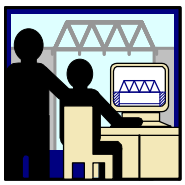

The West Point Bicentennial Engineering Design Contest

A High-Tech Educational Experience

Design a bridge with the award-winning West Point Bridge Designer software, and you could win a $15,000 scholarship!

The word is on the street and in the chat rooms across the country and around the world. The United States Military Academy at West Point is conducting a cutting-edge, nationwide, Internet-based engineering design contest. It all begins on November 11, 2001, at www.usma.edu/bridgecontest. The West Point Bicentennial Engineering Design Contest is open to anyone, but only U.S. students in Kindergarten through Grade 12 are eligible to win prizes. Students can compete individually or in teams of two. The contest will use a unique, award winning, computer-aided design software package called the West Point Bridge Designer. Thanks to this software, specially developed curriculum materials, and a sophisticated website that makes the contest accessible to *any* K-12 student in the U.S., the West Point Bicentennial Engineering Design Contest promises to be an exciting and rewarding educational experience for all who participate.

Why West Point? For 200 years, the United States Military Academy has served the nation by educating young men and women in preparation for service as commissioned officers in the Army. But West Point also holds the distinction of being the first institution in the U.S. to offer a formal program of instruction in engineering. Civil engineering was the foundation of the early West Point curriculum and, for the first half of the 19th century, Academy graduates made immense contributions to the design and construction of the young nation's railways, bridges, harbors, and roads. The West Point Bicentennial Engineering Design Contest commemorates the Academy's engineering heritage and celebrates the contributions of its graduates to the development of the nation's infrastructure.

The American Society of Civil Engineers, America's oldest national professional engineering society, is sponsoring the contest as part of the celebration of its own 150th anniversary celebration. ASCE has mobilized its national network of engineering practitioners and educators to visit schools and help teachers and students use the contest as a means of learning more about the exciting world of engineering. USMA and ASCE—two great institutions with a common mission of service to the nation—have formed a unique partnership to serve American education.

Yes, you can design a bridge!

The West Point Bridge Designer will introduce you to engineering through the design of a steel highway bridge. The software provides an engaging, hands-on engineering design experience that demonstrates how practicing engineers design real structures. It is available for free download from the contest website at www.usma.edu/bridgecontest and requires a personal computer running Windows 95 or better. Colonel Stephen J. Ressler, a civil engineering professor at the Academy, developed the software five years ago specifically for use in the West Point Bicentennial Engineering Design Contest. According to Ressler, "The software is intended to get students excited about math, science, and technology by challenging them with an important real-world application—the creative design of a structure that serves society."

How does it work? To design a bridge using this software, you will begin by drawing joints and structural members on the screen with your computer mouse. You must choose the material (different grades of steel), the cross-section (solid or hollow), and the size (the width in millimeters) of each structural member. As you create the bridge, its cost is computed automatically. Once your structural model is complete, you can test its strength with the click of a single button. The Bridge Designer will run a simulated load test of your structure, subjecting the bridge to its own weight and the weight of a truck driving across it. Upon completion of the load test, the software displays a full-color 3-D animation of a truck crossing your bridge. If the truck crosses the entire span successfully, the strength of your design is adequate. If the bridge collapses, you must go "back to the drawing board" and fix the problem. The load test animation provides you with real-time feedback about the quality of your design and also provides some helpful hints about how to improve your bridge on the next try. Your ultimate goal is to minimize the cost of the structure, while still ensuring that it passes the load test. You will probably need to do quite a few trials to reach this goal. This trial-and-error approach is very similar to the iterative process used by practicing engineers to design real bridges.

Since the West Point Bridge Designer was introduced in 1996, tens of thousands of copies have been distributed via the Internet. The software has been widely used and enthusiastically praised by engineering practitioners, teachers, and students from the elementary grades through college. Ressler has used teachers' feedback as the basis for numerous upgrades to the Bridge Designer. The latest edition, Version 4, won the 2000 National Engineering Education Delivery System (NEEDS) Premier Award for Excellence in Engineering Education Courseware. (See www.needs.org for more information.) The West Point Bridge Designer has also been formally endorsed as an educational tool by the Educational Activities Department of the American Society of Civil Engineers.

You can build a model bridge too.

One of the primary purposes of the West Point Bridge Designer software is to provide teachers with an educational tool to enrich their classroom instruction in mathematics, physical sciences and technology. Yet many teachers have found that the software alone does not entirely meet their educational needs. These teachers have requested curriculum materials that will explain the mathematical and scientific concepts on which the Bridge Designer is based and, more importantly, that will connect the software to a hands-on model bridge building project. To meet this need, Colonel Ressler wrote

Designing and Building File-Folder Bridges: A Problem-Based Introduction to Engineering. The book consists of five closely integrated learning activities, which challenge students to design a model truss bridge using authentic scientific principles and engineering tools, then build the model using manila file folders as a construction material.

The engineering firm of Parsons Brinckerhoff contributed to the book by authoring a section about how practicing engineers design real bridges. This first-hand account of the world of engineering helps the reader to understand how different kinds of engineers contribute to the design and construction of a major structure.

Designing and Building File-Folder Bridges isn't actually part of the contest, but many teachers and students will find it useful as a tool to relate the contest to their math, science, and technology instruction in an authentic and rigorous way. You can download the entire manual (as a series of .pdf files) from the website and start building your model bridge today. As Ressler notes, "The only way to truly appreciate the challenges and rewards of engineering is to actively engage in the creative process of design." In July 2001 *Designing and Building File-Folder Bridges* was sent to the Technology Coordinator at every high school in the United States. If you didn't receive a copy and are interested in getting one, see http://www.usma.edu/bridgecontest/resources for more information.

What about the contest?

The concept of the West Point Bicentennial Engineering Design Contest is as exciting as it is unique—contestants register, enter, have their entries judged, and receive feedback *entirely* via the worldwide web. The contest begins with a Qualifying Round, starting on November 11, 2001. The Qualifying Round is open to anyone in the world; however, only U.S. students in grades Kindergarten through Grade 12 are eligible for prizes. Contestants are encouraged to participate in teams of two, but individual submissions are also permitted. Teams enter the contest by downloading WPBD 2002, the Special Contest Edition of the West Point Bridge Designer; using this software to design a bridge; and submitting the design electronically to the contest website for judging. (WPBD 2002 will not be available until November 2001.) To qualify for judging, entries must pass the simulated load test performed automatically by the Bridge Designer. Qualified entries are judged and ranked based on minimum cost. Contestants can see how they rate by checking the contest scoreboard on the website. The scoreboard—which also won't be available until the contest begins—is divided into four geographical zones and one additional "open category" for contestants who are not U.S. K-12 students (and thus are not eligible for prizes). The qualifying round ends on February 28, 2002; but for a few high performing teams, the fun will have only just begun.

The top ten contestants from each of the four zones will be invited to participate in the Semi-Final Round, which will take place on March 16, 2002. Competing students will work at a location of their own choosing but will be required to arrange for a monitor to verify their original work. At a specified time, contestants will download a new design project for the West Point Bridge Designer and then will have just three hours to create and submit a design for judging. The top four teams from each zone and the top two teams overall will be invited to travel to West Point, all expenses paid, to compete in the Final Round of the contest on the weekend of April 26-28, 2002. During the Final Round, the six finalists will again receive a new design project for the Bridge Designer and will

have just two hours to develop their designs. The best designs created during this round will be declared the winners of the West Point Bicentennial Engineering Design Contest.

Prizes…Prizes…Prizes

The prize for each member of the first place team is a $15,000 cash scholarship. Members of the second and third place teams will each receive $10,000 and $5,000 cash scholarships, respectively. These scholarships can be used at any school. Additionally, the members of all teams that successfully complete the Final Round at West Point will receive notebook computers. These students will also have an opportunity to spend a few days at one of America's finest educational institutions—the United States Military Academy.

Wow! Impressive website

A contest of this scope would simply not be possible without the power of the Internet to automate many of the most important aspects of contest administration. At the heart of the West Point Bicentennial Engineering Design Contest is a cutting-edge website that—like all other aspects of the contest—was created entirely by members of the Academy faculty and staff. Its two principal authors are Colonel Gene Ressler, a Professor of Computer Science, and Major Steve Schweitzer, an Aerospace Engineering instructor. Schweitzer did the graphic design and web programming for the "front end" of the site, while Ressler programmed the complex automated judging and database management functions that make this contest so unique. And, yes, Gene and Steve Ressler are brothers.

Here's how the website works. To enter the contest, you will begin by accessing the contest website to read the rules and fill out an on-line registration form. As part of the registration process, you must certify your eligibility, designate a Team Captain, and provide an e-mail address, user ID, and password. Once registration is complete, the website creates a personalized home page for your team. You can check your home page at *any time,* to get up-to-the-minute information about your standing in the contest. WPBD 2002, the Special Contest Edition of the West Point Bridge Designer, is also available on the website. You will need to download this software, install it on a home or school computer, and then use it to design your bridge. When your design is complete, you will log into the website again to upload your "bridge design file" for automated judging. According to the contest rules, any design that is identical to a previously submitted design will not be accepted. Thus the website automatically checks each new design submission to ensure that no duplicate design is already saved in the contest database. The website then tests your bridge to make sure it can carry the specified loading successfully, records the bridge cost, and immediately informs your team of its current standing in the contest. All this happens in the blink of an eye, so you receive real-time feedback about your performance. And if your design is not one of the top ten submissions for your contest zone, don't worry! You can enter as many times as you like—right up to the end of the round.

Creating the contest website has been an extraordinary technical challenge—one that has proved to be as beneficial to the West Point academic program as it has been to the contest. Says developer Gene Ressler, "It's interesting that the bridge design contest has required a significant automated system design effort. The Department of Electrical Engineering and Computer Science, where I work, teaches cadets about all the basic principles involved in the contest website design. In fact, cadets designed and built an early prototype. It is a great experience for both the faculty and students to see computer science and telecommunications principles in action, supporting such a big and exciting project."

So why not give it a try?

The West Point Bicentennial Engineering Design Contest will be challenging, yet rewarding and fun. Anyone with basic computer skills will be able to create and submit an entry successfully. And once you've experienced the joy of designing your own bridge, you might not want to stop. If you are a U.S. K-12 student, this is a great opportunity to earn some money for your education. And if you're not, it's still a great opportunity to pit your problem-solving skills against those of other virtual bridge designers around the globe.

The exciting world of engineering is only a click away: www.usma.edu/bridgecontest.