

Future Engineers

S·T·E·M PROJECT



RESOURCES

- A Merge Cube or Merge Paper Cube
- Merge EDU account
- Fusion 360 student account
- A science or STEM project notebook
- A device with the Merge Object Viewer app
- **Project worksheets available at:**
dashboard.mergeedu.com/stem/projects/future-engineers

THE CHALLENGE


3 weeks


Hybrid learning

A suspension bridge, which was the only means of access to the village of Taveng, Cambodia, has broken due to old age. Since then, the villagers and students have had to use a bamboo raft to cross the river, posing a variety of safety hazards for them during the rainy season. This is a major problem because most of the villagers are farmers and depend heavily on selling their produce at the markets across the river. In addition, students are also greatly affected because they must travel across the river daily to get to school.

You are part of a team of engineers who have been given the challenge to design a new bridge to help the village in Taveng. As part of this project, you will need to research different types of bridges, brainstorm ideas, learn how to create a bridge in 3D, then build one on your own using Fusion 360. During the evaluation stage, you will test the maximum weight the bridge can hold, and get feedback from others to help improve your design. Once the bridge is complete, you will share your final design with the Board of Directors.

Are you up to the challenge?



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STEP 1

Ask

- What is the problem you have been asked to solve?
- What are the challenges?
- Why is the maximum amount of weight the bridge can bear so important?
- What role does the aesthetics of the bridge play in your design?
- Why is iteration so important when designing a structure?



Journal - Write the answers in your journal, and discuss if you are in person, or through your digital learning format if you are distance learning.

STEP 2

Imagine

Have you ever crossed a bridge on foot before? What about in a car? What did the bridges look like, and were they the same or different? Bridges have been used since ancient times to help people cross rivers and other obstacles. Before you draw ideas for the type of bridge you will create, conduct research on the 6 main types of bridges. After you've learned more about each type and their uses, choose the top 2 that you feel could be a good fit for the project, and the reasons why.

Using the internet and other sources of information, complete the [Research Document](#) - this will give you some ideas for when you brainstorm your design ideas.

Now that you have an idea of the types of bridge you may create, it's time to put your ideas together and draw out two (2) bridge designs using the [Brainstorm Document](#).

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STEP 3

Plan

Before you create a detailed design of your bridge, you'll need to understand the process of building and testing your bridge using Fusion 360. This will help you to make better decisions in your design. Follow along with the [video tutorial](#) to create the example bridge.

Now that you've completed the Fusion 360 tutorial and understand the process, go back to your brainstorm document to choose the bridge design that will work best for your project and refine your chosen design using the [Plan and Design Document](#). This plan will need to have as much detail as possible, as this will be used when constructing the bridge in 3D using Fusion 360.

STEP 4

Create

Now it's time to design your bridge in Fusion 360! Remember to follow your plan from your Plan & Design Document. After your bridge design is complete, perform the stress test and record your results.

Once you have built the bridge in Fusion 360 and completed the stress test, you will need to export the bridge into Object Viewer for inspection. Inspecting your design is an important step in the process, and using augmented reality with the Merge Cube provides a great way to examine your design from all angles and catch any potential problems.

To bring your model into Object Viewer, you will first right click it then save it as an STL to your desktop. Upload your file to the Merge Dashboard, then open Object Viewer and find your bridge design under "My Objects." From here, you will see a unique object code. Make sure that the Object Code is included in your Bridge Report that you will need to share with your boss (in this case, your teacher).

What does the bridge look like in the real world? Use the "place" tool in Object Viewer to place the bridge outside and scale to the approximate size in the real world. Now that you can see it in the real world, can you see any potential problems with it? Make sure you document all of this in your [Bridge Report](#).

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STEP 5

Improve

Evaluation is very important, especially asking others to evaluate what you have created. Do not take the feedback personally, but instead listen openly to the suggestions you receive.

For this part of the project, you will need to share your Merge Object Code with 2 engineers (students) and ask them to complete the [Bridge Evaluation Document](#). Once they have the Object Code, they will be able to download your bridge to their Object Viewer and inspect it closely.

You will also need to complete an evaluation for a fellow engineer. To evaluate, use the Merge Cube to view a scale model of the Bridge from all angles. You can also place a larger version of the bridge in the real world and walk around the structure to inspect it more closely. This will help you to give more detailed, meaningful feedback.

Once you have received the evaluations back, it's important to read over them and ask yourself if anything they have suggested would improve your bridge. Complete the [Response Document](#) and make the improvements you have identified in your bridge.

STEP 6

Share

Now that you have responded to feedback and made improvements to your final design, it's time to present your bridge to the Board of Directors and get the green light to build the bridge and save the village!

Video Presentation

Use the screen recording feature on your device to take the audience through your project. Record your bridge 3D model in the Object Viewer app as you talk about the points below.

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VIDEO Presentation

For your video presentation, you will need to explain:

- What bridge design you chose and why
- The process of determining what loads your bridge could handle
- What changes you made to your design to increase structural integrity
- How you incorporated aesthetics into your work
- If your peers models influenced your design and how
- What the most difficult piece of this process was
- If having the model in AR was helpful to view the changes you wanted to make
- What makes your model unique



Congratulations! Through this project you have designed, created and stress tested a complex bridge design! You have gotten a taste of what a job could be like using Computer Aided Design as a structural engineer or urban planner. Amazing work!

About the teacher

Say Hello to Vice Principal Mike Page and Learning Coordinator, Nate Lott, from School District 20 in beautiful British Columbia Canada. Mike and Nate are innovative technology advocates who have presented across their province and country as well as at international events such as ISTE. Outside their school hours they run STEM camps through their company OpenSourceLab, in which they introduce children and adults to the joy of the Maker movement ranging from game design to 3D printing and beyond.



For more STEM Projects visit
<https://dashboard.mergeedu.com/stem/projects>

MERGE EDU