KiDSPARK EDUCATION

STEM-Maker CURRICULUM v2.1

ROK Creek Bridge

STEM Fundamentals: Engineering Basics | **Curriculum Packet**

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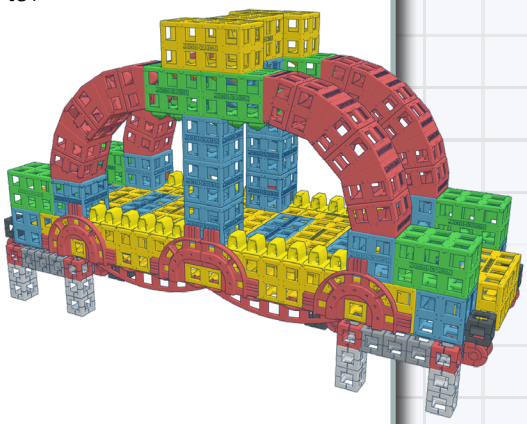
A Bridge Design and Engineering Project

Educational Objectives

At the conclusion of this lesson, students should be able to:



- ✓ *Understand the basics of bridge design.*
- ✓ *Recognize different forces that are acting on a bridge.*
- ✓ *Recognize several different types of bridges and how they work.*
- ✓ *Determine the dimensions of different bridges.*
- ✓ *Work as a member of a team to research, design, engineer, and present a custom bridge design.*

Education Standards

NGSS Learning Dimensions

Scientific/Engineering Practice:
Planning and carrying out investigations

Crosscutting Concept:
Structure and function

Standards for Technological Literacy

1.K-5 2.K-5 3.K-5 6.K-5
7.K-5 8.K-5 9.K-5 10.K-5
11.K-5 12.K-5 20.K-5

Common Core Standards

CCSS.MATH.CONTENT.3.M.D.C.7
CCSS.MATH.CONTENT.3.M.D.D.8
CCSS.MATH.CONTENT.3.G.A.1
CCSS.MATH.CONTENT.4.M.D.A.1

Welcome

Activity Information

This activity is designed to introduce students to the basics of bridge design. Students will learn about the different components of a bridge, the forces acting on a bridge, and how different bridge designs work. Students will apply knowledge they have previously learned as they progress through the design project.

Classroom Management

This activity packet should serve as a guide for teachers and students to learn about important concepts in design and engineering. Students will work in groups of up to four to learn about basic bridge design. Groups will be required to complete a specific bridge build plan and present it to the rest of the class. Teams of eight will then be formed to design and engineer a new custom bridge.

Resources Needed

ROK Blocks Mobile STEM Lab (One per group of four students)

Activity Time

120-180 Minutes

Table of Contents

STEM Fundamentals: ROK Creek Bridge

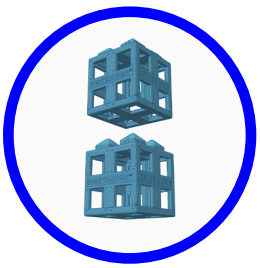
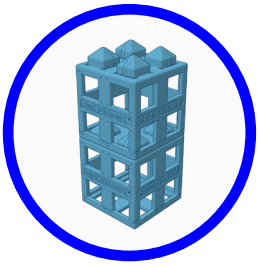
Building Basics

Building Basics with Rokenbok

The following tips will be helpful when using Kid Spark Engineering Materials.

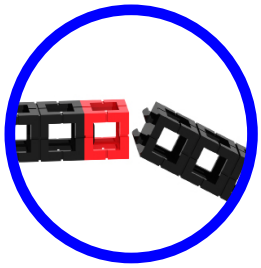
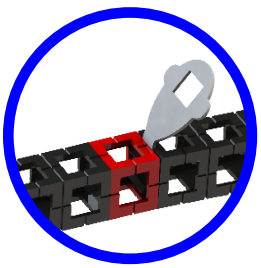
Connecting/Separating ROK Blocks:

ROK Blocks use a friction-fit, pyramid and opening system to connect. Simply press pyramids into openings to connect.
To separate blocks, pull apart.

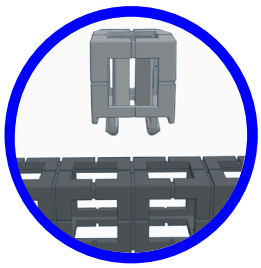
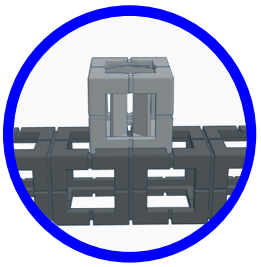
Connecting/Separating Rokenbok Components

Smaller Rokenbok components use a tab and opening system to connect. Angle one tab into the opening, and then snap into place.
To separate, insert key into the engineered slot and twist.

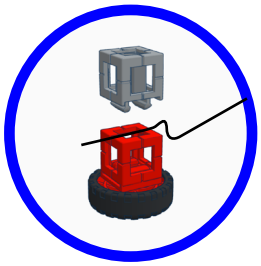
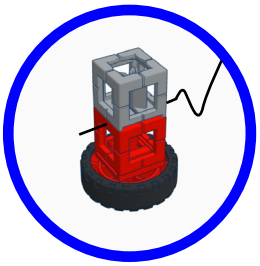
Snapping Across Openings

The tabs on Rokenbok components can also be snapped across openings to provide structural support to a design. This will also allow certain designs to function correctly.

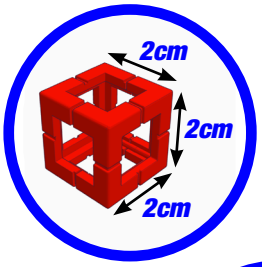
Attaching String:

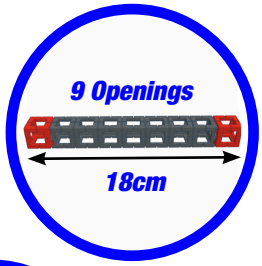
In some instances, string may be needed in a design. Lay string across opening. Snap any Rokenbok component with tabs or pyramids into opening. Make sure tabs run perpendicular to string for a tight hold.

Measuring:

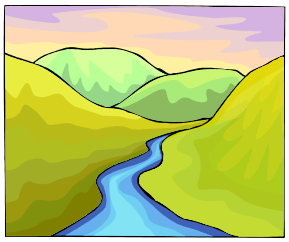
The outside dimensions of each Rokenbok connector block is 2cm^3. This means the length, depth, and height are all the same.
To determine the size of a Rokenbok build in cm, simply count the number of openings and multiply by two. Repeat this process for length, depth and height.





Introduction

Breaking News: ROK Creek Bridge Flooded



A recent thunderstorm caused severe flooding and washed out the old ROK Creek Bridge. The bridge was the only way across the creek for miles and needs to be replaced as soon as possible.

Until a new permanent bridge can be designed and built, a temporary bridge must be constructed with materials on hand.

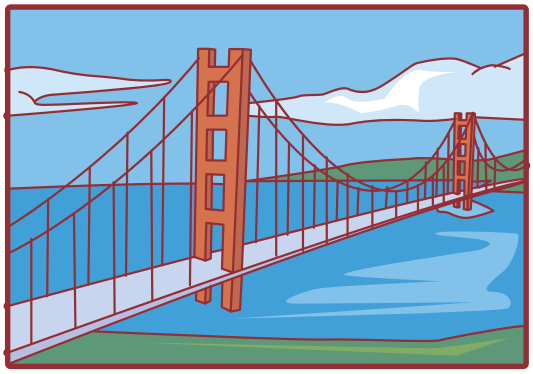
Bridge Reconstruction Plan

Your Structural Engineering team has been selected to design, engineer, and build a suitable bridge to replace the old one as soon as possible. The bridge must be designed to allow vehicles to pass over and boats to pass under.

Project Information

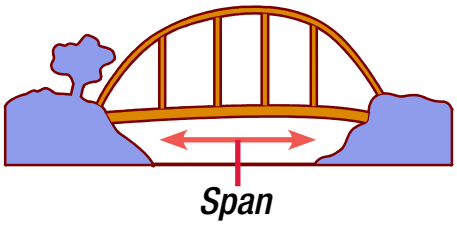
Each team will learn the basics of bridge building and design. A specific type of bridge will then be selected by each team to be constructed and presented to the rest of the class. These bridges will serve as small prototypes for the entire class. Two teams will then combine to form a group of eight students to work together to design and build a new, custom ROK Creek Bridge.

Teams will work through the Kid Spark Design and Engineering Process as they develop ideas and solutions to the ROK Creek Bridge Challenge.



Bridge Building: Basics

Building Bridges

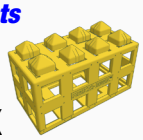
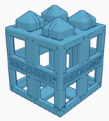


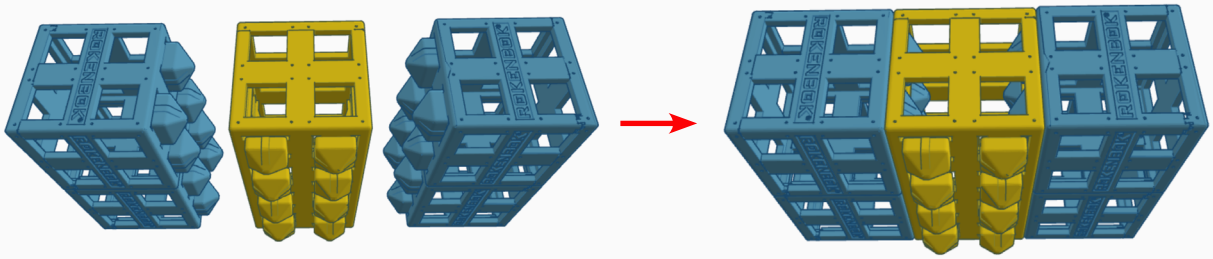
Have you ever placed a board over a puddle of water so that you wouldn't get your shoes wet? If you have, then you have already built a bridge. A bridge is a simple way to pass over an obstacle, like a river, valley, or railroad track. There are many types of bridges, and usually, they are designed to connect two points together. The distance between the two points is called the span of the bridge. The distance of the span will determine which type of bridge is to be constructed.

First, let's look at the basics of building a bridge. In order for a bridge to carry a load, it must be designed to support a lot of weight across an open space. Bridges are designed to spread the weight of the load out over the span of the bridge so that it is not just pushing down at one point. This is called dissipation. Let's look at how this works:

1 Build Bridge Roadway

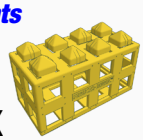
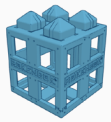
Components

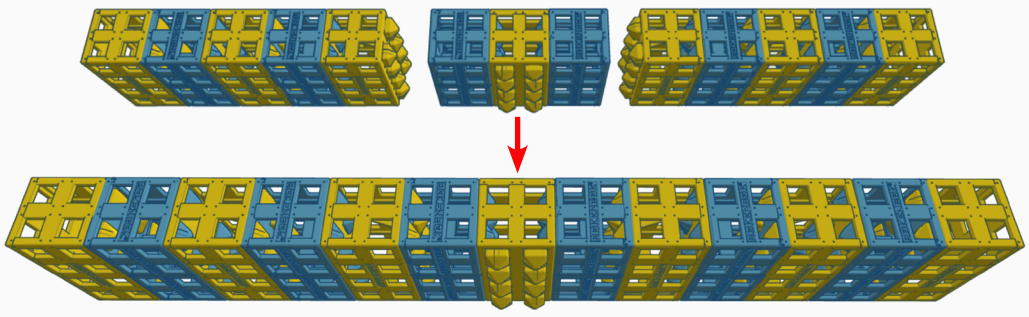
1x  4x 



2 Build Bridge Roadway (Continued)

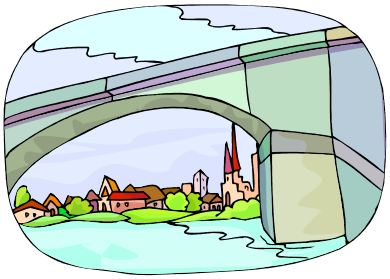
Components

6x  8x 



Bridge Building: Basics

Abutments

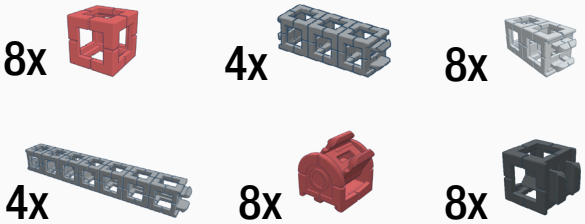


At each end of a bridge, you will find a solid support that allows the bridge to be anchored or attached to each end of the span. These supports are known as abutments. On real bridges, these are usually made of concrete and are very large and very heavy. Abutments hold up each end of the bridge and on most bridges, are needed to make the bridge strong.

In order to build your bridge design, you need to first build the anchor abutments for each end of the bridge. The instructions for building the abutments are shown below:

1 Build Bridge Abutments

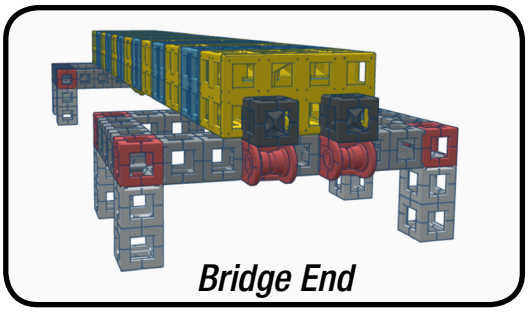
Components

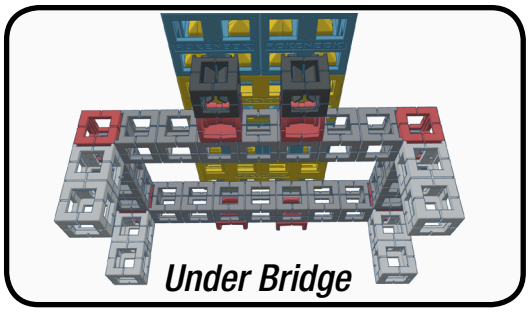


Bridge Building: Basics

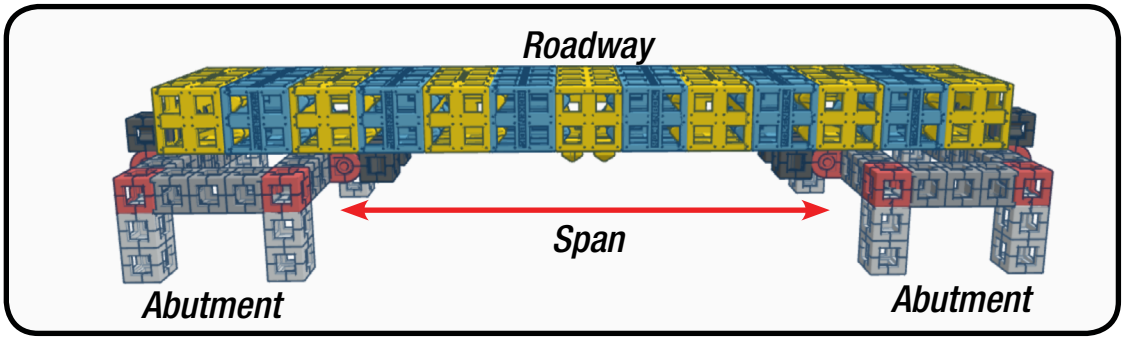
How Does a Bridge Work?

Once the bridge abutments have been built, it is time to connect the bridge roadway to the abutments. Connect the single snaps to the blocks as shown below:



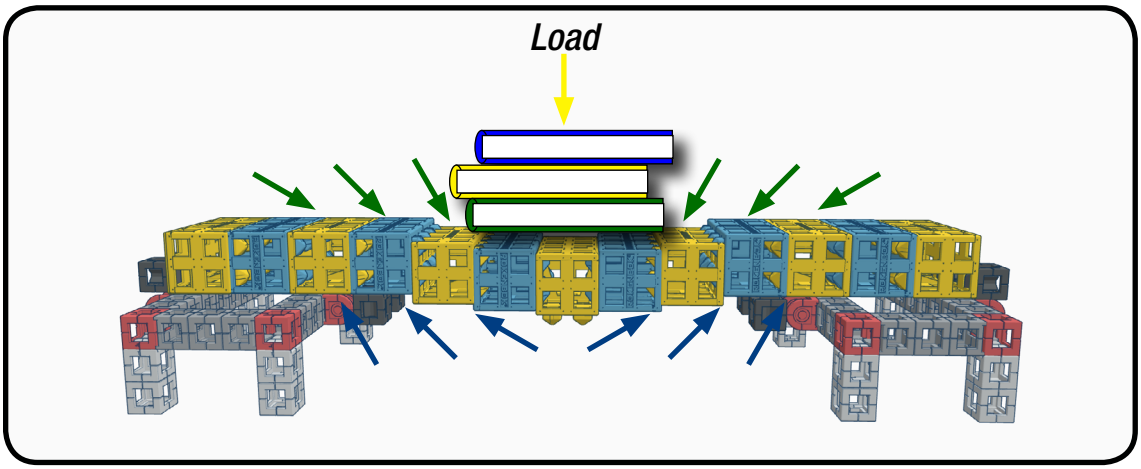


After both abutments have been attached, the bridge roadway should be suspended as shown below. The space between abutments is referred to as the span.



Testing Bridge Roadway

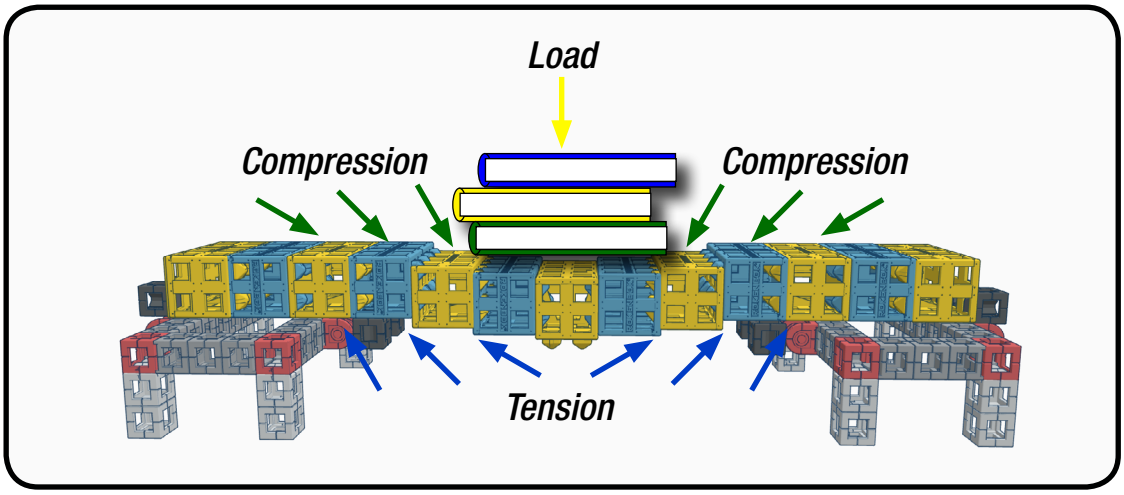
Next, let's test our bridge to see how strong it is. Place a few textbooks on the center of the bridge and see what happens. Keep adding weight until the bridge begins to fail.



Bridge Building: Basics

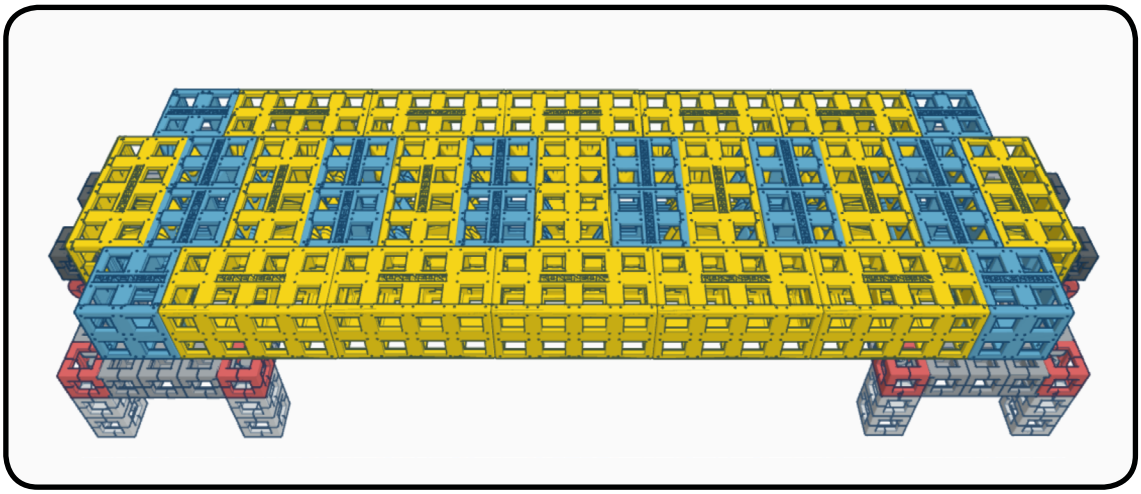
What Makes a Bridge Strong?

When a load is placed on a bridge, the weight of the load causes forces to react to the stress created by the load. The force on the top of the bridge is pushing downward and causes the top of the bridge to compress or squeeze together, while the force on the bottom of the bridge creates tension and has a tendency to pull apart. The effect of these two forces must be overcome in order for the bridge to hold the load.



Adding Strength to the Roadway

Locate ten yellow blocks and four blue blocks and attach them to each side of the roadway as shown below. Next, test the bridge again with the books to see what happens.



Bridge Building: Bridge Types

Why Are There Different Kinds of Bridges?

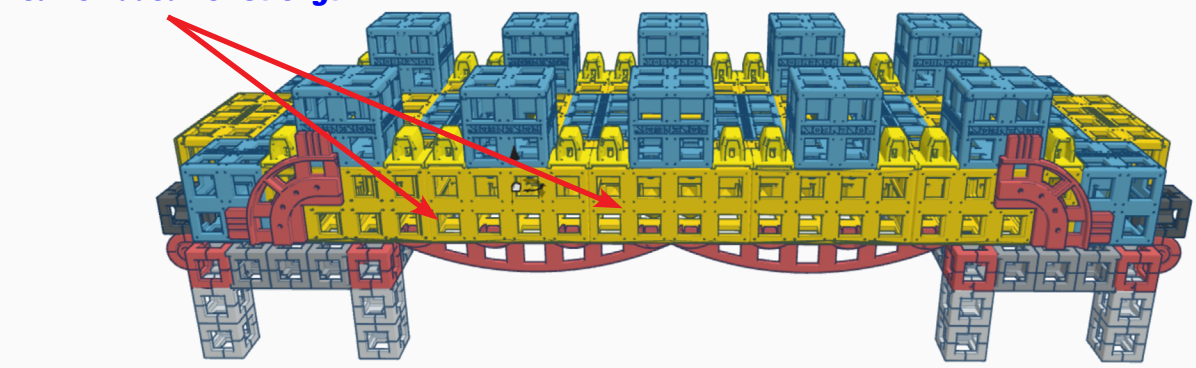
There are many different types of bridges that are designed for different purposes, but bridges are mainly designed and engineered to carry loads over different spans.

Let's take a look at several common bridge designs and learn a little about the design and engineering needed for each type of bridge to carry a load. Your structural engineering team will then choose one of the bridge designs to build and present to the rest of the class.

Girder/Beam Bridges

The first bridges were beam bridges. Large logs placed across a creek or valley were strong enough to hold a lot of weight, but could only span a short distance based on the length and diameter of the logs.

The bridge roadway that you tested was an example of a girder/beam bridge. All of the load is dissipated over the entire surface of the roadway and is only as strong as the beams that you attached to the side of the roadway.

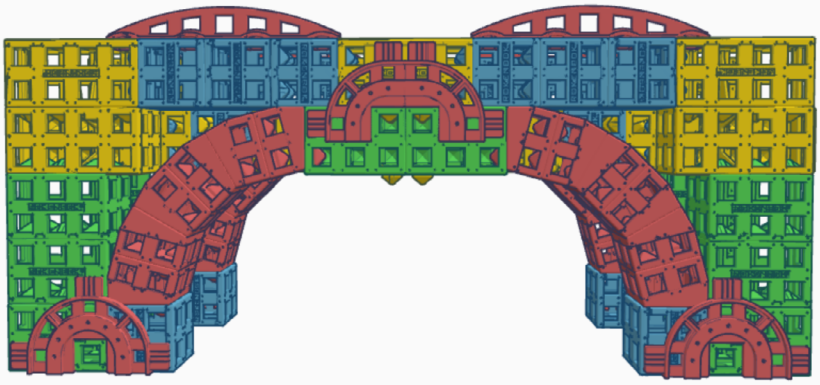


Rokenbok Beam Bridge

Bridge Building: Bridge Types

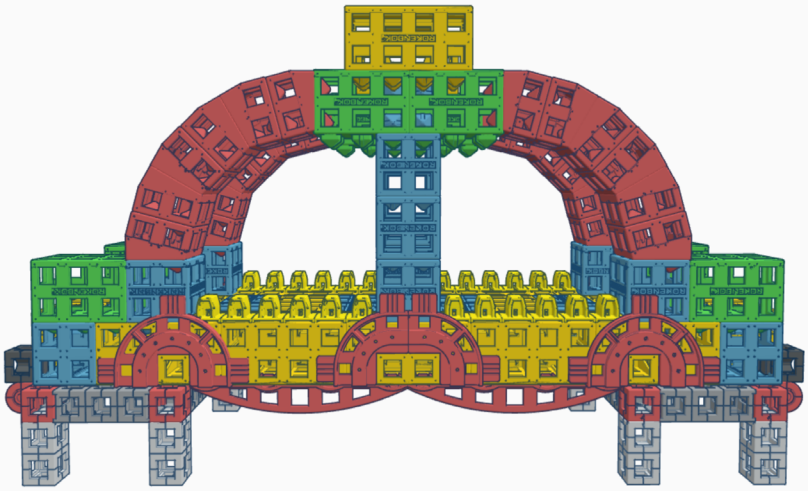
Arch Bridges

Many ancient bridges were built based on an arch design. The shape of the arch allowed the load to be dissipated from the bridge roadway down through the arch shape to the ground. Using multiple arches in a row allowed for the bridge to be longer and carry heavier loads.



Rokenbok Deck Arch Bridge

Arch bridges can also be engineered with the arch on top of the bridge roadway. While it looks different than the first example, the load is dissipated from the lower arch support to the abutments rather than directly to the ground.

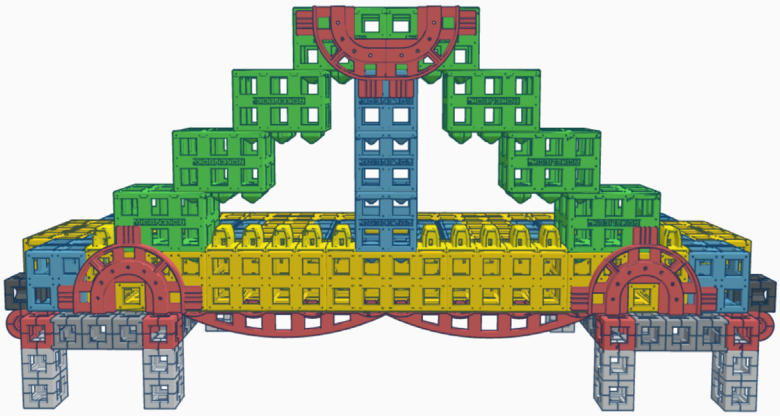


Rokenbok Through Arch Bridge

Bridge Building: Bridge Types

Truss Bridges

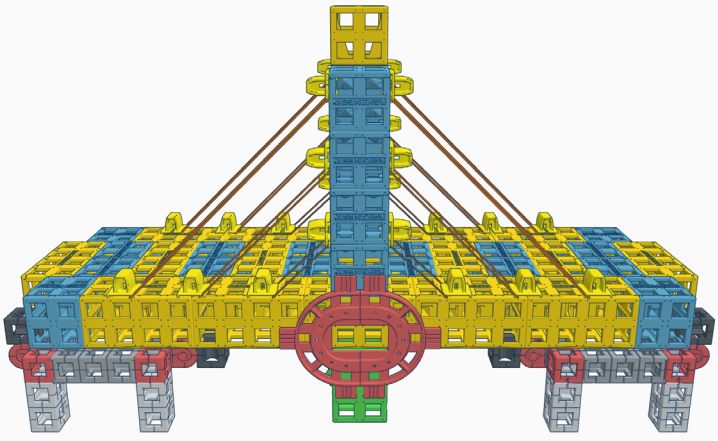
The truss bridge uses the strength of the triangle to help spread the load throughout the bridge structure. The truss is made of smaller components and then assembled on site. It is used on many railroad bridges because of its ability to carry heavy loads like a locomotive.



Rokenbok Truss Bridge

Cable-Stayed Bridges

A cable-stayed bridge has at least one tower, from which cables support the bridge roadway. It looks similar to a suspension bridge, but only requires one tower and the cables are attached directly to the tower and anchored at intervals along the bridge roadway and to the abutments. Some cable-stayed bridges have a single row of cables on each side of the tower, and some have two sets of cables to allow traffic to pass through the center of the bridge.



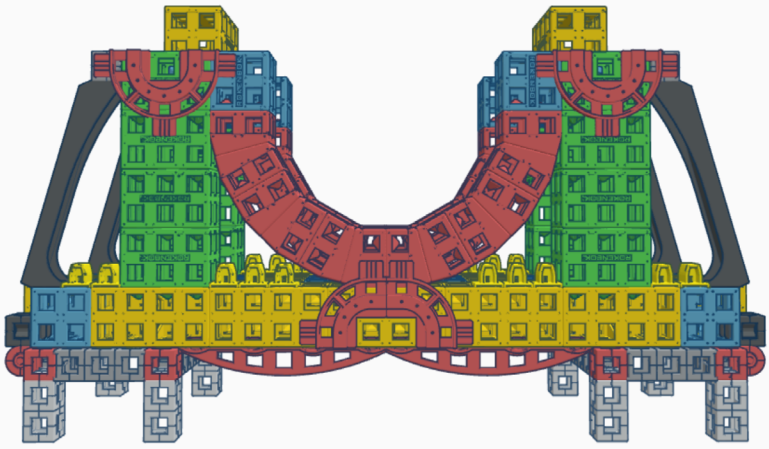
Rokenbok Cable-Stayed

Bridge Building: Bridge Types

Suspension Bridges

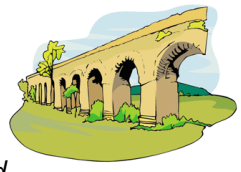
The suspension bridge allows for the longest spans of any bridge because of its unique design.The concept of the suspension bridge is really not new. Ancient bridge builders used to pull ropes across a span and tied the roadway with vertical ropes to the main ropes above.

Suspension bridges begin with the construction of two tall towers near each end of the bridge. Once the towers are in place, cables are attached to each abutment and then connected to the top of the towers to form the primary cable system that will hold up the roadway. Next, vertical cables are connected from the primary cable to the roadway and this is how the roadway is supported.



Rokenbok Suspension Bridge

STEM-Maker Build: Bridges



Now that several different types of bridges have been reviewed, it is time for your structural engineering team to choose one of the bridges to research, build, and present to the rest of the class. Each team should select a different bridge, unless there are more teams than types of bridges.

Once each team has settled on a design, follow the step-by-step graphic instructions in the build plan to build a specific type of bridge. Once the bridge has been built, work as a team to research and understand the history of the bridge and how the design works. Be prepared to give a short presentation to the rest of the class.

Beam Bridge

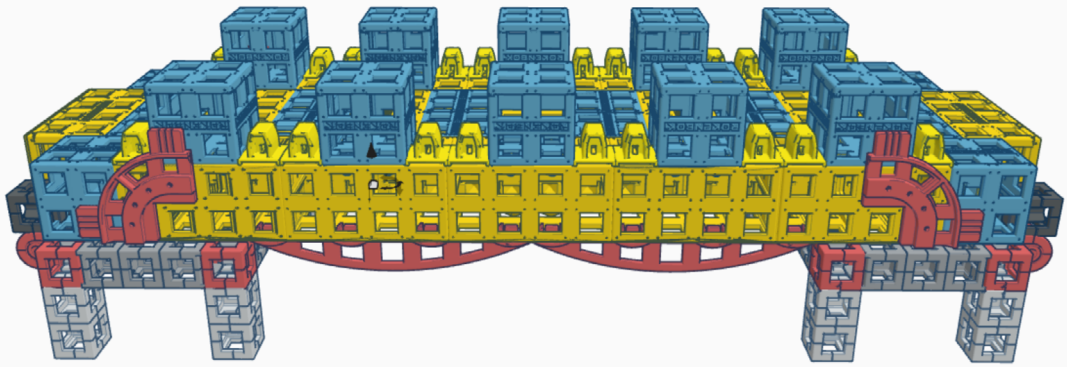
Build Plan and Team Worksheet

Instructions

Follow the step-by-step graphic instructions in this packet to assemble a beam bridge. After the bridge has been built, complete the team worksheet and prepare a short presentation about the bridge.

Team Members

1. _____
2. _____
3. _____
4. _____

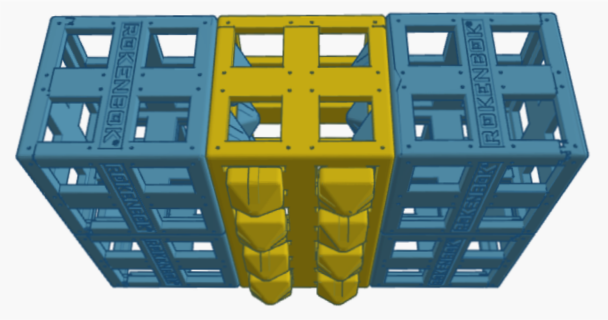


Build Plan: Beam Bridge

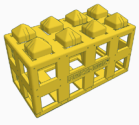
STEM-Maker Build: Beam Bridge

Follow the step-by-step instructions to assemble a beam bridge.

1 Bridge Roadway



Components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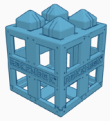
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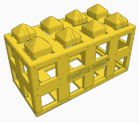
2 Bridge Roadway (Continued)

Components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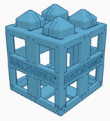
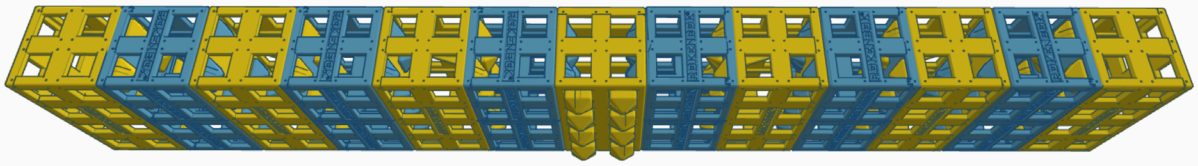
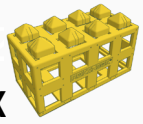
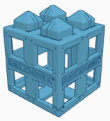

8x

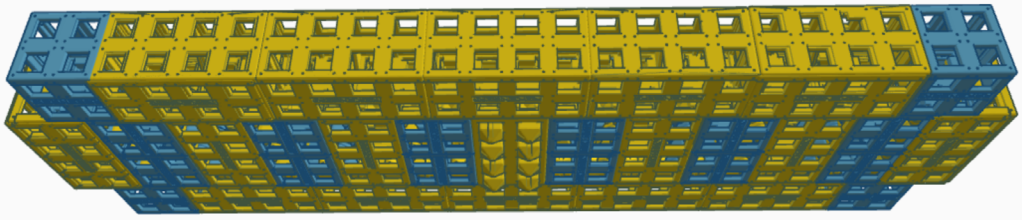


3 Attach Side Supports

Components

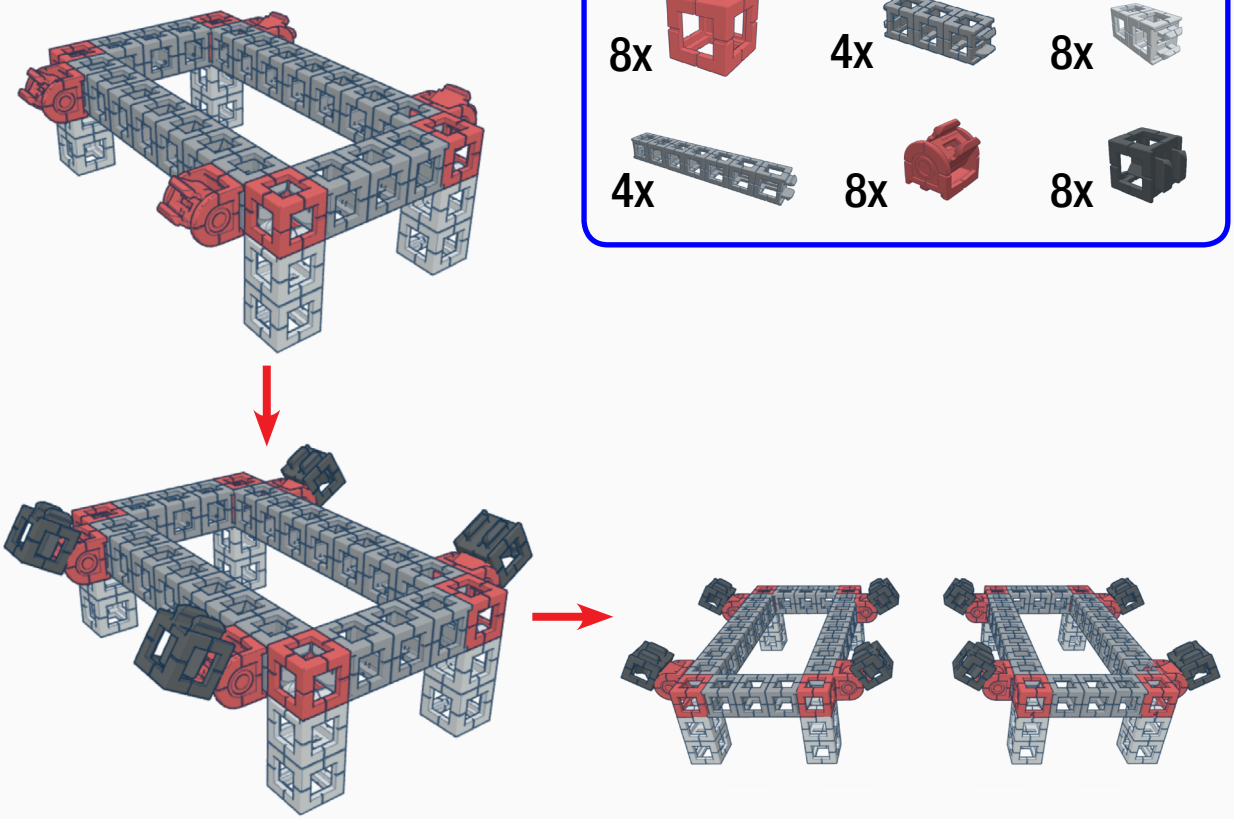

10x


4x



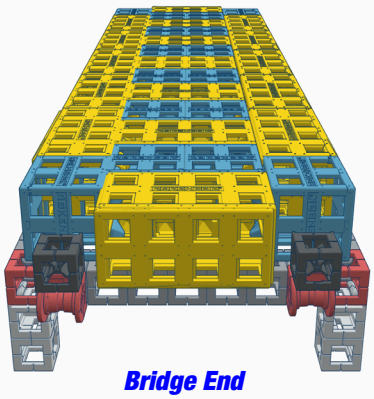
Build Plan: Beam Bridge

4 Build Abutments

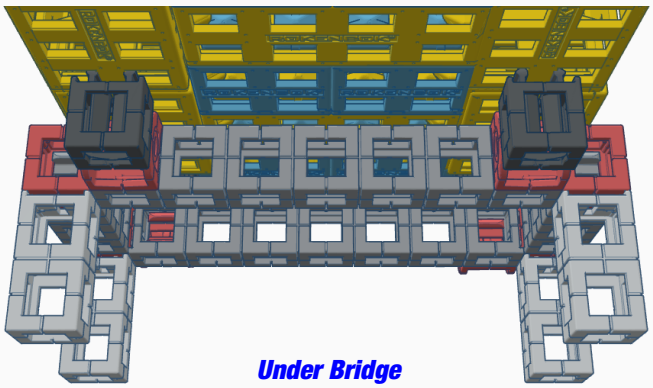


Components

5 Place Roadway on Abutments



Bridge End

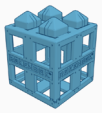


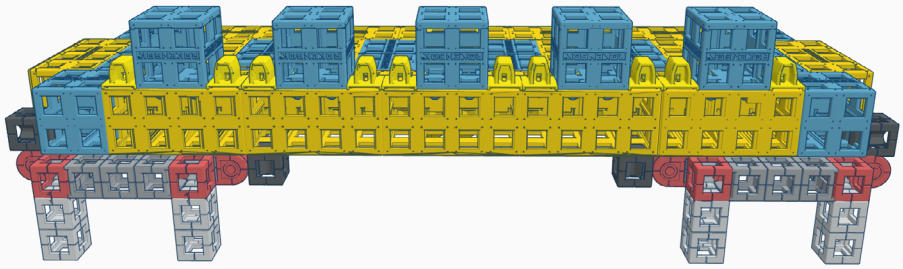
Under Bridge

Build Plan: Beam Bridge

6 Attach Pillars and Gear Teeth

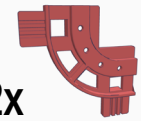
Components

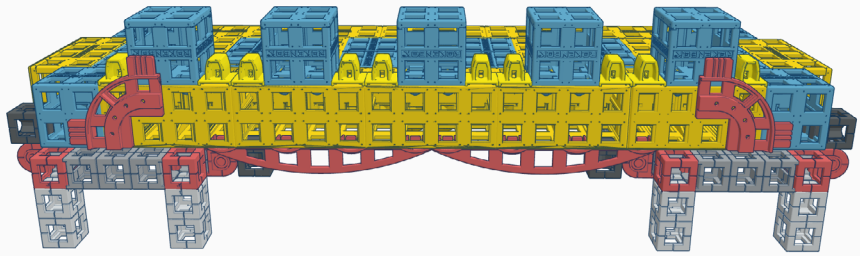
5x  10x 



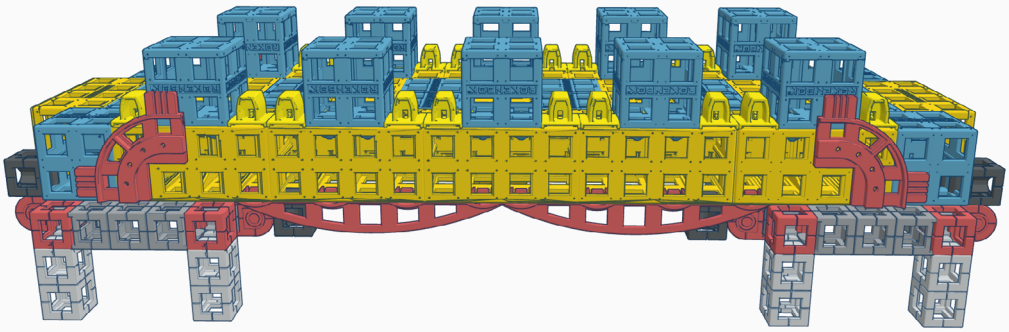
7 Attach Support Structures

Components

2x  2x 



8 Repeat Steps 6-7 on Opposite Side



Beam Bridge: Team Worksheet

Instructions

Once the beam bridge has been built, complete the following sections about the bridge and prepare to present it to the rest of the class.

Measurement

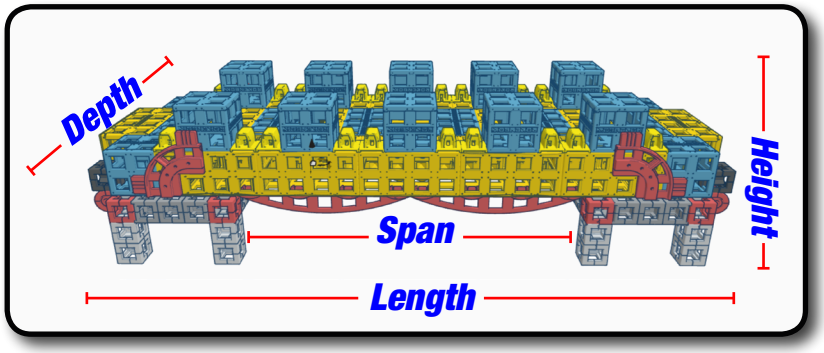
Fill in the dimensions of the beam bridge below:

Length_____mm

Height_____mm

Depth_____mm

Span_____mm

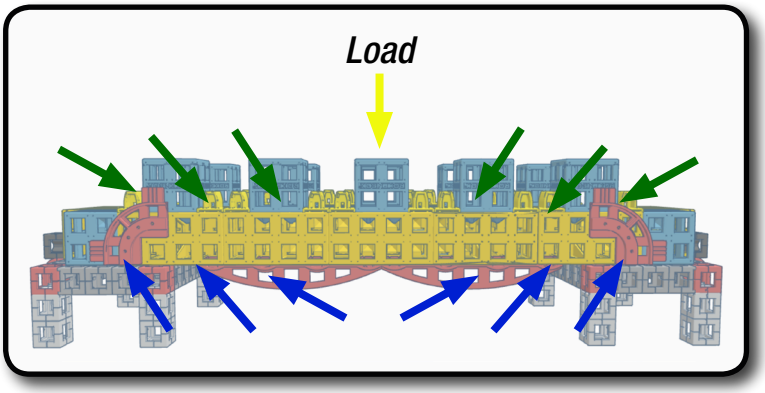


Forces

Compression and tension are forces being distributed throughout the bridge.
Fill in the correct force in the spaces below:

_____

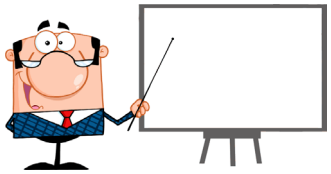
_____



Presentation

An important part to design and engineering is the ability to communicate the design to someone else. Prepare a short presentation to explain:

-The type of bridge that was built
-How the bridge distributes weight to support a load
-A real-life example of the type of bridge
-The role of each team member



Deck Arch Bridge

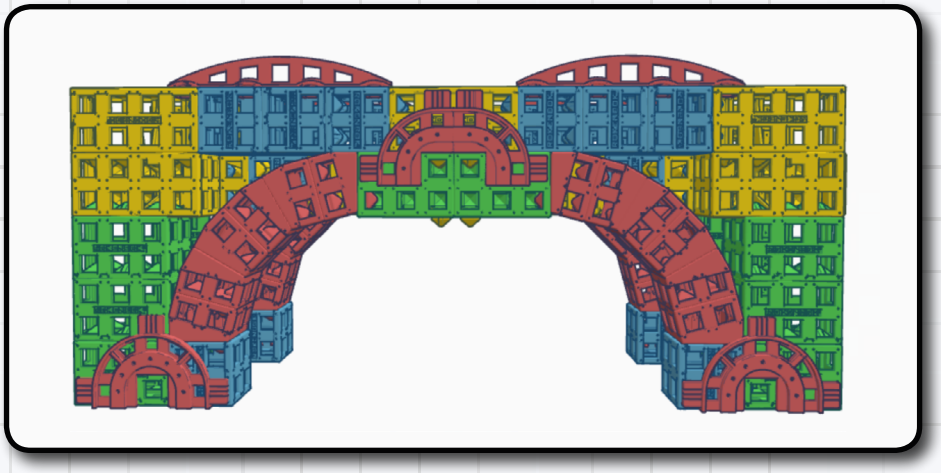
Build Plan and Team Worksheet

Instructions

Follow the step-by-step graphic instructions in this packet to assemble a deck arch bridge. After the bridge has been built, complete the team worksheet and prepare a short presentation about the bridge.

Team Members

1. _____
2. _____
3. _____
4. _____

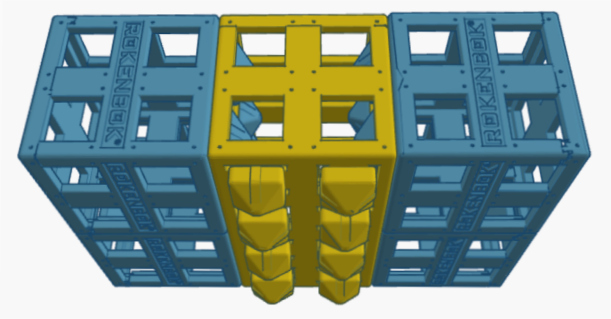


Build Plan: Deck Arch Bridge

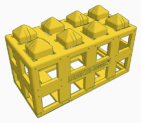
STEM-Maker Build: Deck Arch Bridge

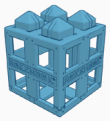
Follow the step-by-step instructions to assemble a deck arch bridge.

1 Bridge Roadway



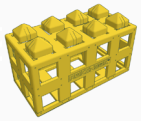
Components

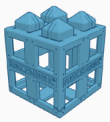
1x 

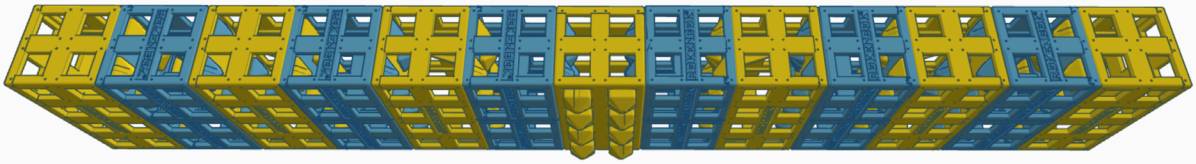
4x 

2 Bridge Roadway (Continued)

Components

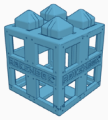
6x 

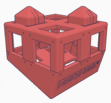
8x 

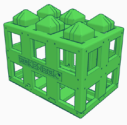


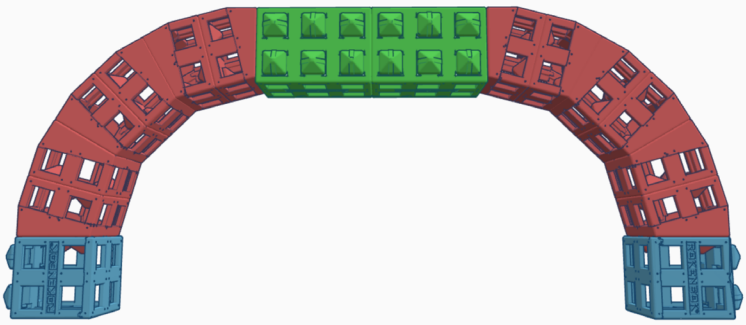
3 Building Arch (2x)

Components

4x 

24x 

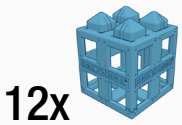
4x 

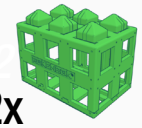


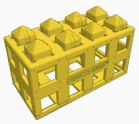
Build Plan: Deck Arch Bridge

4 Attach Structure (2x)

Components

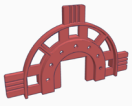


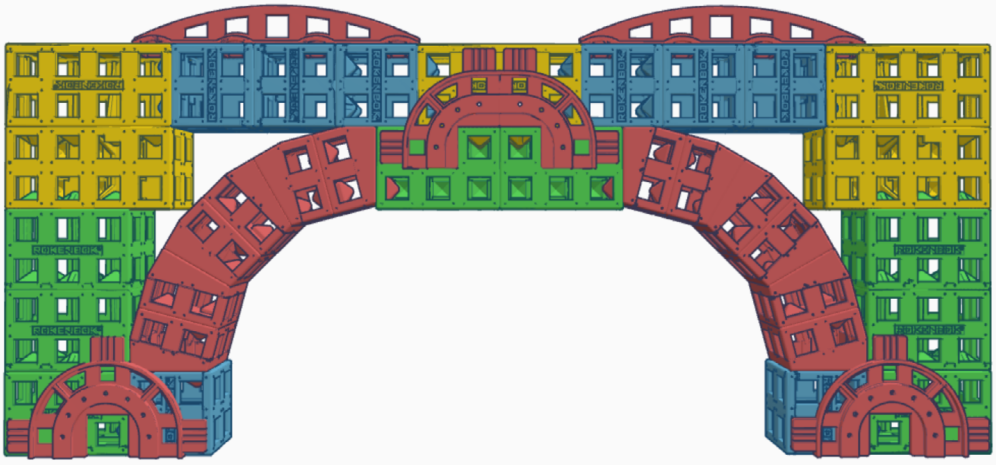




5 Attach Support Bracing (2x)

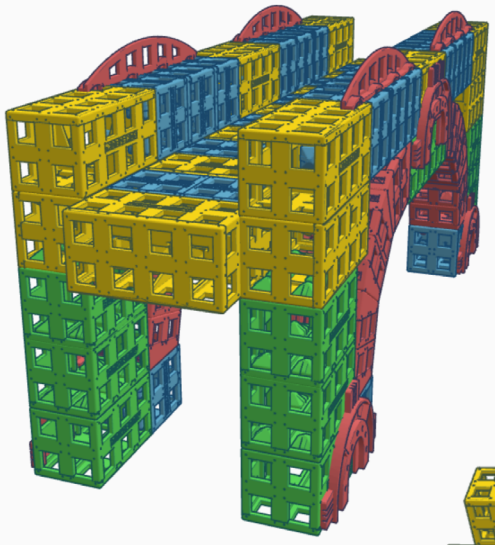
Components

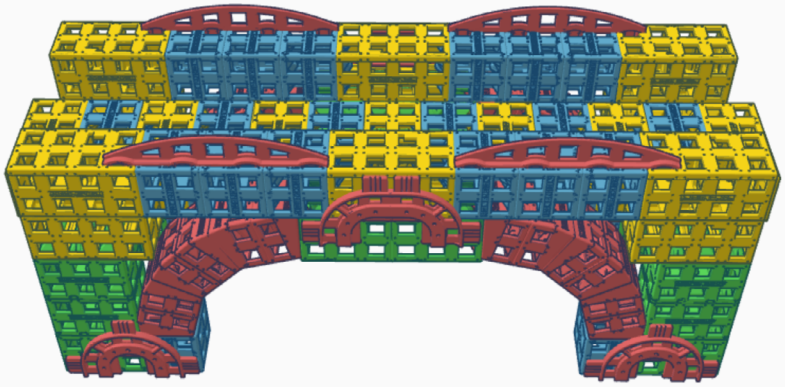




Build Plan: Deck Arch Bridge

6 Connecting Arches/Structures to Roadway





Deck Arch Bridge: Team Worksheet

Instructions

Once the deck arch bridge has been built, complete the following sections about the bridge and prepare to present it to the rest of the class.

Measurement

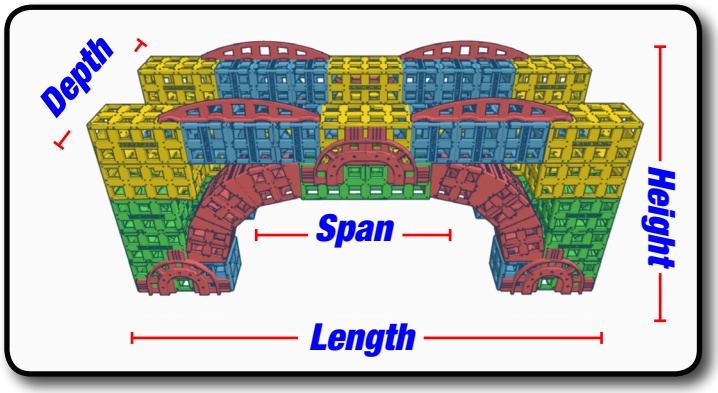
Fill in the dimensions of the deck arch bridge below:

Length_____mm

Height_____mm

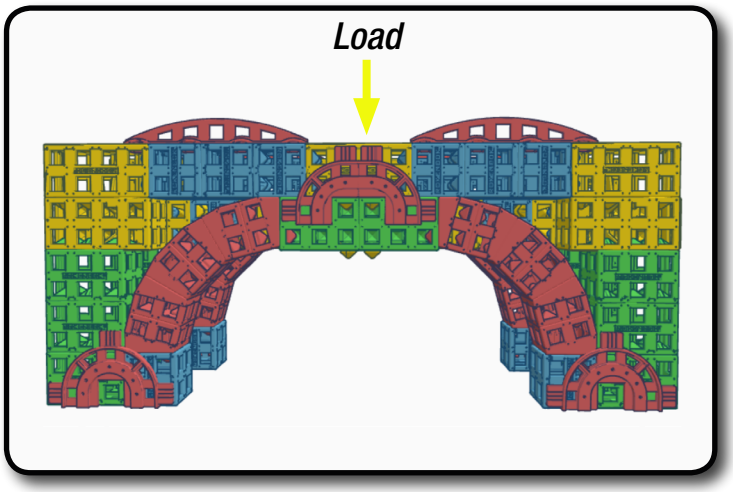
Depth_____mm

Span_____mm



Weight Distribution

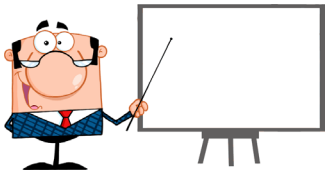
Do some research on how weight is distributed in a deck arch bridge. Then, draw arrows on the figure to the right that demonstrate how the weight is distributed through the bridge.



Presentation

An important part to design and engineering is the ability to communicate the design to someone else. Prepare a short presentation to explain:

-The type of bridge that was built
-How the bridge distributes weight to support a load
-A real-life example of the type of bridge
-The role of each team member



Through Arch Bridge

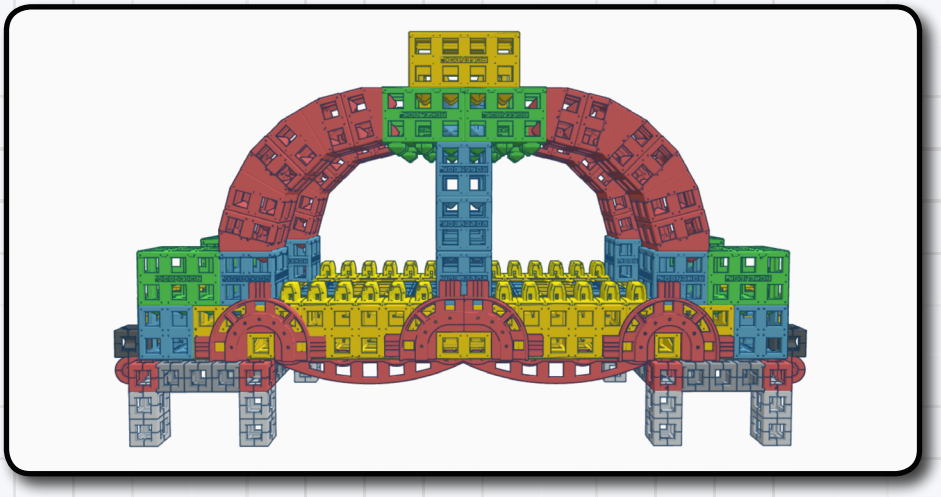
Build Plan and Team Worksheet

Instructions

Follow the step-by-step graphic instructions in this packet to assemble a through arch bridge. After the bridge has been built, complete the team worksheet and prepare a short presentation about the bridge.

Team Members

1. _____
2. _____
3. _____
4. _____

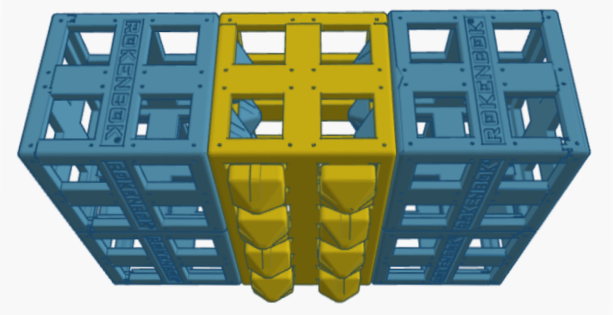


Build Plan: Through Arch Bridge

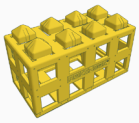
STEM-Maker Build: Through Arch Bridge

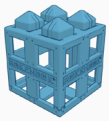
Follow the step-by-step instructions to assemble a through arch bridge.

1 Bridge Roadway



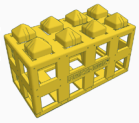
Components

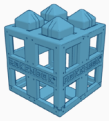
1x 

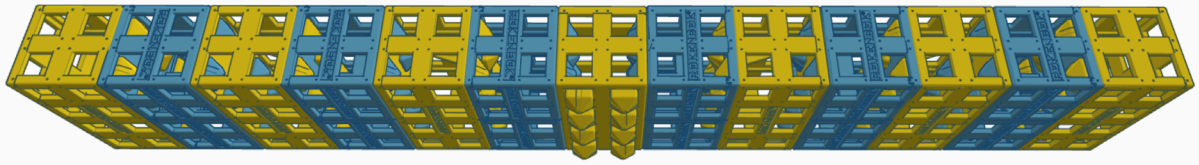
4x 

2 Bridge Roadway (Continued)

Components

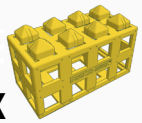
6x 

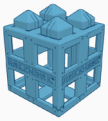
8x 

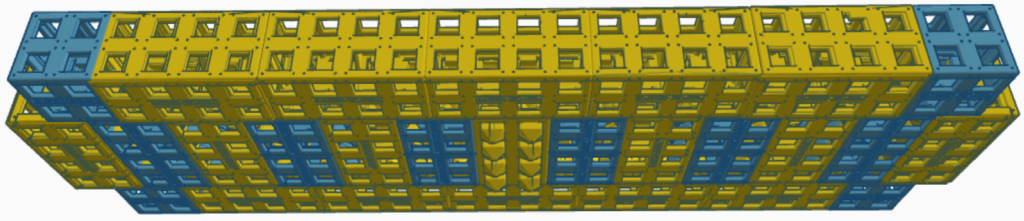


3 Attach Side Supports

Components

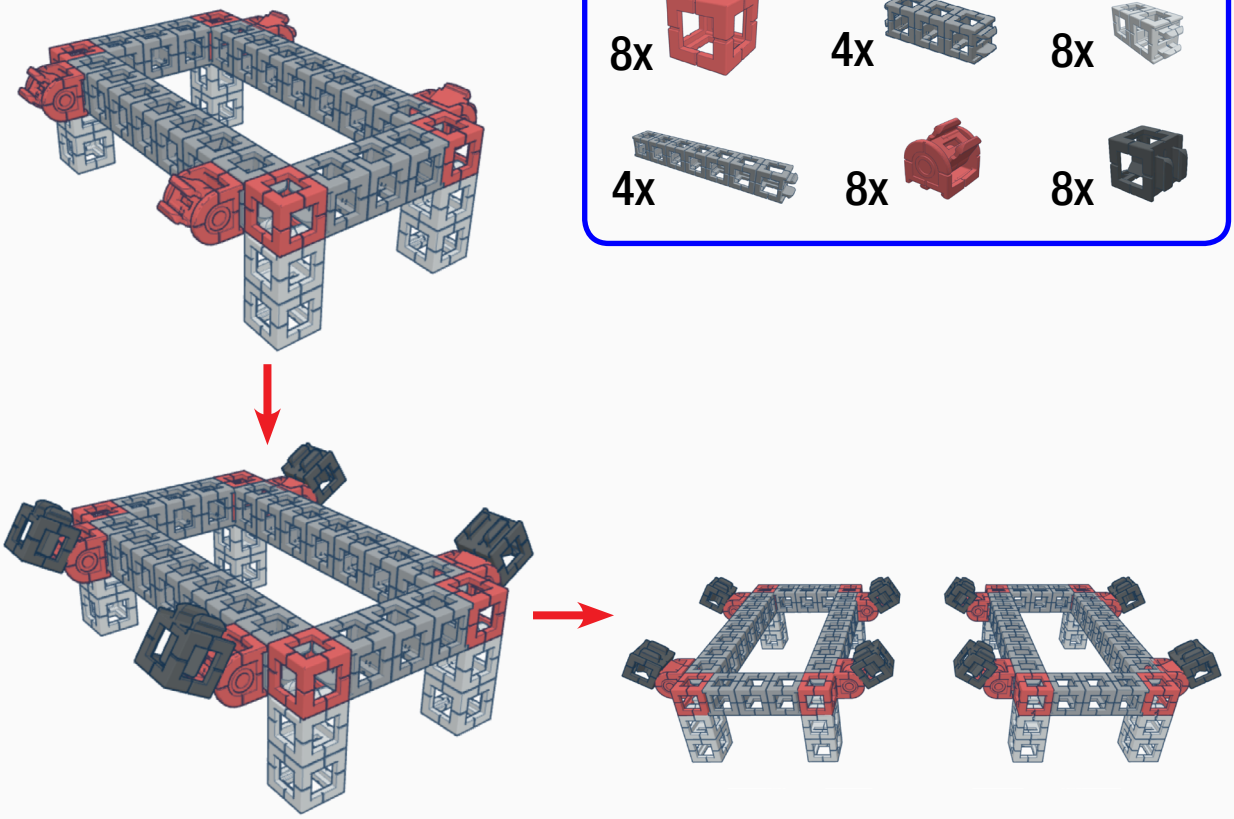
10x 

4x 



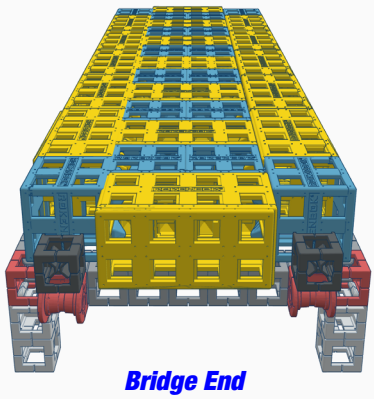
Build Plan: Through Arch Bridge

4 Build Abutments

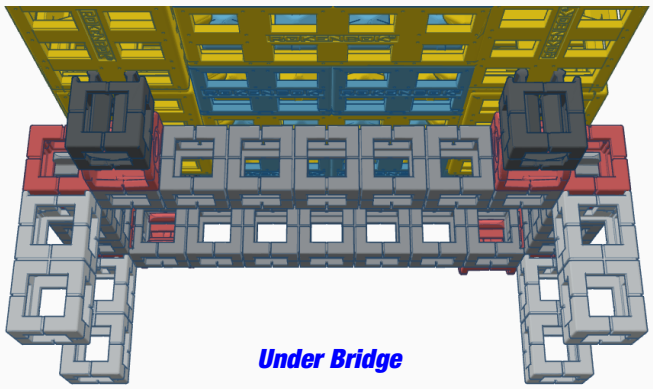


Components

5 Place Roadway on Abutments



Bridge End



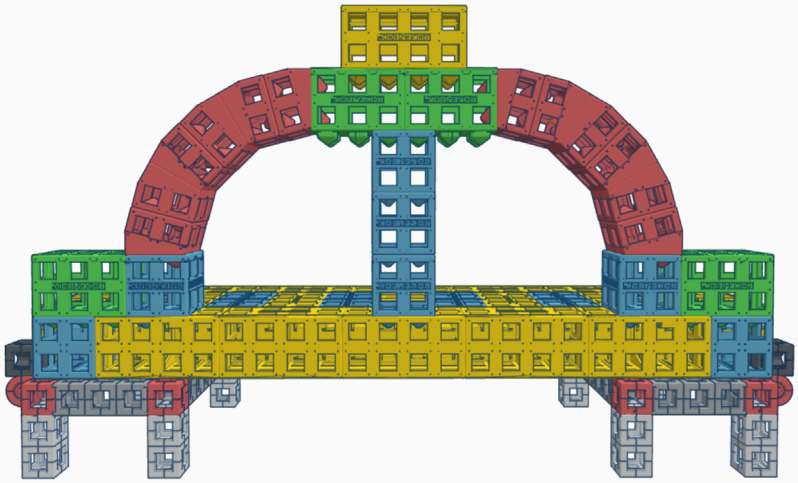
Under Bridge

Build Plan: Through Arch Bridge

6 Attach Arch (First Side)

Components

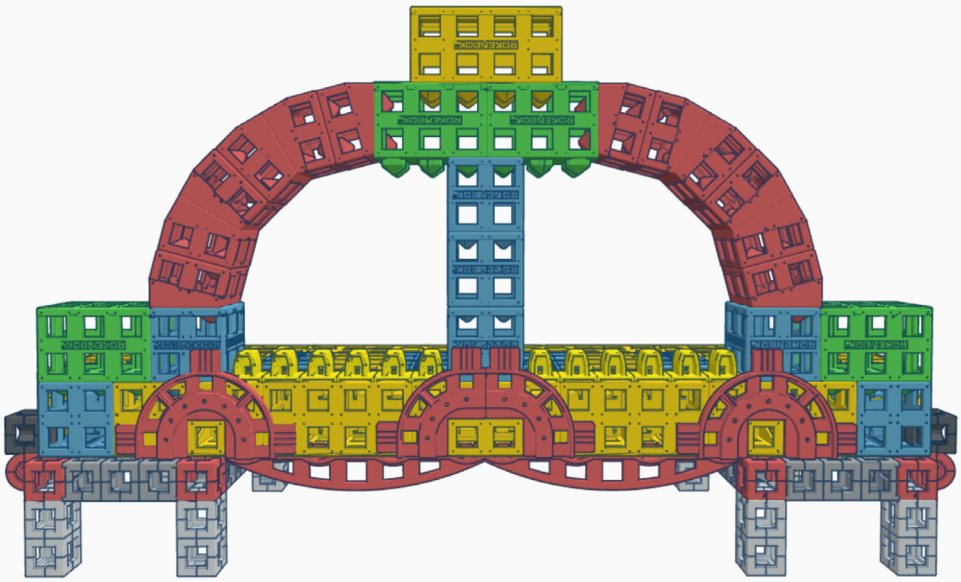
5x 12x 4x 1x



7 Attach Bracing and Gear Teeth

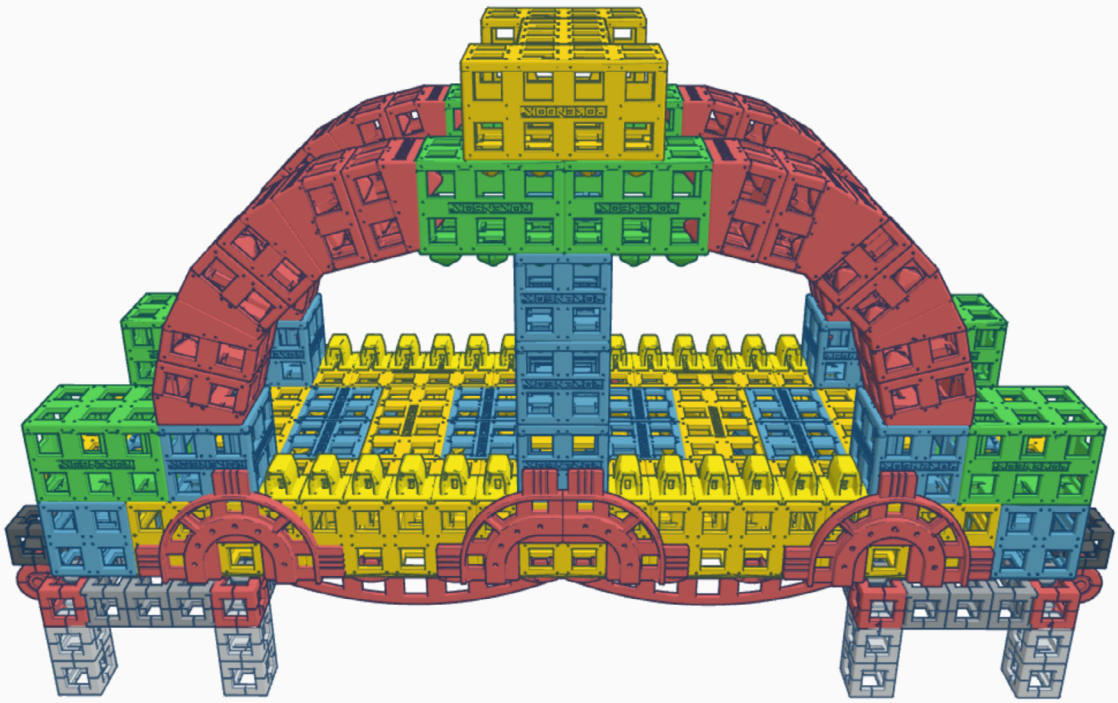
Components

2x 2x 2x 12x

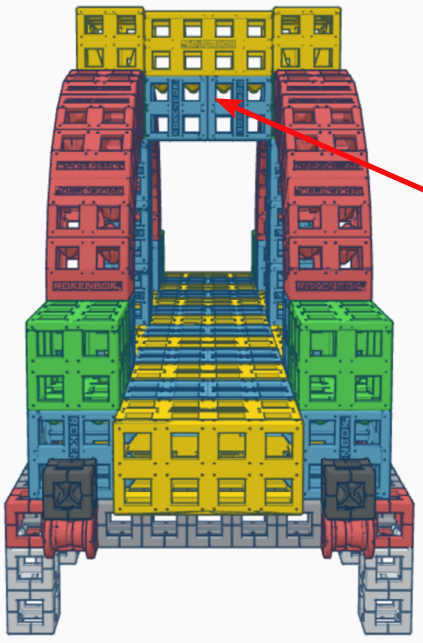


Build Plan: Through Arch Bridge

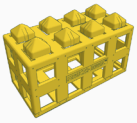
8 Repeat Steps 6-7 on Opposite Side

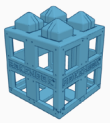


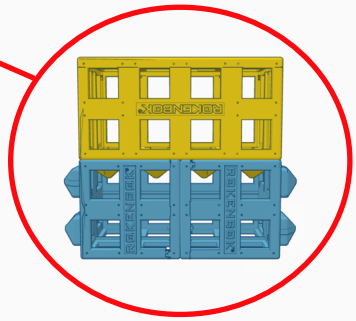
9 Connect Arches Together



Components

1x 

2x 



Through Arch Bridge: Team Worksheet

Instructions

Once the through arch bridge has been built, complete the following sections about the bridge and prepare to present it to the rest of the class.

Measurement

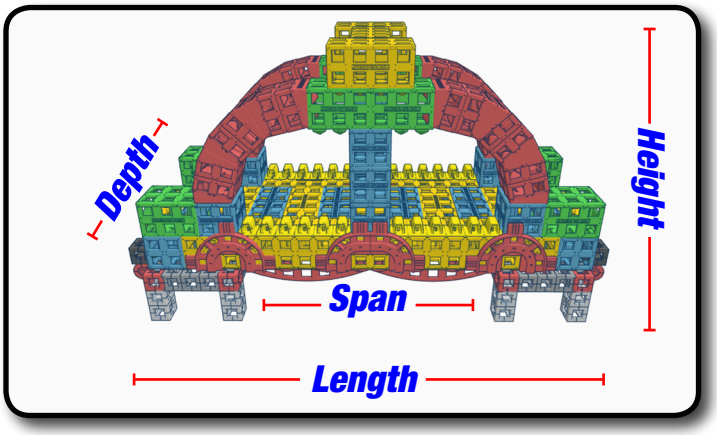
Fill in the dimensions of the through arch bridge below:

Length_____mm

Height_____mm

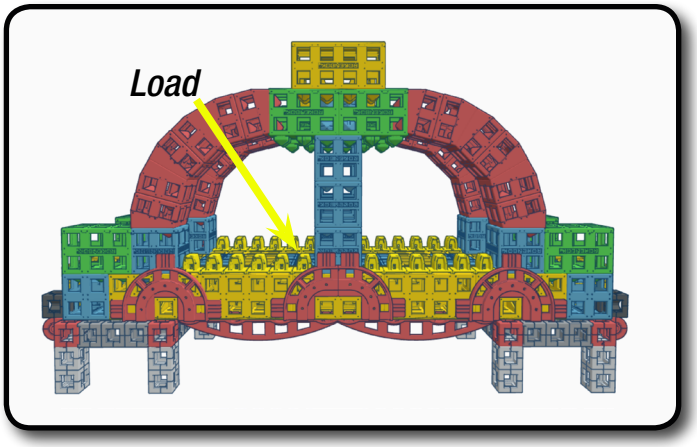
Depth_____mm

Span_____mm



Weight Distribution

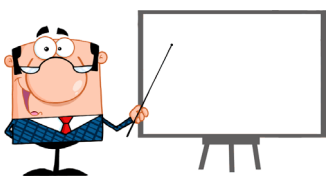
Do some research on how weight is distributed in a through arch bridge. Then, draw arrows on the figure to the right that demonstrate how the weight is distributed through the bridge.



Presentation

An important part to design and engineering is the ability to communicate the design to someone else. Prepare a short presentation to explain:

-The type of bridge that was built
-How the bridge distributes weight to support a load
-A real-life example of the type of bridge
-The role of each team member



Truss Bridge

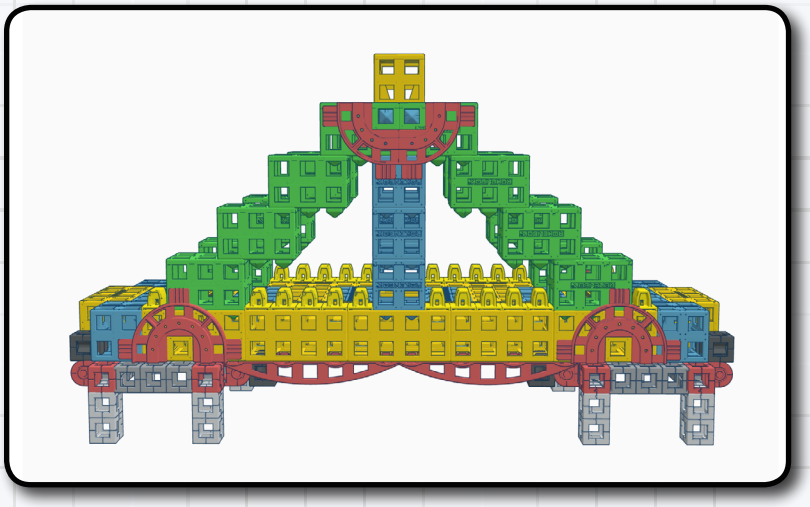
Build Plan and Team Worksheet

Instructions

Follow the step-by-step graphic instructions in this packet to assemble a truss bridge. After the bridge has been built, complete the team worksheet and prepare a short presentation about the bridge.

Team Members

1. _____
2. _____
3. _____
4. _____

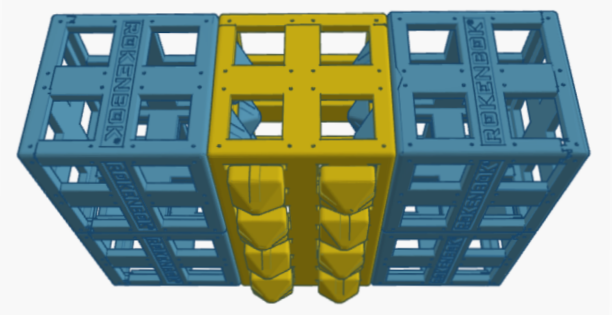


Build Plan: Truss Bridge

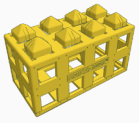
STEM-Maker Build: Truss Bridge

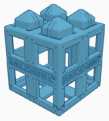
Follow the step-by-step instructions to assemble a truss bridge.

1 Bridge Roadway



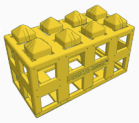
Components

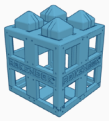
1x 

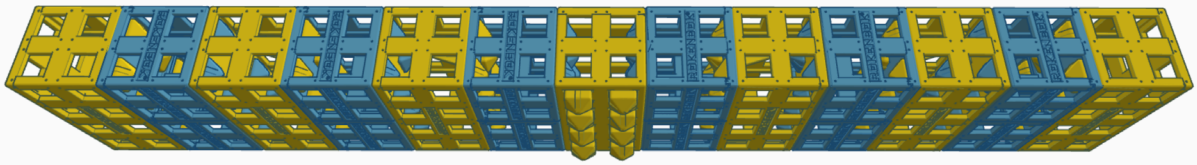
4x 

2 Bridge Roadway (Continued)

Components

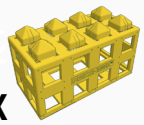
6x 

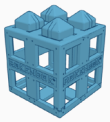
8x 

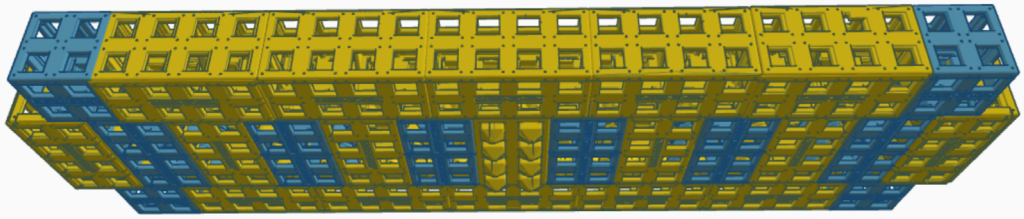


3 Attach Side Supports

Components

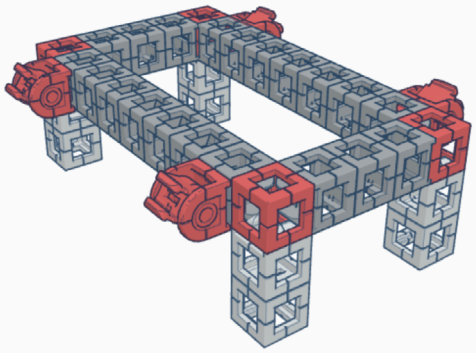
10x 

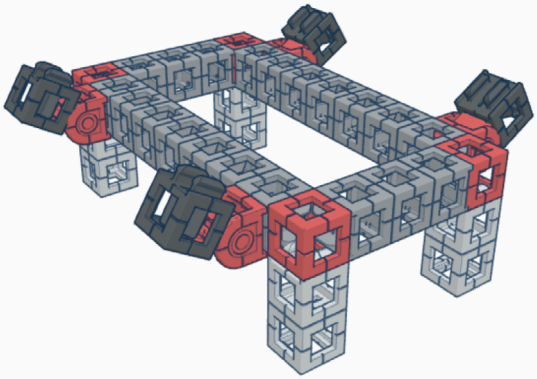
4x 



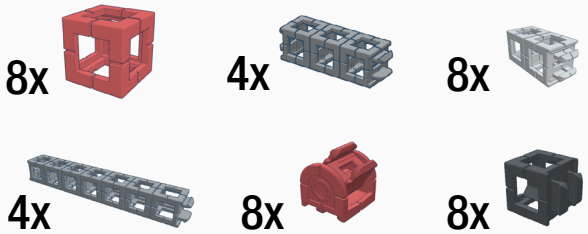
Build Plan: Truss Bridge

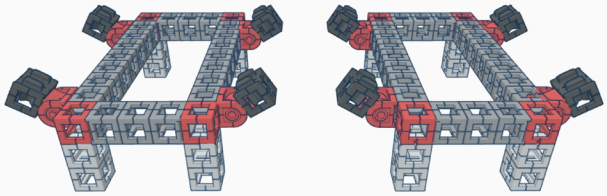
4 Build Abutments



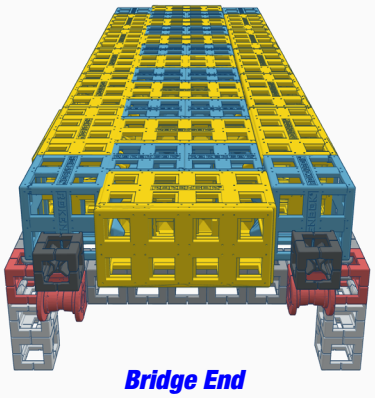


Components

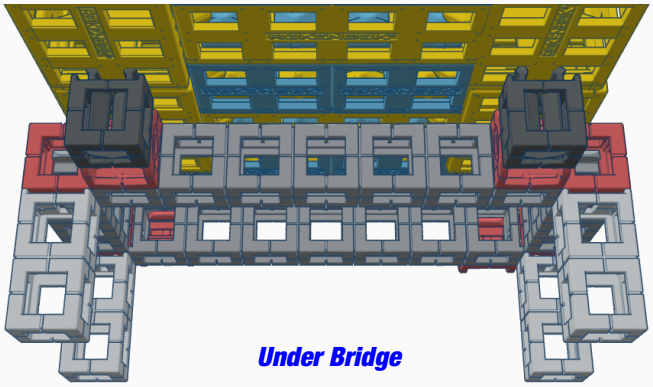




5 Place Roadway on Abutments



Bridge End

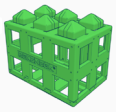


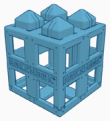
Under Bridge

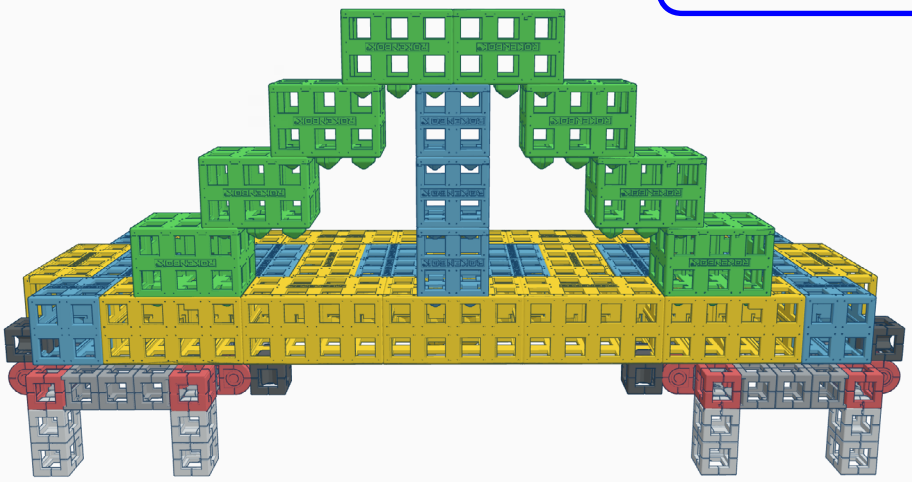
Build Plan: Truss Bridge

6 Attach Truss to Roadway

Components

8x 

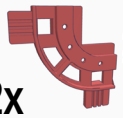
3x 



7 Attach Bracing and Gear Teeth

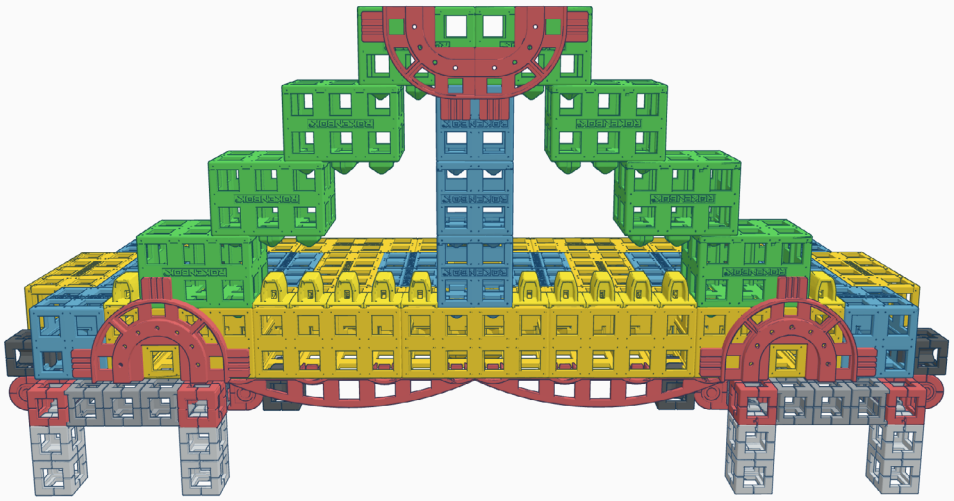
Components

2x 

2x 

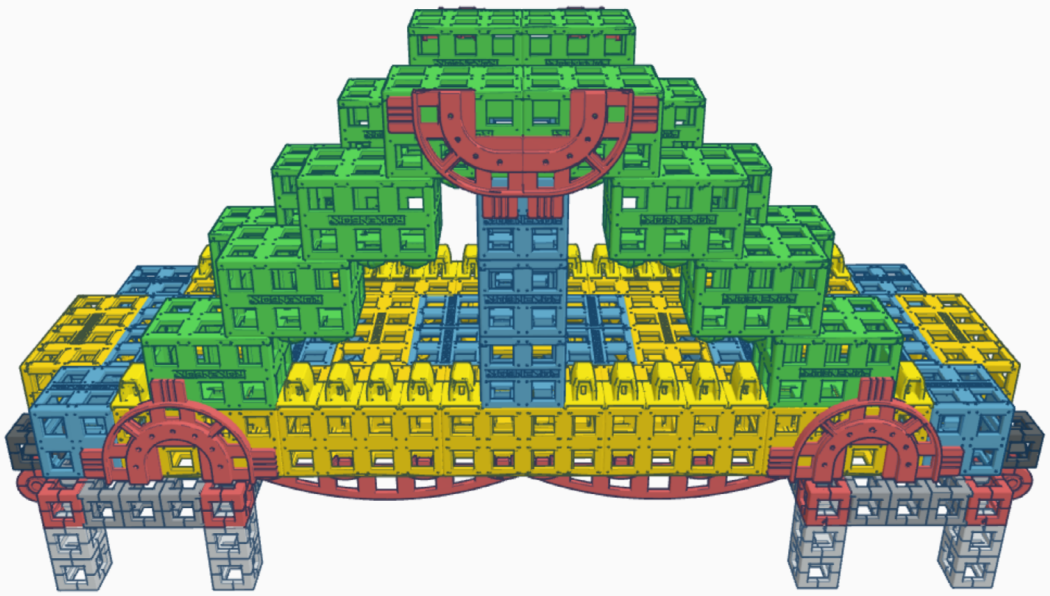
2x 

12x 



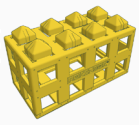
Build Plan: Truss Bridge

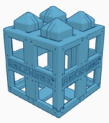
8 Repeat Steps 6-7 on Opposite Side

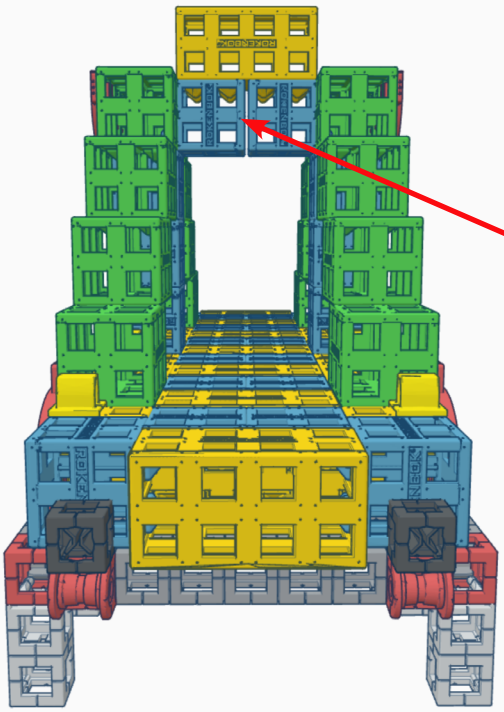


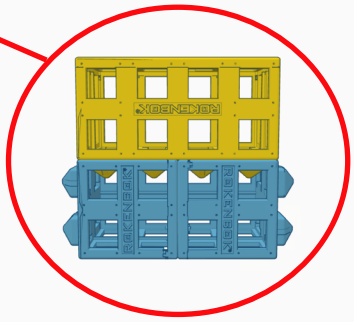
9 Connect Trusses Together

Components

1x 

2x 





Truss Bridge: Team Worksheet

Instructions

Once the truss bridge has been built, complete the following sections about the bridge and prepare to present it to the rest of the class.

Measurement

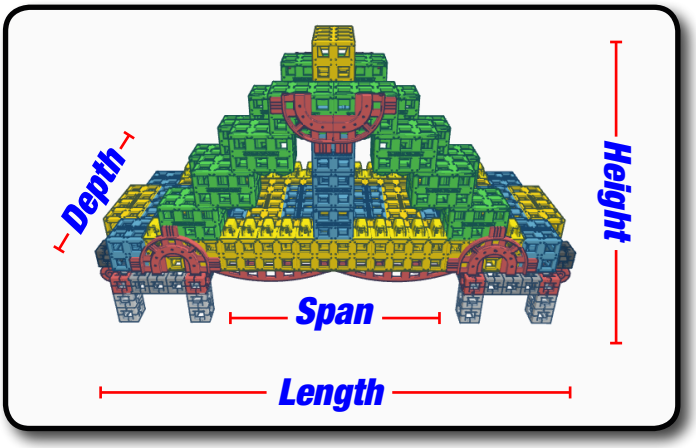
Fill in the dimensions of the truss bridge below:

Length_____mm

Height_____mm

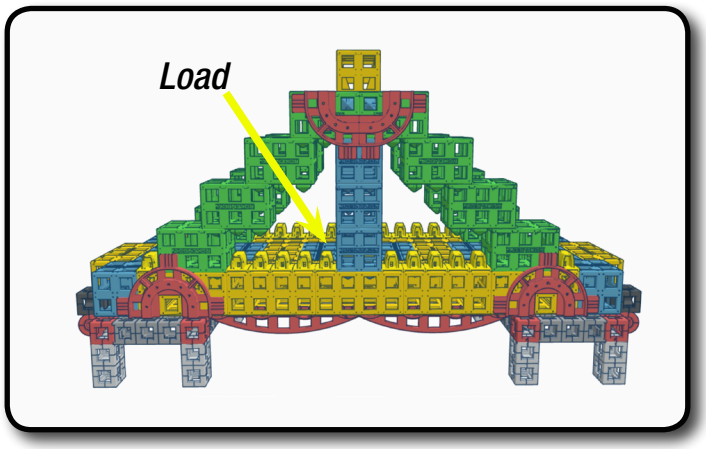
Depth_____mm

Span_____mm



Weight Distribution

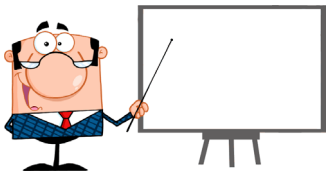
Do some research on how weight is distributed in a truss bridge. Then, draw arrows on the figure to the right that demonstrate how the weight is distributed through the bridge.



Presentation

An important part to design and engineering is the ability to communicate the design to someone else. Prepare a short presentation to explain:

-The type of bridge that was built
-How the bridge distributes weight to support a load
-A real-life example of the type of bridge
-The role of each team member



Cable-Stayed Bridge

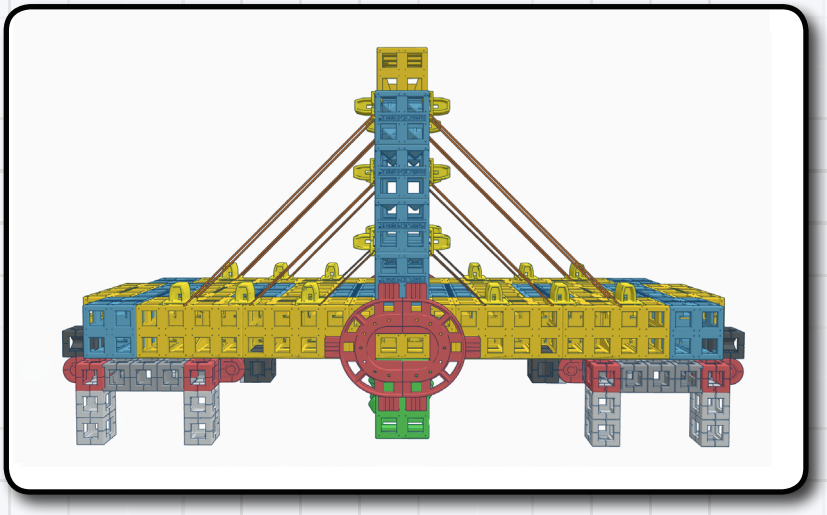
Build Plan and Team Worksheet

Instructions

Follow the step-by-step graphic instructions in this packet to assemble a cable-stayed Bridge. After the bridge has been built, complete the team worksheet and prepare a short presentation about the bridge.

Team Members

1. _____
2. _____
3. _____
4. _____

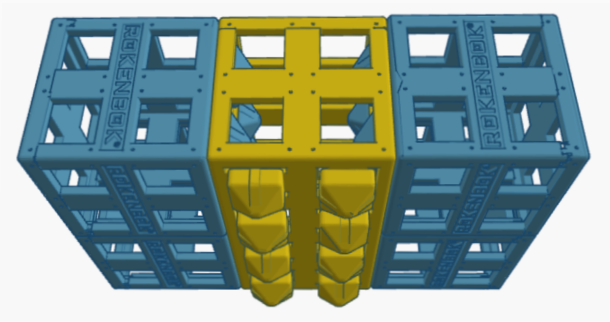


Build Plan: Cable-Stayed Bridge

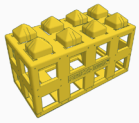
STEM-Maker Build: Cable-Stayed Bridge

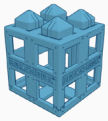
Follow the step-by-step instructions to assemble a Rokenbok cable-stayed bridge.

1 Bridge Roadway



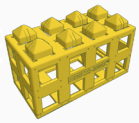
Components

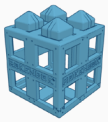
1x 

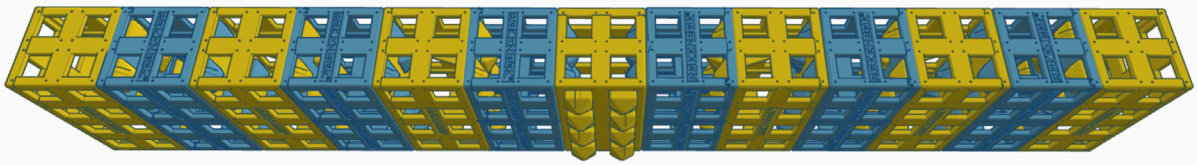
4x 

2 Bridge Roadway (Continued)

Components

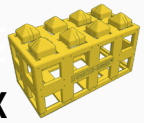
6x 

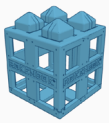
8x 

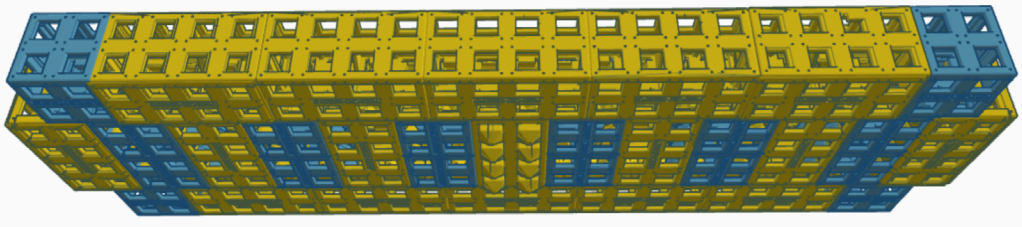


3 Attach Side Supports

Components

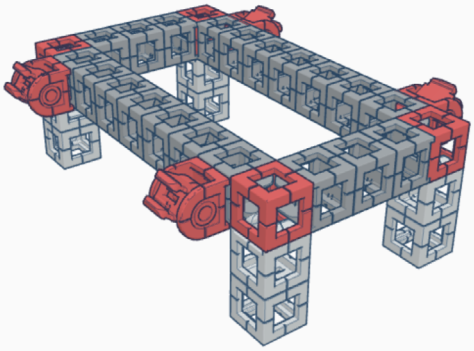
10x 

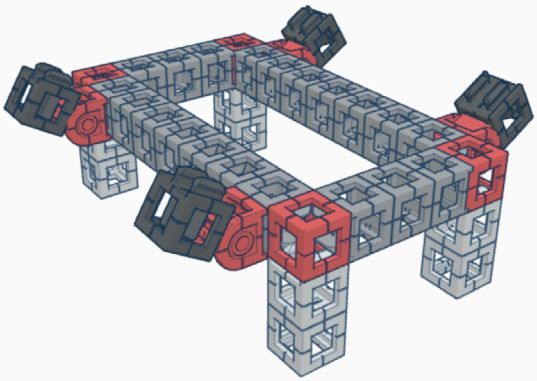
4x 



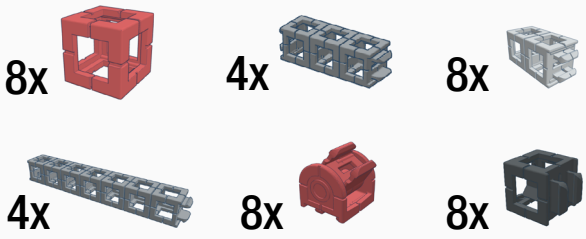
Build Plan: Cable-Stayed Bridge

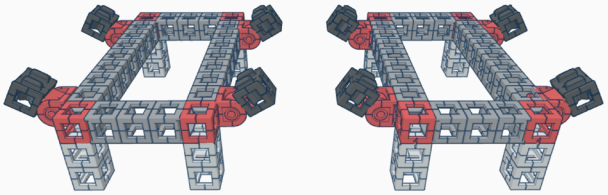
4 Build Abutments



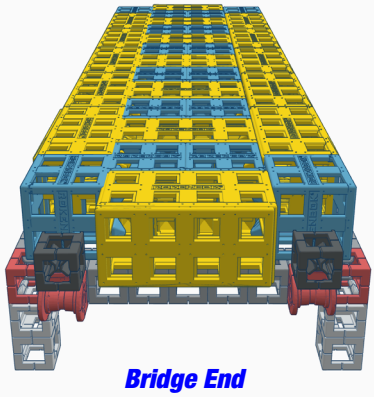


Components

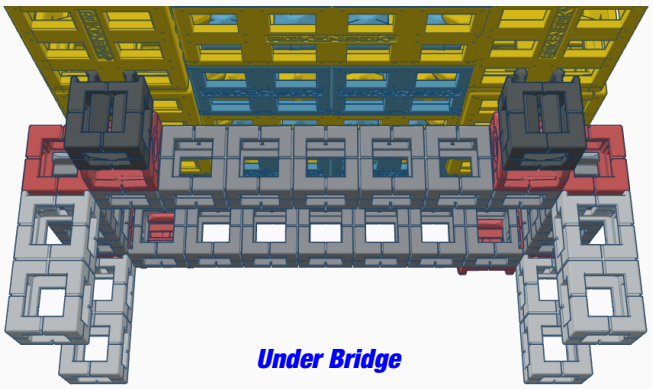




5 Place Roadway on Abutments



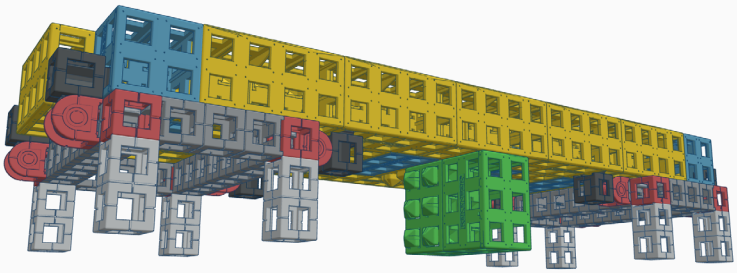
Bridge End



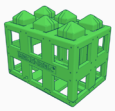
Under Bridge

Build Plan: Cable-Stayed Bridge

6 Attach Foundational Support



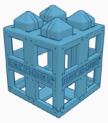
Components

2x 

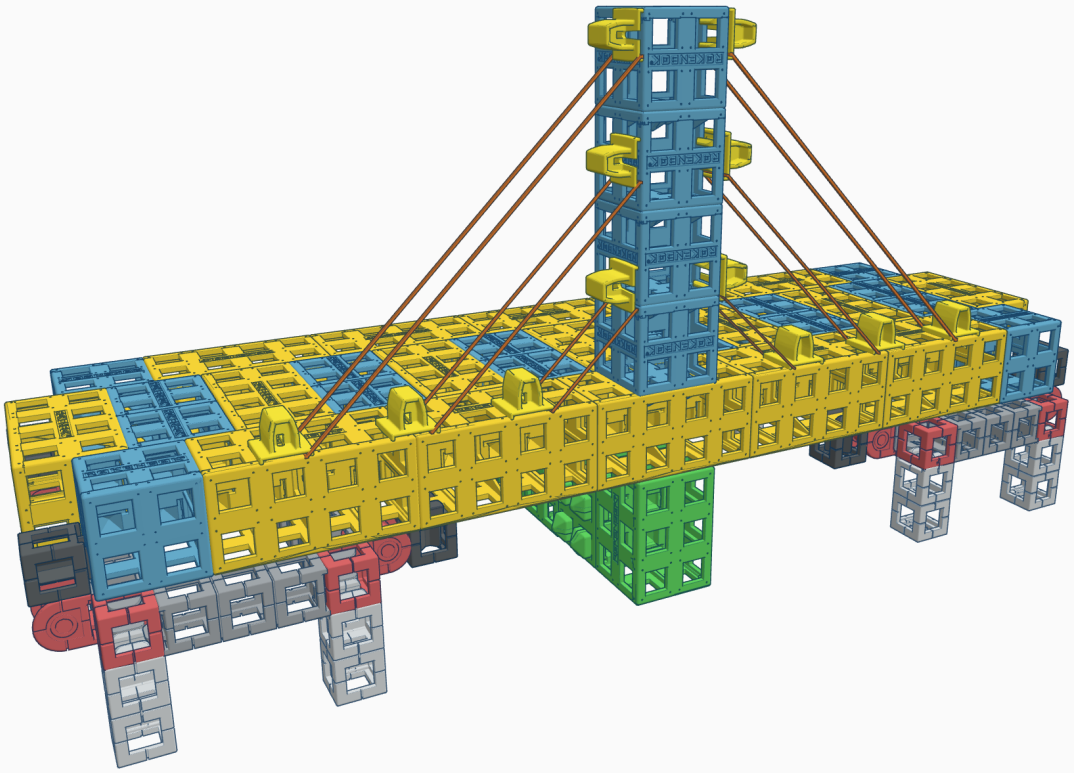
7 Build Tower, Attach Teeth and Cables (Rubber Bands)

Components

12x 

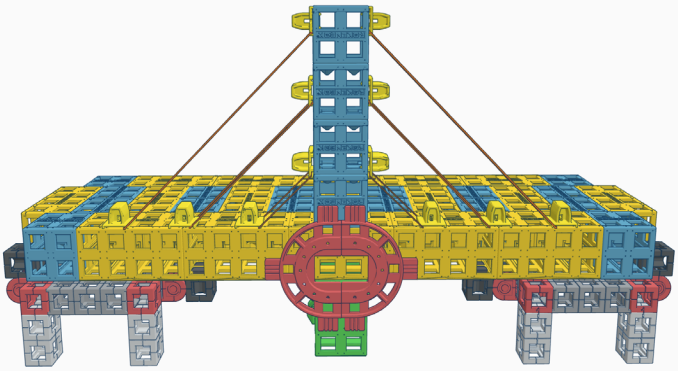
4x 

6x 

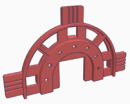


Build Plan: Cable-Stayed Bridge

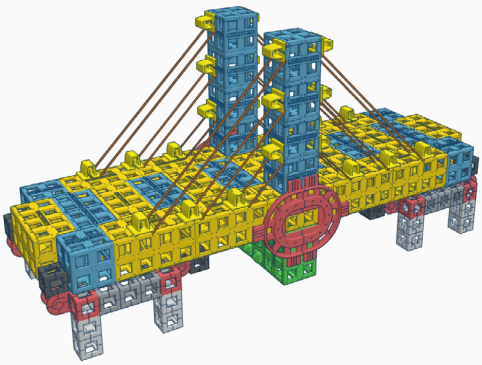
8 Attach Bracing



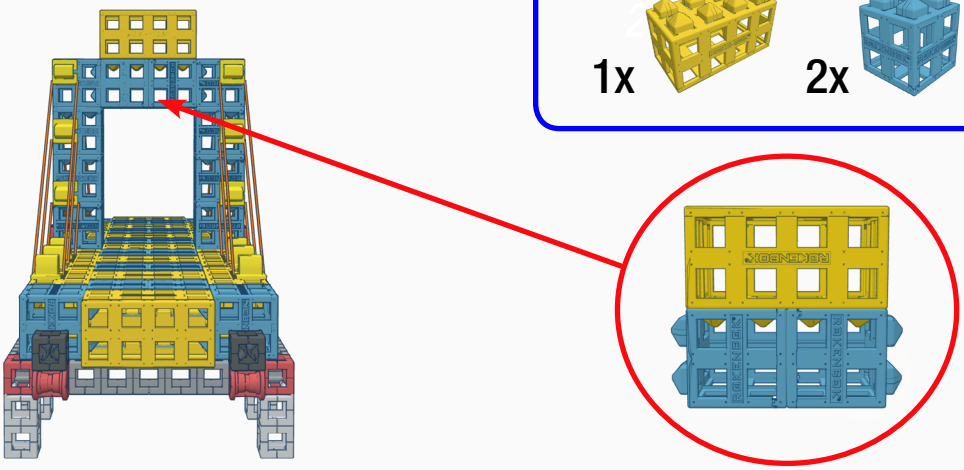
Components

2x 

9 Repeat Steps 5-7 on Opposite Side



10 Connect Towers



Components

1x

2x

Cable-Stayed Bridge: Team Worksheet

Instructions

Once the cable-stayed bridge has been built, complete the following sections about the bridge and prepare to present it to the rest of the class.

Measurement

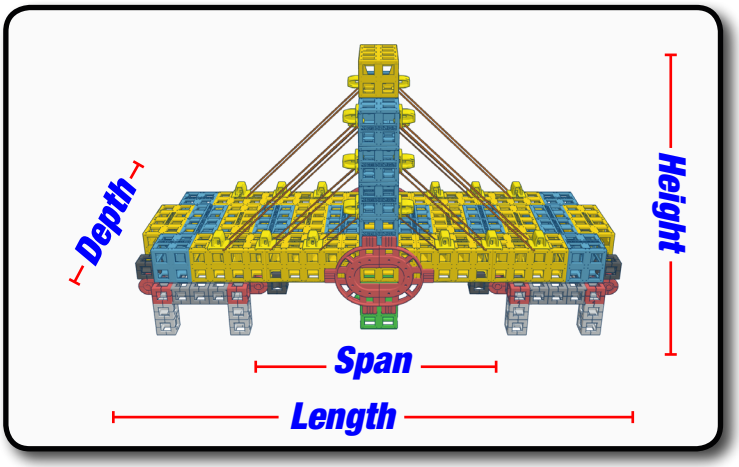
Fill in the dimensions of the cable-stayed bridge below:

Length_____mm

Height_____mm

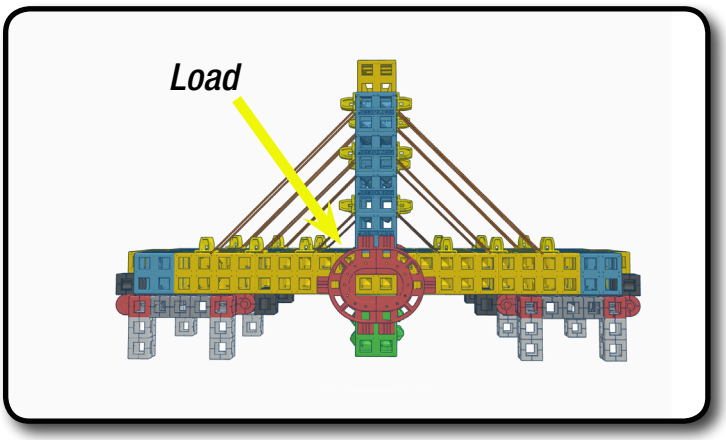
Depth_____mm

Span_____mm



Weight Distribution

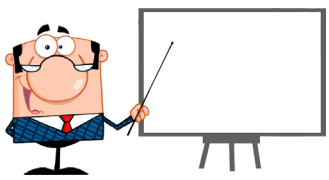
Do some research on how weight is distributed in a cable-stayed bridge. Then, draw arrows on the figure to the right that demonstrate how the weight is distributed through the bridge.



Presentation

An important part to design and engineering is the ability to communicate the design to someone else. Prepare a short presentation to explain:

-The type of bridge that was built
-How the bridge distributes weight to support a load
-A real-life example of the type of bridge
-The role of each team member



Suspension Bridge

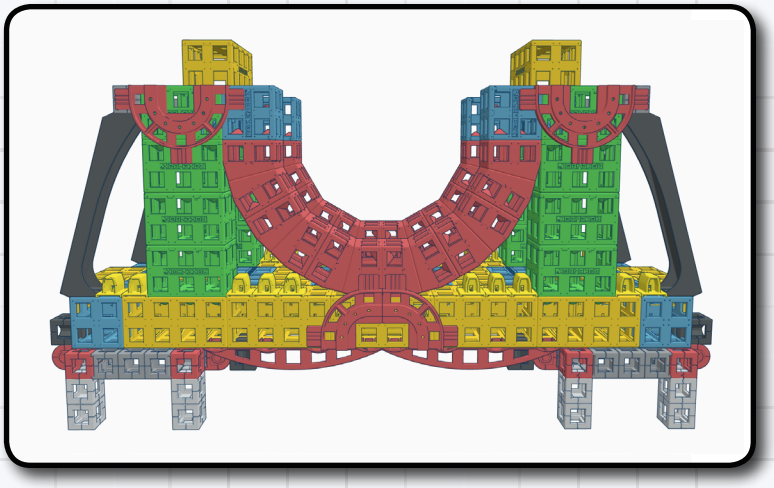
Build Plan and Team Worksheet

Instructions

Follow the step-by-step graphic instructions in this packet to assemble a suspension bridge. After the bridge has been built, complete the team worksheet and prepare a short presentation about the bridge.

Team Members

1. _____
2. _____
3. _____
4. _____

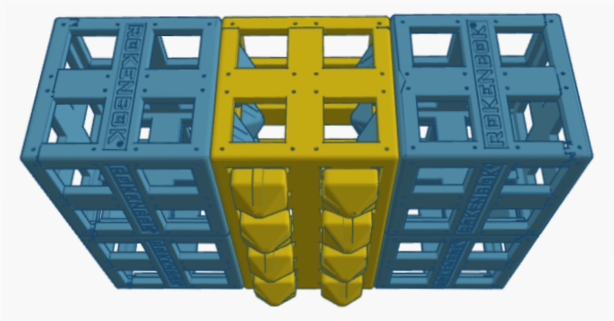


Build Plan: Suspension Bridge

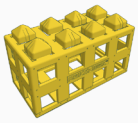
STEM-Maker Build: Suspension Bridge

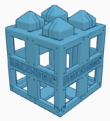
Follow the step-by-step instructions to assemble a suspension bridge.

1 Bridge Roadway



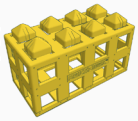
Components

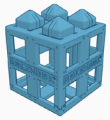
1x 

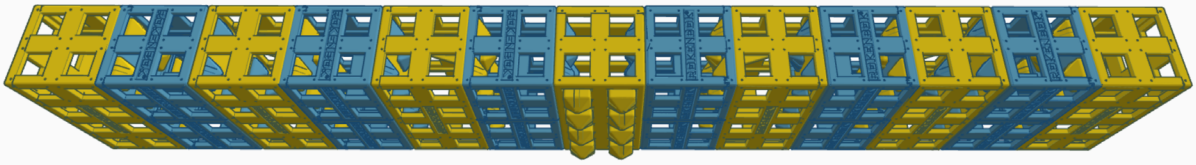
4x 

2 Bridge Roadway (Continued)

Components

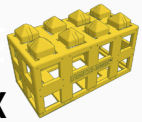
6x 

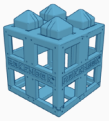
8x 

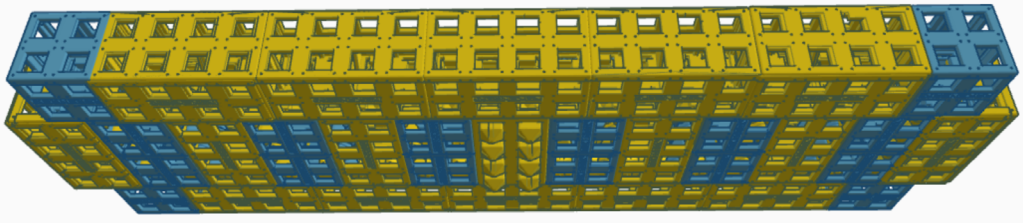


3 Attach Side Supports

Components

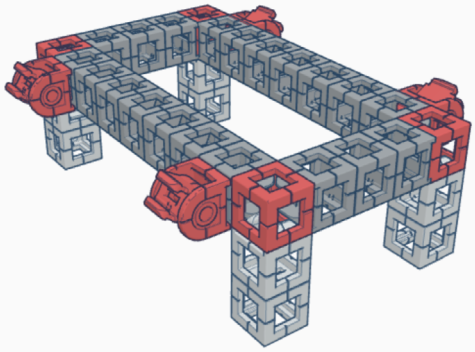
10x 

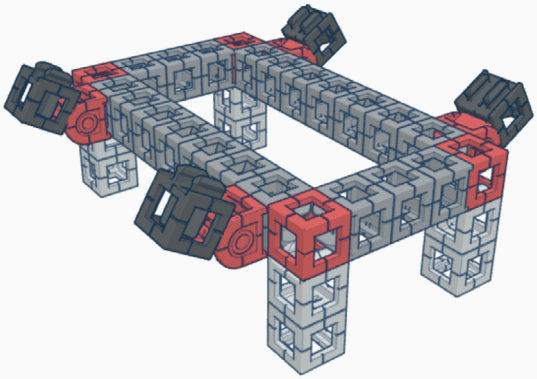
4x 



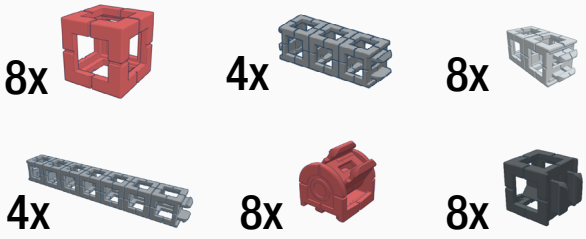
Build Plan: Suspension Bridge

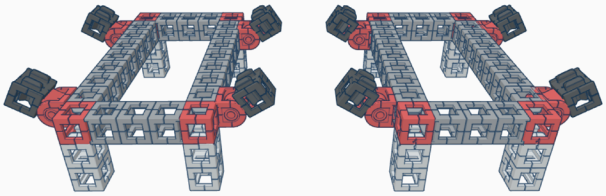
4 Build Abutments



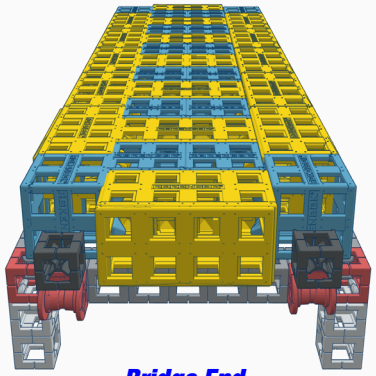


Components

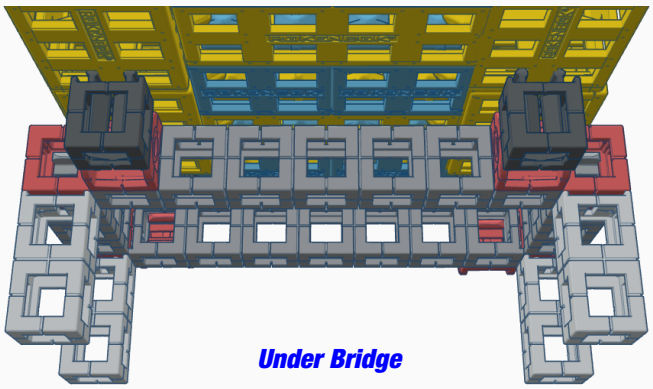




5 Place Roadway on Abutments



Bridge End



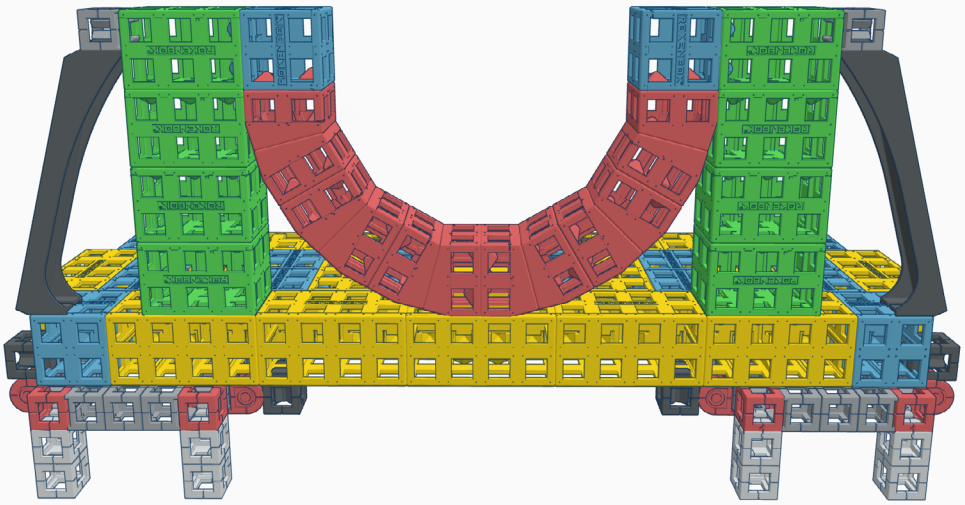
Under Bridge

Build Plan: Suspension Bridge

6 Construct Towers and Suspension System

Components

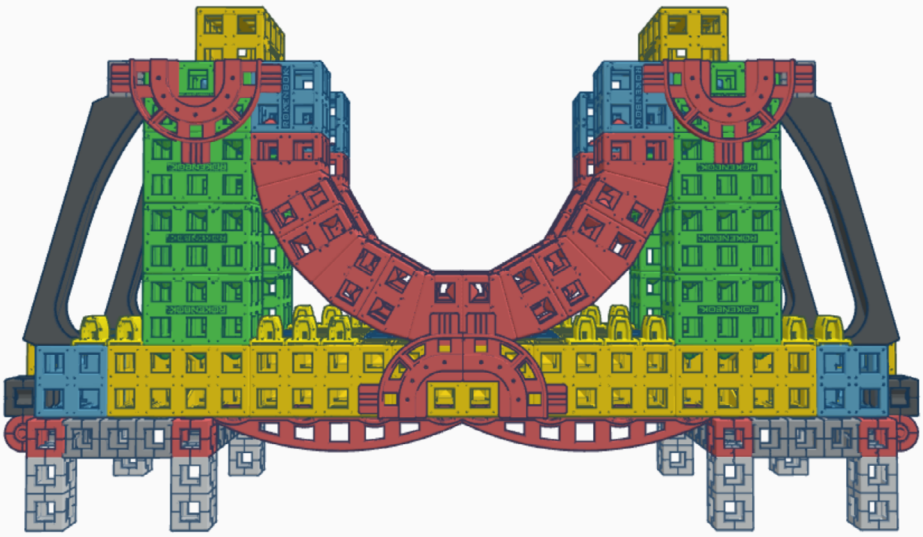
8x 12x 2x 2x 2x



7 Attach Bracing and Gear Teeth

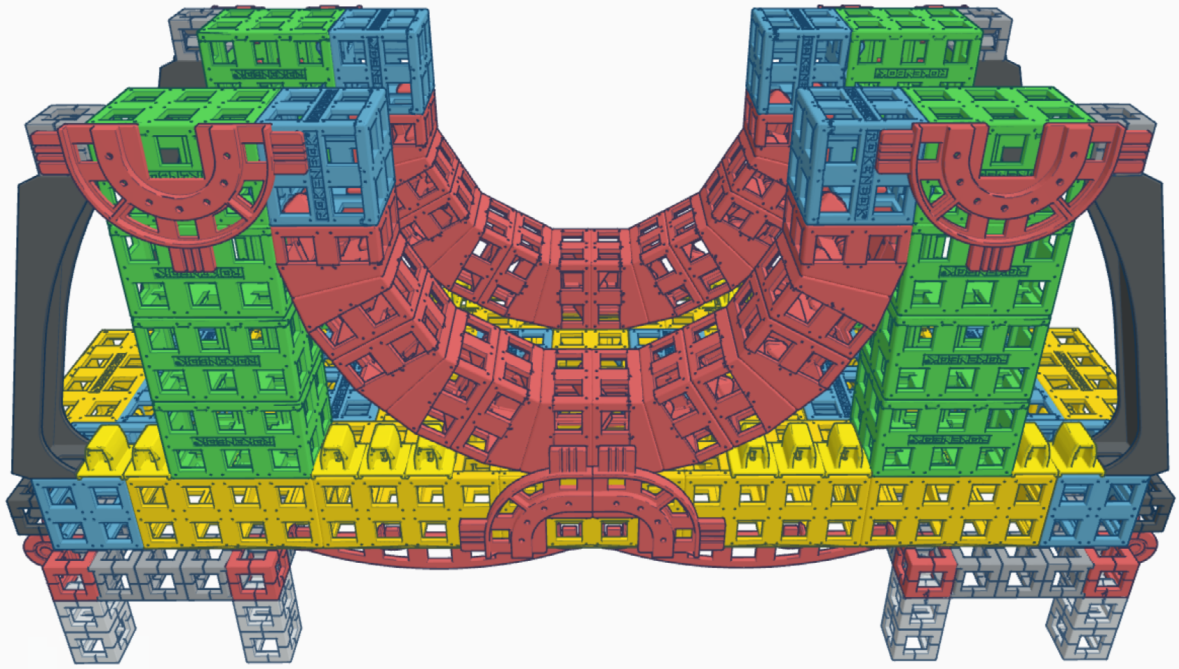
Components

2x 2x 2x 10x



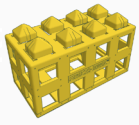
Build Plan: Suspension Bridge

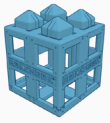
8 Repeat Steps 5-6 on Opposite Side

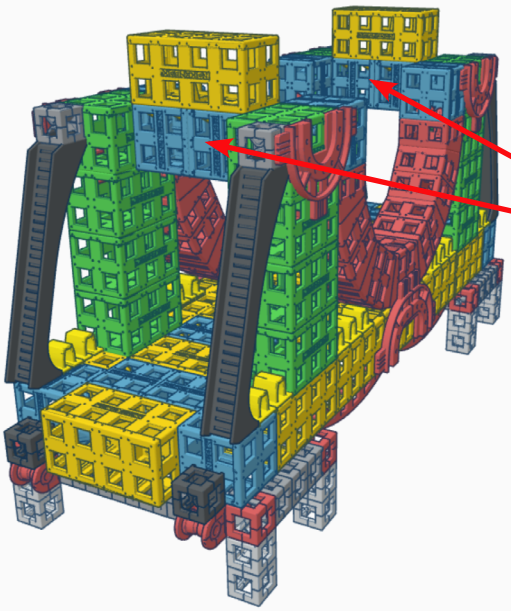


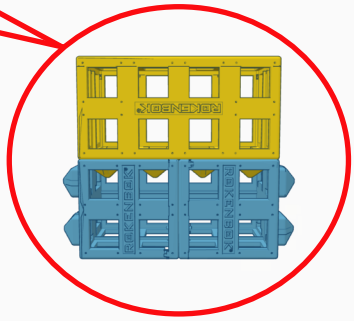
9 Connect Towers (2x)

Components

2x 

4x 





Suspension Bridge: Team Worksheet

Instructions

Once the suspension bridge has been built, complete the following sections about the bridge and prepare to present it to the rest of the class.

Measurement

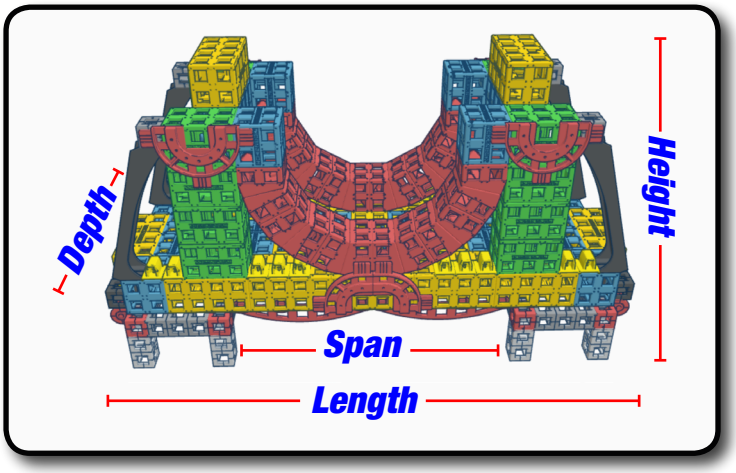
Fill in the dimensions of the suspension bridge below:

Length_____mm

Height_____mm

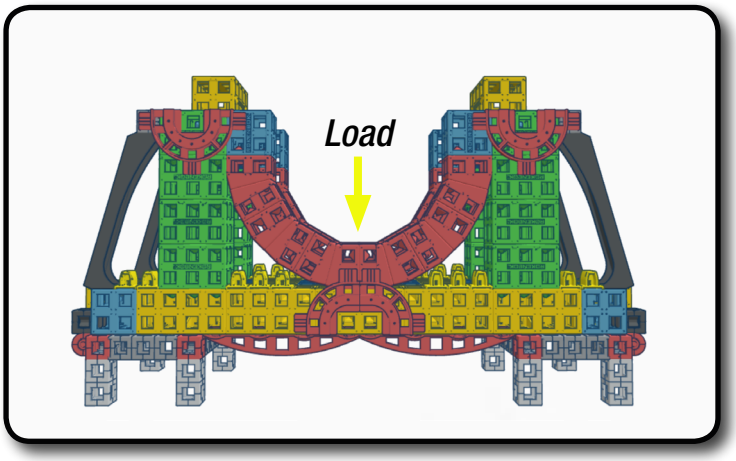
Depth_____mm

Span_____mm



Weight Distribution

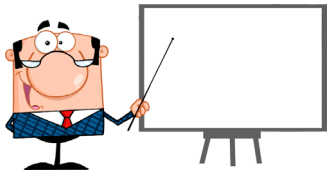
Do some research on how weight is distributed in a suspension bridge. Then, draw arrows on the figure to the right that demonstrate how the weight is distributed through the bridge.



Presentation

An important part to design and engineering is the ability to communicate the design to someone else. Prepare a short presentation to explain:

-The type of bridge that was built
-How the bridge distributes weight to support a load
-A real-life example of the type of bridge
-The role of each team member



ROK Creek Bridge

Designing and Engineering a New Bridge

Instructions

Now that you have learned how bridges work and have been introduced to six different types of bridges, it is time for your team to pair up with another team to begin construction of the new ROK Creek Bridge. Your new team will work through the Kid Spark Design & Engineering process to develop a new bridge.

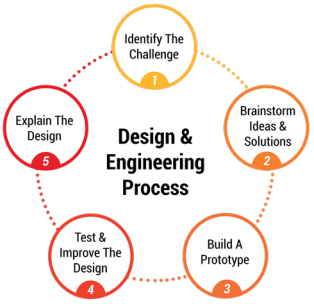
Team Members

1.
2.
3.
4.
5.
6.
7.
8.

ROK Creek Bridge: Design Brief

Design Brief: Scenario

Now that you are familiar with the different types of bridges and how they work, it is time to design and engineer the new ROK Creek Bridge.



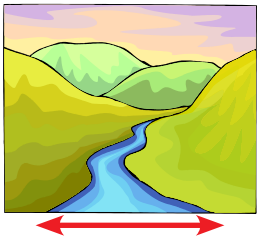
Design Challenge

Design and Engineer a custom bridge based on the following specifications:

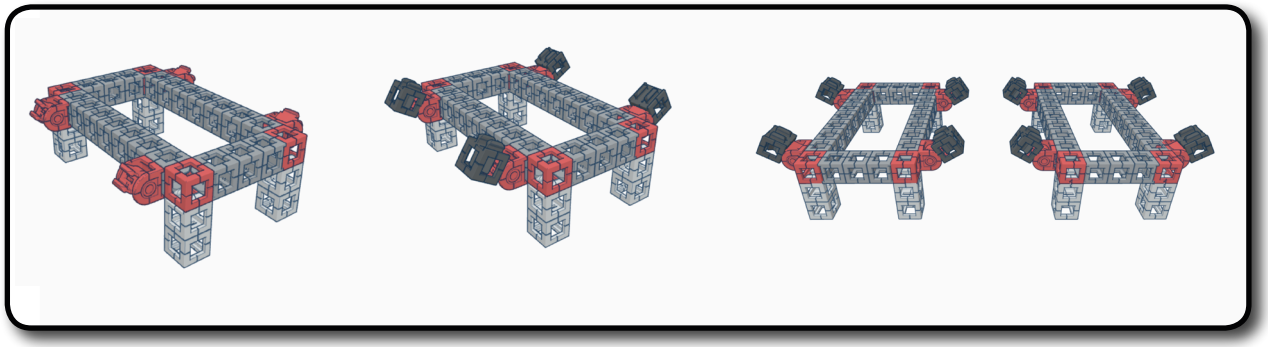
1. *Bridge must be built out of components located within the ROK Blocks Lab. Two ROK Blocks Labs may be used to complete the bridge.*
2. *Teams can select the preferred type of bridge to be built.*
3. *The bridge must have a span of at least 56cm.*
3. *Bridge design should be strong and safe.*
4. *Bridge design should be attractive and balanced.*
5. *Bridge must be completed in allotted time.*
6. *Teams should identify correct dimensions of bridge.*
7. *Teams should prepare a short presentation to explain the bridge to rest of the class.*
8. *With each component costing $2, the bridge must cost less than $180.*
9. *Teams should work through each step in the Kid Spark Design & Engineering process to develop the bridge.*

Getting Started

The new ROK Creek Bridge will use the same abutments as used in previous bridges. Build two abutments as shown below, then work through each step in the Rokenbok Design & Engineering process to develop a high quality bridge.



Span (56cm)



Design and Engineering

Design & Engineering Challenge

Follow each step in the design & engineering process to develop a solution to the challenge. Place a check in the box as each step is completed. Fill in the blanks when necessary.

1. ***Identify The Challenge***

   ☐ *Challenge:* _____

   ☐ *Review specifications.*

2. ***Brainstorm Ideas & Solutions***

   ☐ *Discuss design ideas.*

   ☐ *Consider building components.*

3. ***Build A Prototype***

   ☐ *Build a working prototype of the design.*

4. ***Test & Improve The Design***

   ☐ *Test & improve the design for performance and consistency.*

   ☐ *New challenge discovered:* _____

   ☐ *Review grading rubric and design specifications.*

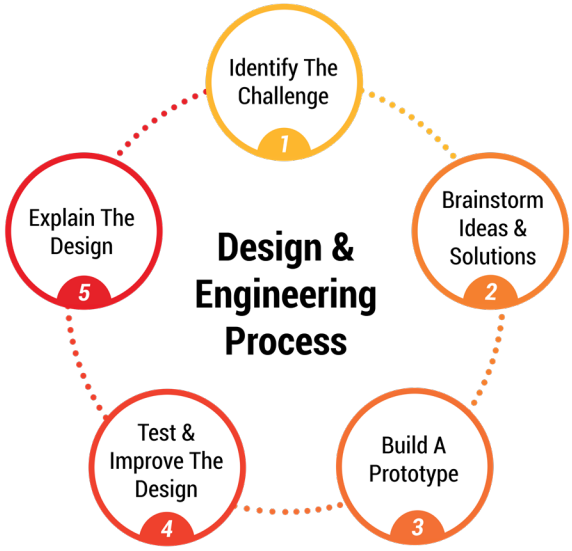
5. ***Explain The Design***

   ☐ *Prepare to demonstrate and present the design to others.*

   ☐ *Review project grading rubric.*

   ☐ *Explain any unique design features that were included.*

   ☐ *Describe at least one new problem/challenge discovered during Step 4 (Test and Improve The Design) and how the team redesigned a new solution.*



Design and Engineering

Challenge Evaluation

When teams have completed the design & engineering challenge, it should be presented to the teacher and classmates for evaluation. Teams will be graded on the following criteria:

- ***Specifications:*** *Does the design meet all specifications as stated in the design brief?*
- ***Performance:*** *How well does the design work? Does it function consistently?*
- ***Team Collaboration:*** *How well did the team work together? Can each student descibe how they contributed?*
- ***Design Quality/Aesthetics:*** *Is the design of high quality? Is it structurally strong, attractive, and well proportioned?*
- ***Material Cost:*** *What was the total cost of the design? Was the team able to stay on or under budget?*
- ***Presentation:*** *How well did the team communicate all aspects of the design to others?*

Grading Rubric	Advanced 5 Points	Proficient 4 Points	Partially Proficient 3 Points	Not Proficient 0 Points
Specifications	☐ Meets all specifications	☐ Meets most specifications	☐ Meets some specifications	☐ Does not meet specifications
Performance	☐ Design performs consistently well	☐ Design performs well often	☐ Design is partially functional	☐ Design does not work
Team Collaboration	☐ Every member of team contributed	☐ Most members of team contributed	☐ Some members of team contributed	☐ Team did not work together
Design Quality/ Aesthetics	☐ Great design/ aesthetics	☐ Good design/ aesthetics	☐ Average design/ aesthetics	☐ Poor design/ aesthetics
Material Cost	☐ On Budget ($180 or Less)	☐ Slightly Over Budget ($181-185)	☐ Over Budget ($186-195)	☐ Significantly Over Budget ($196+)
Presentation	☐ Great presentation/ well explained	☐ Good presentation/ well explained	☐ Poor presentation/ explanation	☐ No presentation/ explanation
Points	……..	……..	……..	……..
Total Points				…….. /30