencil which is your **PLAN** to create each section of the bridge.
- You will need to arrange the parts of the bridge as you would a puzzle, and determine which parts need to be welded together to **CREATE** the 3D form of the bridge.
- When you finish the model, think about ways you could **IMPROVE** the process or design.
- **ASK** and **IMAGINE** how you could **PLAN** and **CREATE** your own design for a 3D bridge model.

**Materials Needed:** Bridge Stencil 01 & 02, 3D Pen, 2-3 colors of PLA filament, scissors, silicon thumb & finger protectors, a paper towel or napkin.

Optional: To keep your stencil intact, place it in a plastic sheet protector.



## BRAIN BUSTER 3D Art Pro Plus Kit Contents



AC/DC Adapter & USB



Thumb & Finger Protectors



3 Pack of PLA Filament



Plastic Tool



**Art Pro Plus**  
3D Printing Pen

## STEP ONE:



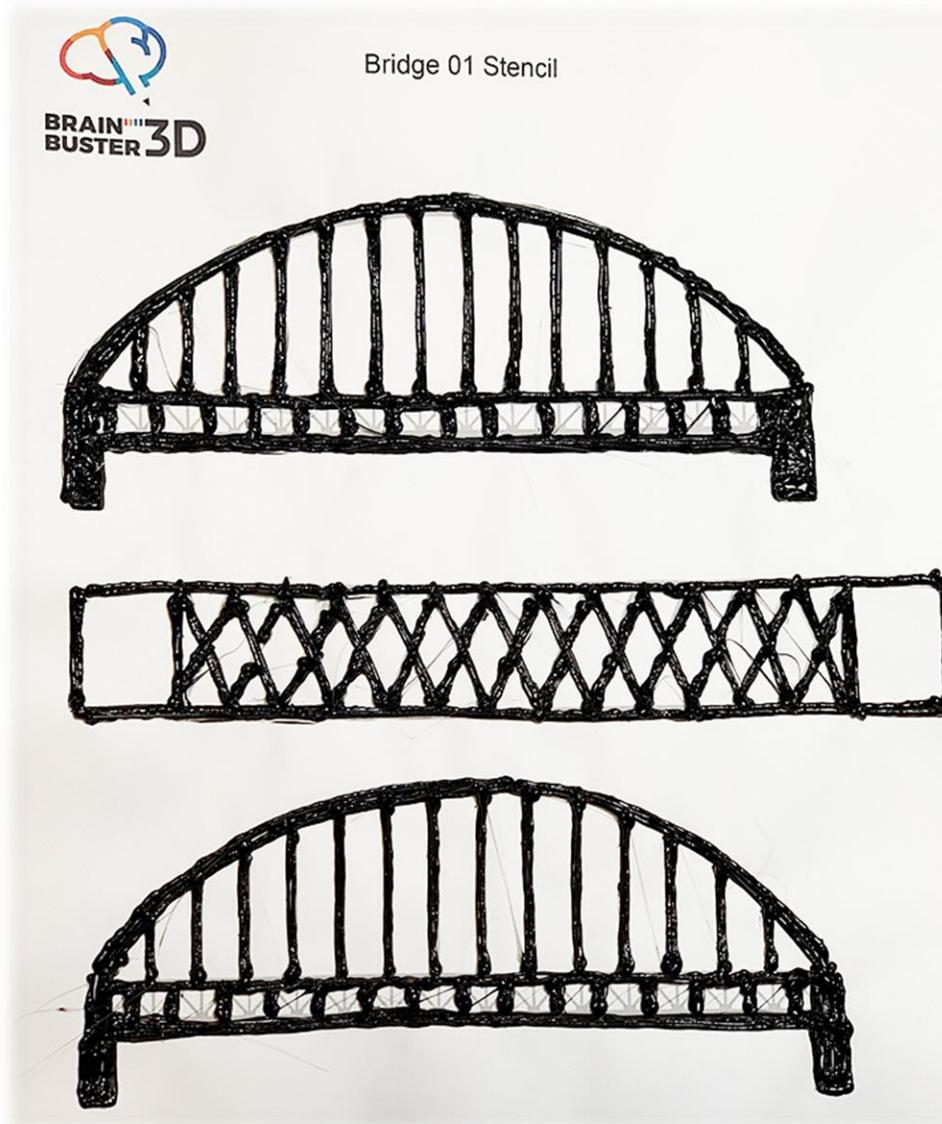
Find a starting point on the stencil to anchor your filament.

Move your 3D pen along the lines to outline each part.

Once all the parts are outlined, fill in each part by moving your 3D pen back and forth between the outline you made.

You can select any color of filament to create your bridge model. If you do not like the PLA filament colors' that you have, you can paint the parts with acrylic paint before you remove them from the stencil or paint your finished bridge model.

## STEP TWO:

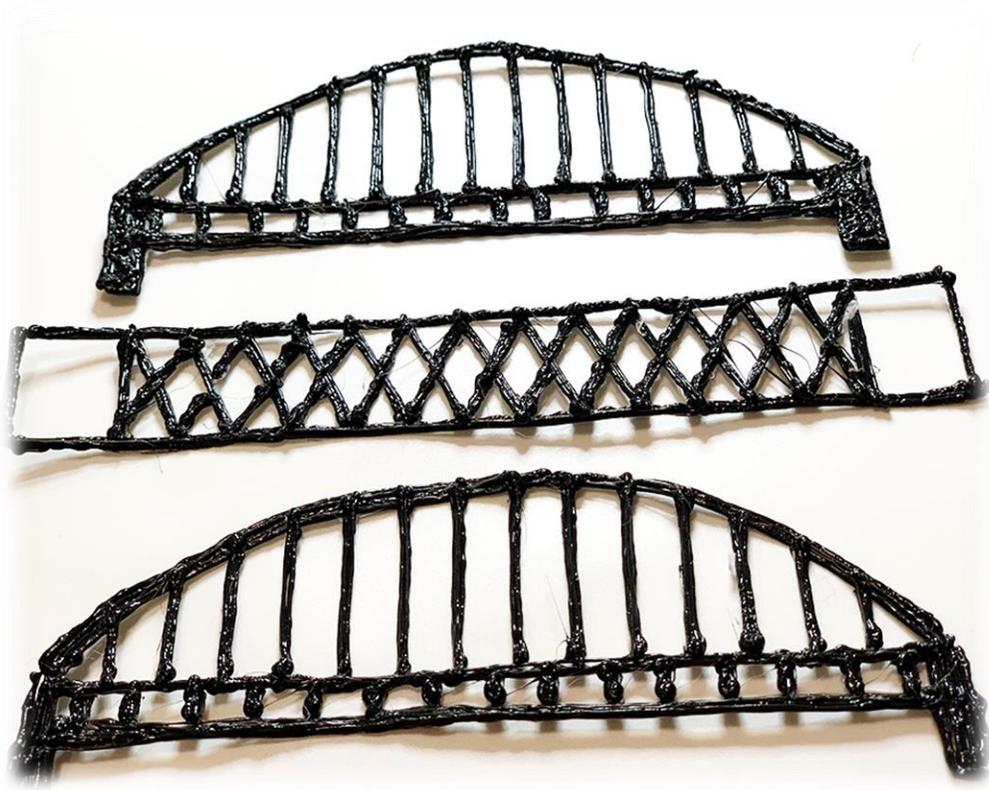


If you use a plastic sheet protector, the parts should peel off the stencil easily.

If you made the parts by extruding the filament directly on the paper stencil, some of the paper will stick to the back of the parts you made.

To remove the paper, rinse the plastic parts with warm water and dry them with a paper towel.

### STEP THREE:



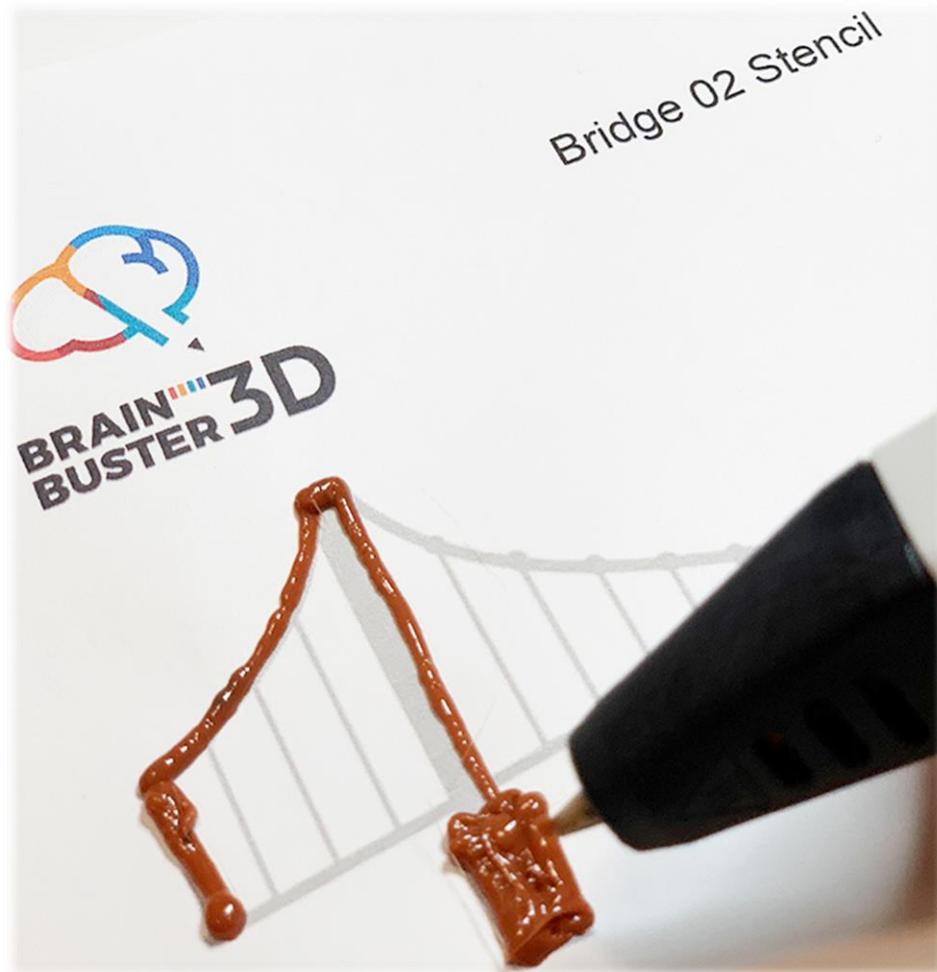
Arrange the parts as you would a puzzle to see which ones will need to be welded together to form your 3D bridge model.

### STEP FOUR:



Weld two parts edge to edge, welding them together from the inside at 90 degree angles as pictured above.

## STEP FIVE:



Find a starting point on the stencil to anchor your filament.

Move your 3D pen along the lines to outline each part.

Once all the parts are outlined, fill in each part by moving your 3D pen back and forth between the outline you made.

## STEP SIX:



If you use a plastic sheet protector, the parts should peel off the stencil easily.

If you made the parts by extruding the filament directly on the paper stencil, some of the paper will stick to the back of the parts you made.

To remove the paper, rinse the plastic parts with warm water and dry them with a paper towel.

## STEP SEVEN:



Arrange the parts as you would a puzzle to see which ones will need to be welded together to form your 3D bridge model.

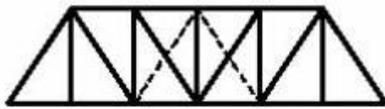
## STEP EIGHT:



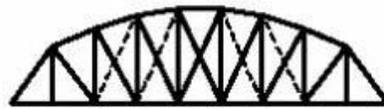
Weld two parts edge to edge, welding them together from the inside at 90 degree angles as pictured above.

Think about ways you could IMPROVE the process or design.

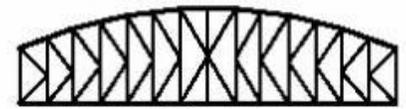
IMAGINE how you would PLAN and CREATE your own design for a 3D bridge model. Below are bridge truss designs you could consider when making plans for your next bridge construction project.



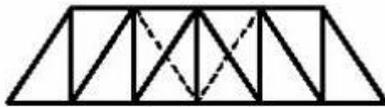
**Pratt**



**Parker**



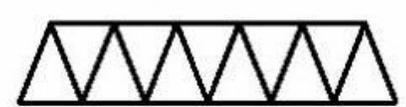
**K-Truss**



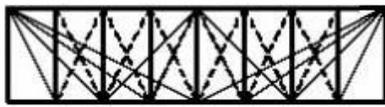
**Howe**



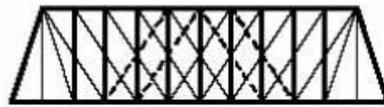
**Camelback**



**Warren**



**Fink**



**Double Intersection Pratt**



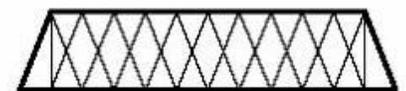
**Warren (with Verticals)**



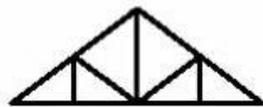
**Bowstring**



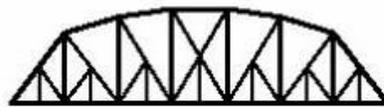
**Baltimore**



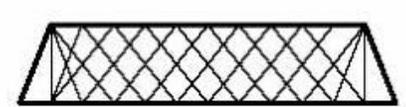
**Double Intersection Warren**



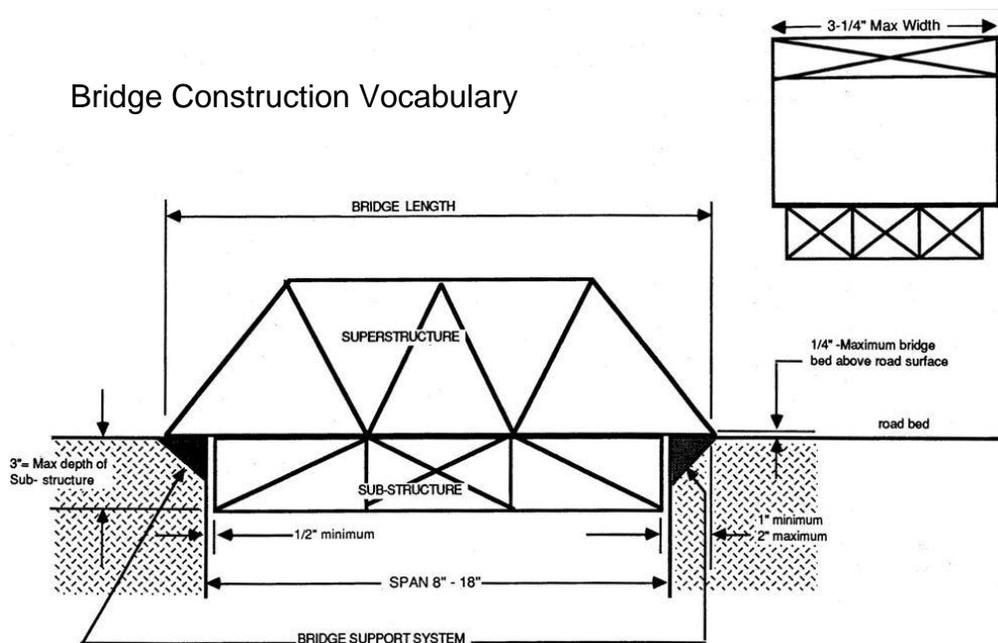
**Waddell "A" Truss**



**Pennsylvania**



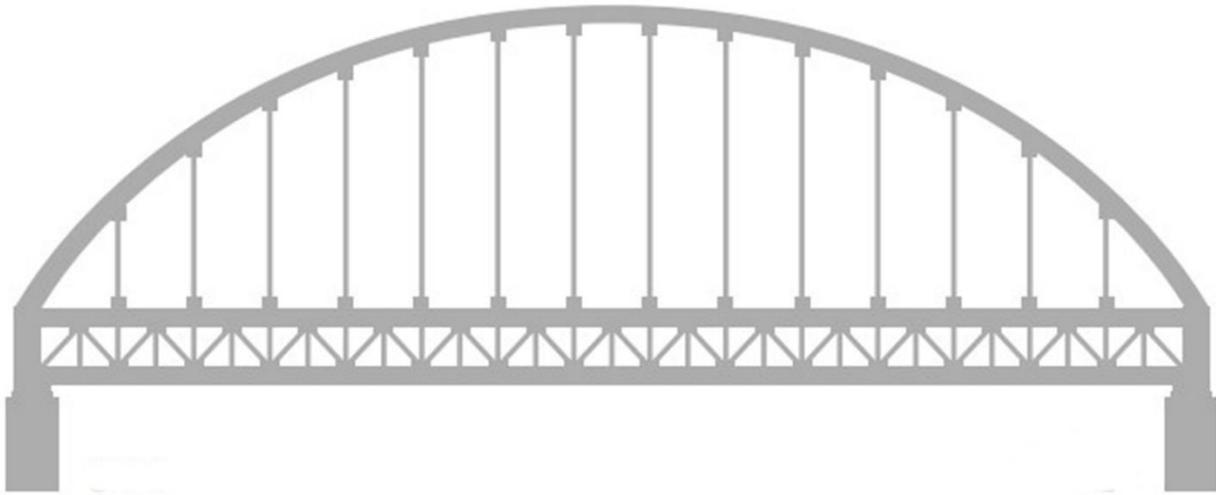
**Lattice**





**BRAIN  
BUSTER 3D**

## Bridge 01 Stencil





# Bridge 02 Stencil

**BRAIN  
BUSTER 3D**

