



# BALSA BRIDGES

Read how teachers and students are finding success with Pitsco Education products in their classrooms

The competition was on at Leominster High School in Leominster, Massachusetts. Teacher Todd Rathier challenged his students to build a balsa wood bridge from the Pitsco BridgePak. To make the activity more interesting, Mr. Rathier didn't abstain from the competition.

## MR. RATHIER WAS ASKED THE FOLLOWING QUESTIONS ABOUT THE PROJECT:

### HOW WAS THE PITSCO PRODUCT USED IN THE CLASSROOM?

The specific challenge was to design the most efficient bridge possible built only from the balsa wood in the BridgePak and the green competition glue also in the BridgePak. The BridgePak included student handouts as well as a bridge-building

## PROFILE »

**SCHOOL:** Leominster High School – Center for Technical Education Innovation

**LOCATION:** Leominster, MA

**TEACHER:** Todd Rathier

**GOAL:** To design the most efficient bridge possible from a specific list of supplies

resource guide, which was reviewed as part of the challenge. The students were given a specific set of constraints for bridge size as well as a “no laminations” rule. They were allowed the use of any software installed in the CAD room, which included 2-D design software (AutoCAD) as well as 3-D design software (Autodesk Inventor) and a bridge simulation software package called West Point Bridge Design.

### WHAT WERE THE SUCCESSES/CHALLENGES DURING THE ACTIVITY?

The successes outnumbered the challenges. Any time a set of students can be fully engaged in a project while learning science and making use of technology and engineering design as well as math (such as calculating bridge efficiency), then I call it a great success. By challenging the students to beat the instructor using the same constraints, it kept the excitement going right up to bridge-breaking day.

There were some challenges involved. The West Point Bridge Design software is designed to represent specific bridge-building scenarios and is not really meant to simulate a balsa wood structure. While the basic concepts and bridge styles can be represented and compression and tension visually simulated, a better software package should be developed to work specifically with balsa wood bridges.

The BridgePak provided exactly what was needed for structural materials, and there were no complaints whatsoever about the quality of the materials.

### WHAT EDUCATIONAL VALUE DID THIS ACTIVITY AND PRODUCT BRING TO THE STUDENTS?

The activity enabled the students to research, design, and experiment with various styles of bridge designs. Specifically, established bridge truss designs such as the Howe, Pratt, and Warren trusses were reviewed and class discussion was conducted as to the pros and cons of each one. Compression and tension in truss members, how they applied to balsa wood structures, and how to make a strong wood joint were also discussed.

Students were allowed a number of class periods to design a bridge of their choice using the West Point Bridge Design software. This produced a good understanding of basic bridge design and how bridge structures generally were based on triangle shapes as the strongest structural element (square openings lead to structural failure). Further class periods were used to transfer their successful designs to 2-D or 3-D CAD models to create accurate paper plans for building the balsa wood models.

Virtual prototyping and how finite element analysis can be applied to find the weak points in their designs was demonstrated using the Inventor software and the virtual model of the instructor's bridge.



“ THIS ACTIVITY HELPED ME LEARN ABOUT CUSTOMIZING A BRIDGE DESIGN. MY FAVORITE PART WAS USING THE STRESS ANALYZER TO TEST THE BRIDGES.

– Nathan, senior high student ”

Bridges were tested in a stress analysis device linked to a computer, and charts were produced showing the yield strength point on the stress curve. Reviewing how each bridge failed opened a discussion about strength of materials as well as how each bridge design had strengths and weaknesses.

### HOW DID THE STUDENTS INTERACT WITH/RESPOND TO THE PRODUCT AND ACTIVITY?

Student response was very positive. They initially were excited to create the virtual design and the usual experimentation of making the thinnest and cheapest bridge to the strongest and most expensive bridge occurred. After they had determined what their bridge design would or could realistically be and printed it out on paper, it became good-natured rivalry as to who could build the cleanest, neatest bridge design and beat the instructor in efficiency. The competition glue color assisted with this as a visual guide to how much glue was being used per joint. They failed in beating my bridge design, of course, but I've had practice.

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